paradigm
TRANSPORTATION SOLUTIONS LIMITED

Winston Road and North Service Road, Town of Grimsby Fifth Wheel Site Transportation Impact Study Brief

Paradigm Transportation Solutions Limited

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30 May 2018
Project: 170205

Lorraine Roberts
Land Development Manager
Losani Homes
430 McNeilly Road, Suite 203
Stoney Creek, ON L8E 5E3

Dear Ms. Roberts:

RE: WINSTON ROAD AND NORTH SERVICE ROAD, TOWN OF GRIMSBY – FIFTH WHEEL SITE – TRANSPORTATION IMPACT STUDY BRIEF

Losani Homes retained **Paradigm Transportation Solutions Limited** (Paradigm) to carry out this Transportation Impact Study Brief for a proposed mixed-use development on the former Fifth Wheel lands located in the northeast quadrant of the Casablanca Boulevard and Queen Elizabeth Way interchange in the Town of Grimsby. The subject site is proposed to consist of the following land uses:

- 48 townhouse units (standard and back to back);
- 148 condominium apartment units (mid-rise);
- 1,099 condominium apartment units (high-rise); and
- 5,334 square metres (57,415 square feet) of retail land uses.

Vehicular access to the site is proposed by four (4) driveway connections to the North Service Road. The driveways are positioned approximately 210 metres, 375 metres, 555 metres and 720 metres east of Casablanca Boulevard on the north side of the North Service Road. The North Service Road is a two-lane roadway that runs generally east/west across the site's southern frontage. The build-out of the site is anticipated to occur by Year 2020-21. The timing may change to reflect market conditions. **Figure 1** (attached) details the site concept plan and access locations.

Site Traffic Estimates

The Institute of Transportation Engineers (ITE) Trip Generation[1] rates were used to estimate the site trip generation. **Table 1** indicates that the subject site is estimated to generate approximately 428 new vehicle trips during the AM peak hour and approximately 621 new vehicle trips during the PM peak

[1] Trip Generation Manual 9th Edition Institute of Transportation Engineers Washington DC 2012 – Regression Equations LUC 230, 252, & 820

hour. Internal trip capture was estimated using the NCHRP 684 and TTS mode choice data for the Town of Grimsby[2]. Pass-by trips have also been considered but are assumed to be part of the external vehicle trips.

TABLE 1: TRIP GENERATION ESTIMATE

Land Use	Number of Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
Multifamily Housing (Low-Rise) (220) - Units*	48		6	18	**24**		20	11	**31**
Multifamily Housing (Mid-Rise) (221) - Units*	148		13	37	**50**		40	25	**65**
Multifamily Housing (High-Rise) (222) - Units*	1,099		77	244	**321**		233	149	**382**
Shopping Center (820) - 1,000 sqft**	57.42		33	21	**54**		105	114	**219**
Total Generation			**129**	**320**	**449**		**398**	**299**	**697**
NCHRP Report 684 Internal Trip Capture			8	13	21		40	36	76
External Vehicle Trips			**121**	**307**	**428**		**358**	**263**	**621**
Pass-By Trips - Shopping Centre		0%	0	0	**0**	34%	37	37	**74**

* - Regression Equation ** - Average Rate

Figure 2 (attached) illustrates the forecast Year 2026 total traffic volumes. The forecast was developed using the trips generated by the proposed development and the most current traffic estimates prepared by the Town's consultant for the traffic operations review for the Future Development on Casablanca Boulevard between Winston Road and the South Service Road.

The Town's West End Development assumptions for the subject lands assumed the site would yield approximately 90 townhouse units, 690 apartment units and 13,000 square metres of commercial/retail space[3]. The resulting trip generation was noted to be approximately 448 AM peak hour trips and 475 PM peak hour trips.

Remedial Measures

Planned Remedial Measures

Traffic control signals have been implemented at the intersection of Casablanca Boulevard and the North Service Road/Winston Road. An eastbound right-turn lane and a westbound left-turn lane are also proposed as part of the planned intersection improvements. The northbound approach is planned as a single lane approach.

Site Specific Remedial Measures

The forecast traffic volumes on the North Service Road across the site's frontage are high enough to warrant eastbound left-turn lanes at all site driveway connections. The warrants for left-turn lanes follow the requirements in the MTO's TAC Design Supplement[4] and the following storage lane lengths are identified:

[2] Transportation Tomorrow Survey 2011 Modal Split Data for Town of Grimsby
[3] Traffic Operations Study for the Future Development on Casablanca Boulevard between Winston Road and South Service Road, CIMA+, November 2016 - B000658_Casablanca blvd_e05
[4] MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads – June 2017

- North Service Road at Winston Road – 40 metres of storage;
- North Service Road at Driveway A – 15 metres of storage;
- North Service Road at Driveway B – 30 metres of storage; and
- North Service Road at Driveway C – 15 metres of storage.

Appendix A contains the warrant analysis. To limit the improvements along the North Service Road, consideration should be given to restricting access at the Driveway A and C locations to right-in/right-out. Restricting access will allow for an opportunity to develop a cross-section along this section of the North Service Road that is similar to what is proposed west of Casablanca Boulevard (raised centre medians with on-street bicycle lanes) on Winston Road/North Service Road. Moreover, the proposed driveway spacing may result in deficient taper lane/deceleration lane lengths for the warranted auxiliary left-turn lanes.

Operational Conditions

The operations of the intersections in the study area were evaluated using the proposed lane configurations[5], traffic controls and the forecast traffic volumes. The Level of Service conditions have been assessed using Synchro 9 with HCM 2000 procedures and ten 60-minute SimTraffic simulations. **Table 2** details the operational performance measures at the study area intersections corresponding to the Year 2026 Total Traffic conditions. The following key findings are noted:

- Casablanca Boulevard and Winston Road/North Service Road is forecast to be at capacity during the AM and PM peak hours with overall delays in the LOS D to F range. The following critical movements are noted:
  - Westbound left-turn – High levels of delay with v/c ratio greater than 1.00. The current 60 metres of storage is insufficient, and additional storage should be provided to limit potential impact to the upstream intersection of Winston Road (Site Access) at the North Service Road.
  - Northbound approach - High levels of delay with v/c ratio greater than 1.00. Queue lengths may impact the operation of the upstream ramp terminal. Expanded lane geometry should be considered to allow for separated northbound left-turn and right-turn lanes.
- The site driveway connections are forecast to operate with acceptable levels of service during the AM and PM peak hours. Extensive queue lengths generated by the poor operation of the Casablanca Boulevard and Winston Road/North Service Road intersection, are expected to impact the normal operations of the Winston Road (Site driveway) intersection with the North Service Road. Queue lengths on the Winston Road and Driveway B connections are estimated to be approximately 85-100 metres and may impact on-site circulation. Additional clear throat length is recommended on all site driveway connections to the North Service Road.

Appendix B contains the detailed Synchro 9 output.

[5] Winston Road Reconstruction Drawing TS-2 Casablanca Boulevard at Winston Road/North Service Road Town of Grimsby Traffic Signal Design.

TABLE 2: YEAR 2026 OPERATIONAL CONDITIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Casablanca Blvd & North Service Road/Winston Road	TCS	LOS		C	C	**C**	D	B		**C**	D		>	**D**					**D**
			Delay		28	32	**32**	37	19		**34**	52		>	**52**					**41**
			V/C		0.14	0.43		0.81	0.11			1.01		>						**0.95**
			95th		130	99		171	314			143		>						
	North Service Road & Winston Road	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**1**		0	>	**0**					14		>	**14**	
			V/C	0.04	0.24				0.20	>						0.26		>		
			95th	8	0				147	>						112		>		
	North Service Road & Driveway A	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**0**		0	>	**0**					11		>	**11**	
			V/C	0.00	0.26				0.19	>						0.03		>		
			95th	3	0				60	>						12		>		
	North Service Road & Driveway B	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**1**		0	>	**0**					12		>	**12**	
			V/C	0.03	0.23				0.13	>						0.22		>		
			95th	8	0				8	>						24		>		
	North Service Road & Driveway C	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**0**		0	>	**0**					10		>	**10**	
			V/C	0.01	0.25				0.12	>						0.02		>		
			95th	4	0				0	>						20		>		
PM Peak Hour	Casablanca Blvd & North Service Road/Winston Road	TCS	LOS		D	A	**B**	F	C		**F**	F		>	**F**					**F**
			Delay		46	6	**11**	247	27		**226**	262		>	**262**					**193**
			V/C		0.30	0.48		1.44	0.10			1.52		>						**1.50**
			95th		43	67		145	232			142		>						
	North Service Road & Winston Road	TWSC	LOS	A	A		**A**		A	>	**A**					D		>	**D**	
			Delay	9	0		**2**		0	>	**0**					27		>	**27**	
			V/C	0.15	0.36				0.36	>						0.45		>		
			95th	15	0				155	>						102		>		
	North Service Road & Driveway A	TWSC	LOS	A	A		**A**		A	>	**A**					C		>	**C**	
			Delay	9	0		**0**		0	>	**0**					16		>	**16**	
			V/C	0.02	0.37				0.36	>						0.06		>		
			95th	4	0				233	>						30		>		
	North Service Road & Driveway B	TWSC	LOS	A	A		**A**		A	>	**A**					C		>	**C**	
			Delay	9	0		**2**		0	>	**0**					23		>	**23**	
			V/C	0.14	0.29				0.32	>						0.42		>		
			95th	14	0				156	>						85		>		
	North Service Road & Driveway C	TWSC	LOS	A	A		**A**		A	>	**A**					C		>	**C**	
			Delay	9	0		**0**		0	>	**0**					15		>	**15**	
			V/C	0.02	0.29				0.31	>						0.07		>		
			95th	5	0				202	>						25		>		

MOE - Measure of Effectiveness
TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
LOS - Level of Service
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
Ex. - Existing Storage (m)
Avail. - Available Storage (m)
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

Sensitivity Analysis – Modified Driveway Connections & Casablanca Boulevard Improvements

The site concept plan includes four (4) driveway connections to the North Service Road. **Table 2** indicates that the site driveway connections are forecast to operate with delays in the LOS C to D range during the AM and PM peak hours. From a capacity perspective, the four (4) connections are not viewed as necessary to support the site generated traffic. To limit conflict, reduce the amount of improvements required along the North Service Road, and to establish a cross-section similar to what is proposed west of Casablanca Boulevard (raised centre medians with on-street bicycle lanes), it is recommended that the Driveway A and Driveway C connections be restricted to right-in/right-out operation by use of raised centre medians. **Figure 3** (attached) illustrates the forecast Year 2026 total traffic volumes with left-turns restricted at the Driveway A and Driveway C intersections.

Table 3 details the operational performance with the Driveway A and Driveway C turning restrictions implemented. The analysis indicates that with only two (2) driveway connections, the driveway approaches are forecast to operate with delays in the LOS B to D range.

With Driveway A and Driveway C restricted to right-in/right-out operations, the amount of storage warranted for the eastbound left-turn lanes on North Service Road at Winston Road and at Driveway B are identified as follows:

- North Service Road at Winston Road – 50 metres of storage; and
- North Service Road at Driveway B – 40 metres of storage.

The storage requirements for the Casablanca Boulevard and Winston Road/North Service Road auxiliary turn lanes are noted as follows:

- Eastbound right-turn – 130 metres. This storage length is greater than what is proposed in the EA recommendations for the Casablanca Road improvements;
- Westbound left-turn – 235 metres. The storage length is greater than what is proposed in the EA recommendations. There is insufficient spacing between Casablanca Boulevard and Winston Road (Site Access) to develop a taper. Two westbound lanes would be required with the inside lane designated as a left-turn lane. The auxiliary turn lane requirements for the Winston Road (Site Access) intersection would expand the cross-section to four-lanes at the site access.
- Northbound right-turn – 75 metres. Turn lane not identified as part of the EA improvements.

Appendix C contains the detailed Synchro 9 output.

