



Stantec

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May 14, 2013
File: 163808203

Robinson Park Development Corp.
5699 Power Road
Ottawa, ON, K1G 3N4

Attention: Mr. Americo Rego, President

Dear Sir:

**Reference: 17, 19 and 23 Robinson Avenue
Proposed Zoning By-law Amendment and Site Plan Control Application
D02-02012-0100/D07-12-12-0159
Transportation Assessment**

This transportation assessment has been prepared in support of the subject development application and will address two transportation concerns raised by the City of Ottawa or through public comment. These include:

- 1) Intersection performance (i.e. operations) at the Lees Avenue / Robinson Avenue intersection; and
- 2) The need for traffic control signals at the Lees Avenue / Robinson Avenue intersection.

Context

The proposed development at 17, 19 and 23 Robinson Avenue is a 6-storey, 37-unit mid-rise condominium apartment building located in the City of Ottawa. Of the 37 units, 11 units are one-bedroom and the remaining 26 units are two-bedroom units. In total, 46 parking spaces will be provided in a two-level underground parking structure.

The proposed development is located within 800m of an existing Transit Station where infill developments and intensification are encouraged.

For development proposals featuring less than 75 units, the City of Ottawa typically does not require Transportation Impact Assessment (TIA) reports, as it is satisfied that impacts on the adjacent transportation network can be accommodated without the need for roadway modifications.

Attachment 1 includes an estimation of the traffic generation potential of the subject development which was prepared by Stantec in November 2012. As outlined in Attachment 1, the development is projected to generate 23 and 27 total site trips during the AM and PM peak hours respectively. The correspondence contained in Attachment 1 concluded that the addition of less than 30 peak hour vehicles trips to Robinson Avenue would have a negligible effect on area traffic operations.



Transportation Assessment

Stantec undertook a turning movement count survey of the Lees Avenue / Robinson Avenue intersection on Wednesday May 8, 2013. **Attachment 2** provides a summary of the collected data.

Intersection performance was assessed for existing conditions, future background conditions (2018) and for total future traffic conditions (2018) using the methodologies of the Highway Capacity Manual and facilitated by Synchro 8.0 software. Future background conditions represent future conditions but without traffic from the proposed development. A 5-year future horizon of 2018 was developed by applying a 2 percent annual rate of growth to the Lees Avenue / Robinson Avenue intersection for a total of 10 percent over 5 years. Total future traffic conditions for the 2018 horizon were derived by applying the traffic generated by the subject development to the future background traffic volumes for the same horizon.

Table 1 provides a summary of intersection operations at the Lees Avenue / Robinson Avenue intersection.

Table 1 – Lees Avenue / Robinson Avenue Intersection Level of Service Analysis (LOS)

Horizon	Level of Service	
	AM Peak	PM Peak
Existing 2013 Conditions	LOS C	LOS C
Future Background Conditions (2018)	LOS C	LOS C
Total Future Traffic Conditions (2018)	LOS C	LOS C

As show in Table 1, the subject intersection currently operates acceptably (LOS C) during peak times. This is expected to remain unchanged as a result of background growth and with the addition of the trips generated by the proposed development. The development has a negligible impact on the operations of the Lees Avenue / Robinson Avenue intersection.

Detailed intersection performance worksheets can be found in **Attachment 3**.

The need for traffic control signals at the Lees Avenue / Robinson Avenue intersection was assessed using the methodologies of Ontario Traffic Manual (OTM) Book 12. Traffic signals were found not to be warranted under existing, future background or total future traffic conditions.

Detailed signal warrant worksheets can be found in **Attachment 4**.

Conclusions

It is concluded that the proposed development at 17, 19 and 23 Robinson Avenue will have a negligible impact on traffic operations at the Lees Avenue / Robinson Avenue intersection which currently operates acceptably and will continue to do so with the additional traffic generated by the subject site.

It is concluded that the proposed development does not trigger the need for traffic control signals at the Lees Avenue / Robinson Avenue intersection.



From a transportation impact perspective it is concluded that the proposed development can be accommodated by the existing transportation network and that it should be permitted to proceed.

Should you have any questions please do not hesitate to contact me.

All of which is respectfully submitted;

Sincerely,

STANTEC CONSULTING LTD.

A handwritten signature in blue ink, appearing to read "Robert Vastag", with a horizontal line extending to the right.

Robert Vastag, MCIP, RPP
Senior Transportation Planner
robert.vastag@stantec.com

cc. David Krajaefski, MCIP, RPP, Senior Project Manager, Stantec Consulting Ltd.

- Attachment 1: Trip Generation Letter, Stantec, November 21, 2012
- Attachment 2: Traffic Data, May 8, 2013
- Attachment 3: Detailed Intersection Performance Worksheets
- Attachment 4: Signal Warrant Analysis

**17, 19 and 23 Robinson Avenue Residential Redevelopment
Transportation Assessment**



Attachment 1: Trip Generation Letter, Stantec, November 21, 2012



Stantec

Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower
Markham ON L3R 0B8
Tel: (905) 944-7777
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November 21, 2012
File: 163808203

Robinson Park Development Corp.
5699 Power Road
Ottawa, ON, K1G 3N4

Attention: Americo Rego, President

Dear Sir:

**Reference: 17, 19, and 23 Robinson Avenue, Proposed Development
Trip Generation**

The proposed development at 17, 19, and 23 Robinson Avenue is a 6-storey, 37-unit mid-rise apartment building. Of the 37 units, 11 units are one-bedroom units, and the remaining 26 units are two-bedroom units. In total, 46 parking spaces will be provided in a two-level underground parking structure.

As this development proposes less than 75 units, a community transportation study is not required by the City of Ottawa Traffic Impact Assessment Guidelines. However this letter has been prepared to comment on the expected trip generation of the proposed site in order to address any potential concerns.

The City's threshold level of 75 units (and associated 75 trips) is typical of other municipalities in Ontario:

- City of Hamilton (100 trips);
- Municipality of Chatham-Kent (100 trips);
- Durham Region (100 trips);
- Essex County (50 trips);
- Halton Region (100 trips);
- City of London (100 trips);
- City of Toronto (10 trips);
- York Region (100 trips); and
- Regional Municipality of Waterloo (100 trips).

This threshold is also consistent with the Institute of Transportation Engineer's (ITE) *Transportation Impact Analyses for Site Development – Recommended Practice* threshold of 100 trips. This literature identifies this threshold as appropriate for the following two reasons.

1. Site generated peak hour traffic volumes less than 100 vehicles per hour typically do not have an appreciable effect on the level of service or volume to capacity ratio of an intersection approach.
2. Site generated peak hour traffic volumes less than 100 vehicles per hour typically can be accommodated without the need for auxiliary left or right-turn lanes and without adversely affecting through (non-site) traffic.

The vehicular traffic that would be generated by the subject site during the peak a.m. and p.m. peak hours was based on the ITE *Trip Generation Manual, 8th Edition (2008)*. Information in this manual is widely

**Reference: 17, 19, and 23 Robinson Avenue, Proposed Development
Trip Generation**

accepted by municipalities in Canada and the United States for use in estimating the number of trips that may be generated by a specific land use.

The most appropriate land use type for this development is residential condominium/townhouse, land use code #230. Data for this land use is based off of approximately 60 sites typically averaging 200 dwelling units surveyed between the mid-1970s and the 2000s throughout the United States and Canada.

For the proposed residential development the resultant peak hour site trip generation is shown in **Table 1**. Details of the trip generation calculation sheet have been attached for reference.

Table 1 17, 19, and 23 Robinson Avenue Trip Generation ¹ Residential Condominium/Townhouse Land Use						
# of Units	AM Peak Hour ²			PM Peak Hour ²		
	In	Out	Total	In	Out	Total
37	4	19	23	18	9	27

¹Source: ITE Trip Generation Manual, 8th Edition
²Trip estimates generated from trip equation

It should be noted that no adjustments/reductions have been made to account for public transit or alternative travel modes.

As shown in **Table 1**, it is expected that 23 and 27 trips would be generated by the proposed development during the a.m. and p.m. peak hours, respectively. The addition of less than 30 peak hour vehicle trips to Robinson Avenue would have a negligible effect on traffic operations.

Robinson Avenue is classified as an urban local road by the City of Ottawa's Official Plan. It is expected that even with the addition of the proposed development, traffic volumes on Robinson Avenue would continue to be less than 1000 vehicles per day, well within the typical daily volumes for local roads.

Sincerely,

STANTEC CONSULTING LTD.



Steven Kwan
Transportation Engineer
Tel: (905) 944-7788
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Steven.Kwan@stantec.com

Project: 17, 19, 23 Robinson Avenue - Proposed Development
 Project #: 163808203
 Task: Trip Generation

Apartment Dwelling, Mid Rise 37 Units 11 - 1 Bedroom Units
 6 Storey Building 46 Parking Spaces 26 - 2 Bedroom Units

Land Use: Residential Condominium/Townhouse
 LUC Code 230

Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday

Peak Hour of Adjacent Street Traffic,
 One Hour between 7 and 9 a.m.

Directional Distribution: 17% Entering
 83% Exiting

Average Rate: 0.44
 Equation: $\ln(T) = 0.80 \ln(X) + 0.26$
 Where T = Average Vehicle Trip Ends
 Where X = Number of Dwelling Units

		In	Out
Total Trips	16	3	13
	23	4	19

Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday

Peak Hour of Adjacent Street Traffic,
 One Hour between 4 and 6 p.m.

Directional Distribution: 67% Entering
 33% Exiting

Average Rate: 0.52
 Equation: $\ln(T) = 0.82 \ln(X) + 0.32$
 Where T = Average Vehicle Trip Ends
 Where X = 1000 SF of G.F.A.

		In	Out
Total Trips	19	13	6
	27	18	9

**17, 19 and 23 Robinson Avenue Residential Redevelopment
Transportation Assessment**



Attachment 2: Traffic Data, May 8, 2013

Robinsons Traffic Count - Intersection Lees Avenue and Robinsons, May 8, 2013

	NB						EB						WB					
	Left Turn (WB)		Right Turn (EB)		Through		Right Turn (SB)		Through		Left Turn (SB)		Hourly		Weather			
	Autos	Bikes	Autos	Heavies	Autos	Heavies	Autos	Heavies	Autos	Bikes	Autos	Heavies	Autos	Heavies	Total			
7:00-7:15	3	1	2		154	8	5	1	38		4						Clear Sky, Dry	
7:15-7:30	5		2		198	2	2		29		1						Clear Sky, Dry	
7:30-7:45	12	3	5	4	110	7	2	1	51	4	3	2					Clear Sky, Dry	
7:45-8:00	5	2	8	2	123	3	1	3	45	4	3			865			Clear Sky, Dry	
8:00-8:15	7	2	5	1	150	3	6	1	45	2	1			873			Clear Sky, Dry	
8:15-8:30	11	2	2	1	115	6	5		88	2	2			871			Clear Sky, Dry	
8:30-8:45	5	2	6	6	115	5	2	1	100	3	5	1		912			Clear Sky, Dry	
8:45-9:00	7	1	3	3	88	5	1		74	1	1	3		894			Clear Sky, Dry	
9:00-9:15	2		6		148	7			57	4	1	2		897			Clear Sky, Dry	
9:15-9:30	2		5	5	112	6	4		45	2	3			840			Clear Sky, Dry	
9:30-9:45	4		6		72	4	13		41	2	4	1		739			Clear Sky, Dry	
9:45-10:00	2		4	4	93	2	8		43	2	1	8		717			Clear Sky, Dry	
AM Totals	65	3	11	54	1478	58	4	50	656	26	17	36	5	0				
11:30-11:45	1	1	3	3	101	6	3	5	40	2	5						Sunny With Clouds, Dry	
11:45-12:00	1		6	1	86	1	10	3	44	2	6						Sunny With Clouds, Dry	
12:00-12:15	3		3	1	123	5	9		41		5						Sunny With Clouds, Dry	
12:15-12:30	3	1	2	1	120	5	4		39	3	1			704			Sunny With Clouds, Dry	
12:30-12:45	6		5	1	127	2	8	1	36	1	1			726			Sunny With Clouds, Dry	
12:45-1:00	9	1	6	2	100	7	1		43		6			736			Sunny With Clouds, Dry	
1:00-1:15	5	1	4	1	139	2	7	2	55	6	9			778			Sunny With Clouds, Dry	
1:15-1:30	7		5		84	5	1	4	36	2	2	1		745			Sunny With Clouds, Dry	
Midday Totals	35	2	3	34	880	33	6	48	334	14	7	33	1	1				
3:00-3:15	4		1		185	7		3	54	3	1	3					Sunny With Clouds, Dry	
3:15-3:30	22		11		164	17	2		50	3	1	1					Sunny With Clouds, Dry	
3:30-3:45	8	2	1	2	171	4	6		57	5	1	2					Sunny With Clouds, Dry	
3:45-4:00			3	2	152	4	3	3	53	1	1	2		1022			Sunny With Clouds, Dry	
4:00-4:15	3	4	6		180	3	1	2	43	2	2	1		1008			Sunny With Clouds, Dry	
4:15-4:30	4		1		145	3	5		62	1	1	3		966			Sunny With Clouds, Dry	
4:30-4:45	4	2	2		173	1	4		55		6			951			Sunny With Clouds, Dry	
4:45-5:00	5		5		133	4	2	7	51		7	1		941			Cloudy With Sun, Dry	
5:00-5:15	3		4	1	151	7	3	7	56	1	1	3		935			Cloudy With Sun, Dry	
5:15-5:30	2		5		156	4	1	3	55	1	2	6		943			Cloudy With Sun, Dry	
5:30-5:45	3	1			134		2	7	69		1	9		928			Cloudy With Sun, Dry	
5:45-6:00	1		4		129	4	1	7	75	1	2	2		938			Cloudy With Sun, Dry	
PM Totals	59	3	10	49	1873	58	15	56	680	18	13	44	7	1			Cloudy With Sun, Dry	

