



paradigm
TRANSPORTATION SOLUTIONS LIMITED

33400 Richmond Street, Lucan-Biddulph Residential Development

Transportation Impact Assessment

Paradigm Transportation Solutions Limited

2024-08
230774



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33400 Richmond Street, Lucan-Biddulph Residential Development Transportation Impact Assessment



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Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) has been retained to conduct this Transportation Impact Assessment (TIA) for a proposed Mixed-Use development located at 33400 Richmond Street in the Township of Lucan-Biddulph, Middlesex County.

This TIA includes an analysis of existing traffic conditions, a description of the proposed development, analysis of future traffic conditions, and assessment of development traffic impacts with recommendations as appropriate to accommodate the proposed development.

Development Concept

The subject lands are located on the north side of Richmond Street (Highway 4), east of Saintsbury Line (Middlesex Road 47). The proposed development will include a Five-Storey, Mixed-Use Apartment Building accommodating 58 apartment units and a commercial use of 932 sq. ft. The development will include 82 parking spaces and will have a single access on Richmond Street.

TIA Scope

The scope of the Transportation Impact Assessment for the proposed development includes:

- ▶ **Study Area Intersections:**
 - Richmond Street/Main Street and Saintsbury Line (signalized); and
 - access intersection on Richmond Street.
- ▶ **Analysis Periods:** Weekday AM and PM peak hours.
- ▶ **Background Developments:** The proposed residential development located at the northwest corner of Richmond Street and Olde Clover Drive is included in background traffic forecasts.
- ▶ **Traffic Conditions:** Existing (2024), year of completion (2027), five years after completion (2032), and ten years after completion (2037).

Conclusions

Based on the investigations carried out, it is concluded that:



- ▶ **Existing Traffic Conditions:** The intersection of Richmond Street/Main Street and Saintsbury Line is operating at acceptable levels of service, and with no problem movements.
- ▶ **Development Trip Generation:** The development is forecast to generate 16 trips during the AM peak hour, 37 trips during the PM peak hour, and 29 trips during the Saturday peak hour.

The net trips for the Saturday peak hour are lower than the trips during the weekday PM peak hour. The analysis herein is based on the weekday AM/PM peak hour trip generation estimates

- ▶ **Background Traffic Conditions:** The intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours under 2027, 2032, and 2037 background traffic conditions.
- ▶ **Total Traffic Conditions:** The intersections of Richmond Street/Main Street and Saintsbury Line, and the Site Access intersection on Richmond Street are forecast to operate at acceptable levels of service during the AM and PM peak hours under 2027, 2032, and 2037 total traffic conditions.
- ▶ **Site Access:** The site access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B) under 2027, 2032, and 2037 total traffic conditions.

An eastbound (inbound) auxiliary left-turn lane or a westbound (inbound) auxiliary right-turn lane is not warranted on Richmond Street at the Site Access under 2027, 2032, or 2037 total traffic conditions.

Recommendations

Based on the findings and conclusions of this study, it is recommended that the development be considered for approval as proposed.



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1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) has been retained to conduct this Transportation Impact Assessment (TIA) for a proposed Mixed-Use development located at 33400 Richmond Street in the Township of Lucan-Biddulph, Middlesex County. **Figure 1.1** details the subject development location.

The subject lands are located on the north side of Richmond Street (Highway 4), east of Saintsbury Line (Middlesex Road 47). The proposed development will include a Five-Storey, Mixed-Use Apartment Building accommodating 58 apartment units and a commercial use of 932 sq. ft. The development will include 82 parking spaces and will have a single access on Richmond Street.

1.2 Purpose and Scope

The purpose of this report is to identify and assess the potential traffic impact resulting from the proposed development. The scope of the study, developed in consultation with MTO and County staff via e-mail in January 2024, includes:

- ▶ assessment of the current traffic and site conditions within the study area;
- ▶ comparison of weekday AM/PM and Saturday peak hour trip generation estimates;
- ▶ estimates of background traffic growth for the year of completion (2027), five years after completion (2032), and ten years after completion (2037);
- ▶ the proposed residential development located at the northwest corner of Richmond Street and Olde Clover Drive is included in background traffic forecasts;
- ▶ estimates of additional traffic generated by the subject site;
- ▶ analyses of the impact of the future traffic on the surrounding road network, including the following study area intersections:
 - Richmond Street/Main Street and Saintsbury Line (signalized); and
 - access intersection on Richmond Street, including the need assessment for auxiliary left-turn and right-turn lanes.
- ▶ recommendations, if necessary, to mitigate the site generated traffic in a satisfactory manner.

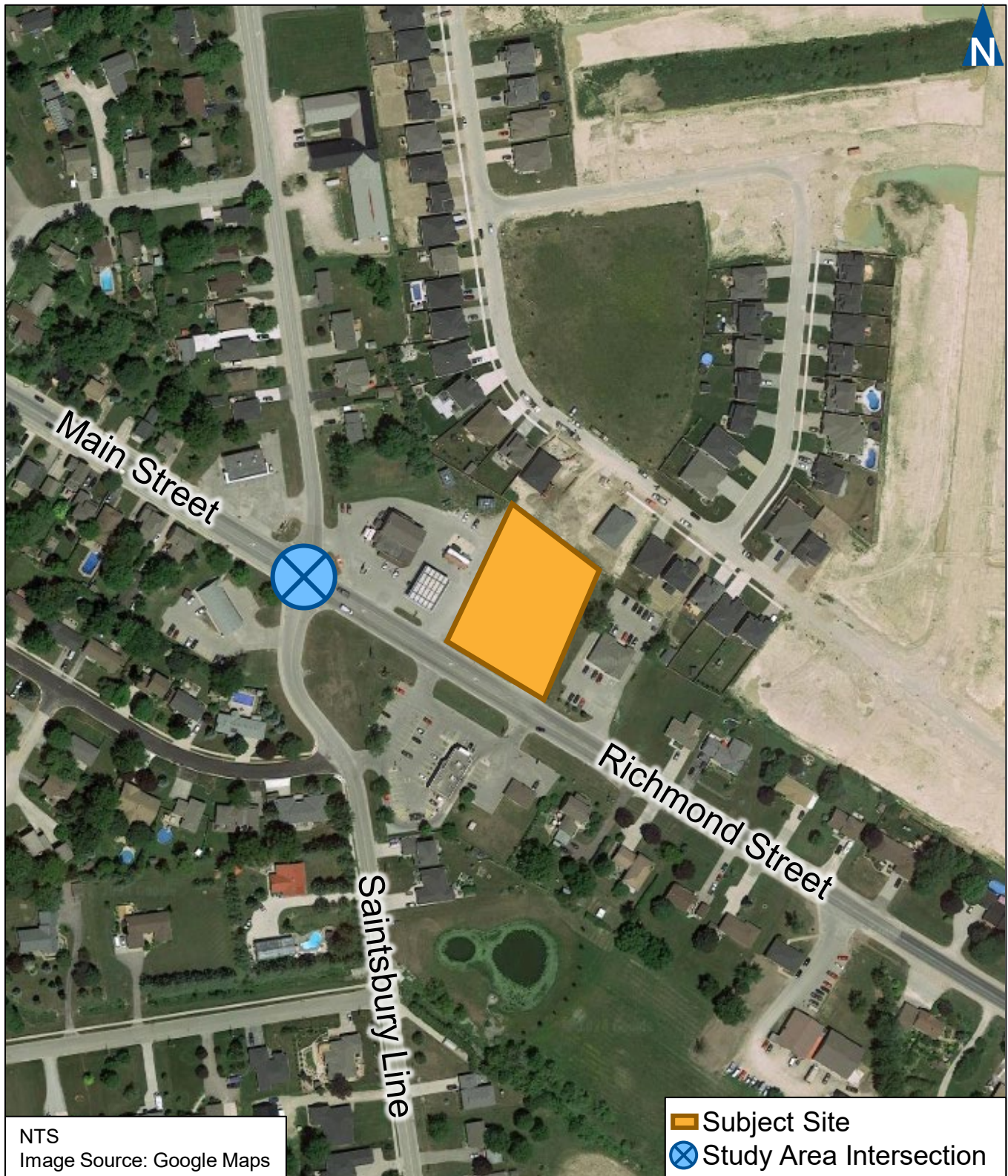


Appendix A contains the pre-study consultation material and responses from Middlesex County and MTO.

This study has been prepared in accordance with the requirements detailed by the MTO Traffic Impact Study Guidelines¹.

¹ MTO, General Guidelines for Preparation of Traffic Impact Studies, February 2021.





Location of Subject Site

33400 Richmond Street, Lucan-Biddulph TIA
230774

Figure 1.1

2 Existing Conditions

2.1 Existing Roadways

The main roadways near the subject development considered in assessing the traffic impacts of the development include:

- ▶ **Richmond Street/Main Street (Highway 4)** is an east-west provincial highway² with a three-lane cross-section, including a centre two-way left-turn lane. Sidewalks are provided on both sides of the roadway west of Saintsbury Line and on the south side of the roadway between Saintsbury Line and the westerly Tim Hortons access. The posted speed limit is 50 km/h.
- ▶ **Saintsbury Line** is a north-south County collector road with a two-lane cross section. Sidewalks are provided on the west side of the roadway. The posted speed limit is 50 km/h.

Traffic signals are provided at the intersection of Richmond Street/Main Street and Saintsbury Line.

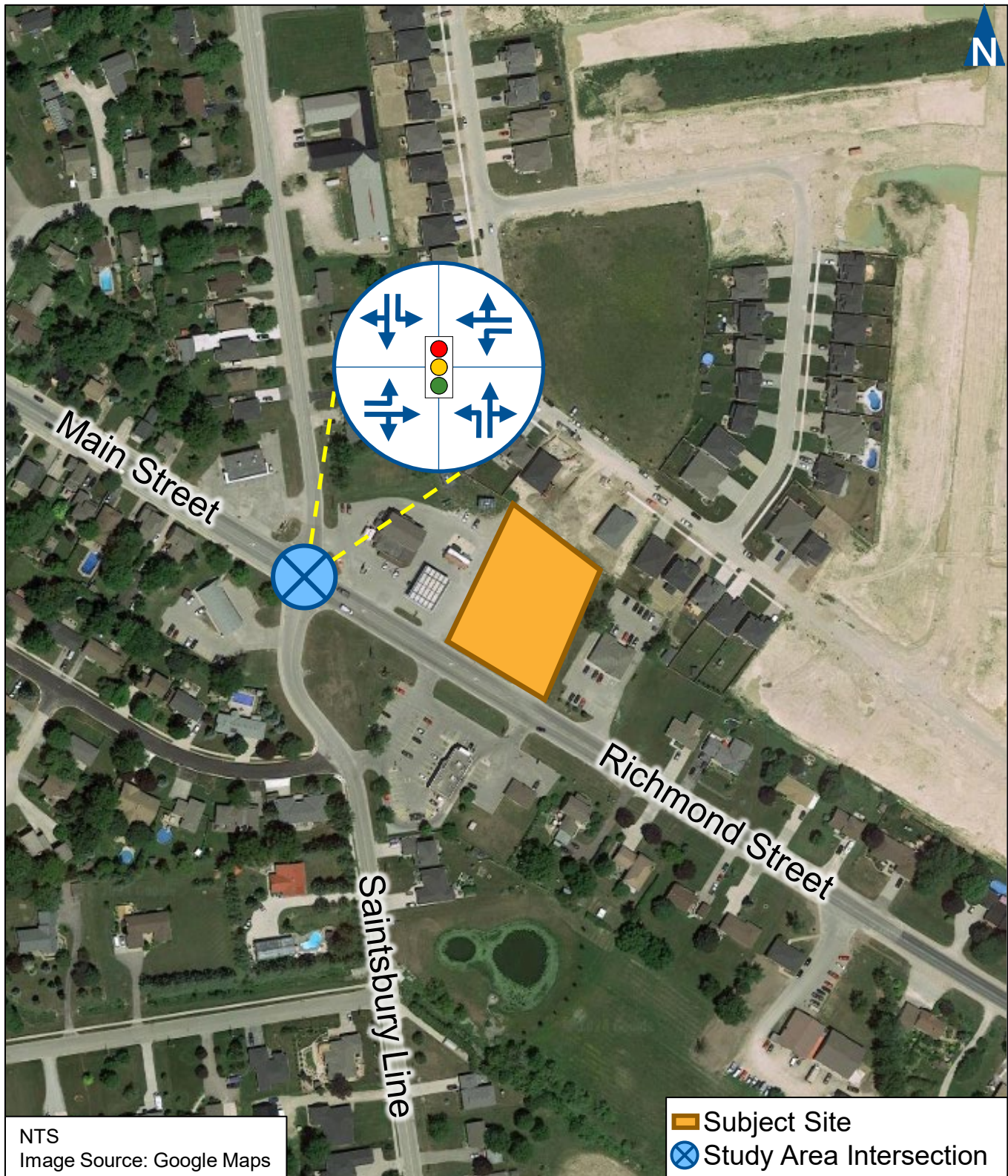
Figure 2.1 illustrates the traffic control and lane configuration at the intersection of Richmond Street/Main Street and Saintsbury Line.

2.2 Transit Service

Middlesex County Transit operates one route, Route 1, within the study area. **Figure 2.2** illustrates the existing transit service. Route 1 operates between Lucan, Ilderton, Arva, and London from Monday to Friday. The route stops in Lucan four times per day, travelling in both directions each time.

² *County of Middlesex Official Plan* Schedule B: Transportation, 07 July 2023.

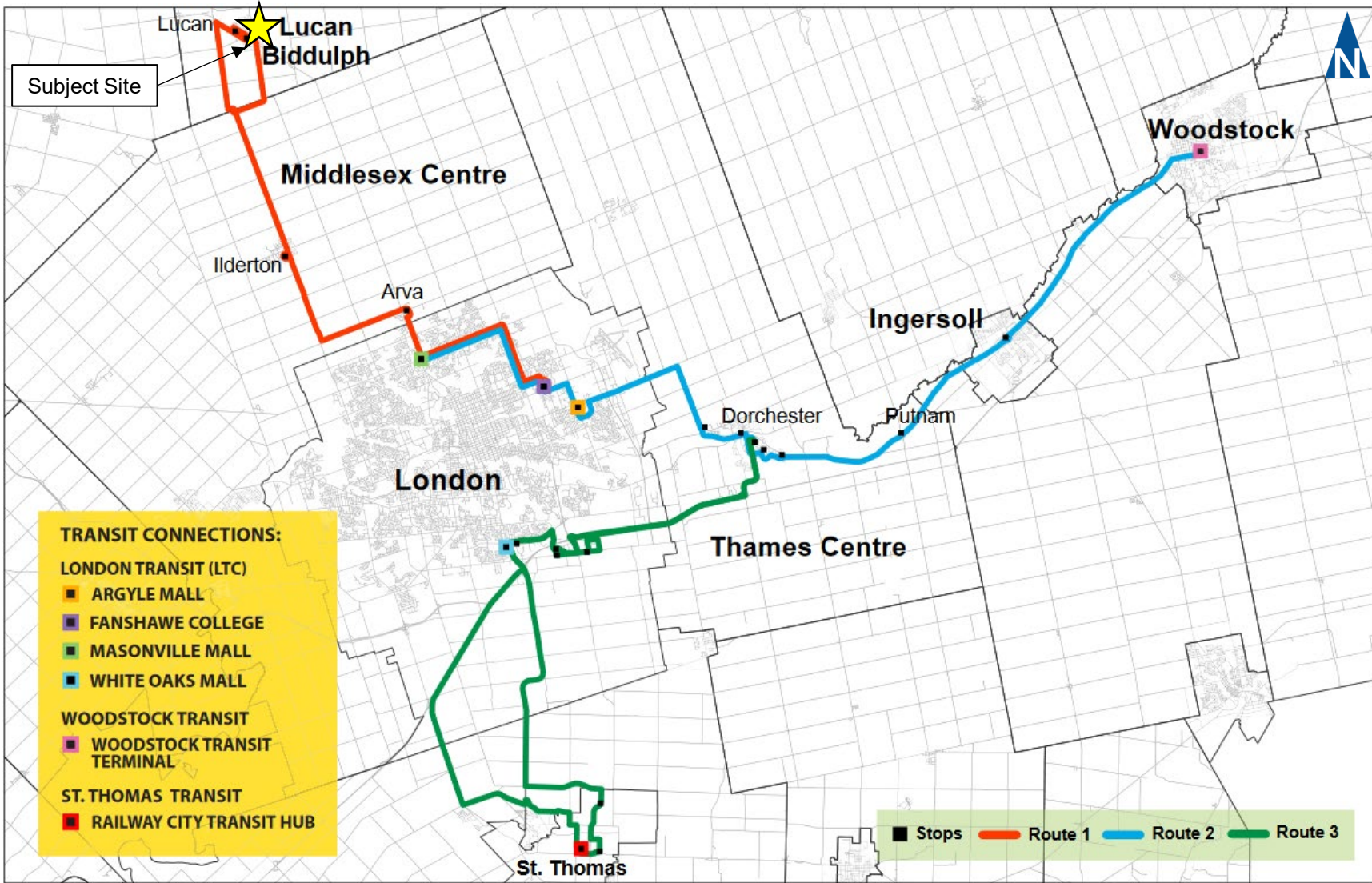




Existing Lane Configuration and Traffic Control

33400 Richmond Street, Lucan-Biddulph TIA
230774

Figure 2.1



Existing Transit Network

2.3 Traffic Volumes

Paradigm conducted turning movement counts at the intersection of Richmond Street/Main Street and Saintsbury Line on 16 January 2024.

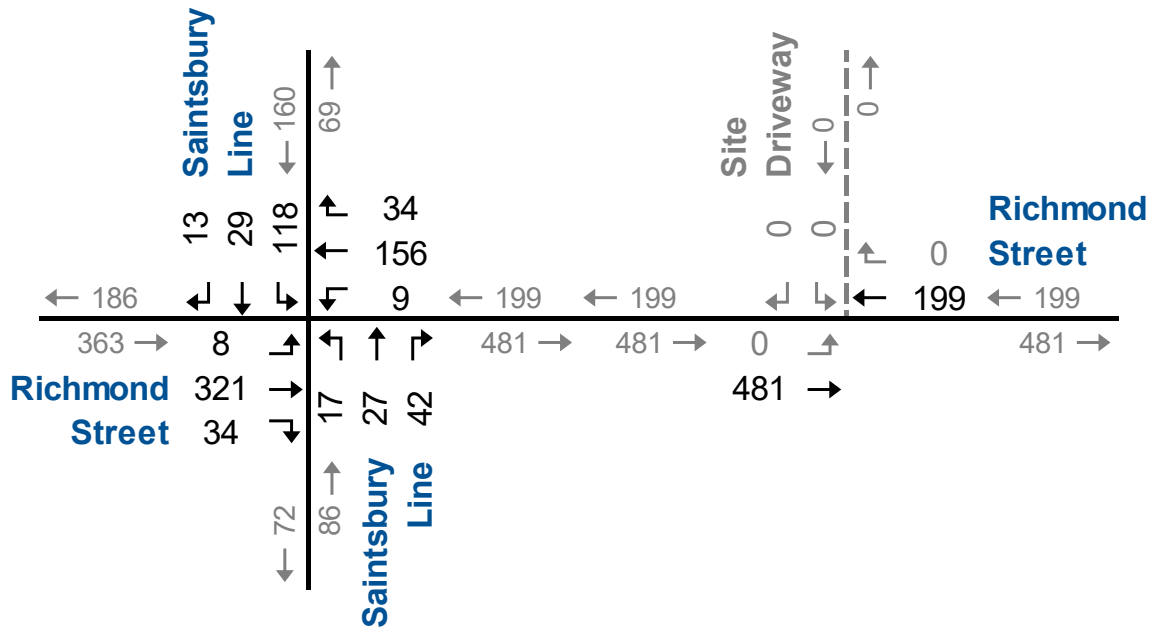
Figure 2.3 illustrates the existing AM (7:15 – 8:15) and PM (4:30 – 5:30) weekday peak hour turning movement traffic volumes.

Appendix B contains the detailed traffic counts and signal timings for the intersection of Richmond Street/Main Street and Saintsbury Line.

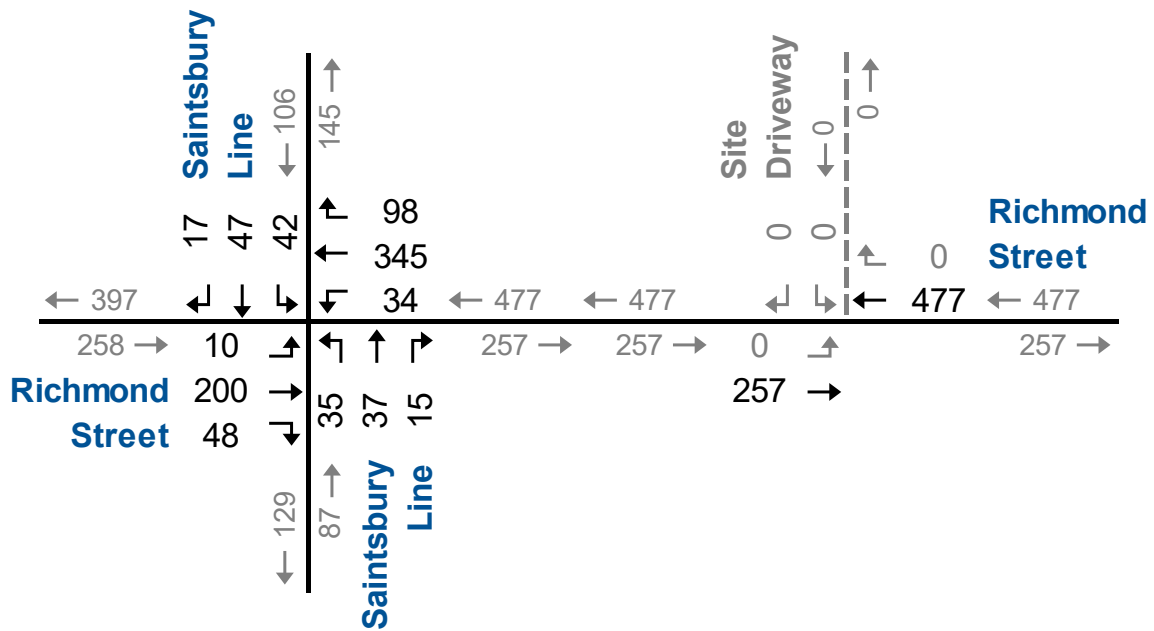




AM Peak Hour



PM Peak Hour



Existing Traffic Volumes

2.4 Traffic Operations

The level of service conditions at the intersection of Richmond Street/Main Street and Saintsbury Line have been assessed through intersection operational analysis using Synchro 11.

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles intending to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows and intersection geometry.

The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity (v/c) ratio is greater than 1.00, the movement is classed as LOS F and remedial measures are usually implemented if they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

Movements are considered critical under the following conditions:

- ▶ v/c ratios for overall intersection operations, through movements or shared through/turning movements increased to 0.85 or above;
- ▶ LOS based on average delay per vehicle, on individual movements exceeds LOS “E”; or
- ▶ the estimated 95th percentile queue length for an individual movement exceeds the available queue storage.

Table 2.1 summarizes the results of the intersection operational analysis under existing conditions, including the AM and PM peak hour LOS, v/c ratios, and 95th percentile queues experienced.

The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is operating at acceptable levels of service, and with no problem movements.

Appendix C contains the detailed Synchro 11 reports.



TABLE 2.1: EXISTING TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	B
			Delay	6	6	>	6	8	5	>	5	26	25	>	26	30	25	>	29	12	
			V/C	0.01	0.35	>	0.02	0.19	>	0.06	0.27	>	0.45	0.17	>						
			Q	0	1	>	0	0	>	2	6	>	14	4	>						
			Stor.	70	-	>	15	-	>	70	-	>	25	-	>						
Avail.	70	-	>	15	-	>	68	-	>	11	-	>									
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	A
			Delay	8	5	>	5	6	6	>	6	27	26	>	26	27	26	>	26	10	
			V/C	0.02	0.23	>	0.05	0.41	>	0.14	0.21	>	0.17	0.25	>						
			Q	0	1	>	0	1	>	4	4	>	4	6	>						
			Stor.	70	-	>	15	-	>	70	-	>	25	-	>						
Avail.	70	-	>	15	-	>	66	-	>	21	-	>									

MOE - Measure of Effectiveness Q - 95th Percentile Queue Length (m) </> - Shared with through movement
 LOS - Level of Service Stor. - Existing Storage (m)
 Delay - Average Delay per Vehicle in Seconds Avail. - Available Storage (m)
 V/C - Volume to Capacity Ratio TCS - Traffic Control Signal



2.5 Queue Analysis

In addition to the Synchro 11 analysis, queue length analysis for through and left-turn lanes were carried out at the intersection of Richmond Street/Main Street and Saintsbury Line.

This method was completed using the MTO Traffic Signal Operating and Timing Policy³ Table 1 under Level of Service (LOS) A conditions and assuming a vehicle length of 7.5 metres.

The methods require the conversion of volumes to Passenger Car Equivalents (PCE) by multiplying the number of heavy vehicles by a conversion factor of 2⁴.

It is noted that there are no exclusive right-turn lanes at the intersection of Richmond Street/Main Street and Saintsbury Line. Therefore, no exclusive right-turn lane analysis is included herein.

Table 2.2 summarize the results of the queue length analysis under existing traffic conditions. The results indicate that the southbound left-turn movement at Richmond Street/Main Street and Saintsbury Line is operating with queues exceeding the existing storage of 25 metres during the AM peak hour, and the westbound left-turn movement is operating with queues exceeding the existing storage of 15 metres during the PM peak hour.

It is noted that the Synchro 11 analysis in **Section 2.4** did not identify these queueing issues under existing traffic conditions.

³ Traffic Signal Operating and Timing Policy 2010-02, Ministry of Transportation Ontario, June 2016.

⁴ Canadian Capacity Guide, February 2008.



