

# KINGSVIEW DEVELOPMENT

## Traffic Impact Assessment

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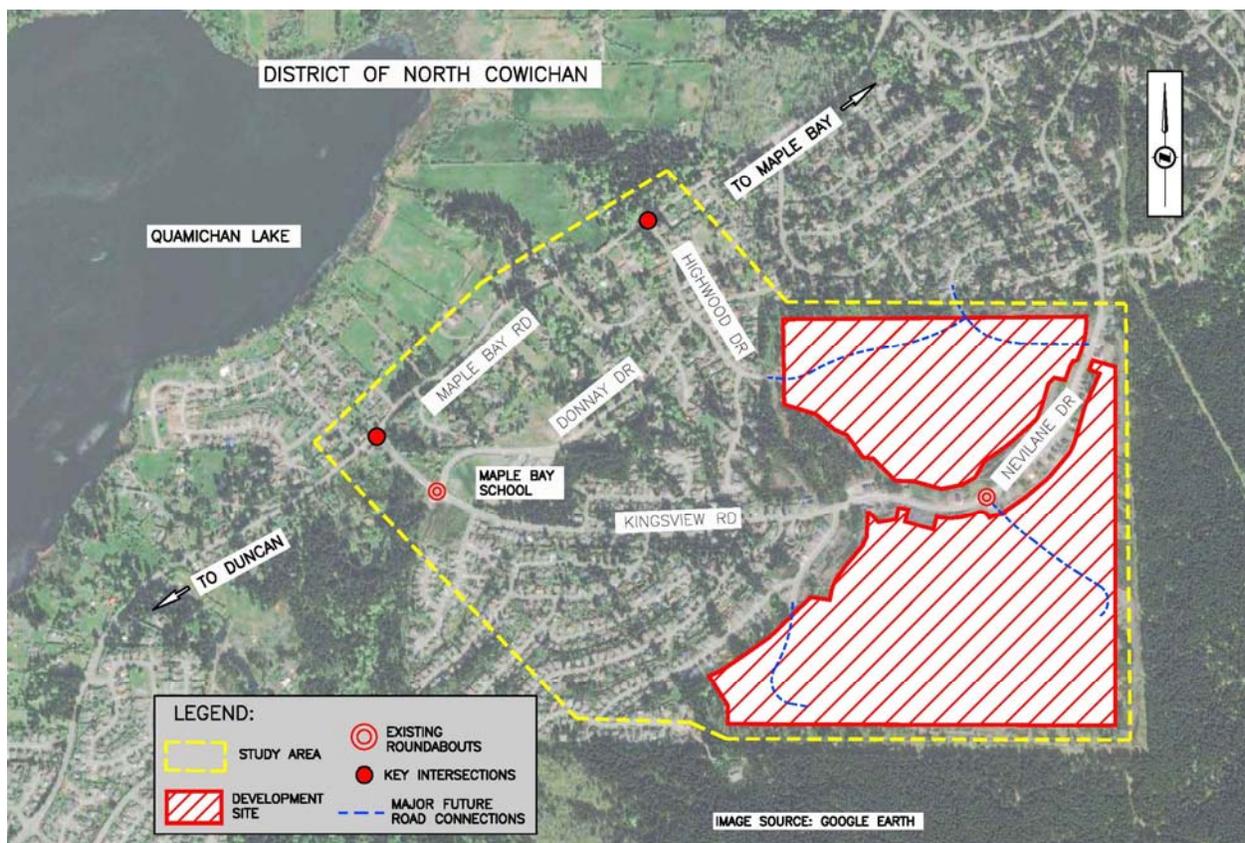
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## 1.0 INTRODUCTION

Boulevard Transportation Group, a division of Watt Consulting Group, was retained by Strandlund Investments Ltd. to conduct a traffic impact assessment for the proposed KingsView development in North Cowichan, BC. This study reflects the proposed development plan from September 8, 2015.

An analysis of post-development conditions was undertaken in order to provide a clear view of the impacts on the adjacent roadways after full build-out and occupancy. The study assessed traffic impacts of the development, reviewed the site access roads, and assessed the need for any mitigation measures. Study recommendations and conclusions are to provide safe and efficient movement of pedestrians, bicycles and vehicular traffic for the proposed development while minimizing the impact to non-site trips. The study area includes Maple Bay Road, Kingsview Road, Nevilane Drive, Highwood Drive and the site accesses. There are two key intersections in the study area from a traffic conditions / capacity perspective: Maple Bay Road & Kingsview Road and Maple Bay Road & Highwood Dr. See **Figure 1** for the study area and site location.



**Figure 1: Study Area and Site Location**

## 2.0 EXISTING CONDITIONS

### 2.1 Road Network

The development site is located in the District of North Cowichan to the east of Duncan. Maple Bay Road serves as a rural arterial road connecting the community of Maple Bay with Duncan. Kingsview Road is a two-lane collector road that runs east-west, connecting several residential neighbourhoods in the east (and becomes Nevilane Drive at the roundabout on the hillside 400m east of Sunsum Drive) and Maple Bay Road to the west, where it terminates at a T-intersection. Kingsview Road is a major access road to the development as this road passes through the development area, and would serve the south portion of the site. There are two existing roundabouts on Kingsview Road, one at Donnay Drive (adjacent to Maple Bay School) and one at the proposed development site (east end of Kingsview Road). Note that due to the site topography and proposed on-site road network, the south portion of the site (south of Kingsview Road) would use Kingsview Road to access / egress the site, while the north portion of the site would use Highwood Drive. Note that in the future, Donnay Drive will be extended to the south, providing a parallel and alternative route to Maple Bay Road. This was not, however, considered in the analysis due to the uncertainty of when the extension may occur, as well as since it is not expected to be a major alternative route since Maple Bay Road is a more direct roadway to/from Duncan.

Highwood Drive provides another site access route from Maple Bay Road, and is one kilometre north of the Kingsview Road intersection. Highwood Drive is currently a two-lane local road with a dead end to the east, but a connection and extension to the site would be made to serve the north portion of the development site (north of Kingsview Road).

The intersection of Maple Bay Road & Kingsview Road is currently stop-controlled on Kingsview Road. At the intersection, Kingsview Road is divided with a wide landscaped median (8m wide 70m long) and a raised island to channelize westbound right turns. On Maple Bay Road there is a southbound left-turn lane and a northbound right-turn lane. The intersection of Maple Bay Road & Highwood Drive is stop-controlled on Highwood Dr, and there are no dedicated turn lanes.

The posted speed limit on Maple Bay Road is 60km/h. The speed limits on Kingsview Road and Highwood Drive are 50 km/h, except for the school frontage on Kingsview Road (between Donnay Drive and Algonkin Road) where there are playground zone warning signs with 30 km/h posted speed limit signs.

### 2.2 Traffic Volumes

Manual counts were undertaken at the two intersections of Kingsview Road/Maple Bay Road and Highwood Drive/Maple Bay Road during the AM and PM peak hours on March 25, 2014. At both intersections, the overall intersection volumes (i.e. entering the intersection) were found to

be almost same for the AM peak hour and the PM peak hour, with significant differences in directional flow. Overall the volumes at the Highwood Drive intersection were found to be much lower than at Kingsview Road, with less than half the volume. See **Figures 2 and 3** for existing AM and PM peak hour turning movement counts at Maple Bay Road & Kingsview Road and at Maple Bay Road & Highwood Dr.

In June 2004, peak hour traffic volumes were measured at the same location (Kingsview Road/Maple Bay Road) for a previous study. The 2014 through volumes on Maple Bay Road were actually lower than the 2004 volumes. The AM peak hour through volume (both directions total) was measured at 323 vehicles in 2014 and 352 vehicles in 2004. The PM peak hour through volume was measured at 337 vehicles in 2014 and 407 vehicles in 2004. As there has been a negative traffic growth trend in the area, the 2014 counts were considered to be reflective of 2015 volumes, and were used for background conditions without application of a growth factor.

### 2.3 Traffic Modelling – Background Information

Analysis of the traffic conditions at the intersections within the study area were undertaken using Synchro software (for stop-controlled intersections) and SIDRA (for roundabout intersections).

Synchro / SimTraffic is a two-part traffic modelling software that provides analysis of traffic conditions based on traffic control, geometry, volumes and traffic operations. Synchro software (Synchro 9) is used because of its ability to provide analysis using the Highway Capacity Manual (2010) methodology, while SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. SIDRA provides results using HCM 2010 methodology as well. SIDRA and Synchro uses measures of effectiveness to return the results of the analysis. These measures of effectiveness include level of service (LOS), delay and 95<sup>th</sup> percentile queue length. The delays and type of traffic control are used to determine the level of service. The level of services are broken down into six letter grades with LOS A being excellent operations and LOS F being unstable/failure operations. Level of service C is generally considered to be an acceptable LOS by most municipalities. Level of service D is generally considered to be on the threshold between acceptable and unacceptable operations.

### 2.4 Existing Traffic - Results

Existing traffic conditions were analysed during the AM and PM peak hours for the two key intersections (Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road).

At the intersection of Kingsview Road/Maple Bay Road, the westbound left turn movement (from Kingsview Road onto Maple Bay Road) is operating at a LOS C during the AM peak hour and LOS B during the PM peak hour. All other movements are operating at a LOS A during the AM

and PM peak hours. The westbound left 95<sup>th</sup> percentile queue length is 4.0 vehicles during the AM peak hour and 0.6 vehicles during the PM.

The westbound turn movement (from Highwood Drive onto Maple Bay Road) is operating at a LOS B during both AM and PM peak hours. On Maple Bay Road, all movements are operating at LOS A during both AM and PM peak hours.

**Tables 1 and 2** summarize 2015 existing traffic conditions at the two key intersections: Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road respectively. Analysis results include delays, LOS and queue lengths. The 2015 existing AM/PM peak hour volumes and levels of service are shown in **Figure 2 and 3**. See *Appendix C* for existing condition Synchro reports.

