Memo

Date:	Friday, April 29, 2022
Project:	Kirby Road Widening Environmental Assessment Study – Jane Street to Dufferin Street
To:	City of Vaughan – Hilda Esedebe
From:	HDR
Subject:	Keele Street Driveway Access (Access Alternative 3) Review Memo

Introduction

The Kirby Road Widening EA study's preferred design includes an Underpass to grade-separate Kirby Road at its existing at-grade crossing of the Barrie GO Rail, west of Keele Street. The proposed Underpass requires Kirby Road to be lowered to meet vertical clearance requirements at the existing rail crossing. Lowering Kirby Road at this location results in significant changes to two existing accesses that currently service businesses on the north side of Kirby Road, which are the Kirby Road private entrance to the Mid-Ontario Truck Centre (Driveway 1) and the Kirby Road cul-de-sac private entrance that services the adjacent undeveloped parcel (Driveway 2).

To address the proposed changes to the two driveway accesses, the project team developed the following access alternative design concepts for consideration:

- **Access Alternative 1** - North side Jug Handle (Driveway 1 and 2 consolidated and reconfigured further east on Kirby Road)
- **Access Alternative 2** - North side Jug Handle Modified (Driveway 1 and 2 consolidated and reconfigured further east on Kirby Road)
- **Access Alternative 3** - New Driveway Access Connection to Keele Street (Driveway 1 and 2 closed on Kirby)
- **Access Alternative 4** – Re-grade and maintain Driveway 2 connection to Kirby. Close Driveway #1 on Kirby Road and provide connections to Driveway 2
- **Access Alternative 5** – Re-grade and maintain Driveway 1 and Driveway 2 connections to Kirby Road

The project team reviewed the concepts and provided the following recommendations:

- **Access Alternatives 1, 4,5** - are **not carried forward**:
  - **Access Alternative 1** - is not precluded by Access Alternative 2, but as a connection to the GO Station lands is not identified at this time, this access configuration is not currently required
  - **Access Alternative 4** - there is insufficient space to accommodate truck turning movements on the adjacent property with the proposed ramp
  - **Access Alternative 5** - is too disruptive to the adjacent property and site operations

- **Access Alternative 3** - **requires further review and assessment** to confirm if feasible and supported by the Region

- **Access Alternative 2** is **preferred** and would be restricted to right-in-right-out movements based on sightline analysis and safety concerns; left turns (in or out) are not permitted at the access

The EA project team recommended Access Alternative 2 which consolidates the two existing Kirby Road accesses and relocates them east of the existing entrances; access is restricted to right-in-right-out (RIRO) due to sight lines and safety concerns.

Access Alternative 3, new private driveway access to Keele Street north of Kirby Road, requires additional assessment. This Access Alternative is also revised to be considered in conjunction with Access Alternative 2, to review opportunities to mitigate the proposed change in access to right-in-right-out at Kirby Road. As Keele Street is under the jurisdiction of York Region, the feasibility of the new private driveway connection to Keele Street requires approval by York Region.

York Region acknowledged a preference to maintain the business access on Kirby Road, relocated as needed to accommodate the future grade separation, which follows the EA project team recommendation. The EA project team has requested York Region to provide input for the new private driveway access to Keele Street (Access Alternative 3), to confirm the feasibility of the option.

This memo documents the consideration of the Access Alternative 3 and recommendations.

Traffic Analysis

A detailed traffic assessment was undertaken to review and inform the recommendations for the preferred access configuration(s) to both Kirby Road (Access Alternative 2) and Keele Street (Access Alternative 3). The Traffic Assessment Memo is found in **Appendix A**.

The traffic assessment included analysis of Level of Service (LOS), volume to capacity ratios (V/C), and 95th percentile queue lengths and was conducted for the AM and PM peak hours for the future 2031 horizon year. In addition to a future “Do Nothing” condition, the following three scenarios were developed:

- **Scenario 1:** Combined RIRO access located west of the existing Petro-Canada gas station (Access Alternative 2).
- **Scenario 2:** Combined RIRO access located west of the existing Petro-Canada gas station (Access Alternative 2), and a RIRO access connecting to Keele Street (Access Alternative 3 as RIRO).
- **Scenario 3:** Combined RIRO access west of the existing Petro-Canada gas station (Access Alternative 2), and a full movement access connecting to Keele Street (Access Alternative 3 as full movements).

Based on the assessment the following findings were made:

- The changes in access configurations will have a negligible impact on the intersection of Keele Street with Kirby Road due to the low number of trips generated by the truck centre and trailer storage compound during the AM and PM peak hours.

- The site accesses will operate with low delays and within their available capacities, with the exception of the eastbound approach at the Keele Street access during the AM peak hour in Scenario 3, which will operate with an LOS of F.

- The AM peak hour 95th percentile queues on the southbound through movement at Keele Street / Kirby Road are projected to extend beyond the storage lengths of the southbound left and right auxiliary lanes. This condition is observed in the 2031 Do Nothing condition and does not become exacerbated as a result of the driveway reconfigurations.

- Provision of dedicated left and right turn lanes on the eastbound approach to the Keele Street access will result in an LOS of F on the eastbound left turning movement during the AM peak hour, due to insufficient gaps in the north-south flows on Keele Street.

- The southbound through 95th percentile queue length during the AM peak hour in Scenario 3 at the intersection of Keele Street with Kirby Road will spill back beyond the Keele Street access, potentially blocking left turning vehicles as well as northbound left turning vehicles. The blockage of northbound left turning vehicles could result in unsafe conditions without the provision of an auxiliary northbound left storage lane.

- The proposed Keele Street driveway is relatively close to the intersection of Keele Street with Kirby Road (approximately 140 metres away) and would not satisfy York Region's minimum signal spacing of 350 metres for 90 km/h design speeds, as per the 2020 York Region Access Guidelines.

It is recommended that Scenario 2 be considered for implementation as it can provide improved routing options relative to Scenario 1 while avoiding the operational and safety issues identified in Scenario 3. The design should consider construction of a centre median to enforce the right-in-right-out configuration, or a pork-chop island where available right-of-way is insufficient/ limited.

Design Concept

Additional topographic survey was completed and the driveway design refined to reflect the recommendations from the Traffic Assessment to further develop **Scenario 2 - Combined RIRO access located west of the existing Petro-Canada gas station (Access Alternative 2), and a RIRO access connecting to Keele Street (Access Alternative 3)**.

Plan and profile design drawings for the Keele Street access were prepared. The connection to Keele Street was developed as a private driveway entrance with a cross-section that maintains two existing 5.75m lanes within a 23.0m corridor as per the existing portion of the driveway. The pork-chop connection at Keele Street follows *York Region's Design Standard DS-202 - Commercial Typical Right turn in/ Right turn out only - rural, January 2019*. Two culverts are proposed at the connection to Keele Street; one to maintain the existing drainage path that conveys flows from the stormwater outlet and a second to maintain the existing roadside

drainage along the west side of the Keele Street right-of-way. The details of culvert sizing and other design considerations will be determined during Detailed Design.

The location of the Keele Street access is proposed to be spaced approximately 30m north of the existing Tim Hortons driveway entrance. According to TAC standards, commercial entrance spacing is approximately 20m. As discussed later in this memo, the location of the proposed Keele Street access traverses a portion of the southern extension of a wetland unit that is part of the Don River West Branch Headwater Provincially Significant Wetland (PSW) complex. It is understood that a driveway alignment further south, to completely avoid the southern extension of the wetland (i.e., south of the stormwater drainage outlet and headwall), would need to move the proposed Keele Street driveway access an additional 30m south and would therefore not meet the 20m spacing to the existing Tim Horton's entrance and not meet standards. An alignment further south would place the proposed entrance in closer proximity to the Keele Street intersection. An alignment further south would also not be feasible as it would bisect the adjacent property parcels and may not allow for an efficient future use of the site. Although the construction of the proposed driveway access road will require land, it will remain part of the internal private site circulation and provide an alternate access and connection.

A sight distance review was conducted for Access Alternative 3 (Keele Street access). Based on a design speed of 90km/h (posted speed 70km/h) for Keele Steet, the sightline requirements for a passenger car is 165m and 262.71m for trucks. The proposed Keele Street driveway entrance location satisfies these minimum requirements.

Truck turning templates were prepared to demonstrate the accommodation of WB-33 truck turning paths for both driveway entrances; at Kirby Road (Access Alternative 2) and at Keele Street (Access Alternative 3). An additional WB-20 truck turning analysis was prepared for the Keele Street driveway entrance as it is the governing turning template.

The design drawings, including the sight distance review and truck turning templates, are found in **Appendix B.**

Natural Heritage

A supplementary assessment to the Natural Heritage Report completed for the EA study was completed in October 2021 for the terrestrial and wetland habitats in the vicinity of the proposed Keele Street access construction, and in November 2021 for the aquatic habitat assessment. The supplementary assessment was completed to further characterize and map the wetland and aquatic features adjacent to the proposed driveway, to identify potential impacts associated with driveway construction and use, and to recommend measures to avoid, or otherwise minimize or mitigate these potential impacts to the natural features. The natural heritage assessment is provided in **Appendix C.**

The area of the proposed Keele Street access (private driveway entrance) contains a portion of the southern extension of a wetland unit that is part of the Don River West Branch Headwater Provincially Significant Wetland (PSW) complex. The wetland has formed along shallow channels that convey stormwater drainage. The westernmost channel receives stormwater drainage from the adjacent Tim Hortons parking lot via a drainage outlet with headwall, while an

eastern channel represents a roadside drainage ditch. Both flow into the core wetland area to the immediate north, which also contains the furthest upstream extent of the Don River West Branch ephemeral watercourse that has been labelled HDF3 in the EA natural environment study.

The preferred alignment of the private driveway will require that it cross the southern extension of the wetland unit. The wetland area that would be impacted is of relatively low ecological quality and functional value, and contains a high proportion of invasive/non-native vegetation growth. Removal of this portion of wetland is not considered to represent a negative impact. Stormwater drainage paths within the channels will be maintained through the installation of culverts under the driveway. Various measures are recommended to mitigate negative direct and indirect impacts to the adjacent natural features and their ecological functions. Recommendations are also provided to restore and enhance the ecological quality of the wetland in the immediate vicinity of the proposed driveway as documented in **Appendix C.**

Commitments for Detailed Design
The following are recommended to be addressed at the Detailed Design stage:

- Prepare a stormwater drainage plan for the driveway, including management of flows and to mitigate water quality impacts to the adjacent natural features. Confirm appropriate culvert sizing and other design details to maintain existing stormwater flows that input to the wetland feature and HDF3 watercourse;

- Complete vegetation removal activities outside of the period March 15-August 31 to avoid direct impacts to amphibian and bird species that may use the wetland as breeding habitat. If construction must occur within this timing window, additional targeted surveys by a qualified biologist may be required to confirm the presence or absence of nesting birds, and/or to capture and relocate amphibians within the construction zone. Identify details of an amphibian/small wildlife capture and relocation plan, if applicable based on potential timing of vegetation removal;
- Demarcate the limits of construction with silt fencing to impede small wildlife movement into the construction zone;

- Prepare a detailed Erosion and Sediment Control (ESC) Plan for review and approval by the City and TRCA. Install heavy-duty silt fencing along the limits of construction, minimize exposed soils and re-vegetate exposed soil areas where necessary. Silt fencing must be regularly inspected and repaired when necessary;

    - Areas of exposed soil within or adjacent to the wetland should be re-seeded with a suitable native seed mix. This may be augmented with or preceded by an application of a standard nurse crop (e.g., Annual Oats (*Avena sativa*), Annual Rye (*Lolium multiflorum*), or White Millet (*Panicum miliaceum*)) to provide soil stabilization. Seeding details are to be provided in the ESC Plan;

- Maintain all construction activities within the authorized work zone;

- All material and equipment stockpiles should be located at least 15m from the wetland. Silt fencing should be installed around stockpiles where runoff of sediments or deleterious substances may occur;

- Construction work that occurs within the drainage channel should be completed “in the dry” if possible, to avoid potential water quality impacts downstream;
- Prepare a Spill Response Plan, if appliable to the undertaking; and
- Prepare a Restoration and Enhancement Plan, based on TRCA guidelines, for review and approval by the City and TRCA.

Conclusion

Scenario 2: Combined RIRO access located west of the existing Petro-Canada gas Station (Alternative Access 2), and a RIRO access connecting to Keele Street (Alternative Access 3) is recommended.

Based on the traffic assessment, implementation of the Alternative Access 3 in conjunction with Alternative Access 2 (Scenario 2) provides improved routing options relative to only implementing Alternative Access 2 (Scenario 1), while avoiding the operational and safety issues identified with full movements access at Keele Street (Scenario 3). It is also noted the location of the Keele Street access does not satisfy York Region’s minimum signal spacing.

Alignment of the Keele Street access further south, to completely avoid the southern extension of the wetland (i.e., south of the stormwater drainage outlet and headwall), would not be feasible as it would not meet the 20m spacing requirements to the existing Tim Horton’s entrance . Alignment of the Keele Street further south would also bisect the adjacent property parcels and not allow for an efficient future use of the site, and place the proposed entrance in closer proximity to the Keele Street intersection. The location of the proposed Keele Street driveway entrance satisfies the minimum sight distance requirements.

The Keele Street access is proposed as a private driveway entrance with a cross-section that maintains two existing 5.75m lanes within a 23.0m corridor as per the existing portion of the driveway. Construction of a pork-chop island at the connection at Keele Street is recommended, following York Region’s Design Standards to enforce right-in right-out restrictions. This entrance design accommodates the truck turning paths for WB-33 and WB-20 trucks.

The Keele Street access will cross the southern extension of a wetland unit considered to be of relatively low ecological quality and functional value, which contains a high proportion of invasive/non-native vegetation growth. Removal of this portion of wetland is not considered to represent a negative impact. Stormwater drainage paths within the channels will be maintained through the installation of two culverts under the driveway; one to maintain the existing drainage path that conveys flows from the stormwater outlet and a second to maintain the existing roadside drainage along the west side of the Keele Street right-of-way. Various measures are recommended to mitigate negative direct and indirect impacts to the adjacent natural features and their ecological functions. Recommendations for Detailed Design are also provided to restore and enhance the ecological quality of the wetland in the immediate vicinity of the proposed driveway. Additional design considerations will be reviewed and confirmed during Detailed Design.

APPENDIX A

Transportation Assessment

Memo

Date:	Friday, March 18, 2022
Project:	City of Vaughan – Kirby Road Widening EA (Jane Street to Dufferin Street)
To:	Hilda Esedebe, P.Eng.
From:	Jason Zhou, P.Eng., Martin Kaczmarek, P.Eng., PTOE
Subject:	Keele Street Alternate Access Review - Transportation Assessment

1 Introduction

HDR has been retained by the City of Vaughan to undertake a Schedule 'C' Class Environmental Assessment (EA) study for the Kirby Road corridor between Jane Street and Dufferin Street. The preferred design includes widening Kirby Road to four-lanes, urbanization, grade separation at the Barrie GO Rail line crossing on Kirby Road with an underpass, re-aligning Kirby Road at a new central consolidated intersection at Jane Street, continuous boulevard cycle tracks and sidewalks, and streetscaping.

Due to the proximity to the Barrie Go Rail crossing and recommended underpass, the existing accesses to the east of the railway crossing require reconfiguration. Further to the EA study's Transportation Assessment Report, additional access management discussions resulted in the recommendation of consolidating the accesses to the Mid Ontario Truck Centre and the adjacent trailer storage compound into a single right-in/right-out driveway to improve safety and performance along Kirby Road. The consolidated access would be relocated further east, closer to the A&W and gas station access. The purpose of this memorandum is to recommend a preferred configuration of the reconfigured access by assessing various configurations connecting to both Kirby Road and Keele Street. The current site location with the existing two accesses is illustrated in **Figure 1-1**.

Figure 1-1: Site Location

2 Future Conditions

2.1 Analysis Methodology

The subject assessment carries forward the 2031 demand forecasts at the intersection of Kirby Road with Keele Street that were used in previous analyses for the Kirby Road Environmental Assessment. The Mid Ontario Truck Centre and the trailer storage compound trips are captured within the trip forecasts and are redistributed per analysis scenario based on available accesses. Synchro Version 11 is utilized for the intersection operations analysis, with Highway Capacity Manual (HCM) 2000 outputs, consistent with the approach of the previous analyses in the Kirby Road Widening EA.

In addition to a “Do Nothing” condition, three scenarios have been developed with different access configurations at the Mid Ontario Truck Centre, located at 2400 Kirby Road in Maple Ontario. The assessment considers various connection configurations with Kirby Road and Keele Street, and the operations are compared to identify the preferred scenario. In all scenarios, it is assumed that the Petro-Canada gas station and Tim Hortons accesses remain right-in/right-out (RIRO) access configurations. The Mid Ontario Truck Centre access configuration scenarios are detailed below. Preliminary illustrations of the scenario access plans are provided in **Appendix A**.

- **Scenario 1:** Combined RIRO access located west of the existing Petro-Canada gas station.
- **Scenario 2:** Combined RIRO access located west of the existing Petro-Canada gas station, and a RIRO access connecting to Keele Street.
- **Scenario 3:** Combined RIRO access west of the existing Petro-Canada gas station, and a full movement access connecting to Keele Street.

2.2 Trip Generation

No future expansion has been identified for the Mid Ontario Truck Centre or the storage trailer compound, therefore it is assumed that future trip generation from the sites should be consistent with the existing trip generation as captured in the volumes shown in shown in **Appendix B**. To capture the trips generated by the trailer storage compound, it is assumed that only trucks are using that access, and that the number is equal to the trucks using the main access to the Mid Ontario Truck Centre.

The total site trips are 17 outbound and 40 inbound during the AM peak hour, and 47 outbound and 31 inbound during the PM peak hour. The total trips include 8 outbound and 18 inbound trucks during the AM peak hour, and 18 inbound and 24 outbound trucks during the PM peak hour.

2.3 Trip Distribution & Assignment

It is assumed that the distribution of the truck centre volumes observed in the count will remain consistent in the 2031 horizon year; with the movements at the intersection of Kirby Road with Keele Street being assigned proportionally based on existing turning movement count trends during the AM and PM peak hour. Separate assignment layers had been prepared for automobile vehicles and truck vehicles travelling to and from the Mid Ontario Truck Centre site to identify the heavy vehicle percentages at each movement in the study area. The following assumptions were applied for the assignment of vehicles:

- The base auto and truck volumes originating and destined to the Mid Ontario Truck Centre will remain constant across all scenarios.
- Re-assignment of the eastbound left inbound trips at the existing access:
    - Conversion of the Kirby Road access to a right-in/right-out configuration will divert current eastbound left trips on Kirby Road to the north and south ends of Keele Street with a 50% split.
- Re-assignment of the southbound left outbound trips at the existing access:
    - Scenario 1: Vehicles travelling southbound left at the current Kirby Road access will instead travel southbound right.
    - Scenario 2: Vehicles travelling southbound left at the current Kirby Road access will use the Keele Street RIRO access when destined to the south end of Keele Street or the east end of Kirby Road. All vehicles travelling southbound from the northern end of Keele Street will enter the site via the Keele Street access.
    - Scenario 3: Vehicles travelling southbound left at the current Kirby Road access will use the Keele Street full movement access. All vehicles travelling southbound

from the northern end of Keele Street will enter the site via the Keele Street access. Half of the vehicles travelling northbound from the southern end of Keele Street will use the Keele Street access.