TABLE 2.2: EXISTING THROUGH AND LEFT-TURN QUEUE ANALYSIS

Intersection	Horizon	Lane	# of Lanes	Cycle Length (s)		Volumes (vph)		m _s max	Calc'd Length per Lane (m)	Available Length (m)
				AM	PM	AM	PM			
Richmond Street/Main Street and Saintsbury Line	Existing	EBL	1			9	10	0.3	7.5	70
		EBTR	1			383	257	9.9	112.5	-
		WBL	1			12	34	0.9	22.5	15*
		WBTR	1	93	93	208	453	11.7	135.0	-
		NBL	1			17	35	0.9	22.5	70
		NBTR	1			75	53	1.9	30.0	-
		SBL	1			122	42	3.2	45.0	25*
		SBTR	1			49	64	1.7	30.0	-

* Storage extends beyond length of solid line.



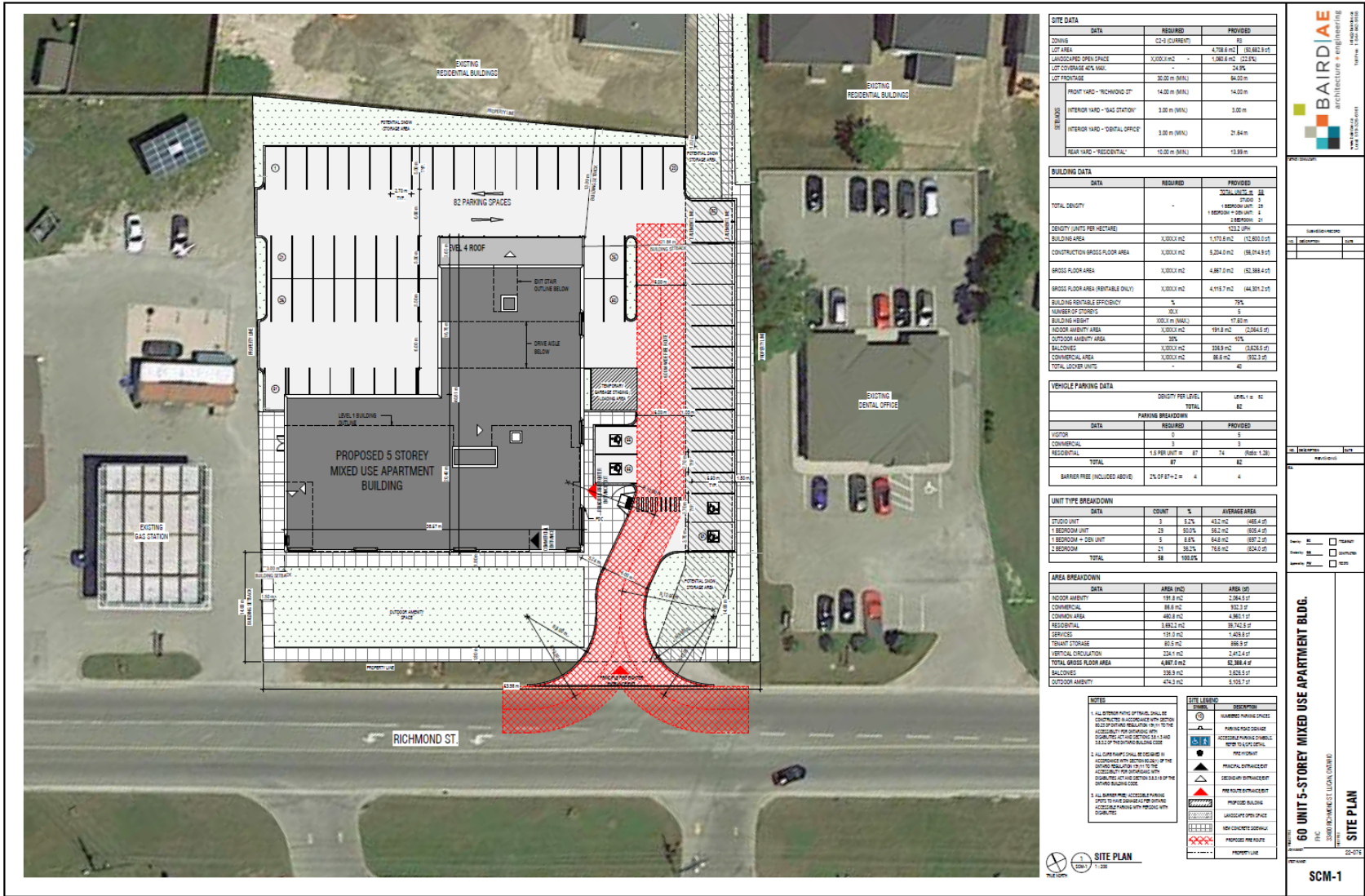
3 Development Concept

3.1 Development Description

The subject lands are located on the north side of Richmond Street (Highway 4), east of Sainsbury Line (Middlesex Road 47). The proposed development will include a Five-Storey, Mixed-Use Apartment Building accommodating 58 apartment units and a commercial use of 932 sq. ft. The development will include 82 parking spaces and will have a single access on Richmond Street.

Figure 3.1 shows the concept site plan.





SITE DATA		
DATA	REQUIRED	PROVIDED
COV. CURB CUT	95	95
LOT AREA	4,788.0 m ²	4,788.0 m ² (100.00%)
LANDSCAPED OPEN SPACE	3,000.0 m ²	1,980.0 m ² (66.00%)
LOT COVERAGE 4% MAX.	191.52 m ²	24.9%
LOT FRONTAGE	30.00 m (MIN)	60.00 m
FRONT YARD - "RICHMOND ST"	14.00 m (MIN)	14.00 m
INTERIOR YARD - "BUS STATION"	3.00 m (MIN)	3.00 m
INTERIOR YARD - "DENTAL OFFICE"	3.00 m (MIN)	21.84 m
REAR YARD - "RESIDENTIAL"	10.00 m (MIN)	13.99 m

BUILDING DATA		
DATA	REQUIRED	PROVIDED
TOTAL DENSITY	120.00 U/HA	120.00 U/HA (100.00%)
DENSITY (LAND PER HECTARE)	120.00 U/HA	120.00 U/HA
BUILDING AREA	3,000.0 m ²	1,570.8 m ² (52.36%)
CONSTRUCTION GROSS FLOOR AREA	3,000.0 m ²	5,254.4 m ² (175.15%)
GROSS FLOOR AREA	3,000.0 m ²	4,887.2 m ² (162.91%)
GROSS FLOOR AREA (RENTABLE ONLY)	3,000.0 m ²	4,111.7 m ² (137.06%)
BUILDING RENTABLE EFFICIENCY	%	79%
NUMBER OF STOREYS	5	5
BUILDING HEIGHT	100.0 m (MAX)	17.80 m
INDOOR AMENITY AREA	3,000.0 m ²	191.8 m ² (6.39%)
OUTDOOR AMENITY AREA	3,000.0 m ²	12.0 m ² (0.40%)
BALCONIES	3,000.0 m ²	338.9 m ² (11.29%)
COMMERCIAL AREA	3,000.0 m ²	88.8 m ² (2.96%)
TOTAL COVER UNITS	-	40

VEHICLE PARKING DATA		
DATA	REQUIRED	PROVIDED
VEHICLE PER LEVEL	82	82
TOTAL	82	82

UNIT TYPE BREAKDOWN		
DATA	COUNT	%
STUDIO UNIT	3	5.0%
1 BEDROOM UNIT	29	48.3%
1 BEDROOM + DEN UNIT	5	8.3%
2 BEDROOM	23	38.3%
TOTAL	60	100.0%

AREA BREAKDOWN		
DATA	AREA (m ²)	AREA (sq ft)
INDOOR AMENITY	191.8 m ²	2,064.3 sq ft
COMMERCIAL	88.8 m ²	953.3 sq ft
COMMON AREA	480.8 m ²	5,181.1 sq ft
RESIDENTIAL	3,887.2 m ²	41,928.1 sq ft
SERVICES	131.0 m ²	1,418.9 sq ft
TENANT STORAGE	88.8 m ²	953.3 sq ft
VERTICAL CIRCULATION	224.1 m ²	2,402.4 sq ft
TOTAL GROSS FLOOR AREA	4,887.2 m ²	52,544.0 sq ft
BALCONIES	338.9 m ²	3,628.5 sq ft
OUTDOOR AMENITY	474.3 m ²	5,105.7 sq ft

NOTES

- ALL STRUCTURE OPTIMAL SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 10.2 OF THE BUILDING REGULATIONS (B.R.) TO THE BUILDING ACT AND SECTION 10.1 AND 10.2 OF THE BUILDING CODE.
- ALL CURB CUTS SHALL BE DESIGNED IN ACCORDANCE WITH SECTION 10.2 OF THE BUILDING REGULATIONS (B.R.) TO THE BUILDING ACT AND SECTION 10.1 OF THE BUILDING CODE.
- ALL BARBERSHOP ACCESSIBLE PARKING SPOTS TO HAVE SIGNAGE AS PER SIGNAGE ACCESSIBLE PARKING WITH PRECISE WITH SIGNATURE.

BAIRD | AE
ARCHITECTURE + ENGINEERING
PLANNING + URBAN DESIGN

60 UNIT 5-STORY MIXED USE APARTMENT BLDG.
33400 RICHMOND STREET, LUCAN, ONTARIO
SCM-1

SITE PLAN
DATE: 02-27-24



Concept Site Plan

33400 Richmond Street, Lucan-Biddulph TIA
230774

Figure 3.1

3.2 Development Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation Manual⁵ rates and equations were used to estimate the peak hour traffic volumes generated by the subject development based on the following ITE Land Use Codes:

- ▶ 221, Multifamily Housing (Mid Rise); and
- ▶ 822, Strip Retail Plaza (<40k).

Table 3.1 summarizes the forecast number of net new trips generated by the proposed development for the weekday AM/PM peak hours.

TABLE 3.1: TRIP GENERATION

Land Use Code	Units/Gross Floor Area	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
221: Multifamily Housing (Mid-Rise)	58 Units	Eq	3	11	14	Eq	14	9	23
822: Strip Retail Plaza (<40k)	932 sq. ft.	2.36	1	1	2	Eq	7	7	14
Total Trip Generation			4	12	16		21	16	37

LUC 221 | AM: $T = 0.44(X) - 11.61$ | PM: $T = 0.39(X) + 0.34$

LUC 822 | PM: $\ln(T) = 0.71 \ln(X) + 2.72$

Trip generation was estimated for the Saturday peak hour for comparison based on ITE trip generation rates. **Table 3.2** summarizes the subject site trip generation during the Saturday peak hour.

TABLE 3.2: SATURDAY PEAK HOUR TRIP GENERATION

Land Use Code	Units/Gross Floor Area	Saturday Peak Hour			
		Rate	In	Out	Total
221: Multifamily Housing (Mid-Rise)	58 Units	Eq	12	11	23
822: Strip Retail Plaza (<40k)	932 sq. ft.	6.57	3	3	6
Total Trip Generation			15	14	29

LUC 221 | Saturday: $\ln(T) = 1.00 \ln(X) - 0.91$

The net trips for the Saturday peak hour are lower than the trips during the weekday PM peak hour. The analysis herein is based on the weekday AM/PM peak hour trip generation estimates.

⁵ Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington, DC: ITE, 2021).



3.3 Development Trip Distribution and Assignment

The trip distribution was determined based on existing traffic patterns at the intersection of Richmond Street and Saintsbury Line. **Table 3.3** displays the breakdown of trip distributions used in this study.

TABLE 3.3: ESTIMATED TRIP DISTRIBUTION

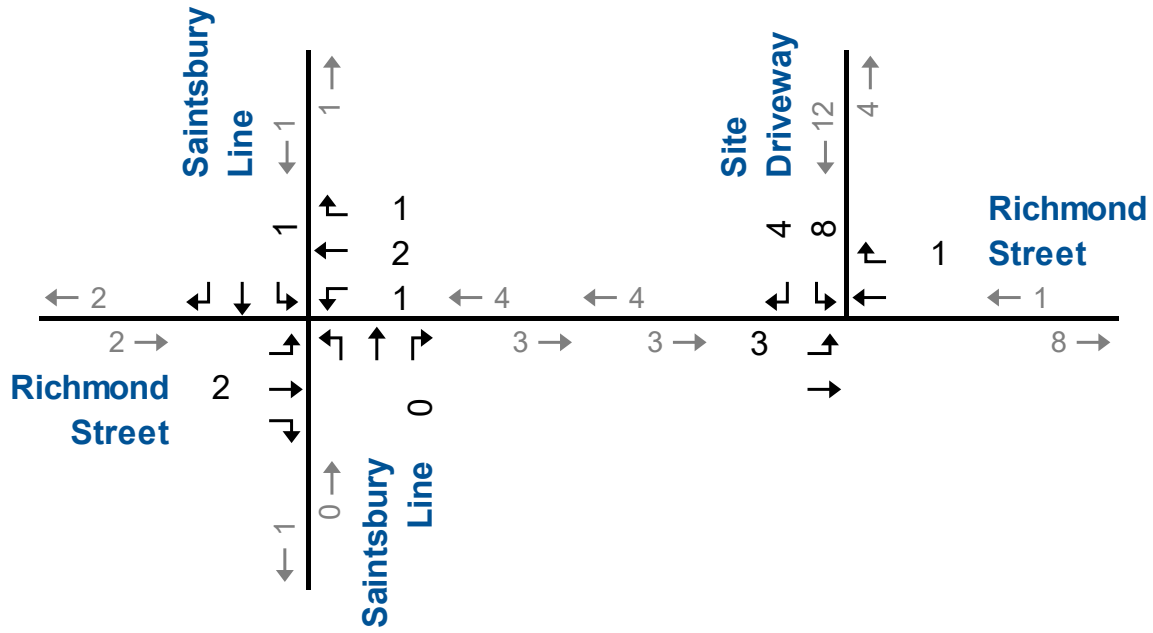
Origin/Destination	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
North via Saintsbury Ln	20%	10%	10%	20%
South via Saintsbury Ln	10%	10%	10%	10%
East via Richmond St	25%	60%	60%	25%
West via Richmond St	45%	20%	20%	45%
Total	100%	100%	100%	100%

Figure 3.2 illustrates the site-generated traffic volumes for the AM and PM peak hours.

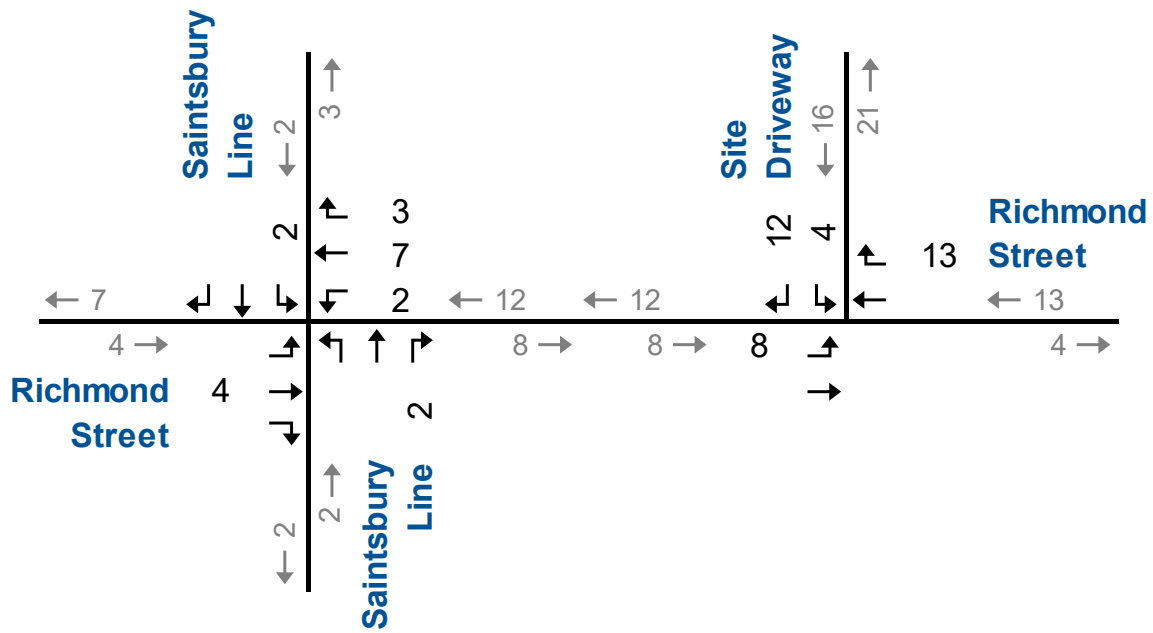




AM Peak Hour



PM Peak Hour



Site Generated Traffic Volumes

4 Evaluation of Future Traffic Conditions

The assessment of future traffic conditions contained in this section includes estimates of future background and total traffic volumes, and the analyses for the traffic conditions for the year of completion (2027), five years after completion (2032), and ten years after completion (2037).

4.1 Background Traffic Forecasts

In order to derive the generalized background traffic volumes, a growth rate of 2.0% per annum was applied to the existing roadway traffic volumes. This growth rate was confirmed with MTO and the County during the pre-study consultation.

4.1.1 Other Area Developments

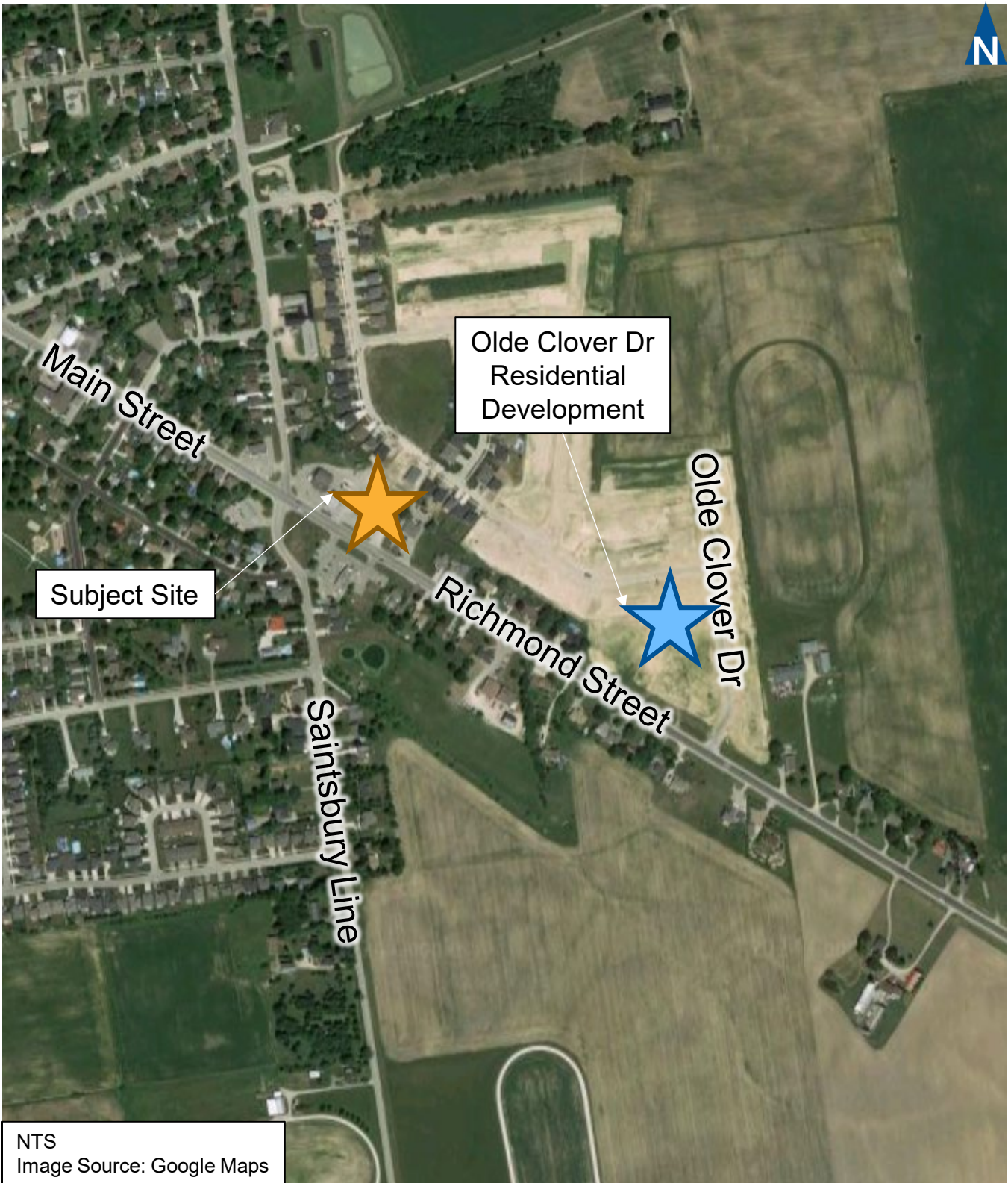
During pre-study consultation, County staff indicated that there is a site plan approved high density residential development located on Olde Clover Drive.

The proposed residential development is located at the northwest corner of the intersection of Richmond Street and Olde Clover Drive. **Figure 4.1** illustrates the location of the other area development.

The development consists of a 4-storey, 57-unit apartment building and is assumed to be completed by 2027. The trip generation, estimated as part of this study, indicates a total of 13 AM peak hour trips and 23 PM peak hour trips are forecast to be generated by the development.

Appendix D contains the trip generation table and the background development traffic volumes.





Other Area Development Location

33400 Richmond Street, Lucan-Biddulph TIA
230774

Figure 4.1

4.2 2027 Traffic Forecasts

4.2.1 Background Traffic Operations

Figure 4.2 illustrates the 2027 background traffic volumes, including road traffic growth and other area development traffic.

The 2027 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions. Signal timings have not been optimized.

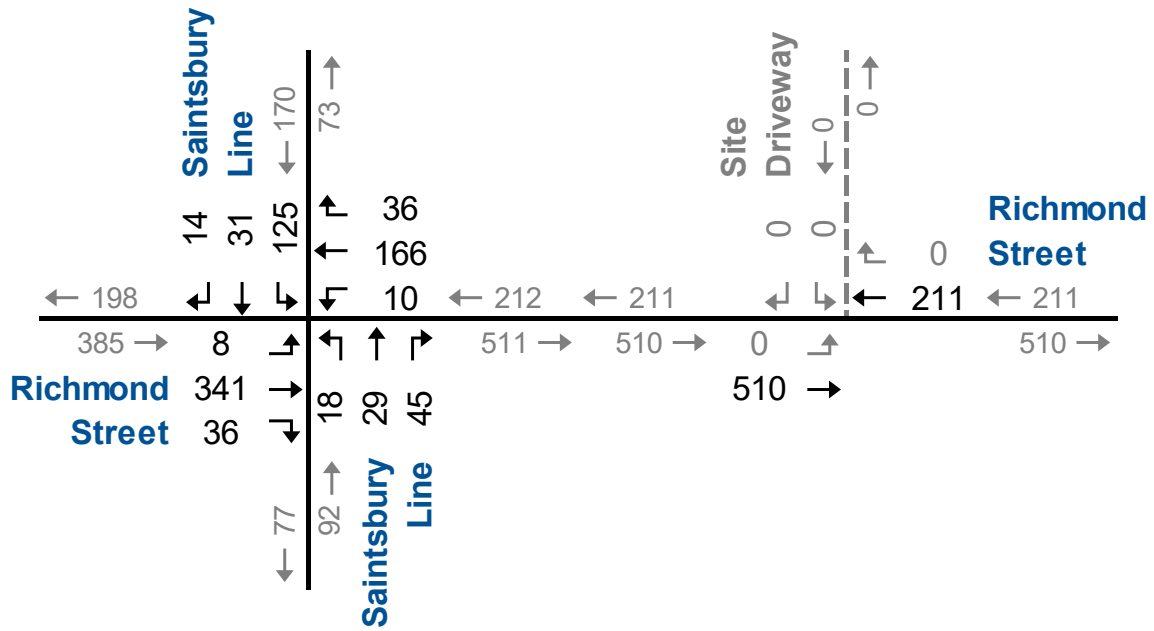
Table 4.1 summarizes the results of the 2027 background traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

Appendix E contains the supporting detailed Synchro 11 reports.

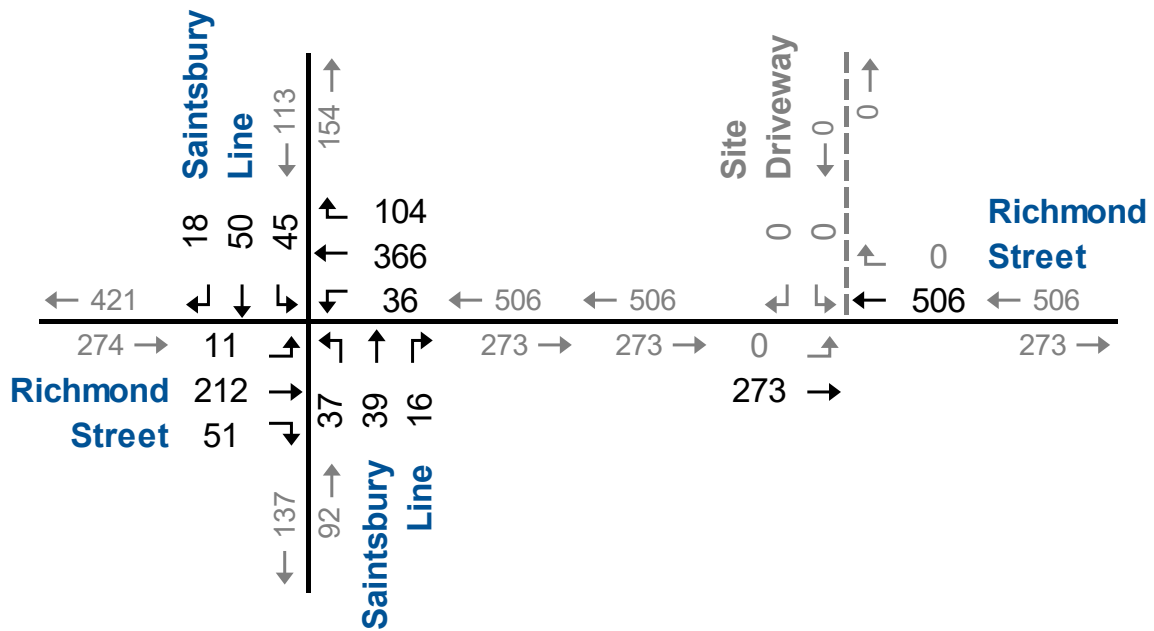




AM Peak Hour



PM Peak Hour



2027 Background Traffic Volumes

TABLE 4.1: 2027 BACKGROUND TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	B		
			Delay	6	7	>	7	8	>	6	6	>	6	26	25	>	25	30	24	>	29	13	
			V/C	0.01	0.38	>	0.02	0.21	>	0.06	0.27	>	0.47	0.17	>	14	4	>	25	-	>	11	-
			Q	0	1	>	0	1	>	2	7	>	70	-	>	68	-	>	11	-	>	11	-
			Stor.	70	-	>	15	-	>	70	-	>	70	-	>	68	-	>	11	-	>	11	-
Avail.	70	-	>	15	-	>	66	-	>	21	-	>	21	-	>	21	-	>	21	-			
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	A		
			Delay	8	5	>	5	6	>	6	6	>	6	28	26	>	26	28	26	>	27	10	
			V/C	0.02	0.25	>	0.05	0.44	>	0.15	0.22	>	0.18	0.26	>	4	6	>	25	-	>	21	-
			Q	0	1	>	0	2	>	4	5	>	70	-	>	66	-	>	21	-	>	21	-
			Stor.	70	-	>	15	-	>	70	-	>	70	-	>	66	-	>	21	-	>	21	-
Avail.	70	-	>	15	-	>	66	-	>	21	-	>	21	-	>	21	-	>	21	-			

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 V/C - Volume to Capacity Ratio
 Q - 95th Percentile Queue Length (m) </> - Shared with through movement
 Stor. - Existing Storage (m)
 Avail. - Available Storage (m)
 TCS - Traffic Control Signal



4.2.2 Total Traffic Operations

Figure 4.3 illustrates the 2027 total traffic volumes, including trips generated by the proposed development.