**TABLE 1: 2015 EXISTING PEAK HOUR CONDITIONS AT KINGSVIEW ROAD/MAPLE BAY ROAD**

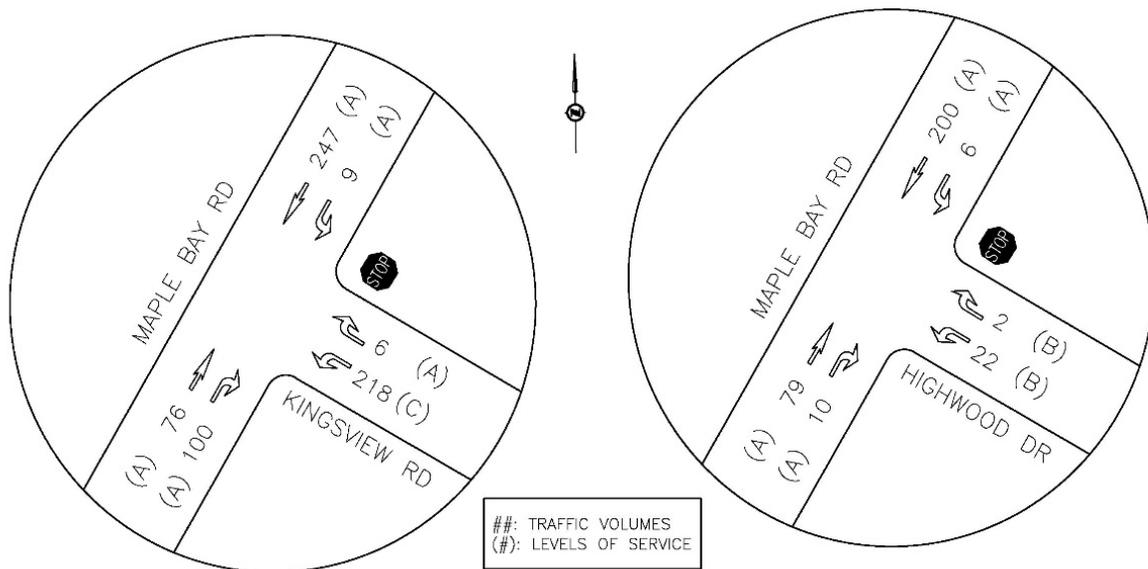
	Southbound (On Maple Bay Rd) Left	Westbound (On Kingsview Rd) Left	Westbound (On Kingsview Rd) Right
Average Delay (s)	7.5 (7.8)	20.6 (13.4)	8.9 (9.7)
LOS	A (A)	C (B)	A (A)
95 <sup>th</sup> Queue (veh)	0.0 (0.1)	4.0 (0.6)	0.0 (0.0)

\*Note: ## indicates AM; (##) indicates (PM)

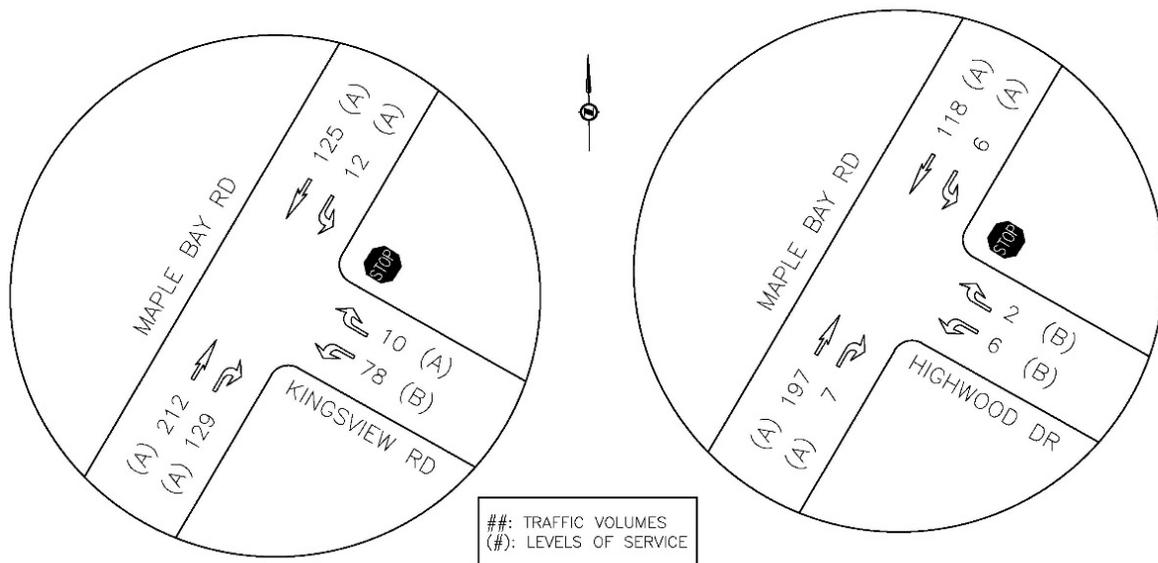
**TABLE 2: 2015 EXISTING PEAK HOUR CONDITIONS AT HIGHWOOD DR/MAPLE BAY RD**

	Southbound (On Maple Bay Rd) Left	Westbound (On Highwood Dr) Left	Westbound (On Highwood Dr) Right
Average Delay (s)	7.5 (7.7)	11.2 (11.2)	11.2 (11.2)
LOS	A (A)	B (B)	B (B)
95 <sup>th</sup> Queue (veh)	0.0 (0.0)	0.3 (0.1)	0.3 (0.1)

\*Note: ## indicates AM; (##) indicates (PM)



**Figure 2: 2015 Existing AM Peak Hour Conditions**



**Figure 3: 2015 Existing PM Peak Hour Conditions**

### 3.0 POST DEVELOPMENT

#### 3.1 Land Use

The site is currently undeveloped although the major access road (Kingsview Road extension) is already constructed or upgraded. The KingsView development proposes a total of 1,280 residential units, comprising a mix of single family, single family small lot, townhouses/multi-

family and duplex lot. **Table 3** summarizes the dwelling units by type and location for the proposed development.

**TABLE 3: BUILD-OUT PLAN**

Land Use Type	North Side	South Side	Total
Single Family (Detached)	151 Units	230 Units	381 Units
Townhouse / Multi-family	250 Units	649 Units	899 Units
<b>Total:</b>	<b>401 Units</b>	<b>879 Units</b>	<b>1,280 Units</b>

### 3.2 Site Access

Kingsview Road and Highwood Drive are the main access roads to/from the site, and connect to Maple Bay Road. (Although it will be possible to travel to/from Maple Bay via Nevilane Drive, this would be used by a small number of site trips only.) The site is effectively divided into two portions (one north and one south of Kingsview Road) due to the elevation and topography characteristics. Trips to/from the south portion of the development would use Kingsview Road to access to/from Maple Bay Road, and trips to/from the north portion of the development would use Highwood Drive, based on route length and travel times. See **Figure 4** for the site accesses and site plan.



**Figure 4: Access Roads and Site Plan (surrounded by red border)**

### 3.3 Trip Generation

Site trips were estimated from the *ITE Trip Generation Manual (9th Edition)*. The *Trip Generation Manual* provides trip rates for a wide variety of land uses gathered from actual sites across North America over the past 35 years. The ITE manual does not provide trip generation rates specifically for single family small lot and duplex lots, and therefore the single family trip rates were used as a worst case estimate. The trip generation rates are shown for the AM and PM peak hours in **Table 4** *Error! Reference source not found.*.

**TABLE 4: TRIP GENERATION RATES**

AM Peak Hour					
Land Use Type	Code	ITE Land Use	Trip Rate / unit	In	Out
Multi-Family	230	Condo / Townhouse	0.44	17%	83%
Single Family	210	Single Family Detached	0.75	25%	75%
Single Family Small Lot	210	Single Family Detached	0.75	25%	75%
Duplex Lot	210	Single Family Detached	0.75	25%	75%
PM Peak Hour					
Multi-Family	230	Condo / Townhouse	0.52	67%	33%
Single Family	210	Single Family Detached	1.00	63%	37%
Single Family Small Lot	210	Single Family Detached	1.00	63%	37%
Duplex Lot	210	Single Family Detached	1.00	63%	37%

**Tables 5 to 8** summarize the generated site trips by location with full build-out during the AM and PM peak hours. Note that the development will likely be constructed in phases, but phasing details have yet to be determined.

**TABLE 5: AM PEAK HOUR TRIP GENERATION (NORTH SIDE)**

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	250	0.44 / unit	19	91	110
Single Family	210	151	0.75 / unit	28	85	113
<b>Total</b>				<b>47</b>	<b>176</b>	<b>223</b>

**TABLE 6: AM PEAK HOUR TRIP GENERATION (SOUTH SIDE)**

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	649	0.44 / unit	49	237	286
Single Family	210	230	0.75 / unit	43	130	173
<b>Total</b>				<b>92</b>	<b>367</b>	<b>459</b>

**TABLE 7: PM PEAK HOUR TRIP GENERATION (NORTH SIDE)**

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	250	0.52 / unit	87	43	130
Single Family	210	151	1.00 / unit	95	56	151
<b>Total</b>				<b>182</b>	<b>99</b>	<b>281</b>

**TABLE 8: PM PEAK HOUR TRIP GENERATION (SOUTH SIDE)**

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	649	0.52 / unit	226	111	337
Single Family	210	230	1.00 / unit	145	85	230
<b>Total</b>				<b>371</b>	<b>196</b>	<b>567</b>

Typically a residential development does not generate pass-by trips and the generated development trips are considered all primary trips. Therefore, the generated trips are directly used for the analysis without any trip modifications.

### 3.4 Trip Assignment

The generated total site trips are 682 vehicles during the AM peak hour and 848 vehicles during the PM peak hour. The generated site trips were assigned based on the existing trip distributions at the two key intersections on Maple Bay Road. The future site traffic patterns are

assumed to match the existing trip distributions at the two key access intersections. Directional splits for the site trips are as follows:

### **AM Peak Hour**

#### Trips In

- 88% of the trips total from Maple Bay Road South (Duncan)
- 12% of the trips total from Maple Bay Road North (Maple Bay)

#### Trips Out

- 97% of the trips total to Maple Bay Road South (Duncan)
- 3% of the trips total to Maple Bay Road North (Maple Bay)

### **PM Peak Hour**

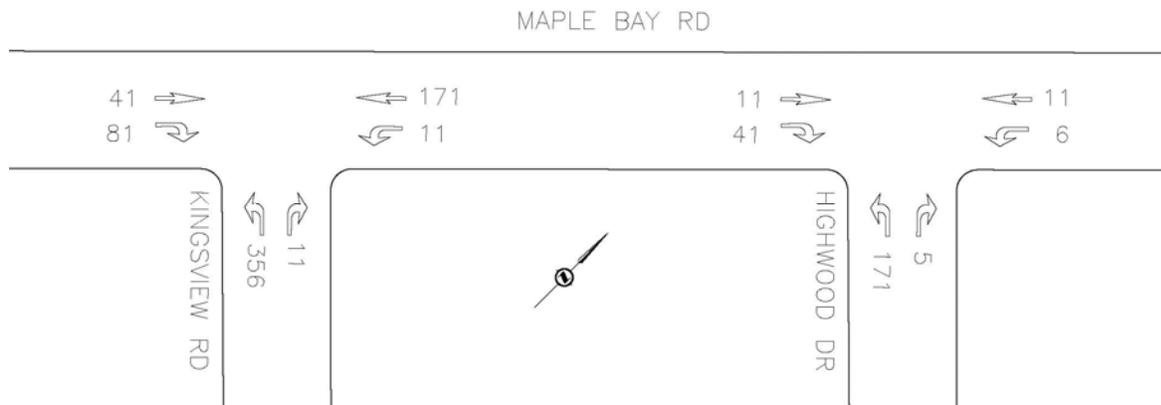
#### Trips In

- 95% of the trips total from Maple Bay Road South (Duncan)
- 5% of the trips total from Maple Bay Road North (Maple Bay)