TABLE 3: SENSITIVITY ANALYSIS – YEAR 2026 OPERATIONAL CONDITIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																	
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Casablanca Blvd & North Service Road/Winston Road	TCS	LOS		C	C	**C**	B	B		**B**	C		B	**C**					**C**
			Delay		23	28	**27**	17	12		**16**	27		19	**27**					**23**
			V/C		0.11	0.43		0.57	0.08			0.75		0.26						**0.66**
			95th		140	130		113	21			141		72						
	North Service Road & Winston Road	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**1**		0	>	**0**					14		>	**14**	
			V/C	0.04	0.24				0.20	>						0.28		>		
			95th	10	0				0	>						18		>		
	North Service Road & Driveway A	TWSC	LOS		A		**A**		A	>	**A**							B	**B**	
			Delay		0		**0**		0	>	**0**							10	**10**	
			V/C		0.26				0.19	>								0.02		
			95th		0				0	>								10		
	North Service Road & Driveway B	TWSC	LOS	A	A		**A**		A	>	**A**					B		>	**B**	
			Delay	8	0		**1**		0	>	**0**					12		>	**12**	
			V/C	0.04	0.23				0.13	>						0.23		>		
			95th	9	0				0	>						23		>		
	North Service Road & Driveway C	TWSC	LOS		A		**A**		A	>	**A**							A	**A**	
			Delay		0		**0**		0	>	**0**							9	**9**	
			V/C		0.25				0.12	>								0.02		
			95th		0				0	>								10		
PM Peak Hour	Casablanca Blvd & North Service Road/Winston Road	TCS	LOS		D	A	**B**	F	C		**F**	C		B	**C**					**E**
			Delay		40	6	**11**	181	22		**166**	32		19	**32**					**56**
			V/C		0.28	0.49		1.29	0.09			0.89		0.58						**1.06**
			95th		51	69		232	228			141		72						
	North Service Road & Winston Road	TWSC	LOS	A	A		**A**		A	>	**A**					D		>	**D**	
			Delay	10	0		**2**		0	>	**0**					32		>	**32**	
			V/C	0.17	0.35				0.36	>						0.52		>		
			95th	20	17				144	>						120		>		
	North Service Road & Driveway A	TWSC	LOS		A		**A**		A	>	**A**							B	**B**	
			Delay		0		**0**		0	>	**0**							13	**13**	
			V/C		0.37				0.36	>								0.03		
			95th		0				230	>								28		
	North Service Road & Driveway B	TWSC	LOS	A	A		**A**		A	>	**A**					D		>	**D**	
			Delay	9	0		**3**		0	>	**0**					28		>	**28**	
			V/C	0.17	0.27				0.32	>						0.50		>		
			95th	18	0				154	>						84		>		
	North Service Road & Driveway C	TWSC	LOS		A		**A**		A	>	**A**							B	**B**	
			Delay		0		**0**		0	>	**0**							12	**12**	
			V/C		0.30				0.31	>								0.03		
			95th		0				210	>								22		

MOE - Measure of Effectiveness
TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
LOS - Level of Service
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

North Service Road Sight Lines

The existing design of the North Service Road should allow for minimum stopping sight distance (105 metres) in both travel directions[6]. However, sight distance requirements on the North Service Road will need to be reviewed considering the recommended modifications, including the addition of eastbound left-turn lanes at the Winston Road and Driveway B connections, and the provision of raised centre medians at the Driveway A and Driveway C connections to restrict left-turns.

It would be appropriate for the Town of Grimsby to consider lowering the posted speed limit on the North Service Road across the site's frontage to 50 kilometres per hour. This would be supportive to the increasing urbanization of the corridor and will lower the design requirements for designing auxiliary turn lanes and sight distances.

General Site Plan Design Issues/Considerations

Driveway Design

In order for major driveways to operate efficiently, both from the road side and internally, it is desirable to provide a no conflict and storage zone within the driveway. This zone is commonly referred to as the clear throat length or set-back distance and is measured from the ends of the driveway curb return radii at the roadway and the point of first conflict on-site.

The recommended clear throat length for each site driveway is 25 metres[7]. The site plan indicates a clear throat distance of approximately 10-15 metres for all four (4) driveway connections. It is recommended the driveway connections be designed to include 25 metres of clear throat length.

Underground Parking Access Ramps

The underground parking ramp to Building A-B is located on the inside of the Winston Road curve. To maintain clear sightlines, the area between the ramp and the parking spaces to the west should be kept clear of all obstructions.

Additional separation between the underground ramp located west of Building G and the at grade roadway is recommended. A tangent section measuring at least 2.0 metres[8] should **be** placed between the curb return of the roadway and the curb return for the underground ramp.

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[6] Transportation Association of Canada, Geometric Design Guide for Canadian Roads (2017) Table 2.5.2: Stopping Sight Distance on level roadways for Automobiles

[7] Transportation Association of Canada, Geometric Design Guide for Canadian Roads (2017), chapters 8.9.10 Clear Throat Lengths

[8] Transportation Association of Canada, Geometric Design Guide for Canadian Roads (2017) Figure 8.9.2: Driveway Spacing Guidelines – Locals and Collectors

Emergency Access

Vehicular access for Buildings G-J on the lands east of the bioswale is provided by one roadway connection across the northerly limits of the site. From an emergency access perspective, a secondary point of access is desirable for these lands.

Pedestrian Infrastructure

All on-site sidewalks should conform to the Town's design standards and/or the Accessibility for Ontarians with Disabilities Act (AODA) design standards.

The site plan includes provisions for sidewalk facilities on at least one side of all internal roadways. Multi-use paths and sidewalk connections are proposed to the waterfront trail across the site's northern frontage.

The on-site sidewalks crossing the site's loading zones should be continuous and the site's loading zones should be designed to avoid impacting the pedestrian realm.

To support active transportation, pedestrian crosswalks should be provided at internal intersections where sidewalks are present. Sidewalk connections to the external municipal sidewalk network is also recommended. All crosswalks should intersect with the adjacent roadways at 90 degrees or as close as possible. Skewed crossings can be challenging to persons with visual impairments.

Parking

The site's parking requirement per the Town of Grimsby's Zoning By-law[9] is estimated to be 2,121 spaces. The Town's Parking in Mixed Use Zones methodology suggests the parking supply can be reduced by approximately 18 spaces to 2,103 spaces. The site's proposed parking supply is noted to consist of 1,845 spaces and would be considered deficient (258 spaces) when compared to the zoning by-law.

To support a reduction in parking Transportation Demand Management (TDM) measures should be included in the site design. TDM approaches consider how people's choices of travel mode are affected by land use patterns, development design, parking availability, parking cost, and the relative cost, convenience and availability of alternative modes of travel. Various TDM strategies are used to influence those factors so that the alternatives are more competitive with driving alone and potentially reduce the reliance on automobiles.

The following are potential TDM strategies that could be considered at final site design:

- Cycling Infrastructure
  - Long-term bicycle parking for apartment units be provided at grade or on the first level of below grade parking. The amount of bicycle parking should conform or exceed the Town's Zoning by-law.

[9] Zoning By-law Town of Grimsby Zoning By-law Review Section 5: Parking and Loading 5.1 Parking Space Requirements

- Short-term bicycle parking for visitor to the site be located at grade and near the main lobby to the residential buildings and near the main entrances to the commercial units. The amount of bicycle parking should conform or exceed to the Town's Zoning by-law.
- End of trip change facilities (locker room/changeroom and showers) be considered for the non-residential land uses consistent with LEED requirements; and
- Bicycle friendly access points to the waterfront multi-use pathway be provided.

- Walking Infrastructure
  - Safe and attractive walkways for pedestrians linking building entrances with public sidewalks;
  - Enhanced pedestrian amenities on-site (e.g., benches, landscaping, lighting); and
  - Orient the functional building entrances to public space or to locations where pedestrians arrive from such as a street, square, park or plaza.
- Parking
  - Provide no more than the minimum number of required spaces for residents and visitors;
  - Unbundle parking from the purchase of the unit and charge a monthly fee for use of excess spaces. Requires parking management of excess parking spaces (sell or lease) and measures to prevent sale of multiple spaces to single buyers;
  - Shared parking supply for residential visitor and retail patrons. No parking visitor spaces be assigned to one specific on-site use; and
  - Reduced minimum parking requirements based on provision of other TDM measures.
- Carshare/Shuttle Service
  - The site operator consider carshare vehicles and at grade parking spaces as a future amenity for residents.
  - Shuttles service between the future GO Station and/or other high demand centres may be considered by the site operator.
- Wayfinding/Travel Planning/Education/Promotion
  - Travel planning resources for residents (individualized marketing, active transportation maps, community resources) be provided with new home/condo purchases.
  - Wayfinding signage to destinations such as public amenities, and commercial areas be considered in the landscaping plans; and
  - Contribute to building a strong TDM brand. Highlight TDM elements in marketing materials: proximity to future GO transit, cycling facilities, carshare/bikeshare facilities, etc.;

The above TDM measures can assist in mitigating the site's impact on the adjacent road network, promote a strong and vibrant economy, and create a livable community that has a balanced transportation network that accommodates all modes of transportation.

While the Town of Grimsby currently does not have any specific reductions for parking requirements with TDM measures incorporated, the Region of Waterloo has developed a TDM checklist which is a tool intended for developers' when determining potential parking reductions in exchange for certain TDM measures.

According to the Region of Waterloo TDM worksheet (**Appendix D**) the proposed development, based on the TDM measures outlined above, could classify for a 13 percent reduction to the site's zoning by-law parking requirements or a savings of up to 273 parking spaces. This reduction and the associated shift towards non-automotive travel would allow for the site's proposed parking supply to meet demand.

The unbundling of parking spaces from units and shared parking between visitors of the residential uses and patrons of the commercial uses will be crucial in managing the site's parking demand. The temporal distribution of peak parking demand for the non-residential land uses generally occurs outside the peak parking demand for residential land uses.

In the longer term the Casablanca Boulevard GO Transit station will help to increase the modal split for the Secondary Plan area. However, in the short-term no significant modal split is likely to occur as the Town of Grimsby does not currently offer transit services. Occupants of the subject site are predicted to maintain vehicle ownership rates inline with existing conditions. The unbundling of parking spaces from units and shared parking between visitors of the residential uses and patrons of the commercial uses will be crucial in managing the site's parking demand.

Cycling Infrastructure

The North Service Road abutting the site's frontage is identified as a Regional Cycling route[10]. The planned Winston Road reconstruction improvements[11] include designated 1.5 metre on-street bicycle lanes. The designated 1.5 metre on-street bicycle lane should be extended along the site's frontage to connect to and complement the proposed Winston Road reconstruction plans. It may be desirable to design the on-street bicycle lane with a 0.5-1.0 metre buffer.

The site's bicycle parking supply should meet or exceed the Town's Zoning By-law requirement[12]. 13 short-term bicycle parking spaces are recommended for the retail component of the subject site. The residential units without the exclusive use of a garage/driveway should be provided with at least 374 bicycle parking spaces. The proposed apartment buildings should include secured bicycle rooms for occupant bicycle parking and secure/convenient bicycle parking spaces for visitors. The bicycle rooms could include a bicycle repair station and or other amenities supportive to cycling.

It may be desirable from the Town's perspective to provide designated bicycle facilities to connect to and complement the Waterfront Trail. Wide shared roadway/signed bicycle routes would be suitable for the low volume internal roadways[13]. The site plan includes a 3.0 metre sidewalk connection east of Driveway B intersection that connects to the Waterfront Trail. A similar connection maybe desirable west of the Winston Road (Site driveway) connection to the North Service Road.

[10] https://www.niagararegion.ca/exploring/cycle/default.aspx - Grimsby Long Route
[11] Winston Road Reconstruction – PWC17-02-320102
[12] Zoning By-law Town of Grimsby Zoning By-law Review Section 5: Parking and Loading 5.18 Bicycle parking
[13] OTM Book 18 – Cycling Facilities Table 4.1 – Desired and Suggested Minimum Lane Widths for Urban Shared Roadways / Signed Bicycle Routes

Conclusions & Recommendations

Based on the forgoing the following conclusions and recommendations are submitted for consideration:

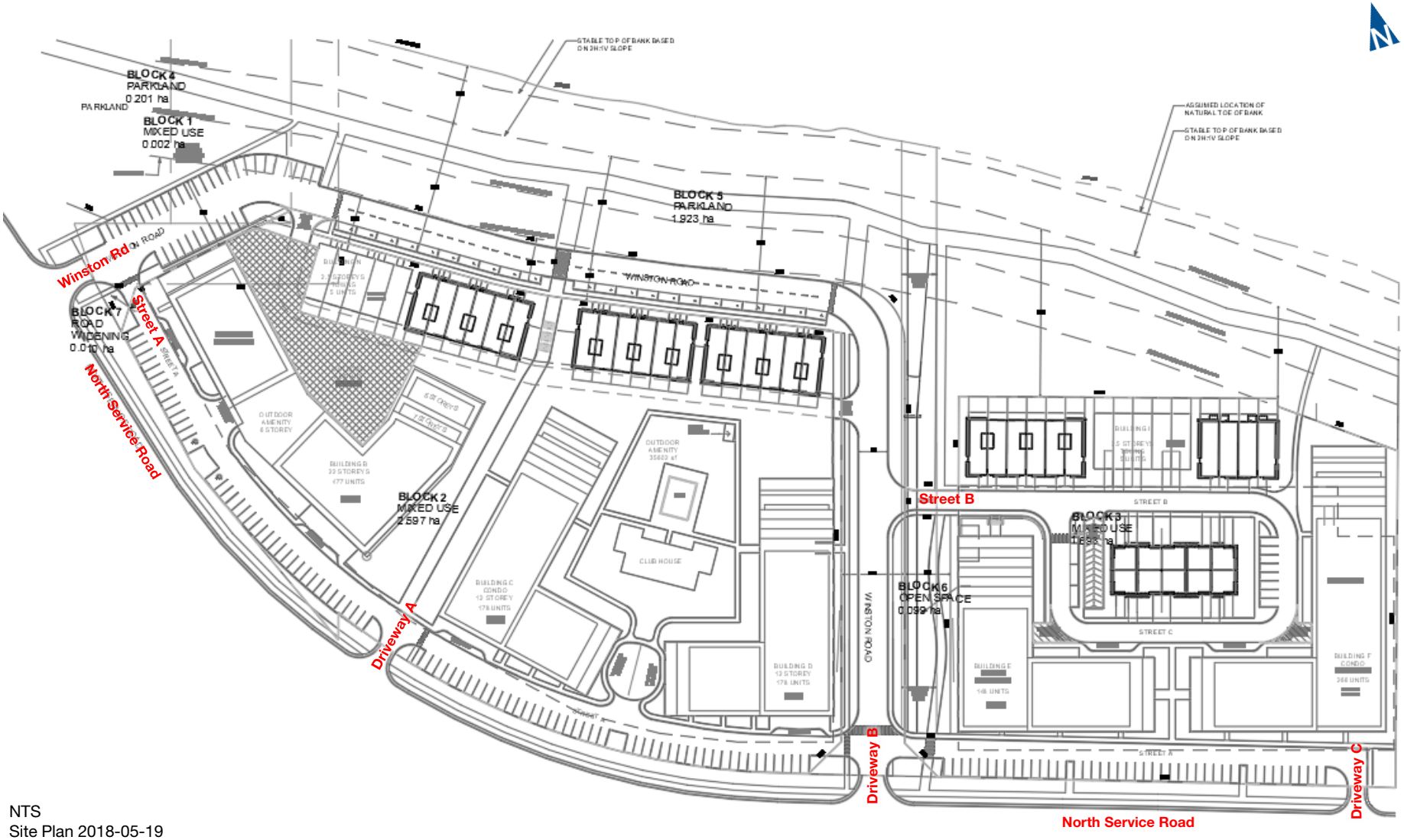
- Geometric modifications and additional turn-lane storage are recommended at the Casablanca Boulevard intersection with Winston Road/North Service Road. Delays are forecast to occur on the northbound and westbound approaches. Expanded northbound geometry should be considered to reduce overall intersection delays. The westbound left-turn lane may require 130 metres of storage;
- Consideration be given to restricting the Driveway A and Driveway C connections to right-in/right-out. Turning restrictions can be applied through the use of raised centre medians. The cross-section elements and the general design planned on the Winston Road/North Service Road west of Casablanca Boulevard can be extended across the site's North Service Road frontage;
- The Winston Road (Site Access) and Driveway B intersections be designed to include auxiliary eastbound left-turn lanes on the North Service Road;
- The driveway connections be redesigned to include at least 25 metres of clear throat length;
- A secondary point of vehicular access to Buildings G-J east of the Bioswale be considered for emergency services;
- Pedestrian crosswalks be provided at all internal locations where sidewalks are proposed;
- All on-site sidewalks should conform to the Town's design standards and/or the AODA design standards for accessibility compliance;
- On-street bicycle lanes be provided along the site's North Service Road frontage; and
- To manage the site's parking demand and to mitigate the site's transportation impacts, a TDM program should be developed in support of the development and strategies may include:
  - Unbundled parking and the building owner/occupant agrees to charge for parking as a separate cost to occupants.
  - Shared parking supply for visitors and patrons of the commercial uses.
  - Bicycle parking be provided to meet or exceed the Town's Zoning by-law requirement.
  - Landscaping plans consider enhancing the common amenity areas to include pedestrian amenities such as benches, seating areas and/or pedestrian scale lighting.
  - Development incorporates functional building entrances that are oriented to public space or to locations where pedestrians arrive from such as a street, square, park or plaza.
  - Shower and change facilities be considered for the non-residential land uses consistent with LEED requirements.

If you have any questions related to this Transportation Impact Study Brief, please contact me. Thank you very much.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

Stew Elkins, Vice-President
BES, MITE



NTS
Site Plan 2018-05-19

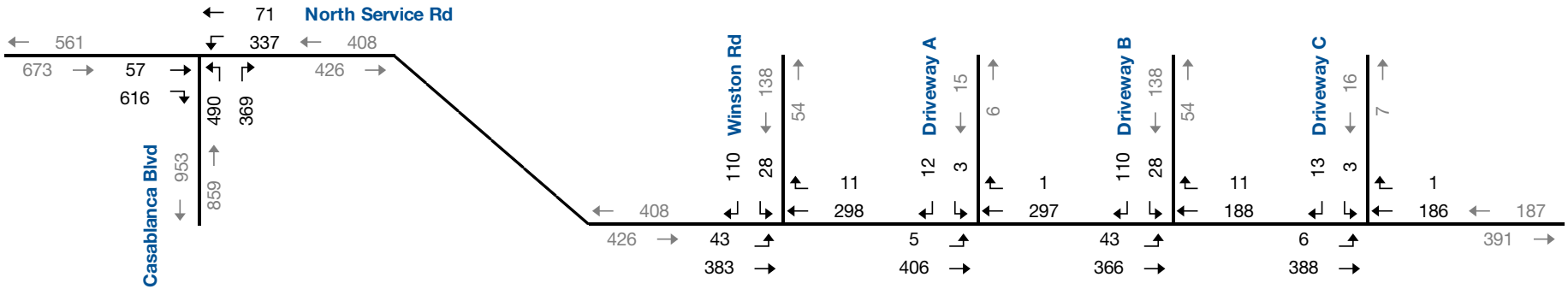
paradigm
TRANSPORTATION SOLUTIONS LIMITED

Site Concept Plan

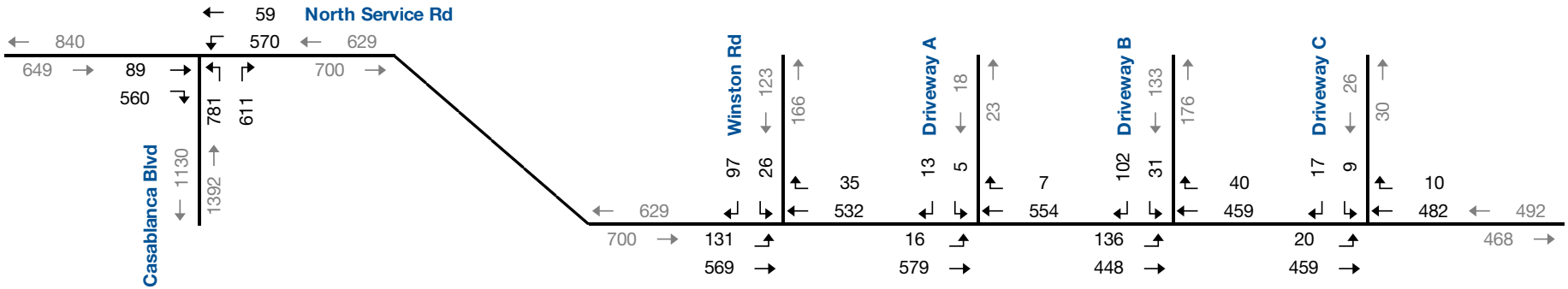
Fifth Wheel Lands TIS
170205

Figure 1

AM Peak Hour



PM Peak Hour



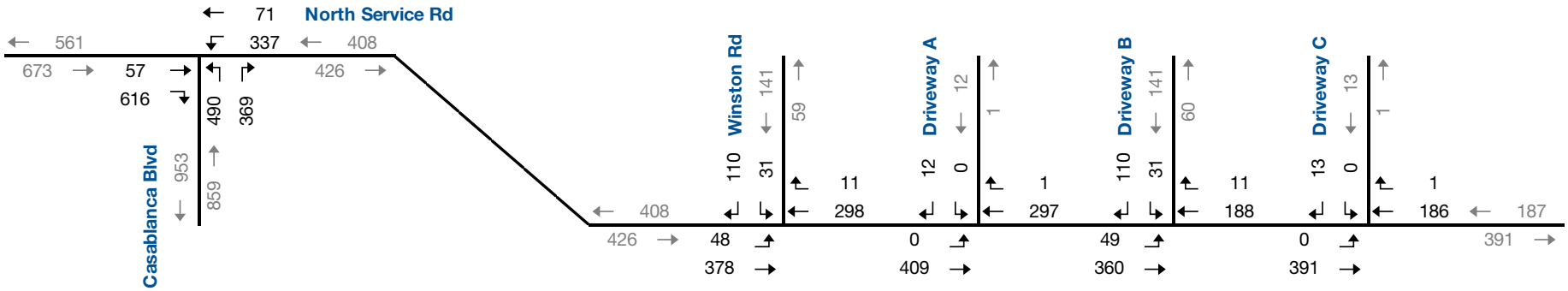
NTS

Year 2026 Total Traffic Forecast

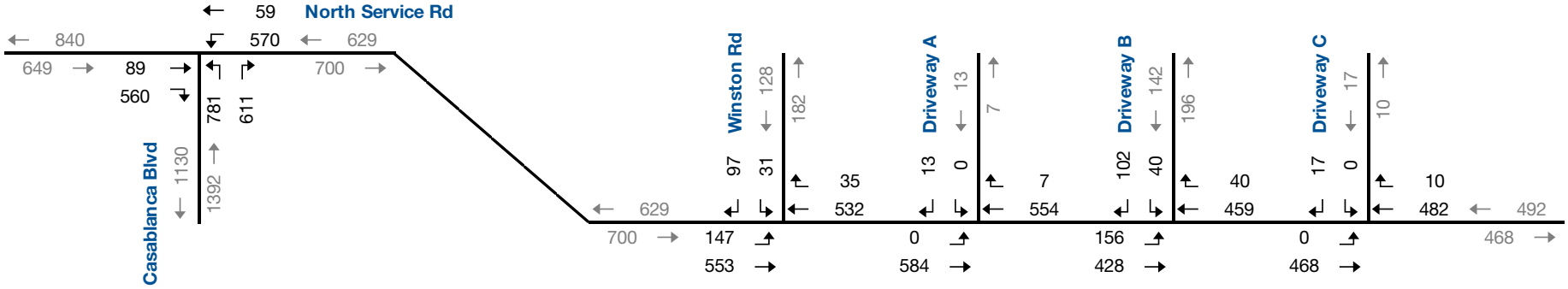
Fifth Wheel Lands TIS
170205

Figure 2

AM Peak Hour



PM Peak Hour



NTS

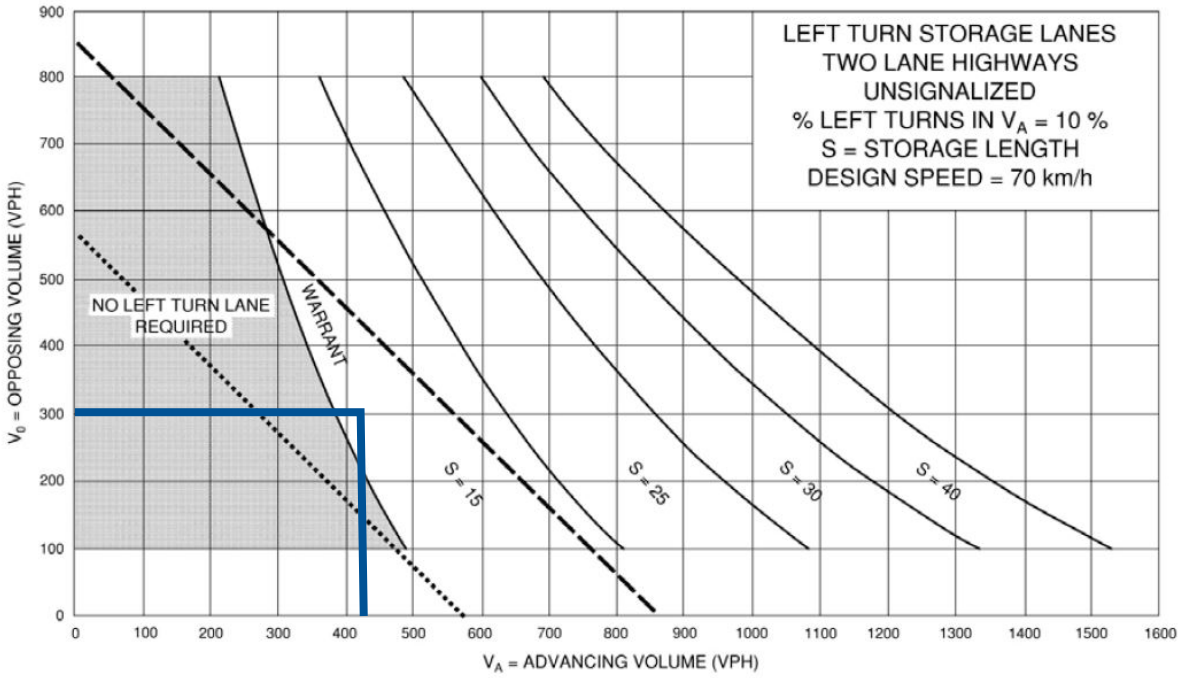
Year 2026 Total Traffic Forecast
Driveway A & C Restricted to Right-In/Right-Out

