

**Proposed Residential Development  
2710 Draper Avenue  
Traffic Brief**

Presented to:

**Greatwise Developments**  
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## **1.0 INTRODUCTION**

The original TIA document was undertaken in August 2008 for the proposed Morrison / Baseline development followed by subsequent addendum reports to address changes to the site plan. Given that the original study was undertaken a decade ago, The City of Ottawa staff requested that the original TIA (August 2008) be updated to meet current conditions of the study area limiting the brief to immediate study area intersections.

A meeting was held with City staff (December 1<sup>st</sup>, 2017) to define the scope of work. It was agreed with City staff that a traffic brief would suffice to supersede the original study and addendum reports given the development size has been reduced since the original TIA [original TIA – 537 units vs current plan 250 units]. The brief would update the existing conditions, undertake analysis of the most recent site plan and focus on the immediate study area intersections (Baseline/Morrison, Baseline/Guthrie and Morrison/Draper).

## **2.0 THE PROPOSED DEVELOPMENT**

Exhibit 2.1 illustrates the proposed overall site plan for the 2710 Draper Avenue development located at the north-east corner of Morrison Drive / Draper Avenue. The proposed site plan illustrates 90 townhome units that will replace the 48 existing townhome units. The development also illustrates a 4-storey building (Building “F”) that accommodates 80 units and ground floor commercial area (~600 m<sup>2</sup>). In term of site access.

- *Access #1* would be a right-in/right-out that would provide access to visitor parking;
- *Access #2* would provide exclusive access to Building “F” garage along Morrison Drive; and
- *Access #3 and #4* would provide access to the townhome units along Morrison Drive; and
- *Access #5* would provide access to the townhomes and also the existing Building “E” garage along Draper Avenue.

## **3.0 HORIZON YEARS AND DEVELOPMENT PHASING**

For the purpose of this traffic brief, the proposed 90 townhome units are anticipated to be build-out by 2019. Building “F” is anticipated to be constructed at a later stage after the townhomes are build-out. Therefore, the trips generated by the 4-storey Building “F” were included as background traffic and not as site traffic volumes. The traffic brief would analyze 2019 build-out of the townhomes and 2024 (5-year post development) that would include the build-out of the 4-storey Building “F”. The brief would analyze morning and afternoon peak hours of travel demand as they are anticipated to represent worst-case scenario in terms of site traffic volumes.



## 4.0 EXISTING CONDITIONS

The area within the vicinity of the proposed site is characterized by a combination of residential, institutional, and business park development.

### 4.1 STUDY AREA ROADWAYS

The following provides an overview of the roadways supporting the proposed development:

- **Baseline Road** is an arterial roadway provides for 4 east-west through lanes (2 lanes per direction of travel separated by a median) and is signed with a posted speed of 70 km/hr in the vicinity of the site. Baseline Road is defined as an *arterial* roadway within the City of Ottawa's Transportation Master Plan. Pedestrian facilities include both sidewalks and dedicated bike lanes on both sides of the roadway.
- **Morrison Drive** is defined as a *collector* road as per the City's Transportation Master Plan (Map 6) intersecting Baseline Road at its southern terminus and terminating at Greenbank Road.
- **Draper Avenue** is a *local* road within the community intersecting Morrison Drive approximately 150 m north of Baseline Road and intersecting (and terminating) again at the northern end of Morrison Drive approximately 180 m west of Greenbank Road. Draper Avenue provides access to the two schools in addition to the adjacent residential developments.

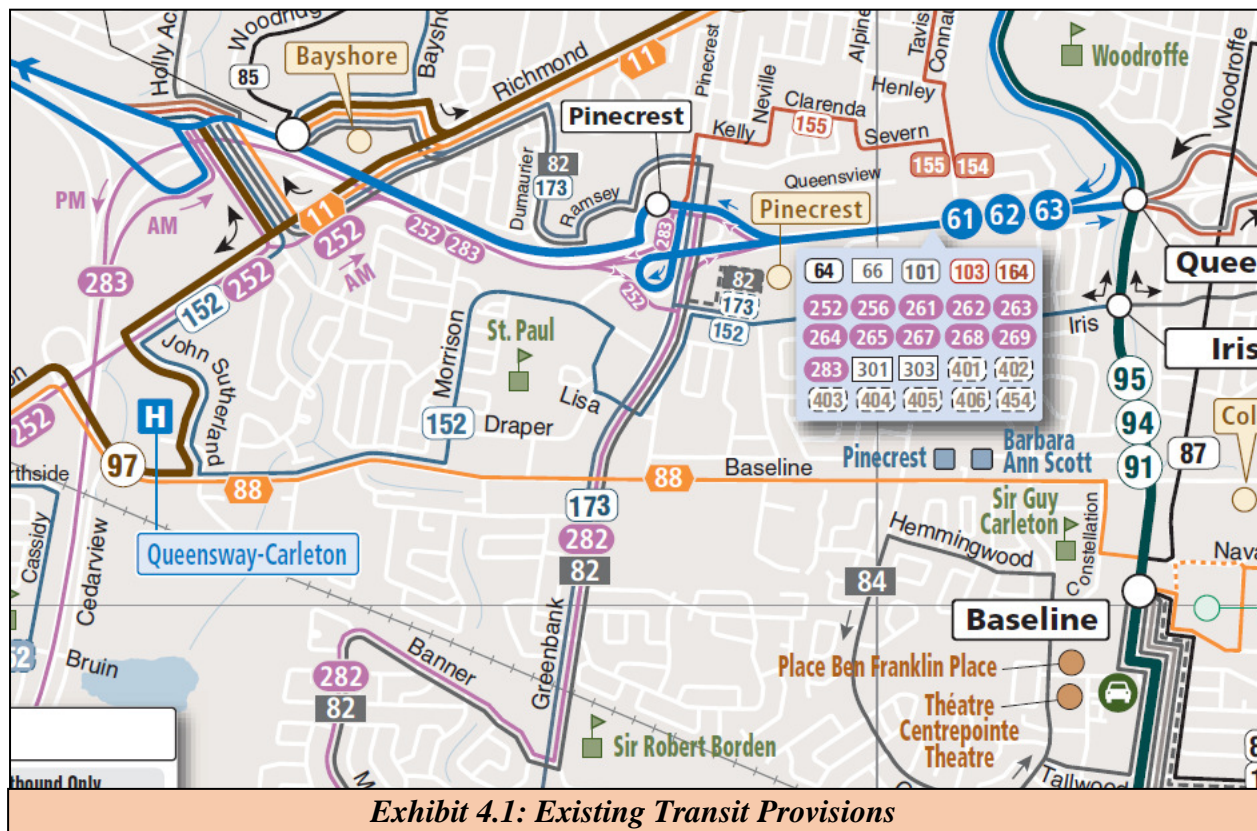
### 4.2 CURRENT TRANSIT PROVISIONS

Exhibit 4.1 illustrates the transit provision service routes within the study area. Bust stops with shelter are located along Baseline Road 120m east of Morrison Drive in the vicinity of Guthrie Street. Bus stops also exists along Morrison Drive north of Baseline Road.

A review of the most recent route maps and timetables indicated the following:

- **Route 88** runs adjacent to the proposed site and connects to Hurdman and Terry Fox stations. (This route connects to Baseline Station, Confederation station and the Transitway at Billings Bridge Shopping Centre). The transit frequency is approximately every 10 minutes during the peak periods of travel demand; and
- **Route 152** provides service between Lincoln Fields and Bayshore Station running through the study area adjacent to the proposed site along Morrison Drive. Frequencies of approximately 15 minutes and 30 minutes occur during the peak periods of travel demand.





#### 4.3 CURRENT PEDESTRIAN PROVISIONS

Table 4.1 depicts the pedestrian activities within the study area during the peak periods of travel demand. The following provides a summary of the table:

- *Baseline Road / Morrison Drive*: The highest pedestrian activity was observed along the north leg of the intersection with 24 pedestrians crossing during the afternoon peak period.
- *Baseline Road / Guthrie Street*: The highest pedestrian activity was observed along the west leg of the intersection with 30 pedestrians crossing during the afternoon peak period.
- *Morrison Drive / Draper Avenue*: The highest pedestrian activity was observed along the west leg of the intersection with 24 pedestrians crossing during the afternoon peak period.

**Table 4.1: Existing Pedestrian Activities**

Intersections	AM Peak Period				PM Peak Period			
	North Leg	South Leg	East Leg	West Leg	North Leg	South Leg	East Leg	West Leg
<i>Baseline/Morrison</i>	10		7	7	<b>24</b>		4	11
<i>Baseline/Guthrie</i>		8	1	9		15	4	<b>30</b>
<i>Morrison/Draper</i>	13	5	7	14	13	21	21	<b>24</b>

Sidewalks exist on both sides of Baseline Road and on the west side of Morrison Drive. A sidewalk is provided on the south side of Draper Avenue between Morrison Drive and the St. Paul High School east access. East of St. Paul High School, sidewalks are provided on both sides of the roadway.

#### 4.4 CURRENT CYCLING PROVISIONS

A review of the Summer cycling activity at the Baseline Road / Guthrie Street intersection indicated that:

- 15 cyclists were observed in the westbound direction during the morning period and;
- 22 cyclists were observed in the eastbound direction during the afternoon peak period.

The City of Ottawa's Transportation Master Plan indicates Baseline Road is a spine route. Currently, bicycle lanes are provided alongside the eastbound and westbound lanes of Baseline Road (west of Greenbank Road) to facilitate cycling activities.

#### 4.5 COLLISION STATISTICS

Five (5) year (January 2012 to January 2017) collision information were reviewed for the study area intersections:

- Baseline Road / Morrison Drive;
- Baseline Road / Guthrie Street; and
- Morrison Drive / Draper Avenue.

The collision information provides the date and time of each collision, the environmental condition at the time of the collision, the type of collision (i.e. angle collision, rear-end), the level of damage involved, vehicle details (truck, passenger vehicle, etc.), vehicle path/maneuver characteristics and the number of pedestrians involved (in the collision).

The following provides a summary of the collisions:

- *Baseline Road / Morrison Drive*: A total of 9 collisions occurred at this intersection in the past 5 years and 56% (5) of collisions were rear-end collisions. Majority (89%) of the collisions resulted in property damage.
- *Baseline Road / Guthrie Street*: A total of 3 collisions occurred at this intersection in the past 5 years.
- *Morrison Drive / Draper Avenue*: A single collision occurred at this intersection in the past 5 years.

None of the collisions reported in the past five years for the study area intersections involved pedestrians.



#### 4.6 EXISTING (2017) TRAFFIC VOLUMES

Recent traffic counts were obtained from the City of Ottawa for:

- Baseline Road / Morrison Drive (Wednesday October 26<sup>th</sup>, 2016); and
- Baseline Road / Guthrie Street (Wednesday August 3<sup>rd</sup>, 2016).

Additional traffic counts were undertaken by Castleglenn staff at Morrison Drive and Draper Avenue intersection (Monday December 4<sup>th</sup>, 2017) during the morning and afternoon peak periods of travel demand.