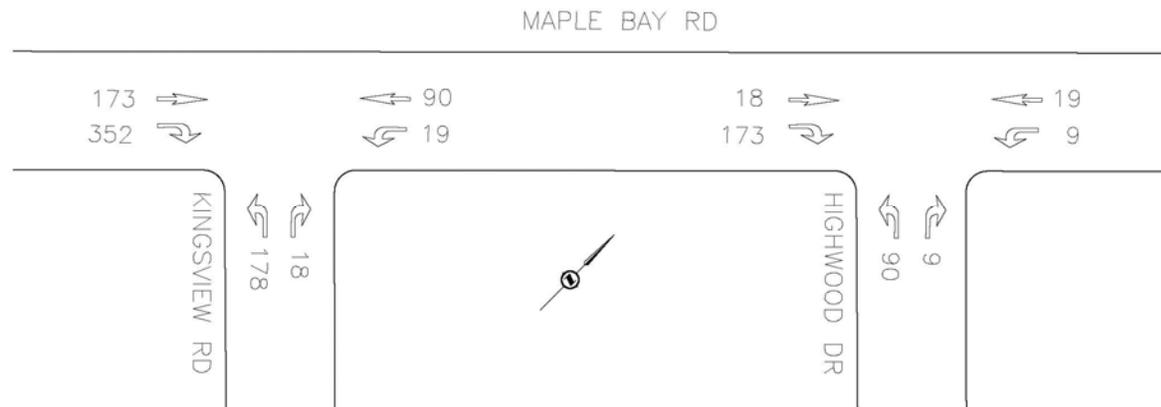
#### Trips Out

- 91% of the trips total to Maple Bay Road South (Duncan)
- 9% of the trips total to Maple Bay Road North (Maple Bay)

**Figures 5 and 6** outline the site trips assigned during the AM and PM peak hours at the two key intersections: Kingsview Road/Maple Bay Road and Highwood Drive/Maple Bay Road.



**Figure 5: Site Trips Assigned during AM Peak Hour**



**Figure 6: Site Trips Assigned during PM Peak Hour**

### 3.5 Post-development Analysis Results - Full Buildout

The post development traffic volumes were entered into Synchro to determine the post development traffic conditions, in consideration of full buildout of the site, to establish ultimate traffic implications for the site (even though the site will be built out in phases over a number of years).

At the stop-controlled intersection of Kingsview Road/Maple Bay Road with full build-out, the westbound left turn movement will experience a failing level of service (LOS F) during the AM and PM peak hours (although with significantly longer delays in the AM peak). Other movements will operate at good levels of service (LOS A/B) during the AM and PM peak hours. The westbound left movement will have a 95<sup>th</sup> percentile queue length of 41.5 vehicles during the post development AM peak hour. Alternative traffic control would be required at the intersection to improve the failing level of service.

However, no mitigations would be required at the intersection of Highwood Drive/Maple Bay Road since all movements will continue to operate at acceptable levels of service (LOS C or better) with full build-out.

**Tables 9** and **10** summarize post development traffic conditions (short term) at the two key intersections: Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road. The post development peak hour volumes and levels of service are shown in **Figures 7** and **8**. See *Appendix D* for the Synchro post-development summary reports.

**TABLE 9: POST DEVELOPMENT PEAK HOUR CONDITIONS AT KINGSVIEW ROAD/MAPLE BAY ROAD**

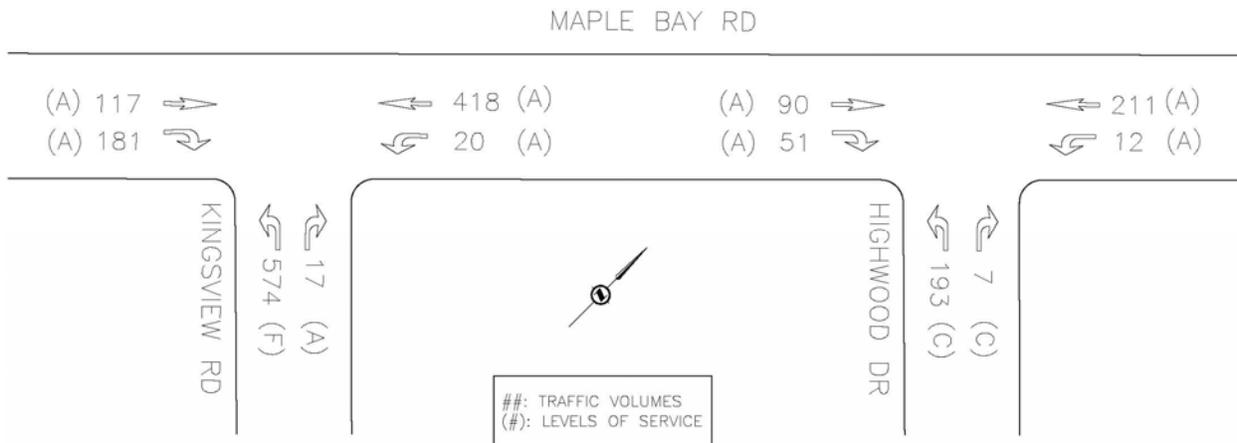
	Southbound (On Maple Bay Rd)	Westbound (On Kingsview Rd)	Westbound (On Kingsview Rd)
	Left	Left	Right
Average Delay (s)	7.6 (8.4)	360 (69.5)	9.2 (11.2)
LOS	A (A)	F (F)	A (B)
95 <sup>th</sup> Queue (veh)	0.1 (0.1)	41.5 (9.2)	0.1 (0.2)

\*Note: ## indicates AM; (##) indicates (PM)

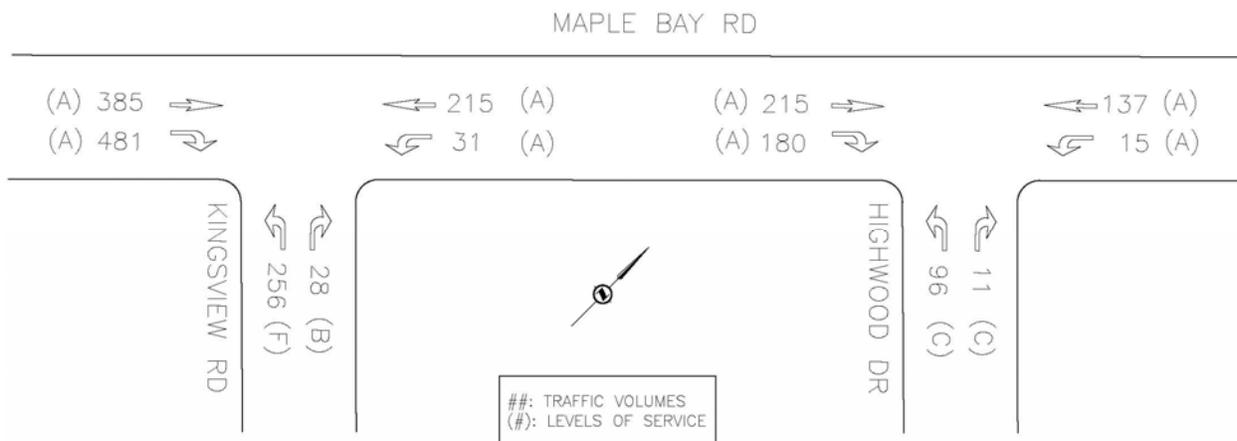
**TABLE 10: POST DEVELOPMENT PEAK HOUR CONDITIONS AT HIGHWOOD DRIVE/MAPLE BAY ROAD**

	Southbound (On Maple Bay Rd)	Westbound (On Highwood Dr)	Westbound (On Highwood Dr)
	Left	Left	Right
Average Delay (s)	7.7 (8.6)	17.6 (22.1)	17.6 (22.1)
LOS	A (A)	C (C)	C (C)
95 <sup>th</sup> Queue (veh)	0.1 (0.1)	2.7 (2.8)	2.7 (2.8)

\*Note: ## indicates AM; (##) indicates (PM)



**Figure 7: Post Development Conditions during AM Peak Hour, Existing Traffic Control**



**Figure 8: Post Development Conditions during PM Peak Hour, Existing Traffic Control**

### 3.6 Mitigation for Kingsview Road/Maple Bay Road (full buildout)

The current stop control and geometry at Kingsview Road/Maple Bay Road will result in the westbound left turn movement having an LOS F during the AM and PM peak hours with the development at full buildout. Alternative traffic control will be required to improve this failing level of service. Three options that were considered were: (1) all-way stop, (2) roundabout, and (3) traffic signal. The future intersection conditions were reviewed for each traffic control option.

All-way stop control was found to be ineffective, as the westbound movement would remain at LOS F in the AM peak hour. Either a one-lane roundabout or a signal would however provide a good level of operation. A roundabout would have better levels of service, with all movements at LOS A, while a signal would have some movements at LOS B/C. A roundabout may therefore be preferable, and would fit with North Cowichan's approach to using roundabout traffic control on roads with capacity considerations. **Table 11** summarizes the analysis result of AM peak hour traffic conditions with a roundabout/signal at the Kingsview Road/Maple Bay Road.

**TABLE 11: COMPARISON BETWEEN ROUNDABOUT AND SIGNAL AT KINGSVIEW ROAD/MAPLE BAY ROAD – AM PEAK HOUR**

Movement	LOS		Delay (Sec)		95th Queue Length (m)	
	RA*	Signal	RA*	Signal	RA*	Signal
Northbound through	A	B	0.1	15.2	9.1	17.9
Northbound right	A	A	0.5	4.2	9.1	6.6
Southbound left	A	B	8.9	13.7	28.1	4.3
Southbound through	A	C	4.6	26.8	28.1	78.1
Westbound left	A	C	5.1	23.4	21.2	85.6
Westbound right	A	A	1.1	3.5	21.2	1.5

\* RA indicates a roundabout with single lane

### 3.7 Trigger for Mitigation at Kingsview Road & Maple Bay Road

A review was conducted to establish the number of units for which traffic control improvements would be triggered due to excessive vehicle delays for westbound Kingsview Road at Maple Bay Road. The point at which the westbound left turn movement, in the AM peak hour, would drop from LOS D to LOS E is at 238 new site trips (161 trips for the south side development and 77 trips for the north side).