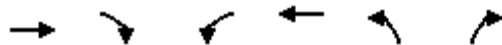


Attachment 3: Detailed Intersection Performance Worksheets

HCM Unsignalized Intersection Capacity Analysis
5: Robinson Avenue & Lees Avenue

AM Peak - Existing Conditions

5/14/2013



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	
Volume (veh/h)	520	19	10	289	30	25
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)	565	21	11	314	33	27
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			586		911	576
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			586		911	576
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		89	95
cM capacity (veh/h)			989		301	517

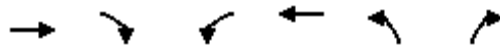
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	586	11	314	60
Volume Left	0	11	0	33
Volume Right	21	0	0	27
cSH	1700	989	1700	372
Volume to Capacity	0.34	0.01	0.18	0.16
Queue Length 95th (m)	0.0	0.3	0.0	4.3
Control Delay (s)	0.0	8.7	0.0	16.5
Lane LOS		A		C
Approach Delay (s)	0.0	0.3		16.5
Approach LOS				C

Intersection Summary			
Average Delay		1.1	
Intersection Capacity Utilization	38.5%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
7: Robinson Avenue & Lees Avenue

PM Peak - Existing Conditions

5/14/2013



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Volume (veh/h)	704	15	11	186	36	20
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)	765	16	12	202	39	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			782		999	773
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			782		999	773
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		85	95
cM capacity (veh/h)			836		266	399

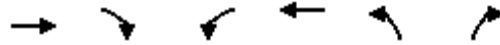
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	782	12	202	61
Volume Left	0	12	0	39
Volume Right	16	0	0	22
cSH	1700	836	1700	302
Volume to Capacity	0.46	0.01	0.12	0.20
Queue Length 95th (m)	0.0	0.3	0.0	5.6
Control Delay (s)	0.0	9.4	0.0	19.9
Lane LOS		A		C
Approach Delay (s)	0.0	0.5		19.9
Approach LOS				C

Intersection Summary			
Average Delay		1.3	
Intersection Capacity Utilization	48.0%		ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: Robinson Avenue & Lees Avenue

AM Peak - Future Background

5/14/2013



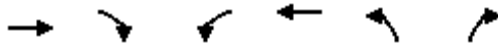
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→		↙	↑	↘	
Volume (veh/h)	572	21	11	318	33	28
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	622	23	12	346	36	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			645		1003	633
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			645		1003	633
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		86	94
cM capacity (veh/h)			941		265	480

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	645	12	346	66
Volume Left	0	12	0	36
Volume Right	23	0	0	30
cSH	1700	941	1700	334
Volume to Capacity	0.38	0.01	0.20	0.20
Queue Length 95th (m)	0.0	0.3	0.0	5.5
Control Delay (s)	0.0	8.9	0.0	18.4
Lane LOS	A		C	
Approach Delay (s)	0.0	0.3		18.4
Approach LOS	C			

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization		41.6%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
7: Robinson Avenue & Lees Avenue

PM Peak - Future Background
5/14/2013



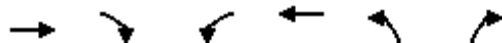
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻		↻	↻	↻	
Volume (veh/h)	774	17	12	205	40	22
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	841	18	13	223	43	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			860	1099	851	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			860	1099	851	
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	81	93	
cM capacity (veh/h)			782	231	360	

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	860	13	223	67
Volume Left	0	13	0	43
Volume Right	18	0	0	24
cSH	1700	782	1700	265
Volume to Capacity	0.51	0.02	0.13	0.25
Queue Length 95th (m)	0.0	0.4	0.0	7.5
Control Delay (s)	0.0	9.7	0.0	23.2
Lane LOS		A		C
Approach Delay (s)	0.0	0.5		23.2
Approach LOS				C

Intersection Summary			
Average Delay		1.5	
Intersection Capacity Utilization		52.0%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: Robinson Avenue & Lees Avenue

AM Peak - Total Future Conditions
5/14/2013



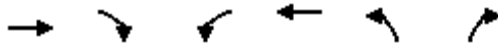
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	
Volume (veh/h)	572	24	12	318	43	36
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	622	26	13	346	47	39
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			648	1007	635	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			648	1007	635	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			99	82	92	
cM capacity (veh/h)			938	263	479	

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	648	13	346	86
Volume Left	0	13	0	47
Volume Right	26	0	0	39
cSH	1700	938	1700	331
Volume to Capacity	0.38	0.01	0.20	0.26
Queue Length 95th (m)	0.0	0.3	0.0	7.7
Control Delay (s)	0.0	8.9	0.0	19.6
Lane LOS		A		C
Approach Delay (s)	0.0	0.3		19.6
Approach LOS				C

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		42.8%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
7: Robinson Avenue & Lees Avenue

PM Peak - Total Future Conditions
5/14/2013



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻		↻	↻	↻	
Volume (veh/h)	774	27	20	205	45	25
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)	841	29	22	223	49	27
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			871	1122	856	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			871	1122	856	
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	78	92	
cM capacity (veh/h)			774	221	357	

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	871	22	223	76
Volume Left	0	22	0	49
Volume Right	29	0	0	27
cSH	1700	774	1700	256
Volume to Capacity	0.51	0.03	0.13	0.30
Queue Length 95th (m)	0.0	0.7	0.0	9.1
Control Delay (s)	0.0	9.8	0.0	24.9
Lane LOS		A		C
Approach Delay (s)	0.0	0.9		24.9
Approach LOS				C

Intersection Summary			
Average Delay		1.8	
Intersection Capacity Utilization		53.1%	ICU Level of Service A
Analysis Period (min)		15	



Attachment 4: Signal Warrant Analysis

Input Data Sheet

Analysis Sheet

Results Sheet

Proposed Collision

GO TO Justification:

What are the intersecting roadways?

Robinson at Lees Avenue

What is the direction of the Main Road street?

East-West

When was the data collected?

May 8, 2013 - Existing Conditions

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road?

1

b.- Number of lanes on the Minor Road?

1

c.- How many approaches?

3

d.- What is the operating environment?

Urban

Population >= 10,000

AND

Speed < 70 km/hr

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00		605	14	25		23	13	171					1
9:00		487	15	33		18	10	315					0
10:00		444	25	10		21	18	196					0
12:30		447	31	9		17	15	169					0
13:30		466	24	28		24	19	179					0
16:00		704	15	36		20	11	226					0
17:00		642	19	16		14	18	214					0
18:00		585	24	10		19	22	258					0
Total	0	4,380	167	167	0	156	126	1,728	0	0	0	0	1

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

* Include only collisions that are susceptible to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Factored 8 hour pedestrian volume	0		0		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									0
Net 8 Hour Vehicular Volume on Street Being Crossed									6,411

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	0		0		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									0
Net 8 Hour Volume of Delayed Pedestrians									0

Justification 1: Minimum Vehicle Volumes

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
1A	480	720	600	900	851	878	714	688	740	1,012	923	918		
	COMPLIANCE %				100	100	99	96	100	100	100	100	795	99
1B	180	255	180	255	48	51	31	26	52	56	30	29		
	COMPLIANCE %				19	20	12	10	20	22	12	11	127	16
Restricted Flow					Both 1A and 1B 100% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 1:					Lesser of 1A or 1B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 2: Delay to Cross Traffic

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
2A	480	720	600	900	803	827	683	662	688	956	893	889		
	COMPLIANCE %				100	100	95	92	96	100	100	100	782	98
2B	50	75	50	75	26	33	10	9	28	36	16	10		
	COMPLIANCE %				35	44	13	12	37	48	21	13	224	28
Restricted Flow					Both 2A and 2B 100% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 2:					Lesser of 2A or 2B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 3: Combination

Combination Justification 1 and 2

Justification Satisfied 80% or More				Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
Justification 2	Delay Cross Traffic	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	NOT JUSTIFIED	

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main)	Heaviest Minor Approach	Required Value	Average % Compliance	Overall % Compliance
		X	Y (actual)	Y (warrant threshold)		
Justification 4	9:00	827	51	144	35 %	33 %
	16:00	956	56	111	50 %	
	17:00	893	30	126	24 %	
	18:00	889	29	127	23 %	

Results Sheet

[Input Sheet](#)

[Analysis Sheet](#)

[Proposed Collision](#)

GO TO Justification:

Intersection: Robinson at Lees Avenue

Count Date: May 8, 2013 - Existing Conditions

Summary Results

Justification		Compliance		Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A Total Volume	99	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Volume	16	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. Delay to Cross Traffic	A Main Road	98	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Road	28	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Combination	A Justificaton 1	16	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Justification 2	28	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. 4-Hr Volume		33	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>

5. Collision Experience		0	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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6. Pedestrians	A Volume	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Delay	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Input Data Sheet

Analysis Sheet

Results Sheet

Proposed Collision

GO TO Justification:

What are the intersecting roadways?

Robinson at Lees Avenue

What is the direction of the Main Road street?

East-West

When was the data collected?

Future Background Conditions (2018)

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road?

1

b.- Number of lanes on the Minor Road?

1

c.- How many approaches?

3

d.- What is the operating environment?

Urban

Population >= 10,000

AND

Speed < 70 km/hr

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00		666	15	28		25	14	188					1
9:00		536	17	36		20	11	347					0
10:00		488	28	11		23	20	216					0
12:30		492	34	10		19	17	186					0
13:30		513	26	31		26	21	197					0
16:00		774	17	40		22	12	249					0
17:00		706	21	18		15	20	235					0
18:00		644	26	11		21	24	284					0
Total	0	4,818	184	184	0	172	139	1,901	0	0	0	0	1

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

* Include only collisions that are susceptible to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Factored 8 hour pedestrian volume	0		0		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									0
Net 8 Hour Vehicular Volume on Street Being Crossed									6,411

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	0		0		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									0
Net 8 Hour Volume of Delayed Pedestrians									0

Justification 1: Minimum Vehicle Volumes

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
1A	480	720	600	900	936	966	785	757	814	1,113	1,015	1,010		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
1B	180	255	180	255	53	56	34	29	57	62	33	32		
	COMPLIANCE %				21	22	13	11	22	24	13	13	139	17
Restricted Flow					Both 1A and 1B 100% Fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 1:					Lesser of 1A or 1B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 2: Delay to Cross Traffic

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
2A	480	720	600	900	883	910	751	728	757	1,052	982	978		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
2B	50	75	50	75	29	36	11	10	31	40	18	11		
	COMPLIANCE %				38	48	15	13	41	53	23	15	246	31
Restricted Flow					Both 2A and 2B 100% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 2:					Lesser of 2A or 2B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 3: Combination

