BELCAL INC

BELWOOD SUBDIVISION

TRAFFIC IMPACT STUDY

DECEMBER 05, 2023

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TRAFFIC IMPACT STUDY

BELCAL INC.

IM22102047

DATE: DECEMBER 05, 2023

WSP
3450 HARVESTER ROAD,
BURLINGTON, ON L7N 3W5

T: 905-335-2353
WSP.COM

December 05, 2023

Belcal Inc.
2907 Upper James St.
Mt. Hope, ON L0R 1W0

Attention: Steve Schiedel, Owner

Dear Sir:

Subject: Belwood Subdivision Traffic Impact Study, Wellington County, ON

Enclosed is our Traffic Impact Study for your proposed Belwood Subdivision in the community of Belwood.

I trust that it will support your development application to Wellington County and the Township of Centre Wellington. Please let me know if there are any follow up questions.

Thank you for the opportunity to support you with this interesting study.

Yours sincerely,

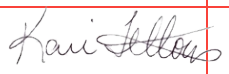
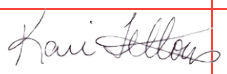
Kari Fellows, P.Eng., PTOE,
RSP_1

Sr. Transportation Engineer

KF

WSP ref.:

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Final Report			
Date	December 5, 2023			
Prepared by	Kari Fellows			
Signature				
Checked by	Kari Fellows			
Signature				
Authorised by	Lachlan Fraser			
Signature	 Digitally signed by Fraser, Lachlan (wds_lachlan.fraser) Date: 5-Dec-23			
Project number	IM22102047			

PRODUCTION TEAM

CLIENT

Client	Steve Schiedel
Function	Name
Function	Name

WSP

Project Manager	Kari Fellows
Traffic Analyst	Blake Prescott
Quality Reviewer	Lachlan Fraser

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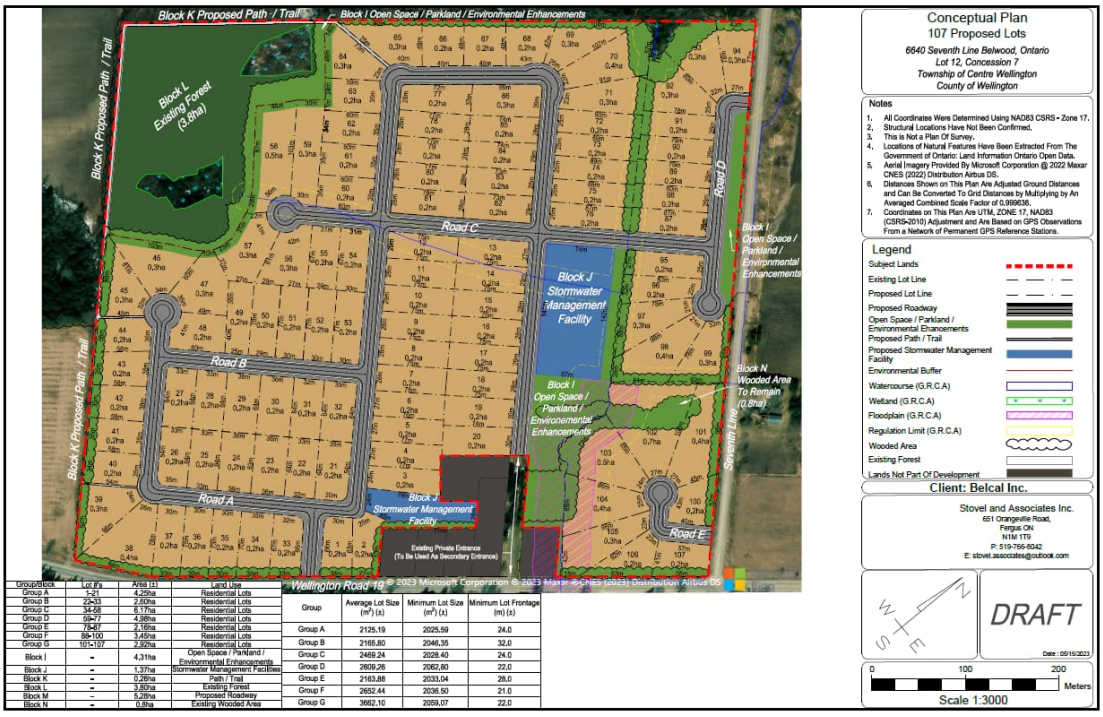
1 INTRODUCTION

1.1 DEVELOPMENT PROPOSAL

BelCal Inc. proposes to develop a residential subdivision in the northwest quadrant of the intersection of Wellington County Road 19 & Wellington County Road 26 in the Hamlet of Belwood. The proposal includes 108 lots with a minimum area of half an acre each.

The development concept is illustrated in Figure 1.



Group/Block	Lot #'s	Area (±)	Land Use
Group A	1-21	4.29ha	Residential Lots
Group B	22-33	2.60ha	Residential Lots
Group C	34-66	6.17ha	Residential Lots
Group D	68+77	4.36ha	Residential Lots
Group E	78-87	2.16ha	Residential Lots
Group F	88+100	3.45ha	Residential Lots
Group G	101+107	2.92ha	Residential Lots
Block I	-	4.31ha	Open Space / Parkland / Environmental Enhancements
Block J	-	1.37ha	Stormwater Management Facilities
Block K	-	0.26ha	Path / Trail
Block L	-	3.80ha	Existing Forest
Block M	-	0.28ha	Proposed Roadway
Block N	-	0.8ha	Existing Wooded Area

Group	Average Lot Size (m^2) (±)	Minimum Lot Size (m^2) (±)	Minimum Lot Frontage (m) (±)
Group A	2125.19	2025.59	24.0
Group B	2165.80	2046.35	32.0
Group C	2469.24	2028.40	24.0
Group D	2609.26	2062.80	22.0
Group E	2163.88	2033.04	28.0
Group F	2652.44	2036.50	22.0
Group G	3662.10	2059.07	22.0

Figure 1. Development Concept

As Figure 1 shows, the 8 parcels in the southeast corner of the site access 7th Line via Road E, which is a short cul-de-sac. The remaining 100 parcels can enter or exit the subdivision via Road D to 7th Line or via Road A to Wellington Road 19.

The build out year for the site assumed for the purpose of this study is 2032.

Peak periods for traffic impacts from residential development include the weekday morning and weekday afternoon commuting peak hours.

1.2 SCOPE OF STUDY

Wellington County's Guidelines for Traffic Impact Studies were followed for this study.

These guidelines identify four different analysis categories based on trip generation for the proposed development. This developed will generate just over 100 trips per hour during the weekday afternoon peak hour, putting this development in the "small" category, requiring analysis of site accesses, major unsignalized intersections within 200 meters and adjacent signalized intersections within 500 meters. There are no signalized intersections within this distance from the site, and Wellington Road 19 & 7th Line/ Wellington Road 26 is the only major unsignalized intersection within 200 meters of the site.

The scope of work for this Traffic Impact Study was confirmed with Wellington County through their consultant Dillon Consulting Limited. The proposed scope was also provided to and discussed with the Township of Centre Wellington.

Scope confirmation correspondence is included in Appendix A.

2 STUDY AREA

2.1 AREA ROAD NETWORK

The proposed development location is illustrated in Figure 2.

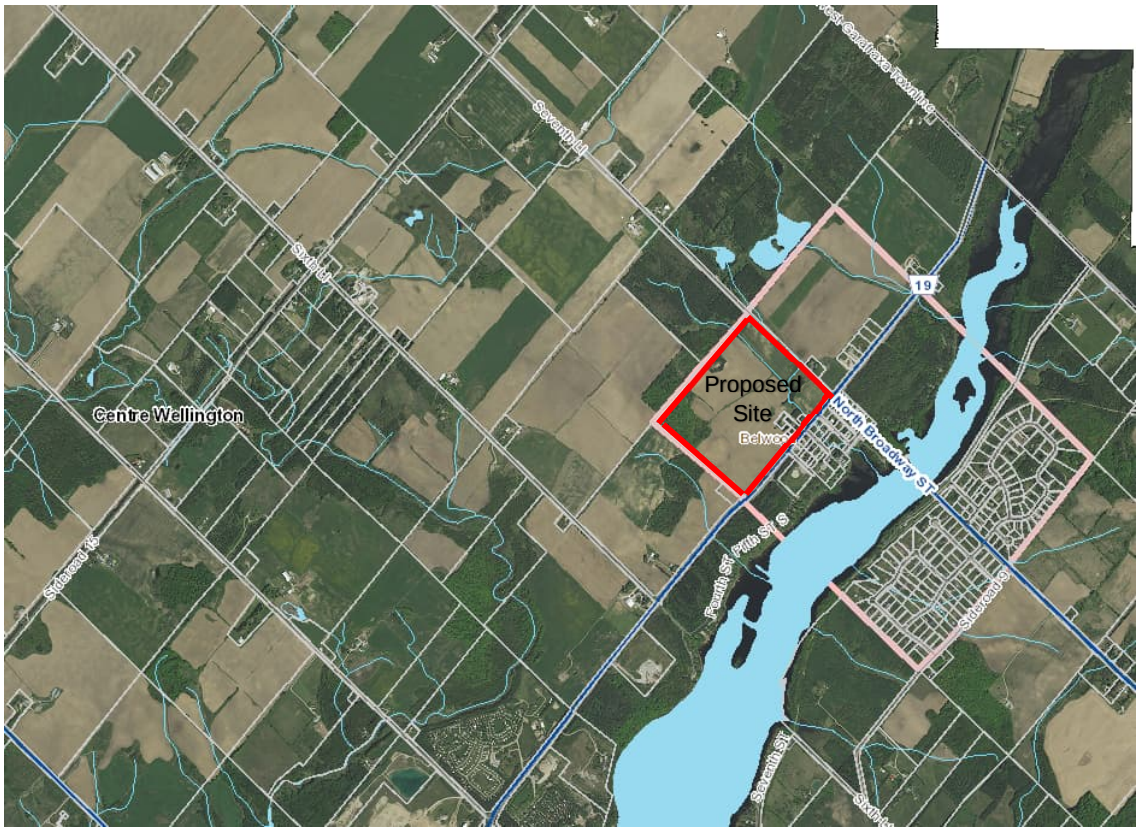


Figure 2. Study Area

As illustrated in Figure 2, the proposed site is north of Wellington County Road 19 and west of 7th Line (assuming Wellington County Road 19 has an east-west orientation).

The proposed development parcel and several parcels in the area have agricultural and environmental land uses. There is an area of existing residential development along the south side of County Road 19 west of County Road 26/7th Line.

2.2 STUDY AREA BOUNDARIES

The proposed development is expected to generate just over 100 peak hour trips, categorizing this as a Small development based on the Wellington County Traffic Impact Study Guidelines. This size of development requires analysis of site access driveways, adjacent signalized intersections within 500 meters of the proposed development and unsignalized driveways within 200 meters of the proposed development.

Since there are no signalized intersections within the prescribed distance, the resulting study intersections include the unsignalized intersection of Wellington County Road 19 & Wellington County Road 26/7th Line and the 3 proposed site accesses. The intersection is under the jurisdiction of Wellington County, and 7th Line is under the jurisdiction of Centre Wellington Township.

2.3 STUDY AREA TRANSPORTATION NETWORK

County Road 19 is under Wellington County jurisdiction and extends to the east boundary of Wellington County and Dufferin County. Along the frontage of the proposed development site, the road is two lanes wide with partially paved shoulder on the east leg and curb and gutter on the east side between Smith Street and County Road 26/7th Line. There is a narrow concrete sidewalk on the east side between the third property east of Smith Street and Queen Street, and between Nelson Street and County Road 26/7th Line, there is an asphalt sidewalk adjacent to the curb.

The speed limit for County Road 19 between approximately 50 meters west of Fifth Street South (approximately 550 meters west of 7th Line) and approximately 735 meters east of 7th Line is 50 kilometers per hour. Further west and further east of these points, the speed limit on County Road 19 is 80 kilometers per hour.

7th Line in under the jurisdiction of the Township of Wellington Centre. It has a two lane cross section with a narrow gravel shoulder and drainage ditches on both sides. A 5 tonne per axle load limit is in place from March 1 to April 30.

The intersection of County Road 19 & 7th Line/County Road 26 is stop controlled for 7th Line and County Road 26, with a single approach lane in each direction.

There is currently no transit service in this area.

3 EXISTING CONDITIONS

3.1 TRAFFIC VOLUMES

Wellington County provided Average Annual Daily Traffic (AADT) data for a counting station on County Road 19 east of 5th Line for the years 2005, 2007, 2010, 2013, 2016, 2019 and 2020. The volumes are summarized in Table 1.

Table 1. County Road 19 East of 5th Line Historical AADT

YEAR	AADT
2004	2268
2007	3552
2010	2788
2013	3362
2016	3519
2019	3371
2020	3134

As Table 1 indicates, the daily volume along County Road 19 varied from year to year, without a clear pattern of increasing.

The County also provided historical turning movement counts for the intersection of County Road 19 & 7th Line/County Road 26 for the years 2012, 2016 and 2019. A turning movement count was also collected specifically for this project on Thursday, August 25, 2022. Table 2 provides a summary of weekday morning and weekday afternoon peak hour turning movement volumes from each of these counts. To match the site drawing, it has been assumed that Wellington County Road 19 is oriented eastbound and westbound and 7th Line and Wellington Country Road 26 are oriented northbound and southbound.

Turning movement count data is provided in Appendix B. Note that the turning movement counts assume that Wellington County Road 19 is oriented northbound and southbound, with 7th Line oriented eastbound and Wellington County Road 26 westbound at the intersection.

As Table 2 shows, approach volumes at the intersection have generally increased over the period 2012 to 2022, although some approach volumes have fluctuated up and down. Overall, peak hour traffic volumes approaching the intersection were low during each of the counts. Based on this comparison, the August 25, 2022 was used in this study to represent existing conditions.

Weekday morning and weekday afternoon peak hour vehicle turning movement volumes collected at the intersection of Wellington County Road 19 & 7th Line/Wellington County Road 26 on August 25, 2022 and traffic control for this intersection are illustrated in Figure 3.

Table 2. Peak Hour Turning Movement Volumes – County Road 19 & 7th Line/County Road 26

TIME PERIOD	COUNT DATE	SOUTHBOUND – 7TH LINE (VEHICLES PER HOUR)			NORTHBOUND – CR 26 (VEHICLES PER HOUR)			WESTBOUND – CR 19 (VEHICLES PER HOUR)			EASTBOUND – CR 19 (VEHICLES PER HOUR)		
		LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT
AM PEAK	Thursday, June 28, 2012	1	8	5	53	4	12	26	23	0	1	29	37
	Tuesday, June 14, 2016	0	5	10	57	5	12	21	59	1	4	36	49
	Thursday, May 23, 2019	8	8	1	54	3	10	16	49	1	1	35	53
	Thursday, August 25, 2022	2	16	6	51	10	12	20	52	0	1	52	41
PM PEAK	Thursday, June 28, 2012	17	8	11	71	13	40	31	69	7	4	66	53
	Tuesday, June 14, 2016	0	3	7	96	12	15	17	41	0	7	56	86
	Thursday, May 23, 2019	2	4	1	92	7	33	16	49	1	8	54	61
	Thursday, August 25, 2022	0	15	5	67	29	31	15	69	0	12	62	64

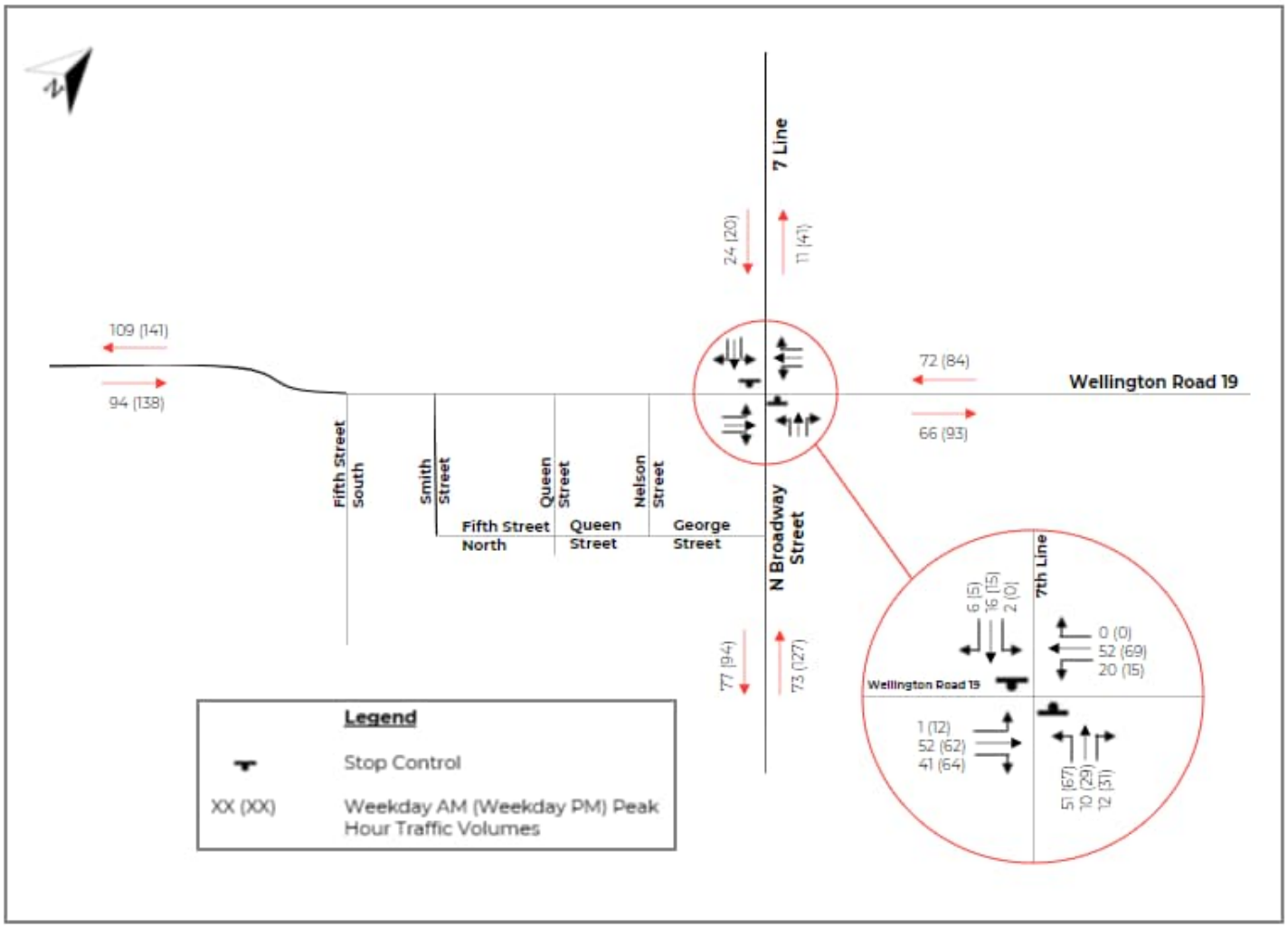


Figure 3. Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

During the Thursday, August 25, 2022 8-hour turning movement count, only one pedestrian was observed to cross at this intersection, crossing Wellington County Road 26 (the south leg of the intersection). The pedestrian crossed between 11:00AM and 11:15AM.

Peak hour truck volumes and peak hour cyclist volumes at the intersection of County Road 19 & 7th Line/County Road 26 during the August 25, 2022 count are summarized in Table 3.

As Table 3 indicates, some movements had relatively high heavy truck percentages during the peak hours, however since the total volumes are relatively low, the numbers of trucks are also low. The table also shows that the numbers of cyclists travelling through this intersection on this summer day were also low.

Table 3. 2022 Peak Hour Truck Percentages and Cyclist Turning Movement Volumes – County Road 19 & 7th Line/County Road 26

DATA	TIME PERIOD	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND		
		LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT
Truck %	AM Peak Hour	25%	2%	0%	2%	0%	0%	0%	12%	7%	0%	19%	17%
	PM Peak Hour	7%	7%	0%	7%	14%	10%	8%	6%	3%	0%	7%	0%
Bike Volume	AM Peak Hour	0	0	0	0	1	0	0	1	0	0	0	0
	PM Peak Hour	0	0	0	1	0	0	0	0	0	0	0	0

3.2 INTERSECTION CAPACITY ANALYSIS

Capacity analysis was conducted for the intersection of Wellington County Road 19 & 7th Line/Wellington County Road 26 based on the turning movement count data collected on Thursday, August 25, 2022. Synchro 11 software, based on Highway Capacity Analysis 6th Edition (published by the US Transportation Research Board National Research Council) methods, was the basis of the analysis.

The following intersection performance measures are reported: average delay, Level of Service (LOS) volume to capacity ratio (v/c)and 95th percentile queue lengths. Average delay is a weighted average for all vehicles making a specific movement during the analysis hour. Level of Service is based on the average delay per vehicle for a given movement or approach, with ranges of average delay assigned a letter between A and F.

Table 4 is a summary of the delay ranges for Level of Service for signalized and unsignalized intersections.

Table 4. Intersection Level of Service Criteria

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (SECONDS/VEHICLE)	
	SIGNALIZED INTERSECTION	UNSIGNALIZED INTERSECTION
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Wellington County Traffic Impact Study Guidelines (October 29, 2021) establish the following thresholds for critical movements:

- For signalized intersections:
  - Volume to Capacity (v/c) ratio for the overall intersection operation, through movements, or shared through/turn movements is greater than 0.85;
  - Volume to Capacity (v/c) ratio for a dedicated left or right turn movement is greater than 0.90; or
  - 95th percentile queues exceed available storage.
- For unsignalized intersections:
  - Overall intersection Level of Service is LOS E or F; or
  - 95th percentile queues exceed available storage.

Capacity analysis results for the intersection of existing peak hour conditions at Wellington Road 19 & 7th Line/Wellington Road 26 are summarized in Table 5.

As Table 5 indicates, all movements operate acceptably with Levels of Service are B or better for all movements and no critical performance measures.

Synchro reports for existing conditions are provided in Appendix C.

Field observations on Thursday July 21, 2022 that there are no existing operating problems at this intersection.

Table 5. Weekday Morning and Afternoon Peak Hour Capacity Analysis Results

INTERSECTION	TRAFFIC CONTROL	APPROACH	LANE GROUP	TIME OF DAY	PERFORMANCE MEASURES			
					VOLUME TO CAPACITY RATIO	AVERAGE DELAY (SECONDS PER VEHICLE)	LEVEL OF SERVICE	95TH PERCENTILE QUEUE LENGTH (METERS)
County Road 19 & Broadway Street/7th Line	Stop Control for Broadway Street/ 7th Line	Eastbound	Shared	AM Peak Hour	0.00	0.1	A	0.0
		Westbound	Shared		0.02	2.2	A	0.4
		Northbound	Shared		0.10	10.3	B	2.6
		Southbound	Shared		0.04	10.2	B	0.9
		Eastbound	Shared	PM Peak Hour	0.01	0.7	A	0.2
		Westbound	Shared		0.01	1.4	A	0.3
		Northbound	Shared		0.20	11.3	B	5.5
		Southbound	Shared		0.03	10.5	B	0.7

4 STUDY HORIZONS AND BACKGROUND TRAFFIC GROWTH

4.1 STUDY HORIZONS

The proposed development is expected to be built out by 2027. Traffic impacts for 2027 and 2032 have been evaluated.

4.2 BACKGROUND TRAFFIC GROWTH

A traffic volume growth rate of 2% per year has been assumed to forecast future background traffic volumes for the horizon years.

Future background traffic volumes are illustrated in Figures 3 and 4 for 2027 and 2032, respectively.

4.3 BACKGROUND DEVELOPMENT

On the site of the Fergus Golf Club, located approximately 5.7 kilometers west of the subject site in the southwest quadrant of the intersection of County Road 19 and Third Line, a residential development including 118 detached residential dwellings is proposed. A traffic impact study was prepared for this development in February 2022 by BA Group, and traffic forecast for this development has been considered in the future total volumes, assuming that all trip ends east of the proposed golf club residential development travel to County Road 19 and 7th Line/County Road 26. The study assumed build out of the proposed development by 2026.

Forecast trips for this background development are provided in Appendix D.

The assignment of these trips to the study area road network are illustrated in Figure 5.

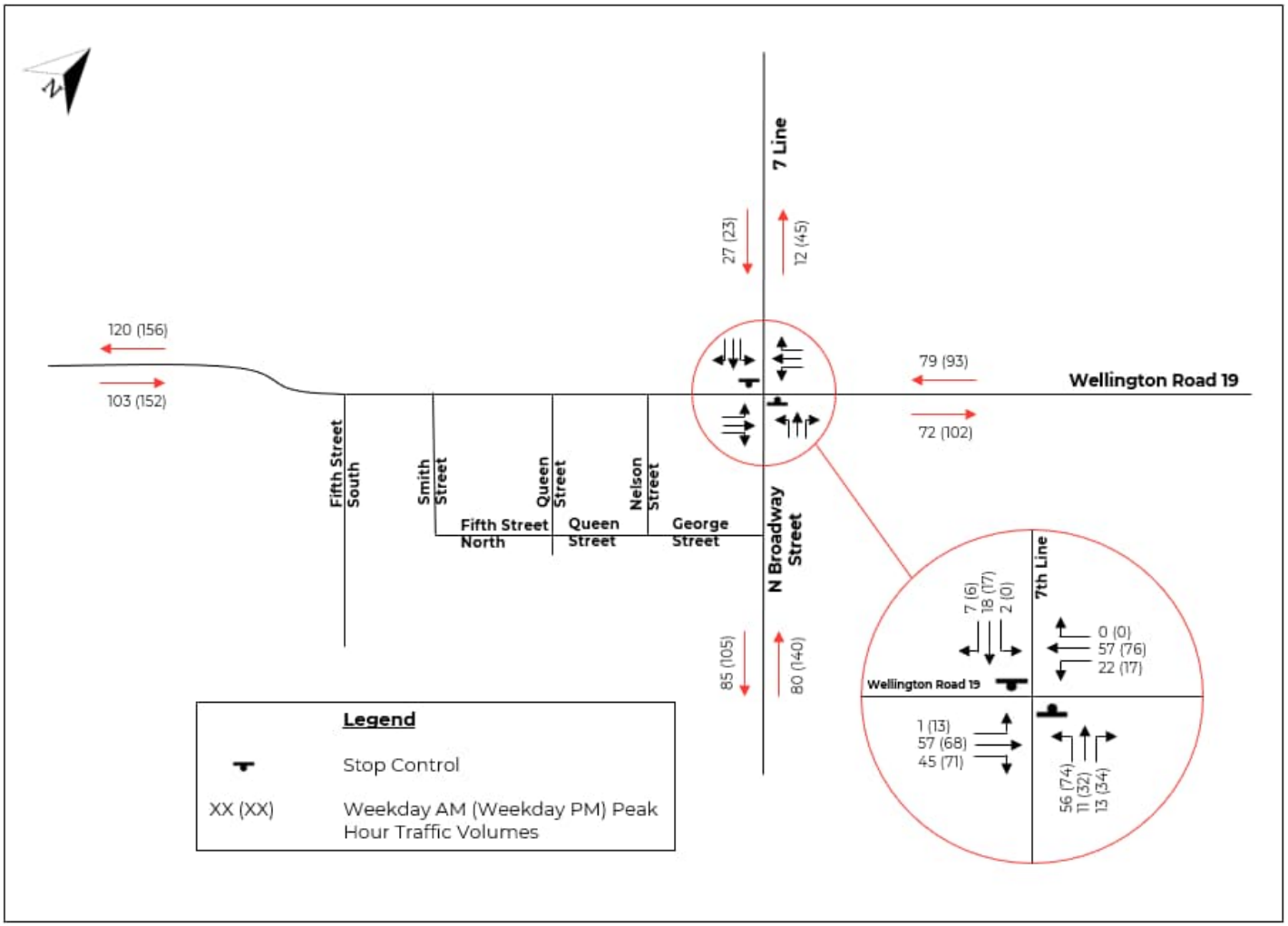


Figure 4 2027 Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

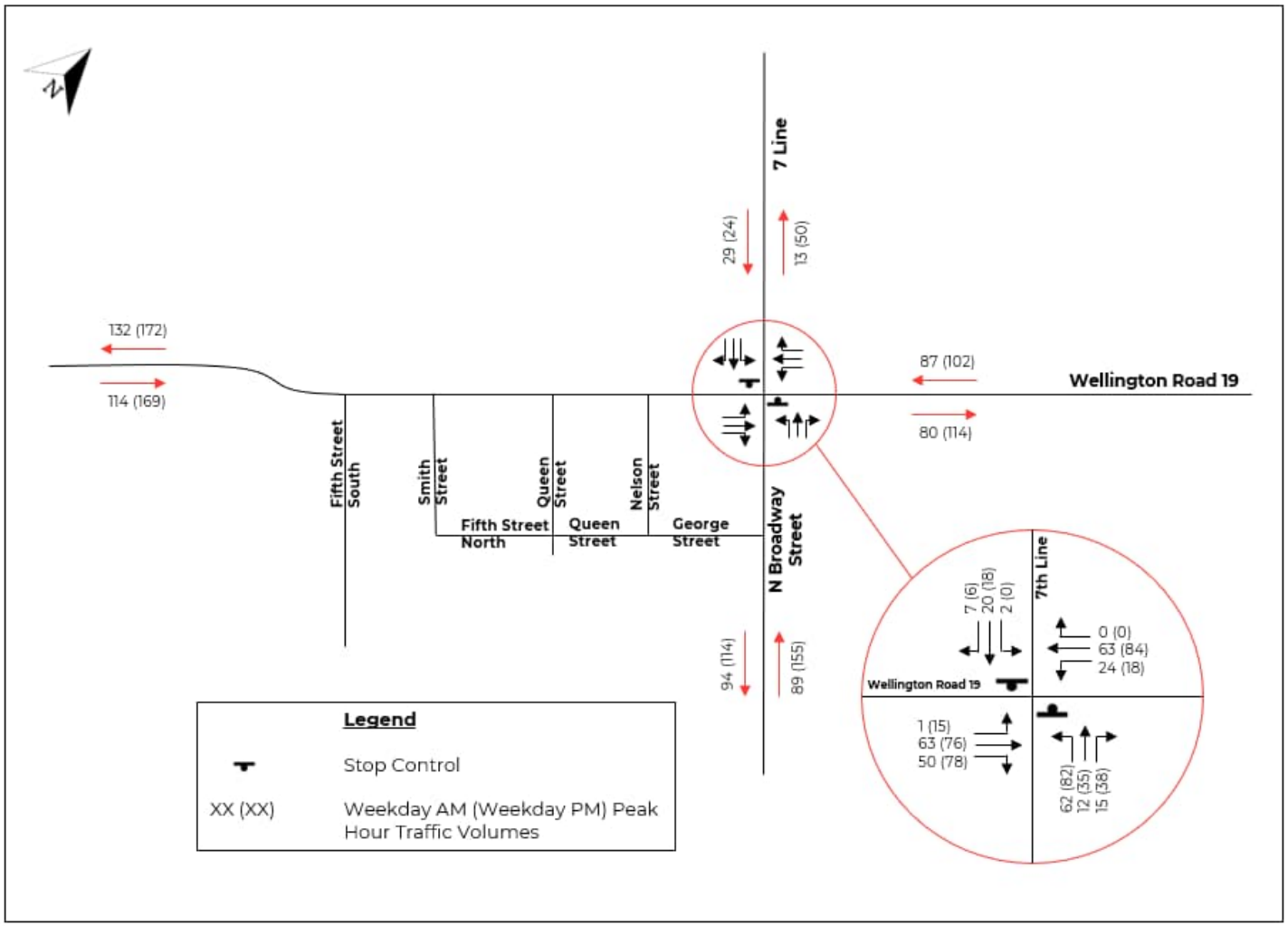


Figure 5. 2032 Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

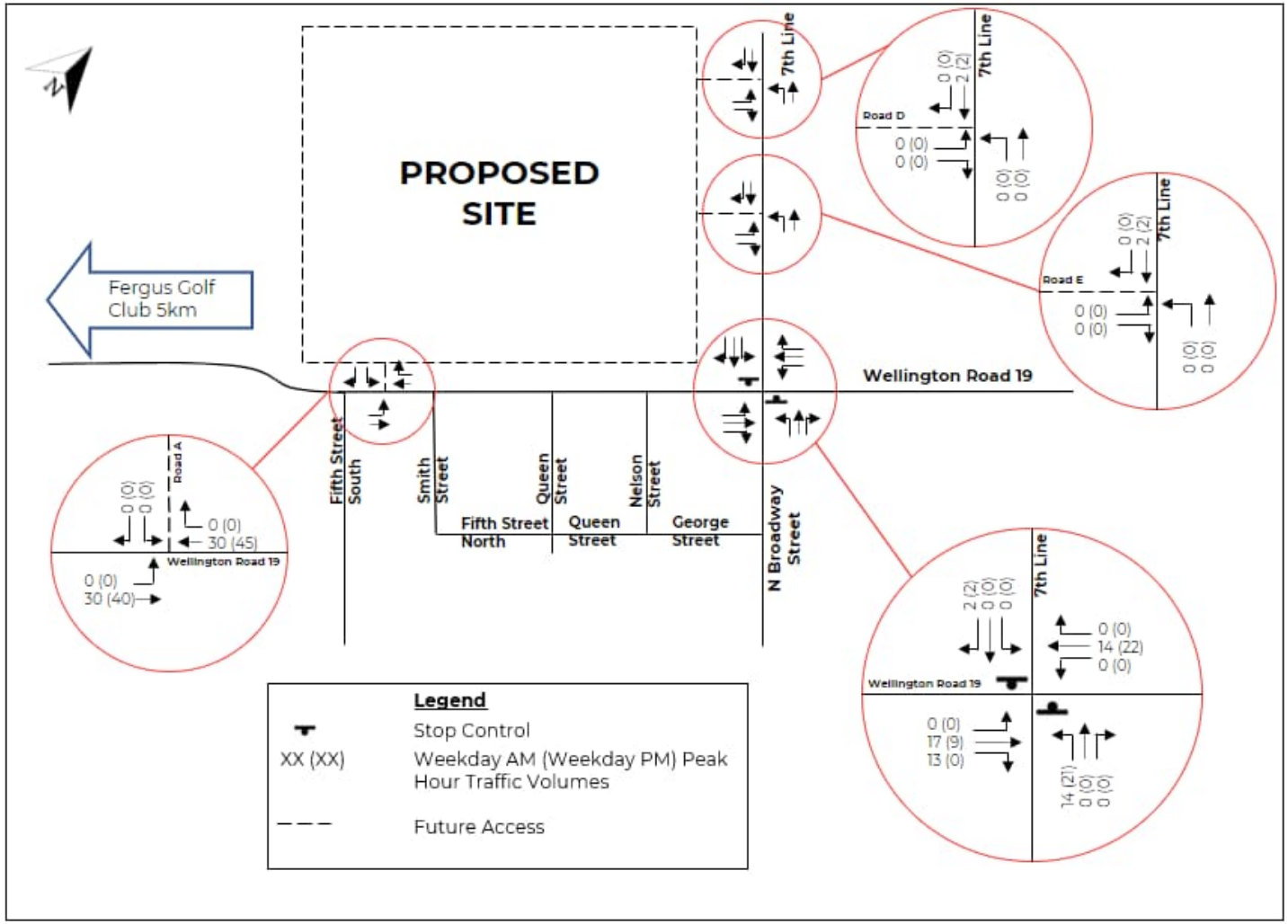


Figure 6. Fergus Golf Club Development Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

5 DEVELOPMENT RELATED TRAFFIC

5.1 TRIP GENERATION

Future traffic to and from the proposed subdivision was forecast based on the Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition. The Land Use Code for Single Family Detached Housing is a good match for the proposed development and was used for the trip generation.

To facilitate the route assignment step in the traffic forecast, trip generation for the 8 lots that will access the road network via Street F were calculated separately from the trips for the 100 lots with access to the road network via either Stret A or Street E.

Trip generation for the proposed development in summarized in Table 6.

Table 6. Trip Generation

ITE CODE	DESCRIPTION	UNIT	TIME OF DAY	QUANTITY	RATE	TOTAL TRIPS	INBOUND %	OUTBOUND %	INBOUND TRIPS	OUTBOUND TRIPS
210	Single Family Detached Housing – Road A/D	Dwelling Unit	AM peak hour	100	0.70	70*	25%	75%	18*	53*
210	Single Family Detached Housing – Road E	Dwelling Unit		8	0.70	6*	25%	75%	1*	4*
Subdivision Total				108		76			19	57
210	Single Family Detached Housing – Road A/D	Dwelling Unit	PM peak hour	100	0.94	94	63%	37%	59	35
210	Single Family Detached Housing – Road E	Dwelling Unit		8	0.94	8	63%	37%	5	3
Subdivision Total				108		102			64	38

* Note that variations between total trips and the sum of inbound and outbound trips are due to rounding. Differences are minor and do not affect findings and recommendations.

5.2 TRIP DISTRIBUTION AND NETWORK ASSIGNMENT

Traffic patterns from the August 2022 turning movement count at the intersection of Country Road 19 and 7th Line/County Road 26 were used as the basis for trip distribution for travel to and from the proposed subdivision.

Proportions of new trips traveling to and from each direction are summarized in Table 7.

Table 7. Trip Distribution

TO / FROM	AM		PM	
	In	Out	In	Out
North	9%	4%	5%	11%
East	27%	25%	23%	25%
South	28%	29%	34%	25%
West	36%	41%	37%	38%
TOTAL	100%	100%	100%	100%

For the 8 lots that will access the road network via Road E, drivers will use 7th Line to travel north, 7th Line and County Road 19 to travel east or west and 7th Line and North Broadway Street to travel south.

The following route assignment assumptions were made regarding route assignment for the remaining lots in the subdivision:

- 100% of trips to and from the north will be via the Road D access
- 100% of trips to and from the south will be via the Road D access
- For trips to and from County Road 19, 100% will be via Road A

Site generated trips are illustrated in Figure 6.

5.3 FUTURE TOTAL TRAFFIC VOLUMES

Future total traffic volumes, including the future background traffic, Fergus Golf Club redevelopment traffic and site traffic were calculated for 2027 and 2032.

Future total traffic volumes for 2027 are illustrated in Figure 7 and future total traffic volumes for 2032 are illustrated in Figure 7.

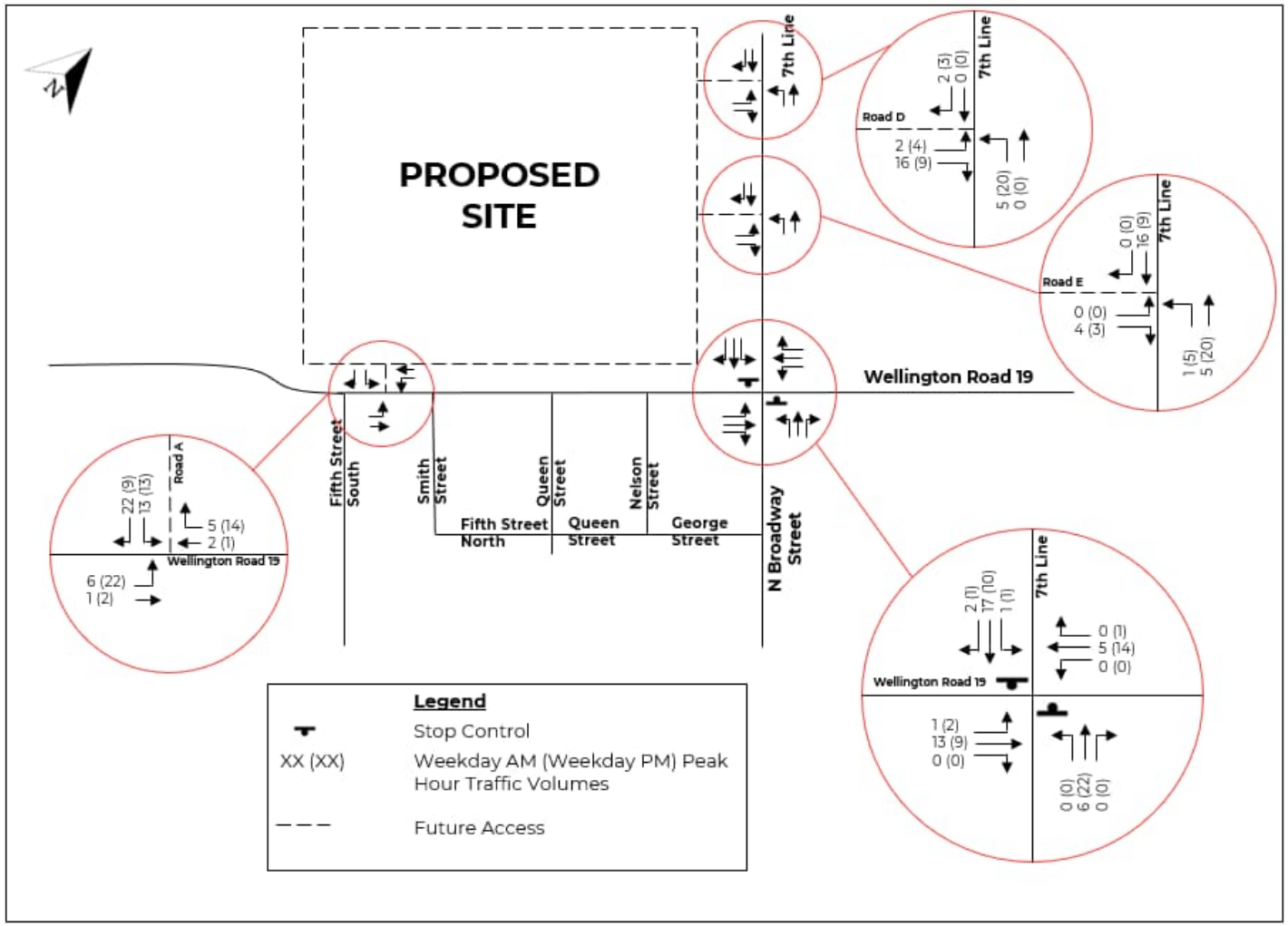


Figure 7. Site Generated Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

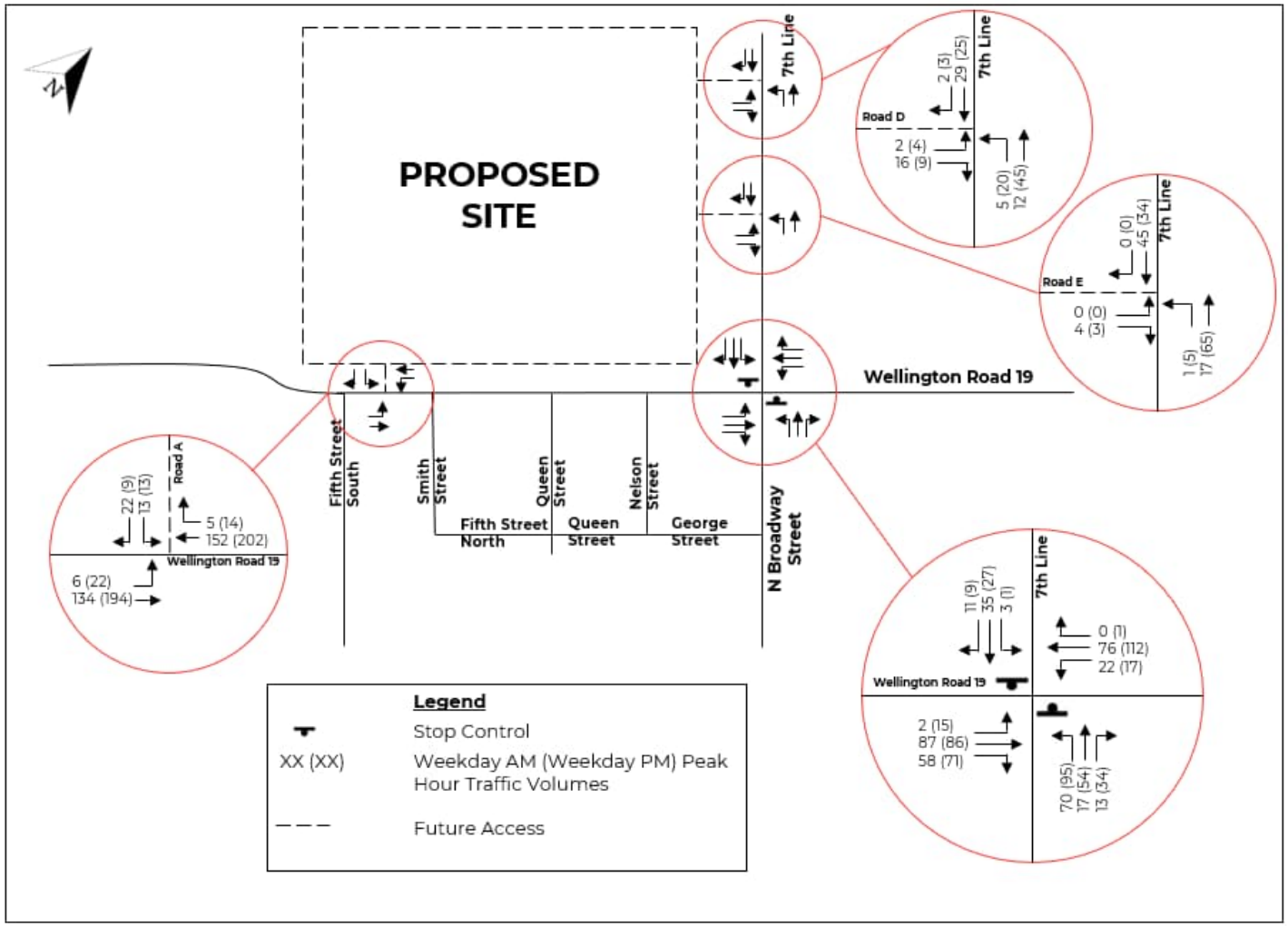


Figure 8. 2027 Total Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

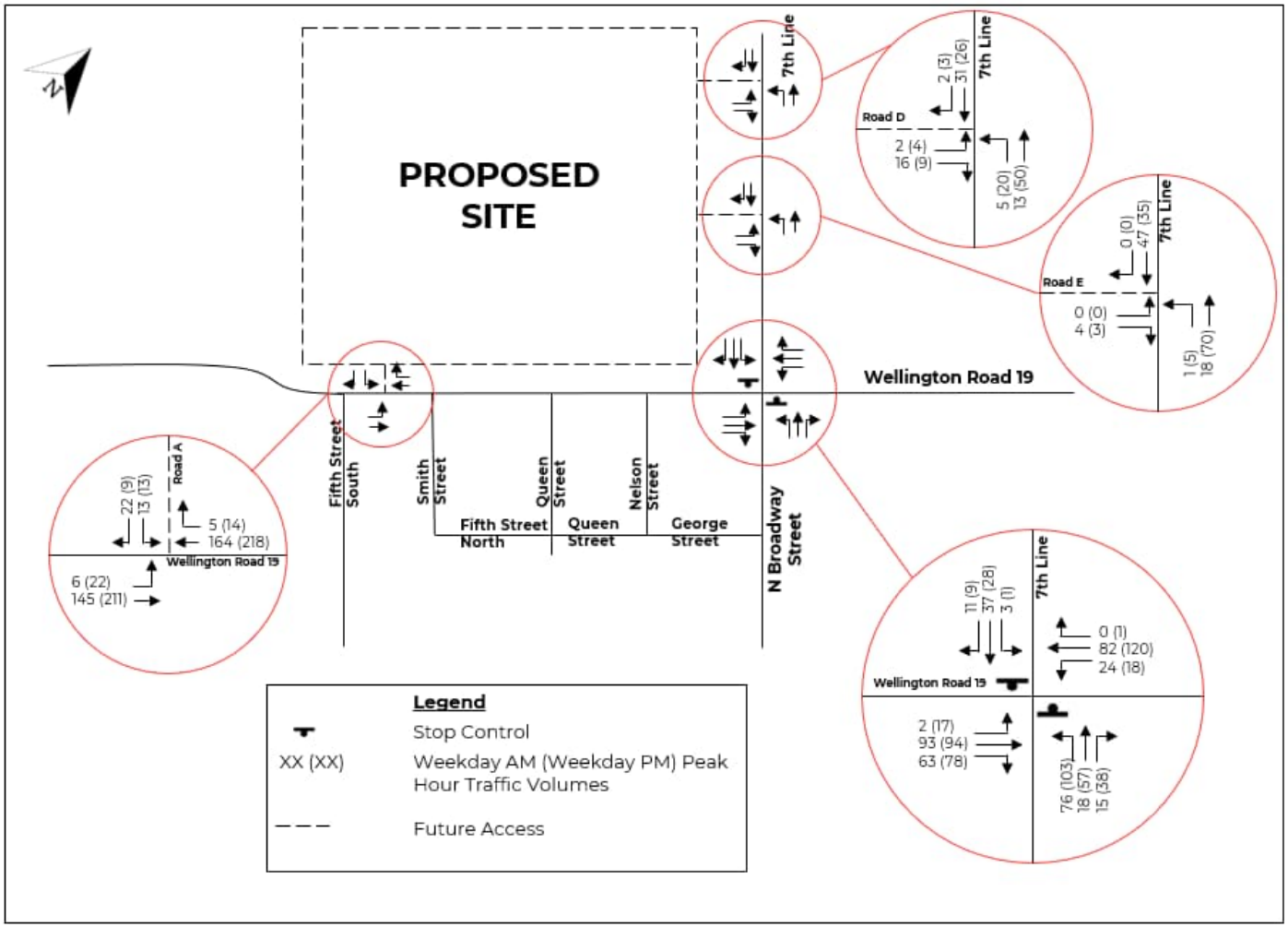


Figure 9. 2032 Total Weekday Morning and Weekday Afternoon Peak Hour Turning Movement Volumes

6 EVALUATION OF TRAFFIC IMPACTS

6.1 FUTURE INTERSECTION CAPACITY ANALYSIS

Capacity analysis was done for the intersection of County Road 19 & 7th Line/County Road 26 and the proposed intersections of County Road 19 & Road A, 7th Line & Road E and 7th Line & Road D.

Capacity analysis results are provided in Table 7 for 2027 and Table 8 for 2032.

Synchro reports are provided in Appendix E for 2027 and Appendix F for 2032.

As can be seen from Table 7 and Table 8, with forecast traffic volumes and existing lane configurations, all movements at the intersection of County Road 19 & 7th Line/County Road 26 and the proposed intersections of County Road 19 & Road A, 7th Line & Road E and 7th Line & Road D will operate acceptably, with Level of Service B or better for all movements. 95th percentile queue lengths will be less than one vehicle in length, with the longest 95th percentile queue length being 13.1 meters, for the northbound movement during the weekday afternoon peak hour for the intersection of County Road 19 & 7th Line/County Road 26.

Table 8. 2027 Total Weekday Morning and Afternoon Peak Hour Capacity Analysis Results

INTERSECTION	TRAFFIC CONTROL	APPROACH	LANE GROUP	TIME OF DAY	PERFORMANCE MEASURES			
					VOLUME TO CAPACITY RATIO	AVERAGE DELAY (SECONDS PER VEHICLE)	LEVEL OF SERVICE	95TH PERCENTILE QUEUE LENGTH (METERS)
County Road 19 & Broadway Street/7th Line	Stop Control for Broadway Street/ 7th Line	Eastbound	Shared	AM Peak Hour	0.00	0.1	A	0.0
		Westbound	Shared		0.02	1.9	A	0.4
		Northbound	Shared		0.17	11.7	B	4.6
		Southbound	Shared		0.08	11.2	B	2.1
		Eastbound	Shared	PM Peak Hour	0.01	0.7	A	0.3
		Westbound	Shared		0.01	1.1	A	0.3
		Northbound	Shared		0.33	13.9	B	11.0
		Southbound	Shared		0.07	11.4	B	1.6
County Road 19 & Proposed Road A	Stop Control for Road A	Eastbound	Shared	AM Peak Hour	0.00	0.4	A	0.1
		Westbound	Shared		0.10	0.0	A	0.0
		Southbound	Shared		0.05	9.8	A	1.2
		Eastbound	Shared	PM Peak Hour	0.02	0.9	A	0.4
		Westbound	Shared		0.14	0.0	A	0.0
		Southbound	Shared		0.04	11.0	B	0.9
7th Line & Proposed Road E	Stop Control for Road E	Eastbound	Shared	AM Peak Hour	0.00	8.5	A	0.1
		Northbound	Shared		0.00	0.4	A	0.0
		Southbound	Shared		0.03	0.0	A	0.0
		Eastbound	Shared	PM Peak Hour	0.00	8.5	A	0.1
		Northbound	Shared		0.00	0.5	A	0.1
		Southbound	Shared		0.02	0.0	A	0.0
7th Line & Proposed Road D	Stop Control for Road D	Eastbound	Shared	AM Peak Hour	0.02	8.6	A	0.4
		Northbound	Shared		0.00	2.0	A	0.1
		Southbound	Shared		0.02	0.0	A	0.0
		Eastbound	Shared	PM Peak Hour	0.01	8.7	A	0.3
		Northbound	Shared		0.01	2.3	A	0.3
		Southbound	Shared		0.02	0.0	A	0.0

Table 9. 2032 Total Weekday Morning and Afternoon Peak Hour Capacity Analysis Results

INTERSECTION	TRAFFIC CONTROL	APPROACH	LANE GROUP	TIME OF DAY	PERFORMANCE MEASURES			
					VOLUME TO CAPACITY RATIO	AVERAGE DELAY (SECONDS PER VEHICLE)	LEVEL OF SERVICE	95TH PERCENTILE QUEUE LENGTH (METERS)
County Road 19 & Broadway Street/7th Line	Stop Control for Broadway Street/ 7th Line	Eastbound	Shared	AM Peak Hour	0.00	0.1	A	0.0
		Westbound	Shared		0.02	1.9	A	0.5
		Northbound	Shared		0.19	12.1	B	5.3
		Southbound	Shared		0.09	11.4	B	2.2
		Eastbound	Shared	PM Peak Hour	0.01	0.8	A	0.3
		Westbound	Shared		0.01	1.1	A	0.3
		Northbound	Shared		0.37	14.9	B	13.1
		Southbound	Shared		0.07	11.7	B	1.7
County Road 19 & Proposed Road A	Stop Control for Road A	Eastbound	Shared	AM Peak Hour	0.01	0.4	A	0.1
		Westbound	Shared		0.11	0.0	A	0.0
		Southbound	Shared		0.05	9.9	A	1.2
		Eastbound	Shared	PM Peak Hour	0.02	0.9	A	0.4
		Westbound	Shared		0.15	0.0	A	0.0
		Southbound	Shared		0.04	11.3	B	1.0
7th Line & Proposed Road E	Stop Control for Road E	Eastbound	Shared	AM Peak Hour	0.00	8.6	A	0.1
		Northbound	Shared		0.00	0.4	A	0.0
		Southbound	Shared		0.03	0.0	A	0.0
		Eastbound	Shared	PM Peak Hour	0.00	8.5	A	0.1
		Northbound	Shared		0.00	0.5	A	0.1
		Southbound	Shared		0.02	0.0	A	0.0
7th Line & Proposed Road D	Stop Control for Road D	Eastbound	Shared	AM Peak Hour	0.02	8.6	A	0.4
		Northbound	Shared		0.00	1.9	A	0.1
		Southbound	Shared		0.02	1.0	A	0.0
		Eastbound	Shared	PM Peak Hour	0.01	8.7	A	0.3
		Northbound	Shared		0.01	2.2	A	0.3
		Southbound	Shared		0.02	0.0	A	0.0

7 ACCESS ANALYSIS

7.1 FUTURE LEFT TURN LANE WARRANT ANALYSIS

The need for left turn lanes on County Road 19 and 7th Line at the proposed accesses was evaluated based on Geometric Design Standards for Ontario Highways published by the MTO. This method considers the peak hour traffic volume approaching in each direction, the volume of left turns as a percentage of approaching vehicle volume and the design speed. These parameters are applied to monographs for a matching range of conditions and the need for and required length of a left turn lane is the result.

The input parameters based on 2032 forecast total traffic volumes for the analysis were determined and are summarized in Table 9.

Design speeds were conservatively assumed to be 20 kilometers per hour greater than the speed limits.

Based on this analysis, it was determined that left turn lanes are not required for any of the proposed access roads for the proposed subdivision.

Left turn lane warrant nomographs are included in Appendix G.

7.2 SIGHT DISTANCE ANALYSIS

Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads provides guidance on the sight distance required for drivers to safely turn from a stop at an intersection or stop when approaching a stop controlled intersection.

These requirements vary based on the design speed and grade for the uncontrolled road. Available sight distance was determined based on road centerline profiles and an assumed driver eye height of 1.05 meters and an assumed object height of 0.38 meters. Analysis was done using a conservative assumption that operating speeds will be the speed limit plus 20 km/h.

The analysis of required and available sight distance and available sight distance is summarized in the following series of tables:

- Table 10 for drivers approaching Road A via County Road 19
- Table 11 for drivers intending to turn from Road A onto County Road 19
- Table 12 for drivers approaching Road E via 7th Line
- Table 13 for drivers intending to turn from Road E onto 7th Line
- Table 14 for drivers approaching Road D via 7th Line
- Table 15 for drivers intending to turn from Road D onto 7th Line

Table 10. Input for 2032 Left Turn Lane Warrant Analysis

INTERSECTION	DESIGN SPEED (KM/H)	PEAK HOUR	LEFT TURN VOLUME (VEH/HR)	ADVANCING VOLUME (VEH/HR)	% LEFT TURNS	OPPOSING VOLUME (VEH/HR)
County Road 19 & Proposed Road A	70	AM	6	151	4%	164
		PM	22	233	9%	218
7th Line & Road E	100	AM	1	18	6%	37
		PM	5	70	7%	35
7th Line & Road D	100	AM	5	13	38%	31
		PM	20	50	40%	26

Table 11. Sight Distance Analysis approaching Road A via County Road 19

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	STOPPING SIGHT DISTANCE (DESIGN SPEED OF 70 KM/HR)		AVAILABLE SIGHT DISTANCE (M)	GRADE	COMMENT
				MINIMUM REQUIREMENT (M)	DESIRABLE DISTANCE (M)			
West of Road A, facing east	Eastbound through, approaching Road A	Road A	Stopped, before turning left/right onto County Road 19	110	275	245	-2%	Exceeds minimum requirement; approximately 30 metres less than desirable
East of Road A, facing west	Westbound through, approaching Road A	Road A	Stopped, before turning left/right onto County Road 19	100	275	>583	2%	Meets minimum and desirable

Table 12. Sight Distance Analysis Turning from Road A onto County Road 19

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	INTERSECTION SIGHT DISTANCE, RURAL ROADS (DESIGN SPEED OF 70 KM/HR)	AVAILABLE SIGHT DISTANCE (M)	COMMENT
Road A, facing south	Stopped, before turning right onto County Road 19	County Road 19, east of Road A	Westbound, approaching Road A	130	>583	Meets design requirement
Road A, facing south	Stopped, before turning left onto County Road 19	County Road 19, west of Street A	Eastbound, approaching Street A	150	227	Meets design requirement

Table 13. Sight Distance Analysis approaching Road E via 7th Line

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	STOPPING SIGHT DISTANCE (DESIGN SPEED OF 100 KM/HR)		AVAILABLE SIGHT DISTANCE (M)	GRADE	COMMENT
				TAC MINIMUM REQUIREMENT (M)	DESIRABLE DISTANCE (M)			
North of Road E, facing south	Southbound through, approaching Road E	Road E	Stopped, before turning left/right onto 7 Line	207	400	935	-6%	Meets minimum and desirable
South of Road E, facing north	Northbound through, approaching Road E	Road E	Stopped, before turning left/right onto 7 Line	N/A	N/A	147	2%	N/A since drivers are accelerating from a stop or 90° turn over 50 meters therefore cannot reach this speed. Available distance will be adequate to stop at speed achievable over 50 meters

Table 14. Sight Distance Analysis Turning from Road E onto 7th Line

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	INTERSECTION SIGHT DISTANCE, RURAL ROADS (DESIGN SPEED OF 100 KM/HR)	AVAILABLE SIGHT DISTANCE (M)	COMMENT
Road E, facing east	Stopped, before turning right onto 7 Line	7 Line, north of Road E	Southbound, approaching Road E	185	908	Meets design requirement
Road E, facing east	Stopped, before turning left onto 7 Line	7 Line, south of Road E	Northbound, approaching Road E	210	198	Meets design requirement

Table 15. Sight Distance Analysis approaching Road D via 7th Line

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	STOPPING SIGHT DISTANCE (DESIGN SPEED OF 100 KM/HR)		AVAILABLE SIGHT DISTANCE (M)	GRADE	COMMENT
				MINIMUM REQUIREMENT (M)	DESIRABLE DISTANCE (M)			
North of Road D, facing south	Southbound through, approaching Road D	Road D	Stopped, before turning left/right onto 7 Line	207	400	438	-6%	Meets minimum and desirable
South of Road D, facing north	Northbound through, approaching Road D	Road D	Stopped, before turning left/right onto 7 Line	174	400	520	3%	Meets minimum and desirable

Table 16. Sight Distance Analysis Turning from Road D onto 7th Line

DRIVER LOCATION	DRIVER MOVEMENT	APPROACHING VEHICLE LOCATION	APPROACHING VEHICLE MOVEMENT	INTERSECTION SIGHT DISTANCE, RURAL ROADS (DESIGN SPEED OF 100 KM/HR)	AVAILABLE SIGHT DISTANCE (M)	COMMENT
Road D, facing east	Stopped, before turning right onto 7 Line	7 Line, north of Road D	Southbound, approaching Road D	185	416	Meets design requirement
Road D, facing east	Stopped, before turning left onto 7 Line	7 Line, south of Road D	Northbound, approaching Road D	210	503	Meets design requirement

As the series of tables indicates, all desirable sight distances will be exceeded except for eastbound drivers on County Road 19 approaching Road A and northbound drivers on 7th Line approaching Road D.

For the eastbound drivers approaching Road A, the minimum sight distance of 110 meters is exceeded however the available sight distance is about 30 meters less than the desirable stopping sight distance for an operating speed of 70 km/h. At the speed limit of 50 km/h, both the minimum and desirable sight distances (66 meters and 195 meters, respectively) are exceeded. Since the desirable sight distance based on the speed limit is available, and since the available sight distance is more than double the minimum sight distance at the design speed, the proposed intersection of County Road 19 & Road A is expected to operate safely.

For the northbound approach to proposed Road E, drivers will have either turned from County Road 19 or stopped and then started at County Road 19, which is approximately 50 meters south of the access point, therefore their speed is expected to be low, significantly less than the speed limit of 80 km/h as they approach Road E. 146 meters of sight distance is available for northbound drivers, therefore approaching drivers will have sufficient time and distance to react to any turns from Road E.

Measurements of available sight distance based on centerline profiles are provided in Appendix H.

8 FINDINGS AND RECOMMENDATIONS

8.1 FINDINGS

Following are the findings from this study:

1. The stop-controlled intersection of County Road 19 & 7th Line/County Road 26 currently operates acceptably during peak hours, with all movements at Level of Service B or better, reserve capacity for all movements and short queues.
2. A residential subdivision including 108 detached housing units is proposed for the northwest quadrant of the intersection, with 2 accesses to 7th Line and 1 access to County Road 19. Build out of this subdivision is assumed to be 2027 for the purpose of the study.
3. The proposed subdivision is expected to generate 76 trip ends (19 inbound and 57 outbound) during the weekday morning peak hour and 102 trip ends (64 inbound and 38 outbound) during the weekday afternoon peak hour
4. Trips from a 118 unit residential development proposed to be built approximately 5.7 kilometers west of the subject site have been determined in a 2022 Traffic Impact Study and considered as background traffic for this study.
5. In addition, background traffic volume growth of 2% per year has been assumed for the study.
6. Based on total forecast traffic for 2027 and 2032, the MTO Geometric Design Standards for Ontario Highways left turn lane warrant method indicates that left turn lanes will not be warranted at the proposed new intersections of County Road 19 & Road A, 7th Line & Road E nor 7th Line & Road D.
7. Capacity analysis indicates that the proposed new intersections of County Road 19 & Road A, 7th Line & Road E nor 7th Line & Road D and the existing intersection of County Road 19 & 7th Line/County Road 26 will operate acceptably, with all movements at Level of Service B or better, reserve capacity for all movements and short queues.
8. There is rolling terrain along County Road 19 and 7th Line in the study area which limits available sight distance for the proposed intersections of County Road 19 & Road A, 7th Line & Road E nor 7th Line & Road D. However, based on TAC Geometric Design Guidelines for Canadian Roads, there will be sufficient sight distance for safe operation at these locations.

8.2 RECOMMENDATIONS

It is recommended that this study be considered in support of the application for this proposed subdivision.

APPENDIX

A

SCOPE CONFIRMATION CORRESPONDENCE

Fellows, Kari

From: Kooistra, Tim <tkooistra@dillon.ca>
Sent: Friday, July 29, 2022 2:40 PM
To: Fellows, Kari
Cc: Rob Stovel; Pasquale Costanzo; Soni, Darshan
Subject: Re: FW: Input for Traffic Study - Proposed Residential Subdivision in Belwood

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Kari,

Thanks for your email and I hope you are doing well. As you may be aware, Dillon Consulting Limited has been retained by the County of Wellington to review the proposed scope of work for traffic impact studies that may impact the County road network and associated intersections. As a result, this response is being provided on behalf of the County of Wellington for your consideration.

It should be noted that it would have been helpful to see a concept plan for this parcel in order to have a full understanding of future land use, the internal road network and as well as any proposed connections to the existing road network (Wellington Road 19 or 7th Line).

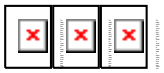
The scope you have identified is largely acceptable, noting the following needs to be considered:

- At this time, Wellington County is not requiring an assessment of collision history within this study. Should you need to obtain collision history at this location, please contact the Centre Wellington OPP Operations Centre at 519-846-5930.
- A 2.0% per annum growth rate (compounded annually) should be applied to any County road corridors.
- There is no anticipated posted speed limit changes along the Wellington Road 19 road corridors and it will remain at 50 km/h at this time.
- There are no recent turning movement counts available at the Wellington Road 19 and Wellington Road 26 intersection. As a result, a new TMC will need to be conducted at this intersection.
- The County TIS guidelines do refer to a number of references and you are correct that this references the 1993 MTO Roadside Safety Manual.

Thank you,

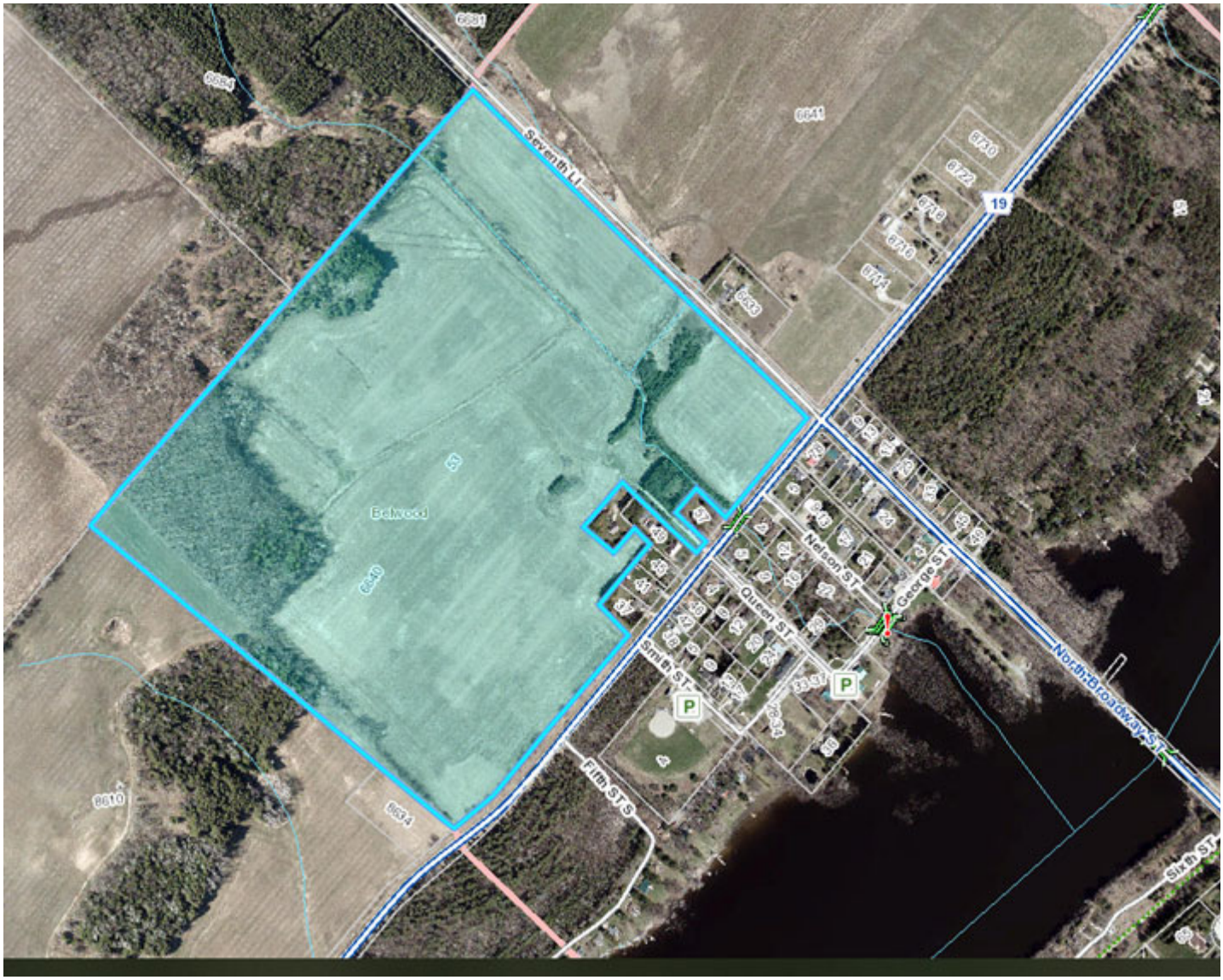
Tim

Tim Kooistra, C.E.T.
Dillon Consulting Limited
130 Dufferin Avenue Suite 1400
London, Ontario, N6A 5R2
T - 519.438.1288 ext. 1330
F - 519.672.8209
M - 519.851.5403
TKooistra@dillon.ca
www.dillon.ca



On Wed, Jul 27, 2022 at 9:02 AM Pasquale Costanzo <pasqualec@wellington.ca> wrote:

> Hi Tim,
>
> Could you review the TIS Scope below for a proposed subdivision in Belwood located in the Northwest corner of the intersection WR 19 and WR 26.
>
> If you have any questions please let me know.
>
> Take care



Pasquale Costanzo, C.E.T., CMMII Infrastructure Specialist

Technical Services Supervisor

County of Wellington, Roads Division

T 519.837.2601 x 2250

E pasqualec@wellington.ca

From: Fellows, Kari <kari.fellows@woodplc.com>
Sent: Friday, July 22, 2022 8:49 AM
To: Don Kudo <donk@wellington.ca>; Pasquale Costanzo <pasqualec@wellington.ca>
Cc: Rob Stovel <stovel.associates@outlook.com>; Soni, Darshan <darshan.soni@woodplc.com>
Subject: Input for Traffic Study - Proposed Residential Subdivision in Belwood

Hi Don & Pasquale –

I hope your week has gone well so far.

Wood is working with Stovel & Associates on a traffic impact study to support a subdivision application in Belwood. I am reaching out with a few questions about the road network in the study area, a request for any available data and to share our proposed scope for any comments or questions that your team has. I understand from Rob Stovel that you are the appropriate contacts, but please let me know if we should contact others at the County. We will also be contacting Wellington Centre for their comments and any input information since the proposed development abuts a Township road.

We would be happy to set up a short virtual meeting to discuss the scope and data if that would work best for you. Alternatively, we can correspond by e-mail. Details of the proposed development, proposed study scope and questions/data requested are below.

Please let me know if you would like to discuss, if you can provide any of the identified data and if you have comments on or questions about the proposed scope.

Thanks, Kari

Purpose of Study:

- Traffic impact assessment to support subdivision application for residential parcel in the NW quadrant of Wellington County Road 19 & 7th Line/Wellington County Road 26
- 70-100 lot subdivision – detached residential units
- Constructed in a single phase with anticipated build out in 10 years

Study Scope and Assumptions

- The study area will include the road segments of Wellington Road 19 and 7 Line abutting the proposed development and ~ 500 meters in either direction, and the intersection of Wellington Road 19 @ 7 Line.

- Collision data available from the County will be reviewed to determine any trends in collisions along the frontage of the site and at the intersection

- Available sight distance between the public roads and proposed subdivision access roads will be determined based on analysis of centre line profiles and field observations

- The study horizon will be full build out date + 5 years as per the requirements for Category A TIS in Table 1 of the TIS Guidelines.

- Wood will compare 2041 projected AADT volumes as per the Wellington County Road Master Action Plan appendix C to existing link volumes to derive a background growth rate. In the absence of sufficient data for analysis, a linear growth rate of 2% per annum will be proposed as per section 3.5 in the TIS guidelines.

- Wood proposes incorporating future background traffic due to the proposed residential development near the Fergus Golf Club can be incorporated based on the BA Group report Fergus Golf Club Proposed Residential Re-development Urban Transportation Considerations dated February 2022

- One existing intersection is to be analyzed – the unsignalized intersection of Wellington Road 19 @ 7 Line.

- Intersection capacity analysis for

- existing,

- future background 2032,

- future background 2037

- future background with site 2032 and

- future background with site 2037

- if indicated by capacity analysis problems, signal warrant analysis for

- existing,

- future background 2032,

- future background 2037

- future background with site 2032 and

- future background with site 2037

- Proposed accesses to subdivision will be analyzed

- Capacity analysis for

- future background with site 2032 and

- future background with site 2037

- And left turn lane analysis using nomographs based on the MTO Design Supplement to TAC Geometric Design Guidelines for

- future background with site 2032 and

- future background with site 2037

- Offsite improvements required to support existing, future background, future with development and future with development plus 5 years traffic volumes will be recommended.

Questions for County Staff

- The County TIS Guidelines list "Roadside Safety Manual" as a reference document in Section 2.2. Is this a County document or the MTO Roadside Safety Manual (1993, which was superseded by the Roadside Design Manual 2017)?

- The posted speed limit for Wellington Road 19 between Wellington Road 16 and 8746 Wellington Road 19 is to be increased from 50 km/hr to 60 km/hr as per Table 27 of the Road Master Action Plan. Is this still anticipated and if so, is there an anticipated date when this is to be in effect?

Data Requests for County Staff

- Any available turning movement count data (7+ hours, with peak AM and PM periods) for the unsignalized intersection of Wellington Road 19 @ 7 Line?

- If the count is a few years old, multiple years of counts will help us estimate a growth rate factor to generate 2022 volumes.

- Any available collision data for the last 5 complete years for the following locations? – to be used for reviewing safety considerations as per TIS Guidelines for the County.

- Wellington Road 19 @ 7 Line/Wellington County Road 26

- Wellington Road 19 @ Nelson Street

- Wellington Road 19 @ Queen Street

- Wellington Road 19 @ Smith Street

- Are there any other significant developments that will generate trips to be accounted for in this TIS (in addition to the Fergus Golf Course development noted above)?

- If any, an up to date TIS report, trip generation / distribution tables or figures will be helpful.

- Is a profile of Wellington Road 19 or elevation data / contour map available for the area around the intersection of Wellington Road 19 @ 7 Line.

Kari Fellows, P.Eng., PTOE, RSP[1]

Sr. Transportation Engineer | Project Manager

Southwest Ontario
C. 519.476.8507

kari.fellows@woodplc.com
www.woodplc.com

APPENDIX

B

TURNING MOVEMENT COUNT DATA

Wellington Road 19 @ Wellington Road 26

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:45:00
To: 8:45:00

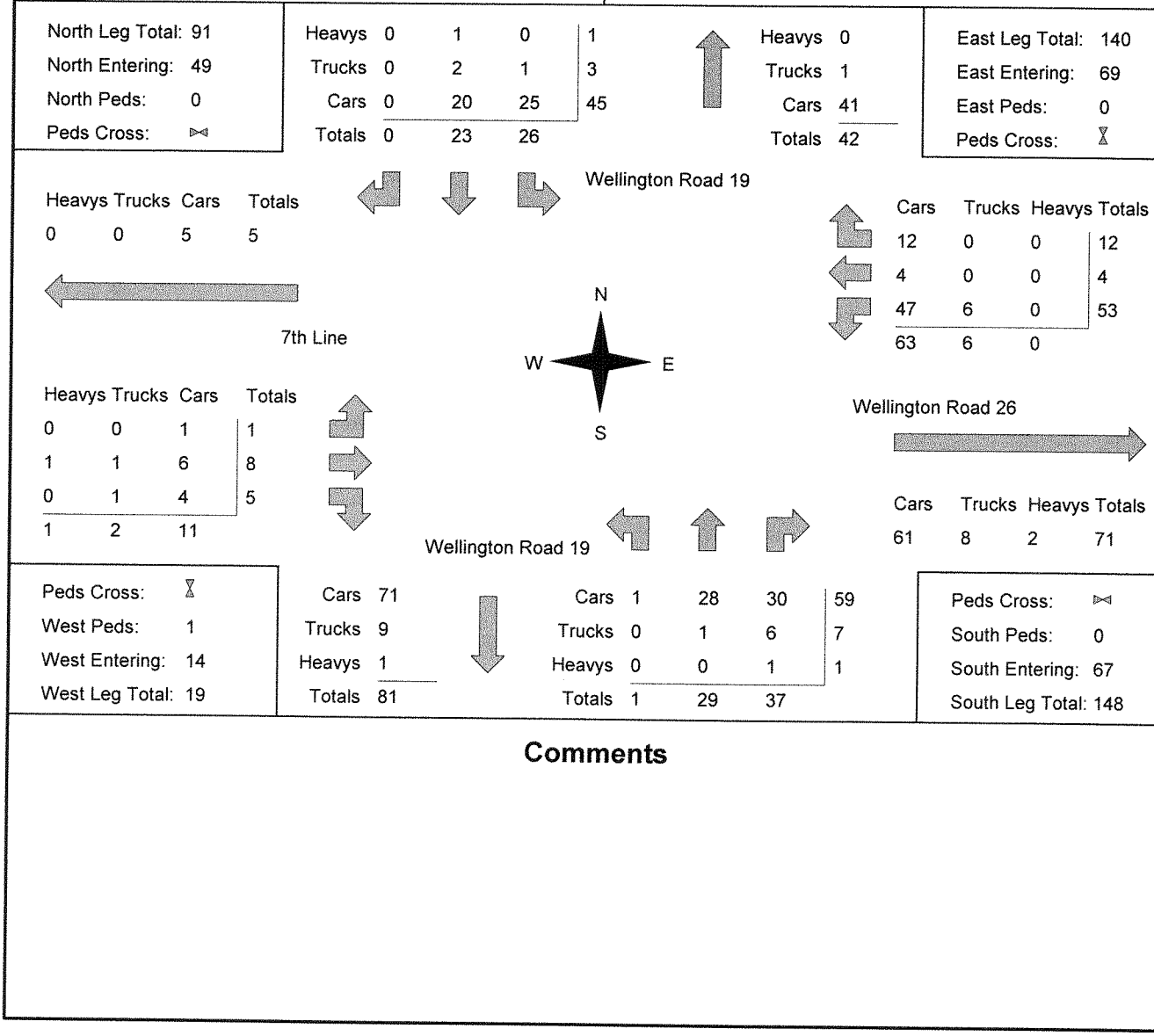
Municipality: Belwood
Site #: 0000002619
Intersection: Wellington Road 19 & Wellington Rc
TFR File #: 15
Count date: 28-Jun-12

Weather conditions:
Clear skies, sunshine

Person(s) who counted:
Rachel Wilson

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

Major Road: Wellington Road 19 runs N/S



Comments

Wellington Road 19 @ Wellington Road 26

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 17:30:00
To: 18:30:00

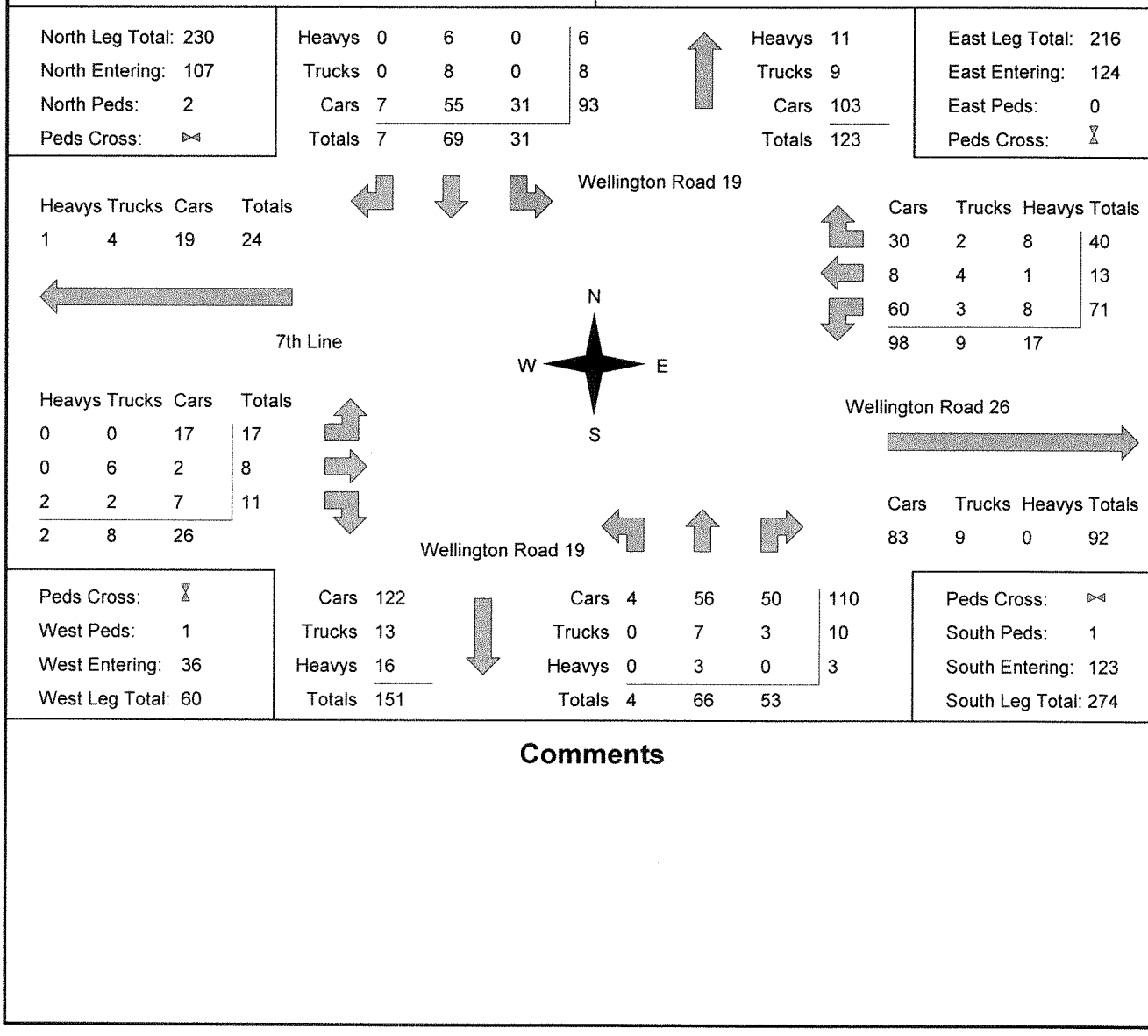
Municipality: Belwood
Site #: 0000002619
Intersection: Wellington Road 19 & Wellington Rc
TFR File #: 15
Count date: 28-Jun-12

Weather conditions:
Clear skies, sunshine

Person(s) who counted:
Rachel Wilson

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

Major Road: Wellington Road 19 runs N/S



Comments

Wellington Road 19 @ Wellington Road 26

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

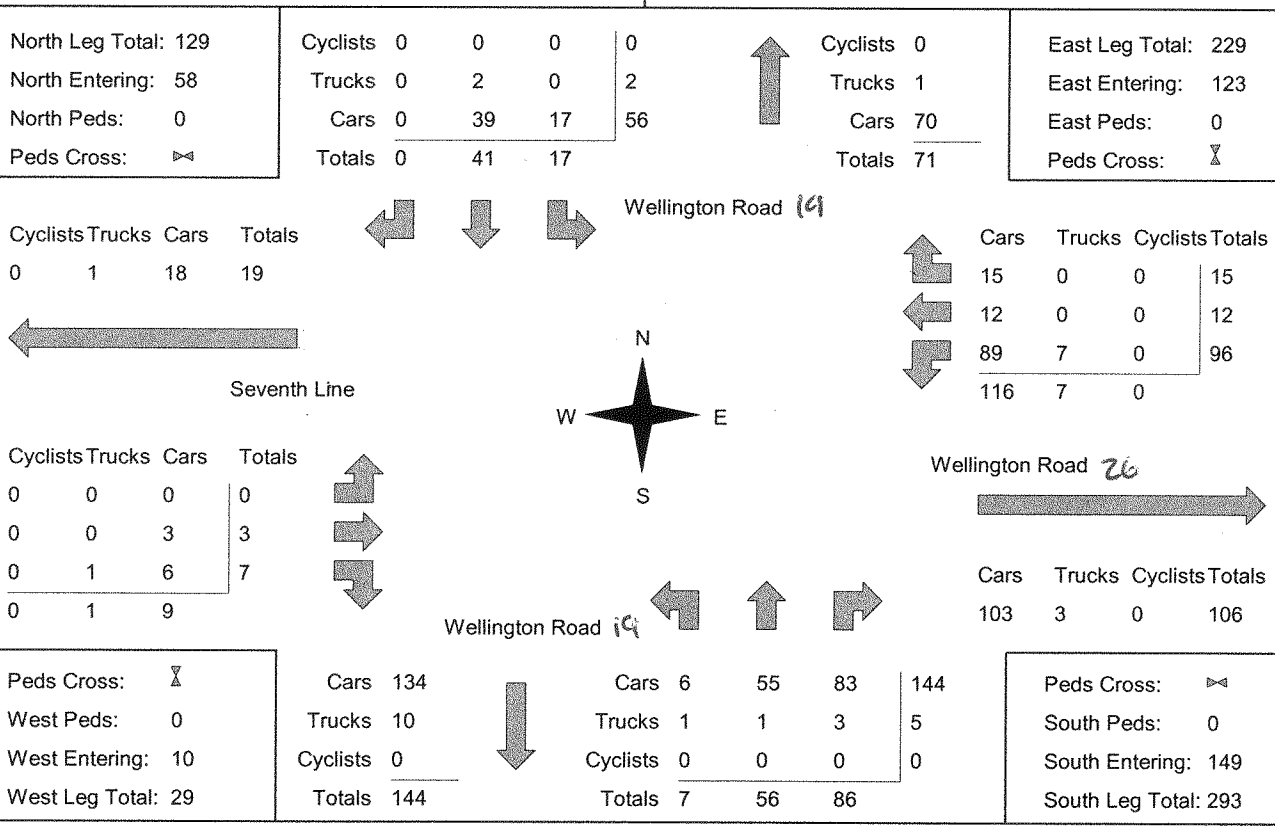
Municipality: Centre Wellington
Site #: 0000002619
Intersection: Wellington Road 19 & Wellington Rc
TFR File #: 11
Count date: 14-Jun-16

Weather conditions:
Overcast / Rainy / 21 Degrees

Person(s) who counted:
Connor Messner

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

Major Road: Wellington Road 19 runs N/S



Comments

- For large trucks travelling south bound on Wellington Road 26, it would be very difficult to stop downhill if lights were installed

Wellington Road 19 @ Wellington Road 26

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:15:00
To: 8:15:00

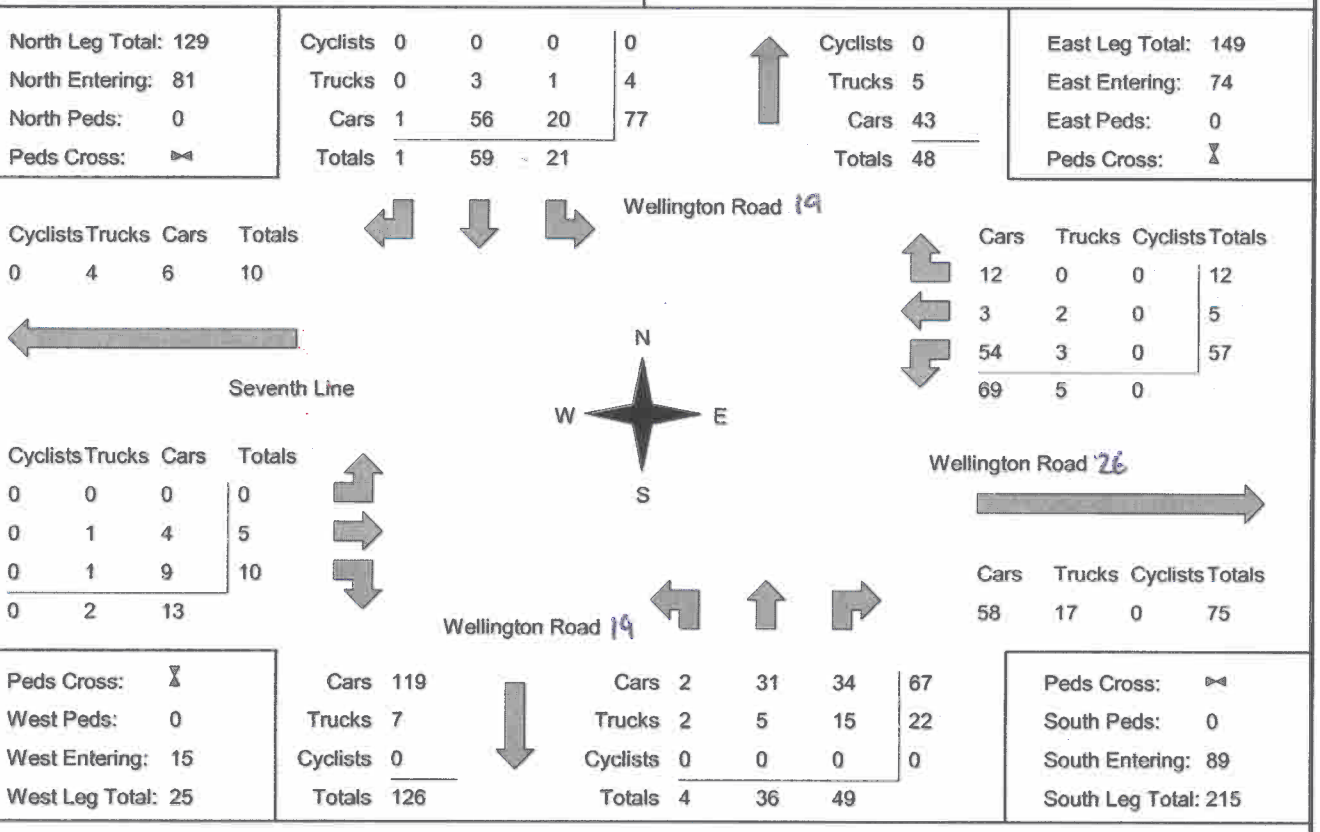
Municipality: Centre Wellington
Site #: 0000002619
Intersection: Wellington Road 19 & Wellington Rc
TFR File #: 11
Count date: 14-Jun-16

Weather conditions:
Overcast / Rainy / 21 Degrees

Person(s) who counted:
Connor Messner

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

Major Road: Wellington Road 19 runs N/S



Comments

- For large trucks travelling south bound on Wellington Road 26, it would be very difficult to stop downhill if lights were installed

WELLINGTON COUNTY TRAFFIC COUNT SUMMARY	
Intersection:	WR 19 @ WR 26
Site code:	00001926
Count date:	May 23, 2019
Counted by:	Jepson London

North approach:	**WR 19**				**N/S**	**South approach:**	**WR 19**			
Hour	Right	Thru	Left	Peds	**totals**	Hour	Right	Thru	Left	Peds
7:00	1	49	16	0	155	7:00	53	35	1	0
8:00	0	44	25	0	139	8:00	41	28	1	0
9:00	0	0	0	0	0	9:00	0	0	0	0
10:00	0	0	0	0	0	10:00	0	0	0	0
11:00	0	22	8	0	109	11:00	43	29	7	0
12:00	2	36	11	0	116	12:00	42	22	3	0
13:00	0	17	12	0	108	13:00	46	26	7	0
14:00	0	0	0	0	0	14:00	0	0	0	0
15:00	0	0	0	0	0	15:00	0	0	0	0
16:00	0	41	13	0	170	16:00	63	45	8	0
17:00	1	30	12	0	166	17:00	61	54	8	0
18:00	0	13	8	0	104	18:00	42	37	4	1
Totals	**4**	**252**	**105**	**0**		**Totals**	**391**	**276**	**39**	**1**

East approach:	**WR 26**				**E/W**	**West approach:**	**7th Line**			
Hour	Right	Thru	Left	Peds	**totals**	Hour	Right	Thru	Left	Peds
7:00	10	3	54	0	84	7:00	8	8	1	0
8:00	10	2	53	1	78	8:00	11	2	0	0
9:00	0	0	0	0	0	9:00	0	0	0	0
10:00	0	0	0	0	0	10:00	0	0	0	0
11:00	15	5	48	0	76	11:00	2	6	0	0
12:00	14	9	50	0	83	12:00	6	4	0	0
13:00	18	5	50	0	88	13:00	11	3	1	0
14:00	0	0	0	0	0	14:00	0	0	0	0
15:00	0	0	0	0	0	15:00	0	0	0	0
16:00	17	8	82	0	111	16:00	2	1	1	0
17:00	33	7	92	0	139	17:00	1	4	2	0
18:00	17	8	64	0	97	18:00	5	3	0	0
Totals	**134**	**47**	**493**	**1**		**Totals**	**46**	**31**	**5**	**0**

Wellington Rd 19 @ Seventh Line

Municipality: Wellington
Major Road: Wellington Rd 19
Minor Road: Seventh Line

Date: Aug 25, 2022

Major Road Runs: North/South
Weather Conditions: Cloudy/Wet
Person No. 1 Matt
Person No. 2

Period	North Approach										East Approach										South Approach										West Approach										Veh. Summary	
	Cars			Trucks			Bikes			Ped.	Cars			Trucks			Bikes			Ped.	Cars			Trucks			Bikes			Ped.	Cars			Trucks			Bikes			Ped.		
Ending	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Cross.	15	60
7:15	7	5	0	1	3	0	0	0	0	0	3	4	5	0	0	0	0	0	0	0	3	15	10	0	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	61	
7:30	5	11	0	0	0	0	0	0	0	0	5	2	5	0	2	0	0	0	0	0	0	14	5	0	0	0	0	0	0	0	0	4	1	0	0	1	0	0	0	0	55	
7:45	5	13	0	0	1	0	0	0	0	0	7	1	0	0	0	0	0	0	0	0	0	12	11	0	1	0	0	0	0	0	0	7	2	0	1	0	0	0	0	0	61	
8:00	6	14	0	2	0	0	0	0	0	0	12	2	4	0	0	0	0	1	0	0	0	9	14	0	2	2	0	1	0	0	2	3	1	0	1	0	0	0	0	0	76	253
8:15	1	10	0	2	0	0	0	0	0	0	17	5	5	1	0	0	0	0	0	0	0	14	5	0	2	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	66	258
8:30	3	14	0	1	0	0	0	0	0	0	14	2	3	0	0	0	0	0	0	0	1	11	8	0	1	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	62	265
8:45	5	10	0	0	0	0	0	0	0	0	6	2	1	0	1	0	0	0	0	0	0	14	10	0	0	2	0	0	1	0	0	3	1	0	0	0	0	0	0	0	56	260
9:00	3	3	0	0	0	0	0	0	0	0	11	0	7	0	0	1	0	0	1	0	0	6	4	0	1	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	42	226
11:15	6	11	0	0	2	0	0	0	0	0	8	4	2	0	0	0	0	0	0	1	0	8	8	1	4	2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	58	
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11:45	5	9	0	0	1	0	0	0	0	0	10	2	4	0	1	4	0	0	0	0	1	6	11	0	1	1	0	0	0	0	0	3	6	0	1	0	0	0	0	0	66	
12:00	3	8	0	1	4	0	0	0	0	0	9	5	3	0	0	1	0	0	0	0	1	5	12	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	56	237
12:15	2	11	0	1	1	0	0	0	0	0	11	2	3	0	0	0	0	0	0	0	3	8	12	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	57	236
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12:45	9	12	0	0	2	0	0	0	0	0	15	5	2	0	0	0	0	0	0	0	0	13	12	0	1	0	0	0	0	0	0	4	1	0	1	1	0	0	0	0	78	247
13:00	7	8	0	0	1	0	0	0	0	0	8	3	2	0	0	1	0	0	0	0	0	9	6	1	3	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	56	247
13:15	5	8	0	0	1	0	0	0	0	0	11	2	4	0	0	0	0	0	0	0	1	5	14	0	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	55	245
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13:45	3	11	0	1	2	0	0	0	0	0	9	2	3	0	0	0	0	0	0	0	2	10	11	1	0	2	0	0	0	0	0	3	3	0	0	0	0	0	0	0	63	243
14:00	4	7	0	2	2	0	0	0	0	0	5	2	7	0	1	0	0	0	0	0	2	9	11	0	3	1	0	0	1	0	0	3	0	0	1	0	0	0	0	0	61	248
15:15	7	17	0	1	0	0	0	0	0	0	12	4	2	3	3	1	0	0	0	0	1	13	11	0	1	6	0	0	0	0	0	7	1	0	1	0	0	0	0	0	91	
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16:00	2	12	1	0	1	0	0	0	0	0	12	10	6	0	0	1	0	0	0	0	1	22	11	0	1	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	85	335
16:15	5	23	0	1	2	0	0	0	0	0	12	4	7	3	0	2	1	0	0	0	2	12	11	0	1	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	90	334
16:30	2	15	0	0	1	0	0	0	0	0	18	5	4	0	3	0	0	0	0	0	1	14	17	1	0	1	0	0	0	0	0	5	1	0	0	0	0	0	0	0	88	348
16:45	3	13	0	0	1	0	0	0	0	0	15	6	6	1	1	1	0	0	0	0	2	15	19	0	2	1	0	0	0	0	0	3	1	0	0	0	0	0	0	0	90	353
17:00	4	13	0	0	1	0	0	0	0	0	17	10	11	1	0	0	0	0	0	0	6	17	15	0	1	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	102	370
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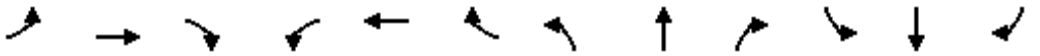
17:30	2	16	0	0	1	0	0	0	0	0	9	10	4	0	0	0	0	0	0	0	2	14	17	1	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	80	350
17:45	6	15	0	0	0	0	0	0	0	0	14	5	3	0	0	3	0	0	0	0	3	18	9	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	82	342
18:00	3	11	0	0	0	0	0	0	0	0	26	10	9	1	1	0	0	0	0	0	0	7	7	0	0	0	0	0	0	0	0	4	1	0	0	1	0	0	0	0	81	321

APPENDIX

C

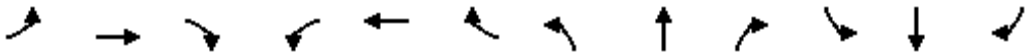
SYNCHRO REPORTS – EXISTING CONDITIONS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	52	41	20	52	0	51	10	12	2	16	6
Future Volume (Veh/h)	1	52	41	20	52	0	51	10	12	2	16	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	57	45	22	57	0	55	11	13	2	17	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	57			102			198	182	80	201	205	57
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	57			102			198	182	80	201	205	57
tC, single (s)	4.1			4.3			7.1	6.5	6.2	7.1	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.4			3.5	4.0	3.3	3.5	4.2	3.5
p0 queue free %	100			98			92	98	99	100	97	99
cM capacity (veh/h)	1560			1358			731	703	986	733	651	969

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	103	79	79	26
Volume Left	1	22	55	2
Volume Right	45	0	13	7
cSH	1560	1358	759	721
Volume to Capacity	0.00	0.02	0.10	0.04
Queue Length 95th (m)	0.0	0.4	2.6	0.9
Control Delay (s)	0.1	2.2	10.3	10.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	2.2	10.3	10.2
Approach LOS			B	B

Intersection Summary				
Average Delay	4.4			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	62	64	15	69	0	67	29	31	0	15	5
Future Volume (Veh/h)	12	62	64	15	69	0	67	29	31	0	15	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	67	70	16	75	0	73	32	34	0	16	5
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	75			137			248	235	102	285	270	75
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	75			137			248	235	102	285	270	75
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.1	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.5	4.1	3.3
p0 queue free %	99			99			89	95	96	100	97	99
cM capacity (veh/h)	1487			1417			668	632	932	612	615	992

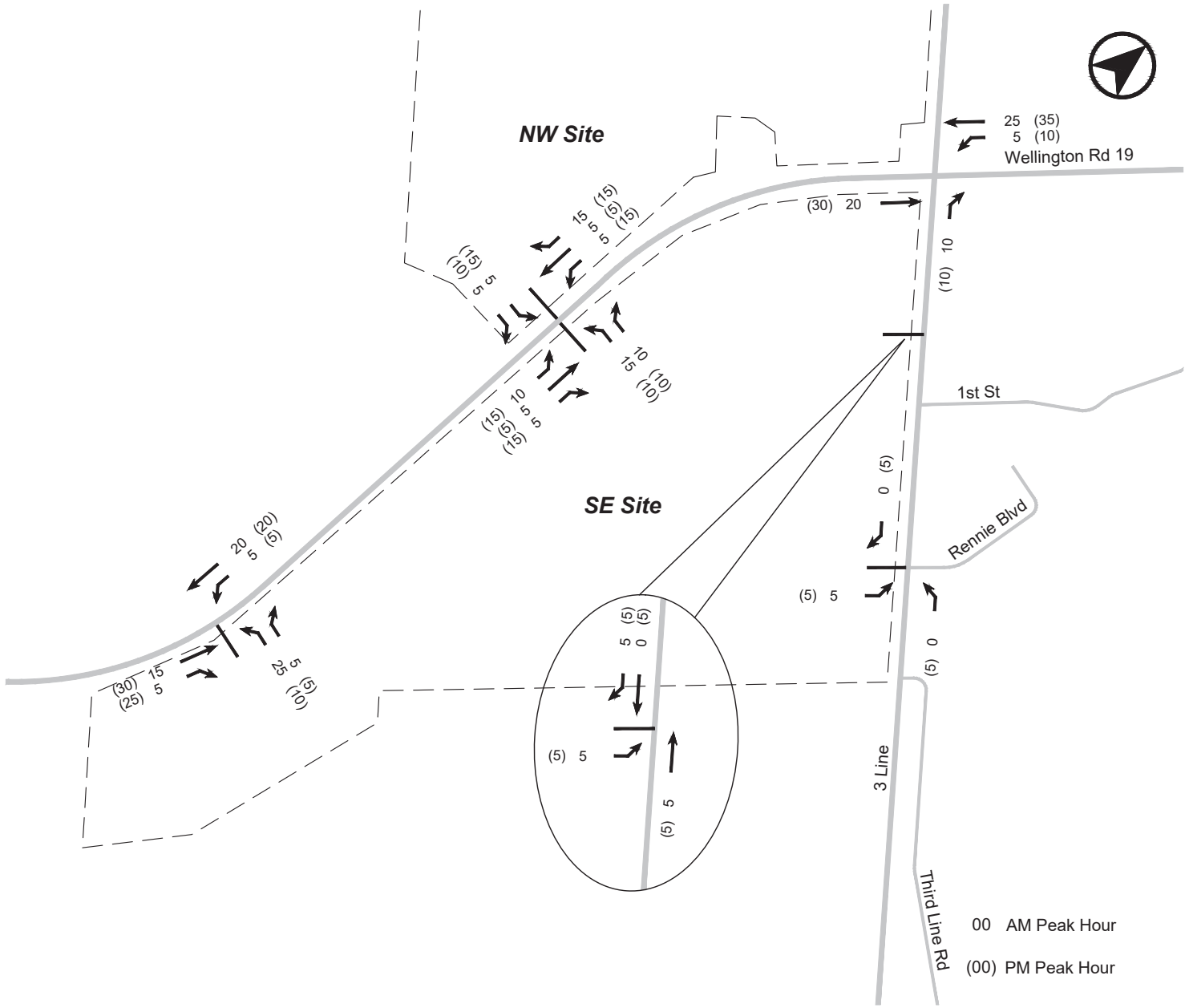
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	150	91	139	21
Volume Left	13	16	73	0
Volume Right	70	0	34	5
cSH	1487	1417	708	677
Volume to Capacity	0.01	0.01	0.20	0.03
Queue Length 95th (m)	0.2	0.3	5.5	0.7
Control Delay (s)	0.7	1.4	11.3	10.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.7	1.4	11.3	10.5
Approach LOS			B	B

Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	29.4%	ICU Level of Service	A	
Analysis Period (min)	15			

APPENDIX

D

FORECAST TRIPS – FERGUS GOLF CLUB RESIDENTIAL DEVELOPMENT



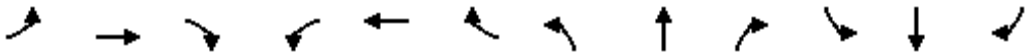
Date Plotted: February 9, 2022 Filename: P:\68\60\39\Graphics\CAD\Fig13-05-ST.dwg

FIGURE 13 SITE TRAFFIC VOLUMES

APPENDIX

E

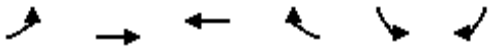
SYNCHRO REPORTS – 2027 TOTAL VOLUMES



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	87	58	22	76	0	70	17	13	3	35	11
Future Volume (Veh/h)	2	87	58	22	76	0	70	17	13	3	35	11
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	95	63	24	83	0	76	18	14	3	38	12
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	83			158			292	262	126	284	293	83
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	83			158			292	262	126	284	293	83
tC, single (s)	4.1			4.3			7.1	6.5	6.2	7.1	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.4			3.5	4.0	3.3	3.5	4.2	3.5
p0 queue free %	100			98			88	97	98	100	93	99
cM capacity (veh/h)	1527			1293			609	634	929	638	579	936

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	160	107	108	53
Volume Left	2	24	76	3
Volume Right	63	0	14	12
cSH	1527	1293	642	637
Volume to Capacity	0.00	0.02	0.17	0.08
Queue Length 95th (m)	0.0	0.4	4.6	2.1
Control Delay (s)	0.1	1.9	11.7	11.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	1.9	11.7	11.2
Approach LOS			B	B

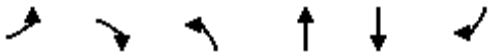
Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	35.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	134	152	5	13	22
Future Volume (Veh/h)	6	134	152	5	13	22
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	146	165	5	14	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	170				328	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	170				328	168
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				98	97
cM capacity (veh/h)	1407				663	877

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	153	170	38
Volume Left	7	0	14
Volume Right	0	5	24
cSH	1407	1700	784
Volume to Capacity	0.00	0.10	0.05
Queue Length 95th (m)	0.1	0.0	1.2
Control Delay (s)	0.4	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	0.4	0.0	9.8
Approach LOS			A

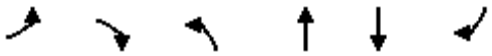
Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	4	1	17	45	0
Future Volume (Veh/h)	0	4	1	17	45	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	1	18	49	0
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	69	49	49			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	69	49	49			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	935	1020	1558			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	19	49
Volume Left	0	1	0
Volume Right	4	0	0
cSH	1020	1558	1700
Volume to Capacity	0.00	0.00	0.03
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	8.5	0.4	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	0.4	0.0
Approach LOS	A		

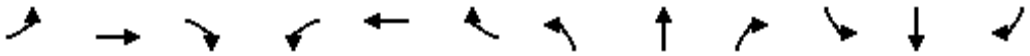
Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	16	5	12	29	2
Future Volume (Veh/h)	2	16	5	12	29	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	17	5	13	32	2
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	56	33	34			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	56	33	34			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	949	1041	1578			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	19	18	34
Volume Left	2	5	0
Volume Right	17	0	2
cSH	1030	1578	1700
Volume to Capacity	0.02	0.00	0.02
Queue Length 95th (m)	0.4	0.1	0.0
Control Delay (s)	8.6	2.0	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	2.0	0.0
Approach LOS	A		

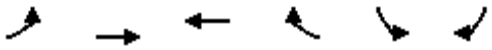
Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	15.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	86	71	17	112	1	95	54	34	1	27	9
Future Volume (Veh/h)	15	86	71	17	112	1	95	54	34	1	27	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	93	77	18	122	1	103	59	37	1	29	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	123			170			346	322	132	388	360	122
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	123			170			346	322	132	388	360	122
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.1	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.5	4.1	3.3
p0 queue free %	99			99			82	89	96	100	95	99
cM capacity (veh/h)	1428			1378			558	562	897	497	545	934

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	186	141	199	40
Volume Left	16	18	103	1
Volume Right	77	1	37	10
cSH	1428	1378	601	607
Volume to Capacity	0.01	0.01	0.33	0.07
Queue Length 95th (m)	0.3	0.3	11.0	1.6
Control Delay (s)	0.7	1.1	13.9	11.4
Lane LOS	A	A	B	B
Approach Delay (s)	0.7	1.1	13.9	11.4
Approach LOS			B	B

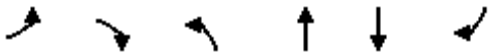
Intersection Summary				
Average Delay	6.2			
Intersection Capacity Utilization	35.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	22	194	202	14	13	9
Future Volume (Veh/h)	22	194	202	14	13	9
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)	24	211	220	15	14	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	235				486	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	235				486	228
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	99
cM capacity (veh/h)	1332				530	812

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	235	235	24
Volume Left	24	0	14
Volume Right	0	15	10
cSH	1332	1700	620
Volume to Capacity	0.02	0.14	0.04
Queue Length 95th (m)	0.4	0.0	0.9
Control Delay (s)	0.9	0.0	11.0
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.0
Approach LOS			B

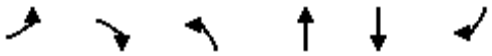
Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	3	5	65	34	0
Future Volume (Veh/h)	0	3	5	65	34	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	5	71	37	0
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	118	37	37			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	118	37	37			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	875	1035	1574			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	3	76	37
Volume Left	0	5	0
Volume Right	3	0	0
cSH	1035	1574	1700
Volume to Capacity	0.00	0.00	0.02
Queue Length 95th (m)	0.1	0.1	0.0
Control Delay (s)	8.5	0.5	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	0.5	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	4	9	20	45	25	3
Future Volume (Veh/h)	4	9	20	45	25	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	10	22	49	27	3
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	122	28	30			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122	28	30			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	862	1046	1583			

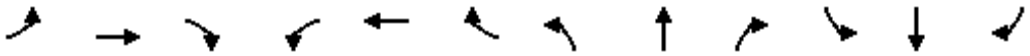
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	14	71	30
Volume Left	4	22	0
Volume Right	10	0	3
cSH	986	1583	1700
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (m)	0.3	0.3	0.0
Control Delay (s)	8.7	2.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	2.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX

F

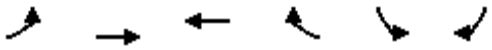
SYNCHRO REPORTS – 2032 TOTAL VOLUMES



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	93	63	24	82	0	76	18	15	3	37	11
Future Volume (Veh/h)	2	93	63	24	82	0	76	18	15	3	37	11
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	101	68	26	89	0	83	20	16	3	40	12
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	89			169			312	280	135	306	314	89
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	89			169			312	280	135	306	314	89
tC, single (s)	4.1			4.3			7.1	6.5	6.2	7.1	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.4			3.5	4.0	3.3	3.5	4.2	3.5
p0 queue free %	100			98			86	97	98	100	93	99
cM capacity (veh/h)	1519			1281			588	618	919	613	562	929

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	171	115	119	55
Volume Left	2	26	83	3
Volume Right	68	0	16	12
cSH	1519	1281	623	618
Volume to Capacity	0.00	0.02	0.19	0.09
Queue Length 95th (m)	0.0	0.5	5.3	2.2
Control Delay (s)	0.1	1.9	12.1	11.4
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	1.9	12.1	11.4
Approach LOS			B	B

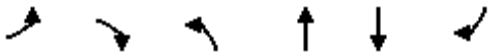
Intersection Summary				
Average Delay	5.0			
Intersection Capacity Utilization	37.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	145	164	5	13	22
Future Volume (Veh/h)	6	145	164	5	13	22
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	158	178	5	14	24
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	183				352	180
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	183				352	180
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				98	97
cM capacity (veh/h)	1392				642	862

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	165	183	38
Volume Left	7	0	14
Volume Right	0	5	24
cSH	1392	1700	765
Volume to Capacity	0.01	0.11	0.05
Queue Length 95th (m)	0.1	0.0	1.2
Control Delay (s)	0.4	0.0	9.9
Lane LOS	A		A
Approach Delay (s)	0.4	0.0	9.9
Approach LOS			A

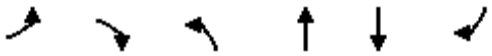
Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	4	1	18	47	0
Future Volume (Veh/h)	0	4	1	18	47	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	1	20	51	0
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	73	51	51			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	73	51	51			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	930	1017	1555			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	21	51
Volume Left	0	1	0
Volume Right	4	0	0
cSH	1017	1555	1700
Volume to Capacity	0.00	0.00	0.03
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	8.6	0.4	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	0.4	0.0
Approach LOS	A		

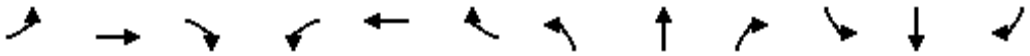
Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	16	5	13	31	2
Future Volume (Veh/h)	2	16	5	13	31	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	17	5	14	34	2
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	59	35	36			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	59	35	36			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	98	100			
cM capacity (veh/h)	945	1038	1575			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	19	19	36
Volume Left	2	5	0
Volume Right	17	0	2
cSH	1027	1575	1700
Volume to Capacity	0.02	0.00	0.02
Queue Length 95th (m)	0.4	0.1	0.0
Control Delay (s)	8.6	1.9	0.0
Lane LOS	A	A	
Approach Delay (s)	8.6	1.9	0.0
Approach LOS	A		

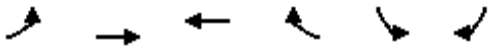
Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	15.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	94	78	18	120	1	103	57	38	1	28	9
Future Volume (Veh/h)	17	94	78	18	120	1	103	57	38	1	28	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	102	85	20	130	1	112	62	41	1	30	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	131			187			376	352	144	423	394	130
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	131			187			376	352	144	423	394	130
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.1	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.5	4.1	3.3
p0 queue free %	99			99			79	89	95	100	94	99
cM capacity (veh/h)	1418			1358			530	539	882	464	521	924

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	205	151	215	41
Volume Left	18	20	112	1
Volume Right	85	1	41	10
cSH	1418	1358	577	581
Volume to Capacity	0.01	0.01	0.37	0.07
Queue Length 95th (m)	0.3	0.3	13.1	1.7
Control Delay (s)	0.8	1.1	14.9	11.7
Lane LOS	A	A	B	B
Approach Delay (s)	0.8	1.1	14.9	11.7
Approach LOS			B	B

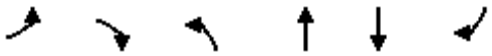
Intersection Summary				
Average Delay	6.6			
Intersection Capacity Utilization	37.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	22	211	218	14	13	9
Future Volume (Veh/h)	22	211	218	14	13	9
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)	24	229	237	15	14	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	252				522	244
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	252				522	244
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	99
cM capacity (veh/h)	1313				506	794

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	253	252	24
Volume Left	24	0	14
Volume Right	0	15	10
cSH	1313	1700	596
Volume to Capacity	0.02	0.15	0.04
Queue Length 95th (m)	0.4	0.0	1.0
Control Delay (s)	0.9	0.0	11.3
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.3
Approach LOS			B

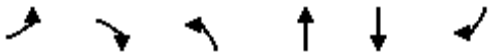
Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	3	5	70	35	0
Future Volume (Veh/h)	0	3	5	70	35	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	5	76	38	0
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	124	38	38			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	124	38	38			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	868	1034	1572			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	3	81	38
Volume Left	0	5	0
Volume Right	3	0	0
cSH	1034	1572	1700
Volume to Capacity	0.00	0.00	0.02
Queue Length 95th (m)	0.1	0.1	0.0
Control Delay (s)	8.5	0.5	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	0.5	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	4	9	20	50	26	3
Future Volume (Veh/h)	4	9	20	50	26	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	10	22	54	28	3
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	128	30	31			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	128	30	31			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	855	1045	1582			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	14	76	31
Volume Left	4	22	0
Volume Right	10	0	3
cSH	983	1582	1700
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (m)	0.3	0.3	0.0
Control Delay (s)	8.7	2.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	2.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	20.4%	ICU Level of Service	A
Analysis Period (min)	15		