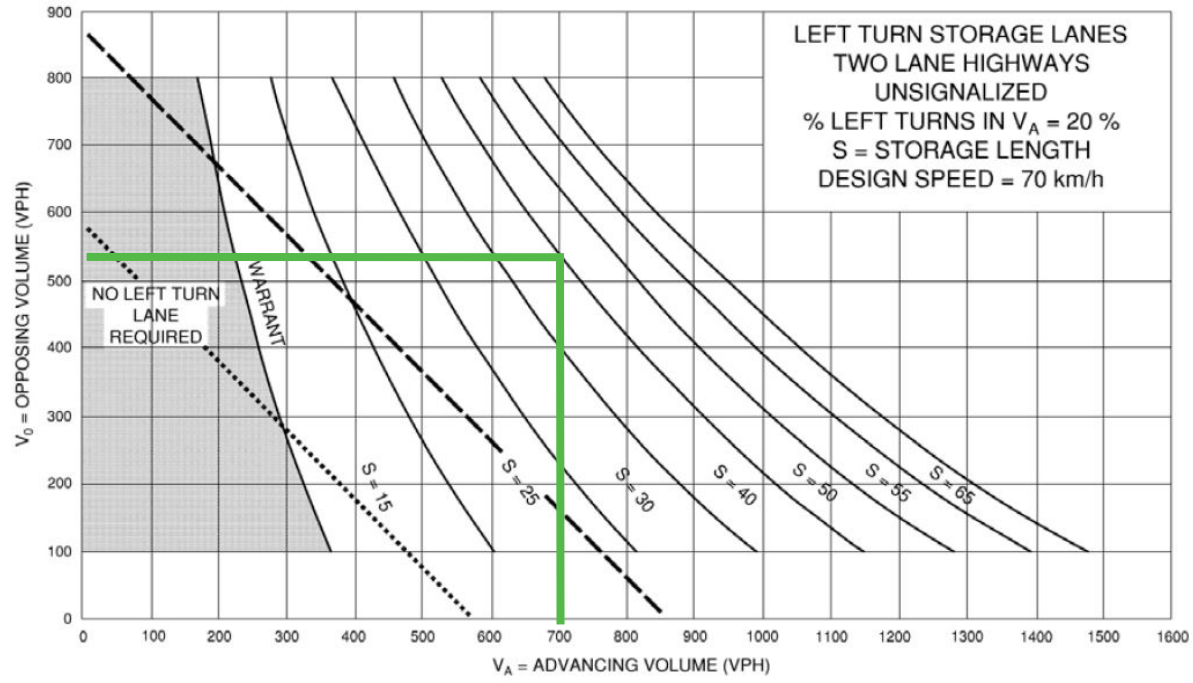
Fifth Wheel Lands TIS
170205

Figure 3

Appendix A

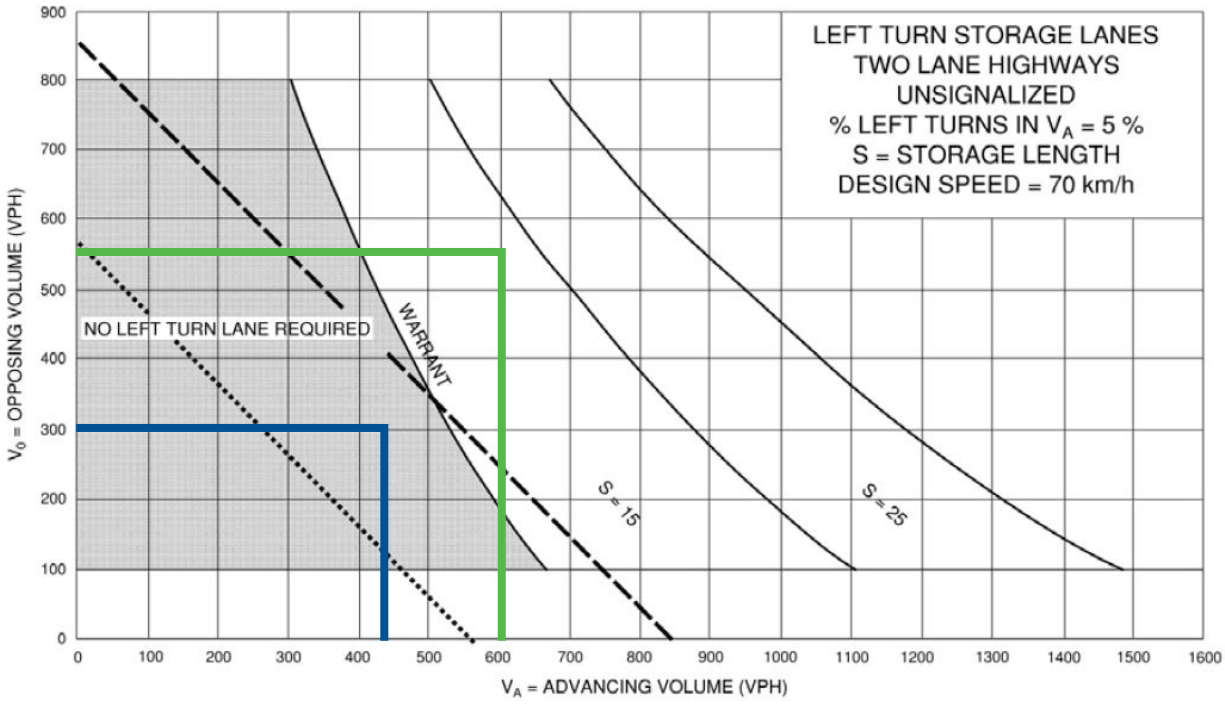
Left-Turn Lane Warrants





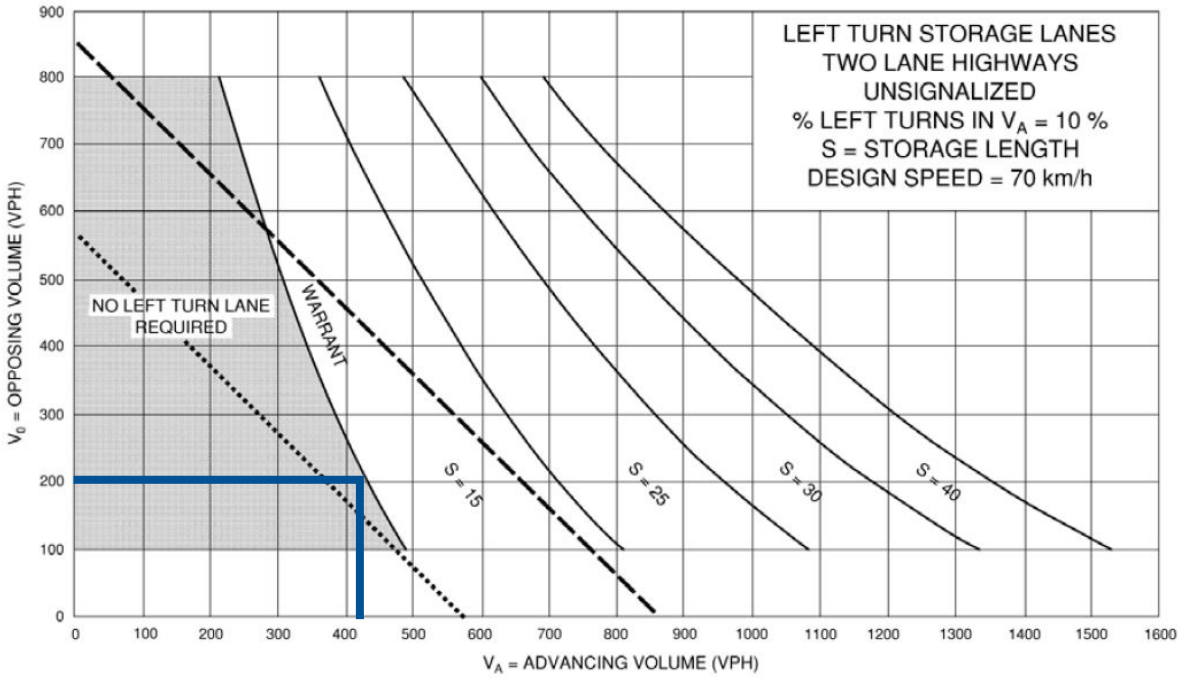
AM Peak Hour PM Peak Hour

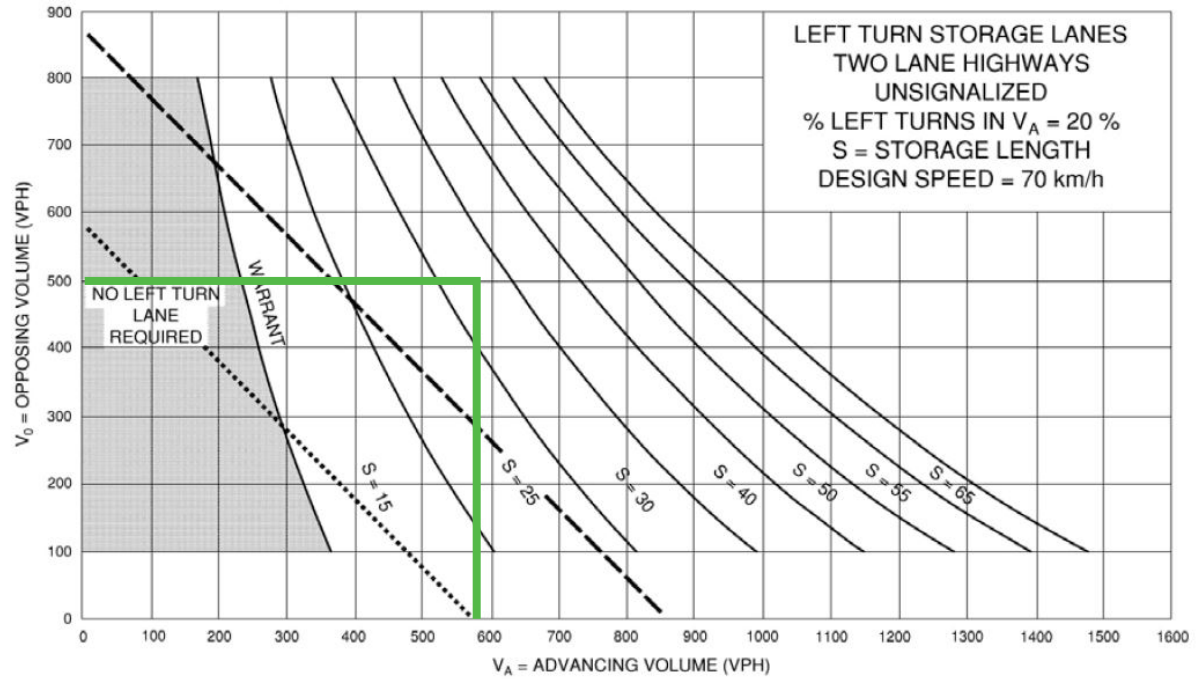
Location: North Service Road & Winston Road
Direction: Eastbound
Horizon Year: Total Traffic



