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TRANSPORTATION SOLUTIONS LIMITED

**2118 Richmond Street,  
London**

**Transportation Impact  
Assessment**

Paradigm Transportation Solutions Limited

2024-07  
240036



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## 2118 Richmond Street, London 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 Residential Development at 2118 Richmond Street North in the City of London.

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 site is located in the northeast corner of the intersection of Richmond Street and Sunningdale Road and is proposed to be developed to accommodate a ten-storey Apartment Building with 158 units along with underground and surface parking. Vehicular access is proposed via a single RIRO access on Richmond Street.

The development is expected to be completed by 2026.

## TIA Scope

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

- ▶ **Study Area Intersections:**
  - Richmond Street and Sunningdale Road (signalized);
  - Richmond Street and Villagewalk Boulevard (unsignalized); and
  - proposed RIRO site access on Richmond Street.
- ▶ **Analysis Periods:** Weekday AM and PM peak hours.
- ▶ **Background Developments:**
  - 135 Villagewalk Boulevard;
  - 58 Sunningdale Road;
  - 2300 Richmond Street; and
  - 100 & 30 Villagewalk Boulevard.
- ▶ **Traffic Conditions:** Existing (2024) and five years after development completion (2031).



## Conclusions

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

- ▶ **Base Year (2024) Traffic Conditions:** The intersection of Richmond Street and Sunningdale Road and the intersection of Richmond Street and Villagewalk Boulevard are operating at acceptable levels of service overall, but with the following problem movements at Richmond Street and Sunningdale Road:
  - The eastbound shared through/right-turn movement is operating at LOS E with a v/c ratio greater than 0.90 during the AM and PM peak hours;
  - The westbound left-turn movement is operating at LOS F with a v/c ratio greater than 0.90 during the AM peak hour. The 95<sup>th</sup> percentile queue lengths are also exceeding the available storage of 25 metres during the AM and PM peak hours; and
  - The northbound left-turn movement is operating with a 95<sup>th</sup> percentile queue exceeding the available storage of 65 metres during the PM peak hour.
- ▶ **Development Trip Generation:** The development is forecast to generate 57 and 62 vehicle trips during the weekday AM and PM peak hours, respectively.
- ▶ **Future Intersection Analysis:** Intersection operational analysis was undertaken for the two Richmond Street intersections at Villagewalk Boulevard (under stop control) and at Sunningdale Road (under traffic signal control). The signalized intersection at Richmond Street and Sunningdale Road was analyzed under existing signal timing, as well as optimized signal timing to address problem movements.
- ▶ **2031 Background Traffic Conditions:** The two study area intersections are forecast to operate at acceptable levels of service overall, similar to existing conditions but with the following additional problem movements:

### Richmond Street and Sunningdale Road (Existing Signal Timings)

- The eastbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00, and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the PM peak hour;



- The eastbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the AM and PM peak hours;
- The westbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the AM peak hour, and at LOS E with a v/c ratio greater than 0.90 during the PM peak hour. The 95<sup>th</sup> percentile queues are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the PM peak hour. The 95<sup>th</sup> percentile queue lengths are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the PM peak hour; and
- The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.

#### Richmond Street and Sunningdale Road (Optimized Signal Timings)

- The 95<sup>th</sup> percentile queue lengths of the eastbound left-turn movement are projected to exceed the future storage of 45 metres during the PM peak hour;
- The 95<sup>th</sup> percentile queue lengths of the eastbound right-turn movement are projected to exceed the future storage of 45 metres during the AM peak hour;
- The 95<sup>th</sup> percentile queue lengths of the westbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound left-turn movement is forecast to operate at LOS E with a v/c ratio greater than 0.90 during the AM peak hour, and at LOS F with a v/c ratio greater than 1.00. The 95<sup>th</sup> percentile queue lengths are projected to exceed the available storage of 45 metres during the AM and PM peak hours; and
- The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.



### Richmond Street and Villagewalk Boulevard

- The eastbound left-turn movement is forecast to operate at LOS F during the AM and PM peak hours.
- ▶ **2031 Total Traffic Conditions:** With the existing signal timings at Richmond Street and Sunningdale Road, the study area intersections are forecast to operate at similar levels of service as under 2031 background traffic conditions with the existing signal timings.

With optimized signal timings at Richmond Street and Sunningdale Road, the intersection is forecast to operate at similar levels of service as under 2031 background traffic conditions with optimized signal timings, with the additional problem movement of the eastbound left-turn, which is forecast to operate at LOS F with a v/c ratio of 1.00.

- ▶ **Site Access:** The Site Access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B) during the AM and PM peak hours under 2031 total traffic conditions.
- ▶ **Transportation Demand Management:** The following TDM measures are appropriate for implementation at the subject development:
  - Internal sidewalks with connections to the adjacent roadway network.
  - Bicycle parking in accordance with the City's Zoning By-Law requirements for residential developments.
  - Access to existing and future transit routes on adjacent roadways.
  - Parking unbundled from the sale/rent of apartment units.
  - Transit, carshare, and active transportation information provided in a welcome package to new residents and/or posted in central locations on-site.

## 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 Residential Development at 2118 Richmond Street North in the City of London. **Figure 1.1** details the subject development location.

The subject site is located in the northeast corner of the intersection of Richmond Street and Sunningdale Road and is proposed to be developed to accommodate a ten-storey Apartment Building with 158 units along with underground and surface parking. Vehicular access is proposed via a single RIRO access on Richmond Street.

The development is expected to be completed by 2026.

## 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 City of London staff via e-mail in May 2024, includes:

- ▶ assessment of the current traffic and site conditions within the study area;
- ▶ estimates of background traffic growth for five years after development completion (2031);
- ▶ the following developments are included in background traffic forecasts:
  - 135 Villagewalk Boulevard;
  - 58 Sunningdale Road;
  - 2300 Richmond Street; and
  - 100 & 30 Villagewalk Boulevard.
- ▶ 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 and Sunningdale Road (signalized);
  - Richmond Street and Villagewalk Boulevard; and
  - proposed RIRO site access on Richmond Street.



- ▶ recommendations, if necessary, to mitigate the site generated traffic in a satisfactory manner.

**Appendix A** contains the pre-study consultation material and responses from the City of London.

This study has been prepared in accordance with the requirements detailed by the City of London Transportation Impact Assessment Guidelines<sup>1</sup>.

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<sup>1</sup> Transportation Impact Assessment Guidelines, City of London, April 2012.





# Location of Subject Site

2118 Richmond Street, London TIA  
240036

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** is a north-south urban thoroughfare under the City's Official Plan (OP)<sup>2</sup>. The roadway has a four-lane cross section, and a posted speed limit of 60 km/h south of Villagewalk Boulevard and 80 km/h to the north. Sidewalks are provided on the east side of the roadway south of Sunningdale Road.
- ▶ **Sunningdale Road** is an east-west civic boulevard with a two-lane cross section, and a posted speed limit of 50 km/h east of Villagewalk Boulevard and 60 km/h to the west.
- ▶ **Villagewalk Boulevard** is a main street between Richmond Street and Sunningdale Road and neighbourhood connector south of Sunningdale Road. The roadway has a two-lane cross section, and an assumed speed limit of 50 km/h north of Sunningdale Road and 40 km/h to the south. Sidewalks are provided on both sides of the roadway south of Sunningdale Road West and on the west side to the north.

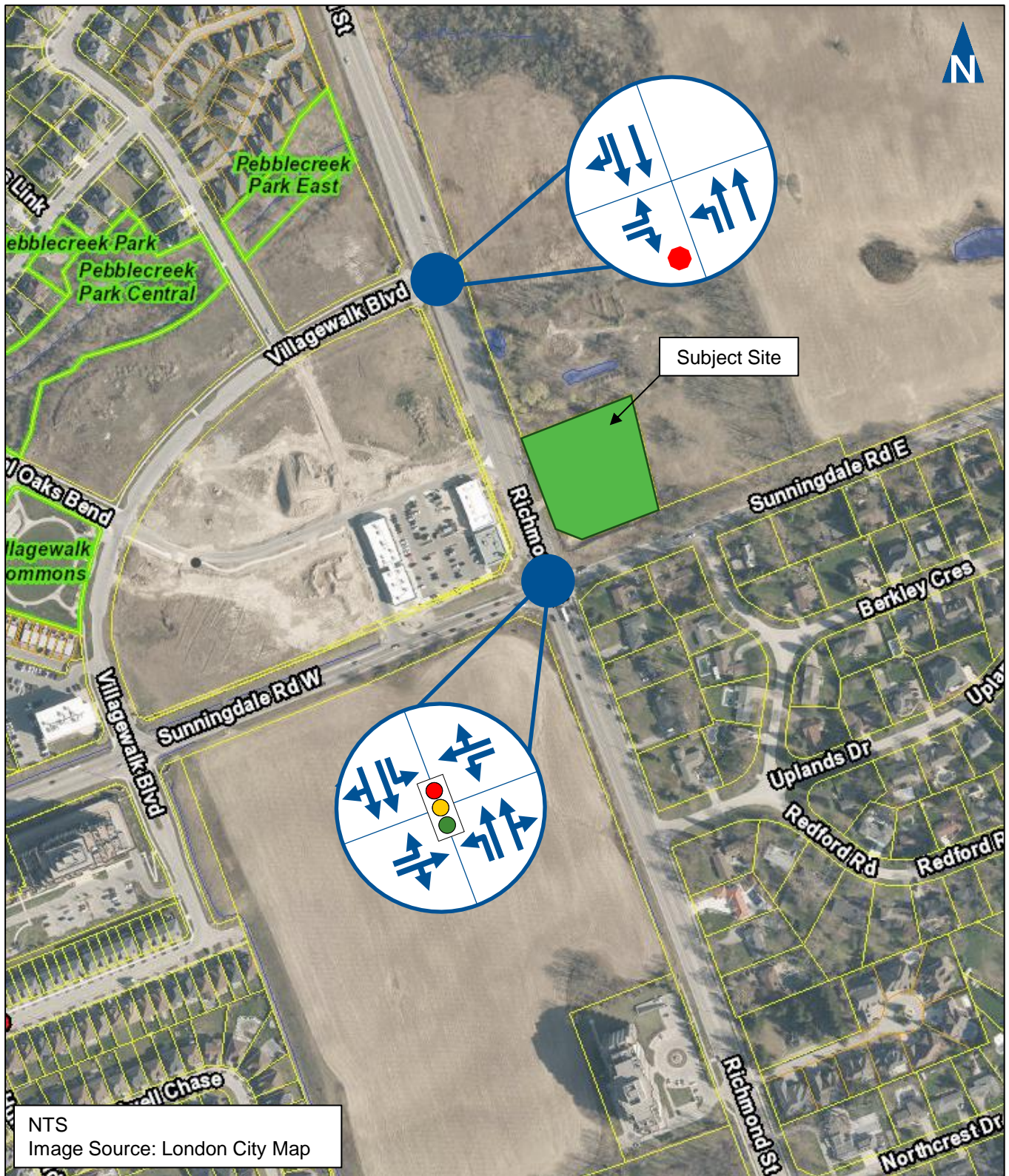
Traffic signals are provided at the intersection of Richmond Street and Sunningdale Road.