Combination Justification 1 and 2

Justification Satisfied 80% or More				Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
Justification 2	Delay Cross Traffic	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	NOT JUSTIFIED	

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main)	Heaviest Minor Approach	Required Value	Average % Compliance	Overall % Compliance
		X	Y (actual)	Y (warrant threshold)		
Justification 4	9:00	910	56	122	46 %	43 %
	16:00	1,052	62	92	67 %	
	17:00	982	33	106	31 %	
	18:00	978	32	107	30 %	

Results Sheet

[Input Sheet](#)

[Analysis Sheet](#)

[Proposed Collision](#)

[GO TO Justification:](#)

Intersection: Robinson at Lees Avenue

Count Date: Future Background Conditions (2018)

Summary Results

Justification		Compliance		Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A Total Volume	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Volume	17	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. Delay to Cross Traffic	A Main Road	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Road	31	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Combination	A Justificaton 1	17	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Justification 2	31	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. 4-Hr Volume		43	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>

5. Collision Experience	0	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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6. Pedestrians	A Volume	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Delay	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>

Input Data Sheet

Analysis Sheet

Results Sheet

Proposed Collision

GO TO Justification:

What are the intersecting roadways?

Robinson at Lees Avenue

What is the direction of the Main Road street?

East-West

When was the data collected?

Total Future Conditions (2018)

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road?

1

b.- Number of lanes on the Minor Road?

1

c.- How many approaches?

3

d.- What is the operating environment?

Urban

Population >= 10,000

AND

Speed < 70 km/hr

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00		666	26	38		34	22	188					1
9:00		536	27	47		28	19	347					0
10:00		488	38	21		32	27	216					0
12:30		492	44	20		27	24	186					0
13:30		513	37	41		35	29	197					0
16:00		774	27	50		31	20	249					0
17:00		706	31	28		24	27	235					0
18:00		644	37	21		30	32	284					0
Total	0	4,818	267	267	0	241	200	1,901	0	0	0	0	1

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

* Include only collisions that are susceptible to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Factored 8 hour pedestrian volume	0		0		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									0
Net 8 Hour Vehicular Volume on Street Being Crossed									6,411

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	0		0		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									0
Net 8 Hour Volume of Delayed Pedestrians									0

Justification 1: Minimum Vehicle Volumes

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
1A	480	720	600	900	973	1,003	822	794	851	1,150	1,052	1,047		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
1B	180	255	180	255	72	75	53	48	76	81	52	51		
	COMPLIANCE %				28	29	21	19	30	32	20	20	199	25
Restricted Flow					Both 1A and 1B 100% Fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 1:					Lesser of 1A or 1B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 2: Delay to Cross Traffic

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>										
2A	480	720	600	900	901	928	769	746	775	1,070	1,000	996		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
2B	50	75	50	75	39	47	21	20	41	50	28	21		
	COMPLIANCE %				52	62	28	27	55	67	37	28	357	45
Restricted Flow					Both 2A and 2B 100% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Signal Justification 2:					Lesser of 2A or 2B at least 80% fulfilled each of 8 hours								Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

Justification 3: Combination

Combination Justification 1 and 2

Justification Satisfied 80% or More				Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
Justification 2	Delay Cross Traffic	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>	NOT JUSTIFIED	

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main)	Heaviest Minor Approach	Required Value	Average % Compliance	Overall % Compliance
		X	Y (actual)	Y (warrant threshold)		
Justification 4	9:00	928	75	118	64 %	64 %
	16:00	1,070	81	89	90 %	
	17:00	1,000	52	102	51 %	
	18:00	996	51	103	50 %	

Results Sheet

[Input Sheet](#)

[Analysis Sheet](#)

[Proposed Collision](#)

GO TO Justification:

Intersection: Robinson at Lees Avenue

Count Date: Total Future Conditions (2018)

Summary Results

Justification		Compliance		Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A Total Volume	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Volume	25	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. Delay to Cross Traffic	A Main Road	100	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Crossing Road	45	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Combination	A Justificaton 1	25	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Justification 2	45	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. 4-Hr Volume		64	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>

5. Collision Experience	0	%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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6. Pedestrians	A Volume	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	B Delay	Justification not met		<input type="checkbox"/>	<input checked="" type="checkbox"/>