

**4129 Hixon Street
Transportation Study**

**Hixon Development Ltd.
Town of Lincoln, ON**

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Town of Lincoln, ON**

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Executive Summary

R.J. Burnside & Associates Limited (Burnside) was retained by Hixon Development Ltd. (the Client) to undertake a Transportation Study as part of Draft Plan of Subdivision, Zoning By-law Amendment and Vacant Land Condominium applications. The development proposes a mix of single-family homes, semi-detached homes, street townhomes and a multi-unit residential building at 4129 Hixon Street in the Beamsville community, Town of Lincoln. The property is currently partially occupied by a church that will remain.

The following is a summary of our key findings:

- Under existing and future conditions, all movements at study intersections are operating and will operate with excess capacity and a level of service D or better with the following exception.
 - Under background conditions, the eastbound movement at Mountain Street / King Street / Central Avenue intersection during the weekday PM peak hour will approach capacity. As this is a background issue, the Region should monitor this movement for improvements. By increasing the cycle length, it will reduce the volume to capacity ratio.
- The existing and projected queue lengths are and will be within their existing storage and link distances with the exception of the eastbound queue at Mountain Street / King Street / Central Avenue intersection during the weekday PM peak hour. As the queue will be metered by the upstream intersection, no improvements will be required and / or will be triggered by the proposed development.
- The proposed neighbourhood is well designed to accommodate all modes of travel.
- The proposed right-of-ways for all local roads and the widths of laneways are proposed to be reduced in comparison to the Town's Municipal Design and Quality Standards. The proposed reduced widths in combination with other traffic calming measures such as raised intersections and on-street layby parking will assist in slowing traffic through the neighbourhood and creating a more pedestrian friendly environment. A swept path analysis confirms that the proposed geometrics can accommodate all expected design vehicles.

In addition, there are various transportation demand management (TDM) measures that either exist and / or are planned that will discourage vehicle use and dependency such as:

- Internal sidewalk connections to existing sidewalks on Bush Crescent and Ashby Drive as well as future sidewalks on Edwards Street.
- Internal sidewalks are provided on both sides of all local streets.
- Internal secured bicycle storage is available at each residence either within a private garage, an accessory building, private yard, or dedicated storage facility in the case of multi-unit apartments.

- An information package on available transit/walking/cycling facilities will be provided to residents.

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Abbreviations

The following are abbreviations utilized within this report:

- Burnside – R.J. Burnside & Associates Limited
- Directions
 - EB – Eastbound
 - SB – Southbound
 - NB – Northbound
 - WB – Westbound
- ITE – Institute of Transportation Engineers
- LOS – Level of service
- PHF – Peak hour factor
- Region – Niagara Region
- Town – Town of Lincoln
- Traffic Movements
 - LT – shared left-through movement
 - LTR – shared left-through-right movement
 - LR – shared left-right movement
 - TR – shared through-right movement
- TDM – Transportation demand management
- v/c – Volume to capacity ratio

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1.0 Introduction

1.1 Background

Hixon Development Ltd. (the Client) is proposing to develop a mix of single-family homes, semi-detached homes, street townhomes and a multi-unit residential building at 4129 Hixon Street in the Beamsville community of the Town of Lincoln. The property is currently occupied by a church, which will remain. Access will be provided via an extension of Edward Street to Bush Crescent, a local street (Street A) connection to the extended Edward Street and a local street (Hope Street) connection to Ashby Drive. A series of privately owned rear laneways are also proposed to improve the streetscape, urban design, and walkability of the neighborhood. Through the consolidation of numerous driveways off a rear lane, fewer conflict points exist along the traveled street between those walking, cycling, and driving vehicles. Additional lay-by street parking and uninterrupted landscaped boulevards will improve mobility, safety, comfort and assist in traffic calming goals. The proposed development location is shown in Figure 1.

Draft Plan of Subdivision, Zoning By-law Amendment and Vacant Land Condominium applications are required, and R.J. Burnside & Associates Limited (Burnside) was retained to undertake a Transportation Study as part of those applications.

Figure 1: Site Location



1.2 Scope of Work

The following scope of work was discussed and confirmed with staff from Niagara Region (the Region) and Town of Lincoln (the Town).

Analysis Scenarios	- Existing traffic conditions 2030 background and total traffic conditions
Analysis Time Periods	- Weekday AM peak hour (7:00 AM to 9:00 AM) - Weekday PM peak hour (4:00 PM to 6:00 PM)
Analysis Intersection (Study Area)	- Mountain Street (Regional Road 18) / King Street (Regional Road 81) / Central Avenue - Mountain Street (Regional Road 18) / Hillside Drive / Highland Park Drive - Hixon Street / King Street (Regional Road 81) - Ashby Drive / Hillside Drive - Ashby Drive / Proposed Street (Hope Street)
Signal Warrant Analysis	Mountain Street / Hillside Drive / Highland Park Drive
Draft Plan Review	- Street network geometrics - Intersection control - Active transportation accommodation

1.3 Intersection Analysis Methodology

Signalized and stop controlled intersection operations were assessed for intersections in the study area using the software program Synchro 11, which employs methodology from the *Highway Capacity Manual* (HCM 2000, HCM 2010 and HCM 6), published by the Transportation Research Board National Research Council.

Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network taking into account the spacing, interaction, queues and operations between intersections. The analysis utilizes the HCM 2000 methodology for all intersections. The signalized and stop controlled intersection analysis methodology is provided in Appendix A.

2.0 Existing Conditions

2.1 Site Context

The community of Beamsville consists of approximately 13,323 people (Statistics Canada, 2021). The majority of the retail and restaurant businesses in Beamsville are

along King Street (Region Road 81), which is the main east-west road in the community. The overall development site is approximately 4.05 ha. The development is located east of existing homes on Hixon Street, west of the existing homes on Ashby Drive, south of the Edward Street terminus and north of the Bush Crescent terminus. The subject site is occupied by a church in the northerly limits and the remaining property is vacant.

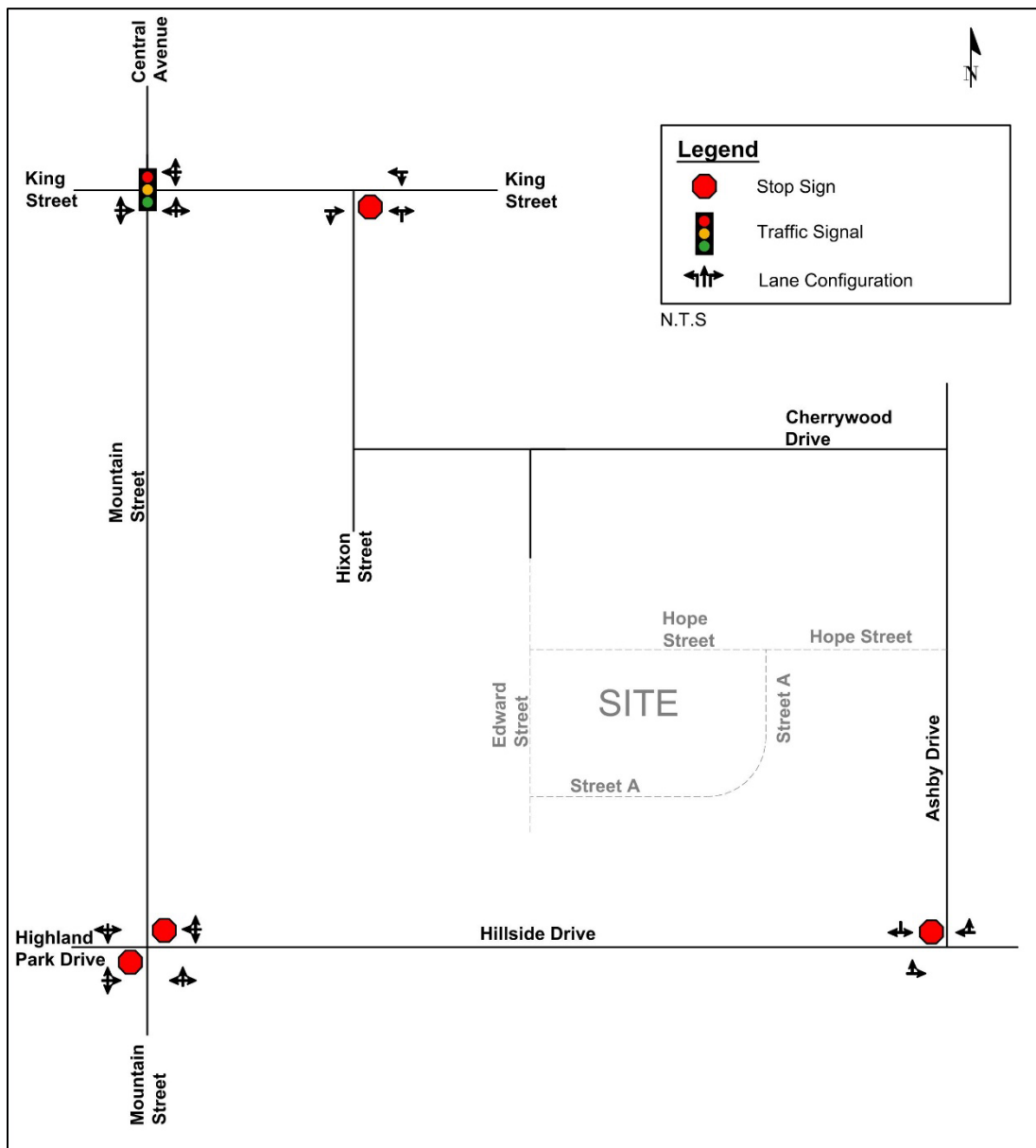
2.2 Existing Road Network

The existing road network is described below and is illustrated in Figure 2, including existing traffic control. All streets are under the Town's jurisdiction, except where noted.

King Street (Regional Road 81)	King Street is an east-west arterial road under the Region's jurisdiction. The roadway has a 2-lane urban cross-section in the study area and a posted speed limit of 50 km/h. Sidewalks are provided on both sides of the roadway. Between Ontario Street and Academy Street, on-street parking is limited to one hour from 9:00 AM to 6:00 PM, Saturday to Thursday and from 9:00 AM to 9:00 PM on Fridays, on both sides of the roadway.
Mountain Street (Regional Road 18) / Central Avenue	Mountain Street (Regional 18) is a north-south arterial road south of King Street under the Region's jurisdiction. The roadway consists of a 2-lane urban cross section and a posted speed limit of 50 km/h, except for between Douglas Street and just north of George Street, where the speed limit is reduced to 40 km/h due to an elementary school. Sidewalks are provided on both sides of the roadway, except for the west side where there is no sidewalk south of Cassandra Drive. Bicycle lanes are provided on both sides of the road south of Hillside Drive / Highland Park Drive. North of King Street, the roadway is called Central Avenue and it is local street under the Town's jurisdiction. Central Avenue is a one-way street (northbound only) between King Street and North Lane. The roadway has a 2-lane cross section and a posted speed limit of 40 km/h. Sidewalks are provided on both sides of the street, except for the east side south of North Lane.
Hixon Street	Hixon Street is a north-south 2-lane urban local road and has an assumed unposted speed limit of 50 km/h. A sidewalk is provided on the west side of the roadway from King Street to Ann Street and from George Street to Barry

	Drive. A sidewalk is provided on the east side of Hixon Street from Ann Street to George Street. Parking is prohibited on both sides of the roadway, north of Ann Street and parking is prohibited on the west side south of Ann Street.
Hillside Drive / Highland Park Drive	East of Mountain Street, the roadway is Hillside Drive and to the west, it is Highland Park Drive. Hillside Drive / Highland Park Drive is an east-west local road and has a 2-lane urban cross section and a posted speed limit of 50 km/h. Sidewalks are provided on the south side west of Hixon Street and on the north side east of Hixon Street. Parking is prohibited on the south side of the street.
Ashby Drive	Ashby Drive is a north-south local road and consists of a 2-lane urban cross section and a posted speed limit of 40 km/h. A sidewalk is provided on the east side of the roadway.
Edward Street	Edward Street is a north-south local road and terminates 105 m south of Cherrywood Drive. The roadway consists of a 2-lane rural cross-section and has an assumed unposted speed limit of 50 km/h. Parking is prohibited on the east side.
Bush Crescent	Bush Crescent is a local road that forms a crescent with a north leg that terminates 45 m north of Kennedy Street and an east leg that terminates at Ashby Drive. The roadway consists of a 2-lane urban cross section and has an assumed unposted speed limit of 50 km/h. Sidewalks are provided on the north and east side and parking is prohibited on the north and east side.

Figure 2: Existing Road Network



2.3 Existing Transit Services

Niagara Region Transit OnDemand provides year-round, Monday to Saturday, 7:00 AM to 10:00 PM services within the Town. This is a rideshare service where residents can book a ride via a mobile application and / or by calling a service number. There is no fixed route. Trip requests are real-time. The service will take riders within the Town for a fixed fee and across West Niagara and to designated transit hubs in St. Catharines, Welland and Port Colborne.

2.4 Existing Traffic Volumes

Existing traffic counts at the intersections identified in Section 1.2 were undertaken for the weekday morning (7:00 AM to 9:00 AM) and afternoon (4:00 PM to 6:00 PM) peak periods. Traffic counts were conducted by Accu-Traffic Inc. on behalf of Burnside on Tuesday, September 14, 2021, with the exception of the Mountain Street / King Street intersection. The turning movement counts for this intersection were obtained from the Region and are dated Thursday, April 18, 2019. The weekday AM and PM peak hours were selected as these are typical peak traffic periods for this particular type of development.

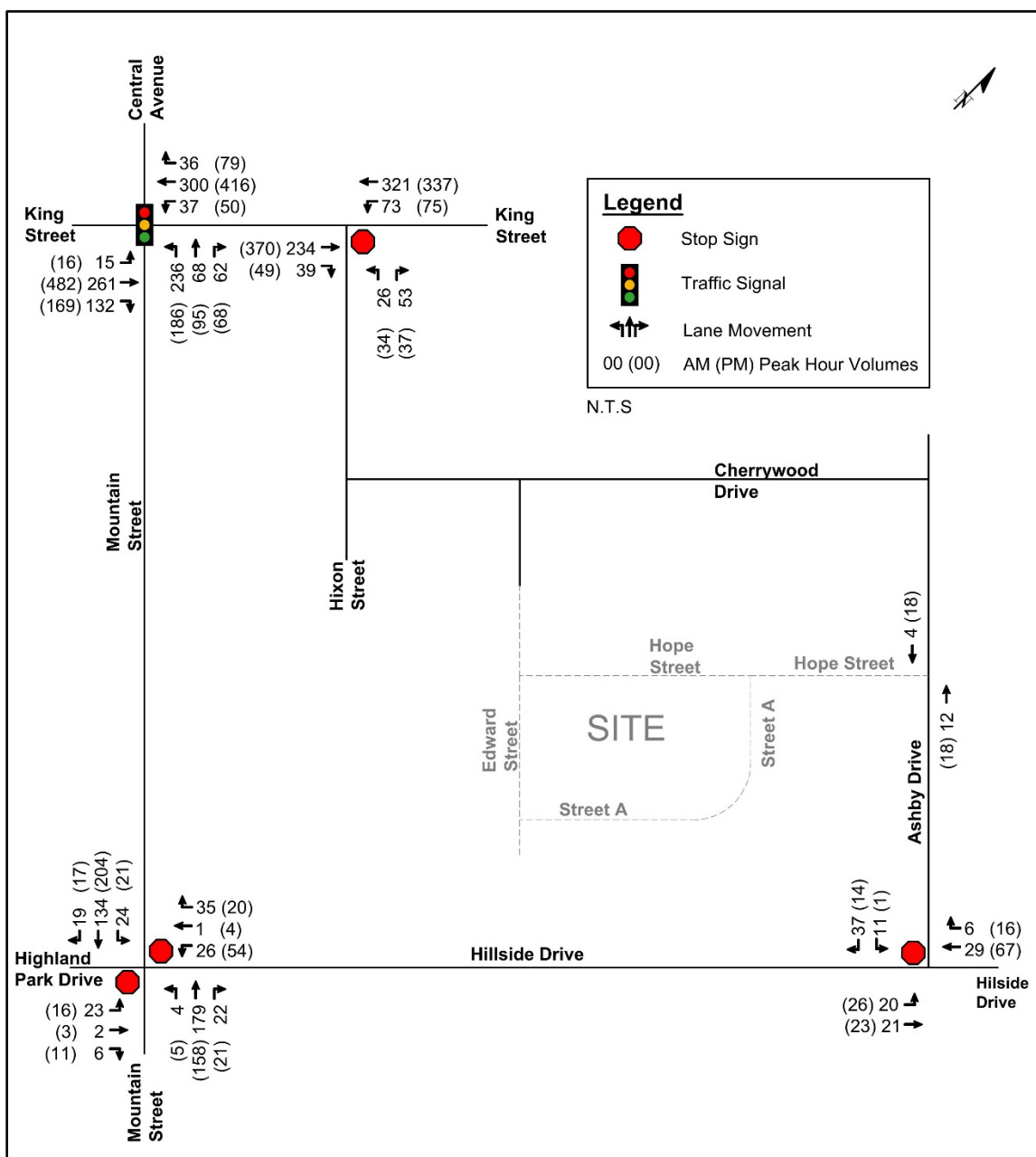
The majority of COVID-19 restrictions were lifted when the counts were conducted. However, to be conservative, the possible impacts of COVID were reviewed by developing an adjustment factor based on the difference between the Region's average annual daily traffic (AADT) for 2017 and 2020. Table 1 summarizes the AADT for Mountain Street and King Street within the study area and the resulting adjustment factor.

Table 1: AADT Summary

Road	Segment	AADT		Adjustment Factor
		2017	2020	
Mountain Street	King Street and Fly Road	5,700	6,300	0.90
King Street	Mountain Street and Merritt Road	7,100	6,400	1.11

To be conservative, an adjustment factor of 1.11 was applied to the King Street / Hixon Street intersection. The adjustments factor of 0.9 was not applied to the other intersections to be conservative. In addition, as requested by the Region, a 2% compound annual growth rate was assumed and applied to all movements to bring traffic volumes to existing conditions (year 2023). The adjusted existing 2023 traffic volumes are illustrated in Figure 3. All historical counts are provided in Appendix B.

Figure 3: Existing 2023 Traffic Volumes



Traffic operations were observed in the field on Wednesday, March 9, 2022, during the afternoon peak period. Most intersections appeared to operate adequately, with the exception of the King Street / Mountain Street intersection. The eastbound queue was observed to extend upstream to Ontario Street. Drivers travelling eastbound and westbound (all movements) would utilize the majority of the yellow phase and occasionally a portion of all red phase.

3.0 Future Background Conditions

Future background traffic consists of existing traffic, background traffic growth and traffic from other developments. Background traffic growth and traffic from other developments are discussed below. Future road network and transit improvements within the study horizon year are also discussed. The horizon year of 2030 was selected for future projections, assuming buildout by 2025.

3.1 Future Road Network

Under background conditions, there are no planned road network improvements within the study area.