**Figure 2.1** illustrates the traffic control and lane configuration at the study area intersections.

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<sup>2</sup> City of London, The London Plan, May 2021.





## Existing Lane Configuration and Traffic Control

2118 Richmond Street, London TIA  
240036

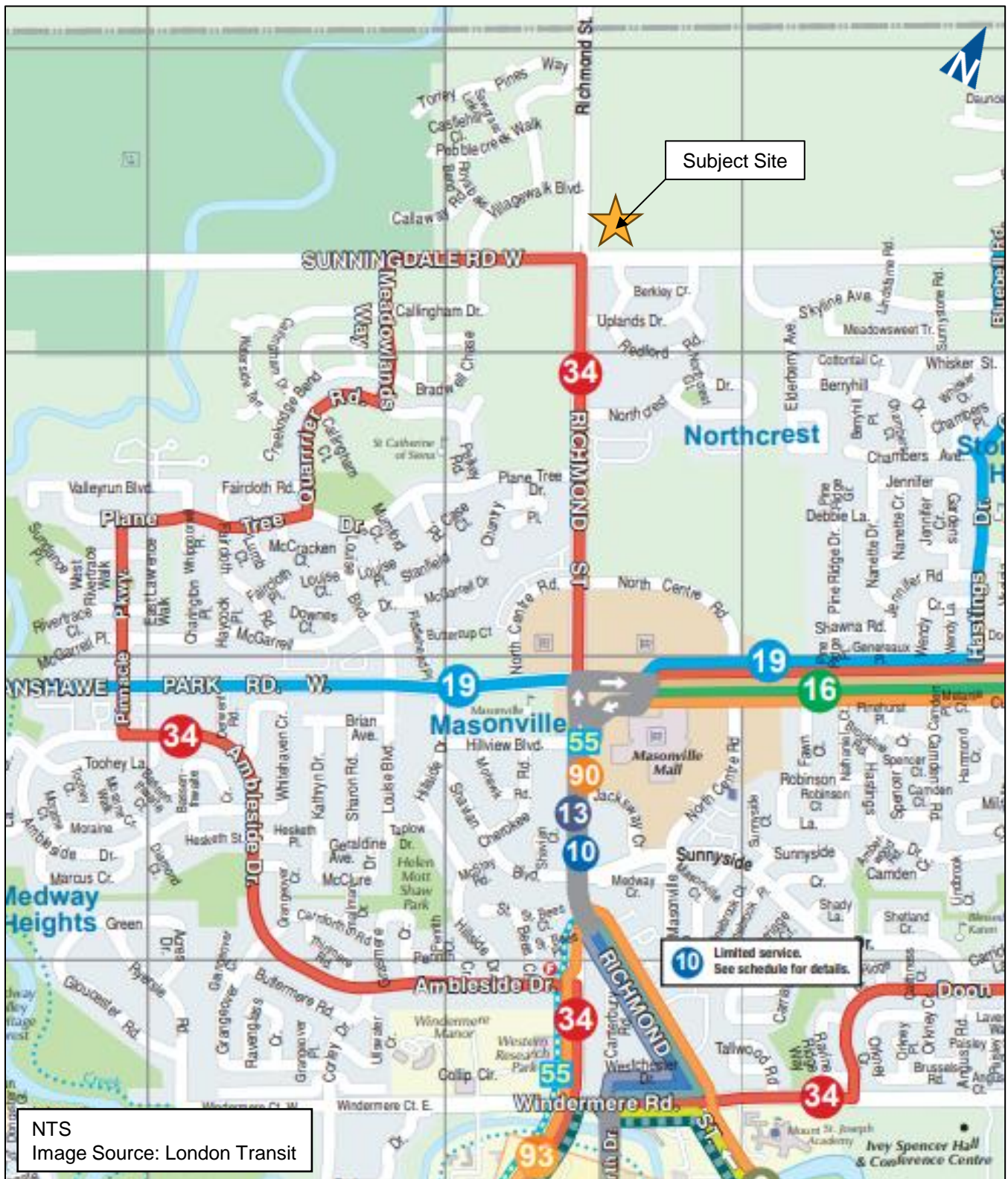
Figure 2.1

## 2.2 Transit Service

London Transit **Route 34 Masonville Place – Alumni Hall/Natural Science** operates along Sunningdale Road and Richmond Street south with major stops at Masonville Mall and University Hospital. The route operates Monday to Friday (6:00AM to 1:00AM) with 40-minute headways, Saturday (8:00AM to 11:00PM) with 40-minute headways and Sunday/Holidays (10:00AM to 9:30PM) with 40-minute headways. The nearest eastbound and westbound stops (Stop #2881 and #2880) are located on Sunningdale Road west of Richmond Street.

**Figure 2.2** illustrates the existing transit service.





NTS  
Image Source: London Transit



## Existing Transit Network

Figure 2.2

## 2.3 Traffic Volumes

Turning movement counts were either provided by the City or collected by Paradigm. **Table 2.1** summarizes the traffic count date, source, and peak hour start times for each study area intersection.

**TABLE 2.1: EXISTING TURNING MOVEMENT COUNT SUMMARY**

Intersection	Count Date	Source	AM Peak Hour	PM Peak Hour
Richmond Street & Sunningdale Road	2023-04-20	City	8:00 AM	4:30 PM
Richmond Street & Villagewalk Boulevard	2023-01-18	PTSL	7:30 AM	4:00 PM

**Figure 2.3** illustrates the existing AM and PM weekday peak hour turning movement traffic volumes.

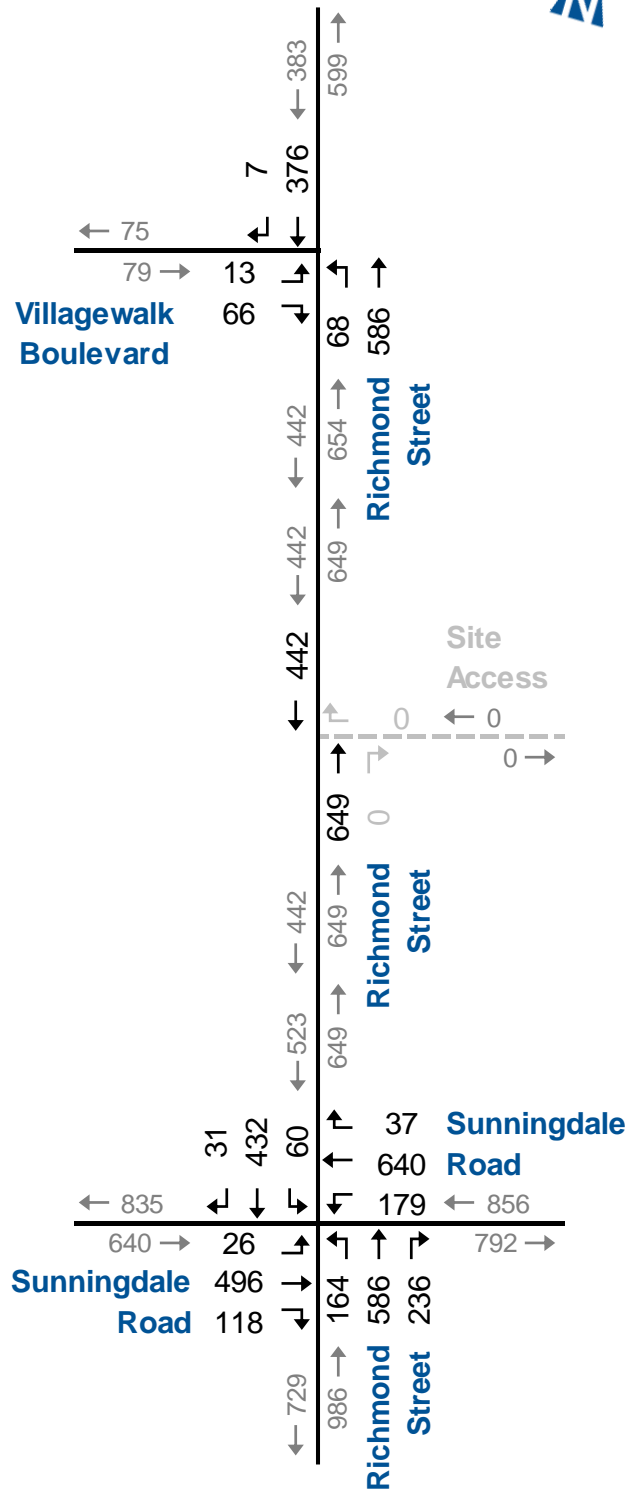
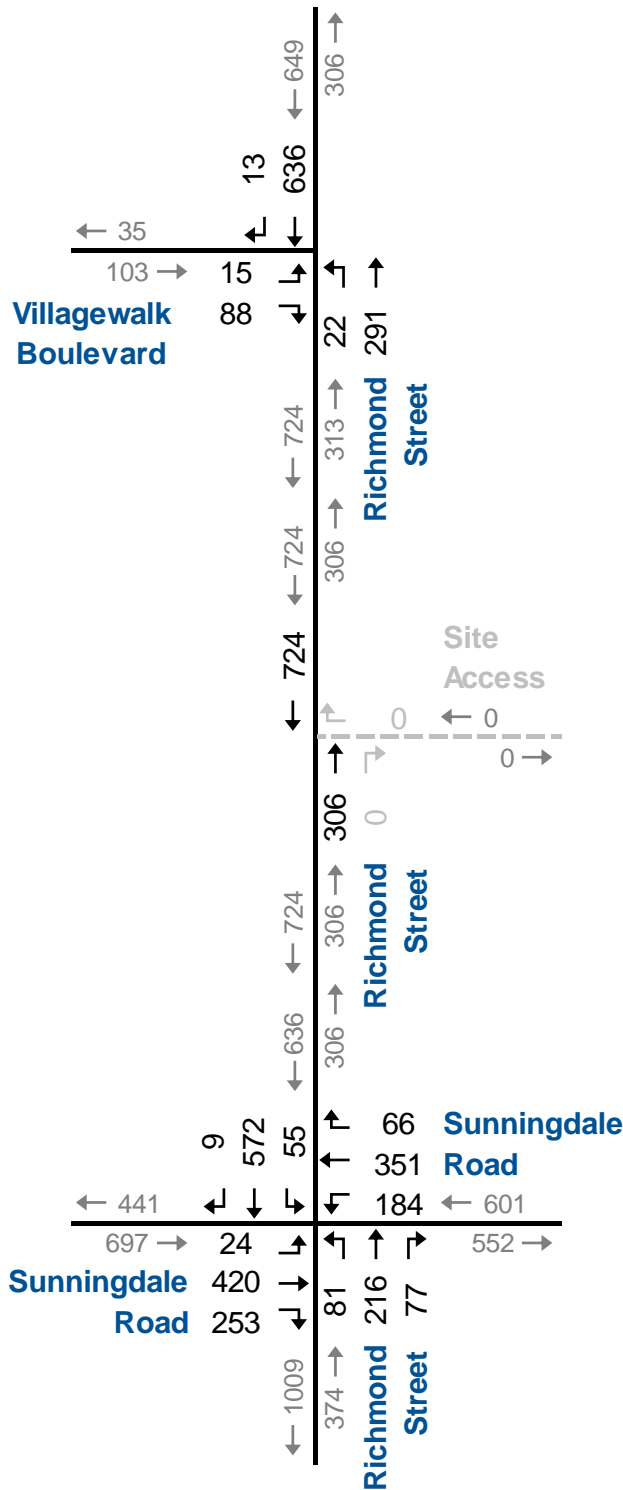
**Appendix B** contains the detailed traffic counts and signal timings for the intersection of Richmond Street and Sunningdale Road.





