36 Robinson Avenue Transportation Impact Assessment

Step 1 Screening Form

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report (Draft)

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1 Screening

This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form was completed, and a TIA report is required. The Screening and the Certification Form for TIA Study PM have been provided in Appendix A.

2 Existing and Planned Conditions

2.1 Proposed Development

The proposed development, located at 36 Robinson Avenue, will convert existing residential units to a nine-storey apartment building. The development is located within the Sandy Hill Secondary Plan and Lees Transit-Orient Design (TOD) Community Design Plan area. The current zoning is for Residential (R5) and permits low and midrise apartments. Access to the building will be directly to Robinson Avenue. In total, 193 apartment units will be constructed, with amenity space provided on the roof. The site will include 74 parking spaces and 100 bike parking spaces. The anticipated full build-out and occupancy horizon is 2020.

Figure 1 illustrates the Study Area Context. Figure 2 illustrate the proposed site plans.

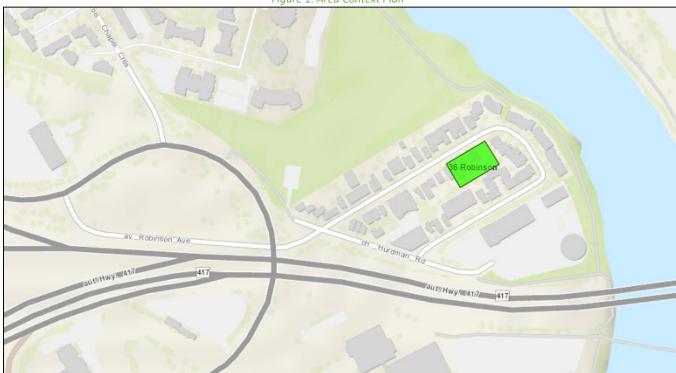
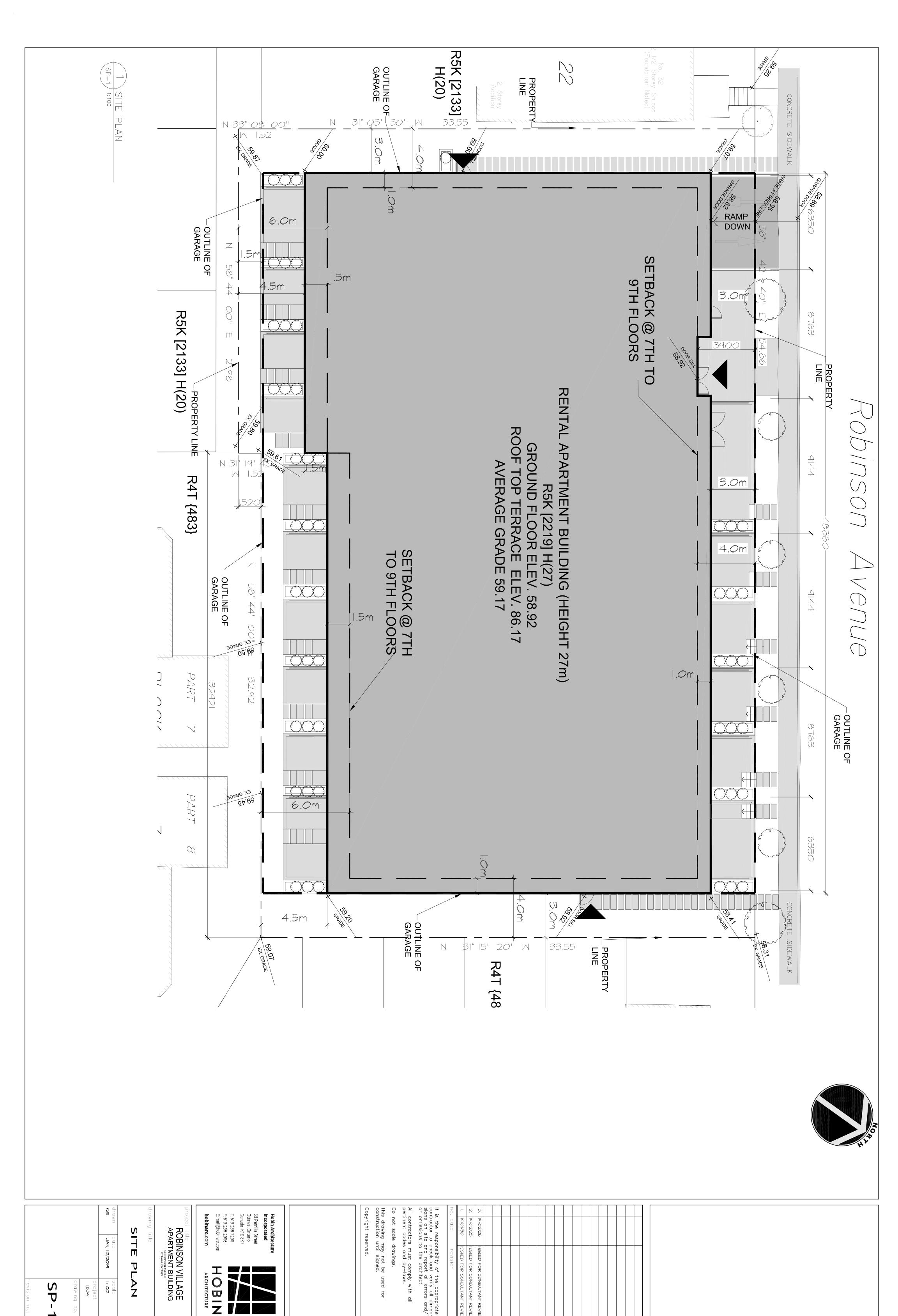


Figure 1: Area Context Plan

Source: http://maps.ottawa.ca/geoOttawa/ Accessed: January 2, 2019





PLAN

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HOB Z

2.2 Existing Conditions

2.2.1 Area Road Network

Robinson Avenue

Robinson Avenue is a City of Ottawa local road with a two-lane urban cross-section including a 40 km/h posted speed limit. The reserved right-of-way varies from approximately 12.0m to 16.0m east of Hurdman Road, and 20.0m west of Hurdman Road with a 16.0m width at the Lees Avenue Overpass.

Hurdman Road

Hurdman Road is a City of Ottawa local road with a two-lane urban cross-section including an unposted speed limit assumed to be 40km/h. The current right-of-way is approximately 18.0m.

Lees Avenue

Lees Avenue is a City of Ottawa arterial road with a two-lane urban cross-section including a 50 km/h posted speed limit. The Ottawa Official Plan reserves a 26.0m right of way for Lees Avenue between Robinson Avenue and Mann Avenue, and 23.0m between Robinson Avenue and Main Street.

2.2.2 Existing Intersections

Robinson Avenue / Hurdman Road (North)	The north	intersection	of	Robinson	Avenue	an	d

Hurdman Road is an all-way stop-controlled intersection with shared all movement lanes on each

approach. No turn restrictions were noted.

Robinson Avenue / Hurdman Road (South) The south intersection of Robinson Avenue and

Hurdman Road is a minor stop-controlled T-intersection with shared movement lanes on all

approaches. No turn restrictions were noted.

Robinson Avenue / Lees Avenue

The intersection of Robinson Avenue and Lees is a minor stop-controlled intersection with shared movement lanes on the eastbound and northbound approaches, and an auxiliary left-turn lane and through lane on the westbound approach. An offset painted median is provided opposite the auxiliary left turn lane on the eastbound approach. No turn

restrictions were noted.

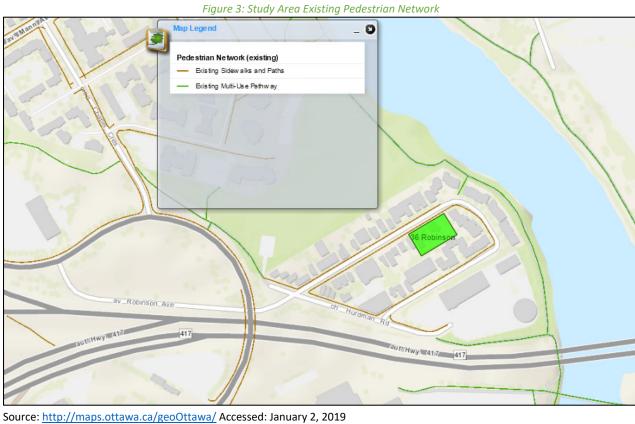
2.2.3 Existing Driveways

Residential driveways exist along Robinson Avenue and Hurdman Road. A commercial access is located at the south intersection of Robinson Avenue and Hurdman Road, and at the southern end of Hurdman Road, the access is provided for the City's Municipal Hurdman Yard.

2.2.4 Cycling and Pedestrian Facilities

Sidewalks are provided on Robinson Avenue and Hurdman Road, and along Lees Avenue. No sidewalk connection exists on Robinson Avenue west of Hurdman Road. The multi-use pathway network along the Rideau River and through Robinson Park provide the cycling connectivity and allow pedestrians to access Lees Avenue and cross south under Highway 417. Figure 3 illustrates the study area pedestrian network and Figure 4 illustrates the study are cycling network.





