

**TRANSPORTATION IMPACT ASSESSMENT (TIA)**

**THUNDER ROAD & BOUNDARY ROAD  
PROPOSED INDUSTRIAL DEVELOPMENT  
CITY OF OTTAWA**

**PREPARED FOR:  
THUNDER ROAD DEVELOPMENTS (2019) INC.**

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

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

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

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I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;



I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;



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I am either a licensed<sup>1</sup> or registered<sup>2</sup> professional in good standing, whose field of expertise



is either transportation engineering



or transportation planning .


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Dated at  this  day of , 20 .

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Professional title:

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

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**Stamp**



## Executive Summary

### Background

C.F. Crozier & Associates Inc. (Crozier) was retained by Thunder Road Developments (2019) Inc. to prepare a Transportation Impact Assessment in support of the Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) applications for the proposed industrial development located at Thunder Road and Boundary Road in the City of Ottawa.

This TIA assesses the site specific requirements and impacts of the proposed industrial development on the boundary road network and recommends required mitigation measures, as warranted.

The proposed development has an anticipated buildout by 2025 and includes three industrial buildings outlined below:

- Industrial Building 1: consists of 600,611 sq. ft of Gross Floor Area (GFA), 426 auto parking spaces, 98 trailer parking spaces and two full-moves accesses to Thunder Road;
- Industrial Building 2: consists of 41,449 sq. ft of GFA, 57 auto parking spaces and a full-moves access to Thunder Road, and
- Industrial Building 3: consists of 31,988 sq. ft of GFA, 52 auto parking spaces and a full-moves access to Boundary Road opposite the South Amazon access.

The proposed industrial development is projected to generate a total of 156 and 165 two-way auto trips during the weekday a.m. and p.m. peak hours, respectively.

### Existing Traffic Operations

Under 2020 existing traffic conditions, the study intersections are projected to operate at the Level of Services (LOS) below.

- The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is operating below capacity at a LOS "C" or better during the a.m. and p.m. peak hours.
- The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are operating at a LOS "B" or better during the a.m. and p.m. peak hours.
- The stop-controlled South Amazon Access at Boundary Road is operating below capacity at a LOS "D" or better during the a.m. and p.m. peak hours.
- The stop-controlled Mitch Owens Road connection to Boundary Road is operating below capacity at a LOS "E" for the eastbound left turn movement during the a.m. and p.m. peak hours. All other movements at the intersection are at a LOS "A".

### Future Background Traffic Operations

Under the 2025, 2030 and 2035 future background conditions:

- The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is forecast to operate at a LOS "E" or better during the a.m. peak hour and a LOS "B" or better during the p.m. peak hour.

- The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are both forecast to operate at a LOS "D" or better during the a.m. and p.m. peak hours.
- The stop-controlled South Amazon Access at Boundary Road is projected to operate at a LOS "E" and "F" during the a.m. and p.m. peak hours, respectively.
- The stop-controlled Mitch Owens Road connection to Boundary Road is expected to operate at a LOS "F" during the a.m. and p.m. peak hours. However, similar to Novatech's recommendation, adding a northbound left turn lane (2025 horizon) and implementing traffic signals (2035 horizon) is expected to result in a forecasted LOS "B" or better during the a.m. and p.m. peak hours.

### Future Total Traffic Operations

For the 2025, 2030 and 2035 total traffic conditions (includes site generated trips), the study intersections are projected to operate as follows:

- The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is forecast to operate at a LOS "F" or better during the a.m. peak hour and a LOS "C" or better during the p.m. peak hour.
- The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are both forecast to operate at a LOS "D" or better during the a.m. and p.m. peak hours, similar to the future background conditions.
- The stop-controlled Mitch Owens Road connection to Boundary Road is expected to operate at a LOS "F" during the a.m. and p.m. peak hours under the ultimate 2035 horizon. Similar to the future background conditions, adding the northbound left turn lane (2025 horizon) and implementing traffic signals (2035 horizon) is expected to result in a forecasted LOS "B" or better during the a.m. and p.m. peak hours.
- The stop-controlled South Amazon Access at Boundary Road is projected to operate at a LOS "F" during the a.m. and p.m. peak hours under the ultimate 2035 horizon. This is a future background issue and is attributable to an increase in through volumes on Boundary Road.
- The proposed three stop-controlled site access connections to Thunder Road are projected to operate below capacity at a LOS "B" or better during the a.m. and p.m. peak hours, under all study horizons.

A signal warrant assessment based on the ultimate 2035 traffic volumes indicates that traffic signals are not warranted at the intersections of Boundary Road and South Amazon Access / Site Access and Thunder Road with the proposed three Site Accesses. Additionally, no left or right turn auxiliary lanes are warranted on Thunder Road or Boundary Road at the site access connections.

The proposed site accesses are projected to operate efficiently and safely without any issues related to sight-lines, corner clearance, access conflicts, truck movements and transit operational conflicts.

The vehicle parking supply of for each of the three buildings exceeds the City's Zoning By-Law minimum parking requirements.

Recommendations and Conclusion

Given the analysis herein, the recommendations presented in the Table E-1 should be considered to support the proposed development.

**Table E-1: Summary of Recommendations for Development Full build-Out**

Category	Improvement	Responsibility	Timeline
<b>Parking</b>	Provide bicycle parking spaces for each building per City of Ottawa Zoning By-Law 2008-250 requirements	Developer	Full build-out (2025)
<b>Roadway Improvements</b>	<b>Boundary Road and Site Access / South Amazon Access:</b> Repurpose existing runout lane at south approach to provide auxiliary northbound left-turn with 15 metres of storage	Developer	Full build-out (2025)
<b>Network Monitoring</b>	<b>Boundary Road south of Highway 417 Westbound Ramp Terminal:</b> Monitor future traffic growth and demand on Boundary Road to identify any future potential network concept changes to accommodate the forecasted volumes from a capacity perspective (e.g., road widening to add additional through lanes).	City of Ottawa	Ongoing (prior to 2031 planning year)
<b>TDM Measures</b>	Provide cycling provisions such as secure bicycle parking, lockers, and showers	Developer	Full build-out (2025)
	Provide preferred carpool parking spaces to promote carpooling	Developer	Full build-out (2025)
	Co-ordinate with City to list development on the City's ride-matching portal and/or implement an internal ride-matching service to help employees find carpool partners	--	Full build-out (2025)
	Implement an Emergency Ride Home program to guarantee employees a ride home in the case of an emergency	--	Full build-out (2025)
	Provide information on available TDM opportunities through promotion and education	--	Full build-out (2025)
	Establish a TDM program to monitor implementation and effectiveness of TDM measures	--	Full build-out (2025)

Further, in addition to the City's network monitoring, given the potential long term impact of the Covid-19 pandemic on home-work trips, the forecasted future volumes may be overstated, it is important to monitor intersection volumes in future to confirm if any roadway improvements and or traffic signal modifications are needed for optimal performance of relevant surrounding intersections.

Based on this study findings, it is our conclusion that the traffic generated by the proposed industrial development at Thunder Road and Boundary Road can be accommodated by the boundary road network. The Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) applications can be supported from a traffic operations perspective as the boundary road system is forecast to adequately accommodate the increase in traffic volumes attributable to the proposed development.

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## 1.0 Introduction

### 1.1 Background

Crozier & Associates Inc. (Crozier) was retained by Thunder Road Developments (2019) Inc. to prepare a Transportation Impact Assessment in support of the Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) applications for the proposed industrial development located at Thunder Road and Boundary Road in the City of Ottawa.

Based on the City of Ottawa's "Transportation Impact Assessment Guidelines (2017)" requirements a Transportation Impact Assessment (TIA) Screening and Scoping Report, a Forecasting Report and a Strategy Report were all submitted and confirmed by the City of Ottawa as part of the first four steps of the TIA submission process.

As required by the City's TIA Guidelines, this TIA report fulfils the final step of the TIA submission by compiling the TIA Screening and Scoping, Forecasting and Strategy Reports into a single document to support the proposed development application.

The subject property is within the Ministry of Transportation of Ontario (MTO) Permit Controlled Area and therefore subject to MTO review and approval, including conformance to the MTO's "Traffic Impact Study Guideline" (September 2014). Thus, the scope of work presented in this TIA report conforms to both the City and MTO's guidelines.

### 1.2 Subject Property

The subject property covers an area of approximately 43.15 acres and is located in a rural area east of the urban core of Ottawa. The subject property is located south of Highway 417 and near the Amazon Facility east of Boundary Road that was constructed in 2019. Highway 417 functions as the transportation link between Ottawa and Quebec.

The subject property is designated as "General Rural Area" per the City's Official Plan which permits farms, rural housing, wood lots and forests, small industries, golf courses and existing clusters of residential subdivisions and severances and commercial development. It is noted that the east side of Boundary Road is identified as "Employment Area" per the City's Official Plan.

The subject property is currently zoned as "Rural Countryside Zone" (RU) per the City's Zoning By-Law 2008-250. The purpose of the RU zone is to "accommodate agricultural, forestry, country residential lots created by severance and other land uses characteristic of Ottawa's countryside, in areas designated as General Rural Area, Rural Natural Features and Greenbelt Rural in the Official Plan..."

The subject property is bound by Thunder Road to the north, treed areas to the south and west, and Boundary Road to the east. With the exception of two residences at Boundary Road and a residential dwelling on Thunder Road, the subject property is primarily vacant. **Figure 1** contains the Site Location Plan.

### 1.3 Development Proposal

Per the Conceptual Site Plan prepared by Ware Malcomb dated November 2, 2020 (see **Appendix A**), the development proposes the following:

- An industrial building (Industrial Building 1) with 600,611 sq. ft of Gross Floor Area (GFA), 426 auto parking spaces, 98 trailer parking spaces and two full-moves accesses to Thunder Road;
- An industrial building (Industrial Building 2) with 41,449 sq. ft of GFA, 57 auto parking spaces and a full-moves access to Thunder Road, and
- An industrial building (Industrial Building 3) with 31,988 sq. ft of GFA, 52 auto parking spaces and a full-moves access to Boundary Road opposite the South Amazon access.

The development is expected to be built-out and occupied within a five-year horizon (i.e., 2025).

### 2.0 Screening

The City's TIA Guidelines contain a screening form that must be reviewed and completed to determine if a TIA is required for the proposed development. There are three triggers as part of the screening analysis: trip generation trigger, location trigger and safety trigger.

The **trip generation trigger** is satisfied as the proposed industrial development exceeds the 5,000 sq. m threshold.

The **location trigger** is not satisfied as the subject property is not located in a Design Priority Area (DPA), Transit-Oriented Development (TOD) zone, nor fronting a roadway that is part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks.

The **safety trigger** is satisfied as the posted speed limit on Boundary Road is 80 km/h and three of the proposed site accesses are within 300 metres of the signalized intersection of Thunder Road and Boundary Road. Additionally, City staff have identified concerns per the pre-application notes dated December 23, 2019 regarding the location of the proposed site accesses to Thunder Road particularly near the horizontal curve.

Therefore, a TIA is required to support the proposed development leading into the next step of scoping the work. The completed screening form is included as **Appendix B**.

### 3.0 Scoping

#### 3.1 Existing Conditions

##### 3.1.1. Roadways

The boundary road network is described in **Table 3-1**.

**Table 3-1: Boundary Road Network – Roadways**

Feature	Roadway				
	Highway 417	Thunder Road	Boundary Road	Mitch Owens Road	Amazon Way
Direction	Two-way (East-West)	Two-way (East-West)	Two-way (North-South)	Two-way (East-West)	Two-way (East-West)
Jurisdiction	MTO	Ottawa	Ottawa	Ottawa	Private
Classification	Highway	Collector	Arterial (Regional Road 41)	Arterial (Regional Road 8)	Private Road
Speed Limit	110 km/h posted <sup>1</sup> 40 km/h advised for ramps	60 km/h posted	80 km/h posted	80 km/h posted	15 km/h posted
Span	Highway 17 to Quebec	Ramsayville Road to Boundary Road	Russel Road to Craig Street	Regional Road 49 to Boundary Road	Boundary Road to within the site
Alignment in Study Area	Straight and Flat	45m radius curve west of Boundary Road, straight westerly Flat	Straight and Flat	Straight and Flat	Straight and Flat
Existing Developments in Study Area	None	Residential dwellings on south side, gas-station at southwest corner of intersection with Boundary Road	Distribution centre and other commercial uses, gas-station at southwest corner of intersection with Thunder Road	None	Distribution centre (Amazon)
Number of travel lanes	Four	Two	Two	Two	Two
Divided?	Yes	No	No	No	No
Intersection Control	Signal control at East Terminal and stop control at West Terminal	Signal control at Boundary Road	Signal control at Thunder Road and Amazon Way	Stop control at Boundary Road	Signal control at Boundary Road

Note 1: The posted speed limit of 110 km/h is a part of an MTO Pilot Project for 110 km/h speed limits within Ontario.

**Figure 2** illustrates the existing boundary road network lane configurations and intersection control.

### 3.1.2. Intersections

**Table 3-2** outlines the existing traffic control, configurations, and pedestrian crossing provisions at the intersections on the boundary road network.

**Table 3-2: Boundary Road Network – Intersections**

Intersection	Control	Approaches	Major Street	Lane Configurations	Pedestrian Crossing
Boundary Road and Highway 417 Westbound Terminal	Stop (Minor Street)	3	Boundary Road	NBTR SBLT WBLR	None
Boundary Road and Highway 417 Eastbound Terminal	Signal	3	Boundary Road	NBL NBT SBTR EBL EBR – channelized	South and West Approaches
Boundary Road and Thunder Road / Amazon Way	Signal	4	Boundary Road	SBL SBTR NBL NBT NBR WBTL WBR EBTLR	All Approaches
Boundary Road and South Amazon Access	Stop (Minor Street)	3	Boundary Road	NBTR SBL SBT WBLR	East Approach
Boundary Road and Mitch Owens Road	Stop (Minor Road)	3	Boundary Road	EBR EBL NBTL SBR SBT	None

The Amazon Facility Y0W1 has recently been constructed in the study area. A review of the supporting “Transportation Impact Study Addendum #1” prepared by NOVATECH (dated April 2018, herein referred to as the NOVATECH study) indicates that roadway improvements were recommended along Boundary Road at the Amazon site accesses, and the Highway 417 south ramp terminal. The intersection improvements were implemented in 2019 including auxiliary turn lanes at the intersections, as well as traffic signal control at the intersections of Boundary Road and Thunder Road / Amazon Access, and Boundary Road and Highway 417 south ramp terminal.

### 3.1.3. Adjacent Driveways

There are several existing driveways on the boundary road network within 200 metres of the proposed site accesses as described below:

- Four driveways to residential dwellings on the south side of Thunder Road, west of the proposed site access to Building 2;
- One driveway to a residential dwelling on the south side of Thunder Road, between the proposed site accesses to Buildings 1 and 2. This driveway will be removed as part of the development proposal;
- One driveway to a gas station on the south side of Thunder Road, at the southwest corner of Thunder Road and Boundary Road;
- One driveway to a gas station on the west side of Boundary Road, at the southwest corner of Thunder Road and Boundary Road;
- One driveway to a restaurant on the west side of Boundary Road, north of the proposed site

- access to Building 3;
- Two driveways to residential dwellings on the west side of Boundary Road, south of the proposed site access to Building 3 (these dwelling units are within the development boundary and thus would be replaced by the development build-out);
- One driveway to a commercial use on the west side of Boundary Road, south of the proposed site access to Building 3;
- One driveway to a residential dwelling on the east side of Boundary Road at the southeast corner of Thunder Road and Amazon Way;
- Two driveways to a commercial use on the east side of Boundary Road, north of the proposed site access to Building 3;
- One driveway to the Amazon Facility on the east side of Boundary Road, opposite the proposed site access to Building 3;
- Two driveways to commercial properties on the east side of Boundary Road, south of the proposed site access to Building 3; and
- One driveway to a residential dwelling on the east side of Boundary Road, south of the proposed site access to Building 3.

### 3.1.4. Existing Transit Services

OC Transpo operates one transit route within the study area. **Table 3-3** outlines the existing transit route, direction, days of operation, peak hour headways, and the location of bus stops in the study area.

**Table 3-3: Existing Transit Services**

Route	Direction	Span	Days of Operation	Peak Hour Headways (min)	Bus Stops in Study Area
Route 222 (OC Transpo)	West (AM Peak) East (PM Peak)	Rockdale Road to Blair Station	Monday to Friday (6:00AM - 9:00AM and 3:00PM – 6:00PM)	60	None (Bus stop 1.25 km north of site on Boundary Road at GreyHawk Golf Club)

As outlined above, one bus route operates within the study area but does not actually service the immediate site frontage nor the nearby distribution centre. As there are no pedestrian facilities on Boundary Road between the site and the existing bus stop at GreyHawk Golf Club, there is a lack of convenient transit accessibility to and from the immediate study area. Additionally, the route only operates westbound (from Rockdale Road to Blair Station) during the weekday a.m. peak period and vice versa during the weekday p.m. peak period.

### 3.1.5. Existing Active Transportation Facilities

The existing active transportation facilities on the boundary road network are described in **Table 3-4**.

**Table 3-4: Existing Active Transportation Network**

Roadway	Pedestrian Facilities	Separation from Roadway	Cycling Facilities	Separation from Roadway
Highway 417	None	N/A	None	N/A
Thunder Road	None	N/A	None	N/A
Boundary Road	None	N/A	Paved Shoulders – Highway 417 Eastbound Terminal to South Amazon Access	None
Mitch Owens Road	None	N/A	None	N/A

As outlined above, the only existing pedestrian or cycling facilities in the study area are paved shoulders on Boundary Road between Highway 417 Eastbound Terminal to the South Amazon Access.

**3.1.6. Area Traffic Management**

There are no Area Traffic Management measures in the study area nor are there any Area Traffic Management studies in progress.

**3.1.7. Existing Traffic Volumes**

Commissioned traffic counts were provided by the proponent and collected during the weekday peak periods (6:00 a.m. – 10:00 a.m. and 3:00 p.m. – 7:00 p.m.) on January 7, 2020. The existing traffic volumes are illustrated in **Figure 3** and the traffic count data is included as **Appendix C**.

The recorded volumes on the boundary road network were auto traffic including heavy trucks. No pedestrian volumes were observed during the weekday a.m. and p.m. count periods.

**3.1.8. Collision History**

Historical collision data was provided by the proponent from January 1, 2014 to December 31, 2018. A collision analysis was conducted to identify any existing collision trends in the area, with the critical threshold per the City’s guidelines being more than six collisions within a five-year time frame for any collision type. The collision data is included as **Appendix D**.

**Table 3-5** outlines the collision frequency by type, severity, and weather conditions in the area



**Table 3-5: Collision History**

<b>Intersection</b>	<b>Collision Type</b>	<b>Severity</b>	<b>Weather Conditions</b>
Boundary Road and Highway 417 Westbound Ramp Terminal	Angle – 2 Rear-End – 5 Sideswipe – 1 Single Manned Vehicle (SMV)/Other – 1 <b>Total - 9</b>	Fatal – 1 Property Damage (PD) Only - 8	Rain – 1 Clear - 8
Boundary Road and Highway 417 Eastbound Ramp Terminal	Rear-End – 3 SMV/Other – 1 <b>Total - 4</b>	Injury – 1 PD Only - 3	Rain – 2 Clear – 2
Boundary Road and Thunder Road	Turning Movement – 2 <b>Total - 2</b>	PD Only - 2	Snow – 1 Clear – 1
Boundary Road and Mitch Owens Road	Angle – 7 Rear-End – 3 SMV/Other – 8 <b>Total - 18</b>	Injury – 3 PD Only – 15	Rain – 1 Snow – 2 Fog – 3 Clear - 12

As outlined above, the only collision patterns in the area that exceeds the City's threshold of six collisions within five years are angle collisions and SMV / other collisions at the intersection of Boundary Road and Mitch Owens Road, with seven and eight collisions (respectively) in the five-year time period.

Therefore, the TIA will include a safety analysis of the intersection of Boundary Road and Mitch Owens Road to identify existing conditions at the intersection and opportunities to address the pattern of angle collisions and SMV / other collisions, particularly under future conditions with the inclusion of development generated traffic.

### **3.2 Future Planned Conditions**

#### **3.2.1. Roadway Improvements**

No future roadway capacity improvements nor alternative transportation infrastructure plans have been identified on Thunder Road nor Boundary Road in the study area per the City's Transportation Master Plan (2013). Further, several roadway improvements have recently been implemented on Boundary Road to support the Amazon Facility build-out.

However, the City is currently updating their Transportation Master Plan which may include improvements to Thunder Road or Boundary Road. The City can confirm if any future improvements are planned in the study area.

#### **3.2.2. Background Developments**

A review of the City's development applications map indicates a background development located on the properties at 5471-5613 Boundary Road and 5508-5800 Frontier Road. The development application is for Site Plan Control and is for a future waste management facility for the Capital Region Resource Recovery Centre (CRRRC). Thus, this development will be accounted for in the TIA. In the absence of current anticipated development build-out timing, build-out of the development will be accounted for under all future horizon years.

### **3.3 Study Area**

The study area for the TIA will consist of the following study intersections:

- Highway 417 and Westbound Terminal
- Highway 417 and Eastbound Terminal
- Thunder Road and Boundary Road / Amazon Way
- Boundary Road and South Amazon Access / future site access
- Boundary Road and Mitch Owens Road

### **3.4 Time Periods**

The employment nature of the proposed development will result in additional traffic on the boundary road network during the critical weekday commuter peak hours. Per typical TIS practice for employment developments, the TIA will analyze the weekday a.m. and p.m. peak periods.

### **3.5 Horizon Years**

Per the City's guidelines, the year of full build-out and the five-year horizon must be analyzed. However, the MTO requires analysis of the year of full build-out, the five-year horizon and ten-year horizon.

It can reasonably be assumed that the development will be built-out by 2025. Therefore, the TIA will analyze the 2025, 2030 and 2035 horizon years.

### **3.6 Exemptions Review**

This section reviews possible exemptions in the scope of work elements of the TIA study per the City's guidelines. **Table 3-6** summarizes the City's possible exemptions and the developments status in meeting the exemption.

**Table 3-6: Possible Exemptions**

Module	Element	Exemption Condition	Development Status
<b>Design Review Component</b>			
Development Design	Circulation and Access	Only required for Site Plans	Not exempt
	<b>New Street Networks</b>	<b>Only required for Plans of Subdivision</b>	<b>Exempt</b>
Parking	Parking Supply	Only required for Site Plans	Not exempt
	<b>Spillover Parking</b>	<b>Only required for Site Plans where parking supply is 15% below unconstrained demand</b>	<b>Exempt</b>
Transportation Demand Management	All elements	Not required for Site Plans expected to have fewer than 60 employees and/or students on location at any given time	Not exempt
Neighbourhood Traffic Management	<b>Adjacent Neighbourhoods</b>	<b>Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds</b>	<b>Exempt</b>
Network Concept	---	Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	Not exempt

Therefore, the TIA will contain analysis of circulation and access, parking supply and demand, Transportation Demand management, and Network Concept (changes to Transportation Master Plan concepts for auto and transit use).

## 4.0 Forecasting

### 4.1 Trip Generation Forecasts

Trip generation for the proposed development was forecasted using the latest published data from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10<sup>th</sup> Edition. The ITE Trip Generation Manual is a compendium of industry collected trip generation data across North America for a variety of land uses and is used industry wide as a source for trip generation forecasts.

#### 4.1.1. Auto Trip Generation

The trip generation rates for Land Use Category (LUC) 150 “Warehousing” were applied to the proposed industrial buildings to forecast auto trips generated by the buildings. The fitted curve equation was applied to the proposed building GFAs from which a trip generation rate (trips generated per 1,000 sq. ft) was reverse calculated to determine non-auto trip generation rates.

The total trip generation for the proposed industrial buildings was categorized into passenger cars and heavy truck traffic. Per the ITE Trip Generation Handbook (3<sup>rd</sup> Edition), Table I.1, approximately 20% of site traffic generated by LUC 150 “Warehousing” on a weekday is heavy truck traffic. Site traffic generated by similar land use LUC 130 “Industrial Park” consists of between 1-31% of heavy truck traffic during the weekday peak hours with an average of 13%, and site traffic generated by similar land use LUC 152 “High-Cube Warehouse/Distribution Centre” consists of between 9-29% of heavy truck traffic during the weekday peak hours. Therefore, an estimate of 20% for heavy truck traffic is considered

reasonable.

**Table 4-1** outlines the auto trip generation for the proposed development.

**Table 4-1: Auto Trip Generation**

Building	GFA	Land use	Trips Generated – A.M. Peak			Trips Generated – P.M. Peak		
			In	Out	Total	In	Out	Total
<b>Total Auto Trip Generation</b>								
1	600,611 sq. ft	Industrial	<b>75</b> (77%)	<b>22</b> (23%)	<b>97</b> (0.17)	<b>27</b> (27%)	<b>73</b> (73%)	<b>100</b> (0.17)
2	41,449 sq. ft	Industrial	<b>23</b> (77%)	<b>7</b> (23%)	<b>30</b> (0.72)	<b>9</b> (27%)	<b>24</b> (73%)	<b>33</b> (0.80)
3	31,988 sq. ft	Industrial	<b>22</b> (77%)	<b>7</b> (23%)	<b>29</b> (0.91)	<b>9</b> (27%)	<b>23</b> (73%)	<b>32</b> (1.00)
<b>DEVELOPMENT TOTAL:</b>			<b>120</b>	<b>36</b>	<b>156</b>	<b>45</b>	<b>120</b>	<b>165</b>
<b>Passenger Car Trip Generation (80%)</b>								
1	600,611 sq. ft	Industrial	<b>60</b>	<b>18</b>	<b>78</b>	<b>22</b>	<b>58</b>	<b>80</b>
2	41,449 sq. ft	Industrial	<b>18</b>	<b>6</b>	<b>24</b>	<b>7</b>	<b>19</b>	<b>26</b>
3	31,988 sq. ft	Industrial	<b>18</b>	<b>6</b>	<b>24</b>	<b>7</b>	<b>18</b>	<b>25</b>
<b>DEVELOPMENT TOTAL:</b>			<b>96</b>	<b>30</b>	<b>126</b>	<b>36</b>	<b>95</b>	<b>131</b>
<b>Heavy Truck Trip Generation (20%)</b>								
1	600,611 sq. ft	Industrial	<b>15</b>	<b>4</b>	<b>19</b>	<b>5</b>	<b>15</b>	<b>20</b>
2	41,449 sq. ft	Industrial	<b>5</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>5</b>	<b>7</b>
3	31,988 sq. ft	Industrial	<b>4</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>5</b>	<b>7</b>
<b>DEVELOPMENT TOTAL:</b>			<b>24</b>	<b>6</b>	<b>30</b>	<b>9</b>	<b>25</b>	<b>34</b>

The full build-out of the proposed development is expected to generate approximately 126 and 131 total two-way passenger car trips during the weekday a.m. and p.m. peak hour, respectively, and approximately 30 and 34 total two-way heavy truck trips during the weekday a.m. and p.m. peak hour, respectively.

Given that the proposed development is solely industrial use, no trip synergy is expected between the buildings and no pass-by trips are expected to be generated by the development. Therefore, no internal trip synergy reductions or pass-by trip reductions were applied.

#### **4.1.2. Non-Auto Trip Generation**

The City's TIA Guidelines provide methodology for forecasting non-auto trips using the ITE Trip Generation Rates, as follows:

- Assume a 10% non-auto mode share for trips generated by the proposed development for low-density areas with low transit mode shares; and
- Assume an average vehicle occupancy of 1.15 for the purposes of translating auto trips to person trips.

The methodology outlined above equates to a factor of 1.28 to be applied to the ITE auto trip rates outlined in **Table 1** to forecast person trips.

**Table 4-2** outlines the non-auto trip generation for the proposed development.

**Table 4-2: Non-Auto Trip Generation**

Building	GFA	Land use	Trips Generated – A.M. Peak			Trips Generated – P.M. Peak		
			In	Out	Total	In	Out	Total
<b>Total Person Trip Generation</b>								
1	600,611 sq. ft	Industrial	<b>95</b> (77%)	<b>29</b> (23%)	<b>124</b> (0.21)	<b>35</b> (27%)	<b>93</b> (73%)	<b>128</b> (0.21)
2	41,449 sq. ft	Industrial	<b>29</b> (77%)	<b>9</b> (23%)	<b>38</b> (0.93)	<b>11</b> (27%)	<b>31</b> (73%)	<b>42</b> (1.02)
3	31,988 sq. ft	Industrial	<b>28</b> (77%)	<b>9</b> (23%)	<b>37</b> (1.16)	<b>11</b> (27%)	<b>30</b> (73%)	<b>41</b> (1.28)
<b>DEVELOPMENT TOTAL:</b>			<b>152</b>	<b>47</b>	<b>199</b>	<b>57</b>	<b>154</b>	<b>211</b>
<b>Non-Auto Trip Generation (10%)</b>								
1	600,611 sq. ft	Industrial	<b>10</b>	<b>3</b>	<b>13</b>	<b>4</b>	<b>9</b>	<b>13</b>
2	41,449 sq. ft	Industrial	<b>3</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>4</b>
3	31,988 sq. ft	Industrial	<b>3</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>4</b>
<b>DEVELOPMENT TOTAL:</b>			<b>16</b>	<b>5</b>	<b>21</b>	<b>6</b>	<b>15</b>	<b>21</b>

The full build-out of the proposed development is expected to generate approximately 199 and 211 total person trips during the weekday a.m. and p.m. peak hour, respectively, and approximately 21 and 21 total non-auto trips during the weekday a.m. and p.m. peak hour, respectively.

## 4.2 Mode Shares

### 4.2.1 Existing Mode Shares

The National Capital Region (NCR) Origin-Destination survey was reviewed to identify existing mode shares in the study area for transit, walking, cycling, auto passengers and auto trips for the Traffic Assessment Zone (TAZ) that contains the proposed development.

The subject property is located in the Rural Southeast TAZ. Thus, the latest census data (2011) was analyzed for the Rural Southeast TAZ. Specifically, the mode shares for trips entering and exiting the Rural Southeast TAZ during the weekday a.m. and p.m. peak periods (6:30 a.m. – 9:00 a.m., and 3:30 p.m. – 6:00 p.m.) were analyzed and are outlined in **Table 4-3**.

**Appendix E** contains the NCR survey data.

**Table 4-3: Existing Mode Share**

Travel Mode	Weekday A.M. Peak Period		Weekday P.M. Peak Period		Average	Assumed Existing for Study Area
	Inbound	Outbound	Inbound	Outbound		
Auto Driver	69%	68%	73%	64%	69%	77%
Auto Passenger	9%	14%	18%	30%	18%	20%
Transit	0%	6%	5%	3%	3%	3%
Cycling	0%	0%	0%	0%	0%	0%
Walking	2%	0%	0%	0%	0%	0%
Other <sup>1</sup>	20%	12%	4%	3%	10%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Note 1: Per the NCR survey methodology, "other" refers to trips made by school bus, paratransit, taxi, motorcycle/scooter, intercity/chartered bus, ferry, rail transit or air.

As outlined above, the average auto mode share is approximately 87% and the average non-auto mode share is approximately 13%. It is noted that the mode share for "other" is significantly higher during the weekday a.m. peak hour compared to the weekday p.m. peak hour. This could be attributed to school bus activity during the morning school hours which overlap with the weekday a.m. commuter peak hours, whereas afternoon school hours do not typically overlap with weekday p.m. commuter peak hours.

It is further noted that the Rural Southeast TAZ consists of suburban areas such as Greely and Metcafe which may act as the origin or destination points for walking and other trips such as school bus and taxi. The subject lands are located in a rural area with no nearby suburban areas that would act as origin or destination points for walking trips and other trips made by school bus, ferry, rail, or air.

Therefore, the existing "other" mode share for the immediate study area would realistically be expected to be none or negligible at best. Thus, the mode share for auto driver and auto passenger would be expected to be higher than the average from the census data. The transit mode share assumption of 3% is also considered conservative as the nearest transit facility in the study area is the Route 222 (OC Transpo) bus stop at the GreyHawk Golf Club located 1.25 kilometres north of the subject property and there are no existing pedestrian facilities on Boundary Road in the area. Additionally, the route only operates westbound (from Rockdale Road to Blair Station) during the weekday a.m. peak period and vice versa during the weekday p.m. peak period, further limiting transit service availability for employees of the proposed future development.

Based on these assumptions, the existing non-auto mode share in the study area is only 3% which is less than the City's standard base assumption of 10% for low-density areas. This means that the person and non-auto trip generation forecasts outlined in **Table 4-2** may be overstated.

#### **4.2.2. Future Mode Shares Targets**

Future mode share targets have been established for the proposed development considering the context of the development proposal, the assumed horizon year of 2025 for build-out, planned future roadway capacity and alternative transportation infrastructure improvements in the study area, and non-auto trip generation opportunities of the proposed development.

**Table 4-4** outlines the future mode share targets for the proposed development.

**Table 4-4: Future Mode Share Targets**

Travel Mode	Assumed Existing Mode Share for Study Area	Target Mode Share (2025)	Rationale
Auto Driver	77%	70% (-7%)	Potential to increase auto passenger and transit mode shares may result in reductions in single-occupant vehicle (SOV) trips
Auto Passenger	20%	27% (+7%)	Potential for development to promote carpooling (e.g., provide preferred carpool parking spaces) to reduce SOV trips
Transit	3%	3%	Nearest transit stop is 1.25 kilometres north of site with no pedestrian facilities on Boundary Road, and weekday peak hour transit services are limited to westbound only in a.m. peak hour and eastbound only in p.m. peak hour
Cycling	0%	0%	Rural area with no nearby origin/destination points for cycling or walking trips, no planned cycling or walking infrastructure improvements in the study area, warehouse distribution nature of development typically not associated with cycling or walking trips
Walking	0%	0%	
<b>Total</b>	<b>100%</b>	<b>100%</b>	--

As outlined above, a heavy reliance on auto travel is still expected in the future given the warehouse distribution nature of the proposed development, the rural context of the study area with no nearby origin or destination points for walking or cycling trips, and the absence of planned alternative transportation infrastructure improvements in the study area.

However, there are potential opportunities for the proposed development to reduce single-occupant vehicle (SOV) trips by promoting carpooling (e.g., provide preferred carpool parking spaces and incentives for employees to travel together), thus reducing the SOV trips generated by the proposed development. Co-ordination with City staff should also occur to list the proposed future development on the City's ride-matching portal to increase and encourage carpooling opportunities for employees.

### 4.3 Trip Distribution and Assignment

#### 4.3.1. Employee Trip Distribution

The employee trips generated by the proposed development will be distributed to the road network based on origin and destination data from the NCR survey (2011) for the Rural Southeast and Rural East TAZ, given that the subject property is adjacent to the Rural East TAZ. The percentage of trips from origin points outside of the study area entering the study area during the weekday a.m. peak hour were analyzed, and the following trip distribution was derived:

- 35% to and from the south via Boundary Road
- 5% to and from the south/west via Mitch Owens Road
- 20% to and from the north via Boundary Road
- 25% to and from the west via Highway 417
- 15% to and from the east via Highway 417

**Appendix E** contains the NCR survey data and **Appendix F** contains the trip distribution analysis based on percentage of trips from various origin points.

It is noted that this trip distribution is similar to the trip distribution that was applied to the "Transportation Impact Study Addendum #1" prepared by NOVATECH for the Amazon Warehouse and Distribution Facility (Y0W1) that was recently constructed in the study area. The study was prepared in April 2018 and is herein referred to as the NOVATECH study.

Employee trip distribution was derived in the NOVATECH study based on:

- origin and destination data provided by the proponent;
- origin and destination data from the NCR survey (2011) for the Rural Southeast and Rural East TAZ; and
- the population of surrounding communities per Statistics Canada.

The rationale listed above are accepted justification for trip distribution assumptions per the City's TIA Guidelines. Additionally, the 2011 NCR survey data used in the NOVATECH study still reflects the latest NCR survey data that is currently available.

The assumed trip distribution for employees in the NOVATECH study is as follows:

- 30% to and from the south via Boundary Road
- 5% to and from the south/west via Mitch Owens Road
- 20% to and from the north via Boundary Road
- 25% to and from the west via Highway 417
- 20% to and from the east via Highway 417

The study was approved by the City in 2018 and the proposed development will operate similarly to this warehouse and distribution facility. Therefore, given the similar land use and the similar trip distributions, the employee trip distribution in the NOVATECH study will be applied to this TIA for consistency.

#### **4.3.2. Heavy Truck Trip Distribution**

The heavy truck trips generated by the proposed development will be distributed to the road network based on expected catchment areas for heavy trucks. The City of Ottawa and surrounding areas, as well as the Gatineau areas of Quebec are considered to be the major truck origin and destination points to the west, and the Montreal and surrounding areas are considered to be the major truck origin and destination point to the east. Therefore, a reasonable truck distribution is as follows:

- 60% to and from the west via Highway 417
- 40% to and from the east via Highway 417

Heavy truck trip distribution was derived in the NOVATECH study based on logical routing assumptions (given Ottawa to the west and Quebec to the east via Highway 417), as follows:

- 65% to and from the west via Highway 417
- 35% to and from the east via Highway 417

Given the similar land use and the similar assumed trip distributions, the heavy truck trip distribution in the NOVATECH study will be applied to this TIA for consistency.



### **4.3.3. Trip Assignment**

Employee and truck trips generated by the proposed development will be assigned to the road network based on the trip distribution outlined in subsequent Sections. Trips are assumed to travel to and from their origin and destination points based on the most convenient route available and the route with the shortest travel time.

For Building 1, employees are expected to enter and exit the site via the easterly access to Thunder Road (located at the horizontal curve) and the proposed access to Boundary Road. Heavy trucks are expected to enter and exit the site via the westerly access to Thunder Road. The westerly access extends within the site as a drive aisle solely connecting to the truck loading area while employee parking connects solely to the drive aisle extending from the easterly access.

For Building 2, all employees and heavy trucks will enter and exit the site via the sole proposed access to Thunder Road.

For Building 3, all employees and heavy trucks are expected to enter the site via the proposed access to Boundary Road. Most employees and heavy trucks are expected to exit the site via the proposed easterly access to Thunder Road to turn left onto Boundary Road at the signalized intersection.

**Figures 8 and 9** outline the employee and heavy truck trip assignment, respectively.

## **4.4 Background Network Travel Demands**

### **4.4.1. Background Transportation Network Plans**

No future roadway capacity improvements nor alternative transportation infrastructure plans have been identified on Thunder Road nor Boundary Road in the study area per the City's Transportation Master Plan (2013). Further, several roadway improvements have recently been implemented on Boundary Road to support the Amazon Facility build-out.

As mentioned in the Screening and Scoping Report, the City is currently updating their Transportation Master Plan which may include improvements to Thunder Road or Boundary Road. The City can confirm if any future improvements are planned in the study area. However, for the purposes of this study, no background roadway improvements are assumed to occur.

The NOVATECH study that was prepared for the Amazon Facility recommended that the City consider implementing traffic signal control and an auxiliary northbound left-turn lane at the intersection of Boundary Road and Mitch Owens Road. The study found that under 2017 existing conditions, traffic signals and an auxiliary left-turn lane were warranted at the intersection, and that under future total conditions, the forecasted operations at the intersection were poor and indicated the need for traffic signal control. While this improvement has not been implemented as have the NOVATECH recommended improvements on Boundary Road at Highway 417 Eastbound Ramp Terminal and at Thunder Road / Amazon Way, this TIA will consider this recommendation. Therefore, the TIA will analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to compare operations and validate the NOVATECH recommendation.

#### **4.4.2. Background Growth**

Historical growth rates were derived from Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) trends on Highway 417 at the Boundary Road Interchange. The latest AADT and SADT data available are for 2016; thus, growth rates from 2012 to 2016 were analyzed. **Appendix G** contains the growth rate analysis.

A compounded growth rate of 0.19% compounded annually was determined from the AADT for Highway 417 between 2012 and 2016, and a compounded growth rate of 0.66% compounded annually was determined from the SADT for Highway 417 between 2012 and 2016. These low growth rates indicate low traffic growth in the study area.

The NOVATECH study applied a conservative growth rate of 2% compounded annually to existing traffic volumes to forecast future background traffic volumes. This growth rate is exclusive of background development generated traffic in the study area. Additionally, the "Traffic Impact Study – Addendum 2" prepared by Taggart Group of Companies for the future Capital Region Resource Recovery Centre (CRRRC) in the study area also applied a growth rate of 2% compounded annually.

Therefore, given the calculated growth rates in the study area and the growth rate applied in background studies, the 2% growth rate compounded annually will be applied in this TIA for consistency.

#### **4.4.3. Background Development**

A review of the City's development applications map indicates a background development located on the properties at 5471-5613 Boundary Road and 5508-5800 Frontier Road. The development application is for Site Plan Control and is for a future waste management facility for the Capital Region Resource Recovery Centre (CRRRC). Thus, this development will be accounted for in the TIA.

Per Figure 3.1 from the "Traffic Impact Study – Addendum 2" prepared by Taggart Group of Companies for the CRRRC, the development is expected to add site traffic to the study intersections. The weekday peak hour volumes outlined in Figure 3.1 of the CRRRC were added to the boundary road network under 2025, 2030 and 2035 future background conditions. **Appendix H** contains excerpts from the CRRRC TIS. **Figure 4** outlines the CRRRC background site traffic.

#### **4.5 Demand Rationalization**

Preliminary capacity analysis was conducted for this forecasting report to determine if there are any locations or movements under future analysis scenarios where the forecasted demand exceeds capacity. Per the City's TIA guidelines, if the forecasted demand for a location or movement is expected to exceed capacity (i.e., volume-to-capacity ratio exceeding 1.00), then future travel demands must be rationalized to account for capacity limitations on the transportation network.

For the purposes of this analysis, the ultimate build-out scenario (2035 future total conditions) was analyzed. The analysis methodology follows the City's TIA guidelines for Synchro 9.2 inputs and modelling parameters and will be detailed in the TIA Strategy Report as part of the next step in the TIA process.

**Figures 5, 6 and 7** outline the 2025, 2030 and 2035 future background traffic volumes, respectively, on the road network (with the growth rate outlined in Section 4.4.2 applied to the existing volumes plus

the CRRC background site traffic outlined in **Figure 4**). **Figures 10, 11 and 12** outline the 2025, 2030 and 2035 future total traffic volumes, respectively (with the site trip assignment outlined in **Figures 8 and 9** added to the future background traffic volumes).

Preliminary modelling of 2035 future total conditions indicates that the only movement expected to operate with a volume-to-capacity ratio exceeding 1.00 is the eastbound left-turn movement at Boundary Road and Mitch Owens Road during the weekday p.m. peak hour, with a ratio of 1.01. These operations are attributed to the reduced available capacity for the eastbound left-turn movement given the stop-controlled approach and the heavy through volumes on Boundary Road, as evidenced by the high forecasted average delay of 85 seconds.

However, these results are consistent with the findings of the NOVATECH study and as discussed earlier, the NOVATECH study recommended that the City implement traffic signal control and an auxiliary northbound left-turn lane at the intersection to improve traffic operations. If traffic signals are implemented, then the intersection is expected to operate with an average delay less than 20 seconds and a maximum volume-to-capacity ratio less than 0.80, thus resulting in no movements on the road network under 2035 future total conditions expected to exceed capacity.

Therefore, the TIA will analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to rationalize the future forecasted demand at the intersection.

## **5.0 Analysis**

### **5.1 Development Design**

#### **5.1.1. Design for Sustainable Modes**

As detailed in the Forecasting Report (March 2021), there is a heavy reliance on auto travel in the study area given the rural industrial nature of the area and the lack of existing dedicated pedestrian, cycling, and transit facilities. However, there are opportunities for the proposed development to promote non-auto mode of travel as detailed further in Section 5.5.

#### **5.1.2. Circulation and Access**

For Building 1, employees are expected to enter and exit the site via the easterly access to Thunder Road (located at the horizontal curve) and the proposed access to Boundary Road. Heavy trucks are expected to enter and exit the site via the westerly access to Thunder Road. The westerly access extends within the site as a drive aisle solely connecting to the truck loading area while employee parking connects solely to the drive aisle extending from the easterly access.

For Building 2, all employees and heavy trucks will enter and exit the site via the sole proposed access to Thunder Road.

For Building 3, all employees and heavy trucks are expected to enter the site via the proposed access to Boundary Road. Most employees and heavy trucks are expected to exit the site via the proposed easterly access to Thunder Road to turn left onto Boundary Road at the signalized intersection.

Vehicle turning analysis was conducted at the site accesses and within the sites for the most constrained vehicle profiles expected to navigate within the site. The purpose of this analysis is to

determine if there are any expected vehicle maneuverability issues within the site.

Analysis was conducted for the following vehicle profiles:

- a passenger car (per TAC GDGCR standards) navigating the passenger car parking areas;
- a WB-20 tractor semi-trailer (per TAC GDGCR standards) navigating the heavy truck areas; and
- a pumper firetruck navigating around the industrial buildings.

Vehicle turning analysis indicates that there are generally no expected maneuverability constraints within the site. Internal site geometrics and details will be finalized at a later stage in the project.

**Appendix I** contains the vehicle turning diagrams for each vehicle profile.

## 5.2 Parking Analysis

The proposed parking supply for the industrial buildings is outlined in **Table 5-1**.

**Table 5-1: Proposed Passenger Car Parking Supply**

Building	GFA (sq. m)	Proposed Passenger Car Parking Supply
1	55,799	426 spaces
2	3,850	52 spaces
3	2,972	57 spaces

### 5.2.1. Auto Parking

The minimum parking requirements for warehouse land uses in Area D "Rural" per the City of Ottawa Zoning By-Law 2008-250 (consolidated) is:

- 0.8 spaces per 100 sq. m for the first 5,000 sq. m of GFA, and
- 0.4 spaces per 100 sq. m for GFA greater than 5,000 sq. m.

**Table 5-2** outlines the minimum auto parking required for each building compared to the proposed supply for each building.

**Table 5-2: City of Ottawa Zoning By-Law Minimum Auto Parking Requirements**

Building	GFA (sq. m)	Zoning Land Use	Minimum Spaces Required	Proposed Supply	Surplus or Deficiency
1	55,799	Warehouse	244 spaces	426 spaces	+182
2	3,850	Warehouse	31 spaces	52 spaces	+21
3	2,972	Warehouse	24 spaces	57 spaces	+33

As outlined above, the proposed parking supply for each building exceeds the minimum requirements per the City's Zoning By-Law. Therefore, the proposed auto parking supply is sufficient.

### 5.2.2. Bicycle Parking

The minimum bicycle parking requirements for the proposed warehouse development per the City's Zoning By-Law are calculated as follows:

- 1 space per 2,000 sq. m of GFA

**Table 5-3** outlines the minimum bicycle parking required for each building.

**Table 5-3: City of Ottawa Zoning By-Law Minimum Bicycle Parking Requirements**

Building	GFA (sq. m)	Zoning Land Use	Minimum Bicycle Parking Spaces Required
1	55,799	Warehouse	28
2	3,850	Warehouse	2
3	2,972	Warehouse	2

Bicycle parking spaces should be provided for each building in conformance with the City's Zoning By-law to encourage cycling as a viable mode of transportation to and from the site.

### 5.3 Boundary Streets

#### 5.3.1. Multi-modal Level of Service

A multi-modal level of service (MMLOS) assessment was conducted for non-auto modes of transportation in the study area following the City's MMLOS guidelines. **Table 5-4** outlines the MMLOS for pedestrian, cycling, transit and truck modes.

**Table 5-4: Boundary Street Multi-Modal Levels of Service**

Intersection	Approach / Direction	Pedestrian LOS	Cycling LOS	Transit LOS	Truck LOS
Boundary Road between Highway 417 Eastbound Ramp Terminal	Northbound	F	F	E	C
	Southbound	F	F	E	C
Boundary Road and Thunder Road / Amazon Way	East Approach	C	F	N/A <sup>2</sup>	E
	West Approach	B	D	N/A <sup>2</sup>	E
	North Approach	E	F	N/A <sup>2</sup>	E
	South Approach	E	F	N/A <sup>2</sup>	E
Thunder Road west of Boundary Road	Eastbound	F	F	E	C
	Westbound	F	F	E	C
Boundary Road between Thunder Road and South Amazon Access	Northbound	F	F	E	C
	Southbound	F	F	E	C
Boundary Road and Thunder Road / South Amazon Access	East Approach	N/A <sup>1</sup>	D	N/A <sup>2</sup>	C
	West Approach	N/A <sup>1</sup>	N/A <sup>3</sup>	N/A <sup>2</sup>	N/A <sup>3</sup>
	North Approach	N/A <sup>1</sup>	D	N/A <sup>2</sup>	N/A <sup>3</sup>
	South Approach	N/A <sup>1</sup>	N/A <sup>3</sup>	N/A <sup>2</sup>	C
Boundary Road between South Amazon Access and Mitch Owens Road	Northbound	F	F	E	C
	Southbound	F	F	E	C

Note 1: Analysis not completed due to intersection constraints with unsignalized intersection while calculations require a signalized intersection per the City of Ottawa's "The Multimodal Level of Service (MMLoS) Guidelines".

Note 2: Transit Level of Service at intersections not required for Rural areas per City of Ottawa's "The Multimodal Level of Service (MMLoS) Guidelines".

Note 3: Leg of intersection required to complete analysis is not constructed (i.e., no leg for cyclists to turn left onto or from, or no leg for trucks to turn right onto or from).

The multi-modal level of service analysis results reflects the existing rural industrial nature of the area and the lack of existing dedicated pedestrian, cycling, and transit facilities on the road network. Additionally, no future multi-modal improvements are currently identified in the study area.

### 5.3.2. Road Safety Analysis

As identified in the Screening and Scoping Report, safety analysis was conducted for the intersection of Boundary Road and Mitch Owens Road to address the existing pattern of angle collisions and SMV / other collisions.

The dominant trend in the reported angle collisions is driver right-of-way conflicts with drivers turning left from the stop-controlled approach of Mitch Owens Road onto Boundary Road and colliding with northbound or southbound through traffic during clear weather and road surface conditions. There was no dominant trend in the reported SMV / other collisions, as they were observed to be relatively evenly distributed by direction, weather and road surface condition, time of day and driver action. These types of collisions are not uncommon on high-speed rural roadways.

A desktop review of the existing intersection indicates that the intersection is illuminated, the pavement markings and signage at the intersection appear to be in good condition, and there appears to be proper warning signs of the intersection at each intersection approach (stop ahead sign on Mitch Owens Road, and intersection ahead signs on Boundary Road). There is also a

checkerboard sign at the east leg of the intersection facing eastbound traffic approaching from Mitch Owens Road. The intersection also features an overhead flashing beacon (flashing amber on Boundary Road and flashing red on Mitch Owens Road) to further emphasize the three-legged intersection and provide caution to approaching drivers. These measures appear to have been in place since 2012 (per desktop historical imagery), suggesting that these reported collisions are more attributed to driver error and inclement weather conditions (e.g., snow and ice) as opposed to insufficient traffic control at the intersection.

However, as discussed in the Forecasting Report, the NOVATECH study recommended the implementation of traffic signals and an auxiliary northbound left-turn lane at the intersection of Boundary Road and Mitch Owens Road (warranted as a "background" improvement without the Amazon Facility build-out). If these improvements were to be implemented by the City (as recommended in this TIA), then the traffic signal control would evenly distribute right-of-way at the intersection and address the angle collision trend observed at the intersection. The traffic signal control implementation would "interrupt flow" on Boundary Road and thus force drivers to stop on the red indication, thus potentially addressing the SMV / other collisions occurring from drivers along Boundary Road. The implementation of the proper traffic control signage and pavement markings at the signalized intersection per OTM standards will further reduce the potential of SMV / other collisions occurring at the intersection.

## **5.4 Access Intersections Analysis and Design**

### **5.4.1 Access Location**

#### 5.4.1.1 Adjacent Driveways

As detailed in the Screening & Scoping Report (March 2021), there are several existing driveways on the boundary road network within 200 metres of the proposed site accesses as described below:

- Four driveways to residential dwellings on the south side of Thunder Road, west of the proposed site access to Building 2;
- One driveway to a residential dwelling on the south side of Thunder Road, between the proposed site accesses to Buildings 1 and 2. This driveway will be removed as part of the development proposal;
- One driveway to a gas station on the south side of Thunder Road, at the southwest corner of Thunder Road and Boundary Road;
- One driveway to a gas station on the west side of Boundary Road, at the southwest corner of Thunder Road and Boundary Road;
- One driveway to a restaurant on the west side of Boundary Road, north of the proposed site access to Building 3;
- Two driveways to residential dwellings on the west side of Boundary Road, south of the proposed site access to Building 3 (these dwelling units are within the development boundary and thus would be replaced by the development build-out);
- One driveway to a commercial use on the west side of Boundary Road, south of the proposed site access to Building 3;
- One driveway to a residential dwelling on the east side of Boundary Road at the southeast corner of Thunder Road and Amazon Way;
- Two driveways to a commercial use on the east side of Boundary Road, north of the proposed site access to Building 3;
- One driveway to the Amazon Facility on the east side of Boundary Road, opposite the

- proposed site access to Building 3;
- Two driveways to commercial properties on the east side of Boundary Road, south of the proposed site access to Building 3; and
- One driveway to a residential dwelling on the east side of Boundary Road, south of the proposed site access to Building 3.

The existing private driveways not located within the subject property limits are spaced more than 15 metres from the proposed Building 2 and 3 site accesses to Thunder Road and Boundary Road and spaced more than 60 metres from the proposed Building 1 site accesses to Thunder Road (per the City's Private Approach By-law No. 2003-477, Section 25.1.m.ii).

#### 5.4.1.2 Number of Proposed Accesses

Per the City's Private Approach By-law No. 2003-477, Section 25.1.a., the maximum number of private approaches permitted to a property is:

- One two-way access with frontage less than 35 metres;
- Two two-way accesses with frontage between 35 – 150 metres; and
- An additional two-way access for every 90 metres of frontage exceeding 150 metres.

The property frontage to Building 1 along Thunder Road is approximately 300 metres; thus, technically permitting four two-way accesses to Thunder Road. The development proposes two two-way accesses to Thunder Road, thus satisfying the City's By-law.

The property frontage to Building 2 along Thunder Road is approximately 135 metres; thus, technically permitting two two-way accesses to Thunder Road. The development proposes one two-way access to Thunder Road, thus satisfying the City's By-law.

The property frontage to Building 3 along Boundary Road is approximately 85 metres; thus, technically permitting two two-way accesses to Boundary Road. The development proposes one two-way access to Boundary Road, thus satisfying the City's By-law.

#### 5.4.1.3 Sight Distance Analysis

The City identified the location of Site Access C to Thunder Road (adjacent to the horizontal curve) as a potential issue given that the horizontal curve may restrict sight distance availability from the access. Therefore, sight distance analysis was conducted at the proposed site accesses to Thunder Road and Boundary Road.

The available sightlines at the proposed accesses must satisfy minimum sight distance requirements set out in the TAC GDGCR. The design speed of a collector roadway in a rural environment is typically 10-20 km/h greater than the posted speed limit. The posted speed limit on Thunder Road is 60 km/h.

However, the sharp horizontal curve on Thunder Road approaching Boundary Road currently has a curve advisory speed of 30 km/h which would lower design speeds as a result. Thus, a conservative design speed of 50 km/h was applied to Site Access C facing east.

There is another horizontal curve on Thunder Road west of the subject property which, while not as tight as the horizontal curve approaching Boundary Road, would reduce operating speeds along Thunder Road approaching the curve and within the straight segment between the two curves. Therefore, a design speed of 70 km/h was applied to the site accesses west of Site Access C.



A design speed of 100 km/h was assumed for Boundary Road given the 80 km/h posted speed limit. **Table 5-5** outlines the required sight distance at the site accesses.

**Table 5-5: Sight Distance Requirements**

Parameter	Thunder Road and Site Access A	Thunder Road and Site Access B	Thunder Road and Site Access C	Boundary Road and Site Access / South Amazon Access
<b>Design Vehicle</b>	WB-20 Tractor Semi-Trailer	WB-20 Tractor Semi-Trailer	WB-20 Tractor Semi-Trailer	WB-20 Tractor Semi-Trailer
<b>Posted Speed Limit of Roadway</b>	60 km/h	60 km/h	60 km/h	80 km/h
<b>Assumed Design Speed</b>	70 km/h	70 km/h	70 km/h facing west) 50 km/h (facing east)	100 km/h
<b>Base Time Gap</b>	11.5 s <sup>1</sup>	11.5 s <sup>1</sup>	11.5 s <sup>1</sup>	11.5 s <sup>1</sup>
<b>Additional Time Gap</b>	None	None	None	None
<b>Vertical Alignment of Roadway</b>	Relatively flat	Relatively flat	Relatively flat	Relatively flat
<b>Horizontal Alignment of Roadway</b>	Curves east and west of subject property	Curves east and west of subject property	Curves east and west of subject property	Straight
<b>Sight Distance Required</b>	225 m <sup>2</sup>	225 m <sup>2</sup>	225 m <sup>2</sup> (facing west) 160 m <sup>2</sup> (facing east)	320 m <sup>2</sup>
<b>Sight Distance Available</b>	Approx. 230 m (facing west) +350 m (facing east)	+350 m (facing west) To Boundary Road / Thunder Road intersection (facing east)	+350 m (facing west) To Boundary Road / Thunder Road intersection (facing east)	+400 m (facing north and south)

Note 1: Time gap for left-turning WB-20 trucks from a stop onto a two-lane highway with no median and with a grade less than 3%. Value from Table 9.9.3 in the GDGCR.

Note 2: Sight distance values calculated from Intersection Sight Distance equation 9.9.1 in the GDGCR.

The proposed site access locations satisfy minimum sight distance requirements. It is noted that Site Access B and C to Thunder Road (near the sharp horizontal curve) are positioned so that the available sightlines extend to the signalized intersection of Boundary Road and Thunder Road / Amazon Way. Thus, drivers exiting from those site accesses will be able to see vehicles arriving from the east (turning from Boundary Road onto Thunder Road) and from the west (given the flat and straight segment providing sufficient sightlines).

#### 5.4.2. Access Width

Per the City's Private Approach By-law No. 2003-477, the maximum width of a private approach cannot exceed 9.0 metres, but a higher width may be permitted for transport loading areas.

The proposed accesses to Thunder Road and Boundary Road range in width from 8.0 – 9.4 metres, thus exceeding 9.0 metres. However, these accesses will be utilized by heavy trucks to access the trucking areas for each building, thus justifying the excess width of 0.4 metres.

Access alignment and geometrics can be confirmed at a later stage in the project.

**5.4.3. Traffic Control and Turn Lane Warrant Assessment**

5.4.3.1 Signal Warrant Analysis

A signal warrant analysis was conducted for the proposed site accesses to Thunder Road and proposed site access to Boundary Road under the ultimate 2035 horizon year. The TAC signal warrant analysis was applied per the City’s TIA Guidelines.

Given the rural nature of the study area and the higher speed limits, a “free flow” type was applied to this warrant.

**Table 5-6** outlines the results of the signal warrant analysis.

**Table 5-6: Signal Warrant Analysis Results**

Location	Flow Type	Horizon Year	Number of lanes on major road	Traffic Signals Warranted?
<b>Thunder Road and Site Access A</b>	Free Flow	2035	Two	<b>No</b>
<b>Thunder Road and Site Access B</b>	Free Flow	2035	Two	<b>No</b>
<b>Thunder Road and Site Access C</b>	Free Flow	2035	Two	<b>No</b>
<b>Boundary Road and South Amazon Access / Site Access</b>	Free Flow	2035	Two	<b>No</b>

The results of the signal warrant analysis indicate that traffic signals are not warranted at the proposed site accesses to Thunder Road and proposed site access to Boundary Road opposite the South Amazon access. These results are attributed to the low forecasted minor-street volumes at the site accesses not triggering the minimum thresholds for traffic signal justification.

**Appendix J** contains the signal warrant sheets.

5.4.3.2 Left-Turn Lane Warrant Analysis

Auxiliary left-turn lane warrant analysis was conducted for the proposed site accesses to Thunder Road and proposed site access to Boundary Road under 2035 future total conditions. The analysis was conducted using the Ministry of Transportation (MTO)’s “Design Supplement for TAC Geometric Design Guide for Canadian Roads – April 2020.”

Consistent with the sight distance analysis, a design speed of 70 km/h and 100 km/h was assumed for Thunder Road and Boundary Road, respectively.

**Table 5-7** outlines the results of the left-turn lane warrant analysis.

**Table 5-7: Left-Turn Lane Warrant Analysis Results**

Location	Movement	Design Speed	Horizon Year	Number of lanes on major road	Left-Turn Lane Storage Requirement?
<b>Thunder Road and Site Access A</b>	Westbound left-turn movement	70 km/h	2035	Two	None
<b>Thunder Road and Site Access B</b>	Westbound left-turn movement	70 km/h	2035	Two	None
<b>Thunder Road and Site Access C</b>	Westbound left-turn movement	70 km/h	2035	Two	None
<b>Boundary Road and South Amazon Access / Site Access</b>	Northbound left-turn movement	100 km/h	2035	Two	None

The results of the left-turn lane analysis indicate that auxiliary westbound left-turn lanes are not required on Thunder Road at the site accesses given the low forecasted approaching and opposing volumes along Thunder Road.

An auxiliary northbound left-turn lane is also not warranted on Boundary Road at the site access opposite the South Amazon access given the low forecasted northbound left-turn volumes not triggering the minimum thresholds for the left-turn lane warrant. However, there is an existing runout lane and taper at the south approach from the existing southbound left-turn lane on Boundary Road entering the South Amazon access that could be repurposed to provide a northbound left-turn lane into the site access. Left-turn lanes should be provided on opposing approaches at an intersection even if a left-turn lane is only warranted or existing at one approach, as to maintain geometric alignment along the roadway through the intersection. **Appendix K** contains the left-turn lane warrant analysis worksheets.

Therefore, it is recommended that the existing runout lane at the south approach of Boundary Road and South Amazon Access / Site Access be repurposed to provide an auxiliary northbound left-turn lane with a minimum storage length of 15 metres for passenger cars (as heavy trucks are not expected to arrive from the south).

#### 5.4.3.3 Right-Turn Lane Warrant Analysis

Auxiliary right-turn lane warrant analysis was conducted for the proposed site accesses to Thunder Road and proposed site access to Boundary Road under 2035 future total conditions. Per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GFGCR), June 2017, a right-turn auxiliary lane on an urban or rural road should be implemented at unsignalized intersections when the volume of decelerating or accelerating vehicles compared with the through traffic volume causes undue hazard.

It is a common convention in traffic engineering that an auxiliary right-turn lane should be considered where the right-turn volume exceeds 60 vehicles per hour. Therefore, this threshold was applied to the proposed site accesses to gauge right-turn lane requirements.

**Table 5- 8** outlines the results of the right-turn lane warrant analysis.

**Table 5-8: Right-Turn Lane Warrant Analysis Results**

Location	Movement	Design Speed	Horizon Year	Forecasted Critical Right-Turn Volume <sup>1</sup>	Right-Turn Lane Storage Requirement?
<b>Thunder Road and Site Access A</b>	Eastbound right-turn movement	70 km/h	2035	0 veh/hr	None
<b>Thunder Road and Site Access B</b>	Eastbound right-turn movement	70 km/h	2035	0 veh/hr	None
<b>Thunder Road and Site Access C</b>	Eastbound right-turn movement	70 km/h	2035	0 veh/hr	None
<b>Boundary Road and South Amazon Access / Site Access</b>	Southbound right-turn movement	100 km/h	2035	16 veh/hr (12 passenger cars, 4 heavy trucks)	None

Note 1: Volumes forecasted for 2035 future total conditions.

The results of the right-turn lane analysis indicate that auxiliary right-turn lanes are not required at the proposed site accesses given the low forecasted right-turning volumes at the site accesses.

#### 5.4.3.4 Access Operations

The traffic operations at the proposed site accesses are detailed in Section 5.7.7 of this report.

### 5.5 Transportation Demand Management (TDM) Analysis

As detailed in the Forecasting Report (March 2021), there is a heavy reliance on auto travel in the study area given the rural industrial nature of the area and the lack of existing dedicated pedestrian, cycling, and transit facilities. The existing auto modal split is assumed to be 97% and the non-auto modal split is assumed to be 3% (per the Forecasting Report).

A heavy reliance on auto travel is still expected in the future given the warehouse distribution nature of the proposed development, the rural context of the study area with no nearby origin or destination points for walking or cycling trips, and the absence of planned alternative transportation infrastructure improvements in the study area. Given the warehousing and distribution focus of the proposed development, employees would be required to physically work at the site during set hours, thus further restricting TDM opportunities such as flexible working hours and telework.

However, there are potential opportunities for the proposed development to reduce single-occupant vehicle (SOV) trips as described in this section.

#### 5.5.1. Active Transportation

The development could encourage cycling to and from the proposed development via the provision of bicycle parking spaces in conformance with the City's Zoning By-Law requirements. Additionally, further cycling provisions such as secure bicycle parking, lockers and showers could be implemented to encourage employees to bike to and from work.

#### 5.5.2. Carpooling

The development could promote carpooling by providing preferred carpool parking spaces and

incentives for employees to travel together. The provision of carpool parking spaces will encourage carpooling as an alternate mode of transportation with benefits such as cost savings, reduced environmental pollution and reduced commuting stress. Encouraging carpooling would contribute to a reduction in SOV trips and a reduction in peak hour auto trip generation and peak auto parking demand on site.

Co-ordination with City staff should occur to list the proposed future development on the City's ride-matching portal to help employees find carpool partners and increase and encourage carpooling opportunities for employees.

An internal ride-matching service to employees could also be implemented to maximize carpooling opportunities for employees, as carpooling with coworkers may be more appealing to employees compared to carpooling with strangers.

### **5.5.3. Emergency Ride Home**

The employer could set up an Emergency Ride Home program that guarantees non-driving commuters that they will be taken home immediately and in a convenient manner in the case of unplanned circumstances which require employees to get home immediately. This program would provide reimbursements to employees for taxi, carshare or rental car usage to facilitate this Emergency Ride Home incentive, which may encourage employees to carpool.

### **5.5.4. Promotion and Education**

There are opportunities for the implementation of other "soft" TDM measures. For example, the employer could provide information on available TDM opportunities such as preferred carpool parking, ride-matching opportunities, and programs such as Emergency Ride Home to educate employees of alternate modes of transportation. This promoted awareness of TDM opportunities can encourage the use of alternate modes of transportation, reduce SOV trip to and from the site, and reduce peak parking demand at the site.

### **5.5.5. TDM Program Management**

A TDM program could be established by the employer to monitor the implementation and effectiveness of proposed TDM measures. This could include an internal or external program co-ordinator to oversee performance monitoring (e.g., in the form of employee feedback surveys or parking utilization surveys to determine if the TDM measures are effective in reducing auto demand), and to co-ordinate with the City on available TDM opportunities.

### **5.5.6. Summary of Potential TDM Measures**

**Table 5-9** outlines the recommended TDM measures to reduce single-occupant vehicle (SOV) trips.

**Table 5-9: Summary of Potential TDM Measures and Implementation**

Measure	Implementation
Bicycle Storage and Amenities	Full build-out (2025)
Preferential parking for Carpooling	Full build-out (2025)
Ride-Matching Service (co-ordination with City and/or internal service)	Full build-out (2025)
Emergency Ride Home	Full build-out (2025)
Promotion and Education	Full build-out (2025)
TDM Program Management	Full build-out (2025)

## 5.6 Review of Network Concept

As detailed in the Forecasting Report and Screening & Scoping Reports, no future roadway capacity improvements nor alternative transportation infrastructure plans have been identified on Thunder Road nor Boundary Road in the study area per the City's Transportation Master Plan (2013) and proposed 2031 network concept. Further, several roadway improvements have recently been implemented on Boundary Road to support the Amazon Facility build-out.

The City is currently updating their Transportation Master Plan which may include improvements to Thunder Road or Boundary Road. The City can confirm if any future improvements are planned in the study area. However, for the purposes of this study, no background roadway improvements are assumed to occur.

However, forecasts of 2025, 2030 and 2035 future background traffic volumes indicate heavy through volumes along Boundary Road that exceed the typical capacity of 900 vehicles per hour per lane during the weekday a.m. and p.m. peak hours.

**Table 5-10** outlines the forecasted 2030 future background traffic volumes on Boundary Road by direction and time period, in line with the horizon year for the network concept. Volumes exceeding 900 veh/hr are highlighted.

**Table 5-10: 2030 Future Background – Boundary Road Through Volumes Forecasts**

Segment	Weekday A.M. Peak Hour Volume (veh/hr)		Weekday P.M. Peak Hour Volume (veh/hr)	
	Northbound	Southbound	Northbound	Southbound
Boundary Road north of Highway 417 Westbound Ramp Terminal	139	197	160	160
Boundary Road between Highway 417 Westbound Ramp Terminal and Highway 417 Eastbound Ramp Terminal	1052	224	361	250
Boundary Road between Highway 417 Eastbound Ramp Terminal	1069	534	441	1037
Boundary Road between Thunder Road and South Amazon Access	1043	268	349	991
Boundary Road between South Amazon Access and Mitch Owens Road	1033	253	283	999
Boundary Road south of Mitch Owens Road	1094	168	205	977

These volumes suggest that Boundary Road is expected to operate beyond capacity during the weekday a.m. and p.m. peak hours from the Highway 417 Eastbound Ramp Terminal southerly in both directions, and that the northbound segment between the ramp terminals is expected to operate beyond capacity during the weekday a.m. peak hour.