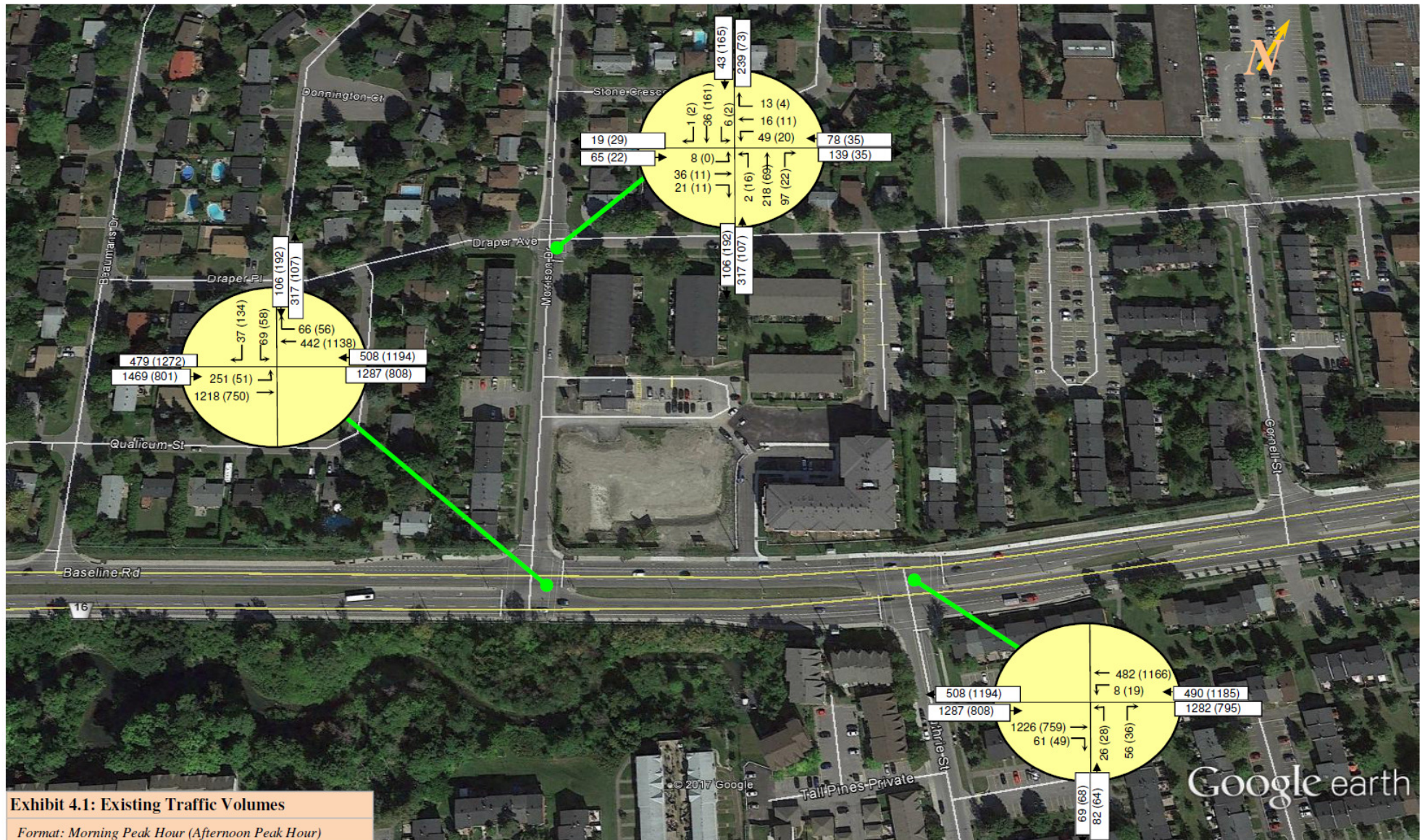
One can appreciate that the approach and egress volumes between individual intersections did not balance as the traffic counts were undertaken on different dates. As such, existing traffic count information was rationalized to develop a balanced condition between the intersections. This represents a conservative approach in that the highest value (between the egress traffic volume recorded leaving the downstream intersection and the approach traffic volume arriving at the adjacent intersection upstream) was selected. By selecting the higher of the two values, and iteratively repeating this process throughout the network, a “worst-case” estimate of existing conditions was developed.

Exhibit 4.1 illustrates the resulting existing traffic volumes at the study area intersections.

#### 4.7 EXISTING (2017) TRAFFIC ANALYSIS

Intersection capacity analysis was performed using Synchro 10<sup>TM</sup> traffic analysis software to determine the existing traffic operational characteristics of intersections within the study area (See Appendix “A”). The analysis assumed the current roadway network configuration and the existing signal timing obtained from the City of Ottawa. Table 4.2 contains a summary of the results of the Synchro analysis of the existing (2017) travel demand conditions within the study area. For the purpose of this traffic brief, a volume-to-capacity (v/c) ratio greater than 0.90 is considered unsatisfactory.

The results indicate all the study area intersections operate at satisfactory level of service LOS “D” or better.





**Table 4.2: Existing (2017) Intersection Capacity Analysis Results**

Intersections	Morning Peak Hour			Afternoon Peak Hour		
	Overall LOS	Critical Approach		Overall LOS	Critical Approach	
		Movement	LOS, V/C		Movement	LOS, V/C
Baseline Rd / Morrison Dr (Signalized)	A	SB-LT	C, 0.56	A	SB	D, 0.73
Baseline Rd / Guthrie St (Signalized)	A	NB-LT	D, 0.18	A	NB-LT	D, 0.26
Morrison Dr / Draper Ave (All-Way STOP Control)	A	NB	A, 0.41	A	SB	A, 0.21

## 5.0 FORECAST TRAFFIC CONDITIONS

The following sections represents the traffic forecasting methodology.

### 5.1 SITE GENERATED TRIP

The Trans Trip Generation Study (2009) was used to determine the site traffic volumes for the proposed development. Table below is an extract from the Trans Trip Generation Study.

Table 6.3: Recommended Vehicle Trip Generation Rates for Residential Land Uses with Transit Bonus

Recommended Vehicle Trip Generation Rates with Transit Bonus AM and PM Peak Hours									
ITE Land Use Code	Geographic Area Dwelling Unit Type		Vehicle Trip Rate						
			Core		Urban (Inside the Greenbelt)		Suburban (Outside the Greenbelt)		Rural
			Base Rate	< 600m to Rapid Transit	Base Rate	< 600m to Rapid Transit	Base Rate	< 600m to Rapid Transit	Base Rate
210	Single-detached dwellings	AM	0.40	0.31	0.67	0.50	0.70	0.49	0.62
		PM	0.60	0.33	0.76	0.57	0.90	0.63	0.92
224	Semi-detached dwellings, townhouses, rowhouses	AM	0.34	0.34	0.51	0.50	0.54	0.39	0.62
		PM	0.39	0.38	0.51	0.51	0.71	0.51	0.67
231	Low-rise condominiums (1 or 2 floors)	AM	0.34	0.34	0.50	0.50	0.60	0.60	0.71
		PM	0.29	0.29	0.49	0.49	0.66	0.66	0.72
232	High-rise condominiums (3+ floors)	AM	0.26	0.26	0.38	0.38	0.46	0.46	0.54
		PM	0.20	0.20	0.34	0.34	0.46	0.46	0.50
233	Luxury condominiums	AM	0.31	0.31	0.45	0.45	0.55	0.55	0.65
		PM	0.24	0.24	0.40	0.40	0.55	0.55	0.59
221	Low-rise apartments (2 floors)	AM	0.21	0.21	0.31	0.31	0.37	0.37	0.44
		PM	0.20	0.20	0.34	0.34	0.46	0.46	0.50
223	Mid-rise apartments (3-10 floors)	AM	0.17	0.17	0.24	0.24	0.29	0.29	0.35
		PM	0.16	0.16	0.28	0.28	0.37	0.37	0.41
222	High-rise apartments (10+ floors)	AM	0.17	0.17	0.24	0.24	0.29	0.29	0.35
		PM	0.16	0.16	0.27	0.27	0.36	0.36	0.39

The proposed development falls within the urban (inside the Greenbelt) area. The ITE land use code 224 was used to determine the automobile trip generation for the townhomes (Townhomes: 90 units x 0.51 = 46 vehicle trips during the AM and PM peak hours).

Once the vehicle trip generations were determined, the vehicle trips were converted to persons-trip using the table below (Table 3.13 from 2009 Trans Trip Generation Study).

- *Townhomes*: 46 vehicle trips / 0.45 = 102 persons-trip during the morning peak hour and 46 vehicle trips / 0.53 = 87 persons-trip during the afternoon peak hour.

Table 3.13: Mode Shares - (all households with residents not older than 55 years of age)

Reported Mode Shares																
All Households with persons 55 years of age or less AM and PM Peak Hours																
Geographic Areas Dwelling Unit Types		Core Area			Urban Area (Inside the greenbelt)			Suburban (Outside the greenbelt)			Rural*			All Areas		
		Vehicle Trips	Transit Share	Non-Motorised	Vehicle Trips	Transit Share	Non-Motorised	Vehicle Trips	Transit Share	Non-Motorised	Vehicle Trips	Transit Share	Non-Motorised	Vehicle Trips	Transit Share	Non-Motorised
Single - Detached:	AM	35%	20%	33%	51%	26%	11%	55%	25%	9%	60%	27%	4%	54%	25%	10%
	PM	45%	11%	32%	58%	19%	13%	64%	19%	6%	73%	13%	2%	63%	17%	8%
Semi-Detached:	AM	38%	30%	26%	44%	35%	10%	52%	24%	12%	64%	27%	5%	49%	28%	12%
	PM	36%	20%	34%	51%	27%	13%	62%	17%	7%	77%	12%	1%	58%	20%	10%
Row / Townhouse:	AM	33%	22%	40%	45%	34%	10%	55%	27%	8%	73%	15%	3%	49%	30%	11%
	PM	39%	15%	42%	53%	28%	8%	61%	22%	6%	74%	15%	1%	57%	24%	9%
Apartment:	AM	27%	27%	43%	37%	41%	14%	44%	34%	13%	76%	8%	16%	36%	35%	23%
	PM	23%	29%	42%	40%	37%	14%	44%	33%	9%	48%	4%	17%	35%	33%	23%
All Types:	AM	32%	24%	38%	47%	31%	11%	54%	26%	9%	61%	26%	4%	51%	27%	11%
	PM	34%	21%	38%	53%	24%	12%	62%	20%	6%	73%	13%	2%	59%	20%	10%

Note: Percentages do not necessarily sum to 100% as the proportion of automobile passengers have not been tabulated. Vehicle trips reflect the percentage of vehicle drivers.

\* - Rural area sample size is extremely low and mode shares are highly influenced by school types where public transportation levels are high during the AM versus the PM peaks.