The 2027 total traffic volumes have been analyzed using the same methodology as under existing and background traffic conditions. Signal timings have not been optimized.

It is noted that Richmond Street has a centre two-way left-turn lane in vicinity of the proposed Site Access location. Therefore, the site access intersection has been analyzed with an auxiliary eastbound (inbound) left-turn lane with 15 metres of storage.

Table 4.2 summarizes the results of the 2027 total traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Sainsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

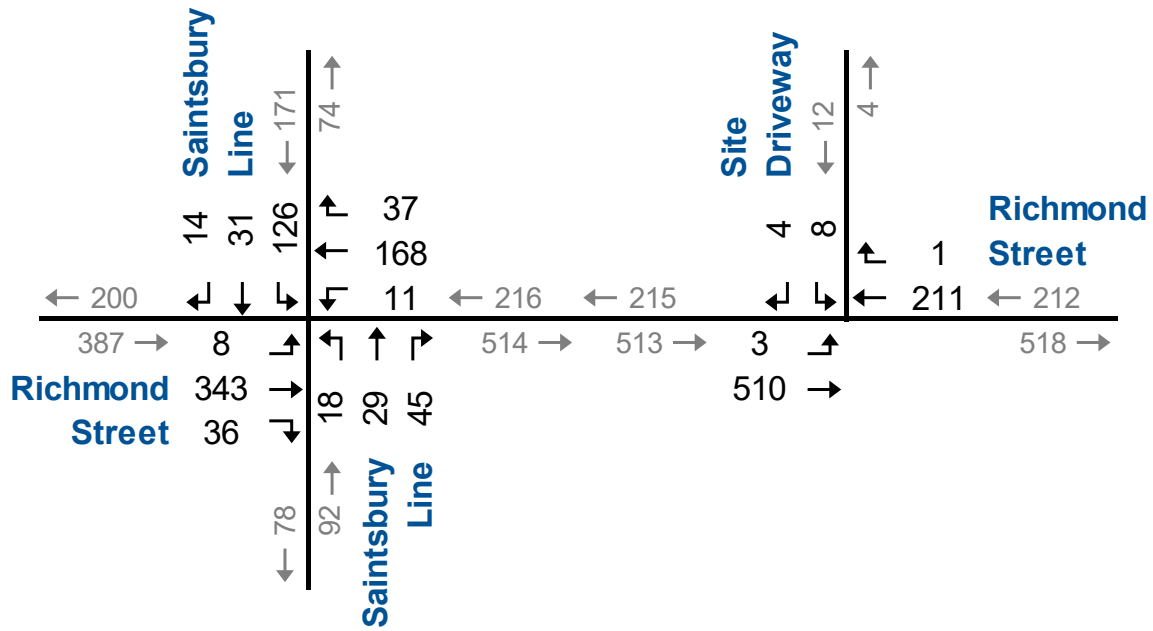
The site access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B).

Appendix F contains the supporting detailed Synchro 11 reports.

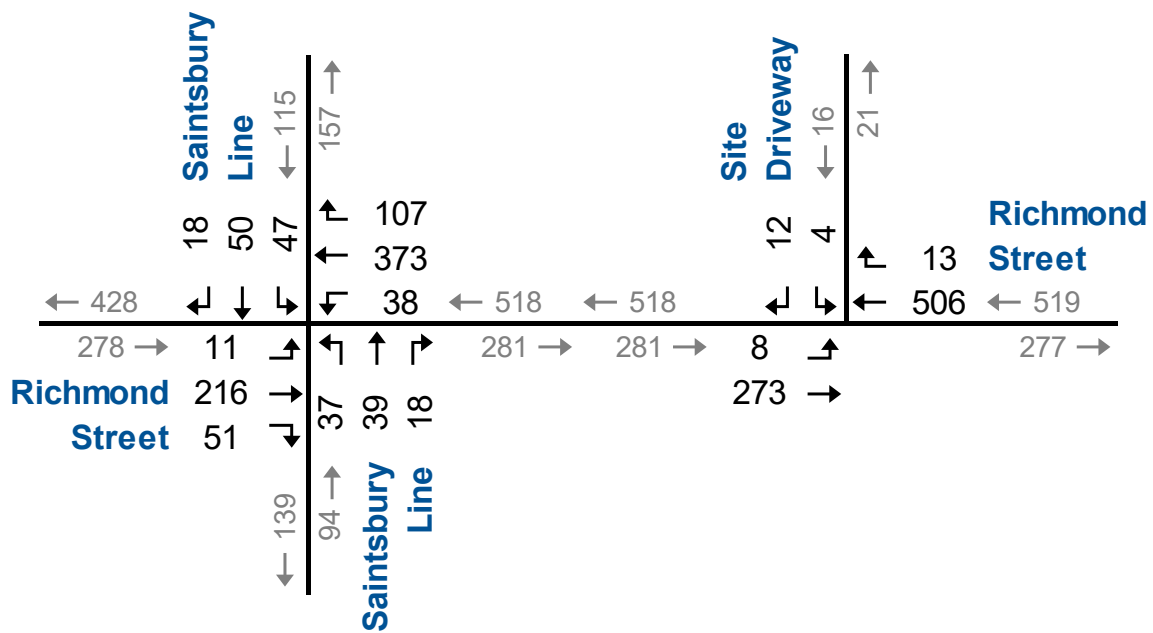




AM Peak Hour



PM Peak Hour



2027 Total Traffic Volumes

TABLE 4.2: 2027 TOTAL TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 7 0.01 0 70 70	A 7 0.38 1 -> ->	> > > > > >	A 7	A 9 0.03 0 15 15	A 6 0.21 1 -> ->	> > > > > >	A 6	C 26 0.06 2 70 68	C 25 0.27 7 -> ->	> > > > > >	C 25	C 30 0.47 14 25 11	C 24 0.17 4 -> ->	> > > > > >	C 29	B 13
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 8 0.00 0 15 15	A 0 0.00 0 -> ->	> > > > > >	A 0	A 0 0.00 0 -> ->	> > > > > >	A 0						B 12 0.02 1 -> ->	> > > > > >	B 12		
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 8 0.02 0 70 70	A 5 0.25 1 -> ->	> > > > > >	A 5	A 6 0.06 0 15 15	A 6 0.45 2 -> ->	> > > > > >	A 6	C 28 0.15 4 70 66	C 26 0.23 5 -> ->	> > > > > >	C 26	C 28 0.19 4 25 21	C 26 0.26 6 -> ->	> > > > > >	C 27	A 10
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 9 0.01 0 15 15	A 0 0.00 0 -> ->	> > > > > >	A 0	A 0 0.00 0 -> ->	> > > > > >	A 0						B 12 0.04 1 -> ->	> > > > > >	B 12		

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 V/C - Volume to Capacity Ratio
 Q - 95th Percentile Queue Length (m)
 Stor. - Existing Storage (m)
 Avail. - Available Storage (m)
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 </> - Shared with through movement

4.2.3 Queueing Analysis

In addition to the Synchro 11 analysis, queue length analysis for the 2027 background and total traffic conditions were carried out at the intersection of Richmond Street/Main Street and Saintsbury Line.

The queue analysis has been conducted using the same methodology as under existing traffic conditions.

Table 4.3 summarizes the results of the queue length analysis for 2027 background and total traffic conditions. The results indicate that the same queueing issues are forecast to occur as under existing traffic conditions.



TABLE 4.3: 2027 THROUGH AND LEFT-TURN QUEUE ANALYSIS

Intersection	Horizon	Lane	# of Lanes	Cycle Length (s)		Volumes (vph)		m _i max	Calc'd Length per Lane (m)	Available Length (m)
				AM	PM	AM	PM			
Richmond Street/Main Street and Sainsbury Line	2027 Background	EBL	1	93	93	9	11	0.3	7.5	70
		EBTR	1			408	266	10.5	120.0	-
		WBL	1			15	37	1.0	22.5	15*
		WBTR	1			224	476	12.3	135.0	-
		NBL	1			18	37	1.0	22.5	70
		NBTR	1			80	56	2.1	37.5	-
		SBL	1			130	46	3.4	52.5	25*
		SBTR	1			52	68	1.8	30.0	-
	2027 Total	EBL	1	93	93	9	11	0.3	7.5	70
		EBTR	1			410	270	10.6	120.0	-
		WBL	1			16	39	1.0	22.5	15*
		WBTR	1			228	486	12.6	142.5	-
		NBL	1			18	37	1.0	22.5	70
		NBTR	1			80	58	2.1	37.5	-
SBL	1	131	48	3.4	52.5	25*				
SBTR	1	52	68	1.8	30.0	-				

* Storage extends beyond length of solid line.



4.3 2032 Traffic Forecasts

4.3.1 Background Traffic Operations

Figure 4.4 illustrates the 2032 background traffic volumes, including road traffic growth and other area development traffic.

The 2032 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions. Signal timings have not been optimized.

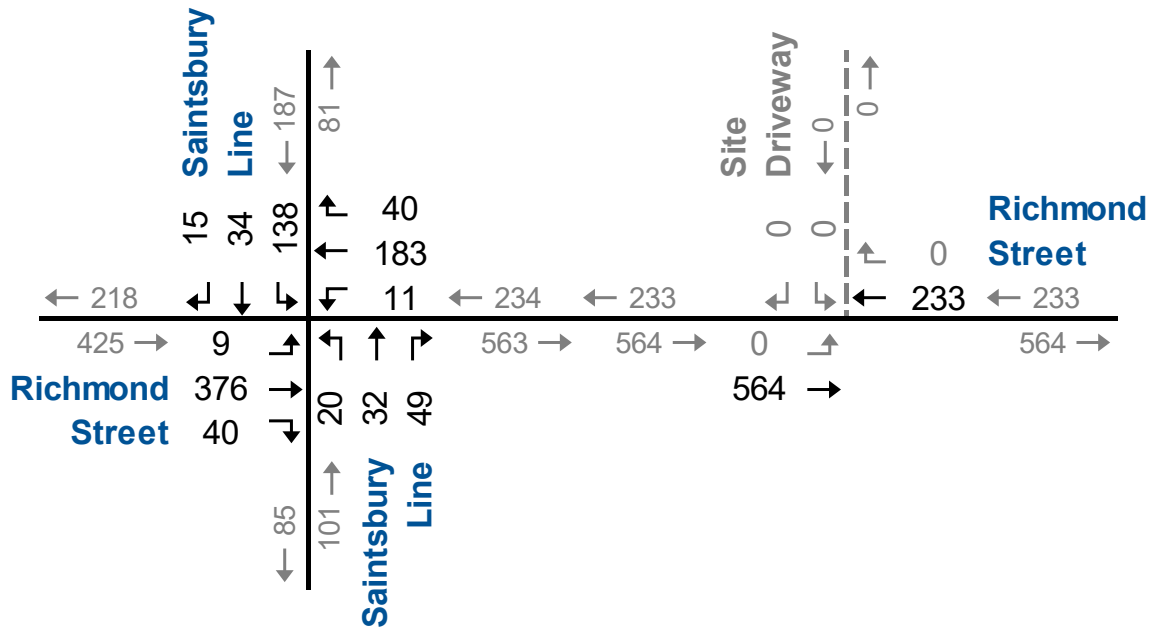
Table 4.4 summarizes the results of the 2032 background traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

Appendix G contains the supporting detailed Synchro 11 reports.

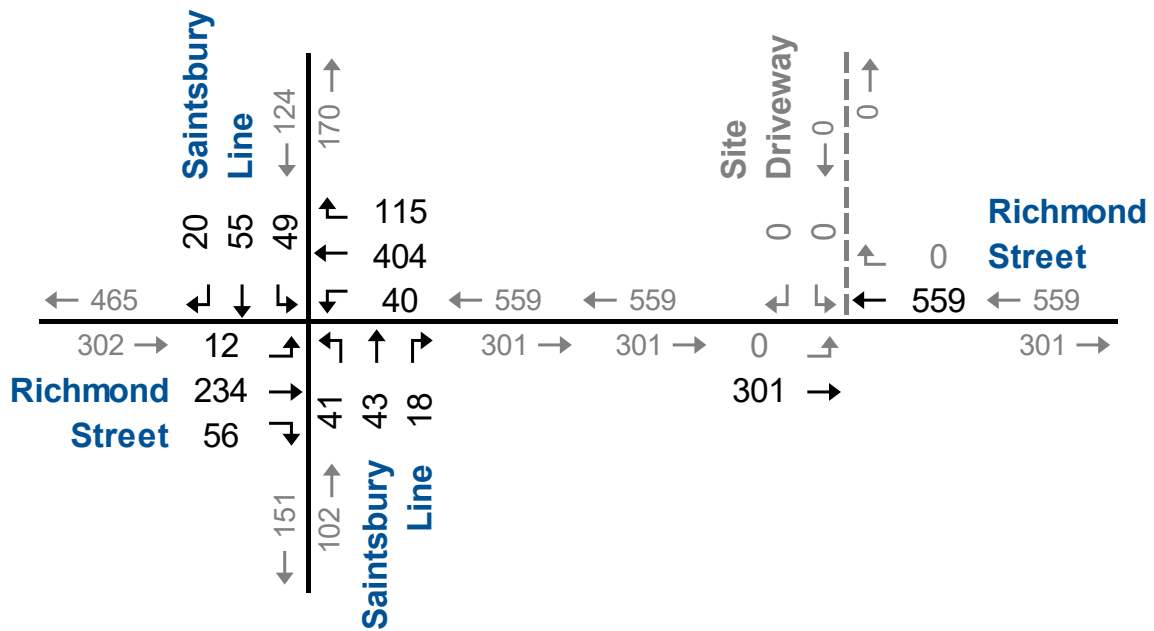




AM Peak Hour



PM Peak Hour



2032 Background Traffic Volumes

TABLE 4.4: 2032 BACKGROUND TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	B		
			Delay	7	7	>	7	10	6	>	6	25	25	>	25	30	24	>	29	13			
			V/C	0.01	0.42	>	0.03	0.23	>	0.06	0.28	>	0.50	0.17	>								
			Q	0	1	>	0	1	>	2	8	>	16	4	>								
			Stor.	70	-	>	15	-	>	70	-	>	25	-	>								
Avail.	70	-	>	15	-	>	68	-	>	9	-	>											
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	>	A	C	C	>	C	C	>	C	C	>	C	B		
			Delay	9	5	>	5	6	6	>	6	28	26	>	27	28	26	>	27	10			
			V/C	0.02	0.27	>	0.06	0.48	>	0.17	0.25	>	0.20	0.29	>								
			Q	0	1	>	0	2	>	4	6	>	5	7	>								
			Stor.	70	-	>	15	-	>	70	-	>	25	-	>								
Avail.	70	-	>	15	-	>	66	-	>	20	-	>											

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

</> - Shared with through movement



4.3.2 Total Traffic Operations

Figure 4.5 illustrates the 2032 total traffic volumes, including trips generated by the proposed development.

The 2032 total traffic volumes have been analyzed using the same methodology as under 2027 total traffic conditions. Signal timings have not been optimized.

Table 4.5 summarizes the results of the 2032 total traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

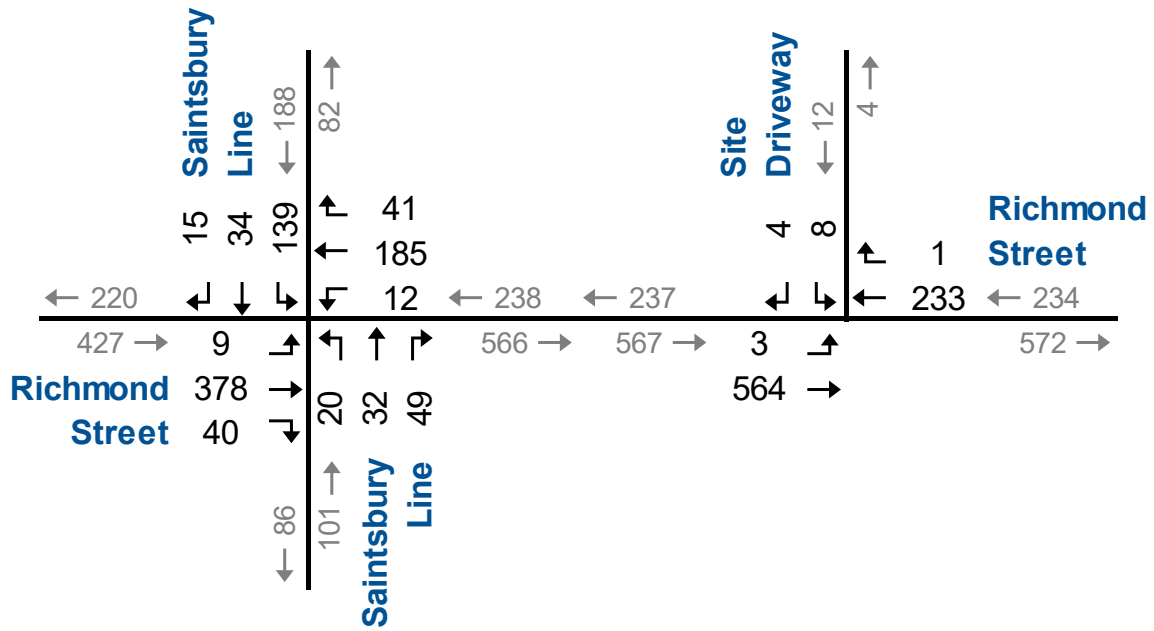
The site access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B).

Appendix H contains the supporting detailed Synchro 11 reports.

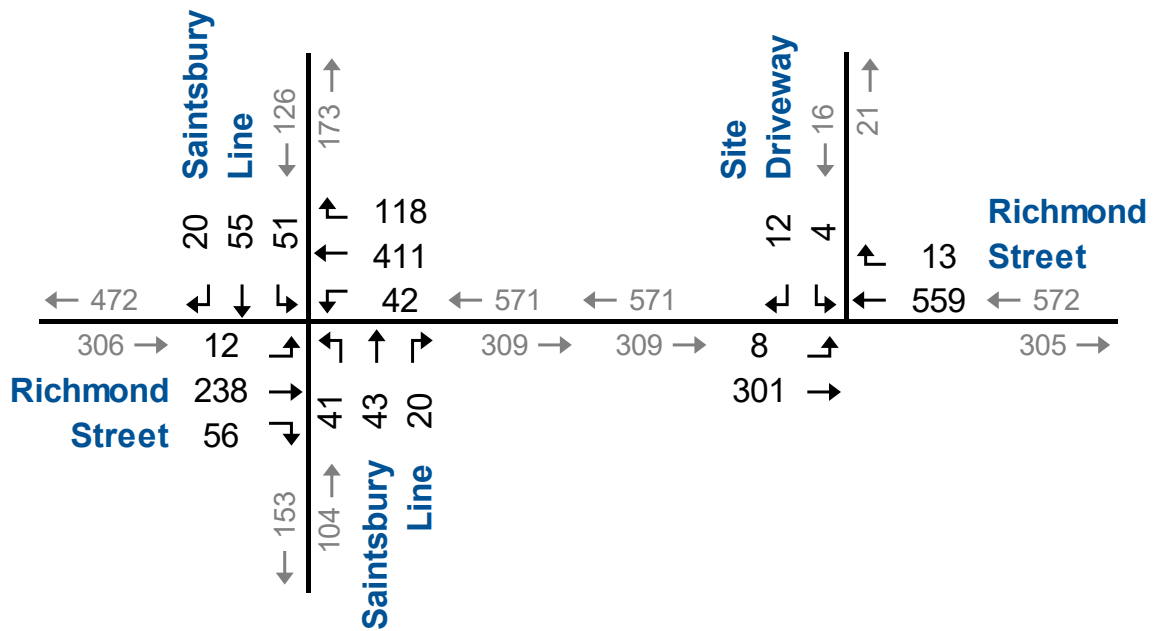




AM Peak Hour



PM Peak Hour



2032 Total Traffic Volumes

TABLE 4.5: 2032 TOTAL TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 7 0.01 0 70 70	A 7 0.42 1 -> ->	> > > > > >	A 7	A 10 0.03 0 15 15	A 6 0.24 1 -> ->	> > > > > >	A 6	C 25 0.06 2 70 68	C 25 0.27 8 -> ->	> > > > > >	C 25	C 30 0.50 16 25 9	C 24 0.17 4 -> ->	> > > > > >	C 29	B 13
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 8 0.00 0 15 15	A 0 0.00 0 -> ->	> > > > > >	A 0	A 0 0.00 0 -> ->	> > > > > >	A 0						B 12		> > > > > >	B 12	
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 9 0.02 0 70 70	A 5 0.28 1 -> ->	> > > > > >	A 5	A 6 0.06 0 15 15	A 6 0.49 2 -> ->	> > > > > >	A 6	C 28 0.17 4 70 66	C 26 0.26 6 -> ->	> > > > > >	C 27	C 28 0.21 5 25 20	C 26 0.29 7 -> ->	> > > > > >	C 27	B 10
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 9 0.01 0 15 15	A 0 0.00 0 -> ->	> > > > > >	A 0	A 0 0.00 0 -> ->	> > > > > >	A 0						B 13		> > > > > >	B 13	

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 V/C - Volume to Capacity Ratio
 Q - 95th Percentile Queue Length (m)
 Stor. - Existing Storage (m)
 Avail. - Available Storage (m)
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 </> - Shared with through movement

4.3.3 Queueing Analysis

In addition to the Synchro 11 analysis, queue length analysis for the 2032 background and total traffic conditions were carried out at the intersection of Richmond Street/Main Street and Saintsbury Line.

The queue analysis has been conducted using the same methodology as under existing traffic conditions.

Table 4.6 summarizes the results of the queue length analysis for 2032 background and total traffic conditions. The results indicate that the same queueing issues are forecast to occur as under existing traffic conditions.



TABLE 4.6: 2032 THROUGH AND LEFT-TURN QUEUE ANALYSIS

Intersection	Horizon	Lane	# of Lanes	Cycle Length (s)		Volumes (vph)		m, max	Calc'd Length per Lane (m)	Available Length (m)
				AM	PM	AM	PM			
Richmond Street/Main Street and Sainsbury Line	2032 Background	EBL	1			10	12	0.3	7.5	70
		EBTR	1			450	293	11.6	127.5	-
		WBL	1			16	41	1.1	22.5	15*
		WBTR	1	93	93	247	525	13.6	150.0	-
		NBL	1			20	41	1.1	22.5	70
		NBTR	1			89	62	2.3	37.5	-
		SBL	1			144	50	3.7	52.5	25*
		SBTR	1			57	75	1.9	30.0	-
	2032 Total	EBL	1			10	12	0.3	7.5	70
		EBTR	1			452	297	11.7	135.0	-
		WBL	1			17	43	1.1	22.5	15*
		WBTR	1	93	93	250	535	13.8	150.0	-
		NBL	1			20	41	1.1	22.5	70
		NBTR	1			89	64	2.3	37.5	-
SBL	1			145	52	3.7	52.5	25*		
SBTR	1			57	75	1.9	30.0	-		

* Storage extends beyond length of solid line.



4.4 2037 Traffic Forecasts

4.4.1 Background Traffic Operations

Figure 4.6 illustrates the 2037 background traffic volumes, including road traffic growth and other area development traffic.

The 2037 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions. Signal timings have not been optimized.

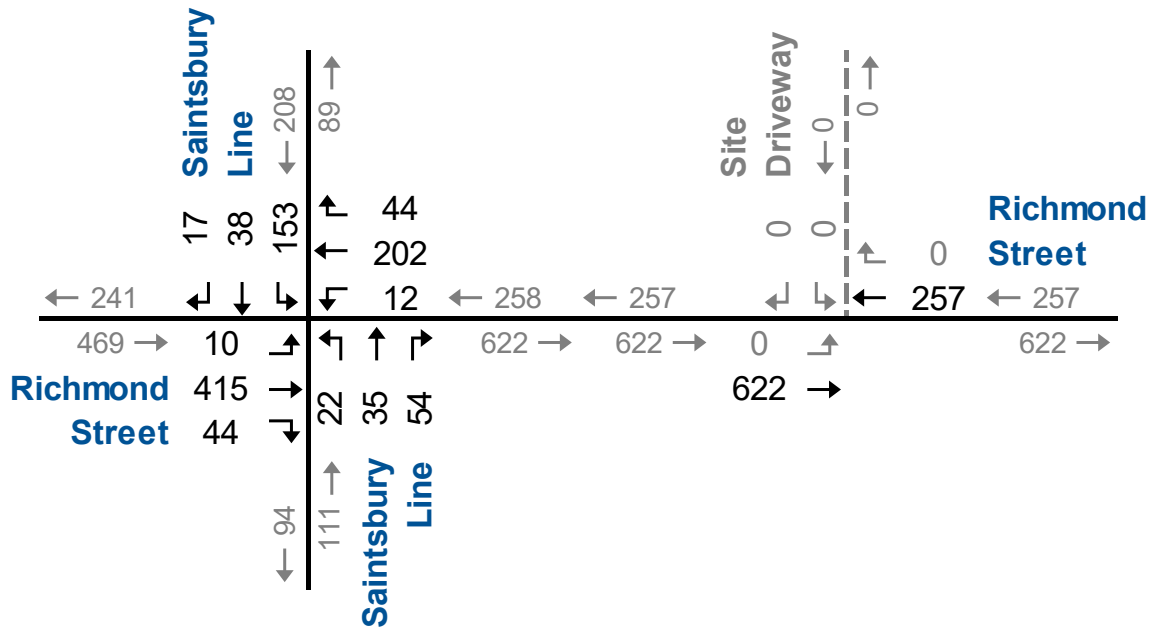
Table 4.7 summarizes the results of the 2037 background traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

Appendix I contains the supporting detailed Synchro 11 reports.