Based on this network concept review, it is recommended that the City monitor future traffic growth and demand on Boundary Road (south of the Highway 417 Westbound Ramp Terminal) to identify any future potential network concept changes to accommodate the forecasted volumes from a capacity perspective (e.g., road widening to add additional through lanes).

## 5.7 Intersection Analysis and Design

The methodology outlined in the Screening & Scoping Reports, and Forecasting Reports was applied to this analysis to forecast future traffic volumes and analyze traffic operations on the road network to determine required improvements to the road network, if required.

### 5.7.1. Traffic Modelling

The boundary road network was modelled in Synchro 11.0 using January 2020 weekday a.m. and p.m. peak hour traffic data in the study area (outlined in **Figure 2**), existing signal timing plans obtained from the City in January 2021, existing roadway geometric conditions and per the Synchro modelling guidelines outlined in the City's TIA guidelines.

The assessment of auto intersections is based on the "Highway Capacity Manual (HCM)" methodology. Intersections are assessed using a Level of Service (LOS) metric with ranges of delay assigned a letter from "A" to "F"; "A" representing low delays and "F" representing heavy delays. The LOS definitions for signalized and unsignalized intersections are included in **Appendix L**.

95<sup>th</sup> percentile queue lengths were derived from Synchro.

A critical volume-to-capacity threshold of 0.85 was applied to all movements on the road network to

flag any movements nearing capacity, except for the off-ramp movements at the ramp terminals for which a threshold of 0.75 was applied per the MTO's TIS guidelines.

### 5.7.2. Existing Auto Operations

The existing auto intersection operations at the study intersections were analyzed using the existing traffic volumes illustrated in **Figure 3**. Detailed capacity analysis worksheets are included in **Appendix M**.

**Table 5-11** outlines the 2020 existing traffic operations.

**Table 5-11: 2020 Existing Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	C	22.2s (WBLR)	0.39 (WBLR)	None
		P.M.	B	12.3s (WBLR)	0.09 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	13.5 s	0.80 (NBT)	None
		P.M.	B	14.3 s	0.88 (EBR)	66.1 m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	B	18.9 s	0.83 (NBT)	243.6m (NBT)
		P.M.	A	9.7 s	0.72 (SBTR)	None
Boundary Road and South Amazon Access	Stop (Minor)	A.M.	D	27.7s (WBLR)	0.05 (WBLR)	None
		P.M.	C	20.0s (WBLR)	0.07 (WBLR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	E	45.1s (EBL)	0.47 (EBL)	None
		P.M.	E	38.6s (EBL)	0.55 (EBL)	None

The road network is currently operating at overall acceptable levels of service with minor control delays.

The NOVATECH study that was prepared for the Amazon Facility recommended that the City consider implementing traffic signal control and an auxiliary northbound left-turn lane at the intersection of Boundary Road and Mitch Owens Road. The study found that under 2017 existing conditions, traffic signals and an auxiliary left-turn lane were warranted at the intersection, and that under future total conditions, the forecasted operations at the intersection were poor and indicated the need for traffic signal control. While this improvement has not been implemented as have the NOVATECH recommended improvements on Boundary Road at Highway 417 Eastbound Ramp Terminal and at Thunder Road / Amazon Way, this improvement has been accounted for under future background and future total conditions in this analysis and is found to significantly improve traffic operations.

No movements on the existing road network are operating over capacity, albeit the eastbound right-turn movement at the Highway 417 Eastbound Ramp Terminal (which currently experiences a peak hour volume of 631 vehicles per hour during the weekday p.m. peak period).



The existing traffic operations on the road network are acceptable.

### **5.7.3. Future Background Volumes Forecasting**

As detailed in the Forecasting Report, growth rate of 2% compounded annually has been applied to all movements on the road network (as consistent with background studies in the area) to forecast 2025, 2030 and 2035 future background traffic volumes. This analysis also accounts for background traffic generated by the future Capital Region Resource Recovery Centre (CRRC) waste management facility south of the Amazon Facility.

**Figure 4** outlines the CRRC background site traffic. **Figures 5, 6 and 7** outline the 2025, 2030 and 2035 future background traffic volumes, respectively, on the road network (with the growth rate outlined in Section 4.4.2 applied to the existing volumes plus the CRRC background site traffic outlined in **Figure 4**).

### **5.7.4. Future Background Auto Operations**

The future background auto intersection operations at the study intersections were analyzed using the 2025, 2030 and 2035 future background traffic volumes illustrated in **Figures 5, 6 and 7**, respectively, and optimized signal timings. Detailed capacity analysis worksheets are included in **Appendix M**.

It is noted that the existing cycle length at the intersection of Boundary Road and Highway 417 Eastbound Ramp Terminal is 80 seconds, which is typically reflective of low-medium volume intersections and not typically reflective of high-volume arterial intersections. Additionally, the existing cycle length at the intersection of Boundary Road and Thunder Road / Amazon Way is 100 seconds. For consistency with the existing cycle length at Boundary Road and Thunder Road / Amazon Way (which is ideal for corridor progression between signalized intersections), the Highway 417 Eastbound Ramp Terminal was modelled with a cycle length of 100 seconds under all future background and total scenarios.

The intersection of Boundary Road and Mitch Owens Road was analyzed under 2035 future background and total conditions under two scenarios: with the recommended NOVATECH improvements, and with the existing side-street stop control.

**Tables 5-12, 5-13 and 5-14** outline the 2025, 2030 and 2035 future background traffic operations, respectively.

**Table 5-12: 2025 Future Background Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	C	22.9s (WBLR)	0.43 (WBLR)	None
		P.M.	B	12.6 s (WBLR)	0.09 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	14.1 s	0.82 (NBT)	None
		P.M.	B	18.9 s	0.91 (EBR)	75.0m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	C	20.1 s	0.87 (NBT)	237.8m (NBT)
		P.M.	A	9.8 s	0.74 (SBTR)	None
Boundary Road and South Amazon Access	Stop (Minor)	A.M.	D	30.1s (WBLR)	0.06 (WBLR)	None
		P.M.	C	22.5s (WBLR)	0.08 (WBLR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	E	45.6s (EBL)	0.48 (EBL)	None
		P.M.	E	38.5s (EBL)	0.56 (EBL)	None

**Table 5-13: 2030 Future Background Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	D	29.8s (WBLR)	0.54 (WBLR)	None
		P.M.	B	13.2 s (WBLR)	0.11 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	16.3 s	0.88 (NBT)	27.3m > 25m (EBR)
		P.M.	C	24.8 s	0.95 (EBR)	143.3 m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	C	28.0 s	0.93 (NBT)	279.3m (NBT)
		P.M.	B	10.4 s	0.78 (SBTR)	None
Boundary Road and South Amazon Access	Stop (Minor)	A.M.	D	34.7s (WBLR)	0.08 (WBLR)	None
		P.M.	D	28.4s (WBLR)	0.11 (WBLR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	F	70.0s (EBL)	0.64 (EBL)	27.2m > 25m (EBL)
		P.M.	F	60.4s (EBL)	0.72 (EBL)	37.0m > 25m (EBL)

**Table 5-14: 2035 Future Background Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	E	43.8s (WBLR)	0.69 (WBLR)	None
		P.M.	B	14.1 s (WBLR)	0.13 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	19.5 s	0.92 (NBT) 0.75 (EBR)	29.2m > 25m (EBR)
		P.M.	C	33.5 s	1.00 (EBR)	189.1m > 25m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	D	46.7 s	1.03 (NBT)	324.6m (NBT)
		P.M.	B	12.3 s	0.82 (SBTR)	277.2m (SBTR)
Boundary Road and South Amazon Access	Stop (Minor)	A.M.	E	43.2s (WBLR)	0.10 (WBLR)	None
		P.M.	F	88.1s (WBLR)	0.34 (WBLR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	F	130.0s (EBL)	0.88 (EBL)	41.8m > 25m (EBL)
		P.M.	F	116.4s (EBL)	0.96 (EBL)	57.7m > 25m (EBL)
	Signal	A.M.	B	13.7s	0.80 (NBT)	33.0m > 25m (EBL)
		P.M.	B	17.6 s	0.84 (SBT)	50.8m > 25m (EBL)

The intersections of Boundary Road and Highway 417 Westbound Ramp Terminal, and Boundary Road and South Amazon Access are expected to operate near or at capacity under 2035 future background conditions. Several movements on the road network are expected to operate near capacity and with 95<sup>th</sup> percentile queue lengths exceeding available storage lengths. These results are mainly attributed to fifteen years of steady traffic growth in the study area, and heavy forecasted volumes on Boundary Road exceeding typical arterial roadway capacity.

Network concept changes such as identifying improvements to Boundary Road (e.g., road widening) would be expected to significantly improve traffic operations on the road network and increase capacity for individual movements. Additionally, the implementation of the recommended NOVATECH improvements at the intersection of Boundary Road and Mitch Owens Road is expected to improve the LOS from "F" to "B."

### 5.7.5. Site Traffic

As detailed in the Forecasting Report (March 2021), the full build-out of the proposed development is expected to generate approximately 199 and 211 total person trips during the weekday a.m. and p.m. peak hour, respectively, and approximately 21 and 21 total non-auto trips during the weekday a.m. and p.m. peak hour, respectively.

Employee trips generated by the proposed development were distributed to the road network based on origin-destination data from the National Capital Region (NCR) survey (2011) and the population of surrounding communities per Statistics Canada. Heavy truck trips generated by the proposed development were distributed to the road network based on expected catchment areas and logical

routing assumptions for heavy trucks.

**Figures 8 and 9** outline the employee and heavy truck trip assignment, respectively.

#### **5.7.6. Basis of Future Total Assessment**

The site generated traffic volumes illustrated in **Figures 8 and 9** were added to the 2025, 2030 and 2035 future background traffic volumes in **Figures 5, 6 and 7**, respectively, to determine the 2025, 2030 and 2035 future total traffic volumes. **Figures 10, 11 and 12** outline the 2025, 2030 and 2035 future total traffic volumes, respectively.

#### **5.7.7. Future Total Auto Operations**

The future total auto intersection operations at the study intersections were analyzed using the 2025, 2030 and 2035 future total traffic volumes illustrated in **Figures 10, 11 and 12**, respectively, and optimized signal timings. Detailed capacity analysis worksheets are included in **Appendix M**.

Given that a significant portion of site traffic entering and exiting the site accesses is heavy truck traffic, heavy truck percentages were calculated and modelled for all movements on the road network to reflect the increase in heavy truck percentages under future total conditions.

**Tables 5-15, 5-16 and 5-17** outline the 2025, 2030 and 2035 future total traffic operations, respectively.

**Table 5-15: 2025 Future Total Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	D	29.0s (WBLR)	0.55 (WBLR)	None
		P.M.	B	13.4s (WBLR)	0.12 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	14.2 s	0.82 (NBT)	28.8m > 25 m (EBR)
		P.M.	C	21.2 s	0.93 (EBR)	107.0 m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	C	22.9 s	0.90 (NBT)	256.8m(NBT)
		P.M.	B	19.5 s	0.88 (SBT)	None
Boundary Road and South Amazon Access / Site Access	Stop (Minor)	A.M.	E	39.4s (WBLR)	0.08 (WBLR)	None
		P.M.	D	30.0s (WBLTR)	0.11 (WBLTR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	F	51.7s (EBL)	0.53 (EBL)	None
		P.M.	E	43.1s (EBL)	0.59 (EBL)	26.8m > 25m (EBL)
Site Access A and Thunder Road	Stop (Minor)	A.M.	A	8.7s (NBLR)	0.02 (NBLR)	None
		P.M.	A	9.2s (NBLR)	0.07 (NBLR)	None
Site Access B and Thunder Road	Stop (Minor)	A.M.	A	9.6s (NBLR)	0.01 (NBLR)	None
		P.M.	A	10.0s (NBLR)	0.02 (NBLR)	None
Site Access C and Thunder Road	Stop (Minor)	A.M.	A	8.7s (NBLR)	0.01 (NBLR)	None
		P.M.	A	9.0s (NBLR)	0.03 (NBLR)	None

**Table 5-16: 2030 Future Total Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	E	40.9s (WBLR)	0.68 (WBLR)	None
		P.M.	B	14.2s (WBLR)	0.14 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	B	16.8 s	0.88 (NBT) 0.75 (EBR)	31.1m > 25 m (EBR)
		P.M.	D	27.2 s	0.97 (EBR)	159.1 m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	C	32.6 s	0.96 (NBT)	299.7m(NBT)
		P.M.	C	23.3 s	0.92 (SBT)	286.5m (SBT)
Boundary Road and South Amazon Access / Site Access	Stop (Minor)	A.M.	E	46.3s (WBLR)	0.10 (WBLR)	None
		P.M.	E	43.2s (WBLTR)	0.17 (WBLTR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	F	82.7s (EBL)	0.71 (EBL)	31.7m > 25m (EBL)
		P.M.	F	70.0.s (EBL)	0.77 (EBL)	40.9m > 25m (EBL)
Site Access A and Thunder Road	Stop (Minor)	A.M.	A	8.7s (NBLR)	0.02 (NBLR)	None
		P.M.	A	9.3s (NBLR)	0.07 (NBLR)	None
Site Access B and Thunder Road	Stop (Minor)	A.M.	A	9.6s (NBLR)	0.01 (NBLR)	None
		P.M.	B	10.1s (NBLR)	0.02 (NBLR)	None
Site Access C and Thunder Road	Stop (Minor)	A.M.	A	8.7s (NBLR)	0.01 (NBLR)	None
		P.M.	A	9.0s (NBLR)	0.03 (NBLR)	None

**Table 5-17: 2035 Future Total Traffic Operations**

Intersection	Control	Peak Hour	Level of Service	Control Delay	Critical v/c ratio	95 <sup>th</sup> Percentile Queue Length > Storage Length
Boundary Road and Highway 417 Westbound Ramp Terminal	Stop (Minor)	A.M.	F	68.5s (WBLR)	0.86 (WBLR)	None
		P.M.	C	15.2s (WBLR)	0.17 (WBLR)	None
Boundary Road and Highway 417 Eastbound Ramp Terminal	Signal	A.M.	C	20.4 s	0.93 (NBT) 0.78 (EBR)	34.6m > 25 m (EBR)
		P.M.	D	40.0 s	1.05 (EBR)	203.5 m > 25 m (EBR)
Boundary Road and Thunder Road/Amazon Way	Signal	A.M.	D	51.4 s	1.06 (NBT) 1.00 (SBL)	347.4 m (NBT)
		P.M.	C	31.6 s	0.96 (SBT)	332.9m (SBT)
Boundary Road and South Amazon Access / Site Access	Stop (Minor)	A.M.	F	61.3s (WBLR)	0.15 (WBLR)	None
		P.M.	F	139.6s (WBLTR)	0.48 (WBLTR)	None
Boundary Road and Mitch Owens Road	Stop (Minor)	A.M.	F	158.6s (EBL)	0.97 (EBL)	47.7m > 25m (EBL)
		P.M.	F	138.6.s (EBL)	1.02 (EBL)	63.1m > 25m (EBL)
	Signal	A.M.	B	14.4s	0.81 (NBT)	34.3m > 25m (EBL)
		P.M.	B	18.5s	0.86 (SBT)	51.1m > 25m (EBL)
Site Access A and Thunder Road	Stop (Minor)	A.M.	A	8.8s (NBLR)	0.02 (NBLR)	None
		P.M.	A	9.3s (NBLR)	0.07 (NBLR)	None
Site Access B and Thunder Road	Stop (Minor)	A.M.	A	9.7s (NBLR)	0.01 (NBLR)	None
		P.M.	B	10.1s (NBLR)	0.02 (NBLR)	None
Site Access C and Thunder Road	Stop (Minor)	A.M.	A	8.8s (NBLR)	0.01 (NBLR)	None
		P.M.	A	9.1s (NBLR)	0.03 (NBLR)	None

The intersections of Boundary Road and Highway 417 Westbound Ramp Terminal, and Boundary Road and South Amazon Access / Site Access are expected to operate beyond capacity under 2035 future total conditions. Several movements on the road network are expected to operate near capacity and with 95<sup>th</sup> percentile queue lengths exceeding available storage lengths. These results are mainly attributed to fifteen years of steady traffic growth in the study area, and heavy forecasted volumes on Boundary Road exceeding typical arterial roadway capacity and are overall consistent with 2035 future background conditions.

When intersections are operating near or beyond capacity under future background conditions, the addition of even a minor amount of site traffic to the intersection can exponentially increase control delays. Therefore, even with the forecasted 2035 future total operations, the addition of site traffic to the road network is not expected to significantly impact traffic operations.

Network concept changes such as identifying future background improvements to Boundary Road

(e.g., road widening) would be expected to significantly improve traffic operations on the road network and increase capacity for individual movements. Additionally, the implementation of the recommended NOVATECH improvements at the intersection of Boundary Road and Mitch Owens Road is expected to improve the LOS from "F" to "B."

The proposed site accesses to Thunder Road are expected to operate at LOS "B" or better with minor control delays and no critical movements nor 95<sup>th</sup> percentile queue lengths.

## 6.0 Conclusions and Recommendations

This Transportation Impact Assessment (TIA) has assessed the transportation impacts of the proposed industrial development at the Thunder Road and Boundary Road site in the City of Ottawa. The analysis contained within this report has resulted in the following key findings:

- The proposed industrial development is projected to generate a total of 156 and 165 two-way auto trips during the weekday a.m. and p.m. peak hours, respectively.
- Under 2020 existing traffic conditions, the study intersections are projected to operate at the Level of Services (LOS) below.
  - The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is operating below capacity at a LOS "C" or better during the a.m. and p.m. peak hours.
  - The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are operating at a LOS "B" or better during the a.m. and p.m. peak hours.
  - The stop-controlled South Amazon Access at Boundary Road is operating below capacity at a LOS "D" or better during the a.m. and p.m. peak hours.
  - The stop-controlled Mitch Owens Road connection to Boundary Road is operating below capacity at a LOS "E" for the eastbound left turn during the a.m. and p.m. peak hours. All other movements at the intersection are at a LOS "A".
- Under the 2025, 2030 and 2035 future background conditions:
  - The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is forecast to operate at a LOS "E" or better during the a.m. peak hour and a LOS "B" or better during the p.m. peak hour.
  - The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are both forecast to operate at a LOS "D" or better during the a.m. and p.m. peak hours.
  - The stop-controlled South Amazon Access at Boundary Road is projected to operate at a LOS "E" and "F" during the a.m. and p.m. peak hours, respectively.
  - The stop-controlled Mitch Owens Road connection to Boundary Road is expected to operate at a LOS "F" during the a.m. and p.m. peak hours. However, similar to Novatech's recommendation, adding a northbound left turn lane (2025 horizon) and



implementing traffic signals (2035 horizon) is expected to result in a forecasted LOS "B" or better during the a.m. and p.m. peak hours.

- For the 2025, 2030 and 2035 total traffic conditions (includes site generated trips), the study intersections are projected to operate as follows:
  - The stop-controlled Highway 417 Westbound Ramp Terminal at Boundary Road is forecast to operate at a LOS "F" or better during the a.m. peak hour and a LOS "C" or better during the p.m. peak hour.
  - The signalized intersections of Boundary Road with Highway 417 Eastbound Ramp Terminal and Thunder Road/Amazon Way are both forecast to operate at a LOS "D" or better during the a.m. and p.m. peak hours, similar to the future background conditions.
  - The stop-controlled Mitch Owens Road connection to Boundary Road is expected to operate at a LOS "F" during the a.m. and p.m. peak hours under the ultimate 2035 horizon. Similar to the future background conditions, adding the northbound left turn lane (2025 horizon) and implementing traffic signals (2035 horizon) is expected to result in a forecasted LOS "B" or better during the a.m. and p.m. peak hours.
  - The stop-controlled South Amazon Access at Boundary Road is projected to operate at a LOS "F" during the a.m. and p.m. peak hours under the ultimate 2035 horizon. This is a future background issue and is attributable to an increase in through volumes on Boundary Road.
  - The proposed three stop-controlled site access connections to Thunder Road are projected to operate below capacity at a LOS "B" or better during the a.m. and p.m. peak hours, under all study horizons.
- A signal warrant assessment based on the ultimate 2035 traffic volumes indicates that traffic signals are not warranted at the intersections of Boundary Road and South Amazon Access / Site Access and Thunder Road with the proposed three Site Accesses. Additionally, no left or right turn auxiliary lanes are warranted on the major roads at the site access connections.
- The proposed site accesses are projected to operate efficiently and safely without any issues related to sight-lines, corner clearance, access conflicts, truck movements and transit operational conflicts. The vehicle parking supply of for each of the three buildings exceeds the City's Zoning By-Law minimum parking requirements.
- It is recommended that the following be considered to support the proposed development:
  - Consideration should be given to repurposing the existing runout lane at the south approach of the intersection of Boundary Road and Site Access / South Amazon Access to provide an auxiliary 15-metre northbound left-turn storage lane. The NBL lane addition along with a potential traffic signalization in the 2035 horizon is expected to improve the intersection performance in the long-term.
  - To support sustainable transportation, the owner may consider TDM measures such as provision of a good internal connection of pedestrian sidewalks and to municipal sidewalks where available, provision of bicycle parking/amenity, carpooling and

liaise with the City to implement TDM promotion/ education programs. These TDM measures are expected to encourage employees and visitors to be less dependent on single occupant auto trips.

- o In addition to the City's existing road network volume monitoring program to assess capacity constrained zones, given the potential long term impact of the Covid-19 pandemic on home-work trips, the forecasted future volumes herein may be overstated, it is important to monitor intersection volumes in future to confirm if any roadway improvements and or traffic signal modifications are needed for optimal performance of the relevant surrounding intersections.

In conclusion, the traffic generated by the proposed industrial development at Thunder Road and Boundary Road can be accommodated by the boundary road network. The Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) applications can be supported from a traffic operations perspective as the boundary road system is forecast to adequately accommodate the increase in traffic volumes attributable to the proposed development.

Minor changes to the site plan will not materially affect the conclusions contained within this Study. Should you have any questions or require further information, please contact the undersigned.

Respectfully submitted by,

**C.F. CROZIER & ASSOCIATES INC.**



Alexander J.W. Fleming, MBA, P.Eng.  
Associate

/dl/pa

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# APPENDIX A

## Conceptual Site Plan

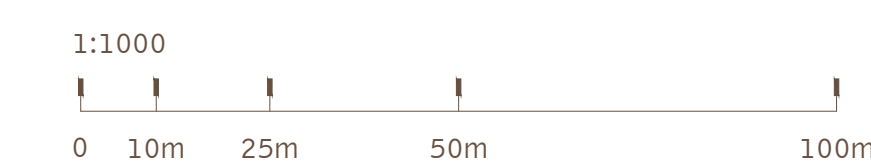
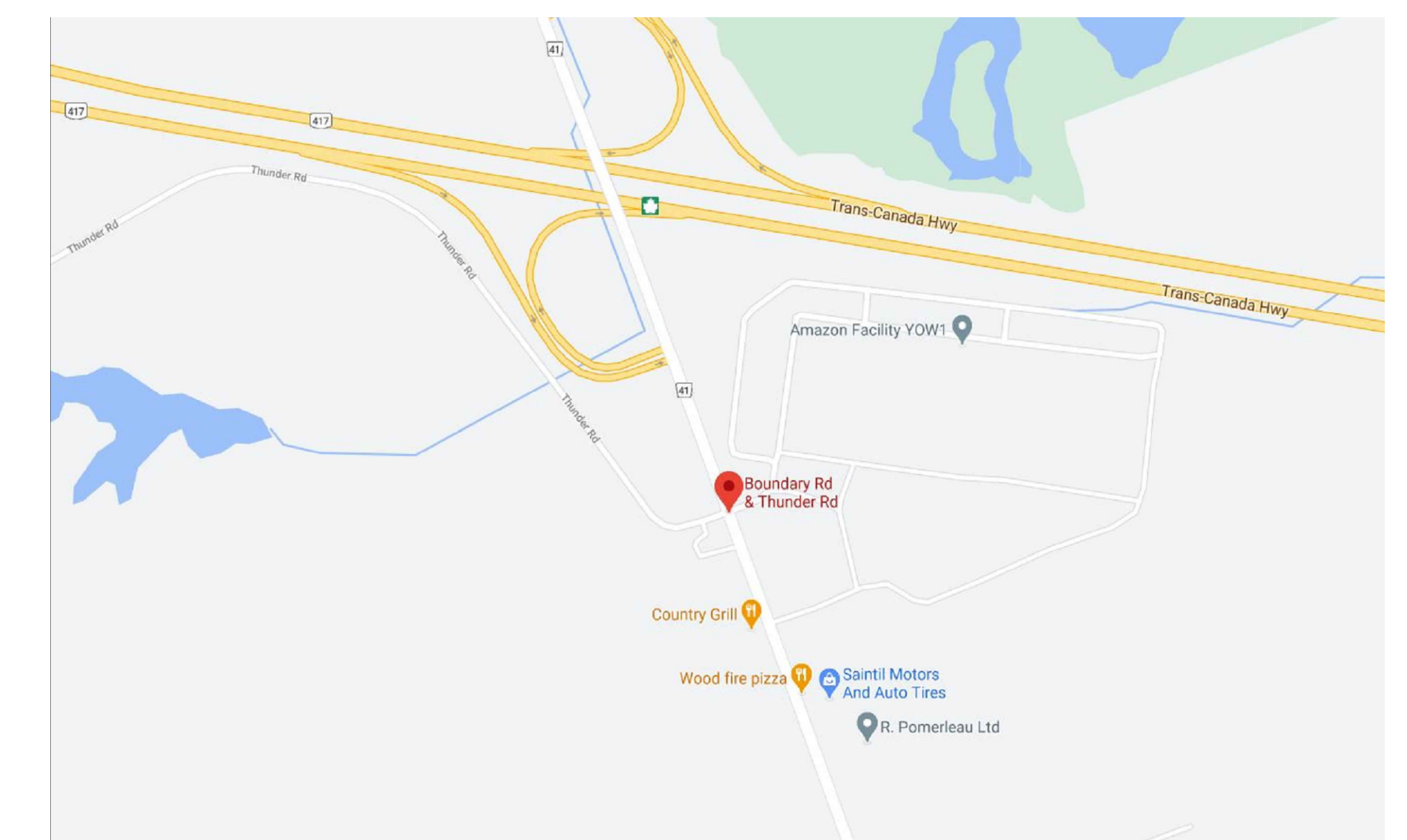


**PROJECT DATA:**

<b>SITE 1 AREA:</b>			
GROSS:		15.34 HA	153,400 m <sup>2</sup>
DETECTION:	@ 3%	4,283 m <sup>2</sup>	
NET:		3.42 HA	149,117 m <sup>2</sup>
<b>BUILDING 1 FOOTPRINT:</b>			
BUILDING 3 FOOTPRINT:		55,799 m <sup>2</sup>	
TOTAL:		2,972 m <sup>2</sup>	
		58,771 m <sup>2</sup>	
<b>COVERAGE:</b>			
GROSS:		38%	
NET:		39%	
<b>BUILDING 1 PARKING PROVIDED:</b>			
AUTO:		426 STALLS	
	<i>REQ. ACCESSIBLE</i>	9 STALLS	
TRAILER:		98 STALLS	
<b>TRUCK DOCKS:</b>			
▲ DOCK-HIGH DOORS		74	
● GRADE-LEVEL DOORS		4	
<b>BUILDING 3 PARKING PROVIDED:</b>			
AUTO:		52 STALLS	
	<i>REQ. ACCESSIBLE</i>	3 STALLS	
● GRADE-LEVEL DOORS		10	
<b>SITE 2 AREA:</b>			
GROSS:		2.41 HA	24,086 m <sup>2</sup>
<b>BUILDING FOOTPRINT:</b>			
COVERAGE:		3,850 m <sup>2</sup>	
GROSS:		16%	
<b>PARKING PROVIDED:</b>			
AUTO:		57 STALLS	
	<i>REQ. ACCESSIBLE</i>	@1.48/100 m <sup>2</sup>	
		3 STALLS	
<b>TRUCK DOCKS:</b>			
▲ DOCK-HIGH DOORS		19	
● GRADE-LEVEL DOORS		2	

This conceptual design is based upon a preliminary review of entitlement requirements and on unverified and possibly incomplete site and/or building information, and is intended merely to assist in exploring how the project might be developed.

Boundary Source:  
 GIS MAP & AERIAL IMAGE



scheme: 1

Conceptual Site Plan

**Thunder Road Industrial**  
 Thunder Road & Boundary Road Ottawa, ON K4B 1P6

**WARE MALCOMB**

TOR20-0041-00  
 11.02.2020

SHEET  
**1**

# APPENDIX B

## Screening Form

## City of Ottawa 2017 TIA Guidelines Screening Form

### 1. Description of Proposed Development

Municipal Address	6150 Thunder Road, Ottawa, ON K0A 1K0
Description of Location	Bound by Thunder Road, forested areas and Boundary Road
Land Use Classification	ZBL - Rural Countryside Zone (RU), OP - General Rural Area
Development Size (units)	
Development Size (m <sup>2</sup> )	Industrial Buildings = 62,621 sq. m
Number of Accesses and Locations	Three full-moves accesses to Thunder Road, one full-moves access to Boundary Road
Phase of Development	TBD
Buildout Year	TBD (2025 assumed)

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

### 2. Trip Generation Trigger

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

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m <sup>2</sup>
Industrial	5,000 m <sup>2</sup> <span style="color: red;">EXCEEDS 5,000 sq. m</span>
Fast-food restaurant or coffee shop	100 m <sup>2</sup>
Destination retail	1,000 m <sup>2</sup>
Gas station or convenience market	75 m <sup>2</sup>

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

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

### 3. Location Triggers

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

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

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

### 4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?	X	
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		X
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?	X	
Is the proposed driveway within auxiliary lanes of an intersection?		X
Does the proposed driveway make use of an existing median break that serves an existing site?		X
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		X
Does the development include a drive-thru facility?		X

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

### 5. Summary

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

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

# APPENDIX C

## Traffic Data

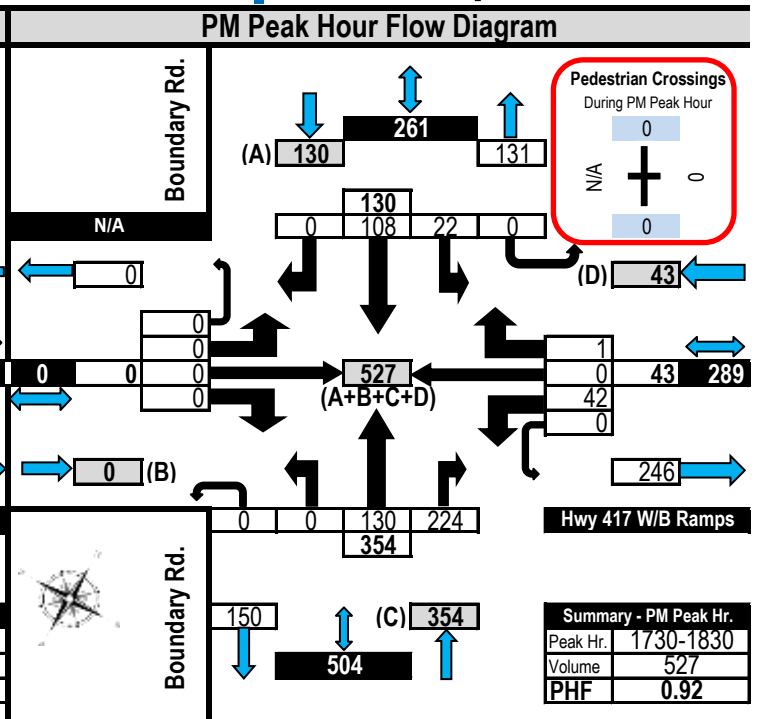
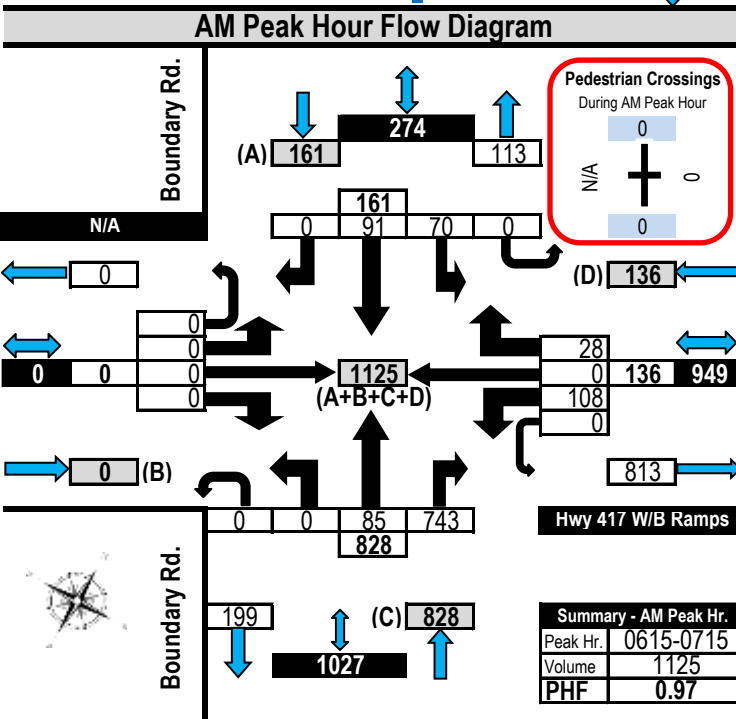
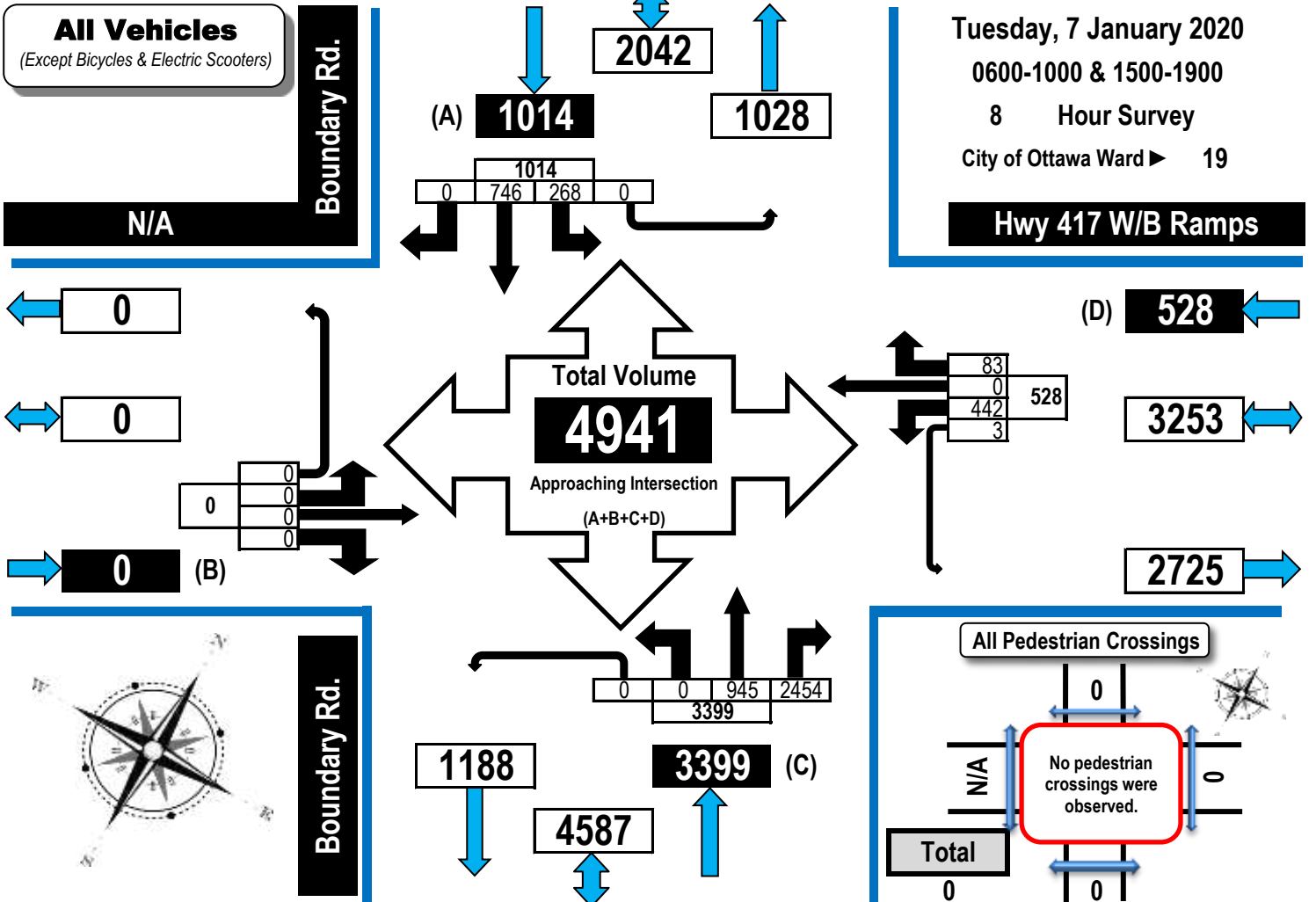




# Turning Movement Count Summary, AM and PM Peak Hour Flow Diagrams

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

## Boundary Road & Highway 417 North Ramps Carlsbad Springs, ON





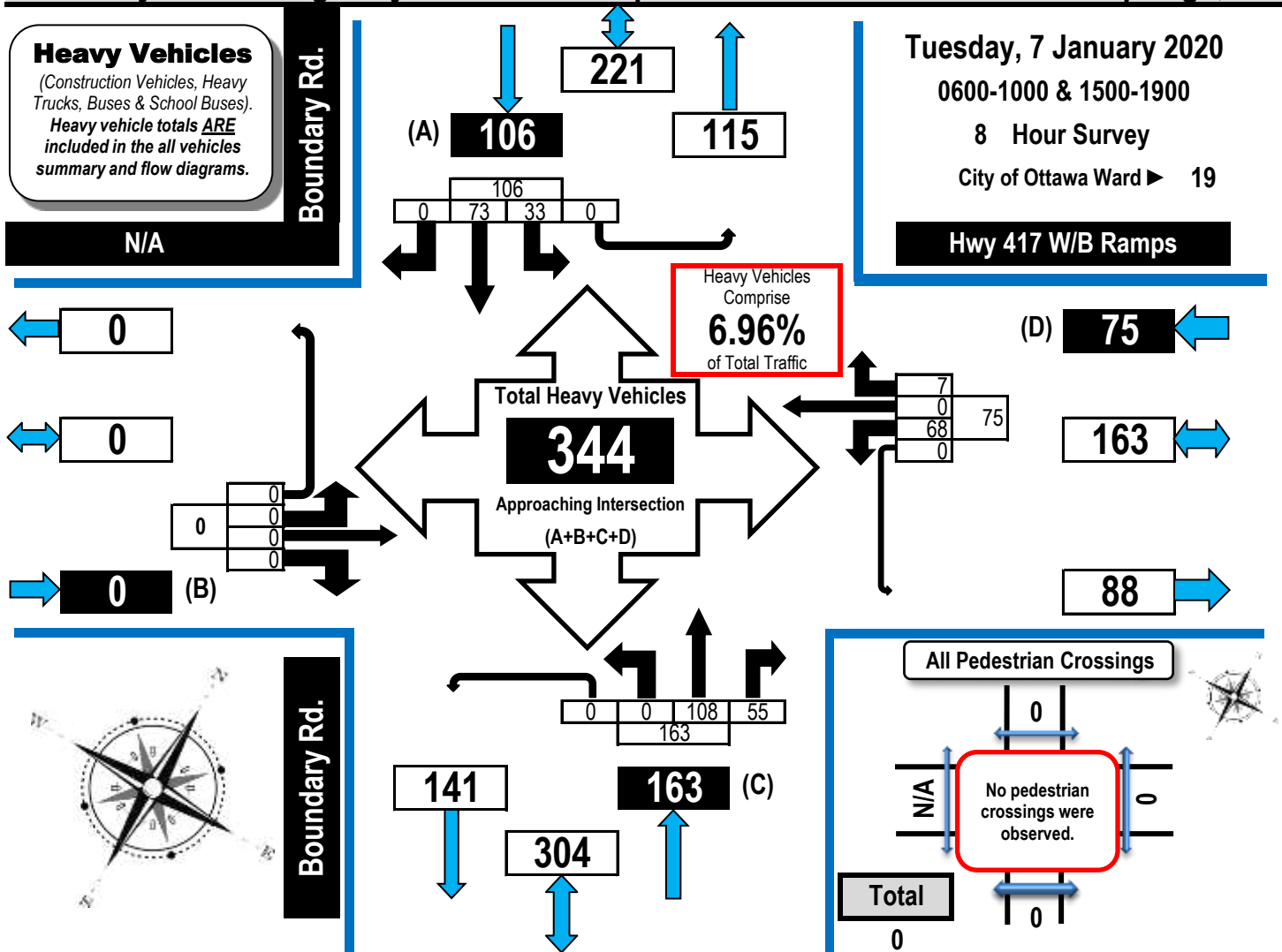
# Turning Movement Count Heavy Vehicle Summary Flow Diagram



## Boundary Road & Highway 417 North Ramps Carlsbad Springs, ON

**Heavy Vehicles**  
(Construction Vehicles, Heavy Trucks, Buses & School Buses).  
Heavy vehicle totals ARE included in the all vehicles summary and flow diagrams.

Tuesday, 7 January 2020  
0600-1000 & 1500-1900  
8 Hour Survey  
City of Ottawa Ward ► 19



N/A Eastbound	Hwy 417 W/B Ramps Westbound	Boundary Rd. Northbound	Boundary Rd. Southbound
---------------	-----------------------------	-------------------------	-------------------------

Time Period	N/A Eastbound					Hwy 417 W/B Ramps Westbound					Boundary Rd. Northbound					Boundary Rd. Southbound					S. Tot	G.Tot.
	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot		
0600-0700	0	0	0	0	0	4	0	4	0	8	0	12	8	0	20	6	10	0	0	16	44	
0700-0800	0	0	0	0	0	10	0	2	0	12	0	9	12	0	21	4	10	0	0	14	47	
0800-0900	0	0	0	0	0	8	0	0	0	8	0	25	8	0	33	11	19	0	0	30	71	
0900-1000	0	0	0	0	0	8	0	1	0	9	0	25	10	0	35	5	9	0	0	14	58	
1500-1600	0	0	0	0	0	12	0	0	0	12	0	11	3	0	14	0	6	0	0	6	32	
1600-1700	0	0	0	0	0	16	0	0	0	16	0	14	5	0	19	4	6	0	0	10	45	
1700-1800	0	0	0	0	0	8	0	0	0	8	0	8	6	0	14	1	10	0	0	11	33	
1800-1900	0	0	0	0	0	2	0	0	0	2	0	4	3	0	7	2	3	0	0	5	14	
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>68</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>75</b>	<b>0</b>	<b>108</b>	<b>55</b>	<b>0</b>	<b>163</b>	<b>33</b>	<b>73</b>	<b>0</b>	<b>0</b>	<b>106</b>	<b>344</b>	



# Turning Movement Count

## Summary Report Including AM, OFF Peak, PM, Evening Peak Hours, and PHF

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

### Boundary Road & Highway 417 North Ramps Carlsbad Springs, ON

**Survey Date:** Tuesday, 7 January 2020      **Start Time:** 0600      **AADT Factor:** 1.1  
**Weather AM:** Overcast -4° C      **Survey Duration:** 8 Hrs.      **Survey Hours:** 0600-1000 & 1500-1900  
**Weather PM:** Cloudy -1° C      **Surveyor(s):** Carmody

Time Period	N/A					Hwy 417 W/B Ramps					Street Total	Boundary Rd.				Boundary Rd.				Street Total	Grand Total		
	Eastbound					Westbound						Northbound				Southbound							
	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot		LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot		
0600-0700	0	0	0	0	0	100	0	19	1	120	120	0	87	685	0	772	72	85	0	0	157	929	1049
0700-0800	0	0	0	0	0	79	0	31	0	110	110	0	112	632	0	744	48	81	0	0	129	873	983
0800-0900	0	0	0	0	0	57	0	9	0	66	66	0	108	360	0	468	54	84	0	0	138	606	672
0900-1000	0	0	0	0	0	32	0	5	1	38	38	0	89	223	0	312	29	52	0	0	81	393	431
1500-1600	0	0	0	0	0	44	0	10	1	55	55	0	155	122	0	277	18	95	0	0	113	390	445
1600-1700	0	0	0	0	0	57	0	5	0	62	62	0	148	106	0	254	15	131	0	0	146	400	462
1700-1800	0	0	0	0	0	44	0	1	0	45	45	0	156	156	0	312	18	138	0	0	156	468	513
1800-1900	0	0	0	0	0	29	0	3	0	32	32	0	90	170	0	260	14	80	0	0	94	354	386
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>442</b>	<b>0</b>	<b>83</b>	<b>3</b>	<b>528</b>	<b>528</b>	<b>0</b>	<b>945</b>	<b>2454</b>	<b>0</b>	<b>3399</b>	<b>268</b>	<b>746</b>	<b>0</b>	<b>0</b>	<b>1014</b>	<b>4413</b>	<b>4941</b>

**Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts conducted during the hours of 0700h - 1000h, 1130h - 1330h and 1500h - 1800h**

<b>AM Peak Hour Factor</b> → 0.97											<b>Highest Hourly Vehicle Volume Between 0500h &amp; 1000h</b>												
<b>AM Peak Hr</b>	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0615-0715	0	0	0	0	0	108	0	28	0	136	136	0	85	743	0	828	70	91	0	0	161	989	1125
<b>OFF Peak Hour Factor</b> → N/A											<b>Highest Hourly Vehicle Volume Between 1000h &amp; 1500h</b>												
<b>OFF Peak Hr</b>	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>PM Peak Hour Factor</b> → 0.92											<b>Highest Hourly Vehicle Volume Between 1500h &amp; 1900h</b>												
<b>PM Peak Hr</b>	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1730-1830	0	0	0	0	0	42	0	1	0	43	43	0	130	224	0	354	22	108	0	0	130	484	527
<b>EVNG Peak Hour Factor</b> → N/A											<b>Highest Hourly Vehicle Volume Between 1900h &amp; 0000h</b>												
<b>EVNG Pk Hr</b>	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Comments:**

No pedestrian crossings or bicycles were observed. Street lights are not present at this intersection.

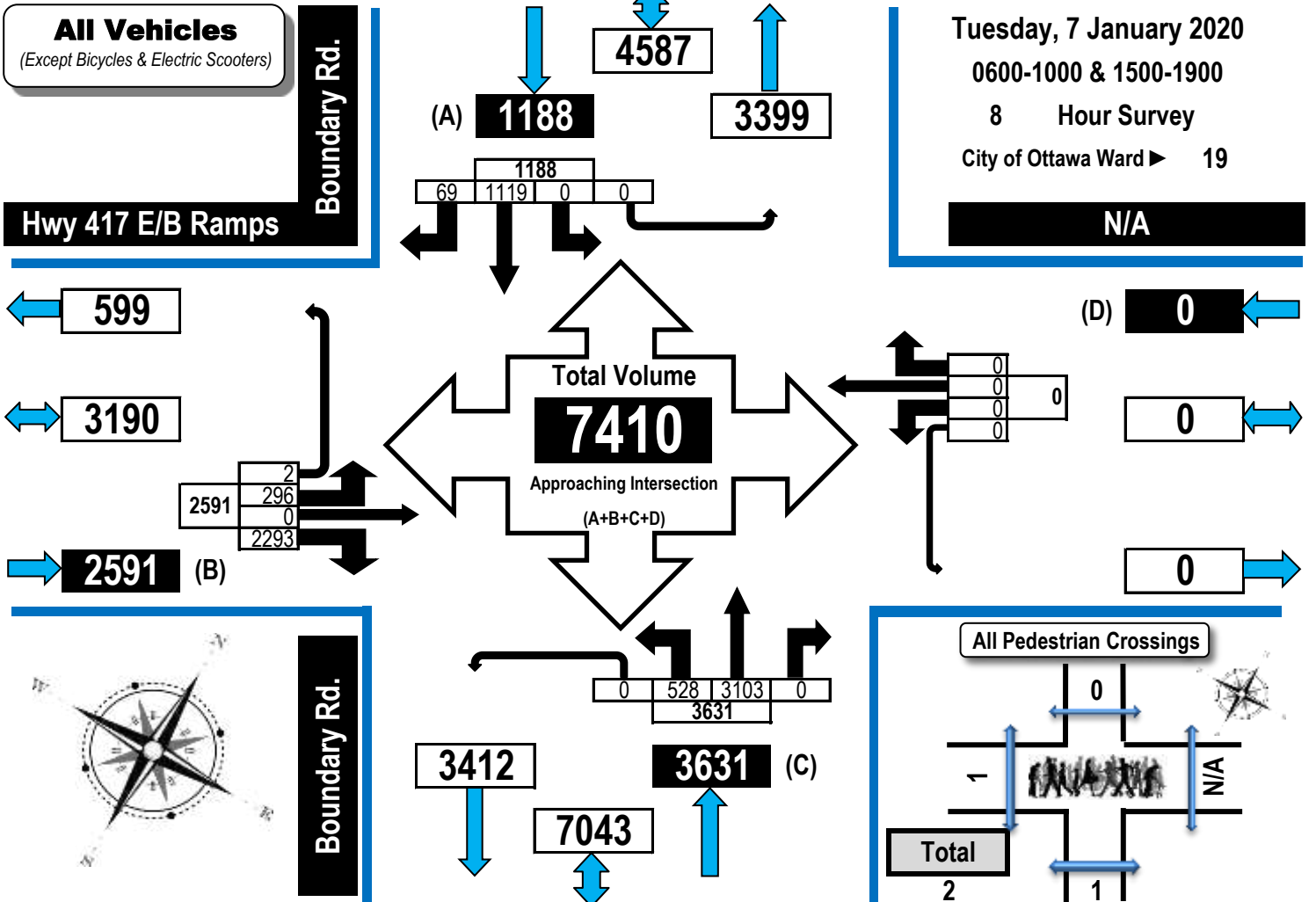
- Notes:**
1. Includes all vehicle types except bicycles and electric scooters.
  2. When expansion and AADT factors are applied, the results will differ slightly due to rounding.



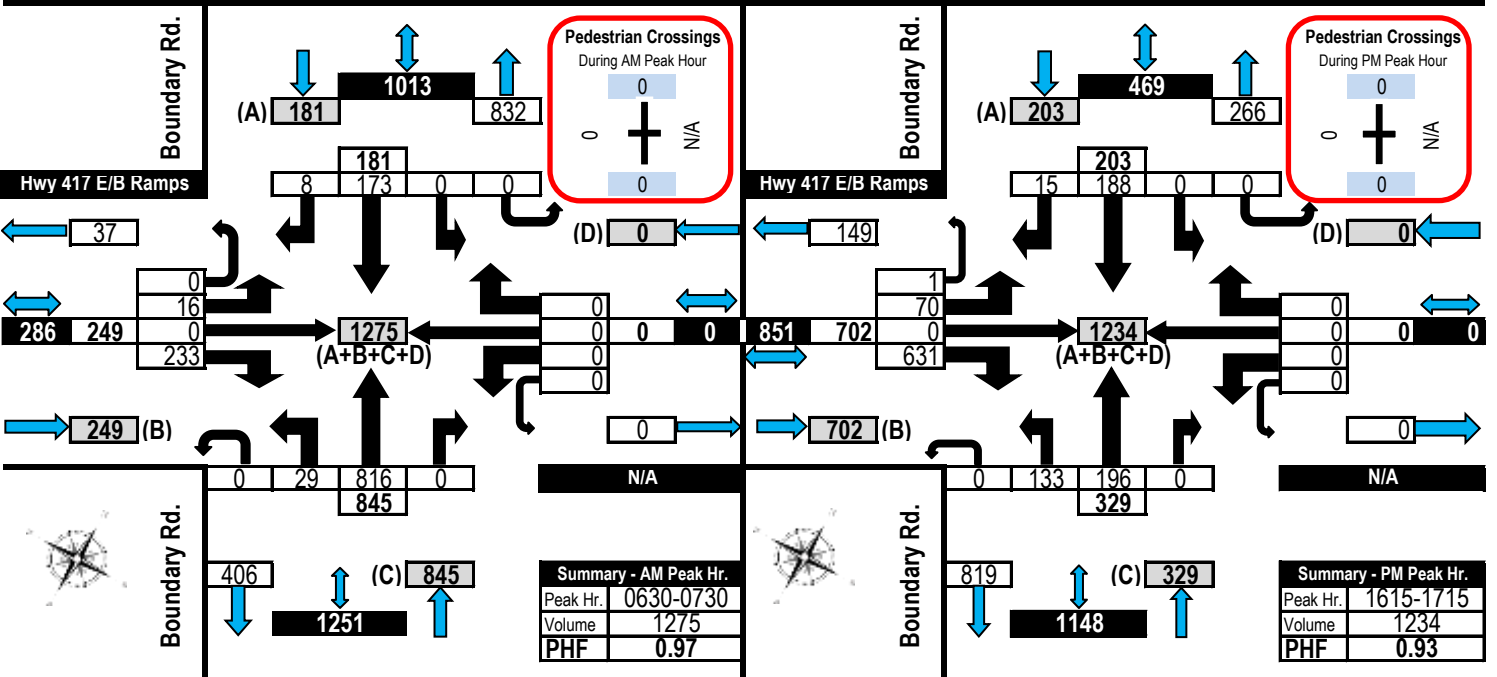
# Turning Movement Count Summary, AM and PM Peak Hour Flow Diagrams

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

## Boundary Road & Highway 417 South Ramps Carlsbad Springs, ON



### AM Peak Hour Flow Diagram PM Peak Hour Flow Diagram





# Turning Movement Count Heavy Vehicle Summary Flow Diagram



## Boundary Road & Highway 417 South Ramps Carlsbad Springs, ON

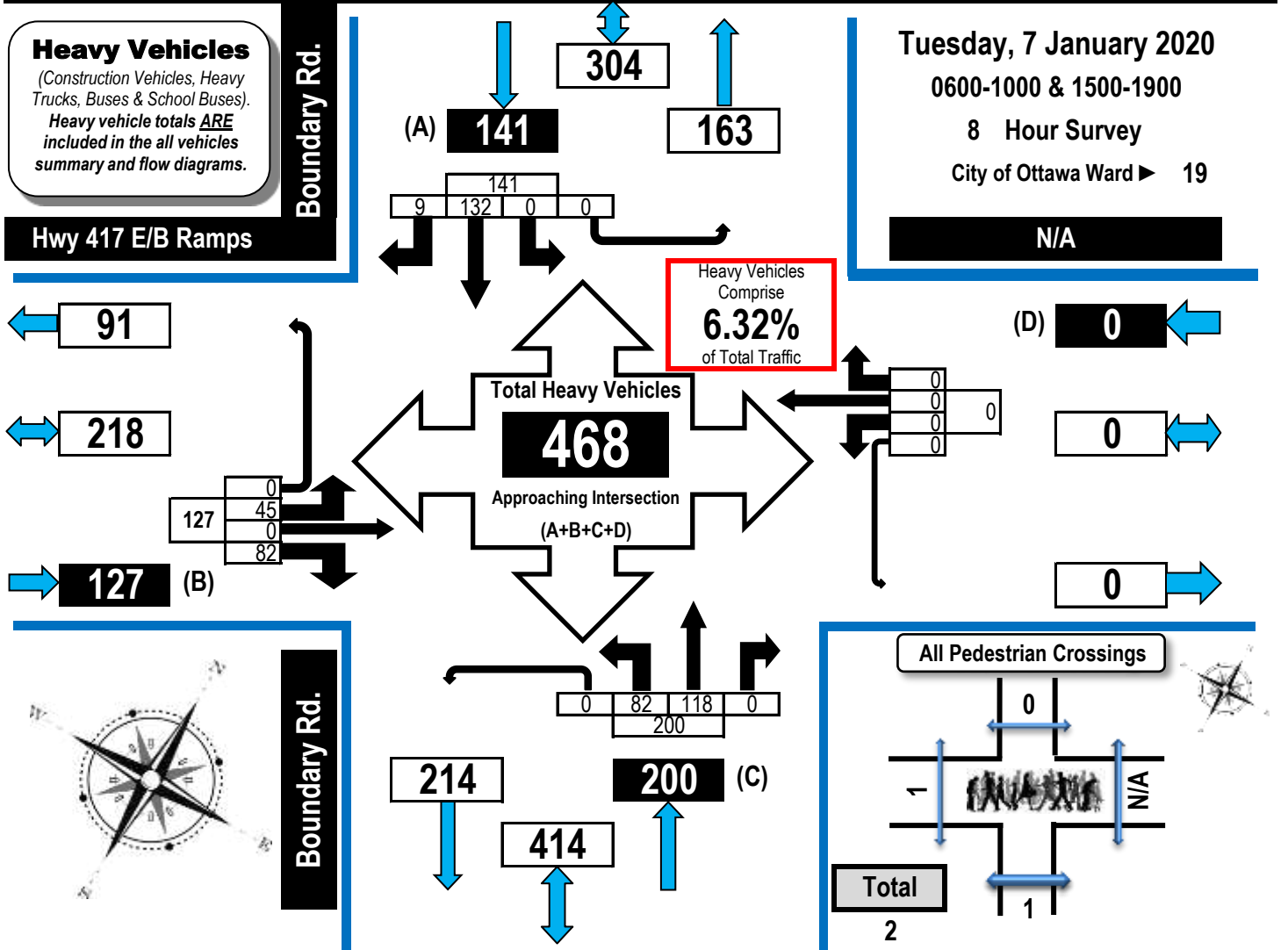
**Tuesday, 7 January 2020**  
**0600-1000 & 1500-1900**  
**8 Hour Survey**  
 City of Ottawa Ward ► 19

**Heavy Vehicles**  
*(Construction Vehicles, Heavy Trucks, Buses & School Buses).*  
 Heavy vehicle totals ARE included in the all vehicles summary and flow diagrams.

**Hwy 417 E/B Ramps**

**Boundary Rd.**

**N/A**



Hwy 417 E/B Ramps Eastbound	N/A Westbound	Boundary Rd. Northbound	Boundary Rd. Southbound
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Time Period	Hwy 417 E/B Ramps Eastbound					N/A Westbound					Boundary Rd. Northbound					Boundary Rd. Southbound					S. Tot	G.Tot.
	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot		
0600-0700	5	0	9	0	14	0	0	0	0	0	4	16	0	0	20	0	14	0	0	14	48	
0700-0800	5	0	14	0	19	0	0	0	0	0	9	16	0	0	25	0	19	1	0	20	64	
0800-0900	8	0	11	0	19	0	0	0	0	0	13	25	0	0	38	0	27	1	0	28	85	
0900-1000	9	0	6	0	15	0	0	0	0	0	13	26	0	0	39	0	15	2	0	17	71	
1500-1600	7	0	12	0	19	0	0	0	0	0	10	6	0	0	16	0	18	1	0	19	54	
1600-1700	6	0	16	0	22	0	0	0	0	0	13	13	0	0	26	0	20	1	0	21	69	
1700-1800	4	0	6	0	10	0	0	0	0	0	15	10	0	0	25	0	15	2	0	17	52	
1800-1900	1	0	8	0	9	0	0	0	0	0	5	6	0	0	11	0	4	1	0	5	25	
<b>Totals</b>	<b>45</b>	<b>0</b>	<b>82</b>	<b>0</b>	<b>127</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>82</b>	<b>118</b>	<b>0</b>	<b>0</b>	<b>200</b>	<b>0</b>	<b>132</b>	<b>9</b>	<b>0</b>	<b>141</b>	<b>468</b>	



# Turning Movement Count

## Summary Report Including AM, OFF Peak, PM, Evening Peak Hours, and PHF

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

### Boundary Road & Highway 417 South Ramps Carlsbad Springs, ON

**Survey Date:** Tuesday, 7 January 2020      **Start Time:** 0600      **AADT Factor:** 1.1  
**Weather AM:** Overcast -4° C      **Survey Duration:** 8 Hrs.      **Survey Hours:** 0600-1000 & 1500-1900  
**Weather PM:** Cloudy -1° C      **Surveyor(s):** Carmody

Hwy 417 E/B Ramps	N/A	Boundary Rd.	Boundary Rd.
Eastbound	Westbound	Northbound	Southbound

Time Period	Hwy 417 E/B Ramps					N/A					Boundary Rd. Northbound					Boundary Rd. Southbound					Street Total	Grand Total		
	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot				
0600-0700	16	0	172	0	188	0	0	0	0	0	188	21	756	0	0	777	0	178	7	0	185	188	962	1150
0700-0800	15	0	171	0	186	0	0	0	0	0	186	39	729	0	0	768	0	151	9	0	160	186	928	1114
0800-0900	18	0	86	1	105	0	0	0	0	0	105	55	450	0	0	505	0	135	6	0	141	105	646	751
0900-1000	21	0	60	0	81	0	0	0	0	0	81	44	291	0	0	335	0	80	4	0	84	81	419	500
1500-1600	75	0	489	0	564	0	0	0	0	0	564	79	202	0	0	281	0	134	5	0	139	564	420	984
1600-1700	70	0	641	1	712	0	0	0	0	0	712	126	184	0	0	310	0	171	17	0	188	712	498	1210
1700-1800	51	0	406	0	457	0	0	0	0	0	457	116	261	0	0	377	0	168	14	0	182	457	559	1016
1800-1900	30	0	268	0	298	0	0	0	0	0	298	48	230	0	0	278	0	102	7	0	109	298	387	685
<b>Totals</b>	<b>296</b>	<b>0</b>	<b>2293</b>	<b>2</b>	<b>2591</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2591</b>	<b>528</b>	<b>3103</b>	<b>0</b>	<b>0</b>	<b>3631</b>	<b>0</b>	<b>1119</b>	<b>69</b>	<b>0</b>	<b>1188</b>	<b>2591</b>	<b>4819</b>	<b>7410</b>

**Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts conducted during the hours of 0700h - 1000h, 1130h - 1330h and 1500h - 1800h**

<b>AM Peak Hour Factor → 0.97</b>											<b>Highest Hourly Vehicle Volume Between 0500h &amp; 1000h</b>												
AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0630-0730	16	0	233	0	249	0	0	0	0	0	249	29	816	0	0	845	0	173	8	0	181	1026	1275
<b>OFF Peak Hour Factor → N/A</b>											<b>Highest Hourly Vehicle Volume Between 1000h &amp; 1500h</b>												
OFF Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>PM Peak Hour Factor → 0.93</b>											<b>Highest Hourly Vehicle Volume Between 1500h &amp; 1900h</b>												
PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1615-1715	70	0	631	1	702	0	0	0	0	0	702	133	196	0	0	329	0	188	15	0	203	532	1234
<b>EVNG Peak Hour Factor → N/A</b>											<b>Highest Hourly Vehicle Volume Between 1900h &amp; 0000h</b>												
EVNG Pk Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Comments:**  
No bicycles were observed.

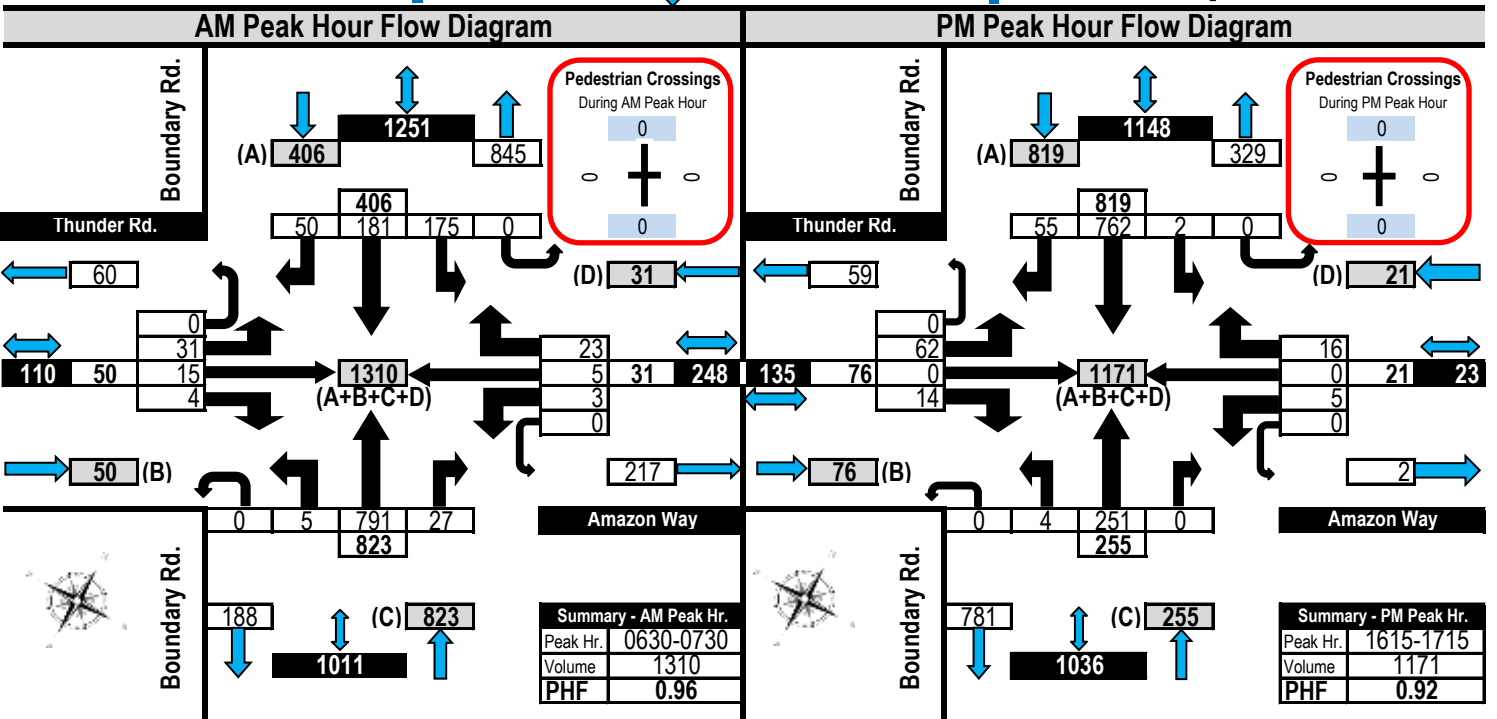
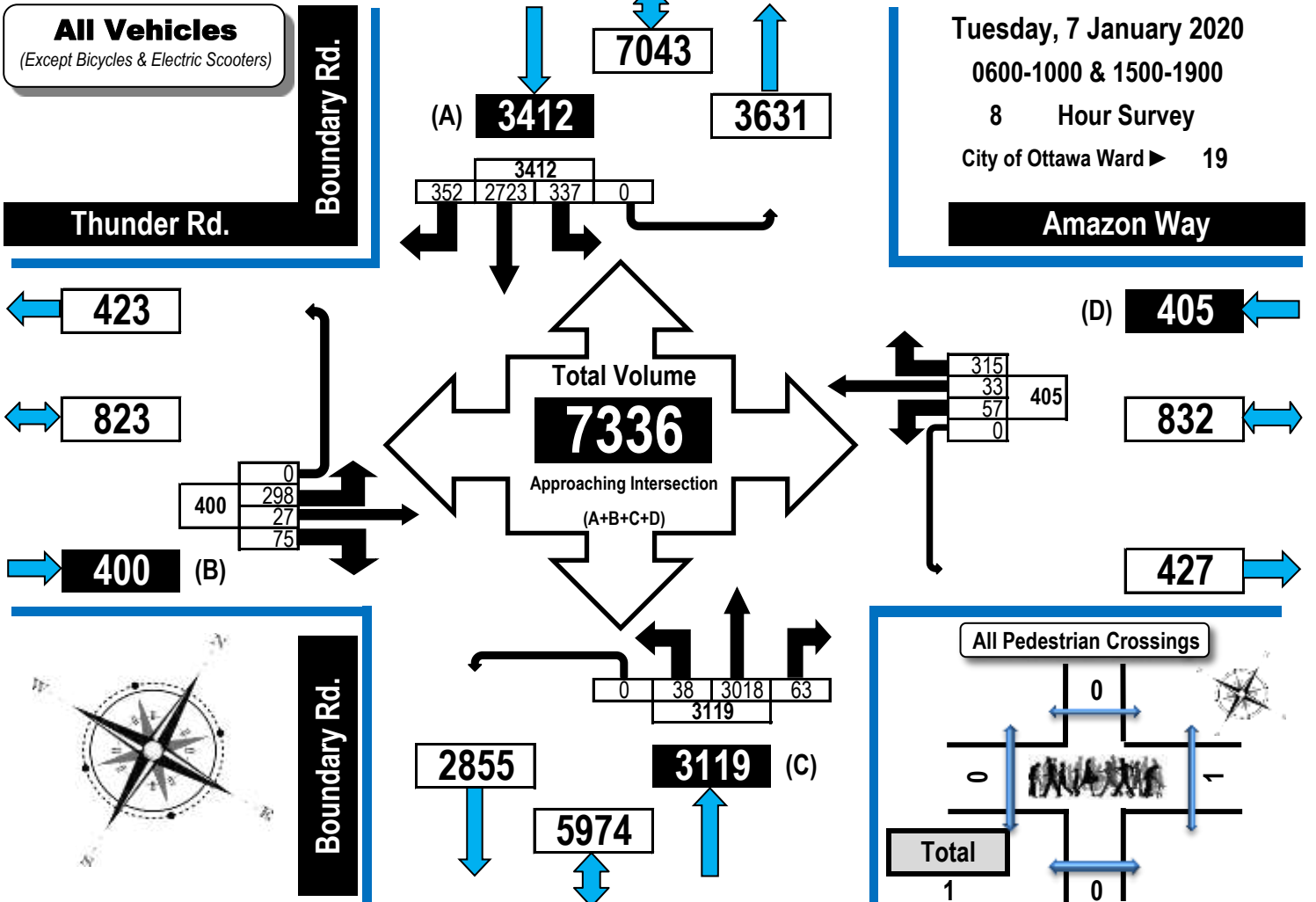
- Notes:**
1. Includes all vehicle types except bicycles and electric scooters.
  2. When expansion and AADT factors are applied, the results will differ slightly due to rounding.