The 2011 Trans OD Survey Report was reviewed to get an understanding of the existing travel mode shares for the area of Bayshore / Cedarview (within the location of the proposed development). Table 5.1 depicts the existing and future travel demand for the study area:

Table 5.1 Existing and Future Travel Mode Shares

Mode Share	Existing Mode Share		Future Mode Share	Rationale
	AM Peak	PM Peak	AM/PM	
<i>Auto Driver</i>	52%	56%	55%	<b>Immediate Study Area:</b> Baseline a Transit Priority Corridor <b>Larger Study Area:</b> Future BRT Baseline to Heron Station / conversion of west transitway to LRT (Baseline to Tunney's Pasture and Pinecrest to Bayshore)
<i>Auto Passenger</i>	12%	16%	12%	
<i>Transit</i>	29%	23%	30%	
<i>Walking</i>	1%	1%	1%	
<i>Cycling</i>	1%	1%	1%	
<i>Other</i>	5%	3%	1%	

The future travel mode share split was applied to the proposed townhomes. Table 5.2 below depicts the total trips generated for each mode share:

**Table 5.2: Site Traffic Volumes by Mode Share**

<i>Travel Mode</i>	<i>Mode Share</i>	<i>AM</i>			<i>PM</i>		
		<i>In</i>	<i>Out</i>	<i>Total</i>	<i>In</i>	<i>Out</i>	<i>Total</i>
<b>Auto Driver</b>	55%	21	36	57	25	22	48
<b>Auto Passenger</b>	12%	5	8	12	6	5	10
<b>Transit</b>	30%	11	20	31	14	12	26
<b>Non-Auto (Cycling/Walking)</b>	3%	1	2	3	1	1	3
<b>Total Person Trips</b>	100%	38	65	103	46	41	87
New Auto Trips – [New 90 Townhome Units]		21	36	57	25	22	48
Original TIA (2008) Auto Trips – [Existing 48 Townhome Units]		11	18	29	18	11	29
<b>Net Auto Trips</b>		<b>10</b>	<b>18</b>	<b>28</b>	<b>7</b>	<b>11</b>	<b>18</b>

The net auto trips (removing the existing 48 townhome unit trips) were forecasted to be less than 30 vehicles per hour (vph) during the worst-case peak hour of travel demand.

## 5.2 ADJACENT DEVELOPMENT INITIATIVES

A review of other adjacent developments planned within the the greater study area was undertaken as part of this traffic brief. The following summarizes the adjacent developments within the immediate study area:

- **2940 Baseline Road:** The proposed site would be re-developed to include four 8-to-18 storey high-rise condominium/apartment towers totaling approximately 440 dwelling units. The site will also include 10,000 ft<sup>2</sup> of office, a 26,500 ft<sup>2</sup> medical facility, 36,000 ft<sup>2</sup> of retail, a 20,000 ft<sup>2</sup> retail food store, 2,500 ft<sup>2</sup> bistro and a 2,700 ft<sup>2</sup> pharmacy. The development is located west of the proposed site and is anticipated to impact the through movement along Baseline Road.
- **Building “F”:** As it was noted earlier, the site traffic volumes for the 4-storey Building “F” at the north-east corner of Baseline Road / Morrison Drive was included as background traffic volumes.

Both of the above development traffic volumes were assumed to be build-out beyond 2019 horizon year and were included as part of the 5-year post development forecast traffic volumes (2024).

## 5.3 BACKGROUND GROWTH

The population growth for the Inner Suburbs was determined to grow less 1 percent annually. However, to be conservative and for the purpose of this traffic analysis, traffic on Baseline Road was assumed to increase at an annual rate of 1 percent. This background growth is above and beyond the adjacent development traffic.

## 5.4 FORECAST (2019) TRAFFIC VOLUMES

The following traffic forecasts were prepared (Appendix “B”):

- **2019 Horizon Year:** This horizon year represents the time of build-out of the 90 townhome units. The traffic forecast was developed by superimposing site generated traffic onto the 2019 background traffic volumes (which includes annual background traffic growth of 1% over a 2-year period).
- **2024 Horizon Year:** This horizon year represents 5-year post-development traffic volumes. The traffic forecast was developed by superimposing site generated traffic onto the 2024 background traffic volumes (which includes adjacent development traffic and annual background traffic growth of 1% over a 7-year period).

## 6.0 FORECAST TRAFFIC ANALYSIS

Intersection capacity analysis was performed using Synchro 10<sup>TM</sup> traffic analysis software to determine the forecast (2019 & 2024) traffic operational characteristics of the study area intersections (Appendix “C”).

### 6.1 FORECAST (2019 & 2024) INTERSECTION CAPACITY ANALYSIS

Table 6.1 depicts the forecast (2019 & 2024) intersection capacity analysis results for the critical approaches. The results indicate that all the study area intersections continue to operate at satisfactory level of service LOS “D” or better.

**Table 6.1: Forecast (2019 & 2024) Intersection Capacity Analysis Results**

Intersections	Morning Peak Hour			Afternoon Peak Hour		
	Overall LOS	Critical Approach		Overall LOS	Critical Approach	
		Movement	LOS, V/C		Movement	LOS, V/C
2019 Traffic Analysis						
Baseline Rd / Morrison Dr (Signalized)	A	SB	D, 0.57	A	SB	D, 0.72
Baseline Rd / Guthrie St (Signalized)	A	NB-LT	D, 0.17	A	NB-LT	D, 0.24
Morrison Dr / Draper Ave (All-Way STOP Control)	A	NB	A, 0.37	A	SB	A, 0.20
2024 Traffic Analysis						
Baseline Rd / Morrison Dr (Signalized) <sup>1</sup>	A	SB-LT	D, 0.51	A	SB-LT	C, 0.38
Baseline Rd / Guthrie St (Signalized)	A	NB-LT	B, 0.17	A	NB-LT	D, 0.24
Morrison Dr / Draper Ave (All-Way STOP Control)	A	NB	A, 0.39	A	SB	A, 0.20

1- A dedicated SB-LT was coded for 2024 horizon year assuming Building “F” would be completed.



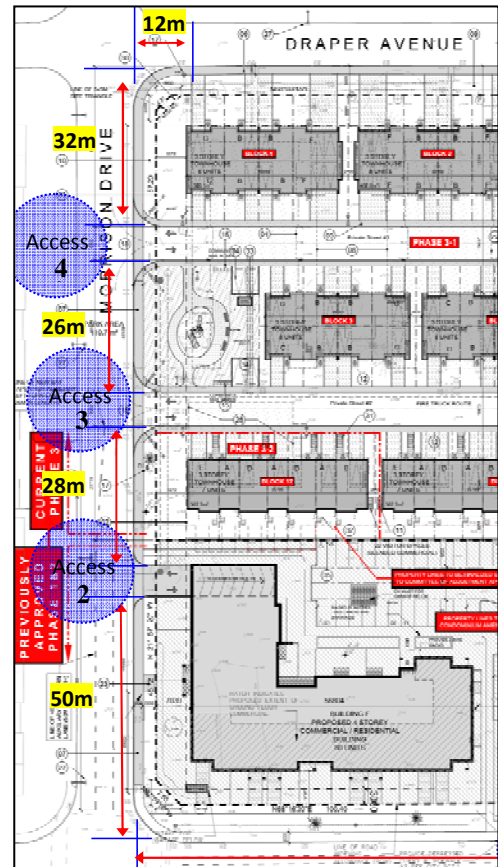
## 6.2 QUEUE ANALYSIS

A review of the proposed site plan was undertaken to assess the adequacy of intersection spacing along Morrison Drive at Baseline Road to accommodate vehicle storage requirements.

### ***2019 Horizon Year:***

It is understood that the townhomes would be build-out by 2019 horizon year and Building “F” would be constructed at a later stage (i.e. beyond 2019 horizon year). Therefore, by 2019 horizon year the queue length along Morrison Drive corridor between the Baseline Road/Morrison Drive intersection and Access #3 was assessed to determine the extent to which southbound queues could occur and if the Access #3 would be blocked.

- The separation between the location of the driveway access (Access #3) and the signalized Baseline Road/Morrison Drive intersection is approximately 80 meters;
- The curb-to-curb throat width along Morrison Drive on the north leg (south approach) is approximately 11.0 meters;
- Currently, the additional paved surface width provides for on-street parking on the west side of Morrison Drive;
- Under the forecast 2019 traffic conditions, the Baseline Road/Morrison Drive intersection was forecast to accommodate:
  - approximately 123 vehicles-per-hour (41 vph SB-RT and 82 vph SB-LT) in total during the morning peak hour of travel demand that would approach the intersection in the southbound direction from Morrison Drive. The queue length was determined to be 32m on average during the morning peak hour of travel demand (assuming the 85 second cycle length during the morning peak hour of travel demand results in approximately 3 vehicles approaching the intersection each cycle - 1.5 safety factor x 3 x 7 m vehicle length); and
  - approximately 202 vehicles-per-hour (137 vph SB-RT and 65 vph SB-LT) in total during the afternoon peak hour of travel demand that would approach the intersection in the southbound direction from Morrison Drive. The queue length was determined to be 63m on average during the afternoon peak hour of travel demand (assuming the 100 second cycle length during the morning peak hour of travel demand results in approximately 6 vehicles approaching the intersection each cycle - 1.5 safety factor x 6 x 7 m vehicle length)



- It should be noted that the 11m width provides the opportunity for SB-RT traffic not to have to queue behind SB-LT vehicles and encourages the “*right-turn-on-red*” maneuver at the intersection (parking is prohibited for the first 15-to-20m north of Baseline/Morrison intersection).

Hence, it was determined that the queue from the southbound approach is not anticipated to extend beyond the available 80 m separation between the driveway access (Access#3) and the signalized Baseline Road/Morrison Drive intersection southbound approach stop line during the build-out 2019 horizon year.

#### ***2024 Horizon Year:***

It should be noted that once Building “F” is constructed, an additional access to serve Building “F” garage would be added along Morrison Drive (Access #2). Access #2 would be located closer to Baseline Road (approximately 50m north of the Baseline Road / Morrison Drive intersection). Given the wide pavement width along Morrison Drive, it might worthwhile to provide a dedicated SB left-turn lane and right-turn lane to ensure that queues do not block the future Access #2. Accommodating a SB left-turn would require delineated pavement marking and prohibition of on-street parking between Access #2 and the signalized Baseline Road / Morrison Drive intersection. The dedicated SB left-turn lane is anticipated to be required once Building “F” is constructed.

### **6.3 SITE ACCESS OPERATIONS**

The proposed site plan illustrates an access off Draper Avenue and ultimately 3 accesses along Morrison Drive. Also, a right-in/right-out access would be provided for visitors along Baseline Road. The accesses serving the residents are located along local and collector roadways with low traffic volumes. Therefore, motorists are not expected to experience delays to enter/egress the site accesses.

## **7.0 PRIVATE APPROACH BY-LAW**

Ultimately the site plan would include three accesses along Morrison Drive and a single access from Draper Avenue. Access #2 for Building “F” garage would be built as a last phase of the development. The following provides the access separation along Morrison Drive assuming full build-out of the entire site:

- Access #2 is located about 50m from Baseline Road;
- Access #3 is located 28m from Access #2; and
- Access #4 is located 26 from Access #3 and 32m from Draper Avenue.

The access to/from Building “F” garage would be off Morrison Drive accommodating about 76 parking stalls. The City of Ottawa Private Approach By-law indicates that distance between a private approach and nearest private approach should be 15m (parking stalls between 20-to-99 spaces). The access separation along Morrison Drive meets the private approach by-law.

## **8.0 NON-AUTO PROVISIONS**

The City of Ottawa Transportation Master Plan (Map 5) was reviewed to get an understanding of the future transit provisions within the greater study area. The following transit provisions are anticipated to be implemented in the future:

- Baseline Road (from Robinson Road to Baseline Station) is anticipated to be a Transit Priority Corridor with isolated measures.
- A Bus Rapid Transit (BRT) line from Baseline to Heron Station Road is also anticipated to be implemented to serve commercial/employment lands along Baseline Road and also residents at major transit stations.
- Conversion of the West Transitway to LRT between Baseline Station to Tunney’s Pasture.
- Conversion of West Transitway to LRT from Pinecrest to Bayshore station.

