Ontario Line

Integrated Transit-Oriented Communities – Cosburn Station

Draft Transportation Impact Assessment Study

Issued for Rezoning

North Site: 1030-1052 Pape Avenue
Toronto, Ontario

South Site: 1002-1028 Pape Avenue, 103-109 Cosburn Avenue
Toronto, Ontario

Contract RFS-2019-NAFC-110

PO 214244

HDR Project 10206938

Ontario Line Technical Advisor

TORONTO, ONTARIO

February 9, 2023

Doug Jackson, PE: Project Manager
Matt DeMarco, PMP: Deputy Project Manager
Tyrone Gan, P. Eng. Principal-In-Charge

hdrinc.com 100 York Boulevard, Suite 300, Richmond Hill, ON, CA L4B 1J8
(289) 695-4600

Disclaimer

The material in this report reflects HDR's professional judgment considering the scope, schedule and other limitations stated in the document and in the contract between HDR and the client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes. In preparing the document, HDR did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that HDR shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party resulting from decisions made or actions taken based on this document.

In preparing this report, HDR relied, in whole or in part, on data and information provided by the Client and third parties that was current at the time of such usage, which information has not been independently verified by HDR and which HDR has assumed to be accurate, complete, reliable, and current. Therefore, while HDR has utilized its best efforts in preparing this report, HDR does not warrant or guarantee the conclusions set forth in this report which are dependent or based upon data, information or statements supplied by third parties or the client, or that the data and information have not changed since being provided in the report. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that HDR shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party resulting from decisions made or actions taken based on this document.

hdrinc.com 100 York Boulevard, Suite 300, Richmond Hill, ON, CA L4B 1J8
(289) 695-4600

Project Team

Project Manager	Carl Wong, P.Eng.
Project Engineer	Adam Beausoleil, P.Eng.
Technical Support	Olivia Polinsky, EIT

Table of Contents

List of Figures

List of Tables

List of Appendices

Appendix A: Signal Timing

Appendix B: Synchro Output

1 Introduction

HDR Corporation was retained by Metrolinx to undertake a Transportation Impact Study (TIS) and Parking Assessment for two proposed mixed-use Transit-Oriented Community (TOC) developments to be located on the future Cosburn Ontario Line Station. Ontario Line runs north-south along the west side of Pape Avenue in the vicinity of Cosburn Station.

The subject properties are located on the north-west and south-west corners of the intersection of Cosburn Avenue and Pape Avenue, as shown in **Figure 1**. The sites are currently occupied by existing buildings which contain general retail-commercial employment uses including small shops, fast food establishments, café(s), and pharmacy. With the construction of Ontario Line, the proposed buildings would sit above the station headhouse lobby on the north side of Cosburn Avenue, and would also sit above the emergency egress on the south side of Cosburn Avenue.

The proposed redevelopment consists of two sites:

- **North Site:** 1030-1052 Pape Avenue
    - 300 residential units
    - 517 square metres gross floor area (SM GFA) of retail space
- **South Site:** 1002-1028 Pape Avenue, 103-109 Cosburn Avenue
    - 323 residential units
    - 1691 square metres gross floor area (SM GFA) of retail space

The sites will be highly transit-oriented given the direct access to Ontario Line and the inherent mixed-use nature of the area, which includes employment uses and other commercial-retail and services that will support the residents. Considering the nature of the development, vehicular parking is not proposed, and the site will leverage the transit availability in the area, as well as the expanded future transit availability with the construction of Ontario Line. In addition to being in close vicinity of a new higher order transit service, the North Site may have direct internal access to the transit station, and this option is being considered and investigated. The south site will sit above the emergency egress for the station but will not have direct access for residents without crossing Cosburn Avenue.

The purpose of this report is to assess the impacts of the proposed developments on the surrounding transportation infrastructure from a multi-modal perspective and to identify potential mitigation in the form of geometric improvements, wayfinding, or signal timing adjustments. Traditionally the City uses a rule-of-thumb threshold of 100 two-way peak hour vehicle trips to determine the need for a transportation impact study for new development. While the developments are anticipated to generate a small number of vehicle trips, the vast majority of trips generated by the developments will be pedestrian trips in the form of walk-in trips or transfers from surface transit routes. These non-vehicle trips will also affect the vehicle operations as a result of pedestrians using crosswalks, despite the station not being a large generator of primary vehicle trips. Therefore, pedestrian and cyclist strips generated by the proposed TOC development were added to the vehicle analysis to assess the impacts.

The traffic impact study report includes draft documentation of the following components:

- Existing Conditions
- Background Conditions
- Proposed TOC Trip Generation
- Future Total Conditions with TOCs & Future Cosburn Station
- Vehicular Operations Analysis
- Parking Assessment
- Loading Assessment
- Preliminary Findings and Next Steps

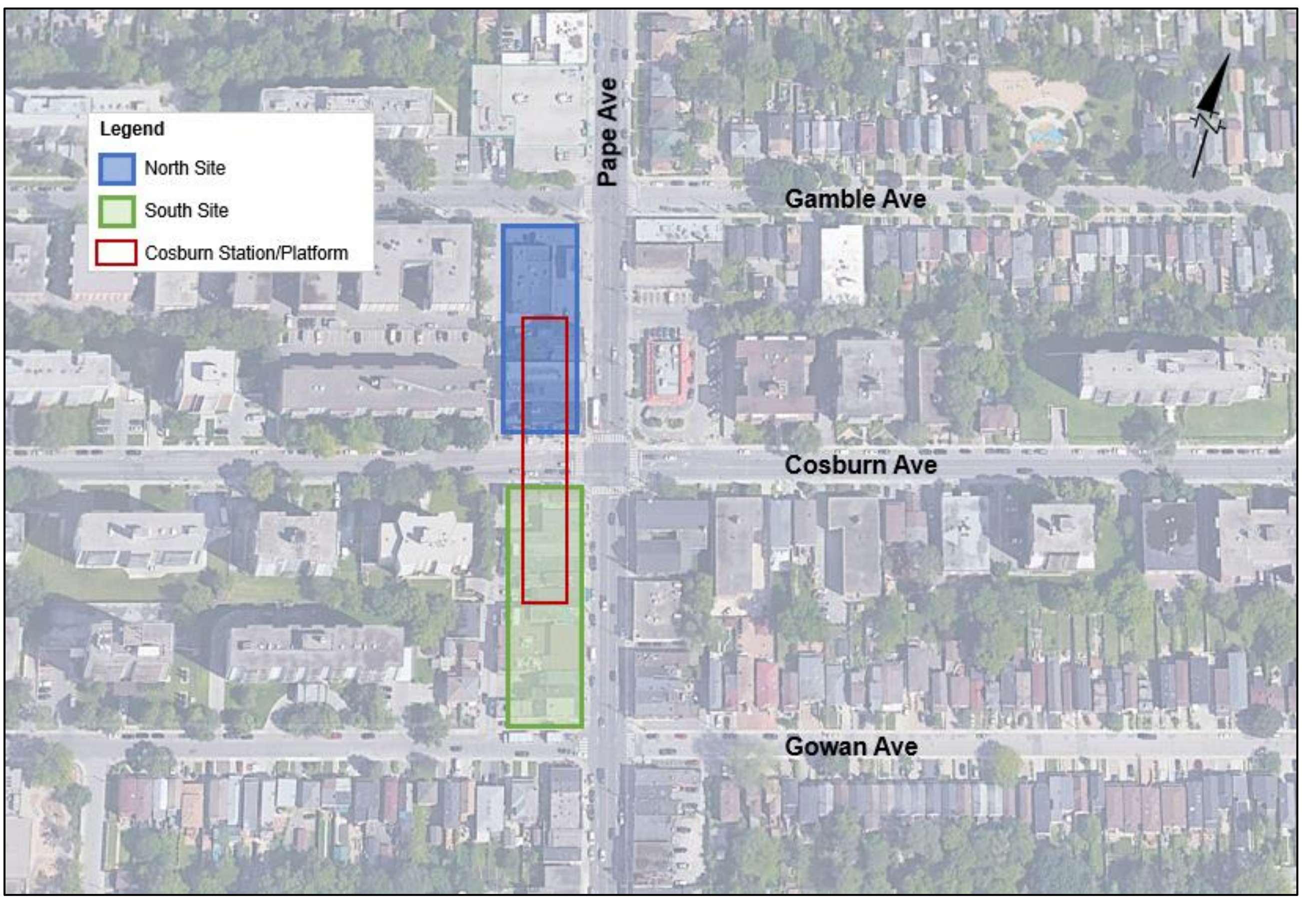


Figure 1: Study Area and Site Context

1.1 Scope of Work

The scope of work has been prepared in accordance with the **City of Toronto Guidelines for the Preparation of Transportation Impact Studies** (2013), and is as follows:

Study Area	• A single intersection (Cosburn and Pape) will be analyzed for capacity, level of service, and delays, as well as a high level review of the surrounding bicycle and pedestrian infrastructure.
Analysis Scenarios	• Existing 2022 Traffic Conditions • Future 2032 Background Conditions (10-year Horizon) *Includes 1.0% annual vehicle traffic background growth and annual active transportation background growth, plus Cosburn Station trips* • Future 2032 Total Conditions (10-year Horizon) *Includes future background traffic volumes plus trips generated by the proposed developments*
Analysis Time Periods	The following time periods are proposed to be analyzed as they represent the peak trip generation times for the stations and the background pedestrian and cycling demand: • Weekday AM peak hour between 7:00am and 9:00am Weekday PM peak hour between 3:00pm and 6:00pm
Trip Generation	• TOC trips will be generated using the ITE Trip Generation 11th Edition based on the proposed development plan • Future Cosburn Station trips were generated based on the Metrolinx 2041 ridership and station forecasts, which were disaggregated into walking, cycling and transit trips. • Station pick-up drop-off (PUDO) trips were generated and assigned as vehicle traffic.
Parking and Loading Review	A parking and loading assessment was undertaken for the proposed development using the City of Toronto Zoning By-law 569-2013 as the basis of the assessment, and in the context of the site as a transit-oriented community. A Transportation Demand Management (TDM) Plan has been developed to further support the proposed parking supply and to ensure a wholesome approach to transportation management that addresses the needs of all modes and achieves planning goals of encouraging multi-modal decision making through the provision of alternative and sustainable modes of travel, and reducing single-occupant vehicle use.
External Network Multi-Modal Level of Service (MMLOS) Analysis	Multi-Modal Level of Service (MMLOS) for the Cosburn TOC development has been reviewed under separate cover, in the report **Ontario Line Cosburn Station Transportation Impact Study (Ontario Line Technical Advisor, January 28, 2022)**, which was submitted as part of a Site Plan Review package for the proposed station – referred herein as the "Station SPR". The Station SPR study assessed the 2041 horizon year, which is 9 years beyond the horizon year assessed in this report. While the station related pedestrian traffic may continue to grow, the TOC related pedestrian traffic will remain relatively constant based on the ultimate development of the site, and the presence of the proposed station. An MMLOS analysis for the 2041 horizon year is included in that assessment and incorporates site traffic generated by the proposed TOC development and for all modes of travel. The MMLOS assessment in the Station SPR is based on the City of Ottawa MMLOS Method for analysis of the surrounding pedestrian and cycling infrastructure, as well as a pedestrian analysis based on Fruin Level of Service methodology for sidewalks and transit waiting areas within the study area. This TOC report does not duplicate the SPR analysis findings but includes a high level overview of the surrounding bicycle and pedestrian infrastructure. Please refer to the Station SPR report for detailed 2041 horizon year MMLOS assessment and Fruin level of service analysis of the study area, which includes the Cosburn TOC development.

1.2 Intersection Operation and Analysis Methodology

Intersection operations were assessed for the study area intersection using the software program Synchro Traffic Signal Coordination Software Version 11, which employs methodology from the Highway Capacity Manual (HCM 2000) published by the Transportation Research Board National Research Council. Synchro can analyze both signalized and unsignalized intersections in a road corridor or network, taking into account the spacing, interaction, queues and operations between intersections.

The intersection analysis considers three separate measures of performance:

- The capacity of all intersection movements, represented by volume to capacity (v/c) ratio;
- The level of service (LOS) for all intersection turning movements as well as for the overall intersection. The overall intersection LOS is based on the average control delay per vehicle (weighted) for the various movements through the intersection; and
- The forecasted queue lengths (95th percentile queue length) and storage requirements.

LOS is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay. The volume to capacity (v/c) ratio is a theoretical measure of the degree of capacity utilized at an intersection. HCM definitions are summarized in **Table 1**.

Table 1: Highway Capacity Manual Level of Service Definitions

Level of Service (LOS)	Signalized Control Delay per Vehicle (s)	Unsignalized Control Delay per Vehicle (s)	Description
A	≤ 10	≤ 10	Ideal
B	> 10 and ≤ 20	> 10 and ≤ 15	Acceptable
C	> 20 and ≤ 35	> 15 and ≤ 25	Acceptable
D	> 35 and ≤ 55	> 25 and ≤ 35	Somewhat undesirable
E	> 55 and ≤ 80	> 35 and ≤ 50	Undesirable
F	> 80	> 50	Unacceptable

The analysis undertaken in this study also follows the **City of Toronto Guidelines for Using Synchro 11 (Including SimTraffic 11[1])** (January 15, 2021), City of Toronto**' Guidelines for the Preparation of Transportation Impact Studies**[2]', and City of Toronto**' Traffic Signal Operations Policies and Strategies**' (May 2015)

1 https://www.toronto.ca/wp-content/uploads/2021/01/964c-TSSignal-OptimizationSynchro-11-Guidelines.pdf
2 http://arris.ca/~arris2/ARCHIVE/traffic-impact-study-guidelines.pdf

2 Existing Conditions

2.1 Site Context

As shown in **Figure 1**, the study sites are bound by Gamble Avenue to the north and Gowan Avenue to the south, with Cosburn Avenue running east-west between the two sites. Both sites are located on the west side of Pape Avenue.

The sites are situated in an area with good surface transit service on both Pape Avenue and Cosburn Avenue in the form of bus routes with mixed traffic. The closest existing subway station is TTC's Pape Station, approximately 1.1 kilometres to the south and accessible by bus. The surrounding area is predominately classified as low density neighborhoods, however, there is a concentration of medium to high density residential buildings along Cosburn Avenue, Gamble Avenue, and Gowan Avenue, on both sides of Pape Avenue. Pape Avenue is mixed use with many small businesses and retail-commercial uses. There are many supporting amenities in the area.

2.2 Existing Road Network

The existing study intersection is shown in **Figure 2,** including existing traffic controls and lane configurations. Both study roadways are under the jurisdiction of the City of Toronto.

The site will be easily accessed by the surrounding road network with direct access to both bounding streets. The DVP is accessible to the west via Broadview Avenue or to the north from Don Mills Road via O'Connor Drive. The existing road network is described below:

Cosburn Avenue	Cosburn Avenue is a two-way east-west minor arterial street with a speed limit of 40 km/h. It has a two-lane cross section, with left turn lane bays on both the eastbound and westbound approaches to the intersection with Pape Avenue. There is on-street parking on the westbound curb lane. There are on-street bike lanes on both sides of the street, and the bike lane is adjacent to the parking lane in the westbound direction. Sidewalks are provided on both sides of the street. Cosburn Avenue terminates to the west at Broadview Avenue and extends east of Woodbine Avenue, and therefore serves the surrounding area.
Pape Avenue	Pape Avenue is a two-way north-south major arterial street with a speed limit of 40 km/h. It has a four-lane cross section. Parking is permitted outside of peak hours in the northbound and southbound curb lanes. During the vehicle peak hours from 7:00-9:00 am and 4:00-6:00 pm the curb lanes are High-Occupancy Vehicle (HOV) Lanes (buses, taxis, personal vehicles with 3 or more persons, cyclists, and motorcycles). Sidewalks are provided on both sides of the street, while bikes share a lane with traffic in both directions and are further permitted to use the HOV lane during the time of day restrictions. Pape Avenue extends south to Gerrard Street where it terminates, and where Ontario Line begins to travel westbound. To the north Pape terminates at Millwood Road which continues to the north and crosses the DVP.

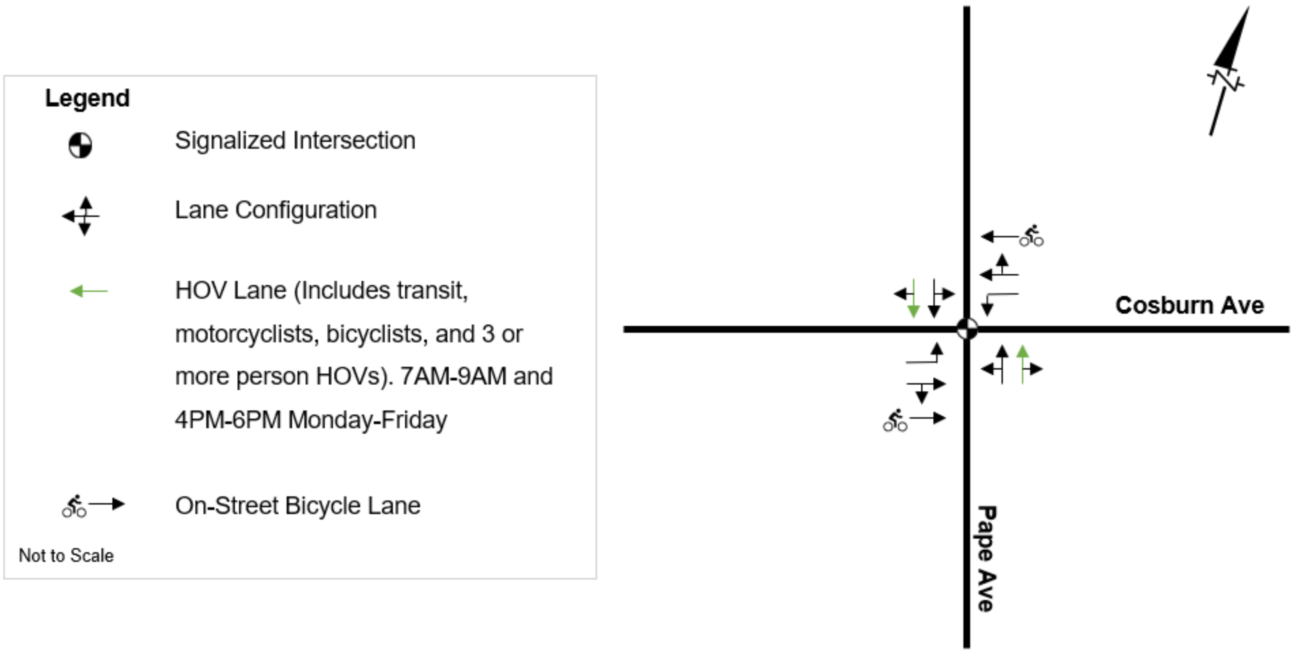


Figure 2: Existing Lane Configuration and Traffic Control

2.3 Existing Transit Services

The Toronto Transit Commission (TTC) operates bus services along both of the study area roadways. The surface transit routes provide connections to downtown and to the Toronto subway system Line 2 at Pape Station which is located only 1.2 kilometres south of the site or about a 15 minute brisk walk. Existing transit services are summarized in **Table 2**, and an excerpt from the TTC system map is also shown in **Figure 3**.