### AM Peak Hour

### PM Peak Hour



## Existing Traffic Volumes

## 2.4 Traffic Operations

The level of service conditions at the intersection of Richmond Street and Sunningdale Road 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 0.90 or above and LOS 'E' or worse;
- ▶ v/c ratios for dedicated turning movements increased to 0.90 or above and LOS 'E' or worse; or
- ▶ 95<sup>th</sup> percentile queue lengths for individual movements exceeds available lane storage.

**Table 2.2** 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 study area intersections are operating at acceptable levels of service, except for the following critical movements at Richmond Street and Sunningdale Road:

- ▶ The eastbound shared through/right-turn movement is operating at LOS E and a v/c ratio greater than 0.90 during the AM and PM peak hours;



- ▶ The westbound left-turn movement is operating at LOS F with a v/c ratio greater than 0.90 during the AM peak hour. The 95<sup>th</sup> percentile queue lengths are also exceeding the available storage of 25 metres during the AM and PM peak hours; and
- ▶ The northbound left-turn movement is operating with a 95<sup>th</sup> percentile queue exceeding the available storage of 65 metres during the PM peak hour.

**Appendix C** contains the detailed Synchro 11 reports.



**TABLE 2.2: EXISTING 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	Richmond Street & Sunningdale Road	TCS	LOS	C	E	>	E	F	C	>	D	D	C	>	C	C	>	C	D	
			Delay	23	65	>	63	85	20	>	40	40	25	>	28	29	33	>	32	43
			V/C	0.07	0.98	>		0.96	0.47	>		0.45	0.25	>		0.16	0.48	>		
Q	10	271	>		87	100	>		36	39	>		22	87	>					
Stor.	25	-	>		25	-	>		65	-	>		85	-	>					
Avail.	15	-	>		-62	-	>		29	-	>		63	-	>					
AM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	C		B	B					A	A		A	A		A		
			Delay	20		12	13				10	0		1	0		0	0		0
			V/C	0.07		0.15					0.03	0.00					0.00	0.00		
Q	2		4					1	0					0	0					
Stor.	-		-					75	-					-	35					
Avail.	-		-					74	-					-	35					
PM Peak Hour	Richmond Street & Sunningdale Road	TCS	LOS	C	E	>	E	E	C	>	D	D	C	>	C	D	C	>	C	D
			Delay	28	57	>	56	67	32	>	39	43	33	>	35	46	29	>	31	40
			V/C	0.19	0.93	>		0.89	0.78	>		0.61	0.65	>		0.48	0.36	>		
Q	12	231	>		77	198	>		69	126	>		32	67	>					
Stor.	25	-	>		25	-	>		65	-	>		85	-	>					
Avail.	13	-	>		-52	-	>		-4	-	>		53	-	>					
PM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	C		A	B					A	A		A	A		A		
			Delay	19		10	12				8	0		1	0		0	0		0
			V/C	0.05		0.09					0.07	0.00					0.00	0.00		
Q	2		2					2	0					0	0					
Stor.	-		-					75	-					-	35					
Avail.	-		-					73	-					-	35					

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



## 3 Development Concept

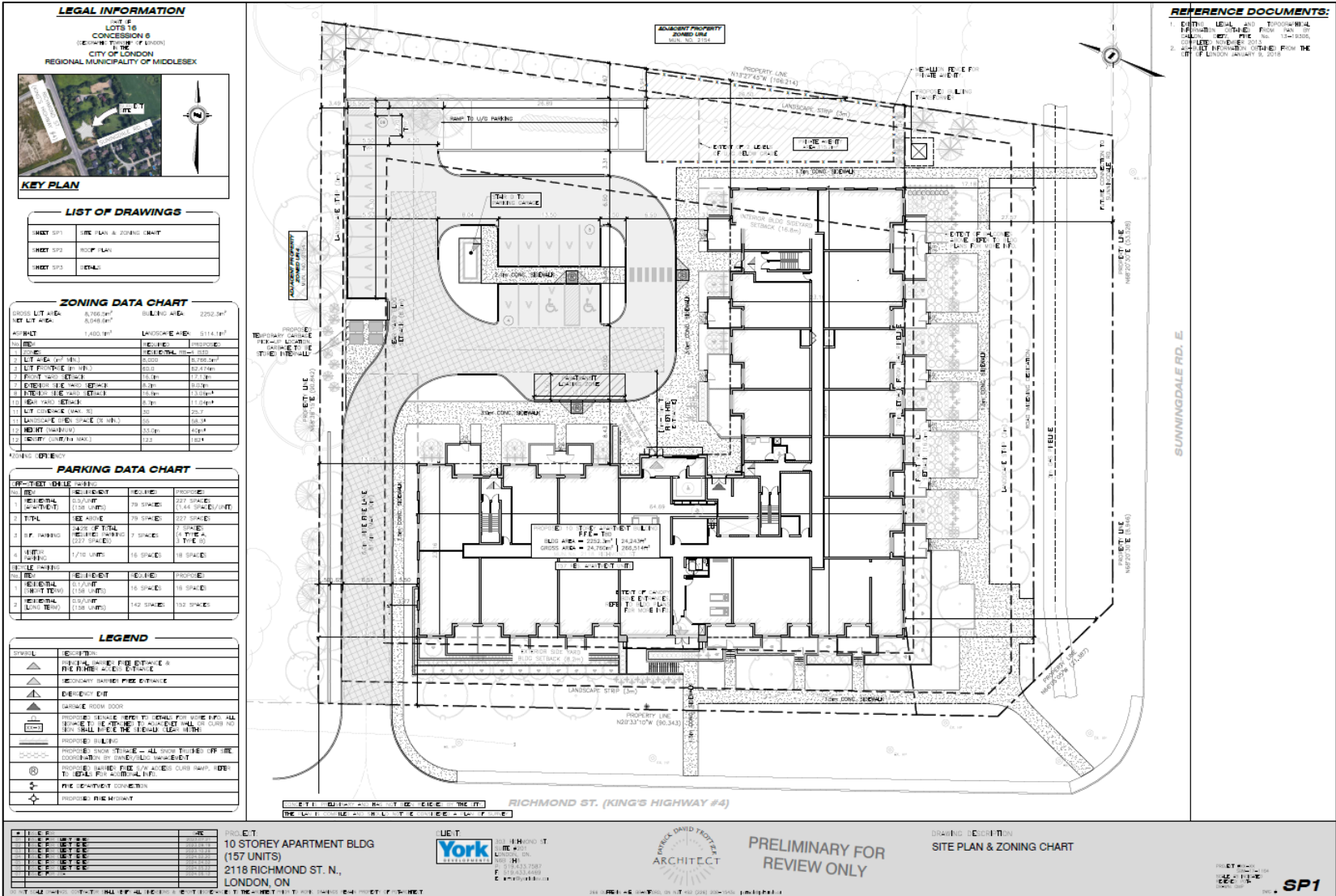
### 3.1 Development Description

The subject site is located in the northeast corner of the intersection of Richmond Street and Sunningdale Road and is proposed to be developed to accommodate a ten-storey Apartment Building with 158 units along with underground and surface parking. Vehicular access is proposed via a single RIRO access on Richmond Street.

The development is expected to be completed by 2026.

**Figure 3.1** shows the preliminary site plan.





2118 Richmond Street, London TIA  
 240036

# Preliminary Site Plan

Figure 3.1

### 3.2 Development Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation Manual<sup>3</sup> equations were used to estimate the peak hour traffic volumes generated by the subject development based on ITE Land Use Code 221, Multifamily Housing (Mid Rise).