The total vehicle volumes are illustrated for each scenario in **Appendix B**.

2.4 Operational Analysis

A detailed assessment including LOS, volume to capacity ratios (V/C), and 95th percentile queue lengths for each scenario was conducted at each intersection for the AM and PM peak hours. The traffic operational analysis results for the intersection of Kirby Road with Keele Street and the truck centre access intersections are summarized in **Table 2-1** to **Table 2-4** for the "Do Nothing" condition to Scenario 3. Critical delays (LOS E or LOS F) and v/c ratios greater than 0.85 are highlighted. It is noted that signal timing splits were optimized to best accommodate the redistributed volumes. Detailed Synchro reports are provided in **Appendix C**.

The following observations are noted for the comparison of access configurations:

- The changes in access configurations will have a negligible impact on the intersection of Keele Street with Kirby Road due to the low number of trips generated by the truck centre and trailer storage compound during the AM and PM peak hours.
- The site accesses will operate with low delays and within their available capacities, with the exception of the eastbound approach at the Keele Street access during the AM peak hour in Scenario 3, which will operate with an LOS of F.
- The AM peak hour 95th percentile queues on the southbound through movement at Keele Street / Kirby Road are projected to extend beyond the storage lengths of the southbound left and right auxiliary lanes. This condition is observed in the 2031 Do Nothing condition and does not become exacerbated as a result of the driveway reconfigurations.
- Provision of dedicated left and right turn lanes on the eastbound approach to the Keele Street access will result in an LOS of F on the eastbound left turning movement during the AM peak hour, due to insufficient gaps in the north-south flows on Keele Street.
- The southbound through 95th percentile queue length during the AM peak hour in Scenario 3 at the intersection of Keele Street with Kirby Road will spill back beyond the Keele Street access, potentially blocking eastbound left turning vehicles as well as northbound left turning vehicles. The blockage of northbound left turning vehicles could result in unsafe conditions without the provision of an auxiliary northbound left storage lane.
- A signal sensitivity analysis was undertaken for the Keele Street driveway intersection; the operations are summarized in **Table 2-5**. For the purposes of the analysis, it was assumed that auxiliary eastbound left and northbound left turn lanes would be provided.

As shown, signalization of the intersection would mitigate the delays on the eastbound approach; however, signalization is not advised for the following reasons:

- The eastbound approach represents a small number of projected vehicles (9 AM and 28 PM peak hour vehicles) and signalization would increase overall delays at the intersection.
- The southbound through queue at Keele Street / Kirby Road would occasionally spill back through the signalized intersection during the AM peak hour, potentially resulting in blockages within the intersection during eastbound green phases.
- The proposed Keele Street driveway is relatively close to the intersection of Keele Street with Kirby Road (approximately 140 metres away) and would not satisfy York Region's minimum signal spacing of 350 metres for 80 km/h design speeds, as per the 2020 York Region Access Guidelines.

Due to the operational and safety concerns in Scenario 3, it is advised that Scenario 1 or Scenario 2 be carried forward for further consideration. Scenario 2 is recommended as it can reduce detouring impacts to truck centre and trailer storage compound customers and staff as a result of the additional RIRO access on Keele Street. To enforce the right-in/right-out configurations at the accesses, it is recommended to construct a raised centre median, or where right-of-way is insufficient / limited, to construct a pork-chop island.

Table 2-1: Future 2031 Do Nothing Operational Conditions

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay (s)	V/C	95th %ile Q	LOS	Delay (s)	V/C	95th %ile Q
Keele Street & Kirby Road	EBL	D	47	0.65	24	C	33	0.53	34
	EBT	D	38	0.45	57	D	54	0.90	135
	EBR	D	36	0.11	15	C	34	0.05	4
	WBL	D	38	0.71	62	D	41	0.70	42
	WBT	E	68	0.97	149	D	43	0.64	72
	NBL	C	27	0.45	11	B	16	0.33	24
	NBT	C	25	0.37	58	C	33	0.82	167
	NBR	C	22	0.06	1	C	22	0.36	45
	SBL	B	15	0.47	37	C	23	0.42	12
	SBT	D	39	0.92	216	C	24	0.40	63
	SBR	B	17	0.08	10	B	20	0.06	5
	Overall	***D***	***41***	***0.95***	***-***	***D***	***36***	***0.86***	***-***
Kirby Road & Truck Centre	EBLT	A	1	0.02	1	A	0	0.01	0
	WBTR	No Conflict							
	SBLR	C	21	0.06	2	D	25	0.21	6

Table 2-2: Future 2031 Scenario 1 Operational Conditions

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay (s)	V/C	95th %ile Q	LOS	Delay (s)	V/C	95th %ile Q
Keele Street & Kirby Road	EBL	D	45	0.62	22	C	32	0.50	33
	EBT	D	38	0.44	56	D	52	0.88	129
	EBR	D	36	0.10	14	C	34	0.05	3
	WBL	D	38	0.71	62	D	42	0.70	42
	WBT	E	68	0.97	149	D	44	0.65	73
	NBL	C	29	0.54	13	B	16	0.35	25
	NBT	C	25	0.37	58	C	33	0.82	167
	NBR	C	22	0.06	1	C	22	0.36	45
	SBL	B	15	0.47	37	C	23	0.42	12
	SBT	D	39	0.92	216	C	24	0.40	64
	SBR	B	17	0.09	11	B	20	0.06	6
	Overall	***D***	***41***	***0.95***	***-***	***D***	***35***	***0.85***	***-***
Kirby Road & Truck Centre	EBT	No Conflict							
	WBTR	No Conflict							
	SBR	B	10	0.03	1	B	10	0.08	2

Table 2-3: Future 2031 Scenario 2 Operational Conditions

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay (s)	V/C	95th %ile Q	LOS	Delay (s)	V/C	95th %ile Q
Keele Street & Kirby Road	EBL	D	45	0.62	22	C	32	0.50	33
	EBT	D	38	0.44	56	D	52	0.88	129
	EBR	D	36	0.10	14	C	34	0.05	3
	WBL	D	38	0.71	62	D	42	0.70	42
	WBT	E	68	0.97	149	D	44	0.65	73
	NBL	C	30	0.54	13	B	16	0.35	25
	NBT	C	26	0.37	58	C	33	0.82	167
	NBR	C	22	0.06	1	C	22	0.36	46
	SBL	B	16	0.48	38	C	28	0.58	15
	SBT	D	39	0.92	217	C	24	0.40	64
	SBR	B	17	0.07	8	B	20	0.05	4
	Overall	***D***	***41***	***0.95***	***-***	***D***	***35***	***0.86***	***-***
Kirby Road & Truck Centre	EBT	No Conflict							
	WBTR	No Conflict							
	SBR	B	10	0.02	0	B	10	0.04	1
Keele Street & Truck Centre	EBR	C	24	0.04	1	B	12	0.04	1
	NBT	No Conflict							
	SBTR	No Conflict							

Table 2-4: Future 2031 Scenario 3 Operational Conditions

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay (s)	V/C	95th %ile Q	LOS	Delay (s)	V/C	95th %ile Q
Keele Street & Kirby Road	EBL	D	45	0.62	22	C	32	0.50	33
	EBT	D	38	0.44	56	D	52	0.88	129
	EBR	D	36	0.10	14	C	34	0.05	3
	WBL	D	38	0.71	62	D	42	0.70	42
	WBT	E	68	0.97	149	D	44	0.65	73
	NBL	C	27	0.49	11	B	16	0.34	24
	NBT	C	26	0.38	58	C	33	0.83	168
	NBR	C	22	0.06	1	C	22	0.36	46
	SBL	B	16	0.48	38	C	28	0.59	15
	SBT	D	39	0.92	217	C	24	0.40	64
	SBR	B	17	0.07	8	B	20	0.05	4
	Overall	***D***	***41***	***0.95***	**-**	***D***	***35***	***0.86***	**-**
Kirby Road & Truck Centre	EBT	No Conflict							
	WBTR	No Conflict							
	SBR	B	10	0.01	0	B	10	0.03	1
Keele Street & Truck Centre	EBLR	F	67	0.15	4	B	14	0.07	2
	NBLT	A	1	0.01	0	A	0	0.01	0
	SBTR	No Conflict							

Table 2-5: Future 2031 Scenario 3 Operational Conditions (Keele Access Signal Sensitivity)

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay (s)	V/C	95th %ile Q	LOS	Delay (s)	V/C	95th %ile Q
Keele Street & Kirby Road	EBL	D	45	0.62	22	C	32	0.50	33
	EBT	D	38	0.44	56	D	52	0.88	129
	EBR	D	36	0.10	14	C	34	0.05	3
	WBL	D	38	0.71	62	D	42	0.70	42
	WBT	E	68	0.97	149	D	44	0.65	73
	NBL	C	27	0.49	11	B	16	0.34	24
	NBT	C	26	0.38	58	C	33	0.83	168
	NBR	C	22	0.06	1	C	22	0.36	46
	SBL	B	16	0.48	38	C	28	0.59	15
	SBT	D	39	0.92	217	C	24	0.40	64
	SBR	B	17	0.07	8	B	20	0.05	4
	Overall	***D***	***41***	***0.95***	**-**	***D***	***35***	***0.86***	**-**
Kirby Road & Truck Centre	EBT	No Conflict							
	WBTR	No Conflict							
	SBR	B	10	0.01	0	B	10	0.03	1
Keele Street & Truck Centre (Signalized)	EBL	D	52	0.10	3	D	54	0.08	5
	EBR	D	50	0.01	5	D	53	0.02	9
	NBL	A	2	0.02	1	A	2	0.01	1
	NBT	A	2	0.26	23	A	4	0.57	73
	SBTR	A	4	0.68	114	A	2	0.28	24
	Overall	***A***	***4***	***0.67***	**-**	***A***	***4***	***0.55***	**-**

3 Findings & Conclusions

The following findings were made through the assessment of the various truck centre access configurations:

- The changes in access configurations will have a negligible impact on the intersection of Keele Street with Kirby Road due to the low number of trips generated by the truck centre and trailer storage compound during the AM and PM peak hours.
- The site accesses will operate with low delays and within their available capacities, with the exception of the eastbound approach at the Keele Street access during the AM peak hour in Scenario 3, which will operate with an LOS of F.
- The AM peak hour 95th percentile queues on the southbound through movement at Keele Street / Kirby Road are projected to extend beyond the storage lengths of the southbound left and right auxiliary lanes. This condition is observed in the 2031 Do Nothing condition and does not become exacerbated as a result of the driveway reconfigurations.
- Provision of dedicated left and right turn lanes on the eastbound approach to the Keele Street access will result in an LOS of F on the eastbound left turning movement during the AM peak hour, due to insufficient gaps in the north-south flows on Keele Street.
- The southbound through 95th percentile queue length during the AM peak hour in Scenario 3 at the intersection of Keele Street with Kirby Road will spill back beyond the Keele Street access, potentially blocking left turning vehicles as well as northbound left turning vehicles. The blockage of northbound left turning vehicles could result in unsafe conditions without the provision of an auxiliary northbound left storage lane.
- A signal sensitivity analysis was undertaken for the Keele Street driveway intersection. Signalization of the intersection would mitigate the delays on the eastbound approach; however, signalization is not advised for the following reasons:
    - The eastbound approach represents a small number of projected vehicles (9 AM and 28 PM peak hour vehicles) and signalization would increase overall delays.
    - The southbound through queue at Keele Street / Kirby Road would occasionally spill back through the signalized intersection during the AM peak hour, potentially resulting in blockages within the intersection during eastbound green phases.
    - The proposed Keele Street driveway is relatively close to the intersection of Keele Street with Kirby Road (approximately 140 metres away) and would not satisfy York Region's minimum signal spacing of 350 metres for 90 km/h design speeds, as per the 2020 York Region Access Guidelines.

It is recommended that Scenario 2 be considered for implementation as it can provide improved routing options relative to Scenario 1 while avoiding the operational and safety issues identified in Scenario 3. The design should consider construction of a centre median to enforce the right-in-right-out configuration, or a pork-chop island where available right-of-way is insufficient / limited.

Appendix A: Kirby Road and Keele Street Reconfiguration Connections

Figure A-1: Scenario 1 Access Plan

Figure A-2: Scenario 2 Access Plan

Figure A-3: Scenario 3 Access Plan

Appendix B: Turning Movement Volumes

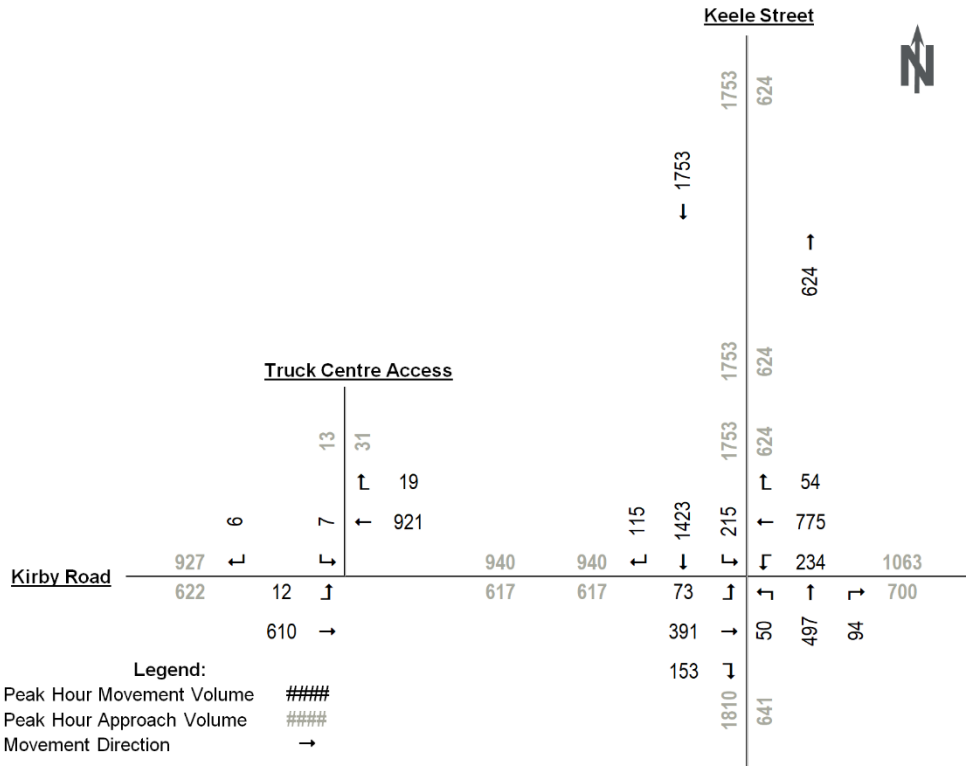


Figure B-1: 2031 Do Nothing Total AM Peak Hour

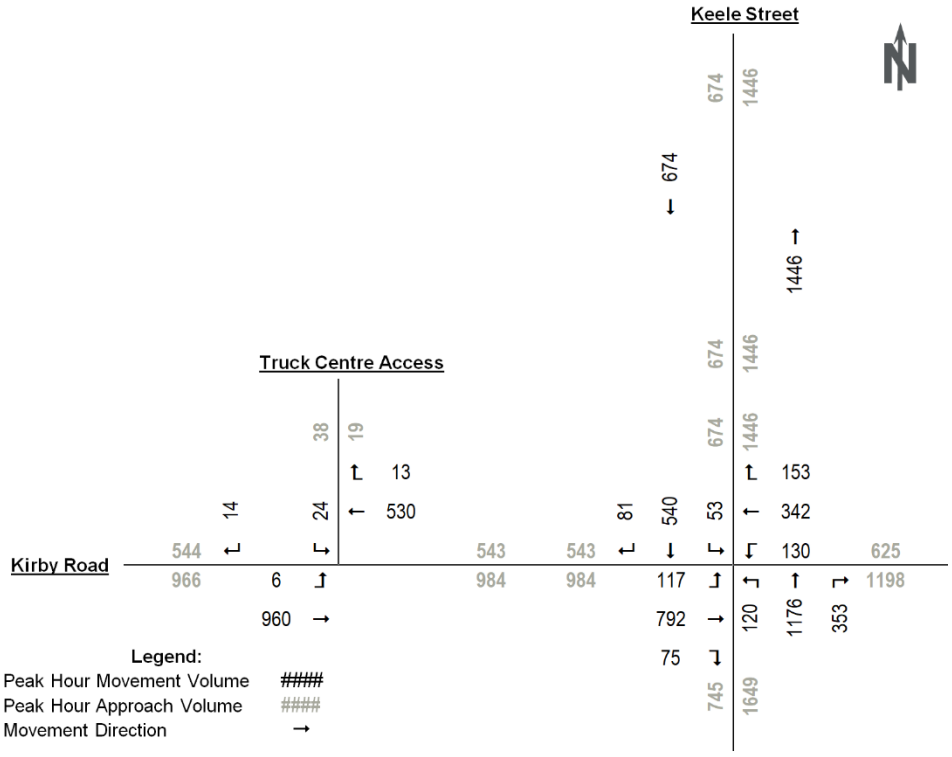


Figure B-2: 2031 Do Nothing Total PM Peak Hour

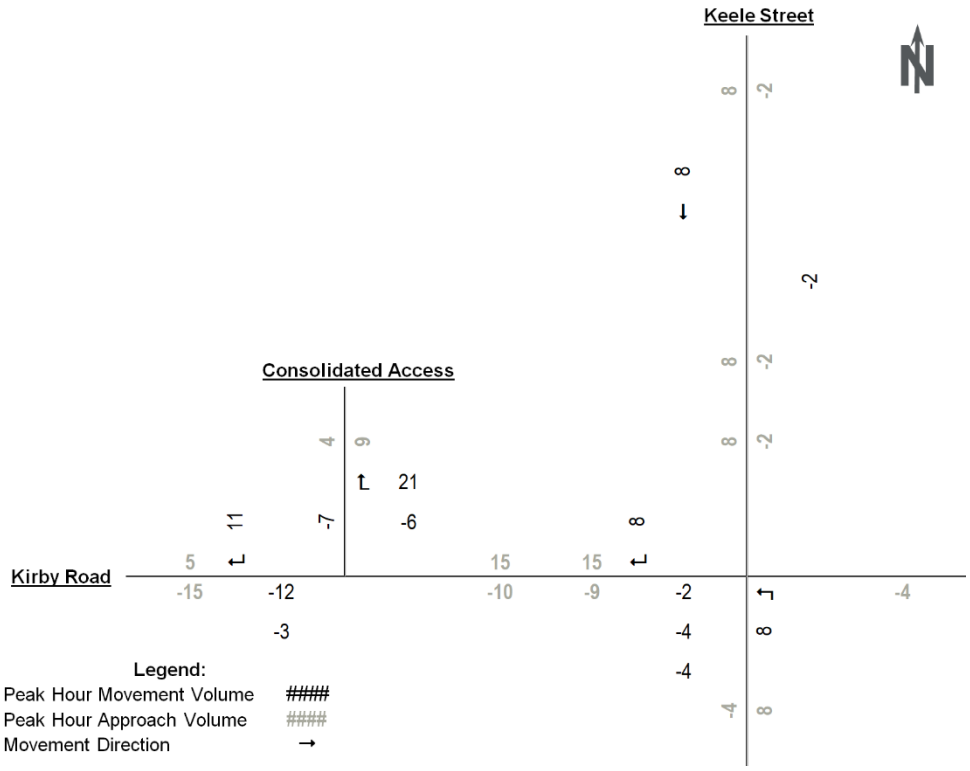


Figure B-3: 2031 Scenario 1 Redistribution AM Peak Hour

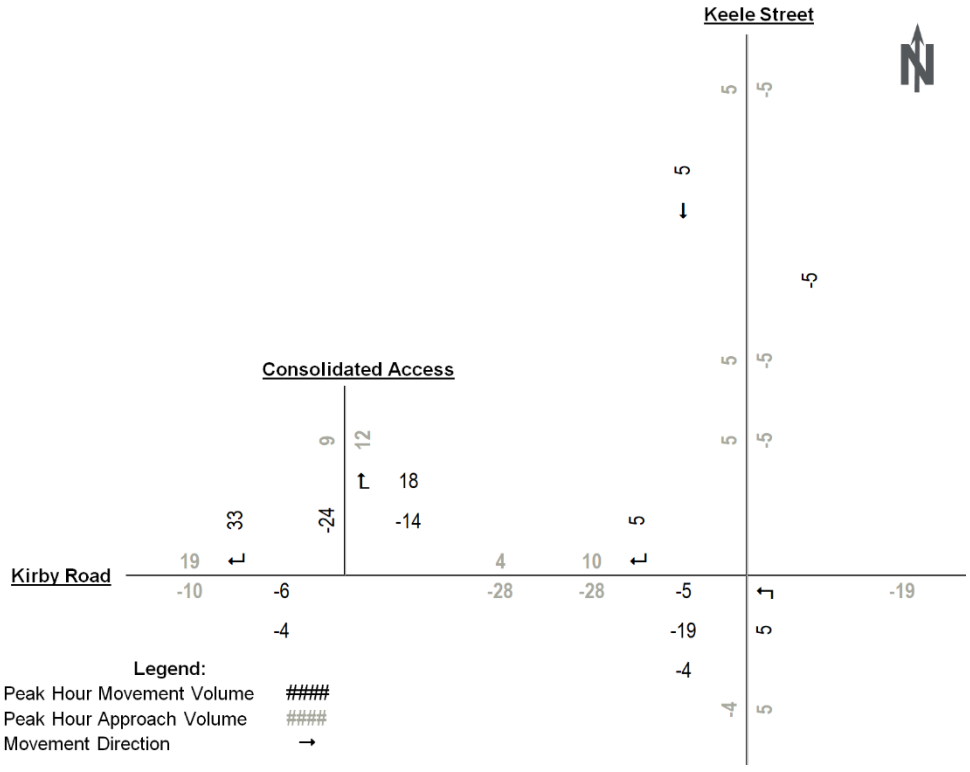


Figure B-4: 2031 Scenario 1 Redistribution PM Peak Hour

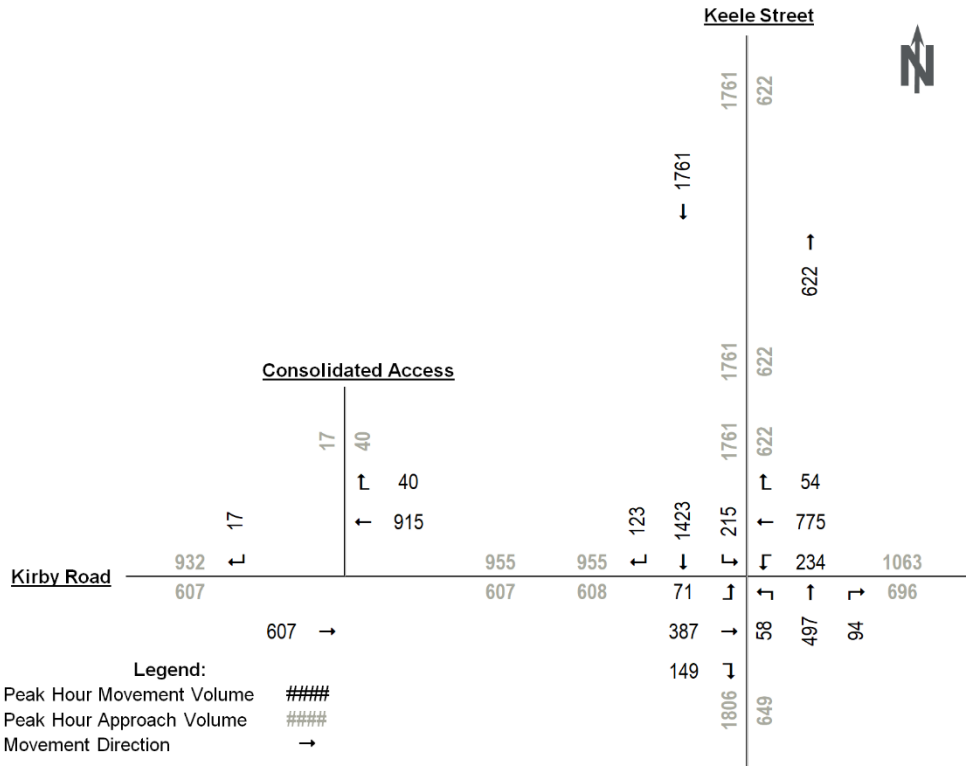


Figure B-5: 2031 Scenario 1 Total AM Peak Hour

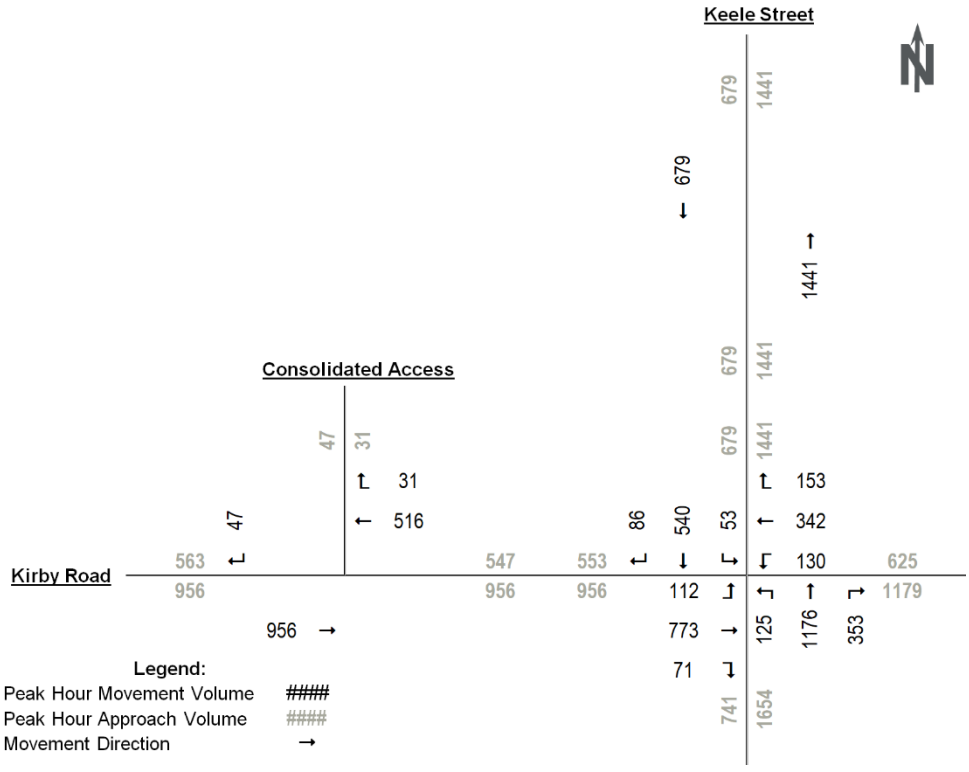


Figure B-6: 2031 Scenario 1 Total PM Peak Hour

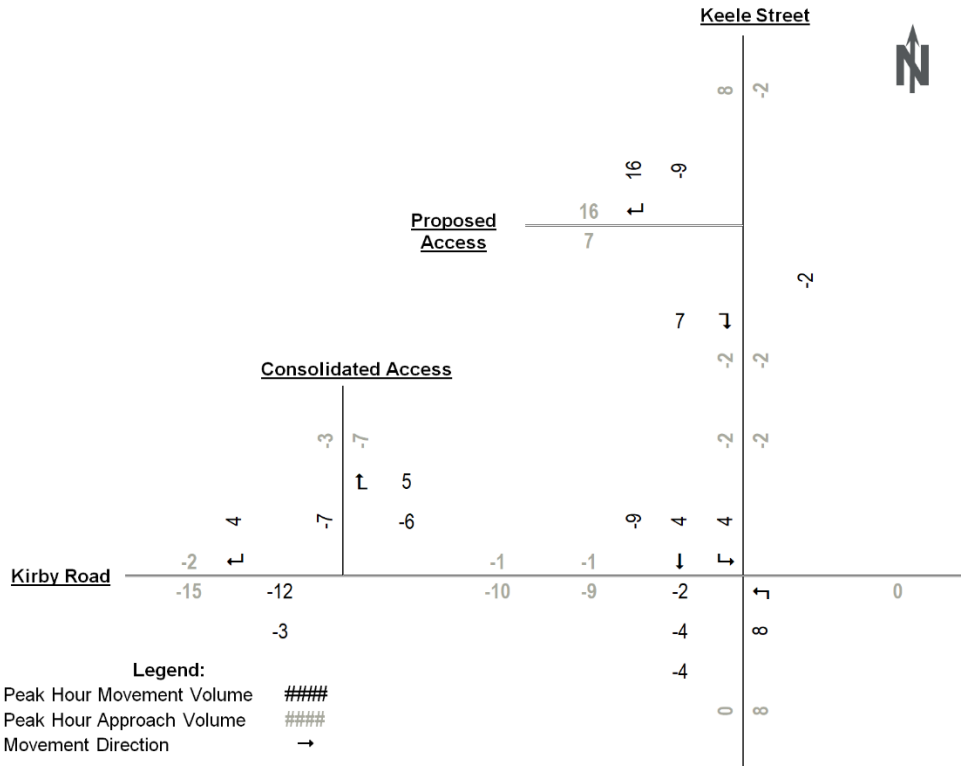


Figure B-7: 2031 Scenario 2 Redistribution AM Peak Hour

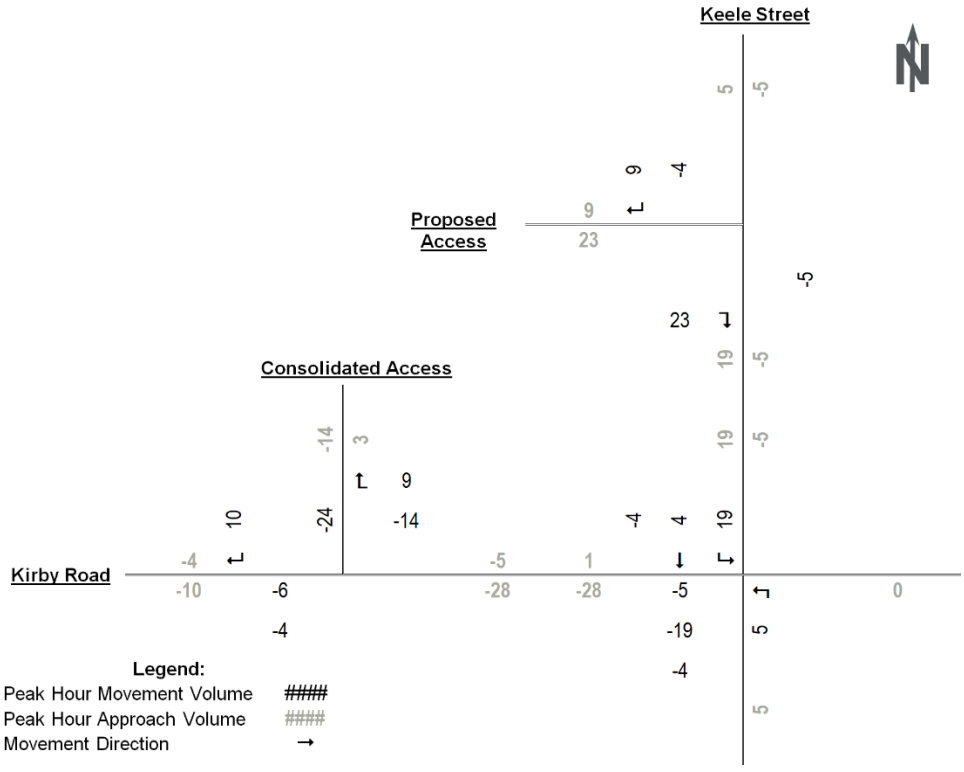


Figure B-8: 2031 Scenario 2 Redistribution PM Peak Hour

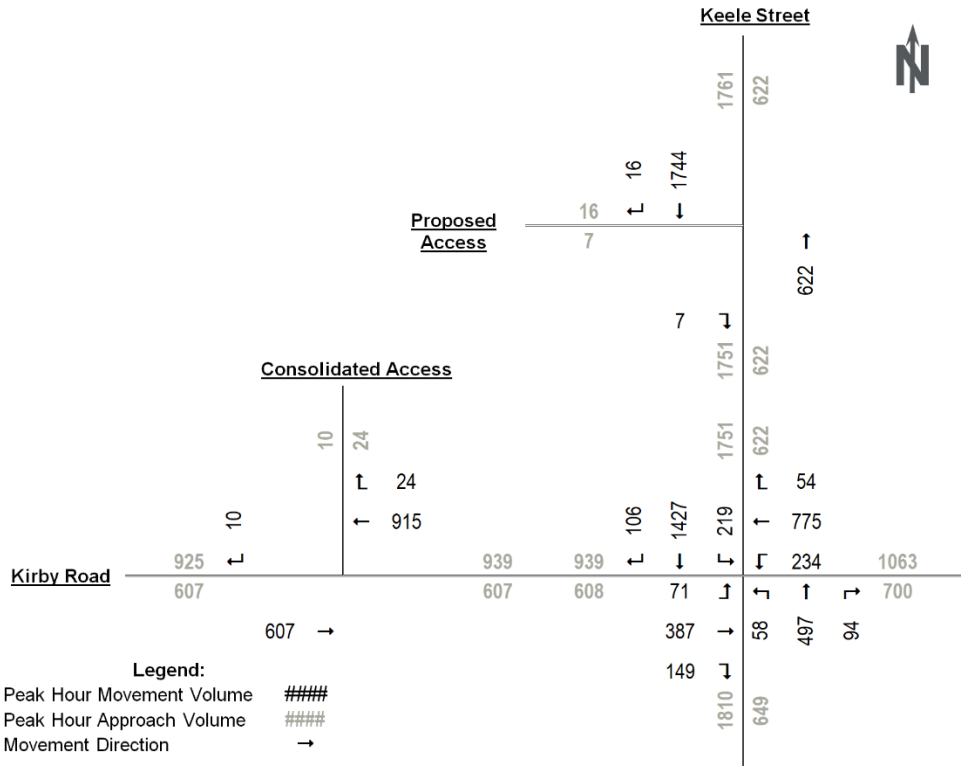


Figure B-9: 2031 Scenario 2 Total AM Peak Hour

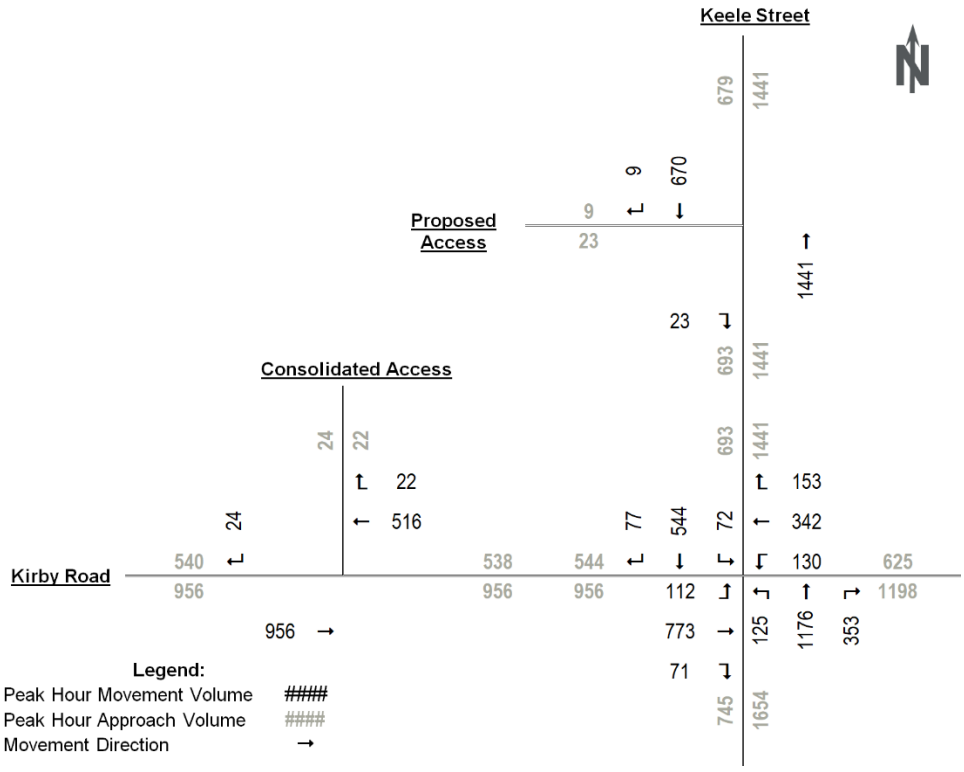


Figure B-10: 2031 Scenario 2 Total PM Peak Hour

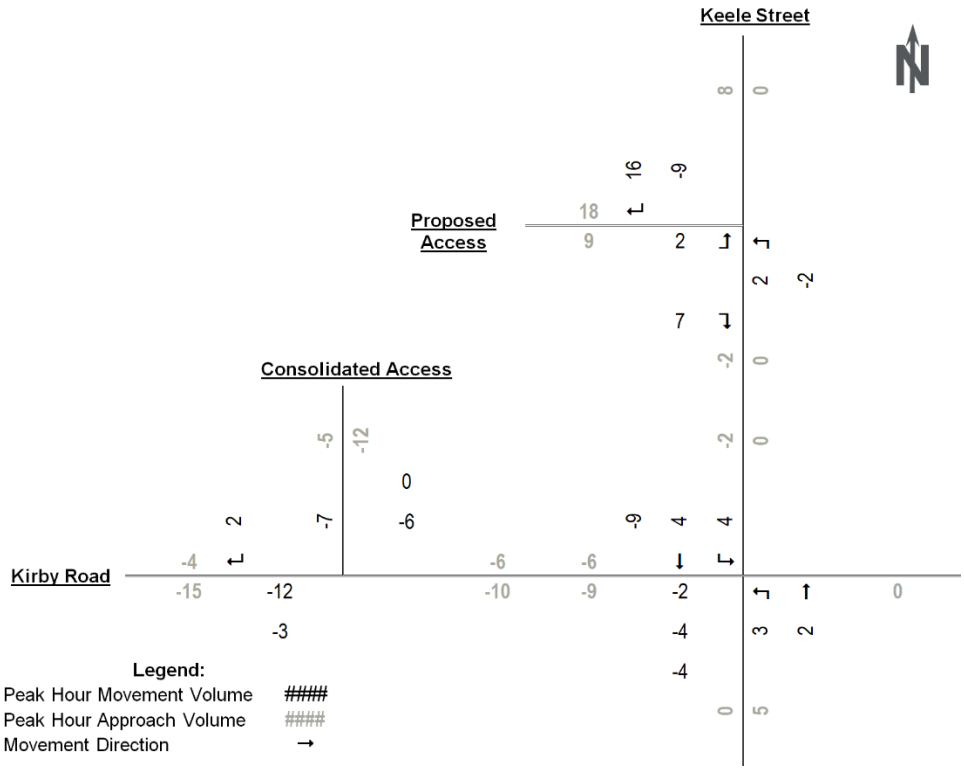


Figure B-11: 2031 Scenario 3 Redistribution AM Peak Hour

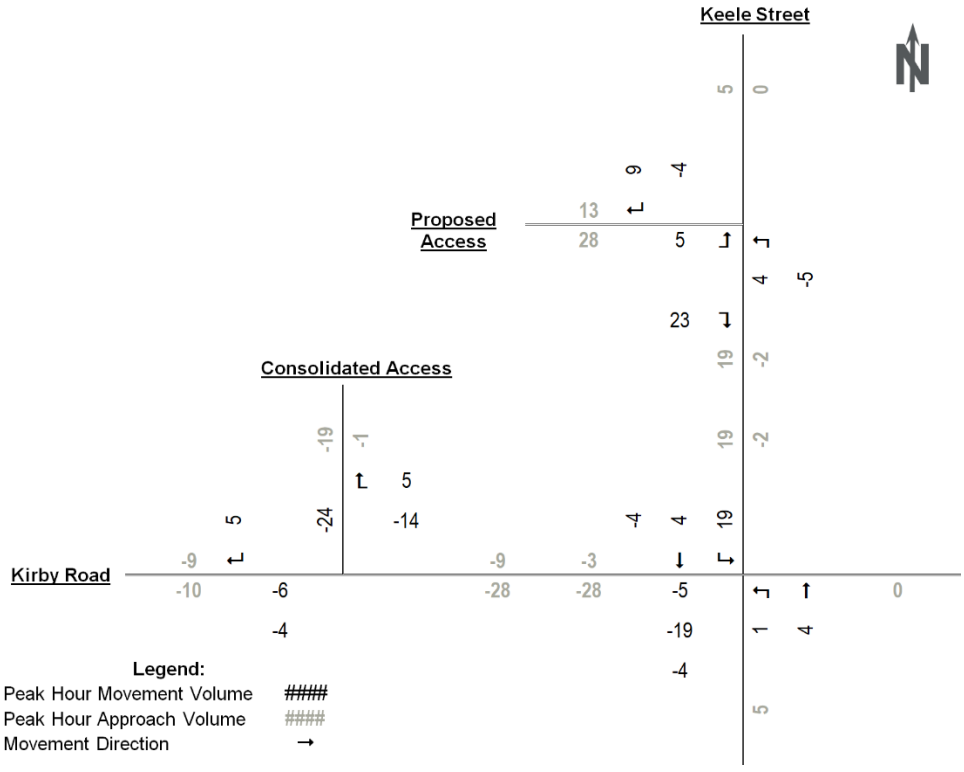


Figure B-12: 2031 Scenario 3 Redistribution PM Peak Hour

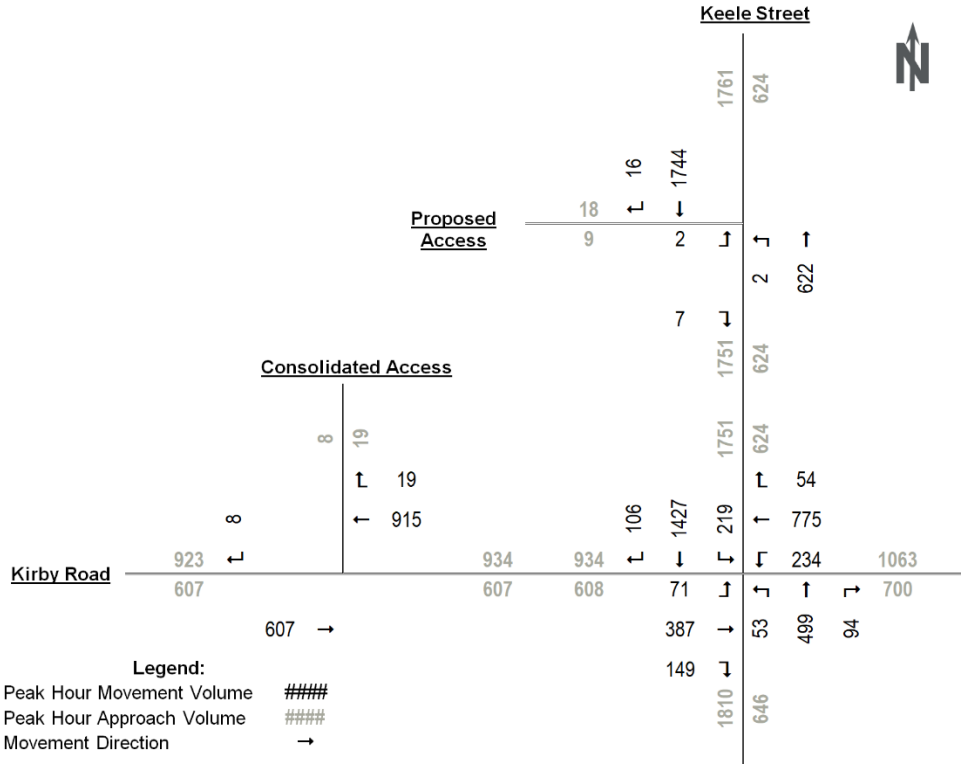


Figure B-13: 2031 Scenario 3 Total AM Peak Hour

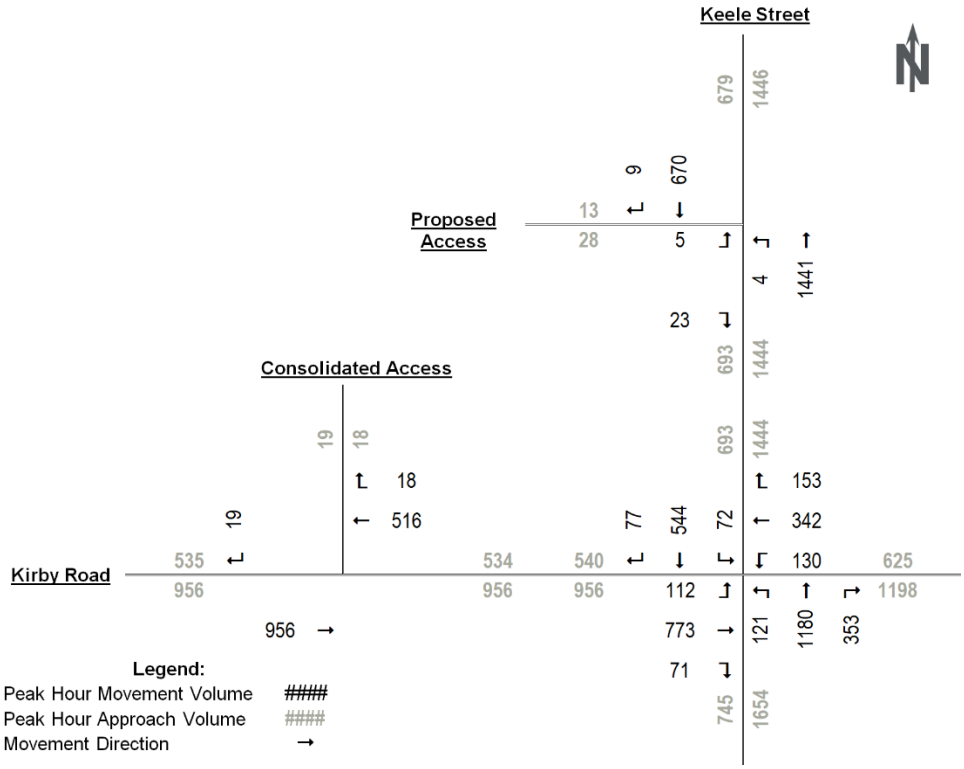


Figure B-14: 2031 Scenario 3 Total PM Peak Hour

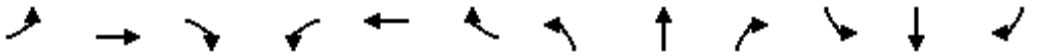
Appendix C: Synchro Analysis Outputs

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	74	399	156	239	846	51	507	96	219	1452	117
v/c Ratio	0.56	0.46	0.33	0.69	0.97	0.38	0.37	0.13	0.45	0.89	0.15
Control Delay	45.0	40.1	7.0	40.4	68.5	21.2	25.4	0.7	15.5	36.5	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	40.1	7.0	40.4	68.5	21.2	25.4	0.7	15.5	36.5	3.6
Queue Length 50th (m)	11.8	41.7	0.0	40.3	~106.1	5.0	43.7	0.0	24.0	165.3	0.0
Queue Length 95th (m)	#23.6	56.7	14.9	61.5	#148.8	10.6	57.8	1.0	37.3	#215.6	9.6
Internal Link Dist (m)		194.2			671.7		353.0			321.3	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	131	890	478	344	871	133	1387	713	498	1634	791
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.45	0.33	0.69	0.97	0.38	0.37	0.13	0.44	0.89	0.15

Intersection Summary

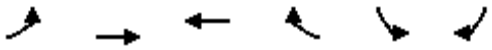
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	73	391	153	234	775	54	50	497	94	215	1423	115
Future Volume (vph)	73	391	153	234	775	54	50	497	94	215	1423	115
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1659	3493	1484	1746	3343		1659	3318	1484	1659	3318	1484
Flt Permitted	0.14	1.00	1.00	0.39	1.00		0.08	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	243	3493	1484	713	3343		142	3318	1484	672	3318	1484
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)	74	399	156	239	791	55	51	507	96	219	1452	117
RTOR Reduction (vph)	0	0	119	0	4	0	0	0	57	0	0	61
Lane Group Flow (vph)	74	399	37	239	842	0	51	507	39	219	1452	56
Heavy Vehicles (%)	10%	10%	10%	10%	8%	10%	10%	10%	10%	10%	10%	10%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	32.8	28.7	28.7	37.6	31.1		53.3	49.3	49.3	65.8	57.3	57.3
Effective Green, g (s)	32.8	30.7	28.7	42.7	31.1		53.3	49.3	49.3	65.8	57.3	57.3
Actuated g/C Ratio	0.27	0.26	0.24	0.36	0.26		0.44	0.41	0.41	0.55	0.48	0.48
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	893	354	335	866		113	1363	609	467	1584	708
v/s Ratio Prot	0.02	0.11		c0.06	c0.25		0.01	0.15		c0.05	c0.44	
v/s Ratio Perm	0.15		0.03	0.20			0.18		0.03	0.21		0.04
v/c Ratio	0.65	0.45	0.11	0.71	0.97		0.45	0.37	0.06	0.47	0.92	0.08
Uniform Delay, d1	35.0	37.5	35.6	31.1	44.0		23.7	24.6	21.4	14.6	29.1	17.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.0	0.4	0.1	7.0	23.7		2.8	0.8	0.2	0.7	9.9	0.2
Delay (s)	47.0	37.9	35.8	38.1	67.8		26.5	25.4	21.6	15.3	39.0	17.2
Level of Service	D	D	D	D	E		C	C	C	B	D	B
Approach Delay (s)		38.4			61.2			24.9			34.7	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	12	610	921	19	7	6
Future Volume (Veh/h)	12	610	921	19	7	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	14	701	1059	22	8	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			218			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1081				1448	540
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	492				973	0
tC, single (s)	4.6				7.4	7.6
tC, 2 stage (s)						
tF (s)	2.5				3.8	3.6
p0 queue free %	98				95	99
cM capacity (veh/h)	705				155	759

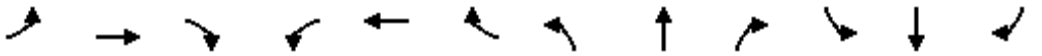
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	248	467	706	375	15
Volume Left	14	0	0	0	8
Volume Right	0	0	0	22	7
cSH	705	1700	1700	1700	247
Volume to Capacity	0.02	0.27	0.42	0.22	0.06
Queue Length 95th (m)	0.5	0.0	0.0	0.0	1.5
Control Delay (s)	0.8	0.0	0.0	0.0	20.5
Lane LOS	A				C
Approach Delay (s)	0.3		0.0		20.5
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	126	852	81	140	533	129	1265	380	57	581	87
v/c Ratio	0.51	0.90	0.17	0.69	0.66	0.32	0.81	0.45	0.37	0.40	0.12
Control Delay	34.1	56.1	2.5	42.6	40.8	15.2	33.1	9.9	19.4	24.3	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.1	56.1	2.5	42.6	40.8	15.2	33.1	9.9	19.4	24.3	1.9
Queue Length 50th (m)	20.0	101.4	0.0	21.4	53.2	14.0	136.2	20.4	5.9	48.6	0.0
Queue Length 95th (m)	34.1	#135.0	4.1	#41.5	71.9	23.9	167.0	45.3	12.2	63.3	4.9
Internal Link Dist (m)		193.2			671.7		353.0			321.3	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	248	960	474	204	825	402	1561	843	156	1449	714
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.89	0.17	0.69	0.65	0.32	0.81	0.45	0.37	0.40	0.12

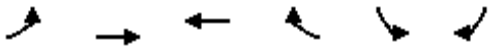
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	117	792	75	130	342	153	120	1176	353	53	540	81
Future Volume (vph)	117	792	75	130	342	153	120	1176	353	53	540	81
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1659	3493	1484	1746	3193		1659	3318	1526	1659	3318	1484
Flt Permitted	0.28	1.00	1.00	0.13	1.00		0.36	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	497	3493	1484	231	3193		627	3318	1526	185	3318	1484
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	126	852	81	140	368	165	129	1265	380	57	581	87
RTOR Reduction (vph)	0	0	60	0	43	0	0	0	127	0	0	49
Lane Group Flow (vph)	126	852	21	140	490	0	129	1265	253	57	581	38
Heavy Vehicles (%)	10%	10%	10%	10%	9%	9%	10%	10%	7%	10%	10%	10%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	38.4	30.4	30.4	35.4	28.9		62.8	55.6	55.6	56.4	52.4	52.4
Effective Green, g (s)	38.4	32.4	30.4	41.4	28.9		62.8	55.6	55.6	56.4	52.4	52.4
Actuated g/C Ratio	0.32	0.27	0.25	0.34	0.24		0.52	0.46	0.46	0.47	0.44	0.44
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	943	375	199	768		390	1537	707	136	1448	648
v/s Ratio Prot	0.04	c0.24		c0.06	0.15		c0.02	c0.38		0.01	0.18	
v/s Ratio Perm	0.13		0.01	0.19			0.15		0.17	0.18		0.03
v/c Ratio	0.53	0.90	0.05	0.70	0.64		0.33	0.82	0.36	0.42	0.40	0.06
Uniform Delay, d1	30.7	42.3	33.9	30.6	40.9		15.2	27.9	20.7	21.0	23.1	19.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	11.8	0.1	10.7	1.7		0.5	5.1	1.4	2.1	0.8	0.2
Delay (s)	33.0	54.1	34.0	41.3	42.6		15.7	33.0	22.1	23.1	23.9	19.7
Level of Service	C	D	C	D	D		B	C	C	C	C	B
Approach Delay (s)		50.0			42.3			29.5			23.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	960	530	13	24	14
Future Volume (Veh/h)	6	960	530	13	24	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	8	1200	662	16	30	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			217			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	678				1286	339
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	476				1137	108
tC, single (s)	5.4				7.1	7.6
tC, 2 stage (s)						
tF (s)	2.9				3.7	3.7
p0 queue free %	99				81	98
cM capacity (veh/h)	675				158	761

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	408	800	441	237	48
Volume Left	8	0	0	0	30
Volume Right	0	0	0	16	18
cSH	675	1700	1700	1700	225
Volume to Capacity	0.01	0.47	0.26	0.14	0.21
Queue Length 95th (m)	0.3	0.0	0.0	0.0	6.0
Control Delay (s)	0.4	0.0	0.0	0.0	25.3
Lane LOS	A				D
Approach Delay (s)	0.1		0.0		25.3
Approach LOS					D

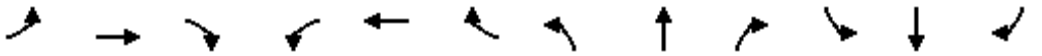
Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	395	152	239	846	59	507	96	219	1452	126
v/c Ratio	0.55	0.46	0.32	0.69	0.97	0.46	0.37	0.13	0.45	0.89	0.16
Control Delay	43.5	40.0	6.5	40.2	68.5	25.6	25.4	0.7	15.5	36.5	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.5	40.0	6.5	40.2	68.5	25.6	25.4	0.7	15.5	36.5	4.3
Queue Length 50th (m)	11.4	41.2	0.0	40.3	~106.1	5.8	43.7	0.0	24.0	165.3	1.0
Queue Length 95th (m)	22.0	56.2	13.8	61.5	#148.8	12.6	57.8	1.0	37.3	#215.6	11.1
Internal Link Dist (m)		194.2			671.7		353.0			321.3	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	132	890	481	345	871	128	1387	713	498	1634	777
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.44	0.32	0.69	0.97	0.46	0.37	0.13	0.44	0.89	0.16

Intersection Summary

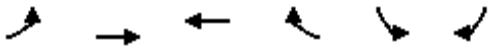
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	387	149	234	775	54	58	497	94	215	1423	123
Future Volume (vph)	71	387	149	234	775	54	58	497	94	215	1423	123
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3343		1601	3318	1484	1659	3318	1458
Flt Permitted	0.14	1.00	1.00	0.39	1.00		0.08	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	246	3493	1498	719	3343		137	3318	1484	672	3318	1458
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)	72	395	152	239	791	55	59	507	96	219	1452	126
RTOR Reduction (vph)	0	0	116	0	4	0	0	0	57	0	0	62
Lane Group Flow (vph)	72	395	36	239	842	0	59	507	39	219	1452	64
Heavy Vehicles (%)	9%	10%	9%	10%	8%	10%	14%	10%	10%	10%	10%	12%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	32.8	28.7	28.7	37.6	31.1		53.3	49.3	49.3	65.8	57.3	57.3
Effective Green, g (s)	32.8	30.7	28.7	42.7	31.1		53.3	49.3	49.3	65.8	57.3	57.3
Actuated g/C Ratio	0.27	0.26	0.24	0.36	0.26		0.44	0.41	0.41	0.55	0.48	0.48
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	116	893	358	337	866		109	1363	609	467	1584	696
v/s Ratio Prot	0.02	0.11		c0.06	c0.25		0.02	0.15		c0.05	c0.44	
v/s Ratio Perm	0.15		0.02	0.20			0.22		0.03	0.21		0.04
v/c Ratio	0.62	0.44	0.10	0.71	0.97		0.54	0.37	0.06	0.47	0.92	0.09
Uniform Delay, d1	34.9	37.5	35.6	31.0	44.0		24.0	24.6	21.4	14.6	29.1	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.9	0.4	0.1	6.7	23.7		5.4	0.8	0.2	0.7	9.9	0.3
Delay (s)	44.8	37.8	35.7	37.7	67.8		29.3	25.4	21.6	15.3	39.0	17.4
Level of Service	D	D	D	D	E		C	C	C	B	D	B
Approach Delay (s)		38.1			61.1			25.2			34.6	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	40.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	607	915	40	0	17
Future Volume (Veh/h)	0	607	915	40	0	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	698	1052	46	0	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			218			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1098				1424	549
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	515				941	0
tC, single (s)	4.6				7.4	7.8
tC, 2 stage (s)						
tF (s)	2.5				3.8	3.8
p0 queue free %	100				100	97
cM capacity (veh/h)	691				167	731

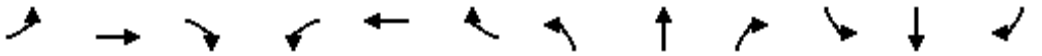
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	349	349	701	397	20
Volume Left	0	0	0	0	0
Volume Right	0	0	0	46	20
cSH	1700	1700	1700	1700	731
Volume to Capacity	0.21	0.21	0.41	0.23	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.6
Control Delay (s)	0.0	0.0	0.0	0.0	10.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.1
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	120	831	76	140	533	134	1265	380	57	581	92
v/c Ratio	0.48	0.89	0.16	0.69	0.67	0.34	0.81	0.45	0.36	0.40	0.13
Control Delay	32.7	54.3	2.0	42.7	41.9	15.5	32.9	9.9	19.3	24.4	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	54.3	2.0	42.7	41.9	15.5	32.9	9.9	19.3	24.4	2.3
Queue Length 50th (m)	19.0	98.2	0.0	21.4	53.8	14.7	136.2	20.4	5.9	48.8	0.0
Queue Length 95th (m)	32.8	#129.3	3.0	#41.5	72.7	24.8	167.0	45.3	12.2	63.6	5.7
Internal Link Dist (m)		193.2			671.7		353.0			321.3	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	255	960	478	204	804	395	1566	844	157	1446	690
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.87	0.16	0.69	0.66	0.34	0.81	0.45	0.36	0.40	0.13

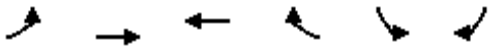
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	773	71	130	342	153	125	1176	353	53	540	86
Future Volume (vph)	112	773	71	130	342	153	125	1176	353	53	540	86
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3193		1615	3318	1526	1659	3318	1432
Flt Permitted	0.27	1.00	1.00	0.13	1.00		0.36	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	482	3493	1498	236	3193		607	3318	1526	187	3318	1432
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	120	831	76	140	368	165	134	1265	380	57	581	92
RTOR Reduction (vph)	0	0	57	0	43	0	0	0	126	0	0	52
Lane Group Flow (vph)	120	831	19	140	490	0	134	1265	254	57	581	40
Heavy Vehicles (%)	9%	10%	9%	10%	9%	9%	13%	10%	7%	10%	10%	14%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	38.9	30.3	30.3	34.7	28.2		63.1	55.7	55.7	56.3	52.3	52.3
Effective Green, g (s)	38.9	32.3	30.3	40.7	28.2		63.1	55.7	55.7	56.3	52.3	52.3
Actuated g/C Ratio	0.32	0.27	0.25	0.34	0.23		0.53	0.46	0.46	0.47	0.44	0.44
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	241	940	378	199	750		381	1540	708	136	1446	624
v/s Ratio Prot	c0.04	c0.24		c0.06	0.15		c0.02	c0.38		0.01	0.18	
v/s Ratio Perm	0.13		0.01	0.18			0.16		0.17	0.18		0.03
v/c Ratio	0.50	0.88	0.05	0.70	0.65		0.35	0.82	0.36	0.42	0.40	0.06
Uniform Delay, d1	30.2	42.1	34.0	30.8	41.5		15.2	27.8	20.7	21.0	23.2	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	9.9	0.1	10.7	2.1		0.6	5.1	1.4	2.1	0.8	0.2
Delay (s)	31.9	52.0	34.0	41.5	43.5		15.8	32.9	22.1	23.1	24.0	19.8
Level of Service	C	D	C	D	D		B	C	C	C	C	B
Approach Delay (s)		48.3			43.1			29.3			23.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	956	516	31	0	47
Future Volume (Veh/h)	0	956	516	31	0	47
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1195	645	39	0	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			217			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	684				1262	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	481				1110	109
tC, single (s)	5.4				7.1	7.7
tC, 2 stage (s)						
tF (s)	2.9				3.7	3.7
p0 queue free %	100				100	92
cM capacity (veh/h)	671				167	754

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	598	598	430	254	59
Volume Left	0	0	0	0	0
Volume Right	0	0	0	39	59
cSH	1700	1700	1700	1700	754
Volume to Capacity	0.35	0.35	0.25	0.15	0.08
Queue Length 95th (m)	0.0	0.0	0.0	0.0	1.9
Control Delay (s)	0.0	0.0	0.0	0.0	10.2
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.2
Approach LOS					B

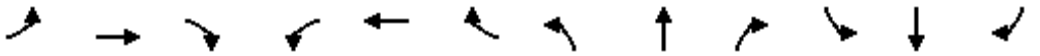
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	395	152	239	846	59	507	96	223	1456	108
v/c Ratio	0.55	0.46	0.32	0.69	0.97	0.46	0.37	0.14	0.46	0.89	0.13
Control Delay	43.5	40.0	6.5	40.2	68.5	25.7	25.6	0.7	15.7	36.7	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.5	40.0	6.5	40.2	68.5	25.7	25.6	0.7	15.7	36.7	3.0
Queue Length 50th (m)	11.4	41.2	0.0	40.3	~106.1	5.8	43.8	0.0	24.6	166.2	0.0
Queue Length 95th (m)	22.0	56.2	13.8	61.5	#148.8	12.6	58.0	1.0	38.2	#216.6	8.1
Internal Link Dist (m)		194.2			671.7		353.0			176.5	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	132	890	481	345	871	128	1382	711	495	1634	818
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.44	0.32	0.69	0.97	0.46	0.37	0.14	0.45	0.89	0.13

Intersection Summary

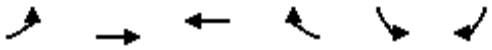
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	387	149	234	775	54	58	497	94	219	1427	106
Future Volume (vph)	71	387	149	234	775	54	58	497	94	219	1427	106
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3343		1601	3318	1484	1644	3318	1541
Flt Permitted	0.14	1.00	1.00	0.39	1.00		0.08	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	246	3493	1498	719	3343		137	3318	1484	665	3318	1541
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)	72	395	152	239	791	55	59	507	96	223	1456	108
RTOR Reduction (vph)	0	0	116	0	4	0	0	0	57	0	0	56
Lane Group Flow (vph)	72	395	36	239	842	0	59	507	39	223	1456	52
Heavy Vehicles (%)	9%	10%	9%	10%	8%	10%	14%	10%	10%	11%	10%	6%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	32.8	28.7	28.7	37.6	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Effective Green, g (s)	32.8	30.7	28.7	42.7	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Actuated g/C Ratio	0.27	0.26	0.24	0.36	0.26		0.44	0.41	0.41	0.55	0.48	0.48
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	116	893	358	337	866		109	1357	607	464	1584	735
v/s Ratio Prot	0.02	0.11		c0.06	c0.25		0.02	0.15		c0.05	c0.44	
v/s Ratio Perm	0.15		0.02	0.20			0.22		0.03	0.21		0.03
v/c Ratio	0.62	0.44	0.10	0.71	0.97		0.54	0.37	0.06	0.48	0.92	0.07
Uniform Delay, d1	34.9	37.5	35.6	31.0	44.0		24.1	24.7	21.5	14.7	29.2	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.9	0.4	0.1	6.7	23.7		5.4	0.8	0.2	0.8	10.1	0.2
Delay (s)	44.8	37.8	35.7	37.7	67.8		29.5	25.5	21.7	15.5	39.3	17.1
Level of Service	D	D	D	D	E		C	C	C	B	D	B
Approach Delay (s)		38.1			61.1			25.3			35.0	
Approach LOS		D			E			C			C	

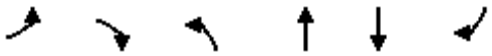
Intersection Summary			
HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	607	915	24	0	10
Future Volume (Veh/h)	0	607	915	24	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	698	1052	28	0	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			218			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1080				1415	540
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	491				929	0
tC, single (s)	4.1				6.8	7.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	98
cM capacity (veh/h)	829				207	723

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	349	349	701	379	11
Volume Left	0	0	0	0	0
Volume Right	0	0	0	28	11
cSH	1700	1700	1700	1700	723
Volume to Capacity	0.21	0.21	0.41	0.22	0.02
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	0.0	0.0	10.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.1
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	7	0	622	1744	16
Future Volume (Veh/h)	0	7	0	622	1744	16
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)	0	8	0	676	1896	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				201		
pX, platoon unblocked	0.91					
vC, conflicting volume	2242	956	1913			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2164	956	1913			
tC, single (s)	6.8	7.7	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.7	2.2			
p0 queue free %	100	96	100			
cM capacity (veh/h)	37	195	314			

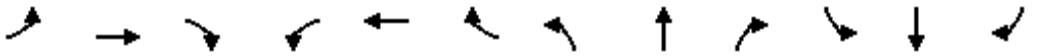
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	8	338	338	1264	649
Volume Left	0	0	0	0	0
Volume Right	8	0	0	0	17
cSH	195	1700	1700	1700	1700
Volume to Capacity	0.04	0.20	0.20	0.74	0.38
Queue Length 95th (m)	1.0	0.0	0.0	0.0	0.0
Control Delay (s)	24.3	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	24.3	0.0		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	120	831	76	140	533	134	1265	380	77	585	83
v/c Ratio	0.48	0.89	0.16	0.69	0.67	0.34	0.81	0.45	0.51	0.40	0.11
Control Delay	32.7	54.3	2.0	42.7	41.9	15.5	33.1	9.9	24.7	24.4	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	54.3	2.0	42.7	41.9	15.5	33.1	9.9	24.7	24.4	1.7
Queue Length 50th (m)	19.0	98.2	0.0	21.4	53.8	14.7	136.5	20.4	8.1	49.3	0.0
Queue Length 95th (m)	32.8	#129.3	3.0	#41.5	72.7	24.8	167.2	45.5	15.4	64.1	4.2
Internal Link Dist (m)		193.2			671.7		353.0			175.4	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	255	960	478	204	804	393	1564	844	152	1446	744
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.87	0.16	0.69	0.66	0.34	0.81	0.45	0.51	0.40	0.11

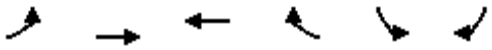
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	773	71	130	342	153	125	1176	353	72	544	77
Future Volume (vph)	112	773	71	130	342	153	125	1176	353	72	544	77
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3193		1615	3318	1526	1601	3318	1555
Flt Permitted	0.27	1.00	1.00	0.13	1.00		0.36	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	482	3493	1498	236	3193		605	3318	1526	179	3318	1555
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	120	831	76	140	368	165	134	1265	380	77	585	83
RTOR Reduction (vph)	0	0	57	0	43	0	0	0	127	0	0	47
Lane Group Flow (vph)	120	831	19	140	490	0	134	1265	253	77	585	36
Heavy Vehicles (%)	9%	10%	9%	10%	9%	9%	13%	10%	7%	14%	10%	5%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	38.9	30.3	30.3	34.7	28.2		63.0	55.6	55.6	56.4	52.3	52.3
Effective Green, g (s)	38.9	32.3	30.3	40.7	28.2		63.0	55.6	55.6	56.4	52.3	52.3
Actuated g/C Ratio	0.32	0.27	0.25	0.34	0.23		0.52	0.46	0.46	0.47	0.44	0.44
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	241	940	378	199	750		379	1537	707	132	1446	677
v/s Ratio Prot	c0.04	c0.24		c0.06	0.15		0.02	c0.38		c0.02	0.18	
v/s Ratio Perm	0.13		0.01	0.18			0.16		0.17	0.25		0.02
v/c Ratio	0.50	0.88	0.05	0.70	0.65		0.35	0.82	0.36	0.58	0.40	0.05
Uniform Delay, d1	30.2	42.1	34.0	30.8	41.5		15.2	27.9	20.7	21.5	23.2	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	9.9	0.1	10.7	2.1		0.6	5.1	1.4	6.4	0.8	0.2
Delay (s)	31.9	52.0	34.0	41.5	43.5		15.8	33.0	22.1	28.0	24.0	19.7
Level of Service	C	D	C	D	D		B	C	C	C	C	B
Approach Delay (s)		48.3			43.1			29.4			24.0	
Approach LOS		D			D			C			C	

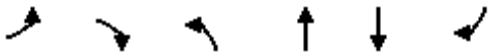
Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	956	516	22	0	24
Future Volume (Veh/h)	0	956	516	22	0	24
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1195	645	28	0	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			217			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	673				1256	336
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	469				1104	103
tC, single (s)	4.1				6.8	7.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	96
cM capacity (veh/h)	1014				192	733

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	598	598	430	243	30
Volume Left	0	0	0	0	0
Volume Right	0	0	0	28	30
cSH	1700	1700	1700	1700	733
Volume to Capacity	0.35	0.35	0.25	0.14	0.04
Queue Length 95th (m)	0.0	0.0	0.0	0.0	1.0
Control Delay (s)	0.0	0.0	0.0	0.0	10.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.1
Approach LOS					B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	23	0	1441	670	9
Future Volume (Veh/h)	0	23	0	1441	670	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)	0	25	0	1566	728	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)				199		
pX, platoon unblocked	0.67					
vC, conflicting volume	1516	369	738			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	770	369	738			
tC, single (s)	6.8	7.4	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.6	2.2			
p0 queue free %	100	96	100			
cM capacity (veh/h)	227	564	877			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	25	783	783	485	253
Volume Left	0	0	0	0	0
Volume Right	25	0	0	0	10
cSH	564	1700	1700	1700	1700
Volume to Capacity	0.04	0.46	0.46	0.29	0.15
Queue Length 95th (m)	1.1	0.0	0.0	0.0	0.0
Control Delay (s)	11.7	0.0	0.0	0.0	0.0
Lane LOS	B				
Approach Delay (s)	11.7	0.0		0.0	
Approach LOS	B				

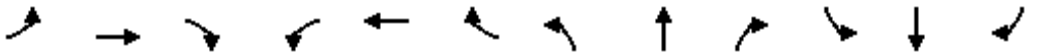
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	395	152	239	846	54	509	96	223	1456	108
v/c Ratio	0.55	0.46	0.32	0.69	0.97	0.42	0.37	0.14	0.46	0.89	0.13
Control Delay	43.5	40.0	6.5	40.2	68.5	23.0	25.6	0.7	15.8	36.7	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.5	40.0	6.5	40.2	68.5	23.0	25.6	0.7	15.8	36.7	3.0
Queue Length 50th (m)	11.4	41.2	0.0	40.3	~106.1	5.3	44.1	0.0	24.6	166.2	0.0
Queue Length 95th (m)	22.0	56.2	13.8	61.5	#148.8	11.0	58.3	1.0	38.2	#216.6	8.1
Internal Link Dist (m)		194.2			671.7		353.0			176.5	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	132	890	481	345	871	129	1382	711	494	1634	818
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.44	0.32	0.69	0.97	0.42	0.37	0.14	0.45	0.89	0.13

Intersection Summary

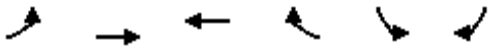
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	387	149	234	775	54	53	499	94	219	1427	106
Future Volume (vph)	71	387	149	234	775	54	53	499	94	219	1427	106
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3343		1615	3318	1484	1644	3318	1541
Flt Permitted	0.14	1.00	1.00	0.39	1.00		0.08	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	246	3493	1498	719	3343		139	3318	1484	663	3318	1541
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)	72	395	152	239	791	55	54	509	96	223	1456	108
RTOR Reduction (vph)	0	0	116	0	4	0	0	0	57	0	0	56
Lane Group Flow (vph)	72	395	36	239	842	0	54	509	39	223	1456	52
Heavy Vehicles (%)	9%	10%	9%	10%	8%	10%	13%	10%	10%	11%	10%	6%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	32.8	28.7	28.7	37.6	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Effective Green, g (s)	32.8	30.7	28.7	42.7	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Actuated g/C Ratio	0.27	0.26	0.24	0.36	0.26		0.44	0.41	0.41	0.55	0.48	0.48
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	116	893	358	337	866		110	1357	607	463	1584	735
v/s Ratio Prot	0.02	0.11		c0.06	c0.25		0.02	0.15		c0.05	c0.44	
v/s Ratio Perm	0.15		0.02	0.20			0.20		0.03	0.21		0.03
v/c Ratio	0.62	0.44	0.10	0.71	0.97		0.49	0.38	0.06	0.48	0.92	0.07
Uniform Delay, d1	34.9	37.5	35.6	31.0	44.0		23.9	24.7	21.5	14.7	29.2	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.9	0.4	0.1	6.7	23.7		3.4	0.8	0.2	0.8	10.1	0.2
Delay (s)	44.8	37.8	35.7	37.7	67.8		27.3	25.5	21.7	15.5	39.3	17.1
Level of Service	D	D	D	D	E		C	C	C	B	D	B
Approach Delay (s)		38.1			61.1			25.1			35.0	
Approach LOS		D			E			C			C	

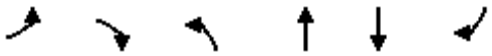
Intersection Summary			
HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	607	915	19	0	8
Future Volume (Veh/h)	0	607	915	19	0	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	698	1052	22	0	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			218			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1074				1412	537
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	483				925	0
tC, single (s)	4.1				6.8	7.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	99
cM capacity (veh/h)	834				208	725

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	349	349	701	373	9
Volume Left	0	0	0	0	0
Volume Right	0	0	0	22	9
cSH	1700	1700	1700	1700	725
Volume to Capacity	0.21	0.21	0.41	0.22	0.01
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	0.0	0.0	10.0
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.0
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	7	2	622	1744	16
Future Volume (Veh/h)	2	7	2	622	1744	16
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)	2	8	2	676	1896	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				201		
pX, platoon unblocked	0.91					
vC, conflicting volume	2246	956	1913			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2168	956	1913			
tC, single (s)	7.9	7.7	5.4			
tC, 2 stage (s)						
tF (s)	4.0	3.7	2.9			
p0 queue free %	89	96	99			
cM capacity (veh/h)	19	195	136			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	227	451	1264	649
Volume Left	2	2	0	0	0
Volume Right	8	0	0	0	17
cSH	67	136	1700	1700	1700
Volume to Capacity	0.15	0.01	0.27	0.74	0.38
Queue Length 95th (m)	3.7	0.3	0.0	0.0	0.0
Control Delay (s)	67.4	0.8	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	67.4	0.3		0.0	
Approach LOS	F				

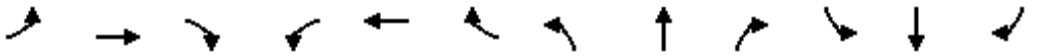
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	72	395	152	239	846	54	509	96	223	1456	108
v/c Ratio	0.55	0.46	0.32	0.69	0.97	0.42	0.37	0.14	0.46	0.89	0.13
Control Delay	43.5	40.0	6.5	40.2	68.5	23.0	25.6	0.7	15.8	36.7	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
Total Delay	43.5	40.0	6.5	40.2	68.5	23.0	25.6	0.7	15.8	39.3	3.0
Queue Length 50th (m)	11.4	41.2	0.0	40.3	~106.1	5.3	44.1	0.0	24.6	166.2	0.0
Queue Length 95th (m)	22.0	56.2	13.8	61.5	#148.8	11.0	58.3	1.0	38.2	#216.6	8.1
Internal Link Dist (m)		194.2			671.7		353.0			176.5	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	132	890	481	345	871	129	1382	711	494	1634	818
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	96	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.44	0.32	0.69	0.97	0.42	0.37	0.14	0.45	0.95	0.13

Intersection Summary

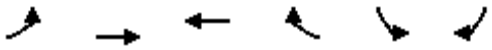
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	387	149	234	775	54	53	499	94	219	1427	106
Future Volume (vph)	71	387	149	234	775	54	53	499	94	219	1427	106
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3343		1615	3318	1484	1644	3318	1541
Flt Permitted	0.14	1.00	1.00	0.39	1.00		0.08	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	246	3493	1498	719	3343		139	3318	1484	663	3318	1541
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)	72	395	152	239	791	55	54	509	96	223	1456	108
RTOR Reduction (vph)	0	0	116	0	4	0	0	0	57	0	0	56
Lane Group Flow (vph)	72	395	36	239	842	0	54	509	39	223	1456	52
Heavy Vehicles (%)	9%	10%	9%	10%	8%	10%	13%	10%	10%	11%	10%	6%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	32.8	28.7	28.7	37.6	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Effective Green, g (s)	32.8	30.7	28.7	42.7	31.1		53.1	49.1	49.1	65.8	57.3	57.3
Actuated g/C Ratio	0.27	0.26	0.24	0.36	0.26		0.44	0.41	0.41	0.55	0.48	0.48
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	116	893	358	337	866		110	1357	607	463	1584	735
v/s Ratio Prot	0.02	0.11		c0.06	c0.25		0.02	0.15		c0.05	c0.44	
v/s Ratio Perm	0.15		0.02	0.20			0.20		0.03	0.21		0.03
v/c Ratio	0.62	0.44	0.10	0.71	0.97		0.49	0.38	0.06	0.48	0.92	0.07
Uniform Delay, d1	34.9	37.5	35.6	31.0	44.0		23.9	24.7	21.5	14.7	29.2	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.9	0.4	0.1	6.7	23.7		3.4	0.8	0.2	0.8	10.1	0.2
Delay (s)	44.8	37.8	35.7	37.7	67.8		27.3	25.5	21.7	15.5	39.3	17.1
Level of Service	D	D	D	D	E		C	C	C	B	D	B
Approach Delay (s)		38.1			61.1			25.1			35.0	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



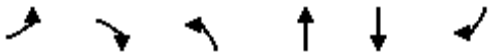
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↱			↱
Traffic Volume (veh/h)	0	607	915	19	0	8
Future Volume (Veh/h)	0	607	915	19	0	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	698	1052	22	0	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			218			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1074				1412	537
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	483				925	0
tC, single (s)	4.1				6.8	7.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	99
cM capacity (veh/h)	834				208	725

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	349	349	701	373	9
Volume Left	0	0	0	0	0
Volume Right	0	0	0	22	9
cSH	1700	1700	1700	1700	725
Volume to Capacity	0.21	0.21	0.41	0.22	0.01
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	0.0	0.0	10.0
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.0
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	2	8	2	676	1913
v/c Ratio	0.02	0.06	0.02	0.23	0.60
Control Delay	43.0	25.4	2.0	1.1	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	25.4	2.0	1.1	2.7
Queue Length 50th (m)	0.3	0.0	0.0	0.0	0.0
Queue Length 95th (m)	2.8	4.7	0.6	22.6	114.1
Internal Link Dist (m)	146.9			176.5	120.8
Turn Bay Length (m)			25.0		
Base Capacity (vph)	418	408	107	2934	3162
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.00	0.02	0.02	0.23	0.60

Intersection Summary



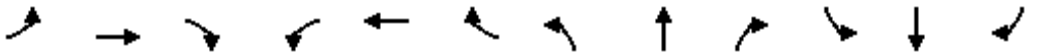
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	2	7	2	622	1744	16
Future Volume (vph)	2	7	2	622	1744	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1193	1150	1093	3067	3304	
Flt Permitted	0.95	1.00	0.10	1.00	1.00	
Satd. Flow (perm)	1193	1150	111	3067	3304	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	8	2	676	1896	17
RTOR Reduction (vph)	0	8	0	0	0	0
Lane Group Flow (vph)	2	0	2	676	1913	0
Heavy Vehicles (%)	53%	42%	67%	19%	10%	47%
Turn Type	Perm	Perm	Perm	NA	NA	
Protected Phases				2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	1.8	1.8	87.4	87.4	87.4	
Effective Green, g (s)	1.8	1.8	87.4	87.4	87.4	
Actuated g/C Ratio	0.02	0.02	0.85	0.85	0.85	
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	20	20	94	2597	2798	
v/s Ratio Prot				0.22	c0.58	
v/s Ratio Perm	c0.00	0.00	0.02			
v/c Ratio	0.10	0.01	0.02	0.26	0.68	
Uniform Delay, d1	49.9	49.8	1.2	1.6	2.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.2	0.1	0.4	0.2	1.4	
Delay (s)	52.1	50.0	1.6	1.8	4.2	
Level of Service	D	D	A	A	A	
Approach Delay (s)	50.4			1.8	4.2	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	3.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	103.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	120	831	76	140	533	130	1269	380	77	585	83
v/c Ratio	0.48	0.89	0.16	0.69	0.67	0.32	0.81	0.45	0.51	0.40	0.11
Control Delay	32.7	54.3	2.0	42.7	41.9	15.2	33.2	10.0	24.9	24.3	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	54.3	2.0	42.7	41.9	15.2	33.2	10.0	24.9	24.3	1.7
Queue Length 50th (m)	19.0	98.2	0.0	21.4	53.8	14.2	137.2	20.5	8.1	49.1	0.0
Queue Length 95th (m)	32.8	#129.3	3.0	#41.5	72.7	24.2	168.1	45.6	15.4	64.0	4.2
Internal Link Dist (m)		193.2			671.7		353.0			175.4	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	255	960	478	204	804	402	1564	843	151	1451	747
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.87	0.16	0.69	0.66	0.32	0.81	0.45	0.51	0.40	0.11

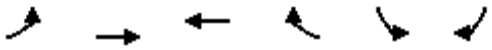
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	773	71	130	342	153	121	1180	353	72	544	77
Future Volume (vph)	112	773	71	130	342	153	121	1180	353	72	544	77
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3193		1659	3318	1526	1601	3318	1555
Flt Permitted	0.27	1.00	1.00	0.13	1.00		0.36	1.00	1.00	0.10	1.00	1.00
Satd. Flow (perm)	482	3493	1498	236	3193		624	3318	1526	176	3318	1555
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	120	831	76	140	368	165	130	1269	380	77	585	83
RTOR Reduction (vph)	0	0	57	0	43	0	0	0	126	0	0	47
Lane Group Flow (vph)	120	831	19	140	490	0	130	1269	254	77	585	36
Heavy Vehicles (%)	9%	10%	9%	10%	9%	9%	10%	10%	7%	14%	10%	5%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	38.9	30.3	30.3	34.7	28.2		62.8	55.6	55.6	56.6	52.5	52.5
Effective Green, g (s)	38.9	32.3	30.3	40.7	28.2		62.8	55.6	55.6	56.6	52.5	52.5
Actuated g/C Ratio	0.32	0.27	0.25	0.34	0.23		0.52	0.46	0.46	0.47	0.44	0.44
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	241	940	378	199	750		388	1537	707	131	1451	680
v/s Ratio Prot	c0.04	c0.24		c0.06	0.15		0.02	c0.38		c0.02	0.18	
v/s Ratio Perm	0.13		0.01	0.18			0.15		0.17	0.26		0.02
v/c Ratio	0.50	0.88	0.05	0.70	0.65		0.34	0.83	0.36	0.59	0.40	0.05
Uniform Delay, d1	30.2	42.1	34.0	30.8	41.5		15.2	28.0	20.7	21.5	23.1	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	9.9	0.1	10.7	2.1		0.5	5.2	1.4	6.6	0.8	0.1
Delay (s)	31.9	52.0	34.0	41.5	43.5		15.8	33.2	22.1	28.1	23.9	19.6
Level of Service	C	D	C	D	D		B	C	C	C	C	B
Approach Delay (s)		48.3			43.1			29.6			23.8	
Approach LOS		D			D			C			C	

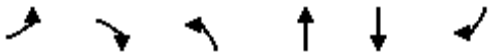
Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	956	516	18	0	19
Future Volume (Veh/h)	0	956	516	18	0	19
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1195	645	22	0	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			217			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	667				1254	334
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				1099	98
tC, single (s)	4.1				6.8	8.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	97
cM capacity (veh/h)	1021				193	732

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	598	598	430	237	24
Volume Left	0	0	0	0	0
Volume Right	0	0	0	22	24
cSH	1700	1700	1700	1700	732
Volume to Capacity	0.35	0.35	0.25	0.14	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.8
Control Delay (s)	0.0	0.0	0.0	0.0	10.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.1
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	23	4	1441	670	9
Future Volume (Veh/h)	5	23	4	1441	670	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)	5	25	4	1566	728	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)				199		
pX, platoon unblocked	0.66					
vC, conflicting volume	1524	369	738			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	776	369	738			
tC, single (s)	7.6	7.4	5.7			
tC, 2 stage (s)						
tF (s)	3.9	3.6	3.0			
p0 queue free %	97	96	99			
cM capacity (veh/h)	176	564	503			

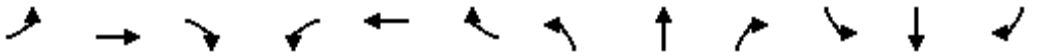
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	30	526	1044	485	253
Volume Left	5	4	0	0	0
Volume Right	25	0	0	0	10
cSH	412	503	1700	1700	1700
Volume to Capacity	0.07	0.01	0.61	0.29	0.15
Queue Length 95th (m)	1.8	0.2	0.0	0.0	0.0
Control Delay (s)	14.4	0.2	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.4	0.1		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	120	831	76	140	533	130	1269	380	77	585	83
v/c Ratio	0.48	0.89	0.16	0.69	0.67	0.32	0.81	0.45	0.51	0.40	0.11
Control Delay	32.7	54.3	2.0	42.7	41.9	15.2	33.2	10.0	24.9	24.3	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	54.3	2.0	42.7	41.9	15.2	33.2	10.0	24.9	24.3	1.7
Queue Length 50th (m)	19.0	98.2	0.0	21.4	53.8	14.2	137.2	20.5	8.1	49.1	0.0
Queue Length 95th (m)	32.8	#129.3	3.0	#41.5	72.7	24.2	168.1	45.6	15.4	64.0	4.2
Internal Link Dist (m)		193.2			671.7		353.0			175.4	
Turn Bay Length (m)	40.0		20.0	65.0		30.0		50.0	50.0		20.0
Base Capacity (vph)	255	960	478	204	804	402	1564	843	151	1451	747
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.87	0.16	0.69	0.66	0.32	0.81	0.45	0.51	0.40	0.11

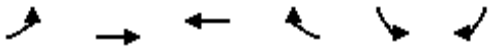
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	773	71	130	342	153	121	1180	353	72	544	77
Future Volume (vph)	112	773	71	130	342	153	121	1180	353	72	544	77
Ideal Flow (vphpl)	1900	2000	1900	2000	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	7.0	1.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1674	3493	1498	1746	3193		1659	3318	1526	1601	3318	1555
Flt Permitted	0.27	1.00	1.00	0.13	1.00		0.36	1.00	1.00	0.10	1.00	1.00
Satd. Flow (perm)	482	3493	1498	236	3193		624	3318	1526	176	3318	1555
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	120	831	76	140	368	165	130	1269	380	77	585	83
RTOR Reduction (vph)	0	0	57	0	43	0	0	0	126	0	0	47
Lane Group Flow (vph)	120	831	19	140	490	0	130	1269	254	77	585	36
Heavy Vehicles (%)	9%	10%	9%	10%	9%	9%	10%	10%	7%	14%	10%	5%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases	4		4	8			6		6	2		2
Actuated Green, G (s)	38.9	30.3	30.3	34.7	28.2		62.8	55.6	55.6	56.6	52.5	52.5
Effective Green, g (s)	38.9	32.3	30.3	40.7	28.2		62.8	55.6	55.6	56.6	52.5	52.5
Actuated g/C Ratio	0.32	0.27	0.25	0.34	0.23		0.52	0.46	0.46	0.47	0.44	0.44
Clearance Time (s)	4.5	7.0	7.0	4.5	7.0		4.5	7.5	7.5	4.5	7.5	7.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	241	940	378	199	750		388	1537	707	131	1451	680
v/s Ratio Prot	c0.04	c0.24		c0.06	0.15		0.02	c0.38		c0.02	0.18	
v/s Ratio Perm	0.13		0.01	0.18			0.15		0.17	0.26		0.02
v/c Ratio	0.50	0.88	0.05	0.70	0.65		0.34	0.83	0.36	0.59	0.40	0.05
Uniform Delay, d1	30.2	42.1	34.0	30.8	41.5		15.2	28.0	20.7	21.5	23.1	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	9.9	0.1	10.7	2.1		0.5	5.2	1.4	6.6	0.8	0.1
Delay (s)	31.9	52.0	34.0	41.5	43.5		15.8	33.2	22.1	28.1	23.9	19.6
Level of Service	C	D	C	D	D		B	C	C	C	C	B
Approach Delay (s)		48.3			43.1			29.6			23.8	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.5
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



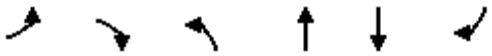
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	956	516	18	0	19
Future Volume (Veh/h)	0	956	516	18	0	19
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1195	645	22	0	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			217			
pX, platoon unblocked	0.92				0.92	0.92
vC, conflicting volume	667				1254	334
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				1099	98
tC, single (s)	4.1				6.8	8.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.8
p0 queue free %	100				100	97
cM capacity (veh/h)	1021				193	732

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	598	598	430	237	24
Volume Left	0	0	0	0	0
Volume Right	0	0	0	22	24
cSH	1700	1700	1700	1700	732
Volume to Capacity	0.35	0.35	0.25	0.14	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.8
Control Delay (s)	0.0	0.0	0.0	0.0	10.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.1
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	5	25	4	1566	738
v/c Ratio	0.04	0.18	0.01	0.54	0.26
Control Delay	51.8	21.8	2.5	4.0	2.4
Queue Delay	0.0	0.0	0.0	0.3	0.0
Total Delay	51.8	21.8	2.5	4.3	2.4
Queue Length 50th (m)	1.1	0.0	0.2	59.9	19.0
Queue Length 95th (m)	5.2	8.6	0.8	73.2	24.3
Internal Link Dist (m)	149.1			175.4	121.9
Turn Bay Length (m)					
Base Capacity (vph)	278	295	350	2893	2810
Starvation Cap Reductn	0	0	0	619	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.08	0.01	0.69	0.26

Intersection Summary

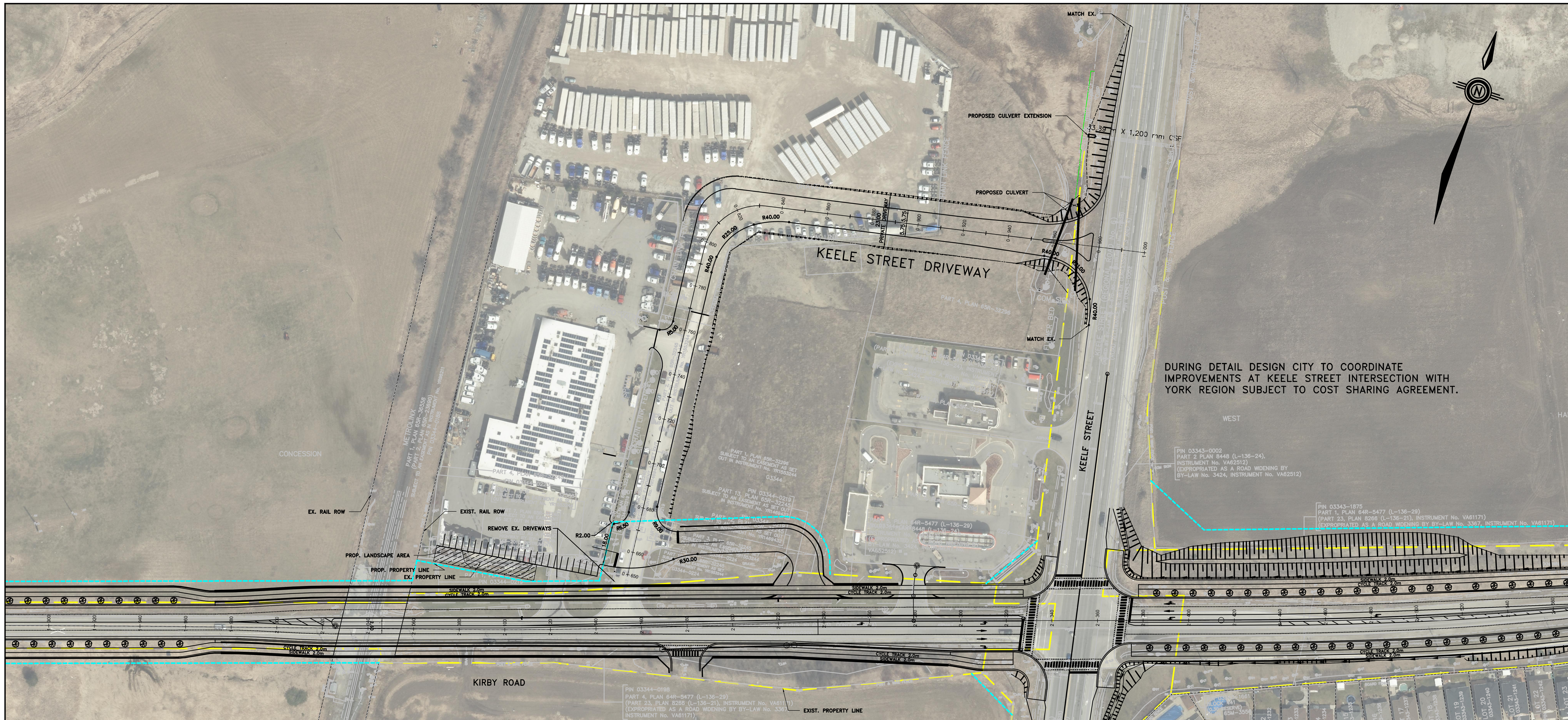


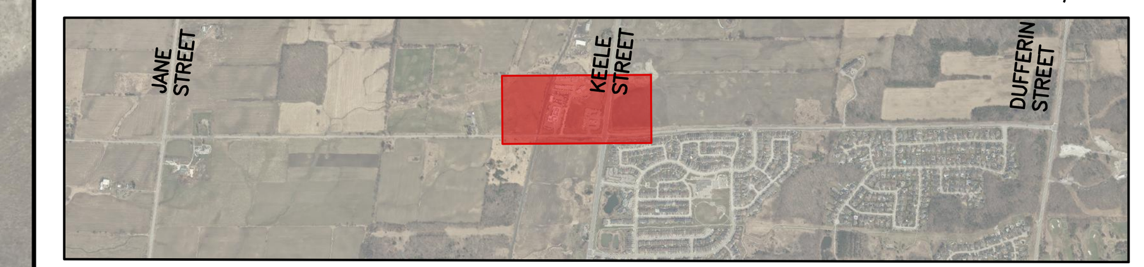
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	23	4	1441	670	9
Future Volume (vph)	5	23	4	1441	670	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1313	1296	1020	3288	3193	
Flt Permitted	0.95	1.00	0.37	1.00	1.00	
Satd. Flow (perm)	1313	1296	399	3288	3193	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	25	4	1566	728	10
RTOR Reduction (vph)	0	24	0	0	1	0
Lane Group Flow (vph)	5	1	4	1566	737	0
Heavy Vehicles (%)	39%	26%	79%	11%	13%	92%
Turn Type	Perm	Perm	Perm	NA	NA	
Protected Phases				2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	5.7	5.7	96.9	96.9	96.9	
Effective Green, g (s)	5.7	5.7	96.9	96.9	96.9	
Actuated g/C Ratio	0.05	0.05	0.83	0.83	0.83	
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	64	63	331	2732	2653	
v/s Ratio Prot				c0.48	0.23	
v/s Ratio Perm	c0.00	0.00	0.01			
v/c Ratio	0.08	0.02	0.01	0.57	0.28	
Uniform Delay, d1	52.9	52.8	1.7	3.2	2.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.5	0.1	0.1	0.9	0.3	
Delay (s)	53.5	52.9	1.7	4.1	2.4	
Level of Service	D	D	A	A	A	
Approach Delay (s)	53.0			4.1	2.4	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	116.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX B

Design Drawings





KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES AND / OR MILLIMETRES UNLESS OTHERWISE INDICATED.
2. LOCATIONS OF STREET 4, 5, 6, AND 8 TO BE CONFIRMED THROUGH SECONDARY PLAN.
3. STREET TREE PLANTING AND SPACING IS CONCEPTUAL AND TO BE CONFIRMED DURING DETAILED DESIGN STAGE.

LEGEND

- EXISTING ROW
- PROPOSED ROW
- TEMPORARY/PERMANENT EASEMENT
- CL PROPOSED ALIGNMENT
- PROPOSED RETAINING WALL
- GRADING LIMIT (FILL)
- GRADING LIMIT (CUT)
- EXISTING ROAD PROFILE
- PROPOSED ROAD PROFILE
- PROPOSED LIGHTING

PC	POINT OF CURVATURE
PT	POINT OF TANGENCY
BVCE	BEGINNING OF VERTICAL CURVE ELEV
BVCS	BEGINNING OF VERTICAL CURVE STATION
ELEV.	ELEVATION
EVCE	END OF VERTICAL CURVE ELEVATION
EVCS	END OF VERTICAL CURVE STATION
LVC	LENGTH OF VERTICAL CURVE
PVI	POINT OF VERTICAL INTERSECTION
STA.	STATION

NO.	DESCRIPTION	BY	DATE
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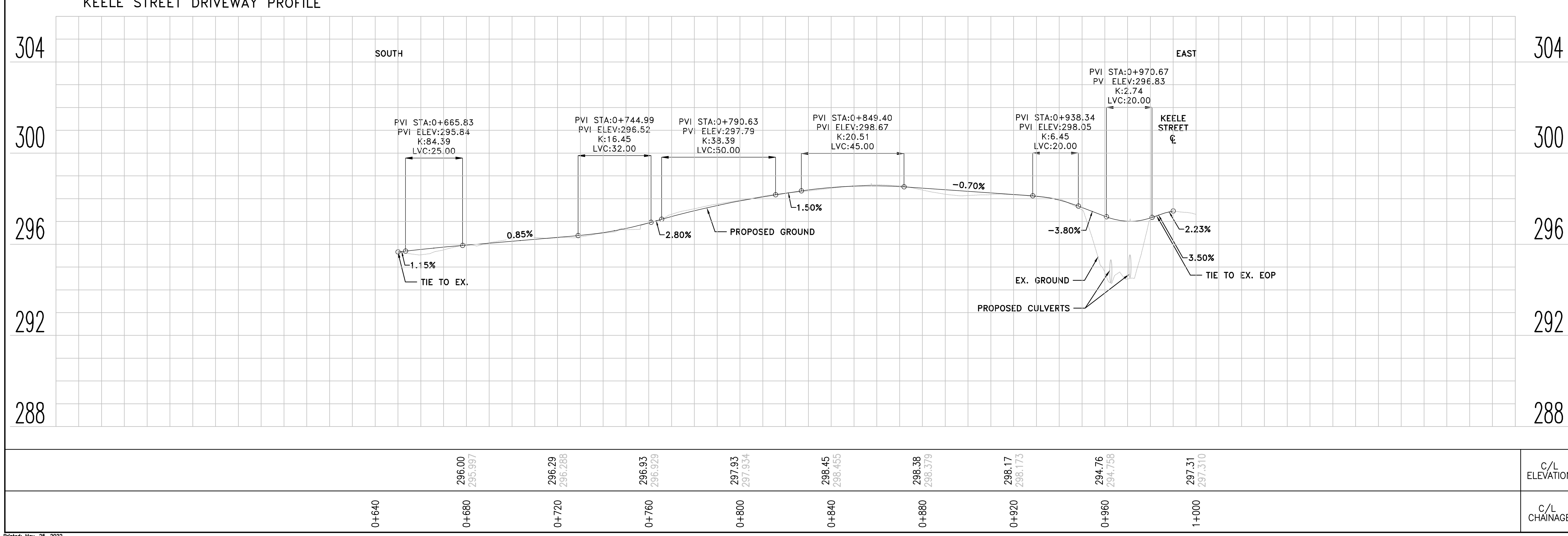
1			

UPDATES & REVISIONS

KEELE STREET DRIVEWAY PROFILE



HDR

SCALES
HORIZONTAL: 0 10 50 100m
VERTICAL: 0 0.5 2.5 5m

KIRBY ROAD WIDENING ENVIRONMENTAL ASSESSMENT PLAN AND PROFILE

VAUGHAN Infrastructure Delivery

DESIGNED & DRAWN BY: JF	CHECKED BY: YC	TENDER No. T18-___
SURVEYED BY: ___	APPROVED BY: ___	
SCALE: HORIZONTAL: 1:1000 VERTICAL: 1:100	PROJ. No. 18-______	DWG. No. 8-A of 15

Printed: May. 25, 2022

KEY PLAN

CONTRACTOR'S NOTES:

1. ALL DIMENSIONS ARE IN METRES AND / OR MILLIMETRES UNLESS OTHERWISE INDICATED.
2. DRAWINGS ARE NOT TO BE SCALED.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD AND SHALL REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY UPON FINDING.
4. THE EXACT LOCATION OF UTILITIES SHALL BE DETERMINED BY CONSULTING THE UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.
5. BENCHMARKS FOR LAYOUT ARE TO BE OBTAINED FROM THE CITY OF VAUGHAN ENGINEERING DEPARTMENT.

NOTE:

EVERY REASONABLE EFFORT HAS BEEN MADE TO ENSURE THAT THE INFORMATION APPEARING ON THIS PLAN IS ACCURATE AND CURRENT. WE BELIEVE THE INFORMATION TO BE RELIABLE, HOWEVER, THE CITY OF VAUGHAN ASSUMES NO RESPONSIBILITY OR LIABILITY DUE TO ERRORS OR OMISSIONS.

BENCH MARK:

MONUMENT IS LOCATED..................................

ELEVATION:

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UPDATES & REVISIONS

ENGINEERING COMPANY NAME:

ENGINEER'S STAMP:

APPROVED AS TO FORM IN RELIANCE, UPON THE PROFESSIONAL SKILL AND ABILITY OF THE CONSULTING ENGINEERS AS TO DESIGN AND SPECIFICATIONS.

JACK GRAZIOSI, P.Eng., M.Eng.
DIRECTOR OF INFRASTRUCTURE DELIVERY

DATE

KIRBY ROAD

SIGHT LINE ANALYSIS

VAUGHAN
Infrastructure Delivery

DESIGNED & DRAWN BY: ___	CHECKED BY: ___	TENDER No.
SURVEYED BY: ___	APPROVED BY: ___	
	PROJ. No.	DWG. No. _ of _

Acad File: C:\pwworking\canada01\d0222363\10195722-C01-...

Layout: Keele Street Sightlines

Printed: Apr. 20, 2022

KEY PLAN

CONTRACTOR'S NOTES:

1. ALL DIMENSIONS ARE IN METRES AND / OR MILLIMETRES UNLESS OTHERWISE INDICATED.
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UPDATES & REVISIONS

ENGINEERING COMPANY NAME:

ENGINEER'S STAMP:

APPROVED AS TO FORM IN RELIANCE, UPON THE PROFESSIONAL SKILL AND ABILITY OF THE CONSULTING ENGINEERS AS TO DESIGN AND SPECIFICATIONS.

JACK GRAZIOSI, P.Eng., M.Eng.
DIRECTOR OF INFRASTRUCTURE DELIVERY

DATE

KIRBY ROAD

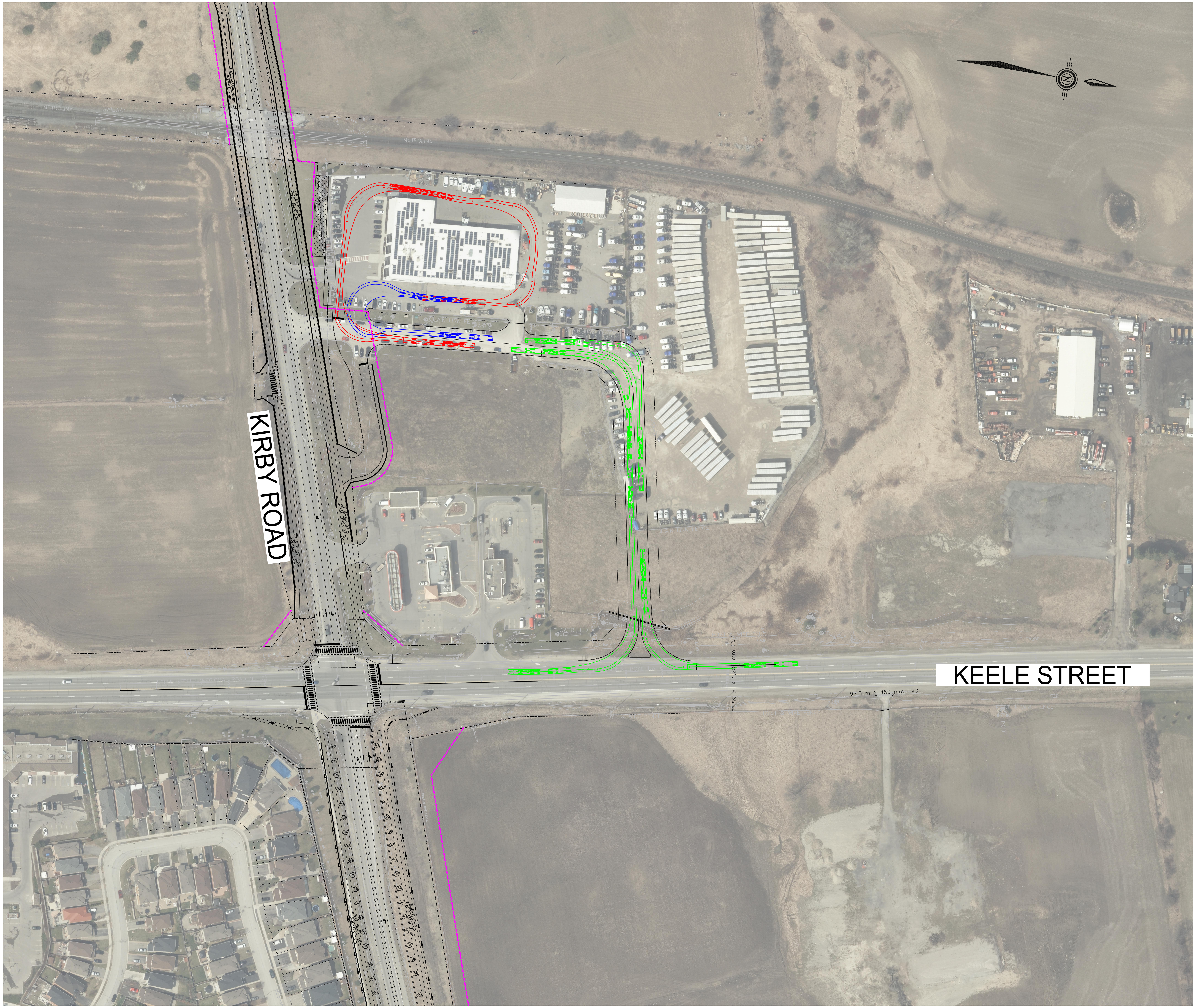
TRUCK TURN ANALYSIS WB20

VAUGHAN
Infrastructure Delivery

DESIGNED & DRAWN BY: ___	CHECKED BY: ___	TENDER No.
SURVEYED BY: ___	APPROVED BY: ___	
	PROJ. No.	DWG. No. _ of _

Acad File: C:\pwworking\canada01\d0222363\10195722-C01-100-EX01_KEELE STREET DRIVEWAY.dwg Layout: RIRO Keele Street WB-20

Printed: Apr. 20, 2022



KEY PLAN

CONTRACTOR'S NOTES:

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BENCH MARK:

MONUMENT IS LOCATED.....................................

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UPDATES & REVISIONS

ENGINEERING COMPANY NAME:

ENGINEER'S STAMP:

APPROVED AS TO FORM IN RELIANCE, UPON THE PROFESSIONAL SKILL AND ABILITY OF THE CONSULTING ENGINEERS AS TO DESIGN AND SPECIFICATIONS.

JACK GRAZIOSI, P.Eng., M.Eng.
DIRECTOR OF INFRASTRUCTURE DELIVERY

DATE

KIRBY ROAD

TRUCK TURN ANALYSIS WB33

VAUGHAN
Infrastructure Delivery

DESIGNED & DRAWN BY: ___	CHECKED BY: ___	TENDER No.
SURVEYED BY: ___	APPROVED BY: ___	
	PROJ. No.	DWG. No. _ of _

Acad File: C:\pwworking\canada01\d0222363\10195722-C01-100-EX01_KEELE STREET DRIVEWAY.dwg Layout: RIRO Keele Street WB-33

Printed: Apr. 21, 2022

KEY PLAN

CONTRACTOR'S NOTES:

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UPDATES & REVISIONS

ENGINEER'S STAMP:

APPROVED AS TO FORM IN RELIANCE, UPON THE PROFESSIONAL SKILL AND ABILITY OF THE CONSULTING ENGINEERS AS TO DESIGN AND SPECIFICATIONS.

JACK GRAZIOSI, P.Eng., M.Eng.
DIRECTOR OF INFRASTRUCTURE DELIVERY

DATE

SCALE HORIZONTAL: 0 10 50 100m

KIRBY ROAD WIDENING ENVIRONMENTAL ASSESSMENT

TRUCK TURN ANALYSIS
WB33

VAUGHAN
Infrastructure Delivery

DESIGNED & DRAWN BY: ___	CHECKED BY: ___	TENDER No. T18-___
SURVEYED BY: ___	APPROVED BY: ___	
SCALE: HORIZONTAL: 1:500 VERTICAL: 1:100	PROJ. No. 18-______	DWG. No. _ of _

APPENDIX C

Natural Heritage Impact Assessment

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

May 2, 2022 Project #2339

Michelle Mascarenhas
HDR
100 York Boulevard, Suite 300
Richmond Hill, Ontario L4B 1J8

Dear Ms. Mascarenhas,

RE: Kirby Road Widening, Environmental Assessment, Vaughan
Natural Environment Assessment of Proposed Keele Street Driveway

Natural Resource Solutions Inc. (NRSI) was retained by HDR Inc., on behalf of the City of Vaughan, to complete a scoped natural environment assessment associated with a proposed new driveway access to Keele Street which will provide access to lands currently serviced at Kirby Road, including an existing trucking company property on the north side of Kirby Road, west of Keele Street. This work is supplementary to natural environment assessment work that was completed by NRSI to inform the environmental assessment (EA) for planned improvements to Kirby Road between Jane Street and Dufferin Street (NRSI 2021). It is NRSI's understanding that the new driveway proposed access to Keele Street will be required to mitigate the change in access proposed at Kirby Road (closure of two full-movement driveway accesses servicing to two adjacent landowners, relocation further west to create one new consolidated access to service both properties, restricted to right-in-right-out movement only at Kirby Road) as part of the road improvement work. The change in access proposed at Kirby Road is required to accommodate the proposed Kirby Road Underpass at the Barrie GO Rail crossing. Various alternative designs of the driveway configuration were considered to mitigate the change in access at Kirby Road as part of an earlier evaluation by HDR. This assessment is based on the alternative design to provide an additional driveway access to Keele Street, which is shown in Appendix I.

The area of the proposed driveway at Keele Street contains a portion of the Don River West Branch Headwater Provincially Significant Wetland (PSW) complex. The wetland unit is traversed by an upstream reach of the Don River West Branch. This watercourse was identified as Headwater Drainage Feature 3 (HDF3) in the Kirby Road Widening EA Natural Environment Assessment. This supplementary assessment was completed to further characterize and map the wetland and aquatic features adjacent to the proposed driveway, to identify potential impacts associated with driveway construction and use, and to recommend measures to avoid, or otherwise minimize or mitigate these potential impacts to the natural features.

Existing Conditions

Terrestrial and Wetland Features

An assessment of the terrestrial and wetland habitats in the vicinity of the proposed driveway construction was completed by NRSI on October 28, 2021. Natural features in this portion of the study area included Mineral Cultural Meadow (CUM1) and Mineral Meadow Marsh (MAM2).

NRSI staff certified in the Ontario Wetland Evaluation System (OWES) surveyed the outer limits of the MAM2 wetland polygon during the assessment as shown on Map 1.

The CUM1 polygon occurs on gently to moderately sloping upland habitat, sloped in an easterly direction towards the MAM2 polygon. A small portion of CUM1 also occurs in between two fingers of the MAM2 polygon at its southern extent. Vegetation species observed within the CUM1 polygon include asters (*Symphyotrichum* spp.), goldenrods (*Solidago* spp.), and Smooth Brome (*Bromus inermis*).

The MAM2 polygon is located along the Keele Street roadside ditch and the low-lying habitats associated with the upstream reach of the Don River West Branch. It functions primarily as a surface water and stormwater conveyance. The western and eastern fingers occurring at the southern extent of the polygon conveys stormwater from the adjacent Tim Hortons parking lot, and the roadside ditch, respectively. Both of these conveyances flow north to meet the Don River West Branch reach. Vegetation species observed within the MAM2 polygon include European Reed (*Phragmites australis* ssp. *australis*), Narrow-leaved Cattail (*Typha angustifolia*), Panicled Aster (*Symphyotrichum lanceolatum* ssp. *lanceolatum*), and young willows (*Salix* spp.).

Aquatic Features

NRSI aquatic biologists undertook an aquatic habitat assessment at the site on November 4, 2021. An Unnamed Drainage Feature was identified that originates at a storm sewer outlet along the west side of Keele Street, just to the north of the Tim Hortons parking lot. The feature was assessed from the point of origin, through the area where the potential driveway will be built, to the confluence with the low-lying area associated with HDF3.

No defined channel was observed along the Unnamed Drainage Feature, and it was characterized as a straight, gently sloped depression or ditch, with a low gradient. Terrestrial vegetation (a cultural meadow) extends 0-10m along the east side and 10-20m along the west side of the feature. The floodplain extent through the investigated area is 0-10m and is dominated by non-native/invasive European Reed and cattails, which lined the roadside ditch area. The substrate within the low-lying ditch or floodplain area was primarily muck with some silt, and was saturated due to recent rain events and morning dew, but no standing water was present. The Unnamed Drainage Feature contained no fish or fish habitat, and functions primarily as a storm outlet for the Tim Hortons parking lot and roadside.

Evidence of source point erosion was noted at the northeast corner of the large parking lot/storage yard at the rear of the trucking company property. It appears that stormwater runoff is directed to this point, which has caused the corner of the lot to be eroded and drain down the vegetated slope into the low-lying meadow marsh.

The HDF3 flow path crosses under Keele Street through an approximately 1.2m corrugated steel pipe (CSP) culvert, where it crosses through the meadow marsh. Upstream or east of Keele Street, the feature does not exist and corn was planted through the agricultural field. The portion of the HDF3 watercourse as mapped on provincial Land Information Ontario (NDMNRF 2021) mapping, which was confirmed through this assessment to be absent, is hatched out as shown on Map 1. A small amount of standing water was present in the culvert with a water temperature of 9.7˚C and a dissolved oxygen level of 11.8mg/L. This reach of HDF3 immediately west of Keele Street also had no defined channel, or presence of fish or fish habitat.

Impact Assessment and Recommended Mitigation Measures

Direct Impacts

As shown on Map 1, the preferred alignment for the proposed property access driveway will bisect the southern extension of the PSW feature immediately west of Keele Street. The location of the property access is proposed to be spaced approximately 30m from the existing Tim Hortons driveway entrance. According to TAC standards, commercial entrance spacing is approximately 20m. It is understood that a driveway alignment further south, to completely avoid the southern extension of the wetland (i.e., south of the stormwater drainage outlet and headwall), would need to move the proposed property access an additional 30m south and would therefore not meet the 20m spacing to the existing entrance and not meet standards. An alignment further south would also not be feasible as it would bisect the adjacent property parcels and not allow for an efficient future use of the site. An alignment further south would also place the proposed entrance in closer proximity to the Keele Street intersection.

The proposed construction of the driveway will therefore result in a direct but localized impact to the wetland feature. However, the portion of the wetland that will be impacted was characterized to be ecologically disturbed and of relatively low quality (e.g., dominated by stands of non-native/invasive European Reed). A portion of this wetland area has also arisen directly as a result of previous site development and anthropogenic land uses, having naturalized within the stormwater drainage channel for the adjacent commercial development and within the roadside drainage ditch. Although the southern wetland extension that will be impacted is contiguous with the Don River West Branch Headwater PSW complex unit to the immediate north, it is of lesser ecological quality and functional value than other areas of natural wetland occurrence within the complex. The proposed driveway alignment will remove the southernmost extension of this wetland. However, the removal of this section of wetland is not considered a negative impact provided measures are taken to protect the adjacent core wetland area to the immediate north. Additional measures to restore or enhance the adjacent wetland area should also be considered as discussed below.

The existing drainage path that conveys flows from the stormwater outlet will be preserved as part of the driveway construction through the installation of an appropriately sized culvert. Existing roadside drainage along the west side of the Keele Street right-of-way will also be maintained through installation of a culvert. No interruptions of flow that input to the HDF3 watercourse or adjacent wetland will therefore occur as a result of the driveway construction. The details of culvert sizing and other design considerations will be determined during the Detailed Design stage.

Vegetation clearing has the potential to directly impact bird breeding activity through damage and destruction of nests, eggs and young, or avoidance of the area by breeding adults. Vegetation clearing should therefore occur outside the bird nesting season so as to limit disturbances to nesting activities of birds and to avoid destruction of active nests. The destruction of migratory birds and their nests is prohibited under the federal *Migratory Birds Convention Act*. Construction of the driveway may also result in the injury or mortality of amphibians (frogs and toads) that may use the wetland area as breeding habitat.

The following measures are recommended to avoid or mitigate potential injury or mortality of wildlife species during driveway construction activities:

- Complete vegetation removal activities outside of the period March 15-August 31 to avoid direct impacts to amphibian and bird species that may use the wetland as breeding habitat.

- If construction must occur within this timing window, additional targeted surveys by a qualified biologist may be required to confirm the presence or absence of nesting birds, and/or to capture and relocate amphibians within the construction zone.
- Demarcate the limits of construction with silt fencing to impede small wildlife movement into the construction zone.

Indirect Impacts

Indirect impacts can arise as a result of driveway construction activities that can lead to degradation of the adjacent natural features, vegetation species and wildlife habitats if not appropriately mitigated. Examples of construction-related indirect impacts include damage to adjacent vegetation that is to be retained, compaction of soils through construction activities, improper storage or stockpiling of materials within natural areas, and release of sediment-laden runoff or other deleterious substances into the adjacent wetland and watercourse.

The proposed driveway construction may cause disturbances (e.g., noise, vibration, presence of human activity) to wildlife species that use the adjacent wetland area, which may cause them to avoid the area. However, species that are likely to use the adjacent wetland area are anticipated to be relatively disturbance-tolerant and adapted to urbanized conditions. Further, construction impacts will be localized and temporary in nature, and wildlife will continue to use the adjacent habitats post-construction.

The following measures are recommended to mitigate construction-stage indirect impacts to adjacent natural features and species:

- Install heavy-duty silt fencing along the limits of construction, minimize exposed soils and re-vegetate exposed soil areas where necessary in accordance with an approved Erosion and Sediment Control (ESC) Plan. Silt fencing must be regularly inspected and repaired when necessary in accordance with the ESC Plan.
    - Areas of exposed soil within or adjacent to the wetland should be re-seeded with a suitable native seed mix. This may be augmented with or preceded by an application of a standard nurse crop (e.g., Annual Oats (*Avena sativa*), Annual Rye (*Lolium multiflorum*), or White Millet (*Panicum miliaceum*)) to provide soil stabilization. Seeding details are to be provided in the ESC Plan.
- Maintain all construction activities within the authorized work zone.
- All material and equipment stockpiles should be located at least 15m from the wetland. Silt fencing should be installed around stockpiles where runoff of sediments or deleterious substances may occur.
- Construction work that occurs within the drainage channel should be completed “in the dry” if possible to avoid potential water quality impacts downstream.
- A Spill Response Plan should be prepared and be ready to be implemented on-site if required.

Creation of the proposed driveway will also result in an increase in impervious surface immediately adjacent to the retained wetland that could result in increased flow rates and volumes of stormwater runoff inputs to the wetland. Measures may be required to mitigate potential for stormwater runoff from the driveway to erode flow paths along the driveway

embankment and cause sedimentation of the wetland and watercourse. Details of the drainage plan for the driveway are to be determined at the Detailed Design stage of development.

Use of the driveway by vehicles will also cause the potential for oils, sediments and other deleterious substances to pollute the adjacent retained wetland and watercourse through stormwater runoff. A plan to mitigate water quality impacts to the adjacent natural features will also be required as part of detailed design of the driveway and its drainage system.

Restoration and Enhancement

Construction of the driveway provides the opportunity to enhance the quality of the adjacent wetland feature, which as noted above is relatively disturbed and contains large patches of non-native/invasive species growth, particularly European Reed. Areas of construction disturbance associated with the driveway will also require restoration post-construction.

Further to the above recommendation that areas of disturbed soil be stabilized with a nurse crop and native seed mix to mitigate erosion and sedimentation effects, it is also recommended that disturbed areas be planted with native woody vegetation species that are suitable to the local site conditions and are native to York Region. These would include, but not be limited to, willows, poplars (*Populus* spp.), and dogwoods (*Cornus* spp.).

Opportunities for invasive species management should also be considered as part of enhancement plans for the adjacent natural features. In particular, removal/control of European Reed (e.g., through herbicide application) would represent a tangible benefit to the ecological quality of the feature. The overall effort and scale of the treatment plan that would be required to effectively control European Reed at the site (e.g., considering the size of the area that would need to be treated to achieve the desired results, the methodology to be employed) will need to be considered against what may be considered feasible for the project.

A detailed Restoration and Enhancement Plan should be prepared during the Detailed Design stage to provide additional details on the locations, methodology, timing, and materials associated with site restoration and enhancement. This will include a detailed planting plan to be completed by a landscape architect or qualified restoration biologist, including specific species, sizes, quantities and locations of plantings. It will also include details of an invasive species management plan if applicable. Any follow-up monitoring tasks to ensure survival and proper establishment of the plantings/seeding will also be described. The Restoration and Enhancement Plan should be developed with reference to Toronto and Region Conservation Authority's (TRCA) Post-Construction Restoration Guidelines (TRCA 2004).

Summary

NRSI was retained by HDR, on behalf of the City of Vaughan, to complete a scoped natural environment assessment associated with a proposed private driveway to be constructed from Keele Street, north of the Kirby Road intersection, to access a commercial business and undeveloped lands to the west of the road. This assessment is supplemental to the broader EA being completed for Kirby Road Widening between Jane Street and Dufferin Street.

The area of the proposed driveway contains a southern extension of a wetland unit that is part of the Don River West Branch Headwater PSW complex. The wetland has formed along shallow channels that convey stormwater drainage. The westernmost channel receives stormwater drainage from the adjacent Tim Hortons parking lot via a drainage outlet with headwall, while an eastern channel represents a roadside drainage ditch. Both flow into the core wetland area to the immediate north, which also contains the furthest upstream extent of the Don River West

Branch ephemeral watercourse that has been labelled HDF3 in the EA natural environment study.

The preferred alignment of the private driveway will require that it cross the southern extension of the wetland unit. The wetland area that would be impacted is of relatively low ecological quality and functional value, and contains a high proportion of invasive/non-native vegetation growth. Removal of this portion of wetland is not considered to represent a negative impact. Stormwater drainage paths within the channels are anticipated to be maintained through the installation of two culverts under the driveway which will be confirmed during Detailed Design. Various measures have been recommended to mitigate negative direct and indirect impacts to the adjacent natural features and their ecological functions. Recommendations have also been provided to restore and enhance the ecological quality of the wetland in the immediate vicinity of the proposed driveway.

The following are recommended to be addressed at the Detailed Design stage:

- Confirm appropriate culvert sizing and other design details to maintain existing stormwater flows that input to the wetland feature and HDF3 watercourse;
- Identify details of an amphibian/small wildlife capture and relocation plan, if applicable based on potential timing of vegetation removal;
- Prepare a detailed ESC Plan for review and approval by the City and TRCA;
- Prepare a Spill Response Plan, if appliable to the undertaking;
- Prepare a stormwater drainage plan for the driveway, including management of flows and to mitigate water quality impacts to the adjacent natural features; and,
- Prepare a Restoration and Enhancement Plan, based on TRCA guidelines, for review and approval by the City and TRCA.

References

HDR. 2022. Kirby Road Widening Environmental Assessment. Driveway Design at Underpass.

Natural Resource Solutions Inc. (NRSI). 2021. Kirby Road Widening Environmental Assessment. Environmental Impact Study Report. Prepared for HDR Inc. September 2021.

Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF). 2022. Make a Map: Natural Heritage Areas. Natural Heritage Information Centre (NHIC). http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US.

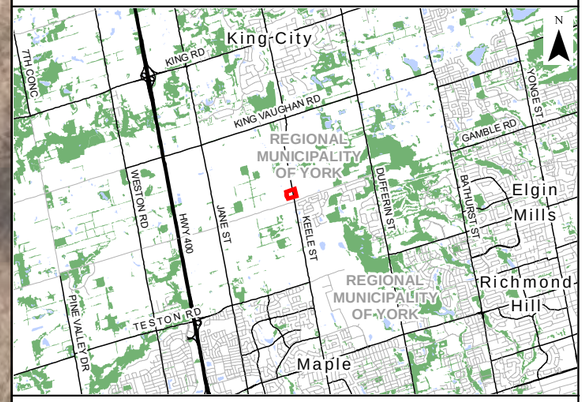
Toronto and Region Conservation Authority (TRCA). 2004. Post-Construction Restoration Guidelines. July 2004.

Map

Map 1

Kirby Road Environmental Assessment

Keele Street Driveway



Legend

- Study Area
- Driveway Alignment
- Driveway Grading
- Existing Conditions
- Outlet Structure
- Wetland Boundary Surveyed by NRSI October 18, 2021
- Ephemeral Watercourse
- Watercourse (No Longer Exists)
- Drainage Feature
- Ecological Land Classification (ELC)

(Ag) Agriculture

(CUM1) Mineral Cultural Meadow Ecosite

(MAM2) Mineral Meadow Marsh Ecosite

- ELC Inclusion

(CUM) Cultural Meadow

MAM2

Industry

Don River West Branch (HDF3)

Unnamed Drainage Feature

KEELE ST

CUM1

Ag (soy)

CUM

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

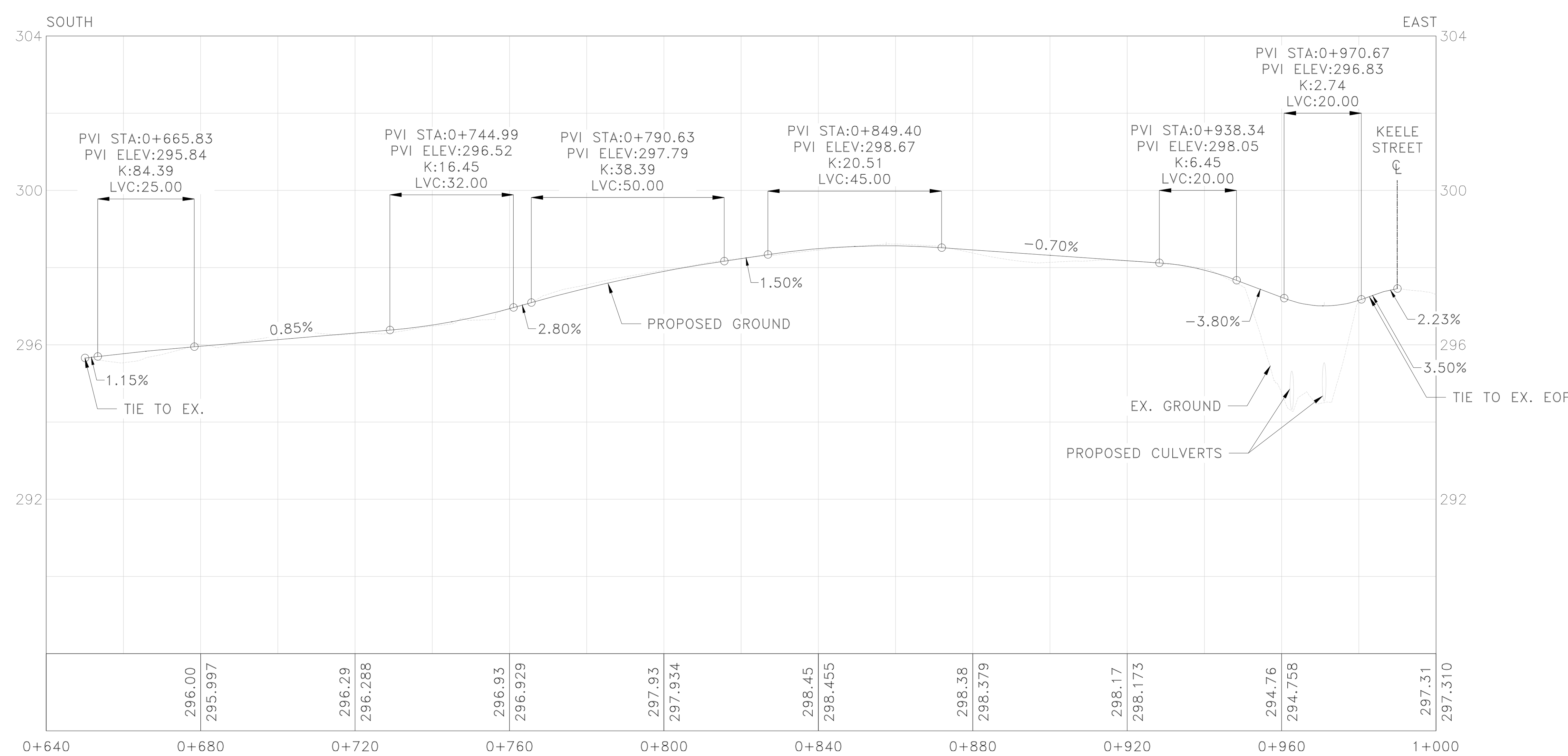
Project: 2339 Date: May 2, 2022	NAD83 - UTM Zone 17 Size: 11x17" **1:700**

0 10 20 30 40 Metres

N

Path: X:\2339_KirbyRdEA\NRSI_2339_Map1_KeeleStreetDriveway_8K_2022_05_02_GCS.mxd

Appendix I
Proposed Private Driveway Design (HDR 2022)



DRAFT FOR DISCUSSION

KEY PLAN

CONTRACTOR'S NOTES:

1. ALL DIMENSIONS ARE IN METRES AND / OR MILLIMETRES UNLESS OTHERWISE INDICATED.
2. DRAWINGS ARE NOT TO BE SCALED.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD AND SHALL REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY UPON FINDING.
4. THE EXACT LOCATION OF UTILITIES SHALL BE DETERMINED BY CONSULTING THE UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.
5. BENCHMARKS FOR LAYOUT ARE TO BE OBTAINED FROM THE CITY OF VAUGHAN ENGINEERING DEPARTMENT.

NOTE:

EVERY REASONABLE EFFORT HAS BEEN MADE TO ENSURE THAT THE INFORMATION APPEARING ON THIS PLAN IS ACCURATE AND CURRENT. WE BELIEVE THE INFORMATION TO BE RELIABLE, HOWEVER, THE CITY OF VAUGHAN ASSUMES NO RESPONSIBILITY OR LIABILITY DUE TO ERRORS OR OMISSIONS.

NO.	DESCRIPTION	BY	DATE
8			
7			
6			
5			
4			
3			
2			
1			

UPDATES & REVISIONS

HDR

ENGINEER'S STAMP:

APPROVED AS TO FORM IN RELIANCE, UPON THE PROFESSIONAL SKILL AND ABILITY OF THE CONSULTING ENGINEERS AS TO DESIGN AND SPECIFICATIONS.

JACK GRAZIOSI, P.Eng., M.Eng.
DIRECTOR OF INFRASTRUCTURE DELIVERY

DATE

SCALE

HORIZONTAL: 0 10 50 100m

KIRBY ROAD WIDENING
ENVIRONMENTAL ASSESSMENT

DRIVEWAY DESIGN

VAUGHAN
Infrastructure Delivery

DESIGNED & DRAWN BY: ___	CHECKED BY: ___	TENDER No. T18-___
SURVEYED BY: ___	APPROVED BY: ___	
SCALE: HORIZONTAL: 1:500 VERTICAL: 1:100	PROJ. No. 18-______	DWG. No. _ of _

Printed: Apr. 29, 2022