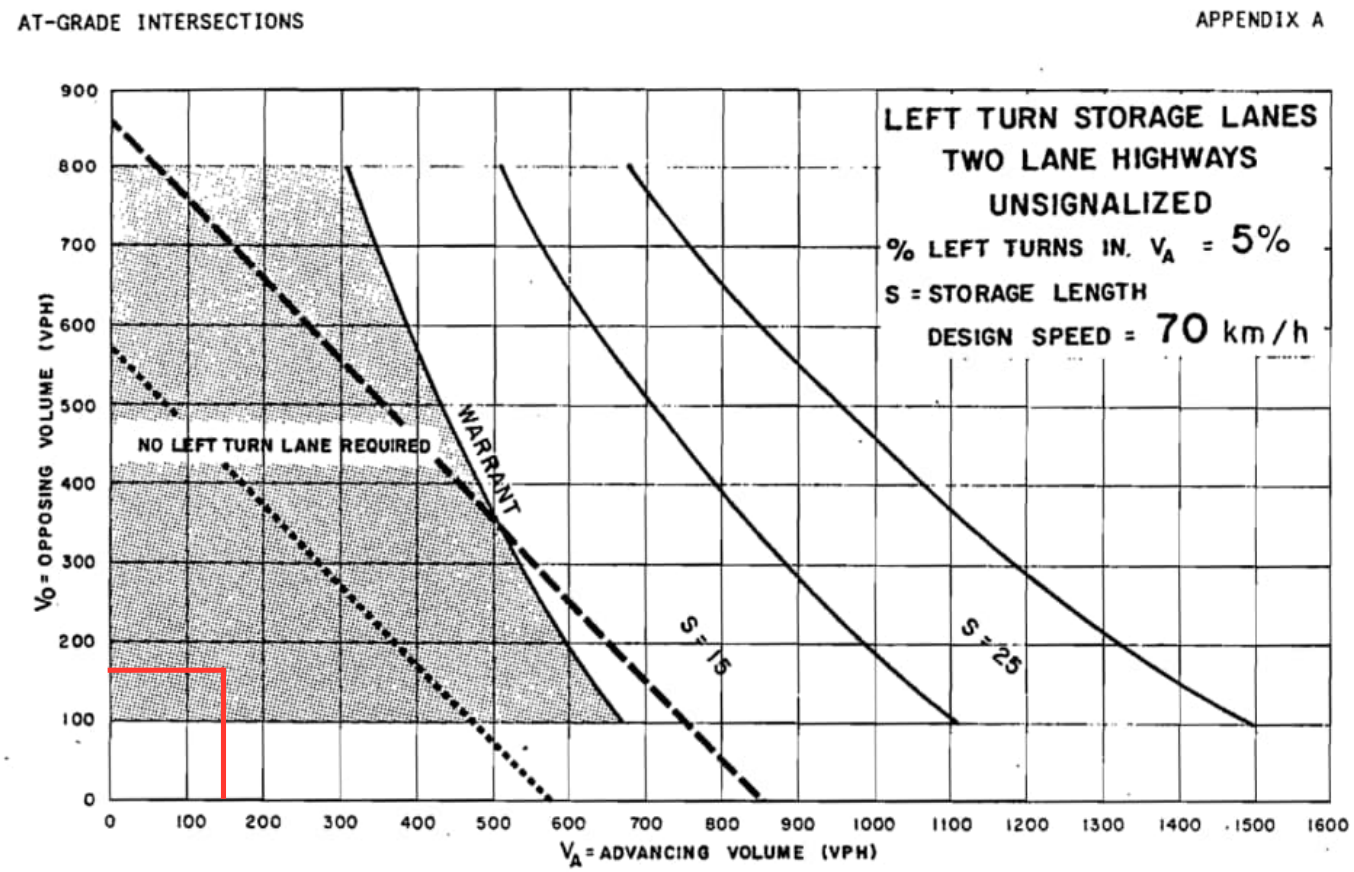
APPENDIX

G

LEFT TURN LANE WARRANT NOMOGRAPHS

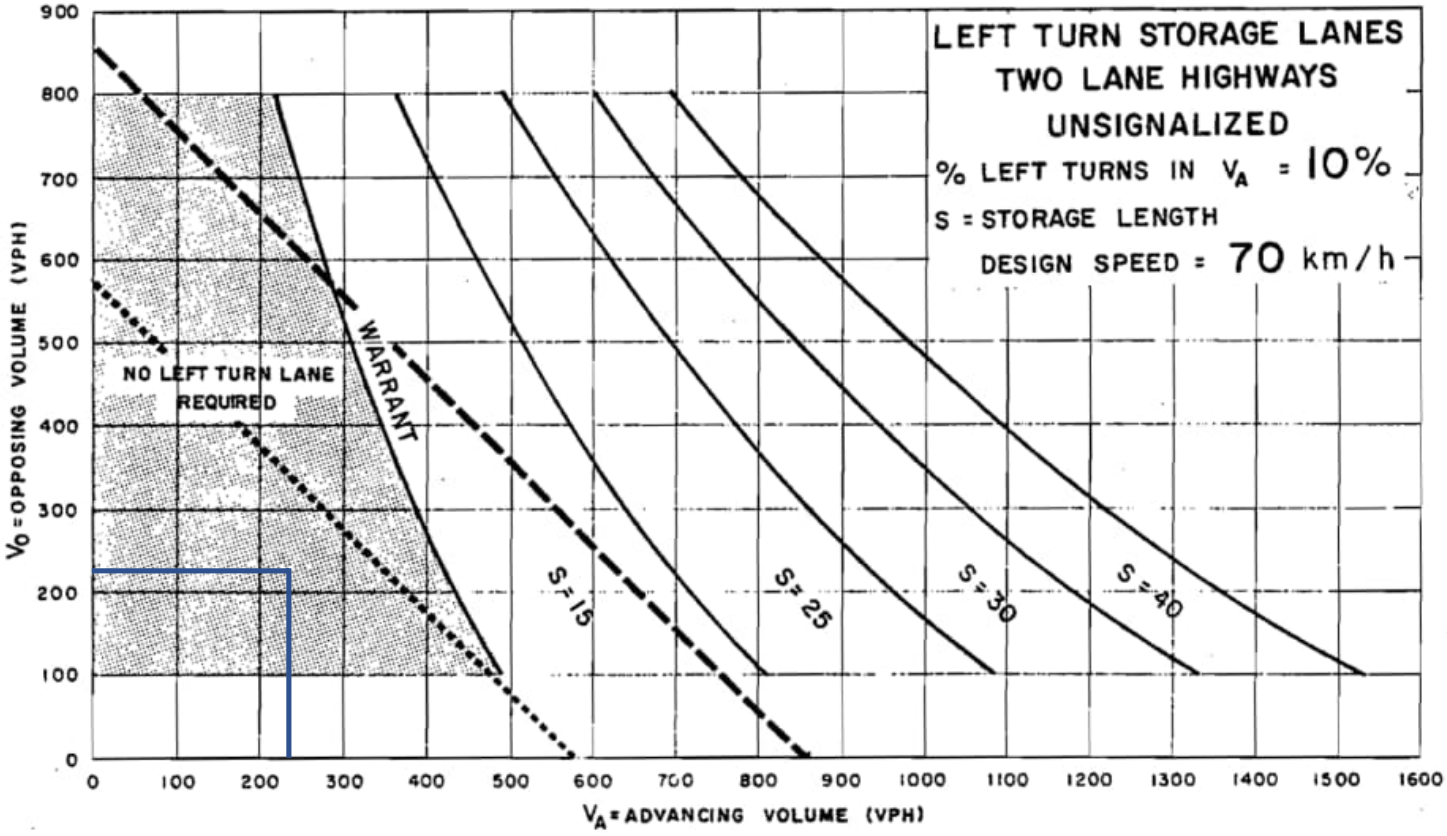
County Road 19 & Proposed Road A

AM Volumes



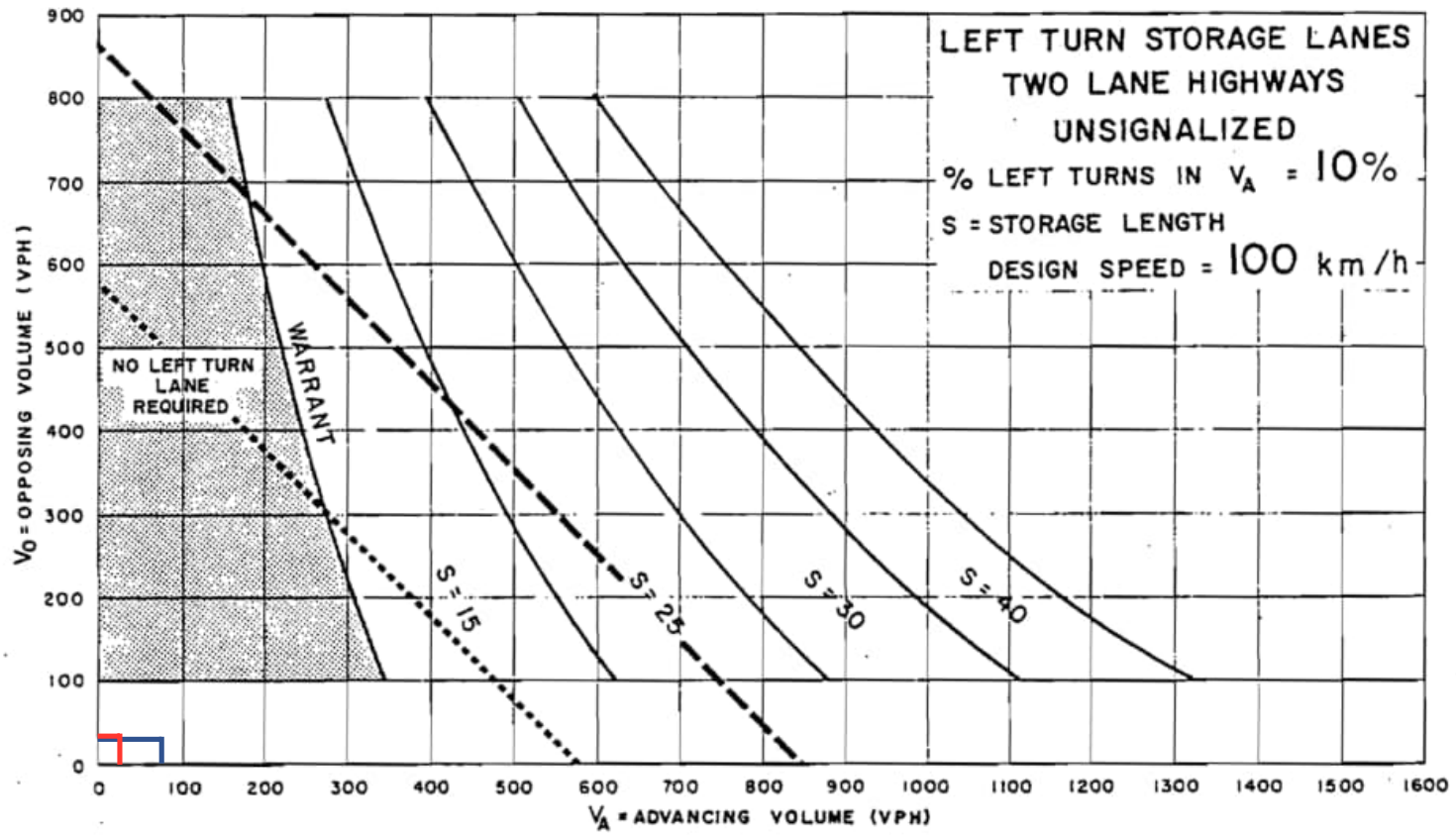
County Road 19 & Proposed Road A

PM Volumes



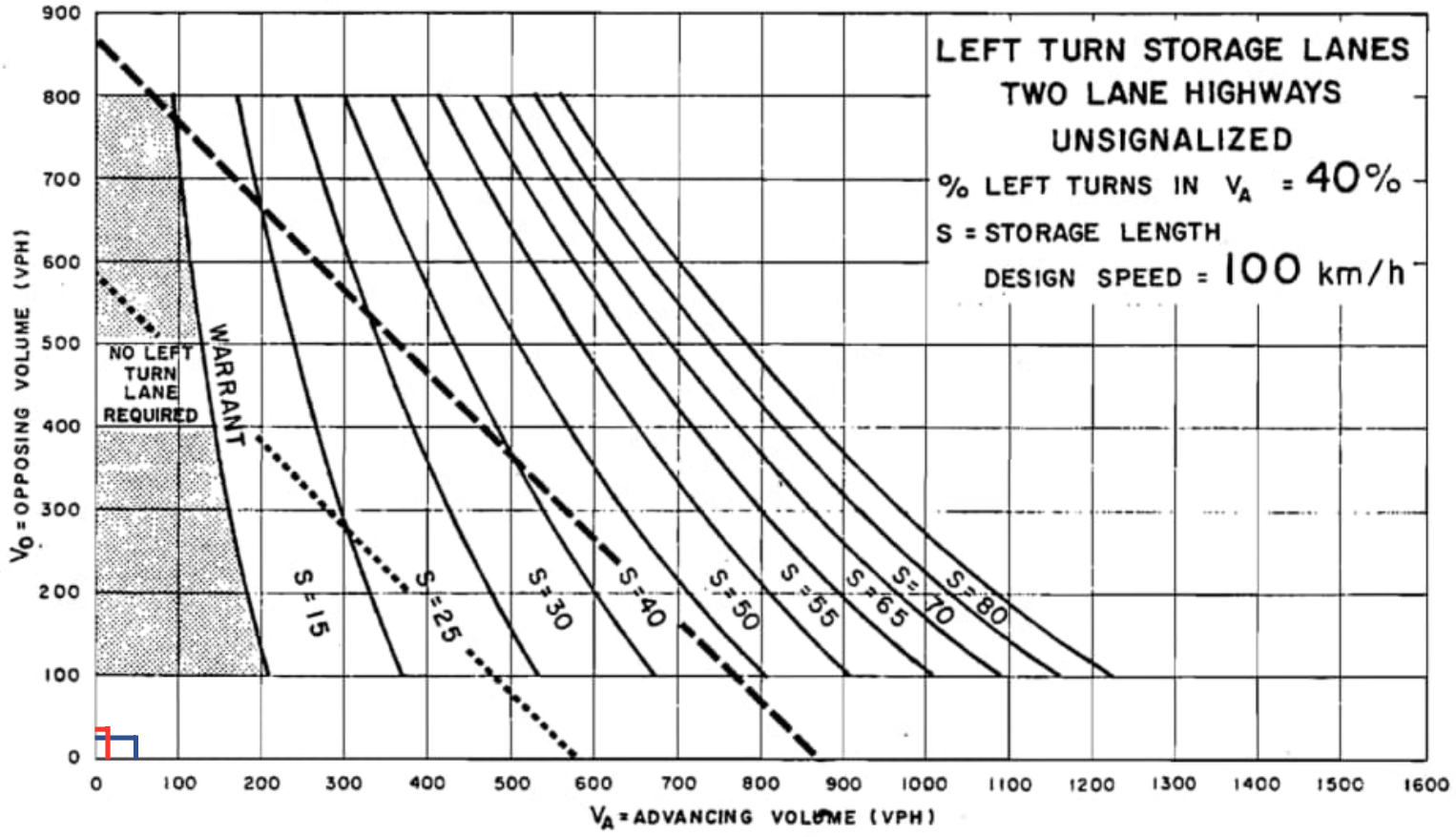
7th Line and Road E

AM Volumes
PM Volumes



7th Line and Road D

AM Volumes
PM Volumes

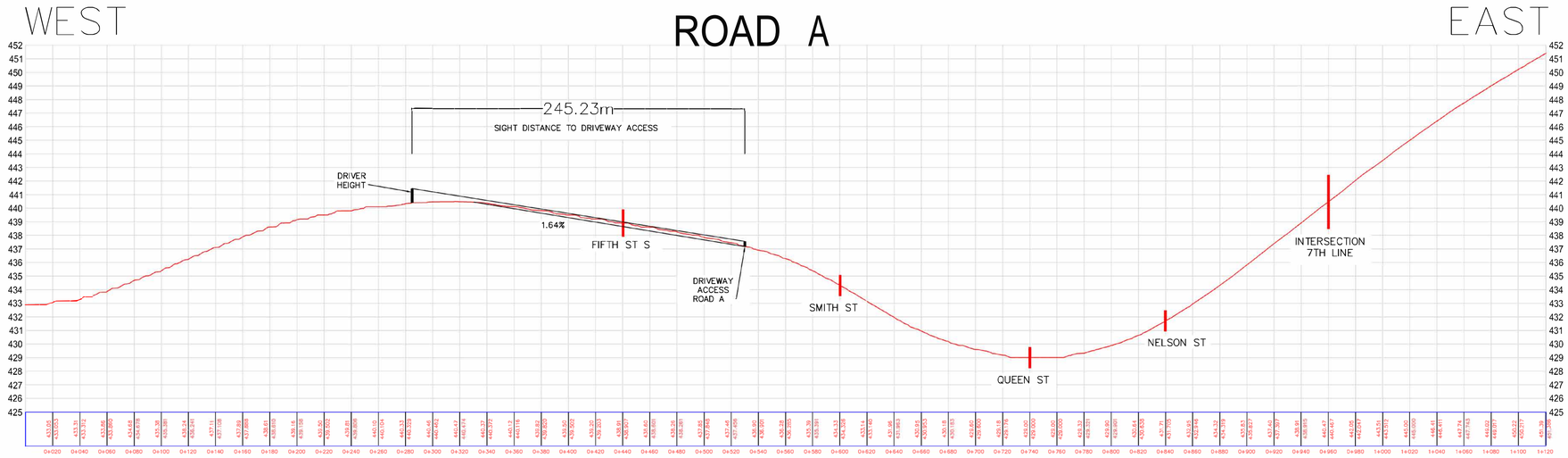


APPENDIX

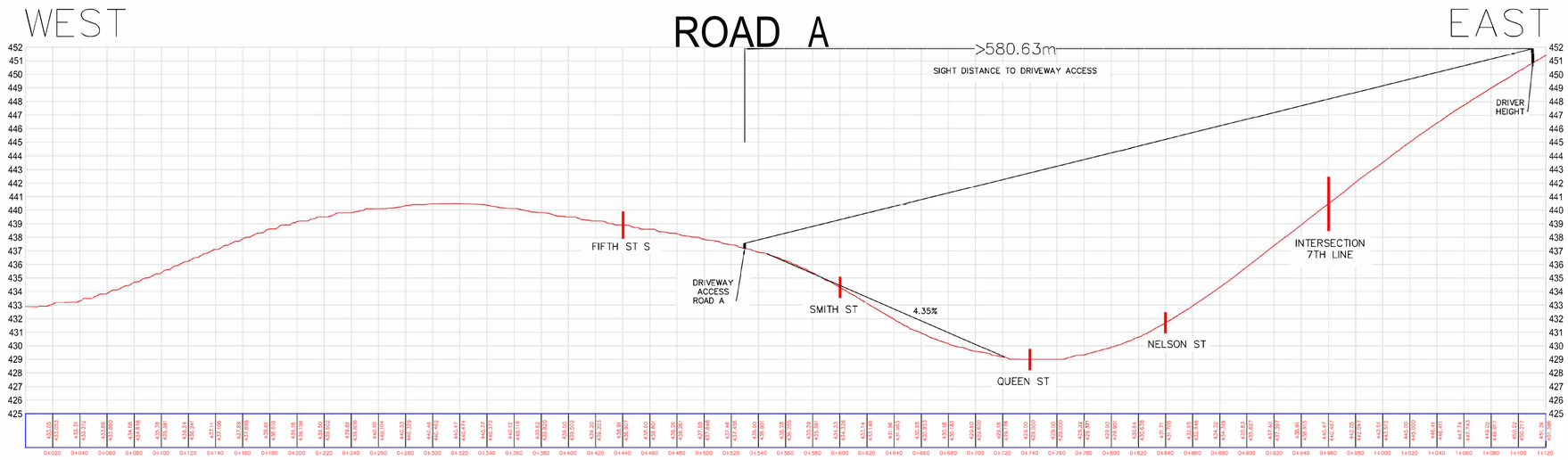
H

AVAILABLE SIGHT DISTANCE MEASUREMENTS

Wellington 19

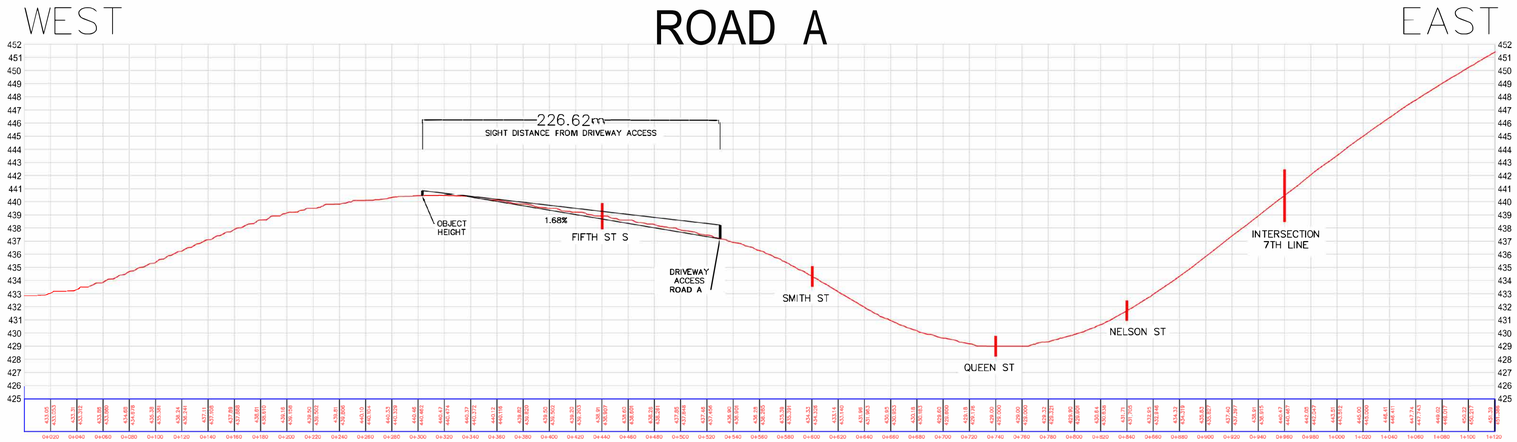


Wellington 19



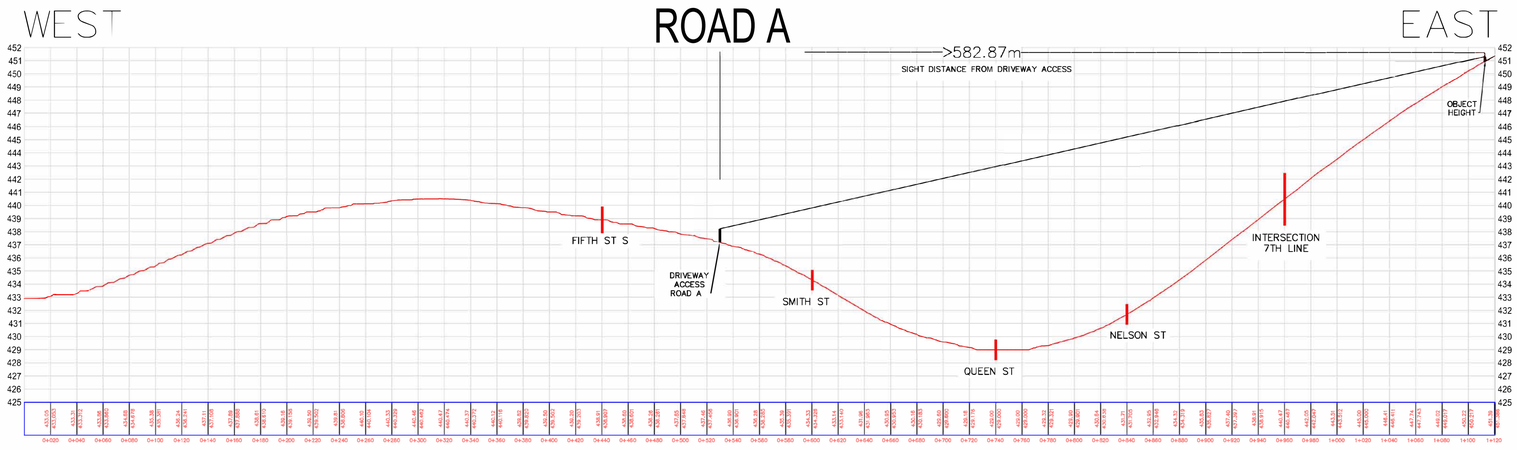
Wellington 19

ROAD A



Wellington 19

ROAD A



7th Line

ROAD E

SOUTH

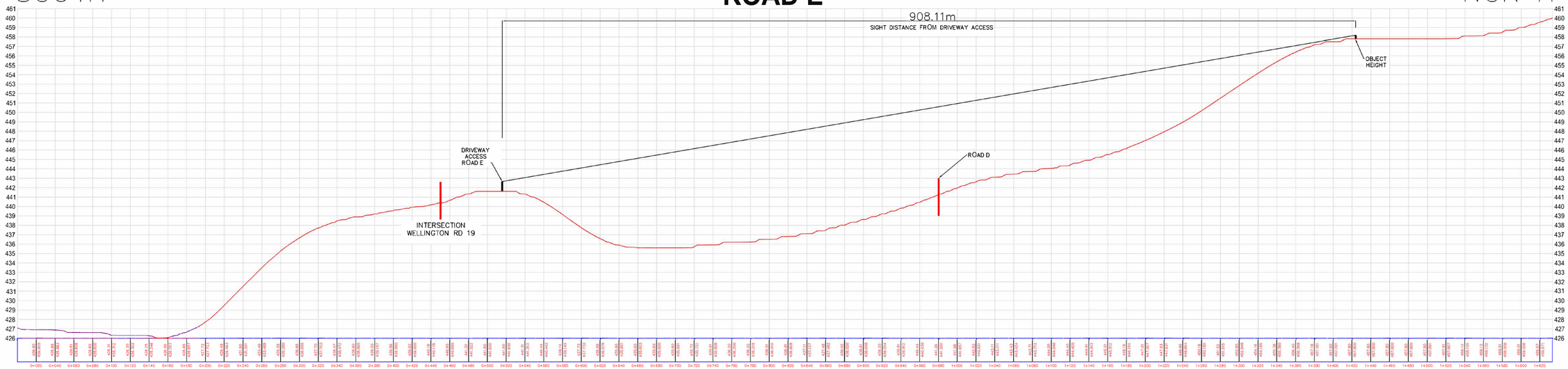
NORTH

7th Line

ROAD E

SOUTH

NORTH

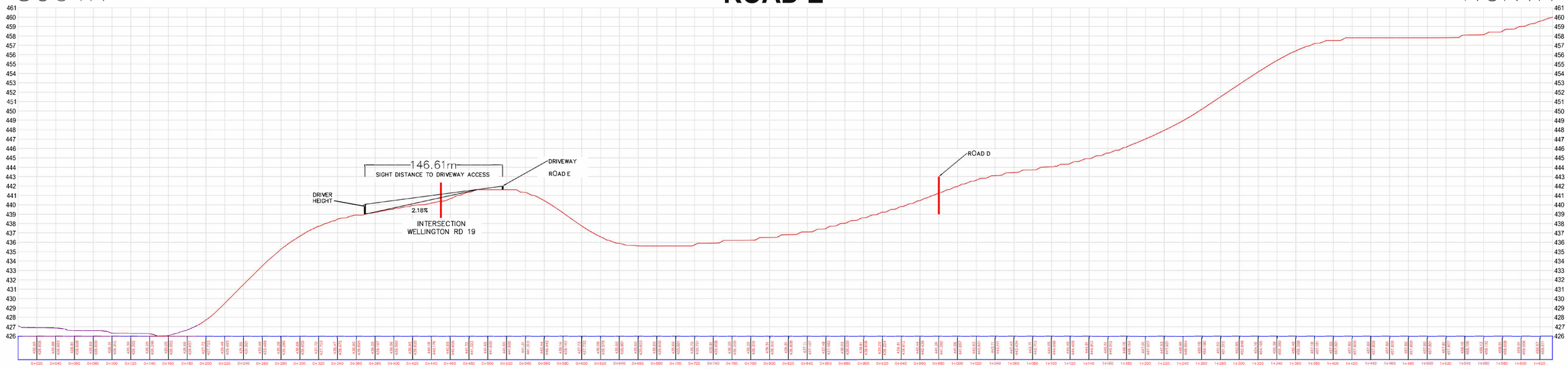


7th Line

SOUTH

ROAD E

NORTH

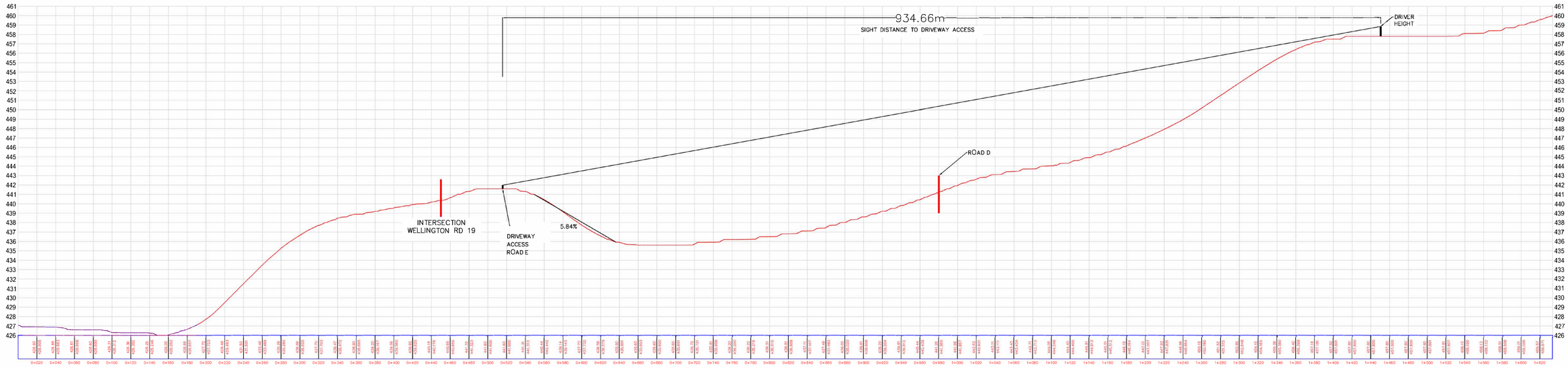


7th Line

SOUTH

ROAD E

NORTH

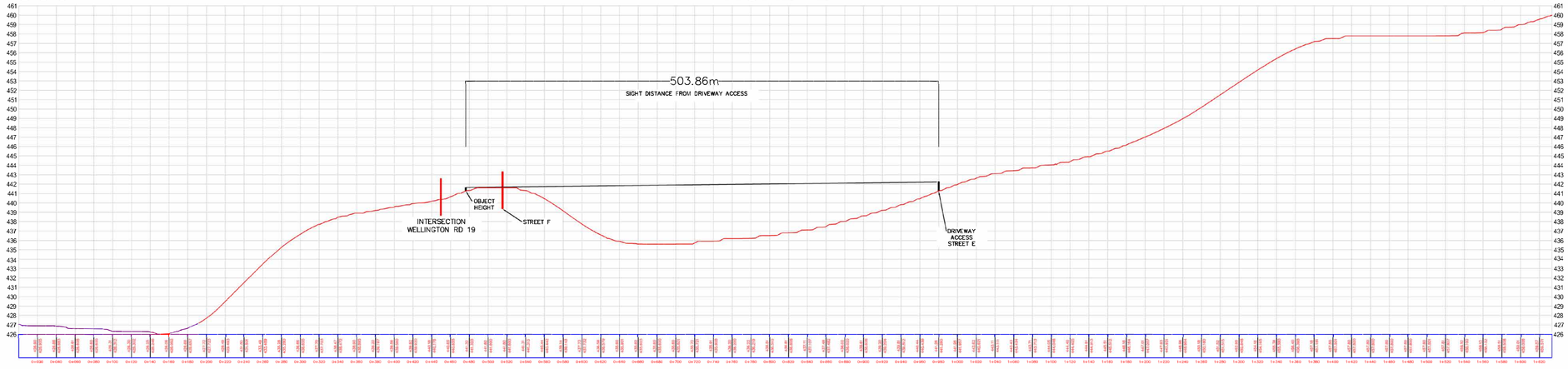


7th Line

ROAD D

SOUTH

NORTH

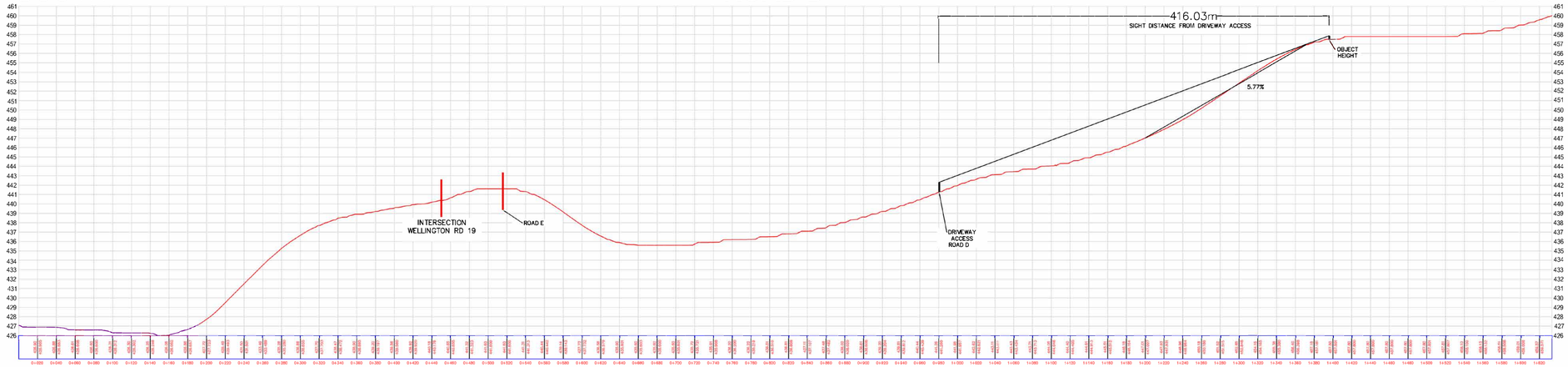


7th Line

ROAD D

SOUTH

NORTH

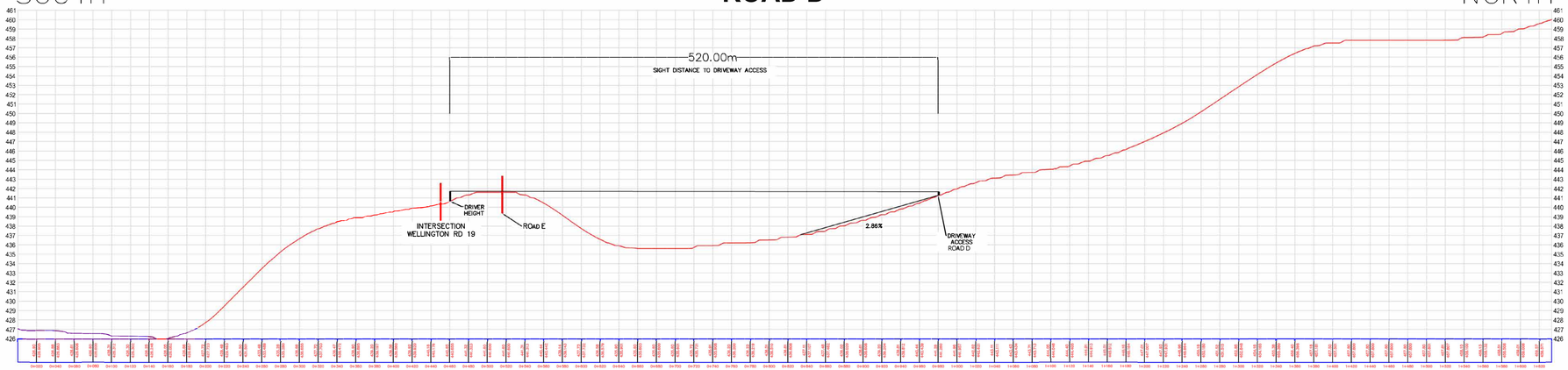


7th Line

ROAD D

SOUTH

NORTH



7th Line

ROAD D

SOUTH

NORTH