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

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

## Boundary Road & Amazon Way/Thunder Road Carlsbad Springs, ON





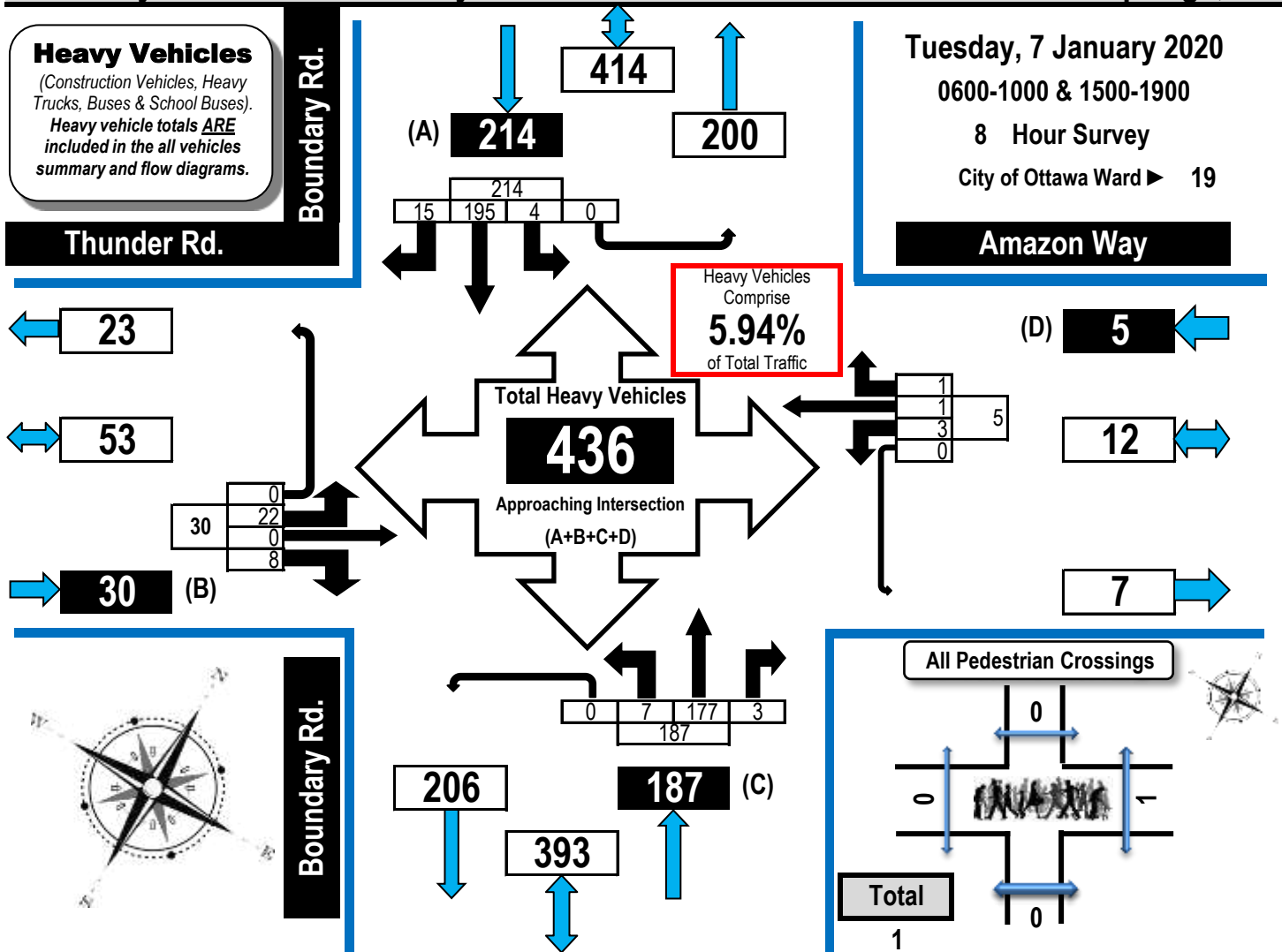
# Turning Movement Count Heavy Vehicle Summary Flow Diagram



## Boundary Road & Amazon Way/Thunder Road Carlsbad Springs, ON

**Heavy Vehicles**  
(Construction Vehicles, Heavy Trucks, Buses & School Buses).  
Heavy vehicle totals ARE included in the all vehicles summary and flow diagrams.

Tuesday, 7 January 2020  
0600-1000 & 1500-1900  
8 Hour Survey  
City of Ottawa Ward ► 19



Time Period	Thunder Rd. Eastbound					Amazon Way Westbound					Boundary Rd. Northbound					Boundary Rd. Southbound					S. Tot	G.Tot.
	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot		
0600-0700	1	0	0	0	1	0	0	0	0	0	1	19	0	0	20	0	23	0	0	23	44	
0700-0800	2	0	1	0	3	0	0	0	0	0	1	22	0	0	23	0	28	4	0	32	58	
0800-0900	8	0	2	0	10	0	0	1	0	1	3	30	1	0	34	1	33	5	0	39	84	
0900-1000	2	0	1	0	3	0	1	0	0	1	1	37	0	0	38	1	19	2	0	22	64	
1500-1600	2	0	3	0	5	1	0	0	0	1	0	14	2	0	16	1	27	2	0	30	52	
1600-1700	4	0	0	0	4	2	0	0	0	2	1	22	0	0	23	1	34	0	0	35	64	
1700-1800	2	0	1	0	3	0	0	0	0	0	0	23	0	0	23	0	20	1	0	21	47	
1800-1900	1	0	0	0	1	0	0	0	0	0	0	10	0	0	10	0	11	1	0	12	23	
<b>Totals</b>	<b>22</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>30</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>7</b>	<b>177</b>	<b>3</b>	<b>0</b>	<b>187</b>	<b>4</b>	<b>195</b>	<b>15</b>	<b>0</b>	<b>214</b>	<b>436</b>	





# Turning Movement Count

## Summary Report Including AM, OFF Peak, PM, Evening Peak Hours, and PHF

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

### Boundary Road & Amazon Way/Thunder Road

**Carlsbad Springs, ON**

Survey Date: Tuesday, 7 January 2020

Start Time: 0600      AADT Factor: 1.1

Weather AM: Overcast - 4° C

Survey Duration: 8 Hrs.

Survey Hours: 0600-1000 & 1500-1900

Weather PM: Cloudy - 1° C

Surveyor(s): Carmody

Thunder Rd.	Amazon Way	Boundary Rd.	Boundary Rd.
Eastbound	Westbound	Northbound	Southbound

Time Period	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	Street Total	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot	Street Total	Grand Total
0600-0700	29	5	3	0	37	10	4	78	0	92	129	7	670	18	0	695	131	163	56	0	350	1045	1174
0700-0800	30	10	3	0	43	1	3	14	0	18	61	3	724	15	0	742	87	193	42	0	322	1064	1125
0800-0900	33	5	4	0	42	1	1	3	0	5	47	7	469	6	0	482	18	170	33	0	221	703	750
0900-1000	24	0	6	0	30	0	2	5	0	7	37	4	306	2	0	312	3	122	15	0	140	452	489
1500-1600	49	0	11	0	60	5	4	15	0	24	84	4	217	6	0	227	8	557	58	0	623	850	934
1600-1700	59	0	19	0	78	6	0	14	0	20	98	9	237	0	0	246	2	745	65	0	812	1058	1156
1700-1800	55	1	15	0	71	11	4	67	0	82	153	1	255	5	0	261	16	509	49	0	574	835	988
1800-1900	19	6	14	0	39	23	15	119	0	157	196	3	140	11	0	154	72	264	34	0	370	524	720
<b>Totals</b>	<b>298</b>	<b>27</b>	<b>75</b>	<b>0</b>	<b>400</b>	<b>57</b>	<b>33</b>	<b>315</b>	<b>0</b>	<b>405</b>	<b>805</b>	<b>38</b>	<b>3018</b>	<b>63</b>	<b>0</b>	<b>3119</b>	<b>337</b>	<b>2723</b>	<b>352</b>	<b>0</b>	<b>3412</b>	<b>6531</b>	<b>7336</b>

**Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts conducted during the hours of 0700h - 1000h, 1130h - 1330h and 1500h - 1800h**

AM Peak Hour Factor → <b>0.96</b>												Highest Hourly Vehicle Volume Between 0500h & 1000h											
AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0630-0730	31	15	4	0	50	3	5	23	0	31	81	5	791	27	0	823	175	181	50	0	406	1229	1310
OFF Peak Hour Factor → <b>N/A</b>												Highest Hourly Vehicle Volume Between 1000h & 1500h											
OFF Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM Peak Hour Factor → <b>0.92</b>												Highest Hourly Vehicle Volume Between 1500h & 1900h											
PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1615-1715	62	0	14	0	76	5	0	16	0	21	97	4	251	0	0	255	2	762	55	0	819	1074	1171
EVNG Peak Hour Factor → <b>N/A</b>												Highest Hourly Vehicle Volume Between 1900h & 0000h											
EVNG Pk Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Comments:**

Much of the traffic, including the majority of the heavy vehicles, to and from Thunder Road is associated with the Petro Canada gas station on the southwest corner. The heavy vehicle total includes 29 school buses and 7 private buses. There were no bicycles observed during this traffic count.

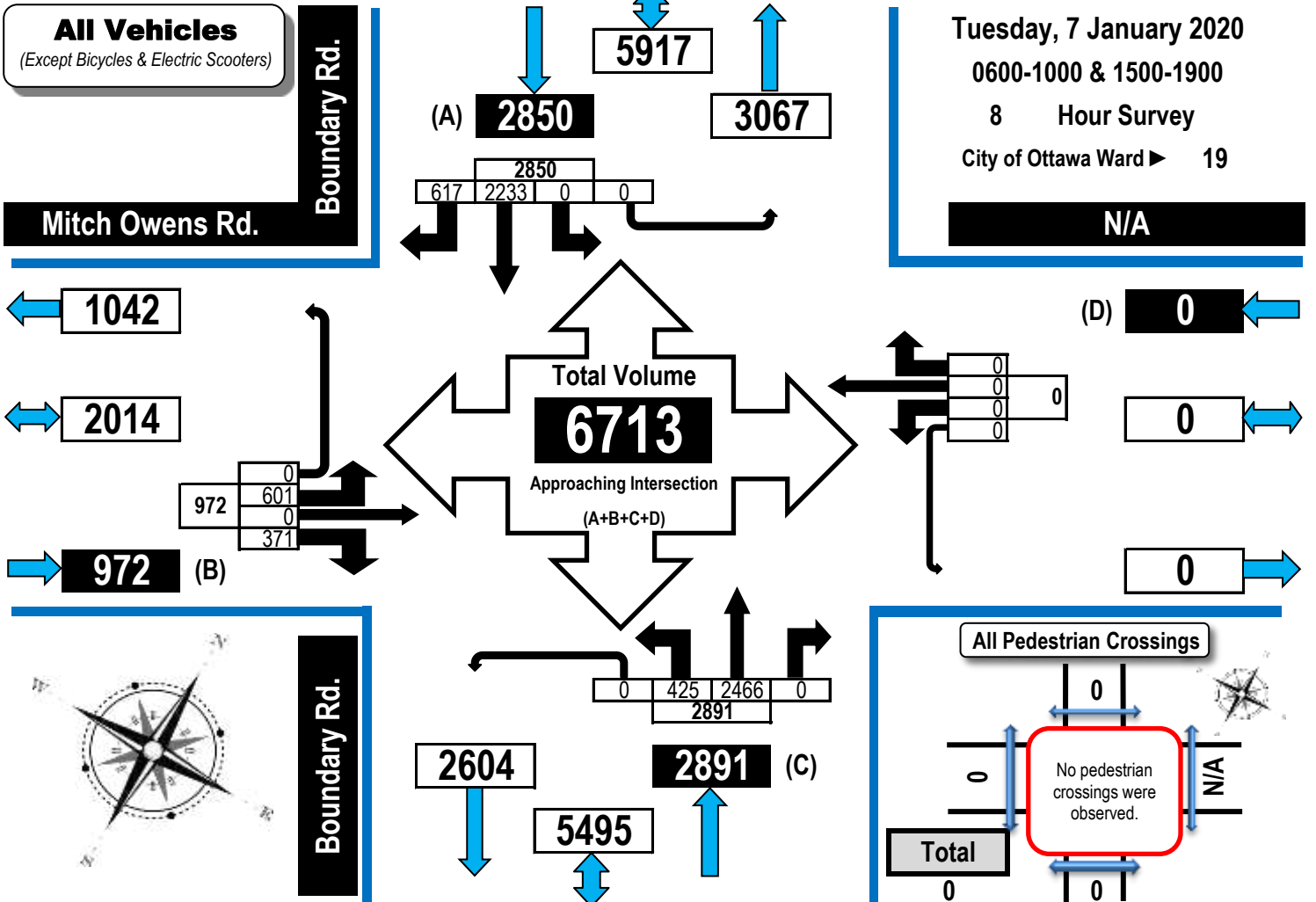
- Notes:**
1. Includes all vehicle types except bicycles and electric scooters.
  2. When expansion and AADT factors are applied, the results will differ slightly due to rounding.



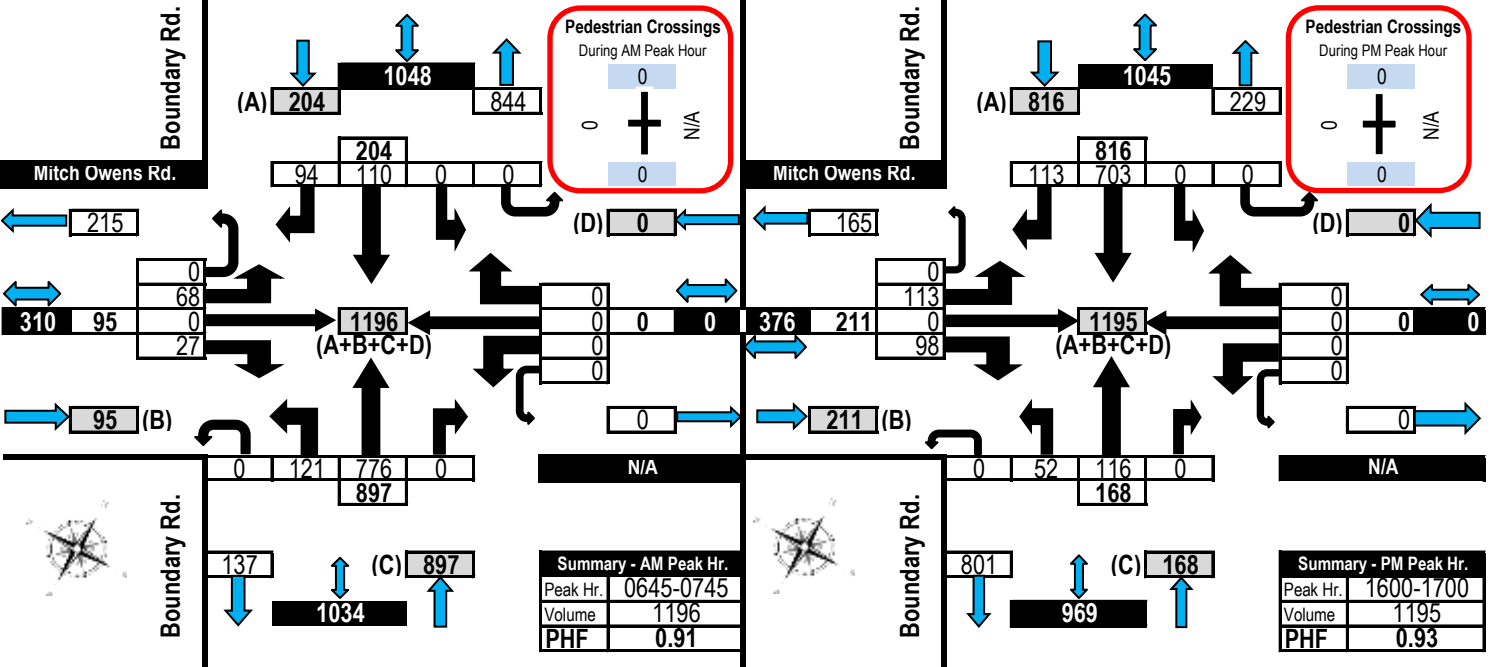
# Turning Movement Count Summary, AM and PM Peak Hour Flow Diagrams

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

## Boundary Road & Mitch Owens Road Carlsbad Springs, ON



### AM Peak Hour Flow Diagram      PM Peak Hour Flow Diagram





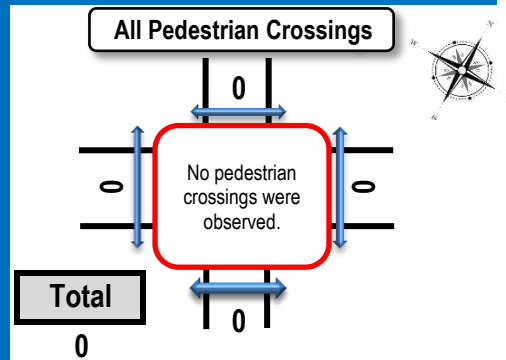
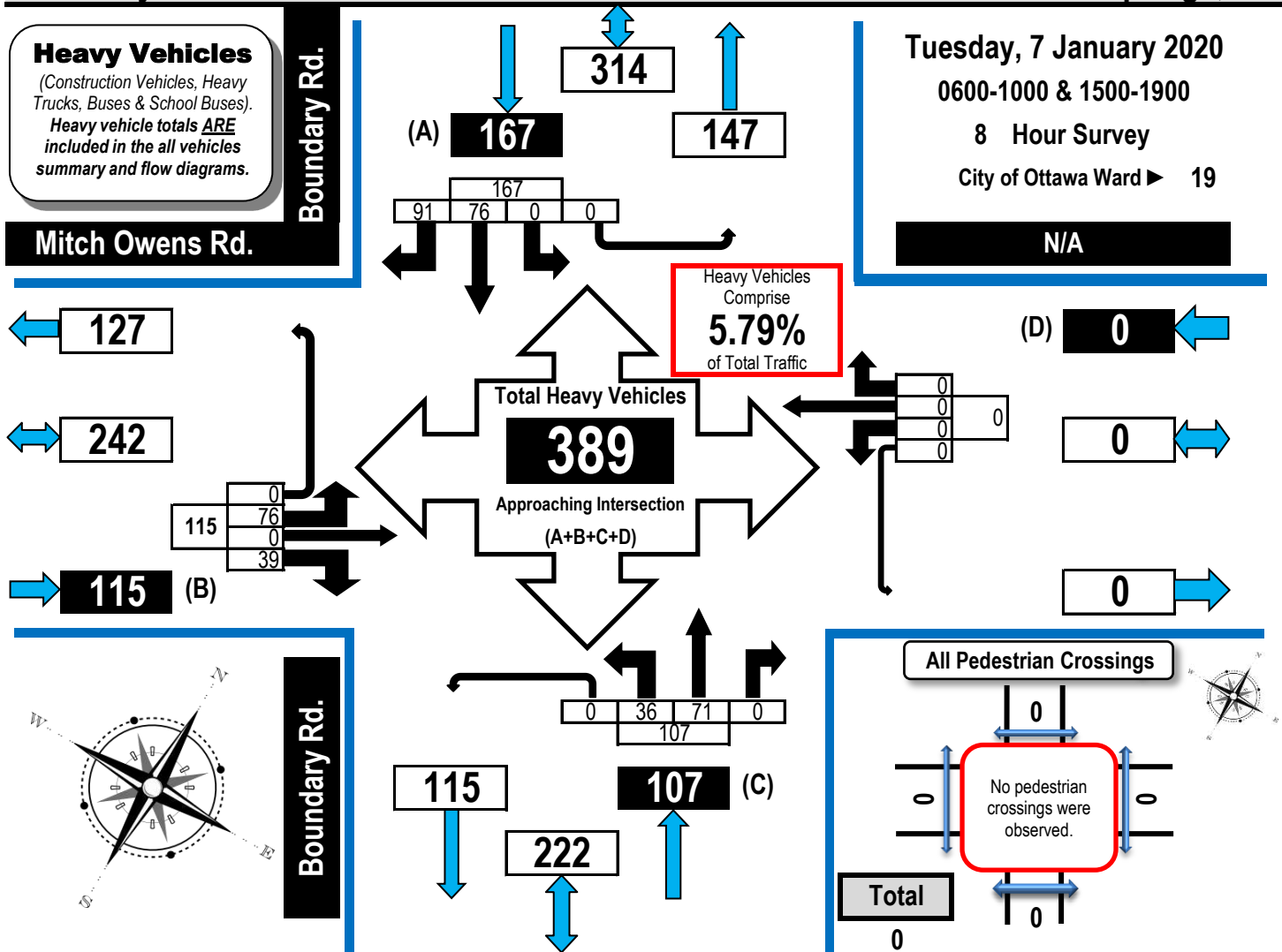
# Turning Movement Count Heavy Vehicle Summary Flow Diagram



**Boundary Road & Mitch Owens Road** **Carlsbad Springs, ON**

**Heavy Vehicles**  
(Construction Vehicles, Heavy Trucks, Buses & School Buses).  
Heavy vehicle totals ARE included in the all vehicles summary and flow diagrams.

**Tuesday, 7 January 2020**  
**0600-1000 & 1500-1900**  
**8 Hour Survey**  
City of Ottawa Ward ► **19**



Mitch Owens Rd. Eastbound
N/A Westbound
Boundary Rd. Northbound
Boundary Rd. Southbound

Time Period	Mitch Owens Rd. Eastbound					N/A Westbound					Boundary Rd. Northbound					Boundary Rd. Southbound					S. Tot	G.Tot.
	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot		
0600-0700	6	0	6	0	12	0	0	0	0	0	4	12	0	0	16	0	4	6	0	10	38	
0700-0800	8	0	4	0	12	0	0	0	0	0	10	10	0	0	20	0	15	16	0	31	63	
0800-0900	12	0	6	0	18	0	0	0	0	0	7	18	0	0	25	0	8	17	0	25	68	
0900-1000	21	0	4	0	25	0	0	0	0	0	3	10	0	0	13	0	9	14	0	23	61	
1500-1600	4	0	11	0	15	0	0	0	0	0	5	5	0	0	10	0	18	12	0	30	55	
1600-1700	15	0	6	0	21	0	0	0	0	0	4	5	0	0	9	0	10	14	0	24	54	
1700-1800	5	0	2	0	7	0	0	0	0	0	2	7	0	0	9	0	10	10	0	20	36	
1800-1900	5	0	0	0	5	0	0	0	0	0	1	4	0	0	5	0	2	2	0	4	14	
<b>Totals</b>	<b>76</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>115</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>36</b>	<b>71</b>	<b>0</b>	<b>0</b>	<b>107</b>	<b>0</b>	<b>76</b>	<b>91</b>	<b>0</b>	<b>167</b>	<b>389</b>	



# Turning Movement Count

## Summary Report Including AM, OFF Peak, PM, Evening Peak Hours, and PHF

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

### Boundary Road & Mitch Owens Road

### Carlsbad Springs, ON

Survey Date: Tuesday, 7 January 2020

Start Time: 0600      AADT Factor: 1.1

Weather AM: Overcast - 4° C

Survey Duration: 8 Hrs.

Survey Hours: 0600-1000 & 1500-1900

Weather PM: Cloudy - 1° C

Surveyor(s): Carmody

#### Mitch Owens Rd.

#### N/A

#### Boundary Rd.

#### Boundary Rd.

Eastbound

Westbound

Northbound

Southbound

Time Period	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	Street Total	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot	Street Total	Grand Total
0600-0700	51	0	28	0	79	0	0	0	0	0	79	81	670	0	0	751	0	57	88	0	145	896	975
0700-0800	63	0	19	0	82	0	0	0	0	0	82	118	681	0	0	799	0	115	95	0	210	1009	1091
0800-0900	80	0	30	0	110	0	0	0	0	0	110	52	412	0	0	464	0	92	75	0	167	631	741
0900-1000	58	0	16	0	74	0	0	0	0	0	74	29	239	0	0	268	0	67	48	0	115	383	457
1500-1600	75	0	74	0	149	0	0	0	0	0	149	45	125	0	0	170	0	488	66	0	554	724	873
1600-1700	113	0	98	0	211	0	0	0	0	0	211	52	116	0	0	168	0	703	113	0	816	984	1195
1700-1800	113	0	74	0	187	0	0	0	0	0	187	30	128	0	0	158	0	459	75	0	534	692	879
1800-1900	48	0	32	0	80	0	0	0	0	0	80	18	95	0	0	113	0	252	57	0	309	422	502
Totals	601	0	371	0	972	0	0	0	0	0	972	425	2466	0	0	2891	0	2233	617	0	2850	5741	6713

**Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts conducted during the hours of 0700h - 1000h, 1130h - 1330h and 1500h - 1800h**

AM Peak Hour Factor → <b>0.91</b>											Highest Hourly Vehicle Volume Between 0500h & 1000h												
AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0645-0745	68	0	27	0	95	0	0	0	0	0	95	121	776	0	0	897	0	110	94	0	204	1101	1196
OFF Peak Hour Factor → <b>N/A</b>											Highest Hourly Vehicle Volume Between 1000h & 1500h												
OFF Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM Peak Hour Factor → <b>0.93</b>											Highest Hourly Vehicle Volume Between 1500h & 1900h												
PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1600-1700	113	0	98	0	211	0	0	0	0	0	211	52	116	0	0	168	0	703	113	0	816	984	1195
EVNG Peak Hour Factor → <b>N/A</b>											Highest Hourly Vehicle Volume Between 1900h & 0000h												
EVNG Pk Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Comments:**

Large heavy vehicles cannot complete their turns without driving into adjacent lanes. The lack of a northbound left-turn lane results in some northbound drivers using the shoulder to pass vehicles waiting to turn. Some southbound drivers pass southbound heavy vehicles turning right onto Mitch Owens Road as the heavy vehicle turns from the southbound through lane.

- Notes:**
1. Includes all vehicle types except bicycles and electric scooters.
  2. When expansion and AADT factors are applied, the results will differ slightly due to rounding.

# APPENDIX D

## Collision Data



# City Operations - Transportation Services

## Collision Details Report - Public Version

**From:** January 1, 2014 **To:** December 31, 2018

**Location:** BOUNDARY RD @ HWY 417 BOUNDARY IC96R15

**Traffic Control:** No control

**Total Collisions:** 3

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuvre	Vehicle type	First Event	No. Ped
2016-May-01, Sun,22:14	Rain	SMV other	P.D. only	Wet	North	Turning left	Automobile, station wagon	Ran off road	
2016-Nov-13, Sun,11:05	Clear	Rear end	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Turning left	Automobile, station wagon	Other motor vehicle	
2018-Mar-22, Thu,14:00	Clear	Rear end	Non-fatal injury	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle	
					North	Turning left	Automobile, station wagon	Other motor vehicle	

**Location:** BOUNDARY RD @ HWY 417 BOUNDARY IC96R16

**Traffic Control:** No control

**Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuvre	Vehicle type	First Event	No. Ped
2015-Sep-12, Sat,11:19	Rain	Rear end	P.D. only	Wet	North	Going ahead	Pick-up truck	Other motor vehicle	
					North	Turning right	Pick-up truck	Other motor vehicle	

**Location:** BOUNDARY RD @ HWY 417 BOUNDARY IC96R51

**Traffic Control:** Stop sign

**Total Collisions:** 7

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuvre	Vehicle type	First Event	No. Ped
---------------	-------------	-------------	----------------	----------------	----------	-------------------	--------------	-------------	---------

2014-Jun-21, Sat,23:06	Clear	Rear end	P.D. only	Dry	North	Going ahead	Unknown	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Aug-22, Fri,16:15	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Slowing or stopping	Automobile, station wagon	Other motor vehicle
2015-May-27, Wed,18:10	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2017-Oct-04, Wed,00:19	Rain	Angle	Fatal injury	Wet	East	Turning right	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2017-Nov-08, Wed,10:30	Clear	Sideswipe	P.D. only	Dry	East	Turning right	Automobile, station wagon	Other motor vehicle
					East	Turning right	Truck and trailer	Other motor vehicle
2018-Sep-06, Thu,15:10	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2018-Apr-11, Wed,17:10	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Slowing or stopping	Automobile, station wagon	Other motor vehicle

**Location:** BOUNDARY RD @ HWY 417 BOUNDARY IC96R61

**Traffic Control:** Stop sign

**Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-May-02, Sat,02:58	Clear	SMV other	P.D. only	Dry	South	Going ahead	Pick-up truck	Pole (sign, parking meter)	
2015-Feb-15, Sun,15:20	Clear	Rear end	P.D. only	Dry	West	Going ahead	Pick-up truck	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	

**Location:** BOUNDARY RD @ MITCH OWENS RD

**Traffic Control:** Stop sign

**Total Collisions:** 18

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Feb-03, Mon,21:45	Clear	SMV other	P.D. only	Dry	North	Going ahead	Pick-up truck	Animal - wild	
2014-Mar-29, Sat,10:14	Clear	SMV other	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Ran off road	
2014-Nov-08, Sat,02:00	Clear	SMV other	P.D. only	Dry	East	Turning right	Pick-up truck	Ran off road	
2014-Sep-27, Sat,08:57	Clear	SMV other	P.D. only	Dry	East	Going ahead	Pick-up truck	Fence/noice barrier	
2015-Feb-25, Wed,16:28	Clear	Angle	P.D. only	Dry	East	Going ahead	Delivery van	Other motor vehicle	
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Jun-18, Sat,14:34	Clear	Angle	P.D. only	Dry	East	Turning left	Passenger van	Other motor vehicle	
					South	Going ahead	Automobile, station wagon	Other motor vehicle	



2015-Oct-30, Fri, 17:16	Clear	Rear end	Non-fatal injury	Dry	North	Going ahead	Delivery van	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle
2015-Oct-13, Tue, 11:34	Rain	SMV other	P.D. only	Wet	North	Overtaking	Automobile, station wagon	Skidding/sliding
2015-Oct-19, Mon, 07:35	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle
2016-Jan-17, Sun, 17:07	Snow	SMV other	P.D. only	Loose snow	South	Going ahead	Automobile, station wagon	Ditch
2016-Jan-01, Fri, 12:28	Snow	Angle	P.D. only	Wet	East	Turning left	Delivery van	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Aug-18, Thu, 17:57	Clear	Angle	P.D. only	Dry	East	Turning left	Pick-up truck	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Nov-08, Tue, 17:42	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Nov-25, Fri, 16:38	Fog, mist, smoke, Rear end dust		Non-fatal injury	Wet	North	Going ahead	Pick-up truck	Other motor vehicle

					North	Turning left	Automobile, station wagon	Other motor vehicle
2017-Jun-01, Thu, 17:20	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2017-Jun-09, Fri, 09:25	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Skidding/sliding
2018-Dec-02, Sun, 22:30	Fog, mist, smoke, dust	Rear end	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Slowing or stopping	Automobile, station wagon	Other motor vehicle
2018-Dec-21, Fri, 19:00	Fog, mist, smoke, dust	SMV other	P.D. only	Ice	South	Going ahead	Automobile, station wagon	Skidding/sliding

**Location:** BOUNDARY RD @ NINTH LINE RD

**Traffic Control:** Stop sign

**Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Sep-06, Wed, 15:07	Clear	Turning movement	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle	
					South	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
2017-Feb-13, Mon, 15:44	Snow	Turning movement	P.D. only	Loose snow	North	Turning left	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Automobile, station wagon	Other motor vehicle	

# APPENDIX E

## NCR Survey Data

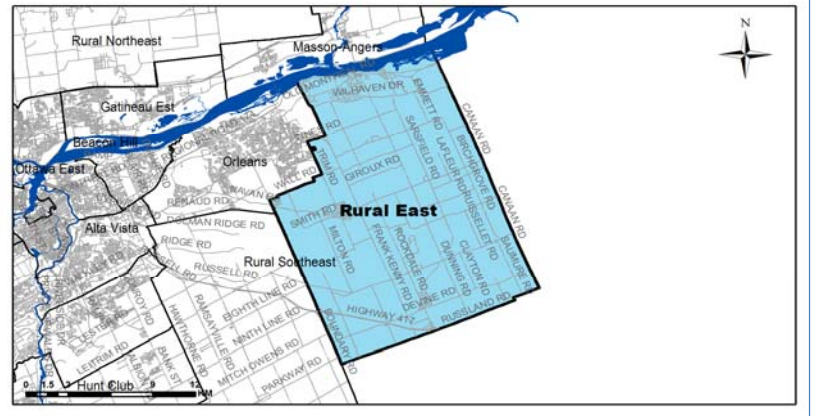
## Demographic Characteristics

Population	11,420	Actively Travelled	9,090
Employed Population	5,480	Number of Vehicles	9,320
Households	4,090	Area (km <sup>2</sup> )	287.5

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	2,850	2,180	5,040
Part Time Employed	90	360	450
Student	1,280	1,320	2,600
Retiree	1,010	1,020	2,030
Unemployed	130	100	240
Homemaker	0	400	400
Other	50	90	150
<b>Total:</b>	<b>5,410</b>	<b>5,480</b>	<b>10,900</b>

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	500	490	990
Licensed Drivers	4,450	4,410	8,850
Telecommuters	0	80	80
Trips made by residents	13,710	14,700	28,410

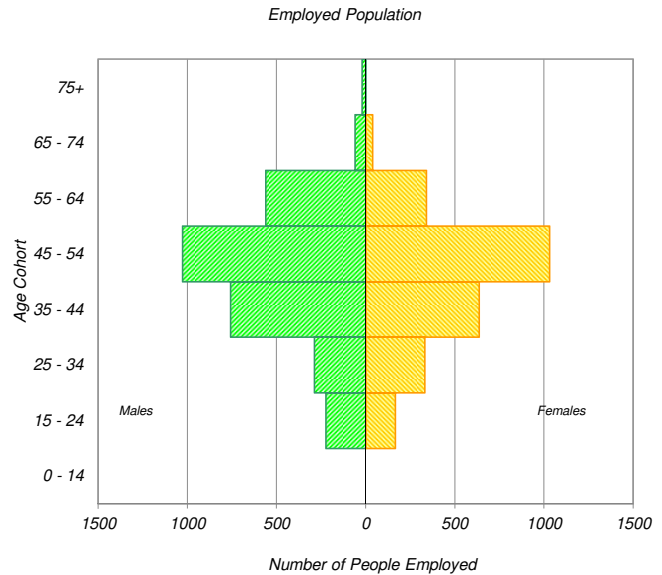
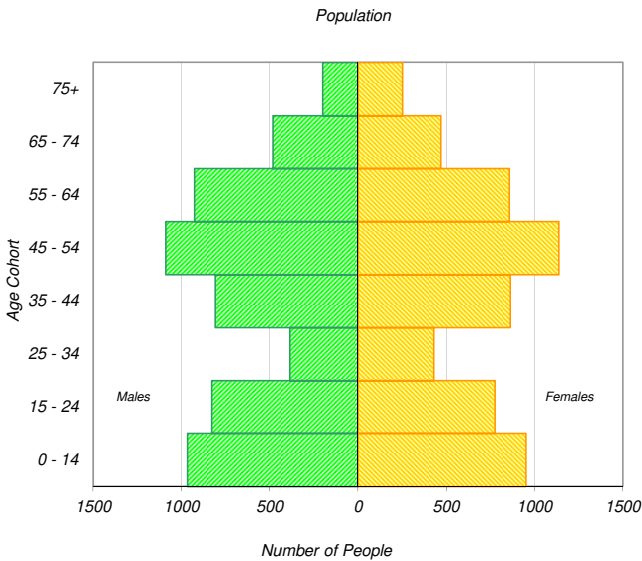
Selected Indicators	
Daily Trips per Person (age 5+)	2.61
Vehicles per Person	0.82
Number of Persons per Household	2.79
Daily Trips per Household	6.95
Vehicles per Household	2.28
Workers per Household	1.34
Population Density (Pop/km <sup>2</sup> )	40



Household Size		
1 person	580	14%
2 persons	1,280	31%
3 persons	780	19%
4 persons	990	24%
5+ persons	460	11%
<b>Total:</b>	<b>4,090</b>	<b>100%</b>

Households by Vehicle Availability		
0 vehicles	60	1%
1 vehicle	810	20%
2 vehicles	1,820	44%
3 vehicles	910	22%
4+ vehicles	490	12%
<b>Total:</b>	<b>4,090</b>	<b>100%</b>

Households by Dwelling Type		
Single-detached	3,270	80%
Semi-detached	270	7%
Townhouse	220	5%
Apartment/Condo	330	8%
<b>Total:</b>	<b>4,090</b>	<b>100%</b>

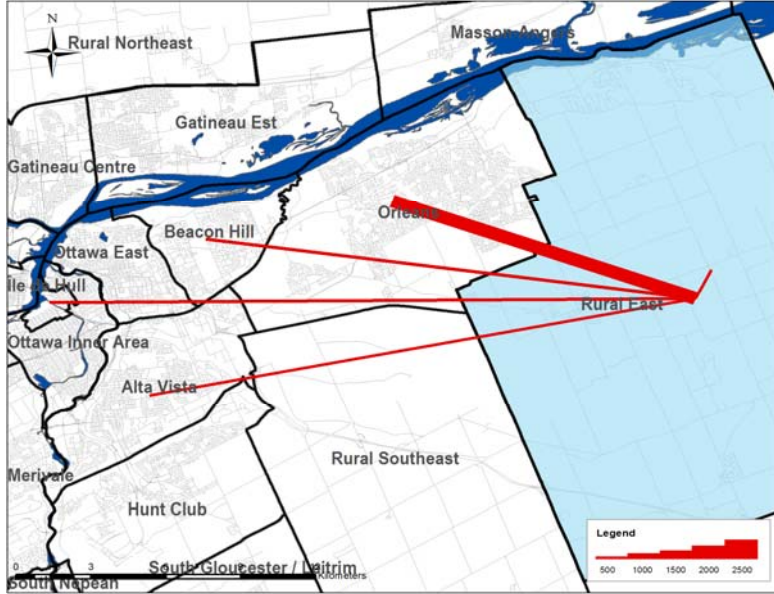


\* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

## Travel Patterns

### Top Five Destinations of Trips from Rural East

#### AM Peak Period



### Summary of Trips to and from Rural East

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

Districts	Destinations of Trips From		Origins of Trips To	
	District	% Total	District	% Total
Ottawa Centre	450	8%	0	0%
Ottawa Inner Area	250	5%	70	3%
Ottawa East	160	3%	70	3%
Beacon Hill	350	7%	60	2%
Alta Vista	430	8%	110	4%
Hunt Club	140	3%	50	2%
Merivale	340	6%	10	0%
Ottawa West	60	1%	40	2%
Bayshore / Cedarview	50	1%	20	1%
Orléans	1,970	37%	1,000	38%
Rural East	820	15%	820	31%
Rural Southeast	30	1%	170	6%
South Gloucester / Leitrim	10	0%	0	0%
South Nepean	60	1%	20	1%
Rural Southwest	20	0%	0	0%
Kanata / Stittsville	30	1%	100	4%
Rural West	0	0%	0	0%
Île de Hull	70	1%	10	0%
Hull Périphérie	30	1%	10	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	30	1%
Rural Northwest	0	0%	0	0%
Pointe Gatineau	0	0%	30	1%
Gatineau Est	0	0%	20	1%
Rural Northeast	40	1%	0	0%
Buckingham / Masson-Angers	0	0%	0	0%
<b>Ontario Sub-Total:</b>	<b>5,170</b>	<b>97%</b>	<b>2,540</b>	<b>96%</b>
<b>Québec Sub-Total:</b>	<b>140</b>	<b>3%</b>	<b>100</b>	<b>4%</b>
<b>Total:</b>	<b>5,310</b>	<b>100%</b>	<b>2,640</b>	<b>100%</b>

### Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	3,600	27%	1,100	8%	710	19%
School	1,590	12%	790	6%	320	9%
Shopping	1,460	11%	300	2%	90	2%
Leisure	1,290	10%	1,160	9%	410	11%
Medical	480	4%	90	1%	0	0%
Pick-up / drive passenger	1,150	9%	580	4%	350	9%
Return Home	3,120	23%	8,900	67%	1,620	43%
Other	670	5%	460	3%	250	7%
<b>Total:</b>	<b>13,360</b>	<b>100%</b>	<b>13,380</b>	<b>100%</b>	<b>3,750</b>	<b>100%</b>

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	2,280	51%	660	36%	270	33%
School	1,370	30%	740	41%	310	38%
Shopping	70	2%	0	0%	0	0%
Leisure	70	2%	100	5%	10	1%
Medical	120	3%	40	2%	0	0%
Pick-up / drive passenger	380	8%	50	3%	120	15%
Return Home	30	1%	130	7%	70	9%
Other	180	4%	100	5%	40	5%
<b>Total:</b>	<b>4,500</b>	<b>100%</b>	<b>1,820</b>	<b>100%</b>	<b>820</b>	<b>100%</b>

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	60	3%	90	2%	60	9%
School	10	0%	0	0%	0	0%
Shopping	180	8%	20	0%	30	5%
Leisure	250	11%	340	8%	110	17%
Medical	120	5%	30	1%	0	0%
Pick-up / drive passenger	250	11%	150	4%	40	6%
Return Home	1,290	58%	3,510	85%	400	61%
Other	60	3%	10	0%	20	3%
<b>Total:</b>	<b>2,220</b>	<b>100%</b>	<b>4,150</b>	<b>100%</b>	<b>660</b>	<b>100%</b>

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	30,490		12%
AM Peak Period	7,140	23%	11%
PM Peak Period	7,030	23%	9%

### Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	8,560	64%	8,540	64%	2,210	59%
Auto Passenger	2,530	19%	2,660	20%	650	17%
Transit	1,210	9%	1,220	9%	20	1%
Bicycle	30	0%	30	0%	100	3%
Walk	20	0%	20	0%	440	12%
Other	1,000	7%	920	7%	330	9%
<b>Total:</b>	<b>13,350</b>	<b>100%</b>	<b>13,390</b>	<b>100%</b>	<b>3,750</b>	<b>100%</b>

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	2,510	56%	830	46%	400	49%
Auto Passenger	750	17%	240	13%	170	21%
Transit	420	9%	550	30%	10	1%
Bicycle	0	0%	20	1%	10	1%
Walk	0	0%	20	1%	70	9%
Other	810	18%	150	8%	160	20%
<b>Total:</b>	<b>4,490</b>	<b>100%</b>	<b>1,810</b>	<b>100%</b>	<b>820</b>	<b>100%</b>

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	1,280	58%	2,770	67%	360	55%
Auto Passenger	390	18%	730	18%	150	23%
Transit	420	19%	440	11%	10	2%
Bicycle	10	0%	10	0%	10	2%
Walk	20	1%	0	0%	60	9%
Other	100	5%	210	5%	70	11%
<b>Total:</b>	<b>2,220</b>	<b>100%</b>	<b>4,160</b>	<b>100%</b>	<b>660</b>	<b>100%</b>

Avg Vehicle Occupancy	From District		To District		Within District	
24 Hours	1.30		1.31		1.29	
AM Peak Period	1.30		1.29		1.43	
PM Peak Period	1.30		1.26		1.42	

Transit Modal Split	From District		To District		Within District	
24 Hours	10%		10%		1%	
AM Peak Period	11%		34%		2%	
PM Peak Period	20%		11%		2%	

# Rural Southeast

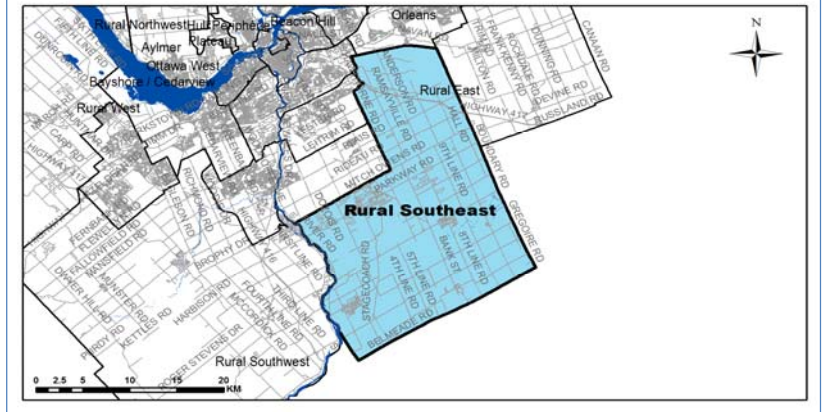
## Demographic Characteristics

Population	26,840	Actively Travelled	21,350
Employed Population	13,620	Number of Vehicles	19,650
Households	9,320	Area (km <sup>2</sup> )	508.6

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	6,760	5,460	12,230
Part Time Employed	310	1,080	1,390
Student	3,300	2,860	6,160
Retiree	2,000	2,150	4,150
Unemployed	230	190	420
Homemaker	10	610	630
Other	200	290	490
<b>Total:</b>	<b>12,820</b>	<b>12,640</b>	<b>25,460</b>

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	590	700	1,290
Licensed Drivers	10,120	10,110	20,230
Telecommuters	10	80	100
Trips made by residents	32,130	35,050	67,170

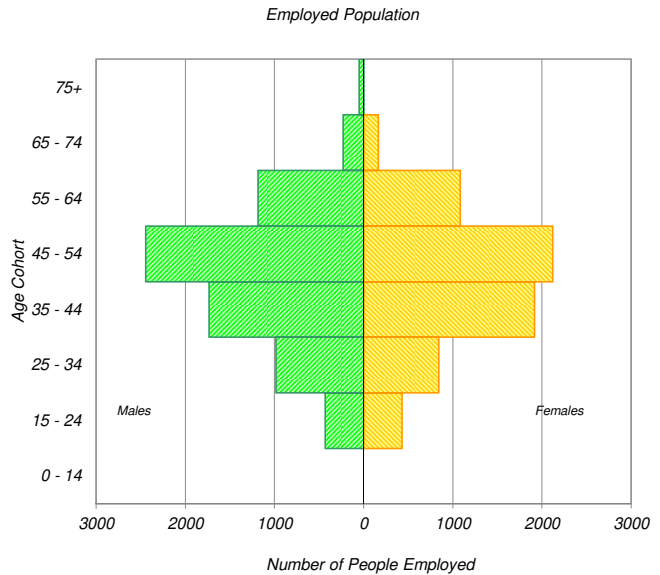
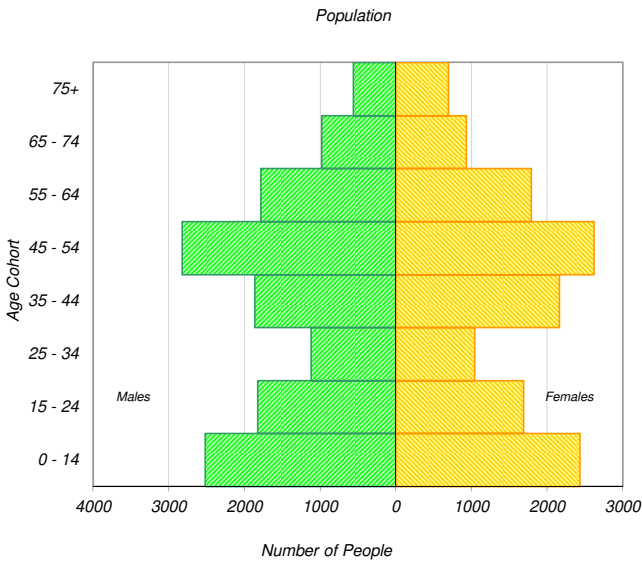
Selected Indicators	
Daily Trips per Person (age 5+)	2.64
Vehicles per Person	0.73
Number of Persons per Household	2.88
Daily Trips per Household	7.21
Vehicles per Household	2.11
Workers per Household	1.46
Population Density (Pop/km <sup>2</sup> )	50



Household Size		
1 person	1,210	13%
2 persons	3,390	36%
3 persons	1,730	19%
4 persons	2,120	23%
5+ persons	880	9%
<b>Total:</b>	<b>9,320</b>	<b>100%</b>

Households by Vehicle Availability		
0 vehicles	200	2%
1 vehicle	1,760	19%
2 vehicles	5,180	56%
3 vehicles	1,470	16%
4+ vehicles	710	8%
<b>Total:</b>	<b>9,320</b>	<b>100%</b>

Households by Dwelling Type		
Single-detached	9,020	97%
Semi-detached	70	1%
Townhouse	140	2%
Apartment/Condo	90	1%
<b>Total:</b>	<b>9,320</b>	<b>100%</b>

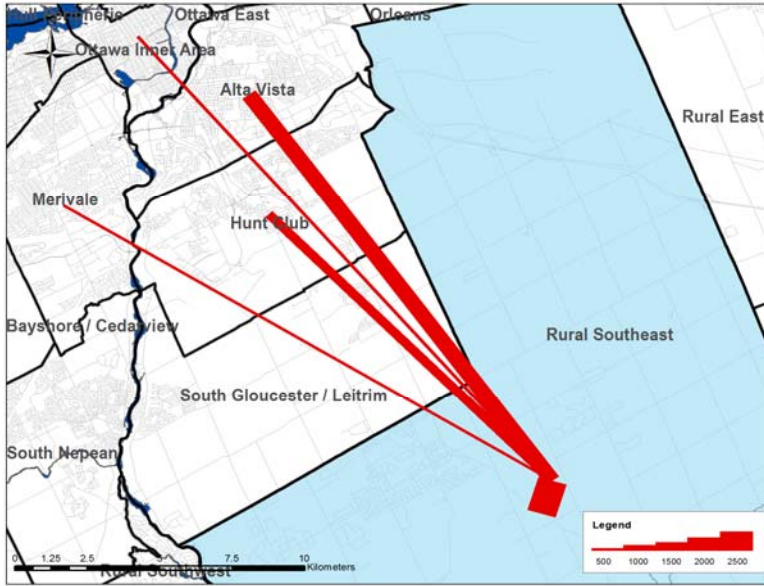


\* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

## Travel Patterns

### Top Five Destinations of Trips from Rural Southeast

#### AM Peak Period



### Summary of Trips to and from Rural Southeast

Districts	Destinations of Trips From		Origins of Trips To	
	District	% Total	District	% Total
Ottawa Centre	690	5%	20	0%
Ottawa Inner Area	830	6%	6	1%
Ottawa East	260	2%	40	1%
Beacon Hill	480	4%	10	0%
Alta Vista	1,550	12%	140	2%
Hunt Club	1,210	9%	190	3%
Merivale	960	7%	10	0%
Ottawa West	190	1%	50	1%
Bayshore / Cedarview	180	1%	40	1%
Orléans	290	2%	70	1%
Rural East	170	1%	30	0%
Rural Southeast	4,440	33%	4,440	73%
South Gloucester / Leitrim	570	4%	210	3%
South Nepean	580	4%	250	4%
Rural Southwest	520	4%	390	6%
Kanata / Stittsville	260	2%	50	1%
Rural West	0	0%	20	0%
Île de Hull	110	1%	0	0%
Hull Périphérie	0	0%	30	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	0	0%
Rural Northwest	0	0%	0	0%
Pointe Gatineau	0	0%	0	0%
Gatineau Est	0	0%	0	0%
Rural Northeast	0	0%	70	1%
Buckingham / Masson-Angers	0	0%	0	0%
Ontario Sub-Total:	13,180	99%	6,020	98%
Québec Sub-Total:	110	1%	100	2%
Total:	13,290	100%	6,120	100%

### Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	7,950	34%	1,470	6%	2,180	13%
School	2,360	10%	440	2%	2,570	16%
Shopping	2,600	11%	490	2%	620	4%
Leisure	2,230	9%	1,950	8%	1,270	8%
Medical	850	4%	300	1%	130	1%
Pick-up / drive passenger	2,180	9%	810	3%	1,170	7%
Return Home	3,780	16%	17,300	74%	7,300	45%
Other	1,580	7%	670	3%	1,110	7%
Total:	23,530	100%	23,430	100%	16,350	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	4,930	56%	710	42%	1,000	23%
School	1,870	21%	380	22%	2,280	51%
Shopping	270	3%	30	2%	30	1%
Leisure	140	2%	130	8%	130	3%
Medical	260	3%	20	1%	10	0%
Pick-up / drive passenger	800	9%	140	8%	380	9%
Return Home	160	2%	170	10%	230	5%
Other	440	5%	120	7%	370	8%
Total:	8,870	100%	1,700	100%	4,430	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	220	8%	60	1%	170	5%
School	50	2%	20	0%	0	0%
Shopping	450	16%	160	2%	110	3%
Leisure	530	19%	590	7%	240	7%
Medical	70	2%	70	1%	0	0%
Pick-up / drive passenger	390	14%	350	4%	210	6%
Return Home	830	29%	6,970	84%	2,670	75%
Other	320	11%	120	1%	150	4%
Total:	2,860	100%	8,340	100%	3,550	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	63,310		26%
AM Peak Period	15,000	24%	30%
PM Peak Period	14,750	23%	24%

### Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	16,890	72%	16,830	72%	7,750	47%
Auto Passenger	4,160	18%	4,250	18%	2,670	16%
Transit	970	4%	960	4%	40	0%
Bicycle	50	0%	20	0%	0	0%
Walk	30	0%	40	0%	1,630	10%
Other	1,460	6%	1,320	6%	4,260	26%
Total:	23,560	100%	23,420	100%	16,350	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	5,960	67%	1,170	69%	1,550	35%
Auto Passenger	1,270	14%	150	9%	530	12%
Transit	530	6%	0	0%	20	0%
Bicycle	20	0%	0	0%	0	0%
Walk	0	0%	30	2%	400	9%
Other	1,070	12%	350	21%	1,940	44%
Total:	8,850	100%	1,700	100%	4,440	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	1,830	64%	6,110	73%	1,530	43%
Auto Passenger	860	30%	1,450	17%	640	18%
Transit	90	3%	430	5%	20	1%
Bicycle	0	0%	0	0%	0	0%
Walk	0	0%	0	0%	310	9%
Other	100	3%	340	4%	1,040	29%
Total:	2,880	100%	8,330	100%	3,540	100%

Avg Vehicle Occupancy	From District		To District		Within District	
24 Hours	1.25		1.25		1.34	
AM Peak Period	1.21		1.13		1.34	
PM Peak Period	1.47		1.24		1.42	

Transit Modal Split	From District		To District		Within District	
24 Hours	4%		4%		0%	
AM Peak Period	7%		0%		1%	
PM Peak Period	3%		5%		1%	

# APPENDIX F

## Trip Distribution Analysis



**EMPLOYEE TRIP DISTRIBUTION ANALYSIS**

District	Trips entering district (am)	% Total	Arriving From:	Route	Total %	Rounded %
Ottawa Inner Area	130	1%	Highway 417 (West)			
Ottawa East	110	1%	Highway 417 (West)	Highway 417 (West)	24%	25%
Beacon Hill	60	1%	Highway 417 (West)	Highway 417 (East)	17%	15%
Alta Vista	250	3%	Highway 417 (West)	Boundary Road (North)	18%	20%
Hunt Club	240	3%	Highway 417 (West)	Mitch Owens Road (West)	5%	5%
Ottawa West	90	1%	Highway 417 (West)	Boundary Road (South)	36%	35%
Bayshore / Cedarview	60	1%	Highway 417 (West)			
Orleans	1070	12%	Boundary Road (North)			
Rural East	820	9%	Highway 417 (East)			
Rural Southeast	4570	52%	<i>10% Highway 417 (West), 5% Highway 417 (East), 5% Boundary Road (North), 32% Boundary Road (South)</i>			
South Gloucester / Leitrim	210	2%	Mitch Owens Road (West)			
South Nepean	270	3%	Mitch Owens Road (West)			
Rural Southwest	390	4%	Boundary Road (South)			
Kanata / Stittsville	150	2%	Highway 417 (West)			
Ile de Hull	10	0%	Highway 417 (West)			
Hull Periphère	10	0%	Highway 417 (West)			
Alymer	30	0%	Highway 417 (West)			
Pointe Gatineau	30	0%	Highway 417 (West)			
Gatineau Est	20	0%	Highway 417 (West)			
Rural Northeast	70	1%	Boundary Road (North)			
Quebec	200	2%	Highway 417 (East)			
	8790	100%				

# APPENDIX G

## Growth Rate Analysis

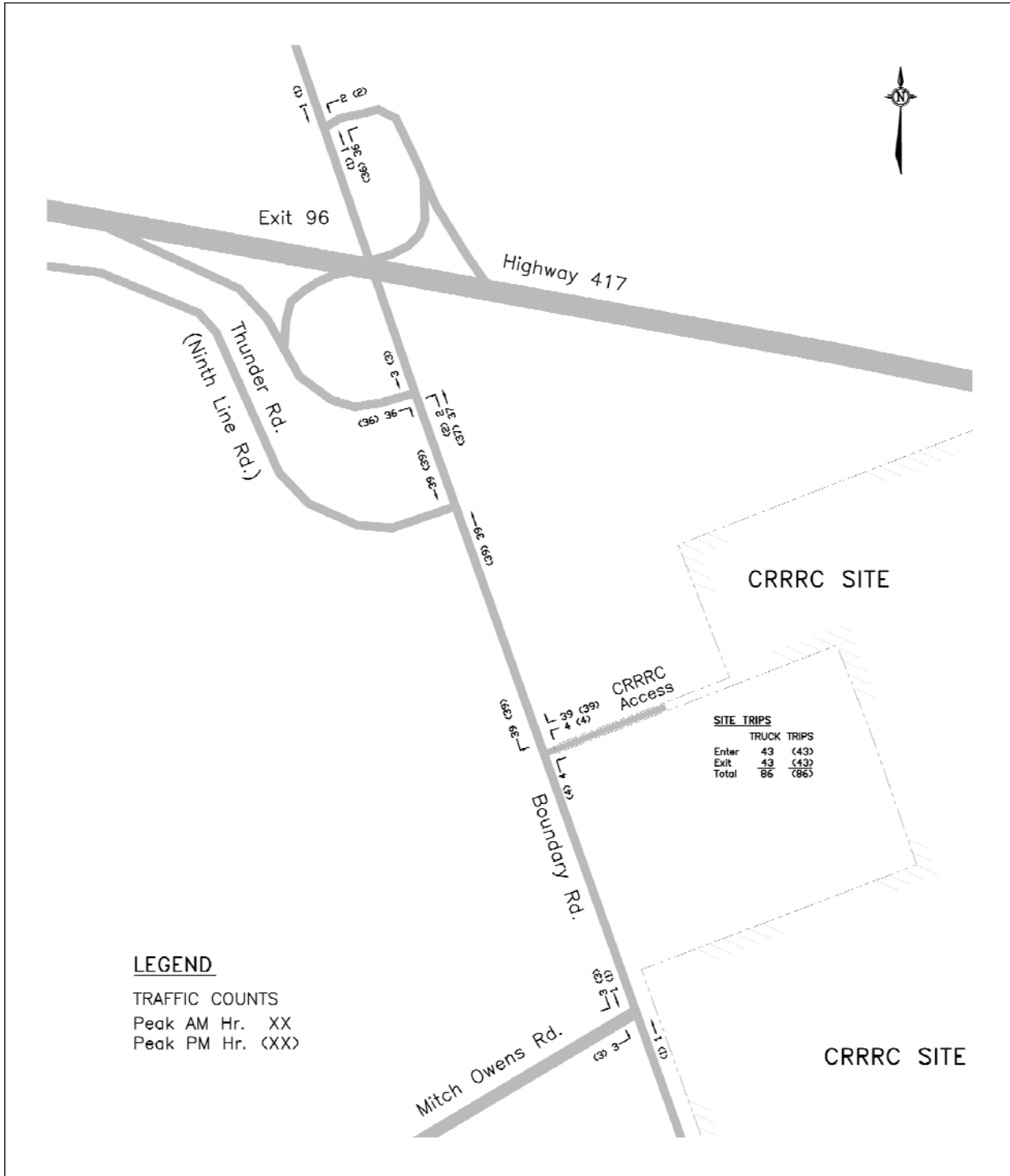
**Highway 417 and Boundary Road Interchange***MTO Data*

<b>Year</b>	<b>AADT</b>	<b>Year-to-Year Increase</b>	<b>Average Increase</b>
2012	44200	-6.56%	0.19%
2013	41300	2.66%	
2014	42400	2.36%	
2015	43400	2.30%	
2016	44400		

<b>Year</b>	<b>SADT</b>	<b>Year-to-Year Increase</b>	<b>Average Increase</b>
2012	65,000	-4.62%	0.66%
2013	62,000	2.42%	
2014	63,500	2.52%	
2015	65,100	2.30%	
2016	66,600		

# APPENDIX H

## CRRRC TIS Excerpts



NOT TO SCALE

Figure 3.1: Weekday Peak AM and PM Hour Site Generated Trips

## 4.0 FUTURE TRAFFIC VOLUMES

This Addendum has assumed an annual compounded growth rate of 2 percent as discussed in the TIS. The growth rate was applied to all lane movements shown in the traffic counts presented in Figure 2.1 for the weekday peak AM and PM hour. Figure 4.1 shows the expected 2022 background traffic, which would represent traffic five years beyond build out from growth outside the immediate area.

The East Gateway Properties truck transfer terminal is proposed to be located on the east side of Boundary Road north of the CRRRC Site. The truck transfer terminal will have an access that will form the east access to the intersection of Boundary Road and Thunder Road. It is understood that the terminal facility expects build out by the year 2026. For the expected background traffic at the year 2027, which represents ten years beyond opening of the CRRRC Site, this Addendum has increased the existing traffic (Figure 2.1) at a 2 percent compounded rate to the year 2027, and added the expected traffic from the truck transfer terminal. The volume and distribution of trips from the proposed terminal were determined from the Transportation Impact Study report dated October 2014 for 5341 Boundary Road Transport prepared by Dillon Consulting Limited (Dillon). The Dillon TIS examined both a “Low Building Coverage” and a “High Building Coverage” scenario. As discussed at the meeting of April 22, 2015, this Addendum has utilized the traffic associated with the average of both scenarios and added the expected terminal trips to the 2027 background traffic, which is shown in Figure 4.2.

The expected total traffic volumes at the year 2022, which are shown in Figure 4.3, were determined by the addition of the expected background traffic of Figure 4.1 and the expected Site generated trips of Figure 3.1. For the expected 2027 total traffic shown in Figure 4.4, the 2027 background traffic (Figure 4.2) was added to the Site generated trips (Figure 3.1).

### 4.1 Traffic Analysis

The following are the results of the intersection analysis at the year 2022 (5 years beyond CRRRC Site opening), and at the year 2027 (10 years beyond opening), including the East Gateway Properties truck transfer terminal trips.

#### Boundary Road and CRRRC Site Access

A left turn lane warrant analysis was conducted at the Site access using the procedure documented in the MTO publication, *Geometric Design Standards for Ontario Highways*. The analysis utilized the expected 2027 traffic and a design speed of 90 km/h. (80 km./h. posted speed) at the access. The warrant analysis, which is presented in the Appendix as Exhibit 5, determined that a southbound left turn lane with 25 m for passenger car storage was required during the both the peak AM and PM hour. Utilizing a passenger car equivalent for heavy vehicles of 2.0 as documented in the MTO publication, the required length of the southbound left turn lane at the CRRRC truck access would therefore be 50 m. The following is the recommended lane configuration:

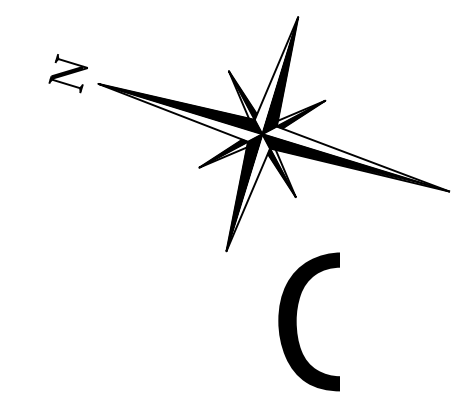
# APPENDIX I

## Vehicle Turning Analysis

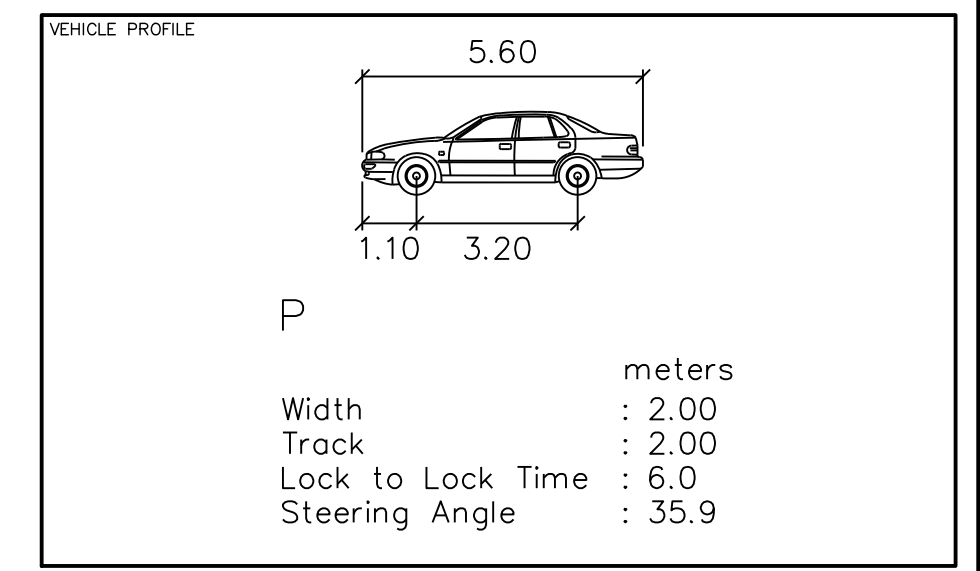
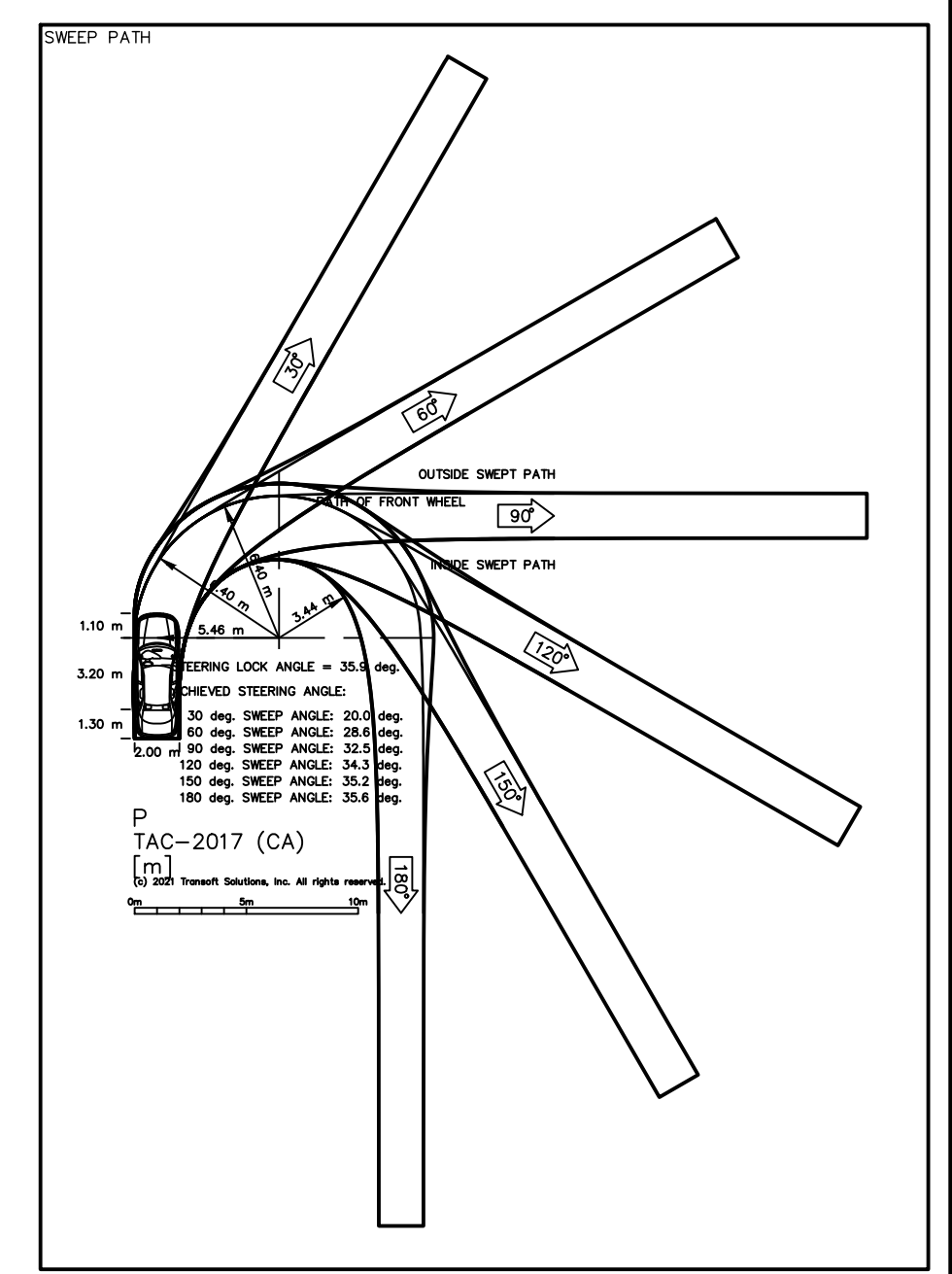
# THUNDER ROAD

# NEW PRIVATE ROAD

## 426 AUTO SPACES



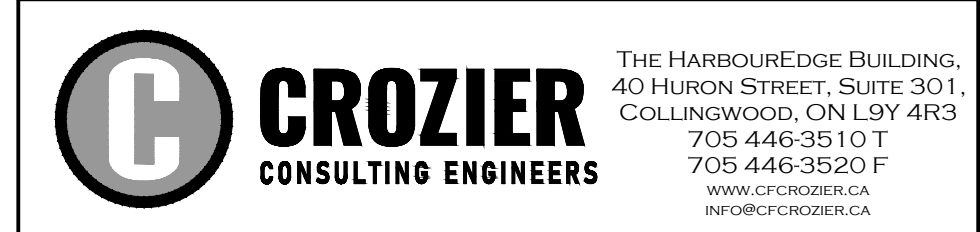
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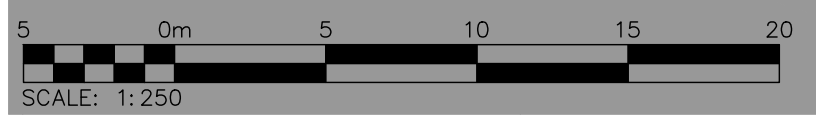
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1	ISSUED FOR REVIEW	03/10/2021

**Project**  
THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA

**Drawing**  
PASSENGER CAR TURNING ANALYSIS  
BUILDING 1

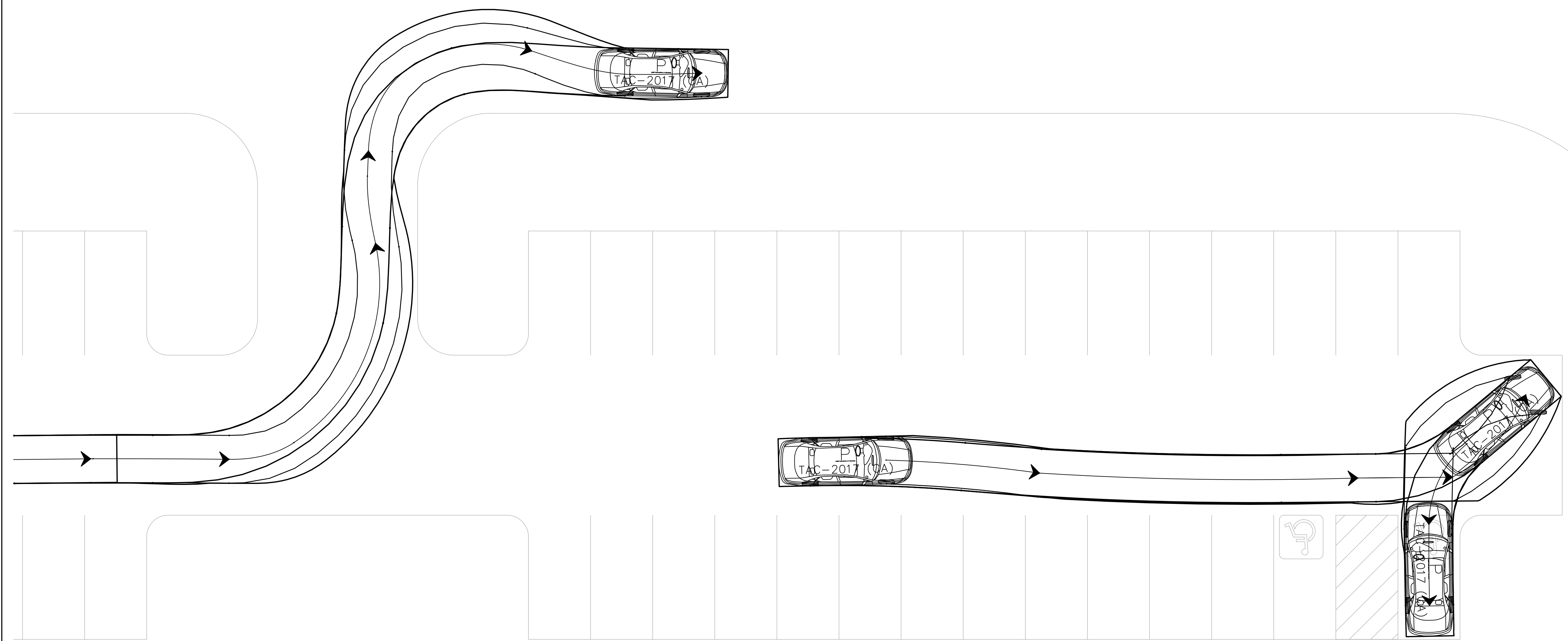
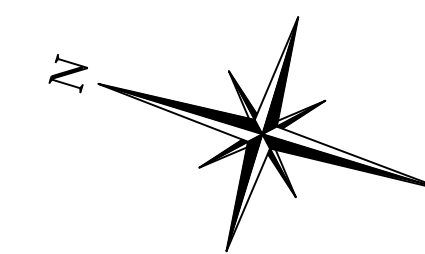


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Check By: D.L. Check By: Scale: 1:250 Drawing: TT 01

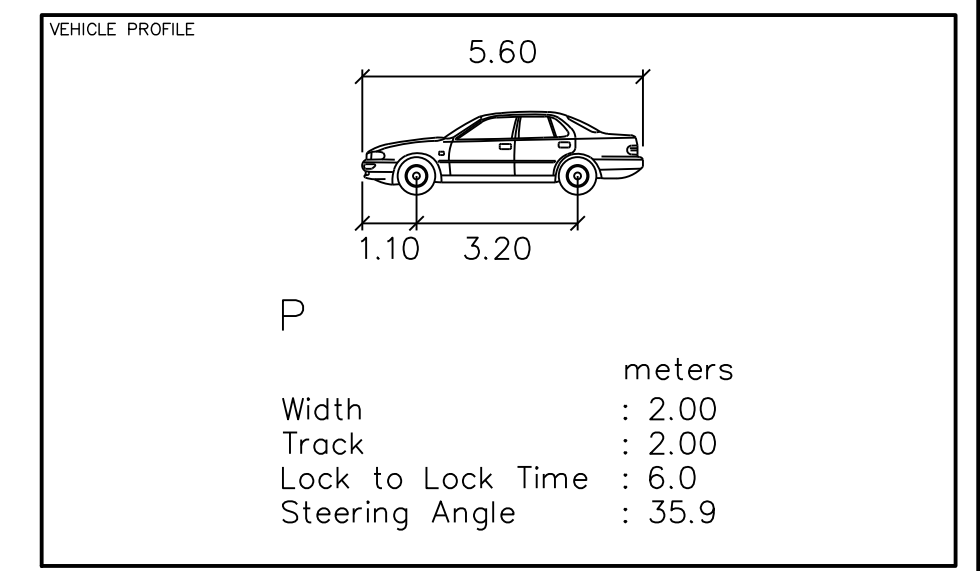
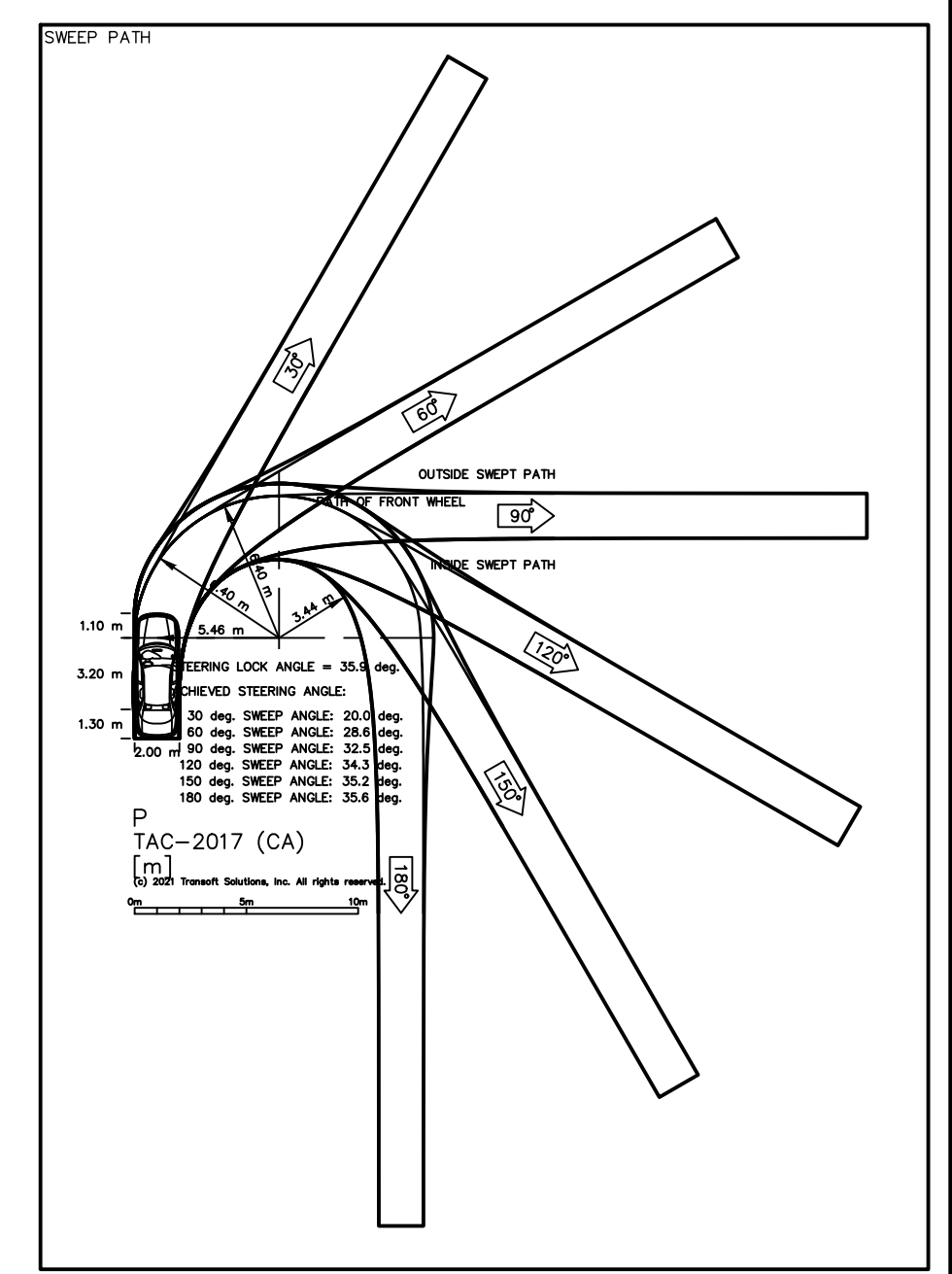


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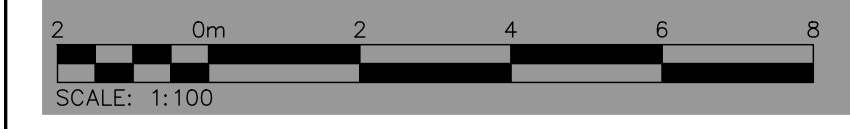


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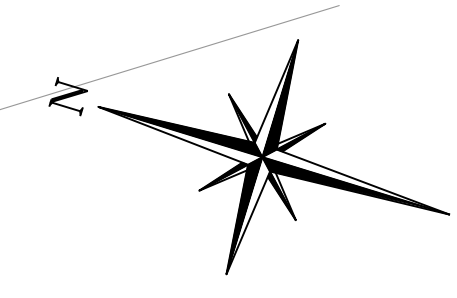


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CITY OF OTTAWA

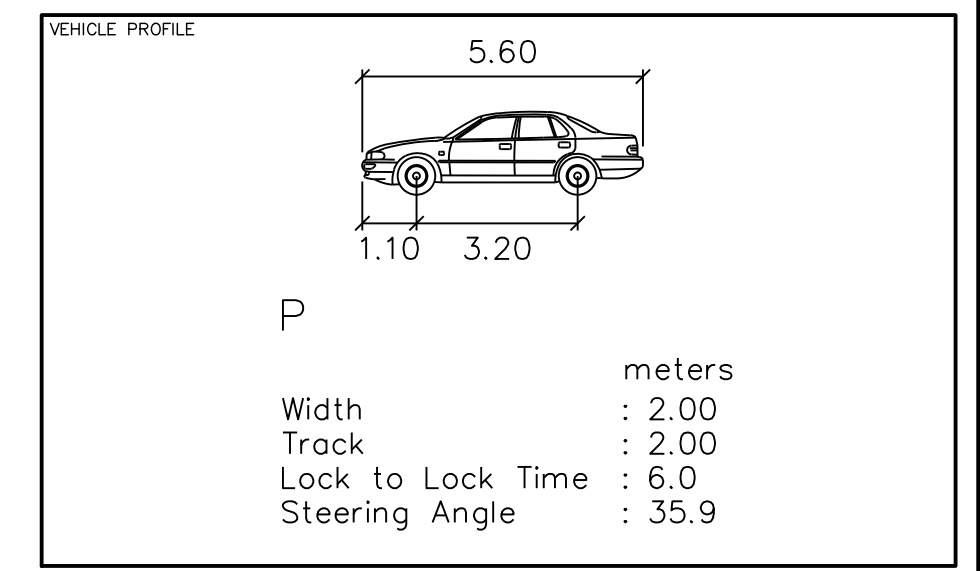
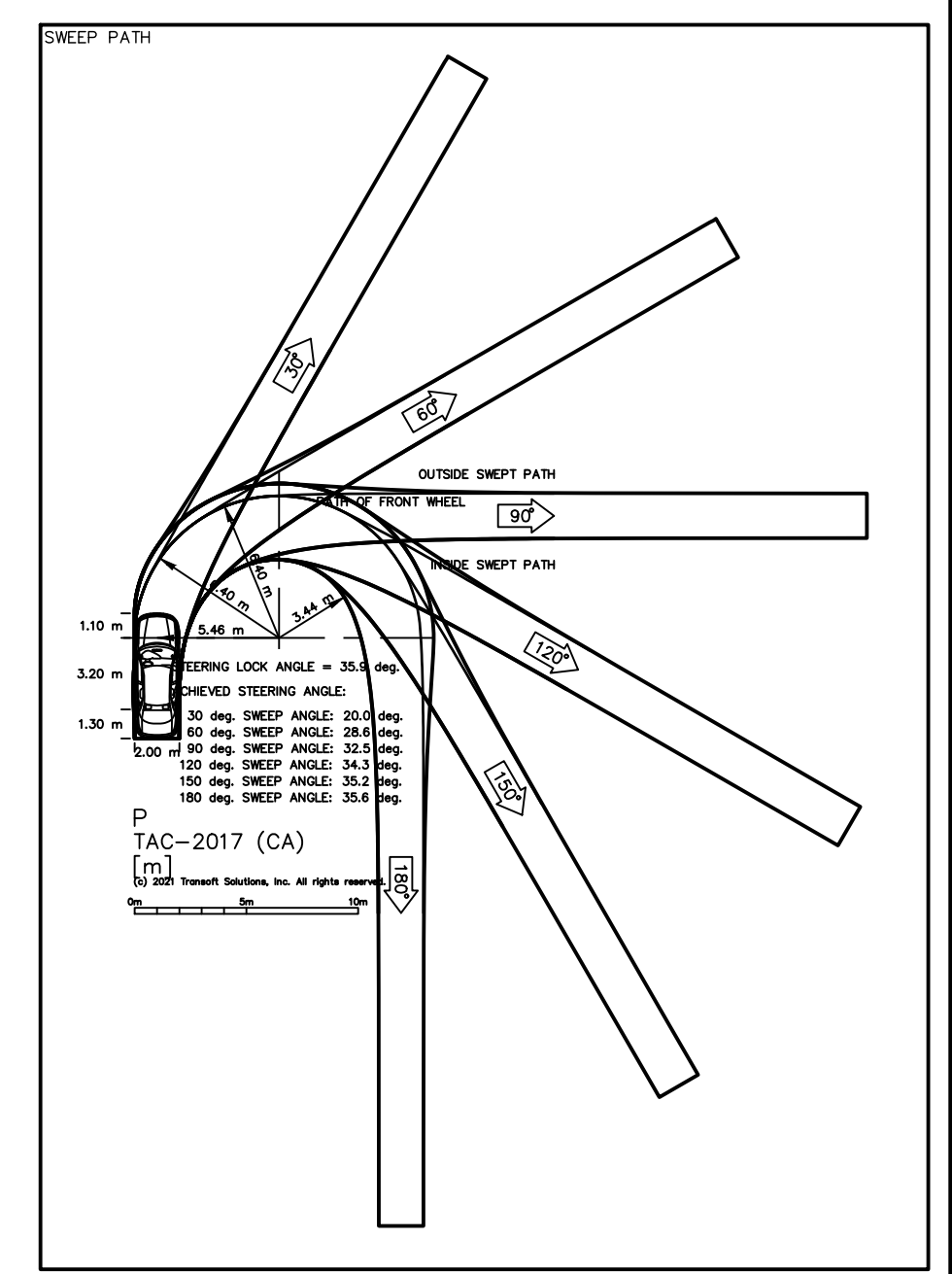
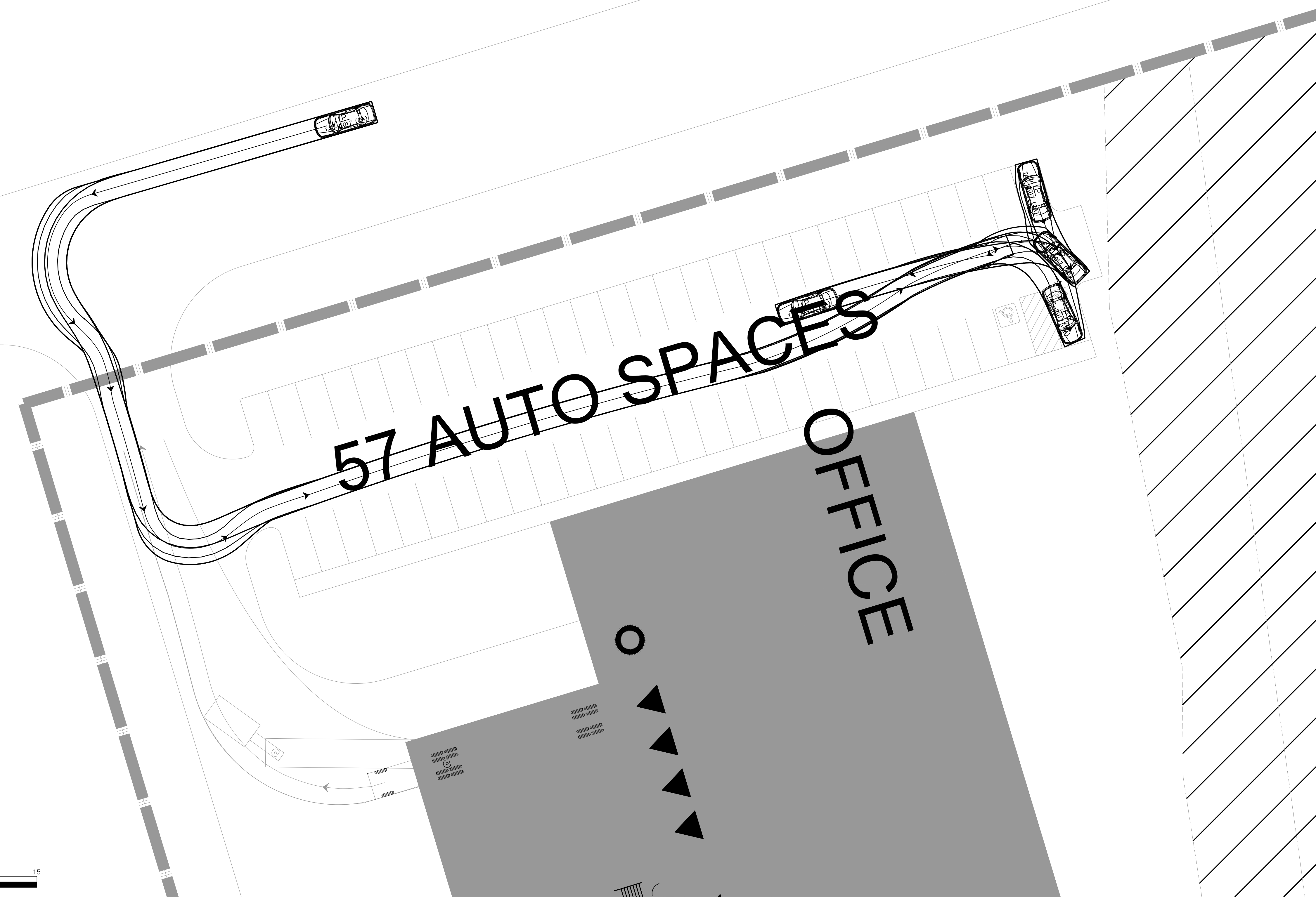
**Drawing**  
PASSENGER CAR TURNING ANALYSIS  
BUILDING 1

**CROZIER CONSULTING ENGINEERS**  
 THE HARBOUREdge BUILDING,  
 40 HURON STREET, SUITE 301,  
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 Check By: D.L. Check By: Scale: 1:100 Drawing: TT 01.1



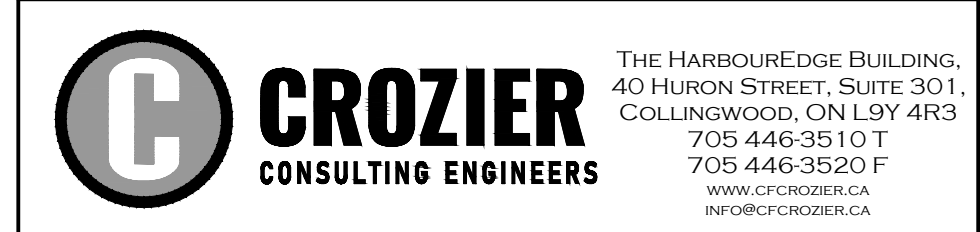
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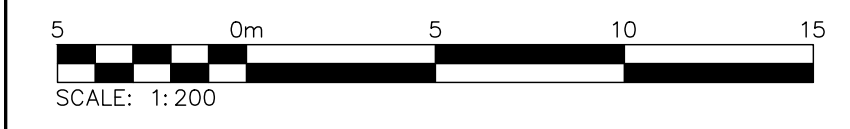
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**THUNDER ROAD & BOUNDARY ROAD**  
CITY OF OTTAWA

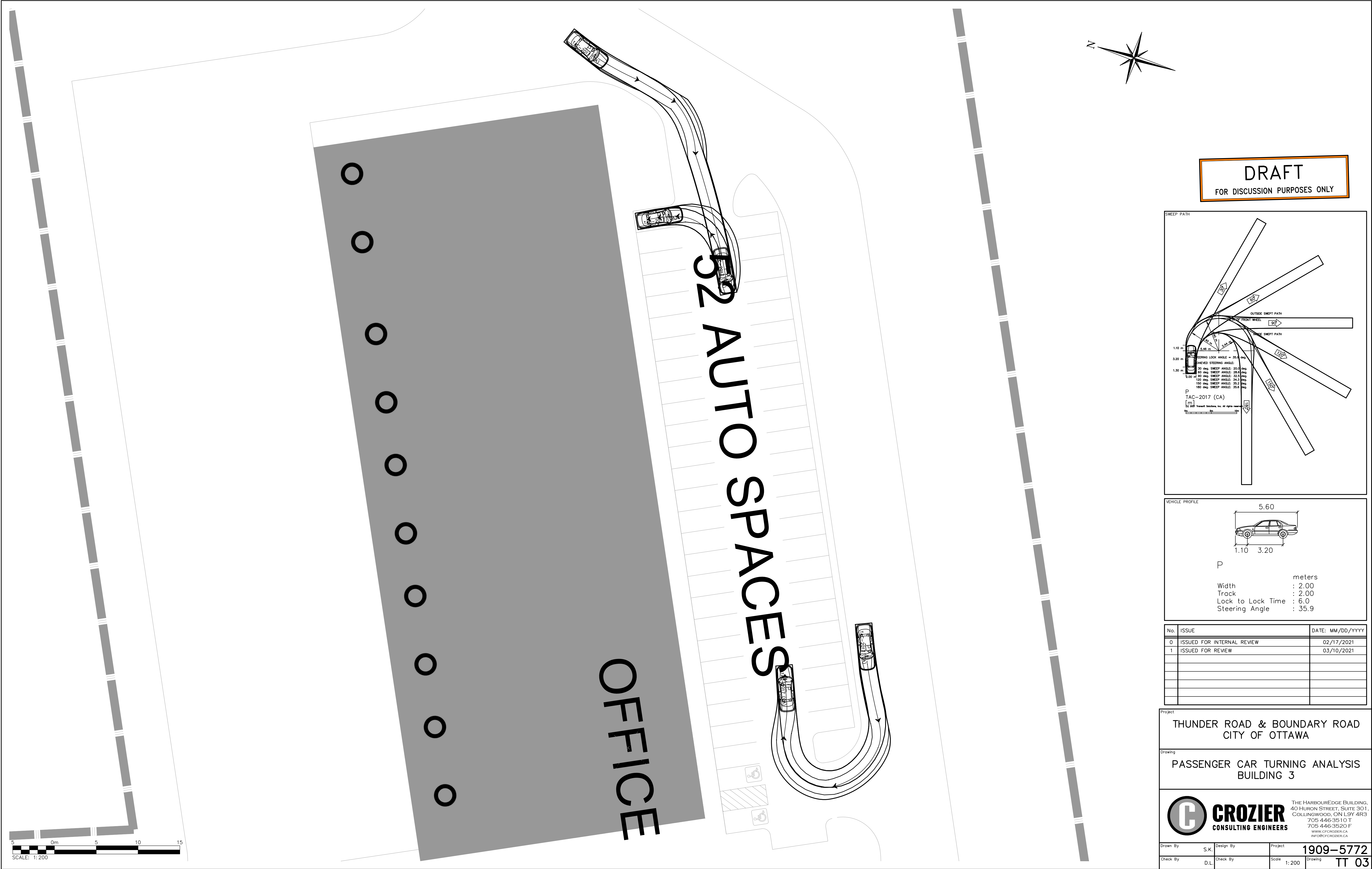
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**PASSENGER CAR TURNING ANALYSIS**  
BUILDING 2



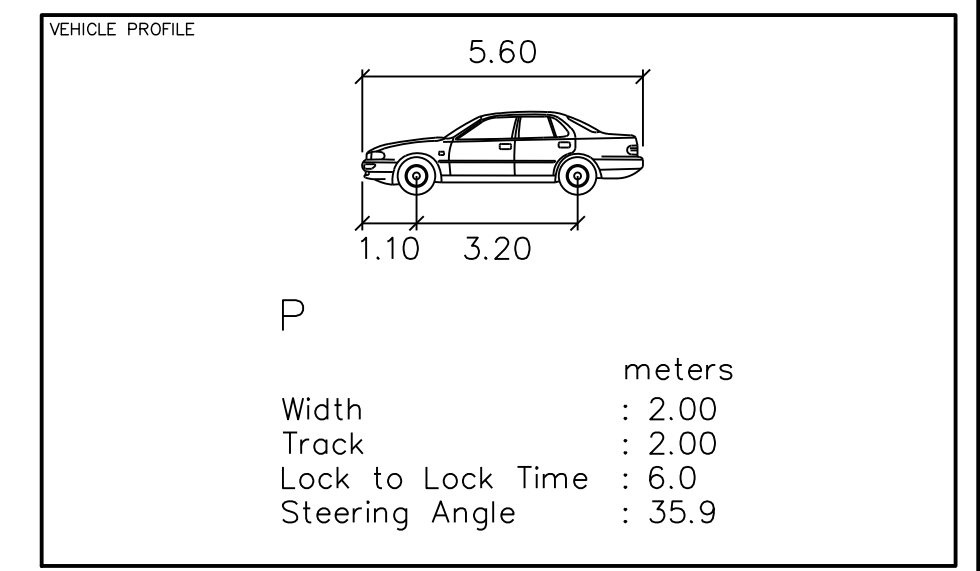
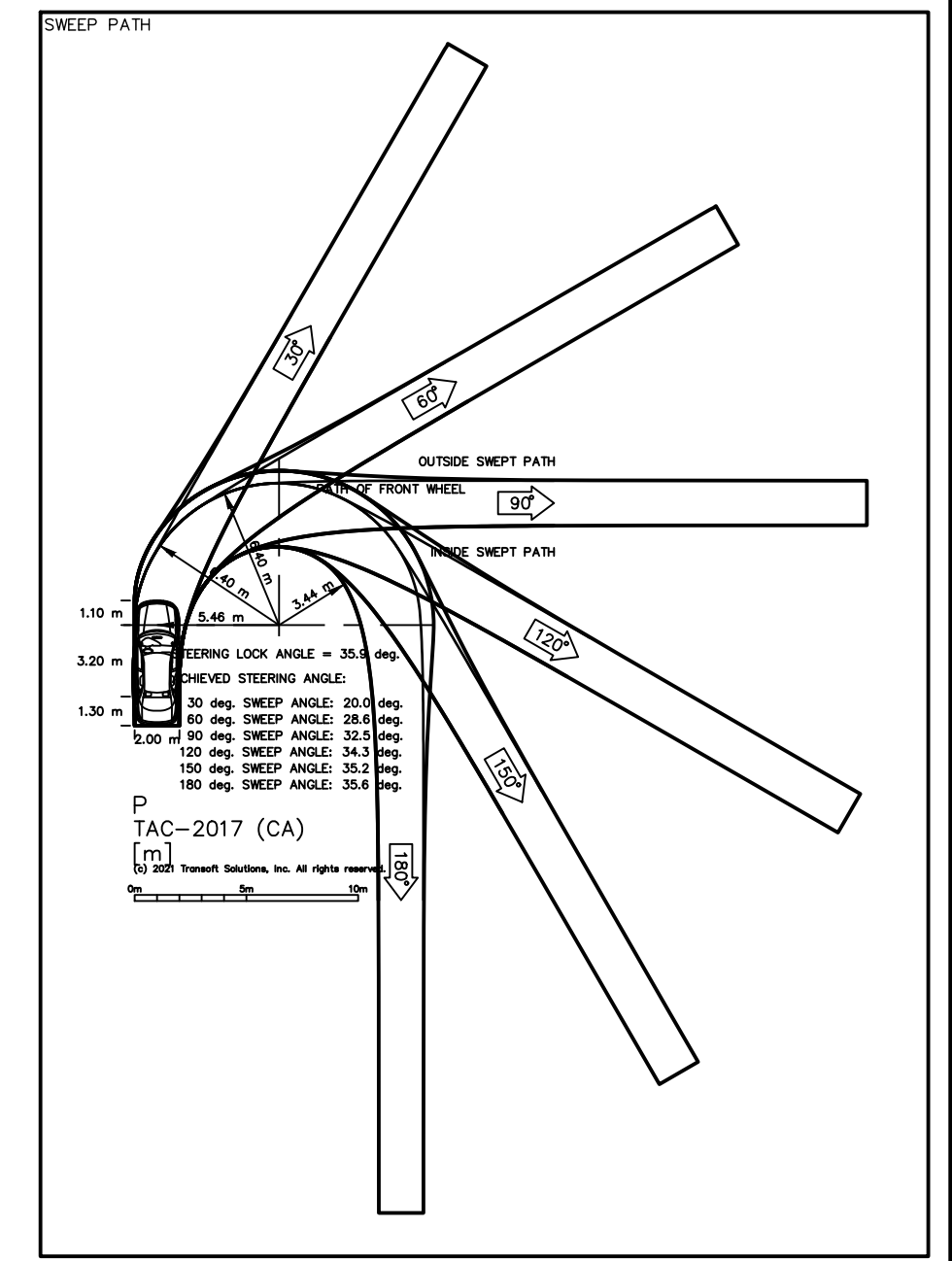
THE HARBOUREDGE BUILDING,  
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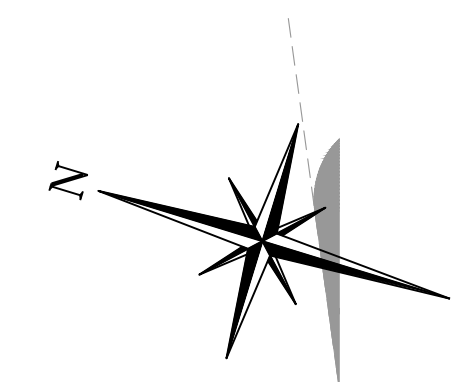
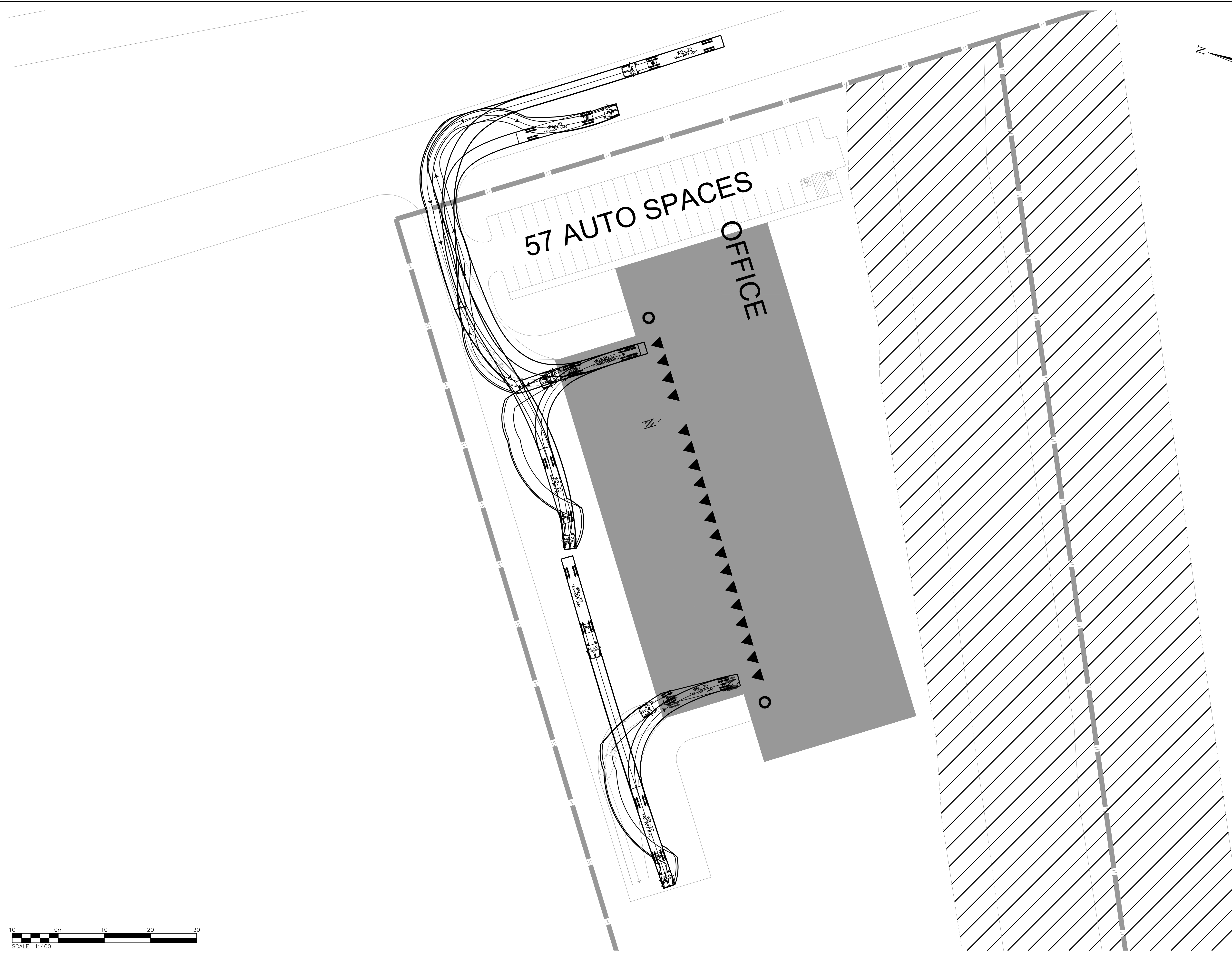
**Project**  
THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA

**Drawing**  
PASSENGER CAR TURNING ANALYSIS  
BUILDING 3

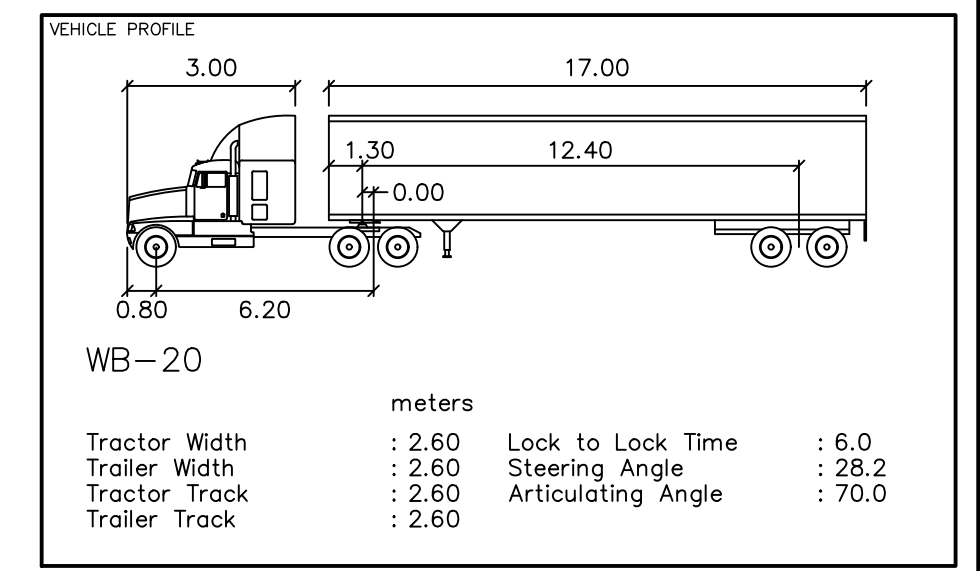
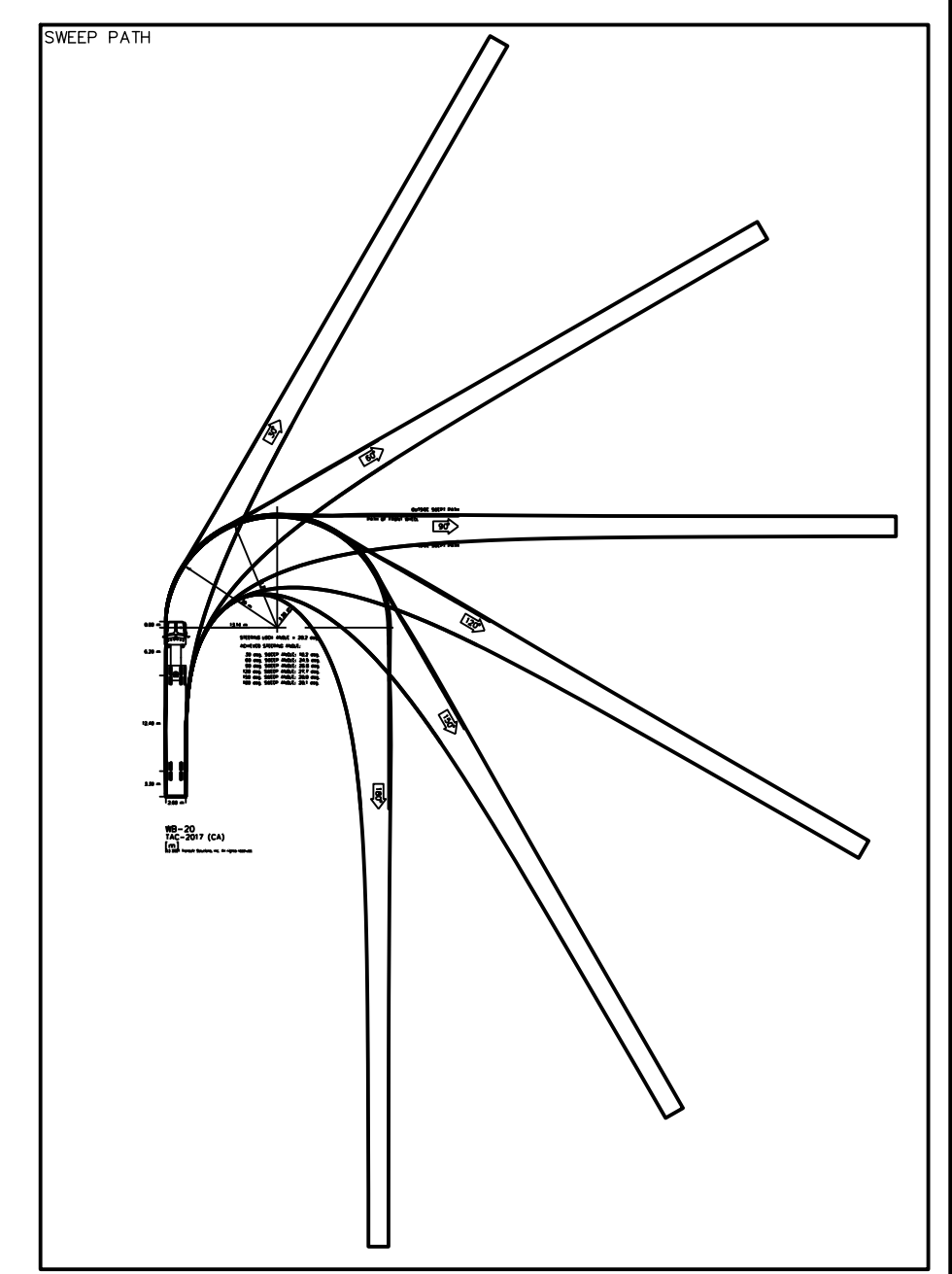
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				<b>TT 03</b>



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No.	ISSUE	DATE: MM/DD/YYYY
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1	ISSUED FOR REVIEW	03/10/2021

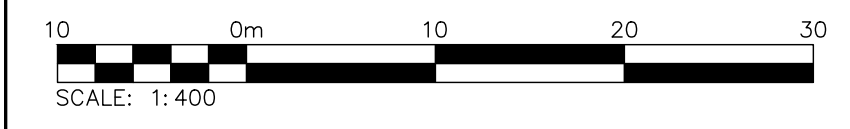
Project  
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CITY OF OTTAWA

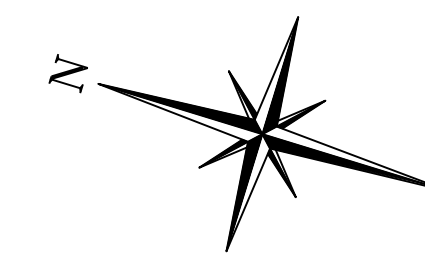
Drawing  
**WB-20 TURNING ANALYSIS**  
BUILDING 2

**CROZIER**  
CONSULTING ENGINEERS

THE HARBOUREdge BUILDING,  
40 HURON STREET, SUITE 301,  
COLLINGWOOD, ON L9Y 4R3  
705.446.3510 T  
705.446.3520 F  
WWW.CROZIER.CA  
INFO@CROZIER.CA

Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:400
			Drawing	<b>TT 04</b>





### INDUSTRIAL BLDG 3

FOOTPRINT:  
2,971.79 m<sup>2</sup>  
31,988 SF  
CLR. HGT: 32'

52 AUTO SPACES

THUNDER ROAD

NEW PRIVATE ROAD

426 AUTO SPACES

OFFICE

OFFICE

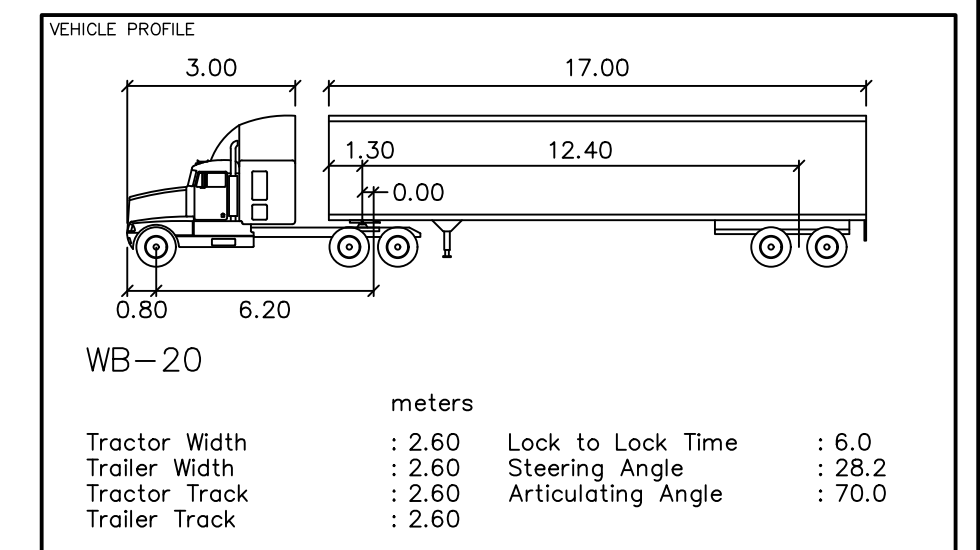
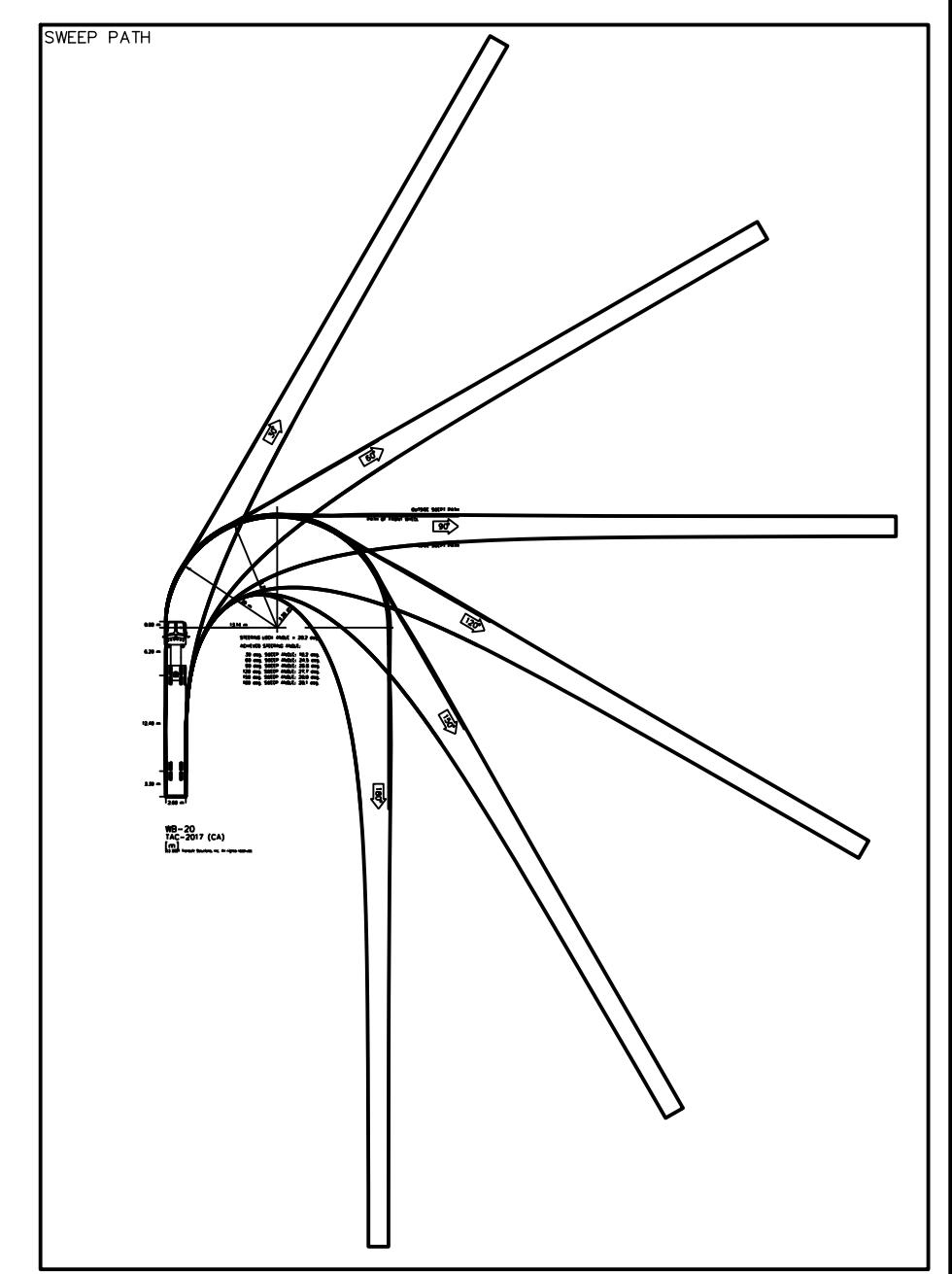
OFFICE

### INDUSTRIAL BLDG 1

FOOTPRINT:  
55,799 m<sup>2</sup>  
600,611 SF  
CLR. HGT: 36'

98 TRAILER SPACES

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Project  
**THUNDER ROAD & BOUNDARY ROAD**  
CITY OF OTTAWA

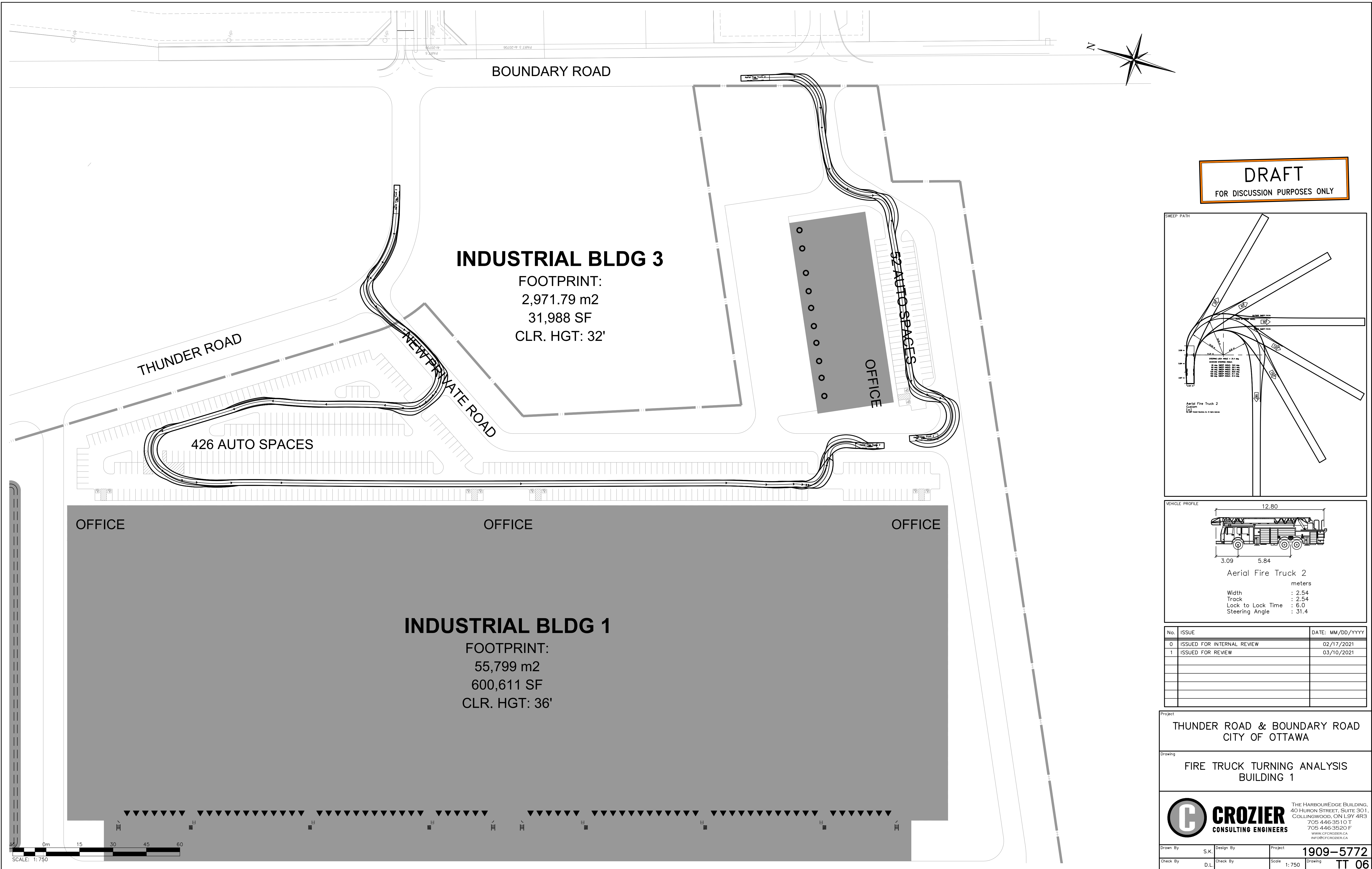
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**WB-20 TURNING ANALYSIS**  
BUILDING 1

**CROZIER**  
CONSULTING ENGINEERS

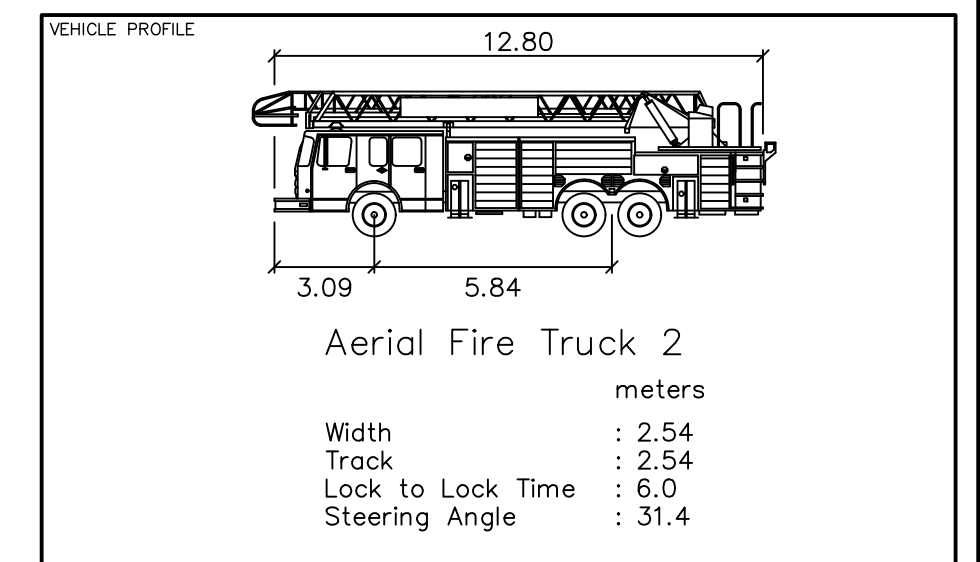
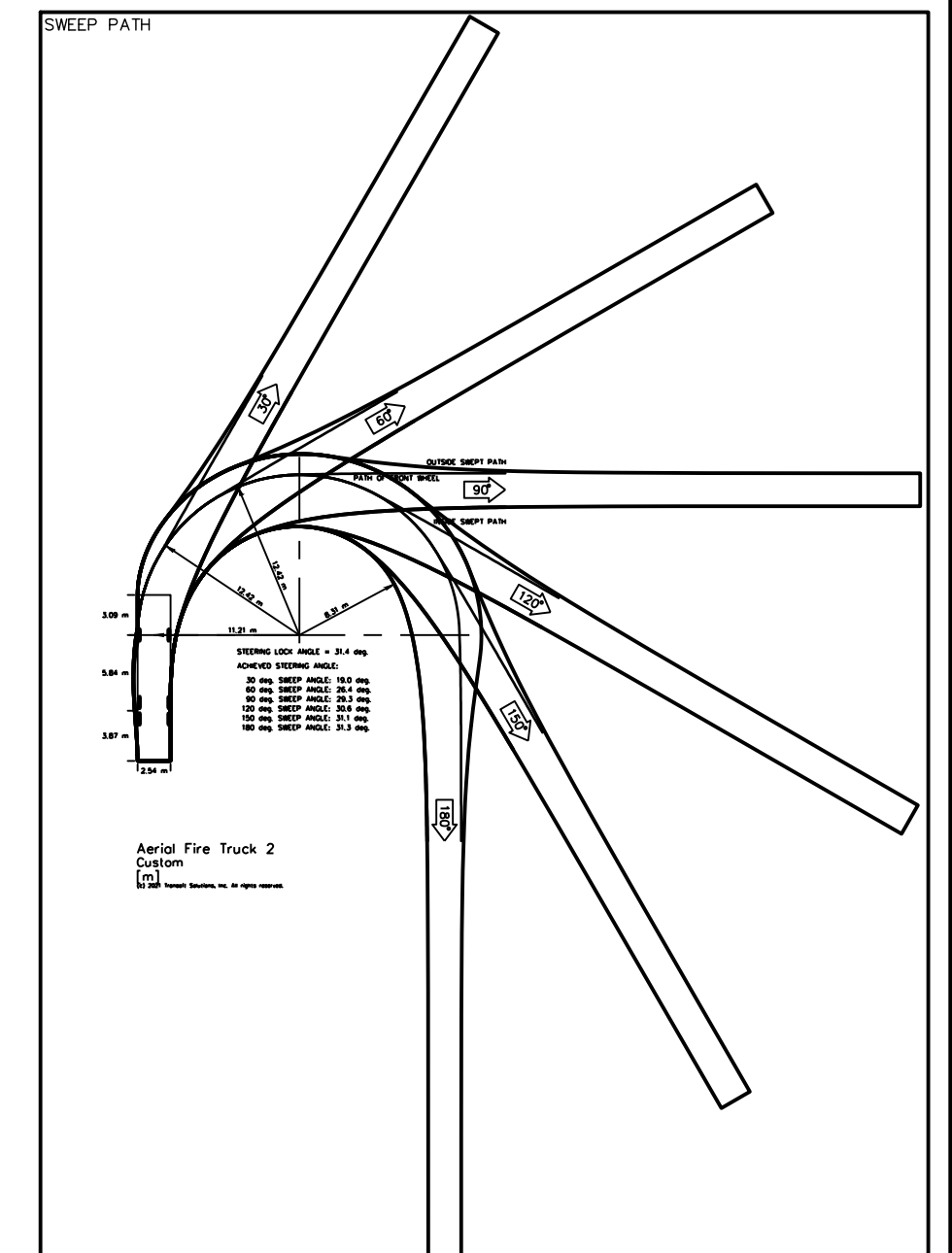
THE HARBOUREDGE BUILDING,  
40 HURON STREET, SUITE 301,  
COLLINGWOOD, ON L9Y 4R3  
705.446.3510 T  
705.446.3520 F  
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Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:750
			Drawing	<b>TT 05</b>





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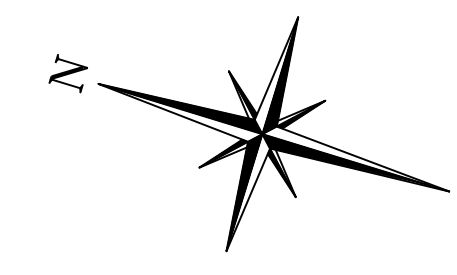
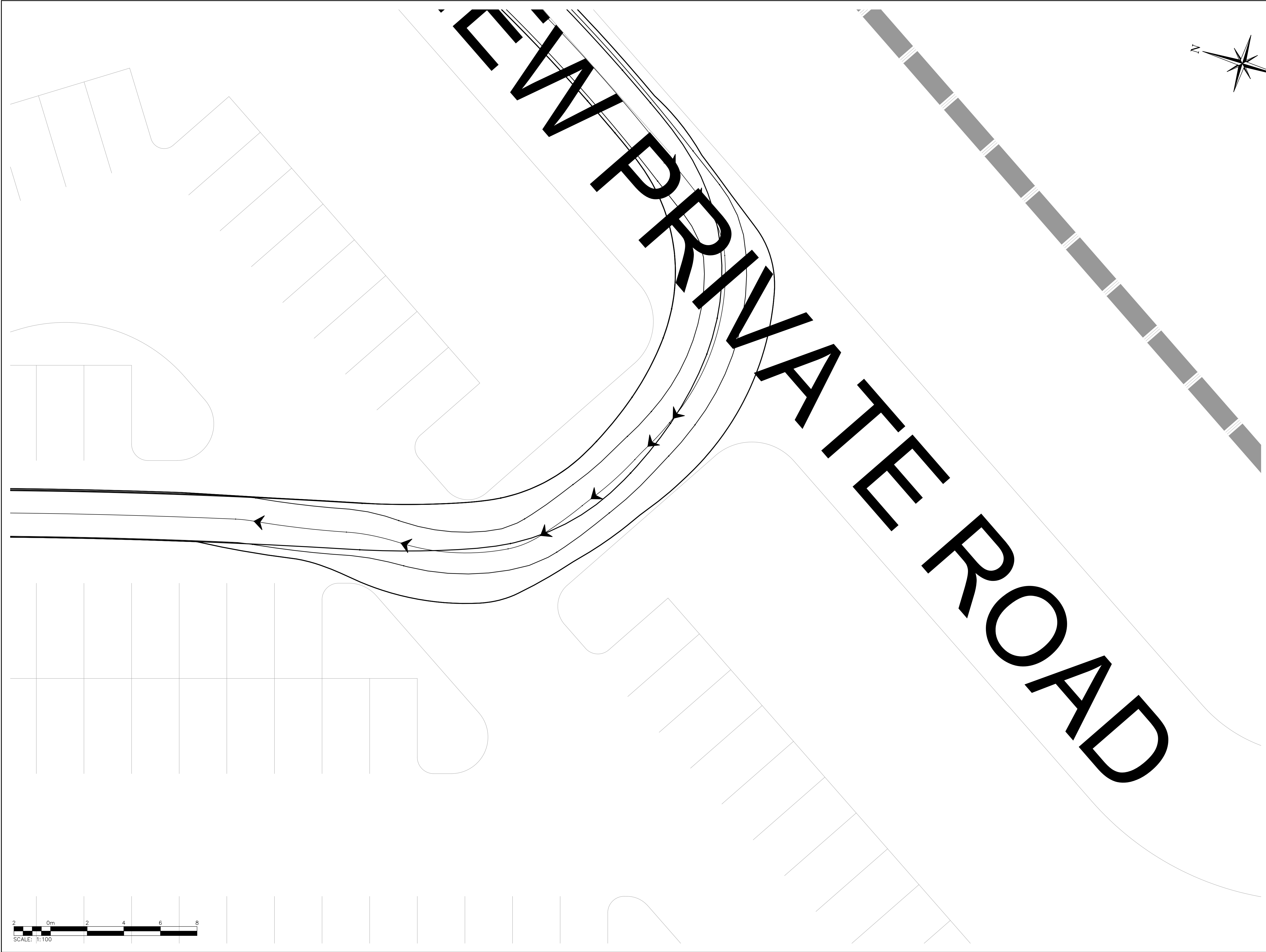
Project  
**THUNDER ROAD & BOUNDARY ROAD**  
 CITY OF OTTAWA

Drawing  
**FIRE TRUCK TURNING ANALYSIS**  
 BUILDING 1

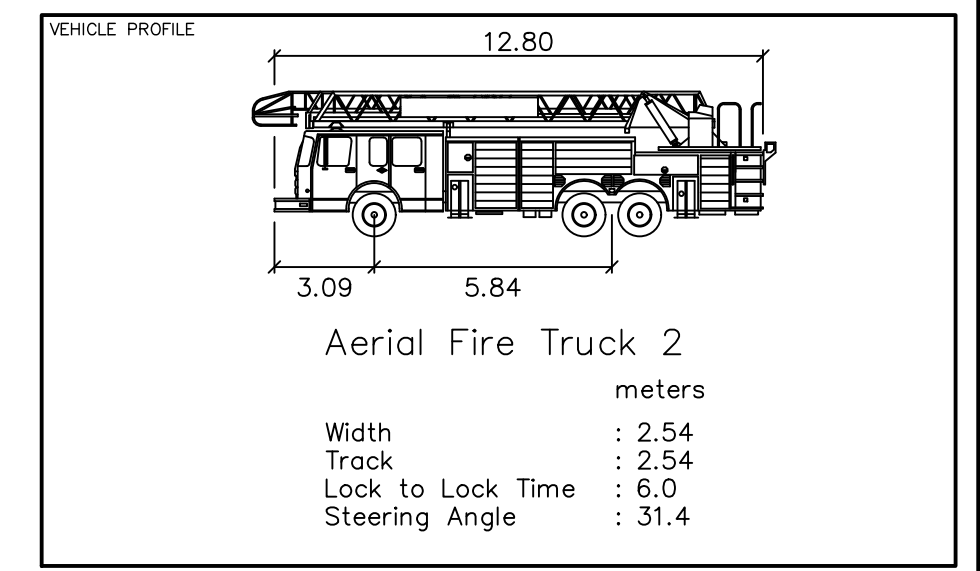
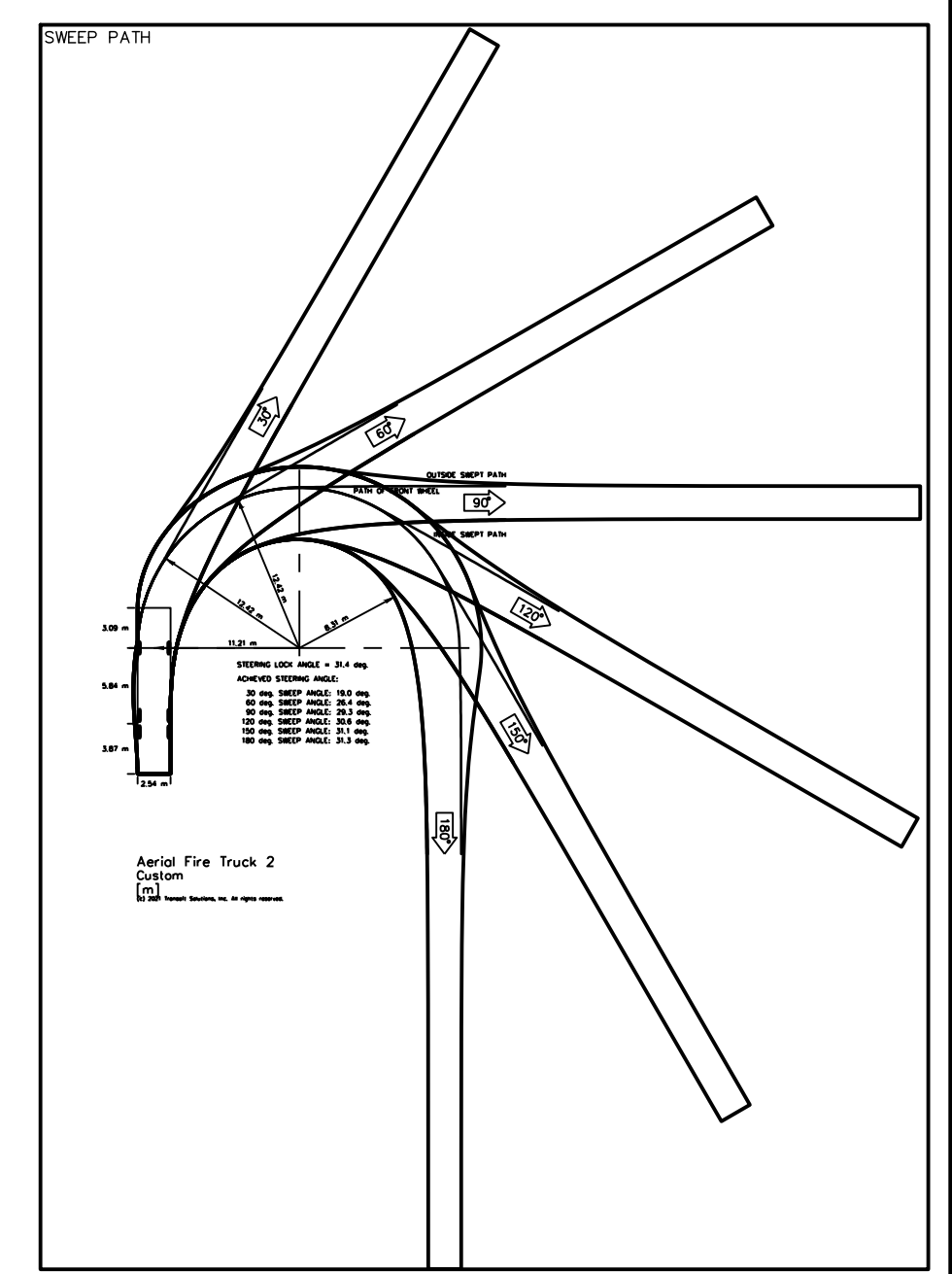
**CROZIER**  
 CONSULTING ENGINEERS

THE HARBOUREDGE BUILDING,  
 40 HURON STREET, SUITE 301,  
 COLLINGWOOD, ON L9Y 4R3  
 705.446.3510 T  
 705.446.3520 F  
 WWW.CFCROZIER.CA  
 INFO@CFCROZIER.CA

Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:750
			Drawing	<b>TT 06</b>



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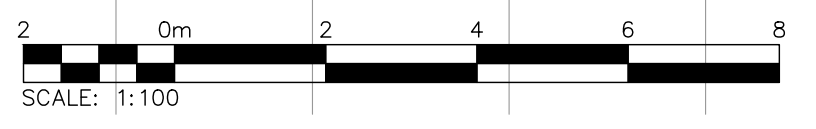
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THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA

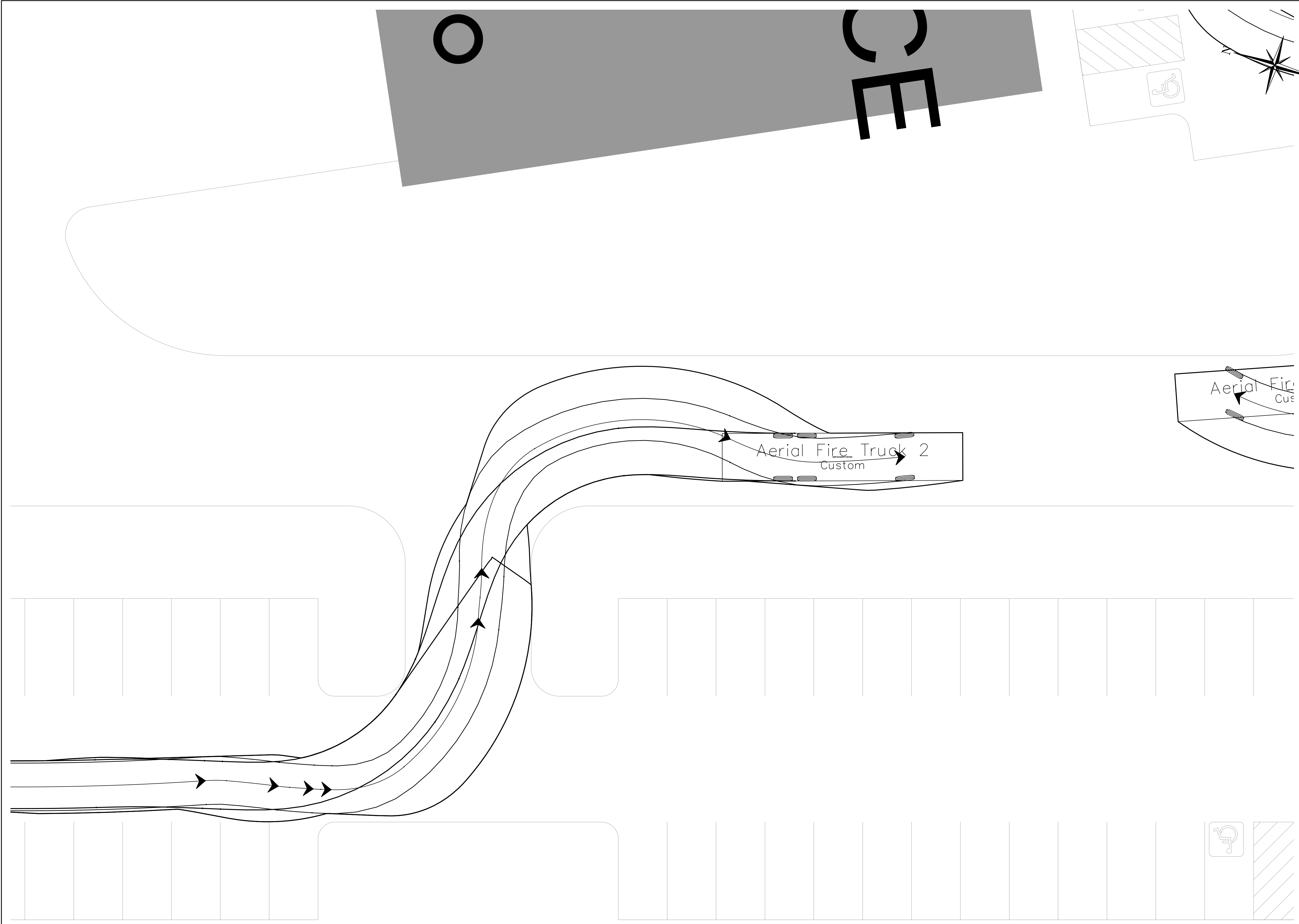
**Drawing**  
FIRE TRUCK TURNING ANALYSIS  
BUILDING 1

**CROZIER**  
CONSULTING ENGINEERS

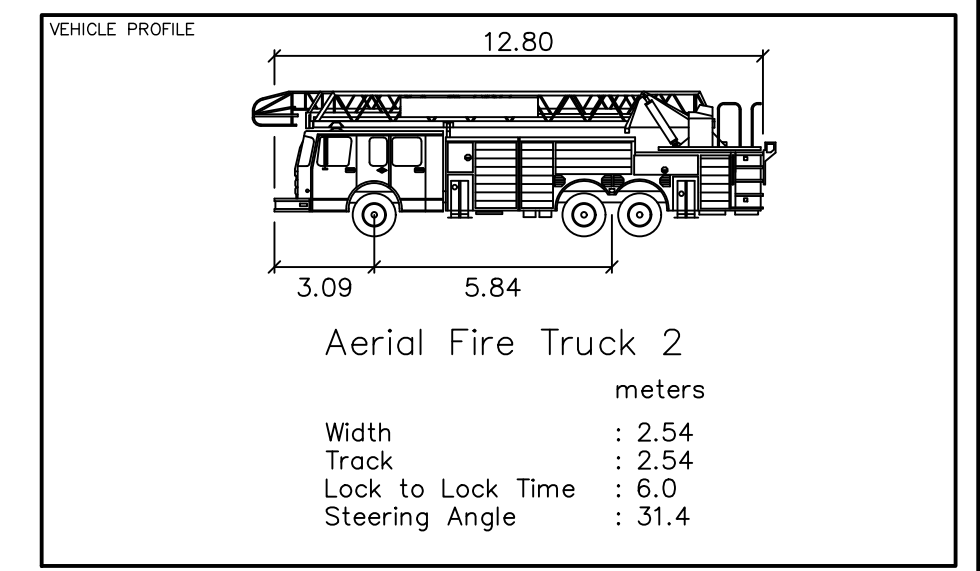
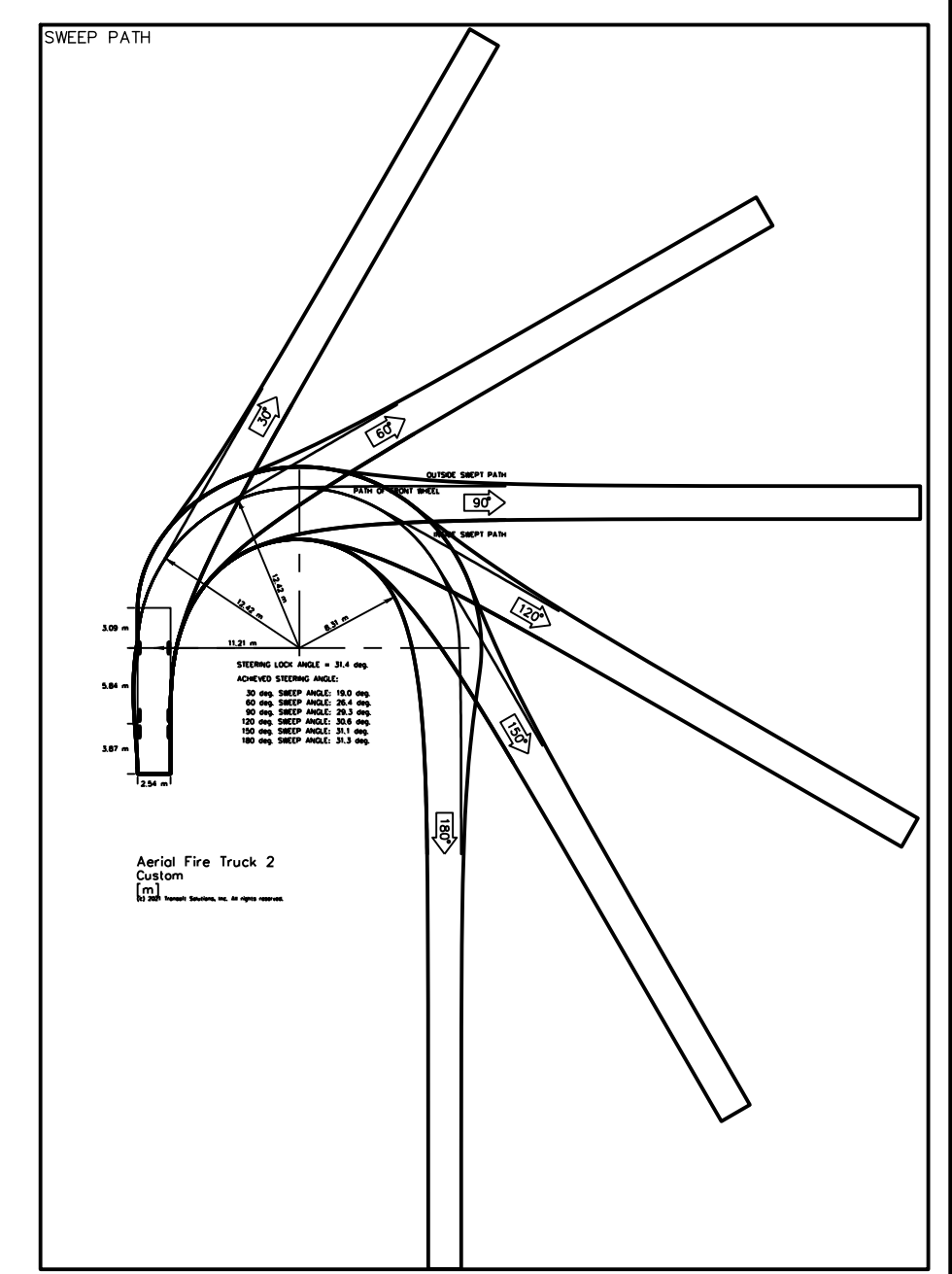
THE HARBOUREdge BUILDING,  
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Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:100 Drawing <b>TT 06.1</b>





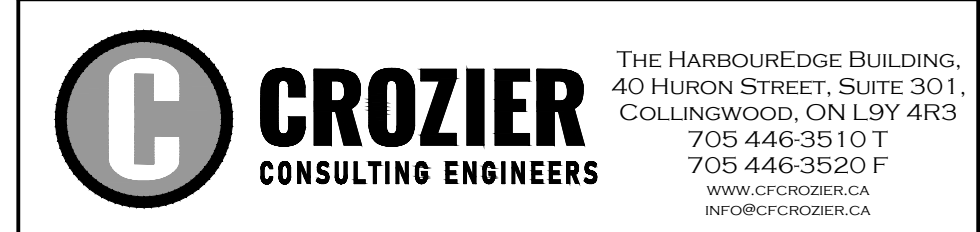
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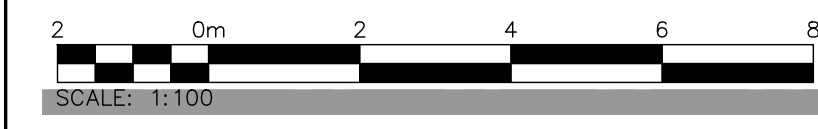
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Project  
**THUNDER ROAD & BOUNDARY ROAD**  
CITY OF OTTAWA

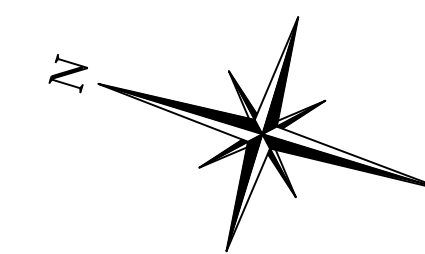
Drawing  
**FIRE TRUCK TURNING ANALYSIS**  
BUILDING 1



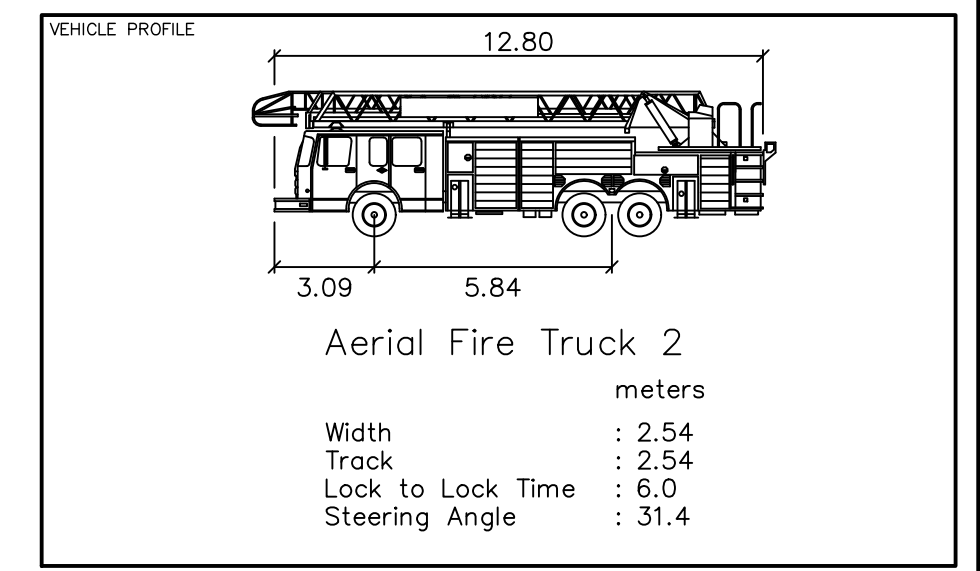
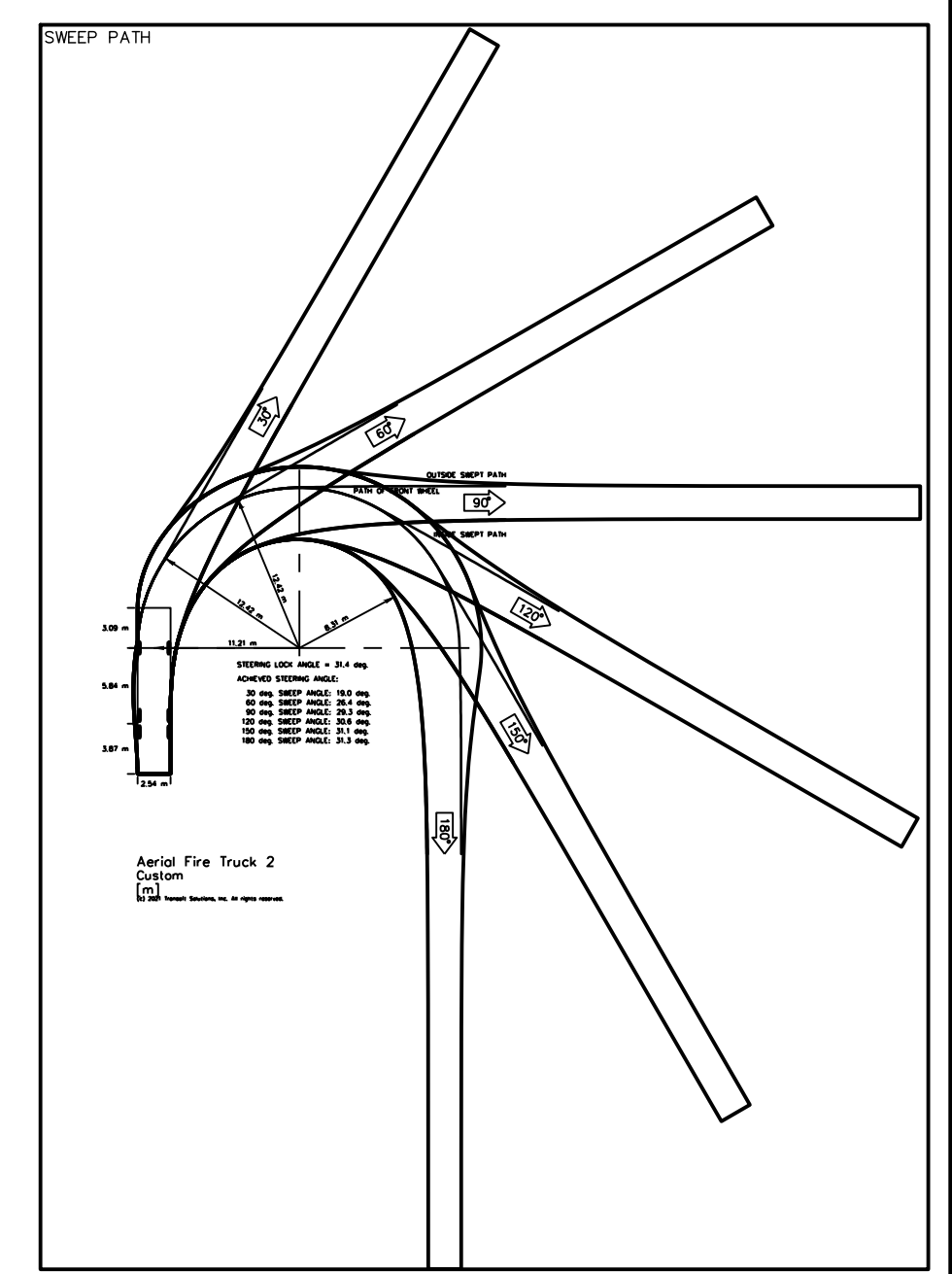
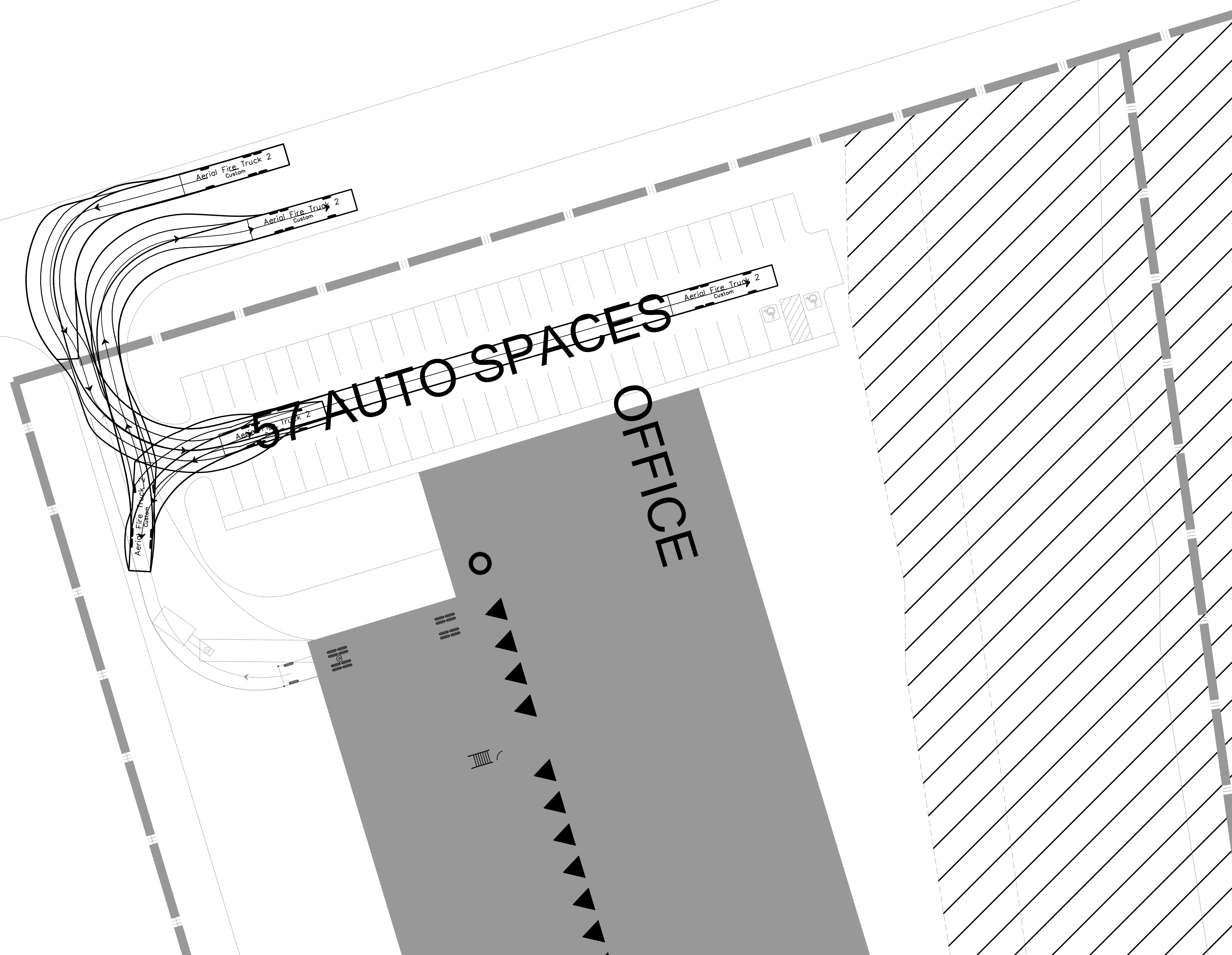
Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:100 Drawing <b>TT 06.2</b>







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Project  
**THUNDER ROAD & BOUNDARY ROAD**  
CITY OF OTTAWA

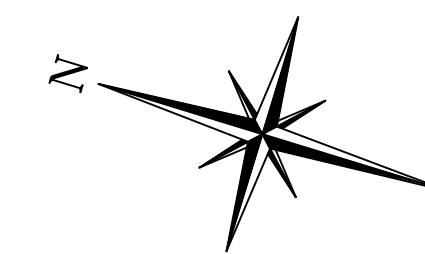
Drawing  
**FIRE TRUCK TURNING ANALYSIS**  
BUILDING 2

**CROZIER**  
CONSULTING ENGINEERS

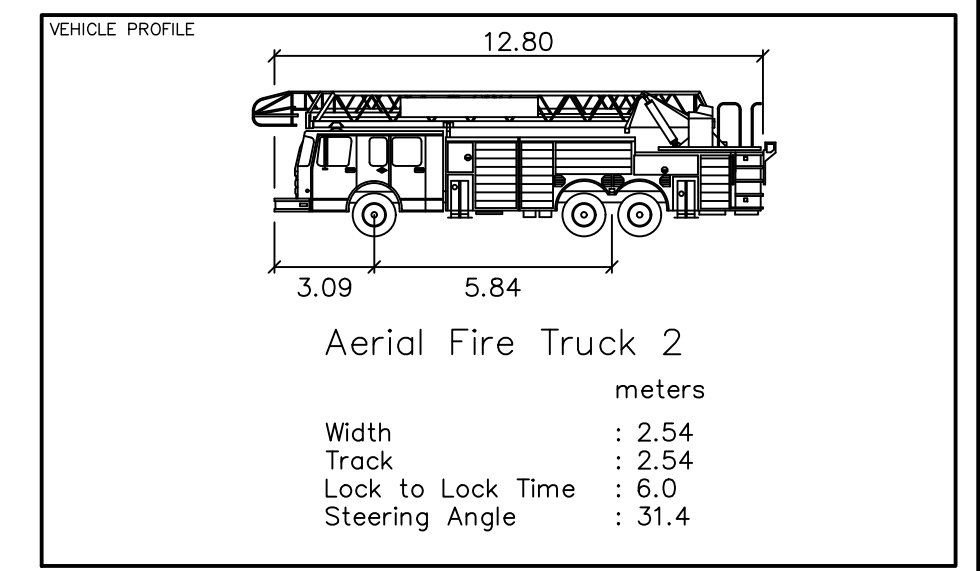
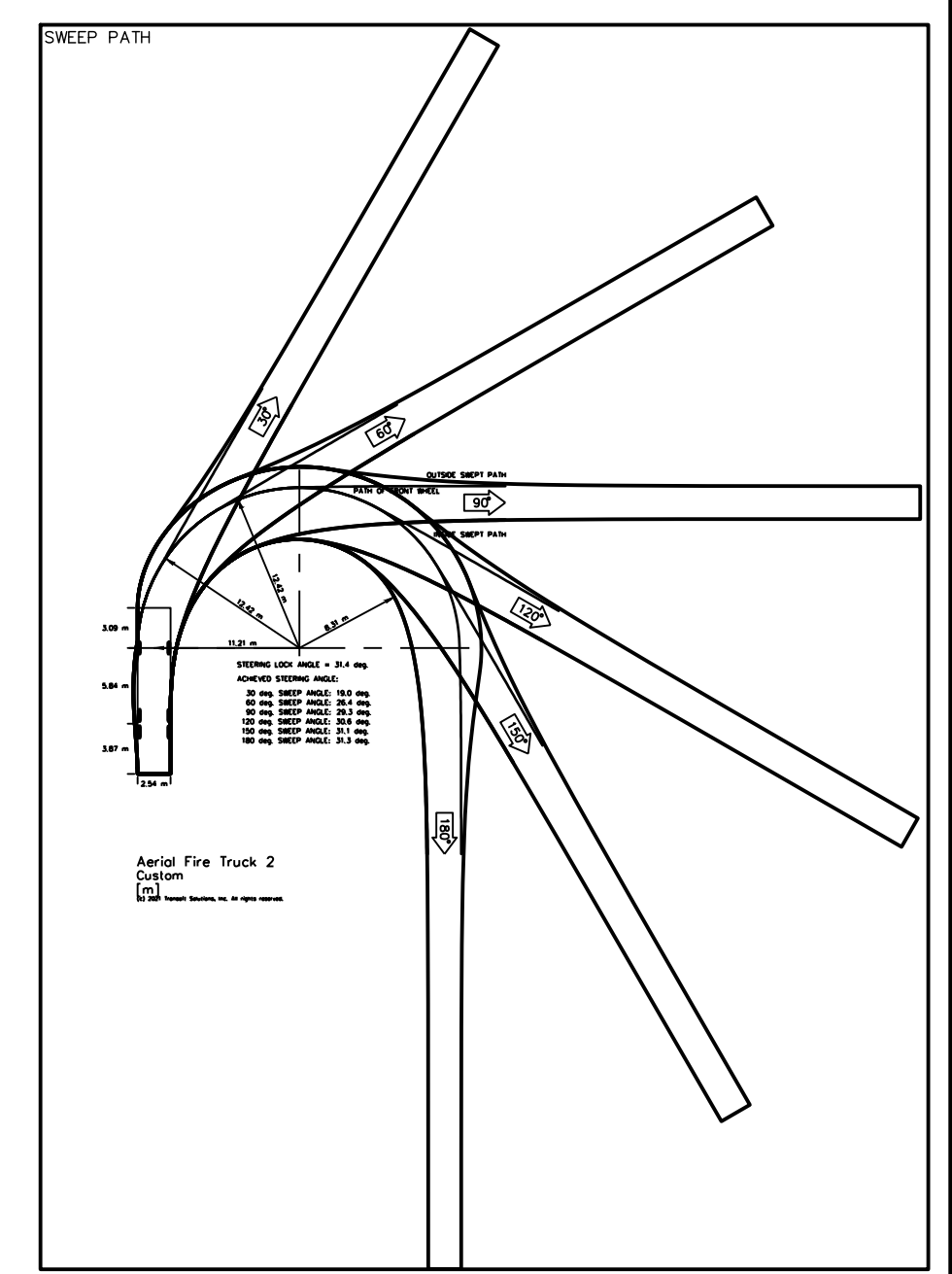
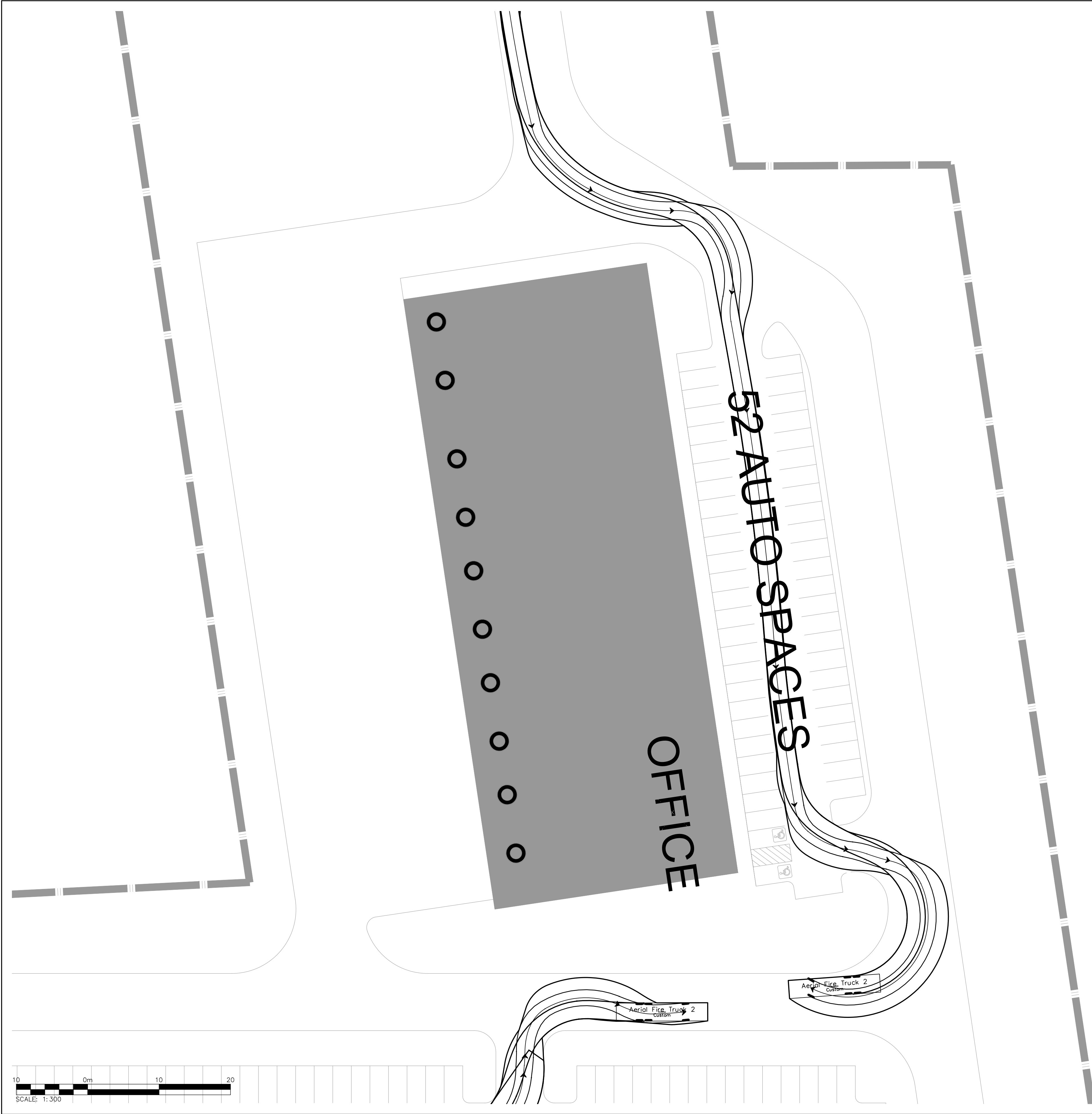
THE HARBOUREdge BUILDING,  
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705.446.3510 T  
705.446.3520 F  
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INFO@CFCROZIER.CA

Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:300
			Drawing	<b>TT 07</b>





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**Project**  
THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA

**Drawing**  
FIRE TRUCK TURNING ANALYSIS  
BUILDING 3

**CROZIER**  
CONSULTING ENGINEERS

THE HARBOUREdge BUILDING,  
40 HURON STREET, SUITE 301,  
COLLINGWOOD, ON L9Y 4R3  
705.446-3510 T  
705.446-3520 F  
WWW.CROZIER.CA  
INFO@CROZIER.CA

Drawn By	S.K.	Design By	Project	<b>1909-5772</b>
Check By	D.L.	Check By	Scale	1:300
			Drawing	<b>TT 08</b>

# APPENDIX J

## Signal Warrant Analysis Worksheets



# Canadian Traffic Signal Warrant Analysis

## Main Street Side Street

MainStreet1Lanes (#) 1  
 MainStreet2Lanes (#) 1  
 MainStreet.LT.Lanes (#) 1  
 SideStreet1Lanes (#) 1  
 SideStreet2Lanes (#) 1  
 MainStreetSpeedLimit (km/h) 80  
 MainStreetTrucks/Buses (%) 30.0%  
 Refuge Width on Median (m) 0.0

### Boundary Road South Amazon Access / Site Access

(#) 1 ← Distance to next signal (m) 165  
 (y/n) n → Elementary School  
 (y/n) n ↑ Senior's Complex  
 (y/n) n ↓ Pathway to School  
 (#) 994,837 Metro Area Population  
 (y/n) n Side Street Bus Route  
 (%) 40.0% Side Street Trucks  
 (y/n) n T or 1-Way Intersection  
 (y/n) n Central Business District

Date: March 10, 2021

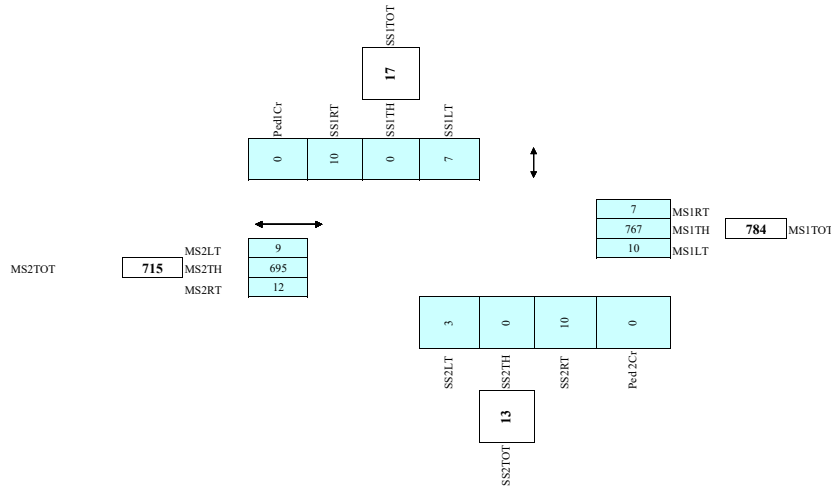
City: City of Ottawa

Vm = 1,499 (MainSt Vol Total) Cs = 0.900 (Int SpacingFactor)  
 Vs = 17 (SideSt Vol Highest) Cmt = 1.150 (MainStTruckFactor)  
 Pc = 0 Peds Crossing Main Cv = 1.100 (SpeedFactor)  
 K1 = 1,400 veh/veh const Cp = 1.000 (PopDemoFactor)  
 K2 = 5,000 veh/ped const Csb = 1.000 (SideStBusFactor)  
 L = 3.0 TotalMainStLanes Cst = 1.050 (SideStTruckFactor)  
 F = 1.000 (PedDemoFactor) Vmx = 784 (MainStHighest)  
 Vm1 = 1,499 (MainStVeh-Veh#) Vm2 = 1,499 (MainStVeh-Ped#)  
 Cvp = 1.139 (product of Cs,Cmt,Cv,Cp) Cbt = 1.050 (maximum of Csb,Cst)  
 Ct1 = 1.000 T Int / one way Factor

	←	→	↓	↑	PedC1	PedC2
	MS1LT MS1TH MS1RT	MS2LT MS2TH MS2RT	SS1LT SS1TH SS1RT	SS2LT SS2TH SS2RT		
7:00 - 8:00	15 1161 7	1 297 16	7 0 4	1 0 5	0	0
8:00 - 9:00	15 1161 7	1 297 16	7 0 4	1 0 5	0	0
11:00 - 12:00	15 1161 7	1 297 16	7 0 4	1 0 5	0	0
12:00 - 13:00	5 373 7	16 1093 7	7 0 15	4 0 15	0	0
16:00 - 17:00	5 373 7	16 1093 7	7 0 15	4 0 15	0	0
17:00 - 18:00	5 373 7	16 1093 7	7 0 15	4 0 15	0	0
Average	10 767 7	9 695 12	7 0 10	3 0 10	0	0

\*\*\* Enter the hourly turning movement counts averaged over the peak six hours of a typical week day

\*\*\* Enter the peak pedestrian volume crossing the main street averaged over the same hours



$$W = [Ct1xCbt(Vm1 \times Vs)/K1 + (F(Vm2 \times Pc)L)/K2] \times Cvp$$

W = 21 21 0  
 Not Warranted - Vs < 75 Veh Ped

Roadway, Vehicle and Pedestrian Factors	Range			
	Min	@	Max	@
Cs = (Int SpacingFactor)	0.90	<200 m	1.10	isolated
Cmt = (MainStTruckFactor)	1.00	<5%	1.15	>20%
Cv = (SpeedFactor)	1.00	<60 km/h	1.10	>80 km/h
Cp = (PopDemoFactor)	1.00	>250,000	1.20	<10,000
Csb = (SideStBusFactor)	1.00	no	1.05	yes
Cst = (SideStTruckFactor)	1.00	<10%	1.05	>10%
F = (Ped DemoFactor)				
(max of)	Elementary School	1.20		
	Seniors Complex	1.10		
	Path to School	1.10		

### Explanation of Factors:

- Cbt = 1.05 if the side street either is a bus route, or has more than 10% trucks, otherwise = 1.00.
- (it is assumed that these two factors only affect the side street vehicles trying to cross the main street, not the pedestrians)
- Ci = the product of the other 4 geographic factors  
 (Cs = intersection spacing, Cmt = main street truck, Cv = Speed, Cp = Population)
- Vm1 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=10.0 metres) (averaged over 6 peak hours)
- Vm2 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=6.0 metres) (averaged over 6 peak hours)
- Vs = the highest side street approach volume (averaged over 6 peak hours)
- \*\*\* note: it has been determined that Vs must be > 75 for signals to be considered \*\*\*
- F = Pedestrian demographic factor - the maximum of the 3 individual pedestrian demographic factors
- Pc = the total pedestrian volume crossing the mainstreet (averaged over 6 peak hours)
- L = number of lanes that the pedestrians have to cross (only half the street if the median is >=5.0 metres)
- Kv = Vehicle - Vehicle denominator constant (Kv = 1,100 if L <= 3, Kv = 1,400 if L > 3)
- Kp = Vehicle - Pedestrian denominator constant (Kp = 2,000 if L <= 3, Kp = 5,000 if L > 3)



# Canadian Traffic Signal Warrant Analysis

## Main Street Side Street

MainStreet1Lanes (#) 1  
 MainStreet2Lanes (#) 1  
 MainStreet.LT.Lanes (#) 0  
 SideStreet1Lanes (#) 0  
 SideStreet2Lanes (#) 1  
 MainStreetSpeedLimit (km/h) 60  
 MainStreetTrucks/Buses (%) 30.0%  
 Refuge Width on Median (m) 0.0

Thunder Road			
Site Access A			
Distance to next signal (m)	100		
Elementary School (y/n)	n		
Senior's Complex (y/n)	n		
Pathway to School (y/n)	n		
Metro Area Population (#)	994,837		
Side Street Bus Route (y/n)	n		
Side Street Trucks (%)	40.0%		
T or 1-Way Intersection (y/n)	y		
Central Business District (y/n)	n		

Date: March 10, 2021

City: City of Ottawa

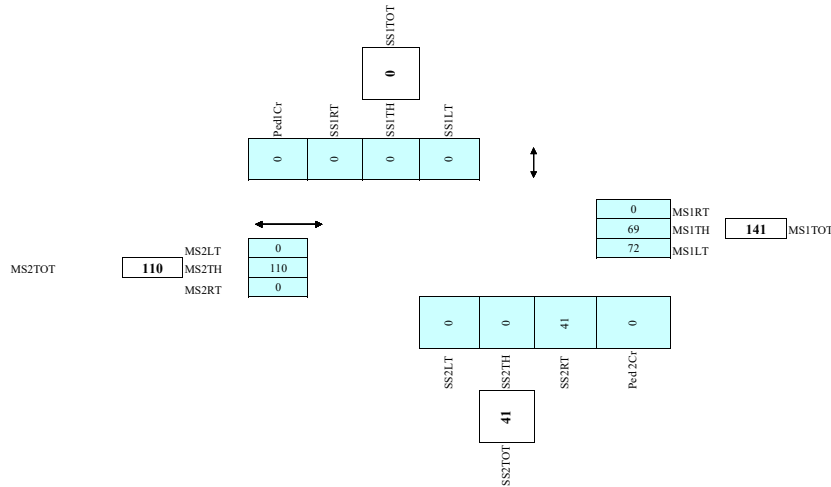
Vm = 251 (MainSt Vol Total)  
 Vs = 41 (SideSt Vol Highest)  
 Pc = 0 Peds Crossing Main  
 K1 = 1,100 veh/veh const  
 K2 = 2,000 veh/ped const  
 L = 2.0 TotalMainStLanes  
 F = 1.000 (PedDemoFactor)  
 Vm1 = 251 (MainStVeh-Veh#)  
 Cvp = 1.035 (product of Cs,Cmt,Cv,Cp)  
 Ct1 = 0.667 T Int / one way Factor

Cs = 0.900 (Int SpacingFactor)  
 Cmt = 1.150 (MainStTruckFactor)  
 Cv = 1.000 (SpeedFactor)  
 Cp = 1.000 (PopDemoFactor)  
 Csb = 1.000 (SideStBusFactor)  
 Cst = 1.050 (SideStTruckFactor)  
 Vmx = 141 (MainStHighest)  
 Vm2 = 251 (MainStVeh-Ped#)  
 Cbt = 1.050 (maximum of Csb,Cst)

	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	51	119	0	0	78	0	0	0	0	0	0	19	0	0
8:00 - 9:00	51	119	0	0	78	0	0	0	0	0	0	19	0	0
11:00 - 12:00	51	119	0	0	78	0	0	0	0	0	0	19	0	0
12:00 - 13:00	93	19	0	0	141	0	0	0	0	0	0	62	0	0
16:00 - 17:00	93	19	0	0	141	0	0	0	0	0	0	62	0	0
17:00 - 18:00	93	19	0	0	141	0	0	0	0	0	0	62	0	0
Average	72	69	0	0	110	0	0	0	0	0	0	41	0	0

\*\*\* Enter the hourly turning movement counts averaged over the peak six hours of a typical week day

\*\*\* Enter the peak pedestrian volume crossing the main street averaged over the same hours



$$W = [Ct1xCbt(Vm1 \times Vs)/K1 + (F(Vm2 \times Pc)L)/K2] \times Cvp$$

$$W = 7 \quad 7 \quad 0$$

Not Warranted - Vs < 75

Veh Ped

Roadway, Vehicle and Pedestrian Factors	Range			
	Min	@	Max	@
Cs = (Int SpacingFactor)	0.90	<200 m	1.10	isolated
Cmt = (MainStTruckFactor)	1.00	<5%	1.15	>20%
Cv = (SpeedFactor)	1.00	<60 km/h	1.10	>80 km/h
Cp = (PopDemoFactor)	1.00	>250,000	1.20	<10,000
Csb = (SideStBusFactor)	1.00	no	1.05	yes
Cst = (SideStTruckFactor)	1.00	<10%	1.05	>10%
F = (Ped DemoFactor)				
(max of)	Elementary School	1.20		
	Seniors Complex	1.10		
	Path to School	1.10		

### Explanation of Factors:

- Cbt = 1.05 if the side street either is a bus route, or has more than 10% trucks, otherwise = 1.00.
- (it is assumed that these two factors only affect the side street vehicles trying to cross the main street, not the pedestrians)
- Ci = the product of the other 4 geographic factors
- (Cs = intersection spacing, Cmt = main street truck, Cv = Speed, Cp = Population)
- Vm1 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=10.0 metres) (averaged over 6 peak hours)
- Vm2 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=6.0 metres) (averaged over 6 peak hours)
- Vs = the highest side street approach volume (averaged over 6 peak hours)
- \*\*\* note: it has been determined that Vs must be > 75 for signals to be considered \*\*\*
- F = Pedestrian demographic factor - the maximum of the 3 individual pedestrian demographic factors
- Pc = the total pedestrian volume crossing the mainstreet (averaged over 6 peak hours)
- L = number of lanes that the pedestrians have to cross (only half the street if the median is >=5.0 metres)
- Kv = Vehicle - Vehicle denominator constant (Kv = 1,100 if L <= 3, Kv = 1,400 if L > 3)
- Kp = Vehicle - Pedestrian denominator constant (Kp = 2,000 if L <= 3, Kp = 5,000 if L > 3)



# Canadian Traffic Signal Warrant Analysis

## Main Street Side Street

MainStreet1Lanes (#) 1  
 MainStreet2Lanes (#) 1  
 MainStreet.LT.Lanes (#) 0  
 SideStreet1Lanes (#) 0  
 SideStreet2Lanes (#) 1  
 MainStreetSpeedLimit (km/h) 60  
 MainStreetTrucks/Buses (%) 30.0%  
 Refuge Width on Median (m) 0.0

Thunder Road			
Site Access B			
Distance to next signal (m)	100		
Elementary School (y/n)	n		
Senior's Complex (y/n)	n		
Pathway to School (y/n)	n		
Metro Area Population (#)	994,837		
Side Street Bus Route (y/n)	n		
Side Street Trucks (%)	40.0%		
T or 1-Way Intersection (y/n)	y		
Central Business District (y/n)	n		

Date: March 10, 2021

City: City of Ottawa

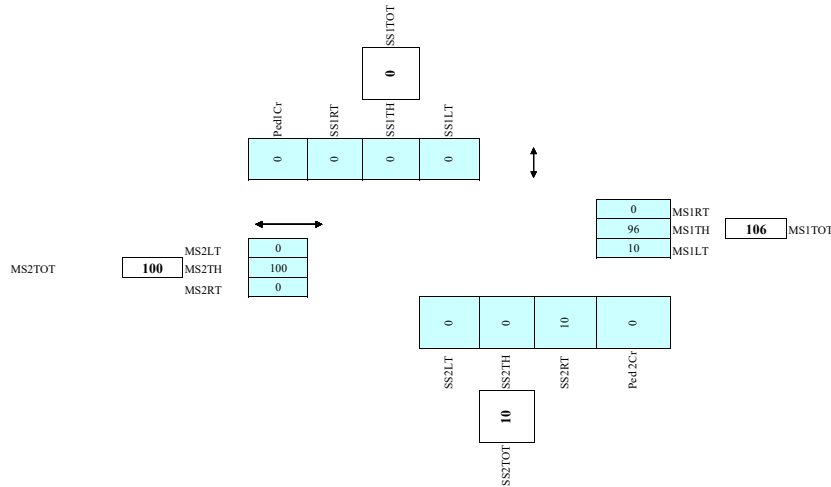
Vm = 206 (MainSt Vol Total)  
 Vs = 10 (SideSt Vol Highest)  
 Pc = 0 Peds Crossing Main  
 K1 = 1,100 veh/veh const  
 K2 = 2,000 veh/ped const  
 L = 2.0 TotalMainStLanes  
 F = 1.000 (PedDemoFactor)  
 Vm1 = 206 (MainStVeh-Veh#)  
 Cvp = 1.035 (product of Cs,Cmt,Cv,Cp)  
 Ct1 = 0.667 T Int / one way Factor

Cs = 0.900 (Int SpacingFactor)  
 Cmt = 1.150 (MainStTruckFactor)  
 Cv = 1.000 (SpeedFactor)  
 Cp = 1.000 (PopDemoFactor)  
 Csb = 1.000 (SideStBusFactor)  
 Cst = 1.050 (SideStTruckFactor)  
 Vmx = 106 (MainStHighest)  
 Vm2 = 206 (MainStVeh-Ped#)  
 Cbt = 1.050 (maximum of Csb,Cst)

	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	15	104	0	0	74	0	0	0	0	0	0	4	0	0
8:00 - 9:00	15	104	0	0	74	0	0	0	0	0	0	4	0	0
11:00 - 12:00	15	104	0	0	74	0	0	0	0	0	0	4	0	0
12:00 - 13:00	5	88	0	0	126	0	0	0	0	0	0	15	0	0
16:00 - 17:00	5	88	0	0	126	0	0	0	0	0	0	15	0	0
17:00 - 18:00	5	88	0	0	126	0	0	0	0	0	0	15	0	0
Average	10	96	0	0	100	0	0	0	0	0	0	10	0	0

\*\*\* Enter the hourly turning movement counts averaged over the peak six hours of a typical week day

\*\*\* Enter the peak pedestrian volume crossing the main street averaged over the same hours



$$W = [Ct1xCbt(Vm1 \times Vs)/K1 + (F(Vm2 \times Pc)L)/K2] \times Cvp$$

$$W = 1 \quad 1 \quad 0$$

Not Warranted - Vs < 75

Veh Ped

Roadway, Vehicle and Pedestrian Factors	Range			
	Min	@	Max	@
Cs = (Int SpacingFactor)	0.90	<200 m	1.10	isolated
Cmt = (MainStTruckFactor)	1.00	<5%	1.15	>20%
Cv = (SpeedFactor)	1.00	<60 km/h	1.10	>80 km/h
Cp = (PopDemoFactor)	1.00	>250,000	1.20	<10,000
Csb = (SideStBusFactor)	1.00	no	1.05	yes
Cst = (SideStTruckFactor)	1.00	<10%	1.05	>10%
F = (Ped DemoFactor)				
(max of)	Elementary School	1.20		
	Seniors Complex	1.10		
	Path to School	1.10		

### Explanation of Factors:

- Cbt = 1.05 if the side street either is a bus route, or has more than 10% trucks, otherwise = 1.00.
- (it is assumed that these two factors only affect the side street vehicles trying to cross the main street, not the pedestrians)
- Ci = the product of the other 4 geographic factors
- (Cs = intersection spacing, Cmt = main street truck, Cv = Speed, Cp = Population)
- Vm1 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=10.0 metres) (averaged over 6 peak hours)
- Vm2 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=6.0 metres) (averaged over 6 peak hours)
- Vs = the highest side street approach volume (averaged over 6 peak hours)
- \*\*\* note: it has been determined that Vs must be > 75 for signals to be considered \*\*\*
- F = Pedestrian demographic factor - the maximum of the 3 individual pedestrian demographic factors
- Pc = the total pedestrian volume crossing the mainstreet (averaged over 6 peak hours)
- L = number of lanes that the pedestrians have to cross (only half the street if the median is >=5.0 metres)
- Kv = Vehicle - Vehicle denominator constant (Kv = 1,100 if L <= 3, Kv = 1,400 if L > 3)
- Kp = Vehicle - Pedestrian denominator constant (Kp = 2,000 if L <= 3, Kp = 5,000 if L > 3)



# Canadian Traffic Signal Warrant Analysis

Main Street  
Side Street

MainStreet1Lanes (#) 1  
MainStreet2Lanes (#) 1  
MainStreet.LT.Lanes (#) 0  
SideStreet1Lanes (#) 0  
SideStreet2Lanes (#) 1  
MainStreetSpeedLimit (km/h) 60  
MainStreetTrucks/Buses (%) 30.0%  
Refuge Width on Median (m) 0.0

Thunder Road			
Site Access C			
Distance to next signal (m)	100		
Elementary School (y/n)	n		
Senior's Complex (y/n)	n		
Pathway to School (y/n)	n		
Metro Area Population (#)	994,837		
Side Street Bus Route (y/n)	n		
Side Street Trucks (%)	40.0%		
T or 1-Way Intersection (y/n)	y		
Central Business District (y/n)	n		

Date: March 10, 2021

City: City of Ottawa

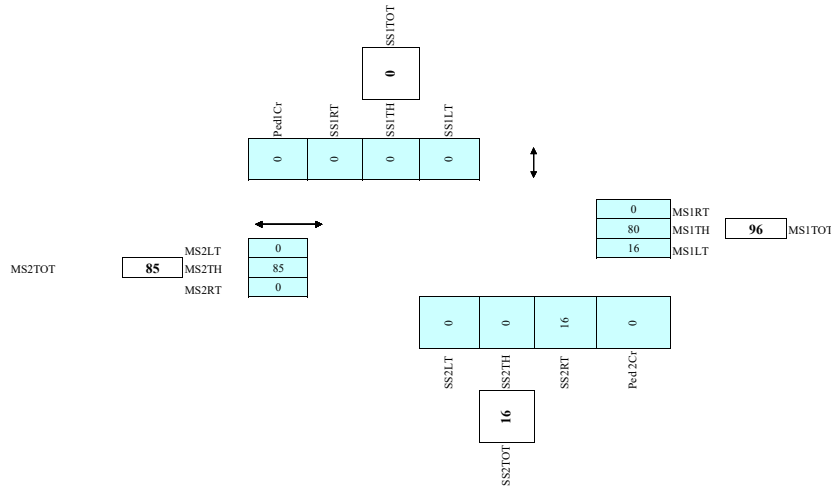
Vm = 181 (MainSt Vol Total)  
Vs = 16 (SideSt Vol Highest)  
Pc = 0 Peds Crossing Main  
K1 = 1,100 veh/veh const  
K2 = 2,000 veh/ped const  
L = 2.0 TotalMainStLanes  
F = 1.000 (PedDemoFactor)  
Vm1 = 181 (MainStVeh-Veh#)  
Cvp = 1.035 (product of Cs,Cmt,Cv,Cp)  
Ct1 = 0.667 T Int / one way Factor

Cs = 0.900 (Int SpacingFactor)  
Cmt = 1.150 (MainStTruckFactor)  
Cv = 1.000 (SpeedFactor)  
Cp = 1.000 (PopDemoFactor)  
Csb = 1.000 (SideStBusFactor)  
Cst = 1.050 (SideStTruckFactor)  
Vmx = 96 (MainStHighest)  
Vm2 = 181 (MainStVeh-Ped#)  
Cbt = 1.050 (maximum of Csb,Cst)

	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	23	81	0	0	67	0	0	0	0	0	0	7	0	0
8:00 - 9:00	23	81	0	0	67	0	0	0	0	0	0	7	0	0
11:00 - 12:00	23	81	0	0	67	0	0	0	0	0	0	7	0	0
12:00 - 13:00	9	79	0	0	102	0	0	0	0	0	0	24	0	0
16:00 - 17:00	9	79	0	0	102	0	0	0	0	0	0	24	0	0
17:00 - 18:00	9	79	0	0	102	0	0	0	0	0	0	24	0	0
Average	16	80	0	0	85	0	0	0	0	0	0	16	0	0

\*\*\* Enter the hourly turning movement counts averaged over the peak six hours of a typical week day

\*\*\* Enter the peak pedestrian volume crossing the main street averaged over the same hours



$$W = [Ct1xCbt(Vm1 \times Vs)/K1 + (F(Vm2 \times Pc)L)/K2] \times Cvp$$

$$W = 2 \quad 2 \quad 0$$

Not Warranted - Vs < 75

Veh Ped

Roadway, Vehicle and Pedestrian Factors	Range			
	Min	@	Max	@
Cs = (Int SpacingFactor)	0.90	<200 m	1.10	isolated
Cmt = (MainStTruckFactor)	1.00	<5%	1.15	>20%
Cv = (SpeedFactor)	1.00	<60 km/h	1.10	>80 km/h
Cp = (PopDemoFactor)	1.00	>250,000	1.20	<10,000
Csb = (SideStBusFactor)	1.00	no	1.05	yes
Cst = (SideStTruckFactor)	1.00	<10%	1.05	>10%
F = (Ped DemoFactor)				
(max of)	Elementary School	1.20		
	Seniors Complex	1.10		
	Path to School	1.10		

### Explanation of Factors:

- Cbt = 1.05 if the side street either is a bus route, or has more than 10% trucks, otherwise = 1.00.
- (it is assumed that these two factors only affect the side street vehicles trying to cross the main street, not the pedestrians)
- Ci = the product of the other 4 geographic factors
- (Cs = intersection spacing, Cmt = main street truck, Cv = Speed, Cp = Population)
- Vm1 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=10.0 metres) (averaged over 6 peak hours)
- Vm2 = the main street volume - either the total of the two approaches or the highest single approach (if the median is >=6.0 metres) (averaged over 6 peak hours)
- Vs = the highest side street approach volume (averaged over 6 peak hours)
- \*\*\* note: it has been determined that Vs must be > 75 for signals to be considered \*\*\*
- F = Pedestrian demographic factor - the maximum of the 3 individual pedestrian demographic factors
- Pc = the total pedestrian volume crossing the mainstreet (averaged over 6 peak hours)
- L = number of lanes that the pedestrians have to cross (only half the street if the median is >=5.0 metres)
- Kv = Vehicle - Vehicle denominator constant (Kv = 1,100 if L <= 3, Kv = 1,400 if L > 3)
- Kp = Vehicle - Pedestrian denominator constant (Kp = 2,000 if L <= 3, Kp = 5,000 if L > 3)

# APPENDIX K

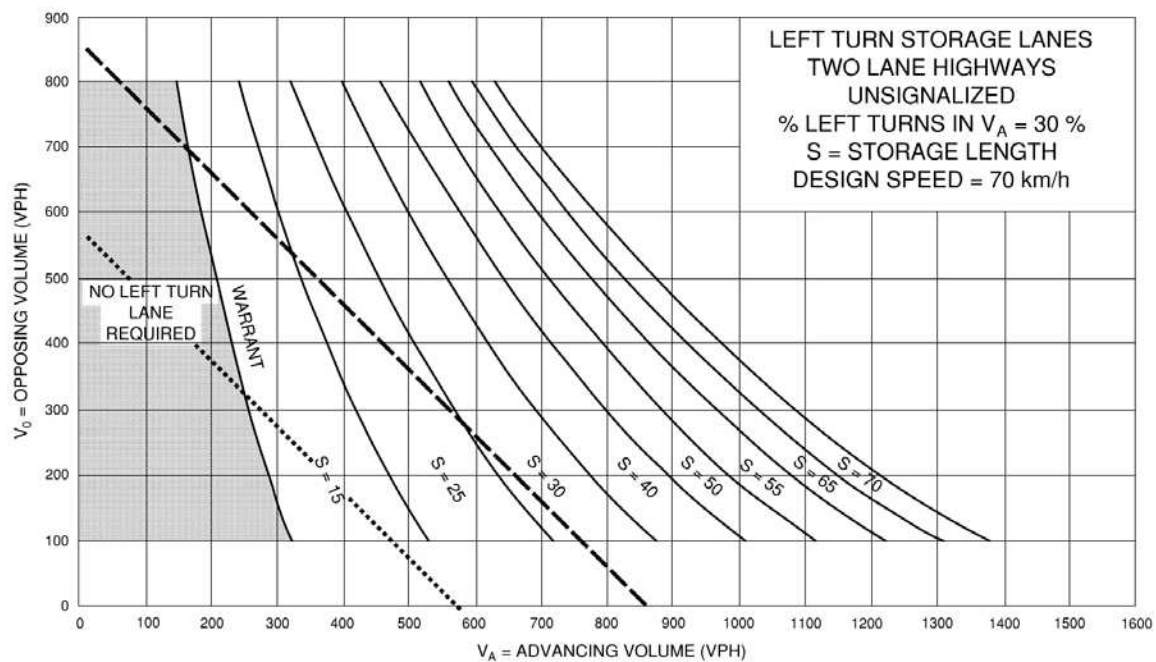
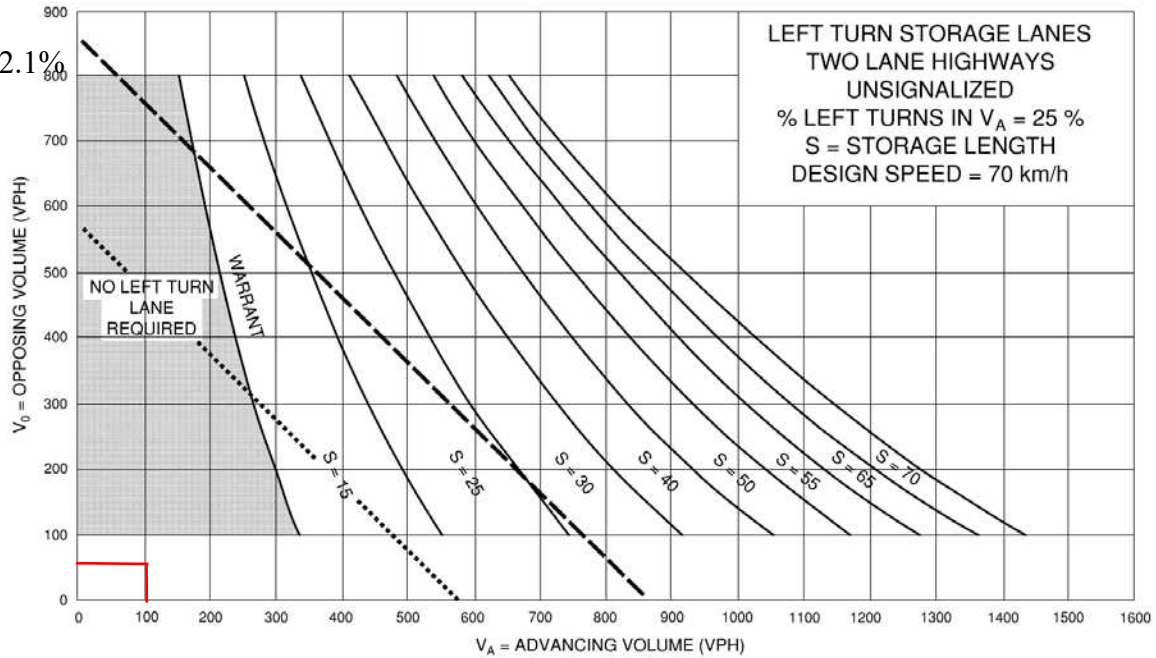
## Left-Turn Lane Warrant Analysis Worksheets



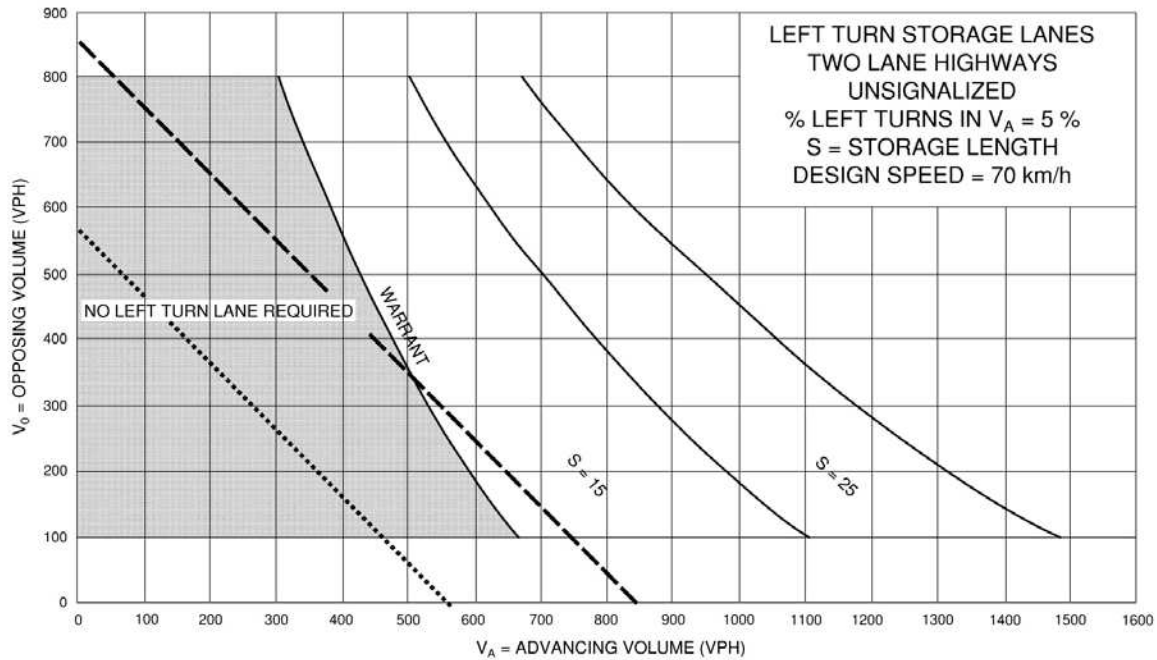
AM PEAK - Site Access C:

**Exhibit 9A-13**

VA = 104 veh/hr  
 VL = 23 veh/hr  
 % LT in VA = 22.1%  
 VO = 67 veh/hr  
 REQ = 0 metres



**Exhibit 9A-11**



**PM PEAK - Site Access C:**

--- TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

..... TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

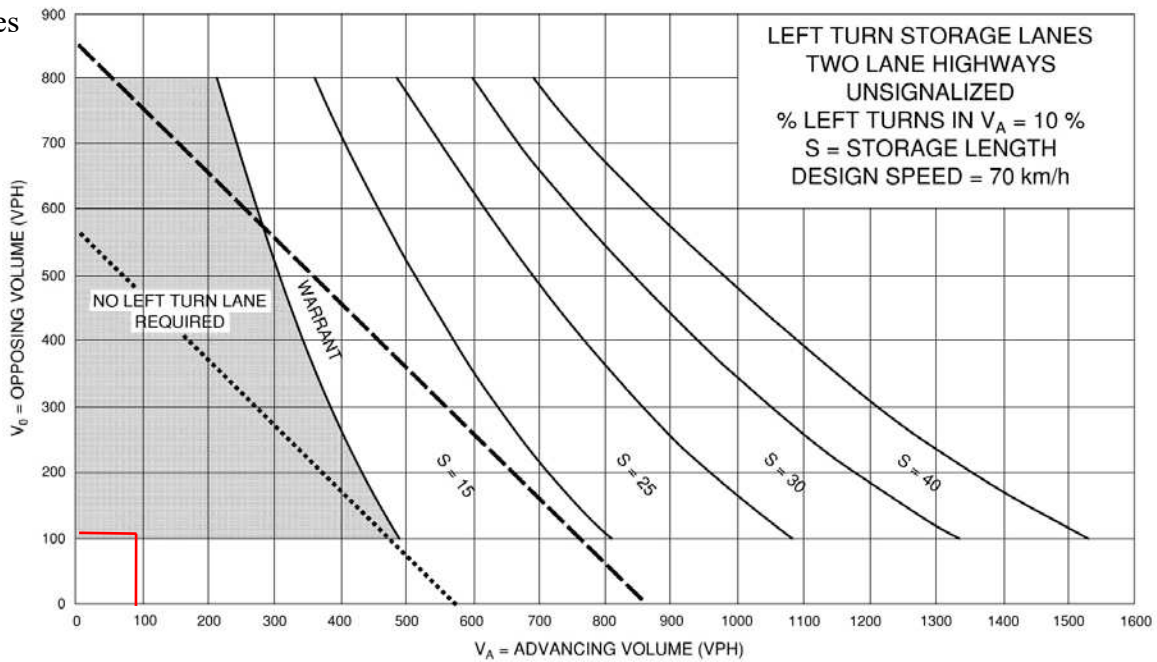
$V_A = 88$  veh/hr

$V_L = 9$  veh/hr

% LT in  $V_A = 10.23\%$

$V_O = 102$  veh/hr

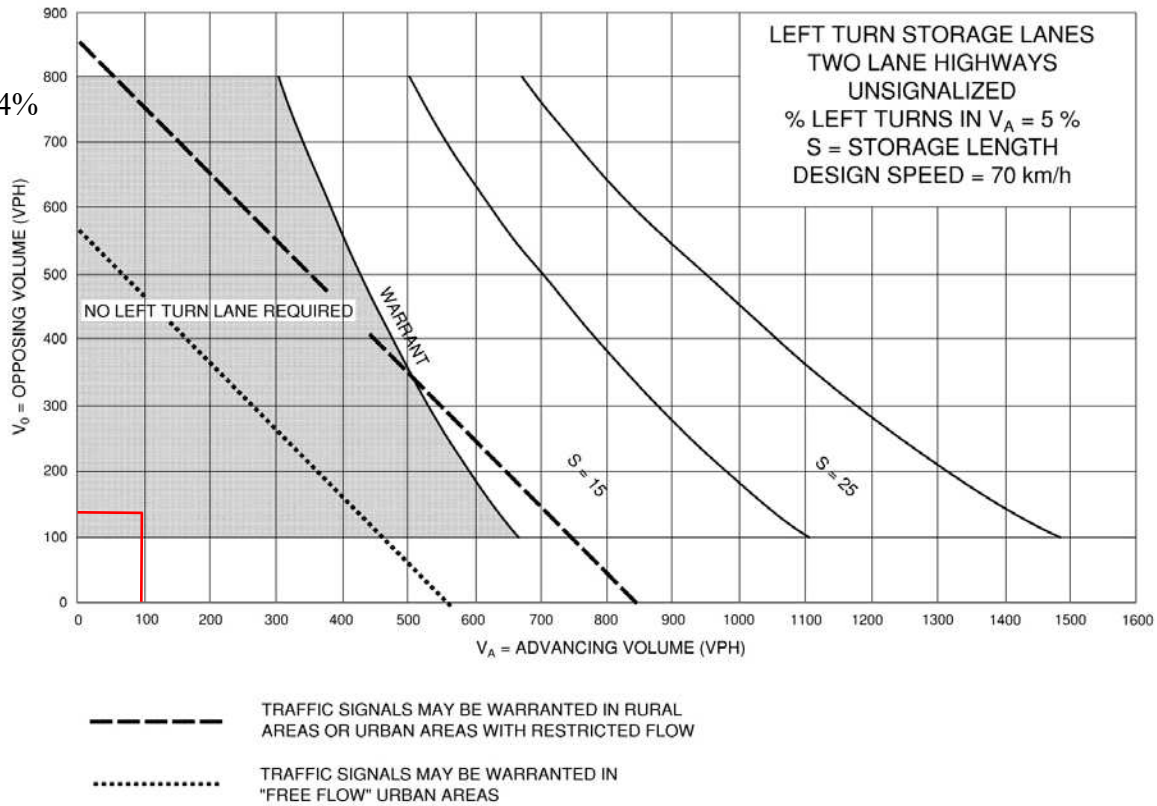
REQ = 0 metres



PM PEAK - Site Access B:

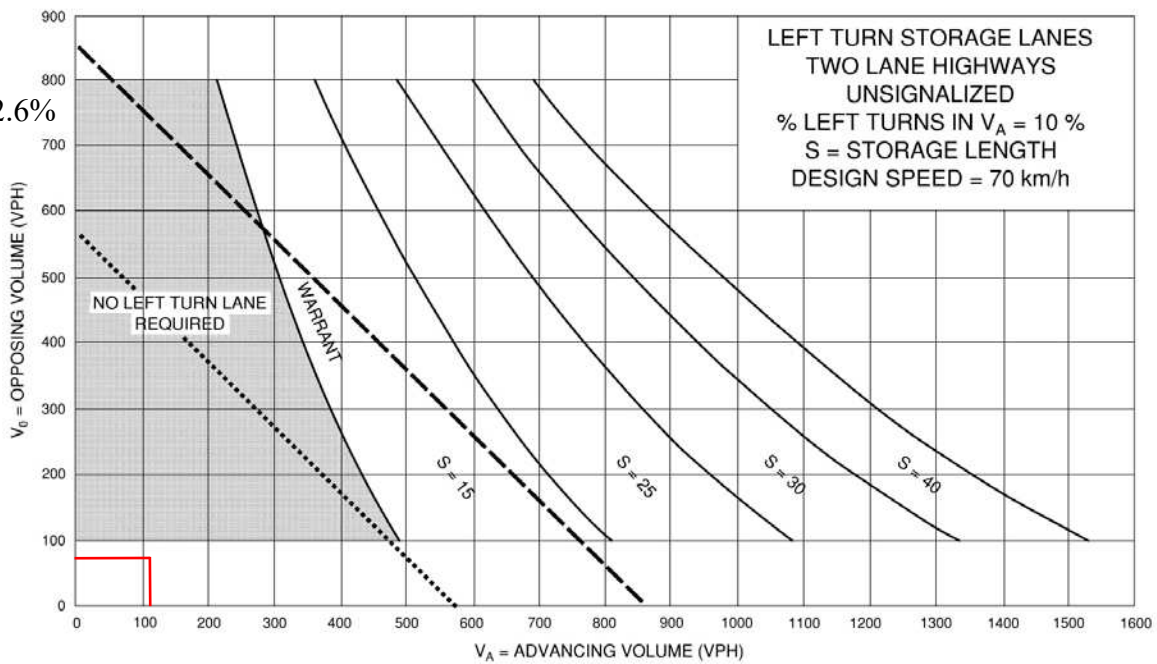
**Exhibit 9A-11**

VA = 93 veh/hr  
 VL = 5 veh/hr  
 % LT in VA = 5.4%  
 VO = 126 veh/hr  
 REQ = 0 metres

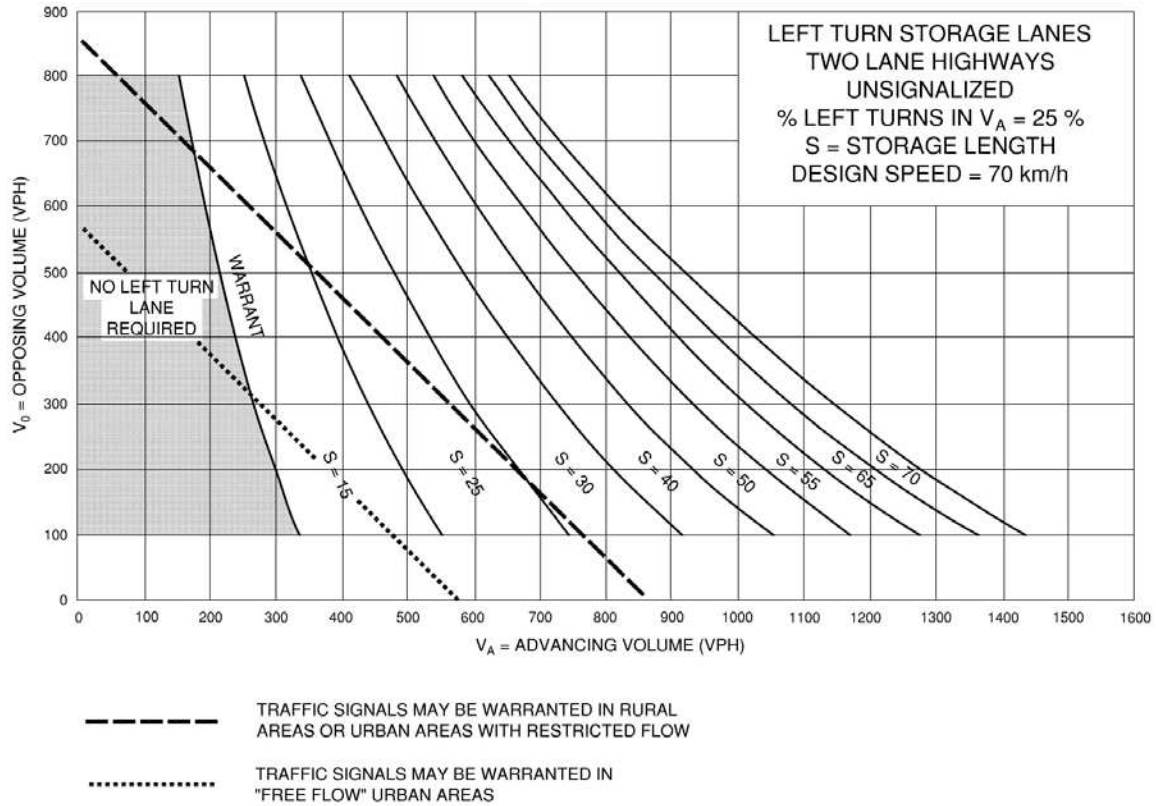


AM PEAK - Site Access B:

VA = 119 veh/hr  
 VL = 159 veh/hr  
 % LT in VA = 12.6%  
 VO = 74 veh/hr  
 REQ = 0 metres

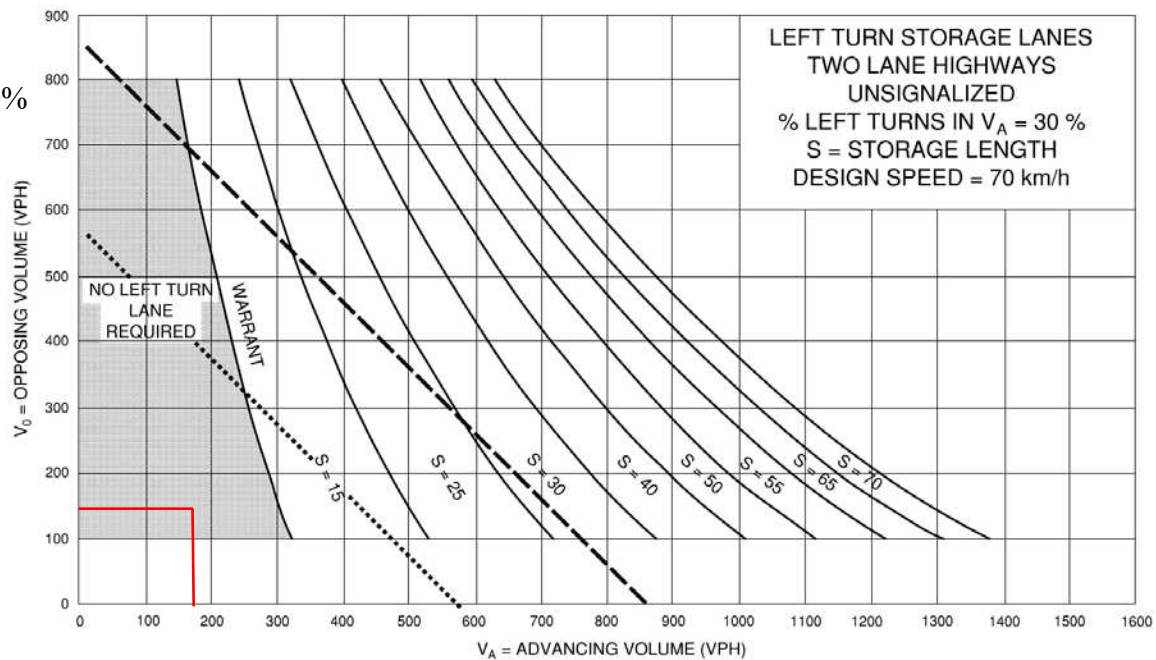


**Exhibit 9A-13**



AM PEAK - Site Access A:

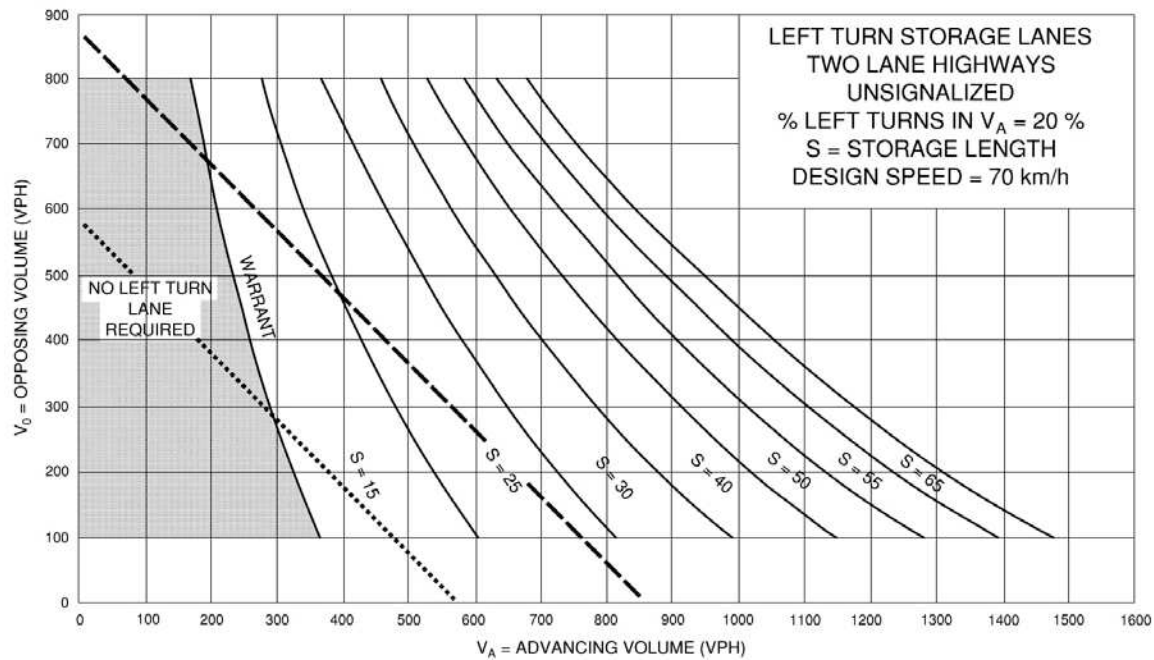
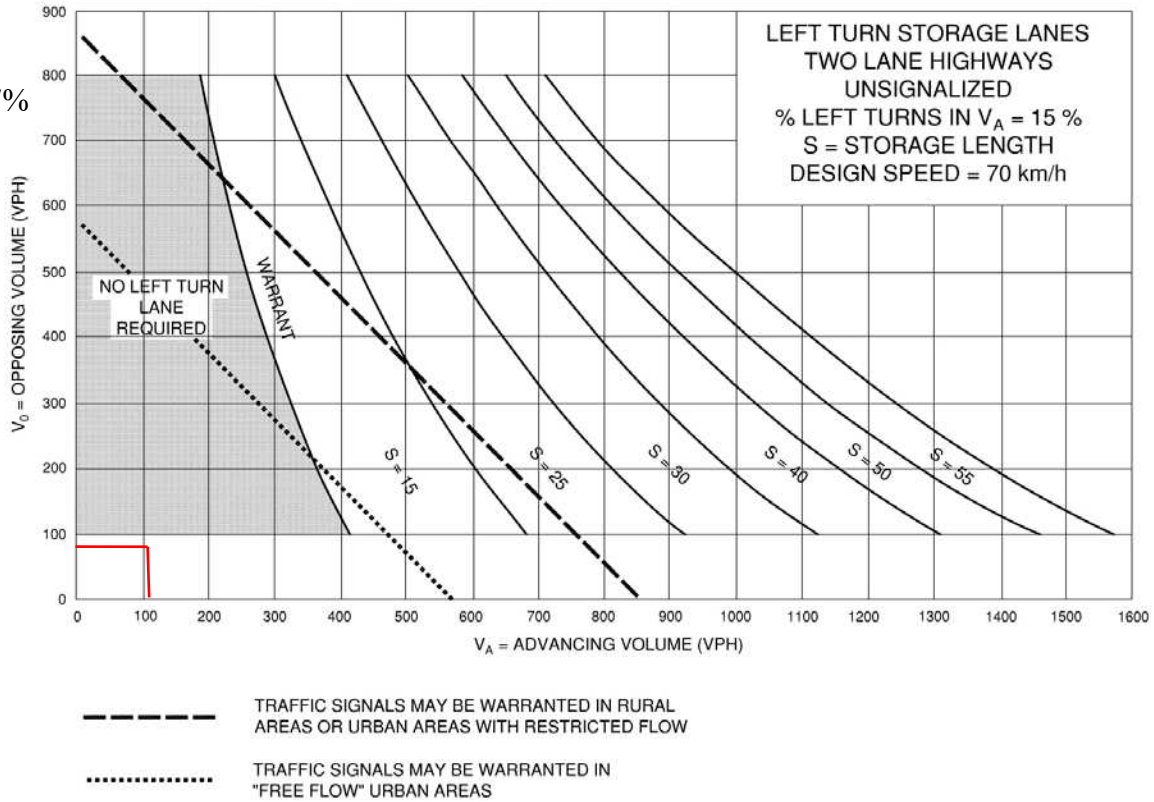
$V_A = 170$  veh/hr  
 $V_L = 51$  veh/hr  
% LT in  $V_A = 30\%$   
 $V_O = 141$  veh/hr  
REQ = 0 metres



PM PEAK - Site Access A:

**Exhibit 9A-12**

VA = 112 veh/hr  
 VL = 19 veh/hr  
 % LT in VA = 17%  
 VO = 78 veh/hr  
 REQ = 0 metres



# APPENDIX L

## Level of Service Definitions

## Level of Service Definitions

### Two-Way Stop Controlled Intersections

<b>Level of Service</b>	<b>Control Delay per Vehicle (seconds)</b>	<b>Interpretation</b>
A	$\leq 10$	EXCELLENT. Large and frequent gaps in traffic on the main roadway. Queuing on the minor street is rare.
B	$> 10$ and $\leq 15$	VERY GOOD. Many gaps exist in traffic on the main roadway. Queuing on the minor street is minimal.
C	$> 15$ and $\leq 25$	GOOD. Fewer gaps exist in traffic on the main roadway. Delay on minor approach becomes more noticeable.
D	$> 25$ and $\leq 35$	FAIR. Infrequent and shorter gaps in traffic on the main roadway. Queue lengths develop on the minor street.
E	$> 35$ and $\leq 50$	POOR. Very infrequent gaps in traffic on the main roadway. Queue lengths become noticeable.
F	$> 50$	UNSATISFACTORY. Very few gaps in traffic on the main roadway. Excessive delay with significant queue lengths on the minor street.

Adapted from Highway Capacity Manual 2000, Transportation Research Board

## Level of Service Definitions

### Signalized Intersections

<b>Level of Service</b>	<b>Control Delay per Vehicle (seconds)</b>	<b>Interpretation</b>
A	$\leq 10$	EXCELLENT. Extremely favourable progression with most vehicles arriving during the green phase. Most vehicles do not stop and short cycle lengths may contribute to low delay.
B	$> 10$ and $\leq 20$	VERY GOOD. Very good progression and/or short cycle lengths with slightly more vehicles stopping than LOS "A" causing slightly higher levels of average delay.
C	$> 20$ and $\leq 35$	GOOD. Fair progression and longer cycle lengths lead to a greater number of vehicles stopping than LOS "B".
D	$> 35$ and $\leq 55$	FAIR. Congestion becomes noticeable with higher average delays resulting from a combination of long cycle lengths, high volume-to-capacity ratios and unfavourable progression.
E	$> 55$ and $\leq 80$	POOR. Lengthy delays values are indicative of poor progression, long cycle lengths and high volume-to-capacity ratios. Individual cycle failures are common with individual movement failures also common.
F	$> 80$	UNSATISFACTORY. Indicative of oversaturated conditions with vehicular demand greater than the capacity of the intersection.

Adapted from Highway Capacity Manual 2000, Transportation Research Board



# APPENDIX M

## Detailed Capacity Analysis Worksheets

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

Existing Conditions AM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	108	28	85	743	70	91
Future Volume (vph)	108	28	85	743	70	91
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.972		0.879			
Flt Protected	0.962					0.979
Satd. Flow (prot)	1746	0	1529	0	0	1582
Flt Permitted	0.962					0.979
Satd. Flow (perm)	1746	0	1529	0	0	1582
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	4%	14%	14%	1%	9%	11%
Adj. Flow (vph)	120	31	94	826	78	101
Shared Lane Traffic (%)						
Lane Group Flow (vph)	151	0	920	0	0	179
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	80.4%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

Existing Conditions AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	108	28	85	743	70	91
Future Volume (Veh/h)	108	28	85	743	70	91
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	120	31	94	826	78	101
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	764	507			920	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	764	507			920	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	63	94			89	
cM capacity (veh/h)	329	542			714	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	151	920	179			
Volume Left	120	0	78			
Volume Right	31	826	0			
cSH	358	1700	714			
Volume to Capacity	0.42	0.54	0.11			
Queue Length 95th (m)	16.3	0.0	2.9			
Control Delay (s)	22.2	0.0	5.3			
Lane LOS	C		A			
Approach Delay (s)	22.2	0.0	5.3			
Approach LOS	C					
<b>Intersection Summary</b>						
Average Delay			3.5			
Intersection Capacity Utilization		80.4%		ICU Level of Service		D
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

Existing Conditions AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	16	233	29	816	173	8
Future Volume (vph)	16	233	29	816	173	8
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.994	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1291	1395	1291	1745	1593	0
Fl <sub>t</sub> Permitted	0.950		0.543			
Satd. Flow (perm)	1291	1395	738	1745	1593	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		259			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	31%	6%	31%	2%	11%	13%
Adj. Flow (vph)	18	259	32	907	192	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	259	32	907	201	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

Existing Conditions AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	12.0	60.0	48.0	
Total Split (%)	25.0%	25.0%	15.0%	75.0%	60.0%	
Maximum Green (s)	13.2	13.2	6.0	53.4	41.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	8.5	8.5	41.5	40.9	36.8	
Actuated g/C Ratio	0.13	0.13	0.66	0.65	0.58	
v/c Ratio	0.10	0.63	0.06	0.80	0.22	
Control Delay	28.3	12.0	4.2	15.0	8.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	28.3	12.0	4.2	15.0	8.6	
LOS	C	B	A	B	A	
Approach Delay	13.0			14.6	8.6	
Approach LOS	B			B	A	
Queue Length 50th (m)	1.7	0.0	1.0	60.6	7.2	
Queue Length 95th (m)	8.4	20.5	4.1	141.6	28.7	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	276	502	539	1511	1071	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.07	0.52	0.06	0.60	0.19	

Intersection Summary

Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	63.1
Natural Cycle:	75
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.80
Intersection Signal Delay:	13.5
Intersection LOS:	B
Intersection Capacity Utilization:	62.3%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

Existing Conditions AM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↑	↔	↔	↔	↔
Traffic Volume (vph)	31	15	4	3	5	23	5	791	27	175	181	50
Future Volume (vph)	31	15	4	3	5	23	5	791	27	175	181	50
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990				0.850			0.850		0.967	
Flt Protected		0.970			0.984		0.950			0.950		
Satd. Flow (prot)	0	1620	0	0	1752	1513	1378	1728	1479	1653	1517	0
Flt Permitted		0.806			0.867		0.600			0.142		
Satd. Flow (perm)	0	1346	0	0	1543	1513	870	1728	1479	247	1517	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				100			96			32
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	6%	0%	25%	0%	0%	0%	20%	3%	0%	0%	15%	8%
Adj. Flow (vph)	34	17	4	3	6	26	6	879	30	194	201	56
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	55	0	0	9	26	6	879	30	194	257	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

Existing Conditions AM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	55.0	55.0	55.0	20.0	75.0	
Total Split (%)	25.0%	25.0%		25.0%	25.0%	25.0%	55.0%	55.0%	55.0%	20.0%	75.0%	
Maximum Green (s)	19.2	19.2		19.2	19.2	19.2	48.8	48.8	48.8	14.0	68.8	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		9.0			9.0	9.0	50.2	50.2	50.2	67.0	69.7	
Actuated g/C Ratio		0.11			0.11	0.11	0.61	0.61	0.61	0.82	0.85	
v/c Ratio		0.37			0.05	0.10	0.01	0.83	0.03	0.51	0.20	
Control Delay		42.0			36.4	0.8	10.2	25.2	0.1	9.5	2.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		42.0			36.4	0.8	10.2	25.2	0.1	9.5	2.8	
LOS		D			D	A	B	C	A	A	A	
Approach Delay		42.0			10.0			24.3			5.7	
Approach LOS		D			A			C			A	
Queue Length 50th (m)		8.6			1.4	0.0	0.4	125.1	0.0	7.1	8.6	
Queue Length 95th (m)		20.9			6.1	0.0	2.5	#243.6	0.0	23.4	18.6	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		322			367	436	532	1057	942	446	1298	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.17			0.02	0.06	0.01	0.83	0.03	0.43	0.20	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	82
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.83
Intersection Signal Delay:	18.9
Intersection LOS:	B
Intersection Capacity Utilization:	78.7%
ICU Level of Service:	D
Analysis Period (min):	15



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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way



Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

Existing Conditions AM  
04-08-2021













Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	5	3	820	5	1	187
Future Volume (vph)	5	3	820	5	1	187
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.955		0.999			
Flt Protected	0.968				0.950	
Satd. Flow (prot)	832	0	1732	0	846	1561
Flt Permitted	0.968				0.950	
Satd. Flow (perm)	832	0	1732	0	846	1561
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	100%	100%	2%	100%	100%	14%
Adj. Flow (vph)	6	3	911	6	1	208
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	0	917	0	1	208
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	55.9%
ICU Level of Service	B
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

Existing Conditions AM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	3	820	5	1	187
Future Volume (Veh/h)	5	3	820	5	1	187
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	3	911	6	1	208
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	175					
pX, platoon unblocked						
vC, conflicting volume	1124	914			917	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1124	914			917	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	96	99			100	
cM capacity (veh/h)	149	224			458	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>	<b>SB 2</b>		
Volume Total	9	917	1	208		
Volume Left	6	0	1	0		
Volume Right	3	6	0	0		
cSH	168	1700	458	1700		
Volume to Capacity	0.05	0.54	0.00	0.12		
Queue Length 95th (m)	1.3	0.0	0.1	0.0		
Control Delay (s)	27.7	0.0	12.9	0.0		
Lane LOS	D		B			
Approach Delay (s)	27.7	0.0	0.1			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay	0.2					
Intersection Capacity Utilization	55.9%		ICU Level of Service		B	
Analysis Period (min)	15					

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

Existing Conditions AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	68	27	121	776	110	94
Future Volume (vph)	68	27	121	776	110	94
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1476	1286	0	1734	1561	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1476	1286	0	1734	1561	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	12%	15%	8%	1%	14%	17%
Adj. Flow (vph)	76	30	134	862	122	104
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	30	0	996	122	104
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	67.5%
ICU Level of Service	C
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

Existing Conditions AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	68	27	121	776	110	94
Future Volume (Veh/h)	68	27	121	776	110	94
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	76	30	134	862	122	104
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1252	122	226			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1252	122	226			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	53	97	90			
cM capacity (veh/h)	163	895	1308			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>SB 1</b>	<b>SB 2</b>	
Volume Total	76	30	996	122	104	
Volume Left	76	0	134	0	0	
Volume Right	0	30	0	0	104	
cSH	163	895	1308	1700	1700	
Volume to Capacity	0.47	0.03	0.10	0.07	0.06	
Queue Length 95th (m)	17.5	0.8	2.7	0.0	0.0	
Control Delay (s)	45.1	9.2	2.5	0.0	0.0	
Lane LOS	E	A	A			
Approach Delay (s)	34.9		2.5	0.0		
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			4.7			
Intersection Capacity Utilization			67.5%	ICU Level of Service		C
Analysis Period (min)			15			

Lanes, Volumes, Timings  
1: Boundary Road & Hwy 417 WB Ramp Terminal

Existing Conditions PM  
04-07-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	42	1	130	224	22	108
Future Volume (vph)	42	1	130	224	22	108
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.914			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1586	0	1563	0	0	1630
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1586	0	1563	0	0	1630
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	19%	0%	6%	3%	5%	9%
Adj. Flow (vph)	47	1	144	249	24	120
Shared Lane Traffic (%)						
Lane Group Flow (vph)	48	0	393	0	0	144
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other  
 Control Type: Unsignalized  
 Intersection Capacity Utilization 35.9% ICU Level of Service A  
 Analysis Period (min) 15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

Existing Conditions PM  
 04-07-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	42	1	130	224	22	108
Future Volume (Veh/h)	42	1	130	224	22	108
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	47	1	144	249	24	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None	None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	436	268			393	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	436	268			393	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	91	100			98	
cM capacity (veh/h)	535	775			1149	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	48	393	144			
Volume Left	47	0	24			
Volume Right	1	249	0			
cSH	539	1700	1149			
Volume to Capacity	0.09	0.23	0.02			
Queue Length 95th (m)	2.3	0.0	0.5			
Control Delay (s)	12.3	0.0	1.5			
Lane LOS	B		A			
Approach Delay (s)	12.3	0.0	1.5			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization		35.9%		ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

Existing Conditions PM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	70	631	133	196	188	15
Future Volume (vph)	70	631	133	196	188	15
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.990	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1551	1436	1537	1664	1592	0
Fl <sub>t</sub> Permitted	0.950		0.527			
Satd. Flow (perm)	1551	1436	853	1664	1592	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		674			7	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	9%	3%	10%	7%	11%	7%
Adj. Flow (vph)	78	701	148	218	209	17
Shared Lane Traffic (%)						
Lane Group Flow (vph)	78	701	148	218	226	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	



Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

Existing Conditions PM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	25.0	25.0	12.0	55.0	43.0	
Total Split (%)	31.3%	31.3%	15.0%	68.8%	53.8%	
Maximum Green (s)	18.2	18.2	6.0	48.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	12.1	12.1	47.8	47.2	35.2	
Actuated g/C Ratio	0.17	0.17	0.66	0.65	0.48	
v/c Ratio	0.30	0.88	0.24	0.20	0.29	
Control Delay	29.0	17.0	6.8	6.6	13.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	29.0	17.0	6.8	6.6	13.3	
LOS	C	B	A	A	B	
Approach Delay	18.2			6.7	13.3	
Approach LOS	B			A	B	
Queue Length 50th (m)	9.9	3.3	6.5	10.3	17.2	
Queue Length 95th (m)	21.3	#66.1	17.0	24.7	37.2	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	389	865	616	1111	803	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.20	0.81	0.24	0.20	0.28	

Intersection Summary

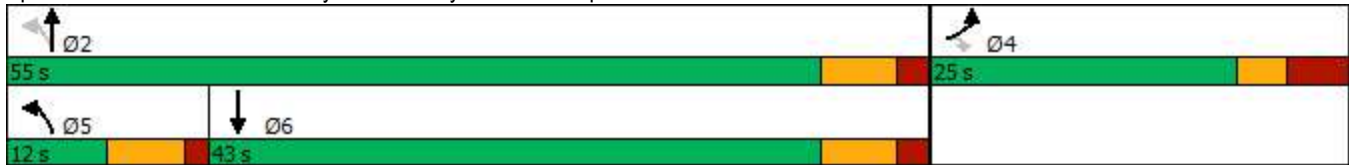
Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	72.8
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	14.3
Intersection LOS:	B
Intersection Capacity Utilization:	81.6%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

Exisitng Conditions PM  
 04-07-2021






















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

Existing Conditions PM  
04-07-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	0	14	5	0	16	4	251	0	2	762	55
Future Volume (vph)	62	0	14	5	0	16	4	251	0	2	762	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.975				0.850						0.990
Flt Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1590	0	0	1208	1513	1322	1633	1740	1102	1699	0
Flt Permitted		0.762			0.856		0.287			0.509		
Satd. Flow (perm)	0	1261	0	0	1088	1513	400	1633	1740	590	1699	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						8
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	6%	0%	0%	40%	0%	0%	25%	9%	0%	50%	4%	0%
Adj. Flow (vph)	69	0	16	6	0	18	4	279	0	2	847	61
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	85	0	0	6	18	4	279	0	2	908	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

Existing Conditions PM  
04-07-2021

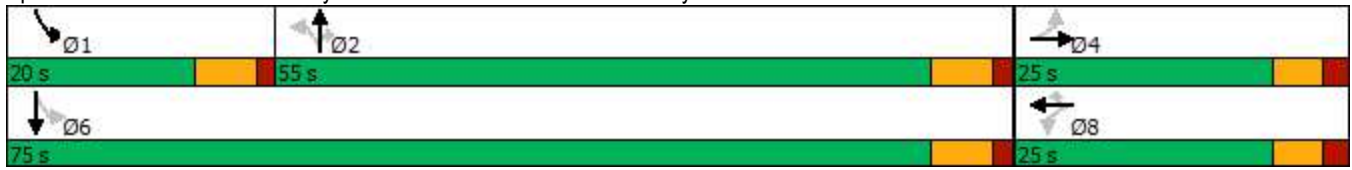


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	55.0	55.0	55.0	20.0	75.0	
Total Split (%)	25.0%	25.0%		25.0%	25.0%	25.0%	55.0%	55.0%	55.0%	20.0%	75.0%	
Maximum Green (s)	19.2	19.2		19.2	19.2	19.2	48.8	48.8	48.8	14.0	68.8	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		7.7			7.7	7.7	40.3	40.3		40.7	42.2	
Actuated g/C Ratio		0.13			0.13	0.13	0.70	0.70		0.71	0.74	
v/c Ratio		0.33			0.04	0.06	0.01	0.24		0.00	0.72	
Control Delay		9.6			27.0	0.4	6.2	6.3		3.0	10.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.3	
Total Delay		9.6			27.0	0.4	6.2	6.3		3.0	10.9	
LOS		A			C	A	A	A		A	B	
Approach Delay		9.6			7.1			6.3			10.8	
Approach LOS		A			A			A			B	
Queue Length 50th (m)		0.0			0.5	0.0	0.1	9.8		0.1	55.9	
Queue Length 95th (m)		10.2			4.3	0.0	1.6	36.0		0.6	114.0	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		507			382	596	342	1397		550	1658	
Starvation Cap Reductn		0			0	0	0	0		0	249	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.17			0.02	0.03	0.01	0.20		0.00	0.64	

Intersection Summary











Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	57.2
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.72
Intersection Signal Delay:	9.7
Intersection LOS:	A
Intersection Capacity Utilization:	67.0%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way













Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

Existing Conditions PM  
04-07-2021

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	5	11	244	5	12	769
Future Volume (vph)	5	11	244	5	12	769
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.910		0.997			
Flt Protected	0.984				0.950	
Satd. Flow (prot)	806	0	1643	0	846	1745
Flt Permitted	0.984				0.950	
Satd. Flow (perm)	806	0	1643	0	846	1745
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	100%	100%	6%	100%	100%	2%
Adj. Flow (vph)	6	12	271	6	13	854
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	0	277	0	13	854
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	52.7%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

Existing Conditions PM  
04-07-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	11	244	5	12	769
Future Volume (Veh/h)	5	11	244	5	12	769
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	12	271	6	13	854
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						175
pX, platoon unblocked	0.66					
vC, conflicting volume	1154	274			277	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	975	274			277	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	95	98			99	
cM capacity (veh/h)	123	579			882	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	18	277	13	854		
Volume Left	6	0	13	0		
Volume Right	12	6	0	0		
cSH	258	1700	882	1700		
Volume to Capacity	0.07	0.16	0.01	0.50		
Queue Length 95th (m)	1.8	0.0	0.4	0.0		
Control Delay (s)	20.0	0.0	9.1	0.0		
Lane LOS	C		A			
Approach Delay (s)	20.0	0.0	0.1			
Approach LOS	C					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			52.7%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

Existing Conditions PM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	113	98	52	116	703	113
Future Volume (vph)	113	98	52	116	703	113
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.985		
Satd. Flow (prot)	1463	1395	0	1666	1762	1351
Flt Permitted	0.950			0.985		
Satd. Flow (perm)	1463	1395	0	1666	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	13%	6%	8%	4%	1%	12%
Adj. Flow (vph)	126	109	58	129	781	126
Shared Lane Traffic (%)						
Lane Group Flow (vph)	126	109	0	187	781	126
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	65.1%
ICU Level of Service	C
Analysis Period (min)	15



HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

Existing Conditions PM  
04-07-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	113	98	52	116	703	113
Future Volume (Veh/h)	113	98	52	116	703	113
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	126	109	58	129	781	126
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1026	781	907			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1026	781	907			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	45	72	92			
cM capacity (veh/h)	228	389	726			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>SB 1</b>	<b>SB 2</b>	
Volume Total	126	109	187	781	126	
Volume Left	126	0	58	0	0	
Volume Right	0	109	0	0	126	
cSH	228	389	726	1700	1700	
Volume to Capacity	0.55	0.28	0.08	0.46	0.07	
Queue Length 95th (m)	24.0	9.1	2.1	0.0	0.0	
Control Delay (s)	38.6	17.8	3.8	0.0	0.0	
Lane LOS	E	C	A			
Approach Delay (s)	29.0		3.8	0.0		
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			5.7			
Intersection Capacity Utilization			65.1%	ICU Level of Service	C	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Background AM  
 04-07-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	121	31	95	856	77	101
Future Volume (vph)	121	31	95	856	77	101
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.972		0.878			
Flt Protected	0.962					0.979
Satd. Flow (prot)	1746	0	1528	0	0	1582
Flt Permitted	0.962					0.979
Satd. Flow (perm)	1746	0	1528	0	0	1582
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	4%	14%	14%	1%	9%	11%
Adj. Flow (vph)	121	31	95	856	77	101
Shared Lane Traffic (%)						
Lane Group Flow (vph)	152	0	951	0	0	178
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	90.3%
Analysis Period (min)	15
	ICU Level of Service E

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Background AM  
 04-07-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	121	31	95	856	77	101
Future Volume (Veh/h)	121	31	95	856	77	101
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	121	31	95	856	77	101
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	778	523			951	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	778	523			951	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	62	94			89	
cM capacity (veh/h)	322	531			695	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	152	951	178			
Volume Left	121	0	77			
Volume Right	31	856	0			
cSH	350	1700	695			
Volume to Capacity	0.43	0.56	0.11			
Queue Length 95th (m)	17.0	0.0	3.0			
Control Delay (s)	22.9	0.0	5.4			
Lane LOS	C		A			
Approach Delay (s)	22.9	0.0	5.4			
Approach LOS	C					
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utilization			90.3%		ICU Level of Service	E
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Background AM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	18	293	34	938	194	9
Future Volume (vph)	18	293	34	938	194	9
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.994	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1291	1395	1291	1745	1593	0
Fl <sub>t</sub> Permitted	0.950		0.547			
Satd. Flow (perm)	1291	1395	743	1745	1593	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		293			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	31%	6%	31%	2%	11%	13%
Adj. Flow (vph)	18	293	34	938	194	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	293	34	938	203	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Background AM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	8.5	8.5	44.2	43.6	39.3	
Actuated g/C Ratio	0.13	0.13	0.67	0.66	0.59	
v/c Ratio	0.11	0.67	0.06	0.82	0.21	
Control Delay	32.1	13.2	3.9	15.1	8.2	
Queue Delay	0.0	0.0	0.0	0.6	0.0	
Total Delay	32.1	13.2	3.9	15.7	8.2	
LOS	C	B	A	B	A	
Approach Delay	14.3			15.3	8.2	
Approach LOS	B			B	A	
Queue Length 50th (m)	1.7	0.0	1.1	65.1	7.3	
Queue Length 95th (m)	9.5	24.7	4.0	145.1	28.7	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	269	522	557	1669	1435	
Starvation Cap Reductn	0	0	0	360	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.07	0.56	0.06	0.72	0.14	

Intersection Summary





















Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	66.1
Natural Cycle:	75
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	14.1
Intersection LOS:	B
Intersection Capacity Utilization:	69.1%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Background AM  
04-07-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	17	4	3	6	25	6	912	30	193	239	55
Future Volume (vph)	34	17	4	3	6	25	6	912	30	193	239	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990				0.850			0.850		0.972	
Flt Protected		0.970			0.984		0.950			0.950		
Satd. Flow (prot)	0	1620	0	0	1752	1513	1378	1728	1479	1653	1522	0
Flt Permitted		0.806			0.872		0.580			0.128		
Satd. Flow (perm)	0	1346	0	0	1552	1513	841	1728	1479	223	1522	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				100			96			27
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	25%	0%	0%	0%	20%	3%	0%	0%	15%	8%
Adj. Flow (vph)	34	17	4	3	6	25	6	912	30	193	239	55
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	55	0	0	9	25	6	912	30	193	294	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Background AM  
04-07-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		9.2			9.2	9.2	50.5	50.5	50.5	65.7	67.3	
Actuated g/C Ratio		0.11			0.11	0.11	0.61	0.61	0.61	0.79	0.81	
v/c Ratio		0.36			0.05	0.10	0.01	0.87	0.03	0.59	0.24	
Control Delay		43.0			36.7	0.8	8.0	26.3	0.1	14.9	3.4	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		43.0			36.7	0.8	8.0	26.3	0.1	14.9	3.4	
LOS		D			D	A	A	C	A	B	A	
Approach Delay		43.0			10.3			25.4			8.0	
Approach LOS		D			B			C			A	
Queue Length 50th (m)		9.0			1.5	0.0	0.4	126.4	0.0	7.1	10.6	
Queue Length 95th (m)		21.0			6.2	0.0	2.1	#237.8	0.0	#29.3	22.1	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		321			368	435	569	1171	1033	330	1240	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.17			0.02	0.06	0.01	0.78	0.03	0.58	0.24	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	83.3
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.87
Intersection Signal Delay:	20.1
Intersection LOS:	C
Intersection Capacity Utilization:	86.8%
ICU Level of Service:	E
Analysis Period (min):	15



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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way

 Ø1	 Ø2	 Ø4
14.7 s	60.5 s	24.8 s
 Ø6		 Ø8
75.2 s		24.8 s

Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access













Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	6	3	944	6	1	245
Future Volume (vph)	6	3	944	6	1	245
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.955		0.999			
Flt Protected	0.968				0.950	
Satd. Flow (prot)	832	0	1750	0	846	1589
Flt Permitted	0.968				0.950	
Satd. Flow (perm)	832	0	1750	0	846	1589
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	1%	100%	100%	12%
Adj. Flow (vph)	6	3	944	6	1	245
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	0	950	0	1	245
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	62.8%
ICU Level of Service	B
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2025 Future Background AM  
04-07-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	3	944	6	1	245
Future Volume (Veh/h)	6	3	944	6	1	245
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	6	3	944	6	1	245
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						175
pX, platoon unblocked	1.00					
vC, conflicting volume	1194	947			950	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1194	947			950	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	95	99			100	
cM capacity (veh/h)	133	213			443	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	9	950	1	245		
Volume Left	6	0	1	0		
Volume Right	3	6	0	0		
cSH	152	1700	443	1700		
Volume to Capacity	0.06	0.56	0.00	0.14		
Queue Length 95th (m)	1.5	0.0	0.1	0.0		
Control Delay (s)	30.1	0.0	13.2	0.0		
Lane LOS	D		B			
Approach Delay (s)	30.1	0.0	0.1			
Approach LOS	D					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			62.8%	ICU Level of Service	B	
Analysis Period (min)	15					

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2025 Future Background AM  
04-07-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	78	30	134	858	122	107
Future Volume (vph)	78	30	134	858	122	107
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1476	1286	0	1734	1561	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1476	1286	0	1734	1561	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	15%	8%	1%	14%	17%
Adj. Flow (vph)	78	30	134	858	122	107
Shared Lane Traffic (%)						
Lane Group Flow (vph)	78	30	0	992	122	107
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	76.8%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2025 Future Background AM  
04-07-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	78	30	134	858	122	107
Future Volume (Veh/h)	78	30	134	858	122	107
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	30	134	858	122	107
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1248	122	229			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1248	122	229			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	52	97	90			
cM capacity (veh/h)	164	895	1304			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	78	30	992	122	107	
Volume Left	78	0	134	0	0	
Volume Right	0	30	0	0	107	
cSH	164	895	1304	1700	1700	
Volume to Capacity	0.48	0.03	0.10	0.07	0.06	
Queue Length 95th (m)	18.0	0.8	2.7	0.0	0.0	
Control Delay (s)	45.6	9.2	2.5	0.0	0.0	
Lane LOS	E	A	A			
Approach Delay (s)	35.4		2.5	0.0		
Approach LOS	E					
<b>Intersection Summary</b>						
Average Delay			4.8			
Intersection Capacity Utilization			76.8%	ICU Level of Service		D
Analysis Period (min)			15			

Lanes, Volumes, Timings  
1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Background PM  
04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	48	1	145	283	24	120
Future Volume (vph)	48	1	145	283	24	120
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1586	0	1559	0	0	1630
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1586	0	1559	0	0	1630
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	6%	3%	5%	9%
Adj. Flow (vph)	48	1	145	283	24	120
Shared Lane Traffic (%)						
Lane Group Flow (vph)	49	0	428	0	0	144
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	38.3%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Background PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	48	1	145	283	24	120
Future Volume (Veh/h)	48	1	145	283	24	120
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	48	1	145	283	24	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	454	286			428	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	454	286			428	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	91	100			98	
cM capacity (veh/h)	522	757			1116	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	49	428	144			
Volume Left	48	0	24			
Volume Right	1	283	0			
cSH	525	1700	1116			
Volume to Capacity	0.09	0.25	0.02			
Queue Length 95th (m)	2.5	0.0	0.5			
Control Delay (s)	12.6	0.0	1.5			
Lane LOS	B		A			
Approach Delay (s)	12.6	0.0	1.5			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.3			
Intersection Capacity Utilization			38.3%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	77	733	149	253	211	17
Future Volume (vph)	77	733	149	253	211	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.990	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1551	1436	1537	1664	1592	0
Flt Permitted	0.950		0.528			
Satd. Flow (perm)	1551	1436	854	1664	1592	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		610			5	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	3%	10%	7%	11%	7%
Adj. Flow (vph)	77	733	149	253	211	17
Shared Lane Traffic (%)						
Lane Group Flow (vph)	77	733	149	253	228	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	



Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	19.0	19.0	49.6	49.0	35.7	
Actuated g/C Ratio	0.23	0.23	0.61	0.60	0.44	
v/c Ratio	0.21	0.91	0.26	0.25	0.33	
Control Delay	24.3	22.5	11.2	11.2	19.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	24.3	22.5	11.2	11.2	19.3	
LOS	C	C	B	B	B	
Approach Delay	22.7			11.2	19.3	
Approach LOS	C			B	B	
Queue Length 50th (m)	10.0	16.6	9.3	17.2	22.4	
Queue Length 95th (m)	20.2	75.0	28.2	47.2	54.5	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	721	994	578	1027	726	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.11	0.74	0.26	0.25	0.31	

Intersection Summary






















Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	81.6
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.91
Intersection Signal Delay:	18.9
Intersection LOS:	B
Intersection Capacity Utilization:	88.2%
ICU Level of Service:	E
Analysis Period (min):	15

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Background PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	0	15	6	0	18	4	316	0	2	880	61
Future Volume (vph)	68	0	15	6	0	18	4	316	0	2	880	61
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.976				0.850						0.990
Fl <sub>t</sub> Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1591	0	0	1208	1513	1322	1633	1740	1102	1699	0
Fl <sub>t</sub> Permitted		0.761			0.854		0.270			0.496		
Satd. Flow (perm)	0	1260	0	0	1086	1513	376	1633	1740	575	1699	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						8
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	0%	40%	0%	0%	25%	9%	0%	50%	4%	0%
Adj. Flow (vph)	68	0	15	6	0	18	4	316	0	2	880	61
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	83	0	0	6	18	4	316	0	2	941	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Background PM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	62.2	62.2	62.2	13.0	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	62.2%	62.2%	62.2%	13.0%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	56.0	56.0	56.0	7.0	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		7.7			7.7	7.7	42.8	42.8		43.0	44.6	
Actuated g/C Ratio		0.13			0.13	0.13	0.72	0.72		0.72	0.75	
v/c Ratio		0.33			0.04	0.06	0.01	0.27		0.00	0.74	
Control Delay		9.7			29.0	0.4	5.8	6.1		3.0	10.7	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.4	
Total Delay		9.7			29.0	0.4	5.8	6.1		3.0	11.1	
LOS		A			C	A	A	A		A	B	
Approach Delay		9.7			7.6			6.1			11.1	
Approach LOS		A			A			A			B	
Queue Length 50th (m)		0.0			0.5	0.0	0.1	11.3		0.1	60.4	
Queue Length 95th (m)		10.0			4.6	0.0	1.6	40.3		0.5	120.2	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		489			365	575	340	1476		481	1644	
Starvation Cap Reductn		0			0	0	0	0		0	278	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.17			0.02	0.03	0.01	0.21		0.00	0.69	











Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	59.5
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.74
Intersection Signal Delay:	9.8
Intersection LOS:	A
Intersection Capacity Utilization:	74.4%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way











 Ø1 13 s	 Ø2 62.2 s	 Ø4 24.8 s
 Ø6 75.2 s	 Ø8 24.8 s	

Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	6	12	308	6	13	888
Future Volume (vph)	6	12	308	6	13	888
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.910		0.997			
Flt Protected	0.984				0.950	
Satd. Flow (prot)	806	0	1661	0	846	1745
Flt Permitted	0.984				0.950	
Satd. Flow (perm)	806	0	1661	0	846	1745
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	5%	100%	100%	2%
Adj. Flow (vph)	6	12	308	6	13	888
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	0	314	0	13	888
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	59.3%			ICU Level of Service B		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2025 Future Background PM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	12	308	6	13	888
Future Volume (Veh/h)	6	12	308	6	13	888
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	6	12	308	6	13	888
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						175
pX, platoon unblocked	0.64					
vC, conflicting volume	1225	311			314	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1069	311			314	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	94	98			98	
cM capacity (veh/h)	102	549			849	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	18	314	13	888		
Volume Left	6	0	13	0		
Volume Right	12	6	0	0		
cSH	224	1700	849	1700		
Volume to Capacity	0.08	0.18	0.02	0.52		
Queue Length 95th (m)	2.1	0.0	0.4	0.0		
Control Delay (s)	22.5	0.0	9.3	0.0		
Lane LOS	C		A			
Approach Delay (s)	22.5	0.0	0.1			
Approach LOS	C					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			59.3%	ICU Level of Service	B	
Analysis Period (min)	15					

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	128	108	57	129	777	128
Future Volume (vph)	128	108	57	129	777	128
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.985		
Satd. Flow (prot)	1463	1395	0	1666	1762	1351
Flt Permitted	0.950			0.985		
Satd. Flow (perm)	1463	1395	0	1666	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	8%	4%	1%	12%
Adj. Flow (vph)	128	108	57	129	777	128
Shared Lane Traffic (%)						
Lane Group Flow (vph)	128	108	0	186	777	128
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	71.1%
ICU Level of Service	C
Analysis Period (min)	15



HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2025 Future Background PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	128	108	57	129	777	128
Future Volume (Veh/h)	128	108	57	129	777	128
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	128	108	57	129	777	128
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1020	777	905			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1020	777	905			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	44	72	92			
cM capacity (veh/h)	231	391	727			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	128	108	186	777	128	
Volume Left	128	0	57	0	0	
Volume Right	0	108	0	0	128	
cSH	231	391	727	1700	1700	
Volume to Capacity	0.56	0.28	0.08	0.46	0.08	
Queue Length 95th (m)	24.2	8.9	2.0	0.0	0.0	
Control Delay (s)	38.5	17.7	3.8	0.0	0.0	
Lane LOS	E	C	A			
Approach Delay (s)	29.0		3.8	0.0		
Approach LOS	D					
Intersection Summary						
Average Delay			5.7			
Intersection Capacity Utilization			71.1%	ICU Level of Service	C	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Background AM  
04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	134	34	105	942	85	112
Future Volume (vph)	134	34	105	942	85	112
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.973		0.879			
Flt Protected	0.962					0.979
Satd. Flow (prot)	1748	0	1529	0	0	1582
Flt Permitted	0.962					0.979
Satd. Flow (perm)	1748	0	1529	0	0	1582
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	4%	14%	14%	1%	9%	11%
Adj. Flow (vph)	134	34	105	942	85	112
Shared Lane Traffic (%)						
Lane Group Flow (vph)	168	0	1047	0	0	197
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	98.5%
ICU Level of Service	F
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Background AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	134	34	105	942	85	112
Future Volume (Veh/h)	134	34	105	942	85	112
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	134	34	105	942	85	112
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	858	576			1047	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	858	576			1047	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	52	93			87	
cM capacity (veh/h)	281	495			638	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	168	1047	197			
Volume Left	134	0	85			
Volume Right	34	942	0			
cSH	308	1700	638			
Volume to Capacity	0.54	0.62	0.13			
Queue Length 95th (m)	24.5	0.0	3.7			
Control Delay (s)	29.8	0.0	5.9			
Lane LOS	D		A			
Approach Delay (s)	29.8	0.0	5.9			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			4.4			
Intersection Capacity Utilization		98.5%		ICU Level of Service		F
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Background AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	320	37	1032	214	10
Future Volume (vph)	20	320	37	1032	214	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.994	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1291	1395	1291	1745	1593	0
Fl <sub>t</sub> Permitted	0.950		0.543			
Satd. Flow (perm)	1291	1395	738	1745	1593	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		320			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	31%	6%	31%	2%	11%	13%
Adj. Flow (vph)	20	320	37	1032	214	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	20	320	37	1032	224	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Background AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	8.7	8.7	48.0	47.3	43.2	
Actuated g/C Ratio	0.12	0.12	0.68	0.67	0.62	
v/c Ratio	0.12	0.71	0.07	0.88	0.23	
Control Delay	35.4	14.1	3.7	18.9	7.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	35.4	14.1	3.7	18.9	7.8	
LOS	D	B	A	B	A	
Approach Delay	15.4			18.4	7.8	
Approach LOS	B			B	A	
Queue Length 50th (m)	2.2	0.0	1.2	81.1	8.2	
Queue Length 95th (m)	10.9	27.3	4.2	183.1	31.3	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	256	533	562	1626	1388	
Starvation Cap Reductn	0	0	0	27	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.08	0.60	0.07	0.65	0.16	

Intersection Summary






















Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	70.2
Natural Cycle:	75
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	16.3
Intersection LOS:	B
Intersection Capacity Utilization:	74.3%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Background AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	18	5	4	6	28	6	1003	33	213	260	61
Future Volume (vph)	38	18	5	4	6	28	6	1003	33	213	260	61
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.989				0.850			0.850		0.971	
Fl <sub>t</sub> Protected		0.970			0.980		0.950			0.950		
Satd. Flow (prot)	0	1614	0	0	1744	1513	1378	1728	1479	1653	1521	0
Fl <sub>t</sub> Permitted		0.805			0.854		0.566			0.086		
Satd. Flow (perm)	0	1340	0	0	1520	1513	821	1728	1479	150	1521	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				100			96			27
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	25%	0%	0%	0%	20%	3%	0%	0%	15%	8%
Adj. Flow (vph)	38	18	5	4	6	28	6	1003	33	213	260	61
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	10	28	6	1003	33	213	321	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Background AM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		9.4			9.4	9.4	54.7	54.7	54.7	69.7	70.9	
Actuated g/C Ratio		0.11			0.11	0.11	0.62	0.62	0.62	0.79	0.81	
v/c Ratio		0.41			0.06	0.11	0.01	0.93	0.03	0.79	0.26	
Control Delay		44.6			36.7	0.9	8.3	34.2	0.1	39.2	3.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		44.6			36.7	0.9	8.3	34.2	0.1	39.2	3.6	
LOS		D			D	A	A	C	A	D	A	
Approach Delay		44.6			10.3			33.0			17.8	
Approach LOS		D			B			C			B	
Queue Length 50th (m)		9.9			1.7	0.0	0.4	158.6	0.0	17.8	12.3	
Queue Length 95th (m)		22.4			6.5	0.0	2.2	#279.3	0.0	#61.1	25.5	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		294			330	407	509	1073	955	268	1231	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.21			0.03	0.07	0.01	0.93	0.03	0.79	0.26	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	88
Natural Cycle:	110
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.93
Intersection Signal Delay:	28.0
Intersection LOS:	C
Intersection Capacity Utilization:	93.4%
ICU Level of Service:	F
Analysis Period (min):	15













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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way













Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

2030 Future Background AM  
04-08-2021

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	6	4	1039	6	1	267
Future Volume (vph)	6	4	1039	6	1	267
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.946		0.999			
Flt Protected	0.971				0.950	
Satd. Flow (prot)	827	0	1751	0	846	1589
Flt Permitted	0.971				0.950	
Satd. Flow (perm)	827	0	1751	0	846	1589
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	1%	100%	100%	12%
Adj. Flow (vph)	6	4	1039	6	1	267
Shared Lane Traffic (%)						
Lane Group Flow (vph)	10	0	1045	0	1	267
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	68.1%			ICU Level of Service C		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2030 Future Background AM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	4	1039	6	1	267
Future Volume (Veh/h)	6	4	1039	6	1	267
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	6	4	1039	6	1	267
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						175
pX, platoon unblocked	0.99					
vC, conflicting volume	1311	1042			1045	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1309	1042			1045	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	95	98			100	
cM capacity (veh/h)	110	184			401	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	10	1045	1	267		
Volume Left	6	0	1	0		
Volume Right	4	6	0	0		
cSH	131	1700	401	1700		
Volume to Capacity	0.08	0.61	0.00	0.16		
Queue Length 95th (m)	2.0	0.0	0.1	0.0		
Control Delay (s)	34.7	0.0	14.0	0.0		
Lane LOS	D		B			
Approach Delay (s)	34.7	0.0	0.1			
Approach LOS	D					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			68.1%		ICU Level of Service	C
Analysis Period (min)			15			

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2030 Future Background AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	86	33	147	947	135	118
Future Volume (vph)	86	33	147	947	135	118
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1476	1286	0	1734	1561	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1476	1286	0	1734	1561	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	15%	8%	1%	14%	17%
Adj. Flow (vph)	86	33	147	947	135	118
Shared Lane Traffic (%)						
Lane Group Flow (vph)	86	33	0	1094	135	118
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	83.7%
ICU Level of Service	E
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2030 Future Background AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	86	33	147	947	135	118
Future Volume (Veh/h)	86	33	147	947	135	118
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	86	33	147	947	135	118
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1376	135	253			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1376	135	253			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	36	96	88			
cM capacity (veh/h)	135	880	1278			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	86	33	1094	135	118	
Volume Left	86	0	147	0	0	
Volume Right	0	33	0	0	118	
cSH	135	880	1278	1700	1700	
Volume to Capacity	0.64	0.04	0.12	0.08	0.07	
Queue Length 95th (m)	27.2	0.9	3.1	0.0	0.0	
Control Delay (s)	70.0	9.2	2.9	0.0	0.0	
Lane LOS	F	A	A			
Approach Delay (s)	53.1		2.9	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			6.5			
Intersection Capacity Utilization			83.7%	ICU Level of Service	E	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Background PM  
04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	53	1	159	309	27	133
Future Volume (vph)	53	1	159	309	27	133
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1586	0	1559	0	0	1630
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1586	0	1559	0	0	1630
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	6%	3%	5%	9%
Adj. Flow (vph)	53	1	159	309	27	133
Shared Lane Traffic (%)						
Lane Group Flow (vph)	54	0	468	0	0	160
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	41.8%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Background PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	53	1	159	309	27	133
Future Volume (Veh/h)	53	1	159	309	27	133
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	53	1	159	309	27	133
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	500	314			468	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	500	314			468	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	89	100			97	
cM capacity (veh/h)	488	732			1078	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	54	468	160			
Volume Left	53	0	27			
Volume Right	1	309	0			
cSH	491	1700	1078			
Volume to Capacity	0.11	0.28	0.03			
Queue Length 95th (m)	2.9	0.0	0.6			
Control Delay (s)	13.2	0.0	1.6			
Lane LOS	B		A			
Approach Delay (s)	13.2	0.0	1.6			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization		41.8%		ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	805	164	276	232	18
Future Volume (vph)	85	805	164	276	232	18
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.990	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1551	1436	1537	1664	1592	0
Fl <sub>t</sub> Permitted	0.950		0.485			
Satd. Flow (perm)	1551	1436	785	1664	1592	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		579			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	3%	10%	7%	11%	7%
Adj. Flow (vph)	85	805	164	276	232	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	85	805	164	276	250	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	



Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	28.0	28.0	49.3	48.7	35.5	
Actuated g/C Ratio	0.31	0.31	0.55	0.54	0.39	
v/c Ratio	0.18	0.95	0.34	0.31	0.40	
Control Delay	22.0	30.7	15.0	14.9	24.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	22.0	30.7	15.0	14.9	24.2	
LOS	C	C	B	B	C	
Approach Delay	29.8			14.9	24.2	
Approach LOS	C			B	C	
Queue Length 50th (m)	11.1	46.0	17.4	31.7	36.4	
Queue Length 95th (m)	21.8	#143.3	30.9	51.7	60.1	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	648	937	488	923	653	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.13	0.86	0.34	0.30	0.38	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 90.3  
 Natural Cycle: 90  
 Control Type: Semi Act-Uncoord  
 Maximum v/c Ratio: 0.95  
 Intersection Signal Delay: 24.8  
 Intersection Capacity Utilization 92.9%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service F





















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Background PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	0	17	6	0	20	5	345	0	2	968	67
Future Volume (vph)	76	0	17	6	0	20	5	345	0	2	968	67
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.975				0.850						0.990
Fl <sub>t</sub> Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1590	0	0	1208	1513	1322	1633	1740	1102	1699	0
Fl <sub>t</sub> Permitted		0.761			0.809		0.226			0.493		
Satd. Flow (perm)	0	1259	0	0	1029	1513	315	1633	1740	572	1699	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						8
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	0%	40%	0%	0%	25%	9%	0%	50%	4%	0%
Adj. Flow (vph)	76	0	17	6	0	20	5	345	0	2	968	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	93	0	0	6	20	5	345	0	2	1035	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Background PM  
04-08-2021








Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	62.2	62.2	62.2	13.0	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	62.2%	62.2%	62.2%	13.0%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	56.0	56.0	56.0	7.0	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		8.0			8.0	8.0	50.6	50.6		50.7	52.5	
Actuated g/C Ratio		0.12			0.12	0.12	0.75	0.75		0.75	0.78	
v/c Ratio		0.39			0.05	0.07	0.02	0.28		0.00	0.78	
Control Delay		12.8			34.2	0.6	5.6	5.7		2.5	11.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		12.8			34.2	0.6	5.6	5.7		2.5	11.8	
LOS		B			C	A	A	A		A	B	
Approach Delay		12.8			8.3			5.7			11.8	
Approach LOS		B			A			A			B	
Queue Length 50th (m)		0.0			0.7	0.0	0.1	12.6		0.1	75.9	
Queue Length 95th (m)		12.9			4.8	0.0	1.8	45.1		0.6	163.5	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		451			311	528	258	1341		490	1590	
Starvation Cap Reductn		0			0	0	0	0		0	17	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.21			0.02	0.04	0.02	0.26		0.00	0.66	











Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	67.2
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.78
Intersection Signal Delay:	10.4
Intersection LOS:	B
Intersection Capacity Utilization:	80.3%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way











 Ø1 13 s	 Ø2 62.2 s	 Ø4 24.8 s
 Ø6 75.2 s	 Ø8 24.8 s	

Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	6	13	336	6	15	976
Future Volume (vph)	6	13	336	6	15	976
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.908		0.998			
Flt Protected	0.984				0.950	
Satd. Flow (prot)	804	0	1665	0	846	1745
Flt Permitted	0.984				0.950	
Satd. Flow (perm)	804	0	1665	0	846	1745
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	5%	100%	100%	2%
Adj. Flow (vph)	6	13	336	6	15	976
Shared Lane Traffic (%)						
Lane Group Flow (vph)	19	0	342	0	15	976
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	64.2%			ICU Level of Service C		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2030 Future Background PM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	13	336	6	15	976
Future Volume (Veh/h)	6	13	336	6	15	976
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	6	13	336	6	15	976
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)	175					
pX, platoon unblocked	0.56					
vC, conflicting volume	1345	339	342			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1225	339	342			
tC, single (s)	7.4	7.2	5.1			
tC, 2 stage (s)						
tF (s)	4.4	4.2	3.1			
p0 queue free %	91	98	98			
cM capacity (veh/h)	70	527	826			
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>	<b>SB 2</b>		
Volume Total	19	342	15	976		
Volume Left	6	0	15	0		
Volume Right	13	6	0	0		
cSH	173	1700	826	1700		
Volume to Capacity	0.11	0.20	0.02	0.57		
Queue Length 95th (m)	2.9	0.0	0.4	0.0		
Control Delay (s)	28.4	0.0	9.4	0.0		
Lane LOS	D		A			
Approach Delay (s)	28.4	0.0	0.1			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay	0.5					
Intersection Capacity Utilization	64.2%		ICU Level of Service		C	
Analysis Period (min)	15					

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2030 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	141	119	63	142	858	141
Future Volume (vph)	141	119	63	142	858	141
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.985		
Satd. Flow (prot)	1463	1395	0	1666	1762	1351
Fl <sub>t</sub> Permitted	0.950			0.985		
Satd. Flow (perm)	1463	1395	0	1666	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	8%	4%	1%	12%
Adj. Flow (vph)	141	119	63	142	858	141
Shared Lane Traffic (%)						
Lane Group Flow (vph)	141	119	0	205	858	141
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	77.5%
ICU Level of Service	D
Analysis Period (min)	15



HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2030 Future Background PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	141	119	63	142	858	141
Future Volume (Veh/h)	141	119	63	142	858	141
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	141	119	63	142	858	141
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1126	858	999			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1126	858	999			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	28	66	91			
cM capacity (veh/h)	195	351	670			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>NB 1</b>	<b>SB 1</b>	<b>SB 2</b>	
Volume Total	141	119	205	858	141	
Volume Left	141	0	63	0	0	
Volume Right	0	119	0	0	141	
cSH	195	351	670	1700	1700	
Volume to Capacity	0.72	0.34	0.09	0.50	0.08	
Queue Length 95th (m)	37.0	11.7	2.5	0.0	0.0	
Control Delay (s)	60.4	20.5	4.1	0.0	0.0	
Lane LOS	F	C	A			
Approach Delay (s)	42.1		4.1	0.0		
Approach LOS	E					
<b>Intersection Summary</b>						
Average Delay			8.1			
Intersection Capacity Utilization			77.5%	ICU Level of Service	D	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Background AM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	147	38	115	1036	94	123
Future Volume (vph)	147	38	115	1036	94	123
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.972		0.878			
Flt Protected	0.962					0.979
Satd. Flow (prot)	1746	0	1528	0	0	1582
Flt Permitted	0.962					0.979
Satd. Flow (perm)	1746	0	1528	0	0	1582
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	4%	14%	14%	1%	9%	11%
Adj. Flow (vph)	147	38	115	1036	94	123
Shared Lane Traffic (%)						
Lane Group Flow (vph)	185	0	1151	0	0	217
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	107.3%
ICU Level of Service	G
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Background AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	147	38	115	1036	94	123
Future Volume (Veh/h)	147	38	115	1036	94	123
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	147	38	115	1036	94	123
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	944	633			1151	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	944	633			1151	
tC, single (s)	6.4	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.3	
p0 queue free %	39	92			84	
cM capacity (veh/h)	242	459			582	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	185	1151	217			
Volume Left	147	0	94			
Volume Right	38	1036	0			
cSH	268	1700	582			
Volume to Capacity	0.69	0.68	0.16			
Queue Length 95th (m)	37.0	0.0	4.6			
Control Delay (s)	43.8	0.0	6.6			
Lane LOS	E		A			
Approach Delay (s)	43.8	0.0	6.6			
Approach LOS	E					
<b>Intersection Summary</b>						
Average Delay			6.1			
Intersection Capacity Utilization			107.3%		ICU Level of Service G	
Analysis Period (min)	15					

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Background AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	22	350	41	1135	236	11
Future Volume (vph)	22	350	41	1135	236	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.994	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1291	1395	1291	1745	1593	0
Flt Permitted	0.950		0.539			
Satd. Flow (perm)	1291	1395	732	1745	1593	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		350			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	31%	6%	31%	2%	11%	13%
Adj. Flow (vph)	22	350	41	1135	236	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	350	41	1135	247	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Background AM  
04-08-2021



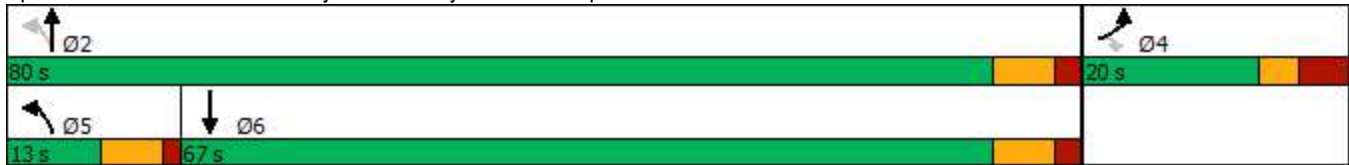
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	9.0	9.0	56.1	55.5	48.6	
Actuated g/C Ratio	0.11	0.11	0.71	0.71	0.62	
v/c Ratio	0.15	0.75	0.07	0.92	0.25	
Control Delay	39.7	15.5	3.5	23.3	8.5	
Queue Delay	0.0	0.0	0.0	0.1	0.0	
Total Delay	39.7	15.5	3.5	23.3	8.5	
LOS	D	B	A	C	A	
Approach Delay	17.0			22.6	8.5	
Approach LOS	B			C	A	
Queue Length 50th (m)	3.1	0.0	1.3	104.3	17.5	
Queue Length 95th (m)	11.5	29.2	4.5	#290.5	34.5	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	228	534	575	1557	1262	
Starvation Cap Reductn	0	0	0	20	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.10	0.66	0.07	0.74	0.20	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	78.6
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.92
Intersection Signal Delay:	19.5
Intersection LOS:	B
Intersection Capacity Utilization:	80.1%
ICU Level of Service:	D
Analysis Period (min):	15

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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Background AM  
04-08-2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	20	5	4	7	31	7	1104	36	236	283	67
Future Volume (vph)	42	20	5	4	7	31	7	1104	36	236	283	67
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.990				0.850			0.850		0.971	
Fl <sub>t</sub> Protected		0.970			0.982		0.950			0.950		
Satd. Flow (prot)	0	1618	0	0	1748	1513	1378	1728	1479	1653	1521	0
Fl <sub>t</sub> Permitted		0.803			0.868		0.551			0.066		
Satd. Flow (perm)	0	1340	0	0	1545	1513	799	1728	1479	115	1521	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				100			96			27
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	25%	0%	0%	0%	20%	3%	0%	0%	15%	8%
Adj. Flow (vph)	42	20	5	4	7	31	7	1104	36	236	283	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	67	0	0	11	31	7	1104	36	236	350	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Background AM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		9.8			9.8	9.8	54.7	54.7	54.7	69.7	71.0	
Actuated g/C Ratio		0.11			0.11	0.11	0.62	0.62	0.62	0.79	0.80	
v/c Ratio		0.44			0.06	0.12	0.01	1.03	0.04	0.97	0.29	
Control Delay		45.3			36.5	1.0	8.6	57.1	0.1	77.2	3.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		45.3			36.5	1.0	8.6	57.1	0.1	77.2	3.9	
LOS		D			D	A	A	E	A	E	A	
Approach Delay		45.3			10.3			55.0			33.4	
Approach LOS		D			B			D			C	
Queue Length 50th (m)		11.0			1.9	0.0	0.5	~225.3	0.0	~28.4	14.2	
Queue Length 95th (m)		24.2			7.0	0.0	2.5	#324.6	0.0	#83.1	29.4	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		293			334	405	494	1068	951	243	1226	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.23			0.03	0.08	0.01	1.03	0.04	0.97	0.29	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	88.4
Natural Cycle:	140
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	1.03
Intersection Signal Delay:	46.7
Intersection LOS:	D
Intersection Capacity Utilization:	100.7%
ICU Level of Service:	G
Analysis Period (min):	15



Lanes, Volumes, Timings  
 3: Boundary Road & Thunder Road/Amazon Way











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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way

 Ø1	 Ø2	 Ø4
14.7 s	60.5 s	24.8 s
 Ø6		 Ø8
75.2 s		24.8 s











Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

2035 Future Background AM  
04-08-2021

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	7	4	1143	7	1	291
Future Volume (vph)	7	4	1143	7	1	291
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.951		0.999			
Flt Protected	0.969				0.950	
Satd. Flow (prot)	829	0	1750	0	846	1589
Flt Permitted	0.969				0.950	
Satd. Flow (perm)	829	0	1750	0	846	1589
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	1%	100%	100%	12%
Adj. Flow (vph)	7	4	1143	7	1	291
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	0	1150	0	1	291
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	73.9%			ICU Level of Service D		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2035 Future Background AM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	4	1143	7	1	291
Future Volume (Veh/h)	7	4	1143	7	1	291
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	4	1143	7	1	291
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						175
pX, platoon unblocked	0.98					
vC, conflicting volume	1440	1146			1150	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1438	1146			1150	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	92	97			100	
cM capacity (veh/h)	88	157			359	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	11	1150	1	291		
Volume Left	7	0	1	0		
Volume Right	4	7	0	0		
cSH	105	1700	359	1700		
Volume to Capacity	0.10	0.68	0.00	0.17		
Queue Length 95th (m)	2.7	0.0	0.1	0.0		
Control Delay (s)	43.2	0.0	15.1	0.0		
Lane LOS	E		C			
Approach Delay (s)	43.2	0.0	0.1			
Approach LOS	E					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			73.9%		ICU Level of Service	D
Analysis Period (min)			15			

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2035 Future Background AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	95	36	163	1045	149	130
Future Volume (vph)	95	36	163	1045	149	130
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1476	1286	0	1734	1561	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1476	1286	0	1734	1561	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	15%	8%	1%	14%	17%
Adj. Flow (vph)	95	36	163	1045	149	130
Shared Lane Traffic (%)						
Lane Group Flow (vph)	95	36	0	1208	149	130
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	91.4%
ICU Level of Service	F
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2035 Future Background AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	95	36	163	1045	149	130
Future Volume (Veh/h)	95	36	163	1045	149	130
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	95	36	163	1045	149	130
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1520	149	279			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1520	149	279			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	12	96	87			
cM capacity (veh/h)	108	864	1250			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	95	36	1208	149	130	
Volume Left	95	0	163	0	0	
Volume Right	0	36	0	0	130	
cSH	108	864	1250	1700	1700	
Volume to Capacity	0.88	0.04	0.13	0.09	0.08	
Queue Length 95th (m)	41.8	1.0	3.6	0.0	0.0	
Control Delay (s)	130.0	9.3	3.6	0.0	0.0	
Lane LOS	F	A	A			
Approach Delay (s)	96.8		3.6	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			10.5			
Intersection Capacity Utilization			91.4%	ICU Level of Service	F	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Background PM  
04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	59	1	176	337	30	146
Future Volume (vph)	59	1	176	337	30	146
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1587	0	1559	0	0	1630
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1587	0	1559	0	0	1630
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	6%	3%	5%	9%
Adj. Flow (vph)	59	1	176	337	30	146
Shared Lane Traffic (%)						
Lane Group Flow (vph)	60	0	513	0	0	176
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	45.4%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Background PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	59	1	176	337	30	146
Future Volume (Veh/h)	59	1	176	337	30	146
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	59	1	176	337	30	146
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	550	344			513	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	550	344			513	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	87	100			97	
cM capacity (veh/h)	454	703			1037	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	60	513	176			
Volume Left	59	0	30			
Volume Right	1	337	0			
cSH	457	1700	1037			
Volume to Capacity	0.13	0.30	0.03			
Queue Length 95th (m)	3.6	0.0	0.7			
Control Delay (s)	14.1	0.0	1.7			
Lane LOS	B		A			
Approach Delay (s)	14.1	0.0	1.7			
Approach LOS	B					
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			45.4%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	94	885	181	301	256	20
Future Volume (vph)	94	885	181	301	256	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.990	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1551	1436	1537	1664	1592	0
Fl <sub>t</sub> Permitted	0.950		0.433			
Satd. Flow (perm)	1551	1436	701	1664	1592	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		545			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	3%	10%	7%	11%	7%
Adj. Flow (vph)	94	885	181	301	256	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	94	885	181	301	276	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	



Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	37.2	37.2	48.6	48.0	35.0	
Actuated g/C Ratio	0.38	0.38	0.49	0.49	0.35	
v/c Ratio	0.16	1.00	0.45	0.37	0.49	
Control Delay	21.3	44.9	18.6	17.5	28.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	21.3	44.9	18.6	17.5	28.0	
LOS	C	D	B	B	C	
Approach Delay	42.7			17.9	28.0	
Approach LOS	D			B	C	
Queue Length 50th (m)	12.3	~92.8	20.1	36.4	42.0	
Queue Length 95th (m)	23.7	#189.1	34.1	56.9	67.0	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	585	881	404	833	590	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.16	1.00	0.45	0.36	0.47	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	98.6
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	1.00
Intersection Signal Delay:	33.5
Intersection LOS:	C
Intersection Capacity Utilization:	98.2%
ICU Level of Service:	F
Analysis Period (min):	15





















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Background PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	0	19	7	0	22	5	377	0	3	1065	74
Future Volume (vph)	83	0	19	7	0	22	5	377	0	3	1065	74
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		0.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.975				0.850						0.990
Fl <sub>t</sub> Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1590	0	0	1208	1513	1322	1633	1740	1102	1699	0
Fl <sub>t</sub> Permitted		0.761			0.785		0.188			0.486		
Satd. Flow (perm)	0	1259	0	0	998	1513	262	1633	1740	564	1699	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						8
Link Speed (k/h)		60			20			80				80
Link Distance (m)		642.8			170.6			174.7				243.1
Travel Time (s)		38.6			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	0%	40%	0%	0%	25%	9%	0%	50%	4%	0%
Adj. Flow (vph)	83	0	19	7	0	22	5	377	0	3	1065	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	7	22	5	377	0	3	1139	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Background PM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	62.2	62.2	62.2	13.0	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	62.2%	62.2%	62.2%	13.0%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	56.0	56.0	56.0	7.0	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		8.3			8.3	8.3	64.3	64.3		64.9	66.6	
Actuated g/C Ratio		0.10			0.10	0.10	0.79	0.79		0.80	0.82	
v/c Ratio		0.47			0.07	0.09	0.02	0.29		0.01	0.82	
Control Delay		16.6			38.1	0.7	5.8	5.4		2.7	13.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.6	
Total Delay		16.6			38.1	0.7	5.8	5.4		2.7	14.4	
LOS		B			D	A	A	A		A	B	
Approach Delay		16.6			9.8			5.4			14.4	
Approach LOS		B			A			A			B	
Queue Length 50th (m)		0.3			1.2	0.0	0.1	14.2		0.1	99.3	
Queue Length 95th (m)		15.2			5.3	0.0	1.9	51.6		0.8	#277.2	
Internal Link Dist (m)		618.8			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		380			241	442	206	1286		496	1402	
Starvation Cap Reductn		0			0	0	0	0		0	61	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.27			0.03	0.05	0.02	0.29		0.01	0.85	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	81.6
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	12.3
Intersection LOS:	B
Intersection Capacity Utilization:	86.6%
ICU Level of Service:	E
Analysis Period (min):	15











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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way













Lanes, Volumes, Timings  
4: Boundary Road & South Amazon Access

2035 Future Background PM  
04-08-2021

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	7	15	367	7	16	1074
Future Volume (vph)	7	15	367	7	16	1074
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.6	3.6	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	0.0		0.0	70.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	7.5				45.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.908		0.997			
Flt Protected	0.984				0.950	
Satd. Flow (prot)	804	0	1662	0	846	1745
Flt Permitted	0.984				0.950	
Satd. Flow (perm)	804	0	1662	0	846	1745
Link Speed (k/h)	20		80			80
Link Distance (m)	151.5		1150.2			174.7
Travel Time (s)	27.3		51.8			7.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	100%	100%	5%	100%	100%	2%
Adj. Flow (vph)	7	15	367	7	16	1074
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	0	374	0	16	1074
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	69.7%			ICU Level of Service C		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis  
4: Boundary Road & South Amazon Access

2035 Future Background PM  
04-08-2021

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	7	15	367	7	16	1074
Future Volume (Veh/h)	7	15	367	7	16	1074
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	15	367	7	16	1074
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						175
pX, platoon unblocked	0.24					
vC, conflicting volume	1476	370			374	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1401	370			374	
tC, single (s)	7.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	4.4	4.2			3.1	
p0 queue free %	69	97			98	
cM capacity (veh/h)	22	503			800	
Direction, Lane #	WB 1	NB 1	SB 1	SB 2		
Volume Total	22	374	16	1074		
Volume Left	7	0	16	0		
Volume Right	15	7	0	0		
cSH	64	1700	800	1700		
Volume to Capacity	0.34	0.22	0.02	0.63		
Queue Length 95th (m)	10.1	0.0	0.5	0.0		
Control Delay (s)	88.1	0.0	9.6	0.0		
Lane LOS	F		A			
Approach Delay (s)	88.1	0.0	0.1			
Approach LOS	F					
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			69.7%		ICU Level of Service	C
Analysis Period (min)			15			

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2035 Future Background PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	155	132	70	157	947	155
Future Volume (vph)	155	132	70	157	947	155
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.985		
Satd. Flow (prot)	1463	1395	0	1666	1762	1351
Fl <sub>t</sub> Permitted	0.950			0.985		
Satd. Flow (perm)	1463	1395	0	1666	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	8%	4%	1%	12%
Adj. Flow (vph)	155	132	70	157	947	155
Shared Lane Traffic (%)						
Lane Group Flow (vph)	155	132	0	227	947	155
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	84.5%
ICU Level of Service	E
Analysis Period (min)	15



HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2035 Future Background PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	155	132	70	157	947	155
Future Volume (Veh/h)	155	132	70	157	947	155
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	155	132	70	157	947	155
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1244	947	1102			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1244	947	1102			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	4	58	89			
cM capacity (veh/h)	162	311	612			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	155	132	227	947	155	
Volume Left	155	0	70	0	0	
Volume Right	0	132	0	0	155	
cSH	162	311	612	1700	1700	
Volume to Capacity	0.96	0.42	0.11	0.56	0.09	
Queue Length 95th (m)	57.7	16.2	3.1	0.0	0.0	
Control Delay (s)	116.4	24.8	4.6	0.0	0.0	
Lane LOS	F	C	A			
Approach Delay (s)	74.3		4.6	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			13.8			
Intersection Capacity Utilization			84.5%	ICU Level of Service		E
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Total AM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	149	31	101	870	77	121
Future Volume (vph)	149	31	101	870	77	121
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.977		0.879			
Flt Protected	0.960					0.981
Satd. Flow (prot)	1693	0	1517	0	0	1602
Flt Permitted	0.960					0.981
Satd. Flow (perm)	1693	0	1517	0	0	1602
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	13%	13%	2%	9%	9%
Adj. Flow (vph)	149	31	101	870	77	121
Shared Lane Traffic (%)						
Lane Group Flow (vph)	180	0	971	0	0	198
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	94.2%
ICU Level of Service	F
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Total AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	149	31	101	870	77	121
Future Volume (Veh/h)	149	31	101	870	77	121
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	149	31	101	870	77	121
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	811	536			971	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	536			971	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	51	94			89	
cM capacity (veh/h)	301	524			683	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	180	971	198			
Volume Left	149	0	77			
Volume Right	31	870	0			
cSH	325	1700	683			
Volume to Capacity	0.55	0.57	0.11			
Queue Length 95th (m)	25.4	0.0	3.0			
Control Delay (s)	29.0	0.0	5.1			
Lane LOS	D		A			
Approach Delay (s)	29.0	0.0	5.1			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			4.6			
Intersection Capacity Utilization			94.2%		ICU Level of Service	F
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	18	334	41	957	240	9
Future Volume (vph)	18	334	41	957	240	9
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.995	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1271	1332	1311	1728	1582	0
Fl <sub>t</sub> Permitted	0.950		0.527			
Satd. Flow (perm)	1271	1332	727	1728	1582	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		334			3	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	33%	11%	29%	3%	12%	11%
Adj. Flow (vph)	18	334	41	957	240	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	18	334	41	957	249	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Total AM  
 04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	8.8	8.8	48.1	47.5	40.5	
Actuated g/C Ratio	0.13	0.13	0.68	0.68	0.58	
v/c Ratio	0.11	0.73	0.07	0.82	0.27	
Control Delay	34.8	14.8	3.8	15.2	9.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	34.8	14.8	3.8	15.2	9.7	
LOS	C	B	A	B	A	
Approach Delay	15.9			14.7	9.7	
Approach LOS	B			B	A	
Queue Length 50th (m)	2.3	0.0	1.3	69.0	17.7	
Queue Length 95th (m)	10.1	28.8	4.5	152.2	35.1	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	249	529	558	1638	1366	
Starvation Cap Reductn	0	0	0	29	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.07	0.63	0.07	0.59	0.18	

Intersection Summary






















Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	70.3
Natural Cycle:	75
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	14.2
Intersection LOS:	B
Intersection Capacity Utilization:	70.2%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Total AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	17	10	3	6	25	24	913	30	193	255	126
Future Volume (vph)	59	17	10	3	6	25	24	913	30	193	255	126
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		35.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.984				0.850			0.850		0.950	
Fl <sub>t</sub> Protected		0.967			0.984		0.950			0.950		
Satd. Flow (prot)	0	1529	0	0	1752	1513	1589	1728	1479	1653	1445	0
Fl <sub>t</sub> Permitted		0.790			0.887		0.536			0.115		
Satd. Flow (perm)	0	1249	0	0	1579	1513	897	1728	1479	200	1445	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				100			96			57
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	14%	0%	10%	0%	0%	0%	4%	3%	0%	0%	16%	19%
Adj. Flow (vph)	59	17	10	3	6	25	24	913	30	193	255	126
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	86	0	0	9	25	24	913	30	193	381	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Total AM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		11.5			11.5	11.5	50.5	50.5	50.5	65.8	67.6	
Actuated g/C Ratio		0.13			0.13	0.13	0.59	0.59	0.59	0.77	0.79	
v/c Ratio		0.50			0.04	0.09	0.05	0.90	0.03	0.63	0.33	
Control Delay		45.9			35.1	0.6	9.5	30.7	0.1	20.1	4.5	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		45.9			35.1	0.6	9.5	30.7	0.1	20.1	4.5	
LOS		D			D	A	A	C	A	C	A	
Approach Delay		45.9			9.7			29.2			9.8	
Approach LOS		D			A			C			A	
Queue Length 50th (m)		14.3			1.5	0.0	1.8	137.3	0.0	8.3	16.0	
Queue Length 95th (m)		29.4			6.0	0.0	6.0	#256.8	0.0	#41.9	35.6	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		296			369	430	596	1147	1014	309	1153	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.29			0.02	0.06	0.04	0.80	0.03	0.62	0.33	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	85.6
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	22.9
Intersection LOS:	C
Intersection Capacity Utilization:	88.7%
ICU Level of Service:	E
Analysis Period (min):	15



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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way



Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access

2025 Future Total AM  
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Volume (vph)	1	0	5	6	0	3	15	962	6	1	251	16
Future Volume (vph)	1	0	5	6	0	3	15	962	6	1	251	16
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.887			0.955			0.999			0.991	
Flt Protected		0.992			0.968		0.950			0.950		
Satd. Flow (prot)	0	1566	0	0	823	0	1691	1750	0	846	1585	0
Flt Permitted		0.992			0.968		0.950			0.950		
Satd. Flow (perm)	0	1566	0	0	823	0	1691	1750	0	846	1585	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	1%	100%	100%	12%	0%
Adj. Flow (vph)	1	0	5	6	0	3	15	962	6	1	251	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	9	0	15	968	0	1	267	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	63.8%
ICU Level of Service	B
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2025 Future Total AM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	6	0	3	15	962	6	1	251	16
Future Volume (Veh/h)	1	0	5	6	0	3	15	962	6	1	251	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	5	6	0	3	15	962	6	1	251	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None				None
Median storage (veh)												
Upstream signal (m)												175
pX, platoon unblocked												
vC, conflicting volume	1256	1259	259	1253	1264	965	267			968		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1256	1259	259	1253	1264	965	267			968		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	99	100	99	94	100	99	99			100		
cM capacity (veh/h)	146	170	785	94	169	207	1308			434		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	6	9	15	968	1	267						
Volume Left	1	6	15	0	1	0						
Volume Right	5	3	0	6	0	16						
cSH	454	115	1308	1700	434	1700						
Volume to Capacity	0.01	0.08	0.01	0.57	0.00	0.16						
Queue Length 95th (m)	0.3	2.0	0.3	0.0	0.1	0.0						
Control Delay (s)	13.0	39.0	7.8	0.0	13.3	0.0						
Lane LOS	B	E	A		B							
Approach Delay (s)	13.0	39.0	0.1		0.0							
Approach LOS	B	E										
Intersection Summary												
Average Delay			0.4									
Intersection Capacity Utilization			63.8%		ICU Level of Service				B			
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2025 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	83	30	134	886	131	108
Future Volume (vph)	83	30	134	886	131	108
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1489	1264	0	1734	1575	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1489	1264	0	1734	1575	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	11%	17%	8%	1%	13%	17%
Adj. Flow (vph)	83	30	134	886	131	108
Shared Lane Traffic (%)						
Lane Group Flow (vph)	83	30	0	1020	131	108
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	79.2%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2025 Future Total AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	30	134	886	131	108
Future Volume (Veh/h)	83	30	134	886	131	108
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	83	30	134	886	131	108
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1285	131	239			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1285	131	239			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.5	2.3			
p0 queue free %	47	97	90			
cM capacity (veh/h)	156	880	1293			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	83	30	1020	131	108	
Volume Left	83	0	134	0	0	
Volume Right	0	30	0	0	108	
cSH	156	880	1293	1700	1700	
Volume to Capacity	0.53	0.03	0.10	0.08	0.06	
Queue Length 95th (m)	21.2	0.8	2.8	0.0	0.0	
Control Delay (s)	51.7	9.2	2.6	0.0	0.0	
Lane LOS	F	A	A			
Approach Delay (s)	40.4		2.6	0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			5.3			
Intersection Capacity Utilization			79.2%	ICU Level of Service		D
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2025 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	66	0	51	105	0	19
Future Volume (vph)	66	0	51	105	0	19
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.984		
Satd. Flow (prot)	1589	0	0	1508	1466	0
Flt Permitted				0.984		
Satd. Flow (perm)	1589	0	0	1508	1466	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			14.3	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	0%	0%	24%	0%	5%
Adj. Flow (vph)	66	0	51	105	0	19
Shared Lane Traffic (%)						
Lane Group Flow (vph)	66	0	0	156	19	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	25.5%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2025 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	66	0	51	105	0	19
Future Volume (Veh/h)	66	0	51	105	0	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	0	51	105	0	19
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			66		273	66
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			66		273	66
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		100	98
cM capacity (veh/h)			1549		697	989
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	66	156	19			
Volume Left	0	51	0			
Volume Right	0	0	19			
cSH	1700	1549	989			
Volume to Capacity	0.04	0.03	0.02			
Queue Length 95th (m)	0.0	0.8	0.5			
Control Delay (s)	0.0	2.6	8.7			
Lane LOS			A			
Approach Delay (s)	0.0	2.6	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			2.4			
Intersection Capacity Utilization			25.5%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2025 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	62	0	15	90	0	4
Future Volume (vph)	62	0	15	90	0	4
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.993		
Satd. Flow (prot)	1679	0	0	1429	770	0
Flt Permitted				0.993		
Satd. Flow (perm)	1679	0	0	1429	770	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			11.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	100%	11%	0%	100%
Adj. Flow (vph)	62	0	15	90	0	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	62	0	0	105	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.5%
Analysis Period (min)	15
	ICU Level of Service A



HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2025 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	↘
Traffic Volume (veh/h)	62	0	15	90	0	4
Future Volume (Veh/h)	62	0	15	90	0	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	62	0	15	90	0	4
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			62		182	62
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			62		182	62
tC, single (s)			5.1		6.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		3.5	4.2
p0 queue free %			99		100	99
cM capacity (veh/h)			1092		801	785
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	62	105	4			
Volume Left	0	15	0			
Volume Right	0	0	4			
cSH	1700	1092	785			
Volume to Capacity	0.04	0.01	0.01			
Queue Length 95th (m)	0.0	0.3	0.1			
Control Delay (s)	0.0	1.3	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.3	9.6			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.0			
Intersection Capacity Utilization			22.5%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2025 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	55	0	23	67	0	7
Future Volume (vph)	55	0	23	67	0	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected				0.987		
Satd. Flow (prot)	1695	0	0	1585	1351	0
Flt Permitted				0.987		
Satd. Flow (perm)	1695	0	0	1585	1351	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			13.3	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	0%	22%	7%	0%	14%
Adj. Flow (vph)	55	0	23	67	0	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	55	0	0	90	7	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	21.7%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
8: Site Access C & Thunder Road

2025 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Traffic Volume (veh/h)	55	0	23	67	0	7
Future Volume (Veh/h)	55	0	23	67	0	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	0	23	67	0	7
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			55		168	55
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			55		168	55
tC, single (s)			4.3		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.4
p0 queue free %			98		100	99
cM capacity (veh/h)			1431		814	979
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	55	90	7			
Volume Left	0	23	0			
Volume Right	0	0	7			
cSH	1700	1431	979			
Volume to Capacity	0.03	0.02	0.01			
Queue Length 95th (m)	0.0	0.4	0.2			
Control Delay (s)	0.0	2.0	8.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.0	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.6			
Intersection Capacity Utilization			21.7%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Total PM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	58	1	165	324	24	126
Future Volume (vph)	58	1	165	324	24	126
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1548	0	1525	0	0	1632
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1548	0	1525	0	0	1632
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	22%	0%	5%	7%	4%	9%
Adj. Flow (vph)	58	1	165	324	24	126
Shared Lane Traffic (%)						
Lane Group Flow (vph)	59	0	489	0	0	150
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	40.3%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2025 Future Total PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	58	1	165	324	24	126
Future Volume (Veh/h)	58	1	165	324	24	126
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	58	1	165	324	24	126
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	501	327			489	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	501	327			489	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	88	100			98	
cM capacity (veh/h)	484	719			1064	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	59	489	150			
Volume Left	58	0	24			
Volume Right	1	324	0			
cSH	487	1700	1064			
Volume to Capacity	0.12	0.29	0.02			
Queue Length 95th (m)	3.3	0.0	0.6			
Control Delay (s)	13.4	0.0	1.5			
Lane LOS	B		A			
Approach Delay (s)	13.4	0.0	1.5			
Approach LOS	B					
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			40.3%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	77	748	178	312	230	17
Future Volume (vph)	77	748	178	312	230	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.991	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1551	1422	1496	1604	1581	0
Flt Permitted	0.950		0.501			
Satd. Flow (perm)	1551	1422	789	1604	1581	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		582			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	4%	13%	11%	12%	6%
Adj. Flow (vph)	77	748	178	312	230	17
Shared Lane Traffic (%)						
Lane Group Flow (vph)	77	748	178	312	247	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2025 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	22.7	22.7	49.6	49.0	35.7	
Actuated g/C Ratio	0.27	0.27	0.58	0.57	0.42	
v/c Ratio	0.19	0.93	0.34	0.34	0.37	
Control Delay	22.9	25.8	13.7	13.7	22.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	22.9	25.8	13.7	13.7	22.0	
LOS	C	C	B	B	C	
Approach Delay	25.5			13.7	22.0	
Approach LOS	C			B	C	
Queue Length 50th (m)	10.0	26.9	14.1	27.6	28.7	
Queue Length 95th (m)	20.2	#107.0	33.7	60.0	59.6	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	689	955	517	946	689	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.11	0.78	0.34	0.33	0.36	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	85.4
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.93
Intersection Signal Delay:	21.2
Intersection LOS:	C
Intersection Capacity Utilization:	89.2%
ICU Level of Service:	E
Analysis Period (min):	15

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






















Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal





Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Total PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	0	34	6	0	18	10	320	0	2	887	87
Future Volume (vph)	151	0	34	6	0	18	10	320	0	2	887	87
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		35.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.975				0.850						0.987
Flt Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1444	0	0	1271	1513	1503	1633	1740	1102	1684	0
Flt Permitted		0.761			0.729		0.205			0.495		
Satd. Flow (perm)	0	1143	0	0	976	1513	324	1633	1740	574	1684	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						11
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	0%	33%	0%	0%	10%	9%	0%	50%	4%	8%
Adj. Flow (vph)	151	0	34	6	0	18	10	320	0	2	887	87
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	185	0	0	6	18	10	320	0	2	974	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2025 Future Total PM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	62.0	62.0	62.0	13.0	75.0	
Total Split (%)	25.0%	25.0%		25.0%	25.0%	25.0%	62.0%	62.0%	62.0%	13.0%	75.0%	
Maximum Green (s)	19.2	19.2		19.2	19.2	19.2	55.8	55.8	55.8	7.0	68.8	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		12.1			12.1	12.1	45.5	45.5		47.6	47.4	
Actuated g/C Ratio		0.17			0.17	0.17	0.63	0.63		0.66	0.65	
v/c Ratio		0.68			0.04	0.05	0.05	0.31		0.00	0.88	
Control Delay		29.8			32.2	0.3	8.4	8.4		4.5	21.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.8			32.2	0.3	8.4	8.4		4.5	21.6	
LOS		C			C	A	A	A		A	C	
Approach Delay		29.8			8.3			8.4			21.6	
Approach LOS		C			A			A			C	
Queue Length 50th (m)		10.5			0.7	0.0	0.4	15.5		0.1	88.7	
Queue Length 95th (m)		39.7			4.6	0.0	3.6	52.3		0.8	203.2	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		400			281	507	263	1325		431	1491	
Starvation Cap Reductn		0			0	0	0	0		0	17	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.46			0.02	0.04	0.04	0.24		0.00	0.66	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	72.6
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	19.5
Intersection Capacity Utilization:	82.5%
Analysis Period (min):	15
Intersection LOS:	B
ICU Level of Service:	E

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way



Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access

2025 Future Total PM  
04-08-2021





















Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↘		↗	↘	
Traffic Volume (vph)	4	0	15	6	0	12	5	314	6	13	907	7
Future Volume (vph)	4	0	15	6	0	12	5	314	6	13	907	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.893			0.910			0.997			0.999	
Flt Protected		0.990			0.984		0.950			0.950		
Satd. Flow (prot)	0	1574	0	0	797	0	1691	1662	0	846	1744	0
Flt Permitted		0.990			0.984		0.950			0.950		
Satd. Flow (perm)	0	1574	0	0	797	0	1691	1662	0	846	1744	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	5%	100%	100%	2%	0%
Adj. Flow (vph)	4	0	15	6	0	12	5	314	6	13	907	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	18	0	5	320	0	13	914	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	

**Intersection Summary**  
 Area Type: Other  
 Control Type: Unsignalized  
 Intersection Capacity Utilization 60.8% ICU Level of Service B  
 Analysis Period (min) 15

HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2025 Future Total PM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	15	6	0	12	5	314	6	13	907	7
Future Volume (Veh/h)	4	0	15	6	0	12	5	314	6	13	907	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	0	15	6	0	12	5	314	6	13	907	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
								None				None
Median storage veh												
Upstream signal (m)												
												175
pX, platoon unblocked	0.55	0.55	0.55	0.55	0.55		0.55					
vC, conflicting volume	1272	1266	910	1275	1267	317	914			320		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1086	1075	426	1090	1076	317	433			320		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	96	100	96	91	100	98	99			98		
cM capacity (veh/h)	103	119	347	66	119	544	625			844		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	19	18	5	320	13	914						
Volume Left	4	6	5	0	13	0						
Volume Right	15	12	0	6	0	7						
cSH	232	159	625	1700	844	1700						
Volume to Capacity	0.08	0.11	0.01	0.19	0.02	0.54						
Queue Length 95th (m)	2.1	3.0	0.2	0.0	0.4	0.0						
Control Delay (s)	21.9	30.5	10.8	0.0	9.3	0.0						
Lane LOS	C	D	B		A							
Approach Delay (s)	21.9	30.5	0.2		0.1							
Approach LOS	C	D										
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			60.8%		ICU Level of Service					B		
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2025 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	129	108	57	140	805	133
Future Volume (vph)	129	108	57	140	805	133
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.986		
Satd. Flow (prot)	1463	1395	0	1664	1762	1363
Fl <sub>t</sub> Permitted	0.950			0.986		
Satd. Flow (perm)	1463	1395	0	1664	1762	1363
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	9%	4%	1%	11%
Adj. Flow (vph)	129	108	57	140	805	133
Shared Lane Traffic (%)						
Lane Group Flow (vph)	129	108	0	197	805	133
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	73.4%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2025 Future Total PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	129	108	57	140	805	133
Future Volume (Veh/h)	129	108	57	140	805	133
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	129	108	57	140	805	133
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1059	805	938			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1059	805	938			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	41	71	92			
cM capacity (veh/h)	218	376	703			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	129	108	197	805	133	
Volume Left	129	0	57	0	0	
Volume Right	0	108	0	0	133	
cSH	218	376	703	1700	1700	
Volume to Capacity	0.59	0.29	0.08	0.47	0.08	
Queue Length 95th (m)	26.8	9.3	2.1	0.0	0.0	
Control Delay (s)	43.1	18.4	3.7	0.0	0.0	
Lane LOS	E	C	A			
Approach Delay (s)	31.8		3.7	0.0		
Approach LOS	D					
Intersection Summary						
Average Delay			6.0			
Intersection Capacity Utilization			73.4%	ICU Level of Service	D	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2025 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	122	0	19	79	0	62
Future Volume (vph)	122	0	19	79	0	62
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.990		
Satd. Flow (prot)	1483	0	0	1631	1426	0
Flt Permitted				0.990		
Satd. Flow (perm)	1483	0	0	1631	1426	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			14.3	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	20%	0%	0%	10%	0%	8%
Adj. Flow (vph)	122	0	19	79	0	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	122	0	0	98	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	26.3%
Analysis Period (min)	15
	ICU Level of Service A



HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2025 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Traffic Volume (veh/h)	122	0	19	79	0	62
Future Volume (Veh/h)	122	0	19	79	0	62
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	122	0	19	79	0	62
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			122			122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			122			122
tC, single (s)			4.1			6.3
tC, 2 stage (s)						
tF (s)			2.2			3.4
p0 queue free %			99			93
cM capacity (veh/h)			1478			913
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	122	98	62			
Volume Left	0	19	0			
Volume Right	0	0	62			
cSH	1700	1478	913			
Volume to Capacity	0.07	0.01	0.07			
Queue Length 95th (m)	0.0	0.3	1.7			
Control Delay (s)	0.0	1.5	9.2			
Lane LOS			A			
Approach Delay (s)	0.0	1.5	9.2			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			2.6			
Intersection Capacity Utilization			26.3%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2025 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	107	0	5	74	0	15
Future Volume (vph)	107	0	5	74	0	15
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.997		
Satd. Flow (prot)	1648	0	0	1612	770	0
Flt Permitted				0.997		
Satd. Flow (perm)	1648	0	0	1612	770	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			11.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	0%	100%	4%	0%	100%
Adj. Flow (vph)	107	0	5	74	0	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	107	0	0	79	15	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	18.4%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2025 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	107	0	5	74	0	15
Future Volume (Veh/h)	107	0	5	74	0	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	107	0	5	74	0	15
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			107		191	107
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			107		191	107
tC, single (s)			5.1		6.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		3.5	4.2
p0 queue free %			100		100	98
cM capacity (veh/h)			1045		799	736
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	107	79	15			
Volume Left	0	5	0			
Volume Right	0	0	15			
cSH	1700	1045	736			
Volume to Capacity	0.06	0.00	0.02			
Queue Length 95th (m)	0.0	0.1	0.5			
Control Delay (s)	0.0	0.6	10.0			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.6	10.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.0			
Intersection Capacity Utilization			18.4%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2025 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	83	0	9	65	0	24
Future Volume (vph)	83	0	9	65	0	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected				0.994		
Satd. Flow (prot)	1695	0	0	1694	1272	0
Flt Permitted				0.994		
Satd. Flow (perm)	1695	0	0	1694	1272	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			13.3	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	0%	22%	2%	0%	21%
Adj. Flow (vph)	83	0	9	65	0	24
Shared Lane Traffic (%)						
Lane Group Flow (vph)	83	0	0	74	24	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	20.8%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
8: Site Access C & Thunder Road

2025 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	83	0	9	65	0	24
Future Volume (Veh/h)	83	0	9	65	0	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	83	0	9	65	0	24
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			83	166		83
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			83	166		83
tC, single (s)			4.3	6.4		6.4
tC, 2 stage (s)						
tF (s)			2.4	3.5		3.5
p0 queue free %			99	100		97
cM capacity (veh/h)			1397	824		926
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	83	74	24			
Volume Left	0	9	0			
Volume Right	0	0	24			
cSH	1700	1397	926			
Volume to Capacity	0.05	0.01	0.03			
Queue Length 95th (m)	0.0	0.2	0.6			
Control Delay (s)	0.0	1.0	9.0			
Lane LOS			A		A	
Approach Delay (s)	0.0	1.0	9.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.6			
Intersection Capacity Utilization			20.8%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Total AM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	162	34	111	956	85	132
Future Volume (vph)	162	34	111	956	85	132
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.977		0.879			
Flt Protected	0.960					0.981
Satd. Flow (prot)	1700	0	1529	0	0	1602
Flt Permitted	0.960					0.981
Satd. Flow (perm)	1700	0	1529	0	0	1602
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	15%	14%	1%	9%	9%
Adj. Flow (vph)	162	34	111	956	85	132
Shared Lane Traffic (%)						
Lane Group Flow (vph)	196	0	1067	0	0	217
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	102.4%
ICU Level of Service	G
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Total AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	162	34	111	956	85	132
Future Volume (Veh/h)	162	34	111	956	85	132
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	162	34	111	956	85	132
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	891	589		1067		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	891	589		1067		
tC, single (s)	6.5	6.4		4.2		
tC, 2 stage (s)						
tF (s)	3.6	3.4		2.3		
p0 queue free %	39	93		86		
cM capacity (veh/h)	264	485		627		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	196	1067	217			
Volume Left	162	0	85			
Volume Right	34	956	0			
cSH	287	1700	627			
Volume to Capacity	0.68	0.63	0.14			
Queue Length 95th (m)	36.9	0.0	3.7			
Control Delay (s)	40.9	0.0	5.6			
Lane LOS	E		A			
Approach Delay (s)	40.9	0.0	5.6			
Approach LOS	E					
Intersection Summary						
Average Delay		6.2				
Intersection Capacity Utilization		102.4%		ICU Level of Service	G	
Analysis Period (min)		15				

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	361	44	1051	260	10
Future Volume (vph)	20	361	44	1051	260	10
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.995	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1301	1345	1331	1745	1582	0
Flt Permitted	0.950		0.521			
Satd. Flow (perm)	1301	1345	730	1745	1582	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		361			3	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	30%	10%	27%	2%	12%	10%
Adj. Flow (vph)	20	361	44	1051	260	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	20	361	44	1051	270	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	



Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Total AM  
 04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	9.0	9.0	50.6	50.0	43.1	
Actuated g/C Ratio	0.12	0.12	0.69	0.68	0.59	
v/c Ratio	0.12	0.75	0.08	0.88	0.29	
Control Delay	36.9	15.3	3.7	19.3	9.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	36.9	15.3	3.7	19.4	9.5	
LOS	D	B	A	B	A	
Approach Delay	16.5			18.7	9.5	
Approach LOS	B			B	A	
Queue Length 50th (m)	2.5	0.0	1.4	84.7	19.6	
Queue Length 95th (m)	10.9	#31.3	4.7	193.5	38.3	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	248	548	566	1599	1324	
Starvation Cap Reductn	0	0	0	26	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.08	0.66	0.08	0.67	0.20	

Intersection Summary

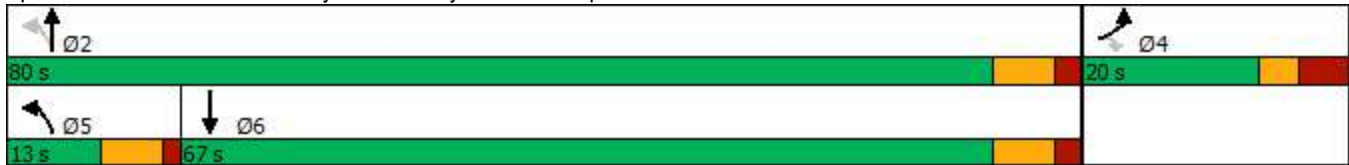
Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	73.2
Natural Cycle:	80
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	16.8
Intersection LOS:	B
Intersection Capacity Utilization:	75.4%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Total AM  
 04-08-2021






















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Total AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	63	18	11	4	6	28	24	1004	33	213	276	132
Future Volume (vph)	63	18	11	4	6	28	24	1004	33	213	276	132
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		35.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.984				0.850			0.850		0.951	
Flt Protected		0.967			0.980		0.950			0.950		
Satd. Flow (prot)	0	1540	0	0	1744	1513	1589	1728	1479	1653	1447	0
Flt Permitted		0.789			0.883		0.523			0.072		
Satd. Flow (perm)	0	1257	0	0	1572	1513	875	1728	1479	125	1447	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				100			96			56
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	0%	9%	0%	0%	0%	4%	3%	0%	0%	16%	19%
Adj. Flow (vph)	63	18	11	4	6	28	24	1004	33	213	276	132
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	92	0	0	10	28	24	1004	33	213	408	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Total AM  
04-08-2021



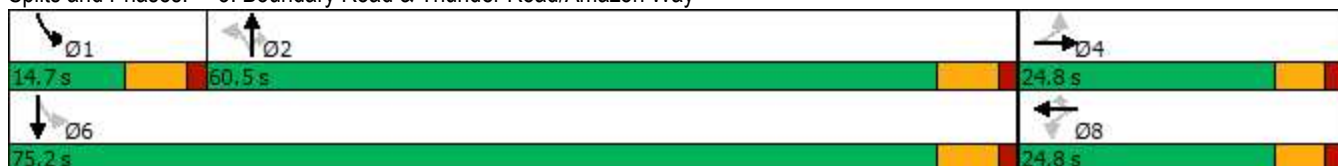
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		11.7			11.7	11.7	54.8	54.8	54.8	69.8	71.1	
Actuated g/C Ratio		0.13			0.13	0.13	0.61	0.61	0.61	0.77	0.79	
v/c Ratio		0.55			0.05	0.10	0.05	0.96	0.04	0.87	0.35	
Control Delay		47.7			35.0	0.7	9.8	40.1	0.1	55.4	4.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		47.7			35.0	0.7	9.8	40.1	0.1	55.4	4.8	
LOS		D			C	A	A	D	A	E	A	
Approach Delay		47.7			9.7			38.2			22.2	
Approach LOS		D			A			D			C	
Queue Length 50th (m)		15.4			1.7	0.0	1.8	172.4	0.0	23.0	18.2	
Queue Length 95th (m)		31.1			6.3	0.0	6.1	#299.7	0.0	#72.9	40.6	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		271			333	399	530	1047	934	244	1150	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.34			0.03	0.07	0.05	0.96	0.04	0.87	0.35	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	90.4
Natural Cycle:	110
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.96
Intersection Signal Delay:	32.6
Intersection LOS:	C
Intersection Capacity Utilization:	95.3%
ICU Level of Service:	F
Analysis Period (min):	15



















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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way






















Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access

2030 Future Total AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	5	6	0	4	15	1057	6	1	273	16
Future Volume (vph)	1	0	5	6	0	4	15	1057	6	1	273	16
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.887			0.946			0.999			0.992	
Flt Protected		0.992			0.971		0.950			0.950		
Satd. Flow (prot)	0	1566	0	0	818	0	1691	1751	0	846	1586	0
Flt Permitted		0.992			0.971		0.950			0.950		
Satd. Flow (perm)	0	1566	0	0	818	0	1691	1751	0	846	1586	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	1%	100%	100%	12%	0%
Adj. Flow (vph)	1	0	5	6	0	4	15	1057	6	1	273	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	10	0	15	1063	0	1	289	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	
<b>Intersection Summary</b>												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	69.1%						ICU Level of Service C					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2030 Future Total AM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	6	0	4	15	1057	6	1	273	16
Future Volume (Veh/h)	1	0	5	6	0	4	15	1057	6	1	273	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	5	6	0	4	15	1057	6	1	273	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None				None
Median storage (veh)												
Upstream signal (m)												175
pX, platoon unblocked												
vC, conflicting volume	1374	1376	281	1370	1381	1060	289			1063		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1374	1376	281	1370	1381	1060	289			1063		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	99	100	99	92	100	98	99			100		
cM capacity (veh/h)	120	144	763	76	143	179	1284			393		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	6	10	15	1063	1	289						
Volume Left	1	6	15	0	1	0						
Volume Right	5	4	0	6	0	16						
cSH	403	99	1284	1700	393	1700						
Volume to Capacity	0.01	0.10	0.01	0.63	0.00	0.17						
Queue Length 95th (m)	0.4	2.6	0.3	0.0	0.1	0.0						
Control Delay (s)	14.1	45.5	7.8	0.0	14.2	0.0						
Lane LOS	B	E	A		B							
Approach Delay (s)	14.1	45.5	0.1		0.0							
Approach LOS	B	E										
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			69.1%		ICU Level of Service					C		
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2030 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	91	33	147	975	144	119
Future Volume (vph)	91	33	147	975	144	119
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1489	1286	0	1734	1575	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1489	1286	0	1734	1575	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	11%	15%	8%	1%	13%	17%
Adj. Flow (vph)	91	33	147	975	144	119
Shared Lane Traffic (%)						
Lane Group Flow (vph)	91	33	0	1122	144	119
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	86.1%
ICU Level of Service	E
Analysis Period (min)	15



HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2030 Future Total AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	91	33	147	975	144	119
Future Volume (Veh/h)	91	33	147	975	144	119
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	91	33	147	975	144	119
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1413	144	263			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1413	144	263			
tC, single (s)	6.5	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	29	96	88			
cM capacity (veh/h)	128	870	1267			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	91	33	1122	144	119	
Volume Left	91	0	147	0	0	
Volume Right	0	33	0	0	119	
cSH	128	870	1267	1700	1700	
Volume to Capacity	0.71	0.04	0.12	0.08	0.07	
Queue Length 95th (m)	31.7	0.9	3.1	0.0	0.0	
Control Delay (s)	82.7	9.3	3.0	0.0	0.0	
Lane LOS	F	A	A			
Approach Delay (s)	63.2		3.0	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			7.4			
Intersection Capacity Utilization			86.1%	ICU Level of Service		E
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2030 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	72	0	51	111	0	19
Future Volume (vph)	72	0	51	111	0	19
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.985		
Satd. Flow (prot)	1604	0	0	1515	1466	0
Flt Permitted				0.985		
Satd. Flow (perm)	1604	0	0	1515	1466	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			14.3	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	11%	0%	0%	23%	0%	5%
Adj. Flow (vph)	72	0	51	111	0	19
Shared Lane Traffic (%)						
Lane Group Flow (vph)	72	0	0	162	19	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	25.8%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2030 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	72	0	51	111	0	19
Future Volume (Veh/h)	72	0	51	111	0	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	72	0	51	111	0	19
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			72	285		72
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			72	285		72
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			97	100		98
cM capacity (veh/h)			1541	686		982
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	72	162	19			
Volume Left	0	51	0			
Volume Right	0	0	19			
cSH	1700	1541	982			
Volume to Capacity	0.04	0.03	0.02			
Queue Length 95th (m)	0.0	0.8	0.5			
Control Delay (s)	0.0	2.5	8.7			
Lane LOS			A		A	
Approach Delay (s)	0.0	2.5	8.7			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			2.3			
Intersection Capacity Utilization			25.8%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2030 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	68	0	15	96	0	4
Future Volume (vph)	68	0	15	96	0	4
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.993		
Satd. Flow (prot)	1679	0	0	1437	770	0
Flt Permitted				0.993		
Satd. Flow (perm)	1679	0	0	1437	770	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			11.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	100%	11%	0%	100%
Adj. Flow (vph)	68	0	15	96	0	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	68	0	0	111	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.9%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2030 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Traffic Volume (veh/h)	68	0	15	96	0	4
Future Volume (Veh/h)	68	0	15	96	0	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	68	0	15	96	0	4
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			68		194	68
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			68		194	68
tC, single (s)			5.1		6.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		3.5	4.2
p0 queue free %			99		100	99
cM capacity (veh/h)			1086		788	778
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	68	111	4			
Volume Left	0	15	0			
Volume Right	0	0	4			
cSH	1700	1086	778			
Volume to Capacity	0.04	0.01	0.01			
Queue Length 95th (m)	0.0	0.3	0.1			
Control Delay (s)	0.0	1.2	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.2	9.6			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.0			
Intersection Capacity Utilization			22.9%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2030 Future Total AM  
04-08-2021



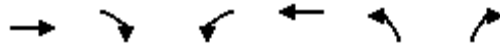
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	61	0	23	73	0	7
Future Volume (vph)	61	0	23	73	0	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.988		
Satd. Flow (prot)	1695	0	0	1579	1351	0
Flt Permitted				0.988		
Satd. Flow (perm)	1695	0	0	1579	1351	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			13.3	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	0%	22%	8%	0%	14%
Adj. Flow (vph)	61	0	23	73	0	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	61	0	0	96	7	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.1%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
8: Site Access C & Thunder Road

2030 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	61	0	23	73	0	7
Future Volume (Veh/h)	61	0	23	73	0	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	61	0	23	73	0	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			61	180	61	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			61	180	61	
tC, single (s)			4.3	6.4	6.3	
tC, 2 stage (s)						
tF (s)			2.4	3.5	3.4	
p0 queue free %			98	100	99	
cM capacity (veh/h)			1424	801	971	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	61	96	7			
Volume Left	0	23	0			
Volume Right	0	0	7			
cSH	1700	1424	971			
Volume to Capacity	0.04	0.02	0.01			
Queue Length 95th (m)	0.0	0.4	0.2			
Control Delay (s)	0.0	1.9	8.7			
Lane LOS			A			
Approach Delay (s)	0.0	1.9	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			22.1%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Total PM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	63	1	179	350	27	139
Future Volume (vph)	63	1	179	350	27	139
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1548	0	1520	0	0	1632
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1548	0	1520	0	0	1632
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	22%	0%	6%	7%	4%	9%
Adj. Flow (vph)	63	1	179	350	27	139
Shared Lane Traffic (%)						
Lane Group Flow (vph)	64	0	529	0	0	166
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other  
 Control Type: Unsignalized  
 Intersection Capacity Utilization 43.0% ICU Level of Service A  
 Analysis Period (min) 15



HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2030 Future Total PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	63	1	179	350	27	139
Future Volume (Veh/h)	63	1	179	350	27	139
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	63	1	179	350	27	139
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	547	354			529	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	547	354			529	
tC, single (s)	6.6	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	86	100			97	
cM capacity (veh/h)	453	694			1028	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	64	529	166			
Volume Left	63	0	27			
Volume Right	1	350	0			
cSH	456	1700	1028			
Volume to Capacity	0.14	0.31	0.03			
Queue Length 95th (m)	3.9	0.0	0.6			
Control Delay (s)	14.2	0.0	1.6			
Lane LOS	B		A			
Approach Delay (s)	14.2	0.0	1.6			
Approach LOS	B					
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			43.0%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	85	820	193	335	251	18
Future Volume (vph)	85	820	193	335	251	18
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.991	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1551	1422	1496	1618	1581	0
Flt Permitted	0.950		0.454			
Satd. Flow (perm)	1551	1422	715	1618	1581	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		552			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	4%	13%	10%	12%	6%
Adj. Flow (vph)	85	820	193	335	251	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	85	820	193	335	269	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2030 Future Total PM  
04-08-2021



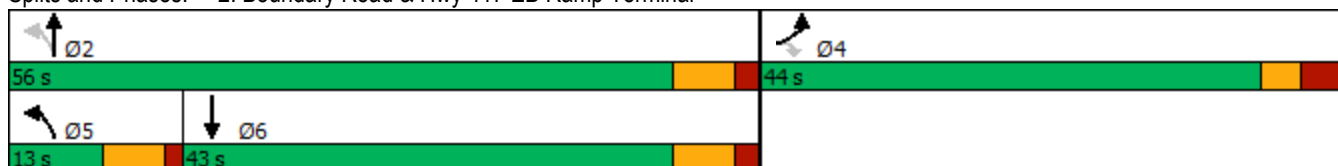
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	32.2	32.2	48.9	48.3	35.2	
Actuated g/C Ratio	0.34	0.34	0.52	0.51	0.37	
v/c Ratio	0.16	0.97	0.45	0.40	0.45	
Control Delay	21.4	34.3	17.9	17.2	26.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	21.4	34.3	17.9	17.2	26.3	
LOS	C	C	B	B	C	
Approach Delay	33.1			17.5	26.3	
Approach LOS	C			B	C	
Queue Length 50th (m)	11.1	60.5	21.7	42.0	40.8	
Queue Length 95th (m)	21.8	#159.1	36.4	64.7	65.4	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	618	898	430	856	619	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.14	0.91	0.45	0.39	0.43	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	94
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.97
Intersection Signal Delay:	27.2
Intersection LOS:	C
Intersection Capacity Utilization:	93.9%
ICU Level of Service:	F
Analysis Period (min):	15






















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Total PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	159	0	36	6	0	20	11	349	0	2	975	93
Future Volume (vph)	159	0	36	6	0	20	11	349	0	2	975	93
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		35.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.975				0.850						0.987
Fl <sub>t</sub> Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1444	0	0	1271	1513	1517	1633	1740	1102	1684	0
Fl <sub>t</sub> Permitted		0.762			0.742		0.162			0.482		
Satd. Flow (perm)	0	1145	0	0	993	1513	259	1633	1740	559	1684	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						11
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	0%	33%	0%	0%	9%	9%	0%	50%	4%	8%
Adj. Flow (vph)	159	0	36	6	0	20	11	349	0	2	975	93
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	195	0	0	6	20	11	349	0	2	1068	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1		2
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2030 Future Total PM  
04-08-2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	62.0	62.0	62.0	13.0	75.0	
Total Split (%)	25.0%	25.0%		25.0%	25.0%	25.0%	62.0%	62.0%	62.0%	13.0%	75.0%	
Maximum Green (s)	19.2	19.2		19.2	19.2	19.2	55.8	55.8	55.8	7.0	68.8	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		13.1			13.1	13.1	54.2	54.2		56.6	56.4	
Actuated g/C Ratio		0.16			0.16	0.16	0.66	0.66		0.69	0.69	
v/c Ratio		0.73			0.04	0.06	0.06	0.32		0.00	0.92	
Control Delay		35.8			33.8	0.3	9.0	8.4		4.5	26.1	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.3	
Total Delay		35.8			33.8	0.3	9.0	8.4		4.5	26.4	
LOS		D			C	A	A	A		A	C	
Approach Delay		35.8			8.1			8.4			26.3	
Approach LOS		D			A			A			C	
Queue Length 50th (m)		16.5			1.0	0.0	0.5	19.6		0.1	127.2	
Queue Length 95th (m)		43.3			4.6	0.0	4.0	57.8		0.8	#286.5	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		358			245	450	196	1238		433	1396	
Starvation Cap Reductn		0			0	0	0	0		0	47	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.54			0.02	0.04	0.06	0.28		0.00	0.79	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	82.2
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.92
Intersection Signal Delay:	23.3
Intersection LOS:	C
Intersection Capacity Utilization:	88.4%
ICU Level of Service:	E
Analysis Period (min):	15



















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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way



Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access



















2030 Future Total PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	15	6	0	13	5	342	6	15	995	7
Future Volume (vph)	4	0	15	6	0	13	5	342	6	15	995	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.893			0.908			0.997			0.999	
Flt Protected		0.990			0.984		0.950			0.950		
Satd. Flow (prot)	0	1574	0	0	795	0	1691	1664	0	846	1744	0
Flt Permitted		0.990			0.984		0.950			0.950		
Satd. Flow (perm)	0	1574	0	0	795	0	1691	1664	0	846	1744	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	5%	100%	100%	2%	0%
Adj. Flow (vph)	4	0	15	6	0	13	5	342	6	15	995	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	19	0	5	348	0	15	1002	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	
<b>Intersection Summary</b>												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	65.7%						ICU Level of Service C					
Analysis Period (min)	15											



HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2030 Future Total PM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	15	6	0	13	5	342	6	15	995	7
Future Volume (Veh/h)	4	0	15	6	0	13	5	342	6	15	995	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	0	15	6	0	13	5	342	6	15	995	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)											175	
pX, platoon unblocked	0.45	0.45	0.45	0.45	0.45		0.45					
vC, conflicting volume	1394	1386	998	1395	1387	345	1002			348		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1262	1247	381	1266	1248	345	389			348		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	94	100	95	85	100	98	99			98		
cM capacity (veh/h)	63	76	301	39	76	522	529			821		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	19	19	5	348	15	1002						
Volume Left	4	6	5	0	15	0						
Volume Right	15	13	0	6	0	7						
cSH	168	106	529	1700	821	1700						
Volume to Capacity	0.11	0.18	0.01	0.20	0.02	0.59						
Queue Length 95th (m)	3.0	5.0	0.2	0.0	0.4	0.0						
Control Delay (s)	29.1	46.2	11.9	0.0	9.5	0.0						
Lane LOS	D	E	B		A							
Approach Delay (s)	29.1	46.2	0.2		0.1							
Approach LOS	D	E										
Intersection Summary												
Average Delay			1.2									
Intersection Capacity Utilization			65.7%		ICU Level of Service				C			
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2030 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	142	119	63	153	886	146
Future Volume (vph)	142	119	63	153	886	146
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.986		
Satd. Flow (prot)	1463	1395	0	1669	1762	1351
Fl <sub>t</sub> Permitted	0.950			0.986		
Satd. Flow (perm)	1463	1395	0	1669	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	8%	4%	1%	12%
Adj. Flow (vph)	142	119	63	153	886	146
Shared Lane Traffic (%)						
Lane Group Flow (vph)	142	119	0	216	886	146
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	79.7%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2030 Future Total PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	142	119	63	153	886	146
Future Volume (Veh/h)	142	119	63	153	886	146
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	142	119	63	153	886	146
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1165	886	1032			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1165	886	1032			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	23	65	90			
cM capacity (veh/h)	184	338	651			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	142	119	216	886	146	
Volume Left	142	0	63	0	0	
Volume Right	0	119	0	0	146	
cSH	184	338	651	1700	1700	
Volume to Capacity	0.77	0.35	0.10	0.52	0.09	
Queue Length 95th (m)	40.9	12.4	2.6	0.0	0.0	
Control Delay (s)	70.0	21.3	4.1	0.0	0.0	
Lane LOS	F	C	A			
Approach Delay (s)	47.8		4.1	0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			8.9			
Intersection Capacity Utilization			79.7%	ICU Level of Service	D	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2030 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	132	0	19	86	0	62
Future Volume (vph)	132	0	19	86	0	62
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.991		
Satd. Flow (prot)	1496	0	0	1643	1426	0
Flt Permitted				0.991		
Satd. Flow (perm)	1496	0	0	1643	1426	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			14.3	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	19%	0%	0%	9%	0%	8%
Adj. Flow (vph)	132	0	19	86	0	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	132	0	0	105	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	27.3%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2030 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	132	0	19	86	0	62
Future Volume (Veh/h)	132	0	19	86	0	62
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	132	0	19	86	0	62
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			132		256	132
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			132		256	132
tC, single (s)			4.1		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.4
p0 queue free %			99		100	93
cM capacity (veh/h)			1466		728	902
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	132	105	62			
Volume Left	0	19	0			
Volume Right	0	0	62			
cSH	1700	1466	902			
Volume to Capacity	0.08	0.01	0.07			
Queue Length 95th (m)	0.0	0.3	1.8			
Control Delay (s)	0.0	1.4	9.3			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.4	9.3			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			2.4			
Intersection Capacity Utilization			27.3%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2030 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	117	0	5	81	0	15
Future Volume (vph)	117	0	5	81	0	15
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.997		
Satd. Flow (prot)	1633	0	0	1619	770	0
Flt Permitted				0.997		
Satd. Flow (perm)	1633	0	0	1619	770	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			11.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	0%	100%	4%	0%	100%
Adj. Flow (vph)	117	0	5	81	0	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	117	0	0	86	15	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	18.8%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2030 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	117	0	5	81	0	15
Future Volume (Veh/h)	117	0	5	81	0	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	117	0	5	81	0	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			117			208
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			117			208
tC, single (s)			5.1			6.4
tC, 2 stage (s)						
tF (s)			3.1			3.5
p0 queue free %			100			100
cM capacity (veh/h)			1034			781
						726
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	117	86	15			
Volume Left	0	5	0			
Volume Right	0	0	15			
cSH	1700	1034	726			
Volume to Capacity	0.07	0.00	0.02			
Queue Length 95th (m)	0.0	0.1	0.5			
Control Delay (s)	0.0	0.5	10.1			
Lane LOS			A	B		
Approach Delay (s)	0.0	0.5	10.1			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			18.8%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2030 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	93	0	9	72	0	24
Future Volume (vph)	93	0	9	72	0	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.994		
Satd. Flow (prot)	1695	0	0	1712	1272	0
Flt Permitted				0.994		
Satd. Flow (perm)	1695	0	0	1712	1272	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			13.3	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	0%	22%	1%	0%	21%
Adj. Flow (vph)	93	0	9	72	0	24
Shared Lane Traffic (%)						
Lane Group Flow (vph)	93	0	0	81	24	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	21.2%
Analysis Period (min)	15
	ICU Level of Service A



HCM Unsignalized Intersection Capacity Analysis  
8: Site Access C & Thunder Road

2030 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	
Traffic Volume (veh/h)	93	0	9	72	0	24
Future Volume (Veh/h)	93	0	9	72	0	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	93	0	9	72	0	24
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			93	183		93
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			93	183		93
tC, single (s)			4.3	6.4		6.4
tC, 2 stage (s)						
tF (s)			2.4	3.5		3.5
p0 queue free %			99	100		97
cM capacity (veh/h)			1385	806		914
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	93	81	24			
Volume Left	0	9	0			
Volume Right	0	0	24			
cSH	1700	1385	914			
Volume to Capacity	0.05	0.01	0.03			
Queue Length 95th (m)	0.0	0.2	0.6			
Control Delay (s)	0.0	0.9	9.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.9	9.0			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.5			
Intersection Capacity Utilization			21.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Total AM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	175	38	121	1050	94	143
Future Volume (vph)	175	38	121	1050	94	143
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.976		0.879			
Flt Protected	0.961					0.981
Satd. Flow (prot)	1705	0	1530	0	0	1593
Flt Permitted	0.961					0.981
Satd. Flow (perm)	1705	0	1530	0	0	1593
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	13%	13%	1%	9%	10%
Adj. Flow (vph)	175	38	121	1050	94	143
Shared Lane Traffic (%)						
Lane Group Flow (vph)	213	0	1171	0	0	237
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	111.3%
ICU Level of Service	H
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Total AM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	175	38	121	1050	94	143
Future Volume (Veh/h)	175	38	121	1050	94	143
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	175	38	121	1050	94	143
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	977	646			1171	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	977	646			1171	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	23	92			84	
cM capacity (veh/h)	227	453			572	
<b>Direction, Lane #</b>						
	WB 1	NB 1	SB 1			
Volume Total	213	1171	237			
Volume Left	175	0	94			
Volume Right	38	1050	0			
cSH	249	1700	572			
Volume to Capacity	0.86	0.69	0.16			
Queue Length 95th (m)	55.8	0.0	4.7			
Control Delay (s)	68.5	0.0	6.3			
Lane LOS	F		A			
Approach Delay (s)	68.5	0.0	6.3			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay			9.9			
Intersection Capacity Utilization		111.3%		ICU Level of Service		H
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	22	391	48	1154	282	11
Future Volume (vph)	22	391	48	1154	282	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.995	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1281	1357	1311	1745	1583	0
Fl <sub>t</sub> Permitted	0.950		0.519			
Satd. Flow (perm)	1281	1357	716	1745	1583	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		391			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	32%	9%	29%	2%	12%	9%
Adj. Flow (vph)	22	391	48	1154	282	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	391	48	1154	293	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Total AM  
04-08-2021



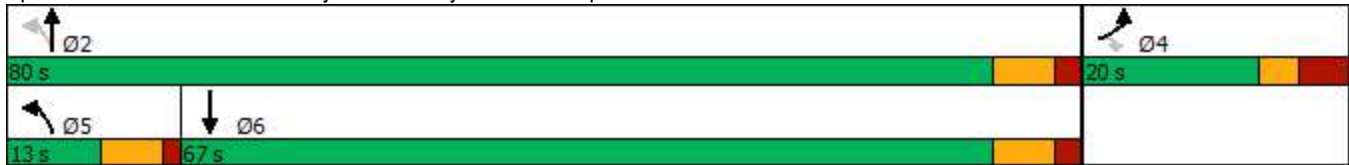
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	17.8	17.8	13.0	41.6	41.6	
Total Split (s)	20.0	20.0	13.0	80.0	67.0	
Total Split (%)	20.0%	20.0%	13.0%	80.0%	67.0%	
Maximum Green (s)	13.2	13.2	7.0	73.4	60.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	5.0	5.0		0.0	7.0	
Flash Dont Walk (s)	6.0	6.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	9.2	9.2	57.6	57.0	50.1	
Actuated g/C Ratio	0.11	0.11	0.72	0.71	0.62	
v/c Ratio	0.15	0.78	0.08	0.93	0.30	
Control Delay	40.0	16.5	3.6	24.9	9.0	
Queue Delay	0.0	0.0	0.0	0.1	0.0	
Total Delay	40.0	16.5	3.6	25.0	9.0	
LOS	D	B	A	C	A	
Approach Delay	17.7			24.1	9.0	
Approach LOS	B			C	A	
Queue Length 50th (m)	3.3	0.0	1.5	109.4	21.6	
Queue Length 95th (m)	11.5	#34.6	5.0	#298.7	41.7	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	221	558	568	1536	1225	
Starvation Cap Reductn	0	0	0	34	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.10	0.70	0.08	0.77	0.24	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	80.3
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.93
Intersection Signal Delay:	20.4
Intersection LOS:	C
Intersection Capacity Utilization:	81.1%
ICU Level of Service:	D
Analysis Period (min):	15






















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

Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal



Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Total AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	20	11	4	7	31	25	1105	36	236	299	138
Future Volume (vph)	67	20	11	4	7	31	25	1105	36	236	299	138
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		35.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.985				0.850			0.850		0.953	
Fl <sub>t</sub> Protected		0.967			0.982		0.950			0.950		
Satd. Flow (prot)	0	1543	0	0	1748	1513	1589	1728	1479	1653	1463	0
Fl <sub>t</sub> Permitted		0.789			0.896		0.509			0.066		
Satd. Flow (perm)	0	1259	0	0	1595	1513	852	1728	1479	115	1463	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				100			96			54
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	0%	9%	0%	0%	0%	4%	3%	0%	0%	15%	18%
Adj. Flow (vph)	67	20	11	4	7	31	25	1105	36	236	299	138
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	98	0	0	11	31	25	1105	36	236	437	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Total AM  
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	24.8	24.8		24.8	24.8	24.8	60.5	60.5	60.5	14.7	75.2	
Total Split (%)	24.8%	24.8%		24.8%	24.8%	24.8%	60.5%	60.5%	60.5%	14.7%	75.2%	
Maximum Green (s)	19.0	19.0		19.0	19.0	19.0	54.3	54.3	54.3	8.7	69.0	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		12.1			12.1	12.1	54.8	54.8	54.8	69.9	71.2	
Actuated g/C Ratio		0.13			0.13	0.13	0.60	0.60	0.60	0.77	0.78	
v/c Ratio		0.57			0.05	0.11	0.05	1.06	0.04	1.00	0.38	
Control Delay		48.5			34.8	0.7	10.0	67.1	0.1	84.7	5.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		48.5			34.8	0.7	10.0	67.1	0.1	84.7	5.2	
LOS		D			C	A	A	E	A	F	A	
Approach Delay		48.5			9.7			63.8			33.1	
Approach LOS		D			A			E			C	
Queue Length 50th (m)		16.6			1.9	0.0	1.9	~238.2	0.0	~32.7	21.0	
Queue Length 95th (m)		32.9			6.8	0.0	6.3	#347.4	0.0	#88.3	46.2	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0		7.5	100.0		
Base Capacity (vph)		270			336	398	514	1043	930	237	1158	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.36			0.03	0.08	0.05	1.06	0.04	1.00	0.38	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	90.8
Natural Cycle:	140
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	1.06
Intersection Signal Delay:	51.4
Intersection LOS:	D
Intersection Capacity Utilization:	102.6%
ICU Level of Service:	G
Analysis Period (min):	15



Lanes, Volumes, Timings  
 3: Boundary Road & Thunder Road/Amazon Way

2035 Future Total AM  
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
















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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way

↙ Ø1	↖ Ø2	→ Ø4
14.7 s	60.5 s	24.8 s
↓ Ø6		↖ Ø8
75.2 s		24.8 s



















Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access

2035 Future Total AM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	5	7	0	4	15	1161	7	1	297	16
Future Volume (vph)	1	0	5	7	0	4	15	1161	7	1	297	16
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.887			0.951			0.999			0.992	
Fl <sub>t</sub> Protected		0.992			0.969		0.950			0.950		
Satd. Flow (prot)	0	1566	0	0	820	0	1691	1750	0	846	1585	0
Fl <sub>t</sub> Permitted		0.992			0.969		0.950			0.950		
Satd. Flow (perm)	0	1566	0	0	820	0	1691	1750	0	846	1585	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	1%	100%	100%	12%	0%
Adj. Flow (vph)	1	0	5	7	0	4	15	1161	7	1	297	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	0	0	11	0	15	1168	0	1	313	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	
<b>Intersection Summary</b>												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	74.9%						ICU Level of Service D					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2035 Future Total AM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	7	0	4	15	1161	7	1	297	16
Future Volume (Veh/h)	1	0	5	7	0	4	15	1161	7	1	297	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	5	7	0	4	15	1161	7	1	297	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)											175	
pX, platoon unblocked												
vC, conflicting volume	1502	1505	305	1498	1510	1164	313			1168		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1502	1505	305	1498	1510	1164	313			1168		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	99	100	99	88	100	97	99			100		
cM capacity (veh/h)	97	121	740	60	120	153	1259			352		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	6	11	15	1168	1	313						
Volume Left	1	7	15	0	1	0						
Volume Right	5	4	0	7	0	16						
cSH	352	77	1259	1700	352	1700						
Volume to Capacity	0.02	0.14	0.01	0.69	0.00	0.18						
Queue Length 95th (m)	0.4	3.8	0.3	0.0	0.1	0.0						
Control Delay (s)	15.4	59.3	7.9	0.0	15.3	0.0						
Lane LOS	C	F	A		C							
Approach Delay (s)	15.4	59.3	0.1		0.0							
Approach LOS	C	F										
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			74.9%		ICU Level of Service					D		
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2035 Future Total AM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	100	36	163	1073	158	131
Future Volume (vph)	100	36	163	1073	158	131
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.993		
Satd. Flow (prot)	1489	1297	0	1734	1575	1293
Fl <sub>t</sub> Permitted	0.950			0.993		
Satd. Flow (perm)	1489	1297	0	1734	1575	1293
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	11%	14%	8%	1%	13%	17%
Adj. Flow (vph)	100	36	163	1073	158	131
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	36	0	1236	158	131
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	93.7%
ICU Level of Service	F
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2035 Future Total AM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	100	36	163	1073	158	131
Future Volume (Veh/h)	100	36	163	1073	158	131
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	36	163	1073	158	131
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1557	158	289			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1557	158	289			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	3	96	87			
cM capacity (veh/h)	103	857	1239			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	100	36	1236	158	131	
Volume Left	100	0	163	0	0	
Volume Right	0	36	0	0	131	
cSH	103	857	1239	1700	1700	
Volume to Capacity	0.97	0.04	0.13	0.09	0.08	
Queue Length 95th (m)	47.7	1.1	3.6	0.0	0.0	
Control Delay (s)	158.6	9.4	3.7	0.0	0.0	
Lane LOS	F	A	A			
Approach Delay (s)	119.1		3.7	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			12.5			
Intersection Capacity Utilization			93.7%	ICU Level of Service		F
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2035 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	78	0	51	119	0	19
Future Volume (vph)	78	0	51	119	0	19
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.985		
Satd. Flow (prot)	1589	0	0	1519	1466	0
Flt Permitted				0.985		
Satd. Flow (perm)	1589	0	0	1519	1466	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			14.3	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	12%	0%	0%	22%	0%	5%
Adj. Flow (vph)	78	0	51	119	0	19
Shared Lane Traffic (%)						
Lane Group Flow (vph)	78	0	0	170	19	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	26.3%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2035 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↘	↙
Traffic Volume (veh/h)	78	0	51	119	0	19
Future Volume (Veh/h)	78	0	51	119	0	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	78	0	51	119	0	19
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			78	299		78
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			78	299		78
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			97	100	98	
cM capacity (veh/h)			1533	673	974	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	78	170	19			
Volume Left	0	51	0			
Volume Right	0	0	19			
cSH	1700	1533	974			
Volume to Capacity	0.05	0.03	0.02			
Queue Length 95th (m)	0.0	0.8	0.5			
Control Delay (s)	0.0	2.4	8.8			
Lane LOS			A		A	
Approach Delay (s)	0.0	2.4	8.8			
Approach LOS			A			
Intersection Summary						
Average Delay			2.2			
Intersection Capacity Utilization			26.3%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2035 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	74	0	15	104	0	4
Future Volume (vph)	74	0	15	104	0	4
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.994		
Satd. Flow (prot)	1664	0	0	1448	770	0
Flt Permitted				0.994		
Satd. Flow (perm)	1664	0	0	1448	770	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			11.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	7%	0%	100%	11%	0%	100%
Adj. Flow (vph)	74	0	15	104	0	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	74	0	0	119	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	23.3%
Analysis Period (min)	15
	ICU Level of Service A



HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2035 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Traffic Volume (veh/h)	74	0	15	104	0	4
Future Volume (Veh/h)	74	0	15	104	0	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	74	0	15	104	0	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			74	208		74
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			74	208		74
tC, single (s)			5.1	6.4		7.2
tC, 2 stage (s)						
tF (s)			3.1	3.5		4.2
p0 queue free %			99	100		99
cM capacity (veh/h)			1079	774		772
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	74	119	4			
Volume Left	0	15	0			
Volume Right	0	0	4			
cSH	1700	1079	772			
Volume to Capacity	0.04	0.01	0.01			
Queue Length 95th (m)	0.0	0.3	0.1			
Control Delay (s)	0.0	1.2	9.7			
Lane LOS			A		A	
Approach Delay (s)	0.0	1.2	9.7			
Approach LOS			A			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			23.3%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2035 Future Total AM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	67	0	23	81	0	7
Future Volume (vph)	67	0	23	81	0	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected				0.989		
Satd. Flow (prot)	1679	0	0	1596	1351	0
Flt Permitted				0.989		
Satd. Flow (perm)	1679	0	0	1596	1351	0
Link Speed (k/h)	60			50	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			13.3	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	0%	22%	7%	0%	14%
Adj. Flow (vph)	67	0	23	81	0	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	67	0	0	104	7	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.5%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
8: Site Access C & Thunder Road

2035 Future Total AM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	67	0	23	81	0	7
Future Volume (Veh/h)	67	0	23	81	0	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	67	0	23	81	0	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			67		194	67
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			67		194	67
tC, single (s)			4.3		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.4
p0 queue free %			98		100	99
cM capacity (veh/h)			1416		786	964
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	67	104	7			
Volume Left	0	23	0			
Volume Right	0	0	7			
cSH	1700	1416	964			
Volume to Capacity	0.04	0.02	0.01			
Queue Length 95th (m)	0.0	0.4	0.2			
Control Delay (s)	0.0	1.8	8.8			
Lane LOS			A			
Approach Delay (s)	0.0	1.8	8.8			
Approach LOS			A			
Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization			22.5%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Total PM  
 04-08-2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	69	1	196	378	30	152
Future Volume (vph)	69	1	196	378	30	152
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	4.5	4.5	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	10.0		0.0	0.0	
Storage Lanes	1	0		0	0	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998		0.911			
Flt Protected	0.953					0.992
Satd. Flow (prot)	1548	0	1520	0	0	1625
Flt Permitted	0.953					0.992
Satd. Flow (perm)	1548	0	1520	0	0	1625
Link Speed (k/h)	40		80			80
Link Distance (m)	155.0		545.7			134.1
Travel Time (s)	14.0		24.6			6.0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	22%	0%	6%	7%	7%	9%
Adj. Flow (vph)	69	1	196	378	30	152
Shared Lane Traffic (%)						
Lane Group Flow (vph)	70	0	574	0	0	182
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	4.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	0.95	0.95	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	46.3%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
 1: Boundary Road & Hwy 417 WB Ramp Terminal

2035 Future Total PM  
 04-08-2021



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	69	1	196	378	30	152
Future Volume (Veh/h)	69	1	196	378	30	152
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	69	1	196	378	30	152
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	597	385			574	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	597	385			574	
tC, single (s)	6.6	6.2			4.2	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.3	
p0 queue free %	84	100			97	
cM capacity (veh/h)	421	667			975	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	70	574	182			
Volume Left	69	0	30			
Volume Right	1	378	0			
cSH	423	1700	975			
Volume to Capacity	0.17	0.34	0.03			
Queue Length 95th (m)	4.7	0.0	0.8			
Control Delay (s)	15.2	0.0	1.7			
Lane LOS	C		A			
Approach Delay (s)	15.2	0.0	1.7			
Approach LOS	C					
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization			46.3%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	94	900	210	360	275	20
Future Volume (vph)	94	900	210	360	275	20
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	0.0	25.0	50.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	7.5		75.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850			0.991	
Fl <sub>t</sub> Protected	0.950		0.950			
Satd. Flow (prot)	1551	1422	1496	1618	1582	0
Fl <sub>t</sub> Permitted	0.950		0.412			
Satd. Flow (perm)	1551	1422	649	1618	1582	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		520			4	
Link Speed (k/h)	40			80	80	
Link Distance (m)	154.2			243.1	545.7	
Travel Time (s)	13.9			10.9	24.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	4%	13%	10%	12%	5%
Adj. Flow (vph)	94	900	210	360	275	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	94	900	210	360	295	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	pm+pt	NA	NA	

Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Total PM  
 04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Detector Phase	4	4	5	2	6	
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	35.0	35.0	
Minimum Split (s)	23.0	23.0	13.0	41.6	41.6	
Total Split (s)	44.0	44.0	13.0	56.0	43.0	
Total Split (%)	44.0%	44.0%	13.0%	56.0%	43.0%	
Maximum Green (s)	37.2	37.2	7.0	49.4	36.4	
Yellow Time (s)	3.0	3.0	4.6	4.6	4.6	
All-Red Time (s)	3.8	3.8	1.4	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.8	6.8	6.0	6.6	6.6	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	Min	Min	
Walk Time (s)	7.0	7.0		0.0	7.0	
Flash Dont Walk (s)	5.0	5.0		0.0	21.0	
Pedestrian Calls (#/hr)	0	0		0	0	
Act Effct Green (s)	37.2	37.2	48.6	48.0	35.0	
Actuated g/C Ratio	0.38	0.38	0.49	0.49	0.35	
v/c Ratio	0.16	1.05	0.55	0.46	0.52	
Control Delay	21.3	58.3	21.6	19.1	28.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	21.3	58.3	21.6	19.1	28.9	
LOS	C	E	C	B	C	
Approach Delay	54.8			20.0	28.9	
Approach LOS	D			C	C	
Queue Length 50th (m)	12.3	~127.1	23.9	45.9	45.7	
Queue Length 95th (m)	23.7	#203.5	39.7	70.5	72.2	
Internal Link Dist (m)	130.2			219.1	521.7	
Turn Bay Length (m)		25.0	50.0			
Base Capacity (vph)	585	860	380	810	586	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.16	1.05	0.55	0.44	0.50	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	98.6
Natural Cycle:	100
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	1.05
Intersection Signal Delay:	40.0
Intersection LOS:	D
Intersection Capacity Utilization:	99.2%
ICU Level of Service:	F
Analysis Period (min):	15

Lanes, Volumes, Timings  
 2: Boundary Road & Hwy 417 EB Ramp Terminal

2035 Future Total PM  
 04-08-2021

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






















Splits and Phases: 2: Boundary Road & Hwy 417 EB Ramp Terminal





Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Total PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	166	0	38	7	0	22	11	381	0	3	1072	100
Future Volume (vph)	166	0	38	7	0	22	11	381	0	3	1072	100
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.5
Storage Length (m)	0.0		15.0	0.0		0.0	35.0		7.5	100.0		0.0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (m)	7.5			7.5			45.0			75.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.975				0.850						0.987
Flt Protected		0.961			0.950		0.950			0.950		
Satd. Flow (prot)	0	1455	0	0	1183	1513	1517	1633	1740	990	1685	0
Flt Permitted		0.761			0.761		0.121			0.471		
Satd. Flow (perm)	0	1152	0	0	947	1513	193	1633	1740	491	1685	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100				100						11
Link Speed (k/h)		60			20			80				80
Link Distance (m)		198.6			170.6			174.7				243.1
Travel Time (s)		11.9			30.7			7.9				10.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	18%	0%	0%	43%	0%	0%	9%	9%	0%	67%	4%	7%
Adj. Flow (vph)	166	0	38	7	0	22	11	381	0	3	1072	100
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	204	0	0	7	22	11	381	0	3	1172	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.12	1.09	1.12	1.12	1.09	1.09
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings  
3: Boundary Road & Thunder Road/Amazon Way

2035 Future Total PM  
04-08-2021



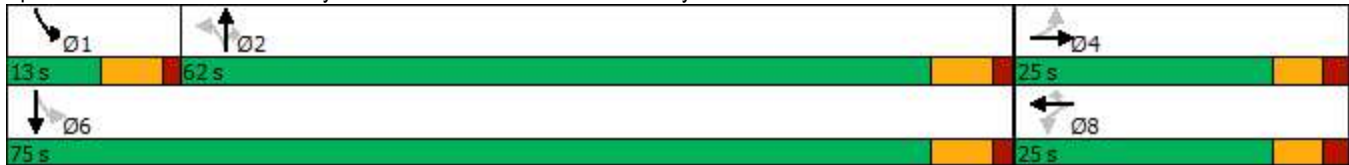
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	20.0	20.0	20.0	7.0	20.0	
Minimum Split (s)	24.8	24.8		24.8	24.8	24.8	26.2	26.2	26.2	13.0	26.2	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	62.0	62.0	62.0	13.0	75.0	
Total Split (%)	25.0%	25.0%		25.0%	25.0%	25.0%	62.0%	62.0%	62.0%	13.0%	75.0%	
Maximum Green (s)	19.2	19.2		19.2	19.2	19.2	55.8	55.8	55.8	7.0	68.8	
Yellow Time (s)	3.7	3.7		3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6	
All-Red Time (s)	2.1	2.1		2.1	2.1	2.1	1.6	1.6	1.6	1.4	1.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.8			5.8	5.8	6.2	6.2	6.2	6.0	6.2	
Lead/Lag							Lag	Lag	Lag	Lead		
Lead-Lag Optimize?							Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min	Min	None	Min	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0		7.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0	12.0	10.0	10.0	10.0		10.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0		0	
Act Effct Green (s)		14.0			14.0	14.0	66.5	66.5		69.2	69.0	
Actuated g/C Ratio		0.15			0.15	0.15	0.70	0.70		0.73	0.73	
v/c Ratio		0.80			0.05	0.07	0.08	0.33		0.01	0.96	
Control Delay		43.3			34.3	0.5	10.0	8.2		4.7	31.7	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	6.2	
Total Delay		43.3			34.3	0.5	10.0	8.2		4.7	37.9	
LOS		D			C	A	A	A		A	D	
Approach Delay		43.3			8.6			8.3			37.8	
Approach LOS		D			A			A			D	
Queue Length 50th (m)		19.4			1.2	0.0	0.6	23.1		0.2	177.1	
Queue Length 95th (m)		#50.4			5.2	0.0	4.3	64.3		1.0	#332.9	
Internal Link Dist (m)		174.6			146.6			150.7			219.1	
Turn Bay Length (m)							35.0			100.0		
Base Capacity (vph)		313			191	386	135	1143		394	1226	
Starvation Cap Reductn		0			0	0	0	0		0	48	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.65			0.04	0.06	0.08	0.33		0.01	0.99	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	95
Natural Cycle:	100
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.96
Intersection Signal Delay:	31.6
Intersection LOS:	C
Intersection Capacity Utilization:	94.8%
ICU Level of Service:	F
Analysis Period (min):	15



















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

Splits and Phases: 3: Boundary Road & Thunder Road/Amazon Way






















Lanes, Volumes, Timings  
4: Boundary Road & Site Access/South Amazon Access

2035 Future Total PM  
04-08-2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	15	7	0	15	5	373	7	16	1093	7
Future Volume (vph)	4	0	15	7	0	15	5	373	7	16	1093	7
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	70.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.5			7.5			45.0			45.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.893			0.908			0.997			0.999	
Flt Protected		0.990			0.984		0.950			0.950		
Satd. Flow (prot)	0	1574	0	0	795	0	1691	1662	0	846	1744	0
Flt Permitted		0.990			0.984		0.950			0.950		
Satd. Flow (perm)	0	1574	0	0	795	0	1691	1662	0	846	1744	0
Link Speed (k/h)		50			20			80			80	
Link Distance (m)		105.7			151.5			1150.2			174.7	
Travel Time (s)		7.6			27.3			51.8			7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	100%	0%	100%	0%	5%	100%	100%	2%	0%
Adj. Flow (vph)	4	0	15	7	0	15	5	373	7	16	1093	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	22	0	5	380	0	16	1100	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.07
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Free			Free	
<b>Intersection Summary</b>												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	71.2%						ICU Level of Service C					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis  
 4: Boundary Road & Site Access/South Amazon Access

2035 Future Total PM  
 04-08-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	15	7	0	15	5	373	7	16	1093	7
Future Volume (Veh/h)	4	0	15	7	0	15	5	373	7	16	1093	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	0	15	7	0	15	5	373	7	16	1093	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
								None				None
Median storage veh												
Upstream signal (m)												
												175
pX, platoon unblocked	0.29	0.29	0.29	0.29	0.29		0.29					
vC, conflicting volume	1526	1518	1096	1526	1518	376	1100			380		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1592	1564	101	1592	1564	376	113			380		
tC, single (s)	7.1	6.5	6.2	8.1	6.5	7.2	4.1			5.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.4	4.0	4.2	2.2			3.1		
p0 queue free %	83	100	95	49	100	97	99			98		
cM capacity (veh/h)	24	31	277	14	31	499	429			795		
Direction, Lane #												
	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	19	22	5	380	16	1100						
Volume Left	4	7	5	0	16	0						
Volume Right	15	15	0	7	0	7						
cSH	86	41	429	1700	795	1700						
Volume to Capacity	0.22	0.54	0.01	0.22	0.02	0.65						
Queue Length 95th (m)	6.2	15.4	0.3	0.0	0.5	0.0						
Control Delay (s)	58.5	168.7	13.5	0.0	9.6	0.0						
Lane LOS	F	F	B		A							
Approach Delay (s)	58.5	168.7	0.2		0.1							
Approach LOS	F	F										
Intersection Summary												
Average Delay			3.3									
Intersection Capacity Utilization			71.2%		ICU Level of Service					C		
Analysis Period (min)			15									

Lanes, Volumes, Timings  
5: Boundary Road & Mitch Owens Road

2035 Future Total PM  
04-08-2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	156	132	70	168	975	160
Future Volume (vph)	156	132	70	168	975	160
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.3	3.3	3.5	3.5	3.5	3.5
Storage Length (m)	25.0	0.0	0.0			30.0
Storage Lanes	1	1	0			1
Taper Length (m)	47.5		7.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected	0.950			0.986		
Satd. Flow (prot)	1463	1395	0	1664	1762	1351
Fl <sub>t</sub> Permitted	0.950			0.986		
Satd. Flow (perm)	1463	1395	0	1664	1762	1351
Link Speed (k/h)	80			80	80	
Link Distance (m)	180.5			135.8	1150.2	
Travel Time (s)	8.1			6.1	51.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	13%	6%	9%	4%	1%	12%
Adj. Flow (vph)	156	132	70	168	975	160
Shared Lane Traffic (%)						
Lane Group Flow (vph)	156	132	0	238	975	160
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.3			3.5	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.09	1.09	1.09	1.09
Turning Speed (k/h)	25	15	25			15
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	86.7%
ICU Level of Service	E
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis  
5: Boundary Road & Mitch Owens Road

2035 Future Total PM  
04-08-2021



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	156	132	70	168	975	160
Future Volume (Veh/h)	156	132	70	168	975	160
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	156	132	70	168	975	160
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1283	975	1135			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1283	975	1135			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	0	56	88			
cM capacity (veh/h)	152	300	591			
Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2	
Volume Total	156	132	238	975	160	
Volume Left	156	0	70	0	0	
Volume Right	0	132	0	0	160	
cSH	152	300	591	1700	1700	
Volume to Capacity	1.02	0.44	0.12	0.57	0.09	
Queue Length 95th (m)	63.1	17.1	3.2	0.0	0.0	
Control Delay (s)	138.6	26.1	4.6	0.0	0.0	
Lane LOS	F	D	A			
Approach Delay (s)	87.1		4.6	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			15.8			
Intersection Capacity Utilization			86.7%	ICU Level of Service	E	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
6: Site Access A & Thunder Road

2035 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	141	0	19	93	0	62
Future Volume (vph)	141	0	19	93	0	62
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.992		
Satd. Flow (prot)	1508	0	0	1643	1426	0
Flt Permitted				0.992		
Satd. Flow (perm)	1508	0	0	1643	1426	0
Link Speed (k/h)	60			60	50	
Link Distance (m)	163.7			198.6	103.6	
Travel Time (s)	9.8			11.9	7.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	18%	0%	0%	9%	0%	8%
Adj. Flow (vph)	141	0	19	93	0	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	141	0	0	112	62	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	28.2%
Analysis Period (min)	15
	ICU Level of Service A



HCM Unsignalized Intersection Capacity Analysis  
6: Site Access A & Thunder Road

2035 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Traffic Volume (veh/h)	141	0	19	93	0	62
Future Volume (Veh/h)	141	0	19	93	0	62
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	141	0	19	93	0	62
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	199					
pX, platoon unblocked						
vC, conflicting volume			141			141
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			141			141
tC, single (s)			4.1			6.3
tC, 2 stage (s)						
tF (s)			2.2			3.4
p0 queue free %			99			93
cM capacity (veh/h)			1455			891
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	141	112	62			
Volume Left	0	19	0			
Volume Right	0	0	62			
cSH	1700	1455	891			
Volume to Capacity	0.08	0.01	0.07			
Queue Length 95th (m)	0.0	0.3	1.8			
Control Delay (s)	0.0	1.4	9.3			
Lane LOS			A			
Approach Delay (s)	0.0	1.4	9.3			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			2.3			
Intersection Capacity Utilization			28.2%		ICU Level of Service	
Analysis Period (min)			15			
			A			

Lanes, Volumes, Timings  
7: Site Access B & Thunder Road

2035 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	126	0	5	88	0	15
Future Volume (vph)	126	0	5	88	0	15
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.997		
Satd. Flow (prot)	1648	0	0	1640	770	0
Flt Permitted				0.997		
Satd. Flow (perm)	1648	0	0	1640	770	0
Link Speed (k/h)	60			60	50	
Link Distance (m)	185.0			163.7	105.8	
Travel Time (s)	11.1			9.8	7.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	8%	0%	100%	3%	0%	100%
Adj. Flow (vph)	126	0	5	88	0	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	126	0	0	93	15	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	19.2%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
7: Site Access B & Thunder Road

2035 Future Total PM  
04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	126	0	5	88	0	15
Future Volume (Veh/h)	126	0	5	88	0	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	126	0	5	88	0	15
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	362					
pX, platoon unblocked						
vC, conflicting volume			126		224	126
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			126		224	126
tC, single (s)			5.1		6.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		3.5	4.2
p0 queue free %			100		100	98
cM capacity (veh/h)			1025		765	716
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	126	93	15			
Volume Left	0	5	0			
Volume Right	0	0	15			
cSH	1700	1025	716			
Volume to Capacity	0.07	0.00	0.02			
Queue Length 95th (m)	0.0	0.1	0.5			
Control Delay (s)	0.0	0.5	10.1			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.5	10.1			
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			0.8			
Intersection Capacity Utilization			19.2%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings  
8: Site Access C & Thunder Road

2035 Future Total PM  
04-08-2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	102	0	9	79	0	24
Future Volume (vph)	102	0	9	79	0	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt					0.865	
Flt Protected				0.995		
Satd. Flow (prot)	1695	0	0	1717	1272	0
Flt Permitted				0.995		
Satd. Flow (perm)	1695	0	0	1717	1272	0
Link Speed (k/h)	60			60	50	
Link Distance (m)	95.5			185.0	109.7	
Travel Time (s)	5.7			11.1	7.9	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	0%	22%	1%	0%	21%
Adj. Flow (vph)	102	0	9	79	0	24
Shared Lane Traffic (%)						
Lane Group Flow (vph)	102	0	0	88	24	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.5	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane						
Headway Factor	1.09	1.09	1.09	1.09	1.09	1.09
Turning Speed (k/h)		15	25		25	15
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	21.6%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis  
 8: Site Access C & Thunder Road

2035 Future Total PM  
 04-08-2021



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	
Traffic Volume (veh/h)	102	0	9	79	0	24
Future Volume (Veh/h)	102	0	9	79	0	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	102	0	9	79	0	24
<b>Pedestrians</b>						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			102		199	102
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			102		199	102
tC, single (s)			4.3		6.4	6.4
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.5
p0 queue free %			99		100	97
cM capacity (veh/h)			1374		789	904
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>			
Volume Total	102	88	24			
Volume Left	0	9	0			
Volume Right	0	0	24			
cSH	1700	1374	904			
Volume to Capacity	0.06	0.01	0.03			
Queue Length 95th (m)	0.0	0.2	0.7			
Control Delay (s)	0.0	0.8	9.1			
Lane LOS			A			
Approach Delay (s)	0.0	0.8	9.1			
Approach LOS			A			
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization			21.6%	ICU Level of Service	A	
Analysis Period (min)			15			

# FIGURES



THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA



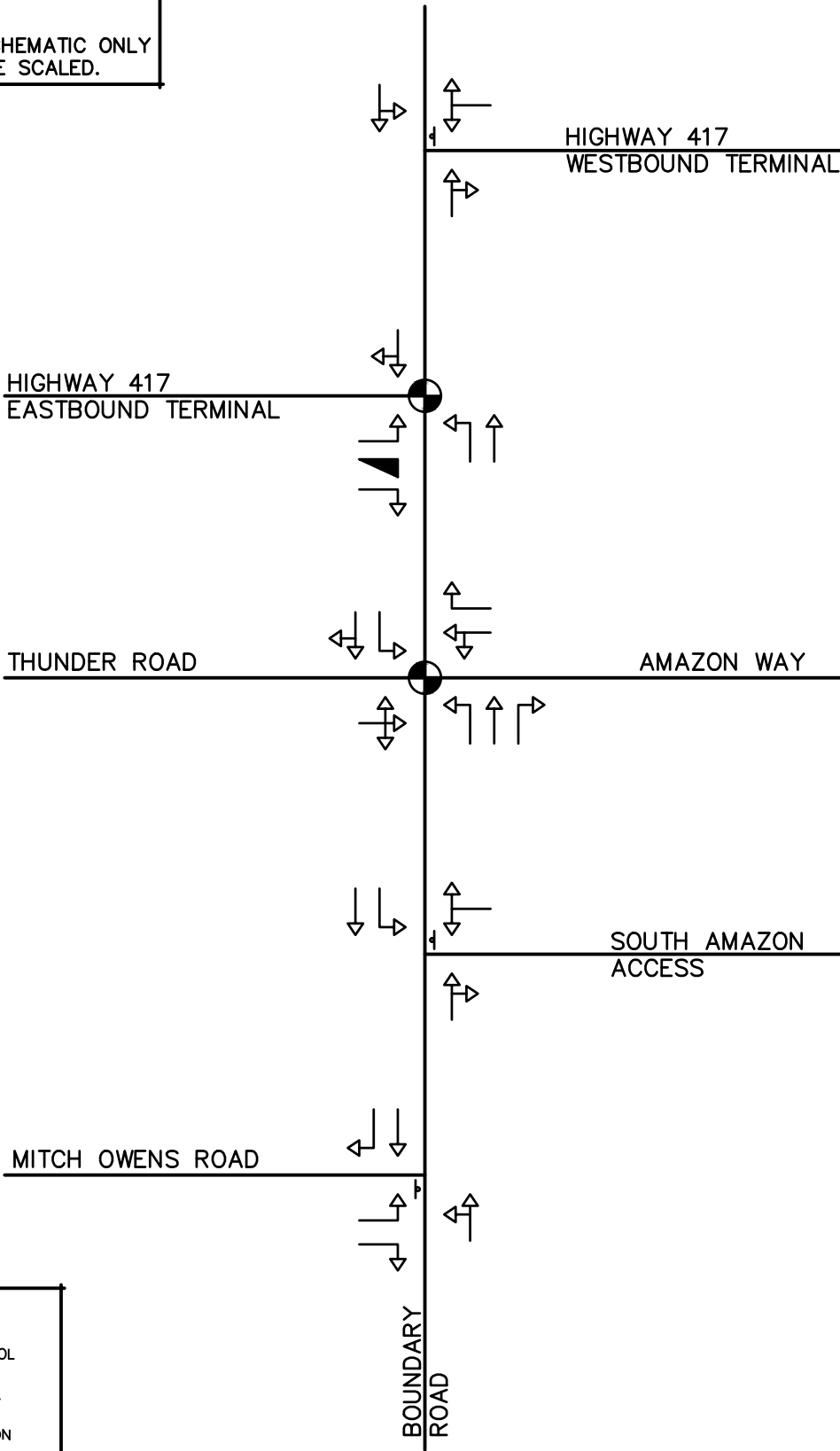
**CROZIER  
& ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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SITE LOCATION PLAN

Drawn	T.D.S.	Design	T.D.S.	Project No.	1909-5772	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. FIG. 01

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- CHANNELIZATION

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**



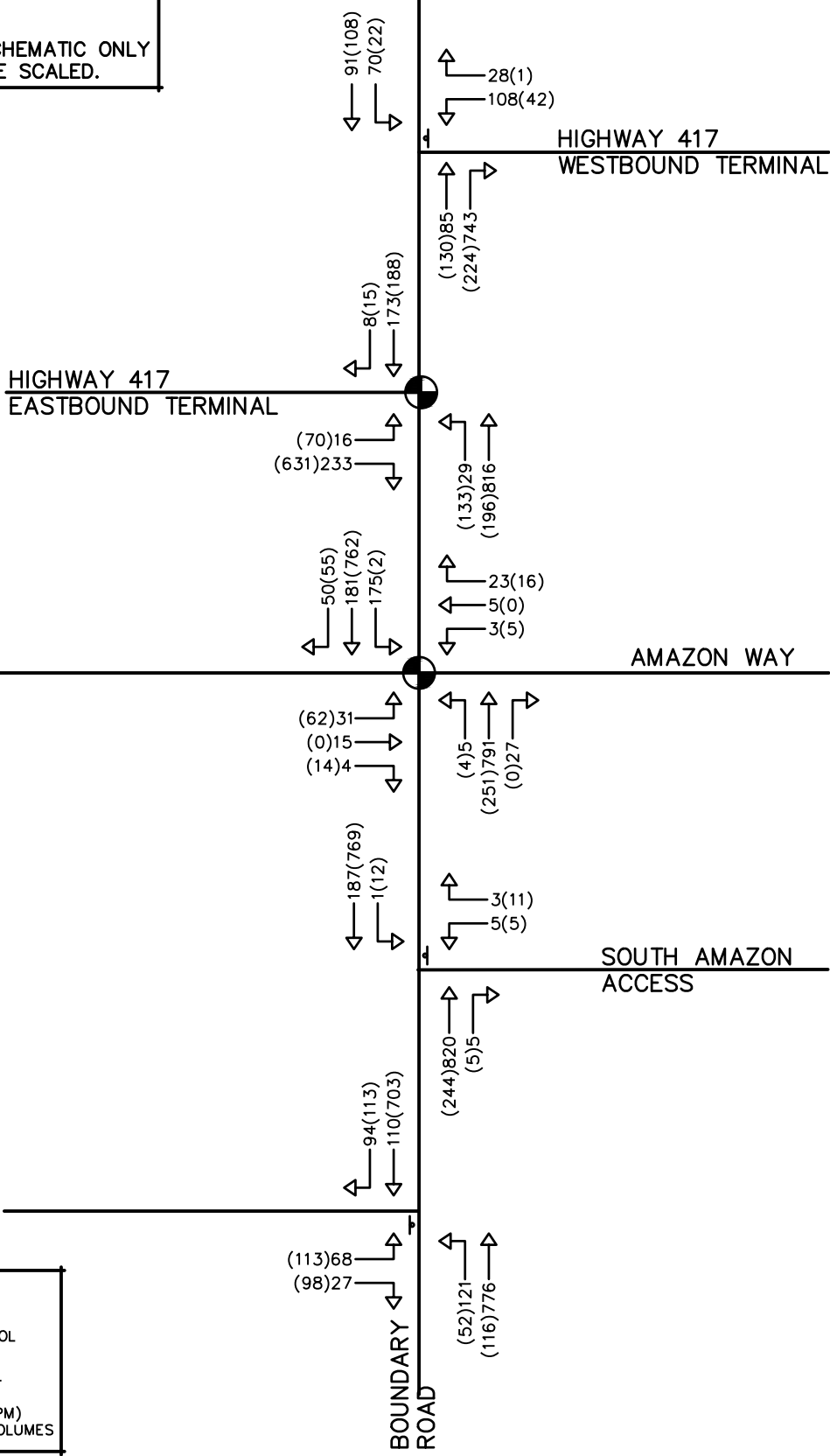
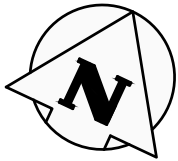
2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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**BOUNDARY ROAD NETWORK**

Drawn	T.D.S.	Design	D.L.	Project No.	<b>1909-5772</b>
Check	T.D.S.	Check	D.L.	Scale	N.T.S. Dwg. <b>FIG. 02</b>



**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

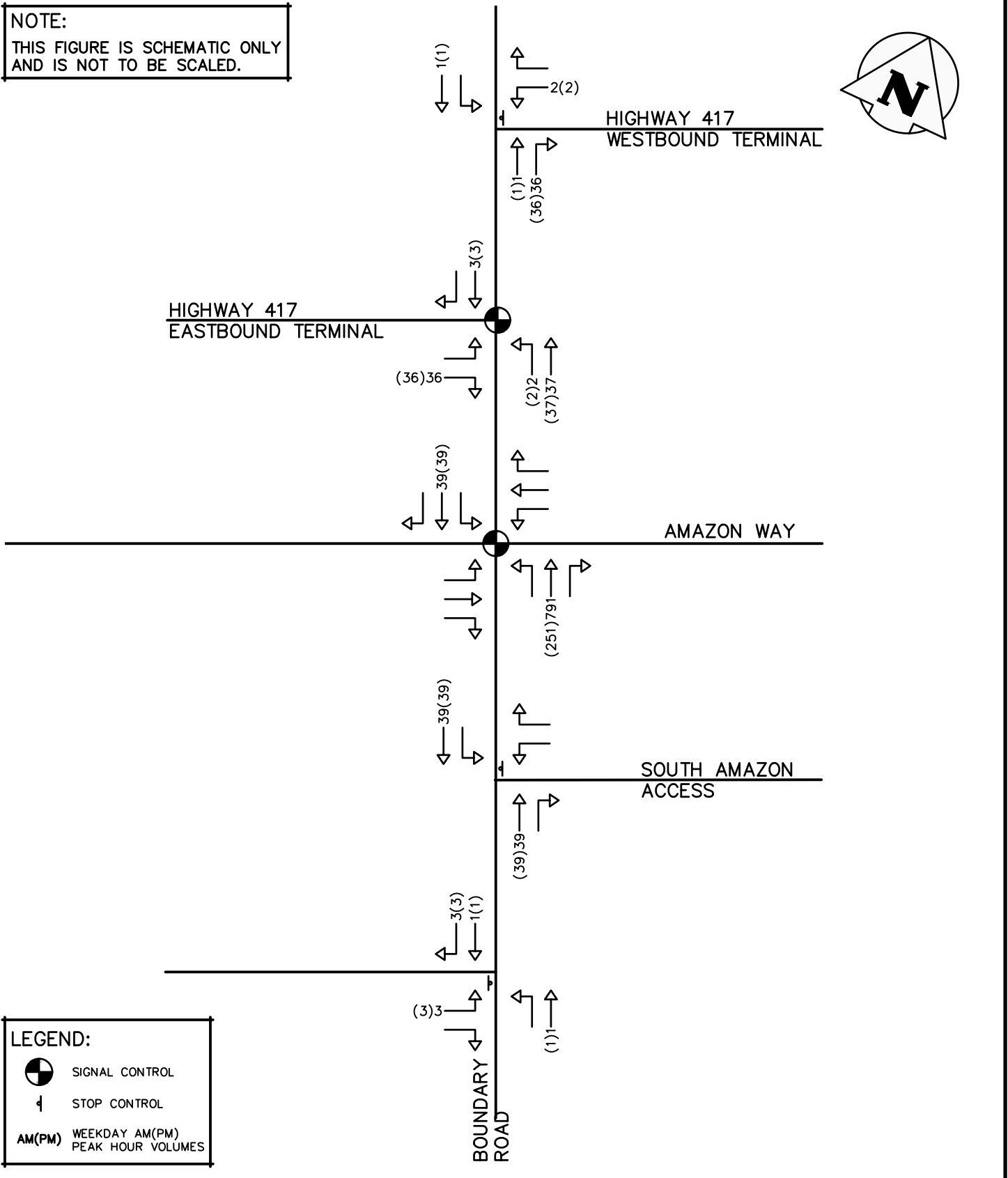
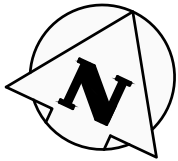
**2020 EXISTING TRAFFIC VOLUMES**



2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	<b>FIG. 03</b>

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**CRRG BACKGROUND TRIP ASSIGNMENT**

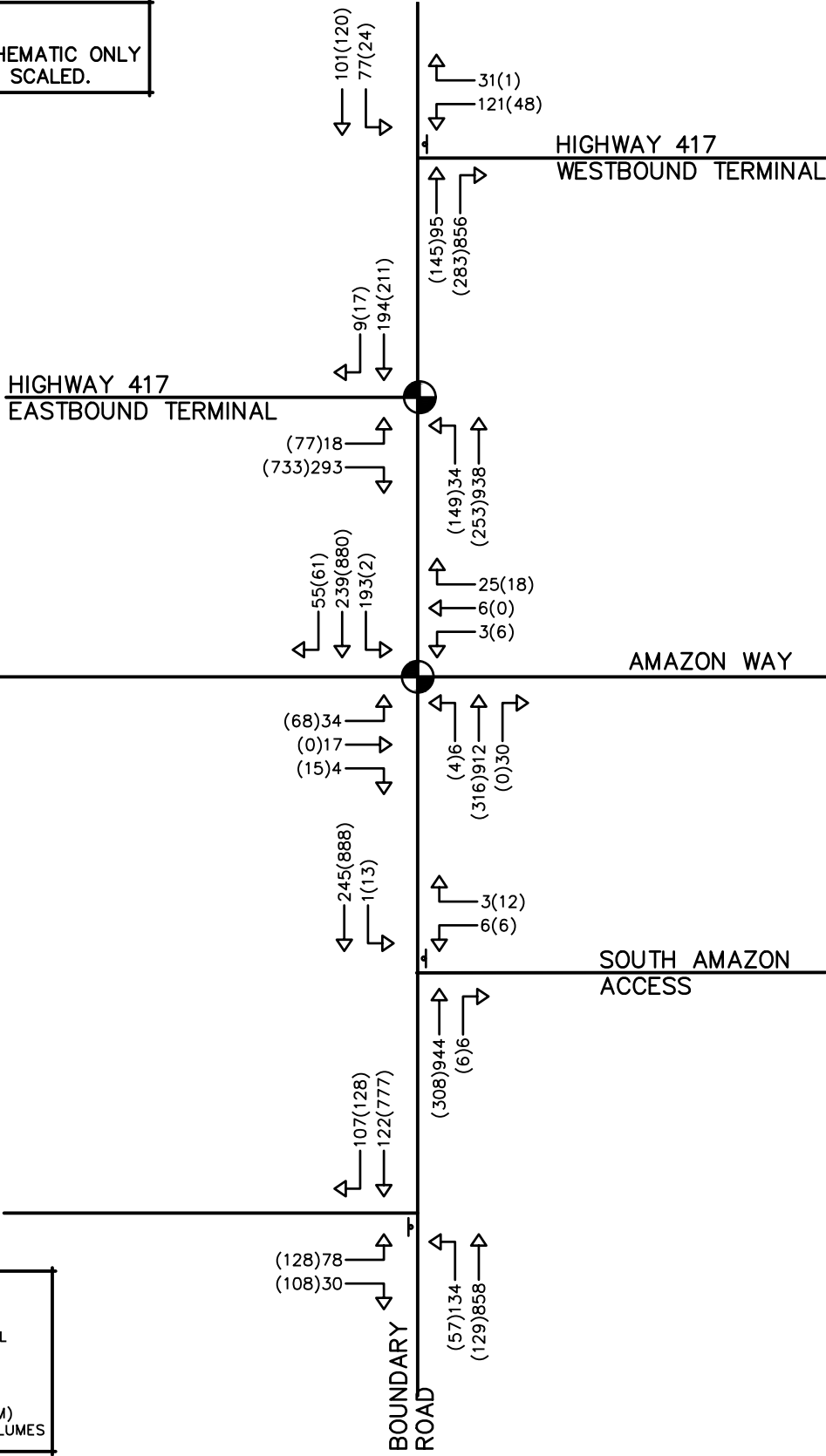
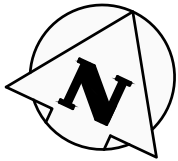


**CROZIER & ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	1909-5772	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. FIG. 04

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**2025 FUTURE BACKGROUND  
TRAFFIC VOLUMES**

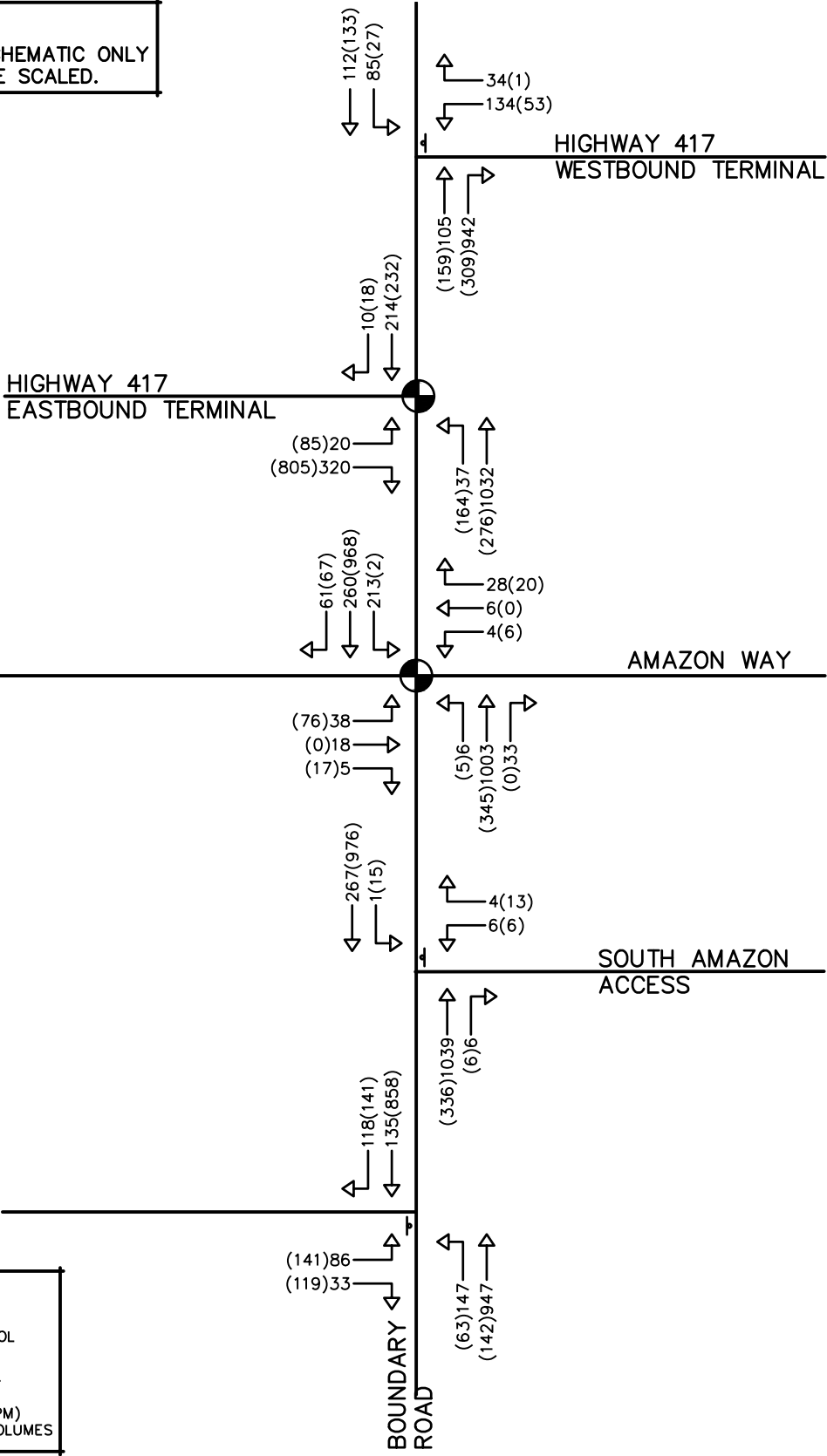
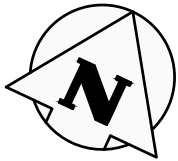


**CROZIER & ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
WWW.CFCROZIER.CA

Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. <b>FIG. 05</b>

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

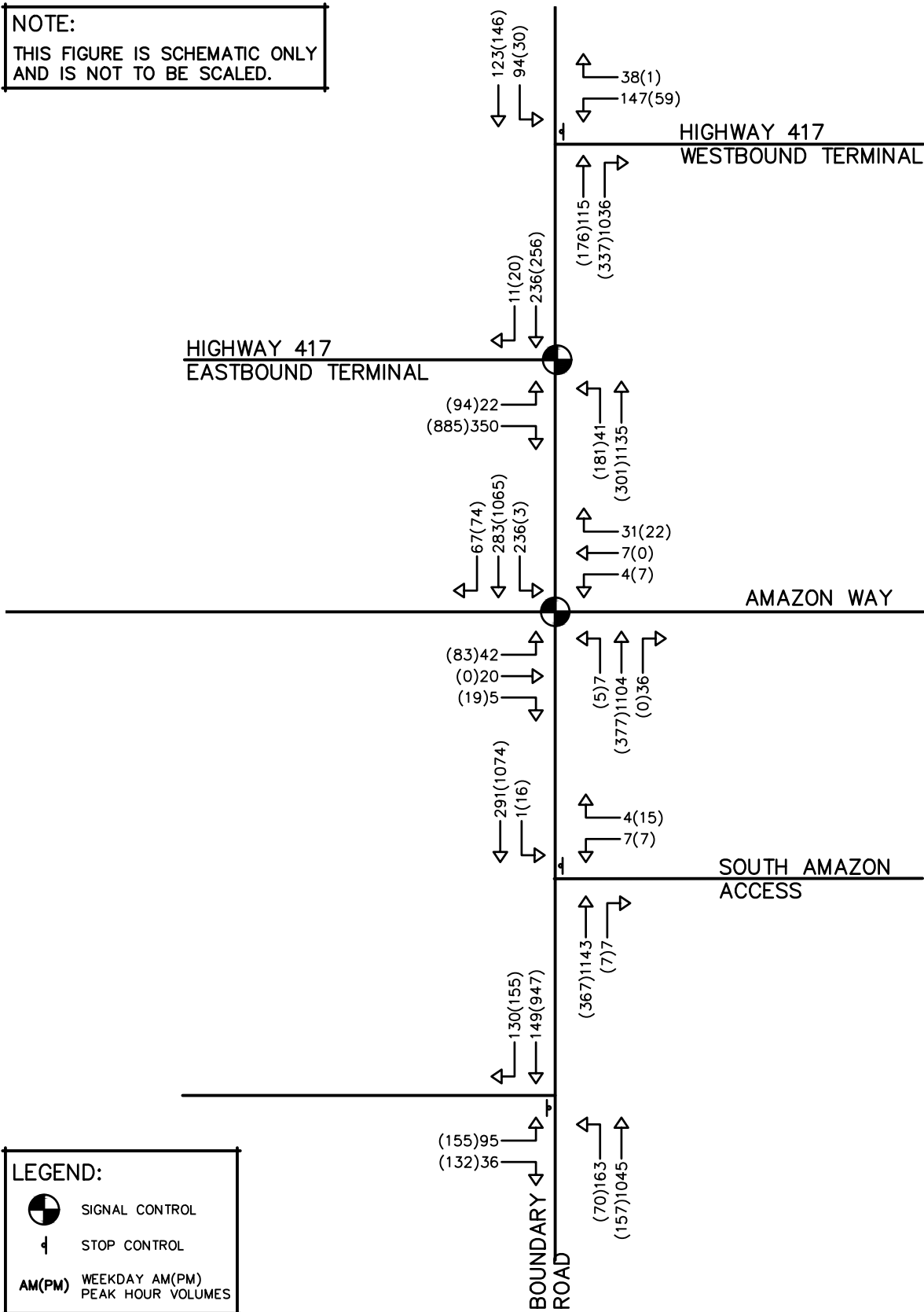
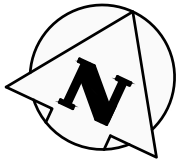
**2030 FUTURE BACKGROUND  
TRAFFIC VOLUMES**



2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	1909-5772	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. FIG. 06

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**2035 FUTURE BACKGROUND  
TRAFFIC VOLUMES**

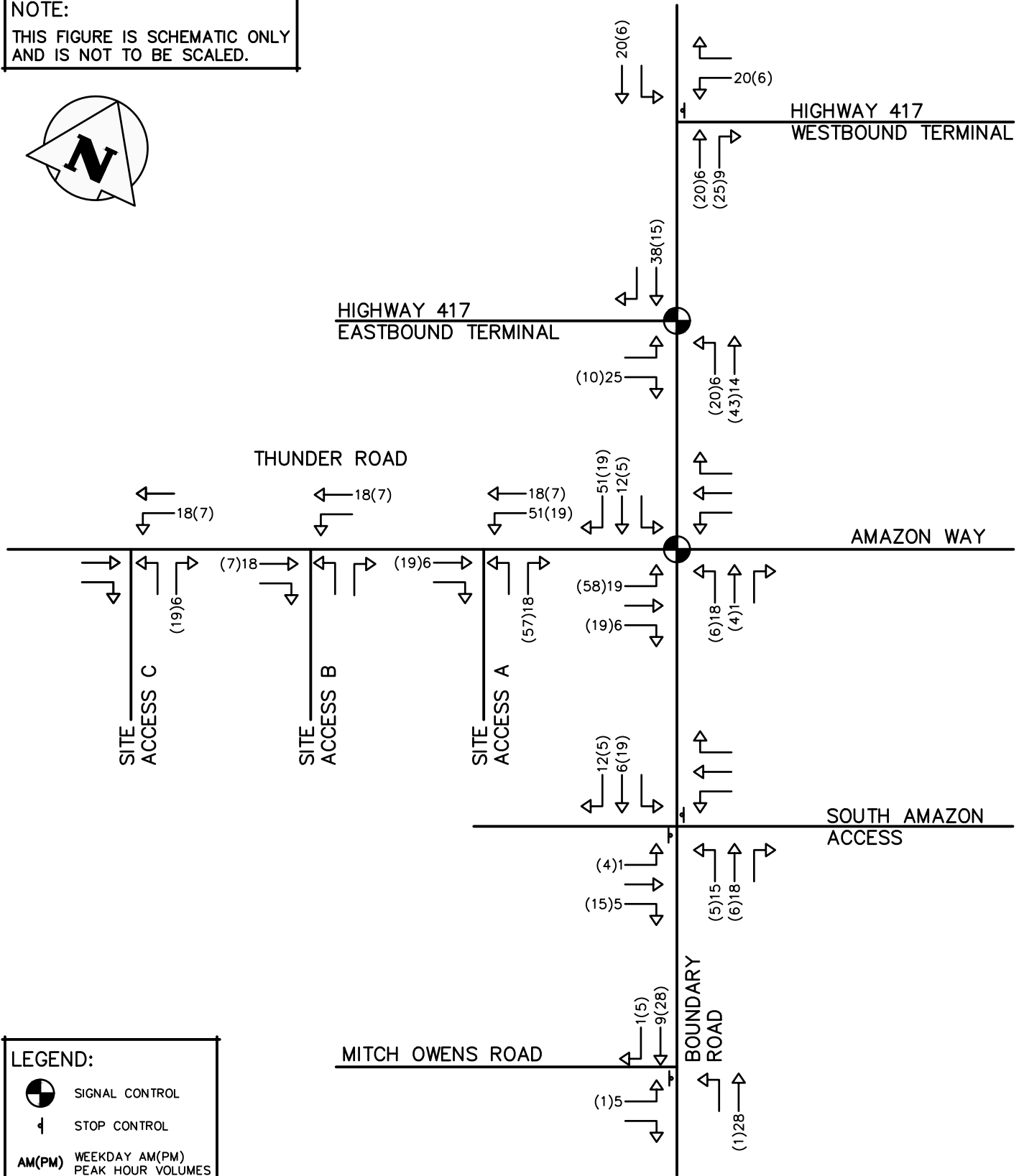
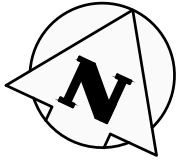


**CROZIER & ASSOCIATES**  
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2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. <b>FIG. 07</b>

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**SITE TRIP ASSIGNMENT – EMPLOYEES**

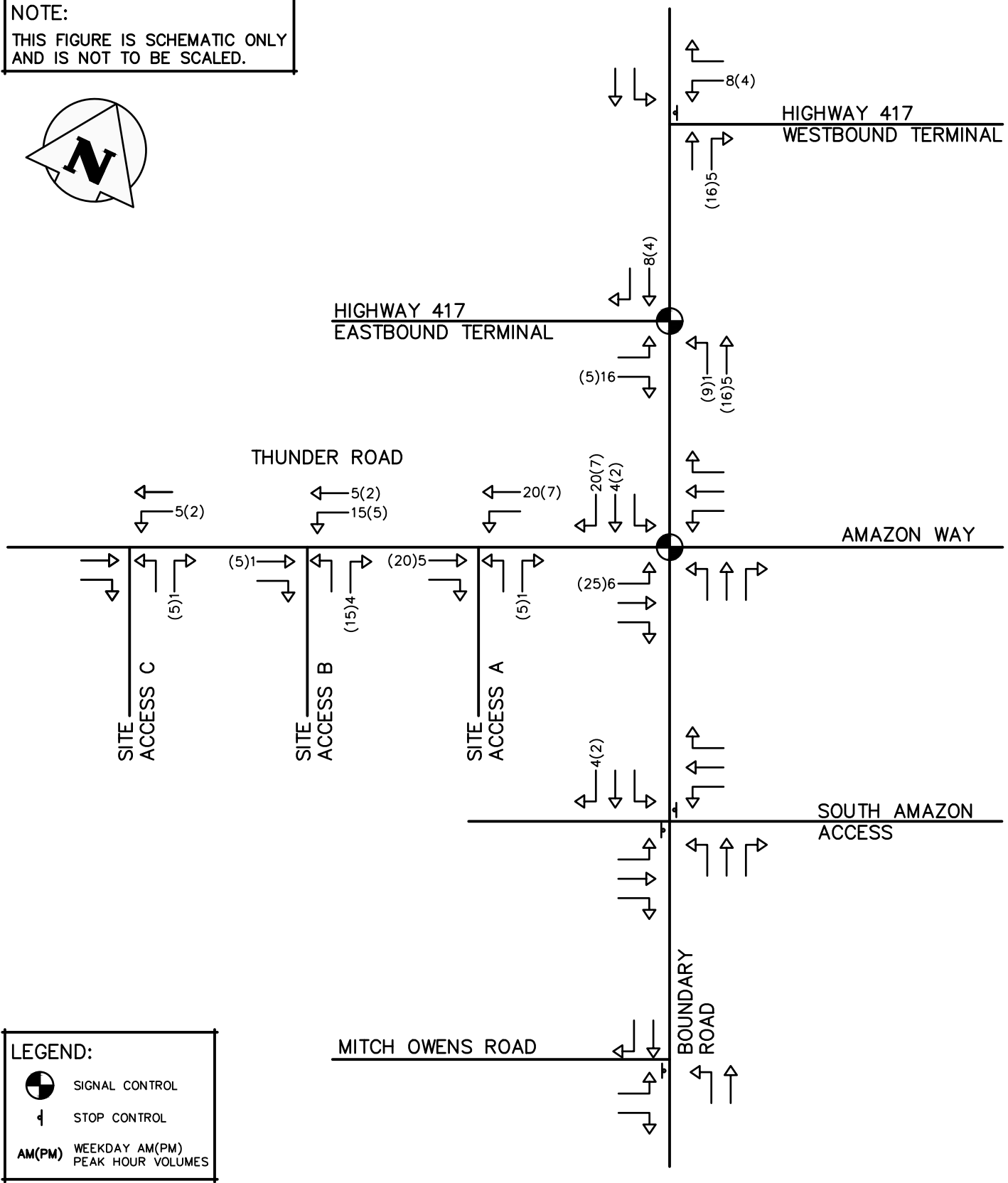


**CROZIER & ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	1909-5772	
Check	D.L.	Check	D.L.	Scale	N.T.S	
					Dwg.	FIG. 08

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

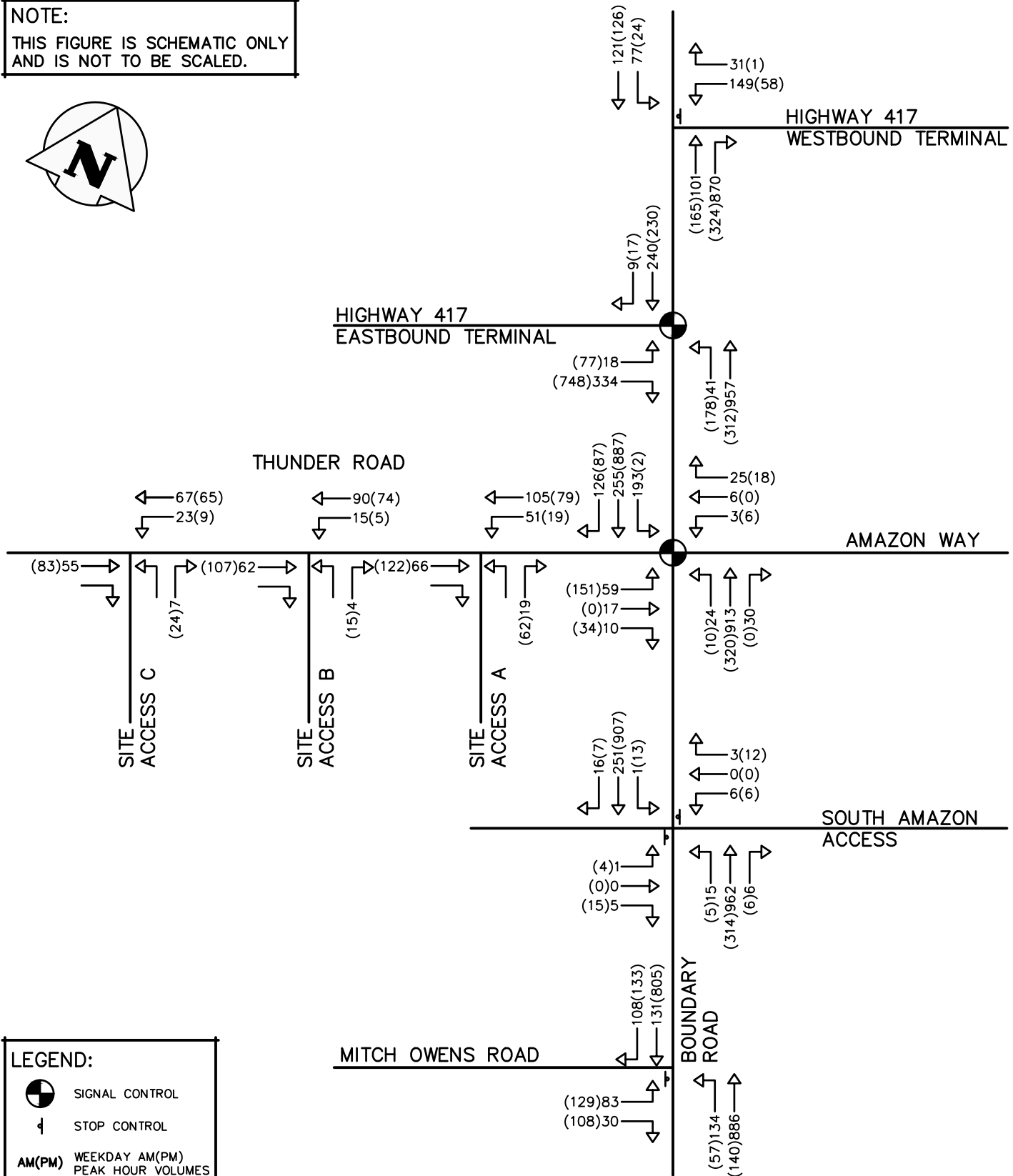
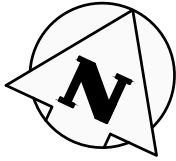
**SITE TRIP ASSIGNMENT – TRUCKS**



2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>
Check	D.L.	Check	D.L.	Scale	N.T.S
					<b>Dwg. FIG. 09</b>

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**2025 FUTURE TOTAL  
TRAFFIC VOLUMES**



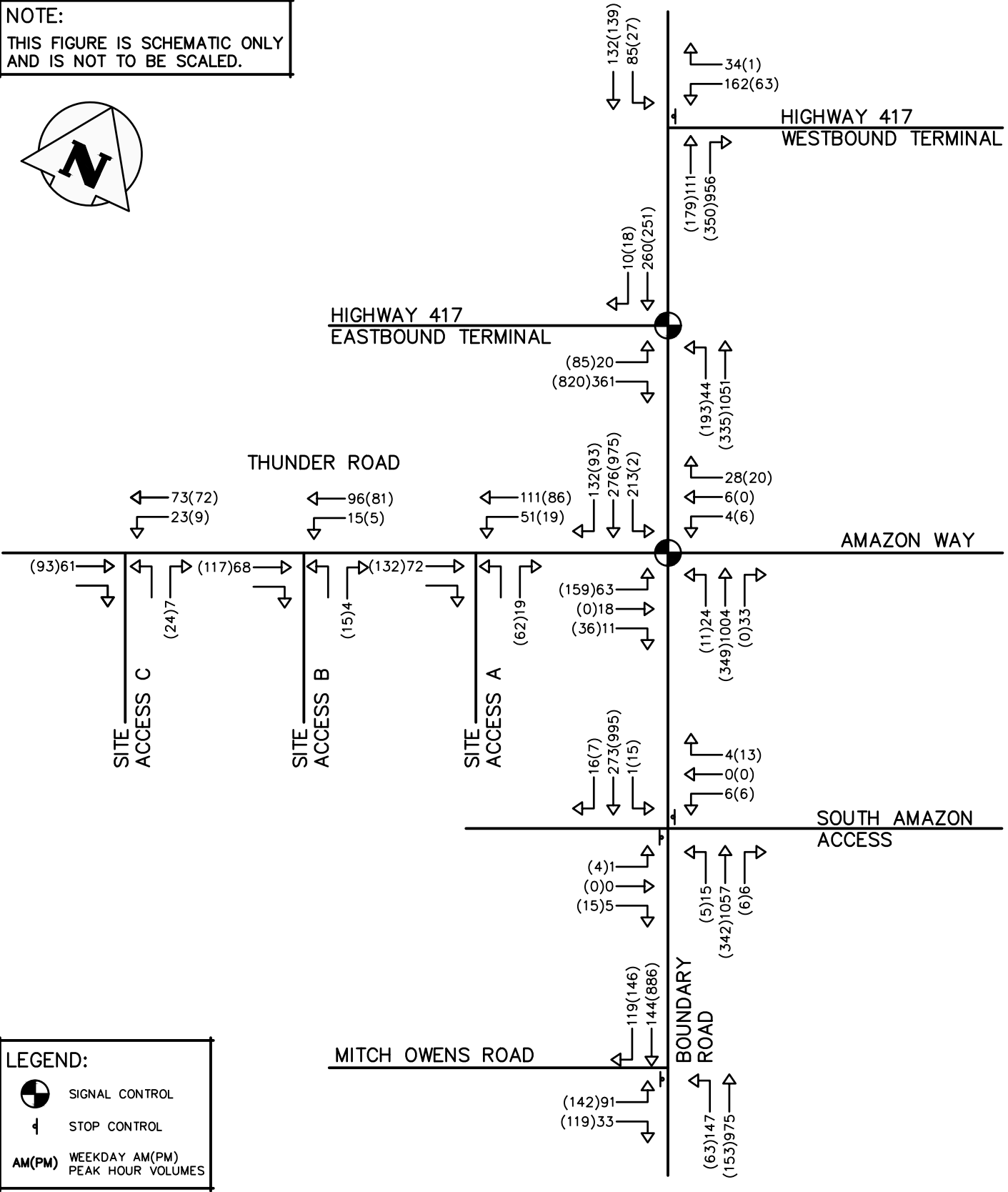
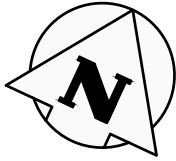
**CROZIER  
& ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
WWW.CFCROZIER.CA

Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. <b>FIG. 10</b>



**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**LEGEND:**

- SIGNAL CONTROL
- STOP CONTROL
- AM(PM)** WEEKDAY AM(PM) PEAK HOUR VOLUMES

**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

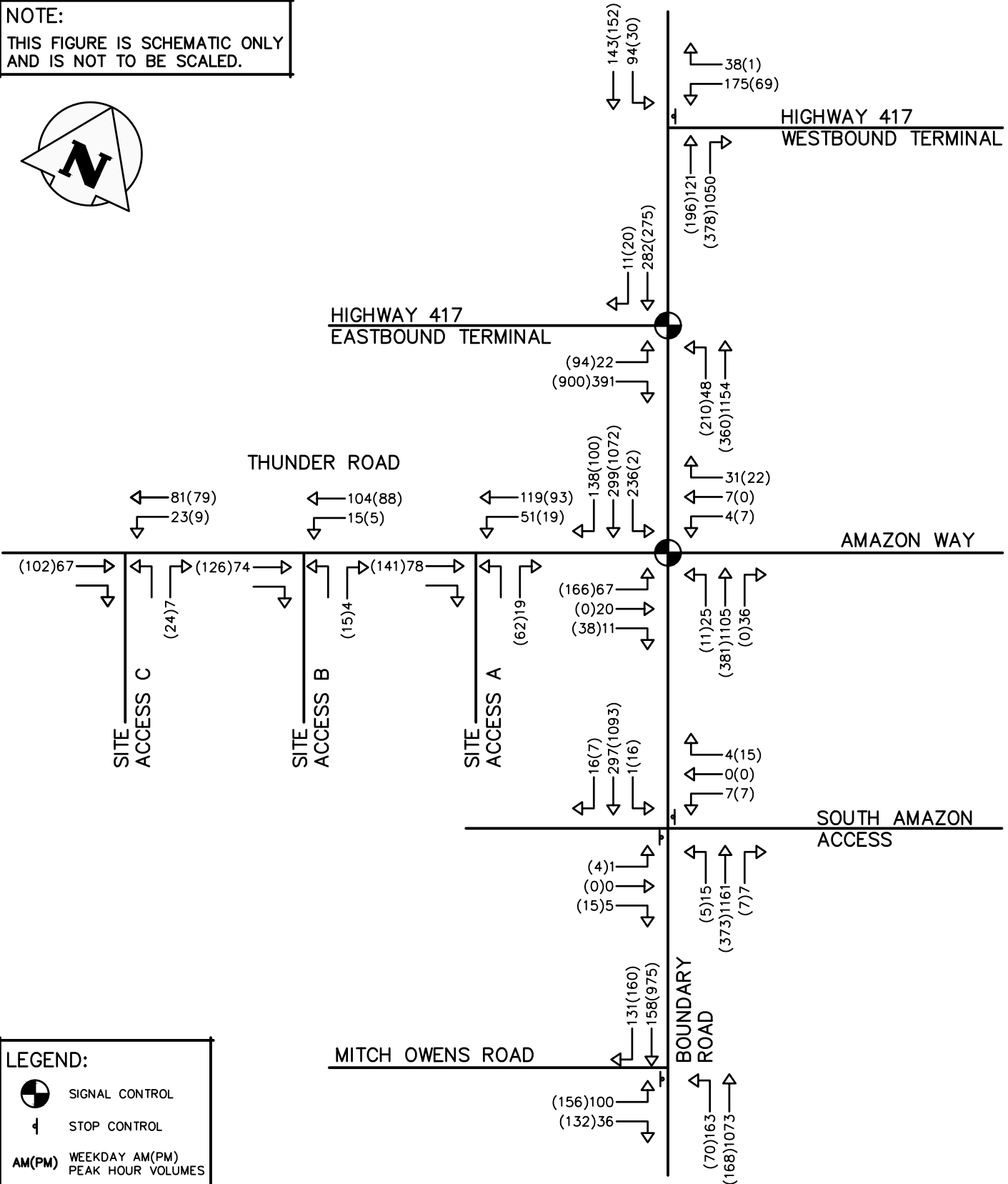
**2030 FUTURE TOTAL  
TRAFFIC VOLUMES**



2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
WWW.CFCROZIER.CA

Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	<b>FIG. 11</b>

**NOTE:**  
THIS FIGURE IS SCHEMATIC ONLY  
AND IS NOT TO BE SCALED.



**THUNDER ROAD & BOUNDARY ROAD  
CITY OF OTTAWA**

**2035 FUTURE TOTAL  
TRAFFIC VOLUMES**



**CROZIER  
& ASSOCIATES**  
Consulting Engineers

2800 HIGH POINT DRIVE  
SUITE 100  
MILTON, ON L9T 6P4  
905 875-0026 T  
905 875-4915 F  
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Drawn	S.K.	Design	S.K.	Project No.	<b>1909-5772</b>	
Check	D.L.	Check	D.L.	Scale	N.T.S	Dwg. <b>FIG. 12</b>