Despite the timing of the above transit provisions are unknown, it should encourage transit ridership for the study area in the future. The addition of 90 townhome units is expected to result in additional 20 persons using transit during the peak direction of peak hour. The current transit provisions (as outlined in Section 4.2) would accommodate the additional passengers with bus routes 88 and 152 providing sufficient frequency along Baseline Road and Morrison Drive.

A new bus stop pad and shelter would be provided along Morrison Drive just north of Baseline Road. The site plan illustrates sidewalks east of Morrison Drive and south of Draper Avenue fronting the proposed development. This would facilitate pedestrian activities to the new bus pad / shelter on Morrison Drive and the existing bus pad / shelter on Baseline Road.

## **9.0 CONCLUSION**

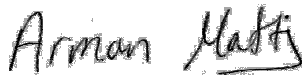
This traffic brief yields the following conclusions:

- The study area intersections operate at satisfactory level of service assuming forecast conditions during both peak hours of travel demand.
- The SB queue length is not anticipated to extend beyond the available 80 m separation between the driveway access (Access#3) and the signalized Baseline Road/Morrison Drive intersection southbound approach stop line during the build-out 2019 horizon year.

- Once Building “F” is constructed, the SB storage length would be reduced to 50m. It might be worthwhile to provide a dedicated SB left-turn lane and right-turn lane to ensure that queues do not block the future Access #2. Accommodating a SB left-turn would require delineated pavement marking and prohibition of on-street parking between Access #2 and the signalized Baseline Road / Morrison Drive intersection.
- The proposed site plan meets the City of Ottawa Private Approach By-law.
- The current transit provisions would accommodate the additional ridership anticipated as a result of the proposed 90 townhome units. The future transit provisions would also encourage transit ridership.
- Sidewalks east of Morrison Drive and south of Draper Avenue fronting the proposed development would facilitate pedestrian activities to the new bus pad / shelter on Morrison Drive and the existing bus pad / shelter on Baseline Road.

The results indicate that the City of Ottawa should be encouraged to assemble the appropriate conditions that would permit the development application to proceed.

Yours Truly,



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Arman Matti, P. Eng.  
Transportation Engineer  
May 2018



# **Appendix A**

## **Existing Traffic Analysis**

Lanes, Volumes, Timings  
2: Baseline & Morrison

Existing Morning PK Hour  
05/14/2018

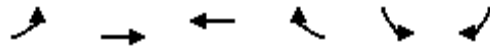


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	251	1218	442	66	69	37
Future Volume (vph)	251	1218	442	66	69	37
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	0.0	0.0
Storage Lanes	1			1	1	0
Taper Length (m)	25.0				7.6	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	1.00			0.97	0.99	
Frt				0.850	0.953	
Flt Protected	0.950				0.968	
Satd. Flow (prot)	1647	3424	3293	1517	1497	0
Flt Permitted	0.473				0.968	
Satd. Flow (perm)	818	3424	3293	1478	1493	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				73	35	
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	3			3	4	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	5%	1%	5%	2%	12%	11%
Adj. Flow (vph)	279	1353	491	73	77	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	279	1353	491	73	118	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	
Detector Template	Left	Thru	Thru	Right	Left	
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	
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)	2.1	0.6	0.6	2.1	2.1	
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			



Lanes, Volumes, Timings  
2: Baseline & Morrison

Existing Morning PK Hour  
05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		2	6			
Permitted Phases	2			6	4	
Detector Phase	2	2	6	6	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	
Total Split (s)	49.0	49.0	49.0	49.0	36.0	
Total Split (%)	57.6%	57.6%	57.6%	57.6%	42.4%	
Maximum Green (s)	43.1	43.1	43.1	43.1	30.0	
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	
Act Effect Green (s)	66.3	66.3	66.3	66.3	10.3	
Actuated g/C Ratio	0.78	0.78	0.78	0.78	0.12	
v/c Ratio	0.44	0.51	0.19	0.06	0.56	
Control Delay	7.7	5.7	3.0	0.8	34.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	7.7	5.7	3.0	0.8	34.4	
LOS	A	A	A	A	C	
Approach Delay		6.1	2.7		34.4	
Approach LOS		A	A		C	

Intersection Summary

Area Type: Other

Cycle Length: 85

Actuated Cycle Length: 85

Offset: 11 (13%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.56

Intersection Signal Delay: 6.7

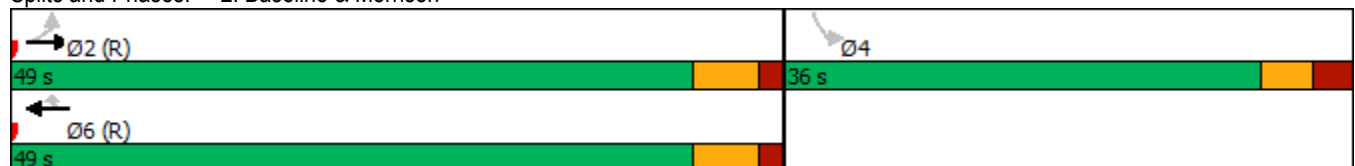
Intersection LOS: A

Intersection Capacity Utilization 57.2%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison



Lanes, Volumes, Timings  
5: Guthrie & Baseline

Existing Morning PK Hour  
05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Traffic Volume (vph)	1226	61	8	482	26	56
Future Volume (vph)	1226	61	8	482	26	56
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.97	1.00		1.00	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1502	1729	3325	1729	1547
Flt Permitted			0.180		0.950	
Satd. Flow (perm)	3390	1463	327	3325	1724	1547
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		45				18
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		4	4		4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	3%	0%	4%	0%	0%
Adj. Flow (vph)	1362	68	9	536	29	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1362	68	9	536	29	62
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Lanes, Volumes, Timings  
5: Guthrie & Baseline

Existing Morning PK Hour  
05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	45.0	45.0	33.2	33.2	39.7	39.7
Total Split (s)	45.0	45.0	45.0	45.0	40.0	40.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%
Maximum Green (s)	38.8	38.8	38.8	38.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	68.5	68.5	68.5	68.5	8.1	8.1
Actuated g/C Ratio	0.81	0.81	0.81	0.81	0.10	0.10
v/c Ratio	0.50	0.06	0.03	0.20	0.18	0.38
Control Delay	1.8	0.3	3.4	3.0	36.6	33.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.9	0.3	3.4	3.0	36.6	33.6
LOS	A	A	A	A	D	C
Approach Delay	1.8			3.0	34.6	
Approach LOS	A			A	C	

Intersection Summary

Area Type: Other

Cycle Length: 85

Actuated Cycle Length: 85

Offset: 22 (26%), Referenced to phase 2:EBT and 6:WBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 3.5

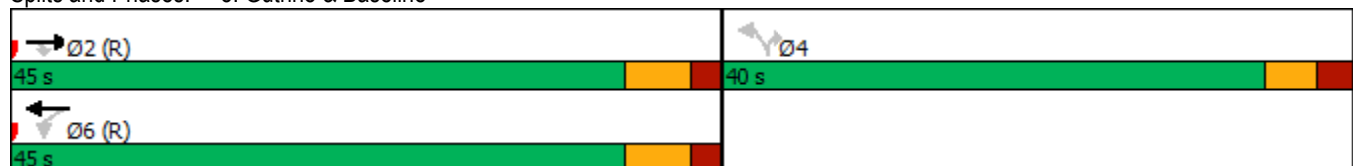
Intersection LOS: A

Intersection Capacity Utilization 49.9%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 5: Guthrie & Baseline



Baseline

Intersection	
Intersection Delay, s/veh	9.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	36	21	49	16	13	2	218	97	6	36	1
Future Vol, veh/h	8	36	21	49	16	13	2	218	97	6	36	1
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, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	9	40	23	54	18	14	2	242	108	7	40	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

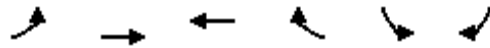
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	8.6	10	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	12%	63%	14%
Vol Thru, %	69%	55%	21%	84%
Vol Right, %	31%	32%	17%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	317	65	78	43
LT Vol	2	8	49	6
Through Vol	218	36	16	36
RT Vol	97	21	13	1
Lane Flow Rate	352	72	87	48
Geometry Grp	1	1	1	1
Degree of Util (X)	0.407	0.095	0.118	0.062
Departure Headway (Hd)	4.163	4.72	4.892	4.672
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	866	758	731	766
Service Time	2.185	2.756	2.929	2.705
HCM Lane V/C Ratio	0.406	0.095	0.119	0.063
HCM Control Delay	10	8.3	8.6	8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	2	0.3	0.4	0.2

Lanes, Volumes, Timings  
2: Baseline & Morrison

Existing PM PK Hour

05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	51	750	1138	56	58	134
Future Volume (vph)	51	750	1138	56	58	134
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	0.0	0.0
Storage Lanes	1			1	1	0
Taper Length (m)	25.0				7.6	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	0.99			0.93	0.98	
Frt				0.850	0.906	
Flt Protected	0.950				0.985	
Satd. Flow (prot)	1631	3390	3390	1547	1519	0
Flt Permitted	0.187				0.985	
Satd. Flow (perm)	319	3390	3390	1440	1517	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				62	53	
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	24			24	4	11
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	6%	2%	2%	0%	8%	4%
Adj. Flow (vph)	57	833	1264	62	64	149
Shared Lane Traffic (%)						
Lane Group Flow (vph)	57	833	1264	62	213	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	
Detector Template	Left	Thru	Thru	Right	Left	
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	
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)	2.1	0.6	0.6	2.1	2.1	
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			

Lanes, Volumes, Timings  
2: Baseline & Morrison

Existing PM PK Hour  
05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Detector Phase	2	2	6	6	4	
Switch Phase						
Minimum Initial (s)	10.0	10.0	5.0	5.0	5.0	
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	
Total Split (s)	64.0	64.0	64.0	64.0	36.0	
Total Split (%)	64.0%	64.0%	64.0%	64.0%	36.0%	
Maximum Green (s)	58.1	58.1	58.1	58.1	30.0	
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	
Act Effect Green (s)	71.8	71.8	71.8	71.8	16.3	
Actuated g/C Ratio	0.72	0.72	0.72	0.72	0.16	
v/c Ratio	0.25	0.34	0.52	0.06	0.73	
Control Delay	9.8	6.4	5.5	0.4	43.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	9.8	6.4	5.6	0.4	43.7	
LOS	A	A	A	A	D	
Approach Delay		6.6	5.3		43.7	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 28 (28%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 9.2

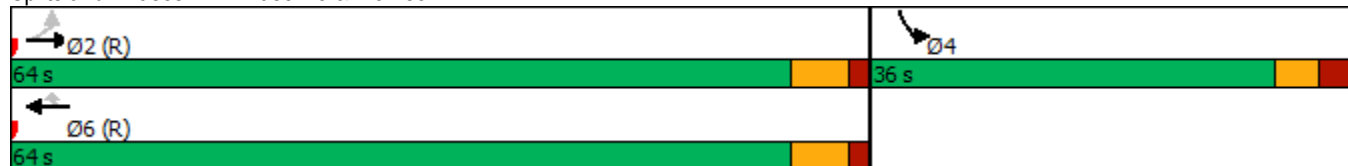
Intersection LOS: A

Intersection Capacity Utilization 71.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison





Lanes, Volumes, Timings  
5: Guthrie & Baseline

Existing PM PK Hour  
05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Traffic Volume (vph)	759	49	19	1166	28	36
Future Volume (vph)	759	49	19	1166	28	36
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.95	0.99		0.97	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1488	1491	3390	1662	1432
Flt Permitted			0.335		0.950	
Satd. Flow (perm)	3390	1417	522	3390	1618	1432
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		54				40
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		15	15		30	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	4%	16%	2%	4%	8%
Adj. Flow (vph)	843	54	21	1296	31	40
Shared Lane Traffic (%)						
Lane Group Flow (vph)	843	54	21	1296	31	40
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Lanes, Volumes, Timings  
5: Guthrie & Baseline

Existing PM PK Hour  
05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	10.0	10.0	5.0	5.0
Minimum Split (s)	46.2	46.2	33.2	33.2	39.7	39.7
Total Split (s)	60.0	60.0	60.0	60.0	40.0	40.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%
Maximum Green (s)	53.8	53.8	53.8	53.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	84.1	84.1	84.1	84.1	7.5	7.5
Actuated g/C Ratio	0.84	0.84	0.84	0.84	0.08	0.08
v/c Ratio	0.30	0.04	0.05	0.45	0.26	0.28
Control Delay	1.7	0.4	2.5	3.4	48.2	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.7	0.4	2.5	3.4	48.2	18.7
LOS	A	A	A	A	D	B
Approach Delay	1.7			3.4	31.6	
Approach LOS	A			A	C	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 33 (33%), Referenced to phase 2:EBT and 6:WBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 3.6

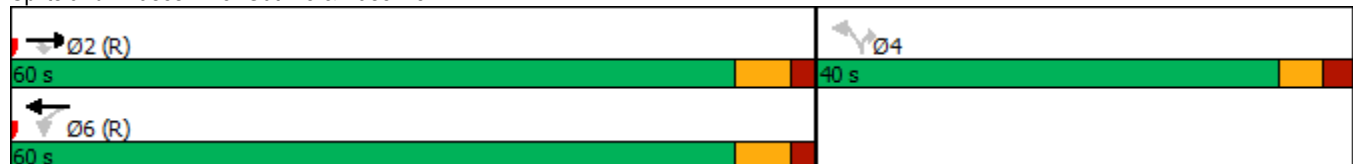
Intersection LOS: A

Intersection Capacity Utilization 48.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 5: Guthrie & Baseline



Baseline

Intersection	
Intersection Delay, s/veh	8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	11	11	20	11	4	16	69	22	2	161	2
Future Vol, veh/h	0	11	11	20	11	4	16	69	22	2	161	2
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, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	12	12	22	12	4	18	77	24	2	179	2
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

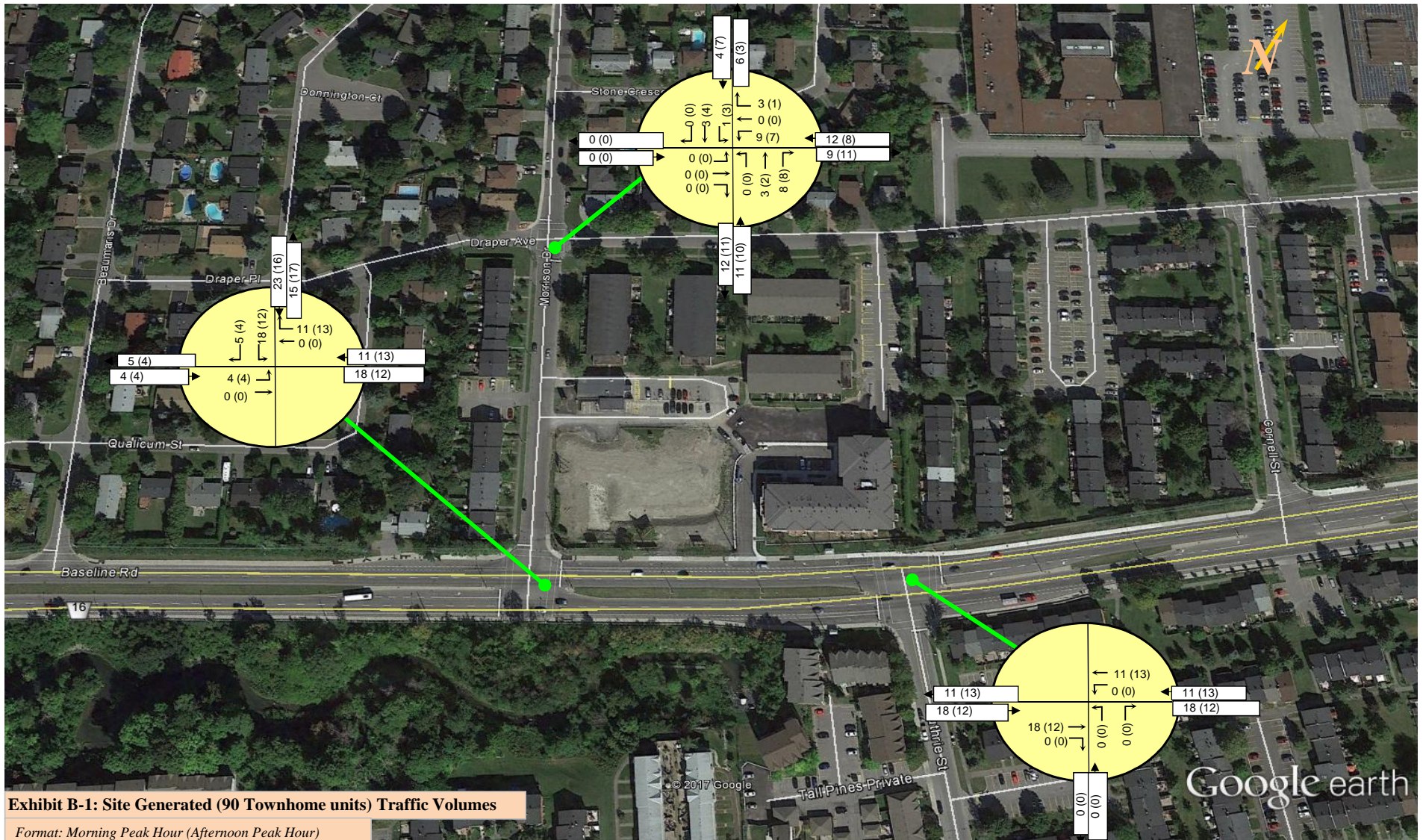
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.4	7.9	7.8	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	15%	0%	57%	1%
Vol Thru, %	64%	50%	31%	98%
Vol Right, %	21%	50%	11%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	107	22	35	165
LT Vol	16	0	20	2
Through Vol	69	11	11	161
RT Vol	22	11	4	2
Lane Flow Rate	119	24	39	183
Geometry Grp	1	1	1	1
Degree of Util (X)	0.134	0.029	0.05	0.209
Departure Headway (Hd)	4.057	4.299	4.627	4.097
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	871	837	779	867
Service Time	2.142	2.301	2.628	2.165
HCM Lane V/C Ratio	0.137	0.029	0.05	0.211
HCM Control Delay	7.8	7.4	7.9	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.1	0.2	0.8