Regional Rail service is provided by GO Transit. The Stouffville and Lakeshore East GO lines are accessible approximately 5.1 kilometres southeast of the site at the Danforth GO Station. From the proposed Cosburn Station, the Danforth GO Station can be reached in about 20 minutes via the 25 TTC bus and Subway Line 2.

Overall, there is good transit network availability in the broader study area.

Table 2: Existing Transit Service Summary

Route #	Route Name	Route Description	Peak Hour Headways	Nearest Stops & Walking Distance
25	Don Mills	North-south route between Pape Station and Steeles Avenue East	10 minutes	Intersection of Cosburn and Pape (near-side stops)
81	Thorncliffe Park	North-south route between Pape Station and the Thorncliffe Park Drive area	15 minutes	
87	Cosburn	East-west route between Broadview Station and Main Street Station	10 minutes	
322	Coxwell	Night Route for Route 22	30 minutes	
325	Don Mills	Night route for Route 25	30 minutes	
925	Don Mills	Express route for Route 25. Operates during the peak periods, midday, and early evening Monday through Friday	10 minutes	

Note: Route 322 differs from the Regular Route 22, which is why Route 322 is listed but Route 22 is not. Route 322 operates between Broadview Station and the area of Kingston road and Victoria Park Avenue, and stops at the eastbound and westbound stops at the intersection of Cosburn and Pape during the night service hours of 1:49-4:49 am.

Figure 3: Existing Transit Service

2.4 Existing Cycling and Pedestrian Facilities

The surrounding area has good pedestrian connectivity in terms of sidewalks, paths, and pedestrian crossings. Both Cosburn Avenue and Pape Avenue have sidewalks on both sides of the roadway. Ladder crosswalks are provided on all legs of nearby signalized intersections and many non-signalized intersections. Some of the painted lines are fading and could benefit from re-painting but do not appear to be in concerning or critical conditions based on desktop review.

There are dedicated bicycle lanes eastbound and westbound along Cosburn Avenue, while Pape Avenue has signs indicating a peak hour shared/HOV vehicle and bicycle lane in the northbound and southbound directions. The dedicated bike lanes and shared/HOV lane signs are shown in **Figure 4**. Throughout the broader area, there are cycle tracks to the east of the station along Woodbine Avenue, cycle tracks to the south along Danforth Avenue, and bike lanes to the north along Millwood Road crossing the DVP bridge. Additionally, the Lower Don Trail is readily accessible west of the station via Pottery Road. An excerpt from the 2021 Toronto Cycling Map is shown in **Figure 5**.

The existing active transportation network is depicted in **Figure 6**. Generally, the sidewalks in the study area are 1.8m wide or wider, but due to objects such as power poles, traffic signals, waste bins, and street trees, the clear pedestrian zone may be narrower in many locations, as illustrated in **Figure 7**.

Figure 4: Existing Bicycle Lanes on Cosburn Avenue Approaching Pape Avenue (Left) And Signing for Peak Hour Shared Bicycle and Vehicle Lane On Pape Avenue Looking North Towards Cosburn Avenue (Right)

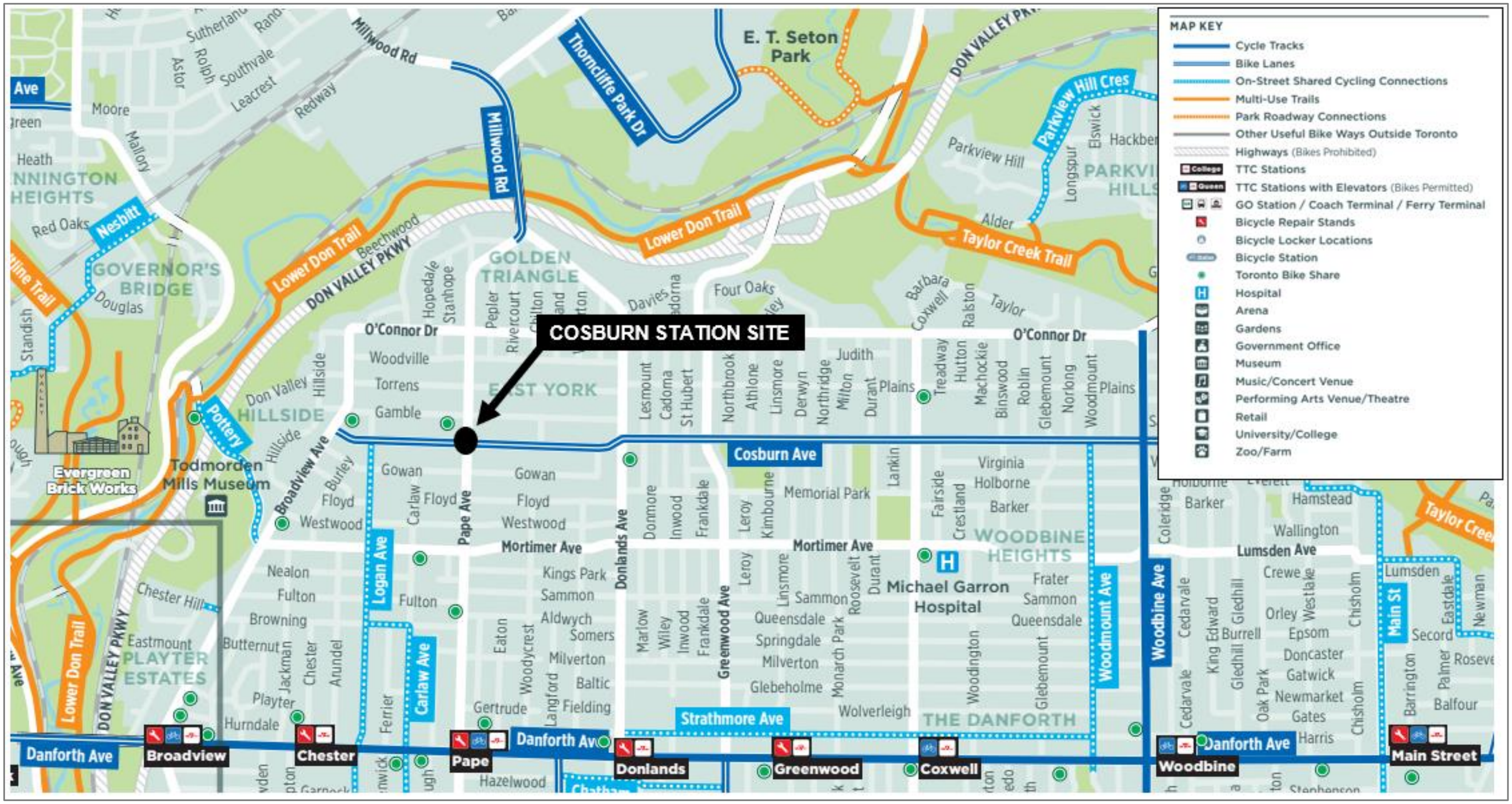


Figure 5: Broader Area Cycling Network

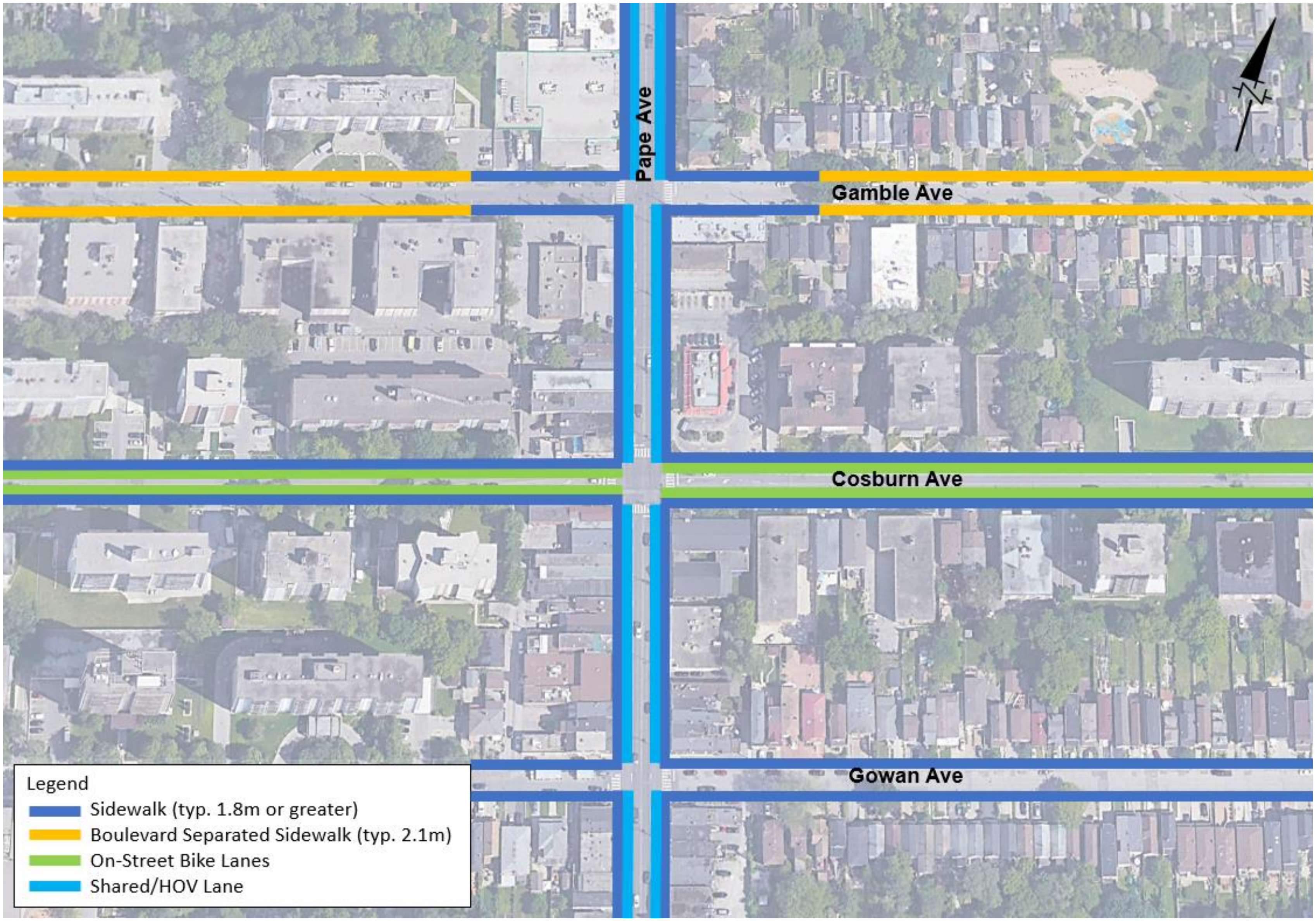


Figure 6: Study Area Existing Active Transportation Network

Figure 7: Existing Pedestrian Realm at Cosburn Avenue and Pape Avenue (4 Quadrants)

2.5 Existing Volumes

The most recent available traffic data for the intersection of Cosburn Avenue and Pape Avenue was captured on January 9, 2017, and was available in the City open database. The counts separated traffic volumes by regular vehicles, trucks, and transit vehicles. Background growth was checked between available 2009 and 2017 traffic counts. Average vehicle annual growth was around 1% but active transportation showed average annual growth of approximately 6%. This type of growth is not considered to be sustainable and the transfer matrix is expected to capture future growth in non-vehicle volumes, so both traffic volumes and active transportation volumes were grown by an annual growth factor of 1.0% to develop representative existing 2022 volumes. Peak hour volumes were used for analysis.

Figure 8 shows the existing volumes (vehicles, pedestrians, bicycles) at the study intersection.

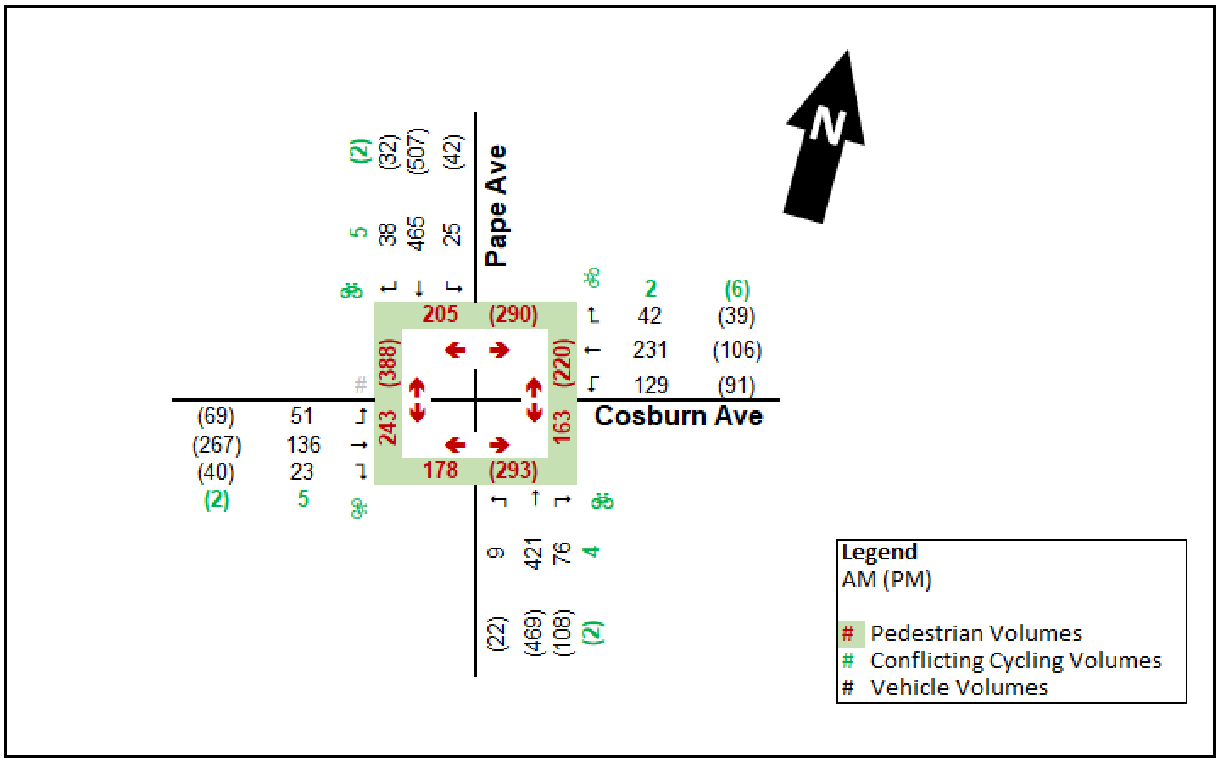


Figure 8: 2022 Existing Intersection Volumes

2.6 Existing Operations

Traffic and pedestrian operations were assessed based on the existing volumes shown in **Figure 8** and existing road network shown in **Figure 2**.

Table 3 summarizes the level-of-service (LOS) and volume/capacity ratio (v/c ratio) for each traffic movement under existing conditions. Detailed HCM 2000 results and reports for all study area intersections are provided in **Appendix B**. During peak hours, the northbound and southbound shared through-right turn lanes along Pape Avenue are signed as HOV lanes. To simulate this, the lane utilization factor was reduced to 0.80 based on previous experience with HOV lanes in the City of Toronto. This lane utilization factor emulates a heavier weighting of traffic in the centre lane of the roadway and reduces the capacity for the approaches along Pape Avenue.

Table 3: 2022 Existing Traffic Conditions – Summary

Intersection and Movement		Lanes	Storage (m)	AM Peak Hour			PM Peak Hour		
				LOS	v/c	95th Q (m)	LOS	v/c	95th Q (m)
Cosburn & Pape Ave		**-**	**-**	**B**	**0.47**	**-**	**B**	**0.52**	**-**
Eastbound	Left	1	15	C	0.32	**16.7**	C	0.29	**19.5**
	Through-Right	1	345	C	0.38	36.4	C	0.71	76.2
Westbound	Left	1	15	C	0.55	**35.9**	D	0.59	**33**
	Through-Right	1	260	C	0.66	63.9	C	0.33	30.7
Northbound	Through-Left	1	90	A	0.36	32.4	A	0.43	40.6
	Through-Right	1							
Southbound	Through-Left	1	90	A	0.38	35.3	A	0.41	38.8
	Through-Right	1							

Note: LOS = level of service; v/c = volume to capacity ratio; 95th Q = 95th Percentile Queue using HCM 2000. Critical movements are highlighted in **red** as defined by the City's TIS Guidelines and movements with LOS F are highlighted in **yellow**. 95th percentile queue values highlighted in **blue** indicate that the queue extends past the available storage length.

Under existing traffic conditions, all intersection movements operate at LOS 'D' or better, with most operating at LOS ‘C’ or better. There are no critical movements under the existing traffic conditions. The 95th percentile eastbound and westbound left turn queues exceed the available storage length. The overall intersection volume to capacity ratio is 0.47 and 0.52 during the weekday AM and PM peak hours, respectively, and the intersection experiences LOS 'B' during both peak hours. Overall this confirms that the intersection has sufficient residual capacity to accommodate an increase in traffic and active transportation trips.

3 Future Background Conditions

3.1 Planned Improvements

Based on the City of Toronto's Ongoing Infrastructure & Construction Projects list[3] which was accessed and reviewed in February 2022, the City does not have any planned improvements to the area that will significantly affect the intersection lane configuration and/or operations, and therefore no configuration changes were made to the future Synchro model compared to existing.

3.2 Background Volumes

3.2.1 2032 Base Background Growth

Based on experience and a review of general traffic patterns and magnitude of volumes in and surrounding downtown Toronto, traffic demand within Toronto has remained relatively stable, despite variations in traffic patterns. To assess worst-case growth conditions, a base background growth rate of 1% was applied to vehicle, pedestrian, and bicycle volumes and is considered a conservative assumption, as discussed in **Section 2.5**. **Figure 8** shows the base background growth volumes (vehicles, pedestrians, bicycles) at the study area intersection.