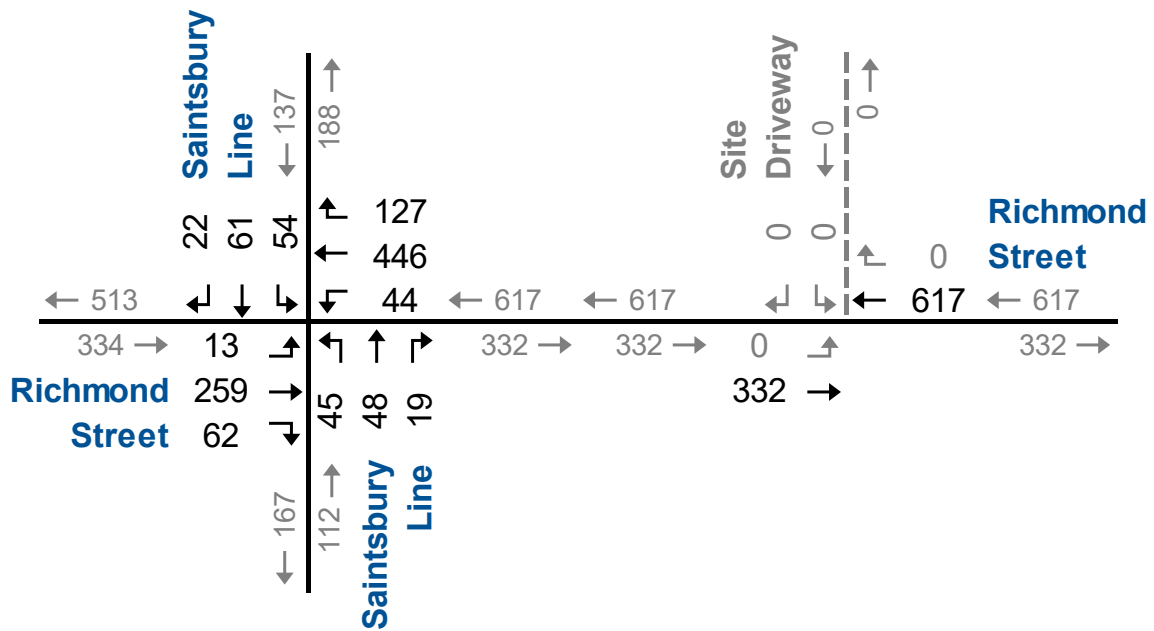




AM Peak Hour



PM Peak Hour



2037 Background Traffic Volumes

TABLE 4.7: 2037 BACKGROUND TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	B	A	>	A	C	C	>	C	C	C	>	C	B
			Delay	8	8	>	8	12	7	>	7	25	24	>	24	31	24	>	29	14
			V/C	0.02	0.47	>	0.03	0.26	>	0.07	0.28	>	0.07	0.28	>	0.53	0.18	>		
			Q	0	2	>	0	1	>	2	8	>	2	8	>	19	4	>		
			Stor.	70	-	>	15	-	>	70	-	>	70	-	>	25	-	>		
Avail.	70	-	>	15	-	>	68	-	>	6	-	>	6	-	>					
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS	A	A	>	A	A	A	>	A	C	C	>	C	C	C	>	C	B
			Delay	10	5	>	5	7	7	>	7	28	26	>	27	28	26	>	27	10
			V/C	0.03	0.30	>	0.07	0.53	>	0.19	0.27	>	0.19	0.27	>	0.23	0.32	>		
			Q	0	1	>	0	2	>	4	6	>	4	6	>	6	8	>		
			Stor.	70	-	>	15	-	>	70	-	>	70	-	>	25	-	>		
Avail.	70	-	>	15	-	>	66	-	>	19	-	>	19	-	>					

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 V/C - Volume to Capacity Ratio
 Q - 95th Percentile Queue Length (m)
 Stor. - Existing Storage (m)
 Avail. - Available Storage (m)
 TCS - Traffic Control Signal
 </> - Shared with through movement



4.4.2 Total Traffic Operations

Figure 4.7 illustrates the 2037 total traffic volumes, including trips generated by the proposed development.

The 2037 total traffic volumes have been analyzed using the same methodology as under 2027 and 2032 total traffic conditions. Signal timings have not been optimized.

Table 4.8 summarizes the results of the 2037 total traffic operations. The results indicate that the intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours.

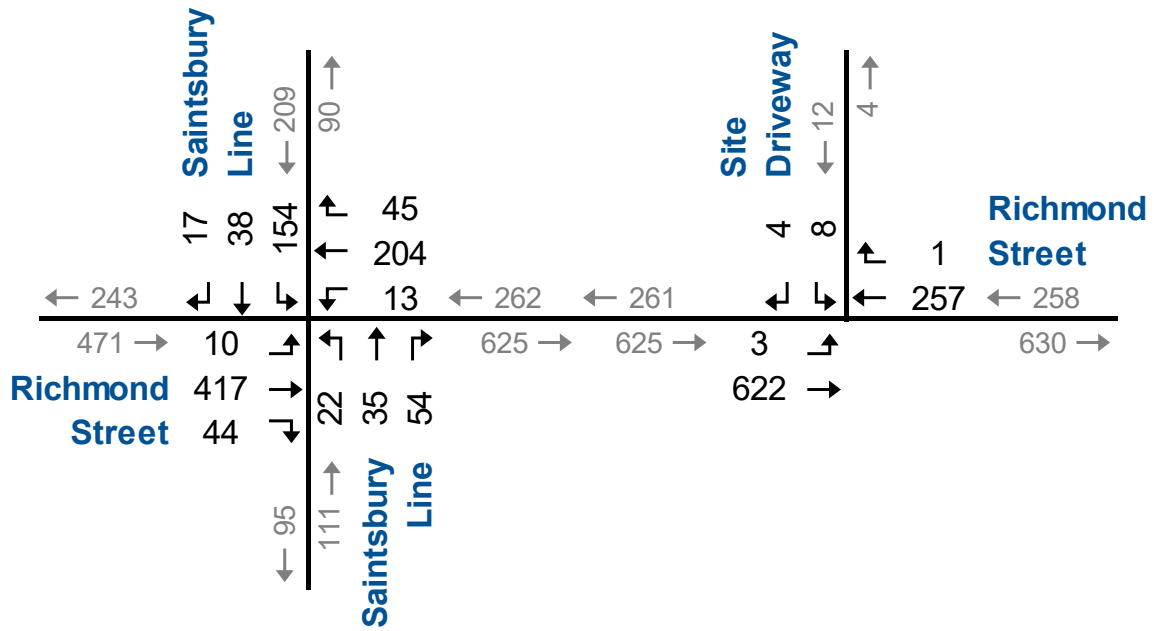
The site access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B).

Appendix J contains the supporting detailed Synchro 11 reports.

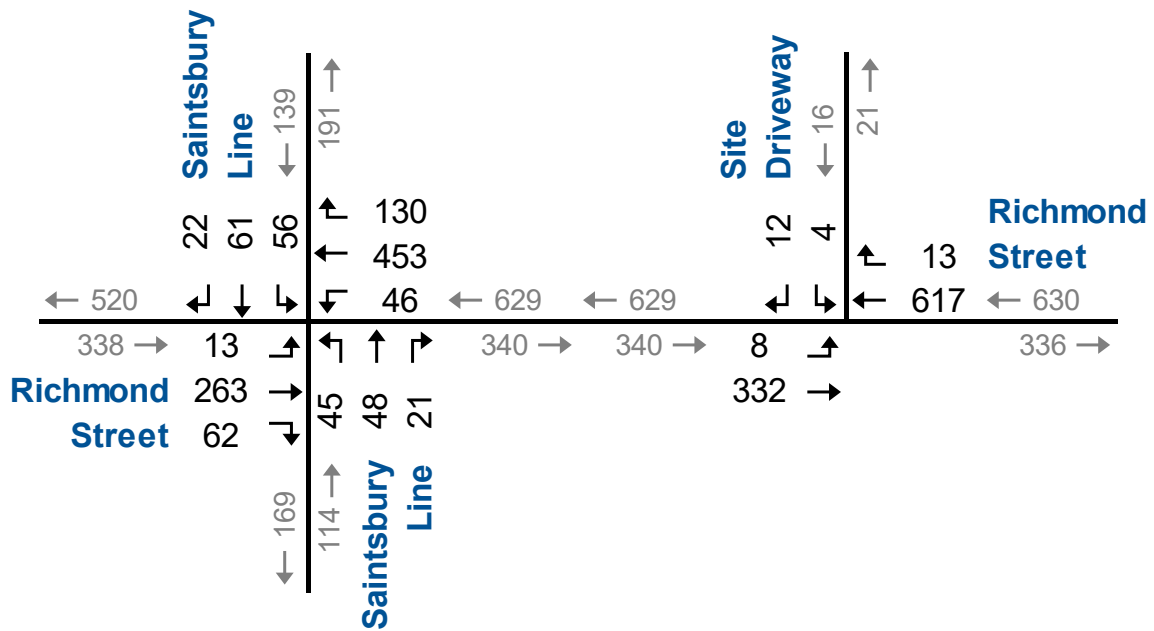




AM Peak Hour



PM Peak Hour



2037 Total Traffic Volumes

TABLE 4.8: 2037 TOTAL TRAFFIC OPERATIONS

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	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 8 0.02 0 70 70	A 8 0.48 2 -> ->	> > > > >	A 8	B 12 0.04 0 15 15	A 7 0.27 1 -> ->	> > > > >	A 7	C 25 0.07 2 70 68	C 24 0.28 8 -> ->	> > > > >	C 24	C 31 0.53 19 25 6	C 24 0.18 4 -> ->	> > > > >	C 29	B 14
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 8 0.00 0 15 15	A 0 0.00 0 -> ->	> > > > >	A 0	A 0 0.00 0 -> ->	> > > > >	A 0						B 13		> > > > >	B 13	
PM Peak Hour	Saintsbury Line & Main Street/Richmond Street	TCS	LOS Delay V/C Q Stor. Avail.	A 10 0.03 0 70 70	A 5 0.30 1 -> ->	> > > > >	A 5	A 7 0.07 0 15 15	A 7 0.54 2 -> ->	> > > > >	A 7	C 28 0.19 4 70 66	C 26 0.28 7 -> ->	> > > > >	C 27	C 28 0.24 6 25 19	C 26 0.32 8 -> ->	> > > > >	C 27	B 11
	Richmond Street & Site Driveway	TWSC	LOS Delay V/C Q Stor. Avail.	A 9 0.01 0 15 15	A 0 0.00 0 -> ->	> > > > >	A 0	A 0 0.00 0 -> ->	> > > > >	A 0						B 14		> > > > >	B 14	

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 V/C - Volume to Capacity Ratio
 Q - 95th Percentile Queue Length (m)
 Stor. - Existing Storage (m)
 Avail. - Available Storage (m)
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 </> - Shared with through movement

4.4.3 Queueing Analysis

In addition to the Synchro 11 analysis, queue length analysis for the 2037 background and total traffic conditions were carried out at the intersection of Richmond Street/Main Street and Saintsbury Line.

The queue analysis has been conducted using the same methodology as under existing traffic conditions.

Table 4.9 summarizes the results of the queue length analysis for 2037 background and total traffic conditions. The results indicate that the same queueing issues are forecast to occur as under existing traffic conditions.



TABLE 4.9: 2037 THROUGH AND LEFT-TURN QUEUE ANALYSIS

Intersection	Horizon	Lane	# of Lanes	Cycle Length (s)		Volumes (vph)		m, max	Calc'd Length per Lane (m)	Available Length (m)
				AM	PM	AM	PM			
Richmond Street/Main Street and Sainsbury Line	2037 Background	EBL	1			11	13	0.3	7.5	70
		EBTR	1			902	324	23.3	232.5	-
		WBL	1			17	45	1.2	22.5	15*
		WBTR	1	93	93	273	579	15.0	165.0	-
		NBL	1			22	45	1.2	22.5	70
		NBTR	1			97	68	2.5	37.5	-
		SBL	1			159	55	4.1	60.0	25*
		SBTR	1			64	83	2.1	37.5	-
	2037 Total	EBL	1			11	13	0.3	7.5	70
		EBTR	1			499	328	12.9	142.5	-
		WBL	1			19	47	1.2	22.5	15*
		WBTR	1	93	93	276	589	15.2	165.0	-
		NBL	1			22	45	1.2	22.5	70
		NBTR	1			97	70	2.5	37.5	-
						160	57	4.1	60.0	25*
						64	83	2.1	37.5	-

* Storage extends beyond length of solid line.



4.5 Auxiliary Turn Lanes

The need for an auxiliary left-turn lane and a right-turn lane on Richmond Street at the proposed site access was reviewed herein.

4.5.1 Left-Turn Lanes

The need for an auxiliary eastbound left-turn turning lane on Richmond Street at the Site Access was assessed based on the requirements and procedures detailed in the Ministry of Transportation Design Supplement for the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads⁶. The assessment is based on the nomographs for left-turn lanes on a two-lane undivided highway at an unsignalized intersection with a design speed of 20 kilometres per hour over the posted speed limits (70 km/h).

It is also noted that the percentage of left-turning vehicles does not meet the threshold of 2.5% under 2027, 2032, or 2037 total traffic conditions during the AM peak hour or under 2037 total traffic conditions during the PM peak hour.

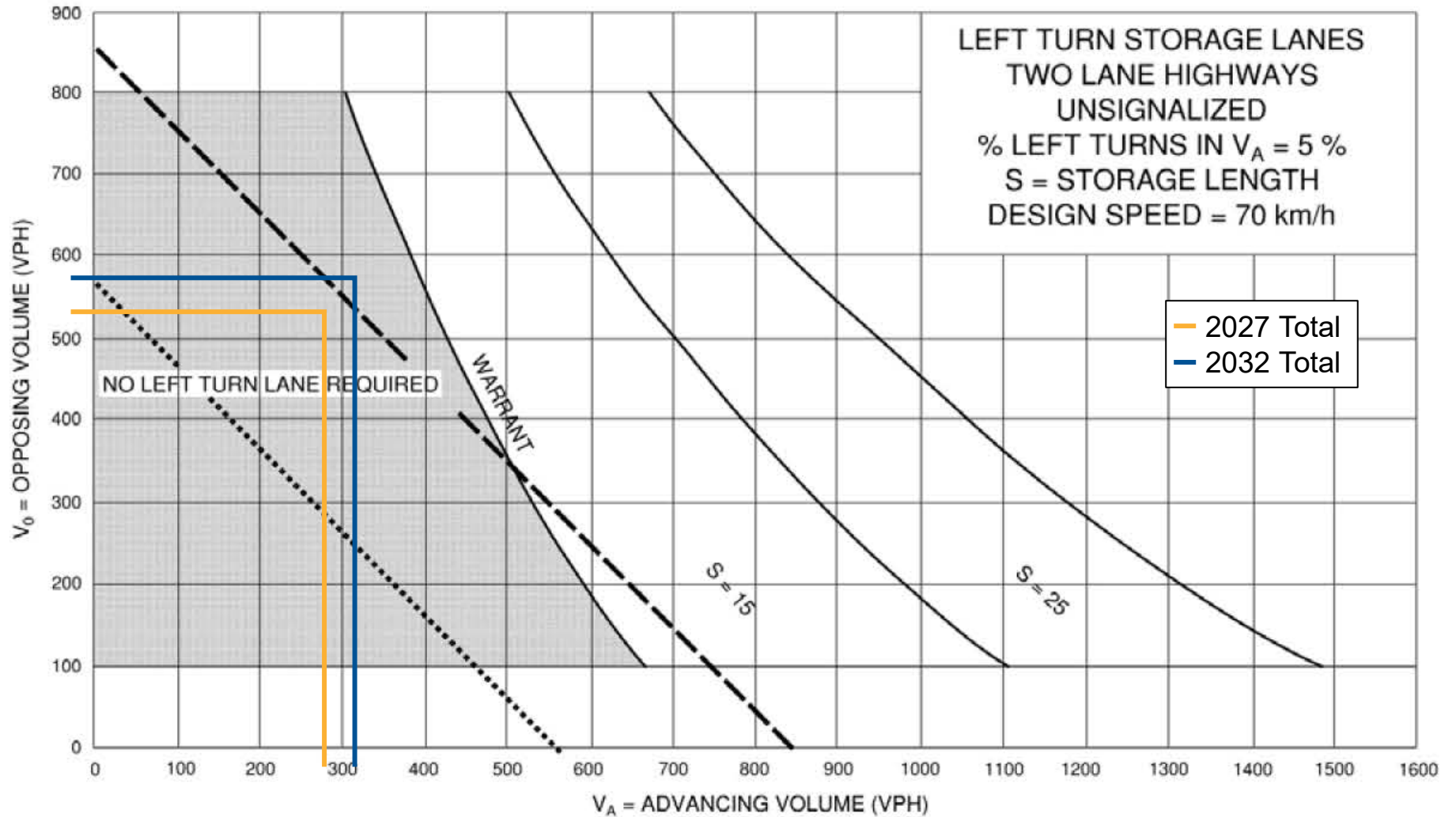
Based on the above criteria, an eastbound left-turn lane on Richmond Street at the Site Access is not warranted under 2027, 2032, or 2037 total traffic conditions.

However, there is an existing two-way left-turn lane on Richmond Street along the subject site frontage, which could be used for inbound (eastbound) left-turns.

Figure 4.8 contains the warrant nomograph.

⁶ MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, June 2017.





Richmond Street and Site Access Eastbound Left-Turn Lane Total Traffic Conditions, PM Peak Hour

4.5.2 Right-Turn Lanes

The need for an auxiliary westbound right-turn turning lane on Richmond Street at the Site Access was assessed based on the requirements detailed in the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads⁷ (GDGCR). According to the GDGCR, a right-turn lane should be implemented “when the volume of decelerating or accelerating vehicles compared with the through traffic volume causes undue hazard”.

The inbound right-turning traffic volumes are projected to be 1 and 13 vph during the AM and PM peak hour, respectively. The right-turning traffic volumes during the AM/PM peak hours are respectively less than 1% and 2% of the total westbound traffic volumes on Richmond Street at the site driveway under 2037 traffic conditions. The proportions of right-turn traffic volumes are not significant to cause a hazard to the traffic movement on Richmond Street. Therefore, a westbound right-turn lane is not required on Richmond Street at the site access.

⁷ Transportation Association of Canada, *Geometric Design Guide for Canadian Roads (2017)*, June 2017.



5 Conclusions and Recommendations

5.1 Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Existing Traffic Conditions:** The intersection of Richmond Street/Main Street and Saintsbury Line is operating at acceptable levels of service, and with no problem movements.
- ▶ **Development Trip Generation:** The development is forecast to generate 16 trips during the AM peak hour and 37 trips during the PM peak hour.

The net trips for the weekday and Saturday peak hours are comparable. The analysis herein is based on the weekday AM/PM peak hour trip generation estimates

- ▶ **Background Traffic Conditions:** The intersection of Richmond Street/Main Street and Saintsbury Line is forecast to operate at acceptable levels of service during the AM and PM peak hours under 2027, 2032, and 2037 background traffic conditions.
- ▶ **Total Traffic Conditions:** The intersections of Richmond Street/Main Street and Saintsbury Line, and the Site Access intersection on Richmond Street are forecast to operate at acceptable levels of service during the AM and PM peak hours under 2027, 2032, and 2037 total traffic conditions.
- ▶ **Site Access:** The site access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B) under 2027, 2032, and 2037 total traffic conditions.

An eastbound (inbound) auxiliary left-turn lane or a westbound (inbound) auxiliary right-turn lane is not warranted on Richmond Street at the Site Access under 2027, 2032, or 2037 total traffic conditions.

5.2 Recommendations

Based on the findings and conclusions of this study, it is recommended that the development be considered for approval as proposed.



Appendix A

Pre-Study Consultation



From: [Chris Traini](#)
To: [Dan FitzGerald](#); [Patrick Neal](#)
Cc: [Rajan Philips](#)
Subject: RE: (230774) 33400 Richmond Street, Lucan-Biddulph TIA - Pre-Study Consultation
Date: July 22, 2024 4:24:29 PM
Attachments: [image002.png](#)
[image004.png](#)

Hi Patrick,

Agreed, no concerns with the proposed scope of work outside of what the MTO has already identified.

Chris

Chris Traini, P.Eng.
Deputy CAO/County Engineer
County of Middlesex
ctraini@middlesex.ca
(519) 434-7321 ext. 2264
www.middlesex.ca

From: Dan FitzGerald <dfitzgerald@middlesex.ca>
Sent: Monday, July 22, 2024 10:55 AM
To: Patrick Neal <pneal@ptsl.com>; Chris Traini <ctraini@middlesex.ca>
Cc: Rajan Philips <rphilips@ptsl.com>
Subject: RE: (230774) 33400 Richmond Street, Lucan-Biddulph TIA - Pre-Study Consultation

Hi Patrick,

I am not sure Chris would have any concerns given Highway 4 is within the jurisdiction of the Ministry of Transportation. In terms of development in close proximity to the site, there is a site plan approved high density residential development just down the street from this site (east of 33340 Richmond Street). This is a 57 unit 4 storey apartment building but gains access through the Olde Clover Drive.

Aside from that development, there are no other active applications within the area.

Regards,

Dan FitzGerald, MPI MCIP RPP | COUNTY OF MIDDLESEX | Manager of Planning | 519.930.1008



From: Patrick Neal <pneal@ptsl.com>

Sent: Monday, July 22, 2024 8:49 AM

To: Dan FitzGerald <dfitzgerald@middlesex.ca>; Chris Traini <ctraini@middlesex.ca>

Cc: Rajan Philips <rphilips@ptsl.com>

Subject: RE: (230774) 33400 Richmond Street, Lucan-Biddulph TIA - Pre-Study Consultation

CAUTION: This email originated from outside of the Middlesex County email system. Please use caution when clicking links or opening attachments unless you recognize the sender and know the content is safe.

Hi Dan and Chris,

Do you have any comments on our proposed scope of work below? And do you have any other area developments that we should include in our analysis?

Regards,

Patrick Neal, P.Eng.
Transportation Consultant



Paradigm Transportation Solutions Limited

p: 416.479.9684 x510

m: 416.688.7338

From: Johnston, Jeremiah (MTO) <Jeremiah.Johnston@ontario.ca>

Sent: Friday, January 12, 2024 9:32 AM

To: Patrick Neal <pneal@ptsl.com>

Cc: Rajan Philips <rphilips@ptsl.com>; ggerstheimer@bairdae.ca; Dan FitzGerald <dfitzgerald@middlesex.ca>; 'ctraini@middlesex.ca' <ctraini@middlesex.ca>

Subject: RE: (230774) 33400 Richmond Street, Lucan-Biddulph TIA - Pre-Study Consultation

Hello Patrick,

The below is acceptable to MTO, however MTO provides the following comments on the ToR. I have made some notes in red below as well.

- It is not a 'two-way centre turn lane' but a two-way left turn lane. It also appears that the location of ingress, EB LTs from the two way left turn lane may impede the WB designated left turn lane at the signals and must be analyzed in the study.

- Include Saturday analysis.
- Background developments – Please check with Chris and Dan at the County on what can be provided.
- We believe there was a typo - First Ave and Hwy 3 'Queue and storage lengths for left turn and through movements for First Avenue and Highway 3 South Ramp will be calculated using the arrival rate method explained on MTO's Signal Timing Policy'. Please do this for Hwy 4.
- As part of the TIS the addition of a RT lane from the highway should be analyzed using TAC and recommendations provided.

Please use MTO TIS Guidelines (March 2023).

If you have any questions please let me know.

Thank you,

Jeremiah Johnston Corridor Management Planner
Corridor Management Section
Ministry of Transportation Operations Branch West
659 Exeter Road, London, ON N6E 1L3
M: (226)-980-6407

From: Patrick Neal <pneal@ptsl.com>

Sent: January 4, 2024 3:14 PM

To: 'ctraini@middlesex.ca' <ctraini@middlesex.ca>; Johnston, Jeremiah (MTO) <Jeremiah.Johnston@ontario.ca>

Cc: Rajan Philips <rphilips@ptsl.com>; ggerstheimer@bairdae.ca

Subject: (230774) 33400 Richmond Street, Lucan-Biddulph TIA - Pre-Study Consultation

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Chris and Jeremiah,

We have been retained to complete the Transportation Impact Assessment (TIA) for a proposed Residential Development with a small commercial component located at 33400 Richmond Street in Lucan-Biddulph, Middlesex County.

The subject lands are located on the north side of Richmond Street (Highway 4), east of Saintsbury Line (Middlesex Road 47). The proposed development will include a Five-Storey, Mixed-Use Apartment Building accommodating 60 apartment units and a commercial use of 1,035 sq. ft. The development will include 87 parking spaces and will have a single access on Richmond Street.

A concept site plan is attached.

It is noted that along the frontage of the subject property, Richmond Street is a three-lane roadway with a two-way centre-turn lane that turns into a westbound left-turn lane at the intersection of Saintsbury Line. The intersection is under traffic signal control. The subject site is currently vacant with a closed-off access on the section of Richmond Street that includes the centre-turn lane.