This trigger point can be achieved by different unit totals depending upon the type of units built first, since single family homes generate more vehicle trips than multi-family units. Three development scenario triggers were considered, ranging from all single family units (least number of units), to all multi-family units (most units), to a mix of them. Each scenario will generate the same site trips. This trigger point review took into account potential added trips (77 trips based on a 35% buildout of the north side) on Maple Bay Road travelling to/from the north portion of the development via Highwood Drive (which can add delay to westbound left turning vehicles on Kingsview Road at Maple Bay Road). **Table 12** summarizes residential unit numbers by scenario for the 238-trip trigger point.

**TABLE 12: TRIGGER POINT UNIT TOTAL SCENARIOS, THAT GENERATE 238 TRIPS**

Land Use Type	South Side Development Units
Scenario 1: Single Family	215 units
Scenario 2: Multi-family	366 units
Scenario 3: Mixed*	Single Family 81 units and Multi-family 227 units (Total 308 units)

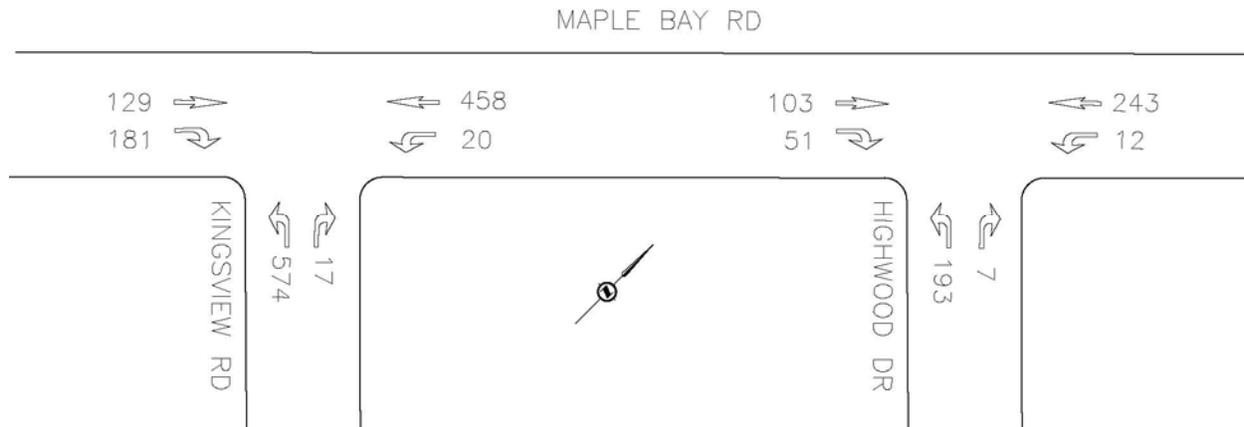
\*The mixed ratio is based on the total south-side proposed ratio of single family to multi-family units

### 3.8 Roadway Corridor Volumes, Post Development

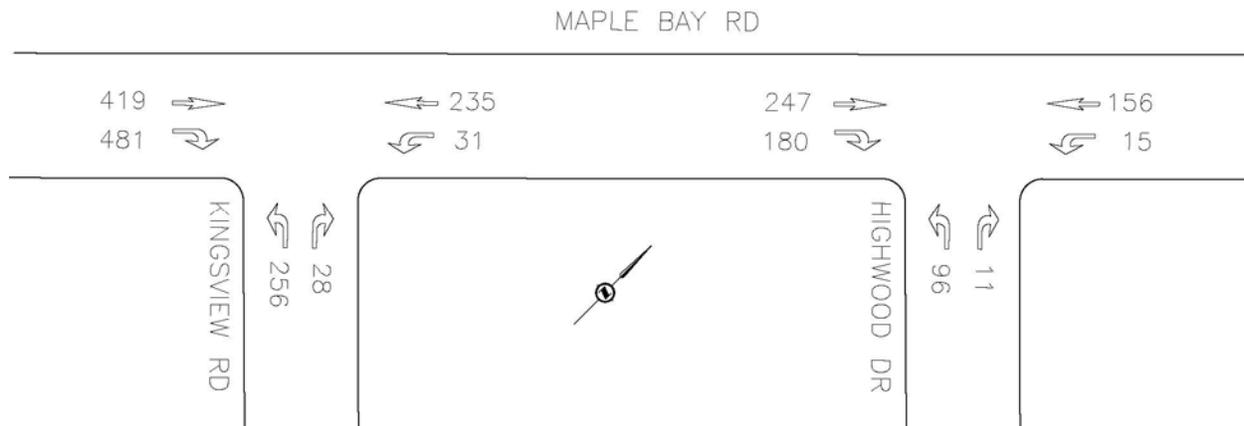
Both Kingsview Road and Highwood Drive will, with full buildout, have a significant increase in the number of vehicles along their length. Kingsview Road will have approximately double the existing peak hour volumes, and Highwood Drive will have an approximate 5-fold increase in traffic (but would still be approximately half of current pre-development Kingsview Road volumes). Although these added volumes can be accommodated on the existing two-lane roads and are not expected to require specific traffic control or capacity mitigation at any intersections (outside of Maple Bay Road), existing residents will likely notice a change in the roadway volumes of these specific roads.

## 4.0 LONG TERM CONDITIONS

A long-term analysis for the 15-year horizon after the opening day (2015 base) with full build-out was conducted. A 15-year horizon was selected as it was indicated by the proponent as a likely minimum build-out timeframe. To obtain 2030 background traffic volumes, a growth rate of 1.0% was applied to the existing 2015 through volumes on Maple Bay Road. Note that this is considered a conservative estimate, since it was determined that there has actually been a decrease in volume on Maple Bay Road over the last 10 years. The proposed development traffic was then added to the 2030 background traffic to obtain the 2030 post development conditions. The long term conditions were analyzed in Synchro and SIDRA software. The long term volumes are shown in **Figures 9 & 10**.



**Figure 9: Long-term Post-Development Traffic Volumes, AM Peak Hour**



**Figure 10: Long-term Post-Development Traffic Volumes, PM Peak Hour**

#### 4.1 2030 Background Conditions

In 2030 without the development, the intersection of Kingsview Road/Maple Bay Road will continue to operate at the same levels of service as 2015 existing (LOS C or better) during the peak hours. The westbound left movement will be a 24.1 second of delay (LOS B) per vehicle. The intersection of Highwood Drive/Maple Bay Road will continue to operate at the same levels of service as 2015 existing (LOS A/B) during the peak hours.

#### 4.2 2030 Post Development Conditions

In 2030 with the development but without traffic control mitigation, at the intersection of Kingsview Road/Maple Bay Road the westbound left movement (from Kingsview onto Maple Bay) will experience a failing level of service (LOS F; delay 429 seconds per vehicle) during the AM peak hour and will also drop to LOS F (delay: 128 seconds) in the PM peak hour. Highwood Drive/Maple Bay Road will continue to operate at acceptable levels of service (LOS C or better) for all movements during the peak hours.

With a roundabout, the intersection would operate at LOS A for all movements (AM and PM peak hours) and with a signal all movements would operate at LOS C or better (AM and PM peak hours). Therefore a roundabout would continue to be an effective traffic control measure into the future.

## **5.0 SAFETY AND GEOMETRICS**

### **5.1 Turn Lanes**

Although improvements at Highwood Drive and Maple Bay Road are not triggered by capacity concerns, turn lanes on Maple Bay Road could be a consideration from a safety and flow perspective. The BC Ministry of Transportation and Infrastructure's left and right turn lane warrants were therefore considered.

At the intersection of Highwood Drive/Maple Bay Road, a southbound left turn lane is not warranted based on the MoTI left turn lane warrant review (based on the warrant chart for a design speed of 60km/h and a percentage of left turns in advancing volume of 10%), for long term (2030) post development volumes (AM and PM peak hours). Therefore, no left turn lane is required on Maple Bay Road at Highwood Drive. The warrant chart review can be found in Appendix F.

There is no similar MoTI warrant for right turn lanes at intersections, when considering the potential need for a right turn lane on Maple Bay Road onto Highwood Drive. Warrants from other jurisdictions are varied in nature, and are based on a combination of the total advancing volume (through plus right turn volume) vs the right turning volume. Based on Minnesota DOT's right turn warrant, a right turn lane would be required once there are 115 right turning vehicles in a design hour, whereas 130 right turning vehicles would be the trigger if using Ohio DOT's right turn lane warrant. The estimated right turn volume at full buildout (of 401 units) of the north portion of the KingsView site is 173 vehicles, which exceeds both of these right-turn lane warrant thresholds. The Minnesota right-turn lane warrant would be met at 68% buildout (268 units) whereas the Ohio warrant would be triggered at 75% buildout of the north side (301 units). Note that this volume of northbound right turning vehicles is very similar to existing peak hour northbound right turn volumes on Maple Bay Road at Kingsview Road (which has up to 129 peak hour right turning vehicles), where there is an existing right turn lane. Therefore a northbound right turn lane on Maple Bay Road at Highwood Drive is a consideration once the north-side development exceeds 268 units, to maintain safety, traffic flow, and intersection design consistency. See Appendix F for the right turn lane warrant chart reviews.

### **5.2 Cross Sections**

Kingsview Road and Nevilane Drive (extension) have been constructed to serve the development area. On the road adjacent to the site, the typical cross section has a 3.5m lane (for each direction), a 1.5m bike lane (uphill direction only), a 2m parking lane (for both sides),

and a concrete sidewalk one side of the road. This meets the Municipal typical cross section standards for a rural collector road.



Looking to Nevilane Drive North

Highwood Drive ranges from 8.7m to 11.5m paved width, with limited unpaved shoulders and no paint markings, which is typical of local roads in the Municipality. Highwood Drive will continue to serve as a local road with the development (albeit with a higher volume). New roadway sections should be constructed to meet the District's roadway specifications.

## 6.0 OTHER MODES

### 6.1 Pedestrian and Bicycle Facilities

There is sidewalk along one side of Kingsview Road but no sidewalk along Highwood Drive. There is a bike lane (1.5m) along one side (uphill side) of Kingsview Road east of Donnay Drive. On Highwood Drive, it was observed that there were not significant pedestrian/cyclist activity, but this could increase with the development. The provision of sidewalks and bicycle facilities should either adhere to Municipal specifications or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads.

### 6.2 Transit

There is one transit bus route (#4) along Kingsview Road (from Maple Bay Road to Chippewa Road) and Donnay Drive (see Figure 11). This bus route connects Duncan to Maple Bay eight times a day on weekdays. In the future the bus route could be extended along Kingsview Road and Nevilane Drive if the transit demand increases around the development area. Based on the current route, the closest bus station is at Chippewa Road/Kingsview Road.



**Figure 11: Transit Bus Route #4**

## 7.0 CONCLUSIONS

The following conclusions are made regarding the traffic study for the proposed 808-unit KingsView development.

The existing intersection of Kingsview Road/Maple Bay Road operates at LOS C or better for all movements in the AM and PM peak hours (with the AM peak hour being the worst-case traffic condition period due to left turns onto Maple Bay Road). With development at full buildout, the westbound left turn movement (from Kingsview Road onto Maple Bay Road) will drop to LOS F (failing level of service) in the AM and PM peak hours, and traffic control improvements would be required (either a one-lane roundabout or intersection signalization). The point at which a traffic control improvement at this intersection is triggered is 238 site trips, which is equivalent to 308 units on the south side of Kingsview Road (for a mix of multi-family and single family in proportion to the full-buildout percentage), and slightly higher or lower unit numbers if more multi-family or single family units are initially developed.

The roadway corridors of Kingsview Road and Highwood Drive can accommodate the increased volume and will not require added traffic control at other intersections, but the total volume will

increase noticeably on these roads (approximately double on Kingsview Road and a 5-fold increase on Highwood Drive).

A review of 15-year horizon conditions found that a roundabout or signal would continue to operate with good levels of service at Kingsview Road & Maple Bay Road.

The existing intersection of Highwood Drive /Maple Bay Road will operate at a LOS C or better for all movements in the long term with the development. Therefore, no mitigation would be required at Highwood Drive /Maple Bay Road from a capacity perspective. A southbound left turn lane is not warranted in the long term, but a northbound right turn lane would be warranted at the 67% buildout stage of the north portion of the site (268 units), and would be beneficial for safety and traffic flow due to the added right turn volumes from the development.

On Kingsview Road there are currently bike facilities (uphill bike lane) and a sidewalk on one side, but no facilities on Highwood Drive. Site road cross sections should either conform to the Municipality's specifications or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads. There is a bus route with service near to the site, which could be expanded to directly serve the development once demand is established in the future.

## 8.0 RECOMMENDATIONS

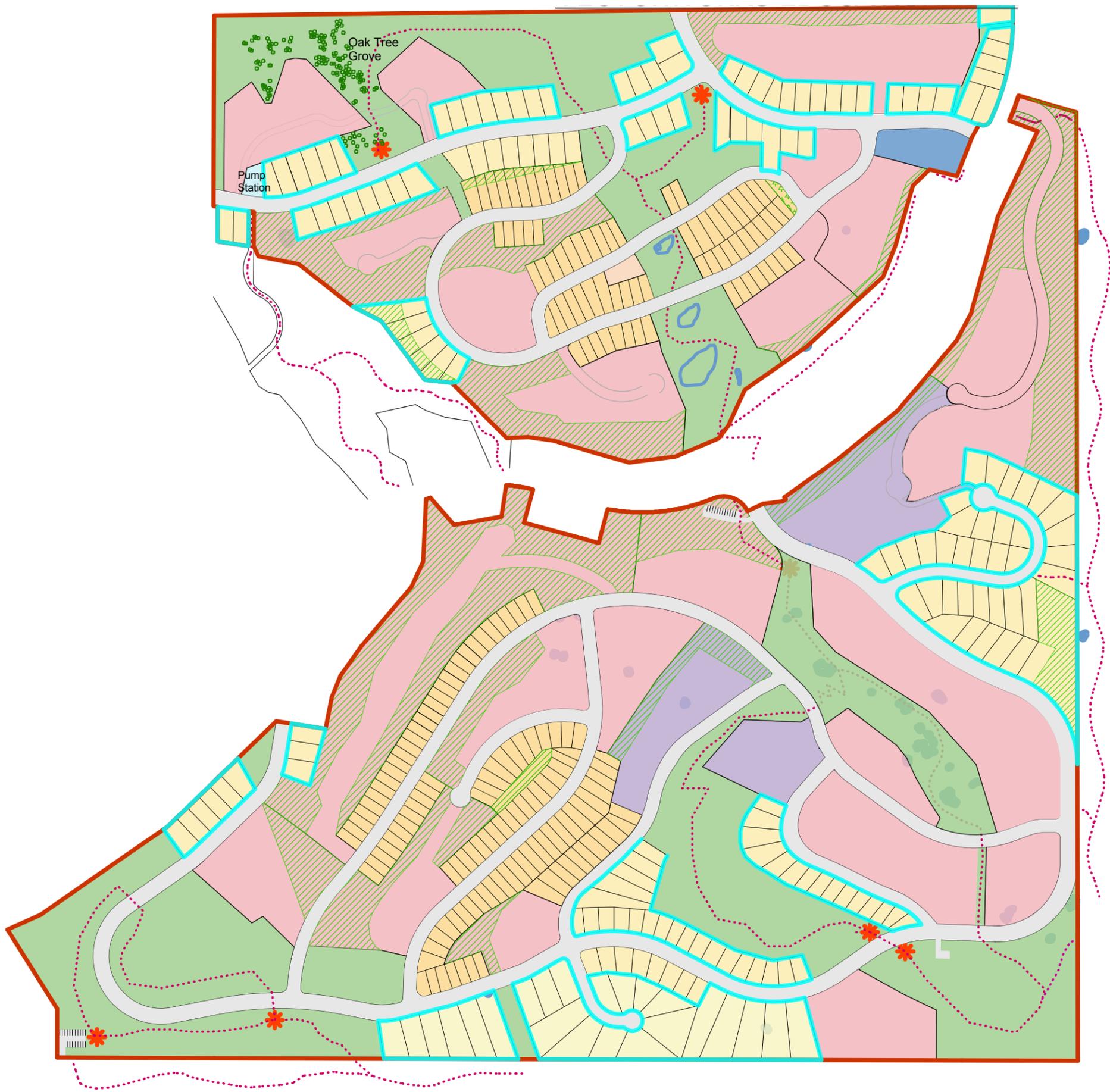
The following measures are recommended:

- Install a single lane roundabout at Kingsview Road & Maple Bay Road once the 238 site trip trigger point is exceeded (e.g. 308 south-side units for mixed initial development (81 single family and 227 multi-family units), or 215 south-side single family units only or 366 south-side multi-family units only).
- Install a northbound right turn lane on Maple Bay Road at Highwood Drive once 268 units are exceeded for the north portion of the site (out of 401 total units).
- Design the development roads should either meet the Municipal standards (in terms of bike facilities and sidewalks) or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads.

## APPENDIX A: SITE PLAN



# Schedule B Land Use Plan KingsView



- Boundary of Site
- Proposed Trail Network
- Trail / Street Crossing
- Lots Permitting Secondary Suites

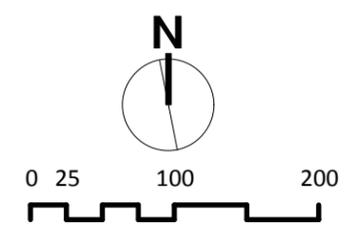
Land Use Area	Total Area	Buildable Area
Area 1 – Large Lot	8.9 acres	8.9 acres
Area 2 – Standard Lot	31.4 acres	29.2 acres
Area 3 – Standard Lot (Duplex)	0.2 acres	0.2 acres
Area 4 – Small Lot Comprehensive	20.0 acres	19.3 acres
Area 5 – Townhouse	98.5 acres	66.4 acres
Area 6 – Multifamily	11.2 acres	8.7 acres
Area 7 – Multifamily w/ commercial	1.1 acres	1.1 acres
Area 8 – Parks & Open Space	59.0 acres	
Covenanted Green Space	(35.7 acres)	
Road ROWs	32.1 acres	
<b>Totals</b>	<b>263 acres</b>	<b>134 acres</b>

**Note:** Secondary suites permitted in Areas 1 & 2.

North Side	
Detached	151 units
TH/Multifamily	250 units
South Side	
Detached	230 units
TH/Multifamily	649 units

**Total: 1,280 units\***

\*Based on 11 units/ac for THs and 22 units/ac for Multifamily.



Scale 1:5,000

September 8, 2015



## APPENDIX B: SYNCHRO BACKGROUND

## SYNCHRO MODELLING SOFTWARE DESCRIPTION

The traffic analysis was completed using Synchro and SimTraffic traffic modeling software. Results were measured in delay, level of service (LOS) and 95th percentile queue length. Synchro is based on the Highway Capacity Manual (HCM) methodology. SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. The simulation is run five times (five different random seedings of vehicle types, behaviours and arrivals) to obtain statistical significance of the results.

### Levels of Service

Traffic operations are typically described in terms of levels of service, which rates the amount of delay per vehicle for each movement and the entire intersection. Levels of service range from LOS A (representing best operations) to LOS E/F (LOS E being poor operations and LOS F being unpredictable/disruptive operations). LOS E/F are generally unacceptable levels of service under normal everyday conditions.

The hierarchy of criteria for grading an intersection or movement not only includes delay times, but also takes into account traffic control type (stop signs or traffic signal). For example, if a vehicle is delayed for 19 seconds at an unsignalized intersection, it is considered to have an average operation, and would therefore be graded as an LOS C. However, at a signalized intersection, a 19 second delay would be considered a good operation and therefore it would be given an LOS B. The table below indicates the range of delay for LOS for signalized and unsignalized intersections.

**Table A1: LOS Criteria, by Intersection Traffic Control**

Level of Service	Unsignalized Intersection Average Vehicle Delay (sec/veh)	Signalized Intersection Average Vehicle Delay (sec/veh)
A	Less than 10	Less than 10
B	10 to 15	11 to 20
C	15 to 25	20 to 35
D	25 to 35	35 to 55
E	35 to 50	55 to 80
F	More than 50	More than 80

## APPENDIX C: 2015 EXISTING CONDITIONS

**Intersection**

Int Delay, s/veh 8.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	218	6	76	100	9	247
Future Vol, veh/h	218	6	76	100	9	247
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	50	68	68	38	91
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	346	12	112	147	24	271

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	431	112	0
Stage 1	112	-	-
Stage 2	319	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	579	947	-
Stage 1	910	-	-
Stage 2	735	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	570	947	-
Mov Cap-2 Maneuver	570	-	-
Stage 1	910	-	-
Stage 2	723	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.2	0	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	570	947	1490	-
HCM Lane V/C Ratio	-	-	0.607	0.013	0.016	-
HCM Control Delay (s)	-	-	20.6	8.9	7.5	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	4	0	0	-

**Intersection**

Int Delay, s/veh 1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	22	2	79	10	6	200
Future Vol, veh/h	22	2	79	10	6	200
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	46	50	71	50	38	91
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	48	4	111	20	16	220

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	372	121	0	0	131	0
Stage 1	121	-	-	-	-	-
Stage 2	251	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	623	816	-	-	1467	-
Stage 1	897	-	-	-	-	-
Stage 2	784	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	616	816	-	-	1467	-
Mov Cap-2 Maneuver	616	-	-	-	-	-
Stage 1	897	-	-	-	-	-
Stage 2	775	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	628	1467	-
HCM Lane V/C Ratio	-	-	0.083	0.011	-
HCM Control Delay (s)	-	-	11.2	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

**Intersection**

Int Delay, s/veh 2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	78	10	212	129	12	125
Future Vol, veh/h	78	10	212	129	12	125
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	83	80	75	38	76
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	92	12	265	172	32	164

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	493	265	0
Stage 1	265	-	-
Stage 2	228	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	534	779	-
Stage 1	777	-	-
Stage 2	808	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	521	779	-
Mov Cap-2 Maneuver	521	-	-
Stage 1	777	-	-
Stage 2	788	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13	0	1.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	521	779	1311	-
HCM Lane V/C Ratio	-	-	0.176	0.015	0.024	-
HCM Control Delay (s)	-	-	13.4	9.7	7.8	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.6	0	0.1	-

**Intersection**

Int Delay, s/veh 0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	6	2	197	7	6	118
Future Vol, veh/h	6	2	197	7	6	118
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	12	4	232	12	12	164

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	426	238	0	0	244	0
Stage 1	238	-	-	-	-	-
Stage 2	188	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	580	696	-	-	1334	-
Stage 1	795	-	-	-	-	-
Stage 2	837	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	574	696	-	-	1334	-
Mov Cap-2 Maneuver	574	-	-	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	829	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	600	1334	-
HCM Lane V/C Ratio	-	-	0.027	0.009	-
HCM Control Delay (s)	-	-	11.2	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-



## APPENDIX D: 2015 POST DEVELOPMENT CONDITIONS

**Intersection**

Int Delay, s/veh 151.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	574	17	117	181	20	418
Future Vol, veh/h	574	17	117	181	20	418
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	60	70	75	50	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	675	28	167	241	40	454

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	701	167	0
Stage 1	167	-	-
Stage 2	534	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	~ 403	882	-
Stage 1	860	-	-
Stage 2	~ 586	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	~ 392	882	-
Mov Cap-2 Maneuver	~ 392	-	-
Stage 1	860	-	-
Stage 2	~ 570	-	-

Approach	WB	NB	SB
HCM Control Delay, s	\$ 345.9	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	392	882	1423	-
HCM Lane V/C Ratio	-	-	1.723	0.032	0.028	-
HCM Control Delay (s)	-	-	\$ 360	9.2	7.6	-
HCM Lane LOS	-	-	F	A	A	-
HCM 95th %tile Q(veh)	-	-	41.5	0.1	0.1	-

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

**Intersection**

Int Delay, s/veh 6.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	193	7	90	51	12	211
Future Vol, veh/h	193	7	90	51	12	211
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	50	75	60	40	92
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	257	14	120	85	30	229

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	452	163	0
Stage 1	163	-	-
Stage 2	289	-	-
Critical Hdwy	6.45	6.7	4.1
Critical Hdwy Stg 1	5.45	-	-
Critical Hdwy Stg 2	5.45	-	-
Follow-up Hdwy	3.545	3.75	2.2
Pot Cap-1 Maneuver	560	771	1378
Stage 1	859	-	-
Stage 2	753	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	546	771	1378
Mov Cap-2 Maneuver	546	-	-
Stage 1	859	-	-
Stage 2	734	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.6	0	0.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	554	1378
HCM Lane V/C Ratio	-	-	0.49	0.022
HCM Control Delay (s)	-	-	17.6	7.7
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	2.7	0.1

**Intersection**

Int Delay, s/veh 13

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	256	28	385	481	31	215
Future Vol, veh/h	256	28	385	481	31	215
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	60	80
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	301	33	453	566	52	269

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	825	453	0
Stage 1	453	-	-
Stage 2	372	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	341	611	-
Stage 1	638	-	-
Stage 2	695	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	325	611	-
Mov Cap-2 Maneuver	325	-	-
Stage 1	638	-	-
Stage 2	663	-	-

Approach	WB	NB	SB
HCM Control Delay, s	63.8	0	1.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	325	611	1118	-
HCM Lane V/C Ratio	-	-	0.927	0.054	0.046	-
HCM Control Delay (s)	-	-	69.5	11.2	8.4	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	9.2	0.2	0.1	-

**Intersection**

Int Delay, s/veh 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	96	11	215	180	15	137
Future Vol, veh/h	96	11	215	180	15	137
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	192	22	253	310	30	190

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	658	408	0 0 563 0
Stage 1	408	-	- - - -
Stage 2	250	-	- - - -
Critical Hdwy	6.45	6.7	- - 4.1 -
Critical Hdwy Stg 1	5.45	-	- - - -
Critical Hdwy Stg 2	5.45	-	- - - -
Follow-up Hdwy	3.545	3.75	- - 2.2 -
Pot Cap-1 Maneuver	424	551	- - 1019 -
Stage 1	665	-	- - - -
Stage 2	785	-	- - - -
Platoon blocked, %			- - - -
Mov Cap-1 Maneuver	410	551	- - 1019 -
Mov Cap-2 Maneuver	410	-	- - - -
Stage 1	665	-	- - - -
Stage 2	759	-	- - - -

Approach	WB	NB	SB
HCM Control Delay, s	22.1	0	1.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	421	1019
HCM Lane V/C Ratio	-	-	0.508	0.029
HCM Control Delay (s)	-	-	22.1	8.6
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	2.8	0.1



## APPENDIX E:2030 LONG TERM CONDITIONS

**Intersection**

Int Delay, s/veh 8.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	218	6	88	100	9	287
Future Vol, veh/h	218	6	88	100	9	287
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	50	68	68	38	91
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	346	12	129	147	24	315

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	492	129	0
Stage 1	129	-	-
Stage 2	363	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	534	926	-
Stage 1	894	-	-
Stage 2	702	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	525	926	-
Mov Cap-2 Maneuver	525	-	-
Stage 1	894	-	-
Stage 2	691	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.6	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	525	926	1469	-
HCM Lane V/C Ratio	-	-	0.659	0.013	0.016	-
HCM Control Delay (s)	-	-	24.1	8.9	7.5	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	4.8	0	0	-

**Intersection**

Int Delay, s/veh 1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	22	2	92	10	6	232
Future Vol, veh/h	22	2	92	10	6	232
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	46	50	71	50	38	91
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	48	4	130	20	16	255

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	427	140	0	0	150	0
Stage 1	140	-	-	-	-	-
Stage 2	287	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	579	795	-	-	1444	-
Stage 1	879	-	-	-	-	-
Stage 2	755	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	571	795	-	-	1444	-
Mov Cap-2 Maneuver	571	-	-	-	-	-
Stage 1	879	-	-	-	-	-
Stage 2	745	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.8	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	584	1444	-
HCM Lane V/C Ratio	-	-	0.089	0.011	-
HCM Control Delay (s)	-	-	11.8	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

**Intersection**

Int Delay, s/veh 2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	78	10	246	129	12	145
Future Vol, veh/h	78	10	246	129	12	145
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	83	80	75	38	76
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	92	12	308	172	32	191

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	562	308	0	0	308	0
Stage 1	308	-	-	-	-	-
Stage 2	254	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	486	737	-	-	1264	-
Stage 1	743	-	-	-	-	-
Stage 2	786	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	474	737	-	-	1264	-
Mov Cap-2 Maneuver	474	-	-	-	-	-
Stage 1	743	-	-	-	-	-
Stage 2	766	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	1.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	474	737	1264	-
HCM Lane V/C Ratio	-	-	0.194	0.016	0.025	-
HCM Control Delay (s)	-	-	14.4	10	7.9	-
HCM Lane LOS	-	-	B	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0.1	0.1	-

**Intersection**

Int Delay, s/veh 0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	6	2	229	7	6	137
Future Vol, veh/h	6	2	229	7	6	137
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	12	4	269	12	12	190

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	489	275	0	0	281	0
Stage 1	275	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	533	662	-	-	1293	-
Stage 1	764	-	-	-	-	-
Stage 2	815	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	528	662	-	-	1293	-
Mov Cap-2 Maneuver	528	-	-	-	-	-
Stage 1	764	-	-	-	-	-
Stage 2	807	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	556	1293	-
HCM Lane V/C Ratio	-	-	0.029	0.009	-
HCM Control Delay (s)	-	-	11.7	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

**Intersection**

Int Delay, s/veh 174.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	574	17	129	181	20	458
Future Vol, veh/h	574	17	129	181	20	458
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	60	70	75	50	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	675	28	184	241	40	498

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	762	184	0
Stage 1	184	-	-
Stage 2	578	-	-
Critical Hdwy	6.43	6.2	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	-
Pot Cap-1 Maneuver	~ 371	864	-
Stage 1	845	-	-
Stage 2	~ 559	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	~ 360	864	-
Mov Cap-2 Maneuver	~ 360	-	-
Stage 1	845	-	-
Stage 2	~ 543	-	-

Approach	WB	NB	SB
HCM Control Delay, s	\$ 412.6	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	360	864	1403	-
HCM Lane V/C Ratio	-	-	1.876	0.033	0.029	-
HCM Control Delay (s)	-	-	\$ 429.5	9.3	7.6	-
HCM Lane LOS	-	-	F	A	A	-
HCM 95th %tile Q(veh)	-	-	45	0.1	0.1	-

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

**Intersection**

Int Delay, s/veh 7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	193	7	103	51	12	243
Future Vol, veh/h	193	7	103	51	12	243
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	50	75	60	40	92
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	257	14	137	85	30	264

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	504	180	0	0	222	0
Stage 1	180	-	-	-	-	-
Stage 2	324	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	522	753	-	-	1359	-
Stage 1	844	-	-	-	-	-
Stage 2	726	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	508	753	-	-	1359	-
Mov Cap-2 Maneuver	508	-	-	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	707	-	-	-	-	-

Approach	WB		NB		SB
HCM Control Delay, s	19.4		0		0.8
HCM LOS	C				

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	517	1359	-
HCM Lane V/C Ratio	-	-	0.525	0.022	-
HCM Control Delay (s)	-	-	19.4	7.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	3	0.1	-

**Intersection**

Int Delay, s/veh 21.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	256	28	419	481	31	235
Future Vol, veh/h	256	28	419	481	31	235
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	83	82	85	38	80
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	284	34	511	566	82	294

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	968	511	0
Stage 1	511	-	-
Stage 2	457	-	-
Critical Hdwy	6.43	6.2	4.1
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	2.2
Pot Cap-1 Maneuver	~ 280	567	1065
Stage 1	600	-	-
Stage 2	636	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	~ 258	567	1065
Mov Cap-2 Maneuver	~ 258	-	-
Stage 1	600	-	-
Stage 2	587	-	-

Approach	WB	NB	SB
HCM Control Delay, s	116	0	1.9
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	258	567	1065	-
HCM Lane V/C Ratio	-	-	1.102	0.059	0.077	-
HCM Control Delay (s)	-	-	128.4	11.8	8.7	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	12.1	0.2	0.2	-

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

**Intersection**

Int Delay, s/veh 3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	96	11	247	180	15	156
Future Vol, veh/h	96	11	247	180	15	156
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	70	60	87	70	60	75
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	137	18	284	257	25	208

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	670	412	0
Stage 1	412	-	-
Stage 2	258	-	-
Critical Hdwy	6.45	6.7	4.1
Critical Hdwy Stg 1	5.45	-	-
Critical Hdwy Stg 2	5.45	-	-
Follow-up Hdwy	3.545	3.75	2.2
Pot Cap-1 Maneuver	418	548	1038
Stage 1	662	-	-
Stage 2	778	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	407	548	1038
Mov Cap-2 Maneuver	407	-	-
Stage 1	662	-	-
Stage 2	757	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.5	0	0.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	420	1038
HCM Lane V/C Ratio	-	-	0.37	0.024
HCM Control Delay (s)	-	-	18.5	8.6
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	1.7	0.1

**Intersection**

Int Delay, s/veh 14.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	343	9	90	128	13	307
Future Vol, veh/h	343	9	90	128	13	307
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	83	50	75	80	38	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	413	18	120	160	34	334

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	522	120	0
Stage 1	120	-	-
Stage 2	402	-	-
Critical Hdwy	6.43	6.2	4.1
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.3	2.2
Pot Cap-1 Maneuver	513	937	1480
Stage 1	903	-	-
Stage 2	673	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	501	937	1480
Mov Cap-2 Maneuver	501	-	-
Stage 1	903	-	-
Stage 2	658	-	-

Approach	WB	NB	SB
HCM Control Delay, s	36.5	0	0.7
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	501	937	1480	-
HCM Lane V/C Ratio	-	-	0.825	0.019	0.023	-
HCM Control Delay (s)	-	-	37.7	8.9	7.5	-
HCM Lane LOS	-	-	E	A	A	-
HCM 95th %tile Q(veh)	-	-	8.1	0.1	0.1	-

### Lanes, Volumes, Timings

#### 3: Maple Bay Rd & Kingsview Rd

10/2/2015

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	574	17	117	181	20	418
Future Volume (vph)	574	17	117	181	20	418
Ideal Flow (vphpl)	1890	1890	1890	1890	1890	1890
Storage Length (m)	0.0	50.0		30.0	15.0	
Storage Lanes	1	1		1	1	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1724	1589	1780	1557	1776	1843
Flt Permitted	0.950				0.651	
Satd. Flow (perm)	1724	1589	1780	1557	1217	1843
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		28		241		
Link Speed (k/h)	50		60			60
Link Distance (m)	369.2		485.6			120.0
Travel Time (s)	26.6		29.1			7.2
Confl. Bikes (#/hr)					3	
Peak Hour Factor	0.85	0.60	0.70	0.75	0.50	0.92
Heavy Vehicles (%)	3%	0%	5%	2%	0%	1%
Bus Blockages (#/hr)	0	0	0	0	0	1
Adj. Flow (vph)	675	28	167	241	40	454
Shared Lane Traffic (%)						
Lane Group Flow (vph)	675	28	167	241	40	454
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.03
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	1	1	1	1
Detector Template						
Leading Detector (m)	15.2	15.2	15.2	15.2	15.2	15.2
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	15.2	15.2	15.2	15.2	15.2	15.2
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	Perm	NA	Perm	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Detector Phase	8	8	2	2	6	6

# Lanes, Volumes, Timings

## 3: Maple Bay Rd & Kingsview Rd

10/2/2015

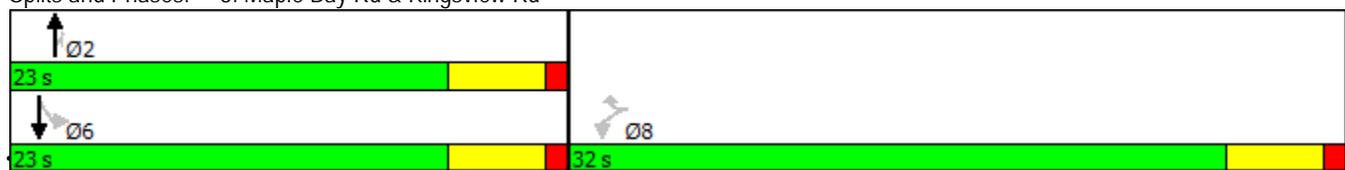


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
<b>Switch Phase</b>						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	32.0	32.0	23.0	23.0	23.0	23.0
Total Split (%)	58.2%	58.2%	41.8%	41.8%	41.8%	41.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
<b>Lead/Lag</b>						
<b>Lead-Lag Optimize?</b>						
Recall Mode	None	None	Min	Min	Min	Min
Act Effect Green (s)	22.8	22.8	15.6	15.6	15.6	15.6
Actuated g/C Ratio	0.47	0.47	0.32	0.32	0.32	0.32
v/c Ratio	0.84	0.04	0.29	0.36	0.10	0.77
Control Delay	23.4	3.5	15.2	4.2	13.7	26.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	3.5	15.2	4.2	13.7	26.8
LOS	C	A	B	A	B	C
Approach Delay	22.6		8.7			25.7
Approach LOS	C		A			C
Queue Length 50th (m)	51.7	0.0	12.1	0.0	2.7	39.4
Queue Length 95th (m)	#85.6	1.5	17.9	6.6	4.3	#78.1
Internal Link Dist (m)	345.2		461.6			96.0
Turn Bay Length (m)		50.0		30.0	15.0	
Base Capacity (vph)	987	922	679	743	464	703
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.03	0.25	0.32	0.09	0.65

### Intersection Summary

Area Type: Other  
 Cycle Length: 55  
 Actuated Cycle Length: 48.8  
 Natural Cycle: 55  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 20.1  
 Intersection LOS: C  
 Intersection Capacity Utilization 62.4%  
 ICU Level of Service B  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

### Splits and Phases: 3: Maple Bay Rd & Kingsview Rd



# MOVEMENT SUMMARY

Site: Kingsview-Maple Bay Rd AM

Kingsview Rd and Maple Bay Rd RA\_AM Peak Hr w Kingsview Development Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Maple Bay Rd												
2	T	123	4.0	0.191	0.1	LOS A	1.3	9.1	0.12	0.03	30.1	
3	R	191	2.0	0.191	0.5	LOS A	1.3	9.1	0.12	0.08	30.1	
Approach		314	2.8	0.191	0.4	LOS A	1.3	9.1	0.12	0.06	30.1	
East: Kingsview Rd												
4	L	604	1.0	0.428	5.1	LOS A	3.0	21.2	0.36	0.50	28.7	
6	R	18	0.0	0.428	1.1	LOS A	3.0	21.2	0.36	0.22	29.2	
Approach		622	1.0	0.428	5.0	LOS A	3.0	21.2	0.36	0.49	28.7	
North: Maple Bay Rd												
7	L	21	0.0	0.490	8.9	LOS A	3.9	28.1	0.80	0.98	28.5	
8	T	440	2.0	0.490	4.6	LOS A	3.9	28.1	0.80	0.76	28.4	
Approach		461	1.9	0.490	4.8	LOS A	3.9	28.1	0.80	0.77	28.4	
All Vehicles		1397	1.7	0.490	3.9	LOS A	3.9	28.1	0.45	0.49	28.9	

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: Kingsview-Maple Bay Rd PM

Kingsview Rd and Maple Bay Rd RA\_PM Peak Hr w Kingsview Development Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	405	2.0	0.547	0.3	LOS A	5.2	37.2	0.22	0.06	29.9
3	R	506	1.0	0.547	0.6	LOS A	5.2	37.2	0.22	0.09	29.8
Approach		912	1.4	0.547	0.5	LOS A	5.2	37.2	0.22	0.07	29.8
East: Kingsview Rd											
4	L	269	1.0	0.268	6.5	LOS A	1.6	11.5	0.56	0.64	28.4
6	R	29	0.0	0.268	2.5	LOS A	1.6	11.5	0.56	0.43	28.6
Approach		299	0.9	0.268	6.1	LOS A	1.6	11.5	0.56	0.62	28.4
North: Maple Bay Rd											
7	L	33	0.0	0.216	5.7	LOS A	1.3	9.4	0.48	0.85	29.3
8	T	226	2.0	0.216	1.3	LOS A	1.3	9.4	0.48	0.22	29.2
Approach		259	1.7	0.216	1.9	LOS A	1.3	9.4	0.48	0.30	29.2
All Vehicles		1469	1.4	0.547	1.9	LOS A	5.2	37.2	0.34	0.23	29.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2030 Kingsview-Maple Bay Rd  
AM

Kingsview Rd and Maple Bay Rd RA\_AM Peak Hr w Kingsview Development Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	136	4.0	0.199	0.1	LOS A	1.3	9.6	0.12	0.03	30.1
3	R	191	2.0	0.199	0.5	LOS A	1.3	9.6	0.12	0.08	30.0
Approach		326	2.8	0.199	0.4	LOS A	1.3	9.6	0.12	0.06	30.1
East: Kingsview Rd											
4	L	604	1.0	0.434	5.2	LOS A	3.1	21.6	0.38	0.51	28.6
6	R	18	0.0	0.434	1.2	LOS A	3.1	21.6	0.38	0.23	29.1
Approach		622	1.0	0.434	5.1	LOS A	3.1	21.6	0.38	0.50	28.7
North: Maple Bay Rd											
7	L	21	0.0	0.537	9.6	LOS A	4.8	33.8	0.83	1.03	28.3
8	T	482	2.0	0.537	5.2	LOS A	4.8	33.8	0.83	0.83	28.3
Approach		503	1.9	0.537	5.4	LOS A	4.8	33.8	0.83	0.84	28.3
All Vehicles		1452	1.7	0.537	4.1	LOS A	4.8	33.8	0.48	0.52	28.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

Processed: Thursday, October 1, 2015 12:39:31 PM

SIDRA INTERSECTION 5.1.13.2093

Project: V:\Project Files\1900 - KingsView TIA Update\SIDRA\Kingsview Development.sip  
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# MOVEMENT SUMMARY

Site: 2030 Kingsview-Maple Bay Rd  
PM

Kingsview Rd and Maple Bay Rd RA\_PM Peak Hr w Kingsview Development Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Maple Bay Rd												
2	T	441	2.0	0.568	0.3	LOS A	5.7	40.1	0.23	0.06	29.8	
3	R	506	1.0	0.568	0.6	LOS A	5.7	40.1	0.23	0.09	29.8	
Approach		947	1.5	0.568	0.5	LOS A	5.7	40.1	0.23	0.07	29.8	
East: Kingsview Rd												
4	L	269	1.0	0.275	6.7	LOS A	1.7	11.9	0.59	0.66	28.3	
6	R	29	0.0	0.275	2.7	LOS A	1.7	11.9	0.59	0.47	28.5	
Approach		299	0.9	0.275	6.3	LOS A	1.7	11.9	0.59	0.64	28.3	
North: Maple Bay Rd												
7	L	33	0.0	0.234	5.7	LOS A	1.5	10.4	0.49	0.85	29.3	
8	T	247	2.0	0.234	1.3	LOS A	1.5	10.4	0.49	0.22	29.2	
Approach		280	1.8	0.234	1.8	LOS A	1.5	10.4	0.49	0.30	29.2	
All Vehicles		1526	1.4	0.568	1.9	LOS A	5.7	40.1	0.35	0.23	29.4	

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

Processed: Thursday, October 1, 2015 12:41:09 PM

SIDRA INTERSECTION 5.1.13.2093

Project: V:\Project Files\1900 - KingsView TIA Update\SIDRA\Kingsview Development.sip

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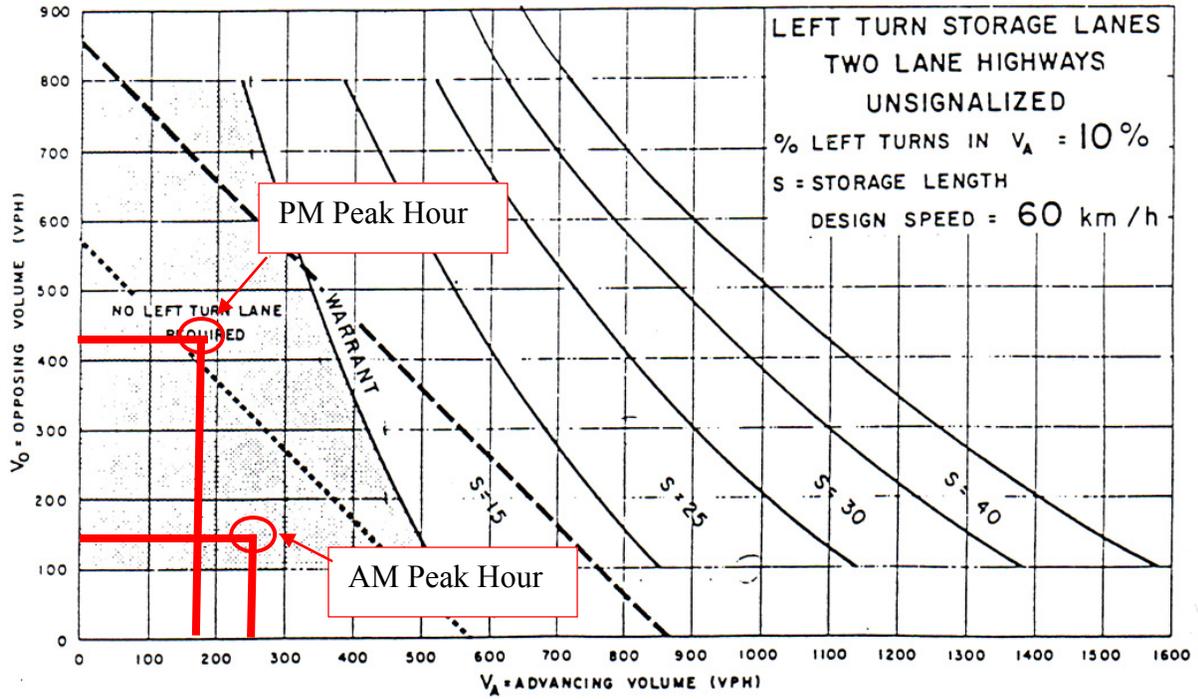
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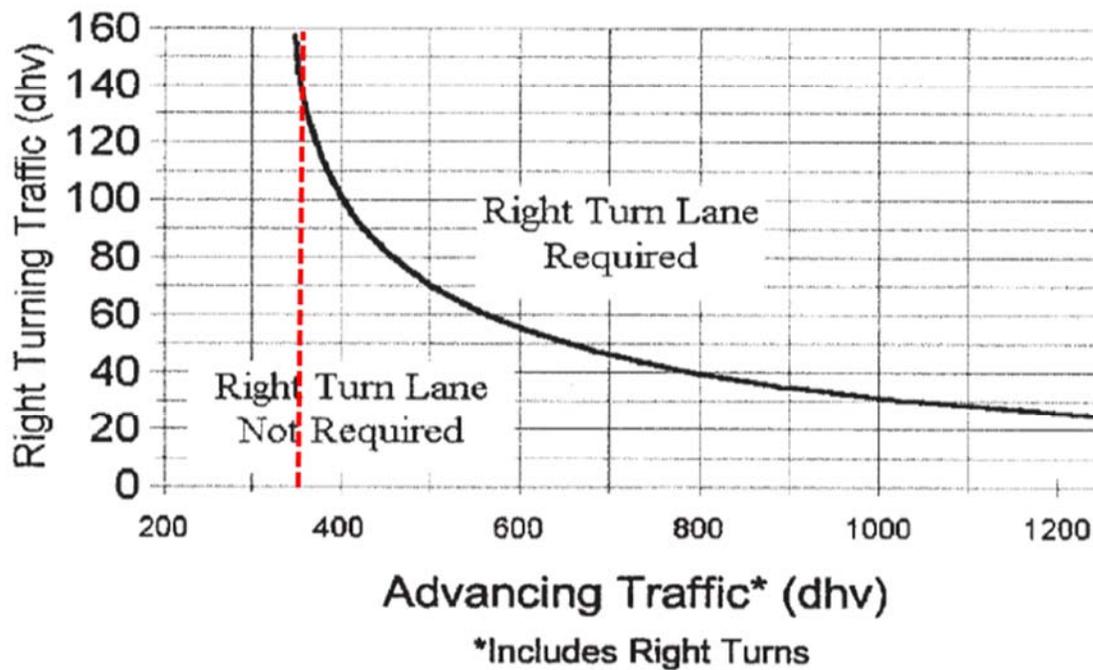
## APPENDIX F: TURN LANE WARRANT REVIEW

**BC MoTI Left Turn Lane Warrant, 2030 Post-Development, Maple Bay Road at Highway Drive**



*Ohio DOT Right Turn Lane Warrant for Maple Bay Rd at Highwood Dr, 2030 Horizon (not warranted until 130 right turning vehicles plus future traffic growth)*

**2-Lane Highway Right Turn Lane Warrant**  
=< 40 mph or 70 kph Posted Speed



Source:

[http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/roadway/Location%20and%20Design%20Manual/Section\\_400\\_July\\_2013.pdf](http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/roadway/Location%20and%20Design%20Manual/Section_400_July_2013.pdf)

*Minnesota DOT Right Turn Lane Warrant for Maple Bay Rd at Highwood Dr, 2030 Horizon  
(not warranted until 115 right turning vehicles plus future traffic growth)*

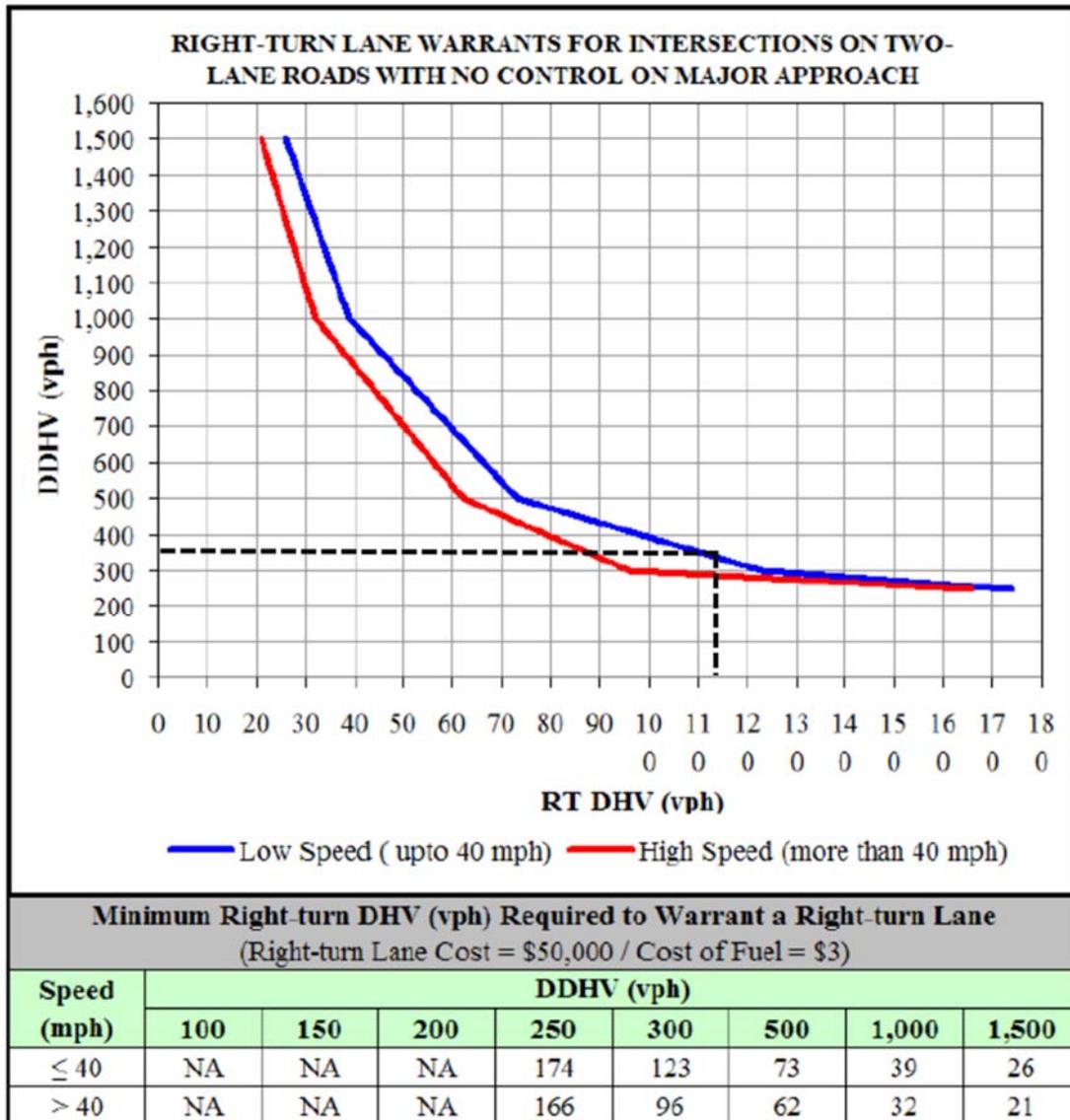


Figure 6.10. Right-turn lane warrants for intersections (fuel cost \$3/gallon, delay cost \$13/hr, right-turn lane cost \$50,000).

Source: <http://www.Irrb.org/media/reports/200825.pdf>