AM Peak Hour PM Peak Hour

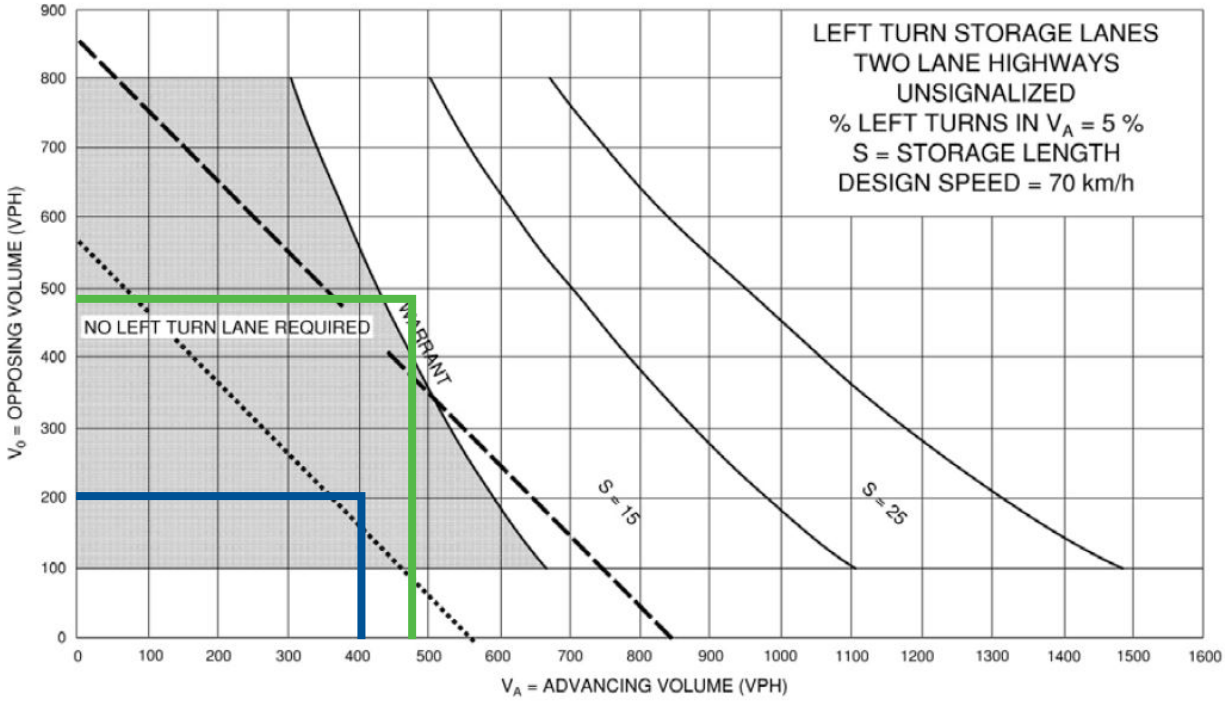
Location: North Service Road & Driveway A
Direction: Eastbound
Horizon Year: Total Traffic





AM Peak Hour PM Peak Hour

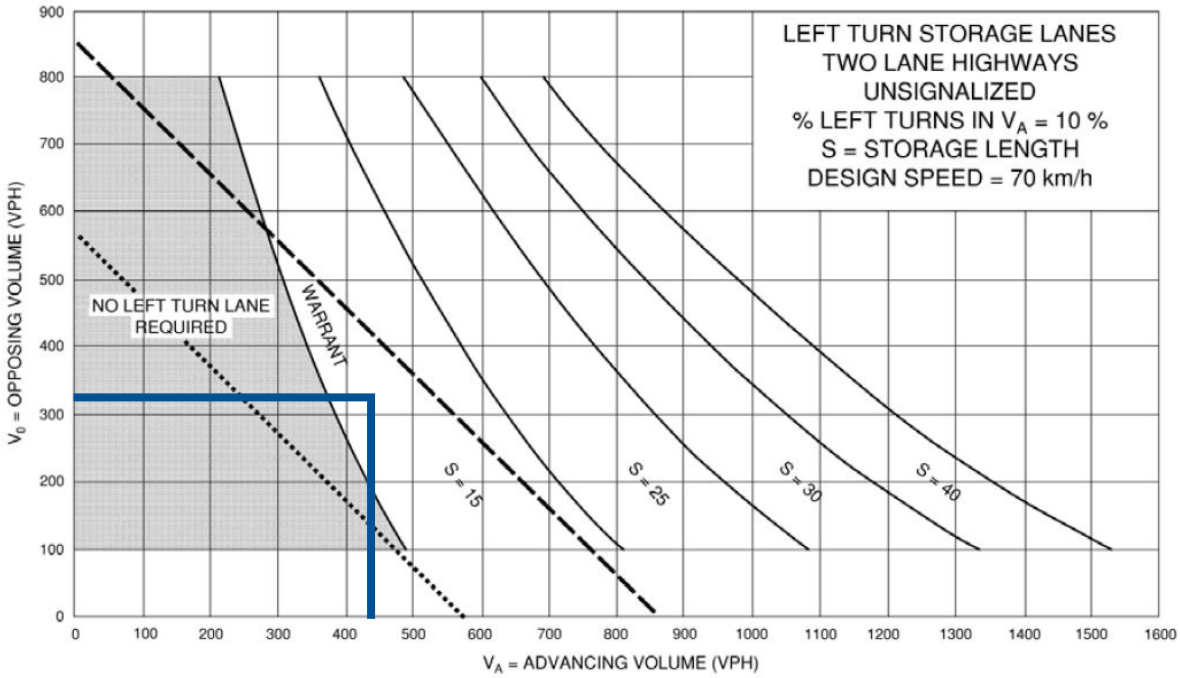
Location: North Service Road & Driveway B
Direction: Eastbound
Horizon Year: Total Traffic

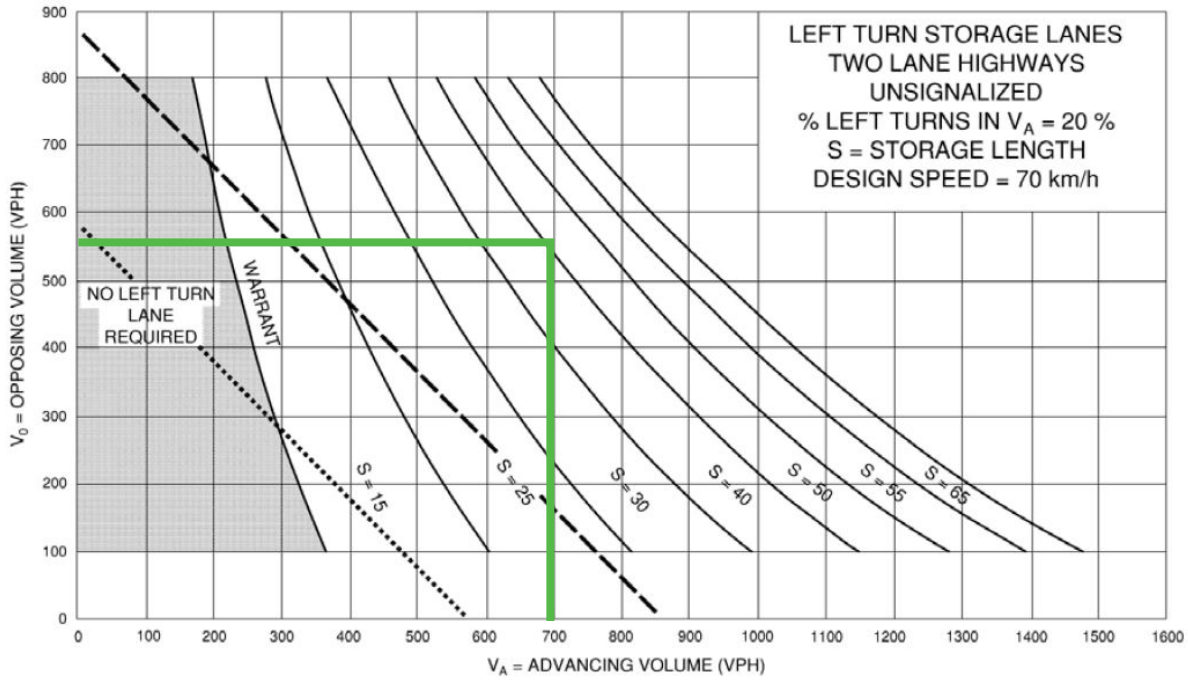


AM Peak Hour PM Peak Hour

Location: North Service Road & Driveway C
Direction: Eastbound
Horizon Year: Total Traffic

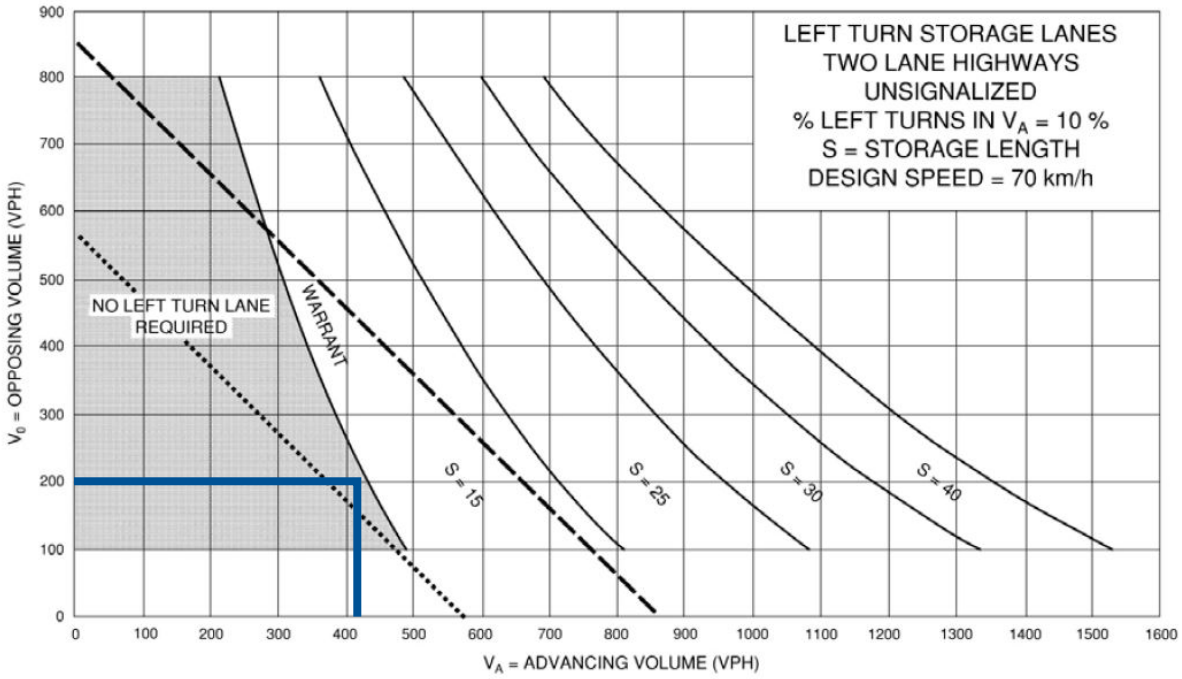
Driveway A & C
Right-In/Right-Out

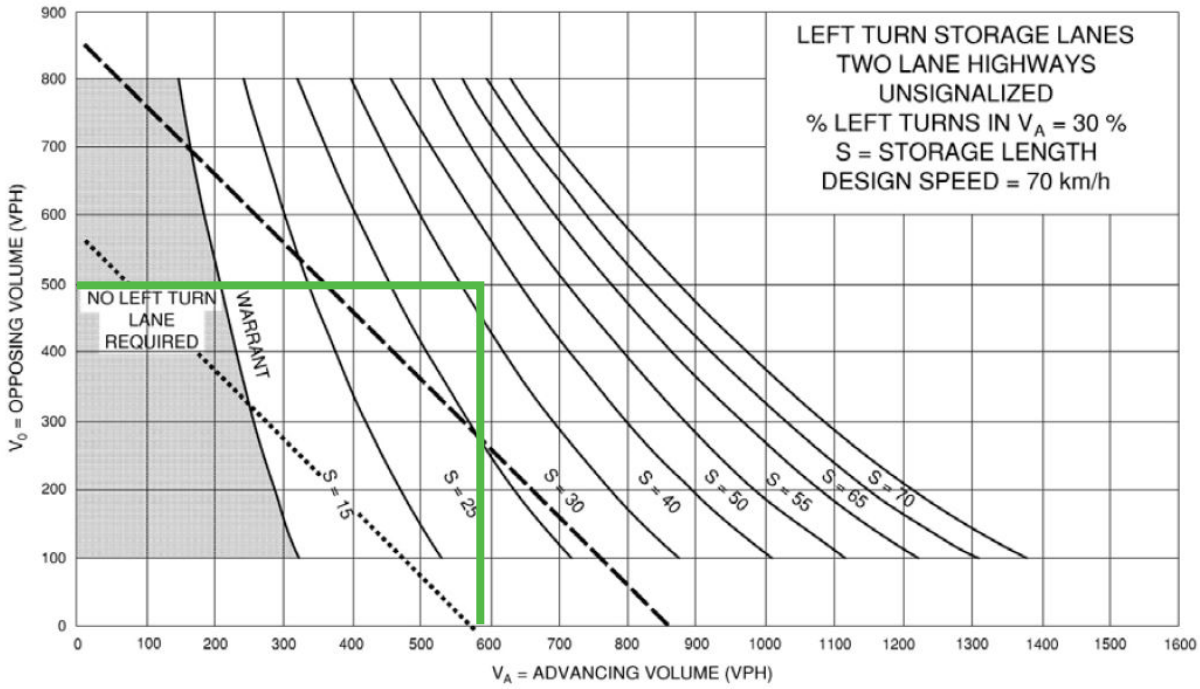




AM Peak Hour PM Peak Hour

Location: North Service Road & Winston Road
Direction: Eastbound
Horizon Year: Total Traffic – Reduced Access