**Table 3.1** summarizes the forecast number of net new trips generated by the proposed development. It is noted that trip generation estimates are based on an earlier Site Plan version that included 157 units, and the updated version shown in **Figure 3.1** includes 158 units. The difference in units results in one additional trip during the AM peak hour, and the same number of trips during the PM peak hour.

**TABLE 3.1: TRIP GENERATION**

Land Use Code	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
<b>221: Multifamily Housing (Mid-Rise)</b>	157	Eq	13	44	<b>57</b>	Eq	38	24	<b>62</b>
<b>Total Trip Generation</b>			<b>13</b>	<b>44</b>	<b>57</b>		<b>38</b>	<b>24</b>	<b>62</b>

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

### 3.3 Development Trip Distribution and Assignment

The trip distribution was determined based on existing traffic patterns at the intersection of Richmond Street and Sunningdale Road, and is appropriate for the subject development given its location and restricted RIRO access configuration. The trip distribution is also consistent with the studies completed for the nearby background developments.

**Table 3.2** summarizes the breakdown of trip distributions used in this study.

**TABLE 3.2: ESTIMATED TRIP DISTRIBUTION**

Origin/Destination	Percentage
North via Richmond Street	10%
South via Richmond Street	50%
East via Sunningdale Road	25%
West via Sunningdale Road	15%
<b>Total</b>	<b>100%</b>

<sup>3</sup> Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington, DC: ITE, 2021).



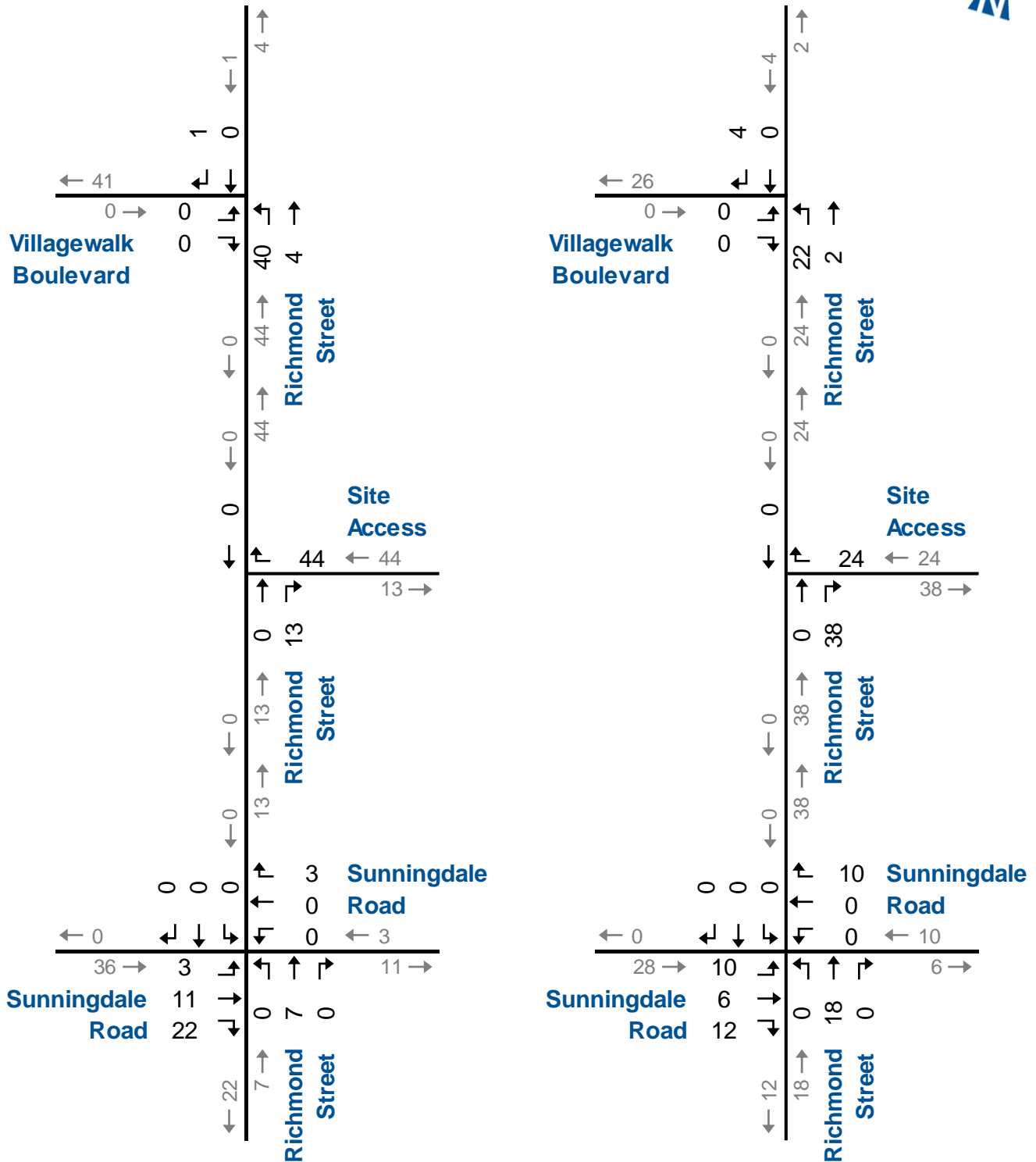
**Figure 3.2** illustrates the site-generated traffic volumes for the weekday AM and PM peak hours.





**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 and analyses of future background and total traffic volumes, corresponding to five years after development opening (2031).

### 4.1 Background Traffic Forecasts

In order to derive the 2031 generalized background traffic volumes, a growth rate of 1.5% per annum was applied to the existing roadway traffic volumes. This growth rate was confirmed with the City during the pre-study consultation.

#### 4.1.1 Other Area Developments

In consultation with the City, the following developments have been included in estimating background traffic volumes:

- ▶ 135 Villagewalk Boulevard: The mixed-use development located on the northwest corner of Richmond Street and Sunningdale Road. The development consists of 443 residential units (80 townhouse units and 363 mid-rise units), 8,516 m<sup>2</sup> (91,665 ft<sup>2</sup>) Gross Floor Area (GFA) of retail uses, 4,179 m<sup>2</sup> (44,982 ft<sup>2</sup>) GFA of office uses, 260 m<sup>2</sup> (2,799 ft<sup>2</sup>) GFA Tim Hortons restaurant with drive-through, and 455 m<sup>2</sup> (4,898 ft<sup>2</sup>) GFA McDonald's fast-food restaurant with drive-through. The development is forecast to generate 778 and 573 trips during the AM and PM peak hours, respectively<sup>4</sup>.
- ▶ 58 Sunningdale Road West: The mixed-use development located on the southwest corner of Richmond Street and Sunningdale Road. The development consists of 315 residential units (45 single-family units, 188 townhouse units and 82 apartment units) and a 2.473 ha commercial block, and is forecast to generate 275 AM peak hour trips and 313 PM peak hour trips<sup>5</sup>.
- ▶ 2300 Richmond Street: The residential development located on the east side of Richmond Street north of Villagewalk Boulevard. The development consists of two eight-storey

<sup>4</sup> Paradigm Transportation Solutions Limited, *135 Villagewalk Boulevard London Transportation Impact Assessment*, (July 2023).

<sup>5</sup> Paradigm Transportation Solutions Limited, *58 Sunningdale Road West London Transportation Impact Assessment Addendum*, (January 2023).



apartment buildings with a total of 320 units and is forecast to generate 107 AM peak hour trips and 135 PM peak hour trips<sup>6</sup>.

- ▶ **30 and 100 Villagewalk Boulevard:** The residential developments located on the north side of Villagewalk Boulevard between Richmond Street and Royal Oaks Bend. The development at 30 Villagewalk Boulevard consists of a 12-storey, 254-unit building; and the development at 100 Villagewalk Boulevard consists of two 12-storey buildings totalling 358 units. The trip generations for the two properties, estimated as part of this study, indicate a total of 173 AM peak hour trips and 205 PM peak hour trips. **Appendix D** contains the trip generation table.

All developments are assumed to be completed by 2031.

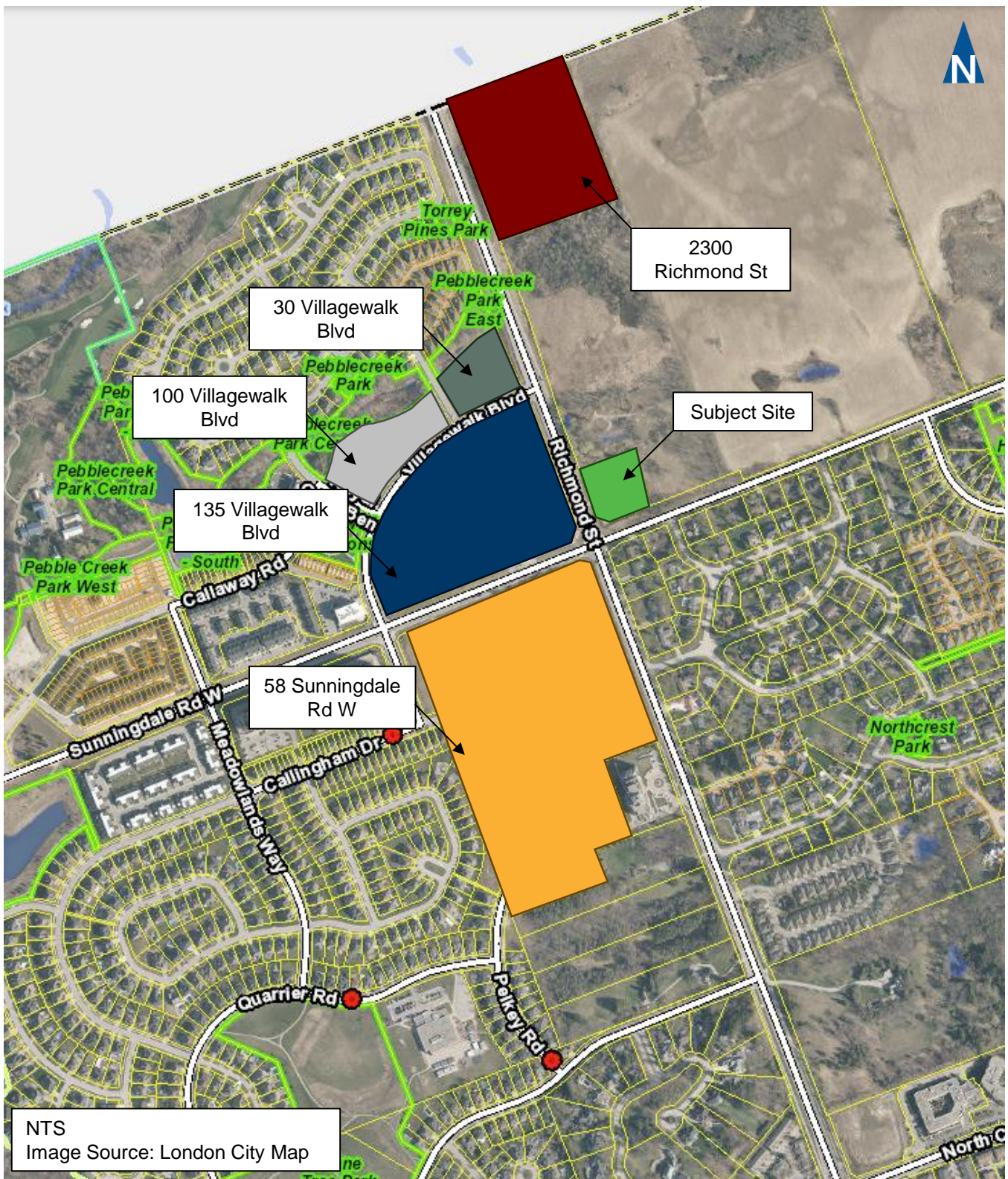
**Figure 4.1** illustrates the location of the background developments.

**Appendix D** contains the background development traffic volumes.

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<sup>6</sup> Paradigm Transportation Solutions Limited, 2300 Richmond Street London Transportation Impact Study, (August 2021).





## Location of Other Area Developments

## 4.1.2 Network Improvements

Sunningdale Road is proposed to be widened from two-lanes to four-lanes between Wonderland Road and Adelaide Street<sup>7</sup>. The widening will include improvements at the intersection of Sunningdale Road and Richmond Street and sidewalks and cycling paths on both sides of Sunningdale Road.

The improvements are anticipated to be completed by 2024. The widening and intersection improvements are included in the analyses of future (2031) traffic conditions.

**Figure 4.2** illustrates the future intersection lane configuration, and **Table 4.1** indicates the existing and future storage lengths for the auxiliary turn lanes at Richmond Street and Sunningdale Road.

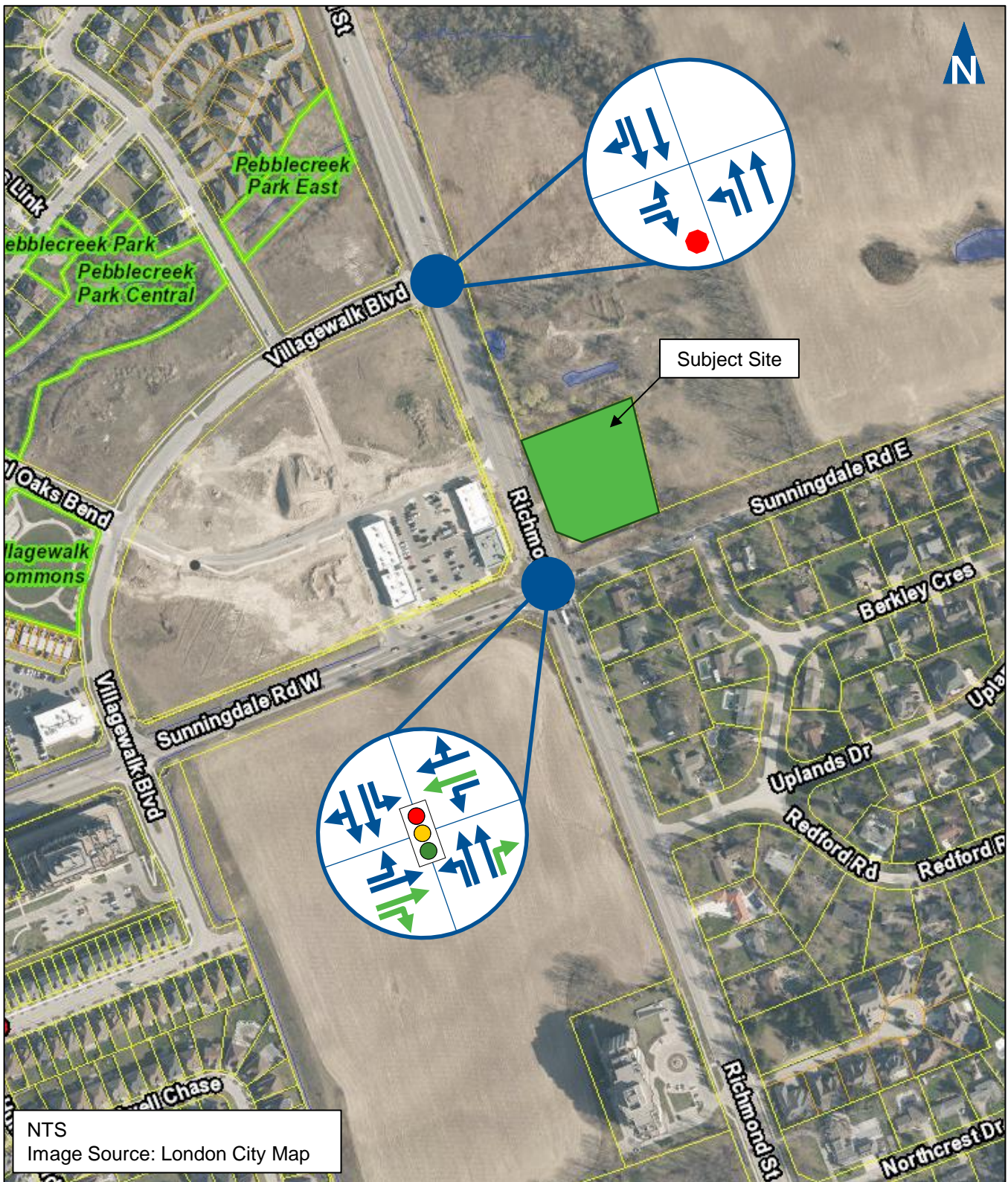
**TABLE 4.1: AUXILIARY TURN-LANE STORAGE LENGTHS**

Auxiliary Turn-Lane	Existing Storage Length	New Storage Length	New Parallel Lane Length
EB Left	25 metres	45 metres	40 metres
EB Right	-	45 metres	40 metres
WB Left	25 metres	45 metres	40 metres
NB Left	65 metres	45 metres	30 metres
NB Right	-	45 metres	30 metres
SB Left	85 metres	45 metres	30 metres

It is also anticipated that the northbound left-turn lane at Richmond Street and Villagewalk Boulevard will have a new storage length of 55 metres compared to existing 75 metres.

<sup>7</sup> City of London Sunningdale Road Environmental Assessment, Sunningdale Road Improvements Wonderland Road North to Bluebell Road. Prepared by AECOM, August 2018.





## Future Lane Configuration and Traffic Control

## 4.2 2031 Background Traffic Operations

Background traffic volumes estimated for 2031 include background increase in road traffic and the addition of background development traffic as identified in **Section 4.1.1**.

**Figure 4.3** illustrates the 2031 background traffic volumes.

Intersection operational analysis was undertaken for the two Richmond Street intersections at Villagewalk Boulevard (under stop control) and at Sunningdale Road (under traffic signal control).

The signalized intersection at Richmond Street and Sunningdale Road was analyzed under existing signal timing, as well as optimized signal timing to address problem movements, as respectively outlined in **Section 4.2.1** and **Section 4.2.2**.

### 4.2.1 Existing Signal Timing

The 2031 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions. Signal timings have not been optimized.

**Table 4.2** summarizes the results of the 2031 background traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service during the AM and PM peak hours, except for the following movements:

#### Richmond Street and Sunningdale Road

- ▶ The eastbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00, and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the PM peak hour;
- ▶ The eastbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the AM and PM peak hours;
- ▶ The westbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the AM peak hour, and at LOS E with a v/c ratio greater than 0.90 during the PM peak hour. The 95<sup>th</sup> percentile queues are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- ▶ The northbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the PM peak hour. The 95<sup>th</sup> percentile queue lengths are projected to exceed



the future storage of 45 metres during the AM and PM peak hours;

- ▶ The northbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the PM peak hour; and
- ▶ The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.

#### Richmond Street and Villagewalk Boulevard

- ▶ The eastbound left-turn movement is forecast to operate at LOS F during the AM and PM peak hours.