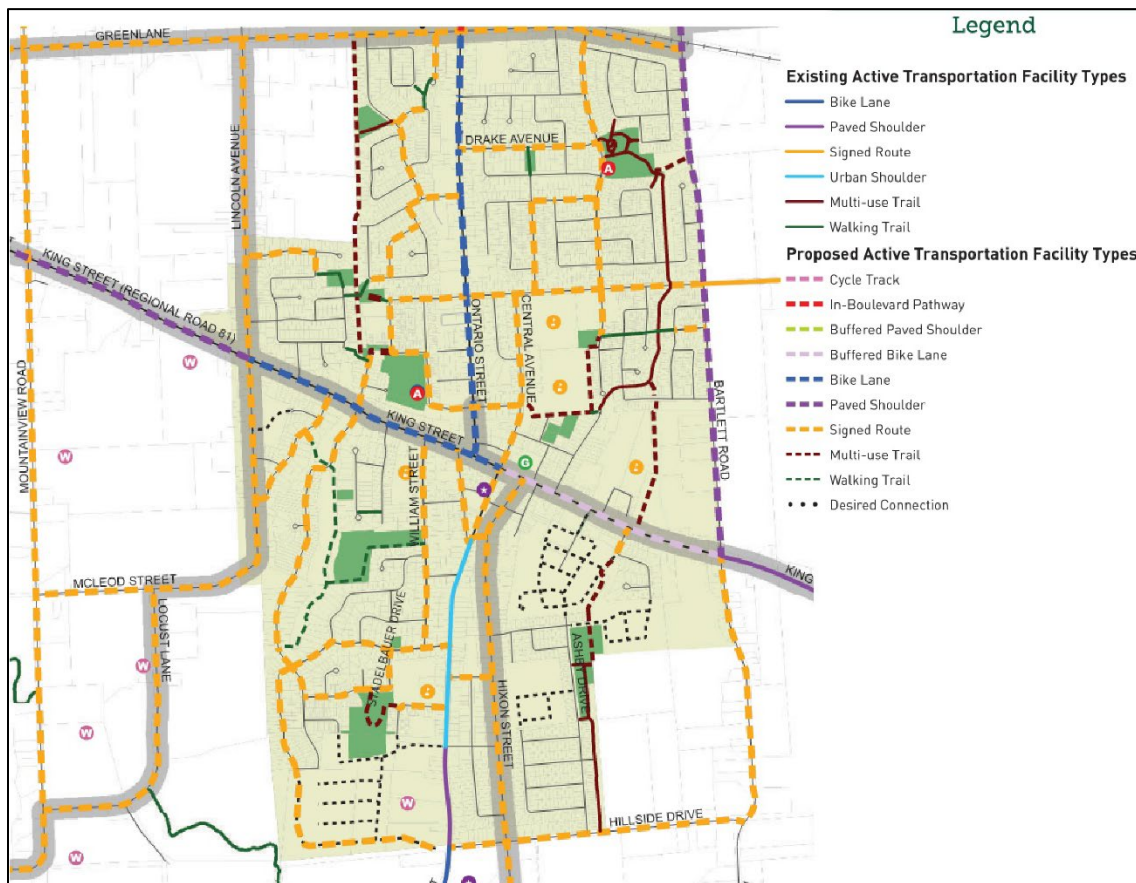
3.2 Future Transit

A potential new GO station in Beamsville is being considered by Metrolinx. The proposed transit station will be located on the Lakeshore West Line, west of Ontario Street, approximately 5 km away from the development. This station can potentially reach 325,000 annual riders by 2041 with 1,355 daily trips. The proposed station will include pick-up and drop-off area, bicycle parking and area for local and regional transit services transfer. However, there is no indication of timeline.

3.3 Future Active Transportation

The Town's *Active Transportation Strategy* (ATS), prepared by the Town and WSP, dated September 2019, proposes active transportation routes within the study area. The following routes are proposed, which are also illustrated in Figure 4 (from Map 2a of the ATS): A signed bicycle route along Mountain Street (between King Street and Queen Street), Hixon Street, Hillside Drive / Highland Park Drive; and extending the Hillside Estates Trail to Cherry Heights Boulevard and bike lanes on King Street. However, there is no indication of timeline.

Figure 4: Future Active Transportation Network



3.4 Background Traffic Growth

As per the Region's request, a growth rate of 2% compounded annually was applied to all movements.

3.5 Background Development

The Town provided information on background developments within the proximity of the site. There is only one development identified within the proximity of the site and details are provided below.

Vista Ridge Development

- Located west of Mountain Street, north of Highland Park Drive.
- Subdivision has two phases:
 - Phase 1: 100 single-family homes, 212 street townhomes for a total of 312 units.
 - Phase 2: 125 single-family homes, 75 street townhomes for a total of 200 units.

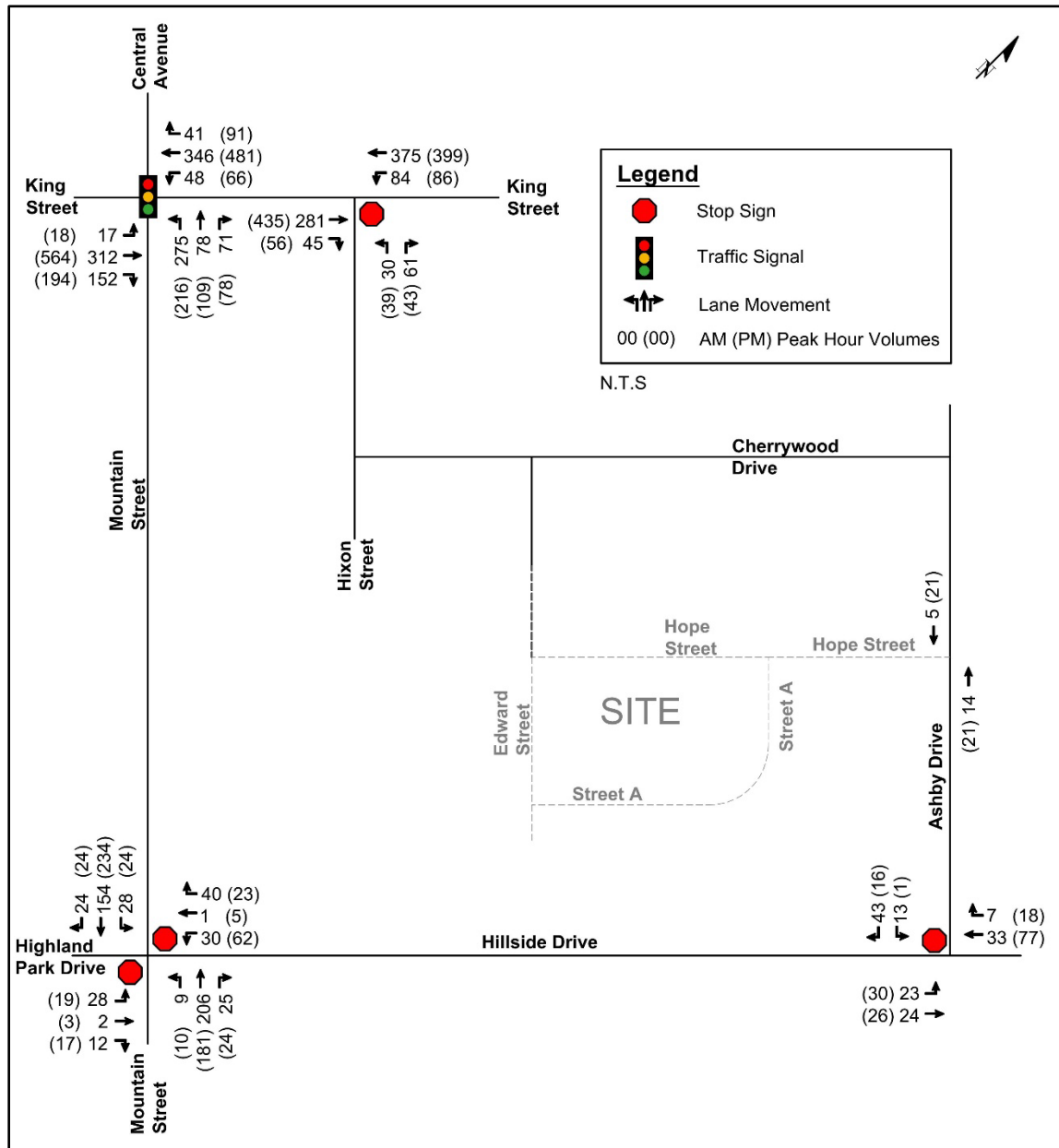
- Construction started in 2019 and there are 62 townhomes that have yet to be constructed and approximately 90% of the built units are occupied. This is equivalent to 22 unoccupied single-family homes and 29 unoccupied townhomes.
- Trip generation for those remaining units and unoccupied units were based upon the information contained in the publication *Trip Generation Manual, 11th Edition* (Trip Generation Manual) published by the Institute of Transportation Engineers (ITE). The assumed ITE Land Use Code (LUC) 210 Single-Family Detached Housing was used for the single-family homes and LUC 215 (Single-Family Attached Housing) was used for the townhouses with general urban / suburban setting was used. Estimated trips for the weekday AM and PM peak hour are 63 and 76, respectively.
- Distribution and assignment of the generated trips was based on the *Vista Ridge Transportation Impact Study*, prepared by Paradigm, dated June 2015.

Excerpts of the site traffic figures for the background development are provided in Appendix C.

3.6 Background Traffic Volumes

Background traffic volumes consist of the application of growth per annum (up to the horizon year of 2030) to the existing traffic volumes shown in Figure 3, along with traffic from background developments. The resulting background 2030 traffic volumes are illustrated in Figure 5.

Figure 5: 2030 Background Traffic Volumes

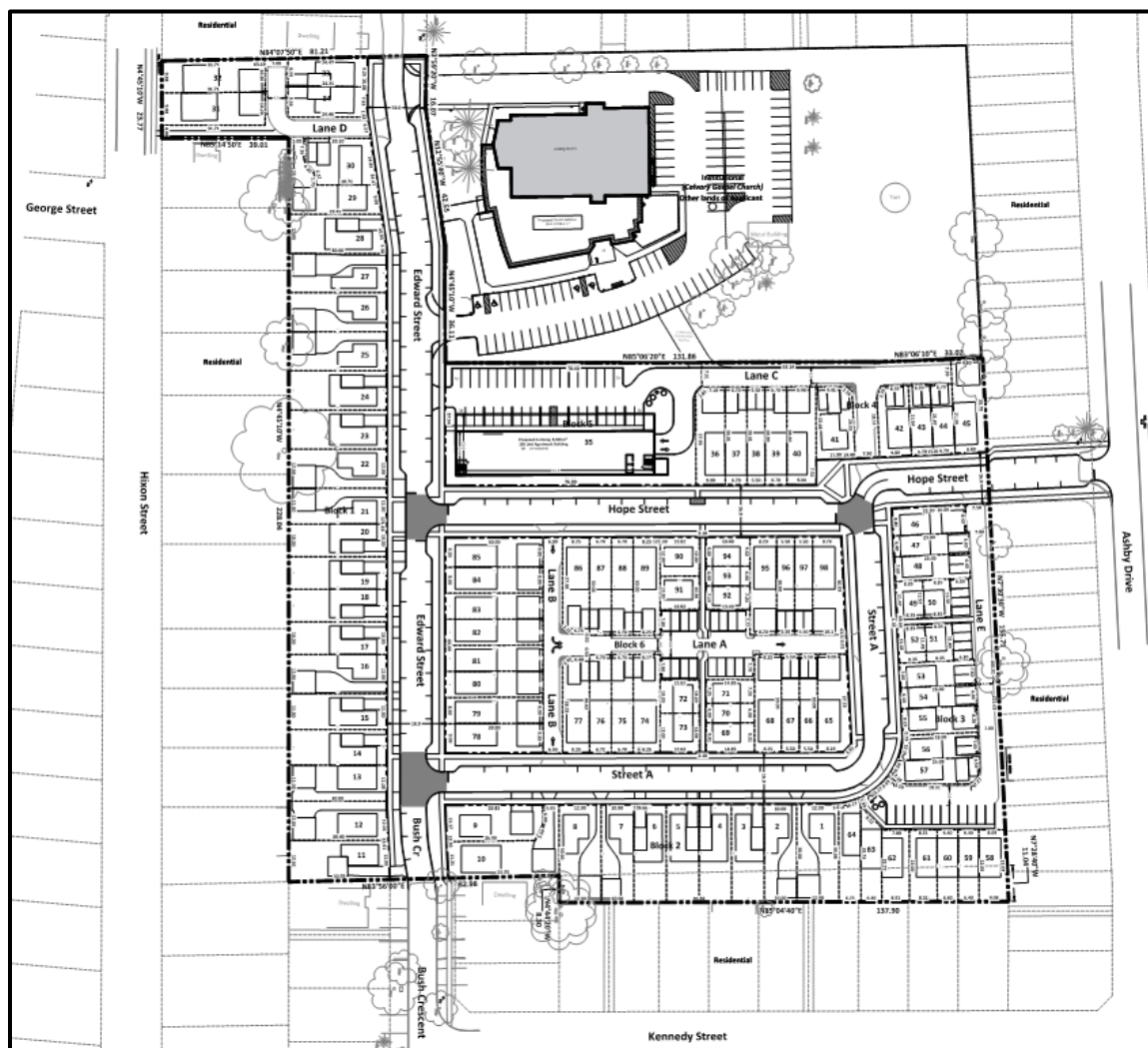


4.0 Proposed Development

According to the concept plan by Better Neighborhoods Inc., dated April 25, 2023, the proposed development will consist of 17 single family homes, 36 semi-detached homes, 44 on-street townhomes and a multi-residential building with 105 units for a total of 202 residential units. It is also anticipated that approximately 10% of the single-family and semi-detached homes (5 units) will have accessory dwelling units (ADUs). As a result, the development is proposing a total of 207 residential units. Access to the subdivision

will be provided via an extension of Edward Street through the site to Bush Crescent, a local street (Street A) connection to the extended Edward Street and a local street (Hope Street) connection to Ashby Drive. The concept plan is shown in Figure 6.

Figure 6: Concept Plan



4.1 Trip Generation

Trip generation was based on information contained in the *Trip Generation Manual, 11th Edition* (Trip Generation Manual) published by the Institute of Transportation Engineers (ITE). The following LUC was used in the generation of trips based on a general urban / suburban environment:

- Single detached residential homes and ADUs: Single-Family Detached Housing (LUC 210)
- Semi-detached and townhomes: Single-Family Attached Housing (LUC 215)
- Multi residential units: Multifamily Housing-Mid-Rise (LUC 221)

The resulting trip generation is summarized in Table 2.

Table 2: Trip Generation

Land Use	Weekday AM Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total
Single-Family Detached Housing (LUC 210) - 22 Units	5	14	19	15	9	24
Single-Family Attached Housing (LUC 215) - 80 Units	12	26	38	26	20	46
Multifamily Housing – Mid Rise (LUC 221) - 105 Units	13	42	55	42	24	66
Total Trips	30	82	112	83	53	136

4.2 Trip Distribution & Assignment

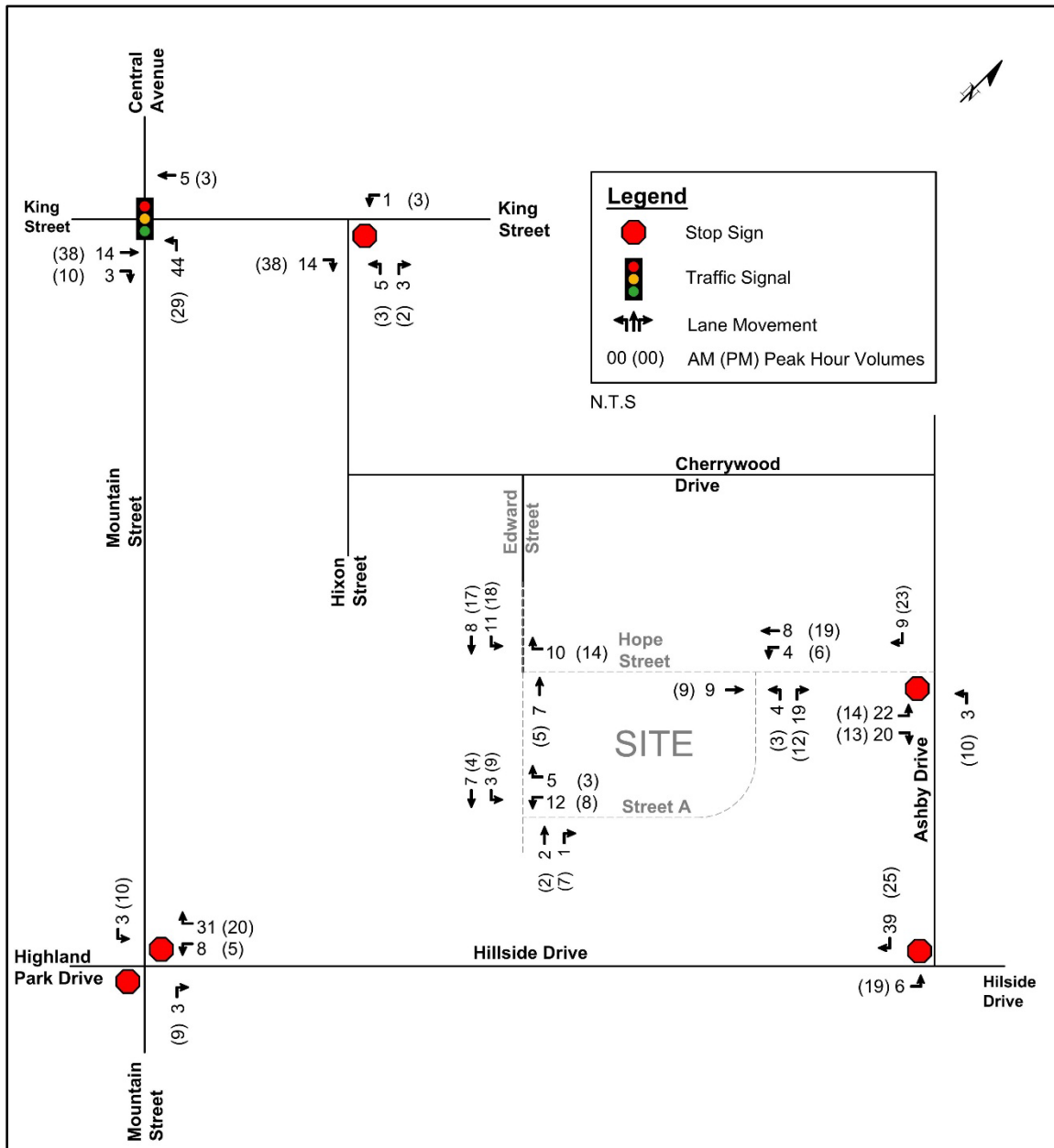
Trip distribution and assignment were derived from existing traffic patterns, 2016 *Transportation Tomorrow Survey* results published by the Data Management Group at the University of Toronto Transportation Research Institute and the available road network. The estimated distribution is summarized in Table 3.

Table 3: Trip Distribution

To/From	Via	Residential
South	Mountain Street	10%
West	King Street	60%
East	King Street	30%
Total		100%

The resulting traffic volumes are shown in Figure 7. Note that as Ashby Drive connects to King Street via Cherry Heights Boulevard, it was assumed that 90% of the trips to / from the east on King Street will utilize Ashby Drive and Cherry Heights Boulevard.