AM Peak Hour PM Peak Hour

Location: North Service Road & Driveway B
Direction: Eastbound
Horizon Year: Total Traffic – Reduced Access

Appendix B

Total Traffic Operational Conditions – Year 2026

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Group Flow (vph)	62	670	366	77	934
v/c Ratio	0.14	0.76	0.77	0.11	1.01
Control Delay	27.9	8.8	36.1	18.8	52.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.9	8.8	36.1	18.8	52.2
Queue Length 50th (m)	8.9	0.0	51.4	8.9	~156.3
Queue Length 95th (m)	19.4	33.4	#88.4	18.3	#249.0
Internal Link Dist (m)	108.5			215.6	121.6
Turn Bay Length (m)		45.0	60.0		
Base Capacity (vph)	444	886	474	695	929
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	0.14	0.76	0.77	0.11	1.01

Intersection Summary

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

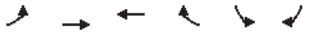
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	57	616	337	71	490	369
Future Volume (vph)	57	616	337	71	490	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	1.00	1.00	0.95	1.00	0.97	
Satd. Flow (prot)	1842	1566	1750	1842	1687	
Flt Permitted	1.00	1.00	0.60	1.00	0.97	
Satd. Flow (perm)	1842	1566	1097	1842	1687	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	670	366	77	533	401
RTOR Reduction (vph)	0	508	0	0	30	0
Lane Group Flow (vph)	62	162	366	77	904	0
Turn Type	NA	Perm	pm+pt	NA	Prot	
Protected Phases	2		1	6	8	
Permitted Phases		2	6			
Actuated Green, G (s)	19.7	19.7	32.0	32.0	46.0	
Effective Green, g (s)	21.7	21.7	32.0	34.0	48.0	
Actuated g/C Ratio	0.24	0.24	0.36	0.38	0.53	
Clearance Time (s)	6.0	6.0	4.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	444	377	450	695	899	
v/s Ratio Prot	0.03		c0.07	0.04	c0.54	
v/s Ratio Perm		0.10	c0.21			
v/c Ratio	0.14	0.43	0.81	0.11	1.01	
Uniform Delay, d1	26.8	28.9	25.9	18.2	21.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	3.5	10.8	0.3	31.4	
Delay (s)	27.5	32.4	36.6	18.5	52.4	
Level of Service	C	C	D	B	D	
Approach Delay (s)	32.0			33.5	52.4	
Approach LOS	C			C	D	

Intersection Summary

HCM 2000 Control Delay	41.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

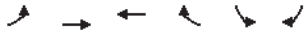
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	43	383	298	11	28	110
Future Volume (Veh/h)	43	383	298	11	28	110
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	47	416	324	12	30	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		240				
pX, platoon unblocked						
vC, conflicting volume	336				840	330
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	336				840	330
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				91	83
cM capacity (veh/h)	1223				323	712

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	47	416	336	150
Volume Left	47	0	0	30
Volume Right	0	0	12	120
cSH	1223	1700	1700	573
Volume to Capacity	0.04	0.24	0.20	0.26
Queue Length 95th (m)	1.0	0.0	0.0	8.3
Control Delay (s)	8.1	0.0	0.0	13.5
Lane LOS	A			B
Approach Delay (s)	0.8		0.0	13.5
Approach LOS				B

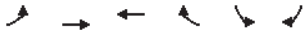
Intersection Summary				
Average Delay		2.5		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	406	297	1	3	12
Future Volume (Veh/h)	5	406	297	1	3	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	441	323	1	3	13
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		397				
pX, platoon unblocked						
vC, conflicting volume	324				774	324
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	324				774	324
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	1236				365	717

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	5	441	324	16
Volume Left	5	0	0	3
Volume Right	0	0	1	13
cSH	1236	1700	1700	608
Volume to Capacity	0.00	0.26	0.19	0.03
Queue Length 95th (m)	0.1	0.0	0.0	0.6
Control Delay (s)	7.9	0.0	0.0	11.1
Lane LOS	A			B
Approach Delay (s)	0.1		0.0	11.1
Approach LOS				B

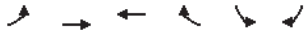
Intersection Summary				
Average Delay		0.3		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	43	366	188	11	28	110
Future Volume (Veh/h)	43	366	188	11	28	110
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	47	398	204	12	30	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	216				702	210
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	216				702	210
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				92	86
cM capacity (veh/h)	1354				390	830

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	47	398	216	150
Volume Left	47	0	0	30
Volume Right	0	0	12	120
cSH	1354	1700	1700	678
Volume to Capacity	0.03	0.23	0.13	0.22
Queue Length 95th (m)	0.9	0.0	0.0	6.7
Control Delay (s)	7.8	0.0	0.0	11.8
Lane LOS	A			B
Approach Delay (s)	0.8		0.0	11.8
Approach LOS				B

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	34.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	388	186	1	3	13
Future Volume (Veh/h)	6	388	186	1	3	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	422	202	1	3	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	203				638	202
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	203				638	202
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	98
cM capacity (veh/h)	1369				438	838

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	7	422	203	17
Volume Left	7	0	0	3
Volume Right	0	0	1	14
cSH	1369	1700	1700	722
Volume to Capacity	0.01	0.25	0.12	0.02
Queue Length 95th (m)	0.1	0.0	0.0	0.6
Control Delay (s)	7.6	0.0	0.0	10.1
Lane LOS	A			B
Approach Delay (s)	0.1		0.0	10.1
Approach LOS				B

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	30.4%	ICU Level of Service		A
Analysis Period (min)	15			

Intersection: 1: Casablanca Blvd & North Service Rd

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	L	T	LR
Maximum Queue (m)	131.2	87.0	145.0	231.7	145.2
Average Queue (m)	46.4	65.2	139.3	195.6	137.2
95th Queue (m)	130.2	99.5	170.5	314.2	142.6
Link Distance (m)	122.5			227.2	131.6
Upstream Blk Time (%)	11			37	62
Queuing Penalty (veh)	0			153	0
Storage Bay Dist (m)		45.0	60.0		
Storage Blk Time (%)	0	39	92		
Queuing Penalty (veh)	0	22	65		

Intersection: 2: North Service Rd & Winston Rd

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	10.7	142.0	95.2
Average Queue (m)	2.0	56.1	51.9
95th Queue (m)	8.2	147.1	111.9
Link Distance (m)		139.5	87.5
Upstream Blk Time (%)		10	40
Queuing Penalty (veh)		30	0
Storage Bay Dist (m)	40.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: North Service Rd & Driveway A

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	5.9	75.8	14.8
Average Queue (m)	0.3	10.4	3.9
95th Queue (m)	2.7	60.3	11.7
Link Distance (m)		176.6	25.9
Upstream Blk Time (%)		1	0
Queuing Penalty (veh)		3	0
Storage Bay Dist (m)	15.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
Total Traffic Year 2026 AM Peak Hour
170205

Intersection: 4: North Service Rd & Driveway B

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	9.7	4.7	31.9
Average Queue (m)	1.9	0.5	13.3
95th Queue (m)	7.8	8.0	24.3
Link Distance (m)		110.4	60.2
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (m)	30.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 5: North Service Rd & Driveway C

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (m)	8.6	11.6
Average Queue (m)	0.5	3.4
95th Queue (m)	3.8	10.7
Link Distance (m)		20.2
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (m)	15.0	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Network Summary

Network wide Queuing Penalty: 273

Paradigm Transportation Solutions Limited
SimTraffic Report

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Group Flow (vph)	97	609	620	64	1513
v/c Ratio	0.30	0.49	1.38	0.10	1.50
Control Delay	46.1	5.4	216.9	26.9	255.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	5.4	216.9	26.9	255.1
Queue Length 50th (m)	21.2	38.4	~204.0	10.6	~518.8
Queue Length 95th (m)	38.0	56.1	#276.2	20.9	#604.8
Internal Link Dist (m)	108.5			215.6	121.6
Turn Bay Length (m)		45.0	60.0		
Base Capacity (vph)	322	1248	448	644	1007
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	0.30	0.49	1.38	0.10	1.50

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	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	89	560	570	59	781	611
Future Volume (vph)	89	560	570	59	781	611
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	1.00	1.00	0.95	1.00	0.97	
Satd. Flow (prot)	1842	1566	1750	1842	1686	
Flt Permitted	1.00	1.00	0.52	1.00	0.97	
Satd. Flow (perm)	1842	1566	965	1842	1686	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	609	620	64	849	664
RTOR Reduction (vph)	0	10	0	0	23	0
Lane Group Flow (vph)	97	599	620	64	1490	0
Turn Type	NA	pm+ov	pm+pt	NA	Prot	
Protected Phases	2	8	1	6	8	
Permitted Phases		2	6			
Actuated Green, G (s)	19.0	87.0	40.0	40.0	68.0	
Effective Green, g (s)	21.0	91.0	40.0	42.0	70.0	
Actuated g/C Ratio	0.18	0.76	0.33	0.35	0.58	
Clearance Time (s)	6.0	6.0	4.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	322	1239	432	644	983	
v/s Ratio Prot	0.05	0.28	c0.20	0.03	c0.88	
v/s Ratio Perm		0.10	c0.27			
v/c Ratio	0.30	0.48	1.44	0.10	1.52	
Uniform Delay, d1	43.1	5.5	38.2	26.3	25.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	0.3	208.7	0.3	237.2	
Delay (s)	45.5	5.8	246.9	26.6	262.2	
Level of Service	D	A	F	C	F	
Approach Delay (s)	11.3			226.3	262.2	
Approach LOS	B			F	F	

Intersection Summary

HCM 2000 Control Delay	192.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	125.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	131	569	532	35	26	97
Future Volume (Veh/h)	131	569	532	35	26	97
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	142	618	578	38	28	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		240				
pX, platoon unblocked					0.99	
vC, conflicting volume	616				1499	597
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	616				1499	597
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				75	79
cM capacity (veh/h)	964				114	503

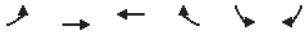
Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	142	618	616	133
Volume Left	142	0	0	28
Volume Right	0	0	38	105
cSH	964	1700	1700	293
Volume to Capacity	0.15	0.36	0.36	0.45
Queue Length 95th (m)	4.1	0.0	0.0	18.0
Control Delay (s)	9.4	0.0	0.0	27.1
Lane LOS	A			D
Approach Delay (s)	1.8		0.0	27.1
Approach LOS				D

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	54.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	579	554	7	5	13
Future Volume (Veh/h)	16	579	554	7	5	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	629	602	8	5	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		397				
pX, platoon unblocked						
vC, conflicting volume	610				1269	606
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	610				1269	606
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				97	97
cM capacity (veh/h)	969				183	497

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	17	629	610	19
Volume Left	17	0	0	5
Volume Right	0	0	8	14
cSH	969	1700	1700	342
Volume to Capacity	0.02	0.37	0.36	0.06
Queue Length 95th (m)	0.4	0.0	0.0	1.4
Control Delay (s)	8.8	0.0	0.0	16.1
Lane LOS	A			C
Approach Delay (s)	0.2		0.0	16.1
Approach LOS				C

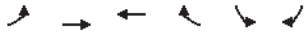
Intersection Summary				
Average Delay	0.4			
Intersection Capacity Utilization	40.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	136	448	459	40	31	102
Future Volume (Veh/h)	136	448	459	40	31	102
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	148	487	499	43	34	111
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	542				1304	520
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	542				1304	520
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	86				78	80
cM capacity (veh/h)	1027				152	556

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	148	487	542	145
Volume Left	148	0	0	34
Volume Right	0	0	43	111
cSH	1027	1700	1700	342
Volume to Capacity	0.14	0.29	0.32	0.42
Queue Length 95th (m)	4.0	0.0	0.0	16.3
Control Delay (s)	9.1	0.0	0.0	23.1
Lane LOS	A			C
Approach Delay (s)	2.1		0.0	23.1
Approach LOS				C

Intersection Summary				
Average Delay		3.5		
Intersection Capacity Utilization		52.1%	ICU Level of Service	A
Analysis Period (min)		15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	459	482	10	9	17
Future Volume (Veh/h)	20	459	482	10	9	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	499	524	11	10	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)						
pX, platoon unblocked						
vC, conflicting volume	535				1072	530
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535				1072	530
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	97
cM capacity (veh/h)	1033				239	549

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	22	499	535	28
Volume Left	22	0	0	10
Volume Right	0	0	11	18
cSH	1033	1700	1700	375
Volume to Capacity	0.02	0.29	0.31	0.07
Queue Length 95th (m)	0.5	0.0	0.0	1.9
Control Delay (s)	8.6	0.0	0.0	15.4
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	15.4
Approach LOS				C