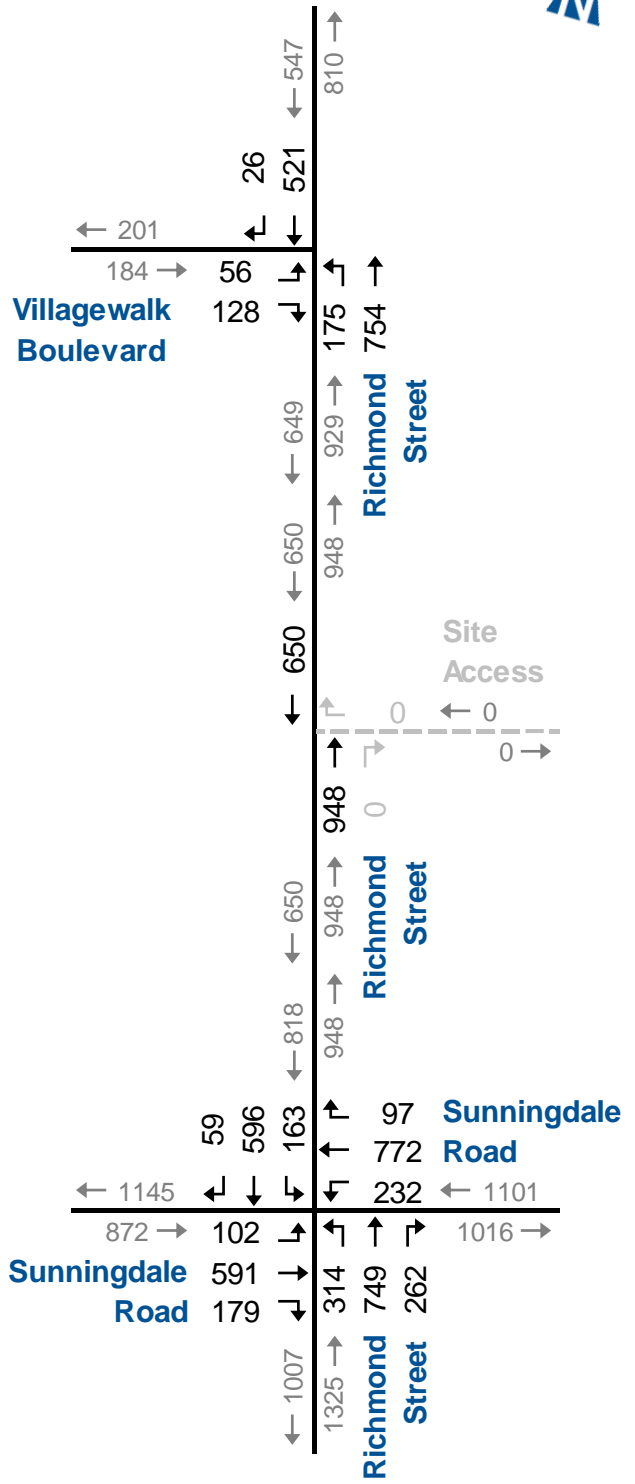
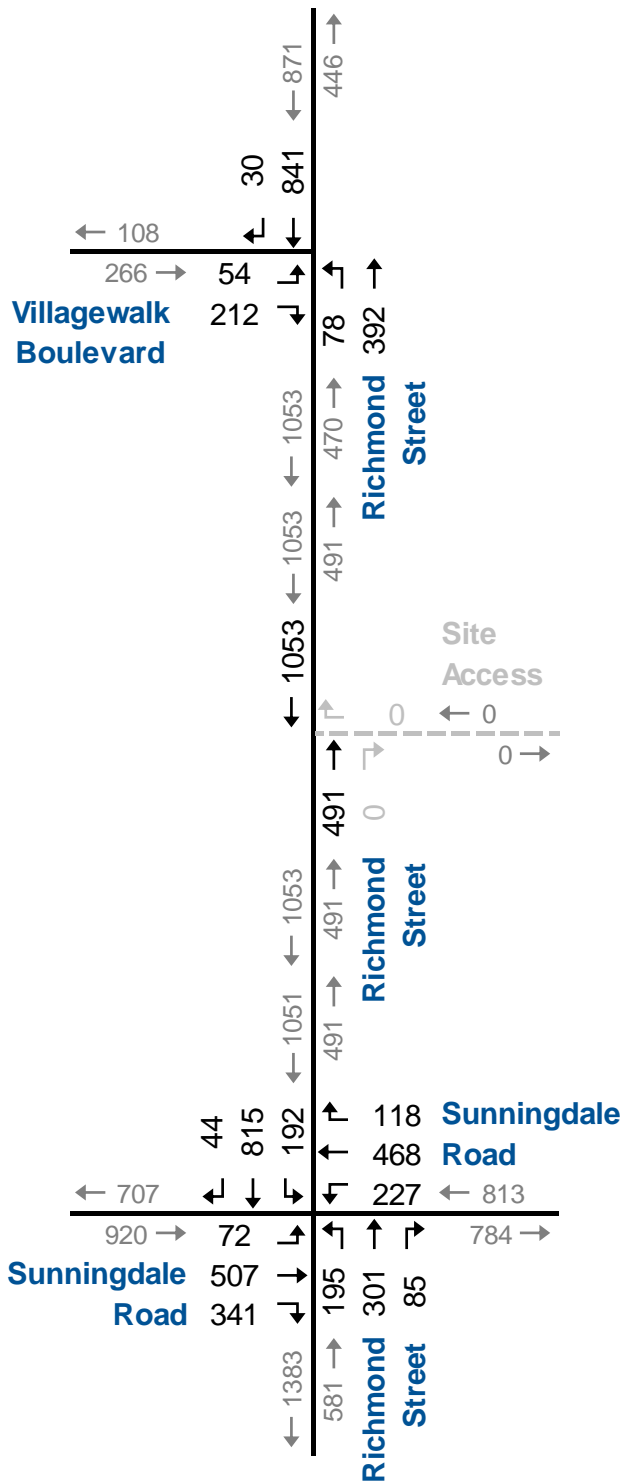
**Appendix E** contains the supporting detailed Synchro 11 reports.





**AM Peak Hour**

**PM Peak Hour**



**2031 Background Traffic Volumes**

**TABLE 4.2: 2031 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	Richmond Street & Sunningdale Road	TCS	LOS	E	E	F	<b>F</b>	F	D	>	<b>D</b>	D	B	D	<b>C</b>	B	B	>	<b>B</b>	<b>E</b>
			Delay	57	56	294	144	103	36	>	55	54	13	53	33	17	17	>	17	64
			V/C	0.51	0.76	1.58		1.03	0.58	>		0.84	0.16	0.82		0.35	0.46	>		
			Q	34	89	140		90	84	>		106	32	26		52	99	>		
Stor.	45	-	45		45	-	>		45	-	45		45	-	>					
Avail.	11	-	-95		-45	-	>		-61	-	19		-7	-	>					
AM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	F		C	<b>D</b>					B	A		<b>A</b>		A	A	<b>A</b>	
			Delay	60		16	25					12	0		2		0	0	0	0
			V/C	0.48		0.42						0.14	0.00				0.00	0.00		
			Q	16		16						4	0				0	0		
Stor.	-		-						55	-				-	35					
Avail.	-		-						51	-				-	35					
PM Peak Hour	Richmond Street & Sunningdale Road	TCS	LOS	F	D	F	<b>F</b>	E	C	>	<b>D</b>	F	C	F	<b>F</b>	D	C	>	<b>C</b>	<b>F</b>
			Delay	133	45	383	125	66	35	>	41	112	22	641	166	41	21	>	25	96
			V/C	1.01	0.66	1.74		0.92	0.69	>		1.10	0.44	2.34		0.67	0.39	>		
			Q	57	84	96		63	105	>		186	110	149		90	94	>		
Stor.	45	-	45		45	-	>		45	-	45		45	-	>					
Avail.	-12	-	-51		-18	-	>		-141	-	-104		-45	-	>					
PM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	F		B	<b>D</b>					A	A		<b>A</b>		A	A	<b>A</b>	
			Delay	67		11	28					10	0		2		0	0	0	0
			V/C	0.53		0.20						0.20	0.00				0.00	0.00		
			Q	19		5						5	0				0	0		
Stor.	-		-						55	-				-	35					
Avail.	-		-						50	-				-	35					

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



## 4.2.2 Optimized Signal Timing

The results of the operational analysis with optimized signal timings for the intersection at Richmond Street and Sunningdale Road are summarized in **Table 4.3**.

The problem movements are noted to be reduced to the following:

- ▶ The 95<sup>th</sup> percentile queue lengths of the eastbound left-turn movement are projected to exceed the future storage of 45 metres during the PM peak hour;
- ▶ The 95<sup>th</sup> percentile queue lengths of the eastbound right-turn movement are projected to exceed the future storage of 45 metres during the AM peak hour;
- ▶ The 95<sup>th</sup> percentile queue lengths of the westbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- ▶ The northbound left-turn movement is forecast to operate at LOS E with a v/c ratio greater than 0.90 during the AM peak hour, and at LOS F with a v/c ratio greater than 1.00. The 95<sup>th</sup> percentile queue lengths are projected to exceed the available storage of 45 metres during the AM and PM peak hours; and
- ▶ The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.

Based on the optimized signal timings, this intersection is forecast to improve from LOS E to D in the AM peak hour and LOS F to D in the PM peak hour. The overall intersection delay is forecast to decrease from 64 seconds to 36 seconds in the AM peak hour and from 96 seconds to 41 seconds in the PM peak hour.

Signal optimization is based on the same 130-second cycle length as without optimization.

**Appendix F** contains the supporting detailed Synchro 11 reports.



**TABLE 4.3: 2031 BACKGROUND TRAFFIC OPERATIONS – OPTIMIZED**

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	Richmond Street & Sunningdale Road	TCS	LOS	D	D	D	D	D	C	>	D	E	B	A	D	C	B	>	B	D
			Delay	53	52	52	52	54	32	>	38	80	16	4	20	20	>	>	20	36
			V/C	0.48	0.71	0.85	0.84	0.52	>	0.95	0.17	0.10	0.37	0.49	>	>	>	>	0.37	0.49
			Q	34	88	103	70	80	>	113	34	9	56	107	>	>	>	>	56	107
			Stor.	45	-	45	45	-	>	45	-	45	45	-	>	45	-	>	>	45
Avail.	11	-	-58	-25	-	>	-68	-	36	-11	-	>	-11	-	>	>	-11	-		
PM Peak Hour	Richmond Street & Sunningdale Road	TCS	LOS	E	D	B	D	D	C	>	C	F	C	A	E	D	C	>	C	D
			Delay	79	45	12	42	35	30	>	31	164	26	10	53	24	>	>	53	41
			V/C	0.80	0.67	0.37	0.73	0.63	>	1.23	0.47	0.33	0.76	0.42	>	>	>	>	0.76	0.42
			Q	46	86	27	50	97	>	194	117	41	98	99	>	>	>	>	98	99
			Stor.	45	-	45	45	-	>	45	-	45	45	-	>	45	-	>	>	45
Avail.	-1	-	18	-5	-	>	-149	-	4	-53	-	>	-53	-	>	>	-53	-		

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 2031 Total Traffic Operations

The 2031 total traffic volumes include the addition of subject development traffic volumes as shown in **Figure 3.2**.

It is noted that the subject development traffic volumes are low in comparison to 2031 background traffic volumes with potentially minimal impacts for road traffic and intersection operations.

The signalized intersection at Richmond Street and Sunningdale Road was analyzed under existing signal timing, as well as optimized signal timing to address problem movements, as respectively outlined in **Section 4.3.1** and **Section 4.3.2**.

**Figure 4.4** illustrates the 2031 total traffic volumes, including trips generated by the proposed development.

### 4.3.1 Existing Signal Timing

The 2031 total traffic volumes have been analyzed using the same methodology as under existing and background traffic conditions. Signal timings have not been optimized.

**Table 4.4** summarizes the results of the 2031 total traffic operations. The results indicate that the study area intersections are forecast to operate at similar levels of service as under 2031 background traffic conditions, as mentioned in **Section 4.2.1**.

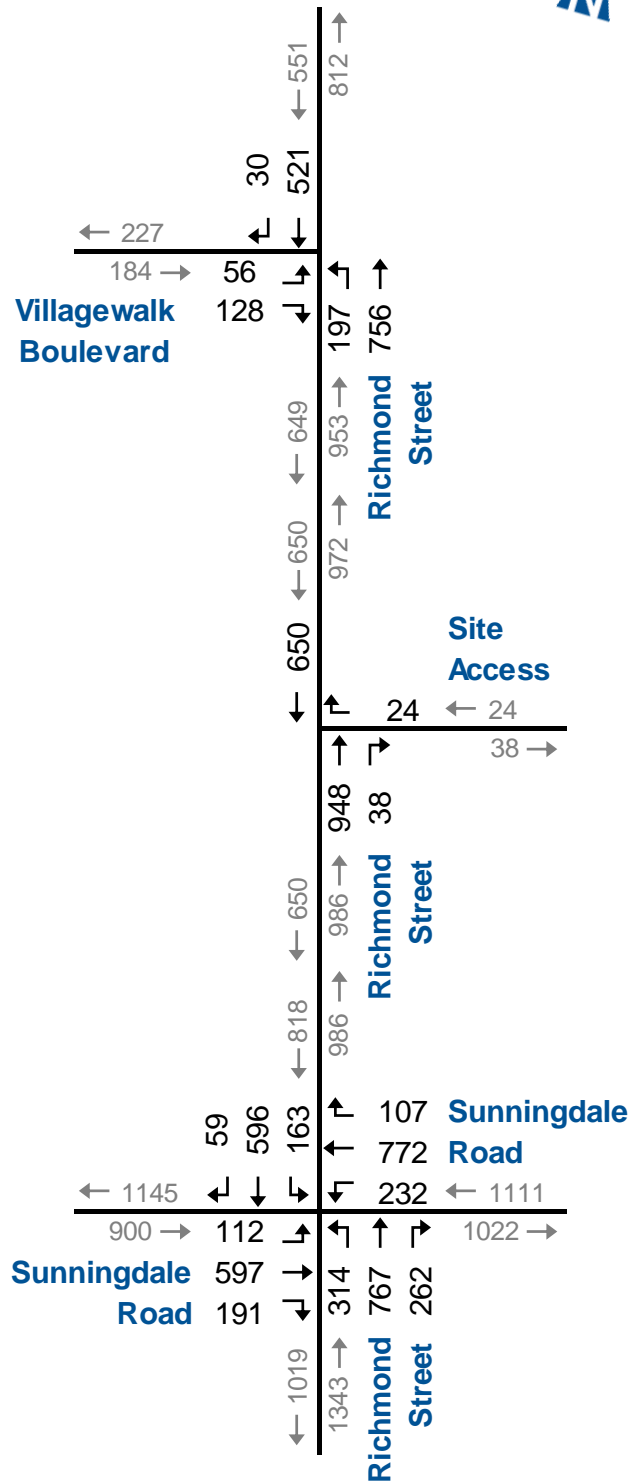
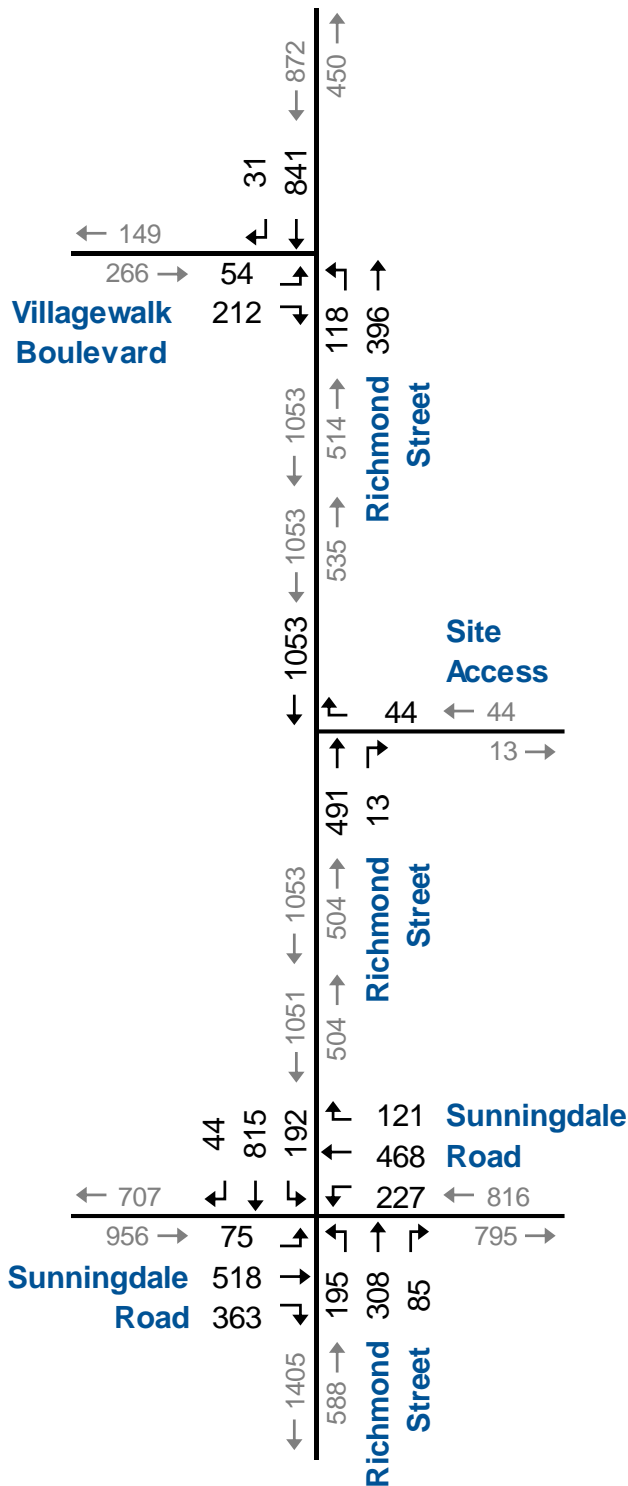
The Site Access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B) during the AM and PM peak hours.

**Appendix G** contains the supporting detailed Synchro 11 reports.



### AM Peak Hour

### PM Peak Hour



## 2031 Total Traffic Volumes

**TABLE 4.4: 2031 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	Richmond Street & Sunningdale Road	TCS	LOS	E	E	F	<b>F</b>	F	D	>	<b>D</b>	E	B	D	<b>C</b>	B	B	>	<b>B</b>	<b>F</b>	
			Delay	58	56	308	<b>152</b>	104	36	>	<b>55</b>	56	14	53	<b>34</b>	18	17	>	<b>17</b>		
			V/C	0.53	0.77	1.61		1.04	0.57	>		0.85	0.17	0.82		0.35	0.46	>			
Q	36	91	148		92	84	>		107	33	26		52	100	>						
Stor.	45	-	45		45	-	>		45	-	45		45	-	>						
Avail.	9	-	-103		-47	-	>		-62	-	19		-7	-	>						
AM Peak Hour	Richmond Street & Site Access	TWSC	LOS					B					A	A		A			<b>A</b>		
			Delay					10						0	0		0			<b>0</b>	
			V/C					0.07						0.00	0.00		0.00				
Q					2						0	0		0							
AM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	F		C	<b>D</b>					B	A		<b>A</b>		A	A	<b>A</b>		
			Delay	87		16	<b>31</b>					12	0		<b>3</b>		0	0	<b>0</b>		
			V/C	0.60		0.42						0.20	0.00				0.00	0.00			
Q	22		16						6	0				0	0						
Stor.	-		-						55	-				-	35						
Avail.	-		-						49	-				-	35						
PM Peak Hour	Richmond Street & Sunningdale Road	TCS	LOS	F	D	F	<b>F</b>	D	C	>	<b>D</b>	F	C	F	<b>F</b>	D	C	>	<b>C</b>	<b>F</b>	
			Delay	126	42	433	<b>135</b>	53	32	>	<b>37</b>	136	25	667	<b>176</b>	50	23	>	<b>28</b>	<b>101</b>	
			V/C	1.00	0.63	1.86		0.87	0.67	>		1.16	0.47	2.39		0.73	0.40	>			
Q	60	81	105		53	100	>		192	119	151		97	98	>						
Stor.	45	-	45		45	-	>		45	-	45		45	-	>						
Avail.	-15	-	-60		-8	-	>		-147	-	-106		-52	-	>						
PM Peak Hour	Richmond Street & Site Access	TWSC	LOS					B					A	A		A			<b>A</b>		
			Delay					13						0	0		0			<b>0</b>	
			V/C					0.05						0.00	0.00		0.00				
Q					2						0	0		0							
PM Peak Hour	Richmond Street & Villagewalk Boulevard	TWSC	LOS	F		B	<b>D</b>					A	A		<b>A</b>		A	A	<b>A</b>		
			Delay	80		11	<b>32</b>					10	0		<b>2</b>		0	0	<b>0</b>		
			V/C	0.58		0.20						0.22	0.00				0.00	0.00			
Q	21		5						6	0				0	0						
Stor.	-		-						55	-				-	35						
Avail.	-		-						49	-				-	35						

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



### 4.3.2 Optimized Signal Timing

The results of the operational analysis with optimized signal timings for the intersection at Richmond Street and Sunningdale Road are summarized in **Table 4.5**.

The intersection at Richmond Street and Sunningdale Road is forecast to operate at similar levels of service as under 2031 background traffic conditions with optimized signal timings, with the additional problem movement of the eastbound left-turn, which is forecast to operate at LOS F with a v/c ratio of 1.00.

Based on the optimized signal timings, the intersection is forecast to improve from LOS E to D in the AM peak hour and from LOS F to D in the PM peak hour. The overall intersection delay is forecast to decrease from 67 seconds to 37 seconds in the AM peak hour and from 101 seconds to 41 seconds in the PM peak hour.

Signal optimization is based on the same 130 seconds cycle length as without optimization.

It is noted that the auxiliary turn lane storage and parallel lengths at the intersection of Richmond Street and Sunningdale Road can mostly accommodate the projected queue lengths. However, improvements are still not completed at the intersection, and the turn lane storages can be increased to accommodate the projected queue lengths under 2031 background and total traffic conditions.

**Appendix H** contains the supporting detailed Synchro 11 reports.





**TABLE 4.5: 2031 TOTAL TRAFFIC OPERATIONS – OPTIMIZED**

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	Richmond Street & Sunningdale Road	TCS	LOS	D	D	D	D	D	C	>	D	F	B	A	D	C	C	>	C	D
			Delay	52	50	55	52	46	31	>	35	96	17	4	41	22	21	>	22	37
			V/C	0.49	0.70	0.88		0.79	0.50	>		1.00	0.18	0.11		0.39	0.50	>		
			Q	36	90	115		66	79	>		115	36	9		57	109	>		
			Stor.	45	-	45		45	-	>		45	-	45		45	-	>		
Avail.	9	-	-70		-21	-	>		-70	-	36		-12	-	>					
PM Peak Hour	Richmond Street & Sunningdale Road	TCS	LOS	F	D	B	D	D	C	>	D	F	C	A	D	D	C	>	C	D
			Delay	129	49	14	52	44	33	>	36	137	23	5	46	48	21	>	27	41
			V/C	1.00	0.71	0.41		0.79	0.67	>		1.16	0.47	0.31		0.73	0.40	>		
			Q	74	105	34		73	128	>		173	96	24		82	79	>		
			Stor.	45	-	45		45	-	>		45	-	45		45	-	>		
Avail.	-29	-	11		-28	-	>		-128	-	21		-37	-	>					

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



## 5 Transportation Demand Management

Transportation Demand Management (TDM) refers to ways of making the capacity of roads more efficient by reducing vehicle demand. TDM approaches consider how people's choices of travel mode are affected by land use patterns, development design, parking availability, parking cost, and the relative cost, convenience, and availability of alternative modes of travel. Various TDM strategies are used to influence those factors so that the alternatives are more competitive with single-occupancy travel and potentially reduce reliance on motor vehicles.

The City of London requires TIA submissions to include a suitable travel demand management plan with reasonable measures to facilitate reduced automobile reliance and promote transit, cycling and walking for trips to and from the site. This requirement is consistent with the goal established by the 2030 Transportation Master Plan to achieve a mode share target of 35% by 2030<sup>8</sup>.

Potential TDM measures appropriate for the proposed development include the following.

### 5.1 Walking

The pedestrian accessibility of a development is essential in helping to ensure that those that can walk, have access to accessible pedestrian connections.

Proper pedestrian connections from the surrounding community to the development should be available to ensure safety and to enhance the experience of those that choose to walk. The concept Site Plan indicates that sidewalks connections will be provided to Richmond Street and Sunningdale Road.

### 5.2 Cycling

Cycling lanes are not currently provided on either side of Sunningdale Road or Richmond Street in vicinity of the subject site. However, the drawings of the future roadway configuration of Sunningdale Road show bike lanes on both sides of the roadway.

To promote cycling to/from the development, the City's Zoning By-Law requires 0.9 long-term and 0.1 short-term bicycle parking spaces per residential unit.

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<sup>8</sup> City of London 2030 Transportation Master Plan: Smart Moves, January 2013.



### 5.3 Transit

As discussed in **Section 2.2**, London Transit currently operates Route 34 within the study area. The nearest eastbound and westbound stops (Stop #2881 and #2880) are located on Sunningdale Road west of Richmond Street, immediately fronting the subject site.

The nearby Route 34 bus stops are easily accessible from the subject development via the future sidewalks along Sunningdale Road and Richmond Street. This route provides good connectivity to the broader network and key destinations within the City.

### 5.4 Parking Management

To further encourage residents of the development to utilize sustainable travel modes, parking spaces could be sold separately from the cost to rent/purchase a unit. This practice of 'unbundling' parking from the unit is also more equitable and efficient since occupants are not forced to pay for parking they do not need.

### 5.5 Car Share

Car sharing refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable while providing an incentive to minimize driving and rely on alternative travel options as much as possible.

Communauto (VRTUCAR) is currently the only car share provider in the City of London and has seven locations. The closest car is located at Oxford Street and Richmond Street (5.6 kilometres).

### 5.6 Wayfinding and Travel Planning

Increasing awareness of sustainable transportation opportunities for residents and visitors of the development should be considered.

Providing a welcome package that outlines the available active transportation options can be helpful to encourage new residents to educate themselves on the support for alternative modes near the subject site. Posting real-time transit and active transportation information in common areas can further support this education.



## 6 Conclusions and Recommendations

### 6.1 Conclusions

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

- ▶ **Base Year (2024) Traffic Conditions:** The intersection of Richmond Street and Sunningdale Road and the intersection of Richmond Street and Villagewalk Boulevard are operating at acceptable levels of service overall, but with the following problem movements at Richmond Street and Sunningdale Road:
  - The eastbound shared through/right-turn movement is operating at LOS E with a v/c ratio greater than 0.90 during the AM and PM peak hours;
  - The westbound left-turn movement is operating at LOS F with a v/c ratio greater than 0.90 during the AM peak hour. The 95<sup>th</sup> percentile queue lengths are also exceeding the available storage of 25 metres during the AM and PM peak hours; and
  - The northbound left-turn movement is operating with a 95<sup>th</sup> percentile queue exceeding the available storage of 65 metres during the PM peak hour.
- ▶ **Development Trip Generation:** The development is forecast to generate 57 and 62 vehicle trips during the weekday AM and PM peak hours, respectively.
- ▶ **Future Intersection Analysis:** Intersection operational analysis was undertaken for the two Richmond Street intersections at Villagewalk Boulevard (under stop control) and at Sunningdale Road (under traffic signal control). The signalized intersection at Richmond Street and Sunningdale Road was analyzed under existing signal timing, as well as optimized signal timing to address problem movements.
- ▶ **2031 Background Traffic Conditions:** The two study area intersections are forecast to operate at acceptable levels of service overall, similar to existing conditions but with the following additional problem movements:
 

Richmond Street and Sunningdale Road (Existing Signal Timings)

  - The eastbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00, and with 95<sup>th</sup>



percentile queues exceeding the future storage of 45 metres during the PM peak hour;

- The eastbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the AM and PM peak hours;
- The westbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the AM peak hour, and at LOS E with a v/c ratio greater than 0.90 during the PM peak hour. The 95<sup>th</sup> percentile queues are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound left-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 during the PM peak hour. The 95<sup>th</sup> percentile queue lengths are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound right-turn movement is forecast to operate at LOS F with a v/c ratio greater than 1.00 and with 95<sup>th</sup> percentile queues exceeding the future storage of 45 metres during the PM peak hour; and
- The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.

#### Richmond Street and Sunningdale Road (Optimized Signal Timings)

- The 95<sup>th</sup> percentile queue lengths of the eastbound left-turn movement are projected to exceed the future storage of 45 metres during the PM peak hour;
- The 95<sup>th</sup> percentile queue lengths of the eastbound right-turn movement are projected to exceed the future storage of 45 metres during the AM peak hour;
- The 95<sup>th</sup> percentile queue lengths of the westbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours;
- The northbound left-turn movement is forecast to operate at LOS E with a v/c ratio greater than 0.90 during the AM peak hour, and at LOS F with a v/c ratio greater than 1.00. The 95<sup>th</sup> percentile queue lengths are projected to exceed the available storage of 45 metres during the AM and PM peak hours; and



- The 95<sup>th</sup> percentile queue lengths of the southbound left-turn movement are projected to exceed the future storage of 45 metres during the AM and PM peak hours.

#### Richmond Street and Villagewalk Boulevard

- The eastbound left-turn movement is forecast to operate at LOS F during the AM and PM peak hours.
- ▶ **2031 Total Traffic Conditions:** With the existing signal timings at Richmond Street and Sunningdale Road, the study area intersections are forecast to operate at similar levels of service as under 2031 background traffic conditions with the existing signal timings.

With optimized signal timings at Richmond Street and Sunningdale Road, the intersection is forecast to operate at similar levels of service as under 2031 background traffic conditions with optimized signal timings, with the additional problem movement of the eastbound left-turn, which is forecast to operate at LOS F with a v/c ratio of 1.00.

- ▶ **Site Access:** The Site Access intersection on Richmond Street is forecast to operate at satisfactory levels of service (LOS A/B) during the AM and PM peak hours under 2031 total traffic conditions.
- ▶ **Transportation Demand Management:** The following TDM measures are appropriate for implementation at the subject development:
  - Internal sidewalks with connections to the adjacent roadway network.
  - Bicycle parking in accordance with the City's Zoning By-Law requirements for residential developments.
  - Access to existing and future transit routes on adjacent roadways.
  - Parking unbundled from the sale/rent of apartment units.
  - Transit, carshare, and active transportation information provided in a welcome package to new residents and/or posted in central locations on-site.

## 6.2 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



# Appendix B

## Existing Traffic Data and Signal Timings





# Appendix C

## Existing Traffic Operations Reports



# Appendix D

## Background Development Traffic Volumes



# Appendix E

## 2031 Background Traffic Operations Reports



# Appendix F

## 2031 Background Traffic Operations Reports – Optimized



# Appendix G

## 2031 Total Traffic Operations Reports



# Appendix H

## 2031 Total Traffic Operations Reports – Optimized