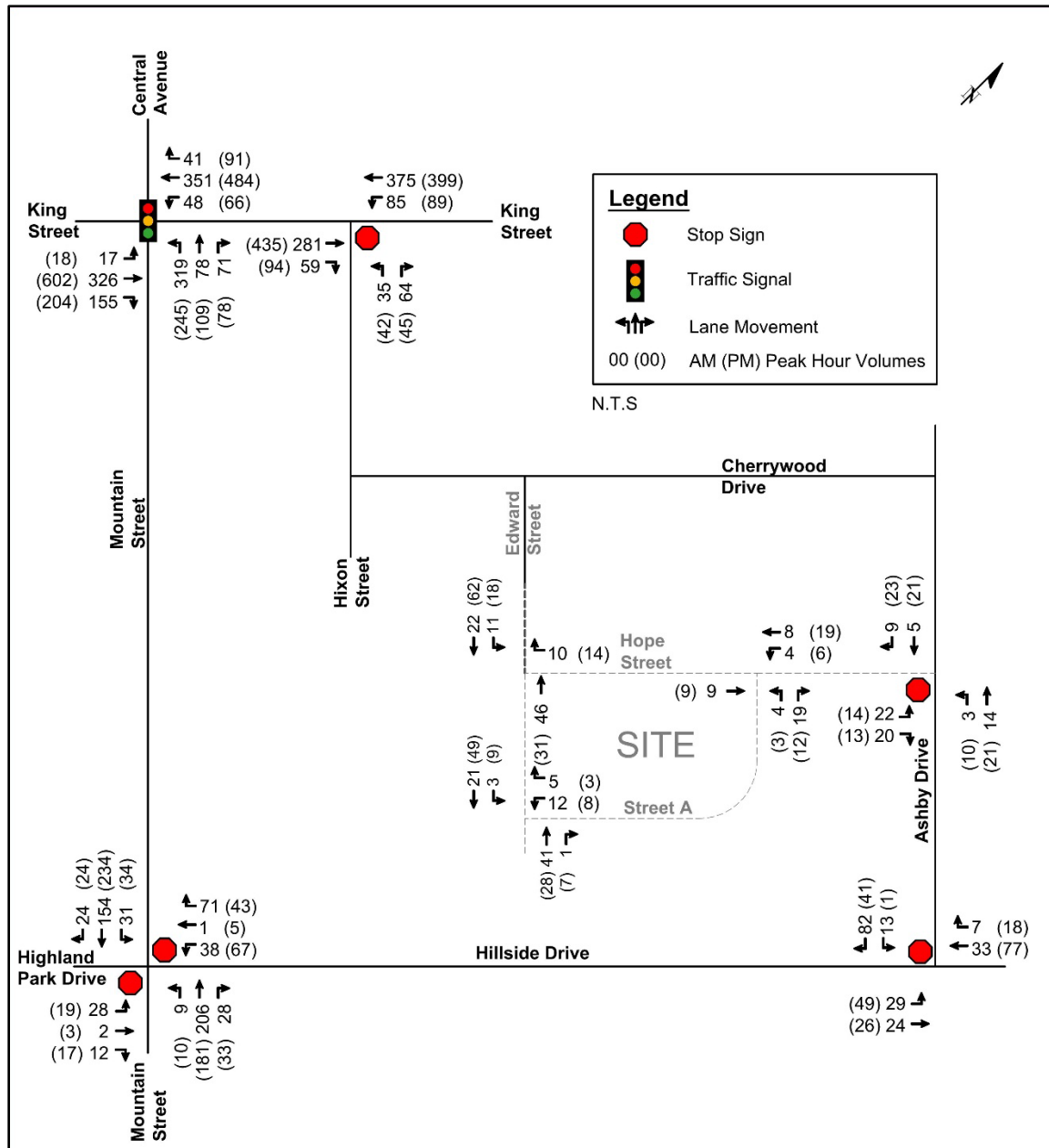
Figure 7: Site Traffic Volumes



5.0 Total Traffic Conditions

Total traffic volumes consist of background traffic volumes plus site trips. The resulting 2030 total traffic volumes are shown in Figure 8.

Figure 8: 2030 Total Traffic Volumes



6.0 Traffic Operations

Traffic operations analyses were conducted under existing and future traffic conditions for the weekday AM and PM peak hours at all study intersections. Queueing was reviewed using Synchro's 95th percentile queue. Comparisons of the existing storage/link distances and projected queues are also summarized. Detailed Synchro reports are provided in Appendices D through F.

6.1 Mountain Street / King Street / Central Avenue

Existing and future traffic operations at the signalized intersection of Mountain Street / King Street / Central Avenue are summarized in Table 4.

Table 4: Mountain / King / Central Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95 th % Queue (m)	v/c	LOS	95 th % Queue (m)
Existing Conditions							
Overall	-	0.71	C	-	0.79	C	-
EBLTR	83	0.8	C	64	0.85	C	117
WBLTR	200+	0.77	C	61	0.84	C	101
NBLTR	200+	0.63	B	89	0.61	C	69
Background Conditions							
Overall	-	0.82	C	-	0.91	D	-
EBLTR	83	0.86	C	84	1.0	D	178
WBLTR	200+	0.84	C	79	0.94	D	148
NBLTR	200+	0.79	C	116	0.78	C	94
Background Conditions (signal timing improvements)							
Overall	-	Not applicable			0.89	C	-
EBLTR	83				0.91	C	163
WBLTR	200+				0.84	C	129
NBLTR	200+				0.87	D	143
Total Conditions							
Overall	-	0.88	C	-	0.91	C	-
EBLTR	83	0.87	C	89	0.92	C	217
WBLTR	200+	0.83	C	80	0.83	C	145
NBLTR	200+	0.88	D	133	0.87	D	140

Under existing and future conditions, all movements at the Mountain Street / King Street / Central Avenue intersection are operating and will operate with excess capacity and a level of service D or better, with the exception of the eastbound movement during the weekday PM peak hour under background conditions. This movement will approach capacity. As this is a background issue, the Region should monitor this movement for possible improvements. It is recommended that the Region consider increasing the cycle length from 70 seconds to 100 seconds to provide more green time for all movements. This recommendation is carried to total conditions. Under total conditions, all movements will operate with excess capacity and a level of service D or better.

The existing and projected queue lengths are and will be within existing storage and link distances, with the exception of the eastbound movement during the AM and PM peak

hours. The existing queue and projected queue will exceed the existing storage by 6 m to 134 m. As observed during the field visit, eastbound queues extend upstream through the Ontario Street intersection. Drivers travelling eastbound (all movements) are utilizing more of the yellow or all red phases. With higher volumes, drivers typically utilize the yellow phase and a portion of all red phase to clear the intersection. As the eastbound queue will be metered by the upstream signalized intersection, there are no improvements recommended and / or will be triggered by the proposed development.

6.2 Mountain Street / Hillside Drive / Highland Park Drive

Existing and future traffic operations at the eastbound / westbound stop-controlled intersection of Mountain Street / Hillside Drive / Highland Park Drive are summarized in Table 5.

Table 5: Mountain / Hillside / Highland Park Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95 th % Queue (m)	v/c	LOS	95 th % Queue (m)
Existing Conditions							
EBLTR	200+	0.06	B	2	0.06	B	2
WBLTR	200+	0.10	B	3	0.15	B	4
NBLTR	200+	0.00	A	1	0.00	A	1
SBLTR	200+	0.02	A	1	0.02	A	1
Background Conditions							
EBLTR	200+	0.09	B	3	0.08	B	2
WBLTR	200+	0.13	B	4	0.19	B	6
NBLTR	200+	0.01	A	1	0.01	A	1
SBLTR	200+	0.02	A	1	0.02	A	1
Total Conditions							
EBLTR	200+	0.1	B	3	0.09	B	3
WBLTR	200+	0.19	B	6	0.24	B	7
NBLTR	200+	0.01	A	1	0.01	A	1
SBLTR	200+	0.03	A	1	0.03	A	1

Under existing and future conditions, all critical movements are operating and will operate with excess capacity and level of service B or better. All queues and projected queues are and will be within their existing storage.

As per the Region's request, a signal warrant analysis was conducted for this intersection based on the methodology contained in the *Ontario Traffic Manual Book 12*, published by the Ministry of Transportation. The results are summarized in Table 6. Detailed analyses are provided in Appendix G.

Table 6: Mountain / Hillside / Highland Park Intersection Signal Warrant Analysis

Condition	Justification	Justification 1 Minimum Vehicular Volume ¹		Justification 2 Delay to Cross Traffic ¹		Justification 3 Combination ²	
		1A	1B	2A	2B	3A	3B
Background	Compliance	41%	36%	33%	49%	36%	33%
	Justified	No		No		No	
Total	Compliance	44%	45%	34%	53%	44%	34%
	Justified	No		No		No	

Note: 1. 1A and 2A are total intersection volumes while 1B and 2B are crossing (of the main road) volumes.
2. 3A is Justification 1, while 3B is Justification 2.

For each justification, the lower percentage governs the warrant. A signal can be warranted by just one of the justifications, provided that it meets the threshold for both categories. The threshold required for each justification is 120% for projected volumes. Therefore, a traffic signal is not warranted under either background or total conditions.

6.3 Hixon Street / King Street

Existing and future traffic operations at the northbound stop-controlled intersection of Hixon Street / King Street are summarized in Table 7.

Table 7: Hixon / King Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95 th % Queue (m)	v/c	LOS	95 th % Queue (m)
Existing Conditions							
WBLT	200+	0.07	A	2	0.07	A	2
NBLR	200+	0.19	B	6	0.2	C	6
Background Conditions							
WBLT	200+	0.09	A	3	0.09	A	3
NBLR	200+	0.26	C	8	0.27	C	9
Total Conditions							
WBLT	200+	0.09	A	3	0.09	A	3
NBLR	200+	0.3	C	10	0.3	C	10

Under existing and future conditions, all critical movements are operating and will operate with excess capacity and level of service C or better. All queues and projected queues are and will be within their existing storage.

6.4 Ashby Drive / Hillside Drive

Existing and future traffic operations at the southbound stop-controlled intersection of Ashby Drive / Hillside Drive are summarized in Table 8.

Table 8: Ashby / Hillside Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95 th % Queue (m)	v/c	LOS	95 th % Queue (m)
Existing Conditions							
EBLT	200+	0.02	A	1	0.02	A	1
SBLR	200+	0.08	A	3	0.02	A	1
Background Conditions							
EBLT	200+	0.02	A	1	0.03	A	1
SBLR	200+	0.1	A	3	0.02	A	1
Total Conditions							
EBLT	200+	0.03	A	1	0.04	A	2
SBLR	200+	0.16	A	5	0.06	A	2

Under existing and future conditions, all critical movements are operating and will operate with excess capacity and level of service A. All queues and projected queues are and will be within their existing storage.

6.5 Ashby Drive / Hope Street

Future traffic operations at the eastbound stop-controlled intersection of Ashby Drive / Hope Street are summarized in Table 9.

Table 9: Ashby / Hope Total Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95 th % Queue (m)	v/c	LOS	95 th % Queue (m)
EBLR	200+	0.04	A	2	0.03	A	1
NBLT	200+	0.00	A	0	0.01	A	1

Under future total conditions, all critical movements will operate with excess capacity and level of service A. All queues and projected queues are and will be within their existing storage.

7.0 Draft Plan Review

Access will be provided via an extension of Edward Street to Bush Crescent, a local street (Street A) connection to the extended Edward Street and a local street (Hope Street) connection to Ashby Drive. This connection will be able to complete the road network grid in the neighborhood and provide alternative routes for existing and future residents. The extended Edward Street, and local streets (Hope Street and Street A) will be designed with raised intersections, lay-by parking and uninterrupted landscaped boulevards will improve mobility, safety, comfort and assist in traffic calming goals. A series of privately owned rear laneways are also proposed to improve the streetscape, urban design, and walkability of the neighborhood. Through the consolidation of numerous driveways off a rear lane, fewer conflict points exist along the traveled street between those walking, cycling, and driving vehicles.

7.1 Road Classification and Geometrics

A review of the proposed Draft Plan was performed based on the Town's Municipal Design and Quality Standards. Edward Street, Hope Street and Street A within the subdivision will be classed as local roads based on function and required traffic capacity. Hope Street and Street A will have a right-of-way of 16 m and Edward Street will have a right-of-way of 18 m. These widths do not meet the minimum width in the Town's design standards. The proposed reduced widths in combination with other traffic calming measures such as raised intersections and on-street layby parking will assist in slowing traffic through the neighbourhood and create a more pedestrian friendly environment. All proposed laneways will have a minimum width of 7.5 m for 2-way laneways and 6.0 m for 1-way laneways. Also, these widths will be able to adequately accommodate all municipal infrastructure needs including utilities, water, sewer, and storm.

A swept path analysis for refuse pickup circulation was conducted for a Region refuse rear loader truck and a front loader truck utilizing AutoTURN, which is shown in Appendix H. The analysis confirms that the proposed geometrics will accommodate all design vehicles.

7.2 Traffic Control

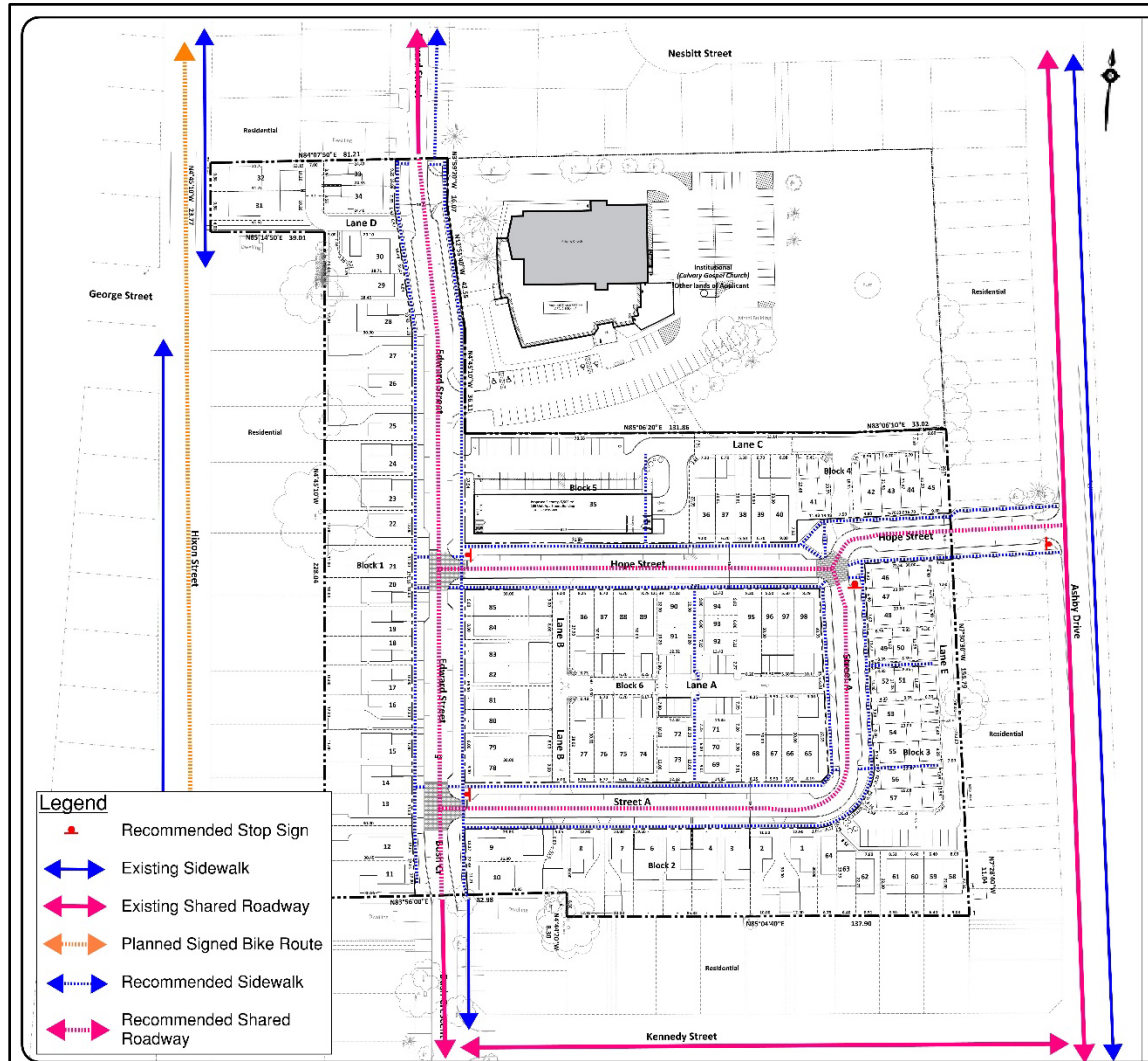
Recommended intersection traffic control is shown in Figure 9.

7.3 Pedestrian and Cyclist Accommodations

Pedestrian accommodation will be provided by sidewalks on both sides of all streets. It is recommended that the Town consider sidewalks on one side of Edward Street. This connection will complete the neighborhood as Edward Street is the only street in the neighborhood without sidewalks. Sidewalks in the development will connect to the existing external sidewalk network on Bush Crescent and Ashby Drive as well as the

recommended future sidewalk on Edwards Street. Cyclists can utilize all proposed local streets and laneways. Active transportation access is illustrated in Figure 9.

Figure 9: Traffic Control, Sidewalk Locations and Cycling Infrastructure



7.4 Parking and Stopping Restrictions

Lay-by parking will be provided on all streets. Any other signed parking or stopping restrictions are unnecessary on the local streets. Due to the travelled width of the laneways, it is recommended that parking and stopping be prohibited on both sides of all laneways.

8.0 Traffic Demand Management Plan

The proposed site plan incorporates design elements to support pedestrians, cyclists, and transit users to discourage the dependency on the single-occupant motor vehicle.

This complements the Town's overall transportation vision to achieve a greater sustainable transportation system by promoting and encouraging alternative modes of travel. As noted in Section 3.3, there are plans for a signed bicycle route along Mountain Street (between King Street and Queen Street), Hixon Street, Hillside Drive / Highland Park Drive; extending the Hillside Estates Trail to Cherry Heights Boulevard and bike lanes on King Street. To further facilitate other modes of travel, the following TDM measures are proposed:

- Internal sidewalk connections to existing sidewalks on Bush Crescent and Ashby Drive as well as a future sidewalk on Edward Street.
- Internal sidewalks are provided on both sides of all local streets.
- Internal secured bicycle storage is either provided in each resident's private garage, within an accessory building, private yard, or dedicated storage facility in the case of multi-unit apartments.
- An information package on available transit/walking/cycling facilities will be provided to residents.

These measures are expected to reduce not only vehicular trips but also parking demand.

9.0 Conclusions

9.1 Traffic Operations

Under existing and future conditions, all intersections are operating and will operate with excess capacity, a level of service D or better and queues that are projected to be within their existing storage and link distances, with one exception as discussed below.

Mountain / King / Central Intersection

The eastbound movement during the weekday PM peak hour under background conditions will approach capacity. As this is a background issue, the Region should monitor this movement for improvements. It is recommended that the Region consider increasing the cycle length from 70 seconds to 100 seconds to provide more green time for all movements.

In addition, existing and projected eastbound queues during the AM and PM peak hours are and will exceed the existing storage by 6 m to 134 m. This was observed during the field visit. Drivers travelling eastbound (all movements) are utilizing more of the yellow or all red phases. With higher volumes, drivers typically utilize the yellow phase and a portion of all red phase to clear the intersection. As the eastbound queue will be metered by the upstream signalized intersection, there are no further improvements recommended and / or will be triggered by the proposed development.