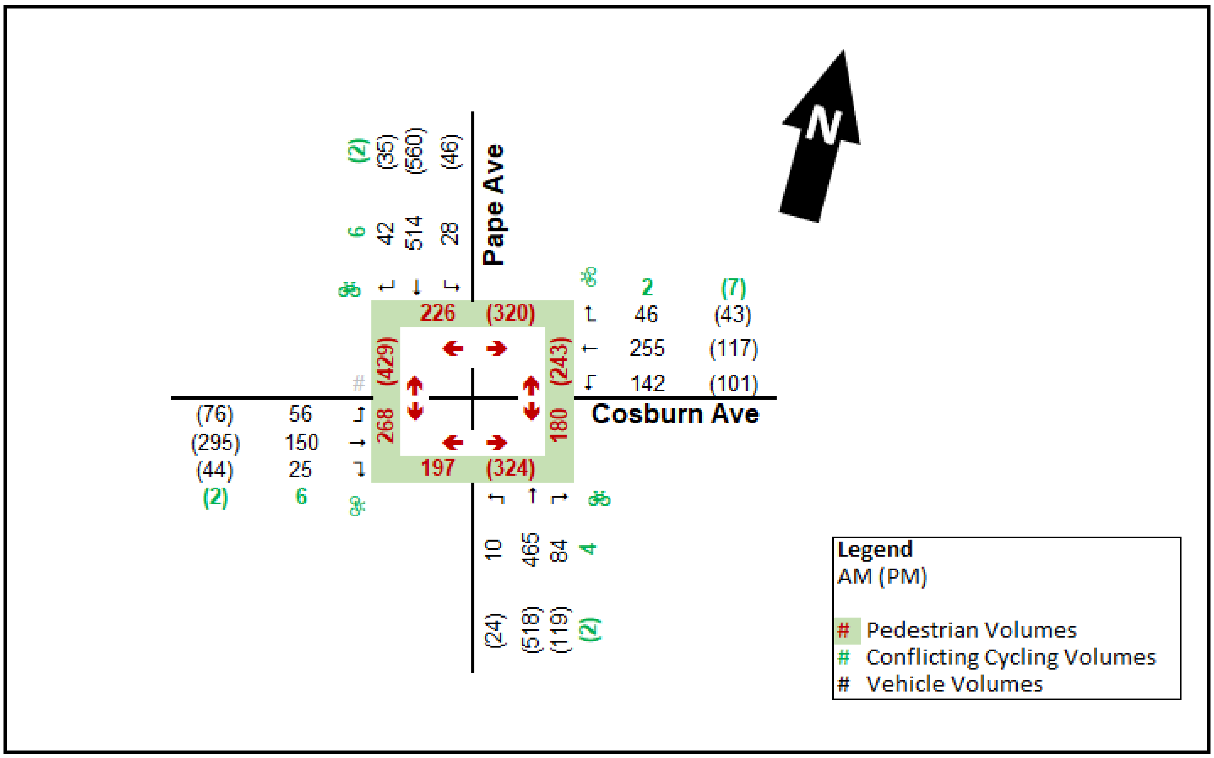


Figure 9: 2032 Base Background Growth Intersection Volumes

[3] https://www.toronto.ca/community-people/get-involved/public-consultations/infrastructure-projects/

3.2.2 Background Developments

Nearby background developments were reviewed. As shown in **Figure 10**, a single active development application was found within a 250m radius of the study site. This development proposal is to construct a parking pad on a single-family home and will have no impact on the study traffic network.

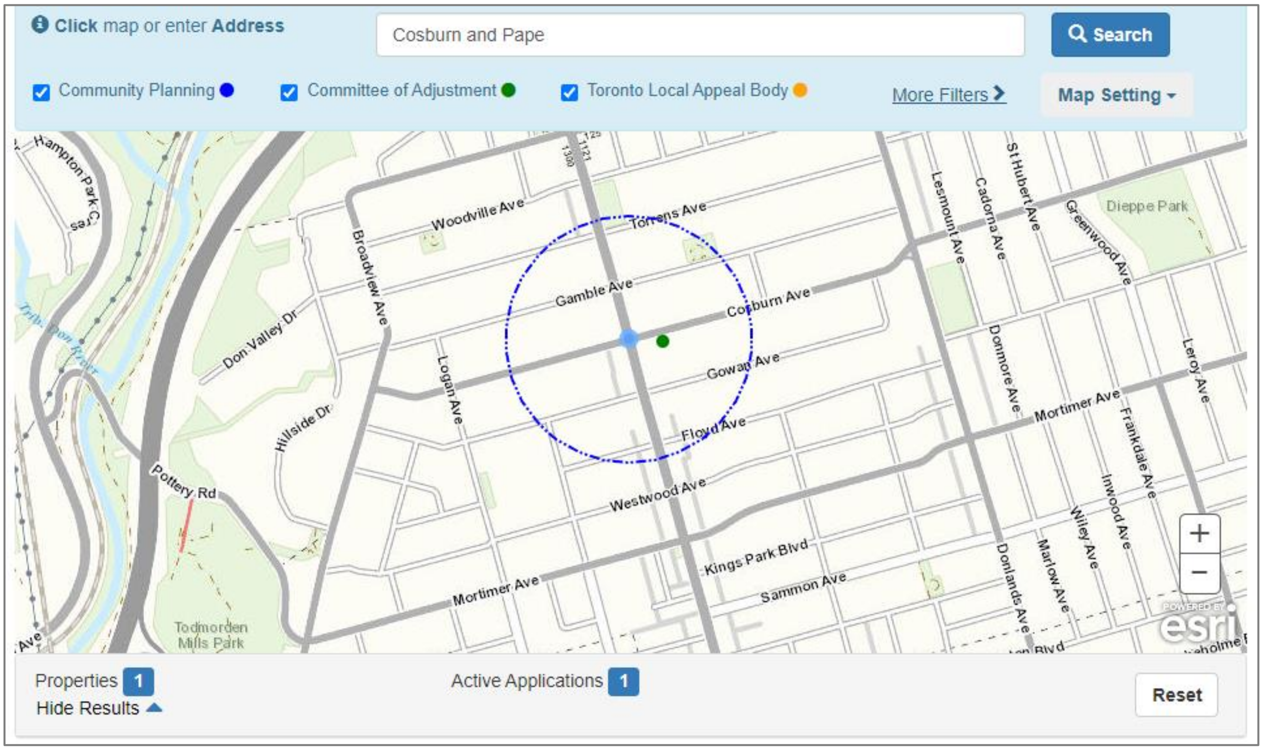


Figure 10: Adjacent Background Developments for Consideration

3.2.3 2032 Ontario Line Cosburn Station Pedestrian Traffic

The Cosburn Station has been included as a layer of background growth, and walking and transit trips to/from the station were generated. Future trips for the station were estimated by the Ontario Line project team based on the travel demand modeling completed for the 2041 horizon year. The generated pedestrian volumes used from this matrix were adjusted to the 2032 horizon year using a 1% per annum reverse growth rate from 2041 to 2032. The adjusted 2032 transfer trip matrix is shown in **Table 4**.

Of the estimated walk-in and walk-out trips directly to and from the Ontario Line Station, 2% were assumed to be bicycle trips and 98% were assumed to be pedestrian trips. This assumption was made to remain consistent with existing bicycle access to bicycle stations (2016 TTS) and the 2016 GO Rail Access Plan. Additional pick-up and drop-off (PUDO) trips were also forecasted, and to be conservative, were estimated to make up an additional 2% of total station trips (included outside of the transfer matrix).

Table 4: 2032 Peak AM Transfer Trip Matrix – Cosburn Station

From \ To	OL EB/NB	OL WB/SB	OL Walk Egress	Bus NB	Bus SB	Bus EB	Bus WB	Bus Walk Egress / Transfer	Total
OL EB/NB	-	-	**82**	119	-	119	55	-	375
OL WB/SB	-	-	**46**	-	55	27	55	-	183
OL Walk Ingress	**210**	**869**	-	-	-	-	-	-	1079
Bus NB	146	-	-	-	-	-	-	-	146
Bus SB	-	119	-	-	-	-	-	-	119
Bus EB	18	274	-	-	-	-	-	-	292
Bus WB	-	283	-	-	-	-	-	-	283
Bus Walk Ingress / Transfer	-	-	-	**84**	**12**	**160**	-	-	256
Total	374	1545	128	203	67	306	110	0	2733

Note: Values in red indicate additional transit trips forecasted at the study intersection that are not coming directly from or going to the new Cosburn Ontario Line Station. Values in blue indicate station walk-in and walk-out trips that were split up as 98% pedestrian trips and 2% bicycle trips.

To generate station trips for the 2032 Peak PM Hour, the 2032 Peak AM Transfer Matrix was transposed, along with the directions (i.e., AM trip from SB bus to OL WB/SB entrance was transposed as PM trip from OL EB/NB to NB bus). This reflects the assumption that the predominant trip patterns in the AM and PM will be reversed and primarily commuter-based. The 2032 PM Transfer Matrix is shown in **Table 5**.

Table 5: 2032 Peak PM Transfer Trip Matrix – Cosburn Station

From \ To	OL EB/NB	OL WB/SB	OL Walk Egress	Bus NB	Bus SB	Bus EB	Bus WB	Bus Walk Egress / Transfer	Total
OL EB/NB	-	-	**869**	119	-	283	274	-	1545
OL WB/SB	-	-	**210**	-	146	-	18	-	374
OL Walk Ingress	**46**	**82**	-	-	-	-	-	-	128
Bus NB	55	-	-	-	-	-	-	**12**	67
Bus SB	-	119	-	-	-	-	-	**84**	203
Bus EB	55	55	-	-	-	-	-	-	110
Bus WB	27	119	-	-	-	-	-	**160**	306
Bus Walk Ingress / Transfer	-	-	-	**-**	**-**	**-**	-	-	0
Total	183	375	1079	119	146	283	292	256	2733

Note: Values in red indicate additional transit trips forecasted at the study intersection that are not coming directly from or going to the new Cosburn Ontario Line Station. Values in blue indicate station walk-in and walk-out trips that were split up as 98% pedestrian trips and 2% bicycle trips.

The generated Ontario Line Cosburn Station trips are summarized in **Table 6**.

Table 6: Generated Station Trips - Summary

Mode	AM	PM
Walk (Egress, Ingress, Transit Transfers)	2,709	2,709
Cycle	24	24
PUDO	55	55

Different distributions were used for the walk trips (to/from the station from the surrounding neighbourhood), pick-up and drop-off vehicle trips, and transit trip transfers to/from the station (applied as walk trips, but destined to/from the nearby surface transit stops). The assumed distribution for these trips are shown in **Table 7** and **Table 8**. The distributions are based on the development density near the site (related to the walking trips to/from the station) and based on the location of the nearest transit stops.

Table 7: Assumed Trip Distribution – Walk and Transit Walk Trips

Mode	Time Period / Direction	Cosburn / Pape				
		To/From Direction (Intersection Quadrant)				Total
		NW	NE	SW	SE	
Walk	**AM / PM**	16%	24%	30%	30%	100%
Transit (Walk)		25%	25%	25%	25%	100%

Table 8: Assumed Trip Distribution – Cycle and PUDO Trips

Mode	Time Period	To/From Direction (Intersection Leg)				
		North	East	South	West	Total
Cycle	**AM / PM**	25%	25%	25%	25%	100%
PUDO		25%	25%	25%	25%	100%

It is important to note that due to the bus stop locations, as well as the Ontario Line entrance location, not all trips going to/from Cosburn station need to cross any legs of the intersection to complete their trip, particularly those destined to or coming from the southbound bus stop on Pape Avenue. However, those destined to or coming from the other transit stops will need to cross one or two legs to reach their destination.

The resulting 2032 Station Background Trips are shown in **Figure 11**.

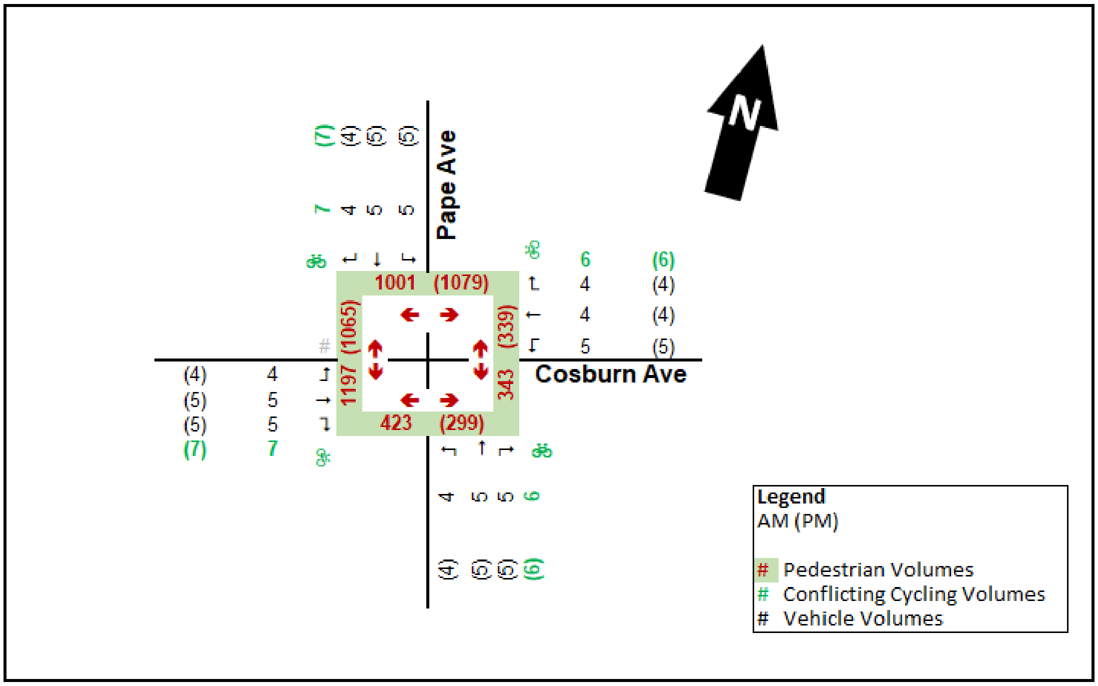


Figure 11: 2032 Ontario Line Cosburn Station Intersection Volumes

3.2.4 2032 Total Background Traffic

Figure 12 shows the resulting total future background traffic volumes, which include the base background traffic and Ontario Line Coburn Station background traffic.

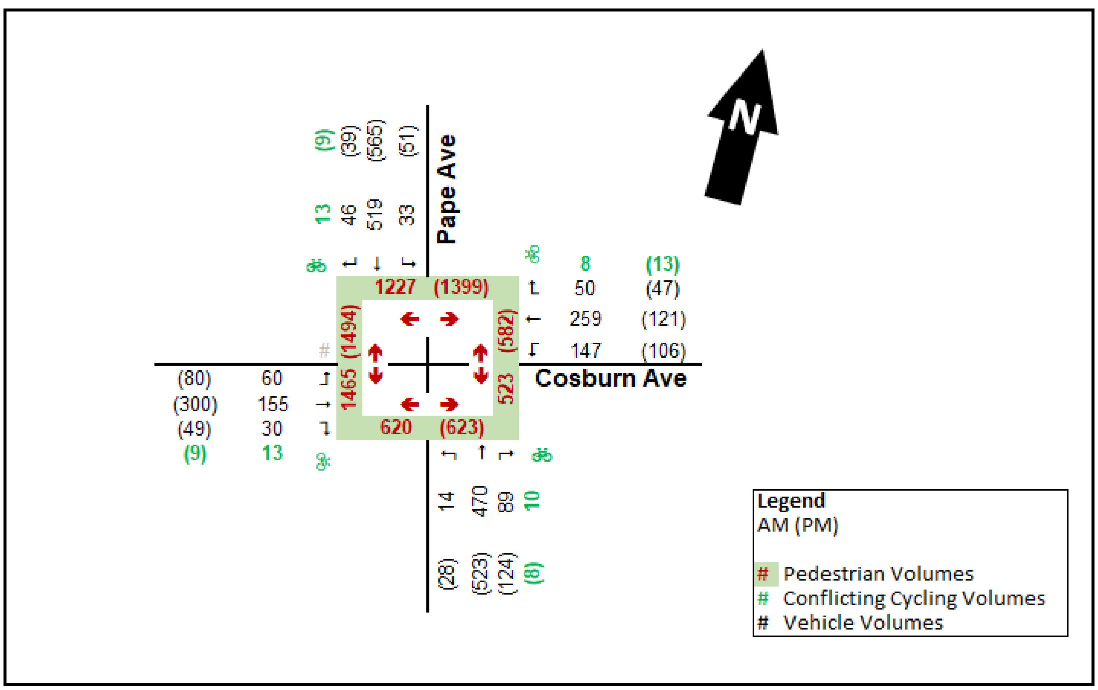


Figure 12: 2032 Total Background Traffic Intersection Volumes

3.3 Future Background Operations

Table 9 summarizes the LOS and v/c ratio for movements under future background conditions based on the forecasted future volumes. Signal timing split optimization was performed to the model but the cycle length was maintained as the existing.

Table 9: 2032 Background Traffic Conditions – Summary

Intersection and Movement		Lanes	Storage (m)	AM Peak Hour			PM Peak Hour		
				LOS	v/c	95th Q (m)	LOS	v/c	95th Q
Cosburn & Pape Ave		**-**	**-**	**B**	**0.56**	**-**	**B**	**0.62**	**-**
Eastbound	Left	1	15	B	0.27	**15.6**	C	0.32	**20.1**
	Through-Right	1	345	B	0.33	35.0	C	0.62	71.5
Westbound	Left	1	15	C	0.48	**34.6**	C	0.48	**28.2**
	Through-Right	1	260	C	0.53	59.3	B	0.33	32.3
Northbound	Through-Left	1	90	B	0.57	58.3	B	0.62	66.0
	Through-Right	1							
Southbound	Through-Left	1	90	B	0.60	62.6	B	0.60	63.2
	Through-Right	1							

Note: LOS = level of service; v/c = volume to capacity ratio; 95th Q = 95th Percentile Queue using HCM 2000. Critical movements are highlighted in **red** as defined by the City's TIS Guidelines and movements with LOS F are highlighted in **yellow**. 95th percentile queue values highlighted in **blue** indicate that the queue extends past the available storage length.

Under future background conditions, all movements will operate at LOS 'C' or better and there are no critical movements. Overall, movements operate at the same LOS or slightly better compared to existing conditions due to the split optimization. However, the overall volume to capacity ratio for the intersection has increased during both peak hours, but demonstrates that under future background conditions the intersection will continue to operate with residual capacity and will be able to accommodate an increase in vehicle and active transportation trips.

The 95th percentile eastbound and westbound left-turn queues continue to exceed the available storage length by up to two vehicle lengths. These queues may temporarily block through traffic in the adjacent lanes.

4 Future Total Conditions with TOCs

4.1 Proposed TOC Developments

4.1.1 Conceptual Site Plan

The site statistics for both sites are reported in **Table 10** below and the conceptual ground floor plans for the sites are shown in **Figure 13** and **Figure 14**. The site traffic projections and the traffic analysis are based on the proposed number of Residential Units and Retail GFA. Transit GFA was not used for trip generation – rather, the transfer matrix discussed in **Section 3.2.3** was used directly.

Table 10: Site Plan Statistics

Proposal	Residential Units	Retail Gross Floor Area (GFA)		Site Plan Date
		Square Metres (SM)	Square Footage (SF)	
Current Site Plan Statistics				
North Site	300 units	517	5,565	October 27, 2022
South Site	323 units	1,691	18,202	October 27, 2022
Analysis Statistics				
North Site	300 units	519	5,587	August 5, 2022
South Site	324 units	1,133	12,196	August 8, 2022

Due to the continual updates to the concept plan for both sites, the traffic forecast and analysis contained in this report is based on the site plan statistics from August 2022 rather than the latest September site statistics. There are some minor differences, with the most notable being the larger retail component at the south site in the current statistics which is 50% greater than the retail component analyzed. However, it is our opinion that the analyzed statistics give a representative understanding of traffic operations. Increasing the retail size would result in a greater number of pedestrian (walking) trips into the site which would be represented in the traffic analysis using the conflicting pedestrians in the Synchro model (pedestrians which conflict with left-turns or right-turns). The increase in trips may increase conflicting pedestrians on any given sidewalk by 10% which does not have a significant impact on the traffic analysis given the conflicting pedestrians are already in the range of 600 to 1,800 pedestrian conflicts per hour. Additionally, maximizing the pedestrian conflicts to the model limit of 3,000 pedestrians per hour still results in acceptable traffic operations based on sensitivity testing.

The future Cosburn Station entrance is located at the North Site, with at-grade pedestrian access to the station from the south and east sides of proposed building. The South Site will also serve as a designated emergency-only egress and under normal conditions will not be used as an ingress or egress to the station.

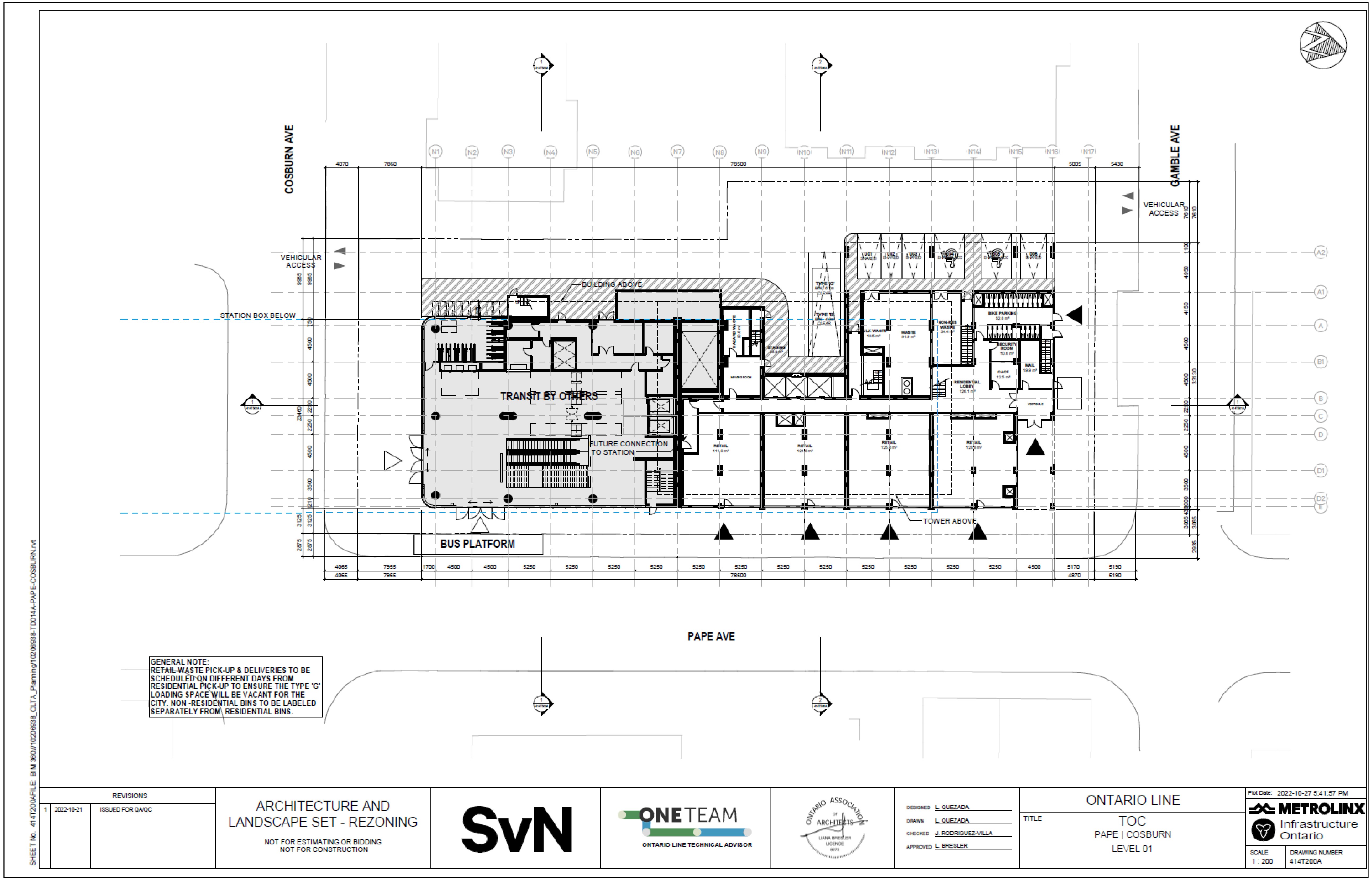


Figure 13: North Building Site Plan – (October 27, 2022)

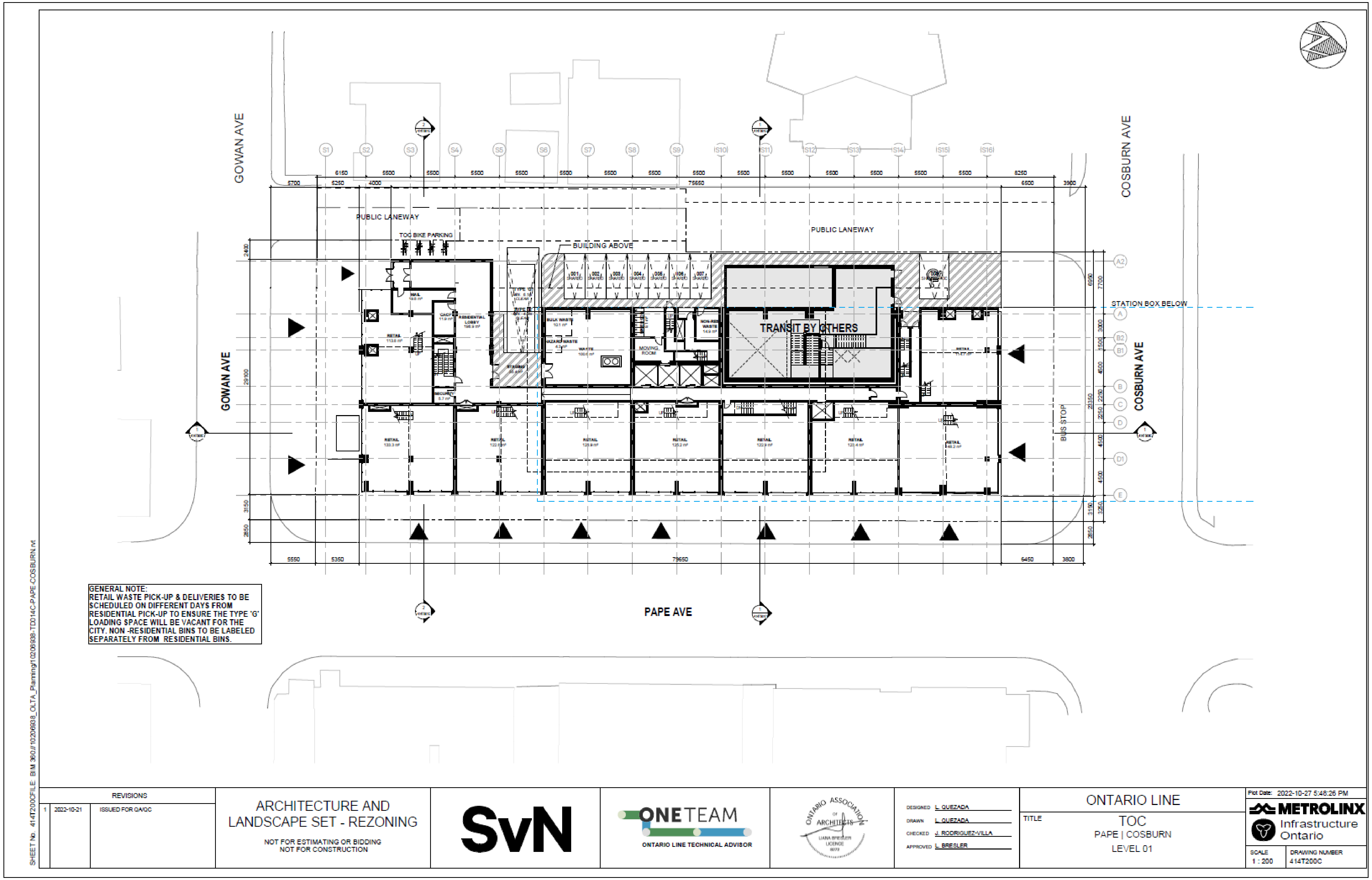


Figure 14: South Building Site Plan – (October 27, 2022)

4.1.2 Site Trip Generation – Mode Splits

The 2016 Transportation Tomorrow Survey (TTS) was used to inform the mode split assumptions for the development using existing information for nearby residents. The TTS is a survey of households within the Greater Golden Horseshoe including the Greater Toronto Area that summarizes travel patterns and other related transportation information that can be used to aid in planning, such as mode splits. The 2016 TTS divides geographical areas into 'zones' for the purposes of determining trip patterns from one zone to another.

The mode split for the area was obtained through a review of TTS (2006) Zones 276 and 280-282, which are the zones surrounding the subject site. The existing mode splits are reported in **Table 11**.

It is assumed that there will be no auto driver trips (0% auto drive mode share) since the proposed sites will have no available parking. The Auto Driver trips were reproportioned to other mode shares using the proportional share of other modes from existing conditions. The proposed modified mode splits are summarized in **Table 12**.

Table 11: Existing Mode Splits (2016 Transportation Tomorrow Survey) – Residential Land Uses

Mode	Existing (TTS)			
	AM (In)	AM (Out)	PM (In)	PM (Out)
Transit	9%	45%	43%	23%
Walking	41%	13%	10%	19%
Cycling	14%	7%	7%	6%
Auto Passenger / Taxi / Rideshare	2%	5%	6%	8%
Auto Driver	34%	30%	34%	44%
Total	100%	100%	100%	100%

Table 12: Proposed Mode Splits (2016 Transportation Tomorrow Survey) – Residential Land Uses

Mode	Modified (TTS)			
	AM (In)	AM (Out)	PM (In)	PM (Out)
Transit	14%	65%	65%	40%
Walking	62%	18%	16%	34%
Cycling	21%	10%	10%	11%
Auto Passenger / Taxi / Rideshare	3%	7%	9%	15%
Auto Driver	0%	0%	0%	0%
Total	100%	100%	100%	100%

Should future residents decide to own a vehicle, they will have to park their vehicle at nearby public or private parking lots. However, the apartments will be marketed toward those who do not own and do not desire to own a vehicle.

Since the retail-commercial uses are expected to serve the surrounding area mostly, the transit trips have been reproportioned to walking and cycling trips. A small number of vehicle driver trips have been assumed since both of the sites have a limited amount of shared parking which may be used to support the retail-commercial component. The shared parking spaces are not intended to be used as a park and ride and will have a 1-hour parking limit for retail-commercial customers and for residential visitors.

4.1.3 Site Trip Generation - Person-Trips

Trips were generated for the proposed development using the information provided in the Institute of Transportation Engineers (ITE) Trip Generation Informational Report (11th edition). Trip generation rates for Land Use 222 (Multifamily Housing – High-Rise) and Land Use 814 (Variety Store) were used. The land use assumes "dense multi-use urban" conditions for both land uses. Residential trips were forecast based on the ITE line of best fit equation for the selected Land use and setting. The commercial trips were forecast based on the average trip generation rates.

Table 13 shows the ITE trip generation rates used for each site, by land use, and it includes estimated person trips per vehicle trip. The purpose of generating person trips rather than vehicle trips was to be able to assign pedestrian, cycling and transit trips to the study network. It is assumed that there will be an increase in the rideshare mode, which includes services like Uber, Lyft as well as taxi service. **Table 14** and **Table 15** show the resulting trip generation by mode for the North and South sites, respectively. For a more conservative result, we have not assumed any interaction between the residential and retail components. Therefore, all non-residential trips are assumed to be primary trips and are being generated outside of the site.

Table 13: ITE 11th Edition Trip Generation Rates

Land Use	ITE LUC	Peak Hour	ITE Average Person Trip Rate	Equation	Entering	Exiting
Residential	222 Multi-family High Rise (Dense Multi-Use Urban)	AM	0.65	T = 0.67(X) - 3.32	24%	76%
		PM	0.57	T = 0.62(X) – 6.41	59%	41%
Retail	814 Variety Store (Dense Multi-Use Urban)	AM	6.24	Fixed rate only	56%	44%
		PM	16.75	Fixed rate only	51%	49%

Table 14: North Site Person Trip Generation by Mode

Land Use	AM Peak Hour			PM Peak Hour		
	Total	In	Out	Total	In	Out
Residential – LUC 222 Multifamily High Rise						
Total	**198**	**47**	**150**	**180**	**106**	**74**
Transit	104	7	98	98	69	29
Walking	56	29	27	42	17	25
Cycling	25	10	15	19	11	8
Auto Passenger	12	1	11	21	10	11
Auto Driver	0	0	0	0	0	0
Retail – LUC 814 Variety Store						
Total	**35**	**20**	**15**	**94**	**48**	**46**
Transit	13	3	10	49	31	18
Walking	15	12	3	23	8	16
Cycling	6	4	2	10	5	5
Auto Passenger	2	1	1	11	4	7
Auto Driver	0	0	0	0	0	0
Site Total						
Total	**233**	**67**	**166**	**273**	**154**	**119**
Transit	117	9	108	148	100	48
Walking	71	42	30	65	25	41
Cycling	31	14	17	29	15	13
Auto Passenger	14	2	12	32	14	18
Auto Driver	0	0	0	0	0	0

Table 15: South Site Person Trip Generation by Mode

Land Use	AM Peak Hour			PM Peak Hour		
	Total	In	Out	Total	In	Out
Residential – LUC 222 Multifamily High Rise						
Total	**214**	**51**	**162**	**194**	**115**	**80**
Transit	113	7	106	106	75	32
Walking	61	32	29	45	18	27
Cycling	27	11	16	20	11	9
Auto Passenger	13	2	11	22	10	12
Auto Driver	0	0	0	0	0	0
Retail – LUC 814 Variety Store						
Total	**76**	**43**	**33**	**204**	**104**	**100**
Transit	28	6	22	108	68	40
Walking	32	26	6	51	17	34
Cycling	12	9	3	21	10	11
Auto Passenger	4	1	2	24	9	15
Auto Driver	0	0	0	0	0	0
Site Total						
Total	**290**	**94**	**196**	**399**	**219**	**180**
Transit	141	13	127	214	142	72
Walking	94	58	35	96	35	61
Cycling	39	20	20	42	22	20
Auto Passenger	17	3	14	47	20	27
Auto Driver	0	0	0	0	0	0

4.1.4 Site Trip Distribution and Assignment

Future trip distribution was estimated using the information from the 2016 TTS. The trip distribution for the site was based on the existing distribution to TTS zones (TTS 2006 Zones 276 and 280-282). Trips were distributed based on each mode of transportation for AM Inbound, AM Outbound, PM Inbound, and PM Outbound trips. These mode distributions are shown in **Table 16**.

Table 16: Assumed Person Trip Distribution – North and South Sites – Residential Trips

Mode	Time Period	Direction	Direction				
			North	East	South	West	Total
Walk	AM	In	5%	29%	25%	41%	100%
		Out	7%	22%	39%	31%	100%
	PM	In	7%	24%	41%	28%	100%
		Out	5%	21%	22%	52%	100%
Cycle	AM	In	3%	30%	34%	33%	100%
		Out	10%	13%	52%	25%	100%
	PM	In	7%	12%	67%	14%	100%
		Out	3%	36%	35%	26%	100%
Transit (Walk)	AM	In	9%	18%	45%	28%	100%
		Out	20%	14%	57%	10%	100%
	PM	In	19%	11%	60%	10%	100%
		Out	14%	12%	72%	2%	100%
Auto	AM	In	3%	55%	23%	19%	100%
		Out	23%	32%	31%	14%	100%
	PM	In	25%	25%	31%	19%	100%
		Out	20%	24%	36%	20%	100%

The transit trips were further divided into predicted Ontario Line trips and surface-level transit trips. Since the North site has direct access to the Ontario Line station, these transit walking trips were not assigned to the surface-level pedestrian network and crosswalks at the intersection of Cosburn Avenue and Pape Avenue as they will not need to exit the building and cross at the intersection to access Ontario Line. Since the South site does not have direct access to the Ontario Line station (as it is designated as emergency access only), these transit walking trips were assigned to the surface-level pedestrian network and would all cross on the west crosswalk at the Cosburn Avenue and Pape Avenue intersection.

For simplicity, 100% of north/south transit walking trips were assigned to the Ontario Line station, since this will be considered the best north/south transit option once completed. Of the east/west transit walking trips, 70% were assigned to the Ontario Line Station (requiring users to travel south to the Pape Avenue station and transfer to the east/west Line 2) and 30% of the transit walking trips were assigned to surface-level transit. All vehicle trips (pick-up/drop-off and rideshare) were assigned as pass-by trips such that they reflected an inbound and outbound trip that would pick-up or drop-off along Cosburn Avenue or Paper Avenue directly. These trips were assigned according to existing traffic patterns.

It should also be noted that some of the walk-in transit trips to and from Ontario Line will include trips from the TOC. This overlap has not been accounted for as this will result in a slightly conservative estimate of future pedestrian trips due to the double counting of TOC trips. However, the TOC trips are marginal compared to the total number of pedestrian trips generated by Ontario Line and the slightly conservative overlap is not expected to significantly alter results. Volumes produced by the North and South sites are shown in **Figure 15** and **Figure 16**, respectively.

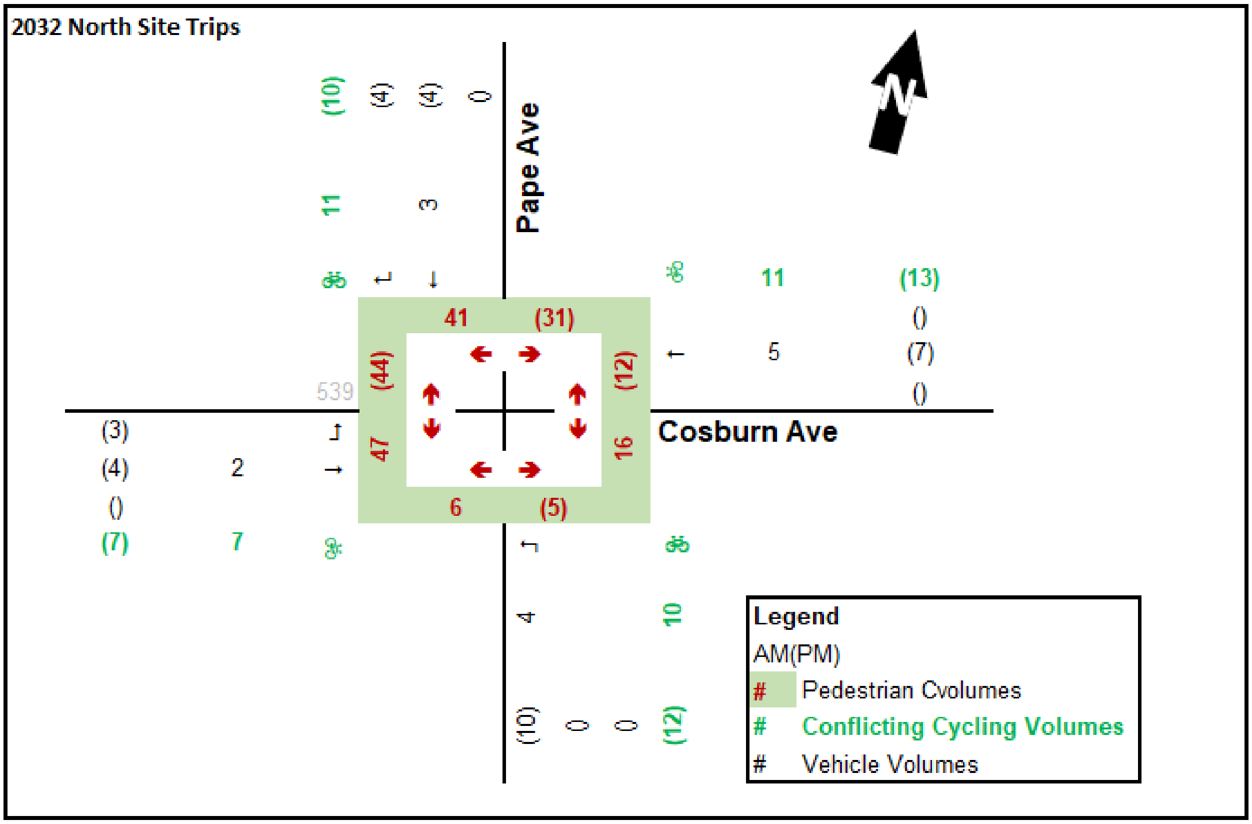


Figure 15: North Site Intersection Volumes

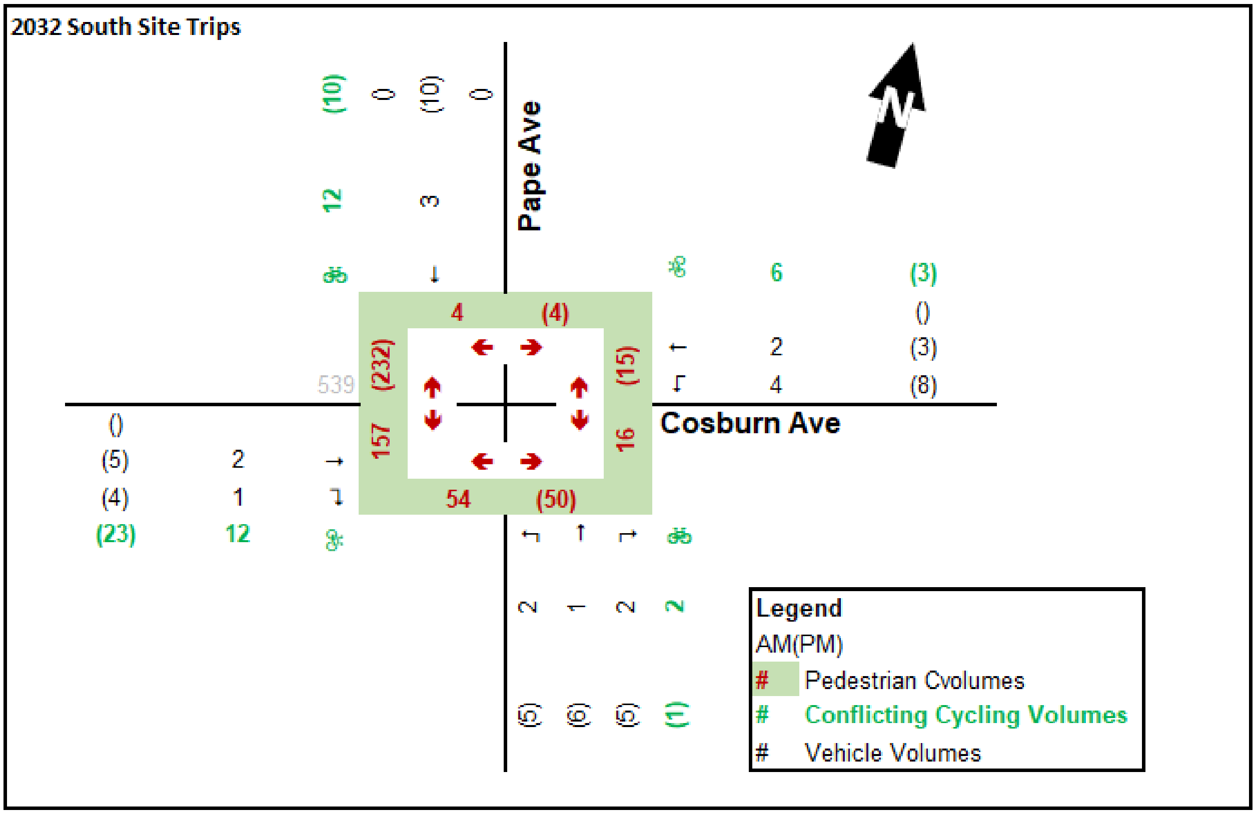


Figure 16: South Site Intersection Volumes

4.2 Future Total Volumes with TOCs

The total new site trips and total traffic volumes, comprised of the future background traffic plus site volumes, are shown in **Figure 17**.

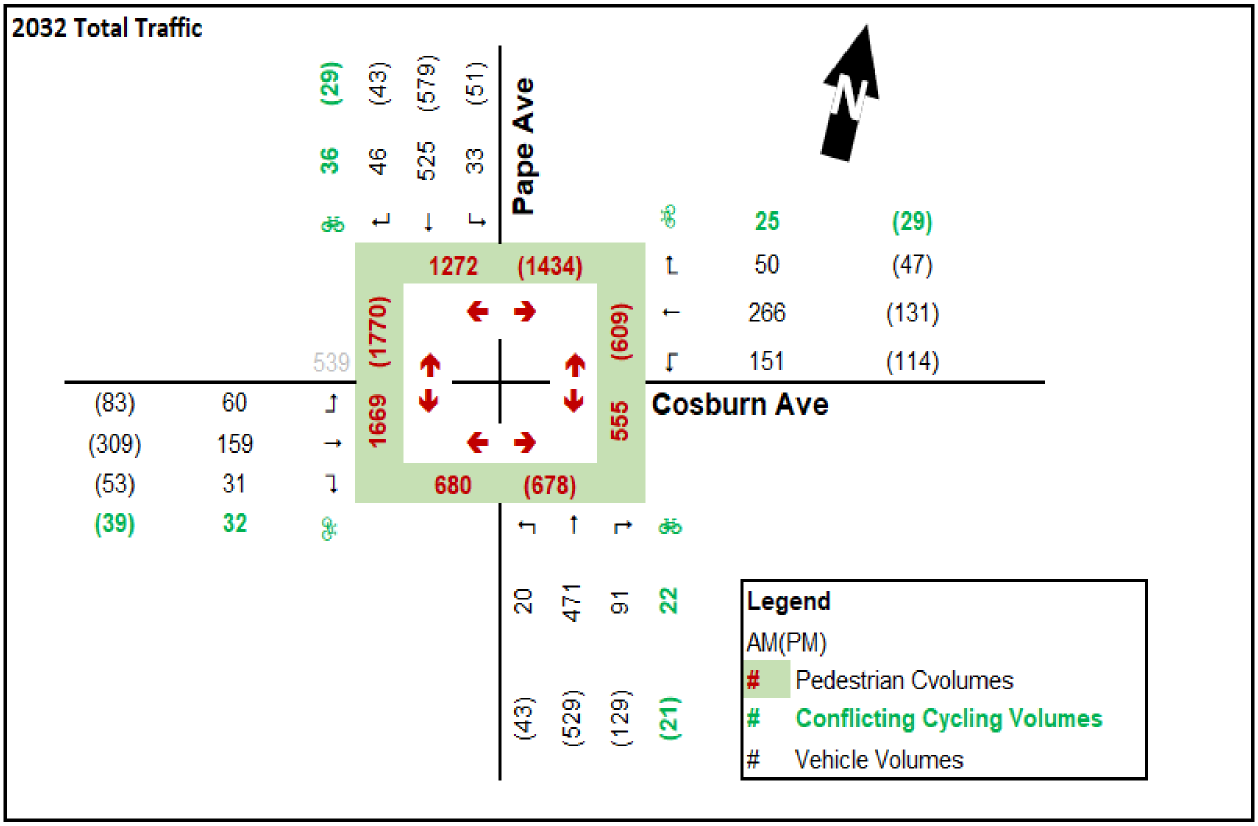


Figure 17: 2032 Total Traffic Intersection Volumes

4.3 Future Total Operations with TOCs

Table 17 summarizes the future total operations at the study area intersection. Signal timing split optimization was performed to the model but the cycle length was maintained as the existing. Detailed reports are provided in **Appendix B**.

Under future total conditions, all movements will still be operating with LOS 'C' or better. Overall the intersection will be operating well, and most vehicles will not experience much delay. The v/c ratios for individual movements will be 0.68 or better, and the overall v/c ratios for the entire intersection will be 0.58 and 0.67 during the weekday AM and PM peak hours, respectively. This demonstrates that even with the inclusion of TOC generated trips, the intersection of Cosburn Avenue at Pape Avenue will be operating within acceptable thresholds and with residual capacity.

Table 17: 2032 Total Traffic Conditions– Summary

Intersection and Movement		Lanes	Storage (m)	AM Peak Hour			PM Peak Hour		
				LOS	v/c	95th Q (m)	LOS	v/c	95th Q
Cosburn & Pape Ave		**-**	**-**	**B**	**0.58**	**-**	**B**	**0.67**	**-**
Eastbound	Left	1	15	B	0.26	**15.2**	C	0.33	**20.7**
	Through-Right	1	345	B	0.33	35.1	C	0.64	74.8
Westbound	Left	1	15	C	0.49	**35.1**	C	0.54	**31.5**
	Through-Right	1	260	B	0.53	60.0	B	0.34	34.4
Northbound	Through-Left	1	90	B	0.61	62.9	B	0.68	72.8
	Through-Right	1							
Southbound	Through-Left	1	90	B	0.62	65.2	B	0.62	65.8
	Through-Right	1							

Note: LOS = level of service; v/c = volume to capacity ratio; 95th Q = 95th Percentile Queue using HCM 2000. Critical movements are highlighted in **red** as defined by the City's TIS Guidelines and movements with LOS F are highlighted in **yellow**. 95th percentile queue values highlighted in **blue** indicate that the queue extends past the available storage length.

4.3.1 Sensitivity Analysis

As previously mentioned, the latest site statistics result in 50% more retail floor area for the south site. This would result in increased pedestrian conflicts. A sensitivity analysis was undertaken to determine the impacts of inputting 3,000 pedestrian conflicts for all movements during each peak period to determine the model sensitivity to pedestrian conflicts. With the conflicts maximized in the software, this increases the overall intersection v/c ratio from 0.58 to 0.60 and from 0.67 to 0.69 during the weekday AM and PM peak periods, respectively. The highest v/c ratio for a given movement will be 0.72 and all movements will continue to operate with LOS 'C'. This confirms that the analysis is representative of future traffic operations and that operations with the TOC will be within acceptable thresholds. Detailed Synchro Reports are provided in **Appendix B**.

There are also a number of potential impacts that the station will have on the surrounding road network that are still uncertain and discussions are ongoing with the City of Toronto and TTC. These changes include potential relocation of the northbound and westbound bus stops to far-side stops, the location of Wheel-Trans stop, and a requested cycle track along Cosburn Avenue. These changes, if implemented, may cumulatively result in:

- The southbound left-turn at Cosburn Avenue and Pape Avenue to be restricted at all times of the day to accommodate the Pape southbound bus stop option, so that southbound buses and Wheel-Trans vehicles do not block the curb lane at the same time that a southbound left-turning vehicle blocks the centreline. Southbound left-turning vehicles may reroute to turn left further to the north or further south.
- The eastbound left-turn lane being removed to accommodate either the cycle track, far-side westbound bus stop, or Wheel-Trans stop, resulting in the eastbound approach reduced to a single shared eastbound approach lane. The westbound approach may also be reduced to a single lane to provide lane balance and alignment with the eastbound approach. This option assumes the plaza space and setback requirements

would be maintained on the north side of Cosburn. If the plaza space or setback requirements are reduced, then it may be possible to retain the eastbound and westbound turning lanes.

A sensitivity analysis was undertaken with all of the above changes including increasing pedestrian conflicts to 3,000 pedestrians per hour for all turning movements. The southbound left-turns were reassigned as southbound through traffic which assumes they turn left further to the south and is more conservative.

The resulting traffic operations result in an overall intersection v/c ratio of 0.85 and 0.81, during the AM and PM peak hours, respectively. The highest individual movement v/c ratio is 0.88 and this applies to the westbound approach during the AM peak hour when the westbound approach demand is highest. All movements will operate with LOS 'C' or better under these conditions. This sensitivity analysis confirms that traffic operations will be within acceptable thresholds.

While the sensitivity analysis confirms that pavement width reductions on Cosburn and traffic turning restrictions on Pape are possible from a traffic operations and capacity perspective, the Pape and Cosburn cross sections will need to be confirmed through further discussions with the City and TTC.

All of the above considerations are also documented under separate cover for the Cosburn Station TIS report.

5 Parking and Loading Assessment

This section of the report reviews the proposed parking supply and the requirements of the new City-wide Zoning By-law 569-2013, as amended (Office Consolidation) Version Date: September 15, 2021. The by-law includes specific requirements for parking (bicycle and vehicle) as well as loading. By-law 89-2022 was also adopted in December 2021 but was repealed. However, as of November 2022 By-law 89-2022 is in-force. By-law 89-2022 modernizes the vehicle parking requirements component of the by-law. Both by-laws have been reviewed and are presented in this report.

5.1 Policy Area Designations and Parking Requirements

The city-wide Zoning By-law 569-2013 is typically applied to new developments throughout the City. The By-law includes multiple sets of vehicle parking rates with diminishing requirements for some areas that have better transit accessibility. Cosburn and Pape TOC sites fall under Policy Area 4, as shown in **Figure 18**.

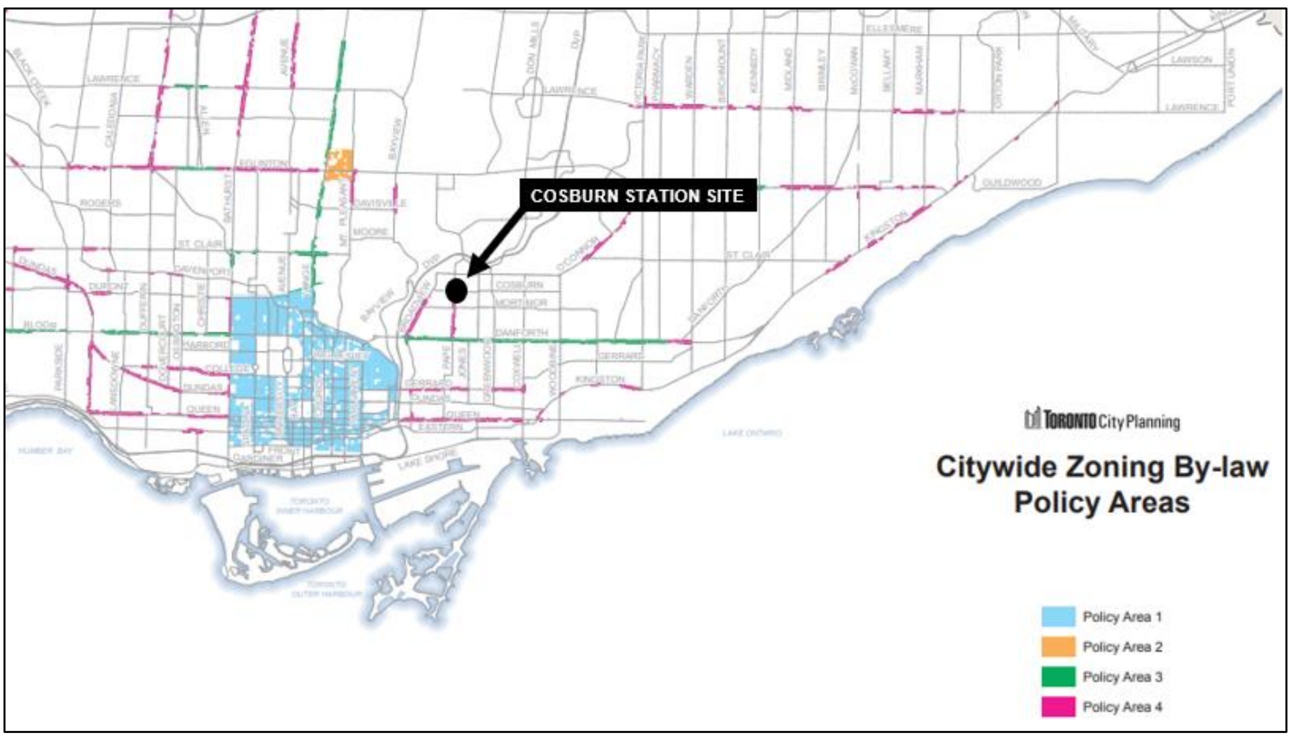


Figure 18: City of Toronto Policy Areas [4]

5.2 Vehicle Parking Requirements (Zoning By-law 569-2013)

Vehicle parking requirements were reviewed using By-law 569-2013, and the requirements are shown in **Table 18** and **Table 19** for the North and South Sites, respectively. In Policy Area 1 "CR" zones, parking is exempted for retail uses with total area less than the lot area. Although this site is in Policy Area 4, the site is still zoned CR and would meet the criteria for a parking exemption if zoned Policy Area 1. Therefore, we believe that the same exemption should apply

[4] https://www.toronto.ca/wp-content/uploads/2017/10/96e8-City-Planning-Zoning-city-wide-Policy-Areas-zone-map.pdf

to the subject development, but have shown the By-law requirements assuming it does not apply. The zoning by-law review is based on the latest conceptual site statistics.