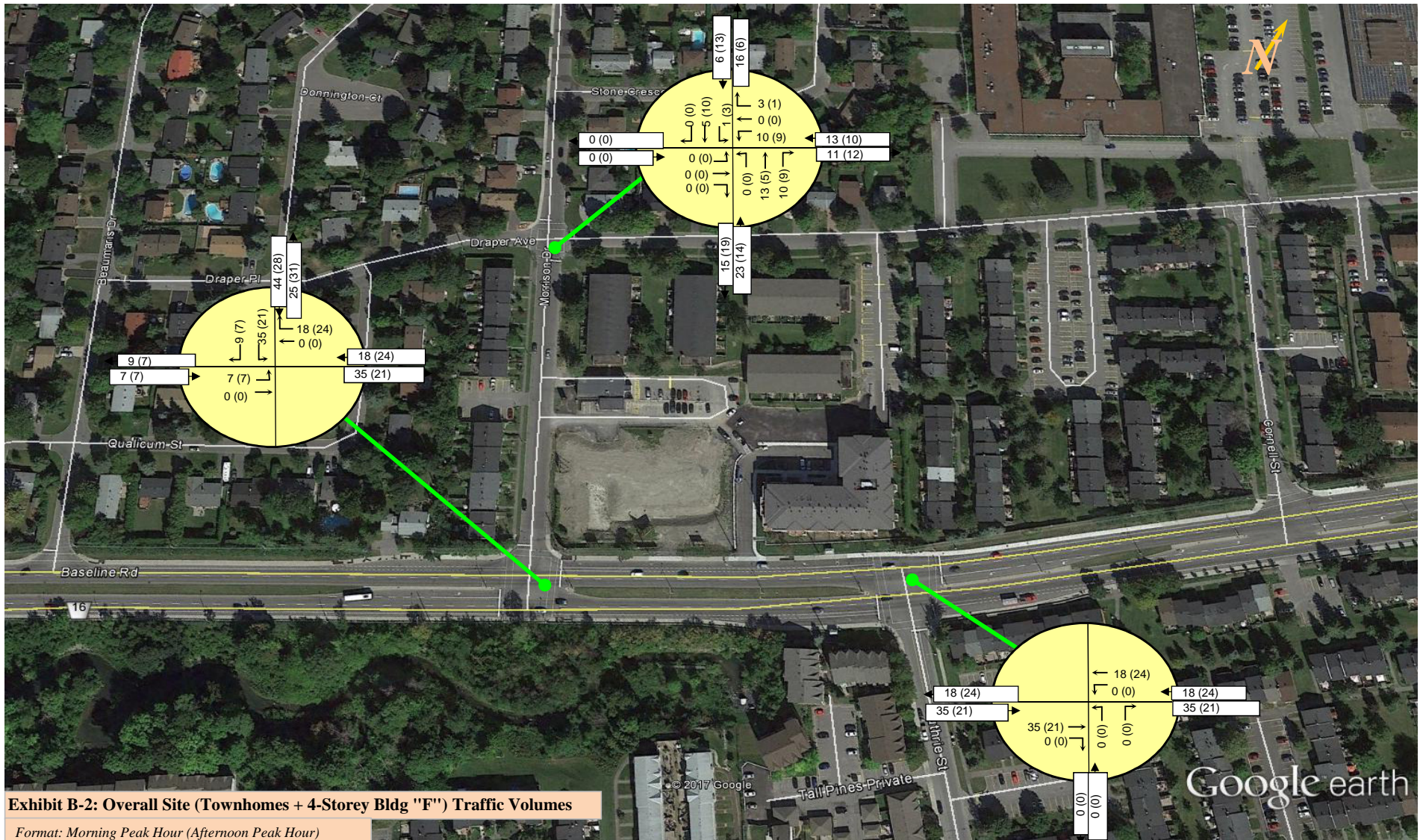
## **Appendix B**

### **Site and Forecast (2019 & 2024) Traffic Volumes**













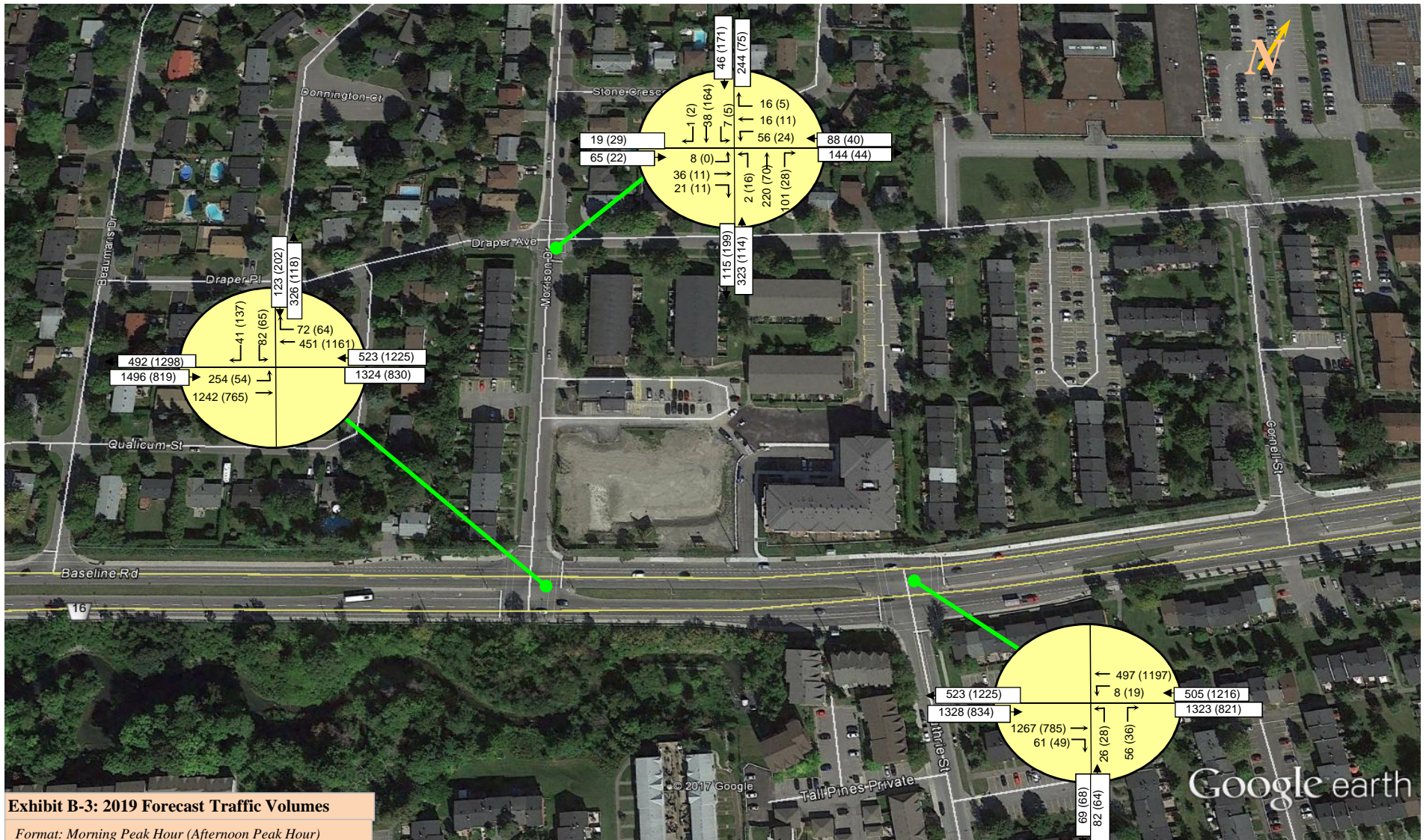
***Exhibit B-2A: Site Traffic Volumes (90-unit Townhomes)***



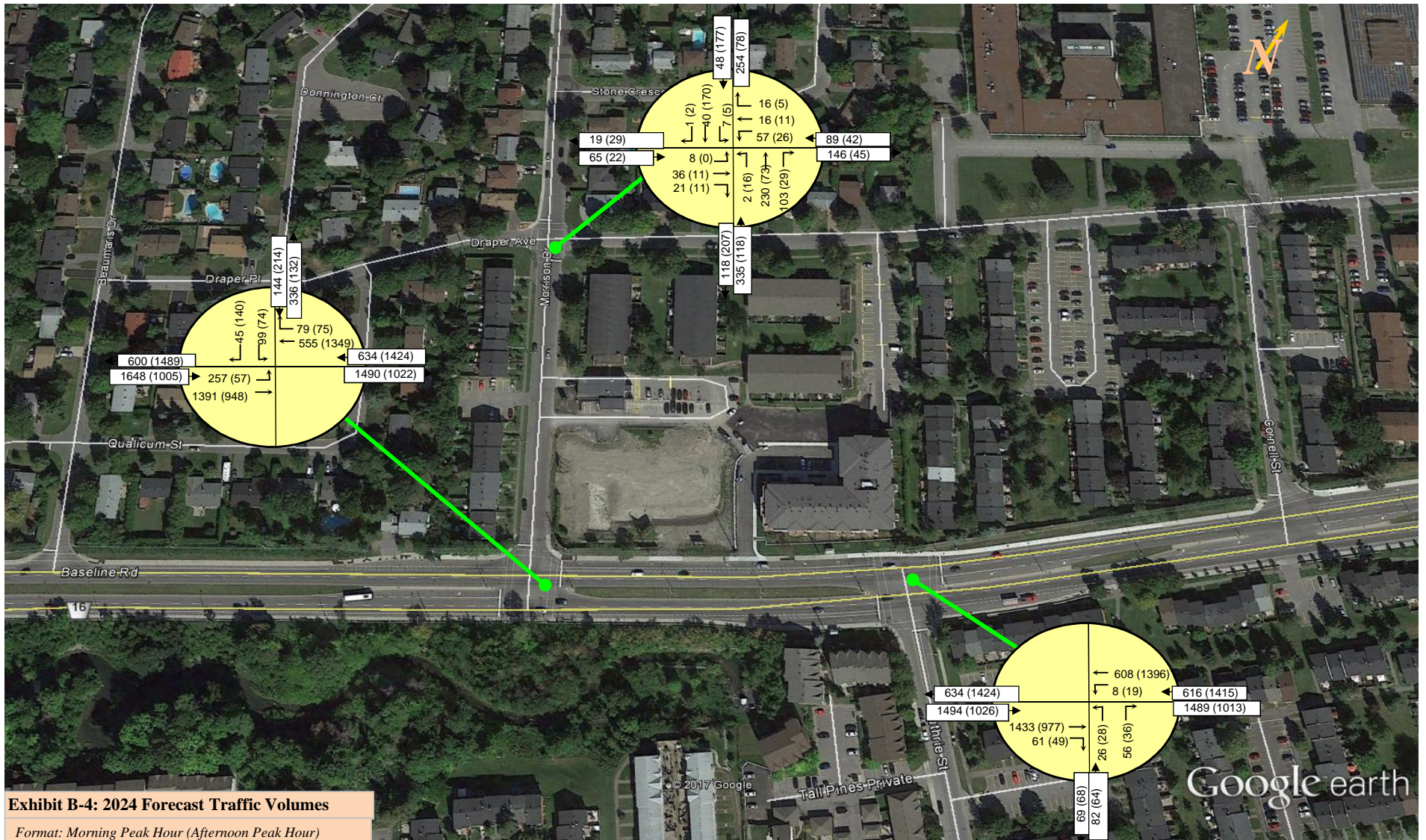


***Exhibit B-2B: Total Site Traffic Volumes (90-unit Townhomes + Existing Bldg. "E" & Future Bldg. "F")***









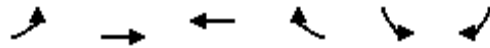
## **Appendix C**

### **Forecast (2019 & 2024) Traffic Analysis**

Lanes, Volumes, Timings  
2: Baseline & Morrison

2019 Analysis - AM PK Hour

05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	254	1242	451	72	82	41
Future Volume (vph)	254	1242	451	72	82	41
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	0.0	0.0
Storage Lanes	1			1	1	0
Taper Length (m)	25.0				7.6	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	1.00			0.97	0.99	
Frt				0.850	0.955	
Flt Protected	0.950				0.968	
Satd. Flow (prot)	1647	3424	3293	1517	1500	0
Flt Permitted	0.491				0.968	
Satd. Flow (perm)	849	3424	3293	1478	1496	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				72	33	
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	3			3	4	2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	1%	5%	2%	12%	11%
Adj. Flow (vph)	254	1242	451	72	82	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	254	1242	451	72	123	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	
Detector Template	Left	Thru	Thru	Right	Left	
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	
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)	2.1	0.6	0.6	2.1	2.1	
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			



Lanes, Volumes, Timings  
2: Baseline & Morrison

2019 Analysis - AM PK Hour  
05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		2	6			
Permitted Phases	2			6	4	
Detector Phase	2	2	6	6	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	
Total Split (s)	49.0	49.0	49.0	49.0	36.0	
Total Split (%)	57.6%	57.6%	57.6%	57.6%	42.4%	
Maximum Green (s)	43.1	43.1	43.1	43.1	30.0	
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	
Act Effect Green (s)	65.9	65.9	65.9	65.9	10.7	
Actuated g/C Ratio	0.78	0.78	0.78	0.78	0.13	
v/c Ratio	0.39	0.47	0.18	0.06	0.57	
Control Delay	7.0	5.5	3.0	0.8	35.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	7.0	5.5	3.0	0.8	35.1	
LOS	A	A	A	A	D	
Approach Delay		5.8	2.7		35.1	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other

Cycle Length: 85

Actuated Cycle Length: 85

Offset: 11 (13%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.57

Intersection Signal Delay: 6.7

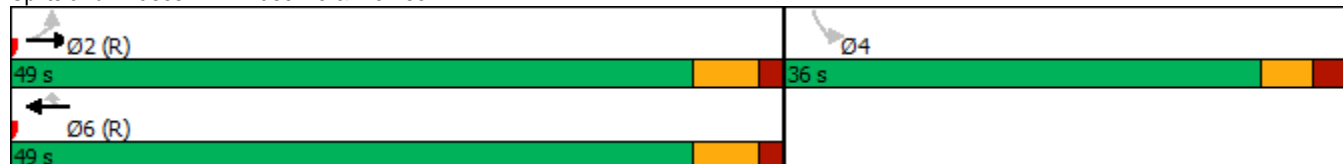
Intersection LOS: A

Intersection Capacity Utilization 58.3%

ICU Level of Service B













Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison



Lanes, Volumes, Timings  
5: Guthrie & Baseline

2019 Analysis - AM PK Hour  
05/14/2018

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1267	61	8	497	26	56
Future Volume (vph)	1267	61	8	497	26	56
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.97	1.00		1.00	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1502	1729	3325	1729	1547
Flt Permitted			0.204		0.950	
Satd. Flow (perm)	3390	1463	371	3325	1724	1547
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		43				25
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		4	4		4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	2%	3%	0%	4%	0%	0%
Adj. Flow (vph)	1267	61	8	497	26	56
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1267	61	8	497	26	56
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Baseline