Mountain / Hillside / Highland Park Intersection

As per the Region's request, a signal warrant analysis was conducted for this intersection based on the methodology contained in the Ontario Traffic Manual Book 12, published by Ministry of Transportation. A traffic signal is not warranted under either background or total conditions.

9.2 Draft Plan Review

Access will be provided to complete the road network grid in the neighborhood and provide alternative routes for existing and future residents. The extended Edward Street will be designed with raised intersections, lay-by parking and uninterrupted landscaped boulevards will improve mobility, safety, comfort and assist in traffic calming goals.

Road Classification and Geometrics

Edward Street, Hope Street and Street A within the subdivision will be classed as local roads based on function and required traffic capacity. All other roadways will be laneways.

Hope and Street A will have a right-of-way of 16 m and Edward Street will have a right-of-way of 18 m. These widths do not meet the minimum width in the Town's Municipal Design and Quality Standards. The proposed reduced width in combination with other traffic calming measures such as raised intersections and on-street parking will assist in slowing traffic through the neighbourhood and creating a more pedestrian friendly environment. Swept path analysis confirms that the proposed geometrics will accommodate a refuse truck, which represents the largest design vehicle that will visit the neighbourhood.

Two-way laneways are proposed to have a minimum width of 7.5 m and one-way laneways will have a minimum width of 6.0 m.

Pedestrian and Cyclist Accommodation

It is recommended that the Town consider sidewalks on one side of Edward Street as it will be the only street in the neighborhood without sidewalks. Sidewalks will connect to the existing external sidewalk network on Bush Crescent and Ashby Drive as well as the recommended future sidewalk on Edward Street. Cyclists can access the site via all proposed local roadways and laneways.

Parking and Stopping Restrictions

Lay-by parking will be provided on all streets. Any signed parking or stopping restrictions are unnecessary on the local streets. Due to the travelled width of the laneways, it is recommended that parking and stopping be prohibited on both sides of all laneways.

9.3 Transportation Demand Management Plan

Various TDM measures currently exist and are planned that will discourage vehicle use and dependency such as:

- Existing sidewalks on Bush Crescent.
- Planned signed bicycle route along Mountain Street (between King Street and Queen Street), Hixon Street and Hillside Drive / Highland Park Drive.
- Planned bike lanes on King Street.
- Planned Hillside Estates Trail extension to Cherry Heights Boulevard

To further facilitate other modes of travel, several TDM measures are proposed by the development as follows:

- Internal sidewalk connections to existing sidewalks on Bush Crescent and Ashby Drive as well as future sidewalks on Edwards Street.
- Internal sidewalks are provided on both sides of all local roads.
- Internal secured bicycle storage is provided in each resident's private garage.
- An information package on available transit/walking/cycling facilities will be provided to residents.

The combination of these proposed TDM measures and the additional active transportation improvements in the area are expected to reduce vehicle trips and parking demand.



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Appendix A

Intersection Analysis Methodology

Intersection Analysis Methodology for Motor Vehicles

Signalized intersection analysis considers two separate measures of performance:

- The capacity of all intersection movements, which is based on a volume to capacity ratio that is a measure of the degree of capacity utilized.
- The level of service (LOS) for all intersection movements, which is based on the average control delay per vehicle for the various movements through the intersection and overall. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between A and F, with F being the longest delay. The link between LOS and delay (in seconds) for signalized intersections is summarized below.

Level of Service	Control Delay per Vehicle(s)
A	≤10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

Unsignalized intersection analysis considers two separate measures of performance:

- The capacity of the intersection's critical movements, which is based on a volume to capacity ratio.
- The level of service for the critical movements, which is based on the average control delay per vehicle for the various critical movements within the intersection. The link between LOS and delay (in seconds) for unsignalized intersections is summarized below.

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



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Appendix B

Historical Counts and Signal Timing Plans

Signal Code: 18M081**Intersection: RR18 (MOUNTAIN ST.) & RR81 (KING ST.)****Municipality: lincoln****Owner: Region****Last Modified: 2021-04-19 3:37:41 PM**

Timing Parameters	EBD & WBD THRU KING ST.	NBD THRU MOUNTAIN ST.	n/a	n/a	n/a	n/a
Min Green	10	8	0	0	0	0
Walk	10	10	0	0	0	0
Ped Clearance	17	13	0	0	0	0
Vehicle Ext.	2.5	2.5	0	0	0	0
Max Green	38	20	0	0	0	0
Yellow	4.1	4.1	0	0	0	0
All Red	2.7	2.2	0	0	0	0

		Offset	
Minimum Cycle	31.1	0	
Pedestrian Cycle	63.1		
Maximum Cycle	71.1	0	
Operation	FA		

Installed On: 2014-12-16

Count Date: 2013-07-13

FA = Fully Actuated

SA = Semi Actuated

FT = Fixed Time

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Accu-Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

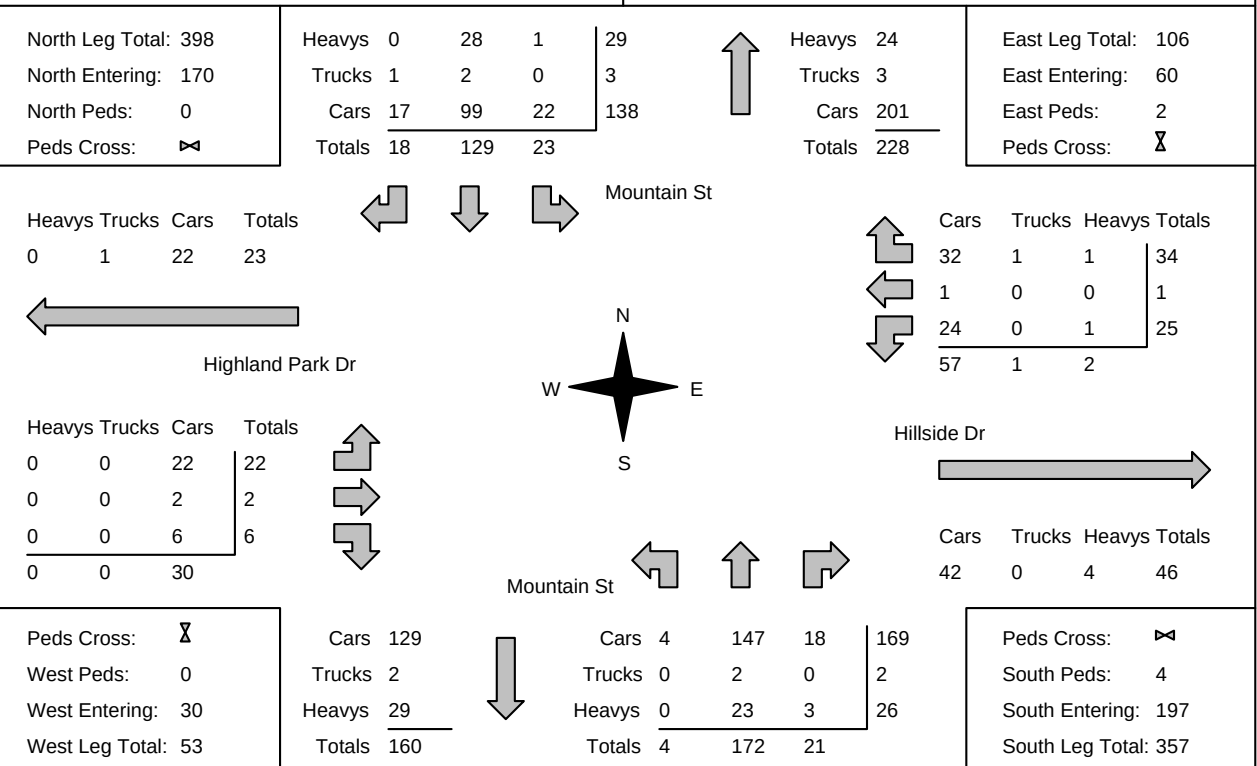
Municipality: Beamsville
Site #: 2107600001
Intersection: Mountain St & Hillside Dr
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Mountain St runs N/S



Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 17:00:00

To: 18:00:00

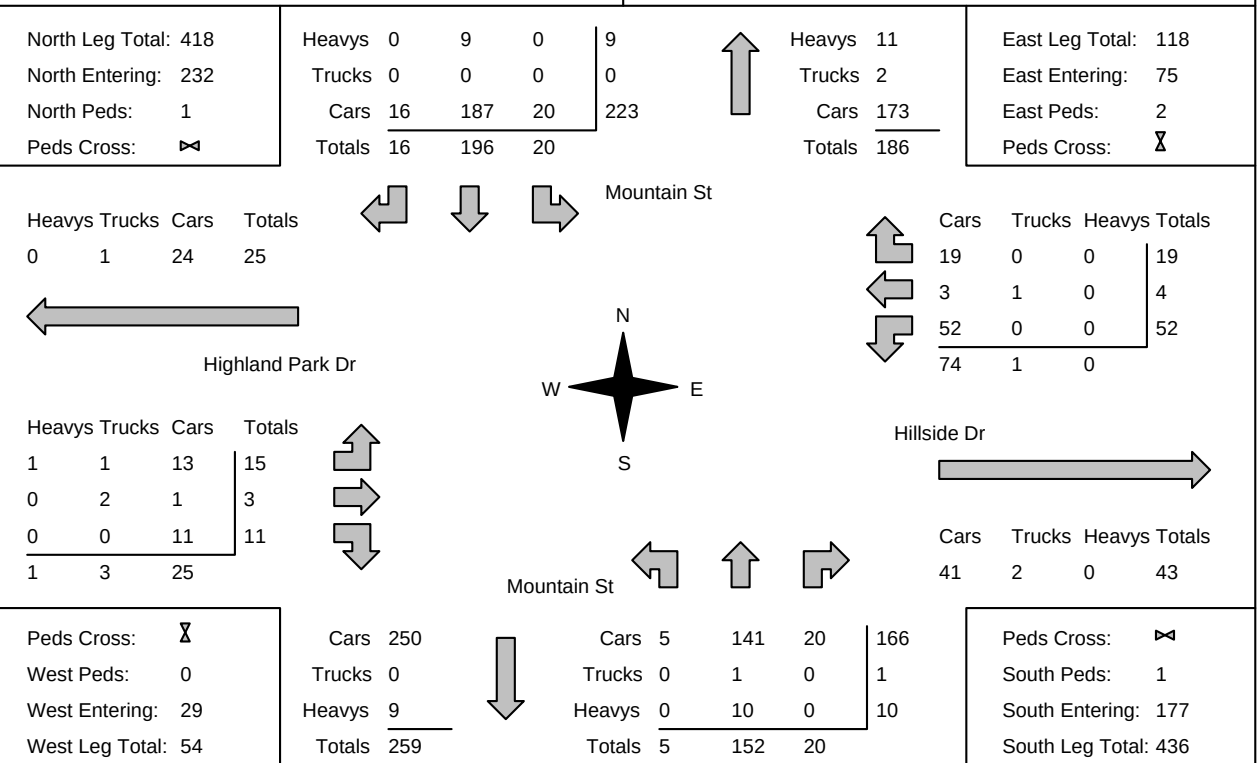
Municipality: Beamsville
Site #: 2107600001
Intersection: Mountain St & Hillside Dr
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Mountain St runs N/S



Comments

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

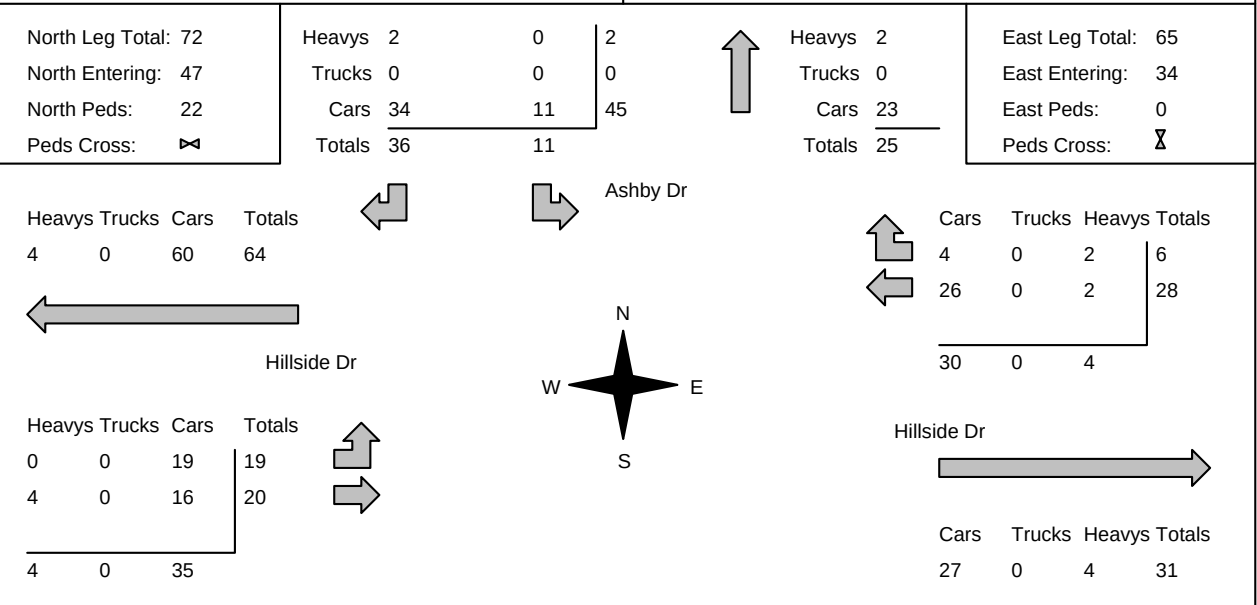
Municipality: Beamsville
Site #: 2107600002
Intersection: Hillside Dr & Ashby Dr
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Hillside Dr runs W/E



Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

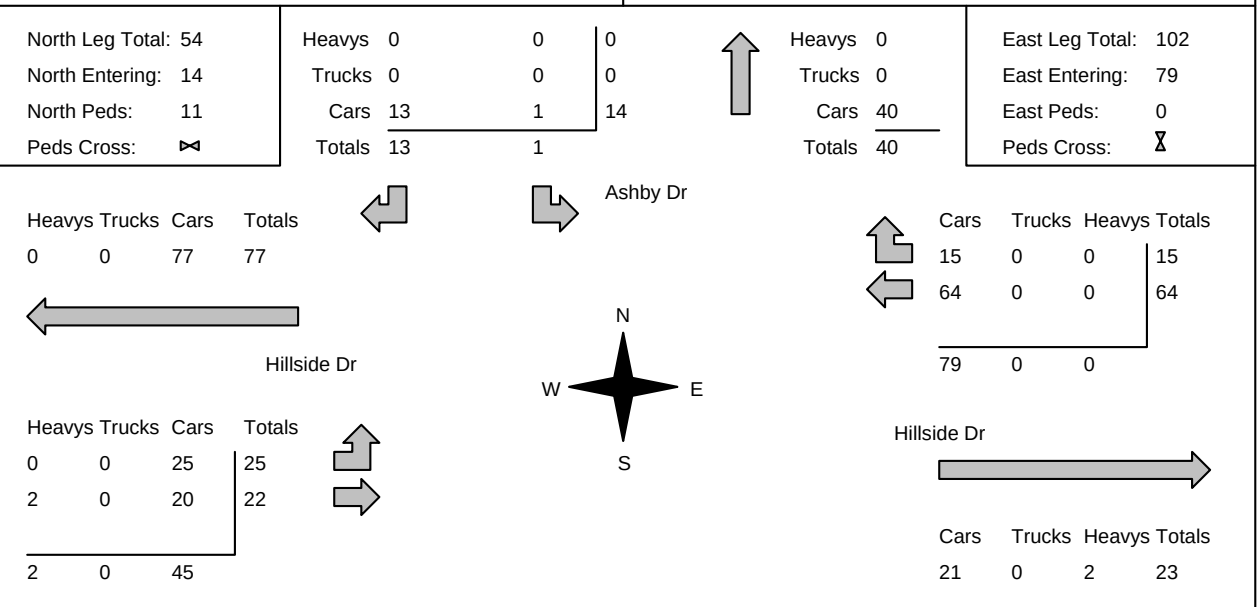
Municipality: Beamsville
Site #: 2107600002
Intersection: Hillside Dr & Ashby Dr
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Hillside Dr runs W/E



Peds Cross: 8
West Peds: 0
West Entering: 47
West Leg Total: 124

Comments

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

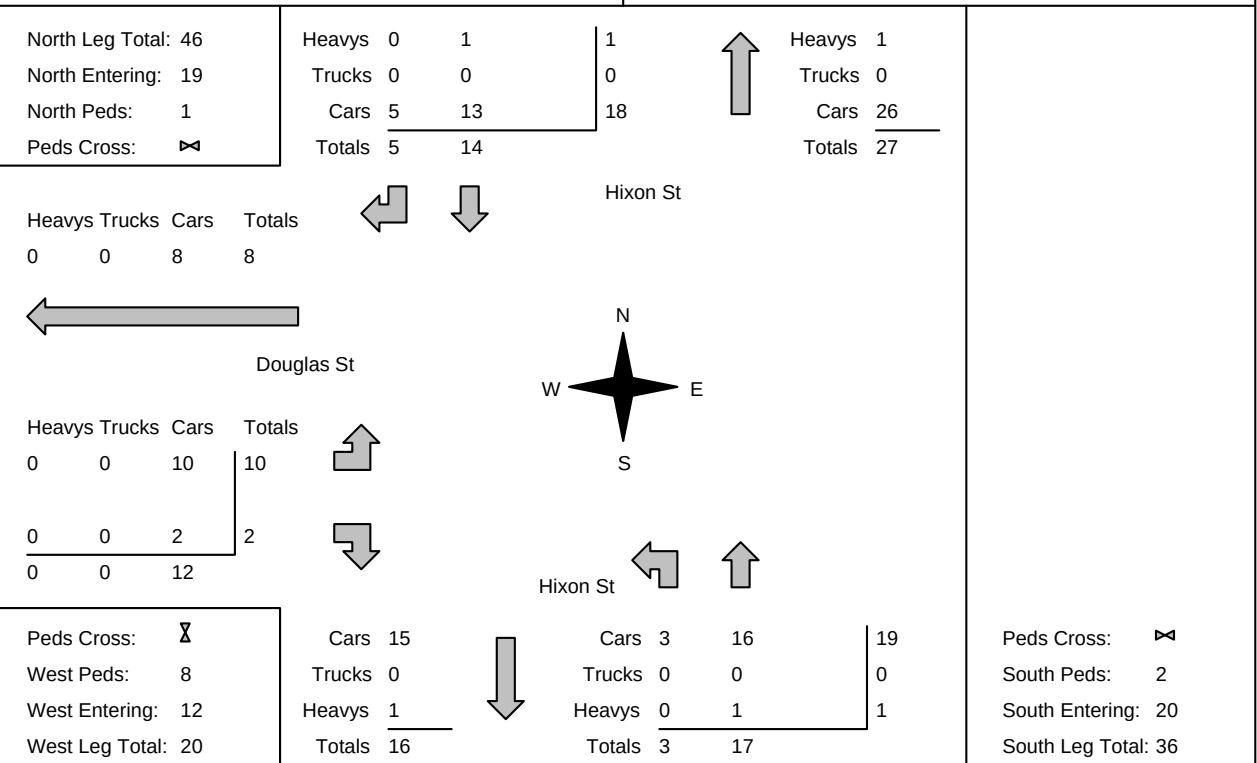
Municipality: Beamsville
Site #: 2107600003
Intersection: Hixon St & Douglas St
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Hixon St runs N/S



Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 17:00:00

To: 18:00:00

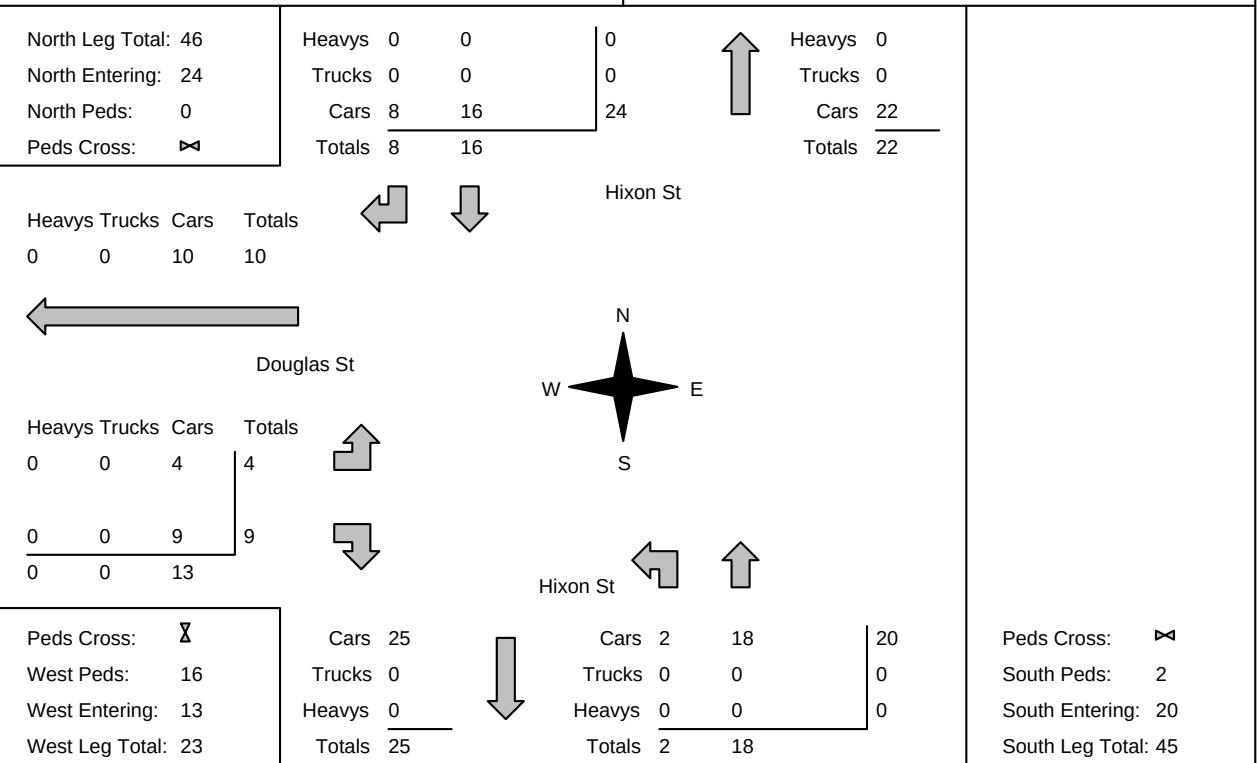
Municipality: Beamsville
Site #: 2107600003
Intersection: Hixon St & Douglas St
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

** Non-Signalized Intersection **

Major Road: Hixon St runs N/S



Comments

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Beamsville
Site #: 2107600004
Intersection: King St & Hixon St
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Non-Signalized Intersection ****

Major Road: King St runs W/E

East Leg Total: 590

East Entering: 341

East Peds: 2

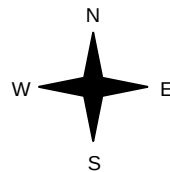
Peds Cross: 8

Heavys	Trucks	Cars	Totals
20	6	274	300



King St

Heavys	Trucks	Cars	Totals
12	4	187	203
0	1	33	34
12	5	220	



Hixon St

Cars	Trucks	Heavys	Totals
252	6	20	278
61	0	2	63
313	6	22	



King St

Cars	Trucks	Heavys	Totals
232	4	13	249

Peds Cross: 8
West Peds: 4
West Entering: 237
West Leg Total: 537

Cars	94
Trucks	1
Heavys	2
Totals	97



Cars	22	45	67
Trucks	0	0	0
Heavys	0	1	1
Totals	22	46	

Peds Cross: 24
South Peds: 24
South Entering: 68
South Leg Total: 165

Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:00:00

To: 17:00:00

Municipality: Beamsville
Site #: 2107600004
Intersection: King St & Hixon St
TFR File #: 1
Count date: 14-Sep-21

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Non-Signalized Intersection ****

Major Road: King St runs W/E

East Leg Total: 709

East Entering: 357

East Peds: 2

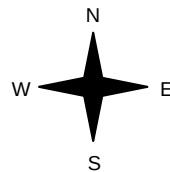
Peds Cross: 8

Heavys	Trucks	Cars	Totals
9	3	310	322



King St

Heavys	Trucks	Cars	Totals
7	3	310	320
1	0	41	42
8	3	351	



Cars	Trucks	Heavys	Totals
280	3	9	292
65	0	0	65
345	3	9	



King St



Cars	Trucks	Heavys	Totals
342	3	7	352

Peds Cross: 8
West Peds: 3
West Entering: 362
West Leg Total: 684

Cars	106
Trucks	0
Heavys	1
Totals	107



Cars	30	32	62
Trucks	0	0	0
Heavys	0	0	0
Totals	30	32	

Peds Cross: 9
South Peds: 9
South Entering: 62
South Leg Total: 169

Comments

Location..... King Street @ Mountain Street/Central Avenue **GeoID.....** 00010

Municipality. LINCOLN

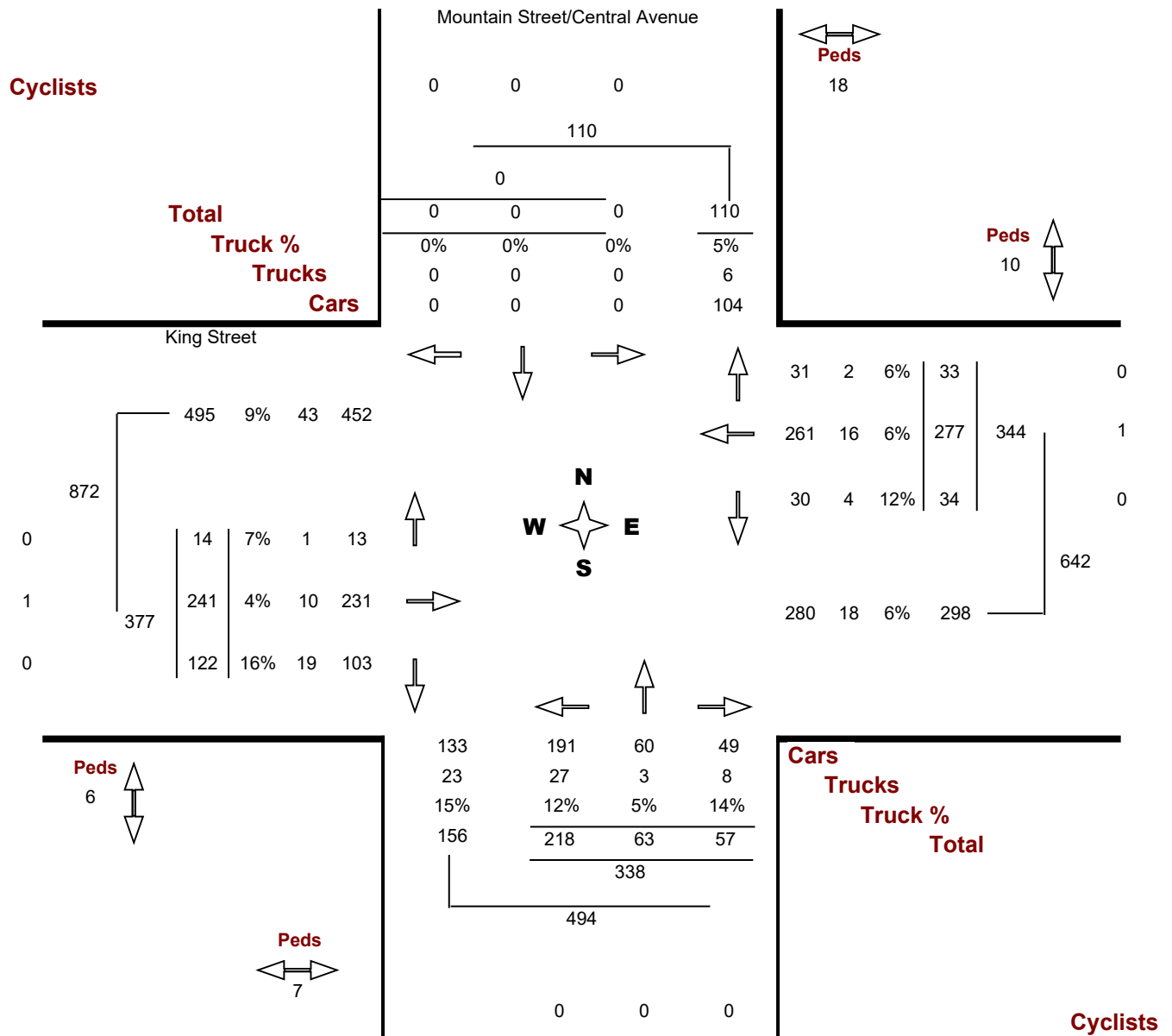
Count Date. Thursday, 18 April, 2019

Traffic Cont.

Count Time. 07:00 AM — 09:00 AM

Major Dir..... East west

Peak Hour.. 08:00 AM — 09:00 AM



Turning Movements Report - PM Period

Location..... King Street @ Mountain Street/Central Avenue **GeoID.....** 00010

Municipality. LINCOLN

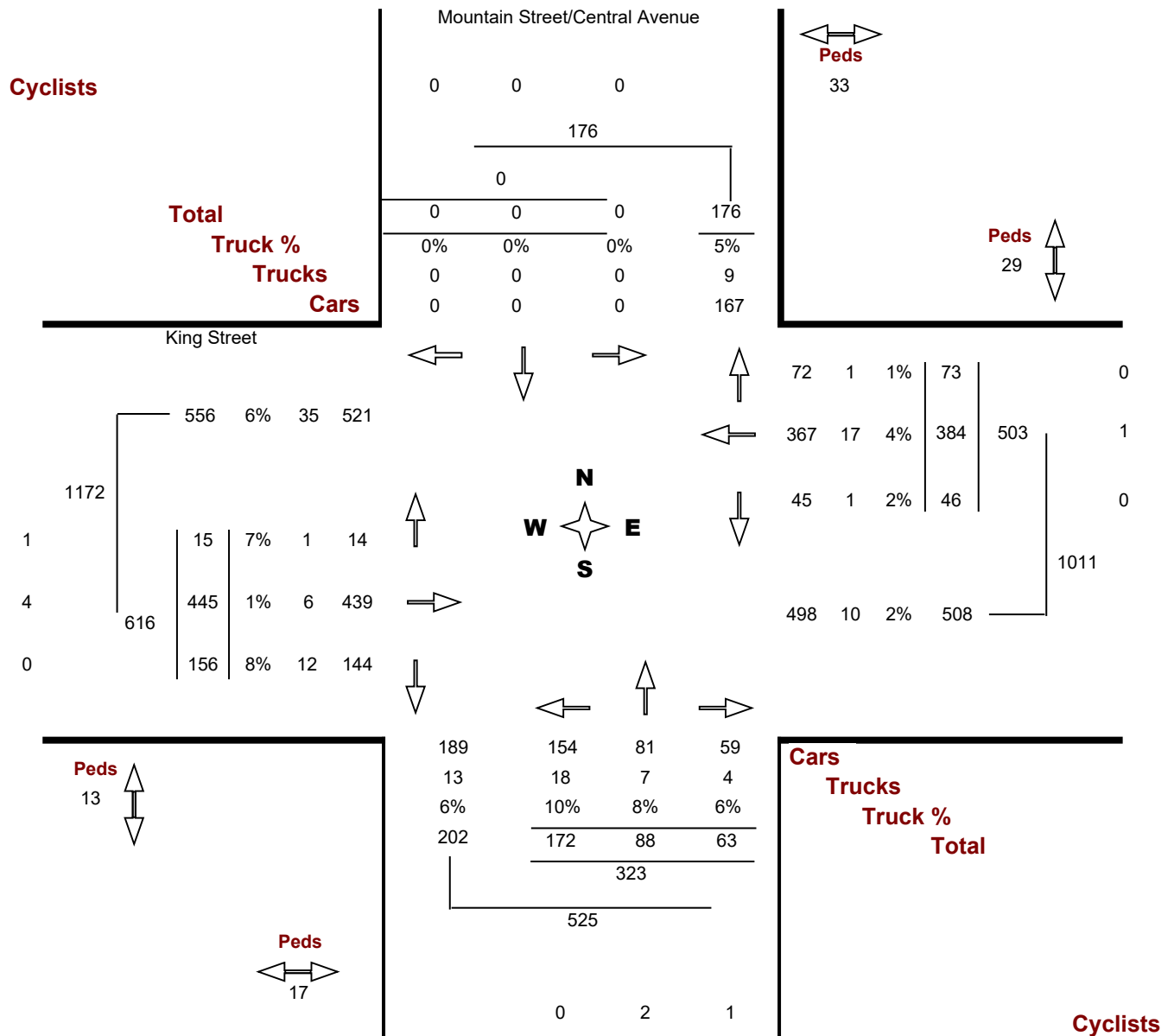
Count Date. Thursday, 18 April, 2019

Traffic Cont.

Count Time. 03:00 PM — 06:00 PM

Major Dir..... East west

Peak Hour.. 03:30 PM — 04:30 PM





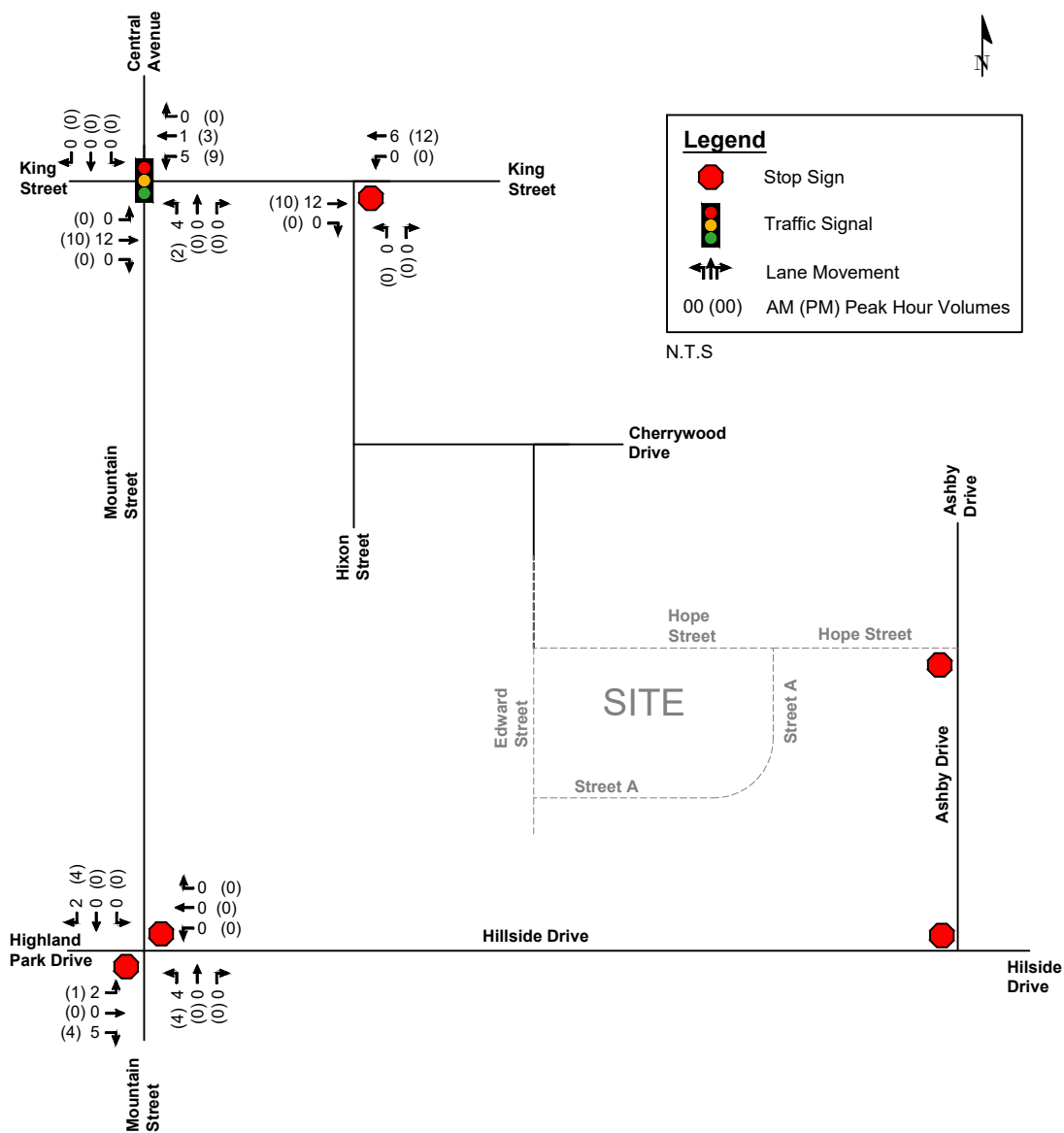
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Appendix C

Background Development Traffic

Vista Ridge Traffic Volumes





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Appendix D

Existing Traffic Operations

Timings

Ex AM

1: Mountain Street/Central Avenue & King Street

	EBL	EBT	WBL	WBT	NBT
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations					
Traffic Volume (vph)	15	261	37	300	68
Future Volume (vph)	15	261	37	300	68
Lane Group Flow (vph)	0	464	0	424	415
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	44.8	44.8	44.8	44.8	26.3
Total Split (%)	63.0%	63.0%	63.0%	63.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.81		0.78	0.64
Control Delay		26.3		25.8	22.4
Queue Delay		0.0		0.0	0.0
Total Delay		26.3		25.8	22.4
Queue Length 50th (m)		37.7		36.9	32.1
Queue Length 95th (m)		64.0		60.8	#88.5
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		964		951	653
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.48		0.45	0.64

Intersection Summary

Cycle Length: 71.1

Actuated Cycle Length: 58.8

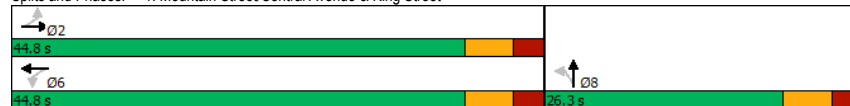
Natural Cycle: 65

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street

053923_EX&BG.syn
R.J. Burnside & AssociatesSynchro 11 Report
05/11/2023 - Page 1

HCM Signalized Intersection Capacity Analysis

Ex AM

1: Mountain Street/Central Avenue & King Street

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	261	132	37	300	36	236	68	62	0	0	0
Future Volume (vph)	15	261	132	37	300	36	236	68	62	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		0.96			0.99			0.98				
Flt Protected		1.00			1.00			0.97				
Satd. Flow (prot)		1472			1551			1621				
Flt Permitted		0.98			0.92			0.97				
Satd. Flow (perm)		1438			1438			1621				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	17	297	150	42	341	41	268	77	70	0	0	0
RTOR Reduction (vph)	0	32	0	0	7	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	432	0	0	417	0	0	407	0	0	0	0
Confl. Peds. (#/hr)	18		7	7		18	6		10	10		6
Heavy Vehicles (%)	7%	4%	16%	12%	6%	0%	12%	5%	14%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5	5	5	5	5	5
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		22.0			22.0			23.4				
Effective Green, g (s)		22.0			22.0			23.4				
Actuated g/C Ratio		0.38			0.38			0.40				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			2.5				
Lane Grp Cap (vph)		540			540			648				
v/s Ratio Prot												
v/s Ratio Perm		0.30			0.29			0.25				
v/c Ratio		0.80			0.77			0.63				
Uniform Delay, d1		16.3			16.0			14.1				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		7.9			6.5			4.6				
Delay (s)		24.1			22.5			18.6				
Level of Service		C			C			B				
Approach Delay (s)		24.1			22.5			18.6			0.0	
Approach LOS		C			C			B			A	

Intersection Summary

HCM 2000 Control Delay 21.8 HCM 2000 Level of Service C

HCM 2000 Volume to Capacity ratio 0.71

Actuated Cycle Length (s) 58.5 Sum of lost time (s) 13.1

Intersection Capacity Utilization 72.0% ICU Level of Service C

Analysis Period (min) 15

c Critical Lane Group

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HCM Unsignalized Intersection Capacity Analysis 2: Hixon Street & King Street

Ex AM

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	234	39	73	321	26	53
Future Volume (Veh/h)	234	39	73	321	26	53
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	275	46	86	378	31	62
Pedestrians					24	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			345		872	322
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			345		872	322
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		89	91
cM capacity (veh/h)			1180		291	702
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	321	464	93			
Volume Left	0	86	31			
Volume Right	46	0	62			
cSH	1700	1180	477			
Volume to Capacity	0.19	0.07	0.19			
Queue Length 95th (m)	0.0	1.8	5.4			
Control Delay (s)	0.0	2.2	14.4			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.2	14.4			
Approach LOS			B			
Intersection Summary						
Average Delay			2.7			
Intersection Capacity Utilization			50.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 7: Mountain Street & Highland Park Drive/Hillside Drive

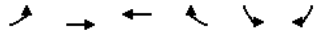
Ex AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	23	2	6	26	1	35	4	179	22	24	134	19
Future Volume (Veh/h)	23	2	6	26	1	35	4	179	22	24	134	19
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	24	2	6	28	1	37	4	190	23	26	143	20
Pedestrians					2			4				
Lane Width (m)					3.7			3.7				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	452	428	157	428	426	204	163			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	452	428	157	428	426	204	163			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	99	95	100	96	100			98		
cM capacity (veh/h)	488	510	890	516	511	841	1428			1341		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	32	66	217	189								
Volume Left	24	28	4	26								
Volume Right	6	37	23	20								
cSH	535	659	1428	1341								
Volume to Capacity	0.06	0.10	0.00	0.02								
Queue Length 95th (m)	1.4	2.5	0.1	0.5								
Control Delay (s)	12.2	11.1	0.2	1.2								
Lane LOS	B	B	A	A								
Approach Delay (s)	12.2	11.1	0.2	1.2								
Approach LOS	B	B										
Intersection Summary												
Average Delay				2.7								
Intersection Capacity Utilization				33.1%			ICU Level of Service			A		
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

Ex AM

8: Hillside Drive /Hillside Drive & Ashby Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	↔
Traffic Volume (veh/h)	20	21	29	6	11	37
Future Volume (Veh/h)	20	21	29	6	11	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.63	0.63	0.63	0.63	0.63	0.63
Hourly flow rate (vph)	32	33	46	10	17	59
Pedestrians					22	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	78				170	73
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	78				170	73
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				98	94
cM capacity (veh/h)	1500				790	960
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	65	56	76			
Volume Left	32	0	17			
Volume Right	0	10	59			
cSH	1500	1700	916			
Volume to Capacity	0.02	0.03	0.08			
Queue Length 95th (m)	0.5	0.0	2.1			
Control Delay (s)	3.8	0.0	9.3			
Lane LOS	A		A			
Approach Delay (s)	3.8	0.0	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay		4.8				
Intersection Capacity Utilization		18.9%		ICU Level of Service	A	
Analysis Period (min)		15				

Timings

Ex PM

1: Mountain Street/Central Avenue & King Street

	↖	→	↗	←	↑
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations		↔		↔	↔
Traffic Volume (vph)	16	482	50	416	95
Future Volume (vph)	16	482	50	416	95
Lane Group Flow (vphpl)	0	680	0	556	356
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	44.8	44.8	44.8	44.8	26.3
Total Split (%)	63.0%	63.0%	63.0%	63.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		-3.0		0.0	0.0
Total Lost Time (s)		3.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.85		0.84	0.62
Control Delay		25.5		28.4	25.3
Queue Delay		0.0		0.0	0.0
Total Delay		25.5		28.4	25.3
Queue Length 50th (m)		64.9		55.9	38.4
Queue Length 95th (m)		#116.7		#100.4	68.9
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		955		807	573
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.71		0.69	0.62

Intersection Summary

Cycle Length: 71.1

Actuated Cycle Length: 67.8

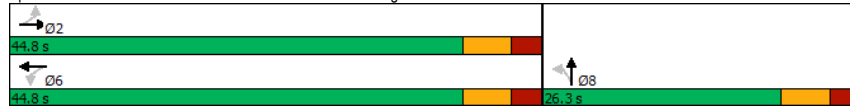
Natural Cycle: 65

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street

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HCM Signalized Intersection Capacity Analysis

Ex PM

1: Mountain Street/Central Avenue & King Street

	↖	→	↗	←	↖	↗	↖	↗	↖	↗	↖	↗
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔				
Traffic Volume (vph)	16	482	169	50	416	79	186	95	68	0	0	0
Future Volume (vph)	16	482	169	50	416	79	186	95	68	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			0.99			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		0.97			0.98			0.97				
Flt Protected		1.00			1.00			0.97				
Satd. Flow (prot)		1559			1575			1640				
Flt Permitted		0.98			0.89			0.97				
Satd. Flow (perm)		1535			1410			1640				
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	16	492	172	51	424	81	190	97	69	0	0	0
RTOR Reduction (vph)	0	20	0	0	10	0	0	11	0	0	0	0
Lane Group Flow (vph)	0	660	0	0	546	0	0	345	0	0	0	0
Confl. Peds. (#/hr)	33		17	17		33	13		29	29		13
Heavy Vehicles (%)	7%	1%	8%	2%	4%	0%	10%	8%	6%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5					
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		31.3			31.3			23.3				
Effective Green, g (s)		34.3			31.3			23.3				
Actuated g/C Ratio		0.51			0.46			0.34				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			2.5				
Lane Grp Cap (vph)		777			651			564				
v/s Ratio Prot												
v/s Ratio Perm		0.43			0.39			0.21				
v/c Ratio		0.85			0.84			0.61				
Uniform Delay, d1		14.5			16.0			18.4				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		8.5			9.1			4.9				
Delay (s)		23.0			25.1			23.3				
Level of Service		C			C			C				
Approach Delay (s)		23.0			25.1			23.3			0.0	
Approach LOS		C			C			C			A	

Intersection Summary

HCM 2000 Control Delay 23.8 HCM 2000 Level of Service C

HCM 2000 Volume to Capacity ratio 0.79

Actuated Cycle Length (s) 67.7 Sum of lost time (s) 13.1

Intersection Capacity Utilization 90.3% ICU Level of Service E

Analysis Period (min) 15

c Critical Lane Group

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HCM Unsignalized Intersection Capacity Analysis 2: Hixon Street & King Street

Ex PM

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (veh/h)	370	49	75	337	34	37
Future Volume (Veh/h)	370	49	75	337	34	37
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	389	52	79	355	36	39
Pedestrians	3			2	9	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.1			1.1	1.1	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			450		940	426
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			450		940	426
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		87	94
cM capacity (veh/h)			1111		271	626
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	441	434	75			
Volume Left	0	79	36			
Volume Right	52	0	39			
cSH	1700	1111	384			
Volume to Capacity	0.26	0.07	0.20			
Queue Length 95th (m)	0.0	1.7	5.4			
Control Delay (s)	0.0	2.2	16.6			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.2	16.6			
Approach LOS			C			
Intersection Summary						
Average Delay			2.3			
Intersection Capacity Utilization			59.3%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 7: Mountain Street & Highland Park Drive/Hillside Drive

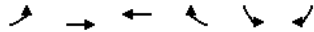
Ex PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (veh/h)	16	3	11	54	4	20	5	158	21	21	204	17
Future Volume (Veh/h)	16	3	11	54	4	20	5	158	21	21	204	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	17	3	11	56	4	21	5	165	22	22	212	18
Pedestrians					2			1			1	
Lane Width (m)					3.7			3.7			3.7	
Walking Speed (m/s)					1.1			1.1			1.1	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	475	464	222	466	462	179	230			189		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	475	464	222	466	462	179	230			189		
tC, single (s)	7.2	7.2	6.2	7.1	6.8	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.6	3.3	3.5	4.2	3.3	2.2			2.2		
p0 queue free %	96	99	99	89	99	98	100			98		
cM capacity (veh/h)	459	404	822	491	454	867	1350			1394		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	31	81	192	252								
Volume Left	17	56	5	22								
Volume Right	11	21	22	18								
cSH	536	550	1350	1394								
Volume to Capacity	0.06	0.15	0.00	0.02								
Queue Length 95th (m)	1.4	3.9	0.1	0.4								
Control Delay (s)	12.1	12.7	0.2	0.8								
Lane LOS	B	B	A	A								
Approach Delay (s)	12.1	12.7	0.2	0.8								
Approach LOS	B	B										
Intersection Summary												
Average Delay				3.0								
Intersection Capacity Utilization				34.9%				ICU Level of Service	A			
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

Ex PM

8: Hillside Drive /Hillside Drive & Ashby Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	↔
Traffic Volume (veh/h)	26	23	67	16	1	14
Future Volume (Veh/h)	26	23	67	16	1	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	34	30	88	21	1	18
Pedestrians					11	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	120				208	110
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	120				208	110
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	98
cM capacity (veh/h)	1464				759	939
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	64	109	19			
Volume Left	34	0	1			
Volume Right	0	21	18			
cSH	1464	1700	928			
Volume to Capacity	0.02	0.06	0.02			
Queue Length 95th (m)	0.5	0.0	0.5			
Control Delay (s)	4.1	0.0	9.0			
Lane LOS	A		A			
Approach Delay (s)	4.1	0.0	9.0			
Approach LOS			A			
Intersection Summary						
Average Delay			2.2			
Intersection Capacity Utilization		19.3%		ICU Level of Service	A	
Analysis Period (min)			15			



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

Background 2030 Traffic Operations

Timings
1: Mountain Street/Central Avenue & King Street

BG30 PM

	EBL	EBT	WBL	WBT	NBT
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations					
Traffic Volume (vph)	18	564	66	481	109
Future Volume (vph)	18	564	66	481	109
Lane Group Flow (vph)	0	792	0	651	411
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	44.8	44.8	44.8	44.8	26.3
Total Split (%)	63.0%	63.0%	63.0%	63.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		1.00		0.94	0.78
Control Delay		51.5		41.2	34.7
Queue Delay		0.0		0.0	0.0
Total Delay		51.5		41.2	34.7
Queue Length 50th (m)		98.7		77.3	49.8
Queue Length 95th (m)		#177.5		#147.7	#93.1
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		811		709	526
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.98		0.92	0.78

Intersection Summary

Cycle Length: 71.1
Actuated Cycle Length: 73.2
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street



HCM Signalized Intersection Capacity Analysis
1: Mountain Street/Central Avenue & King Street

BG30 PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	564	194	66	481	91	216	109	78	0	0	0
Future Volume (vph)	18	564	194	66	481	91	216	109	78	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			0.99			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		0.97			0.98			0.97				
Flt Protected		1.00			0.99			0.97				
Satd. Flow (prot)		1560			1573			1637				
Flt Permitted		0.98			0.85			0.97				
Satd. Flow (perm)		1530			1351			1637				
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	18	576	198	67	491	93	220	111	80	0	0	0
RTOR Reduction (vph)	0	18	0	0	9	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	774	0	0	642	0	0	399	0	0	0	0
Confl. Peds. (#/hr)	33		17	17		33	13		29	29		13
Heavy Vehicles (%)	7%	1%	8%	2%	4%	0%	10%	8%	6%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5	5	5	5	5	5
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		37.1			37.1			23.0				
Effective Green, g (s)		37.1			37.1			23.0				
Actuated g/C Ratio		0.51			0.51			0.31				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			2.5				
Lane Grp Cap (vph)		775			684			514				
v/s Ratio Prot												
v/s Ratio Perm		c0.51			0.48			0.24				
v/c Ratio		1.00			0.94			0.78				
Uniform Delay, d1		18.0			17.0			22.8				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		31.8			20.5			11.0				
Delay (s)		49.9			37.5			33.8				
Level of Service		D			D			C				
Approach Delay (s)		49.9			37.5			33.8			0.0	
Approach LOS		D			D			C			A	

Intersection Summary

HCM 2000 Control Delay 42.0 HCM 2000 Level of Service D
HCM 2000 Volume to Capacity ratio 0.91
Actuated Cycle Length (s) 73.2 Sum of lost time (s) 13.1
Intersection Capacity Utilization 106.4% ICU Level of Service G
Analysis Period (min) 15
c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis 2: Hixon Street & King Street

BG30 PM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↗	↖	↗
Traffic Volume (veh/h)	435	56	86	399	39	43
Future Volume (Veh/h)	435	56	86	399	39	43
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	458	59	91	420	41	45
Pedestrians	3			2	9	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.1			1.1	1.1	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			526		1102	498
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			526		1102	498
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			91		81	92
cM capacity (veh/h)			1042		213	570
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	517	511	86			
Volume Left	0	91	41			
Volume Right	59	0	45			
cSH	1700	1042	317			
Volume to Capacity	0.30	0.09	0.27			
Queue Length 95th (m)	0.0	2.2	8.2			
Control Delay (s)	0.0	2.4	20.5			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.4	20.5			
Approach LOS			C			
Intersection Summary						
Average Delay		2.7				
Intersection Capacity Utilization		67.6%		ICU Level of Service	C	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis 7: Mountain Street & Highland Park Drive/Hillside Drive

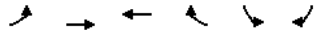
BG30 PM

	↖	→	↘	↙	←	↖	↗	↘	↙	↖	↗	↘	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↖			↗			↖			↗		
Traffic Volume (veh/h)	19	3	17	62	5	23	10	181	24	24	234	24	
Future Volume (Veh/h)	19	3	17	62	5	23	10	181	24	24	234	24	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Hourly flow rate (vph)	20	3	18	65	5	24	10	189	25	25	244	25	
Pedestrians					2			1				1	
Lane Width (m)					3.7			3.7				3.7	
Walking Speed (m/s)					1.1			1.1				1.1	
Percent Blockage					0			0				0	
Right turn flare (veh)													
Median type								None				None	
Median storage (veh)													
Upstream signal (m)													
pX, platoon unblocked													
vC, conflicting volume	556	542	258	550	542	204	269			216			
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	556	542	258	550	542	204	269			216			
tC, single (s)	7.2	7.2	6.2	7.1	6.8	6.2	4.1			4.1			
tC, 2 stage (s)													
tF (s)	3.6	4.6	3.3	3.5	4.2	3.3	2.2			2.2			
p0 queue free %	95	99	98	85	99	97	99			98			
cM capacity (veh/h)	400	359	785	425	405	839	1306			1363			
Direction, Lane #	EB 1	WB 1	NB 1	SB 1									
Volume Total	41	94	224	294									
Volume Left	20	65	10	25									
Volume Right	18	24	25	25									
cSH	505	485	1306	1363									
Volume to Capacity	0.08	0.19	0.01	0.02									
Queue Length 95th (m)	2.0	5.4	0.2	0.4									
Control Delay (s)	12.8	14.2	0.4	0.8									
Lane LOS	B	B	A	A									
Approach Delay (s)	12.8	14.2	0.4	0.8									
Approach LOS	B	B											
Intersection Summary													
Average Delay			3.4										
Intersection Capacity Utilization			37.0%		ICU Level of Service	A							
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis

BG30 PM

8: Hillside Drive /Hillside Drive & Ashby Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	↔
Traffic Volume (veh/h)	30	26	77	18	1	16
Future Volume (Veh/h)	30	26	77	18	1	16
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	39	34	101	24	1	21
Pedestrians					11	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	136			236	124	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	136			236	124	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	97			100	98	
cM capacity (veh/h)	1445			728	922	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	73	125	22			
Volume Left	39	0	1			
Volume Right	0	24	21			
cSH	1445	1700	911			
Volume to Capacity	0.03	0.07	0.02			
Queue Length 95th (m)	0.6	0.0	0.6			
Control Delay (s)	4.1	0.0	9.0			
Lane LOS	A		A			
Approach Delay (s)	4.1	0.0	9.0			
Approach LOS			A			
Intersection Summary						
Average Delay		2.3				
Intersection Capacity Utilization		19.7%		ICU Level of Service	A	
Analysis Period (min)		15				

Timings

BG30 AM

1: Mountain Street/Central Avenue & King Street

	EBL	EBT	WBL	WBT	NBT
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations		↔		↔	↔
Traffic Volume (vph)	17	312	48	346	78
Future Volume (vph)	17	312	48	346	78
Lane Group Flow (vphpl)	0	547	0	495	483
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	44.8	44.8	44.8	44.8	26.3
Total Split (%)	63.0%	63.0%	63.0%	63.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.87		0.84	0.79
Control Delay		30.0		29.6	32.4
Queue Delay		0.0		0.0	0.0
Total Delay		30.0		29.6	32.4
Queue Length 50th (m)		50.1		47.5	48.5
Queue Length 95th (m)		83.3		78.2	#115.5
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		900		857	608
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.61		0.58	0.79

Intersection Summary

Cycle Length: 71.1

Actuated Cycle Length: 63.2

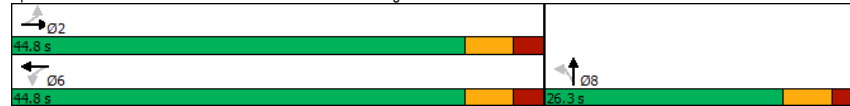
Natural Cycle: 70

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street

053923_EX&BG.syn
R.J. Burnside & AssociatesSynchro 11 Report
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HCM Signalized Intersection Capacity Analysis

BG30 AM

1: Mountain Street/Central Avenue & King Street

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔				
Traffic Volume (vph)	17	312	152	48	346	41	275	78	71	0	0	0
Future Volume (vph)	17	312	152	48	346	41	275	78	71	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		0.96			0.99			0.98				
Flt Protected		1.00			0.99			0.97				
Satd. Flow (prot)		1475			1549			1620				
Flt Permitted		0.97			0.89			0.97				
Satd. Flow (perm)		1439			1392			1620				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	19	355	173	55	393	47	312	89	81	0	0	0
RTOR Reduction (vph)	0	29	0	0	6	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	518	0	0	489	0	0	474	0	0	0	0
Confl. Peds. (#/hr)	18		7	7		18	6		10	10		6
Heavy Vehicles (%)	7%	4%	16%	12%	6%	0%	12%	5%	14%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5						
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		26.4			26.4			23.4				
Effective Green, g (s)		26.4			26.4			23.4				
Actuated g/C Ratio		0.42			0.42			0.37				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			3.0				
Lane Grp Cap (vph)		603			584			602				
v/s Ratio Prot												
v/s Ratio Perm		0.36			0.35			0.29				
v/c Ratio		0.86			0.84			0.79				
Uniform Delay, d1		16.6			16.3			17.5				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		11.5			9.9			10.0				
Delay (s)		28.1			26.3			27.6				
Level of Service		C			C			C				
Approach Delay (s)		28.1			26.3			27.6			0.0	
Approach LOS		C			C			C			A	

Intersection Summary

HCM 2000 Control Delay 27.3 HCM 2000 Level of Service C

HCM 2000 Volume to Capacity ratio 0.82

Actuated Cycle Length (s) 62.9 Sum of lost time (s) 13.1

Intersection Capacity Utilization 83.2% ICU Level of Service E

Analysis Period (min) 15

c Critical Lane Group

053923_EX&BG.syn
R.J. Burnside & AssociatesSynchro 11 Report
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HCM Unsignalized Intersection Capacity Analysis 2: Hixon Street & King Street

BG30 AM

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	281	45	84	375	30	61
Future Volume (Veh/h)	281	45	84	375	30	61
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	331	53	99	441	35	72
Pedestrians					24	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			408		1020	382
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			408		1020	382
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			91		85	89
cM capacity (veh/h)			1118		233	650
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	384	540	107			
Volume Left	0	99	35			
Volume Right	53	0	72			
cSH	1700	1118	410			
Volume to Capacity	0.23	0.09	0.26			
Queue Length 95th (m)	0.0	2.2	7.8			
Control Delay (s)	0.0	2.4	16.8			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.4	16.8			
Approach LOS			C			
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			57.6%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 7: Mountain Street & Highland Park Drive/Hillside Drive

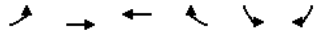
BG30 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	28	2	12	30	1	40	9	206	25	28	154	24
Future Volume (Veh/h)	28	2	12	30	1	40	9	206	25	28	154	24
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	30	2	13	32	1	43	10	219	27	30	164	26
Pedestrians					2			4				
Lane Width (m)					3.7			3.7				
Walking Speed (m/s)					1.1			1.1				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	533	505	181	510	504	234	190			248		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	533	505	181	510	504	234	190			248		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	100	98	93	100	95	99			98		
cM capacity (veh/h)	425	457	863	449	458	808	1396			1304		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	45	76	256	220								
Volume Left	30	32	10	30								
Volume Right	13	43	27	26								
cSH	500	600	1396	1304								
Volume to Capacity	0.09	0.13	0.01	0.02								
Queue Length 95th (m)	2.2	3.3	0.2	0.5								
Control Delay (s)	12.9	11.9	0.4	1.2								
Lane LOS	B	B	A	A								
Approach Delay (s)	12.9	11.9	0.4	1.2								
Approach LOS	B	B										
Intersection Summary												
Average Delay				3.1								
Intersection Capacity Utilization				33.4%			ICU Level of Service			A		
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

BG30 AM

8: Hillside Drive /Hillside Drive & Ashby Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	↔
Traffic Volume (veh/h)	23	24	33	7	13	43
Future Volume (Veh/h)	23	24	33	7	13	43
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.63	0.63	0.63	0.63	0.63	0.63
Hourly flow rate (vph)	37	38	52	11	21	68
Pedestrians					22	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	85				192	80
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	85				192	80
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				97	93
cM capacity (veh/h)	1491				765	952
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	75	63	89			
Volume Left	37	0	21			
Volume Right	0	11	68			
cSH	1491	1700	900			
Volume to Capacity	0.02	0.04	0.10			
Queue Length 95th (m)	0.6	0.0	2.5			
Control Delay (s)	3.8	0.0	9.4			
Lane LOS	A		A			
Approach Delay (s)	3.8	0.0	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization		19.2%		ICU Level of Service	A	
Analysis Period (min)			15			

Timings
1: Mountain Street/Central Avenue & King Street

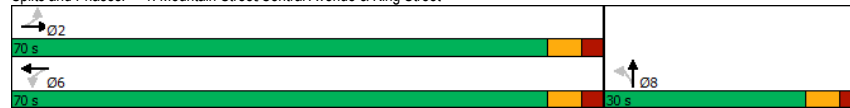
BG30 PM Impt
Improvements

	EBL	EBT	WBL	WBT	NBT
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations		↔		↔	↔
Traffic Volume (vph)	18	564	66	481	109
Future Volume (vph)	18	564	66	481	109
Lane Group Flow (vph)	0	792	0	651	411
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	70.0	70.0	70.0	70.0	30.0
Total Split (%)	70.0%	70.0%	70.0%	70.0%	30.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.91		0.85	0.88
Control Delay		31.4		26.1	53.7
Queue Delay		0.0		0.0	0.0
Total Delay		31.4		26.1	53.7
Queue Length 50th (m)		101.9		78.8	64.4
Queue Length 95th (m)		162.8		128.3	#142.8
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		1160		1032	468
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.68		0.63	0.88

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 85.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street



HCM Signalized Intersection Capacity Analysis
1: Mountain Street/Central Avenue & King Street

BG30 PM Impt
Improvements

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔				
Traffic Volume (vph)	18	564	194	66	481	91	216	109	78	0	0	0
Future Volume (vph)	18	564	194	66	481	91	216	109	78	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			0.99			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		0.97			0.98			0.97				
Flt Protected		1.00			0.99			0.97				
Satd. Flow (prot)		1558			1572			1631				
Flt Permitted		0.98			0.86			0.97				
Satd. Flow (perm)		1529			1363			1631				
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	18	576	198	67	491	93	220	111	80	0	0	0
RTOR Reduction (vph)	0	14	0	0	7	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	778	0	0	644	0	0	403	0	0	0	0
Confl. Peds. (#/hr)	33		17	17		33	13		29	29		13
Heavy Vehicles (%)	7%	1%	8%	2%	4%	0%	10%	8%	6%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5					
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		48.0			48.0			24.3				
Effective Green, g (s)		48.0			48.0			24.3				
Actuated g/C Ratio		0.56			0.56			0.28				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		859			766			464				
v/s Ratio Prot												
v/s Ratio Perm		c0.51			0.47			0.25				
v/c Ratio		0.91			0.84			0.87				
Uniform Delay, d1		16.7			15.5			29.0				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		12.9			8.3			19.3				
Delay (s)		29.6			23.8			48.4				
Level of Service		C			C			D				
Approach Delay (s)		29.6			23.8			48.4			0.0	
Approach LOS		C			C			D			A	

Intersection Summary

HCM 2000 Control Delay 31.7 HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio 0.89
Actuated Cycle Length (s) 85.4 Sum of lost time (s) 13.1
Intersection Capacity Utilization 106.4% ICU Level of Service G
Analysis Period (min) 15
c Critical Lane Group



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix F

Total 2030 Traffic Operations

Timings

1: Mountain Street/Central Avenue & King Street

Tot30 AM

2030 Total AM Conditions

					
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations					
Traffic Volume (vph)	17	326	48	351	78
Future Volume (vph)	17	326	48	351	78
Lane Group Flow (vphpl)	0	565	0	501	533
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	44.8	44.8	44.8	44.8	26.3
Total Split (%)	63.0%	63.0%	63.0%	63.0%	37.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.88		0.84	0.89
Control Delay		31.2		29.0	42.1
Queue Delay		0.0		0.0	0.0
Total Delay		31.2		29.0	42.1
Queue Length 50th (m)		53.0		48.5	58.3
Queue Length 95th (m)		88.3		79.9	#132.5
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		890		844	599
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.63		0.59	0.89

Intersection Summary

Cycle Length: 71.1

Actuated Cycle Length: 64

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street



053923_TOT.syn

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Synchro 11 Report

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HCM Signalized Intersection Capacity Analysis

1: Mountain Street/Central Avenue & King Street

Tot30 AM

2030 Total AM Conditions

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	326	155	48	351	41	319	78	71	0	0	0
Future Volume (vph)	17	326	155	48	351	41	319	78	71	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.8			6.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			1.00			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		0.96			0.99			0.98				
Flt Protected		1.00			0.99			0.97				
Satd. Flow (prot)		1477			1549			1620				
Flt Permitted		0.97			0.89			0.97				
Satd. Flow (perm)		1442			1391			1620				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	19	370	176	55	399	47	362	89	81	0	0	0
RTOR Reduction (vph)	0	28	0	0	6	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	537	0	0	495	0	0	525	0	0	0	0
Confl. Peds. (#/hr)	18		7	7		18	6		10	10		6
Heavy Vehicles (%)	7%	4%	16%	12%	6%	0%	12%	5%	14%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5					
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		27.3			27.3			23.4				
Effective Green, g (s)		27.3			27.3			23.4				
Actuated g/C Ratio		0.43			0.43			0.37				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			2.5				
Lane Grp Cap (vph)		617			595			594				
v/s Ratio Prot												
v/s Ratio Perm		0.37			0.36			0.32				
v/c Ratio		0.87			0.83			0.88				
Uniform Delay, d1		16.6			16.2			18.9				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		12.6			9.5			17.3				
Delay (s)		29.3			25.7			36.2				
Level of Service		C			C			D				
Approach Delay (s)		29.3			25.7			36.2			0.0	
Approach LOS		C			C			D			A	

Intersection Summary

HCM 2000 Control Delay

HCM 2000 Volume to Capacity ratio

Actuated Cycle Length (s)

Intersection Capacity Utilization

Analysis Period (min)

c Critical Lane Group

HCM 2000 Level of Service

Sum of lost time (s)

ICU Level of Service

C

13.1

E

15

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Synchro 11 Report

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HCM Unsignalized Intersection Capacity Analysis 2: Hixon Street & King Street

Tot30 AM
2030 Total AM Conditions

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↖			↖	↖	
Traffic Volume (veh/h)	281	59	85	375	35	64
Future Volume (Veh/h)	281	59	85	375	35	64
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	331	69	100	441	41	75
Pedestrians					24	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			424		1030	390
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			424		1030	390
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			91		82	88
cM capacity (veh/h)			1103		230	643
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	400	541	116			
Volume Left	0	100	41			
Volume Right	69	0	75			
cSH	1700	1103	393			
Volume to Capacity	0.24	0.09	0.30			
Queue Length 95th (m)	0.0	2.3	9.2			
Control Delay (s)	0.0	2.4	18.0			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.4	18.0			
Approach LOS			C			
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			59.1%	ICU Level of Service	B	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 5: Ashby Drive & Hope Street

Tot30 AM
2030 Total AM Conditions

	↖	↘	↙	↑	↓	↗
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖			↖	↖	
Traffic Volume (veh/h)	22	20	3	14	5	9
Future Volume (Veh/h)	22	20	3	14	5	9
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	24	22	3	15	5	10
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	31	10	15			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	31	10	15			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	100			
cM capacity (veh/h)	981	1071	1603			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	46	18	15			
Volume Left	24	3	0			
Volume Right	22	0	10			
cSH	1022	1603	1700			
Volume to Capacity	0.04	0.00	0.01			
Queue Length 95th (m)	1.1	0.0	0.0			
Control Delay (s)	8.7	1.2	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.7	1.2	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.3			
Intersection Capacity Utilization			13.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
7: Mountain Street & Highland Park Drive/Hillside Drive

Tot30 AM
2030 Total AM Conditions

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	2	12	38	1	71	9	206	28	31	154	24
Future Volume (Veh/h)	28	2	12	38	1	71	9	206	28	31	154	24
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	30	2	13	40	1	76	10	219	30	33	164	26
Pedestrians				2			4					
Lane Width (m)				3.7			3.7					
Walking Speed (m/s)				1.1			1.1					
Percent Blockage				0			0					
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	574	514	181	517	512	236	190				251	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	574	514	181	517	512	236	190				251	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	92	100	98	91	100	91	99				97	
cM capacity (veh/h)	381	451	863	443	452	806	1396				1300	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	45	117	259	223								
Volume Left	30	40	10	33								
Volume Right	13	76	30	26								
cSH	458	626	1396	1300								
Volume to Capacity	0.10	0.19	0.01	0.03								
Queue Length 95th (m)	2.5	5.2	0.2	0.6								
Control Delay (s)	13.7	12.1	0.4	1.4								
Lane LOS	B	B	A	A								
Approach Delay (s)	13.7	12.1	0.4	1.4								
Approach LOS	B	B										
Intersection Summary												
Average Delay				3.8								
Intersection Capacity Utilization				36.5%	ICU Level of Service			A				
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis
8: Hillside Drive /Hillside Drive & Ashby Drive

Tot30 AM
2030 Total AM Conditions

												
Movement	EBL	EBT	WBT	WBR	SBL	SBR						
Lane Configurations												
Traffic Volume (veh/h)	29	24	33	7	13	82						
Future Volume (Veh/h)	29	24	33	7	13	82						
Sign Control	Free		Free		Stop							
Grade	0%		0%		0%							
Peak Hour Factor	0.63	0.63	0.63	0.63	0.63	0.63						
Hourly flow rate (vph)	46	38	52	11	21	130						
Pedestrians			22									
Lane Width (m)			3.7									
Walking Speed (m/s)			1.1									
Percent Blockage			2									
Right turn flare (veh)												
Median type	None		None									
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	85			210		80						
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	85			210		80						
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			97		86						
cM capacity (veh/h)	1491			743		952						
Direction, Lane #	EB 1	WB 1	SB 1									
Volume Total	84	63	151									
Volume Left	46	0	21									
Volume Right	0	11	130									
cSH	1491	1700	916									
Volume to Capacity	0.03	0.04	0.16									
Queue Length 95th (m)	0.7	0.0	4.5									
Control Delay (s)	4.2	0.0	9.7									
Lane LOS	A		A									
Approach Delay (s)	4.2	0.0	9.7									
Approach LOS			A									
Intersection Summary												
Average Delay			6.1									
Intersection Capacity Utilization			22.0%		ICU Level of Service			A				
Analysis Period (min)			15									

Timings
1: Mountain Street/Central Avenue & King Street

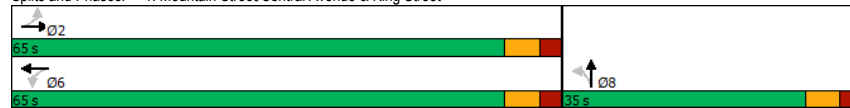
Tot30 PM
2030 Total PM Conditions

	EBL	EBT	WBL	WBT	NBT
Lane Group	EBL	EBT	WBL	WBT	NBT
Lane Configurations		↔		↔	↔
Traffic Volume (vph)	18	602	66	484	109
Future Volume (vph)	18	602	66	484	109
Lane Group Flow (vph)	0	840	0	654	441
Turn Type	Perm	NA	Perm	NA	NA
Protected Phases		2		6	8
Permitted Phases	2		6		
Detector Phase	2	2	6	6	8
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0
Minimum Split (s)	33.8	33.8	33.8	33.8	29.3
Total Split (s)	65.0	65.0	65.0	65.0	35.0
Total Split (%)	65.0%	65.0%	65.0%	65.0%	35.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.2
Lost Time Adjust (s)		-3.0		-2.0	0.0
Total Lost Time (s)		3.8		4.8	6.3
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	Max
v/c Ratio		0.92		0.84	0.88
Control Delay		33.8		27.0	52.3
Queue Delay		0.0		0.0	0.0
Total Delay		33.8		27.0	52.3
Queue Length 50th (m)		123.3		88.3	81.3
Queue Length 95th (m)		#216.3		144.2	#139.6
Internal Link Dist (m)		237.0		85.2	180.6
Turn Bay Length (m)					
Base Capacity (vph)		1009		869	503
Starvation Cap Reductn		0		0	0
Spillback Cap Reductn		0		0	0
Storage Cap Reductn		0		0	0
Reduced v/c Ratio		0.83		0.75	0.88

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 94.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Mountain Street/Central Avenue & King Street



HCM Signalized Intersection Capacity Analysis
1: Mountain Street/Central Avenue & King Street

Tot30 PM
2030 Total PM Conditions

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔				
Traffic Volume (vph)	18	602	204	66	484	91	245	109	78	0	0	0
Future Volume (vph)	18	602	204	66	484	91	245	109	78	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.8			4.8			6.3				
Lane Util. Factor		1.00			1.00			1.00				
Frpb, ped/bikes		0.99			0.99			0.99				
Flpb, ped/bikes		1.00			1.00			0.98				
Frt		0.97			0.98			0.98				
Flt Protected		1.00			0.99			0.97				
Satd. Flow (prot)		1558			1571			1627				
Flt Permitted		0.98			0.85			0.97				
Satd. Flow (perm)		1532			1348			1627				
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	18	614	208	67	494	93	250	111	80	0	0	0
RTOR Reduction (vph)	0	13	0	0	6	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	827	0	0	648	0	0	433	0	0	0	0
Confl. Peds. (#/hr)	33		17	17		33	13		29	29		13
Heavy Vehicles (%)	7%	1%	8%	2%	4%	0%	10%	8%	6%	0%	0%	0%
Parking (#/hr)	5	5	5	5	5	5	5	5	5	5	5	5
Turn Type	Perm	NA		Perm	NA		Perm	NA				
Protected Phases		2			6			8				
Permitted Phases	2			6			8					
Actuated Green, G (s)		52.5			52.5			28.9				
Effective Green, g (s)		55.5			54.5			28.9				
Actuated g/C Ratio		0.59			0.58			0.31				
Clearance Time (s)		6.8			6.8			6.3				
Vehicle Extension (s)		2.5			2.5			2.5				
Lane Grp Cap (vph)		899			777			497				
v/s Ratio Prot												
v/s Ratio Perm		0.54			0.48			0.27				
v/c Ratio		0.92			0.83			0.87				
Uniform Delay, d1		17.5			16.3			31.0				
Progression Factor		1.00			1.00			1.00				
Incremental Delay, d2		14.4			7.5			18.6				
Delay (s)		31.9			23.8			49.7				
Level of Service		C			C			D				
Approach Delay (s)		31.9			23.8			49.7			0.0	
Approach LOS		C			C			D			A	

Intersection Summary

HCM 2000 Control Delay 33.2 HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio 0.91
Actuated Cycle Length (s) 94.5 Sum of lost time (s) 11.1
Intersection Capacity Utilization 107.2% ICU Level of Service G
Analysis Period (min) 15
c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Hixon Street & King Street