We will prepare the TIA based on MTO TIS Guidelines (March 2023), and have prepared the following scope of work for the TIA for review/approval:

- Weekday AM and PM peak hours of analysis.
- Study Area Intersections:
 - o Richmond Street and Saintsbury Line (signalized); and
 - o access intersection on Richmond Street.
- We will collect new counts at Richmond Street and Saintsbury Line.
- **Please provide the signal timing information for the intersection of Richmond Street and Saintsbury Line. Attached**
- Horizon Years (as required by MTO): (1) anticipated year of completion, (2) five years after completion, and (3) ten years after completion.
- Background Growth: 2.0% compounded per annum, **please confirm. Use 2%**
- Background Developments: **Please confirm** and provide corresponding site statistics or TIS.
- Trip Generation: ITE Trip Generation Manual 11th Edition.
- Trip Distribution: Existing traffic patterns.
- Synchro Parameters: PHF of 0.92 and Saturation Flow Rate of 1900.
- Queue and storage lengths for left turn and through movements for First Avenue and Highway 3 South Ramp will be calculated using the arrival rate method explained on MTO's Signal Timing Policy. For queues/storage lengths for right turn movements, we will use Chapter 9 of TAC's Geometric Design Guide for Canadian Roads.

Please let us know if you have any questions or comments.

Regards,

Patrick Neal, EIT

Transportation Consultant



Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8

p: 416.479.9684 x510

m: 416.688.7338

e: pneal@ptsl.com

w: www.ptsl.com

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Appendix B

Existing Traffic Data





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts.com

Count Name: Richmond Street & Saintsbury Line
Site Code: 230774
Start Date: 01/16/2024
Page No: 1

Turning Movement Data

Start Time	Main Street Eastbound						Richmond Street Westbound						Saintsbury Line Northbound						Saintsbury Line Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	2	78	6	0	0	86	1	24	10	0	0	35	2	3	6	0	0	11	24	9	1	0	0	34	166
7:15 AM	2	82	8	0	0	92	1	35	6	0	0	42	5	6	10	0	0	21	27	9	3	0	0	39	194
7:30 AM	3	85	11	0	0	99	3	41	8	0	0	52	4	4	9	0	0	17	37	6	3	0	0	46	214
7:45 AM	2	87	7	0	1	96	2	45	9	0	0	56	7	7	15	0	0	29	28	6	3	0	0	37	218
Hourly Total	9	332	32	0	1	373	7	145	33	0	0	185	18	20	40	0	0	78	116	30	10	0	0	156	792
8:00 AM	1	67	8	0	0	76	3	35	11	0	0	49	1	10	8	0	0	19	26	8	4	0	0	38	182
8:15 AM	1	49	8	0	0	58	2	29	12	0	0	43	1	4	9	0	0	14	29	11	0	0	0	40	155
8:30 AM	3	62	1	0	0	66	5	31	25	0	0	61	5	9	5	0	1	19	20	7	2	0	0	29	175
8:45 AM	2	55	4	0	0	61	4	48	13	0	0	65	7	12	4	0	0	23	39	8	5	0	0	52	201
Hourly Total	7	233	21	0	0	261	14	143	61	0	0	218	14	35	26	0	1	75	114	34	11	0	0	159	713
9:00 AM	6	49	10	0	0	65	1	52	14	0	0	67	5	3	4	0	0	12	22	13	4	0	0	39	183
9:15 AM	2	58	12	0	0	72	3	33	9	0	0	45	5	2	5	0	0	12	18	6	0	0	0	24	153
9:30 AM	2	41	4	0	0	47	1	32	11	0	0	44	5	4	3	0	0	12	8	9	0	0	4	17	120
9:45 AM	2	49	5	0	0	56	3	47	7	0	0	57	8	2	2	0	0	12	12	7	1	0	0	20	145
Hourly Total	12	197	31	0	0	240	8	164	41	0	0	213	23	11	14	0	0	48	60	35	5	0	4	100	601
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	2	47	10	0	0	59	1	29	5	0	0	35	7	13	0	0	0	20	7	5	4	0	0	16	130
11:45 AM	7	50	6	0	0	63	1	34	9	0	0	44	12	2	3	0	0	17	10	5	6	0	0	21	145
Hourly Total	9	97	16	0	0	122	2	63	14	0	0	79	19	15	3	0	0	37	17	10	10	0	0	37	275
12:00 PM	6	43	8	0	0	57	3	45	8	0	0	56	8	4	3	0	0	15	9	6	5	0	0	20	148
12:15 PM	2	46	14	0	1	62	1	40	16	0	0	57	6	5	2	0	0	13	6	5	4	0	0	15	147
12:30 PM	4	53	5	0	0	62	2	42	6	0	0	50	10	3	0	0	0	13	10	4	2	0	0	16	141
12:45 PM	3	46	9	0	0	58	3	41	7	0	0	51	5	5	3	0	0	13	6	8	8	0	0	22	144
Hourly Total	15	188	36	0	1	239	9	168	37	0	0	214	29	17	8	0	0	54	31	23	19	0	0	73	580
1:00 PM	3	49	9	0	0	61	3	62	10	0	0	75	15	2	5	0	0	22	10	9	6	0	0	25	183
1:15 PM	4	44	10	0	0	58	1	45	13	0	0	59	10	2	3	0	0	15	6	4	3	0	0	13	145
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	7	93	19	0	0	119	4	107	23	0	0	134	25	4	8	0	0	37	16	13	9	0	0	38	328
3:00 PM	3	42	15	0	1	60	7	57	14	0	0	78	8	4	2	0	0	14	9	6	0	0	0	15	167
3:15 PM	3	51	15	0	0	69	5	47	15	0	3	67	8	7	3	0	1	18	10	6	6	0	0	22	176
3:30 PM	3	47	9	0	0	59	7	67	19	0	0	93	5	9	3	0	0	17	8	14	4	0	0	26	195
3:45 PM	2	47	9	0	0	58	8	76	19	0	0	103	11	4	2	0	1	17	13	13	5	0	0	31	209
Hourly Total	11	187	48	0	1	246	27	247	67	0	3	341	32	24	10	0	2	66	40	39	15	0	0	94	747
4:00 PM	1	40	8	0	1	49	11	60	18	0	0	89	11	12	3	0	0	26	7	14	6	0	0	27	191
4:15 PM	1	58	10	0	0	69	5	79	22	0	0	106	8	15	3	0	3	26	14	6	6	0	0	26	227

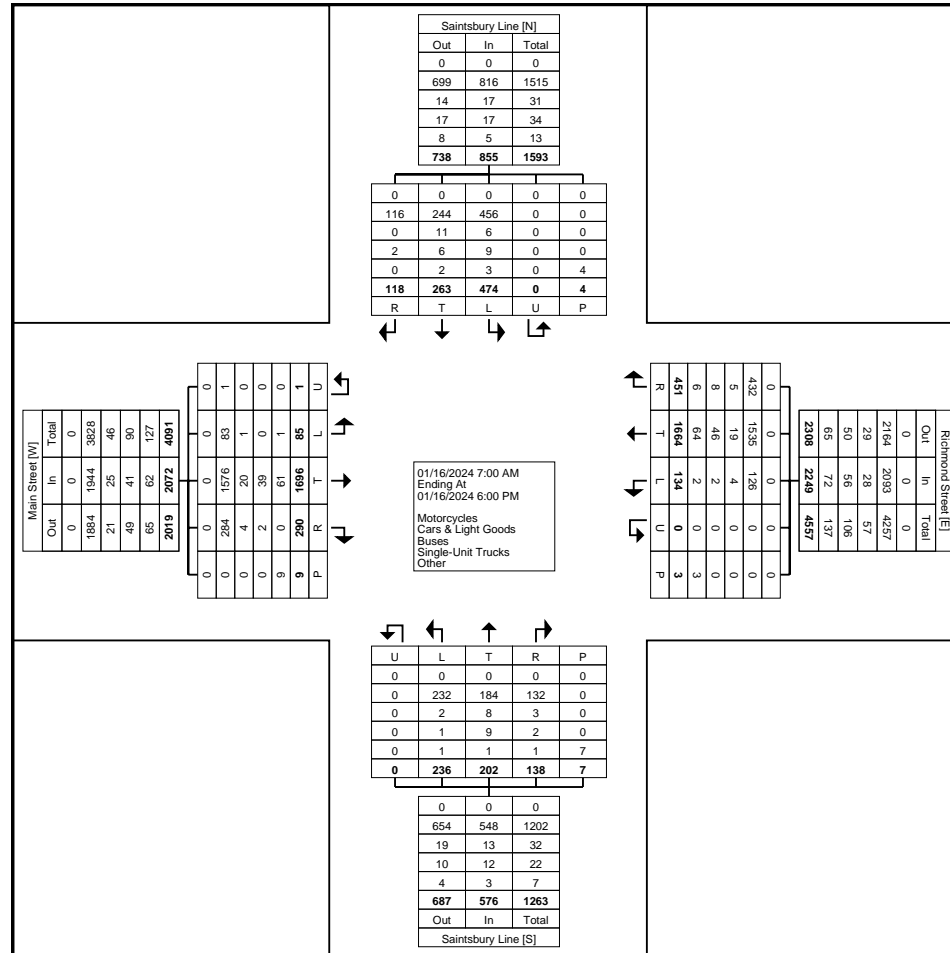
4:30 PM	2	59	12	1	0	74	8	73	20	0	0	101	13	10	4	0	0	27	8	10	4	0	0	22	224
4:45 PM	3	47	11	0	1	61	10	93	28	0	0	131	10	9	6	0	0	25	11	10	1	0	0	22	239
Hourly Total	7	204	41	1	2	253	34	305	88	0	0	427	42	46	16	0	3	104	40	40	17	0	0	97	881
5:00 PM	2	46	13	0	1	61	5	83	26	0	0	114	9	7	2	0	0	18	14	18	6	0	0	38	231
5:15 PM	3	48	12	0	0	63	11	96	24	0	0	131	3	11	3	0	0	17	9	9	6	0	0	24	235
5:30 PM	2	42	11	0	2	55	6	75	24	0	0	105	14	6	5	0	0	25	11	6	3	0	0	20	205
5:45 PM	1	29	10	0	1	40	7	68	13	0	0	88	8	6	3	0	1	17	6	6	7	0	0	19	164
Hourly Total	8	165	46	0	4	219	29	322	87	0	0	438	34	30	13	0	1	77	40	39	22	0	0	101	835
Grand Total	85	1696	290	1	9	2072	134	1664	451	0	3	2249	236	202	138	0	7	576	474	263	118	0	4	855	5752
Approach %	4.1	81.9	14.0	0.0	-	-	6.0	74.0	20.1	0.0	-	-	41.0	35.1	24.0	0.0	-	-	55.4	30.8	13.8	0.0	-	-	-
Total %	1.5	29.5	5.0	0.0	-	36.0	2.3	28.9	7.8	0.0	-	39.1	4.1	3.5	2.4	0.0	-	10.0	8.2	4.6	2.1	0.0	-	14.9	-
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	83	1576	284	1	-	1944	126	1535	432	0	-	2093	232	184	132	0	-	548	456	244	116	0	-	816	5401
% Cars & Light Goods	97.6	92.9	97.9	100.0	-	93.8	94.0	92.2	95.8	-	-	93.1	98.3	91.1	95.7	-	-	95.1	96.2	92.8	98.3	-	-	95.4	93.9
Buses	1	20	4	0	-	25	4	19	5	0	-	28	2	8	3	0	-	13	6	11	0	0	-	17	83
% Buses	1.2	1.2	1.4	0.0	-	1.2	3.0	1.1	1.1	-	-	1.2	0.8	4.0	2.2	-	-	2.3	1.3	4.2	0.0	-	-	2.0	1.4
Single-Unit Trucks	0	39	2	0	-	41	2	46	8	0	-	56	1	9	2	0	-	12	9	6	2	0	-	17	126
% Single-Unit Trucks	0.0	2.3	0.7	0.0	-	2.0	1.5	2.8	1.8	-	-	2.5	0.4	4.5	1.4	-	-	2.1	1.9	2.3	1.7	-	-	2.0	2.2
Articulated Trucks	1	61	0	0	-	62	2	64	6	0	-	72	1	1	1	0	-	3	3	2	0	0	-	5	142
% Articulated Trucks	1.2	3.6	0.0	0.0	-	3.0	1.5	3.8	1.3	-	-	3.2	0.4	0.5	0.7	-	-	0.5	0.6	0.8	0.0	-	-	0.6	2.5
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	9	-	-	-	-	3	-	-	-	-	-	7	-	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Richmond Street & Saintsbury Line
Site Code: 230774
Start Date: 01/16/2024
Page No: 3



Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Richmond Street & Saintsbury Line
Site Code: 230774
Start Date: 01/16/2024
Page No: 4

Turning Movement Peak Hour Data (7:15 AM)

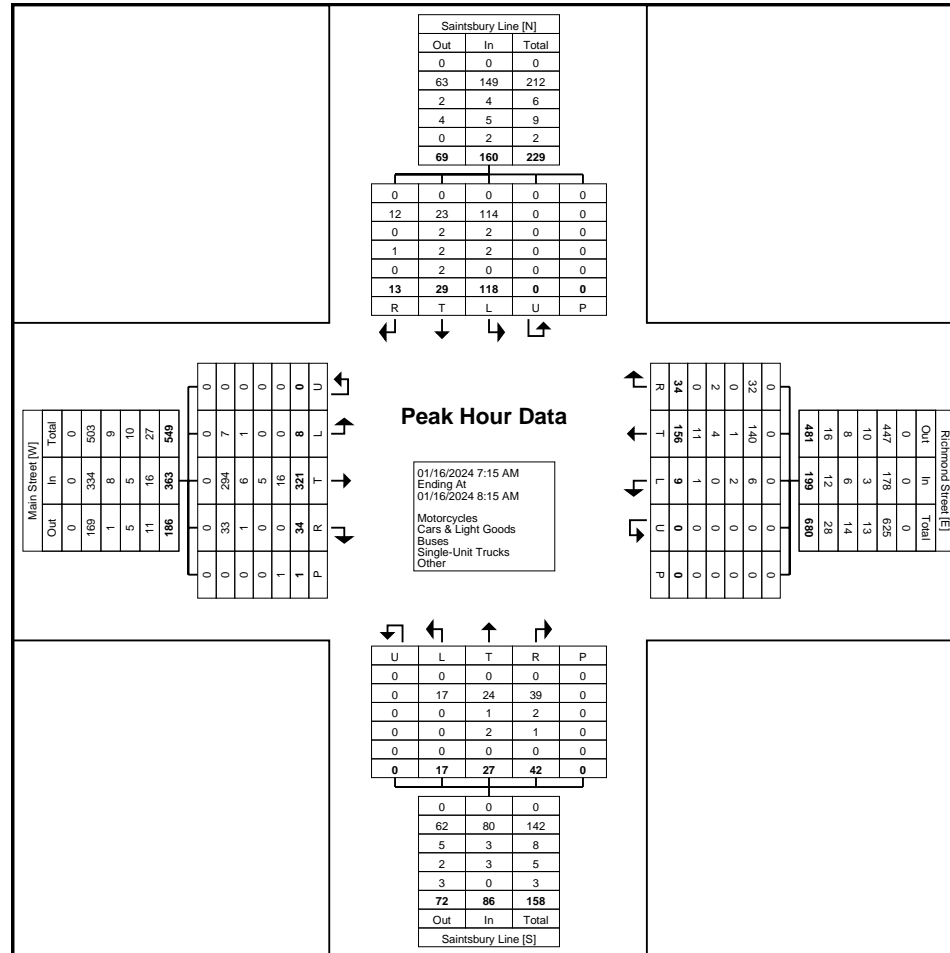
Start Time	Main Street Eastbound						Richmond Street Westbound						Saintsbury Line Northbound						Saintsbury Line Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:15 AM	2	82	8	0	0	92	1	35	6	0	0	42	5	6	10	0	0	21	27	9	3	0	0	39	194
7:30 AM	3	85	11	0	0	99	3	41	8	0	0	52	4	4	9	0	0	17	37	6	3	0	0	46	214
7:45 AM	2	87	7	0	1	96	2	45	9	0	0	56	7	7	15	0	0	29	28	6	3	0	0	37	218
8:00 AM	1	67	8	0	0	76	3	35	11	0	0	49	1	10	8	0	0	19	26	8	4	0	0	38	182
Total	8	321	34	0	1	363	9	156	34	0	0	199	17	27	42	0	0	86	118	29	13	0	0	160	808
Approach %	2.2	88.4	9.4	0.0	-	-	4.5	78.4	17.1	0.0	-	-	19.8	31.4	48.8	0.0	-	-	73.8	18.1	8.1	0.0	-	-	-
Total %	1.0	39.7	4.2	0.0	-	44.9	1.1	19.3	4.2	0.0	-	24.6	2.1	3.3	5.2	0.0	-	10.6	14.6	3.6	1.6	0.0	-	19.8	-
PHF	0.667	0.922	0.773	0.000	-	0.917	0.750	0.867	0.773	0.000	-	0.888	0.607	0.675	0.700	0.000	-	0.741	0.797	0.806	0.813	0.000	-	0.870	0.927
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	7	294	33	0	-	334	6	140	32	0	-	178	17	24	39	0	-	80	114	23	12	0	-	149	741
% Cars & Light Goods	87.5	91.6	97.1	-	-	92.0	66.7	89.7	94.1	-	-	89.4	100.0	88.9	92.9	-	-	93.0	96.6	79.3	92.3	-	-	93.1	91.7
Buses	1	6	1	0	-	8	2	1	0	0	-	3	0	1	2	0	-	3	2	2	0	0	-	4	18
% Buses	12.5	1.9	2.9	-	-	2.2	22.2	0.6	0.0	-	-	1.5	0.0	3.7	4.8	-	-	3.5	1.7	6.9	0.0	-	-	2.5	2.2
Single-Unit Trucks	0	5	0	0	-	5	0	4	2	0	-	6	0	2	1	0	-	3	2	2	1	0	-	5	19
% Single-Unit Trucks	0.0	1.6	0.0	-	-	1.4	0.0	2.6	5.9	-	-	3.0	0.0	7.4	2.4	-	-	3.5	1.7	6.9	7.7	-	-	3.1	2.4
Articulated Trucks	0	16	0	0	-	16	1	11	0	0	-	12	0	0	0	0	-	0	0	2	0	0	-	2	30
% Articulated Trucks	0.0	5.0	0.0	-	-	4.4	11.1	7.1	0.0	-	-	6.0	0.0	0.0	0.0	-	-	0.0	0.0	6.9	0.0	-	-	1.3	3.7
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Count Name: Richmond Street & Saintsbury Line
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Turning Movement Peak Hour Data Plot (7:15 AM)



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Turning Movement Peak Hour Data (12:15 PM)

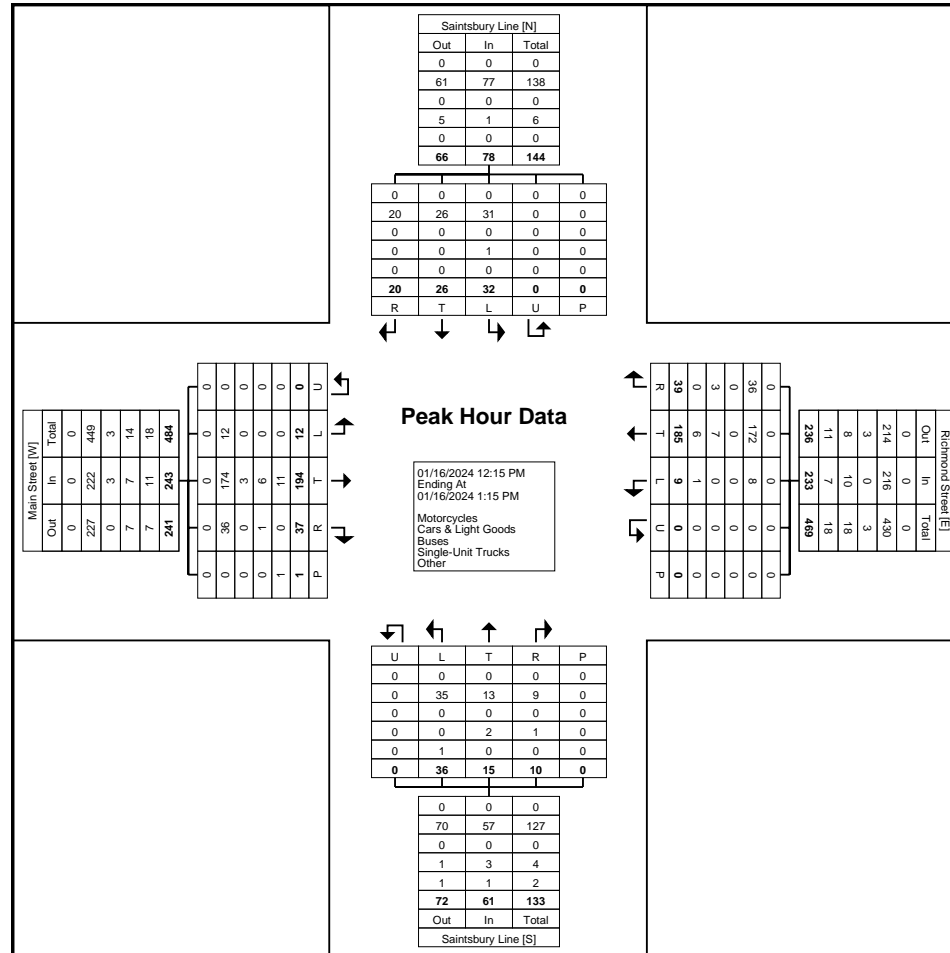
Start Time	Main Street Eastbound						Richmond Street Westbound						Saintsbury Line Northbound						Saintsbury Line Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:15 PM	2	46	14	0	1	62	1	40	16	0	0	57	6	5	2	0	0	13	6	5	4	0	0	15	147
12:30 PM	4	53	5	0	0	62	2	42	6	0	0	50	10	3	0	0	0	13	10	4	2	0	0	16	141
12:45 PM	3	46	9	0	0	58	3	41	7	0	0	51	5	5	3	0	0	13	6	8	8	0	0	22	144
1:00 PM	3	49	9	0	0	61	3	62	10	0	0	75	15	2	5	0	0	22	10	9	6	0	0	25	183
Total	12	194	37	0	1	243	9	185	39	0	0	233	36	15	10	0	0	61	32	26	20	0	0	78	615
Approach %	4.9	79.8	15.2	0.0	-	-	3.9	79.4	16.7	0.0	-	-	59.0	24.6	16.4	0.0	-	-	41.0	33.3	25.6	0.0	-	-	-
Total %	2.0	31.5	6.0	0.0	-	39.5	1.5	30.1	6.3	0.0	-	37.9	5.9	2.4	1.6	0.0	-	9.9	5.2	4.2	3.3	0.0	-	12.7	-
PHF	0.750	0.915	0.661	0.000	-	0.980	0.750	0.746	0.609	0.000	-	0.777	0.600	0.750	0.500	0.000	-	0.693	0.800	0.722	0.625	0.000	-	0.780	0.840
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	12	174	36	0	-	222	8	172	36	0	-	216	35	13	9	0	-	57	31	26	20	0	-	77	572
% Cars & Light Goods	100.0	89.7	97.3	-	-	91.4	88.9	93.0	92.3	-	-	92.7	97.2	86.7	90.0	-	-	93.4	96.9	100.0	100.0	-	-	98.7	93.0
Buses	0	3	0	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	3
% Buses	0.0	1.5	0.0	-	-	1.2	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	6	1	0	-	7	0	7	3	0	-	10	0	2	1	0	-	3	1	0	0	0	-	1	21
% Single-Unit Trucks	0.0	3.1	2.7	-	-	2.9	0.0	3.8	7.7	-	-	4.3	0.0	13.3	10.0	-	-	4.9	3.1	0.0	0.0	-	-	1.3	3.4
Articulated Trucks	0	11	0	0	-	11	1	6	0	0	-	7	1	0	0	0	-	1	0	0	0	0	-	0	19
% Articulated Trucks	0.0	5.7	0.0	-	-	4.5	11.1	3.2	0.0	-	-	3.0	2.8	0.0	0.0	-	-	1.6	0.0	0.0	0.0	-	-	0.0	3.1
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Turning Movement Peak Hour Data Plot (12:15 PM)



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Turning Movement Peak Hour Data (4:30 PM)

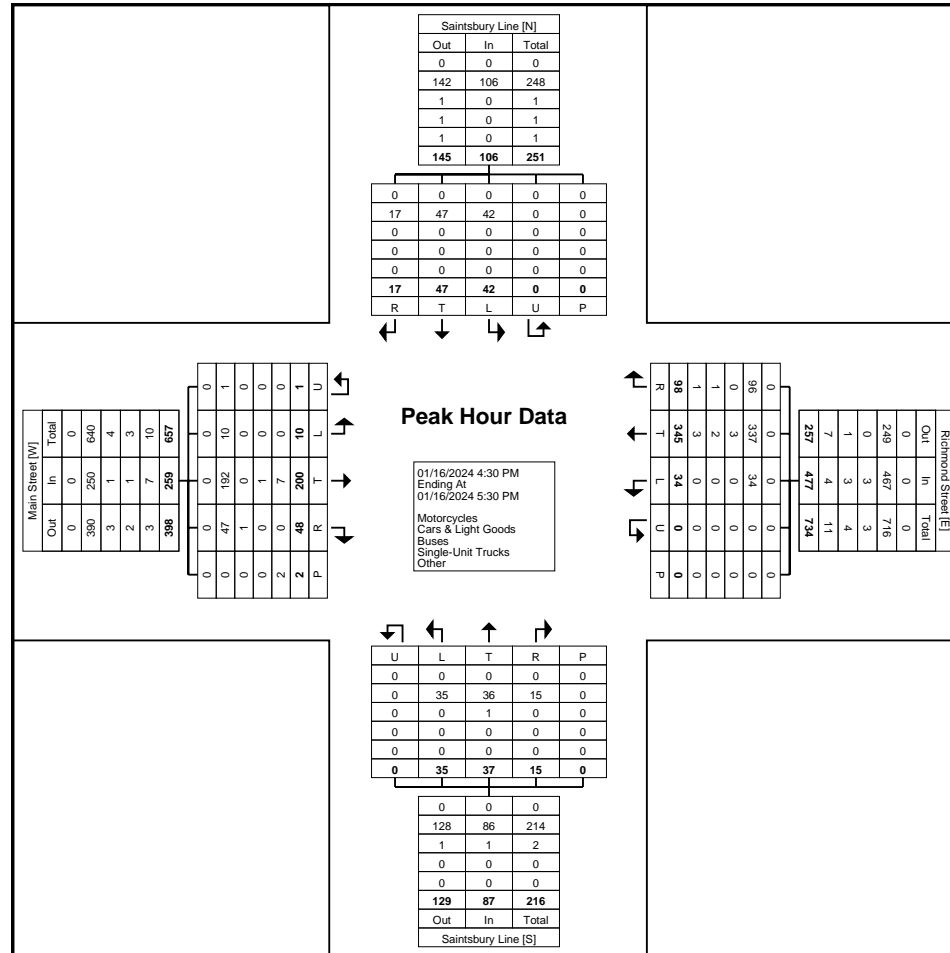
Start Time	Main Street Eastbound						Richmond Street Westbound						Saintsbury Line Northbound						Saintsbury Line Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:30 PM	2	59	12	1	0	74	8	73	20	0	0	101	13	10	4	0	0	27	8	10	4	0	0	22	224
4:45 PM	3	47	11	0	1	61	10	93	28	0	0	131	10	9	6	0	0	25	11	10	1	0	0	22	239
5:00 PM	2	46	13	0	1	61	5	83	26	0	0	114	9	7	2	0	0	18	14	18	6	0	0	38	231
5:15 PM	3	48	12	0	0	63	11	96	24	0	0	131	3	11	3	0	0	17	9	9	6	0	0	24	235
Total	10	200	48	1	2	259	34	345	98	0	0	477	35	37	15	0	0	87	42	47	17	0	0	106	929
Approach %	3.9	77.2	18.5	0.4	-	-	7.1	72.3	20.5	0.0	-	-	40.2	42.5	17.2	0.0	-	-	39.6	44.3	16.0	0.0	-	-	-
Total %	1.1	21.5	5.2	0.1	-	27.9	3.7	37.1	10.5	0.0	-	51.3	3.8	4.0	1.6	0.0	-	9.4	4.5	5.1	1.8	0.0	-	11.4	-
PHF	0.833	0.847	0.923	0.250	-	0.875	0.773	0.898	0.875	0.000	-	0.910	0.673	0.841	0.625	0.000	-	0.806	0.750	0.653	0.708	0.000	-	0.697	0.972
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	10	192	47	1	-	250	34	337	96	0	-	467	35	36	15	0	-	86	42	47	17	0	-	106	909
% Cars & Light Goods	100.0	96.0	97.9	100.0	-	96.5	100.0	97.7	98.0	-	-	97.9	100.0	97.3	100.0	-	-	98.9	100.0	100.0	100.0	-	-	100.0	97.8
Buses	0	0	1	0	-	1	0	3	0	0	-	3	0	1	0	0	-	1	0	0	0	0	-	0	5
% Buses	0.0	0.0	2.1	0.0	-	0.4	0.0	0.9	0.0	-	-	0.6	0.0	2.7	0.0	-	-	1.1	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	1	0	0	-	1	0	2	1	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	4
% Single-Unit Trucks	0.0	0.5	0.0	0.0	-	0.4	0.0	0.6	1.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.4
Articulated Trucks	0	7	0	0	-	7	0	3	1	0	-	4	0	0	0	0	-	0	0	0	0	0	-	0	11
% Articulated Trucks	0.0	3.5	0.0	0.0	-	2.7	0.0	0.9	1.0	-	-	0.8	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	1.2
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Turning Movement Peak Hour Data Plot (4:30 PM)

B.3 System Information

System Id	100014
Name	R1N Hwy 4 @ Saintsbury Line (Lucan)
Location	Hwy 4 & Saintsbury Line

1.2 Unit Setup

Auto Ped Clear	Disabled
Red Revert	5
Min Yellow Time	3
Texas Dmd Mode	Disabled
Texas Dmd Type	4-Phase

1.3 Startup

Flash	0
All Red	5
Start Veh Call	2,4,6,8
Start Ped Call	2,4,6,8

1.4 Channel Setup (1-16)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Type	V	V	P	V	V	P	V	V	P	V	V	P	0	0	0	0
Source	1	2	2	3	4	4	5	6	6	7	8	8	1	2	3	4
Alt 1/2 Hz																
Flash Red	X	X		X	X		X	X		X	X		X	X	X	X
Flash Yel																

1.4 Channel Setup (17-32)

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Type	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	
Source																	
Alt 1/2 Hz																	
Flsh Red																	
Flsh Yel																	
Start Next Phases				4,8													

Program Type	McCain Omni eX
Firmware	1.10
Street 1	Hwy 4
Street 2	Saintsbury Line
Last Modified	1/11/2024 3:34 PM

5.1 Coordination Constants

Correction Mode	Shortway
Max Cycles Trans	3
Coord Max Mode	Max Inhibit
Coord Force Mode	Fixed
Perm Strategy	Maximum
Omit Strategy	Minimum
Sync Point	Begin Green
No Early Return	Disable
Sync Ref Time	0
Operational Mode	0

2.5 Phase Concurrency

	1	2	3	4	5	6	7	8
Phase 1								
Phase 2				X				
Phase 3								
Phase 4							X	
Phase 5								
Phase 6	X							
Phase 7								
Phase 8				X				
Phase 9								
Phase 10								
Phase 11								
Phase 12								
Phase 13								
Phase 14								
Phase 15								
Phase 16								

2.4 Phase Enable and Rings

	1	2	3	4	5	6	7	8
Startup	.	Y	.	.	.	Y	.	.
Enabled		X		X		X		X
Ring1	X	X	X	X				
Ring2					X	X	X	X
Ring3								
Ring4								

Organization
R1NO Hwy 4 @ Saintsbury Line (Lucan) > Phases > Phase
Timing



2.1 Phase Parameters Set 1	1	2	3	4	5	6	7	8
Min Green	0	45	0	10	0	45	0	10
Passage	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Max 1	0	45	0	35	0	45	0	35
Max 2	0	45	0	35	0	45	0	35
Yellow Change	0.0	3.7	0.0	3.7	0.0	3.7	0.0	3.7
Red Clear	0.0	2.9	0.0	2.5	0.0	2.9	0.0	2.5
Walk	0	7	0	7	0	7	0	7
Ped Clear	0	27	0	23	0	27	0	23
Added Initial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	0	45	0	35	0	45	0	35
Time Before Reduction	0	0	0	0	0	0	0	0
Cars Before Reduction	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0
Reduce By	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Min Gap	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Dynamic Max Limit	0	0	0	0	0	0	0	0
Dynamic Max Step	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Revert	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0
Cond. Service Min	0	0	0	0	0	0	0	0
Alternate Min Green	0	0	0	0	0	0	0	0
Alternate Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alternate Walk	0	0	0	0	0	0	0	0
Alternate Ped Clear	0	0	0	0	0	0	0	0
Advanced Walk	0	0	0	0	0	0	0	0
Delay Walk	0	0	0	0	0	0	0	0
Start Delay Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green Clear	0	0	0	0	0	0	0	0

2.2 Phase Options Set 1	1	2	3	4	5	6	7	8
Phase Omit								
Ped Omit								
Min Veh Recall		X				X		
Max Veh Recall								
Soft Veh Recall								
Ped Recall								
Ped Recycle								
Cond. Service								
Lock Detector Memory								
Dual Entry		X		X		X		X
Simultaneous Gap		X		X		X		X
Guaranteed Passage								
Added Initial Calculation								
Rest In Walk								
Red Rest								
Auto Flash Entry								
Auto Flash Exit								
Non-Actuated 1								
Non-Actuated 2								
No Backup								
Max Walk								
Max Extension								
Sequential Timing								
No Min Yellow								
FDW Ped Recycle								

Appendix C

Existing Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

Existing AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	8	321	34	9	156	34	17	27	42	118	29	13
Future Volume (vph)	8	321	34	9	156	34	17	27	42	118	29	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00				0.99	
Fit		0.986			0.973			0.908			0.954	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1589	0	1752	1539	0
Fit Permitted	0.628			0.533			0.727			0.708		
Satd. Flow (perm)	1056	1728	0	761	1692	0	1379	1589	0	1306	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			16			46			14	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		224.6			109.9			169.9			214.3	
Travel Time (s)		16.2			7.9			12.2			15.4	
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	9	349	37	10	170	37	18	29	46	128	32	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	386	0	10	207	0	18	75	0	128	46	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase		2			6			4			8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.1	49.1		49.1	49.1		12.6	12.6		12.6	12.6	
Actuated g/C Ratio	0.71	0.71		0.71	0.71		0.18	0.18		0.18	0.18	
v/c Ratio	0.01	0.32		0.02	0.17		0.07	0.23		0.54	0.16	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

Existing AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	5.8	6.7		5.8	5.6		24.1	14.1		35.1	19.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.8	6.7		5.8	5.6		24.1	14.1		35.1	19.6	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		6.7			5.6			16.1			31.0	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.4	20.2		0.4	9.0		2.1	3.4		16.4	3.8	
Queue Length 95th (m)	2.2	42.7		2.4	21.2		7.1	13.7		32.3	12.0	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	750	1230		540	1207		692	821		656	780	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.01	0.31		0.02	0.17		0.03	0.09		0.20	0.06	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	69.5
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	12.2
Intersection Capacity Utilization:	61.8%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

Existing AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	8	321	34	9	156	34	17	27	42	118	29	13
Future Volume (veh/h)	8	321	34	9	156	34	17	27	42	118	29	13
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	9	349	37	10	170	37	18	29	46	128	32	14
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	734	1003	106	505	891	194	314	108	172	283	188	82
Arrive On Green	0.64	0.64	0.64	0.64	0.64	0.64	0.18	0.18	0.18	0.18	0.18	0.18
Sat Flow, veh/h	1072	1570	166	752	1394	303	1378	604	958	1311	1047	458
Grp Volume(v), veh/h	9	0	386	10	0	207	18	0	75	128	0	46
Grp Sat Flow(s),veh/h/ln	1072	0	1737	752	0	1697	1378	0	1561	1311	0	1505
Q Serve(g_s), s	0.2	0.0	7.3	0.4	0.0	3.5	0.8	0.0	2.9	6.6	0.0	1.8
Cycle Q Clear(g_c), s	3.8	0.0	7.3	7.7	0.0	3.5	2.6	0.0	2.9	9.5	0.0	1.8
Prop In Lane	1.00		0.10	1.00		0.18	1.00		0.61	1.00		0.30
Lane Grp Cap(c), veh/h	734	0	1110	505	0	1085	314	0	280	283	0	270
V/C Ratio(X)	0.01	0.00	0.35	0.02	0.00	0.19	0.06	0.00	0.27	0.45	0.00	0.17
Avail Cap(c_a), veh/h	740	0	1120	510	0	1094	748	0	772	696	0	744
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.0	0.0	5.9	7.7	0.0	5.2	25.6	0.0	24.9	29.0	0.0	24.5
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.5	1.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.8	1.8	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.0	0.0	6.1	7.7	0.0	5.3	25.7	0.0	25.4	30.1	0.0	24.8
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	395			217			93			174		
Approach Delay, s/veh	6.1			5.4			25.5			28.7		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		18.8		51.6		18.8					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	9.3		4.9		9.7		11.5					
Green Ext Time (p_c), s	3.4		0.6		1.7		0.9					

Intersection Summary		
HCM 6th Ctrl Delay	12.5	
HCM 6th LOS	B	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

Existing PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	10	200	48	34	345	98	35	37	15	42	47	17
Future Volume (vph)	10	200	48	34	345	98	35	37	15	42	47	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.971			0.967			0.957				0.961
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1781	0	1805	1801	0	1805	1780	0	1805	1815	0
Fit Permitted	0.478			0.594			0.712			0.720		
Satd. Flow (perm)	908	1781	0	1129	1801	0	1349	1780	0	1368	1815	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			22			16				18
Link Speed (k/h)		50			50			50				50
Link Distance (m)		224.6			109.9			169.9				214.3
Travel Time (s)		16.2			7.9			12.2				15.4
Conf. Peds. (#/hr)							2					2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	11	217	52	37	375	107	38	40	16	46	51	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	269	0	37	482	0	38	56	0	46	69	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases												
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.0	10.0		10.0	10.0	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.02	0.21		0.04	0.36		0.19	0.20		0.23	0.24	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

Existing PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.0	4.4		4.2	5.5		28.1	21.8		28.7	22.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.0	4.4		4.2	5.5		28.1	21.8		28.7	22.7	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.4			5.4			24.3			25.1	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.4	10.9		1.4	23.1		4.5	4.7		5.5	6.0	
Queue Length 95th (m)	1.9	19.6		4.1	38.6		12.6	14.2		14.3	16.5	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0				15.0			70.0			25.0	
Base Capacity (vph)	668	1314		829	1330		694	924		704	943	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.20		0.04	0.36		0.05	0.06		0.07	0.07	

Intersection Summary

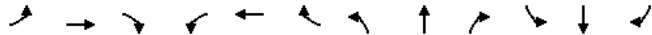
Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	67.6
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.36
Intersection Signal Delay:	9.1
Intersection Capacity Utilization:	58.2%
Intersection LOS:	A
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

Existing PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	10	200	48	34	345	98	35	37	15	42	47	17
Future Volume (veh/h)	10	200	48	34	345	98	35	37	15	42	47	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	11	217	52	37	375	107	38	40	16	46	51	18
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	600	944	226	779	921	263	268	195	78	278	207	73
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.15	0.15	0.15	0.15	0.15	0.15
Sat Flow, veh/h	928	1435	344	1128	1399	399	1346	1258	503	1361	1339	473
Grp Volume(v), veh/h	11	0	269	37	0	482	38	0	56	46	0	69
Grp Sat Flow(s), veh/h/ln	928	0	1779	1128	0	1798	1346	0	1761	1361	0	1811
Q Serve(g_s), s	0.4	0.0	4.2	0.9	0.0	8.6	1.7	0.0	1.9	2.1	0.0	2.3
Cycle Q Clear(g_c), s	8.9	0.0	4.2	5.1	0.0	8.6	4.0	0.0	1.9	4.0	0.0	2.3
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.29	1.00		0.26
Lane Grp Cap(c), veh/h	600	0	1171	779	0	1184	268	0	272	278	0	280
V/C Ratio(X)	0.02	0.00	0.23	0.05	0.00	0.41	0.14	0.00	0.21	0.17	0.00	0.25
Avail Cap(c_a), veh/h	605	0	1181	785	0	1194	745	0	896	760	0	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.5	0.0	4.7	5.7	0.0	5.5	27.2	0.0	25.2	27.0	0.0	25.4
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.2	0.2	0.0	0.4	0.3	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.1	0.5	0.0	0.6	0.6	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	7.6	0.0	4.8	5.8	0.0	5.7	27.4	0.0	25.6	27.2	0.0	25.8
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	280		519				94			115		
Approach Delay, s/veh	4.9		5.7				26.3			26.4		
Approach LOS	A		A				C			C		
Timer - Assigned Phs	2		4				6			8		
Phs Duration (G+Y+Rc), s	51.6		16.8				51.6			16.8		
Change Period (Y+Rc), s	* 6.6		* 6.2				* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45		* 35				* 45			* 35		
Max Q Clear Time (g_c+I1), s	10.9		6.0				10.6			6.0		
Green Ext Time (p_c), s	2.2		0.5				4.6			0.6		

Intersection Summary	
HCM 6th Ctrl Delay	9.8
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

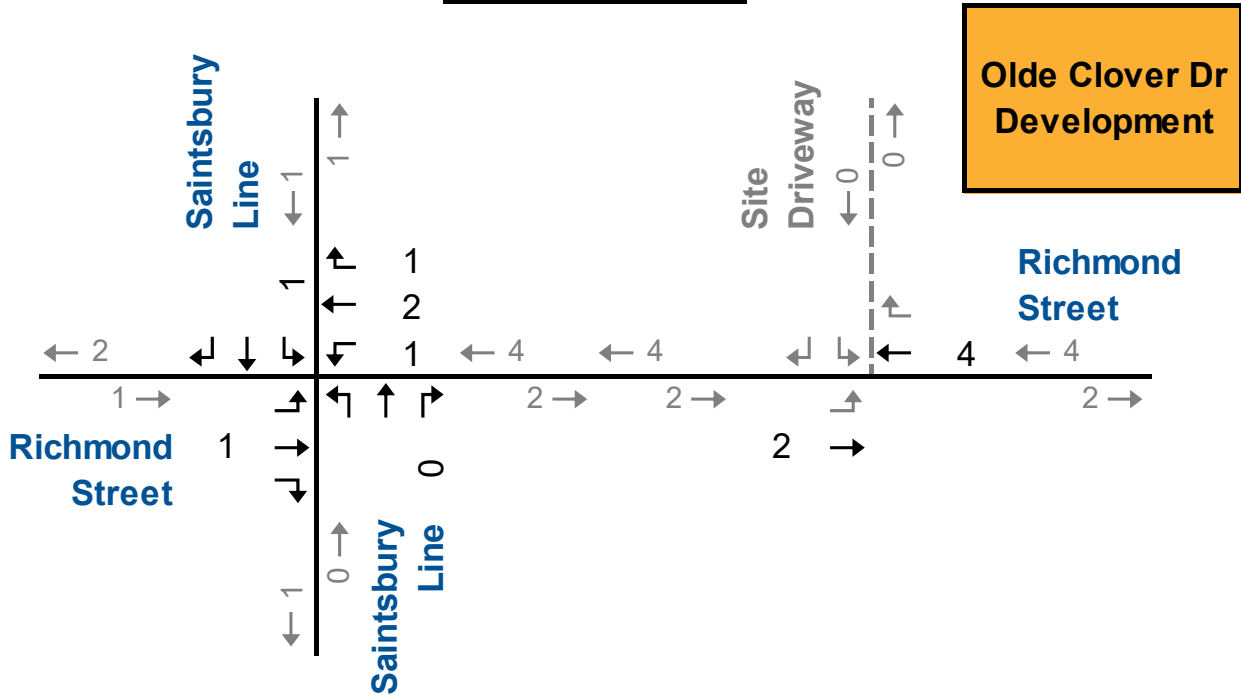
Appendix D

Background Development Traffic Volumes

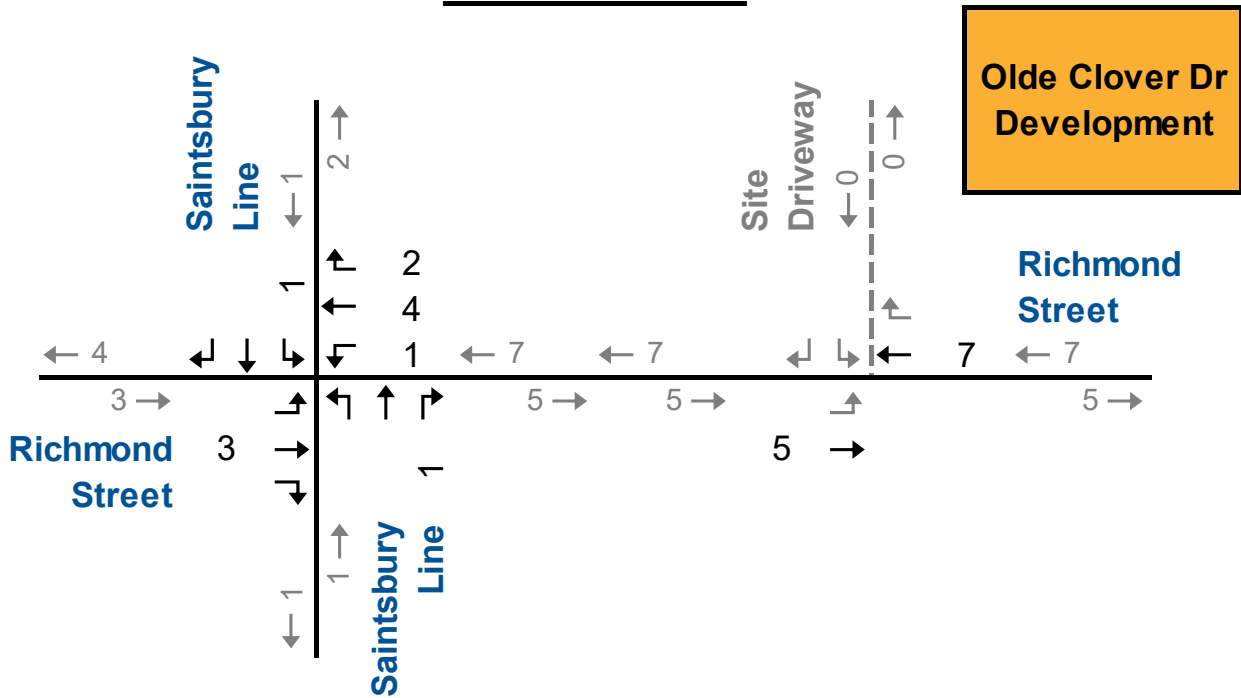




AM Peak Hour



PM Peak Hour



Other Area Development Traffic Volumes Olde Clover Drive Development

Appendix E

2027 Background Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	342	36	11	168	37	18	29	45	126	31	14
Future Volume (vph)	8	342	36	11	168	37	18	29	45	126	31	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Flt		0.986			0.973			0.909				0.954
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1591	0	1752	1539	0
Flt Permitted	0.619			0.509			0.725			0.704		
Satd. Flow (perm)	1041	1728	0	727	1692	0	1376	1591	0	1299	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	8				17			49				15
Link Speed (k/h)	50				50			50				50
Link Distance (m)	224.6				109.9			169.9				214.3
Travel Time (s)	16.2				7.9			12.2				15.4
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	9	372	39	12	183	40	20	32	49	137	34	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	411	0	12	223	0	20	81	0	137	49	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase	2	2			6	6		4	4		8	8
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	45.1	45.1		45.1	45.1		13.1	13.1		13.1	13.1	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.18	0.18		0.18	0.18	
v/c Ratio	0.01	0.37		0.03	0.21		0.08	0.24		0.57	0.17	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.0	7.8		6.1	6.1		23.9	14.0		36.2	19.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.0	7.8		6.1	6.1		23.9	14.0		36.2	19.4	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		7.8			6.1			16.0			31.7	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.4	22.7		0.5	10.2		2.3	3.8		17.6	4.0	
Queue Length 95th (m)	2.3	47.7		2.8	23.5		7.8	14.4		34.2	12.3	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	666	1109		465	1089		675	805		637	763	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.01	0.37		0.03	0.20		0.03	0.10		0.22	0.06	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	71
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	13.0
Intersection Capacity Utilization:	62.2%
Analysis Period (min):	15
Intersection LOS:	B
ICU Level of Service:	B

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2027 Background AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	8	342	36	11	168	37	18	29	45	126	31	14
Future Volume (veh/h)	8	342	36	11	168	37	18	29	45	126	31	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	9	372	39	12	183	40	20	32	49	137	34	15
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	709	992	104	481	879	192	324	117	179	290	198	87
Arrive On Green	0.63	0.63	0.63	0.63	0.63	0.63	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1057	1572	165	735	1393	304	1374	618	946	1304	1044	461
Grp Volume(v), veh/h	9	0	411	12	0	223	20	0	81	137	0	49
Grp Sat Flow(s),veh/h/ln	1057	0	1737	735	0	1697	1374	0	1564	1304	0	1504
Q Serve(g_s), s	0.3	0.0	8.2	0.6	0.0	4.0	0.9	0.0	3.2	7.2	0.0	1.9
Cycle Q Clear(g_c), s	4.2	0.0	8.2	8.7	0.0	4.0	2.8	0.0	3.2	10.3	0.0	1.9
Prop In Lane	1.00		0.09	1.00		0.18	1.00		0.60	1.00		0.31
Lane Grp Cap(c), veh/h	709	0	1096	481	0	1071	324	0	296	290	0	285
V/C Ratio(X)	0.01	0.00	0.38	0.02	0.00	0.21	0.06	0.00	0.27	0.47	0.00	0.17
Avail Cap(c_a), veh/h	715	0	1106	485	0	1080	734	0	763	680	0	734
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.5	0.0	6.4	8.5	0.0	5.6	25.4	0.0	24.7	29.1	0.0	24.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.5	1.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.9	1.9	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.5	0.0	6.6	8.5	0.0	5.7	25.5	0.0	25.2	30.3	0.0	24.5
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	420			235			101			186		
Approach Delay, s/veh	6.6			5.8			25.3			28.8		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		19.7		51.6		19.7					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	10.2		5.2		10.7		12.3					
Green Ext Time (p_c), s	3.6		0.6		1.9		0.9					

Intersection Summary		
HCM 6th Ctrl Delay	12.8	
HCM 6th LOS	B	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	11	215	51	37	370	106	37	39	17	46	50	18
Future Volume (vph)	11	215	51	37	370	106	37	39	17	46	50	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Frt		0.971			0.967			0.955				0.959
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1780	0	1805	1801	0	1805	1777	0	1805	1811	0
Flt Permitted	0.455			0.583			0.709			0.718		
Satd. Flow (perm)	864	1780	0	1108	1801	0	1343	1777	0	1364	1811	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			22			18			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		224.6			109.9			169.9			214.3	
Travel Time (s)		16.2			7.9			12.2			15.4	
Conf. Peds. (#/hr)							2					2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	12	234	55	40	402	115	40	42	18	50	54	20
Shared Lane Traffic (%)												
Lane Group Flow (vph)	12	289	0	40	517	0	40	60	0	50	74	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2			6			4			8
Detector Phase	2	2			6	6			4	4		8
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.1	10.1		10.1	10.1	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.02	0.22		0.05	0.39		0.20	0.21		0.25	0.26	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.1	4.5		4.3	5.8		28.1	21.6		29.0	22.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.1	4.5		4.3	5.8		28.1	21.6		29.0	22.6	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.5			5.6			24.2			25.2	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	12.0		1.6	25.5		4.8	5.0		6.0	6.4	
Queue Length 95th (m)	2.0	21.5		4.4	43.3		13.0	14.8		15.3	17.3	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0				15.0			70.0			25.0	
Base Capacity (vph)	634	1312		813	1329		690	922		701	941	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.22		0.05	0.39		0.06	0.07		0.07	0.08	
Intersection Summary												
Area Type:	Other											
Cycle Length:	93											
Actuated Cycle Length:	67.7											
Natural Cycle:	90											
Control Type:	Semi Act-Uncoord											
Maximum v/c Ratio:	0.39											
Intersection Signal Delay:	9.3						Intersection LOS: A					
Intersection Capacity Utilization:	58.4%						ICU Level of Service B					
Analysis Period (min):	15											
Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street												

HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2027 Background PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	11	215	51	37	370	106	37	39	17	46	50	18
Future Volume (veh/h)	11	215	51	37	370	106	37	39	17	46	50	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	12	234	55	40	402	115	40	42	18	50	54	20
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	572	948	223	760	920	263	265	191	82	275	205	76
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	898	1441	339	1107	1398	400	1340	1230	527	1357	1320	489
Grp Volume(v), veh/h	12	0	289	40	0	517	40	0	60	50	0	74
Grp Sat Flow(s),veh/h/ln	898	0	1780	1107	0	1798	1340	0	1757	1357	0	1808
Q Serve(g_s), s	0.4	0.0	4.5	1.0	0.0	9.5	1.9	0.0	2.0	2.3	0.0	2.5
Cycle Q Clear(g_c), s	9.9	0.0	4.5	5.6	0.0	9.5	4.3	0.0	2.0	4.3	0.0	2.5
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.30	1.00		0.27
Lane Grp Cap(c), veh/h	572	0	1170	760	0	1183	265	0	273	275	0	281
V/C Ratio(X)	0.02	0.00	0.25	0.05	0.00	0.44	0.15	0.00	0.22	0.18	0.00	0.26
Avail Cap(c_a), veh/h	577	0	1181	767	0	1193	738	0	893	755	0	920
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.0	0.0	4.8	5.9	0.0	5.6	27.4	0.0	25.3	27.2	0.0	25.5
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.4	0.3	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.2	0.5	0.0	0.7	0.6	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.0	0.0	4.9	6.0	0.0	5.9	27.6	0.0	25.7	27.5	0.0	25.9
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	301			557			100			124		
Approach Delay, s/veh	5.0			5.9			26.5			26.6		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		16.8		51.6		16.8					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	11.9		6.3		11.5		6.3					
Green Ext Time (p_c), s	2.4		0.5		5.0		0.7					

Intersection Summary		
HCM 6th Ctrl Delay	9.9	
HCM 6th LOS	A	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Appendix F

2027 Total Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Total AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	344	36	12	170	38	18	29	45	127	31	14
Future Volume (vph)	8	344	36	12	170	38	18	29	45	127	31	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Flt		0.986			0.973			0.909				0.954
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1591	0	1752	1539	0
Flt Permitted	0.617			0.507			0.725			0.704		
Satd. Flow (perm)	1037	1728	0	724	1692	0	1376	1591	0	1299	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	8				17			49				15
Link Speed (k/h)	50				50			50				50
Link Distance (m)	224.6				109.9			169.9				214.3
Travel Time (s)	16.2				7.9			12.2				15.4
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	9	374	39	13	185	41	20	32	49	138	34	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	413	0	13	226	0	20	81	0	138	49	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2			6			4			8
Detector Phase	2	2			6	6			4	4		8
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	45.1	45.1		45.1	45.1		13.2	13.2		13.2	13.2	
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.19	0.19		0.19	0.19	
v/c Ratio	0.01	0.38		0.03	0.21		0.08	0.24		0.57	0.16	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Total AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.0	7.9		6.2	6.2		23.9	14.0		36.1	19.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.0	7.9		6.2	6.2		23.9	14.0		36.1	19.4	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		7.9			6.2			16.0				31.7
Approach LOS		A			A			B				C
Queue Length 50th (m)	0.4	22.8		0.6	10.3		2.3	3.8		17.8	4.0	
Queue Length 95th (m)	2.3	48.2		3.0	23.9		7.6	14.4		34.6	12.3	
Internal Link Dist (m)		200.6			85.9			145.9				190.3
Turn Bay Length (m)	70.0				15.0			70.0				25.0
Base Capacity (vph)	663	1108		463	1088		674	805		636	762	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.01	0.37		0.03	0.21		0.03	0.10		0.22	0.06	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	71.1
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	13.0
Intersection Capacity Utilization:	62.2%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2027 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	8	344	36	12	170	38	18	29	45	127	31	14
Future Volume (veh/h)	8	344	36	12	170	38	18	29	45	127	31	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	9	374	39	13	185	41	20	32	49	138	34	15
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	706	992	103	479	875	194	325	118	180	291	199	88
Arrive On Green	0.63	0.63	0.63	0.63	0.63	0.63	0.19	0.19	0.19	0.19	0.19	0.19
Sat Flow, veh/h	1054	1573	164	734	1389	308	1374	618	946	1304	1044	461
Grp Volume(v), veh/h	9	0	413	13	0	226	20	0	81	138	0	49
Grp Sat Flow(s),veh/h/ln	1054	0	1737	734	0	1696	1374	0	1564	1304	0	1504
Q Serve(g_s), s	0.3	0.0	8.2	0.6	0.0	4.1	0.9	0.0	3.2	7.2	0.0	1.9
Cycle Q Clear(g_c), s	4.3	0.0	8.2	8.9	0.0	4.1	2.8	0.0	3.2	10.4	0.0	1.9
Prop In Lane	1.00		0.09	1.00		0.18	1.00		0.60	1.00		0.31
Lane Grp Cap(c), veh/h	706	0	1095	479	0	1069	325	0	298	291	0	286
V/C Ratio(X)	0.01	0.00	0.38	0.03	0.00	0.21	0.06	0.00	0.27	0.47	0.00	0.17
Avail Cap(c_a), veh/h	711	0	1105	483	0	1079	734	0	762	679	0	733
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	6.5	0.0	6.4	8.5	0.0	5.6	25.4	0.0	24.7	29.1	0.0	24.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.5	1.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.9	1.9	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.6	0.0	6.6	8.6	0.0	5.7	25.5	0.0	25.2	30.3	0.0	24.5
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	422			239			101			187		
Approach Delay, s/veh	6.6			5.9			25.2			28.8		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		19.8		51.6		19.8					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	10.2		5.2		10.9		12.4					
Green Ext Time (p_c), s	3.7		0.6		1.9		0.9					
Intersection Summary												
HCM 6th Ctrl Delay				12.8								
HCM 6th LOS				B								
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

Lanes, Volumes, Timings
 2: Richmond Street & Site Driveway

2027 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔		↔	↔
Traffic Volume (vph)	3	512	215	1	8	4
Future Volume (vph)	3	512	215	1	8	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0			0.0	0.0	0.0
Storage Lanes	1			0	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.958	
Fit Protected	0.950				0.967	
Satd. Flow (prot)	1770	1863	1861	0	1726	0
Fit Permitted	0.950				0.967	
Satd. Flow (perm)	1770	1863	1861	0	1726	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	557	234	1	9	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	3	557	235	0	13	0
Sign Control		Free	Free		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization 36.9%				ICU Level of Service A		
Analysis Period (min) 15						

HCM 6th TWSC
 2: Richmond Street & Site Driveway

2027 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↕	↕	↔	↕	↕
Traffic Vol, veh/h	3	512	215	1	8	4
Future Vol, veh/h	3	512	215	1	8	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	557	234	1	9	4
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	235	0	-	0	798	235
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	563	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1332	-	-	-	355	804
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	570	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1332	-	-	-	354	804
Mov Cap-2 Maneuver	-	-	-	-	456	-
Stage 1	-	-	-	-	802	-
Stage 2	-	-	-	-	570	-
Approach	EB	WB	SB			
HCM Control Delay, s	0	0	11.9			
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1332	-	-	-	-	533
HCM Lane V/C Ratio	0.002	-	-	-	-	0.024
HCM Control Delay (s)	7.7	-	-	-	-	11.9
HCM Lane LOS	A	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0.1

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Total PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	11	219	51	39	377	109	37	39	19	48	50	18
Future Volume (vph)	11	219	51	39	377	109	37	39	19	48	50	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.972			0.966			0.950				0.959
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1782	0	1805	1799	0	1805	1770	0	1805	1811	0
Fit Permitted	0.448			0.581			0.709			0.716		
Satd. Flow (perm)	851	1782	0	1104	1799	0	1343	1770	0	1360	1811	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			22			21			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		224.6			109.9			169.9			214.3	
Travel Time (s)		16.2			7.9			12.2			15.4	
Conf. Peds. (#/hr)							2					2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	12	238	55	42	410	118	40	42	21	52	54	20
Shared Lane Traffic (%)												
Lane Group Flow (vph)	12	293	0	42	528	0	40	63	0	52	74	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2			6			4			8
Detector Phase		2		2		6		6		4		4
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.2	10.2		10.2	10.2	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.02	0.22		0.05	0.40		0.20	0.22		0.25	0.26	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2027 Total PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.2	4.6		4.3	5.9		28.1	20.9		29.2	22.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.2	4.6		4.3	5.9		28.1	20.9		29.2	22.5	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.6			5.8			23.7			25.3	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	12.2		1.7	26.3		4.8	5.0		6.2	6.4	
Queue Length 95th (m)	2.0	22.2		4.6	45.3		13.0	15.0		15.7	17.3	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0				15.0			70.0			25.0	
Base Capacity (vph)	624	1312		810	1326		690	919		699	940	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.22		0.05	0.40		0.06	0.07		0.07	0.08	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	67.7
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.40
Intersection Signal Delay:	9.3
Intersection Capacity Utilization:	58.5%
Intersection LOS:	A
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
1: Saintsbury Line & Main Street/Richmond Street

2027 Total PM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↗	↘	↔	↗	↘	↔	↗	↘	↔	↗	↘
Traffic Volume (veh/h)	11	219	51	39	377	109	37	39	19	48	50	18
Future Volume (veh/h)	11	219	51	39	377	109	37	39	19	48	50	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.99		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	12	238	55	42	410	118	40	42	21	52	54	20
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	563	951	220	756	918	264	265	181	90	273	205	76
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	889	1446	334	1103	1396	402	1340	1164	582	1353	1320	489
Grp Volume(v), veh/h	12	0	293	42	0	528	40	0	63	52	0	74
Grp Sat Flow(s), veh/h/ln	889	0	1781	1103	0	1798	1340	0	1746	1353	0	1808
Q Serve(g_s), s	0.5	0.0	4.6	1.1	0.0	9.7	1.9	0.0	2.2	2.4	0.0	2.5
Cycle Q Clear(g_c), s	10.2	0.0	4.6	5.7	0.0	9.7	4.3	0.0	2.2	4.6	0.0	2.5
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.33	1.00		0.27
Lane Grp Cap(c), veh/h	563	0	1171	756	0	1182	265	0	271	273	0	281
V/C Ratio(X)	0.02	0.00	0.25	0.06	0.00	0.45	0.15	0.00	0.23	0.19	0.00	0.26
Avail Cap(c_a), veh/h	568	0	1181	763	0	1193	738	0	888	750	0	920
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.2	0.0	4.8	6.0	0.0	5.7	27.4	0.0	25.3	27.3	0.0	25.4
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.4	0.3	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%), veh/ln	0.0	0.0	0.1	0.0	0.0	0.2	0.5	0.0	0.7	0.6	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.2	0.0	4.9	6.0	0.0	5.9	27.6	0.0	25.8	27.7	0.0	25.9
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	305			570			103			126		
Approach Delay, s/veh	5.0			6.0			26.5			26.6		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			16.8			51.6			16.8		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	12.2			6.3			11.7			6.6		
Green Ext Time (p_c), s	2.4			0.5			5.1			0.7		
Intersection Summary												
HCM 6th Ctrl Delay	10.0											
HCM 6th LOS	A											
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

Lanes, Volumes, Timings
2: Richmond Street & Site Driveway

2027 Total PM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↗	↘	↔	↗	↘
Traffic Volume (vph)	8	278	513	13	4	12
Future Volume (vph)	8	278	513	13	4	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0			0.0	0.0	0.0
Storage Lanes	1			0	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.897	
Fit Protected	0.950				0.988	
Satd. Flow (prot)	1770	1863	1857	0	1651	0
Fit Permitted	0.950				0.988	
Satd. Flow (perm)	1770	1863	1857	0	1651	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	302	558	14	4	13
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	302	572	0	17	0
Sign Control		Free	Free		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	37.8%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 6th TWSC
2: Richmond Street & Site Driveway

2027 Total PM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↗	↘		↗	↘
Traffic Vol, veh/h	8	278	513	13	4	12
Future Vol, veh/h	8	278	513	13	4	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	302	558	14	4	13
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	572	0	-	0	885	565
Stage 1	-	-	-	-	565	-
Stage 2	-	-	-	-	320	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1001	-	-	-	315	524
Stage 1	-	-	-	-	569	-
Stage 2	-	-	-	-	736	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1001	-	-	-	312	524
Mov Cap-2 Maneuver	-	-	-	-	429	-
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	736	-
Approach	EB	WB	SB			
HCM Control Delay, s	0.2	0	12.5			
HCM LOS			B			
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1001	-	-	-	-	497
HCM Lane V/C Ratio	0.009	-	-	-	-	0.035
HCM Control Delay (s)	8.6	-	-	-	-	12.5
HCM Lane LOS	A	-	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	-	0.1

Appendix G

2032 Background Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	9	377	40	12	185	41	20	32	49	139	34	15
Future Volume (vph)	9	377	40	12	185	41	20	32	49	139	34	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.986			0.973			0.910				0.955
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1592	0	1752	1540	0
Fit Permitted	0.606			0.475			0.722			0.700		
Satd. Flow (perm)	1019	1728	0	679	1692	0	1370	1592	0	1291	1540	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			17			53				16
Link Speed (k/h)		50			50			50				50
Link Distance (m)		224.6			109.9			169.9				214.3
Travel Time (s)		16.2			7.9			12.2				15.4
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	10	410	43	13	201	45	22	35	53	151	37	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	453	0	13	246	0	22	88	0	151	53	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase		2			6			4			8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	45.1	45.1		45.1	45.1		13.9	13.9		13.9	13.9	
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.19	0.19		0.19	0.19	
v/c Ratio	0.02	0.42		0.03	0.23		0.08	0.25		0.61	0.17	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.4	8.7		6.6	6.7		23.6	13.7		37.1	19.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.4	8.7		6.6	6.7		23.6	13.7		37.1	19.2	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		8.7			6.7			15.7			32.4	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.5	27.0		0.6	11.9		2.6	4.1		19.7	4.4	
Queue Length 95th (m)	2.5	56.7		3.1	27.5		8.3	15.1		37.5	13.1	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	645	1097		429	1077		664	800		626	755	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.41		0.03	0.23		0.03	0.11		0.24	0.07	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	71.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.61
Intersection Signal Delay:	13.6
Intersection Capacity Utilization:	62.9%
Analysis Period (min):	15
Intersection LOS:	B
ICU Level of Service:	B

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2032 Background AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	9	377	40	12	185	41	20	32	49	139	34	15
Future Volume (veh/h)	9	377	40	12	185	41	20	32	49	139	34	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	10	410	43	13	201	45	22	35	53	151	37	16
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	674	974	102	443	859	192	339	127	192	302	214	93
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	1035	1572	165	707	1386	310	1370	622	942	1296	1051	455
Grp Volume(v), veh/h	10	0	453	13	0	246	22	0	88	151	0	53
Grp Sat Flow(s),veh/h/ln	1035	0	1737	707	0	1696	1370	0	1565	1296	0	1506
Q Serve(g_s), s	0.3	0.0	9.7	0.7	0.0	4.7	1.0	0.0	3.4	8.1	0.0	2.1
Cycle Q Clear(g_c), s	5.0	0.0	9.7	10.4	0.0	4.7	3.1	0.0	3.4	11.5	0.0	2.1
Prop In Lane	1.00		0.09	1.00		0.18	1.00		0.60	1.00		0.30
Lane Grp Cap(c), veh/h	674	0	1076	443	0	1051	339	0	319	302	0	307
V/C Ratio(X)	0.01	0.00	0.42	0.03	0.00	0.23	0.06	0.00	0.28	0.50	0.00	0.17
Avail Cap(c_a), veh/h	680	0	1086	447	0	1060	716	0	750	659	0	722
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.3	0.0	7.1	9.8	0.0	6.1	25.1	0.0	24.4	29.2	0.0	23.8
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.5	1.3	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.1	0.3	0.0	1.0	2.2	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	7.3	0.0	7.4	9.8	0.0	6.3	25.2	0.0	24.8	30.5	0.0	24.1
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	463			259			110			204		
Approach Delay, s/veh	7.4			6.4			24.9			28.8		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			21.0			51.6			21.0		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	11.7			5.4			12.4			13.5		
Green Ext Time (p_c), s	4.1			0.7			2.1			1.0		

Intersection Summary		
HCM 6th Ctrl Delay	13.2	
HCM 6th LOS	B	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	237	56	41	408	117	41	43	19	50	55	20
Future Volume (vph)	12	237	56	41	408	117	41	43	19	50	55	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Frt		0.971			0.967			0.954				0.960
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1780	0	1805	1801	0	1805	1776	0	1805	1813	0
Fit Permitted	0.421			0.567			0.704			0.713		
Satd. Flow (perm)	800	1780	0	1077	1801	0	1334	1776	0	1355	1813	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	18				22			21				22
Link Speed (k/h)	50				50			50				50
Link Distance (m)	224.6				109.9			169.9				214.3
Travel Time (s)	16.2				7.9			12.2				15.4
Conf. Peds. (#/hr)							2					2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	13	258	61	45	443	127	45	47	21	54	60	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	13	319	0	45	570	0	45	68	0	54	82	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2		6			4			8	
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.2	10.2		10.2	10.2	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.02	0.24		0.06	0.43		0.23	0.24		0.27	0.28	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.2	4.7		4.4	6.2		28.6	21.6		29.4	22.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.2	4.7		4.4	6.2		28.6	21.6		29.4	22.9	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.7			6.1			24.4			25.5	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	13.6		1.8	29.6		5.4	5.6		6.5	7.2	
Queue Length 95th (m)	2.1	24.4		5.0	50.9		14.2	15.9		16.3	18.7	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	587	1311		790	1327		685	922		696	942	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.24		0.06	0.43		0.07	0.07		0.08	0.09	
Intersection Summary												
Area Type:	Other											
Cycle Length:	93											
Actuated Cycle Length:	67.7											
Natural Cycle:	90											
Control Type:	Semi Act-Uncoord											
Maximum v/c Ratio:	0.43											
Intersection Signal Delay:	9.6						Intersection LOS: A					
Intersection Capacity Utilization:	58.6%						ICU Level of Service B					
Analysis Period (min):	15											
Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street												

HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2032 Background PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	12	237	56	41	408	117	41	43	19	50	55	20
Future Volume (veh/h)	12	237	56	41	408	117	41	43	19	50	55	20
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	13	258	61	45	443	127	45	47	21	54	60	22
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	531	946	224	733	918	263	259	189	84	269	206	76
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	855	1439	340	1077	1398	401	1330	1212	542	1347	1324	485
Grp Volume(v), veh/h	13	0	319	45	0	570	45	0	68	54	0	82
Grp Sat Flow(s), veh/h/ln	855	0	1779	1077	0	1798	1330	0	1754	1347	0	1809
Q Serve(g_s), s	0.5	0.0	5.1	1.2	0.0	10.9	2.1	0.0	2.3	2.5	0.0	2.7
Cycle Q Clear(g_c), s	11.4	0.0	5.1	6.4	0.0	10.9	4.9	0.0	2.3	4.8	0.0	2.7
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.31	1.00		0.27
Lane Grp Cap(c), veh/h	531	0	1169	733	0	1182	259	0	273	269	0	282
V/C Ratio(X)	0.02	0.00	0.27	0.06	0.00	0.48	0.17	0.00	0.25	0.20	0.00	0.29
Avail Cap(c_a), veh/h	536	0	1180	739	0	1192	728	0	891	744	0	919
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.8	0.0	4.9	6.2	0.0	5.9	27.7	0.0	25.4	27.5	0.0	25.6
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.5	0.4	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.2	0.6	0.0	0.8	0.7	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.8	0.0	5.0	6.3	0.0	6.2	28.0	0.0	25.8	27.9	0.0	26.1
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	332			615			113			136		
Approach Delay, s/veh	5.2			6.2			26.7			26.8		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		16.9		51.6		16.9					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	13.4		6.9		12.9		6.8					
Green Ext Time (p_c), s	2.7		0.6		5.7		0.7					

Intersection Summary		
HCM 6th Ctrl Delay	10.2	
HCM 6th LOS	B	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Appendix H

2032 Total Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Total AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	9	379	40	13	187	42	20	32	49	140	34	15
Future Volume (vph)	9	379	40	13	187	42	20	32	49	140	34	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.986			0.972			0.910				0.955
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1690	0	1805	1592	0	1752	1540	0
Fit Permitted	0.605			0.473			0.722			0.700		
Satd. Flow (perm)	1017	1728	0	676	1690	0	1370	1592	0	1291	1540	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			17			53				16
Link Speed (k/h)		50			50			50				50
Link Distance (m)		224.6			109.9			169.9				214.3
Travel Time (s)		16.2			7.9			12.2				15.4
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	10	412	43	14	203	46	22	35	53	152	37	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	455	0	14	249	0	22	88	0	152	53	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase		2			6			4			8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	45.1	45.1		45.1	45.1		14.0	14.0		14.0	14.0	
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.19	0.19		0.19	0.19	
v/c Ratio	0.02	0.42		0.03	0.23		0.08	0.25		0.61	0.17	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Total AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.4	8.8		6.7	6.7		23.6	13.7		37.1	19.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.4	8.8		6.7	6.7		23.6	13.7		37.1	19.2	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		8.7			6.7			15.7			32.5	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.5	27.3		0.7	12.1		2.6	4.1		19.9	4.4	
Queue Length 95th (m)	2.5	57.3		3.2	27.9		8.3	15.1		37.7	13.1	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	643	1096		427	1075		664	799		626	755	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.42		0.03	0.23		0.03	0.11		0.24	0.07	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	71.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.61
Intersection Signal Delay:	13.6
Intersection Capacity Utilization:	62.9%
Analysis Period (min):	15
Intersection LOS:	B
ICU Level of Service:	B

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2032 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	9	379	40	13	187	42	20	32	49	140	34	15
Future Volume (veh/h)	9	379	40	13	187	42	20	32	49	140	34	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	10	412	43	14	203	46	22	35	53	152	37	16
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	671	974	102	441	856	194	340	127	193	303	215	93
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	1032	1573	164	706	1382	313	1370	622	942	1296	1051	455
Grp Volume(v), veh/h	10	0	455	14	0	249	22	0	88	152	0	53
Grp Sat Flow(s),veh/h/ln	1032	0	1737	706	0	1695	1370	0	1565	1296	0	1506
Q Serve(g_s), s	0.3	0.0	9.8	0.8	0.0	4.8	1.0	0.0	3.4	8.1	0.0	2.1
Cycle Q Clear(g_c), s	5.1	0.0	9.8	10.6	0.0	4.8	3.1	0.0	3.4	11.6	0.0	2.1
Prop In Lane	1.00		0.09	1.00		0.18	1.00		0.60	1.00		0.30
Lane Grp Cap(c), veh/h	671	0	1076	441	0	1050	340	0	320	303	0	308
V/C Ratio(X)	0.01	0.00	0.42	0.03	0.00	0.24	0.06	0.00	0.27	0.50	0.00	0.17
Avail Cap(c_a), veh/h	676	0	1085	445	0	1059	715	0	749	658	0	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.3	0.0	7.1	9.9	0.0	6.2	25.1	0.0	24.4	29.2	0.0	23.8
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.5	1.3	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.1	0.3	0.0	1.0	2.2	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	7.3	0.0	7.4	9.9	0.0	6.3	25.2	0.0	24.8	30.5	0.0	24.1
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	465			263			110			205		
Approach Delay, s/veh	7.4			6.5			24.9			28.9		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			21.1			51.6			21.1		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	11.8			5.4			12.6			13.6		
Green Ext Time (p_c), s	4.1			0.7			2.1			1.0		

Intersection Summary		
HCM 6th Ctrl Delay	13.2	
HCM 6th LOS	B	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
 2: Richmond Street & Site Driveway

2032 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔		↔	↔
Traffic Volume (vph)	3	566	237	1	8	4
Future Volume (vph)	3	566	237	1	8	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0			0.0	0.0	0.0
Storage Lanes	1			0	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.958	
Fit Protected	0.950				0.967	
Satd. Flow (prot)	1770	1863	1861	0	1726	0
Fit Permitted	0.950				0.967	
Satd. Flow (perm)	1770	1863	1861	0	1726	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	615	258	1	9	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	3	615	259	0	13	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization 39.8%	ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
2: Richmond Street & Site Driveway