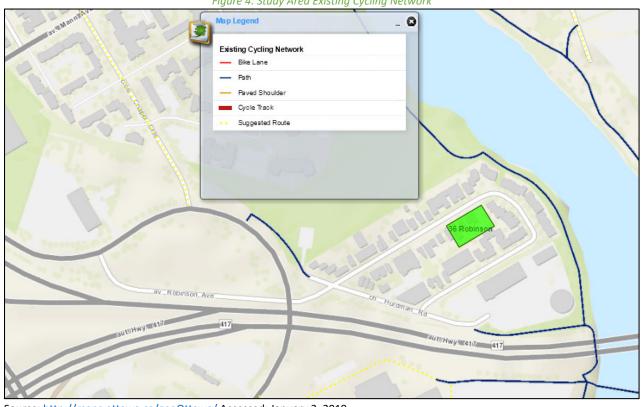


Figure 4: Study Area Existing Cycling Network

Source: http://maps.ottawa.ca/geoOttawa/ Accessed: January 2, 2019



2.2.5 Existing Transit

Transit stops are located at the PXO crossing on Lees Avenue, with routes 16, 56, 85, 97, 98, 101, and 103. Lees LRT Station is over 600m walking distance from the proposed sites.

2.2.6 Existing Area Traffic Management Measures

There are no existing area traffic management measures within the Study Area.

2.2.7 Existing Peak Hour Travel Demand

Existing turning movement counts were acquired during site observations on Wednesday January 9, 2019. Figure 5 illustrates the existing traffic counts and Table 1 summarizes the existing intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. Detailed turning movement count data is included in Appendix B and the Synchro worksheets are provided in Appendix C.

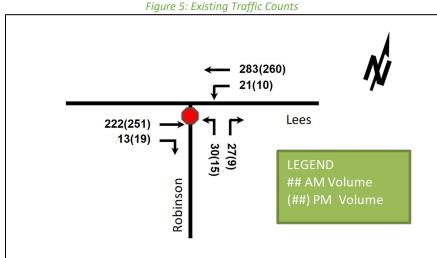


Table 1: Existing Intersection Operations

lutava atiava	Lana	AM Peak Hour				PM Peak Hour			
Intersection	Lane	LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
	EB	-	-	-	-	-	-	-	-
Lees Avenue &	WBL	Α	7.8	0.02	0.1	Α	7.9	0.01	0.0
Robinson Avenue	WBT	-	-	-	-	-	-	-	-
Unsignalized	NB	В	12.2	0.11	0.4	В	12.1	0.05	0.2
	Overall	Α	1.4	-	-	Α	0.7	-	-

Notes: Saturation flow rate of 1800 veh/h/lane

PHF = 0.90

The existing intersection operates satisfactorily during the peak hours.

2.2.8 Collision Analysis

Collision data has been acquired from OpenData Ottawa for four years prior to the commencement of this TIA for the study area. Figure 6 illustrates the study area collisions and Table 2 summarizes the collisions.



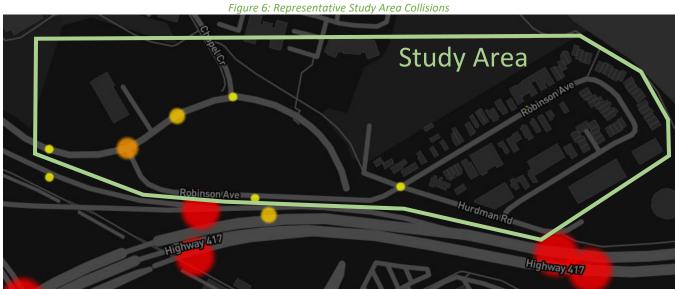


Table 2: Study Area Collision Summary, 2014-2017

	,	Number	%
Total Collisions		19	100%
	Fatality	0	0%
Classification	Non-Fatal Injury	2	11%
	Property Damage Only	17	89%
	Angle	3	16%
	Rear end	3	16%
to the all to a const	Sideswipe	1	5%
Initial Impact	Turning Movement	1	5%
Туре		3	16%
	SMV Other	7	37%
	Other	1	5%
	Dry	11	58%
Dood Conford	Wet	2	11%
Road Surface	Loose Snow	4	21%
Condition	Slush	1	5%
	Packed Snow	1	5%
Pedestrian Invo	lved	0	0%
Cyclist Involved		0	0%

No collision issues are noted within the study area, with three or less collisions identified on the adjacent roadways. Collision data is included in Appendix D.

2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

No major changes are anticipated for the immediate transportation network. Beyond Robinson Avenue, the extension of the Alta Vista Parkway would connect to the Nicolas Street and Highway 417 interchange, and the Confederation LRT will open in the future at the Lees Station. The Alta Vista Parkway is part of the Concept Network and is not scheduled to occur within the Affordable Network timeframe of 2031.



2.3.2 Other Study Area Developments

Three additional sites are currently in the process of being developed along Robinson Avenue. The sites are located at 19, 29, and 134 Robinson Avenue. The site at 19 Robinson Avenue includes 47 residential apartment units, and 29 and 134 Robinson Avenue have 51 residential apartment units each. The TIA forecasted 15 trips outbound trips and 5 inbound trips during the AM peak, and 8 outbound trips and 13 inbound trips during the PM peak.

3 Study Area and Time Periods

3.1 Study Area

The study area will include examining Robinson Avenue a Boundary Road and will focus on the access intersection, parking, and site design aspects of each of the proposed sites.

3.2 Time Periods

As the proposed development is composed entirely of residential units the AM and PM peak hours will be examined.

3.3 Horizon Years

The anticipated build-out year is 2020. As a result, the full build-out plus five years horizon year is 2025.

4 Exemption Review

Table 3 summarizes the exemptions for this TIA and Table 4 summarizes additional recommended exemptions for the TIA.

Table 3: Exemption Review

Module Element		Explanation	Exempt/Required					
Design Review Compo	Design Review Component							
4.1 Development	4.1.2 Circulation and Access	Only required for site plans	Required					
Design	4.2.3 New Street Networks	Only required for plans of subdivision	Exempt					
	4.2.1 Parking Supply	Only required for site plans	Required					
4.2 Parking	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Exempt					
Network Impact Comp	onent							
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Exempt					
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Exempt					
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of equivalent volume permitted by established zoning	Exempt					



As the Screening Form does not identify the need for a TIA, the following exemptions are also recommended for this TIA.

Table 4: Recommended Additional Exemptions

Module	Element	Explanation				
Network Impact Components						
4.4 Access Intersections	4.4.2 Intersection Control	No roadway intersections serve as access to the development sites.				
4.4 Access intersections	4.4.3 Intersection Design	No roadway intersections serve as access to the development sites.				
4.7 Transit	All Elements	No network impact components required due to no trip generation trigger.				

5 Development-Generated Travel Demand

5.1 Trip Generation and Mode Shares

5.1.1 Trip Generation

The 2009 TRANS Trip Generation Study (TRANS Study) has been reviewed to determine the appropriate residential trip generation rates for the proposed sites. Mid-rise apartment dwellings are proposed within the subject development. Vehicle trip rates have been determined using Table 6.3 of the TRANS Study. The initial mode share associated with these trips has been determined using Table 3.13 of the TRANS Study. Using this information, the person trip rate has been calculated. Table 5 below summarizes the vehicle trip rates, initial mode shares, and person trip rates, for each land use this study will consider.

Table 5: TRANS Trip Generation Person Trip Rates

	ITE	Peak	Vehicle		Mode Share		Dougon Trin
Dwelling Type	LUC	Hour	Trip Rate	Vehicle	Transit	Non- Motorized	Person Trip Rates
Mid-Rise	222	AM	0.24	37%	41%	11%	0.65
Apartments	223	PM	0.28	40%	37%	12%	0.70

LUC - Land Use Code

Using the above Person Trip rates, the total person trip generation has been estimated. Table 6 below illustrates the total person trip generation by dwelling type.

Table 6: Total Person Trip Generation

	Land Use	l luita	P	AM Peak Hour			PM Peak Hour			
		Units	In	Out	Total	In	Out	Total		
	Mid-Rise Apartments	193	30	95	125	84	51	135		

LUC – Land Use Code

Using the most recent National Capital Region Origin-Destination survey (OD Survey), the existing mode shares for Ottawa Inner have been summarized in Table 7.

Table 7: OD Survey Existing Mode Share – Ottawa Inner

Travel Mode	Existing Mode Share
Auto Driver	40%
Auto Passenger	10%
Transit	25%
Non-Auto	25%
Total	100%



As the area is located within the Lees TOD area, the modal shares will be modified to reduce the Auto Driver to 20%, Auto Passenger to 5%, and increase the Transit to 50%. Using these TOD mode shares and person trip rates the person trips by mode have been projected. Table 8 summarizes the trip generation by mode.

Table 8: Trip Generation by Mode

the state of the s								
Travel Mode	Mode Share	AM Peak Hour			PM Peak Hour			
Travel Mode		In	Out	Total	In	Out	Total	
Auto Driver	20%	6	19	25	17	10	27	
Auto Passenger	5%	2	5	6	4	3	7	
Transit	50%	15	48	63	42	26	68	
Non-Auto Modes	25%	8	24	31	21	13	34	
Total	100%	30	95	125	84	51	138	

As shown above, 25 AM and 27 PM peak hour two-way vehicle trips are projected as a result of the proposed development.

No trip reductions factors (i.e. synergy, pass-by, etc.) have been applied as the subject site is composed entirely of residential units.

5.2 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the existing travel patterns. Table 9 below summarizes the distribution.

Table 9: OD Survey Distribution – Ottawa Inner

To/From	Percent of Trips
North	20%
South	35%
East	25%
West	20%
Total	100%

While the regional travel would ultimately follow the pattern of the OD Survey, the isolated location of Robinson Avenue and the surrounding road network limit how vehicles enter and exit the area.

5.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network.



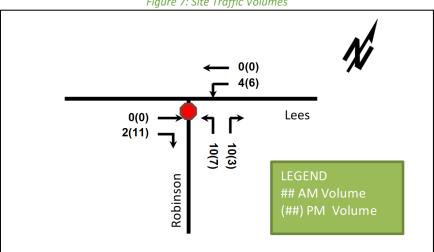


Figure 7: Site Traffic Volumes

Background Network Travel Demands

6.1 Transportation Network Plans

There are no planned changes to the Study Area Transportation Network that would influence the Study Area.

6.2 Background Growth

A 2% background growth has been assumed along Lees Avenue.

6.3 Other Developments

As detailed in Section 2.3.2, the following developments have been included in the background traffic forecasts.

Demand Rationalization

Figure 8 illustrates the 2020 future background traffic volumes and Figure 9 illustrates the 2025 future background traffic volumes. Table 10 summarizes the 2020 future background intersection operations and Table 11 summarizes the 2025 future background intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. The Synchro works sheets have been provided in Appendix E and Appendix F.

Figure 8: 2020 Future Background Volumes 289(265) 24(15) 226(256) Lees 15(27) Robinson



Table 10: 2020 Future Background Intersection Operations

lusta na a ati a n	Lana		AM Pea	ak Hour			PM Pea	ak Hour	
Intersection	Lane	LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
	EB	-	-	-	-	-	-	-	-
Lees Avenue &	WBL	Α	7.8	0.02	0.1	Α	7.8	0.01	0.0
Robinson Avenue	WBT	-	-	-	-	-	-	-	-
Unsignalized	NB	В	12.0	0.12	0.4	В	11.9	0.06	0.2
	Overall	Α	1.7	-	-	Α	0.8	-	-

Saturation flow rate of 1800 veh/h/lane Notes:

PHF = 1.00

The future 2020 background conditions are forecasted to operate well during the peak hours as a minor stopcontrolled intersection. No operational issues are noted, and no auxiliary turn lanes are recommended.

Figure 9: 2025 Future Background Volumes 319(293) 24(15) Lees 250(283)

Table 11: 2025 Future Background Intersection Operations

Interception	Lana		AM Pea	ak Hour			PM Pea	ak Hour	
Intersection	Lane	LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
	EB	-	-	-	-	-	-	-	-
Lees Avenue &	WBL	Α	7.8	0.02	0.1	Α	7.9	0.01	0.0
Robinson Avenue	WBT	-	-	-	-	-	-	-	-
Unsignalized	NB	В	12.5	0.13	0.4	В	12.4	0.06	0.2
	Overall	Α	1.6	-	-	Α	0.8	-	-

Notes: Saturation flow rate of 1800 veh/h/lane

PHF = 1.00

The future 2025 background conditions are forecasted to operate well during the peak hours as a minor stopcontrolled intersection. No operational issues are noted, and no auxiliary turn lanes are recommended.

Development Design

8.1 Design for Sustainable Modes

The proposed development is a residential site plan with underground parking and internal bicycle parking in the underground parking levels. Sidewalks are provided along the frontage of the site on Robinson Avenue.



8.2 Circulation and Access

No issues are noted with the internal circulation or access to the site.

9 Parking

9.1 Parking Supply

While the TOD area does not require any on-site parking, 74 underground parking spaces will be provided. Of these spaces, 18 will be required to be signed as visitor parking. Tenant parking would be at an equivalent rate of approximately 0.3 spaces per unit. A total of 100 bicycle parking spaces are provided in the buildings.

10 Boundary Street Design

Table 12 summarizes the MMLOS analysis for the boundary road of Robinson Avenue. The existing and future conditions are the same and have been provided as a single line. The MMLOS worksheet has been provided in Appendix G.

Pedestrian LOS Transit LOS Truck LOS Bicycle LOS Segment **BLOS PLOS** Target Target **TLOS TrLOS** Target **Target Robinson Avenue** Ē N/A N/A-N/A N/A-Α (600m to transit))

Table 12: Boundary Street MMLOS Analysis

Robinson Avenue does not meet the pedestrian level of service target. While the local road has sidewalks on both sides, the lack of boulevard between the curb and sidewalk does meet the target. To meet the target, the road would need to be reconstructing for a boulevard width between 0.5-2m and widen the sidewalk to 1.8m. This is not a feasible solution to meet the targets within the MMLOS framework and not mitigate measures are recommended to meet the pedestrian level of service.

The remaining targets are met or not applicable for a local road.

11 Access Intersection Design

11.1 Location and Design of Access

The proposed access to the site is located on the western edge of the site and will connect directly to Robinson Avenue. As the access is a private approach, the sidewalk will need to be depressed across the access and an internal stop sign and painted stop bar are recommended for vehicles exiting the underground parking.

12 Network Intersection Design

12.1 Network Intersection Control

No changes are proposed to the existing area intersection control.

12.2 Network Intersection Design

12.2.1 2020 Future Total Conditions

Figure 10 illustrates the 2020 future total traffic volumes and Table 13 summarizes the 2020 future total intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. The Synchro works sheets have been provided in Appendix H.



289(265) 28(21) 226(256) Lees 17(38) LEGEND (##) PM Volume

Figure 10: 2020 Future Total Volumes

Table 13: 2025 Future Background Intersection Operations

Interception	Lana		AM Pea	ak Hour			PM Pea	ak Hour	
Intersection	Lane	LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
	EB	-	-	-	-	-	-	-	-
Lees Avenue &	WBL	Α	7.8	0.02	0.1	Α	7.9	0.02	0.1
Robinson Avenue	WBT	-	-	-	-	-	-	-	-
Unsignalized	NB	В	12.3	0.16	0.6	В	12.3	0.08	0.3
	Overall	Α	2.1	-	-	Α	1.1	-	-

Notes: Saturation flow rate of 1800 veh/h/lane

PHF = 1.00

The future 2020 total conditions are forecasted to operate well during the peak hours as a minor stop-controlled intersection. No operational issues are noted, and no auxiliary turn lanes are recommended.

12.2.2 2025 Future Total Conditions

Figure 11 illustrates the 2025 future total traffic volumes and Table 14 summarizes the 2025 future total intersection operations. The level of service is based on the HCM criteria for average delay at unsignalized intersections. The Synchro works sheets have been provided in Appendix I.

Figure 11: 2025 Future Total Volumes 319(293) 28(21) 250(283) Lees 17(38) ## AM Volume



Table 14: 2025 Future Background Intersection Operations

Intovocation	Lana		AM Pea	ak Hour			PM Pea	ak Hour	
Intersection	Lane	LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
	EB	-	-	-	-	-	-	-	-
Lees Avenue &	WBL	Α	7.8	0.02	0.1	Α	8.0	0.02	0.1
Robinson Avenue	WBT	-	-	-	-	-	-	-	-
Unsignalized	NB	В	12.9	0.17	0.6	В	12.8	0.08	0.3
	Overall	Α	2.0	-	-	Α	1.0	-	-

Notes: Saturation flow rate of 1800 veh/h/lane

PHF = 1.00

The future 2025 total conditions are forecasted to operate well during the peak hours as a minor stop-controlled intersection. No operational issues are noted, and no auxiliary turn lanes are recommended.

12.2.3 Network MMLOS

Table 15 summarizes the MMLOS analysis for the network road of Lees Avenue. The existing and future conditions are the same and have been provided as a single line. The MMLOS worksheet has been provided in Appendix G.

Table 15: Network Street MMLOS Analysis

Coamont	Pedesti	rian LOS	Bicyc	le LOS	Trans	it LOS	Trucl	k LOS
Segment	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target
Lees Avenue (600m to transit))	С	Α	С	В	D	N/A	В	D

Lees Avenue does not meet the pedestrian and cycling level of service targets for an arterial road within 600m of transit. The operating speed of Lees Avenue would need to be reduced to below 40 km/h to increase both to a level of service B, meeting the cycling target, and additional boulevard space between the road and sidewalk to reach the level of service A for pedestrians.

Additional multi-use pathways and pedestrian connections exist in the area, providing alternative and potentially more direct routes for active modes. Therefore, no mitigation measures or improvements are recommended for Lees Avenue.

13 Summary of Improvements Indicated and Modifications Options

The following summarizes the analysis and results presented in this TIA report:

Proposed Site and Screening

- The proposed site is located at 36 Robinson Avenue and will include 193 apartment units
- Access will be provided directly to Robinson Avenue as full movement private approaches
- The site will include 74 visitor parking spaces and 100 interior bicycle parking spaces
- Build-out is anticipated by 2020
- The site required a TIA due to the trip generation and location triggers

Existing Conditions

- Robinson Avenue is a local road with a posted speed limit of 40km/h and Lees Avenue is an arterial road with a posted speed limit of 50km/h
- Sidewalks are located on both sides of the road along the north loop of Robinson Avenue, and on a single side of the road on the east and south parts of the loop, and on the north side of Lees Avenue



No collision issues were noted in the study area

Development Generated Travel Demand

- A total of 125 AM peak two-way people trips and 135 PM peak two-way people trips were forecast from the site
- Given the TOD area, 50% of these trips were assumed to be transit, 25% to be active modes and the remaining 25% to be auto driver and passenger
- The forecasted auto trips total 25 two-way trips during the AM peak, and 27 two-way trips during the PM peak

Background Conditions

No operational issues were noted in the 2020 or 2025 future background conditions

Development Design

- The underground parking provides 74 spaces and the underground parking aisle meets the City By-Law requirement of 6.0m in width
- Bicycle parking is provided on the interior of the building with a total of 100 spaces
- Sidewalks are provided along the frontage of the building on Robinson Avenue
- No circulation issues were noted

Parking

- No parking is required as part of the TOD area zoning
- Visitor parking will be provided with 18 spaces for the building
- A tenant parking rate of 0.3 spaces per unit, with a total of 56 spaces for tenant parking

Boundary Street Design

- Robinson Avenue does not meet the pedestrian MMLOS target due to the lack of boulevard spacing between the curb and sidewalk and the sidewalk being 1.5m in width
- As Robinson Avenue will not be reconstructed and widened, no improvements are recommended to achieve the MMLOS target
- The remaining targets are met or not applicable for a local road

Access Intersection Design

 The private approach access to Robinson Avenue will require a depressed sidewalk and a stop sign and painted stop bar provided for vehicles exiting the underground parking

Network Intersection Design

- No operational issues were noted in the 2020 or 2025 future total conditions
- Lees Avenue does not meet the pedestrian and cycling MMLOS target due to the lack of boulevard spacing between the curb and sidewalk and operating speeds on the roadway
- As alternative and more direct multi-use pathways and pedestrian connections exist in the area, not mitigation or improvements are recommended for Lees Avenue
- The remaining targets are met or not applicable for a local road



14 Next Steps

Following the circulation and review of the TIA Step 4 Report for the site plan submission, any outstanding comments will be documents within the context of the site plan submission. Once sign-off has been received from City Transportation Project Manager, a signed and stamped final report will be provided to City staff.



Appendix A

TIA Screening Form and PM Certification Form

Jan. 01, 2019

CGH TRANSPORTATION INC.

City of Ottawa 2017 TIA Guidelines Step 1 - Screening Form Date: Project Number: Project Reference:

2018-68 TC United - 36 Robinson

1.1 Description of Proposed Development	
Municipal Address	36 Robinson Avenue
Description of Location	Ward 12 - PIN 042070357
Land Use Classification	Residential
Development Size	197 low-rise apartments
Accesses	Single Access, Robinson Avenue
Phase of Development	Single Phase
Buildout Year	2020
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger	
Land Use Type	Townhomes or apartments
Development Size	197 Units
Trip Generation Trigger	Yes

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

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



TIA Plan Reports

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

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

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

CERTIFICATION

- 1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
- 2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
- 3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
- 4. I am either a licensed¹ or registered² professional in good standing, whose field of expertise [check $\sqrt{\text{appropriate field(s)}}$] is either transportation engineering $\sqrt{\text{or}}$ or transportation planning \square .
- License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.

Dated at Ottawa (City)	this 20 day of September	, 2018
Name:	Andrew Harte (Please Print)	_
Professional Title:	Professional Engineer	
Signature	of Individual certifier that s/he meets the above four criteria	

Office Contact Information (Please Print)
Address: 13 Markham Avenue
City / Postal Code: Ottawa / K2G 3Z1
Telephone / Extension: (613) 697-3797
E-Mail Address: Andrew.Harte@CGHTransportation.com



Appendix B

Turning Movement Count Data



Lees Ave.

1050

1953

903

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

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

Automobiles, Taxis

Turning Movement Count AADT and Expansion Factors Summary Report

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

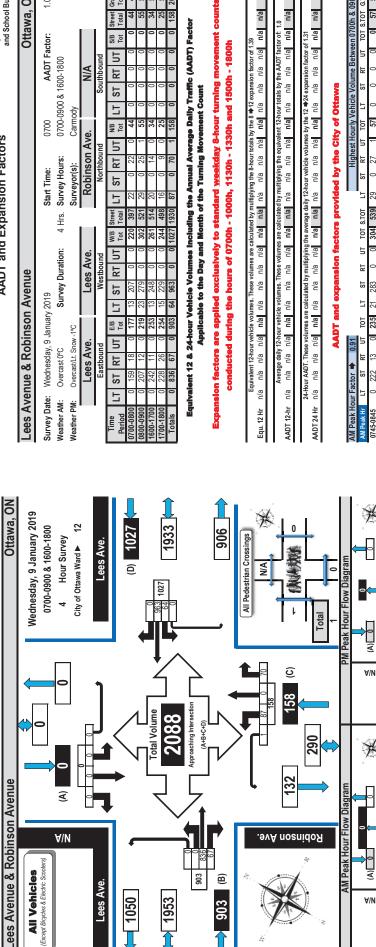
Ottawa, ON

AADT Factor:

0700-0900 & 1600-1800

Carmody

RT ST



n/a n/a n/a

n/a n/a

n/a n/a

Printed on: 1/10/2019

Flow Diagrams: AM PM Peak Prepared by: thetrafficspecialist@gmail.com

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

Summary - PM Peak Hr.

(C) 24

Summary - AM Peak Hr

(C) 27

Robinson Ave.

Comments: The majority of the heavy vehicles consist of OC Transpo, intercity and school buses.

270 530

260 Lees Ave.

270 (B)

249

235 (B)

547 235

Lees Ave.

545 270

283 304 558

(D) 270

Lees Ave. 275

Lees Ave.

312

(D) 304

TOT S.TOT

Prepared by: thetrafficspecialist@gmail.com

Printed on: 1/10/2019

Summary: All Vehicles



Lees Avenue & Robinson Avenue

Turning Movement Count Heavy Vehicle Summary Flow Diagram

Heavy Trucks, Buses, and School Buses

Ottawa, ON

Wednesday, 9 January 2019

0700-0900 & 1600-1800

4 Hour Survey

€

A/N

(Construction Vehicles, Heavy Trucks, Buses & School Buses).

Heavy vehicle totals <u>ARE</u> included in the all vehicles summary and flow diagrams. **Heavy Vehicles**

Lees Ave.

40

164

City of Ottawa Ward ▶ 12

Lees Ave.

(D) 40

169

Approaching Intersection

(A+B+C+D)

124 0 118

124 (B)

otal Heavy Vehicle

129

All Pedestrian Crossings

MA

20 (c)

15

.evA nosnidoЯ

Pedestrian Crossings Summary **Turning Movement Count** and Flow Diagram



Lees Avenue & Robinson Avenue		Ottawa, ON
Pedestrian Crossings N/A	Wednesday 0700-090	Wednesday, 9 January 2019 0700-0900 & 1600-1800 4 Hour Survey
135 pedestrians were observed on the sidewalk during this traffic count.	City of o	City of Ottawa Ward ▶ 12
	←	
Grand Total Grand Total	0	.эvА сээд
*		
	The values in the diagram represent MoI the number For example, For example, approach, then,	Note The values in the summary table below and the flow diagram represent the number of pedestrian crossing. NOT the number of individual pedestrians crossing. For example, some pedestrians will cross one approach, then another to reach their destination.
Robinson Ave.	-	Accordingly, one pedestrian crossing two approaches will be recorded as two crossings.
Time Pariod West Side Crossing East Side Crossing Street S	South Side Crossing North Sid	North Side Crossing Street Grand

Timo Doriod	West Side Crossing	East Side Crossing	Street	Street South Side Crossing	North Side Crossing	Street
9	Lees Ave.	Lees Ave.	Total	Robinson Ave.	N/A	Total
0200-0800	0	0	0	0	0	0
0800-0000	1	0	1	0	0	0
1600-1700	0	0	0	0	0	0
1700-1800	0	0	0	0	0	0
Totals	l l	0	1	0	0	0

Southbound

Robinson Ave. Northbound

> Lees Ave. Westbound

Lees Ave. Eastbound

Total

Total

Comments:The majority of the heavy vehicles consist of OC Transpo, intercity and school buses.

Comments:

Totals

The majority of the heavy vehicles consist of OC Transpo, intercity and school buses

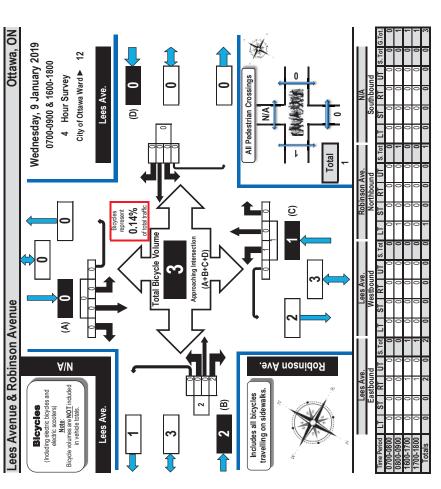
Printed on: 1/10/2019



Turning Movement Count Bicycle Summary







$\begin{tabular}{ll} \label{table} Comments: \\ \end{tabular}$ The majority of the heavy vehicles consist of OC Transpo, intercity and school buses.

Prepared by: thetrafficspecialist@gmail.com

Summary: Bicycles

Printed on: 1/10/2019

Appendix C

Synchro Intersection Worksheets – Existing Conditions

HCM 2010 TWSC 3: Robinson & Lees

Intersection Int Delay, s/veh

01-21-2019

HCM 2010 TWSC 3: Robinson & Lees

01-21-2019

	NBR		6	6	0	Stop	None				06	2 5	2		290			6.22		1 0	3.318	- 1			749						WBT				
	NBL	ž	15	15	0	Stop	٠	0	0	0	8	7 2	=	Minor1	601	290	311	6.42		5.42	- 3.518 3.318	759	743		459	759	736	8	12.1	Ф		1261	- 0.009	7.9	⋖
	WBT	*	260	260	0	Free	- None	•	0		90	-	607		ľ			•		•	1		•	•	•		ľ				EBR WBL	•		•	
	WBL	*	9		0	Free		260			8			Major2	300			- 4.12		1 0	- 2.218	1207 -			- 1261			WB	0.3		EBT		ľ		
	EBR		19		0 (Free Free Free	- None		-		•	2 2			ľ	Ċ	Ċ	Ċ	Ċ	Ċ			Ċ				Ľ	~	0		NBLn1	537	0.02	12.1	m
0.7	EBT		251	25	ر 0	Fre			ge,# 0	_	8	2 2	717	Major1														B	0 s		ımt			s)	
eh		Lane Configurations	h/h	eh/h	Conflicting Peds, #/hi		pez	₽	Veh in Median Storage, #		actor	es, %			ow All	_	5	_	Stg 1	Stg 2	wy	ot cap-1 Maneuver Stage 1	5	ked, %	Nov Cap-1 Maneuver	-	2		HCM Control Delay, s		Minor Lane/Major Mvmt	η/h)	HCM Lane V/C Ratio	HCM Control Delay (s)	SC
nt Delay, s/veh	Movement	Config	raffic Vol, veh/h	-uture Vol, veh/h	licting P	Sign Control	hanneli	Storage Length	n Media	Grade, %	Peak Hour Factor	Heavy Vehicles, %	200	Major/Minor	Conflicting Flow All	Stage 1	Stage 2	Critical Hdwy	Critical Hdwy Stg 1	Critical Hdwy Stg 2	-ollow-up Hdwy	Stage 1	Stage 2	Platoon blocked, %	Cap-1 N	Stage 1	Stage 2	Approach	Contro	HCM LOS	r Lane/I	Capacity (veh/h)	Lane V	Contro	ACM and OS
II D	Move	Lane	Traff	Fuff	Confl	Sign	RTC	Stora	Veh	Grad	Peak	Heav	2	Major	Soff			Critic	Critic	Critics i		Pot		Plato	Mo			Appro	HCM	오	Mino	Capa	오	HC.	2
		Ì													1																				
		1																																	
	NBR		27	27	0	Stop	None				06	2			254			6.22			3.3.18	- '			785						WBT				
	NBL NBR	*	30 27		0 0	Stop Stop	- None			- 0				Minor1		254 -				5.42	.,,	455 / 85 788 -			447 785		693 -	NB	12.2	B	EBR WBL WBT	1303 -		7.8	· V

36 Robinson Ave PM Peak Hour 2019 Existing

. . .

- 1303 . . .

. 4.12 . 4.12 . 2.218 . 1303

Major/Minor Mk
Conflicting Flow All
Stage 1
Stage 1
Stage 2
Critical Hokey
Critical Hokey Sig 1
Critical Hokey Sig 2
Follow-up Hokey
Stage 1
Stage 1
Stage 1
Stage 2
Platoon blocked, %
Mov Cap-1 Maneuver
Mov Cap-1 Maneuver
Stage 1
Stage 2
Stage 1
Stage 2
Stage 3
Stage 3
Stage 3
Stage 3

Major2 0 261

Major1

WB 0.5

0 🖁

Approach HCM Control Delay, s HCM LOS

NBLn1 EBT

562 0.113 12.2 B B

Minor LaneMajor Mvmt
Capadiy (vehh)
HCM Lane V/C Ratio
HCM Control Delay (s)
HCM Lane LOS
HCM Lane LOS
HCM Both %tile Q(veh)

Synchro 10 Light Report Page 2

Synchro 10 Light Report Page 1

36 Robinson Ave AM Peak Hour 2019 Existing

Appendix D

Collision Data

Record	Location	<u>x</u> <u>y</u>	<u>Date</u>	Time Environment	Road_Surface	Traffic_Control	Collision_Location	<u>Light</u>	Collision_Classification	Impact_type
1516	LEES AVE btwn TRANSIT & CHAPEL CRES (2)	369677.5711	5030962.331 2014-01-13	4:33 01 - Clear	02 - Wet	10 - No control	01 - Non intersection	07 - Dark	02 - Non-fatal injury	07 - SMV other
4324	LEES AVE @ ROBINSON AVE W	369576.2073	5031231.868 2014-02-11	17:05 01 - Clear	01 - Dry	02 - Stop sign	02 - Intersection related	05 - Dusk	03 - P.D. only	03 - Rear end
5147	CHAPEL CRES @ LEES AVE	369690.9856	5031286.259 2014-03-10	21:35 03 - Snow	03 - Loose snow	02 - Stop sign	03 - At intersection	07 - Dark	03 - P.D. only	02 - Angle
13099	ROBINSON AVE btwn HURDMAN RD & LEES AVE	369952.5339	5031230.044 2014-06-19	18:40 01 - Clear	08 - Loose sand o	r 09 - Traffic contro	II:01 - Non intersection	01 - Daylight	03 - P.D. only	99 - Other
5374	LEES AVE btwn ROBINSON AVE & CHAPEL CRES	369591.0088	5031239.678 2015-02-04	10:13 03 - Snow	03 - Loose snow	10 - No control	01 - Non intersection	01 - Daylight	03 - P.D. only	07 - SMV other
8053	LEES AVE @ ROBINSON AVE W	369576.5157	5031233.606 2015-06-04	5:01 01 - Clear	01 - Dry	02 - Stop sign	02 - Intersection related	03 - Dawn	03 - P.D. only	07 - SMV other
13525	LEES AVE btwn TRANSIT & CHAPEL CRES (1)	369821.4308	5031206.569 2015-10-21	14:02 01 - Clear	01 - Dry	10 - No control	04 - At/near private drive	01 - Daylight	03 - P.D. only	02 - Angle
8867	LEES AVE btwn TRANSIT & CHAPEL CRES (1)	369826.8772	5031111.254 2016-01-18	1:00 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	07 - Dark	03 - P.D. only	07 - SMV other
8865	LEES AVE btwn ROBINSON AVE & CHAPEL CRES	369664.8058	5031284.755 2016-02-24	12:00 03 - Snow	03 - Loose snow	10 - No control	07 - Overpass or bridge	01 - Daylight	03 - P.D. only	07 - SMV other
8869	LEES AVE btwn TRANSIT & CHAPEL CRES (2)	369719.8562	5030989.043 2016-03-20	16:09 01 - Clear	01 - Dry	10 - No control	04 - At/near private drive	01 - Daylight	03 - P.D. only	02 - Angle
8868	LEES AVE btwn TRANSIT & CHAPEL CRES (1)	369815.0954	5031221.581 2016-04-06	21:57 03 - Snow	03 - Loose snow	10 - No control	01 - Non intersection	07 - Dark	03 - P.D. only	01 - Approaching
8870	LEES AVE btwn TRANSIT & CHAPEL CRES (2)	369716.5452	5030987.834 2016-06-15	20:00 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	01 - Daylight	03 - P.D. only	05 - Turning movement
12038	ROBINSON AVE btwn LEES AVE & HURDMAN RD	369580.6869	5031222.488 2016-08-27	3:27 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	07 - Dark	03 - P.D. only	01 - Approaching
8858	LEES AVE btwn HWY417 IC118 RAMP25 & ROBINSON AVE	369522.753	5031225.477 2016-09-06	11:17 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	01 - Daylight	03 - P.D. only	04 - Sideswipe
7433	HURDMAN RD @ ROBINSON AVE	369889.6066	5031192.507 2016-11-16	21:44 01 - Clear	01 - Dry	02 - Stop sign	02 - Intersection related	07 - Dark	03 - P.D. only	07 - SMV other
8855	LEES AVE @ ROBINSON AVE W	369575.8295	5031234.787 2016-12-18	2:41 03 - Snow	04 - Slush	02 - Stop sign	02 - Intersection related	07 - Dark	03 - P.D. only	03 - Rear end
9379	LEES AVE btwn TRANSIT & CHAPEL CRES (1)	369755.934	5031278.391 2017-01-30	16:17 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	01 - Daylight	03 - P.D. only	01 - Approaching
3522	CHAPEL CRES @ LEES AVE	369691.3773	5031285.233 2017-02-24	23:11 02 - Rain	02 - Wet	02 - Stop sign	02 - Intersection related	07 - Dark	02 - Non-fatal injury	07 - SMV other
9378	LEES AVE btwn TRANSIT & CHAPEL CRES (1)	369795.1819	5031048.435 2017-09-24	16:20 01 - Clear	01 - Dry	10 - No control	01 - Non intersection	01 - Daylight	03 - P.D. only	03 - Rear end

Appendix E

Synchro Intersection Worksheets – 2020 Future Background Conditions

HCM 2010 TWSC

3: Robinson & Lees	ees						01-21-2019
Intersection							
Int Delay, síveh	1.7						
Movement	EBT	EBR	EBR WBL WBT		NBL NBR	BR	
Lane Configurations	4		F	+	>		
Traffic Vol, veh/h	226	15	24	289	38	34	
Future Vol, veh/h	226	15	24	289	38	34	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free Free Free	Free	Free	Stop Stop	itop	
RT Channelized	1	None	1	- None	1	None	
Storage Length	•	٠	260	٠	0	•	
Veh in Median Storage, #	0 #	•	•	0	0	,	
Grade, %	0	٠	٠	0	0	,	
Peak Hour Factor	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	226	15	24	588	38	34	

Major/Minor	Major1		Major2	_	Minor1		
Conflicting Flow All	0	0	241	0	571	234	
Stage 1	•	•	•	•	234		
Stage 2	٠	'	'	•	337		
Critical Hdwy	•	•	4.12	•	6.42	6.22	
Critical Hdwy Stg 1	•		'	•	5.42		
Critical Hdwy Stg 2	1	•	•	1	5.42		
Follow-up Hdwy	•		2.218	٠	3.518 3.318	3.318	
Pot Cap-1 Maneuver	•	•	1326	•	482	802	
Stage 1	'		'	٠	802		
Stage 2	1	1	1	1	723	ì	
Platoon blocked, %	٠			•			
Mov Cap-1 Maneuver		•	1326	•	473	802	
Mov Cap-2 Maneuver			•	٠	473		
Stage 1	•	•	•	•	802		
Stage 2	'		'	٠	710		
Approach	8		WB		8		
HCM Control Delay, s	0		9.0		12		
HCM LOS					ш		
Minor Lane/Major Mvmt		NBLn1	EBT	EBR	EBR WBL	WBT	
Capacity (veh/h)		282	•	•	1326		
HCM Lane V/C Ratio		0.123	•	1	0.018		
HCM Control Delay (s)	·	12	•	•	7.8		
HCM Lane LOS		ш	'	٠	⋖		
HCM 95th %tile Q(veh)	ъ	0.4		1	0.1		

36 Robinson Ave AM Peak Hour 2020 Future Background

Synchro 10 Light Report Page 1

HCM 2010 TWSC 3: Robinson & Lees

01-21-2019

ions h h h h h h h h h h h h h h h h h h h	III el secilori							
Part Part MBL MBT MBL MB	Int Delay, s/veh	0.8						
Photon P	Movement	EBT		WBL		NBL	NBR	
256 27 15 265 21	Lane Configurations	42		-	*	>		
1	Traffic Vol, veh/h	256		5	265	21	=	
Free Free Free Stop O O O O O O O O O	Future Vol, veh/h	256		5	265	21	Ξ	
Free Free Free Free Stop 100	Conflicting Peds, #/hr	0	0	0	0		0	
None	Sign Control	Free		Free	Free		Stop	
100 100	RT Channelized		None	•	None	•	None	
Hoge # 0 <td>Storage Length</td> <td></td> <td></td> <td>260</td> <td></td> <td></td> <td></td> <td></td>	Storage Length			260				
10	Veh in Median Storage,			•	0	0	•	
Majort 100 1	Grade, %	0	•	•	0	0	•	
Majort Majors Minord 0 0 283 0 565 21 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Peak Hour Factor	100		100	100	100	100	
Majort Majors Minort Majort Majors Minort 0 0 283 0 565 0 0 283 0 565 2 0 270 2 0 270 2 0 270 2 0 270 2 1278 2 1278 3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Heavy Vehides, %	2	,	7 ;	2	7 7	7	
Majori Majori Minori 0	Mvmt Flow	720		72	702	17	Ξ	
Majori M		1		5	2	3		
From the control of t		najori		najorz	2	IIIOLI		
F. C. A. 1.2	Conflicting Flow All	0	0	283	0	270	270	
r 4.12 - 6.42 2.218 - 5.42 r 1279 - 5.42 er 1279 - 486 er 1279 - 486 er 1279 - 480 er 1279 - 480 r 1279 - 480 er 1279 - 480 r 1279 - 480 r 1279 - 480 er 1279 - 480 er 1279 - 480 er 1279 - 480 er 1279 - 1279 o 0.058 0.012 eh) 0.2 7.8	Ctogo 2					205		
er 5.42 er 1279 486 er 1279 475 er 1279 480 er 1279 480 er 1279 480 er 1279 480 er 1279 480 er 1279 480 er 1279 1776 er 1279 1279 o 0.058 0.012 (s) 11.9 7.78 eth) 0.2 7.8	Critical Hdwy			4 12		6 42	622	
r - 2218 - 3518 r - 3518 r - 5175 r - 2218 r - 3518 r - 3	Critical Hdwy Sta 1	ľ		'		5.42	'	
r - 2.218 - 3.518 r - 1779 - 486 er - 1779 - 486 er - 1779 - 480 er - 1779 - 480 er - 1779 - 480 er - 1775 - 480 er - 1775 - 1775 er - 1777 er - 1	Critical Hdwy Stg 2		•		•	5.42	1	
Fr - 1279 - 486 76 er - 1279 - 480 76 er - 1279 - 480 76 er - 1279 - 480 76 FR - 1279 - 480 76 FR - 1279 - 140 76 FR WB	Follow-up Hdwy			2.218		3.518	3.318	
er 755 er 1279 - 480 76 er 1279 - 480 76 er 1279 - 480 76 er 1279 - 746 er 1279 - 746 er 1279 er	Pot Cap-1 Maneuver		1	1279	٠	486	269	
Er 755 er 1279 480 76 er 775 EB WB NB s 0 0.4 11.9 What NBLn1 EBT EBR WBL WB 551 1279 0 0.058 0.012 (s) 11.9 78 eh) 0.2 0	Stage 1			•	'	775	•	
er 1279 - 480 76 er 1279 - 480 76 775 775 173 EB WB NB	Stage 2		•	1	•	755	1	
Maneuver - 1279 - 480 76 2 Maneuver - 1775 - 480 ge 1 - 1775 ge 2 - 1775 ge 2 - 1775 ge 2 - 1775 ge 2 - 1776 ge 3 - 1776 ge 4 - 11.9 ge 1 - 1279 wel/h) 551 - 1279 wel/h) 551 - 1279 wel/h) 551 - 1279 wel/h) 651	Platoon blocked, %	•			•			
2 Maneuver 480 291 775 392 746 392 746 392 746 393 - 746 394 - 746 395 - 746 395 - 746 395 - 746 395 - 746 395 - 746 395 - 746 395 - 7479 395 - 7479 395 - 7479 395 - 7479 395 - 748 395 -	Mov Cap-1 Maneuver		•	1279	•	480	269	
99 1 775 99 2 746 99 2 746 99 2 746 90 0.4 11.9 90 0.4 11.9 90 0.4 11.9 90 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Mov Cap-2 Maneuver				٠	480	•	
EB WB NB NB NB NB NB NB N	Stage 1	1	1	1	1	775	1	
rol Delay, s 0 0.4 11.9 B e/Major Mvmt NBLn1 EBT EBR WBL WB veh/n) 551 - 1279 voh/n) 551 - 1279 rol Delay (s) 11.9 - 7.8 B %tilc Q(veh) 0.2 - 0	Stage 2	'		1	•	746	'	
EB WB NB NB								
0 0.4 11.9 B NBLN1 EBT EBR WBL WB 551 - 1279 0.058 - 0.012 11.9 - 7.8 B - 0.02	Approach	EB		WB		NB		
B NBLn1 EBT EBR WBL WB 551 - 1279 0.058 - 0.012 11.9 - 7.8 B - 0.2 - 0	HCM Control Delay, s	0		0.4		11.9		
NBLn1 EBT EBR WBL WB 551 - 1279 0.058 - 0.012 11.9 - 7.8 B - 0.2 0.02 0.02 0.02 0.00 0.00 0.00 0.0	HCM LOS					В		
NBLn1 EBT EBR WBL WB 561 - 1279 0.058 - 0.012 11.9 - 7.8 B - 7.8 B - 0.2 - 0.02								
551 - 1279 0.058 - 0.012 11.9 - 7.8 B - A 0.2 - 0	Minor Lane/Major Mvmt		NBLn1	EBT	EBR	WBL	WBT	
0.058 - 0.012 11.9 - 7.8 B - A 0.2 - 0	Capacity (veh/h)		551	•	•	1279	1	
11.9 - 7.8 B - A 0.2 - 0	HCM Lane V/C Ratio		0.058	•	i	0.012	•	
B A 0.2 - 0	HCM Control Delay (s)		11.9	•	•	7.8	1	
0.2	HCM Lane LOS		ш	١	1	⋖	•	
	HCM 95th %tile Q(veh)		0.2		•	0	1	