Table 18: Vehicle Parking Zoning By-law 569-2013 Requirements – North Site

Building	Land Use	Size (Unit or SM)	By-law No. 569-2013 (PA4)	
			Rate	# Spaces Req.
North Site	Bachelor	26 units	0.7 / unit	18
	1-bed	150 units	0.8 / unit	120
	2-bed	95 units	0.9 / unit	85
	3-bed	29 units	1.1 / unit	31
	Visitors	300 units	0.15 / unit	45
	Retail	517 SM	1.0 / 100SM	5
		Total Required	-	**304**
		Total Proposed	-	**6**
		Total Surplus / Deficit	-	**- 298**

Table 19: Vehicle Parking Zoning By-law 569-2013 Requirements – South Site

Building	Land Use	Size (Unit or SM)	By-law No. 569-2013 (PA4)	
			Rate	# Spaces Req.
South Site	Bachelor	0 units	0.7 / unit	0
	1-bed	188 units	0.8 / unit	150
	2-bed	104 units	0.9 / unit	93
	3-bed	31 units	1.1 / unit	34
	Visitors	323 units	0.15 / unit	48
	Retail	1,691 SM	1.0 / 100SM	16
		Total Required	-	**341**
		Total Proposed	-	**8**
		Total Surplus / Deficit	-	**- 333**

Due to the limited site area and presence of the Ontario Line underneath each building, it would not be possible or realistically feasible to provide the by-law required minimum number of parking spaces at this location without occupying the building podium, which would eliminate the retail-commercial uses. The sites will have limited on-site dedicated vehicle parking with 6 'shared' spaces shown for the north site and 8 'shared' spaces for the south site. These spaces will serve the residential visitors and the retail-commercial customers, but will not be intended to serve the residents of the buildings or transit riders. To enforce this intent, the shared parking spaces will have 1-hour limits posted at each parking space.

Considering the urban trends, character and location of the site in the context of the surrounding area, and planned access to transit, it is not practical to provide the number of parking spaces required by the prevailing Zoning By-law for the proposed development. In recent years, City Council has acknowledged this and has adopted lower standards for approval for new developments in downtown, and more recently Council has approved the motion to eliminate parking minimums for residential multi-family dwellings. These actions have been bolstered by

Ontario's New Five-Year Climate Change Action Plan and numerous other initiatives by the City of Toronto.

There has also been a decline in residential parking demand and vehicle ownership in the areas surrounding downtown Toronto. There have been developments constructed with 'zero' parking across North America, including downtown Toronto, where transit access is very high. This area is well served by transit, with access to the Cosburn Ontario Line station, and will also be well served by a number of bus routes. Also, a very high transit-dependency is the fundamental characteristic of Transit-Oriented Communities, as they promote reduced auto-dependency.

5.3 Parking Requirements (Zoning By-law 89-2022)

Consistent with the City's new approach to parking, parking requirements were assessed in accordance with Zoning By-law 89-2022 and are shown in **Table 20** and **Table 21** for the North and South sites, respectively. The parking requirements according to the new By-law have been reviewed based on an understanding that it is currently in-force and represents a modernized approach where minimum parking rates are eliminated for most uses including retail uses and residential visitors, and maximum parking rates are the determining factor in site design.

According to the Parking Zone Areas Overlay Index Map, both sites fall within the boundaries of Parking Zone B. This new approach proposes maximum parking rates for residents, a permitted range for visitor parking, and minimums for accessible parking.

Table 20: Vehicle Parking Zoning By-law 89-2022 Requirements – North Site

Type	Units	By-law 89-2022 [Parking Zone B]		
		Rate	Minimum # Spaces	Maximum # Spaces
Bachelor (<45 sqm)	26 units	0.7 spaces per unit	n/a	18
1-bed	150 units	0.8 spaces per unit		120
2-bed	95 units	0.9 spaces per unit		85
3-bed	29 units	1.1 spaces per unit		31
		Maximum Resident		254
Visitor Minimum	300 units	2.0 + 0.05/unit	17	-
Visitor Maximum		1.0/unit (first 5 units) + 0.1/unit (6th unit onwards)	-	34
		Proposed Visitor Parking	6 (not between 17 and 34 ✗)	
		Proposed Resident Parking	0 (less than 254 ✓)	
Retail Store	517 SM	4.0 spaces / 100 SM GFA (Maximum)	20 spaces maximum	

Table 21: Vehicle Parking Zoning By-law 89-2022 Requirements – South Site

Type	Units	By-law 89-2022 [Parking Zone B]		
		Rate	Minimum # Spaces	Maximum # Spaces
Bachelor (<45 sqm)	0 units	0.7 spaces per unit	n/a	0
1-bed	188 units	0.8 spaces per unit		150
2-bed	104 units	0.9 spaces per unit		93
3-bed	31 units	1.1 spaces per unit		34
		Maximum Resident		277
Visitor Minimum	323 units	2.0 + 0.05/unit	18	-
Visitor Maximum		1.0/unit (first 5 units) + 0.1/unit (6th unit onwards)	-	36
		Proposed Visitor Parking	8 (not between 18 and 36 ✗)	
		Proposed Resident Parking	0 (less than 277 ✓)	
Retail Store	1,691	4.0 spaces / 100 SM GFA (Maximum)	67 spaces maximum	

Both sites of the new development meet the requirements for resident parking and for retail parking since there are no proposed residential parking spaces and there is also no minimum requirement. Per the by-law, visitor parking should be at least 17 for the north site, and 18 for the south site, but no more than 34 and 36 for the north and south sites, respectively. There's a parking deficiency of 11 and 10 for the north and south sites, respectively.

Accessible parking requirements were reviewed based on the new by-laws. **Table 22** and **Table 23** show the calculation of effective parking and required accessible parking for the north site and south site respectively.

For both sites, the number of effective parking spaces have been calculated. The north site requires 9 accessible parking spaces and the south site requires 10 accessible spaces. Although a small number of accessible spaces will be provided, the north and south sites will be deficient by 7 and 9 spaces, respectively.

Table 22: North Site Effective Parking Rates for Accessible Parking

Type	Units	By-law No. 89-2022	
		Effective Rate	Effective Spaces
Bachelor (<45 sqm)	26 units	0.7 spaces per unit	18
1-bed	150 units	0.8 spaces per unit	120
2-bed	95 units	0.9 spaces per unit	85
3-bed	29 units	1.1 spaces per unit	31
Visitor	300 units	0.1 spaces per unit	30
Retail Store	517 SM	1.0 spaces / 100 SM GFA	5
		Total Effective	289
		Total Parking Provided	6
		Greater of the Above (Actual Effective)	289
		Required Accessible Parking (if the number of effective parking spaces is more than 100, a minimum of 5 accessible parking spaces plus 1 accessible parking space for every 50 effective parking spaces or part thereof in excess of 100 parking spaces)	9 accessible parking spaces required
		Accessible Parking Provided	2 spaces
		Surplus/Deficit	-7 spaces

Table 23: South Site Effective Parking Rates for Accessible Parking

Type	Units	By-law No. 89-2022	
		Rate	Effective Spaces
Bachelor (<45 sqm)	0 units	0.7 spaces per unit	0
1-bed	188 units	0.8 spaces per unit	150
2-bed	104 units	0.9 spaces per unit	93
3-bed	31 units	1.1 spaces per unit	34
Visitor	323 units	0.1 spaces per unit	32
Retail Store	1,691 SM	1.0 spaces / 100 SM GFA	16
		Total Effective	325
		Total Parking Provided	8
		Greater of the Above (Actual Effective)	325
		Required Accessible Parking (if the number of effective parking spaces is more than 100, a minimum of 5 accessible parking spaces plus 1 accessible parking space for every 50 effective parking spaces or part thereof in excess of 100 parking spaces)	10 accessible parking spaces required
		Accessible Parking Provided	1 spaces
		Surplus/Deficit	-9 spaces

5.4 Vehicle Ownership Rates in the Surrounding Area

A review of auto-ownership rates in the immediate area was performed using the same Transportation Tomorrow Survey zones discussed in **Section 4**. The average auto-ownership rate is 0.74 vehicles per household for apartment and townhome units and 1.29 vehicles per unit for regular homes. The lowest auto-ownership rate was 0.70 vehicles per apartment/townhome unit in zone 282 which is the zone north of Cosburn Avenue and west of Pape Avenue. Overall, this does indicate that there are some areas where less than, or approximately three quarters of the units have a vehicle, indicating that there are some units with zero vehicles.

5.5 Zero Parking / Elimination of Parking Minimums

5.5.1 Elimination of Parking Minimums: Toronto

The City already allowed for the elimination of parking minimums for some land uses within Policy Area PA4 as per Zoning By-law 5690-2013, when the interior floor area of all the uses does not exceed 1.0 times the area of the lot. This acknowledges that some uses cannot provide parking, and more importantly, can be sustained without any on-site parking. Although residential land uses are not included, the By-law does acknowledge that some people will either rely on public parking to visit the use, or will be a walk-in trip without any vehicle.

Recently, the Chief Planner and Executive Director of City Planning put out a Report for Action dated January 5, 2021. The Report is entitled Proposed Review of Parking Requirements for New Development[5]. The report essentially outlines the rationale and support for the elimination of parking minimum. The report provides examples of some of City Council's recent decisions which recognize that the current automobile parking standards represent a barrier to the City achieving its housing vision. For example:

- *"In relation to the Queen Street West Planning Study - Bathurst Street to Roncesvalles Avenue, Council removed automobile parking requirements for various forms of development within the study area in order to facilitate the conservation of heritage buildings, and to support Public Realm, Built Form and Transportation objectives. (URL: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2020.TE14.5)*
- *In 2018, City Council requested City Planning to report on exempting low rise apartment buildings from parking requirements in some cases, and other potential incentives to promote purpose-built rentals in Neighbourhoods-designated areas (URL: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.PG27.5)."*

The report makes the following recommendations regarding the elimination of parking minimums:

- ***A shift in focus from minimums to maximums** will further support and encourage land- and cost-efficient forms of development which do not include extensive automobile parking.*

[5] https://www.toronto.ca/legdocs/mmis/2021/ph/bgrd/backgroundfile-159784.pdf

- ***Limiting the supply of automobile parking and increasing the supply of bicycle parking*** *will encourage transportation alternatives to automobiles and support the City's policies related to reducing automobile dependence.*
- ***Removing automobile parking minimums*** *or reducing the number of land uses for which parking rates are specified may simplify the zoning requirements, allowing for easier understanding and application.*
- *Consideration of replacing minimum automobile parking requirements with parking supply guidelines;*
- ***Identification of other mobility infrastructure required if automobile parking requirements are reduced or removed and mechanisms to pay for it;***
- *Development of* ***new parking policy area boundaries*** *to better reflect areas with good alternatives to automobile travel,* ***such as high-quality transit service****;*
- ***Development of an approach to adjust parking requirements without a zoning by-law amendment as new transit infrastructure enters service;***
- *Identification of land uses and areas where the existing ZBL parking standards should be adjusted to meet the intent of the Official Plan by:*
  - ***Reducing or eliminating automobile parking minimums; • Reducing or introducing automobile parking maximums; or***
  - ***Increasing bicycle parking minimums;***

The subject development is a perfect candidate for the elimination of parking minimums, since it achieves many of the goals listed above and meets many of the prerequisites for consideration. The sites will have direct transit access to Ontario Line and surface transit along Cosburn Avenue and Pape Avenue. The sites excellent transit access will make it a perfect location to implement a no parking, truly transit-oriented community. With ample bicycle parking and access to surface cycling routes, the site will also be able to support a zero-vehicle culture by supporting other active modes of transportation.

The new approach to parking contained in By-law 89-2022 reflects the above trends.

5.5.1.1 Examples of Near-Zero Vehicle Parking Condominiums in Toronto

An existing condominium at 426 University Avenue in the City of Toronto just south of St Patrick subway station on the Yonge-University-Spadina subway line (Dundas Street at University Avenue) – referred to as "RCMI" due to it being integrated with the heritage façade of the Royal Canadian Military Institute – was built and began occupancy in 2014[6].

The condominium building is 42 storeys tall and has 315 units, mostly comprised of one-bedroom and bachelor units. The building is equipped with 4 vehicle stacker parking spaces, plus one regular parking space. This allows for parking of up to 9 vehicles, all of which are dedicated car-share parking spaces. The building therefore relies entirely on use of car-sharing, as well as the available surrounding public parking supply for any overflow demand or visitor demand. The building also has 315 bicycle parking spaces which is one space for each unit. This demonstrates the ability for a building to rely on car-share and public parking. Comparatively, the proposed TOC building will have even better (direct) transit access, will have

[6] https://www.toronto.ca/legdocs/mmis/2009/te/bgrd/backgroundfile-21943.pdf

more bicycle parking (on a spaces per unit basis), and will also have car-share available in the surrounding area but not directly in the TOC. Overall, the transportation option availability for the subject TOC is similar but more heavily weighted towards transit and cycling reliance.

5.5.2 Elimination of Parking Minimums

Brampton City Council has also recently passed a vote to enable Open Option Parking city-wide effective July 2, 2020[7]. This means that developers can determine how much parking is required for a development based on market expectations. This allows the market to control the parking needs and to be more flexible to infrastructure changes. This also allows for reduced construction and unit costs when parking is not provided, which is considered in the market assessment when determining if and how much parking would be provided.

As mentioned above, the City of Toronto also recently approved a motion to eliminate parking minimums for multi-family dwellings. Although this has not been formally adopted into the By-law, it does demonstrate the shift towards a market-driven approach to parking which the subject TOC developments are well positioned to leverage and to be some of the first developments in the city to officially adopt this approach.

5.6 Public Parking

There is on-street parking available along Pape Avenue and Cosburn Avenue that will accommodate short-term visitors. The nearest public ("Green P") parking is available to the south along Danforth Avenue.

5.7 Vehicular Parking Supply

The total proposed vehicular parking supply for the North and South sites is 6 and 8 shared spaces, respectively. The north site will have 2 barrier-free spaces and the south site will have 1 barrier free parking space. The spaces will all be marked for 1-hour use only which will accommodate some retail customers, residential visitors, or residents making short stops at home. The surface spaces will not be intended for use by employees to the retail-commercial component or to the residents or transit riders.

The site will be heavily reliant on transit services to access jobs in the downtown core, and the proximity of amenities, which would be in the form of walking and cycling trips.

If there will be vehicles owned by future residents of the TOC development, these vehicles must use nearby parking lots and may also enter rental or sublet agreements with nearby private parking space owners. This will allow for an otherwise underutilized parking space to be used. However, the building will not be marketed to residents or businesses which are vehicle reliant. Rather, the tenants and residents are expected to be those who do not own vehicles or do not intend on owning vehicles.

Parking requirements from the City Zoning By-law 569-2013 were reviewed despite By-law 89-2022 being adopted, which removes parking minimums for many uses.

[7] https://www.edmonton.ca/city_government/urban_planning_and_design/comprehensive-parking-review.aspx

5.8 Bicycle Parking Supply

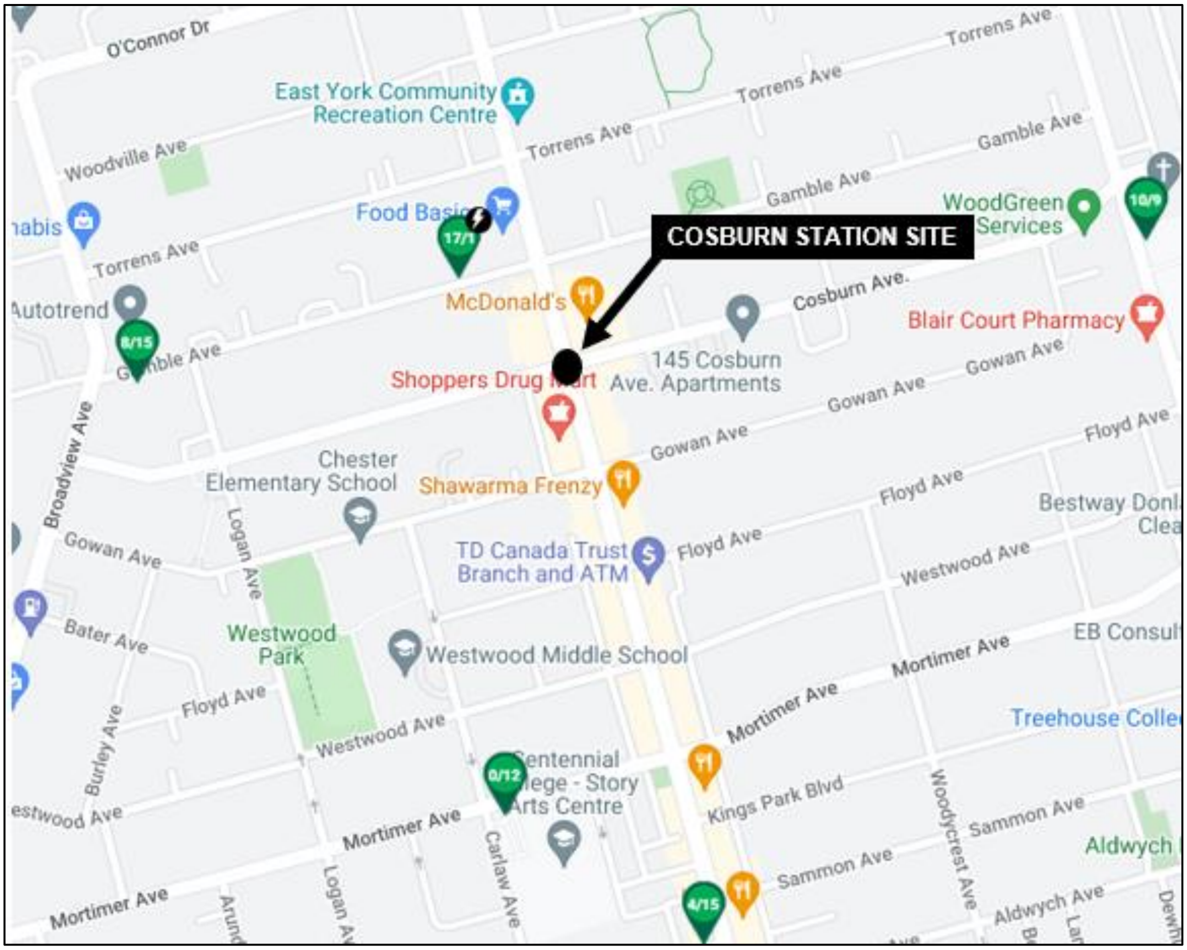
Bicycle parking for the site will be provided in the form of short-term and long-term bicycle parking spaces. Short-term bicycle parking will be provided at-grade (internally or weather protected if outdoors), and will serve residential visitors, commercial patrons, and residents who are making short stops at home. Long-term bicycle parking will be located at grade and on the second floor of the north building, and below grade and at-grade for the south building. The bicycle parking supply is summarized in **Table 24** for both sites.

There are several bike share locations in the area surrounding Cosburn Avenue and Pape Avenue. There is one dock within 200 metres walking distance from the sites, located along Gamble Avenue, with a total number of 18 bike share spaces available, as shown in **Figure 19**. These bikeshare spaces will be available to residents and visitors. Available bicycles will be usable by residents or visitors leaving the sites, while empty spaces will be available for residents and visitors returning back. As a result, all of the bikeshare spaces are considered available to the residents but are not included in the By-law comparison.

Table 24: Bicycle Parking Supply

Site	Bicycle Parking Space Type							
	Residence Long Term	Residential Short Term	Non-Residential Long Term	Non-Residential Short Term	Transit Long Term	Transit Short Term	Off-Site Bike Share	Total
North	314	30	2	10	0	0	18	**374**
South	348	38	4	10	0	0	18	**418**

An additional 15 bikeshare parking spaces are being proposed in a dock located in the station plaza along Cosburn Street, which would be in front of the North TOC site. These bike share spaces are not captured in the above table but would supplement the existing bike share dock on Gamble Avenue.



Source: https://bikesharetoronto.com/system-map/

Figure 19: Bike Share Locations near Cosburn and Pape Intersection

5.9 Bicycle Parking Requirements

Bicycle parking requirements were reviewed for By-law 569-2013. Bicycle parking requirements for the North and South Sites are summarized in **Table 25** and **Table 26**, respectively.

There will be 107 surplus in long-term bicycle parking spaces between both sites, and a 25 space surplus in short-term parking spaces between both sites. Each site will have a surplus of both short-term and long-term bicycle parking spaces which will encourage cycling. This does not account for the nearby bike share spaces that will be available to residents and visitors to the residential or retail components. The bike share dock is located within 200 metres walking distance to the north of the site along Gamble Avenue.

Table 25: Bicycle Parking Zoning By-law Requirements – North Site

Land Use		Unit or per 100 SM	By-law No. 569-2013			
			Long Term		Short Term	
			Rate	# Required	Rate	# Required
North Site	Residential	300 units	0.9 / unit	270	0.1 / unit	30
	Retail [1]	517 SM	0.2 / 100 SM	0[1]	3 + 0.3 / 100 SM	0[1]
Total Required			-	270	-	30
Proposed			-	316	-	40
Surplus / Deficit			-	**+ 46**	-	**+ 10**

Note: 1) According to By-law 569-2013, if a bicycle parking space is required for uses on a lot, other than a dwelling unit, and the total interior floor area of all such uses on that lot is 2000 square metres or less, then no bicycle parking space is required.

Table 26: Bicycle Parking Zoning By-law Requirements – South Site

Land Use		Unit or per 100 SM	By-law No. 569-2013			
			Long Term		Short Term	
			Rate	# Required	Rate	# Required
South Site	Residential	323 units	0.9 / unit	291	0.1 / unit	33
	Retail [1]	1,691 SM	0.2 / 100 SM	0[1]	3 + 0.3 / 100 SM	0[1]
Total Required			-	291	-	33
Proposed			-	352	-	48
Surplus / Deficit			-	**+ 61**	-	**+ 15**

Note: 1) According to By-law 569-2013, if a bicycle parking space is required for uses on a lot, other than a dwelling unit, and the total interior floor area of all such uses on that lot is 2000 square metres or less, then no bicycle parking space is required.

5.10 Loading Space Requirements

Loading space requirements of Zoning By-law 569-2013 were also reviewed. The loading space requirements and proposed configuration are shown in **Table 27** and **Table 28** for the North and South Sites, respectively.

Table 27: Loading Spaces Required Based on By-Law Rates – North Site

Building	Land Use Type	Unit or SM	Loading space required and provided
North Site	Residential	300 units	1 Type 'G'
	Retail	517 SM	1 Type 'B'
		Total Required	**1 Type 'G' + 1 Type 'B'**
		Total Provided	**1 Type 'G'**

Table 28: Loading Spaces Required Based on By-Law Rates – South Site

Building	Land Use Type	Unit or SM	Loading space required and provided
South Site	Residential	323 units	1 Type 'G'
	Retail	1,695 SM	1 Type 'B'
		Total Required	**1 Type 'G' + 1 Type 'B'**
		Total Provided	**1 Type 'G'**

The dimensions of the proposed loadings spaces meet the By-law requirements, with the dimensions of each type listed below.

Type 'G'
- Minimum Length: 13.0 metres
- Minimum Width: 4.0 metres
- Minimum Clearance: 6.1 metres

Type 'B'
- Minimum Length: 11.0 metres
- Minimum Width: 3.5 metres
- Minimum Clearance: 4.0 metres

The north building will be equipped with a Type 'G' loading space that will be accessible via Gamble Avenue or Coburn Avenue but will not be equipped with the Type 'B' loading space which was triggered due to the retail being 17 SM greater than the 500 SM threshold under which no loading space is required. The building manager will need to coordinate use of the loading space with priority given to refuse collection. It is not yet determined if the laneway will operate one-way southbound or northbound, or if it will operate two-way, but the loading options were tested for all configurations. The direction is partly dependent on the station design, location of the Wheel-Trans parking space, and the final width of the laneway.

The south site will be equipped with one Type 'G' loading spaces. A secondary Type 'B' loading space is required due to the size of the retail component but cannot be provided due to the limited site area. Therefore, the Type 'G' loading space will be shared with the retail component and the building manager will need to coordinate use of the loading space with priority given to refuse collection.

5.10.1 Loading Swept Path Analysis

The loading areas were tested using AutoTURN software (AutoCAD-assisted software) to check the loading space accessibility for anticipated design vehicles entering the site, and for each of the building loading areas. The largest vehicles anticipated to enter the site are a medium sized delivery or moving truck (Medium Single Unit or "MSU"), as well as a City of Toronto front-end loader refuse collection truck.

The swept path analysis for the north site is shown in **Figure 20** through to **Figure 23** and the swept path analysis at the south site is shown in **Figure 24** and **Figure 27**. At this time, it is not certain which direction the laneway will operate, particularly for the north site which will have the station plaza and may have a Wheel-Trans stop proposed in the plaza (as one of the options to be discussed with TTC and the City). The paths are shown for the trucks traveling northbound and southbound to demonstrate that the loading accessibility works in both directions (assuming no Wheel-Trans stop using the laneway). The location of the loading space within the loading area may need to be adjusted slightly depending on the angle of entry, however, the paths demonstrate accessibility in both configurations.

The anticipated design vehicles will be able to navigate to the proposed loading areas, load or unload as needed, and then exit the site without conflicting with any obstructions as long as the building manager properly schedules moving/delivery to avoid conflicts with refuse collection pick-up, and ensures the correct design vehicles are using the loading area.

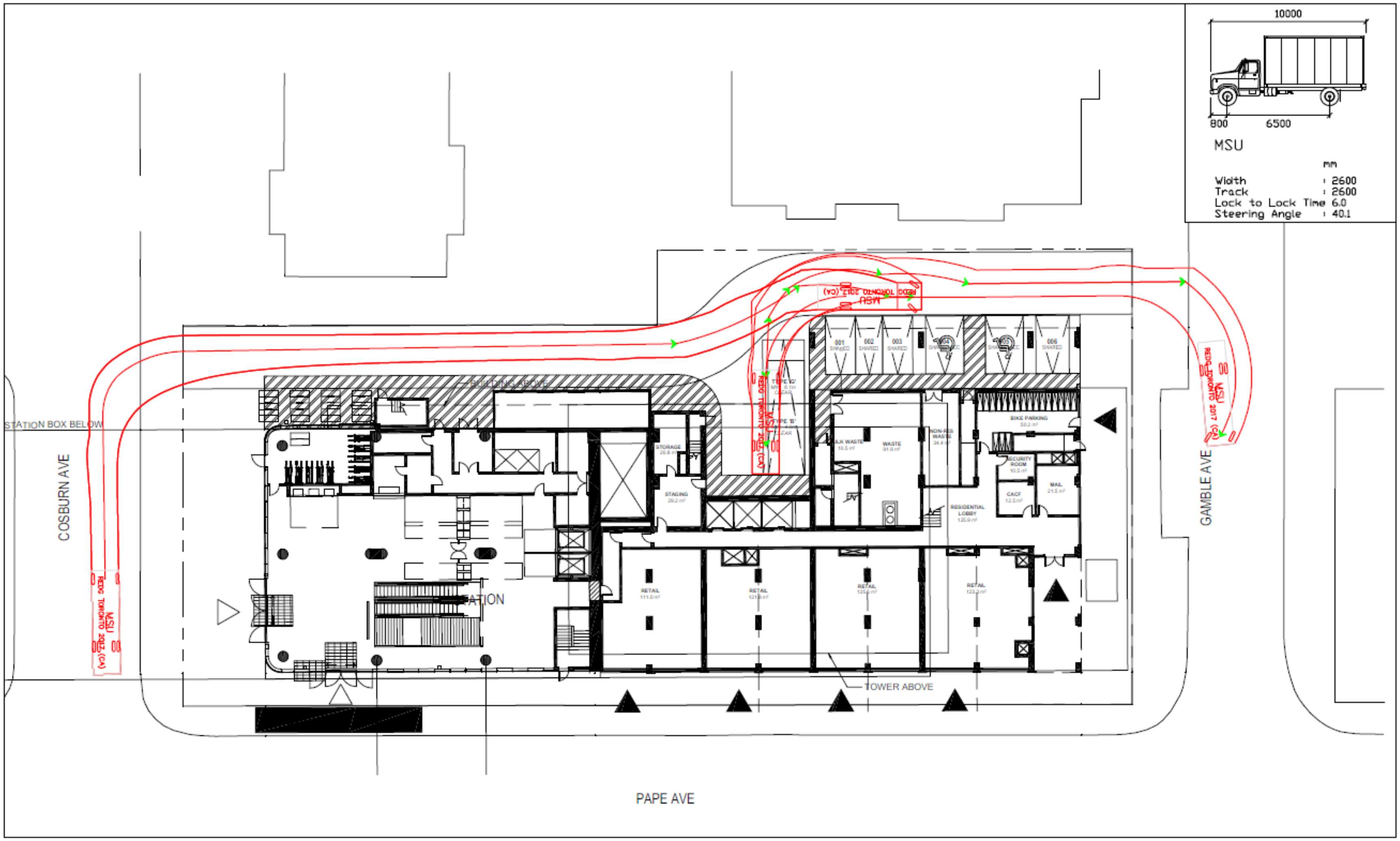


Figure 20: Swept Path Analysis – North Site – Medium Single Unit (Northbound Laneway)

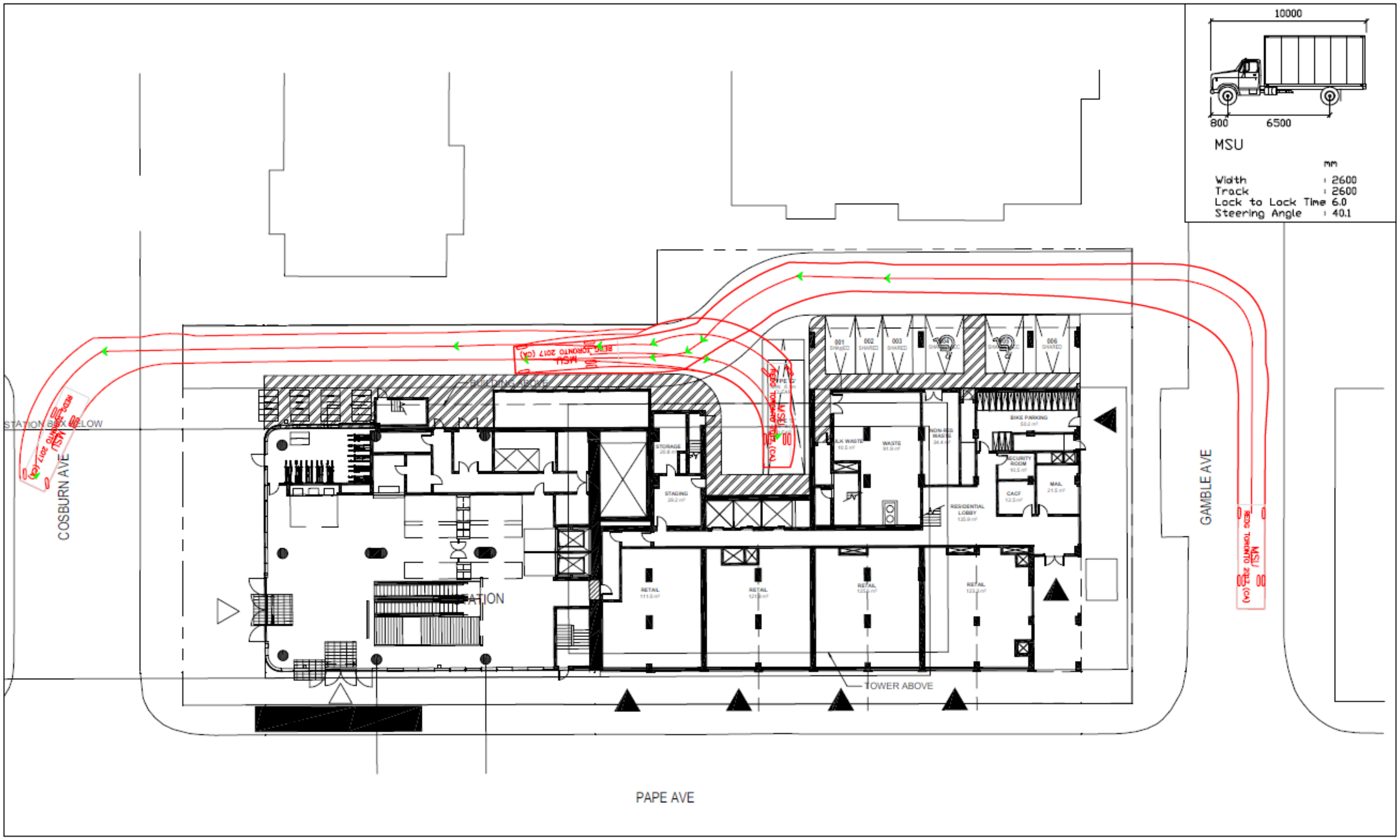


Figure 21: Swept Path Analysis – North Site – Medium Single Unit (Southbound Laneway)

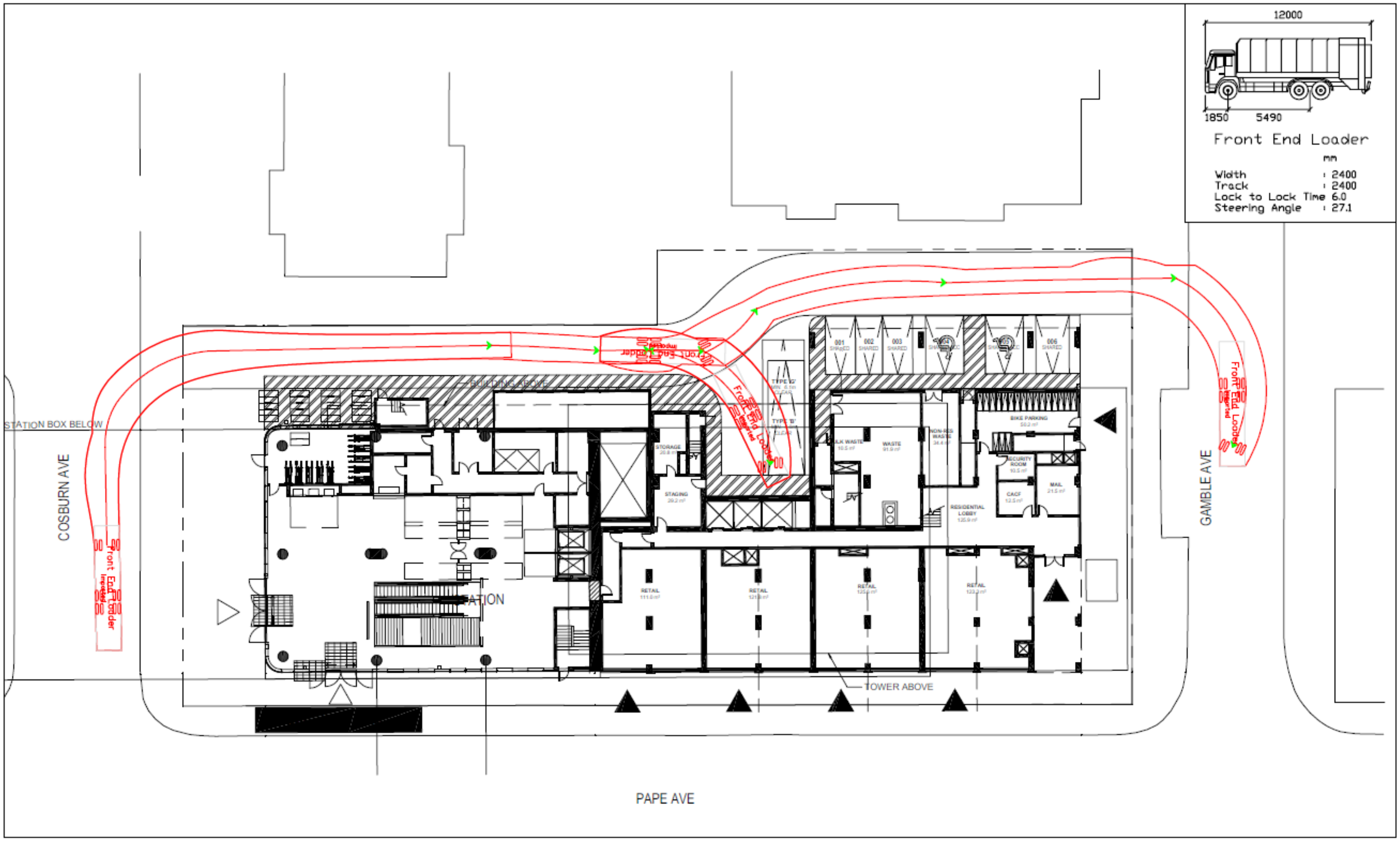


Figure 22: Swept Path Analysis – North Site – Front End Loader (Northbound Laneway)