Intersection Summary				
Average Delay		0.6		
Intersection Capacity Utilization		36.0%	ICU Level of Service	A
Analysis Period (min)		15		

Intersection: 1: Casablanca Blvd & North Service Rd

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	L	T	LR
Maximum Queue (m)	58.4	75.8	145.0	231.7	147.2
Average Queue (m)	20.3	39.5	144.9	229.9	137.3
95th Queue (m)	42.6	66.9	144.9	231.8	141.9
Link Distance (m)	122.5			227.2	131.6
Upstream Blk Time (%)	0			58	55
Queuing Penalty (veh)	0			366	0
Storage Bay Dist (m)		45.0	60.0		
Storage Blk Time (%)	1	4	87		
Queuing Penalty (veh)	5	4	51		

Intersection: 2: North Service Rd & Winston Rd

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	16.9	143.6	98.7
Average Queue (m)	5.5	140.6	88.9
95th Queue (m)	14.7	154.8	101.9
Link Distance (m)		139.5	87.5
Upstream Blk Time (%)		56	92
Queuing Penalty (veh)		318	0
Storage Bay Dist (m)	40.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: North Service Rd & Driveway A

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	6.1	181.1	28.7
Average Queue (m)	0.6	166.8	13.4
95th Queue (m)	4.0	233.0	30.1
Link Distance (m)		176.6	25.9
Upstream Blk Time (%)		48	22
Queuing Penalty (veh)		269	0
Storage Bay Dist (m)	15.0		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
Total Traffic Year 2026 PM Peak Hour
170205

Intersection: 4: North Service Rd & Driveway B

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	18.1	113.9	68.2
Average Queue (m)	4.5	90.6	53.0
95th Queue (m)	13.6	156.1	85.2
Link Distance (m)		110.4	60.2
Upstream Blk Time (%)		39	74
Queuing Penalty (veh)		196	0
Storage Bay Dist (m)	30.0		
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 5: North Service Rd & Driveway C

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	8.9	152.4	23.6
Average Queue (m)	0.8	93.4	11.1
95th Queue (m)	5.0	201.9	25.1
Link Distance (m)		140.0	20.2
Upstream Blk Time (%)		52	28
Queuing Penalty (veh)		0	0
Storage Bay Dist (m)	15.0		
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Network Summary

Network wide Queuing Penalty: 1209

Paradigm Transportation Solutions Limited
SimTraffic Report

Appendix C

Total Traffic Operational Conditions – Year 2026 Sensitivity Analysis – Reduced Driveway Connections

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	62	670	366	77	533	401
v/c Ratio	0.11	0.71	0.55	0.08	0.75	0.47
Control Delay	26.8	7.4	20.1	14.5	29.0	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	7.4	20.1	14.5	29.0	3.5
Queue Length 50th (m)	8.8	0.0	40.3	7.0	79.8	0.0
Queue Length 95th (m)	19.4	33.4	76.8	17.6	97.4	14.4
Internal Link Dist (m)	108.5			215.6	121.6	
Turn Bay Length (m)		45.0				50.0
Base Capacity (vph)	565	945	669	929	933	996
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	0.11	0.71	0.55	0.08	0.57	0.40

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	57	616	337	71	490	369
Future Volume (vph)	57	616	337	71	490	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1842	1566	1750	1842	1750	1566
Flt Permitted	1.00	1.00	0.62	1.00	0.95	1.00
Satd. Flow (perm)	1842	1566	1142	1842	1750	1566
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	670	366	77	533	401
RTOR Reduction (vph)	0	465	0	0	0	247
Lane Group Flow (vph)	62	205	366	77	533	154
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Actuated Green, G (s)	25.6	25.6	43.4	43.4	34.6	34.6
Effective Green, g (s)	27.6	27.6	43.4	45.4	36.6	34.6
Actuated g/C Ratio	0.31	0.31	0.48	0.50	0.41	0.38
Clearance Time (s)	6.0	6.0	4.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	564	480	643	929	711	602
v/s Ratio Prot	0.03		c0.09	0.04	c0.30	
v/s Ratio Perm		0.13	c0.19			0.10
v/c Ratio	0.11	0.43	0.57	0.08	0.75	0.26
Uniform Delay, d1	22.4	24.9	15.4	11.5	22.8	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	2.8	1.2	0.2	4.4	0.2
Delay (s)	22.8	27.7	16.5	11.7	27.1	19.1
Level of Service	C	C	B	B	C	B
Approach Delay (s)	27.3			15.7	23.7	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: Casablanca Blvd & North Service Rd

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	R	L	T	L	R
Maximum Queue (m)	131.8	87.0	122.9	24.6	141.7	57.5
Average Queue (m)	52.5	66.1	60.1	9.2	82.3	39.0
95th Queue (m)	140.6	103.4	112.8	21.4	140.7	72.3
Link Distance (m)	122.5		224.3	224.3	131.9	
Upstream Blk Time (%)	11				4	
Queuing Penalty (veh)	0				0	
Storage Bay Dist (m)		45.0				50.0
Storage Blk Time (%)	0	41			16	0
Queuing Penalty (veh)	0	23			60	1

Intersection: 2: North Service Rd & Winston Rd

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (m)	10.4	25.2
Average Queue (m)	3.2	10.8
95th Queue (m)	10.1	18.4
Link Distance (m)		85.6
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	50.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: North Service Rd & Driveway A

Movement	SB
Directions Served	R
Maximum Queue (m)	9.8
Average Queue (m)	2.8
95th Queue (m)	9.7
Link Distance (m)	26.2
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: North Service Rd & Driveway B

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (m)	11.1	29.7
Average Queue (m)	2.6	13.4
95th Queue (m)	9.3	23.0
Link Distance (m)		60.2
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)	30.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: North Service Rd & Driveway C

Movement	SB
Directions Served	R
Maximum Queue (m)	10.2
Average Queue (m)	2.8
95th Queue (m)	9.5
Link Distance (m)	22.3
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 85

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	97	609	620	64	849	664
v/c Ratio	0.28	0.50	1.25	0.09	0.89	0.66
Control Delay	43.9	5.7	158.9	25.8	34.6	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.9	5.7	158.9	25.8	34.6	10.0
Queue Length 50th (m)	20.5	38.1	~193.8	10.2	161.4	39.1
Queue Length 95th (m)	38.0	56.0	#274.5	20.9	229.0	76.3
Internal Link Dist (m)	108.5			215.6	121.6	
Turn Bay Length (m)		45.0				50.0
Base Capacity (vph)	351	1350	496	702	1112	1117
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	0.28	0.45	1.25	0.09	0.76	0.59

Intersection Summary

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

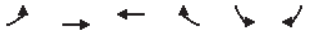
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	89	560	570	59	781	611
Future Volume (vph)	89	560	570	59	781	611
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1842	1566	1750	1842	1750	1566
Flt Permitted	1.00	1.00	0.54	1.00	0.95	1.00
Satd. Flow (perm)	1842	1566	997	1842	1750	1566
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	609	620	64	849	664
RTOR Reduction (vph)	0	12	0	0	0	185
Lane Group Flow (vph)	97	597	620	64	849	479
Turn Type	NA	pm+ov	pm+pt	NA	Prot	Perm
Protected Phases	2	8	1	6	8	
Permitted Phases		2	6			8
Actuated Green, G (s)	19.2	77.9	40.4	40.4	58.7	58.7
Effective Green, g (s)	21.2	81.9	40.4	42.4	60.7	58.7
Actuated g/C Ratio	0.19	0.74	0.36	0.38	0.55	0.53
Clearance Time (s)	6.0	6.0	4.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	351	1210	479	702	956	827
v/s Ratio Prot	0.05	0.27	c0.20	0.03	c0.49	
v/s Ratio Perm		0.11	c0.27			0.31
v/c Ratio	0.28	0.49	1.29	0.09	0.89	0.58
Uniform Delay, d1	38.4	6.0	33.6	22.0	22.2	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3	147.3	0.3	10.1	1.0
Delay (s)	40.3	6.4	181.0	22.3	32.3	18.8
Level of Service	D	A	F	C	C	B
Approach Delay (s)	11.0			166.1	26.4	
Approach LOS	B			F	C	

Intersection Summary

HCM 2000 Control Delay	55.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	111.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

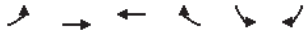
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	147	553	532	35	31	97
Future Volume (Veh/h)	147	553	532	35	31	97
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	160	601	578	38	34	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		240				
pX, platoon unblocked						
vC, conflicting volume	616				1518	597
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	616				1518	597
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	83				69	79
cM capacity (veh/h)	964				109	503

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	160	601	616	139
Volume Left	160	0	0	34
Volume Right	0	0	38	105
cSH	964	1700	1700	267
Volume to Capacity	0.17	0.35	0.36	0.52
Queue Length 95th (m)	4.7	0.0	0.0	22.2
Control Delay (s)	9.5	0.0	0.0	32.2
Lane LOS	A			D
Approach Delay (s)	2.0		0.0	32.2
Approach LOS				D

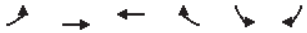
Intersection Summary			
Average Delay		4.0	
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	584	554	7	0	13
Future Volume (Veh/h)	0	584	554	7	0	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	635	602	8	0	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		397				
pX, platoon unblocked						
vC, conflicting volume	610				1241	606
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	610				1241	606
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	97
cM capacity (veh/h)	969				193	497

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	635	610	14
Volume Left	0	0	0
Volume Right	0	8	14
cSH	1700	1700	497
Volume to Capacity	0.37	0.36	0.03
Queue Length 95th (m)	0.0	0.0	0.7
Control Delay (s)	0.0	0.0	12.5
Lane LOS			B
Approach Delay (s)	0.0	0.0	12.5
Approach LOS			B

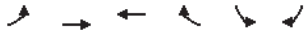
Intersection Summary			
Average Delay		0.1	
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	156	428	459	40	40	102
Future Volume (Veh/h)	156	428	459	40	40	102
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	170	465	499	43	43	111
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	542				1326	520
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	542				1326	520
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	83				70	80
cM capacity (veh/h)	1027				143	556

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	170	465	542	154
Volume Left	170	0	0	43
Volume Right	0	0	43	111
cSH	1027	1700	1700	308
Volume to Capacity	0.17	0.27	0.32	0.50
Queue Length 95th (m)	4.7	0.0	0.0	21.1
Control Delay (s)	9.2	0.0	0.0	27.8
Lane LOS	A			D
Approach Delay (s)	2.5		0.0	27.8
Approach LOS				D

Intersection Summary				
Average Delay	4.4			
Intersection Capacity Utilization	53.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	468	482	10	0	17
Future Volume (Veh/h)	0	468	482	10	0	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	509	524	11	0	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)						
pX, platoon unblocked						
vC, conflicting volume	535				1038	530
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535				1038	530
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	97
cM capacity (veh/h)	1033				256	549

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	509	535	18
Volume Left	0	0	0
Volume Right	0	11	18
cSH	1700	1700	549
Volume to Capacity	0.30	0.31	0.03
Queue Length 95th (m)	0.0	0.0	0.8
Control Delay (s)	0.0	0.0	11.8
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.8
Approach LOS			B

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	36.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection: 1: Casablanca Blvd & North Service Rd

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	R	L	T	L	R
Maximum Queue (m)	78.3	78.9	235.6	230.4	145.5	57.5
Average Queue (m)	22.2	39.4	227.2	68.2	137.3	53.5
95th Queue (m)	51.3	68.8	231.7	227.7	141.3	71.6
Link Distance (m)	122.5		224.3	224.3	131.9	
Upstream Blk Time (%)	0		63	9	34	
Queuing Penalty (veh)	0		197	28	0	
Storage Bay Dist (m)		45.0				50.0
Storage Blk Time (%)	1	5			30	2
Queuing Penalty (veh)	4	4			183	19

Intersection: 2: North Service Rd & Winston Rd

Movement	EB	EB	WB	SB
Directions Served	L	T	TR	LR
Maximum Queue (m)	24.2	29.3	142.3	98.6
Average Queue (m)	8.1	1.1	139.8	72.8
95th Queue (m)	19.6	17.1	143.7	120.4
Link Distance (m)		224.3	138.0	85.6
Upstream Blk Time (%)			60	64
Queuing Penalty (veh)			339	0
Storage Bay Dist (m)	50.0			
Storage Blk Time (%)	0	0		
Queuing Penalty (veh)	1	0		

Intersection: 3: North Service Rd & Driveway A

Movement	WB	SB
Directions Served	TR	R
Maximum Queue (m)	182.7	27.5
Average Queue (m)	171.3	12.3
95th Queue (m)	230.1	28.4
Link Distance (m)	178.2	26.2
Upstream Blk Time (%)	53	23
Queuing Penalty (veh)	297	0
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 4: North Service Rd & Driveway B

Movement	EB	WB	SB
Directions Served	L	TR	LR
Maximum Queue (m)	22.6	112.8	68.4
Average Queue (m)	7.1	97.4	54.6
95th Queue (m)	17.5	153.7	84.4
Link Distance (m)		109.2	60.2
Upstream Blk Time (%)		51	75
Queuing Penalty (veh)		256	0
Storage Bay Dist (m)	30.0		
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 5: North Service Rd & Driveway C

Movement	WB	SB
Directions Served	TR	R
Maximum Queue (m)	156.2	22.8
Average Queue (m)	117.7	7.9
95th Queue (m)	210.6	20.4
Link Distance (m)	141.3	22.3
Upstream Blk Time (%)	72	16
Queuing Penalty (veh)	0	0
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1328

Appendix D

Region of Waterloo TDM Reduction Worksheet

Region of Waterloo

Travel Demand Management (TDM) Implementation Checklist

Version 9/18/2013

Appendix H

Case Study:	170205	**Site Context:**	Fifth Wheel (Losani Homes Grimsby)
TDM Checklist No:		**ZBL Parking Requirement:**	2103
Date:	May 2018	**Applicable Parking Reduction:**	13%

The Transportation Demand Management (TDM) Checklist and Parking Management Worksheet are not designed for residential properties, but can be used to inform mixed-use developments.