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Appendix F

Synchro Intersection Worksheets – 2025 Future Background Conditions

HCM 2010 TWSC 3: Robinson & Lees

Intersection							
Int Delay, s/veh	1.6						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	æ		۴	*	>		
	250	15	24	319	38	34	
	250	15	24	319	38	34	
Conflicting Peds, #/hr	0	0	0	0	0	0	
	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None		None	٠	None	
Storage Length	٠	٠	260		0		
Veh in Median Storage, #		٠	٠	0	0		
Grade, %	0	٠	٠	0	0		
Peak Hour Factor	100	100	100	100	100	100	
Heavy Vehicles, %	7	7	7	7	7	2	
Mvmt Flow	250	15	24	319	38	34	
Major/Minor Ma	Major1	Σ	Major2	2	Minor1		
Conflicting Flow All	0	0	265	0	625	258	
Stage 1	٠	1	1	٠	258		
Stage 2		٠	٠	٠	367		
Critical Hdwy	٠	1	4.12	•	6.42	6.22	
Critical Hdwy Stg 1		٠	٠	٠	5.42		
Critical Hdwy Stg 2	٠	٠	1	1			
Follow-up Hdwy	٠	,	2.218	,		3.318	
Pot Cap-1 Maneuver	٠	٠	1299	•	449	781	
Stage 1	٠	٠	٠	٠	785		
Stage 2		٠	•	•	2		
Platoon blocked, %	٠	٠		٠			
Mov Cap-1 Maneuver	٠	٠	1299	•	4	781	
Mov Cap-2 Maneuver	٠	٠	•	٠	4		
Stage 1	٠	•	•	•	785		
Stage 2	٠	٠	٠	٠	889		
Approach	EB		WB		RB		
HCM Control Delay, s	0		0.5		12.5		
HCM LOS					ш		
Minor Lane/Major Mvmt	Z	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)		222	٠	٠	1299		
HCM Lane V/C Ratio		0.13	٠	•	0.018		
HCM Control Delay (s)		12.5	1	•	7.8		
HCM Lane LOS		<u> </u>	٠	٠	⋖ ;		
HCM 95th %tile Q(veh)		0.4	•	•	0.1		

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HCM 2010 TWSC 3: Robinson & Lees

01-21-2019

01-21-2019

Columbia	Intersection							
Feb BBR WBL WBT NBL SB3 21 15 293 21 15 293 21 15 293 21 15 293 21 15 293 21 15 293 21 15 293 21 15 293 21 20 20 20 20 20 20 20	Int Delay, s/veh	0.8						
S				WBL	WBT	NBL	NBR	
283 27 15 293 21 hr 0 0 0 0 age,# 0 - 260 - 0 age,# 0 - 260 - 0 2 2 2 2 2 283 27 15 293 21 hr 100 100 100 100 100 2 2 2 2 2 283 27 15 293 21 hr 200 100 100 100 100 0 0 10 100 100 100 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Lane Configurations	43		*	*	Þ		
Free Free Free S 21 Free Free Free S 00 O 0 O	Traffic Vol, veh/h	283	27	15	293	21	=	
Hrre Free Free Free Stope Stop	Future Vol, veh/h	283	27	15	293	51	Ξ	
Free Free Free Free Stop - 1	eds, #/hr		0	0	0		0	
age,# 0 - None - None - Oge,# 0 - 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			Free	Free	Free		Stop	
age, # 0 260 - 0 0 100 100 100 100 100 100 100 100	RT Channelized	-	None		None	•	None	
age,# 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Storage Length		•	260	,	0	•	
100 100	Veh in Median Storage, #		•	,	0	0		
Majort 100 100 100 100 100 100 100 100 100 10	Grade, %	0	٠	٠	0	0	٠	
Majort Majorz Minord 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 310 0 620 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Peak Hour Factor	100	100	100	100	100	100	
Majort Majorz Minord O	Heavy Vehides, %	5	7	5	7	5	5	
Majort Major2 Mirrort 0 0 310 0 650 0 0 310 0 630 0 0 310 0 630 0 0 310 0 630 0 0 310 0 630 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Mvmt Flow	283	27	15	293	7	=	
Major1 Major2 Minor1 0 0 310 0 620 0 520 0 620 0 210 0 620 0 210 0 620 0 210 0 620 0 210 0 620 0 210 0 620 0 210 0 620 0 218 0 642 0 218 0 642 0 218 0 642 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0								
er 1250 - 477 - 7297 -		ajor1	2	lajor2	Σ	inor1		
297 4.12 - 6.42 2.218 - 5.42 2.218 - 5.42 1250 - 452 1250 - 452 1250 - 473 1250 - 447 1250 - 447 1250 - 447 1250 - 447 1250 - 124 1250 - 124 1250 - 124 1250 - 124 1250 - 1250 - 124 1250 - 1250 - 1250 12	Conflicting Flow All	0	0	310	0	620	297	
- 4.12 - 6.42 2.218 - 5.42 2.218 - 3.518 1250 - 452 1250 - 452 1250 - 447 1250 - 447 1250 - 447 1250 - 447 1250 - 447 1250 - 417 -	Stage 1			•	•	297	•	
- 4.12 - 6.42 - 5.42 - 2.218 - 3.518 - 1250 - 452 - 1250 - 447 - 1250 - 447 - 1250 - 447 - 1250 - 447 - 734 - 735 - 73	Stage 2	٠		٠	٠	323	٠	
- 2218 - 5.42 - 2218 - 5.42 - 1250 - 452 - 1250 - 452 - 1250 - 447 - 1250 - 447 - 1250 - 447 - 1250 - 447 - 734 - 734 - 735 - 736 - 736	Critical Hdwy			4.12	1	6.42	6.22	
	Critical Hdwy Stg 1	٠	٠			5.42		
- 2218 - 3518 - 3518 - 1250 - 452 - 754 - 754 - 754 - 754 - 754 - 755 -	Critical Hdwy Stg 2	٠	•	1	1	5.45	1	
EB WB NB	Follow-up Hdwy	٠		2.218		3.518	3.318	
EB WB NB	Pot Cap-1 Maneuver	•	٠	1250	•	452	742	
EB WB NB NB B B NB NB NB NB NB NB NB NB NB N	Stage 1			•	•	754		
EB WB NB	Stage 2		٠	٠	•	734	•	
- 1250 - 447 74 1250 - 447 74 447 754 725 725 0 0.4 124 B B tt NBLr1 EBT EBR WBL WB 518 - 1250 0.062 - 0.012 12.4 - 7.54 B B	Platoon blocked, %				,			
EB WB NB	Mov Cap-1 Maneuver	•	•	1250	•	447	742	
EB WB NB NB CONTROL TO TEST OF THE NB	Mov Cap-2 Maneuver	٠	٠	٠	٠	447	٠	
EB WB NB NB ON NB	Stage 1		٠	•	1	754	•	
EB WB NB NB O 0.4 12.4 B B B NB WB WB WB NB	Stage 2	٠	٠	٠	٠	725	٠	
EB WB NB 0 0.4 12.4 B B II NBLn1 EBT EBR WBL WB 518 - 1250 0.062 - 0.012 12.4 - 7.9								
0 0.4 12.4 B B B WBL WB S18 - 1250 0.062 - 0.012 12.4 - 7.9 B B B B B WBL WB WBL WB S18 - 12.50 0.012 12.4 - 7.9 B B - A A A A A A A A A A A A A A A A A	Approach	8		WB		R		
NBLn1	HCM Control Delay, s	0		0.4		12.4		
14 NBL/1 EBT EBR WBL WB 518 - 1250 0.062 - 0.012 12.4 - 7.9	HCM LOS					Ф		
tt NBLn1 EBT EBR WBL WB 518 - 1250 0.062 - 0.012 12.4 - 7.9								
518 - 1250 0.062 - 0.012 12.4 - 7.9 B - A	Minor Lane/Major Mvmt	Z	BLn1	EBT		WBL	WBT	
0.062 - 0.012 12.4 - 7.9 B - A	Capacity (veh/h)		518	•	٠	1250	•	
12.4 - 7.9 B - A	HCM Lane V/C Ratio	0	0.062	٠		0.012	٠	
B A	HCM Control Delay (s)		12.4	•	•	7.9	•	
	HCM Lane LOS		ш	٠	٠	⋖	٠	
0.2	HCM 95th %tile Q(veh)		0.2	•	٠	0	1	

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Appendix G

MMLOS Analysis

Multi-Modal Level of Service - Segments Form

Consultant	CGH Transportation	Proiect	TC United Robinson Sites
	Existing/Future	Date	13-Dec-18
Comments	-		

SEGMENT	·e		Section	Section	Section	Section	Section	Section	Section	Section	Section
SEGMENT			Robinson	Lees	3	4	5	6	7	8	9
	Sidewalk Width Boulevard Width		1.5 m < 0.5 m	≥ 2 m < 0.5							
	Avg Daily Curb Lane Traffic Volume		≤ 3000	≤ 3000							
Pedestrian	Operating Speed On-Street Parking		> 30 to 50 km/h yes	> 50 to 60 km/h no							
est	Exposure to Traffic PLoS	-	E	С	-	-	-	-	-	-	-
ba	Effective Sidewalk Width										
<u> </u>	Pedestrian Volume										
	Crowding PLoS		-	-	•	-	-	-	-	-	-
	Level of Service		-	-	-	-	-	-	-	-	-
	Type of Cycling Facility		Mixed Traffic	Mixed Traffic							
	Number of Travel Lanes		≤ 2 (no centreline)	≤ 2 (no centreline)							
	Operating Speed		≤ 40 km/h	≥ 50 to 60 km/h							
	# of Lanes & Operating Speed LoS		Α	D	-	-	-	-	-	-	-
Bicycle	Bike Lane (+ Parking Lane) Width										
خ	Bike Lane Width LoS	D	-	-	-	-	-	-	-	-	-
Ö	Bike Lane Blockages Blockage LoS			_		-	_	-		-	_
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge	< 1.8 m refuge	= 1	-	-	-	-	-	-
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes	≤ 3 lanes							
	Sidestreet Operating Speed		≤ 40 km/h	>40 to 50 km/h							
	Unsignalized Crossing - Lowest LoS		Α	Α	-	-	-	-	-	-	-
	Level of Service		Α	D	-	-	-	-	-	-	-
#	Facility Type			Mixed Traffic							
Transit	Friction or Ratio Transit:Posted Speed	D		Vt/Vp ≥ 0.8							
F	Level of Service		-	D	-	-	-	-	-	-	
	Truck Lane Width		> 3.7 m	> 3.7 m							
支	Travel Lanes per Direction	В	1	1							
Truck	Level of Service	В	В	В	-	-	-	-	-	-	-
Auto	Level of Service				No	ot Applicat	ole				