Tot30 PM
2030 Total PM Conditions

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖	↗	↖
Traffic Volume (veh/h)	435	94	89	399	42	45
Future Volume (Veh/h)	435	94	89	399	42	45
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	458	99	94	420	44	47
Pedestrians	3			2	9	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.1			1.1	1.1	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	109					
pX, platoon unblocked						
vC, conflicting volume			566		1128	518
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			566		1128	518
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			91		78	92
cM capacity (veh/h)			1007		204	555
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	557	514	91			
Volume Left	0	94	44			
Volume Right	99	0	47			
cSH	1700	1007	303			
Volume to Capacity	0.33	0.09	0.30			
Queue Length 95th (m)	0.0	2.3	9.3			
Control Delay (s)	0.0	2.5	21.9			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.5	21.9			
Approach LOS			C			
Intersection Summary						
Average Delay			2.8			
Intersection Capacity Utilization			70.4%	ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: Ashby Drive & Hope Street

Tot30 PM
2030 Total PM Conditions

	↖	↘	↙	↑	↓	↗
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖			↖	↖	↖
Traffic Volume (veh/h)	14	13	10	21	21	23
Future Volume (Veh/h)	14	13	10	21	21	23
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	14	11	23	23	25
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	80	36	48			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80	36	48			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	99	99			
cM capacity (veh/h)	915	1037	1559			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	29	34	48			
Volume Left	15	11	0			
Volume Right	14	0	25			
cSH	970	1559	1700			
Volume to Capacity	0.03	0.01	0.03			
Queue Length 95th (m)	0.7	0.2	0.0			
Control Delay (s)	8.8	2.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.8	2.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			18.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
7: Mountain Street & Highland Park Drive/Hillside Drive

Tot30 PM
2030 Total PM Conditions

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	3	17	67	5	43	10	181	33	34	234	24
Future Volume (Veh/h)	19	3	17	67	5	43	10	181	33	34	234	24
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	20	3	18	70	5	45	10	189	34	35	244	25
Pedestrians				2			1			1		
Lane Width (m)				3.7			3.7			3.7		
Walking Speed (m/s)				1.1			1.1			1.1		
Percent Blockage				0			0			0		
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	601	572	258	575	567	209	269				225	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	601	572	258	575	567	209	269				225	
tC, single (s)	7.2	7.2	6.2	7.1	6.8	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.6	4.6	3.3	3.5	4.2	3.3	2.2				2.2	
p0 queue free %	94	99	98	83	99	95	99				97	
cM capacity (veh/h)	361	342	785	407	389	834	1306				1353	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	41	120	233	304								
Volume Left	20	70	10	35								
Volume Right	18	45	34	25								
cSH	471	502	1306	1353								
Volume to Capacity	0.09	0.24	0.01	0.03								
Queue Length 95th (m)	2.2	7.0	0.2	0.6								
Control Delay (s)	13.4	14.4	0.4	1.1								
Lane LOS	B	B	A	A								
Approach Delay (s)	13.4	14.4	0.4	1.1								
Approach LOS	B	B										
Intersection Summary												
Average Delay				3.9								
Intersection Capacity Utilization				42.7%	ICU Level of Service			A				
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis
8: Hillside Drive /Hillside Drive & Ashby Drive

Tot30 PM
2030 Total PM Conditions

						
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	49	26	77	18	1	41
Future Volume (Veh/h)	49	26	77	18	1	41
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76
Hourly flow rate (vph)	64	34	101	24	1	54
Pedestrians					11	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	136				286	124
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	136				286	124
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				100	94
cM capacity (veh/h)	1445				670	922
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	98	125	55			
Volume Left	64	0	1			
Volume Right	0	24	54			
cSH	1445	1700	916			
Volume to Capacity	0.04	0.07	0.06			
Queue Length 95th (m)	1.1	0.0	1.5			
Control Delay (s)	5.1	0.0	9.2			
Lane LOS	A		A			
Approach Delay (s)	5.1	0.0	9.2			
Approach LOS			A			
Intersection Summary						
Average Delay			3.6			
Intersection Capacity Utilization		20.7%		ICU Level of Service		A
Analysis Period (min)		15				



BURNSIDE

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Appendix G

Signal Warrant Analysis

Input Sheet

Main Road	Mountain Street
Minor Road	Hillside / Highland
Direction of Main Road	North / South
Date:	Background 2030 C
No. of Lanes on Main	1
T-Intersection	No
Operating Environment	Urban
Scenario	Forecasted Traffic Volumes (Existing Intersection)

Analysis Sheet

Justification 1: Minimum Vehicle Volumes

Justification	Guidance Approach Lanes				Total	Section Percent
	1 Lanes		2 or More Lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
1A (All Approach Lanes)	480	720	600	900		
		x				
	COMPLIANCE %				296	41%
1B (Minor Street Both Approaches)	120	170	120	170		
		x				
	COMPLIANCE %				61	36%
Signal Justification 1:						

Justification 2: Delay to Cross Traffic

Justification	Guidance Approach Lanes				Total	Section Percent
	1 lanes		2 or More lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
2A (Major Street Both Approaches)	480	720	600	900		
		x				
	COMPLIANCE %				236	33%
2B (Traffic Crossing Major Street)	50	75	50	75		
		x				
	COMPLIANCE %				37	49%
Signal Justification 2:						

Justification 3: Combination (Justification 1 and 2)

Justification Satisfied 80% or More	
Justification 1	Minimum Vehicular Volume
Justification 2	Delay Cross Traffic

Results Sheet

Justification		Compliance	Minimum Target	Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A. Total Volume	41%	120%		NO
	B. Crossing Volume	36%			
2. Delay to Cross Traffic	A. Main Road	33%	120%		NO
	B. Crossing Road	49%			
3. Combination	A. Justificaton 1	36%	120%		NO
	B. Justification 2	33%			

Input Sheet

Main Road	Mountain Street
Minor Road	Hillside / Highland
Direction of Main Road	North / South
Date:	Total 2030
No. of Lanes on Main	1
T-Intersection	No
Operating Environment	Urban
Scenario	Forecasted Traffic Volumes (Existing Intersection)

Analysis Sheet

Justification 1: Minimum Vehicle Volumes						
Justification	Guidance Approach Lanes				Total	Section Percent
	1 Lanes		2 or More Lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
1A (All Approach Lanes)	480	720	600	900		
		x				
COMPLIANCE %					319	44%
1B (Minor Street Both Approaches)	120	170	120	170		
		x				
COMPLIANCE %						
Signal Justification 1:						

Justification 2: Delay to Cross Traffic						
Justification	Guidance Approach Lanes				Total	Section Percent
	1 lanes		2 or More lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
2A (Major Street Both Approaches)	480	720	600	900		
		x				
COMPLIANCE %					242	34%
2B (Traffic Crossing Major Street)	50	75	50	75		
		x				
COMPLIANCE %						
Signal Justification 2:						

Justification 3: Combination (Justification 1 and 2)	
Justification Satisfied 80% or More	
Justification 1	Minimum Vehicular Volume
Justification 2	Delay Cross Traffic

Results Sheet

Justification		Compliance	Minimum Target	Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A. Total Volume	44%	120%		NO
	B. Crossing Volume	45%			
2. Delay to Cross Traffic	A. Main Road	34%	120%		NO
	B. Crossing Road	53%			
3. Combination	A. Justificaton 1	44%	120%		NO
	B. Justification 2	34%			

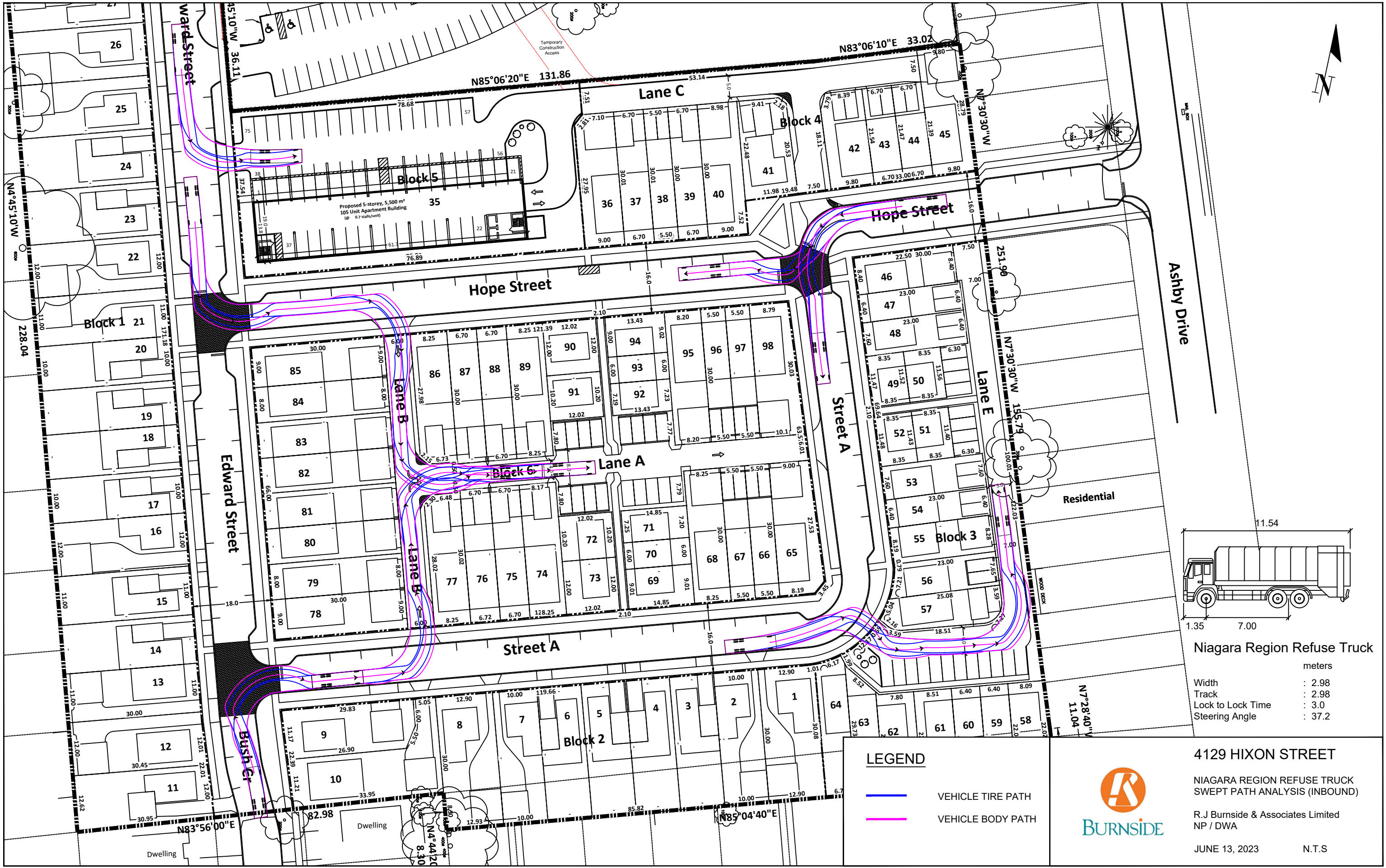


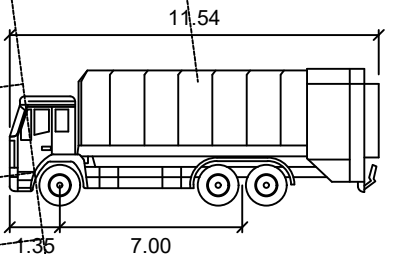
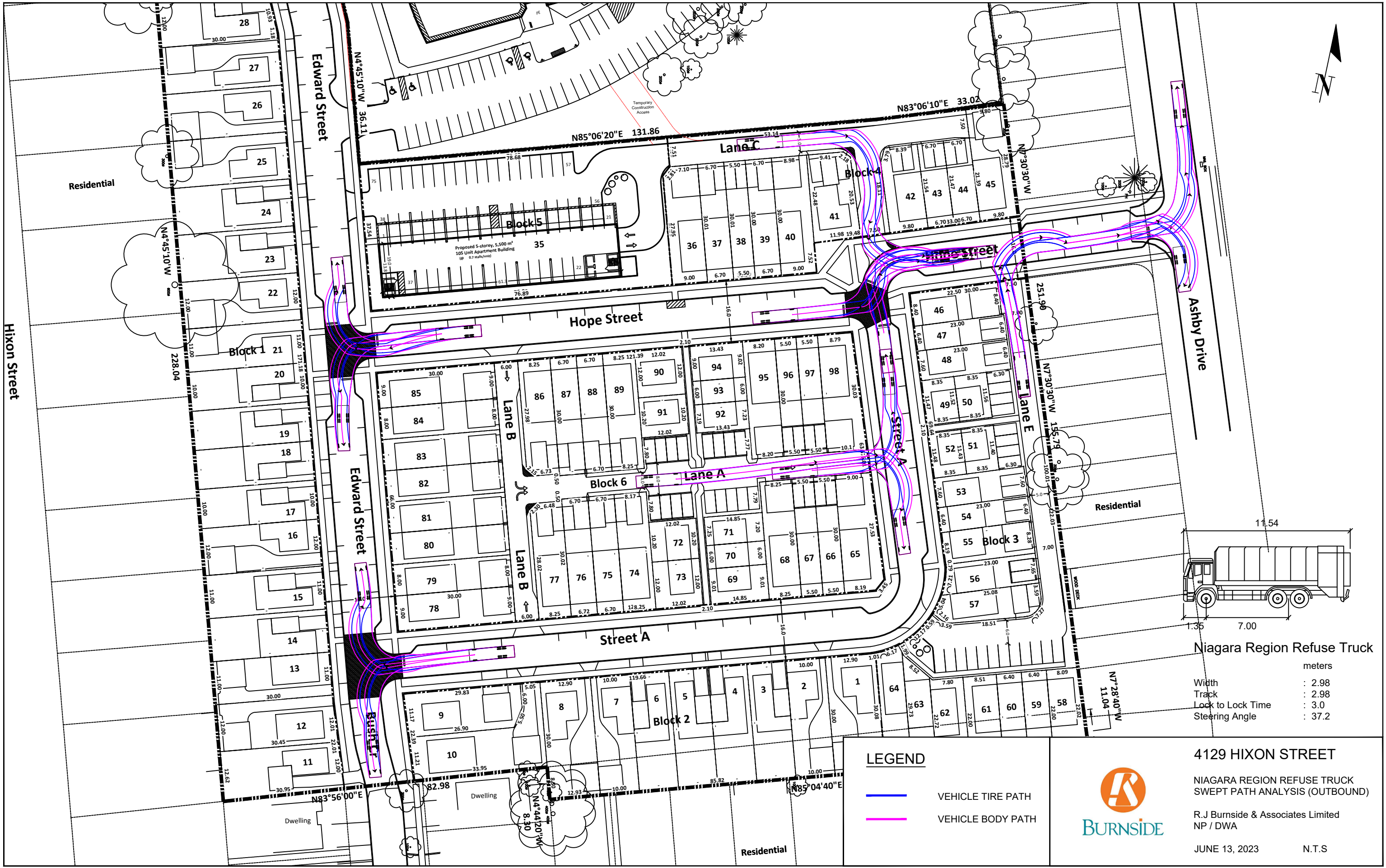
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Appendix H

Swept Path Analysis





Niagara Region Refuse Truck

	metres
Width	: 2.98
Track	: 2.98
Lock to Lock Time	: 3.0
Steering Angle	: 37.2

- LEGEND**
- VEHICLE TIRE PATH
 - VEHICLE BODY PATH

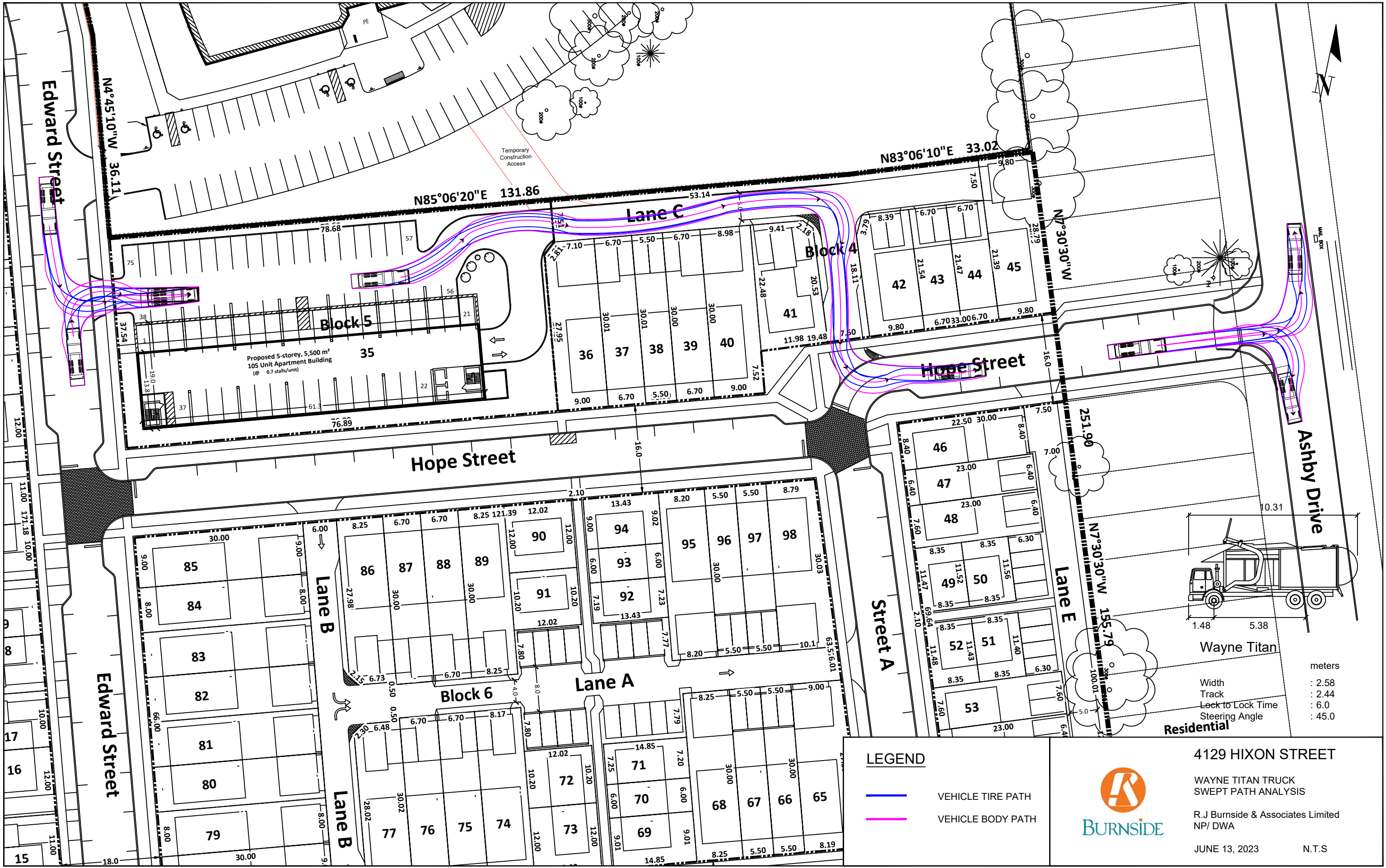


4129 HIXON STREET

NIAGARA REGION REFUSE TRUCK
SWEEP PATH ANALYSIS (OUTBOUND)

R.J Burnside & Associates Limited
NP / DWA

JUNE 13, 2023 N.T.S



4129 HIXON STREET

WAYNE TITAN TRUCK
SWEEP PATH ANALYSIS

R.J Burnside & Associates Limited
NP/ DWA

JUNE 13, 2023 N.T.S