Synchro 10 Report  
Page 3

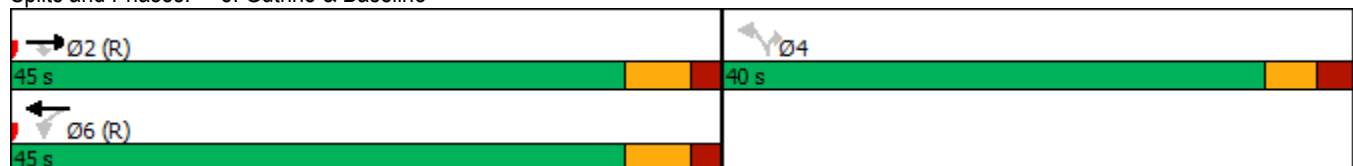
Lanes, Volumes, Timings  
5: Guthrie & Baseline

2019 Analysis - AM PK Hour

05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	45.0	45.0	33.2	33.2	39.7	39.7
Total Split (s)	45.0	45.0	45.0	45.0	40.0	40.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%
Maximum Green (s)	38.8	38.8	38.8	38.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	69.0	69.0	69.0	69.0	7.5	7.5
Actuated g/C Ratio	0.81	0.81	0.81	0.81	0.09	0.09
v/c Ratio	0.46	0.05	0.03	0.18	0.17	0.35
Control Delay	1.8	0.3	3.0	2.7	37.3	29.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.8	0.3	3.0	2.7	37.3	29.0
LOS	A	A	A	A	D	C
Approach Delay	1.7			2.7	31.6	
Approach LOS	A			A	C	
Intersection Summary						
Area Type:	Other					
Cycle Length: 85						
Actuated Cycle Length: 85						
Offset: 22 (26%), Referenced to phase 2:EBT and 6:WBTL, Start of Green						
Natural Cycle: 85						
Control Type: Actuated-Coordinated						
Maximum v/c Ratio: 0.46						
Intersection Signal Delay: 3.2				Intersection LOS: A		
Intersection Capacity Utilization 51.1%				ICU Level of Service A		
Analysis Period (min) 15						

Splits and Phases: 5: Guthrie & Baseline



Intersection

Intersection Delay, s/veh	9.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	36	21	56	16	16	2	220	101	7	38	1
Future Vol, veh/h	8	36	21	56	16	16	2	220	101	7	38	1
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	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	36	21	56	16	16	2	220	101	7	38	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.1	8.5	9.6	7.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	12%	64%	15%
Vol Thru, %	68%	55%	18%	83%
Vol Right, %	31%	32%	18%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	323	65	88	46
LT Vol	2	8	56	7
Through Vol	220	36	16	38
RT Vol	101	21	16	1
Lane Flow Rate	323	65	88	46
Geometry Grp	1	1	1	1
Degree of Util (X)	0.371	0.084	0.117	0.059
Departure Headway (Hd)	4.138	4.649	4.804	4.623
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	872	770	746	775
Service Time	2.155	2.679	2.833	2.65
HCM Lane V/C Ratio	0.37	0.084	0.118	0.059
HCM Control Delay	9.6	8.1	8.5	7.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.7	0.3	0.4	0.2

Lanes, Volumes, Timings  
2: Baseline & Morrison

2019 Analysis - PM PK Hour  
05/14/2018

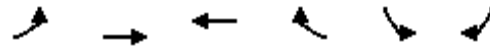


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	54	765	1161	64	65	137
Future Volume (vph)	54	765	1161	64	65	137
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	0.0	0.0
Storage Lanes	1			1	1	0
Taper Length (m)	25.0				7.6	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	0.99			0.93	0.98	
Frt				0.850	0.908	
Flt Protected	0.950				0.984	
Satd. Flow (prot)	1631	3390	3390	1547	1521	0
Flt Permitted	0.218				0.984	
Satd. Flow (perm)	372	3390	3390	1440	1519	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				64	68	
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	24			24	4	11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	2%	2%	0%	8%	4%
Adj. Flow (vph)	54	765	1161	64	65	137
Shared Lane Traffic (%)						
Lane Group Flow (vph)	54	765	1161	64	202	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	
Detector Template	Left	Thru	Thru	Right	Left	
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	
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)	2.1	0.6	0.6	2.1	2.1	
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			

Lanes, Volumes, Timings  
2: Baseline & Morrison

2019 Analysis - PM PK Hour

05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Detector Phase	2	2	6	6	4	
Switch Phase						
Minimum Initial (s)	10.0	10.0	5.0	5.0	5.0	
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	
Total Split (s)	64.0	64.0	64.0	64.0	36.0	
Total Split (%)	64.0%	64.0%	64.0%	64.0%	36.0%	
Maximum Green (s)	58.1	58.1	58.1	58.1	30.0	
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	
Act Effect Green (s)	73.5	73.5	73.5	73.5	14.6	
Actuated g/C Ratio	0.74	0.74	0.74	0.74	0.15	
v/c Ratio	0.20	0.31	0.47	0.06	0.72	
Control Delay	7.7	5.5	4.5	0.4	40.7	
Queue Delay	0.0	0.0	0.1	0.0	0.0	
Total Delay	7.7	5.5	4.5	0.4	40.7	
LOS	A	A	A	A	D	
Approach Delay		5.6	4.3		40.7	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 28 (28%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay: 8.1

Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison









Baseline



Lanes, Volumes, Timings  
5: Guthrie & Baseline

2019 Analysis - PM PK Hour  
05/14/2018

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↵	↑↑	↵	↑
Traffic Volume (vph)	785	49	19	1197	28	36
Future Volume (vph)	785	49	19	1197	28	36
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.95	0.99		0.97	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1488	1491	3390	1662	1432
Flt Permitted			0.355		0.950	
Satd. Flow (perm)	3390	1417	553	3390	1618	1432
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		49				36
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		15	15		30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	2%	4%	16%	2%	4%	8%
Adj. Flow (vph)	785	49	19	1197	28	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	785	49	19	1197	28	36
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Lanes, Volumes, Timings  
5: Guthrie & Baseline

2019 Analysis - PM PK Hour

05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	10.0	10.0	5.0	5.0
Minimum Split (s)	46.2	46.2	33.2	33.2	39.7	39.7
Total Split (s)	60.0	60.0	60.0	60.0	40.0	40.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%
Maximum Green (s)	53.8	53.8	53.8	53.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	84.3	84.3	84.3	84.3	7.3	7.3
Actuated g/C Ratio	0.84	0.84	0.84	0.84	0.07	0.07
v/c Ratio	0.27	0.04	0.04	0.42	0.24	0.26
Control Delay	1.7	0.4	2.4	3.2	47.9	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.7	0.4	2.4	3.2	47.9	19.1
LOS	A	A	A	A	D	B
Approach Delay	1.6			3.1	31.7	
Approach LOS	A			A	C	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 33 (33%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.42

Intersection Signal Delay: 3.4

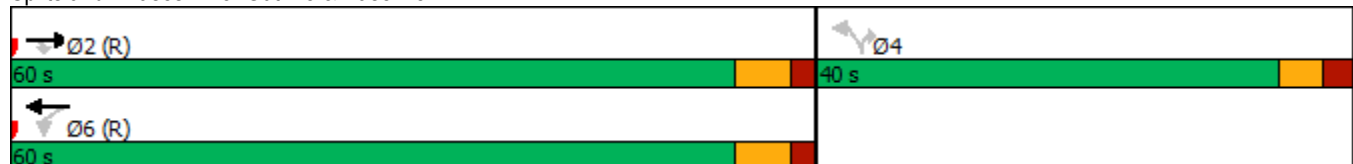
Intersection LOS: A

Intersection Capacity Utilization 49.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 5: Guthrie & Baseline



Baseline

Intersection	
Intersection Delay, s/veh	7.9
Intersection LOS	A

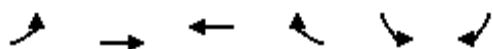
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	11	11	24	11	5	16	70	28	5	164	2
Future Vol, veh/h	0	11	11	24	11	5	16	70	28	5	164	2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	11	11	24	11	5	16	70	28	5	164	2
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.4	7.8	7.7	8.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	60%	3%
Vol Thru, %	61%	50%	28%	96%
Vol Right, %	25%	50%	12%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	114	22	40	171
LT Vol	16	0	24	5
Through Vol	70	11	11	164
RT Vol	28	11	5	2
Lane Flow Rate	114	22	40	171
Geometry Grp	1	1	1	1
Degree of Util (X)	0.127	0.026	0.051	0.195
Departure Headway (Hd)	4.02	4.261	4.584	4.095
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	880	845	786	869
Service Time	2.099	2.263	2.585	2.159
HCM Lane V/C Ratio	0.13	0.026	0.051	0.197
HCM Control Delay	7.7	7.4	7.8	8.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.1	0.2	0.7

Lanes, Volumes, Timings  
2: Baseline & Morrison

2024 Analysis - AM PK Hour  
05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	257	1391	555	79	99	45
Future Volume (vph)	257	1391	555	79	99	45
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	25.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	25.0				20.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	1.00			0.97	1.00	0.99
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1647	3424	3293	1517	1544	1394
Flt Permitted	0.444				0.950	
Satd. Flow (perm)	768	3424	3293	1478	1539	1375
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				79		45
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	3			3	4	2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	5%	1%	5%	2%	12%	11%
Adj. Flow (vph)	257	1391	555	79	99	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	257	1391	555	79	99	45
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	2.1	0.6	0.6	2.1	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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			

Lanes, Volumes, Timings  
2: Baseline & Morrison

2024 Analysis - AM PK Hour  
05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	36.0
Total Split (s)	49.0	49.0	49.0	49.0	36.0	36.0
Total Split (%)	57.6%	57.6%	57.6%	57.6%	42.4%	42.4%
Maximum Green (s)	43.1	43.1	43.1	43.1	30.0	30.0
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	23.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	65.9	65.9	65.9	65.9	10.8	10.8
Actuated g/C Ratio	0.78	0.78	0.78	0.78	0.13	0.13
v/c Ratio	0.43	0.52	0.22	0.07	0.51	0.21
Control Delay	7.9	6.0	3.1	0.7	42.7	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.9	6.0	3.1	0.7	42.7	12.3
LOS	A	A	A	A	D	B
Approach Delay		6.3	2.8		33.2	
Approach LOS		A	A		C	

Intersection Summary

Area Type: Other

Cycle Length: 85

Actuated Cycle Length: 85

Offset: 11 (13%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.52

Intersection Signal Delay: 7.0

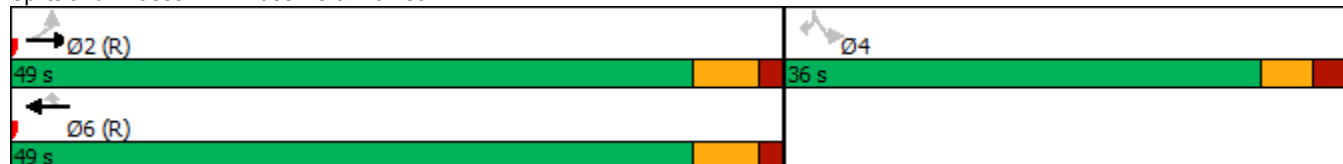
Intersection LOS: A

Intersection Capacity Utilization 57.5%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison



Lanes, Volumes, Timings  
5: Guthrie & Baseline

2024 Analysis - AM PK Hour

05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↘	↑↑	↘	↑
Traffic Volume (vph)	1433	61	8	608	26	56
Future Volume (vph)	1433	61	8	608	26	56
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.97			1.00	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1502	1729	3325	1729	1547
Flt Permitted			0.165		0.950	
Satd. Flow (perm)	3390	1463	300	3325	1724	1547
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		38				15
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		4	4		4	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	2%	3%	0%	4%	0%	0%
Adj. Flow (vph)	1433	61	8	608	26	56
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1433	61	8	608	26	56
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Baseline

Synchro 10 Report  
Page 3



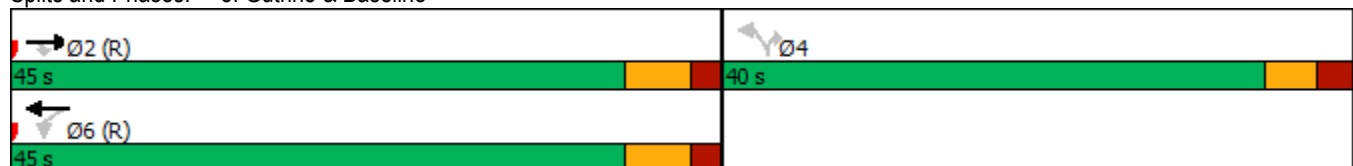
Lanes, Volumes, Timings  
5: Guthrie & Baseline

2024 Analysis - AM PK Hour

05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	45.0	45.0	33.2	33.2	39.7	39.7
Total Split (s)	45.0	45.0	45.0	45.0	40.0	40.0
Total Split (%)	52.9%	52.9%	52.9%	52.9%	47.1%	47.1%
Maximum Green (s)	38.8	38.8	38.8	38.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	68.6	68.6	68.6	68.6	7.9	7.9
Actuated g/C Ratio	0.81	0.81	0.81	0.81	0.09	0.09
v/c Ratio	0.52	0.05	0.03	0.23	0.16	0.35
Control Delay	2.1	0.5	3.4	3.0	36.6	33.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.1	0.5	3.4	3.0	36.6	33.9
LOS	A	A	A	A	D	C
Approach Delay	2.0			3.0	34.8	
Approach LOS	A			A	C	
Intersection Summary						
Area Type:	Other					
Cycle Length: 85						
Actuated Cycle Length: 85						
Offset: 22 (26%), Referenced to phase 2:EBT and 6:WBTL, Start of Green						
Natural Cycle: 85						
Control Type: Actuated-Coordinated						
Maximum v/c Ratio: 0.52						
Intersection Signal Delay: 3.5				Intersection LOS: A		
Intersection Capacity Utilization 55.9%				ICU Level of Service B		
Analysis Period (min) 15						

Splits and Phases: 5: Guthrie & Baseline



Intersection	
Intersection Delay, s/veh	9.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	36	21	57	16	16	2	230	103	7	40	1
Future Vol, veh/h	8	36	21	57	16	16	2	230	103	7	40	1
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	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	36	21	57	16	16	2	230	103	7	40	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

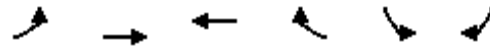
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8.5	9.8	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	12%	64%	15%
Vol Thru, %	69%	55%	18%	83%
Vol Right, %	31%	32%	18%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	335	65	89	48
LT Vol	2	8	57	7
Through Vol	230	36	16	40
RT Vol	103	21	16	1
Lane Flow Rate	335	65	89	48
Geometry Grp	1	1	1	1
Degree of Util (X)	0.386	0.085	0.12	0.062
Departure Headway (Hd)	4.148	4.683	4.838	4.641
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	868	764	740	771
Service Time	2.168	2.717	2.871	2.671
HCM Lane V/C Ratio	0.386	0.085	0.12	0.062
HCM Control Delay	9.8	8.2	8.5	8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.8	0.3	0.4	0.2

Lanes, Volumes, Timings  
2: Baseline & Morrison

2024 Analysis - PM PK Hour

05/14/2018

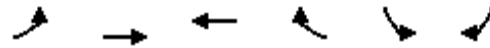


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	57	948	1349	75	74	140
Future Volume (vph)	57	948	1349	75	74	140
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.1			0.0	25.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	25.0				20.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor	1.00			0.93	1.00	0.98
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1631	3390	3390	1547	1601	1488
Flt Permitted	0.176				0.950	
Satd. Flow (perm)	301	3390	3390	1440	1595	1454
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				75		43
Link Speed (k/h)		69	69		50	
Link Distance (m)		126.1	162.0		180.4	
Travel Time (s)		6.6	8.5		13.0	
Confl. Peds. (#/hr)	24			24	4	11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	6%	2%	2%	0%	8%	4%
Adj. Flow (vph)	57	948	1349	75	74	140
Shared Lane Traffic (%)						
Lane Group Flow (vph)	57	948	1349	75	74	140
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.9	4.9		4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	26			14	26	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	2.1	10.0	10.0	2.1	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	2.1	0.6	0.6	2.1	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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			

Lanes, Volumes, Timings  
2: Baseline & Morrison

2024 Analysis - PM PK Hour

05/14/2018



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	10.0	10.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.9	29.9	38.9	38.9	36.0	36.0
Total Split (s)	64.0	64.0	64.0	64.0	36.0	36.0
Total Split (%)	64.0%	64.0%	64.0%	64.0%	36.0%	36.0%
Maximum Green (s)	58.1	58.1	58.1	58.1	30.0	30.0
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	1.7	1.7	1.7	1.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.9	5.9	5.9	5.9	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	10.0	10.0	10.0	10.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	23.0	23.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	75.9	75.9	75.9	75.9	12.2	12.2
Actuated g/C Ratio	0.76	0.76	0.76	0.76	0.12	0.12
v/c Ratio	0.25	0.37	0.52	0.07	0.38	0.65
Control Delay	8.1	5.0	3.7	0.3	44.1	42.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.1	5.0	3.7	0.3	44.1	42.0
LOS	A	A	A	A	D	D
Approach Delay		5.2	3.5		42.7	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 28 (28%), Referenced to phase 2:EBTL and 6:WBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 7.3

Intersection LOS: A

Intersection Capacity Utilization 70.6%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 2: Baseline & Morrison









Baseline

Lanes, Volumes, Timings  
5: Guthrie & Baseline

2024 Analysis - PM PK Hour

05/14/2018

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↵	↑↑	↵	↑
Traffic Volume (vph)	977	49	19	1398	28	36
Future Volume (vph)	977	49	19	1398	28	36
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		39.9	39.9		29.9	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			29.9		14.9	
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Ped Bike Factor		0.95	0.99		0.97	
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3390	1488	1491	3390	1662	1432
Flt Permitted			0.290		0.950	
Satd. Flow (perm)	3390	1417	452	3390	1618	1432
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		45				36
Link Speed (k/h)	50			69	50	
Link Distance (m)	162.0			201.9	106.8	
Travel Time (s)	11.7			10.5	7.7	
Confl. Peds. (#/hr)		15	15		30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	2%	4%	16%	2%	4%	8%
Adj. Flow (vph)	977	49	19	1398	28	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	977	49	19	1398	28	36
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	26		26	14
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (m)	10.0	2.1	2.1	10.0	2.1	2.1
Trailing Detector (m)	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
Detector 1 Size(m)	0.6	2.1	2.1	0.6	2.1	2.1
Detector 1 Type	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
Detector 1 Queue (s)	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
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		

Baseline

Synchro 10 Report  
Page 3



Lanes, Volumes, Timings  
5: Guthrie & Baseline

2024 Analysis - PM PK Hour

05/14/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Type	NA	Perm	Perm	NA	Perm	Perm
Protected Phases	2			6		
Permitted Phases		2	6		4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	10.0	10.0	5.0	5.0
Minimum Split (s)	46.2	46.2	33.2	33.2	39.7	39.7
Total Split (s)	60.0	60.0	60.0	60.0	40.0	40.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%
Maximum Green (s)	53.8	53.8	53.8	53.8	34.3	34.3
Yellow Time (s)	4.2	4.2	4.2	4.2	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	5.7	5.7
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	13.0	13.0	13.0	13.0	7.0	7.0
Flash Dont Walk (s)	14.0	14.0	14.0	14.0	27.0	27.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effect Green (s)	84.3	84.3	84.3	84.3	7.3	7.3
Actuated g/C Ratio	0.84	0.84	0.84	0.84	0.07	0.07
v/c Ratio	0.34	0.04	0.05	0.49	0.24	0.26
Control Delay	1.9	0.4	2.6	3.6	47.9	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.0	0.4	2.6	3.6	47.9	19.1
LOS	A	A	A	A	D	B
Approach Delay	1.9			3.6	31.7	
Approach LOS	A			A	C	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 33 (33%), Referenced to phase 2:EBT and 6:WBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 3.6

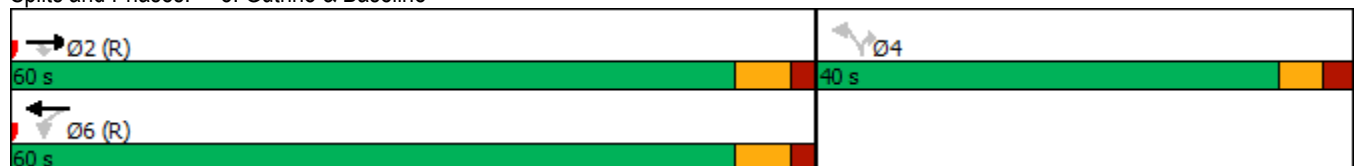
Intersection LOS: A

Intersection Capacity Utilization 54.9%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 5: Guthrie & Baseline



Intersection	
Intersection Delay, s/veh	8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	11	11	26	11	5	16	73	29	5	170	2
Future Vol, veh/h	0	11	11	26	11	5	16	73	29	5	170	2
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	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	11	11	26	11	5	16	73	29	5	170	2
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.4	7.9	7.7	8.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	62%	3%
Vol Thru, %	62%	50%	26%	96%
Vol Right, %	25%	50%	12%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	118	22	42	177
LT Vol	16	0	26	5
Through Vol	73	11	11	170
RT Vol	29	11	5	2
Lane Flow Rate	118	22	42	177
Geometry Grp	1	1	1	1
Degree of Util (X)	0.132	0.026	0.054	0.202
Departure Headway (Hd)	4.025	4.287	4.614	4.1
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	878	840	781	866
Service Time	2.111	2.289	2.615	2.169
HCM Lane V/C Ratio	0.134	0.026	0.054	0.204
HCM Control Delay	7.7	7.4	7.9	8.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.1	0.2	0.8

**Appendix D**

**Pavement Marking Plan**

No.	REVISION	BY	DATE	SURVEYED	DESIGNED	CHECKED	DRAWN	DATE	BY	PHOTO No.	TITLE SEARCH DATE	GRAPHICS FILE	PLAN No.	CONTRACT No.	INTERSECTION ID	BAR CODE	PLAN DESCRIPTION