Appendix H

Synchro Intersection Worksheets – 2020 Future Total Conditions

HCM 2010 TWSC 3: Robinson & Lees

3: Robinson & Lees 02-12-2019

Intersection							
Int Delay, s/veh	2.1						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	÷		-	*	>		
Traffic Vol, veh/h	226	17	78	289	48	44	
Future Vol, veh/h	226	17	28	289	48	44	
Conflicting Peds, #/hr	0	0	0	0	0	0	
	Free	Free	Free	Free	Stop	Stop	
RT Channelized	٠	None	•	None	•	None	
Storage Length		٠	260	٠	0		
Veh in Median Storage, #		1	1	0	0		
Grade, %	0	•	•	0	0		
Peak Hour Factor	100	100	100	100	100	100	
Heavy Vehicles, %	5	2	2	2	2	2	
Mvmt Flow	226	17	28	289	48	44	
Major/Minor Ma	Major1	2	Major2	2	Minor1		
Conflicting Flow All	0	0	243	0	280	235	
Stage 1	•	1	1	1	235		
Stage 2	٠				345		
Critical Hdwy	•	1	4.12	1	6.42	6.22	
Critical Hdwy Stg 1	٠	'	•	١	5.42	•	
Critical Hdwy Stg 2	•	•	•	1			
Follow-up Hdwy	٠	•	2.218	•		3.318	
Pot Cap-1 Maneuver	•	•	1323	1	477	804	
Stage 1	٠	٠	•	٠	804		
Stage 2	•	•	•	•	717		
Platoon blocked, %	٠	1		•			
Mov Cap-1 Maneuver	٠	1	1323	1	467	804	
Mov Cap-2 Maneuver	٠	1	1	١	467		
Stage 1	٠	•	1	1	804		
Stage 2	٠	'	'	•	702		
Approach	B		WB		NB		
HCM Control Delay, s	0		0.7		12.3		
HCM LOS					ш		
Minor Lane/Major Mvmt	Z	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)		284	1	1	1323		
HCM Lane V/C Ratio		0.158	•	٠	0.021		
HCM Control Delay (s)		12.3		•	7.8		
HCM Lane LOS		Ф	•	٠	⋖		
HCM 95th %tile Q(veh)		9.0	•	1	0.1		

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HCM 2010 TWSC 3: Robinson & Lees

02-12-2019

		L NBR					p Stop	- None	- 0	- 0	0 100	2 2 88 11		2 275	2 -		2 6.22	2 -	- 2	က	5 764				7 764	- 2			8	3	а	H				<
		WBT NBL	*		``		Free Stop	None	•	0	100 100	2 2	Minor1	0 582	- 275	- 307	- 6.42	- 5.42	- 5.42	- 3.518	- 475	- 771	- 746		- 467	- 467	- 771	- 733	NB	12.3		IRW WRI		- 0.017	- 7.9	
		WBL	F	21			Free	1	260	٠	100	2 5	Major2	294	٠	٠	4.12	٠	•	- 2.218	1268	•	•		1268	٠	•	٠	WB	9.0		FR				
	_	T EBR	2				e Free	- None		- 0	0 100	2 2 2 2 2 2		0 0					1			'	1				1		В	0		NBI Pu	537	0.078	12.3	0
Intersection	Int Delay, s/veh 1.1	Movement EBT	Lane Configurations 1		7	eds, #/hr	Sign Control Free	RT Channelized	Storage Length	storage, #	Peak Hour Factor 100	Heavy Vehicles, % 256	Major/Minor Major1	Conflicting Flow All	Stage 1	Stage 2	Critical Hdwy	Critical Hdwy Stg 1	Critical Hdwy Stg 2	Follow-up Hdwy	Pot Cap-1 Maneuver	Stage 1	Stage 2	Platoon blocked, %	Mov Cap-1 Maneuver	neuver	Stage 1	Stage 2	Approach	HCM Control Delay, s	HCM LOS	Minor Lane/Major Mymt	Canacity (veh/h)	HCM I ane V/C Ratio	HCM Control Delay (s)	

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Appendix I

Synchro Intersection Worksheets – 2025 Future Total Conditions

HCM 2010 TWSC 3: Robinson & Lees

3: Robinson & Lees

Intersection							
Int Delay, s/veh	7						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	æ		je-	*	>		
Traffic Vol, veh/h	250	11	28	319	48	44	
Future Vol, veh/h	220	11	78	319	48	44	
eds, #/hr		0	0			0	
	Free	Free	Free	Free	Stop	Stop	
RT Channelized	٠	None		None		None	
Storage Length	٠	٠	260	٠	0		
Storage,	0 #	٠	٠	0	0		
Grade, %	0	٠		0	0		
Peak Hour Factor	100	100	100	100	100	00	
Heavy Vehicles, %	2	7 !	2 5	7	7	. 2	
Mvmt Flow	250	14	28	319	48	#	
Major/Minor Ma	Major1	Σ	Major2	Σ	Minor1		
Conflicting Flow All	0	0	267	0	634	259	
Stage 1	1	•		•	259		
Stage 2	٠	٠	٠	١	375		
Critical Hdwy	1	1	4.12	•	6.42	6.22	
Critical Hdwy Stg 1	٠	٠	•	,	5.42		
Critical Hdwy Stg 2	٠	٠	٠	١			
Follow-up Hdwy	٠	,	2.218	1		3.318	
Pot Cap-1 Maneuver	٠	•	1297	•	443	780	
Stage 1	٠	٠	٠	٠	784		
Stage 2	٠	•	•	i.	695		
Platoon blocked, %	٠	٠		٠			
Mov Cap-1 Maneuver	٠	٠	1297	٠	433	780	
Mov Cap-2 Maneuver	٠	٠	٠	٠	433		
Stage 1	٠	•	•	i.	784		
Stage 2	٠	٠	٠	٠	089		
Approach	EB		WB		NB		
HCM Control Delay, s	0		9.0		12.9		
HCM LOS					ш		
Minor Lane/Major Mvmt	Z	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)		220	٠	٠	1297		
HCM Lane V/C Ratio		0.167	٠	•	0.022		
HCM Control Delay (s)		12.9	•	•	7.8		
HCM Lane LOS		മ	٠	٠	⋖ ;		
HCM 95th %tile Q(veh)		9.0		•	0.1		

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HCM 2010 TWSC 3: Robinson & Lees

02-12-2019

02-12-2019

Int Delay, s/veh	-						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	\$		F	+	À		
Traffic Vol, veh/h	283		71	293	78	4	
Future Vol, veh/h	283	38	51	293	28	14	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free		Free	Free	Stop	Stop	
RT Channelized	1	None	1	None	1	None	
Storage Length	•	'	260	•	0	•	
Veh in Median Storage, #	0#	٠	1	0	0	1	
Grade, %	0		•	0	0	٠	
Peak Hour Factor	100	9	9	100	9	100	
Heavy Vehicles, %	2	2	7	2	7	2	
Mvmt Flow	283	38	21	293	78	4	
Major/Minor M	Major1	2	Major2	2	Minor1		
Conflicting Flow All	0	0	321	0	637	302	
Stage 1	1	1	1	1	302	1	
Stage 2	•	'	•	١	335	٠	
Critical Hdwy	•	1	4.12	1	6.42	6.22	
Critical Hdwy Stg 1	•	•	٠	٠	5.45	٠	
Critical Hdwy Stg 2	•	•	•	1	5.45	•	
Follow-up Hdwy	•	•	2.218	•	3.518 3.318	3.318	
Pot Cap-1 Maneuver	1	1	1239	1	441	738	
Stage 1	•	٠	٠	٠	720	٠	
Stage 2	1	٠	•	•	725	•	
Platoon blocked, %	•	,		1			
Mov Cap-1 Maneuver	1	•	1239	•	434	738	
Mov Cap-2 Maneuver	•	٠	٠	٠	434	٠	
Stage 1	•	•	1	1	750	1	
Stage 2	•	•	•	•	713	•	
Approach	B		WB		R		
HCM Control Delay, s	0		0.5		12.8		
HCM LOS					ш		
Minor Lane/Major Mvmt		NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)		503	'	٠	1239	•	
HCM Lane V/C Ratio		0.083		٠	0.017	٠	
HCM Control Delay (s)		12.8	•	•	∞	٠	
HCM Lane LOS		В			⋖		
HCM 95th %tile Q(veh)		0.3	•	1	0.1	•	

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