2032 Total AM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑	↑		↑	↑
Traffic Vol, veh/h	3	566	237	1	8	4
Future Vol, veh/h	3	566	237	1	8	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	615	258	1	9	4
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	259	0	-	0	880	259
Stage 1	-	-	-	-	259	-
Stage 2	-	-	-	-	621	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1306	-	-	-	318	780
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	536	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1306	-	-	-	317	780
Mov Cap-2 Maneuver	-	-	-	-	425	-
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	536	-
Approach	EB	WB	SB			
HCM Control Delay, s	0	0	12.4			
HCM LOS			B			
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1306	-	-	-	501	
HCM Lane V/C Ratio	0.002	-	-	-	0.026	
HCM Control Delay (s)	7.8	-	-	-	12.4	
HCM Lane LOS	A	-	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.1	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Total PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	12	241	56	43	415	120	41	43	21	52	55	20
Future Volume (vph)	12	241	56	43	415	120	41	43	21	52	55	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0	0.0	15.0	0.0	70.0	0.0	25.0	0.0	25.0	0.0	0.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	60.0		30.0		30.0		100.0		100.0		100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00				0.99	
Fit		0.972			0.966			0.951			0.960	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1782	0	1805	1799	0	1805	1771	0	1805	1813	0
Fit Permitted	0.414			0.565			0.704			0.711		
Satd. Flow (perm)	787	1782	0	1074	1799	0	1334	1771	0	1351	1813	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	18				22			23			22	
Link Speed (k/h)	50				50			50			50	
Link Distance (m)	224.6				109.9			169.9			214.3	
Travel Time (s)	16.2				7.9			12.2			15.4	
Conf. Peds. (#/hr)							2					2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	0%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	13	262	61	47	451	130	45	47	23	57	60	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	13	323	0	47	581	0	45	70	0	57	82	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2		6			4			8	
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.2	10.2		10.2	10.2	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.02	0.25		0.06	0.44		0.22	0.24		0.28	0.28	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2032 Total PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.2	4.8		4.4	6.3		28.5	21.2		29.6	22.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.2	4.8		4.4	6.3		28.5	21.2		29.6	22.8	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.7			6.2			24.0			25.6	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	13.7		1.8	30.5		5.4	5.6		6.9	7.2	
Queue Length 95th (m)	2.2	25.2		5.2	53.0		14.2	16.1		16.9	18.7	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	576	1311		787	1325		684	920		693	941	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.25		0.06	0.44		0.07	0.08		0.08	0.09	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	67.8
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.44
Intersection Signal Delay:	9.7
Intersection Capacity Utilization:	58.7%
Intersection LOS:	A
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2032 Total PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Volume (veh/h)	12	241	56	43	415	120	41	43	21	52	55	20
Future Volume (veh/h)	12	241	56	43	415	120	41	43	21	52	55	20
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	13	262	61	47	451	130	45	47	23	57	60	22
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	523	949	221	729	917	264	259	183	90	268	207	76
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	847	1444	336	1074	1396	402	1330	1174	574	1345	1324	485
Grp Volume(v), veh/h	13	0	323	47	0	581	45	0	70	57	0	82
Grp Sat Flow(s),veh/h/ln	847	0	1780	1074	0	1798	1330	0	1748	1345	0	1809
Q Serve(g_s), s	0.5	0.0	5.2	1.3	0.0	11.2	2.1	0.0	2.4	2.7	0.0	2.7
Cycle Q Clear(g_c), s	11.8	0.0	5.2	6.5	0.0	11.2	4.9	0.0	2.4	5.1	0.0	2.7
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.33	1.00		0.27
Lane Grp Cap(c), veh/h	523	0	1170	729	0	1181	259	0	273	268	0	282
V/C Ratio(X)	0.02	0.00	0.28	0.06	0.00	0.49	0.17	0.00	0.26	0.21	0.00	0.29
Avail Cap(c_a), veh/h	528	0	1180	735	0	1192	728	0	888	741	0	919
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.9	0.0	4.9	6.3	0.0	5.9	27.7	0.0	25.4	27.6	0.0	25.5
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.5	0.4	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.2	0.6	0.0	0.8	0.7	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.9	0.0	5.0	6.3	0.0	6.3	28.0	0.0	25.9	28.0	0.0	26.1
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	336			628			115			139		
Approach Delay, s/veh	5.2			6.3			26.7			26.9		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			16.9			51.6			16.9		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	13.8			6.9			13.2			7.1		
Green Ext Time (p_c), s	2.7			0.6			5.8			0.8		

Intersection Summary		
HCM 6th Ctrl Delay	10.3	
HCM 6th LOS	B	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
 2: Richmond Street & Site Driveway

2032 Total PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↗	↖	↗	↖	↗
Traffic Volume (vph)	8	306	566	13	4	12
Future Volume (vph)	8	306	566	13	4	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0		0.0	0.0	0.0	
Storage Lanes	1		0	1	0	
Taper Length (m)	7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.897	
Fit Protected	0.950				0.988	
Satd. Flow (prot)	1770	1863	1857	0	1651	0
Fit Permitted	0.950				0.988	
Satd. Flow (perm)	1770	1863	1857	0	1651	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	333	615	14	4	13
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	333	629	0	17	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	40.6%
Analysis Period (min)	15
	ICU Level of Service A

HCM 6th TWSC
 2: Richmond Street & Site Driveway

2032 Total PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↕	↕	↔	↕	↕
Traffic Vol, veh/h	8	306	566	13	4	12
Future Vol, veh/h	8	306	566	13	4	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	333	615	14	4	13

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	629	0	0	973	622
Stage 1	-	-	-	622	-
Stage 2	-	-	-	351	-
Critical Hdwy	4.12	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	3.518	3.318
Pot Cap-1 Maneuver	953	-	-	280	487
Stage 1	-	-	-	535	-
Stage 2	-	-	-	713	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	953	-	-	277	487
Mov Cap-2 Maneuver	-	-	-	399	-
Stage 1	-	-	-	530	-
Stage 2	-	-	-	713	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	13.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	953	-	-	-	462
HCM Lane V/C Ratio	0.009	-	-	-	0.038
HCM Control Delay (s)	8.8	-	-	-	13.1
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Appendix I

2037 Background Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	10	416	44	13	204	45	22	35	54	154	38	17
Future Volume (vph)	10	416	44	13	204	45	22	35	54	154	38	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0	0.0	15.0	0.0	70.0	0.0	70.0	0.0	25.0	0.0	0.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	60.0		30.0		30.0		100.0		100.0		1.00	1.00
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.986			0.973			0.909				0.954
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1591	0	1752	1539	0
Fit Permitted	0.593			0.437			0.719			0.694		
Satd. Flow (perm)	997	1728	0	624	1692	0	1364	1591	0	1280	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			17			59			18	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		224.6			109.9			169.9			214.3	
Travel Time (s)		16.2			7.9			12.2			15.4	
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	11	452	48	14	222	49	24	38	59	167	41	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	500	0	14	271	0	24	97	0	167	59	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase		2			6			4			8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	45.2	45.2		45.2	45.2		14.9	14.9		14.9	14.9	
Actuated g/C Ratio	0.62	0.62		0.62	0.62		0.20	0.20		0.20	0.20	
v/c Ratio	0.02	0.47		0.04	0.26		0.09	0.26		0.64	0.18	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Background AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.9	9.8		7.2	7.4		23.3	13.2		38.1	18.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.9	9.8		7.2	7.4		23.3	13.2		38.1	18.8	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		9.8			7.4			15.2			33.0	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.5	32.7		0.7	14.1		2.8	4.5		22.1	4.9	
Queue Length 95th (m)	2.9	68.6		3.4	32.2		8.5	15.8		41.1	13.9	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	623	1083		389	1063		653	792		613	746	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.46		0.04	0.25		0.04	0.12		0.27	0.08	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	72.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.64
Intersection Signal Delay:	14.3
Intersection Capacity Utilization:	63.7%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2037 Background AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	10	416	44	13	204	45	22	35	54	154	38	17
Future Volume (veh/h)	10	416	44	13	204	45	22	35	54	154	38	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	11	452	48	14	222	49	24	38	59	167	41	18
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	635	952	101	400	843	186	355	135	210	315	231	102
Arrive On Green	0.61	0.61	0.61	0.61	0.61	0.61	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1012	1570	167	677	1390	307	1363	612	951	1286	1046	459
Grp Volume(v), veh/h	11	0	500	14	0	271	24	0	97	167	0	59
Grp Sat Flow(s),veh/h/ln	1012	0	1737	677	0	1697	1363	0	1563	1286	0	1505
Q Serve(g_s), s	0.4	0.0	11.8	0.9	0.0	5.6	1.1	0.0	3.8	9.2	0.0	2.4
Cycle Q Clear(g_c), s	5.9	0.0	11.8	12.7	0.0	5.6	3.4	0.0	3.8	13.0	0.0	2.4
Prop In Lane	1.00		0.10	1.00		0.18	1.00		0.61	1.00		0.31
Lane Grp Cap(c), veh/h	635	0	1053	400	0	1029	355	0	346	315	0	333
V/C Ratio(X)	0.02	0.00	0.47	0.03	0.00	0.26	0.07	0.00	0.28	0.53	0.00	0.18
Avail Cap(c_a), veh/h	640	0	1062	404	0	1038	693	0	733	634	0	706
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.2	0.0	8.1	11.6	0.0	6.8	24.8	0.0	24.0	29.4	0.0	23.4
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.4	1.4	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.2	0.0	0.0	0.1	0.3	0.0	1.1	2.5	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.2	0.0	8.4	11.6	0.0	7.0	24.9	0.0	24.4	30.8	0.0	23.7
LnGrp LOS	A	A	A	B	A	A	C	A	C	C	A	C
Approach Vol, veh/h	511			285			121			226		
Approach Delay, s/veh	8.4			7.2			24.5			28.9		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			22.6			51.6			22.6		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	13.8			5.8			14.7			15.0		
Green Ext Time (p_c), s	4.6			0.8			2.3			1.1		

Intersection Summary	
HCM 6th Ctrl Delay	13.9
HCM 6th LOS	B

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	13	262	62	45	450	129	45	48	20	55	61	22
Future Volume (vph)	13	262	62	45	450	129	45	48	20	55	61	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00				0.99	
Fit		0.971			0.967			0.955			0.960	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1780	0	1805	1801	0	1805	1777	0	1805	1813	0
Fit Permitted	0.384			0.550			0.699			0.709		
Satd. Flow (perm)	730	1780	0	1045	1801	0	1324	1777	0	1347	1813	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	18				22			22			22	
Link Speed (k/h)	50			50		50		50		50		50
Link Distance (m)	224.6			109.9		169.9		214.3				
Travel Time (s)	16.2			7.9		12.2		15.4				
Conf. Peds. (#/hr)					2		2			2		2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	14	285	67	49	489	140	49	52	22	60	66	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	352	0	49	629	0	49	74	0	60	90	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.3	10.3		10.3	10.3	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.03	0.27		0.06	0.48		0.24	0.26		0.29	0.31	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Background PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.4	5.0		4.5	6.8		28.9	21.9		29.9	23.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.4	5.0		4.5	6.8		28.9	21.9		29.9	23.6	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		4.9			6.6			24.7			26.1	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	15.4		1.9	34.5		5.9	6.2		7.2	8.1	
Queue Length 95th (m)	2.3	28.4		5.5	60.9		15.1	17.0		17.6	20.2	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0		70.0		25.0				
Base Capacity (vph)	534	1309		765	1325		678	922		690	940	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.27		0.06	0.47		0.07	0.08		0.09	0.10	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	67.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.48
Intersection Signal Delay:	10.1
Intersection Capacity Utilization:	58.9%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2037 Background PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	13	262	62	45	450	129	45	48	20	55	61	22
Future Volume (veh/h)	13	262	62	45	450	129	45	48	20	55	61	22
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	14	285	67	49	489	140	49	52	22	60	66	24
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	487	947	223	703	918	263	253	193	82	265	207	75
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	810	1441	339	1045	1398	400	1321	1235	523	1340	1327	483
Grp Volume(v), veh/h	14	0	352	49	0	629	49	0	74	60	0	90
Grp Sat Flow(s),veh/h/ln	810	0	1780	1045	0	1798	1321	0	1758	1340	0	1809
Q Serve(g_s), s	0.6	0.0	5.8	1.4	0.0	12.6	2.3	0.0	2.5	2.8	0.0	3.0
Cycle Q Clear(g_c), s	13.3	0.0	5.8	7.2	0.0	12.6	5.4	0.0	2.5	5.4	0.0	3.0
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.30	1.00		0.27
Lane Grp Cap(c), veh/h	487	0	1169	703	0	1181	253	0	275	265	0	283
V/C Ratio(X)	0.03	0.00	0.30	0.07	0.00	0.53	0.19	0.00	0.27	0.23	0.00	0.32
Avail Cap(c_a), veh/h	492	0	1179	709	0	1192	718	0	893	736	0	919
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.7	0.0	5.0	6.6	0.0	6.2	28.0	0.0	25.5	27.8	0.0	25.7
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.4	0.4	0.0	0.5	0.4	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.3	0.6	0.0	0.8	0.8	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.7	0.0	5.2	6.6	0.0	6.7	28.4	0.0	26.0	28.2	0.0	26.3
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	366			678			123			150		
Approach Delay, s/veh	5.3			6.7			26.9			27.1		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	51.6		16.9		51.6		16.9					
Change Period (Y+Rc), s	* 6.6		* 6.2		* 6.6		* 6.2					
Max Green Setting (Gmax), s	* 45		* 35		* 45		* 35					
Max Q Clear Time (g_c+I1), s	15.3		7.4		14.6		7.4					
Green Ext Time (p_c), s	3.0		0.7		6.4		0.8					

Intersection Summary		
HCM 6th Ctrl Delay	10.5	
HCM 6th LOS	B	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Appendix J

2037 Total Traffic Operations Reports



Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Total AM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	10	418	44	14	206	46	22	35	54	155	38	17
Future Volume (vph)	10	418	44	14	206	46	22	35	54	155	38	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.986			0.973			0.909				0.954
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1597	1728	0	1357	1692	0	1805	1591	0	1752	1539	0
Fit Permitted	0.591			0.436			0.719			0.694		
Satd. Flow (perm)	994	1728	0	623	1692	0	1364	1591	0	1280	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			17			59				18
Link Speed (k/h)		50			50			50				50
Link Distance (m)		224.6			109.9			169.9				214.3
Travel Time (s)		16.2			7.9			12.2				15.4
Conf. Peds. (#/hr)							1					1
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
Heavy Vehicles (%)	13%	9%	3%	33%	10%	6%	0%	11%	7%	3%	21%	8%
Adj. Flow (vph)	11	454	48	15	224	50	24	38	59	168	41	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	502	0	15	274	0	24	97	0	168	59	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases		2			6			4			8	
Detector Phase		2			6			4			8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	45.1	45.1		45.1	45.1		14.9	14.9		14.9	14.9	
Actuated g/C Ratio	0.62	0.62		0.62	0.62		0.20	0.20		0.20	0.20	
v/c Ratio	0.02	0.47		0.04	0.26		0.09	0.26		0.64	0.18	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Total AM Peak Hour

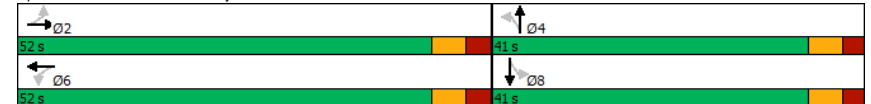
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	6.9	9.9		7.2	7.4		23.3	13.2		38.2	18.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.9	9.9		7.2	7.4		23.3	13.2		38.2	18.8	
LOS	A	A		A	A		C	B		D	B	
Approach Delay		9.8			7.4			15.2			33.1	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	0.5	33.0		0.7	14.4		2.8	4.5		22.3	4.9	
Queue Length 95th (m)	2.9	68.9		3.6	32.6		8.5	15.8		41.5	13.9	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0			70.0			25.0		
Base Capacity (vph)	620	1082		389	1063		653	792		613	746	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.02	0.46		0.04	0.26		0.04	0.12		0.27	0.08	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	72.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.64
Intersection Signal Delay:	14.4
Intersection Capacity Utilization:	63.7%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2037 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (veh/h)	10	418	44	14	206	46	22	35	54	155	38	17
Future Volume (veh/h)	10	418	44	14	206	46	22	35	54	155	38	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1707	1767	1856	1411	1752	1811	1900	1737	1796	1856	1589	1781
Adj Flow Rate, veh/h	11	454	48	15	224	50	24	38	59	168	41	18
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
Percent Heavy Veh, %	13	9	3	33	10	6	0	11	7	3	21	8
Cap, veh/h	632	952	101	398	840	188	356	136	211	316	232	102
Arrive On Green	0.61	0.61	0.61	0.61	0.61	0.61	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1009	1571	166	676	1387	310	1363	612	951	1286	1046	459
Grp Volume(v), veh/h	11	0	502	15	0	274	24	0	97	168	0	59
Grp Sat Flow(s),veh/h/ln	1009	0	1737	676	0	1696	1363	0	1563	1286	0	1505
Q Serve(g_s), s	0.4	0.0	11.9	0.9	0.0	5.6	1.1	0.0	3.8	9.3	0.0	2.4
Cycle Q Clear(g_c), s	6.0	0.0	11.9	12.8	0.0	5.6	3.4	0.0	3.8	13.1	0.0	2.4
Prop In Lane	1.00		0.10	1.00		0.18	1.00		0.61	1.00		0.31
Lane Grp Cap(c), veh/h	632	0	1052	398	0	1028	356	0	347	316	0	334
V/C Ratio(X)	0.02	0.00	0.48	0.04	0.00	0.27	0.07	0.00	0.28	0.53	0.00	0.18
Avail Cap(c_a), veh/h	637	0	1062	402	0	1037	692	0	732	633	0	705
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.3	0.0	8.1	11.7	0.0	6.9	24.8	0.0	24.0	29.4	0.0	23.4
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.4	1.4	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.2	0.0	0.0	0.1	0.3	0.0	1.1	2.5	0.0	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.3	0.0	8.5	11.7	0.0	7.0	24.9	0.0	24.4	30.8	0.0	23.7
LnGrp LOS	A	A	A	B	A	A	C	A	C	C	A	C
Approach Vol, veh/h	513			289			121			227		
Approach Delay, s/veh	8.4			7.3			24.5			28.9		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			22.7			51.6			22.7		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	13.9			5.8			14.8			15.1		
Green Ext Time (p_c), s	4.6			0.8			2.4			1.1		

Intersection Summary		
HCM 6th Ctrl Delay	13.9	
HCM 6th LOS	B	

Notes
 * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Lanes, Volumes, Timings
 2: Richmond Street & Site Driveway

2037 Total AM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↔	↔		↔	↔
Traffic Volume (vph)	3	624	261	1	8	4
Future Volume (vph)	3	624	261	1	8	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0			0.0	0.0	0.0
Storage Lanes	1			0	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.958	
Fit Protected	0.950				0.967	
Satd. Flow (prot)	1770	1863	1863	0	1726	0
Fit Permitted	0.950				0.967	
Satd. Flow (perm)	1770	1863	1863	0	1726	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	678	284	1	9	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	3	678	285	0	13	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	42.8%
ICU Level of Service A	
Analysis Period (min)	15

HCM 6th TWSC
2: Richmond Street & Site Driveway

2037 Total AM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑	↑		↑	↑
Traffic Vol, veh/h	3	624	261	1	8	4
Future Vol, veh/h	3	624	261	1	8	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	678	284	1	9	4

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	285	0	0	969	285
Stage 1	-	-	-	285	-
Stage 2	-	-	-	684	-
Critical Hdwy	4.12	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	3.518	3.318
Pot Cap-1 Maneuver	1277	-	-	281	754
Stage 1	-	-	-	763	-
Stage 2	-	-	-	501	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	1277	-	-	280	754
Mov Cap-2 Maneuver	-	-	-	394	-
Stage 1	-	-	-	761	-
Stage 2	-	-	-	501	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1277	-	-	-	469
HCM Lane V/C Ratio	0.003	-	-	-	0.028
HCM Control Delay (s)	7.8	-	-	-	12.9
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Total PM Peak Hour

(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	13	266	62	47	457	132	45	48	22	57	61	22
Future Volume (vph)	13	266	62	47	457	132	45	48	22	57	61	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	70.0		0.0	15.0		0.0	70.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	60.0			30.0			30.0			100.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor							1.00					0.99
Fit		0.972			0.966			0.953				0.960
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1782	0	1805	1799	0	1805	1774	0	1805	1813	0
Fit Permitted	0.378			0.548			0.699			0.708		
Satd. Flow (perm)	718	1782	0	1041	1799	0	1324	1774	0	1345	1813	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	18				22			24			22	
Link Speed (k/h)	50			50		50		50		50		50
Link Distance (m)	224.6			109.9		169.9		214.3				
Travel Time (s)	16.2			7.9		12.2		15.4				
Conf. Peds. (#/hr)						2		2				2
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
Heavy Vehicles (%)	0%	4%	2%	0%	2%	2%	0%	3%	0%	0%	0%	0%
Adj. Flow (vph)	14	289	67	51	497	143	49	52	24	62	66	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	14	356	0	51	640	0	49	76	0	62	90	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases			2			6			4			8
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	45.0	45.0		45.0	45.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	51.6	51.6		51.6	51.6		36.2	36.2		36.2	36.2	
Total Split (s)	52.0	52.0		52.0	52.0		41.0	41.0		41.0	41.0	
Total Split (%)	55.9%	55.9%		55.9%	55.9%		44.1%	44.1%		44.1%	44.1%	
Maximum Green (s)	45.4	45.4		45.4	45.4		34.8	34.8		34.8	34.8	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7		3.7	3.7	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	49.4	49.4		49.4	49.4		10.3	10.3		10.3	10.3	
Actuated g/C Ratio	0.73	0.73		0.73	0.73		0.15	0.15		0.15	0.15	
v/c Ratio	0.03	0.27		0.07	0.49		0.24	0.26		0.30	0.31	

Lanes, Volumes, Timings

1: Saintsbury Line & Main Street/Richmond Street

2037 Total PM Peak Hour

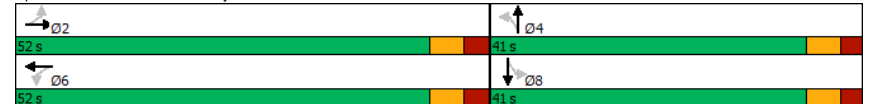
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	4.4	5.0		4.6	6.9		28.9	21.5		30.1	23.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	4.4	5.0		4.6	6.9		28.9	21.5		30.1	23.5	
LOS	A	A		A	A		C	C		C	C	
Approach Delay		5.0			6.8			24.4			26.2	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	15.6		2.0	35.4		5.9	6.2		7.5	8.1	
Queue Length 95th (m)	2.3	28.8		5.7	63.6		15.1	17.1		18.0	20.2	
Internal Link Dist (m)		200.6			85.9			145.9			190.3	
Turn Bay Length (m)	70.0			15.0		70.0		25.0				
Base Capacity (vph)	525	1310		762	1323		678	921		689	940	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.03	0.27		0.07	0.48		0.07	0.08		0.09	0.10	

Intersection Summary

Area Type:	Other
Cycle Length:	93
Actuated Cycle Length:	67.9
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.49
Intersection Signal Delay:	10.1
Intersection Capacity Utilization:	60.5%
Intersection LOS:	B
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Saintsbury Line & Main Street/Richmond Street



HCM 6th Signalized Intersection Summary
 1: Saintsbury Line & Main Street/Richmond Street

2037 Total PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↗	↘	↔	↗	↘	↔	↗	↘	↔	↗	↘
Traffic Volume (veh/h)	13	266	62	47	457	132	45	48	22	57	61	22
Future Volume (veh/h)	13	266	62	47	457	132	45	48	22	57	61	22
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1841	1870	1900	1870	1870	1900	1856	1900	1900	1900	1900
Adj Flow Rate, veh/h	14	289	67	51	497	143	49	52	24	62	66	24
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
Percent Heavy Veh, %	0	4	2	0	2	2	0	3	0	0	0	0
Cap, veh/h	479	949	220	700	917	264	253	187	86	263	207	75
Arrive On Green	0.66	0.66	0.66	0.66	0.66	0.66	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	801	1445	335	1042	1396	402	1321	1199	553	1338	1327	483
Grp Volume(v), veh/h	14	0	356	51	0	640	49	0	76	62	0	90
Grp Sat Flow(s),veh/h/ln	801	0	1780	1042	0	1798	1321	0	1752	1338	0	1809
Q Serve(g_s), s	0.6	0.0	5.9	1.5	0.0	13.0	2.3	0.0	2.6	2.9	0.0	3.0
Cycle Q Clear(g_c), s	13.6	0.0	5.9	7.4	0.0	13.0	5.4	0.0	2.6	5.6	0.0	3.0
Prop In Lane	1.00		0.19	1.00		0.22	1.00		0.32	1.00		0.27
Lane Grp Cap(c), veh/h	479	0	1169	700	0	1181	253	0	274	263	0	283
V/C Ratio(X)	0.03	0.00	0.30	0.07	0.00	0.54	0.19	0.00	0.28	0.24	0.00	0.32
Avail Cap(c_a), veh/h	484	0	1180	706	0	1191	718	0	890	733	0	919
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.9	0.0	5.0	6.6	0.0	6.3	28.0	0.0	25.5	27.9	0.0	25.7
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.0	0.0	0.5	0.4	0.0	0.5	0.5	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.1	0.0	0.0	0.3	0.6	0.0	0.9	0.8	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.9	0.0	5.2	6.7	0.0	6.8	28.4	0.0	26.0	28.4	0.0	26.3
LnGrp LOS	A	A	A	A	A	A	C	A	C	C	A	C
Approach Vol, veh/h	370			691			125			152		
Approach Delay, s/veh	5.4			6.8			27.0			27.2		
Approach LOS	A			A			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.6			16.9			51.6			16.9		
Change Period (Y+Rc), s	* 6.6			* 6.2			* 6.6			* 6.2		
Max Green Setting (Gmax), s	* 45			* 35			* 45			* 35		
Max Q Clear Time (g_c+I1), s	15.6			7.4			15.0			7.6		
Green Ext Time (p_c), s	3.0			0.7			6.6			0.8		
Intersection Summary												
HCM 6th Ctrl Delay	10.6											
HCM 6th LOS	B											
Notes												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

Lanes, Volumes, Timings
 2: Richmond Street & Site Driveway

2037 Total PM Peak Hour
 (230774) 33400 Richmond St, Lucan-Biddulph TIA

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↔	↗	↘	↔	↗	↘
Traffic Volume (vph)	8	337	624	13	4	12
Future Volume (vph)	8	337	624	13	4	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	15.0			0.0	0.0	0.0
Storage Lanes	1			0	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.897	
Fit Protected	0.950				0.988	
Satd. Flow (prot)	1770	1863	1857	0	1651	0
Fit Permitted	0.950				0.988	
Satd. Flow (perm)	1770	1863	1857	0	1651	0
Link Speed (k/h)		50	50		50	
Link Distance (m)		109.9	184.7		113.0	
Travel Time (s)		7.9	13.3		8.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	366	678	14	4	13
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	366	692	0	17	0
Sign Control		Free	Free		Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	43.6%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 6th TWSC
2: Richmond Street & Site Driveway

2037 Total PM Peak Hour
(230774) 33400 Richmond St, Lucan-Biddulph TIA

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↘	↗	↘		↘	↗
Traffic Vol, veh/h	8	337	624	13	4	12
Future Vol, veh/h	8	337	624	13	4	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	15	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	366	678	14	4	13

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	692	0	-	0	1069 685
Stage 1	-	-	-	-	685 -
Stage 2	-	-	-	-	384 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	903	-	-	-	245 448
Stage 1	-	-	-	-	500 -
Stage 2	-	-	-	-	688 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	903	-	-	-	243 448
Mov Cap-2 Maneuver	-	-	-	-	369 -
Stage 1	-	-	-	-	495 -
Stage 2	-	-	-	-	688 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	13.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	903	-	-	-	425
HCM Lane V/C Ratio	0.01	-	-	-	0.041
HCM Control Delay (s)	9	-	-	-	13.8
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1