TABLE A		**Site Access**				
In creating an environment that supports pedestrian and cycling activity, the public realm must be accessible, safe, and comfortable to encourage movement on the street and in the surrounding area(s). These facilities and features should encourage walking and cycling.						
Points		**Features**			**Yes**	**N/A**
A1	**2**	Development incorporates functional building entrances that are oriented to public space or to locations where pedestrians and transit users arrive from such as a street, square, park or plaza.			**YES**	
A2	**1**	External to site: Continuous sidewalks (consistent with AODA Accessible Built Environment Standard) are provided along both sides of all adjacent public streets (over and above requirement) AND Internal to site: Pedestrian walkways (consistent with AODA Accessible Built Environment Standard e.g.1.8m min width) are provided through large parking areas to link the building with the public street sidewalk system			**YES**	
A3	**3**	Non-residential: development provides secure bike storage for 5% of the building occupants. Consistent with LEED requirements.			**YES**	
A4	**4**	Shower and change facilities for employees provided on-site consistent with LEED requirements.			**YES**	
A5	**2**	Provision of active uses at-grade along street frontages (e.g. retail).			**YES**	
Category Max =		10	**Total Points Applicable =**	10	**Score =**	10

TABLE B		**Public Transportation Access**				
The availability and proximity of convenient public transit service with direct pedestrian linkages to the building will provide viable travel options for employees, visitors and residents.						
Points		**Features**			**Yes**	**N/A**
B1	**1**	Bus shelters with seating are provided at the transit stop immediately adjacent to the development in consultation with Transportation Planning at the Region of Waterloo				
B2	**1**	Information regarding public transit routes, schedules and fares are provided in an accessible and visible location on site and in adjacent bus stops				
B3a	**5**	Located within 800m of a Rapid Transit Station				
B3b	**3**	Located within 600 m of a bus service with headways of 15 min or less or is located in a designated mixed use corridor or node. **Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.**				
B3c	**1**	Located within 400 m of a bus service with headways of 16 min to 30 min. **Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.**				
Category Max =		5	**Total Points Applicable =**	5	**Score =**	

TABLE C		**Parking**			
Vehicle parking facilities can affect the character, travel mode and cost of a development. Reducing parking supply to match expected demand can a have a positive influence on the selection of alternative travel modes.					
Points		**Features**		**Yes**	**N/A**
C1	**24**	Utilizes reduced parking supply consistent with the TDM Parking Management Worksheet. Contact your Area Municipal planning authority to determine whether the Worksheet is applicable to your development. **Note: Points are awarded for either C1, C2, or C3 only. Please choose whichever applies with the highest value.**			
C2	**24**	Includes allowances for shared parking in mixed-use zones. **Note: Points are awarded for C1, C2, or C3 only. Please choose whichever applies after consulting with the Area Municipal planning authority.**		**YES**	
C3	**15**	Provides no more than the minimum number of parking spaces, as required by applicable Zoning By-Law. **Note: Points are awarded for either C1, C2, or C3 only. Please choose whichever applies.**			
C4	**10**	Implements paid parking on part or all of the site (e.g. parking permits, paid parking zones near main entrances)			
C5	**3**	Provides priority parking for carpooling/vanpooling participants equivalent to 5% of employee spaces			
C6	**5**	Commercial Uses: Provide car-share spaces equivalent to 2% of building occupants			
C7	**3**	Parking is not located on major street frontage or between a road right of way and the building facade.			
C8	**5**	25% to 50% of parking is located underground or in a structure			

C9	10	50% to 75% of parking is located underground or in a structure				
C10	15	75% of parking or more is located underground or in a structure			YES	
C11	3	Parking spaces provided off-site on a lot within 300 metres of the lot containing such use.				
Category Max =		25	Total Points Applicable =	25	Score =	25

Region of Waterloo TDM Checklist v2.0 **FORM-1**

Case Study: 170205 **Checklist No:** 0
Date: May 2018 **Site Context:** 0

TABLE D		Trip Reduction Incentives		
A formal TDM plan will identify specific initiatives that will be initiated in order to encourage reduced single occupant vehicle travel.				
Points		Features		N/A
D1	2	The building owner/occupant will make available a ride matching service for car/vanpooling		
D2	2	The building owner/occupant will make available emergency ride home options		
D3	5	The building owner/occupant will make available subsidized transit passes for all occupants for a period of two years		
D4	5	The building owner/occupant agrees to charge for parking as an unbundled cost to occupants	YES	
D5	2	The building owner/occupant agrees to provide reduced cost parking for users of car/van pool, bicycle, moped/motorcycle spaces		
D6	10	The building owner/occupant has prepared a TDM plan to the satisfaction of the Region of Waterloo and the Area Municipality that targets a 10% reduction in peak hour trips using forecast trip generation with status quo travel characteristics		
D7	5	The employer has provided flexible working hours, telework or shift work arrangements.		
D8	14	The development agrees to join Travelwise (TMA) that provides the same services outlined under items D1, D2, D6		
D9	5	The building owner/occupant will make available car sharing services		
D10	2	The development includes mixed uses (i.e. retail, commercial or food services, daycares, or other complementary uses) on-site or located within 400 metres.	YES	
Category Max =		25	Total Points Applicable = 25	Score = 5

TABLE E	Checklist Summary			
For each item, a "Yes" answer is equivalent to the points as indicated in the section. N/A sections should be explained in an attachment to this table. The score for each section is reflected as a percentage and calculated by dividing the points by the "Total Applicable".				
Category	**Minimum Requirement**	**Total Applicable**	**Points Scored**	**Comments**
Pedestrian & Cyclist Orientation	24	10	10	
Public Transit Access		5		
Parking		25	25	
SUB-TOTAL		**40**	**35**	
Trip Reduction Incentives		*25*	*5*	
OVERALL TOTAL		***65***	**40**	

TABLE F	Scoring Summary		
FINAL SCORE	**RATING (check one)**		
50 - 65	****		**TDM SUPPORTIVE DEVELOPMENT**
40 -49	***	X	
30 - 39	**		
24 - 29	*		
0 - 23			Non-TDM Supportive Development (Review and upgrade TDM elements to pass)

Comments:

Parking Management Worksheet
Version 9/18/2013

Appendix I

Case Study: 170205 **Site Context:** Fifth Wheel (Losani Homes Grimsby)

Date: **Reduction Worksheet No:**

"**Urban Growth Centres -** (UGC) area classification includes the Downtown / Uptown and RT Station Areas of Kitchener, Waterloo and Cambridge.

"**Intensification Corridor**" (IC) classification is applied to sites within 800 metres of the future CTC line

"**Other**" classification applies to all other sites

Please highlight the cell percentages applicable to your development under the appropriate classification. Please note that the Parking Management Worksheet and the Transportation Demand Management (TDM) Checklist are not designed for residential properties, but can be used for mixed-use developments. Local municipalities are the decision-making bodies with respect to consideration of parking reductions below Zoning By-law requirements.

TABLE A	Pedestrian and Cyclist Orientation			
In creating an environment that supports pedestrian and cycling activity, the public realm must be accessible, safe, and comfortable to encourage movement on the street and in the surrounding area(s). These facilities and features should encourage walking and cycling.				
	Features	**UGC**	**IC**	**Other**
A1	Development incorporates functional building entrances that are oriented to public space or to locations where pedestrians and transit users arrive from such as a street, square, park or plaza.	1%	1%	1%
A2	Continuous sidewalks (1.5m min. width) are provided along both sides of all adjacent public streets and pedestrian walkways (1.5m min width) are provided through large parking areas to link the building with the public street sidewalk system	0%	0%	1%
A3	Non-Residential: Development provides secure bike storage for 4% of the building occupants	2%	2%	1%
A4	Shower and change facilities provided on-site consistent with LEED requirements.	1%	1%	1%
A5	Provision of active uses at-grade along street frontages.	1%	1%	1%
	Category Maximum	**4%**	**4%**	**4%**
	Available Parking Reduction			**4%**

TABLE B	Public Transportation Access			
The availability and proximity of convenient public transit service with direct pedestrian linkages to the building will provide viable travel options for employees, visitors and residents.				
	Features	**UGC**	**IC**	**Other**
B1	Bus shelters with seating are provided at the transit stop immediately adjacent to the development, in consultation with Transportation Planning at the Region of Waterloo	0%	0%	1%
B2	Information regarding public transit routes, schedules and fares are provided in an accessible and visible location on site and in adjacent bus stops	0%	0%	1%
B3a	Located in an UGC or within 800 m of a future Rapid Transit Station	24%	12%	0%
B3b	Located within 600m a transit route with 15 minute headways (or less) or is located in a designated mixed use corridor or node. **Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.**	-	-	3%
B3c	Located within 400 metres of a bus service with headways of 15 min to 30 min. **Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.**	-	-	1%
	Category Maximum	**24%**	**12%**	**5%**
	Available Parking Reduction			**0%**

TABLE C	Parking			
Vehicle parking facilities can affect the character, travel mode and cost of a development. Reducing parking supply to match expected demand can have a positive influence on the selection of alternative travel modes.				
	Features	**UGC**	**IC**	**Other**
C1	Provides priority parking for carpooling/vanpooling participants equivalent to 5% of employee spaces	0%	0%	5%
C2	Commercial Uses: Provide car-share spaces equivalent to 2% of building occupants	2%	2%	0%
C3	Implements paid parking system on all or part of the site (e.g. parking permits, paid parking zones near main entrances)	2%	2%	1%
C4	Parking is not located on major street frontage.	0%	0%	1%
C5	25% to 50% of parking is located underground or in a structure	2%	1%	0%

C6	50% to 75% of parking is located underground or in a structure	4%	2%	0%
C7	75% of parking or more is located underground or in a structure	5%	3%	0%
	Category Maximum	**6%**	**4%**	**6%**
	Available Parking Reduction			**5%**

Sample Parking Reduction Worksheet **FORM-2**

Case Study:	170205	**Site Context:**	0
Date:	00-01-00	**Worksheet No:**	0

TABLE D	Trip Reduction Incentives			
A formal TDM plan will identify specific initiatives that will be initiated in order to encourage reduced single occupant vehicle travel.				
	Features	**UGC**	**IC**	**Other**
D1	The building owner/occupant will provide a ride matching service for car/vanpooling	0%	0%	1%
D2	The building owner/occupant will provide emergency ride home options	3%	2%	1%
D3	The building owner/occupant will provide subsidized transit passes for all occupants for a period of two years	10%	4%	2%
D4	The building owner/occupant agrees to charge for parking as a separate cost to occupants	10%	5%	2%
D5	The building owner/occupant agrees to provide reduced cost for users of car/van pool, bicycle, moped/motorcycle spaces	0%	0%	1%
D6	The development agrees to join Travelwise (TMA) that provides the same services outlined under items D1 and D2	9%	6%	4%
	Category Maximum	**23%**	**11%**	**7%**
	Available Parking Reduction			**4%**

TABLE E	Parking Reduction Summary				
Please indicate the total reduction available based upon Tables A through D above.					
		Maximum Achievable Reduction			
Category	**Reduction Achieved**	**UGC**	**IC**	**Other**	**Comments**
Pedestrian & Cyclist Orientation	**4%**	4%	4%	4%	
Public Transit Access	**0%**	24%	12%	5%	
Parking	**5%**	6%	4%	6%	
Trip Reduction Incentives	**4%**	23%	11%	7%	
TOTAL	**13%**	**57%**	**31%**	**22%**	

TABLE F	TOTAL REDUCTION ACHIEVED	13%

Comments: