



BURNSIDE

**Residential Development
Transportation Impact Study
Belmont, ON**

Craigholme Estates Ltd.

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Executive Summary

Craigholme Estates Ltd. (the Client) is proposing to develop a residential development in the Community of Belmont, Municipality of Central Elgin, Ontario. The proposed residential development will consist of 260 single detached residential lots. R.J. Burnside & Associates Limited (Burnside) has been retained to undertake a Transportation Impact Study (TIS) which reviews the transportation impacts associated with the proposed development.

Based on the analysis completed, the following primary conclusions and recommendations are made in this study:

- The proposed development is forecast to generate total two-way traffic volumes of 192 and 257 vehicles in the weekday AM and PM peak hours, respectively.
- All movements at all intersections in the Study Area are operating with sufficient capacity and low delays, Level of Service (LOS) B or better under 2019 (existing) conditions.
- All movements at all intersections in the Study Area are forecast to operate with sufficient capacity and minimal delays, LOS C or better under 2030 background traffic conditions.
- All movements at all intersections in the Study Area are forecast to operate with sufficient capacity and minimal delays, LOS C or better, except for the eastbound left-right movement at the Belmont Road and Seventh Avenue intersection. Although the movement is forecast to operate at a LOS F (59.7 second delay in the PM peak hour only), the movement is forecasted to operate with sufficient capacity (volume-to-capacity ratio of 0.82), and therefore is considered to be acceptable.
- The minimum stopping sight distance and intersection sight distance requirements are met at the Proposed Access location on Seventh Avenue.
- At the Belmont Road and Seventh Avenue intersection, the theoretical warrants are met for a northbound left-turn lane under 2030 background traffic conditions, based on Ministry of Transportation Ontario (MTO) criteria. The addition of traffic from the proposed development is forecasted to have a minimal impact on these warrants (i.e., increasing the left-turn storage requirement from 15 metres to 25 metres). Considering the availability of the existing parking lane to provide the potential for through traffic to slip around left-turning traffic at this tee intersection, it is recommended that the traffic operations continue to be monitored as development is completed, to confirm if, or when, a left-turn lane should be implemented at this location. In addition, it is noted that the existing pavement width may be sufficient to accommodate the introduction of a left-turn lane via modification of the pavement markings, without widening of the road, should there be operational concerns in the future. A MTO left-turn lane warrant is not met at any other intersection in the Study Area through horizon year 2030.

- A right-turn lane or taper is not warranted at any intersection in the Study Area through horizon year 2030.
- The proposed development is well-served by existing and proposed pedestrian and cyclist facilities.
- No improvements to the road network are required to accommodate the proposed development.

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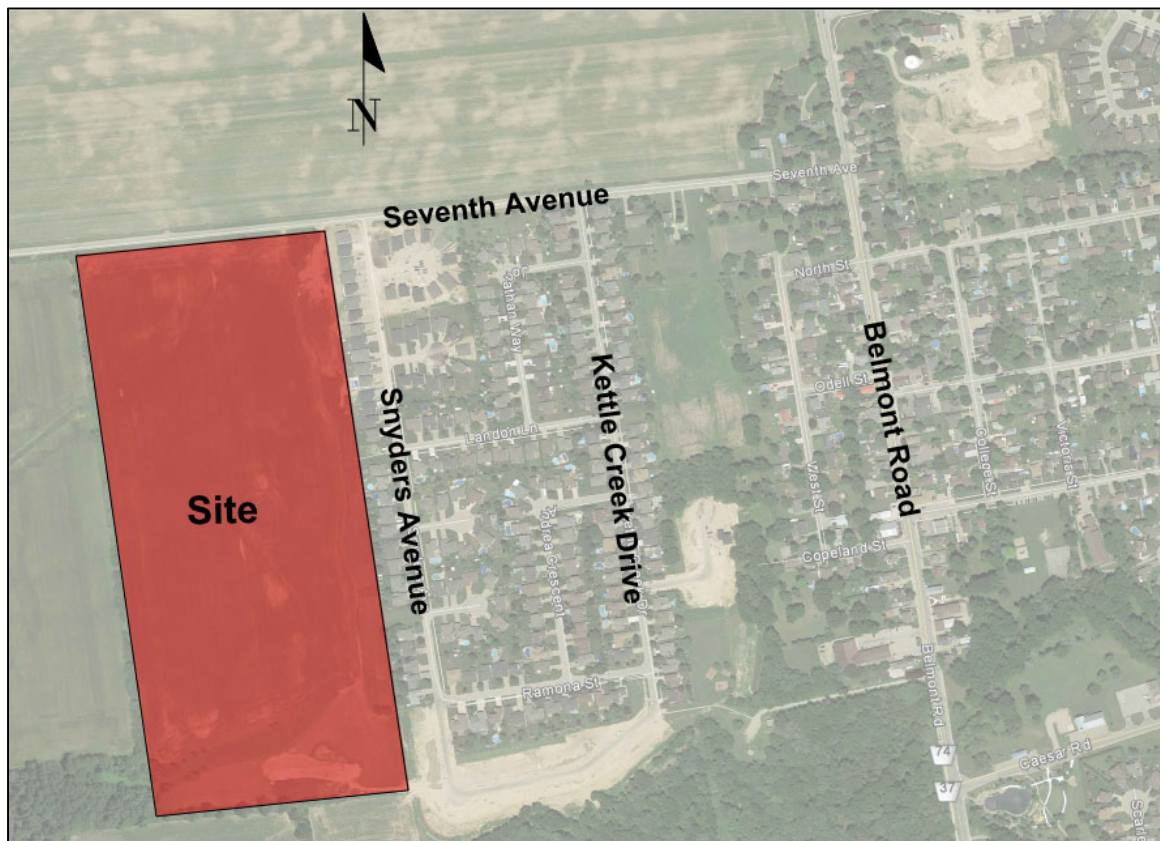
1.0 Introduction

1.1 Background

Craigholme Estates Ltd. (the Client) is proposing to develop a residential development in the Community of Belmont, Municipality of Central Elgin, Ontario. The proposed residential development will consist of 260 single detached residential lots. R.J. Burnside & Associates Limited (Burnside) has been retained to undertake a Transportation Impact Study (TIS) which reviews the transportation impacts associated with the proposed development.

Access to the development will be provided via a new public road access on Seventh Avenue, as well as an extension of Landon Lane. The location of the proposed development is illustrated in Figure 1.

Figure 1: Site Location



Source: Google, 2019

1.2 Scope of Work

The study scope of work is summarized as the following:

Analysis Scenarios	<ul style="list-style-type: none"> Existing (2019) traffic conditions 2030 background traffic conditions 2030 total traffic conditions (i.e., 2030 background traffic plus all development traffic)
Analysis Time Periods	<ul style="list-style-type: none"> Weekday AM peak hour Weekday PM peak hour
Analysis Intersections (Study Area)	<ul style="list-style-type: none"> Belmont Road & Seventh Avenue Kettle Creek Drive & Seventh Avenue Snyders Avenue & Seventh Avenue Proposed Access & Seventh Avenue

1.3 Intersection Analysis Methodology

Intersection operations were assessed for intersections in the study area using the software program Synchro 9, which employs methodology from the *Highway Capacity Manual (HCM2000 and HCM2010)*, published by the Transportation Research Board National Research Council. Synchro 9 can analyze both signalized and unsignalized intersections in a road corridor or network, accounting for the spacing, interaction, queues, and operations between intersections. The analysis has utilized the HCM2000 methodology.

The unsignalized intersection analysis considers two separate measures of performance:

- The capacity of the intersection's critical movements, which is based on a volume to capacity ratio (v/c ratio).
- The Level of Service (LOS) for the critical movements, which is based on the average control delay per vehicle for the various critical movements within the intersection. The link between LOS and control delay (in seconds) for unsignalized intersections is summarized in Table 1.

Table 1: Level of Service Criteria for Unsignalized Intersections

Level of Service	Control Delay per Vehicle(s)
A	0 – 10
B	> 10 – 15
C	> 15 – 25
D	> 25 – 35
E	> 35 – 50
F	> 50

2.0 Existing Conditions

2.1 Site Context

The proposed development is situated in the Community of Belmont. The Community of Belmont had a population of 1,140 as of 2016. The Municipality of Central Elgin had a population of 12,607 as of 2016 (Statistics Canada, 2016).

The site is currently occupied by agricultural lands. The site is classified as “Vacant Residential Land” in the *Central Elgin Official Plan Planning Report* (Central Elgin Planning Office and Dillon Consulting, February 2012).

To the north, the property is bounded by Seventh Avenue. To the south and west, the property is bounded by agricultural lands. To the east, the property is bounded by an existing subdivision, which the proposed subdivision will be connected to via Landon Lane.

2.2 Existing Road Network

The existing road network is described below.

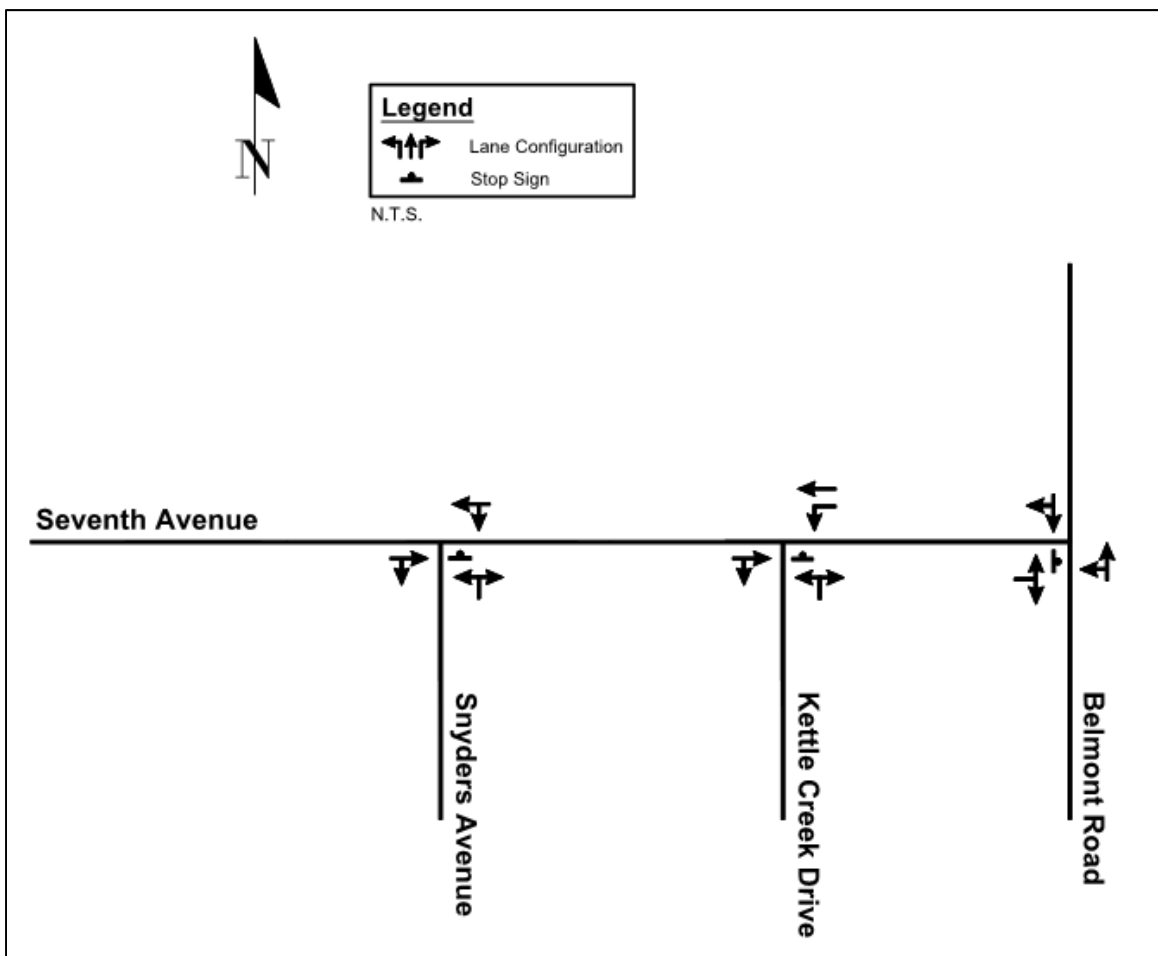
Belmont Road (County Road 74)	Belmont Road is classified as a “County Minor Arterial” road under the jurisdiction of the County of Elgin (County). For the purposes of this study, it is assumed that Belmont Road runs north-south. Through the Community of Belmont, Belmont Road has a posted speed limit of 50 km/h and consists of a two-lane urban cross section. Between Union Street and Seventh Avenue, sidewalks and parking lanes exist along both sides of Belmont Road. The parking lanes continue to the north of Seventh Avenue, with a sidewalk on the east side only.
Seventh Avenue	Seventh Avenue is classified as a “Collector” road under the jurisdiction of the Municipality of Central Elgin (Municipality). For the purposes of this study, it is assumed that Seventh Avenue runs east-west. Seventh Avenue has a posted speed limit of 50 km/h between 20 metres west of Snyders Avenue and Belmont Road. Between Kettle Creek Drive and Belmont Road, Seventh Avenue consists of a two-lane urban cross section with a sidewalk along the south side of the road. To the west of Kettle Creek Drive, Seventh Avenue consists of a two-lane rural cross section.

Kettle Creek Drive Kettle Creek Drive is classified as a “Collector” road under the jurisdiction of the Municipality. Kettle Creek Drive has a posted speed limit of 50 km/h and consists of a two-lane urban cross section. A sidewalk extends along the east side of the road.

Snyders Avenue Snyders Avenue is classified as a “Collector” road under the jurisdiction of the Municipality. Snyders Avenue has a posted speed limit of 50 km/h and consists of two-lane urban cross section. A sidewalk extends along the east side of the road.

Figure 2 depicts the existing lane configurations and traffic controls at all intersections in the Study Area.

Figure 2: Existing Study Area Lane Configurations and Traffic Controls

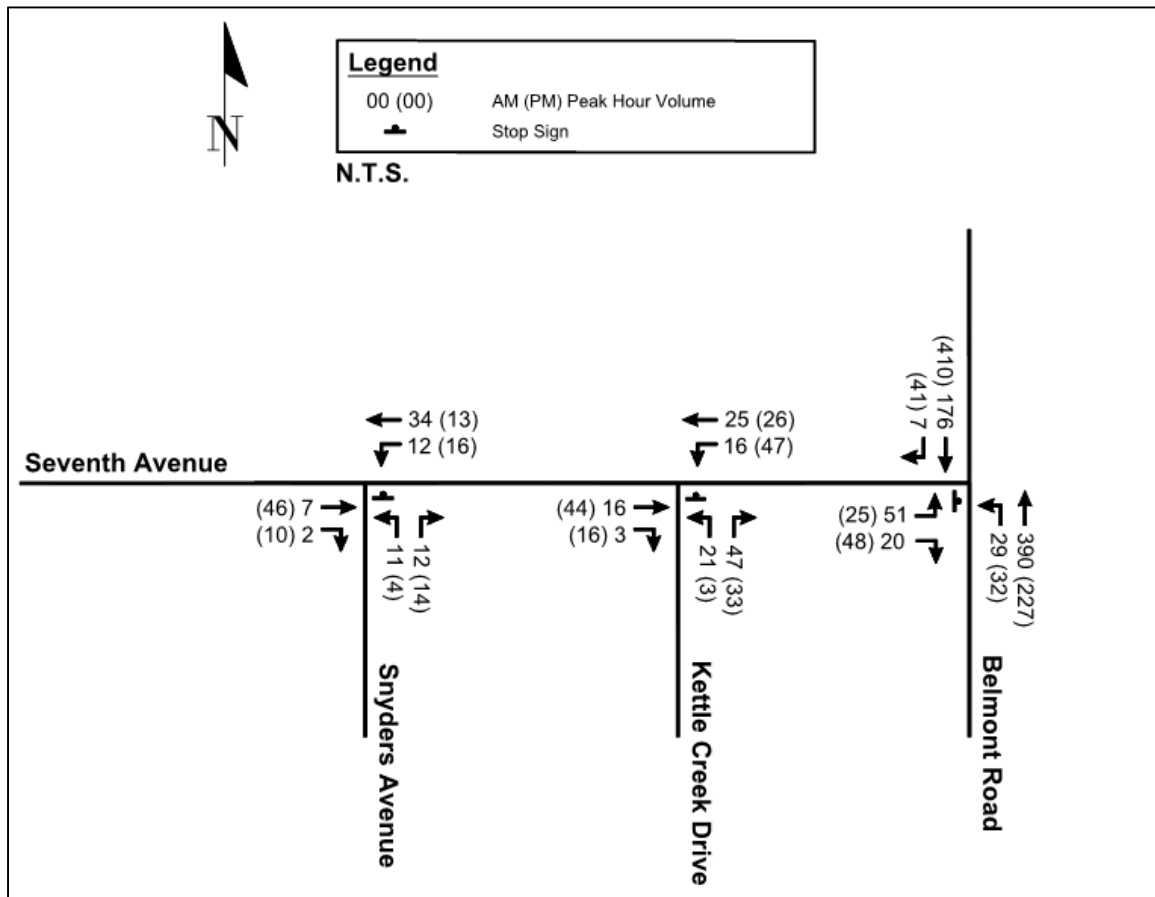


2.3 Existing Traffic Volumes

Burnside's sub-consultant Accu-Traffic conducted Turning Movement Counts (TMCs) at all intersections in the Study Area on Wednesday, May 1, 2019. The TMCs were conducted in the morning from 7:00 AM to 9:00 AM and in the afternoon from 4:00 PM to 6:00 PM. The weekday AM and PM peak hours were selected as these are the typical peak traffic periods for residential developments.

The existing traffic volumes during the weekday AM and PM peak hours are illustrated in Figure 3. The traffic count data collected by Accu-Traffic is provided in Appendix A. At each intersection, the actual AM and PM peak hour traffic volumes were applied, and through volumes on Seventh Avenue between Snyders Avenue and Kettle Creek Drive were balanced.

Figure 3: Existing Traffic Volumes



3.0 Future Background Conditions

Future background traffic consists of existing traffic, background traffic growth, and traffic from other developments within the vicinity of the proposed development (if any). For the purposes of this study, an eleven-year horizon (i.e., 2030) was selected for future traffic projections and analysis.

3.1 Background Developments

The “Current Planning Applications” webpage on the Municipality’s website was reviewed (on April 23, 2019) to determine the status of planning applications throughout the Municipality. Based on a review of several planning applications in the Municipality, one proposed external development was identified in the Community of Belmont that would have an impact on traffic volumes in the Study Area.

The Helen Court subdivision, located at the southeast quadrant of the Seventh Avenue and Kettle Creek Drive intersection, is proposed to consist of 32 residential lots. An extension of Landon Lane (from Kettle Creek Drive) is proposed to form a cul-de-sac named Helen Court, which would provide direct access to 28 of the 32 lots. Two (2) lots will be provided direct access to West Street, however one of the lots on West Street will retain the existing house and detached garage with a new walkway added on the lot (i.e., only one new detached home will be added on West Street). Two (2) new residential lots will be provided with direct access to Seventh Avenue (i.e., rather than via Helen Court). In the *Proposed Residential Subdivision, Helen Court, Belmont, Traffic Impact Assessment* (F.R. Berry & Associates, April 2018), it was assumed that the Helen Court subdivision would be fully occupied in 2019 (although at the time of this study the development has not been built-out). Therefore, the site generated traffic projections from the *Proposed Residential Subdivision, Helen Court, Belmont, Traffic Impact Assessment* report were added to the 2030 background and total scenarios in this TIS. An excerpt from the *Proposed Residential Subdivision, Helen Court, Belmont, Traffic Impact Assessment* report illustrating the site generation projections for the Helen Court development is contained in Appendix B.

At the time of this study, 39 homes in the existing subdivision east of the proposed development (i.e., between Kettle Creek Drive and Snyders Avenue) remain to be built-out and occupied. Therefore, trip generation estimates were made for the 39 remaining homes based on standard trip generation rates contained in *Trip Generation Manual 10th Edition* (Institute of Transportation Engineers [ITE], September 2017). The trip generation estimates for the remaining homes in this existing subdivision are summarized in Table 2. The forecasted trip generation amounts were distributed at the Kettle Creek Drive and Snyders Avenue intersections with Seventh Avenue according to existing travel patterns and origin/destination considerations.

Table 2: Trip Generation – Remaining Unoccupied Homes in Easterly Subdivision

Remaining Homes	Land Use (ITE Code)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
39	Single-Family Detached Housing (ITE Code 210)	8	24	32	26	15	41

The forecasted traffic amounts from the Helen Court subdivision (shown in Appendix B) were added to the trip generation forecasts made for the remaining unoccupied residential lots (shown in Table 2) in order to determine the total background development traffic (excluding general background traffic growth) to be added in the future background and total traffic scenarios in this study.

3.2 Background Traffic Growth

To account for general background traffic growth in the Study Area, Burnside has applied a 1.5% Compound Annual Growth Rate (CAGR) to all through volumes on Seventh Avenue as well as to all movements at the Belmont Road / Seventh Avenue intersection.

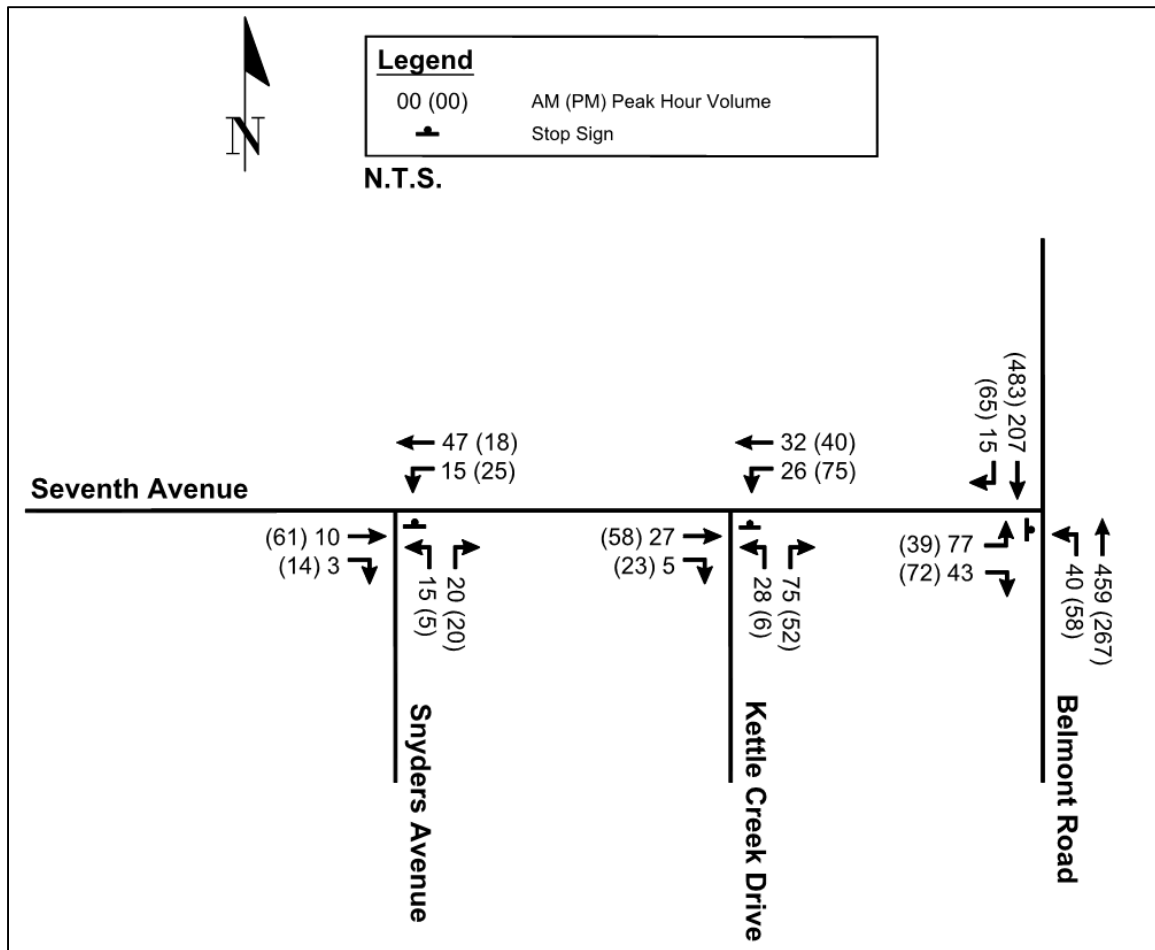
For comparison purposes, the *Proposed Residential Subdivision, Helen Court, Belmont, Traffic Impact Assessment* (F.R. Berry & Associates, April 2018) also applied an annual traffic growth rate of 1.5% to the through volumes on Seventh Avenue and all movements at the Belmont Road / Seventh Avenue intersection. Based on online data contained on the County of Middlesex website, Middlesex Road 74 between Highway 401 and Belmont (Middlesex Road 74 converts to Belmont Road in the County of Elgin jurisdiction) had volumes of 7,195 and 7,359 in 2015 and 2017, respectively, which translates to approximately a 1.13% CAGR over the two-year period. Between 2011 and 2016, the Municipality of Central Elgin's population decreased by 1.1% (Statistics Canada, 2016).

Note that the applied 1.5% CAGR is in addition to the background development traffic, outlined in Section 3.1, that will be added to the future traffic scenarios. No background traffic growth rate has been applied to the traffic entering/exiting Kettle Creek Drive or Snyders Avenue, since all traffic on these roadways will be captured in the traffic counts and in the forecasted background development traffic.

3.3 Future Background Traffic Volumes

Background traffic volumes consist of the application of traffic growth per annum (up to horizon year 2030) to existing traffic volumes, plus the addition of traffic generated by the background developments outlined in Section 3.1. The resulting traffic volumes are illustrated in Figure 4.

Figure 4: 2030 Background Traffic Volumes

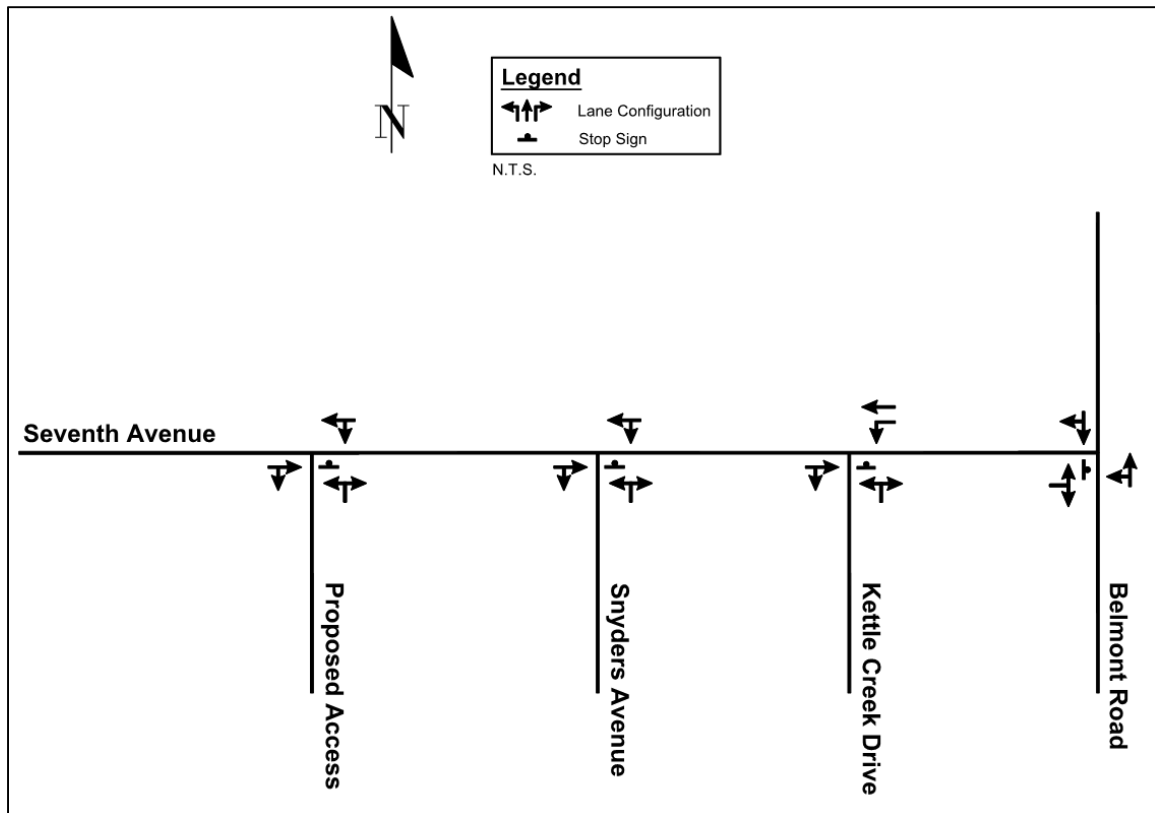


3.4 Future Road Network

The Proposed Access on Seventh Avenue will be located approximately 300 metres west of Snyder's Avenue. Also, Landon Lane will be extended from Snyder's Avenue, providing a second access to the proposed development. No other road network improvements in the Study Area have been identified through horizon year 2030.

Figure 5 depicts the future lane configurations and traffic controls in the Study Area.

Figure 5: Future Study Area Lane Configurations and Traffic Controls



4.0 Proposed Development

4.1 Draft Plan of Subdivision

The proposed development will consist of 260 single detached residential lots. As noted previously, access to the development will be provided via a new roadway connecting to Seventh Avenue as well as via Landon Lane (i.e., extension from Snyders Avenue). The Draft Plan of Subdivision is illustrated in Figure 6.

Figure 6: Draft Plan of Subdivision



4.2 Development Traffic Generation

Site generated traffic volumes from the proposed development have been estimated based on trip rate information contained in the *Trip Generation Manual 10th Edition* (ITE, September 2017). The Single-Family Detached Housing (Land Use Code 210) was utilized and the resulting trips are summarized in Table 3.

Table 3: Forecast Trip Generation from Proposed Development

ITE Land Use Code	Proposed Number of Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
210	260	48	144	192	162	95	257

As shown in Table 3, the total new trip generation (two-way) for the proposed development is forecast to be 192 vehicles in the weekday AM peak hour and 257 vehicles in the weekday PM peak hour.

For comparison purposes, the turning movement count (TMC) data at the Snyders Avenue/Seventh Avenue and Kettle Creek Drive/Seventh Avenue intersections were used to determine the actual trip generation rates for the existing subdivision to the east. A total of 199 homes exist in the subdivision. The trip generation rate comparison is summarized in Table 4.

Table 4: Comparison of Actual & ITE Trip Generation Rates

Trip Generation Source	Trip Generation Rate (Vehicles per Dwelling Unit)	
	AM Peak Hour	PM Peak Hour
Actual (from TMC Data)	0.62	0.72
ITE (from <i>Trip Generation Manual 10th Edition</i>)	0.74	0.99

As shown in Table 4, the standard trip generation rates in the *Trip Generation Manual 10th Edition* (ITE) are slightly higher than the actual observed rates in both the AM and PM peak hours. To be conservative, the ITE trip generation rates were used in this study (as per the forecasts outlined in Table 3).

4.3 Trip Distribution and Assignment

The forecast development traffic has been distributed over the road network according to the existing distributions observed in the TMCs conducted on May 1, 2019.

All traffic travelling to/from the proposed development must ultimately travel to/from the east or west via Seventh Avenue (i.e., vehicles travelling to/from the north or south on Belmont Road will need to turn onto/from Seventh Avenue). Thus, based on origin/destination considerations and the logical routing of vehicles on the adjacent

roadway network to get to/from the proposed development, 60% and 40% of traffic to/from the east was applied at the Proposed Access and Snyders Avenue, respectively. All traffic (100%) to/from the west was applied at the Proposed Access.

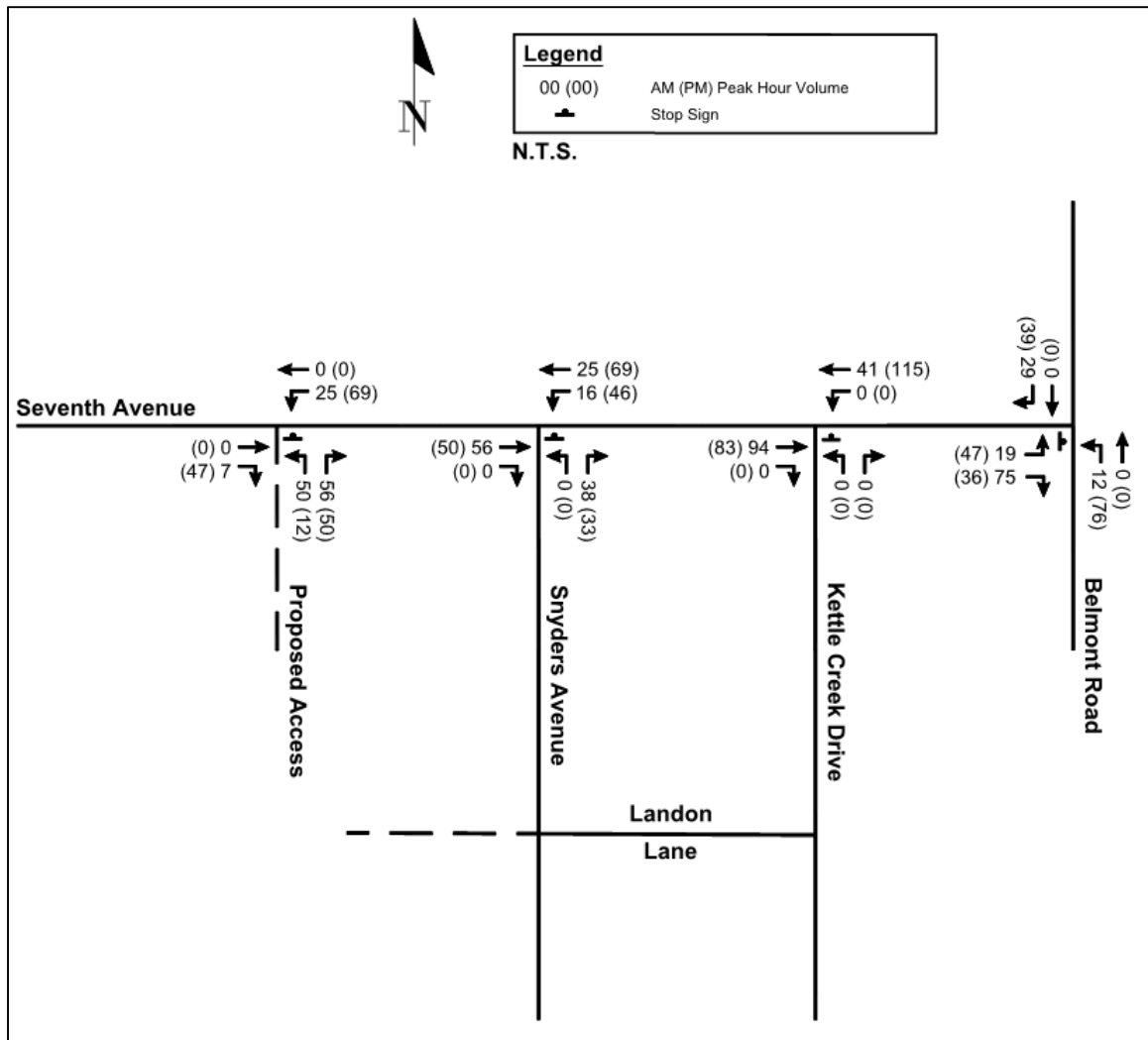
Table 5 summarizes the trip distribution applied to forecasted trips of the proposed development.

Table 5: Trip Distribution of Development Traffic

Direction	On Road	Via	Distribution			
			AM Peak Hour		PM Peak Hour	
			In	Out	In	Out
West	Seventh Avenue	Proposed Access	15%	35%	29%	13%
North	Belmont Road	Proposed Access	37%	8%	14%	29%
		Snyders Avenue	24%	5%	10%	20%
South	Belmont Road	Proposed Access	14%	31%	28%	23%
		Snyders Avenue	10%	21%	19%	15%
Total			100%	100%	100%	100%

The forecast development traffic volumes from the proposed development are shown in Figure 7.

Figure 7: Forecast Development Traffic Volumes

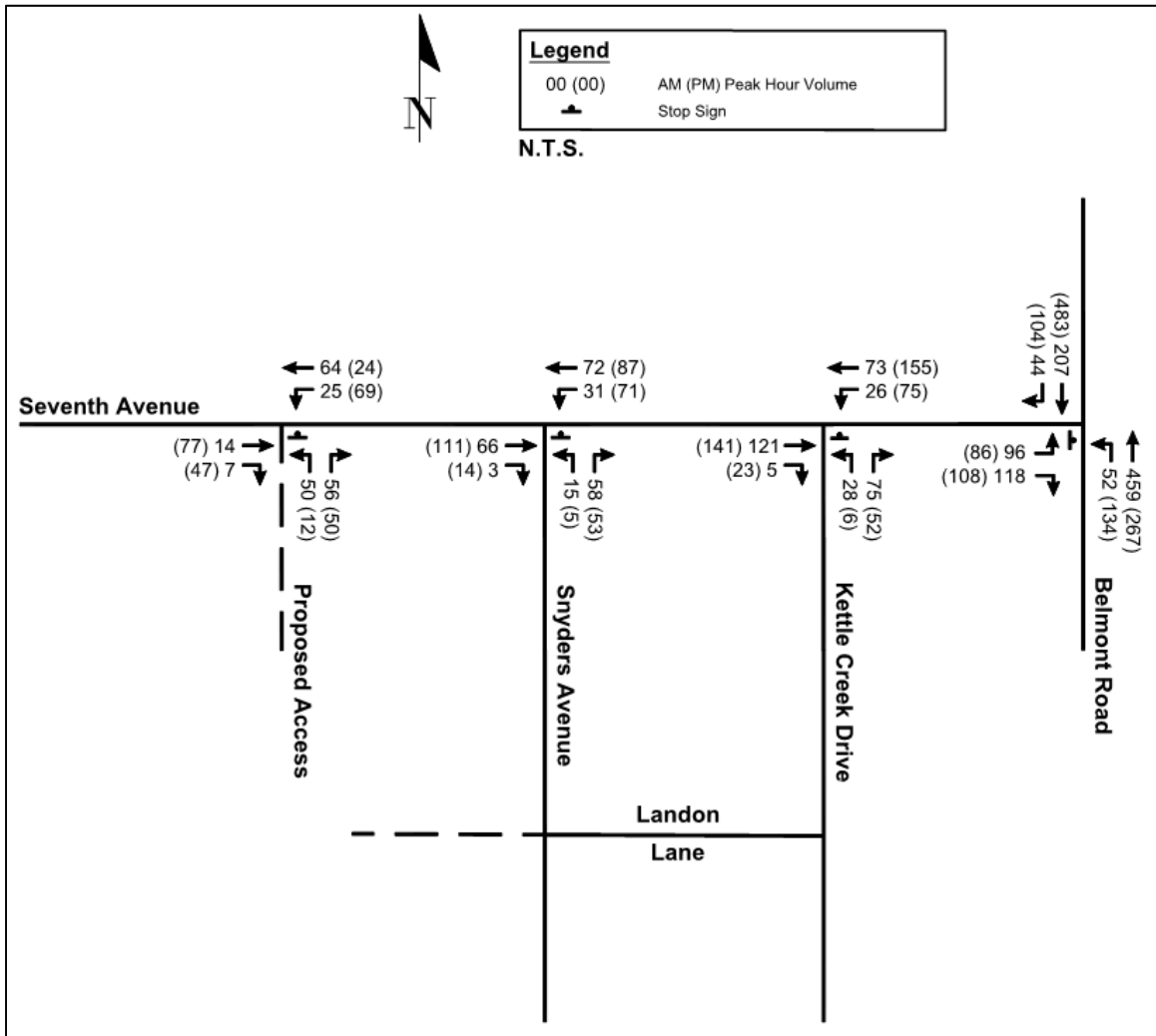


5.0 Future Total Conditions

5.1 2030 Total Traffic Volumes

The development traffic is added to the background traffic to obtain the forecasted total turning movement volumes. The forecast 2030 total traffic volumes (weekday AM and PM peak hours) are summarized in Figure 8.

Figure 8: 2030 Total Traffic Volumes



6.0 Traffic Operations Analysis

6.1 Existing Traffic Operations

Existing traffic operations were assessed at all intersections in the Study Area based on the lane configurations shown in Figure 2 and the traffic volumes shown in Figure 3. The existing Synchro analyses reports are included in Appendix C, and the results are summarized in Table 6.

Table 6: Existing Traffic Operations

Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c	LOS	v/c	LOS
Snyders Avenue & Seventh Avenue				
Eastbound Through-Right	0.01	A	0.04	A
Westbound Through-Left	0.01	A	0.01	A
Northbound Left-Right	0.03	A	0.02	A
Kettle Creek Drive & Seventh Avenue				
Eastbound Through-Right	0.01	A	0.04	A
Westbound Left	0.01	A	0.03	A
Westbound Through	0.02	A	0.02	A
Northbound Left-Right	0.09	A	0.04	A
Belmont Road & Seventh Avenue				
Eastbound Left-Right	0.16	B	0.18	B
Northbound Through-Left	0.02	A	0.04	A
Southbound Through-Right	0.12	A	0.30	A

Note: v/c = volume to capacity ratio, LOS = Level of Service

As shown in Table 6, all movements at all intersections in the Study Area are operating with sufficient capacity and a LOS B or better. Therefore, all intersections in the Study Area are considered to operate acceptably under existing traffic conditions.

6.2 Background Traffic Operations

Based on the 2030 background shown in Figure 4, intersection operations were assessed and are summarized below in Table 7. Detailed Synchro reports for the 2030 background traffic conditions are provided in Appendix D.

Table 7: 2030 Background Traffic Operations

Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c	LOS	v/c	LOS
Snyders Avenue & Seventh Avenue				
Eastbound Through-Right	0.01	A	0.05	A
Westbound Through-Left	0.01	A	0.02	A
Northbound Left-Right	0.05	A	0.03	A

Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c	LOS	v/c	LOS
Kettle Creek Drive & Seventh Avenue				
Eastbound Through-Right	0.02	A	0.05	A
Westbound Left	0.02	A	0.05	A
Westbound Through	0.02	A	0.03	A
Northbound Left-Right	0.14	A	0.07	A
Belmont Road & Seventh Avenue				
Eastbound Left-Right	0.31	C	0.34	C
Northbound Through-Left	0.03	A	0.07	A
Southbound Through-Right	0.14	A	0.36	A

Note: v/c = volume to capacity ratio, LOS = Level of Service

As shown in Table 7, all movements at all intersections in the Study Area are operating with sufficient capacity and a LOS C or better. Therefore, all intersections in the Study Area are considered to operate acceptably under 2030 background traffic conditions.

6.3 Total Traffic Operations

Based on the 2030 total traffic volumes shown in Figure 8, intersection operations were assessed and are summarized in Table 8. Detailed Synchro reports for the 2030 total traffic conditions are provided in Appendix E.

Table 8: 2030 Total Traffic Operations

Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
	v/c	LOS	v/c	LOS
Proposed Access & Seventh Avenue				
Eastbound Through-Right	0.01	A	0.08	A
Westbound Through-Left	0.02	A	0.05	A
Northbound Left-Right	0.12	A	0.08	A
Snyders Avenue & Seventh Avenue				
Eastbound Through-Right	0.06	A	0.09	A
Westbound Through-Left	0.03	A	0.06	A
Northbound Left-Right	0.12	A	0.08	A
Kettle Creek Drive & Seventh Avenue				
Eastbound Through-Right	0.09	A	0.11	A
Westbound Left	0.02	A	0.06	A
Westbound Through	0.05	A	0.10	A
Northbound Left-Right	0.16	B	0.08	A
Belmont Road & Seventh Avenue				
Eastbound Left-Right	0.50	C	0.82	F
Northbound Through-Left	0.05	A	0.17	A
Southbound Through-Right	0.16	A	0.39	A

Note: v/c = volume to capacity ratio, LOS = Level of Service

As shown in Table 8, all movements at all intersections in the Study Area are operating with sufficient capacity and a LOS C or better, except for the eastbound left-right movement at the Belmont Road and Seventh Avenue intersection.

During the 2030 total traffic PM peak hour, it is forecast that the eastbound left-right movement at the Belmont Road and Seventh Avenue intersection will operate with a LOS F (59.7 second delay) and v/c ratio of 0.82. Although the movement operates at a LOS F, it operates with sufficient reserve capacity. Therefore, all movements at all intersections in the Study Area are considered to operate acceptably under 2030 total traffic conditions.

7.0 Geometric Considerations

7.1 Sight Distance Review

The Proposed Access on Seventh Avenue is located approximately 300 metres west of Snyders Avenue. The Proposed Access lies on a relatively straight and flat section of Seventh Avenue. The current speed limit on Seventh Avenue to the west of 20 metres west of Snyders Avenue is 80 km/h (i.e., the posted speed limit changes from 80 km/h to 50 km/h approximately 20 metres west of Snyders Avenue, thus the speed limit on Seventh Avenue at the Proposed Access location is 80 km/h). Therefore, all geometric considerations were based on a design speed of 100 km/h.

Based on criteria in the *Geometric Design Guide for Canadian Roads* (Transportation Association of Canada, June 2017), the following minimum sight distances should be provided at the Proposed Access on Seventh Avenue:

- minimum stopping sight distance of 185 metres;
- minimum intersection sight distance of 210 metres for left-turn from stop; and
- minimum intersection sight distance of 185 metres for right-turn from stop.

The above sight distance requirements on Seventh Avenue are met at the Proposed Access location.

7.2 Left-Turn Lane Warrant Analysis

The warrants for left-turn lanes at all intersections in the Study Area have been assessed based on MTO graphs contained in the *Geometric Design Standards for Ontario Highways* (MTO, 1991). The results of the left-turn lane warrant analysis are summarized in Table 9.

Table 9: Left-Turn Lane Warrants (Based on MTO Nomographs)

Location: Belmont Road & Seventh Avenue		
Design Speed = 60 km/h		Time Period = 2019 Existing Traffic
Approach Direction	Northbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	419	259
Opposing Traffic	183	451
Left Turning Traffic	29	32
Percentage of Left Turning Traffic	6.9%	12.4%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-6	EA-6
Storage Length Required	0 metres	

Location: Belmont Road & Seventh Avenue		
Design Speed = 60 km/h		Time Period = 2030 Background Traffic
Approach Direction	Northbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	499	325
Opposing Traffic	222	548
Left Turning Traffic	40	58
Percentage of Left Turning Traffic	8.0%	17.8%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-6	EA-7
Storage Length Required	15 metres	

Location: Belmont Road & Seventh Avenue		
Design Speed = 60 km/h		Time Period = 2030 Total Traffic
Approach Direction	Northbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	511	401
Opposing Traffic	251	587
Left Turning Traffic	52	134
Percentage of Left Turning Traffic	10.2%	33.4%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-6	EA-9
Storage Length Required	25 metres	

Location: Seventh Avenue & Kettle Creek Drive		
Design Speed = 60 km/h		Time Period = 2030 Total Traffic
Approach Direction	Westbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	99	230
Opposing Traffic	126	164
Left Turning Traffic	26	75
Percentage of Left Turning Traffic	26.3%	32.6%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-8	EA-9
Storage Length Required	0 metres	

Location: Seventh Avenue & Snyders Avenue		
Design Speed = 60 km/h		Time Period = 2030 Total Traffic
Approach Direction	Westbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	103	158
Opposing Traffic	69	125
Left Turning Traffic	31	71
Percentage of Left Turning Traffic	30.1%	44.9%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-8	EA-9
Storage Length Required	0 metres	

Location: Seventh Avenue & Proposed Access		
Design Speed = 80 km/h		Time Period = 2030 Total Traffic
Approach Direction	Westbound	
Peak Hours	Morning	Afternoon
Advancing Traffic	89	93
Opposing Traffic	21	124
Left Turning Traffic	25	69
Percentage of Left Turning Traffic	28.1%	74.2%
Figure Used from <i>Geometric Design Standards for Ontario Highways</i> (MTO, 1991)	EA-16	EA-17
Storage Length Required	0 metres	

Based on the above analysis, the only movement that meets the theoretical warrants for a left-turn lane (based on MTO criteria) in the Study Area through horizon year 2030 is a northbound left-turn lane at the Belmont Road and Seventh Avenue intersection. The left-turn lane warrant is met under either 2030 background conditions. The addition of traffic from the proposed development is forecasted to have a minimal impact on these warrants (i.e., increasing the left-turn storage requirement from 15 metres to 25 metres). It is noted that the existing cross section on Belmont Road (i.e., one travel lane and one parking lane in each direction) currently provides some opportunity for through traffic to slip around left-turn traffic. In addition, the existing pavement width may be sufficient to accommodate the introduction of a left-turn lane via modification of the pavement markings, without widening of the road, should there be operational concerns in the future. It is recommended that the traffic operations continue to be monitored as development is completed, to confirm when, or if, a left-turn lane should be implemented at this location.

No other intersections warrant a left-turn lane through horizon year 2030.

7.3 Right-Turn Lane Warrant Analysis

It is noted in the *Geometric Design Standards for Ontario Highways* (MTO, 1991) that right-turn lanes or tapers may be considered where right-turn volumes exceed 60 vehicles per hour (“vph”) and where right-turning vehicles create a hazard or reduce capacity at the intersection.

In the Study Area through horizon year 2030, right-turning volumes at intersections are relatively low and all movements at all intersections are forecast to operate within their capacity. Therefore, it is concluded that a right-turn lane or taper is not warranted at any intersection in the Study Area.

8.0 Review of Alternate Travel Modes

As noted previously, sidewalks exist on both sides of Belmont Road, to the south of Seventh Avenue. A sidewalk also exists on the east side of Belmont Road (to the north of Seventh Avenue) and on the south side of Seventh Avenue (between Belmont Road and Kettle Creek Drive).

Note that there is a proposed sidewalk connection between West Street and the proposed Helen Court subdivision, which could be accessed by residents of the proposed development via Landon Lane.

There are currently no bicycle routes, lanes or sharrows on any roads in the Study Area. However, in the *Elgin-St. Thomas Cycling Master Plan* (MMM Group, September 2014), the following cycling network improvements have been proposed:

- a signed bicycle route with sharrows is proposed on Belmont Road between Seventh Avenue and Union Street (long-term, 20+ years);
- a bicycle lane is proposed on Belmont Road between Union Street and Borden Avenue (long-term, 20+ years); and
- a proposed multi-use trail is proposed to connect Kettle Creek Drive to Belmont Road, along the south side of Meadows Park (medium-term, 11-20 years).

In the *Municipality of Central Elgin 10 Years Trails Master Plan & Implementation Strategy* (WSP Group / MMM Group, April 2017), a signed bicycle route is also proposed on Seventh Avenue (beyond 10-year horizon).

The proposed development is well-served by existing and proposed pedestrian and cyclist facilities.

Transit services are currently not provided in the Community of Belmont. Given the Community's rural nature and relatively low population, it is not anticipated that transit services will be offered in the next 10-years, nor that the demand for transit services in the Community will be high enough to justify such services.

9.0 Conclusions and Recommendations

Based on the analysis completed, the following primary conclusions and recommendations are made in this study:

- The proposed development is forecast to generate total two-way traffic volumes of 192 and 257 vehicles in the weekday AM and PM peak hours, respectively.
- All movements at all intersections in the Study Area are operating with sufficient capacity and low delays, Level of Service (LOS) B or better under 2019 (existing) conditions.
- All movements at all intersections in the Study Area are forecast to operate with sufficient capacity and minimal delays, LOS C or better under 2030 background traffic conditions.
- All movements at all intersections in the Study Area are forecast to operate with sufficient capacity and minimal delays, LOS C or better, except for the eastbound left-right movement at the Belmont Road and Seventh Avenue intersection. Although the movement is forecast to operate at a LOS F (59.7 second delay in the PM peak hour only), the movement is forecasted to operate with sufficient capacity (volume-to-capacity ratio of 0.82), and therefore is considered to be acceptable.
- The minimum stopping sight distance and intersection sight distance requirements are met at the Proposed Access location on Seventh Avenue.
- At the Belmont Road and Seventh Avenue intersection, the theoretical warrants are met for a northbound left-turn lane under 2030 background traffic conditions, based on Ministry of Transportation Ontario (MTO) criteria. The addition of traffic from the proposed development is forecasted to have a minimal impact on these warrants (i.e., increasing the left-turn storage requirement from 15 metres to 25 metres). Considering the availability of the existing parking lane to provide the potential for through traffic to slip around left-turning traffic at this tee intersection, it is recommended that the traffic operations continue to be monitored as development is completed, to confirm if, or when, a left-turn lane should be implemented at this location. In addition, it is noted that the existing pavement width may be sufficient to accommodate the introduction of a left-turn lane via modification of the pavement markings, without widening of the road, should there be operational concerns in the future. A MTO left-turn lane warrant is not met at any other intersection in the Study Area through horizon year 2030.
- A right-turn lane or taper is not warranted at any intersection in the Study Area through horizon year 2030.
- The proposed development is well-served by existing and proposed pedestrian and cyclist facilities.
- No improvements to the road network are required to accommodate the proposed development.



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Turning Movement Count (TMC) Data

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:15:00

To: 8:15:00

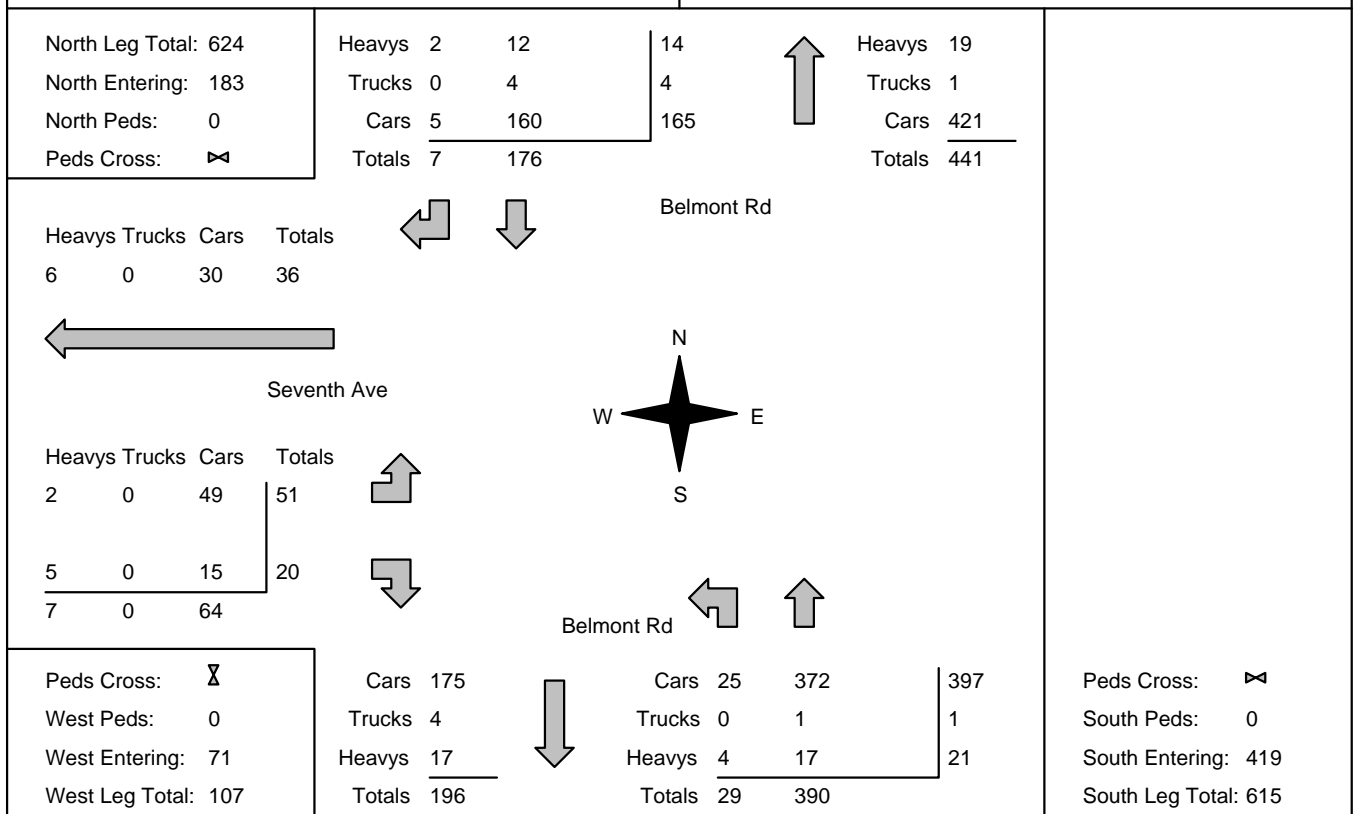
Municipality: Belmont
Site #: 1907300001
Intersection: Belmont Rd & Seventh Ave
TFR File #: 1
Count date: 1-May-19

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Belmont Rd runs N/S



Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Belmont
Site #: 1907300001
Intersection: Belmont Rd & Seventh Ave
TFR File #: 1
Count date: 1-May-19

Weather conditions:

Person counted:
Person prepared:
Person checked:


** Non-Signalized Intersection **

Major Road: Belmont Rd runs N/S

North Leg Total: 703

North Entering: 451

North Peds: 0

Peds Cross: 

Heavys	0	8	8
Trucks	0	3	3
Cars	41	399	440
Totals	41	410	

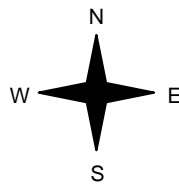
Heavys	13
Trucks	2
Cars	237
Totals	252

Heavys	Trucks	Cars	Totals
2	1	70	73




Seventh Ave

Heavys	Trucks	Cars	Totals
1	0	24	25
1	0	47	48
2	0	71	



Belmont Rd




Peds Cross: 
West Peds: 0
West Entering: 73
West Leg Total: 146

Cars	446
Trucks	3
Heavys	9
Totals	458



Cars	29	213	242
Trucks	1	2	3
Heavys	2	12	14
Totals	32	227	

Peds Cross: 
South Peds: 0
South Entering: 259
South Leg Total: 717

Comments

Accu-Traffic Inc.

<h2>Morning Peak Diagram</h2>	Specified Period From: 7:00:00 To: 9:00:00	One Hour Peak From: 7:45:00 To: 8:45:00																																																
Municipality: Belmont Site #: 1907300002 Intersection: Seventh Ave & Kettle Creek Dr TFR File #: 1 Count date: 1-May-19	Weather conditions: Person counted: Person prepared: Person checked:																																																	
** Non-Signalized Intersection **	Major Road: Seventh Ave runs W/E																																																	
East Leg Total: 103 East Entering: 40 East Peds: 0 Peds Cross: 8																																																		
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Peds Cross:	8
West Peds:	0
West Entering:	19
West Leg Total:	64

Cars	15
Trucks	0
Heavys	4
Totals	19

Cars	21
Trucks	0
Heavys	0
Totals	21

40	61
0	0
7	7
47	

Peds Cross:	8
South Peds:	2
South Entering:	68
South Leg Total:	87

Accu-Traffic Inc.

<h3>Afternoon Peak Diagram</h3>	Specified Period From: 16:00:00 To: 18:00:00	One Hour Peak From: 16:15:00 To: 17:15:00																																																
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East Leg Total: 141 East Entering: 73 East Peds: 0 Peds Cross: 8																																																		
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Accu-Traffic Inc.

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East Leg Total: 65 East Entering: 46 East Peds: 0 Peds Cross: X																																																		
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Peds Cross: X West Peds: 0 West Entering: 9 West Leg Total: 54	<table> <tr><td>Cars</td><td>10</td></tr> <tr><td>Trucks</td><td>0</td></tr> <tr><td>Heavys</td><td>4</td></tr> <tr><td>Totals</td><td>14</td></tr> </table>	Cars	10	Trucks	0	Heavys	4	Totals	14	<table> <tr><td>Cars</td><td>10</td><td>12</td><td>22</td></tr> <tr><td>Trucks</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Heavys</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>Totals</td><td>11</td><td>12</td><td></td></tr> </table>	Cars	10	12	22	Trucks	0	0	0	Heavys	1	0	1	Totals	11	12		Peds Cross: X South Peds: 0 South Entering: 23 South Leg Total: 37																							
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Accu-Traffic Inc.

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2	0	44	46																																																																																							
0	0	10	10																																																																																							
2	0	54																																																																																								
Cars	Trucks	Heavys	Totals																																																																																							
6	0	0	6																																																																																							
16	0	0	16																																																																																							
22	0	0																																																																																								
Cars	Trucks	Heavys	Totals																																																																																							
57	0	3	60																																																																																							
Peds Cross:	8																																																																																									
West Peds:	0																																																																																									
West Entering:	56																																																																																									
West Leg Total:	66																																																																																									
Cars	26																																																																																									
Trucks	0																																																																																									
Heavys	0																																																																																									
Totals	26																																																																																									
Cars	2	13	15																																																																																							
Trucks	0	0	0																																																																																							
Heavys	2	1	3																																																																																							
Totals	4	14																																																																																								
Peds Cross:	8																																																																																									
South Peds:	0																																																																																									
South Entering:	18																																																																																									
South Leg Total:	44																																																																																									
<h3>Comments</h3>																																																																																										



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Appendix B

Background Development Trip Generation Data

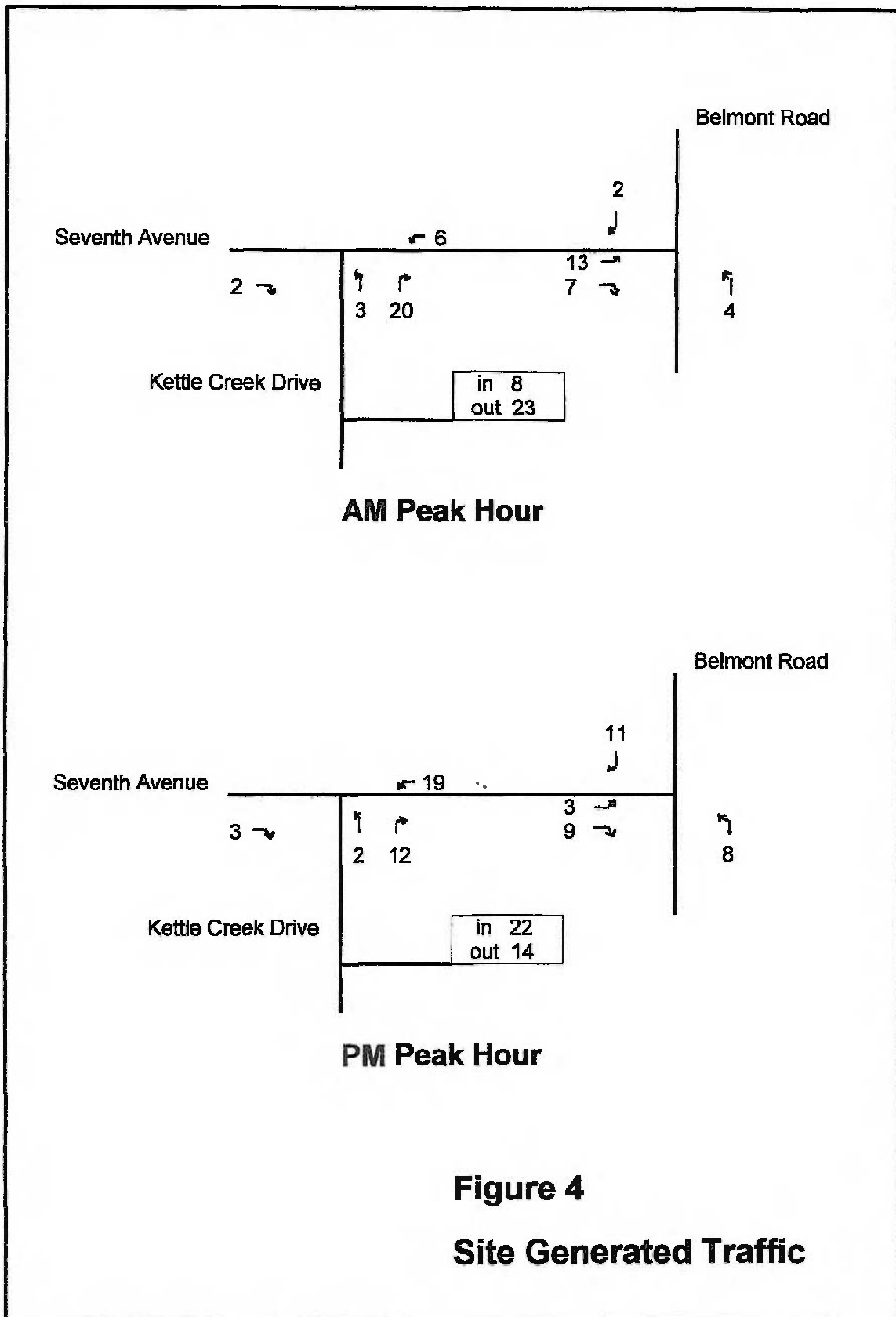


Figure 4

Site Generated Traffic



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Appendix C

Existing Traffic Operations (Synchro Reports)

HCM Unsignalized Intersection Capacity Analysis 2: Snyders Avenue & Seventh Avenue











2019 Existing AM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	7	2	12	34	11	12
Future Volume (Veh/h)	7	2	12	34	11	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	10	3	17	49	16	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			13		94	12
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			13		94	12
tC, single (s)			4.3		6.5	6.2
tC, 2 stage (s)						
tF (s)			2.4		3.6	3.3
p0 queue free %			99		98	98
cM capacity (veh/h)			1468		878	1075
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	13	66	33			
Volume Left	0	17	16			
Volume Right	3	0	17			
cSH	1700	1468	970			
Volume to Capacity	0.01	0.01	0.03			
Queue Length 95th (m)	0.0	0.3	0.8			
Control Delay (s)	0.0	2.0	8.8			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.0	8.8			
Approach LOS			A			
Intersection Summary						
Average Delay			3.8			
Intersection Capacity Utilization			19.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2019 Existing AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	16	3	16	25	21	47
Future Volume (Veh/h)	16	3	16	25	21	47
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	20	4	20	31	26	58
Pedestrians					2	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			26		95	24
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			26		95	24
tC, single (s)			4.3		6.4	6.4
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.4
p0 queue free %			99		97	94
cM capacity (veh/h)			1482		896	1014
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	24	20	31	84		
Volume Left	0	20	0	26		
Volume Right	4	0	0	58		
cSH	1700	1482	1700	974		
Volume to Capacity	0.01	0.01	0.02	0.09		
Queue Length 95th (m)	0.0	0.3	0.0	2.1		
Control Delay (s)	0.0	7.5	0.0	9.0		
Lane LOS		A		A		
Approach Delay (s)	0.0	2.9		9.0		
Approach LOS				A		
Intersection Summary						
Average Delay			5.7			
Intersection Capacity Utilization			18.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

4: Belmont Road & Seventh Avenue










2019 Existing AM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	51	20	29	390	176	7
Future Volume (Veh/h)	51	20	29	390	176	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	55	22	31	419	189	8
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	674	193	197			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	674	193	197			
tC, single (s)	6.4	6.5	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.3			
p0 queue free %	86	97	98			
cM capacity (veh/h)	407	793	1307			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	77	450	197			
Volume Left	55	31	0			
Volume Right	22	0	8			
cSH	473	1307	1700			
Volume to Capacity	0.16	0.02	0.12			
Queue Length 95th (m)	4.4	0.6	0.0			
Control Delay (s)	14.1	0.8	0.0			
Lane LOS	B	A				
Approach Delay (s)	14.1	0.8	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			45.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Snyders Avenue & Seventh Avenue











2019 Existing PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	46	10	16	13	4	14
Future Volume (Veh/h)	46	10	16	13	4	14
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	53	12	19	15	5	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			65		112	59
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			65		112	59
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			99		99	98
cM capacity (veh/h)			1550		855	993
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	65	34	21			
Volume Left	0	19	5			
Volume Right	12	0	16			
cSH	1700	1550	956			
Volume to Capacity	0.04	0.01	0.02			
Queue Length 95th (m)	0.0	0.3	0.5			
Control Delay (s)	0.0	4.1	8.8			
Lane LOS		A	A			
Approach Delay (s)	0.0	4.1	8.8			
Approach LOS			A			
Intersection Summary						
Average Delay		2.7				
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2019 Existing PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	44	16	47	26	3	33
Future Volume (Veh/h)	44	16	47	26	3	33
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	48	18	52	29	3	36
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			66		190	57
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			66		190	57
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	96
cM capacity (veh/h)			1523		776	1006
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	66	52	29	39		
Volume Left	0	52	0	3		
Volume Right	18	0	0	36		
cSH	1700	1523	1700	984		
Volume to Capacity	0.04	0.03	0.02	0.04		
Queue Length 95th (m)	0.0	0.8	0.0	0.9		
Control Delay (s)	0.0	7.4	0.0	8.8		
Lane LOS		A		A		
Approach Delay (s)	0.0	4.8		8.8		
Approach LOS				A		
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			19.3%		ICU Level of Service	
Analysis Period (min)			15		A	

HCM Unsignalized Intersection Capacity Analysis

4: Belmont Road & Seventh Avenue

2019 Existing PM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	48	32	227	410	41
Future Volume (Veh/h)	25	48	32	227	410	41
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	28	54	36	255	461	46
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	484	507			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	484	507			
tC, single (s)	6.4	6.2	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.3			
p0 queue free %	92	91	96			
cM capacity (veh/h)	334	583	1023			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	82	291	507			
Volume Left	28	36	0			
Volume Right	54	0	46			
cSH	465	1023	1700			
Volume to Capacity	0.18	0.04	0.30			
Queue Length 95th (m)	4.8	0.8	0.0			
Control Delay (s)	14.4	1.4	0.0			
Lane LOS	B	A				
Approach Delay (s)	14.4	1.4	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		49.9%		ICU Level of Service		A
Analysis Period (min)		15				



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Appendix D

2030 Background Traffic Operations (Synchro Reports)

HCM Unsignalized Intersection Capacity Analysis

2: Snyders Avenue & Seventh Avenue











2030 Background AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	10	3	15	47	15	20
Future Volume (Veh/h)	10	3	15	47	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	14	4	21	67	21	29
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			18		125	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			18		125	16
tC, single (s)			4.3		6.5	6.2
tC, 2 stage (s)						
tF (s)			2.4		3.6	3.3
p0 queue free %			99		98	97
cM capacity (veh/h)			1461		841	1069
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	18	88	50			
Volume Left	0	21	21			
Volume Right	4	0	29			
cSH	1700	1461	960			
Volume to Capacity	0.01	0.01	0.05			
Queue Length 95th (m)	0.0	0.3	1.3			
Control Delay (s)	0.0	1.9	9.0			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.9	9.0			
Approach LOS			A			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			20.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2030 Background AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	27	5	26	32	28	75
Future Volume (Veh/h)	27	5	26	32	28	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	33	6	32	40	35	93
Pedestrians						2
Lane Width (m)						3.7
Walking Speed (m/s)						1.1
Percent Blockage						0
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			41		142	38
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			41		142	38
tC, single (s)			4.3		6.4	6.4
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.4
p0 queue free %			98		96	91
cM capacity (veh/h)			1463		835	996
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	39	32	40	128		
Volume Left	0	32	0	35		
Volume Right	6	0	0	93		
cSH	1700	1463	1700	946		
Volume to Capacity	0.02	0.02	0.02	0.14		
Queue Length 95th (m)	0.0	0.5	0.0	3.6		
Control Delay (s)	0.0	7.5	0.0	9.4		
Lane LOS			A	A		
Approach Delay (s)	0.0	3.3		9.4		
Approach LOS				A		
Intersection Summary						
Average Delay			6.0			
Intersection Capacity Utilization			20.9%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis










4: Belmont Road & Seventh Avenue

2030 Background AM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	77	43	40	459	207	15
Future Volume (Veh/h)	77	43	40	459	207	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	83	46	43	494	223	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	811	231	239			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	231	239			
tC, single (s)	6.4	6.5	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.3			
p0 queue free %	75	94	97			
cM capacity (veh/h)	334	754	1261			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	129	537	239			
Volume Left	83	43	0			
Volume Right	46	0	16			
cSH	417	1261	1700			
Volume to Capacity	0.31	0.03	0.14			
Queue Length 95th (m)	9.9	0.8	0.0			
Control Delay (s)	17.4	1.0	0.0			
Lane LOS	C	A				
Approach Delay (s)	17.4	1.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		3.1				
Intersection Capacity Utilization		55.1%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 2: Snyders Avenue & Seventh Avenue











2030 Background PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	61	14	25	18	5	20
Future Volume (Veh/h)	61	14	25	18	5	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	71	16	29	21	6	23
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			87		158	79
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			87		158	79
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			98		99	98
cM capacity (veh/h)			1522		799	968
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	87	50	29			
Volume Left	0	29	6			
Volume Right	16	0	23			
cSH	1700	1522	927			
Volume to Capacity	0.05	0.02	0.03			
Queue Length 95th (m)	0.0	0.4	0.7			
Control Delay (s)	0.0	4.4	9.0			
Lane LOS		A	A			
Approach Delay (s)	0.0	4.4	9.0			
Approach LOS			A			
Intersection Summary						
Average Delay			2.9			
Intersection Capacity Utilization			19.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2030 Background PM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	58	23	75	40	6	52		
Future Volume (Veh/h)	58	23	75	40	6	52		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91		
Hourly flow rate (vph)	64	25	82	44	7	57		
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			89		284	76		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			89		284	76		
tC, single (s)			4.1		6.4	6.2		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			95		99	94		
cM capacity (veh/h)			1494		671	982		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1				
Volume Total	89	82	44	64				
Volume Left	0	82	0	7				
Volume Right	25	0	0	57				
cSH	1700	1494	1700	934				
Volume to Capacity	0.05	0.05	0.03	0.07				
Queue Length 95th (m)	0.0	1.3	0.0	1.7				
Control Delay (s)	0.0	7.5	0.0	9.1				
Lane LOS	A		A					
Approach Delay (s)	0.0	4.9		9.1				
Approach LOS			A					
Intersection Summary								
Average Delay			4.3					
Intersection Capacity Utilization			21.0%	ICU Level of Service	A			
Analysis Period (min)			15					

HCM Unsignalized Intersection Capacity Analysis

4: Belmont Road & Seventh Avenue

2030 Background PM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	39	72	58	267	483	65
Future Volume (Veh/h)	39	72	58	267	483	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	44	81	65	300	543	73
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	1010	580	616			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1010	580	616			
tC, single (s)	6.4	6.2	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.3			
p0 queue free %	82	84	93			
cM capacity (veh/h)	245	515	931			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	125	365	616			
Volume Left	44	65	0			
Volume Right	81	0	73			
cSH	371	931	1700			
Volume to Capacity	0.34	0.07	0.36			
Queue Length 95th (m)	11.1	1.7	0.0			
Control Delay (s)	19.5	2.3	0.0			
Lane LOS	C	A				
Approach Delay (s)	19.5	2.3	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization		63.2%		ICU Level of Service		B
Analysis Period (min)		15				



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]










Appendix E

2030 Total Traffic Operations (Synchro Reports)

HCM Unsignalized Intersection Capacity Analysis

1: Proposed Access & Seventh Avenue










2030 Total AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	14	7	25	64	50	56
Future Volume (Veh/h)	14	7	25	64	50	56
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	8	27	70	54	61
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			23		143	19
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			23		143	19
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		94	94
cM capacity (veh/h)			1592		835	1059
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	23	97	115			
Volume Left	0	27	54			
Volume Right	8	0	61			
cSH	1700	1592	941			
Volume to Capacity	0.01	0.02	0.12			
Queue Length 95th (m)	0.0	0.4	3.2			
Control Delay (s)	0.0	2.1	9.4			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.1	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			5.5			
Intersection Capacity Utilization			24.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Snyders Avenue & Seventh Avenue











2030 Total AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	66	3	31	72	15	58
Future Volume (Veh/h)	66	3	31	72	15	58
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	94	4	44	103	21	83
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			98			96
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			98			96
tC, single (s)			4.3			6.2
tC, 2 stage (s)						
tF (s)			2.4			3.3
p0 queue free %			97			91
cM capacity (veh/h)			1363			966
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	98	147	104			
Volume Left	0	44	21			
Volume Right	4	0	83			
cSH	1700	1363	886			
Volume to Capacity	0.06	0.03	0.12			
Queue Length 95th (m)	0.0	0.8	3.0			
Control Delay (s)	0.0	2.5	9.6			
Lane LOS			A			
Approach Delay (s)	0.0	2.5	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			23.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2030 Total AM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	121	5	26	73	28	75		
Future Volume (Veh/h)	121	5	26	73	28	75		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81		
Hourly flow rate (vph)	149	6	32	90	35	93		
Pedestrians						2		
Lane Width (m)						3.7		
Walking Speed (m/s)						1.1		
Percent Blockage						0		
Right turn flare (veh)								
Median type	None		None					
Median storage veh)								
Upstream signal (m)								
pX, platoon unblocked								
vC, conflicting volume			157		308	154		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			157		308	154		
tC, single (s)			4.3		6.4	6.4		
tC, 2 stage (s)								
tF (s)			2.4		3.5	3.4		
p0 queue free %			98		95	89		
cM capacity (veh/h)			1323		670	857		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1				
Volume Total	155	32	90	128				
Volume Left	0	32	0	35				
Volume Right	6	0	0	93				
cSH	1700	1323	1700	797				
Volume to Capacity	0.09	0.02	0.05	0.16				
Queue Length 95th (m)	0.0	0.6	0.0	4.3				
Control Delay (s)	0.0	7.8	0.0	10.4				
Lane LOS			A	B				
Approach Delay (s)	0.0	2.0		10.4				
Approach LOS				B				
Intersection Summary								
Average Delay			3.9					
Intersection Capacity Utilization			26.6%	ICU Level of Service	A			
Analysis Period (min)			15					

HCM Unsignalized Intersection Capacity Analysis

4: Belmont Road & Seventh Avenue

2030 Total AM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	96	118	52	459	207	44
Future Volume (Veh/h)	96	118	52	459	207	44
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	103	127	56	494	223	47
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	852	246	270			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	852	246	270			
tC, single (s)	6.4	6.5	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.3			
p0 queue free %	67	83	95			
cM capacity (veh/h)	312	739	1227			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	230	550	270			
Volume Left	103	56	0			
Volume Right	127	0	47			
cSH	458	1227	1700			
Volume to Capacity	0.50	0.05	0.16			
Queue Length 95th (m)	20.9	1.1	0.0			
Control Delay (s)	20.5	1.3	0.0			
Lane LOS	C	A				
Approach Delay (s)	20.5	1.3	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		5.2				
Intersection Capacity Utilization		63.2%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

1: Proposed Access & Seventh Avenue

2030 Total PM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	77	47	69	24	12	50
Future Volume (Veh/h)	77	47	69	24	12	50
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	84	51	75	26	13	54
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			135		286	110
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			135		286	110
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		98	94
cM capacity (veh/h)			1449		668	944
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	135	101	67			
Volume Left	0	75	13			
Volume Right	51	0	54			
cSH	1700	1449	874			
Volume to Capacity	0.08	0.05	0.08			
Queue Length 95th (m)	0.0	1.2	1.9			
Control Delay (s)	0.0	5.8	9.5			
Lane LOS		A	A			
Approach Delay (s)	0.0	5.8	9.5			
Approach LOS			A			
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			25.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Snyders Avenue & Seventh Avenue











2030 Total PM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶↷	
Traffic Volume (veh/h)	111	14	71	87	5	53
Future Volume (Veh/h)	111	14	71	87	5	53
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	129	16	83	101	6	62
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			145		404	137
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			145		404	137
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			94		99	93
cM capacity (veh/h)			1450		554	898
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	145	184	68			
Volume Left	0	83	6			
Volume Right	16	0	62			
cSH	1700	1450	852			
Volume to Capacity	0.09	0.06	0.08			
Queue Length 95th (m)	0.0	1.4	2.0			
Control Delay (s)	0.0	3.7	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	3.7	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization			28.8%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Kettle Creek Drive & Seventh Avenue










2030 Total PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	141	23	75	155	6	52
Future Volume (Veh/h)	141	23	75	155	6	52
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	155	25	82	170	7	57
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			180		502	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			180		502	168
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		99	93
cM capacity (veh/h)			1384		501	874
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	180	82	170	64		
Volume Left	0	82	0	7		
Volume Right	25	0	0	57		
cSH	1700	1384	1700	808		
Volume to Capacity	0.11	0.06	0.10	0.08		
Queue Length 95th (m)	0.0	1.4	0.0	2.0		
Control Delay (s)	0.0	7.8	0.0	9.8		
Lane LOS			A	A		
Approach Delay (s)	0.0	2.5			9.8	
Approach LOS					A	
Intersection Summary						
Average Delay			2.6			
Intersection Capacity Utilization			26.5%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

4: Belmont Road & Seventh Avenue

2030 Total PM

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	86	108	134	267	483	104
Future Volume (Veh/h)	86	108	134	267	483	104
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	97	121	151	300	543	117
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	1204	602	660			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1204	602	660			
tC, single (s)	6.4	6.2	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.3			
p0 queue free %	42	76	83			
cM capacity (veh/h)	168	500	896			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	218	451	660			
Volume Left	97	151	0			
Volume Right	121	0	117			
cSH	266	896	1700			
Volume to Capacity	0.82	0.17	0.39			
Queue Length 95th (m)	49.7	4.6	0.0			
Control Delay (s)	59.7	4.6	0.0			
Lane LOS	F	A				
Approach Delay (s)	59.7	4.6	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay		11.4				
Intersection Capacity Utilization		74.6%		ICU Level of Service		D
Analysis Period (min)		15				