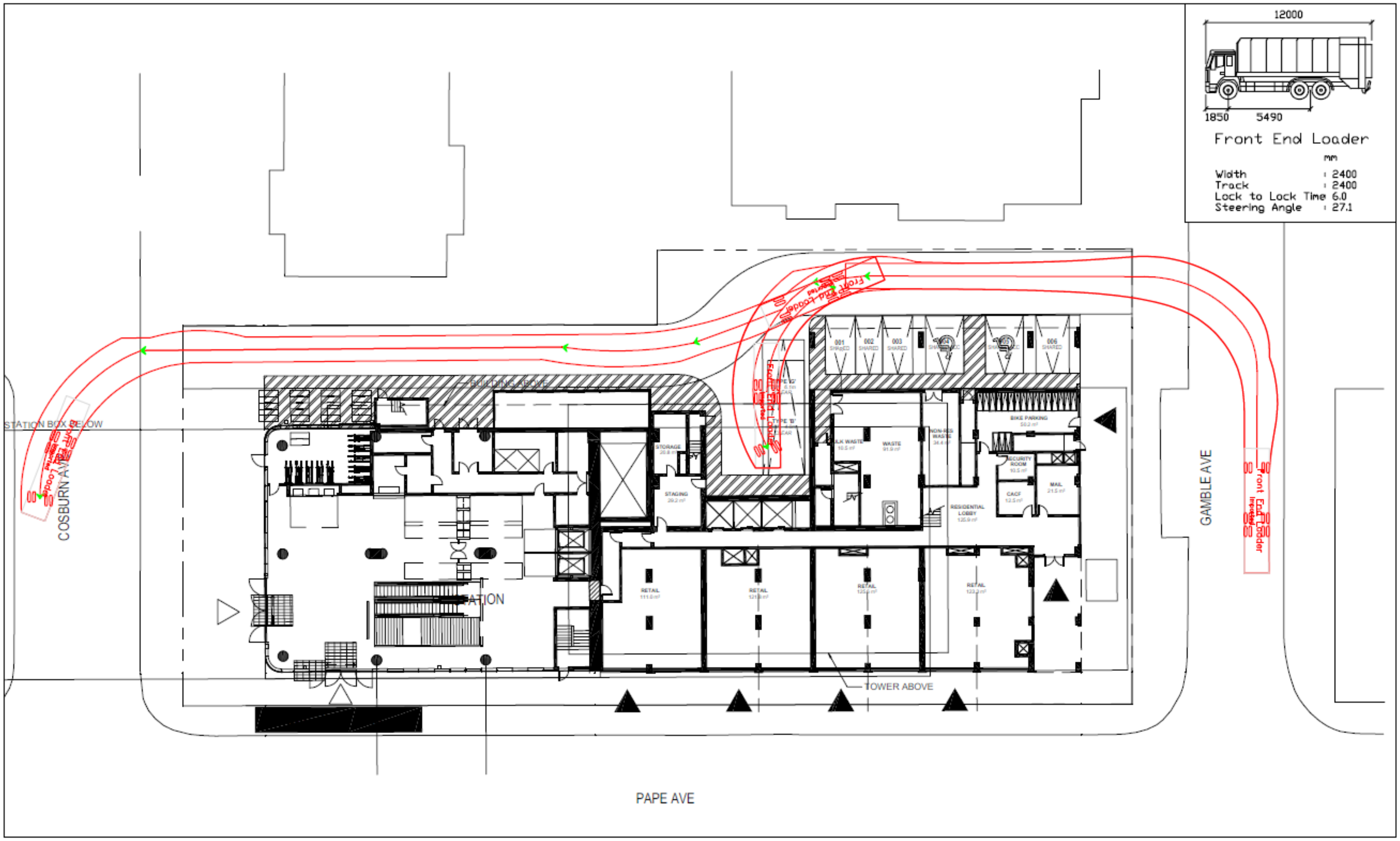


Figure 23: Swept Path Analysis – North Site – Front End Loader (Southbound Laneway)

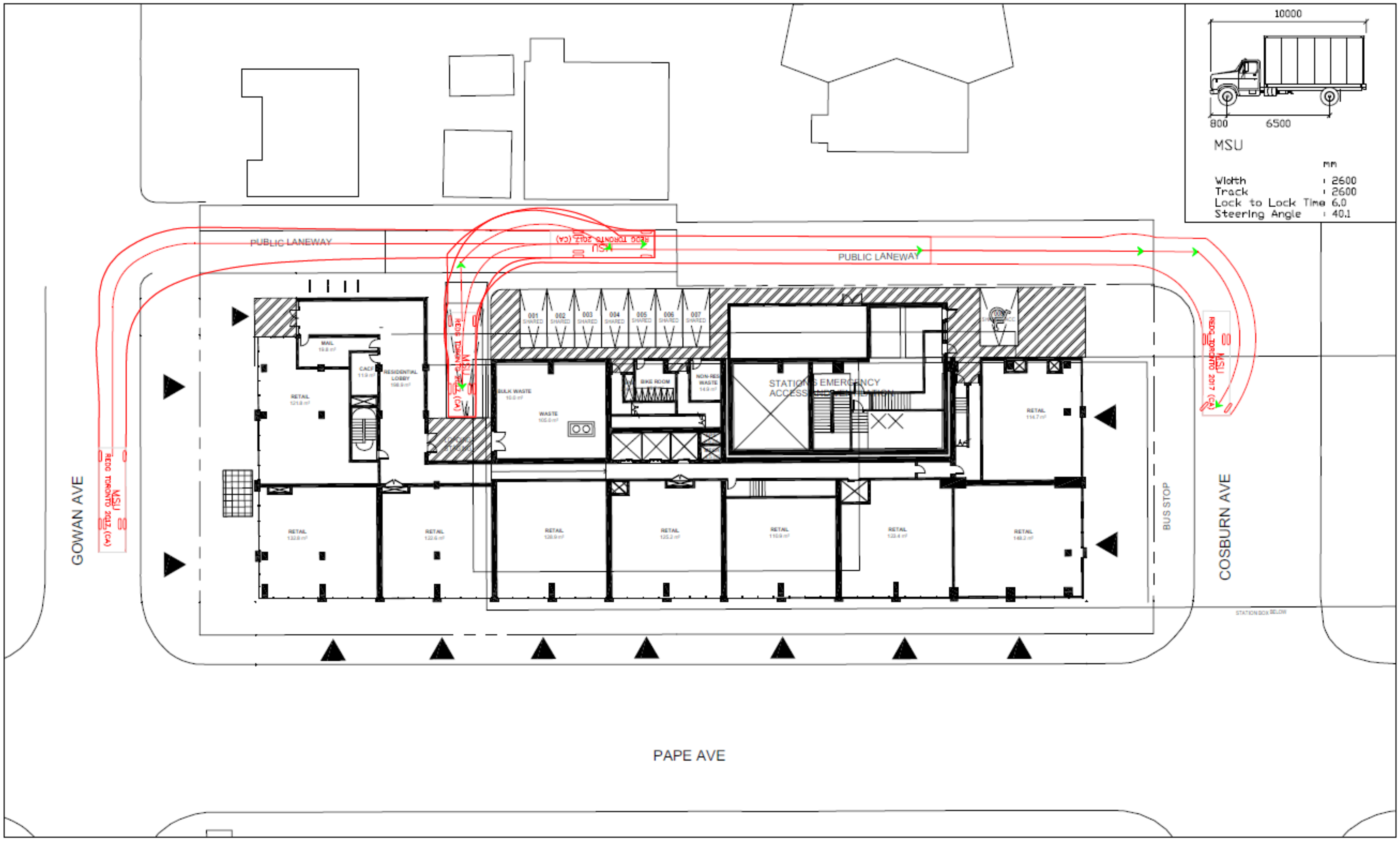


Figure 24: Swept Path Analysis – South Site – Medium Single Unit (Northbound)

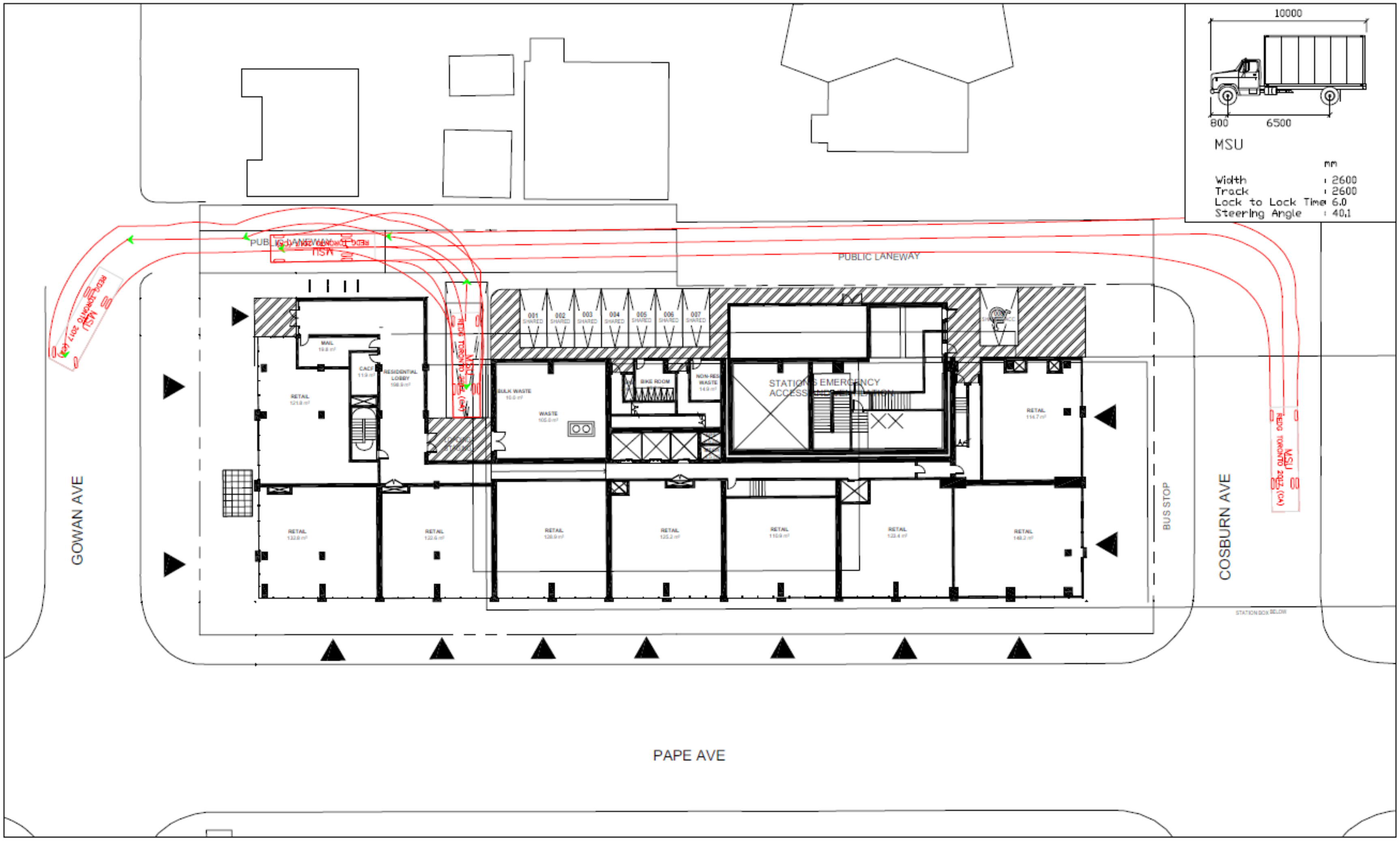


Figure 25: Swept Path Analysis – South Site – Medium Single Unit (Southbound)

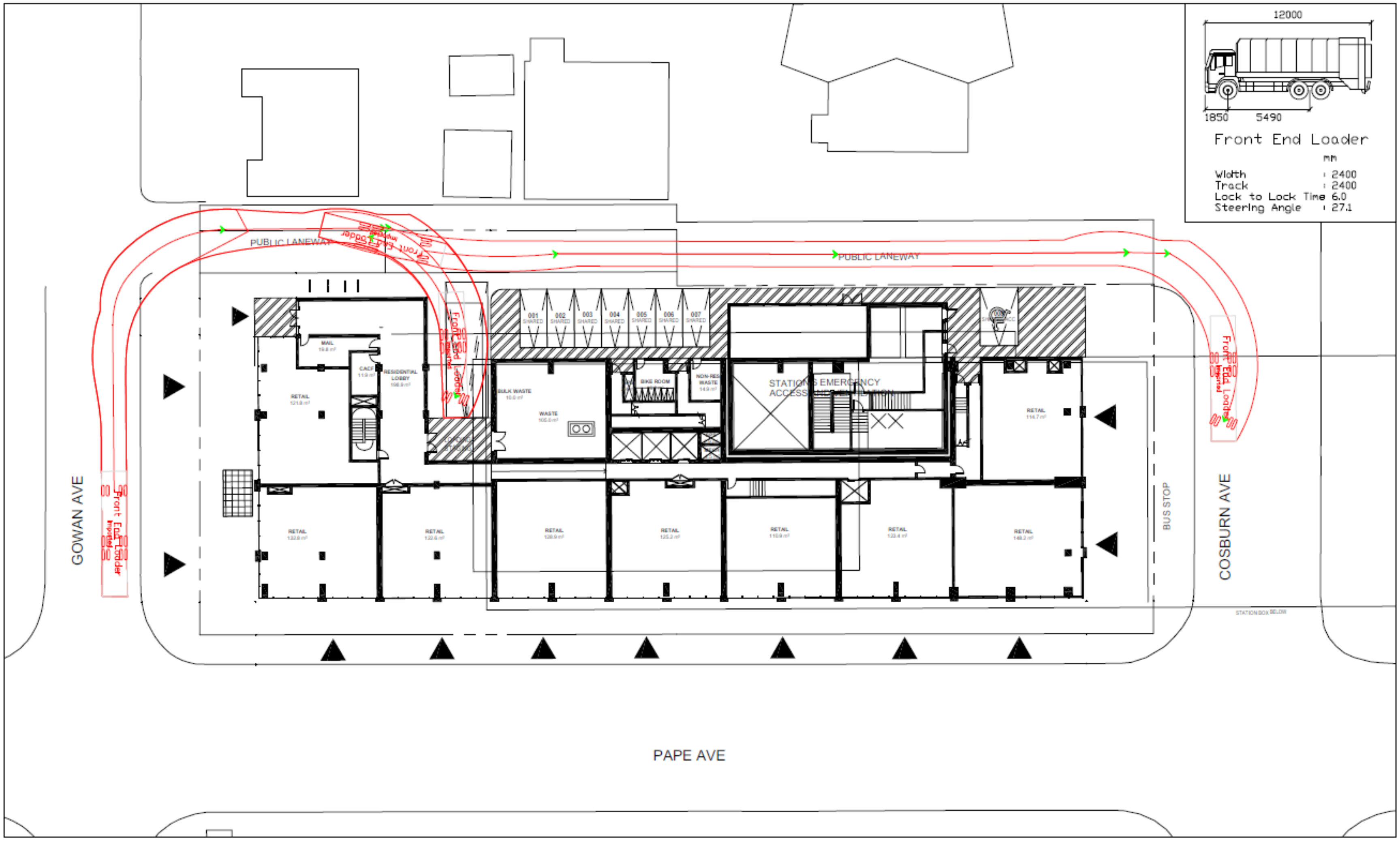


Figure 26: Swept Path Analysis – South Site – Front End Loader (Northbound)

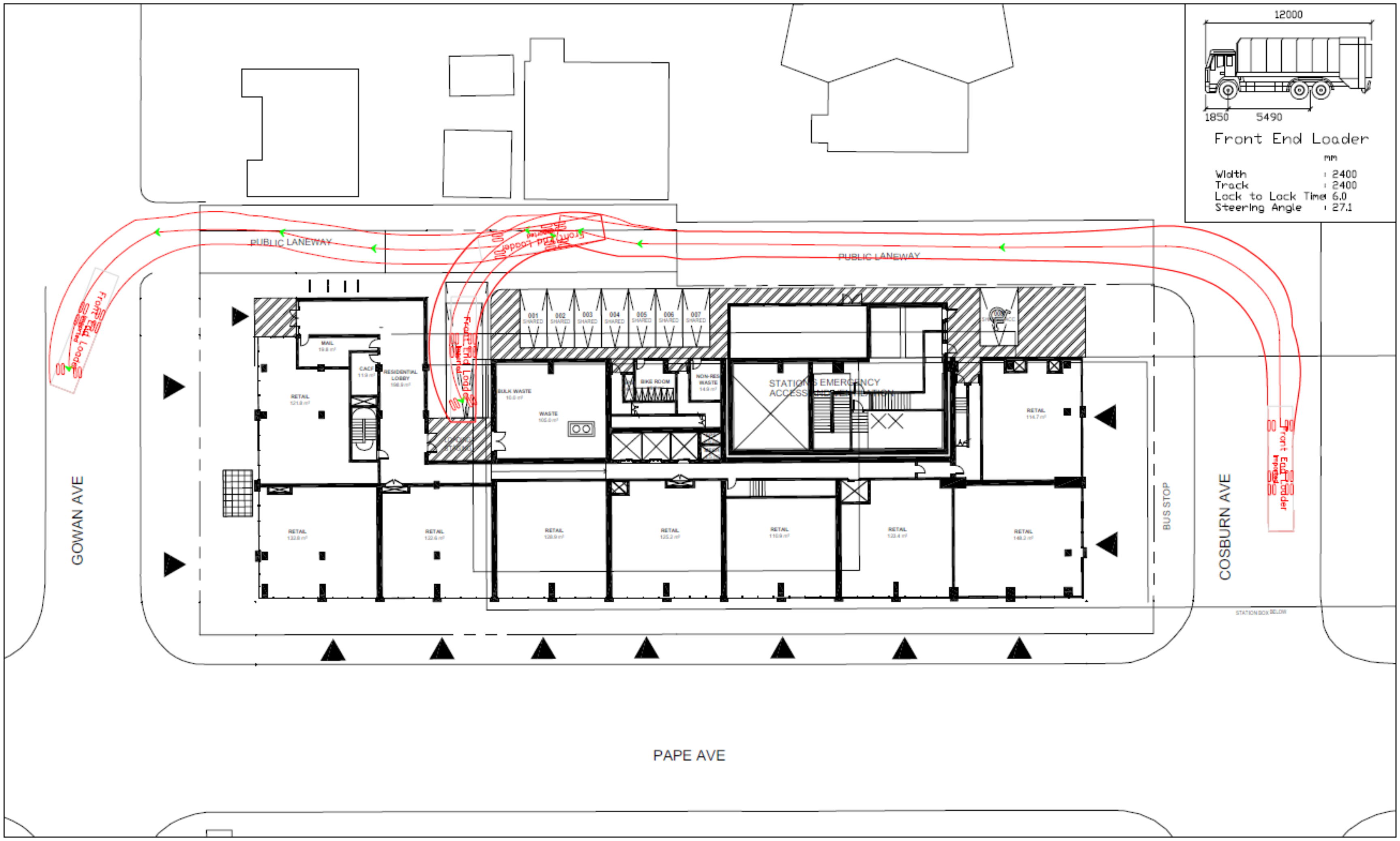


Figure 27: Swept Path Analysis – South Site – Front End Loader (Southbound)

5.11 Travel Demand Management ('TDM')

Transportation Demand Management (TDM) measures are methods employed to reduce the traffic impacts of a development through the reduction of Single-Occupant Vehicle (SOV) trips as well as the encouragement of more sustainable forms of travel and more efficient use of the transportation network for all modes of travel.

TDM measures can be 'hard measures', such as infrastructure like bicycle parking, or can be 'soft measures' such as policies that allow for working-from-home or flex hours. TDM measures must also be tied to the surrounding transportation network context of the development. For example, bicycle parking will be ineffective if there is no surrounding bicycle infrastructure like bicycle lanes, multi-use paths, or a lack of bicycle parking at the ultimate destination. For this reason, successful TDM implementation requires a united effort and coordination between the City and developers.

Hard measures are physically infrastructure improvements that encourage alternative modes of travel and mode shifts away from single-occupant vehicles. This can include the provision of bicycle parking or enhanced pedestrian and cyclist facilities on-site including shower and change facilities for employment uses.

Soft measures are programs or policies, such as unbundling or condo units to parking spaces, work-from-home policies, transit subsidies, carpooling assistance etcetera. In many cases, hard and soft measures work together and provide mutual benefit. For instance, transit pass subsidies are soft measures, but when paired with hard measures like improved waiting areas, they can have a greater impact on mode choice.

The Toronto Green Standard (Version 4) requires measures that will support a 25% or greater reduction in single-occupancy vehicle (SOV) trips.

For the subject site, the general context of the area as a mixed-use environment with excellent transit access and future access to the Ontario Line, will have an impact on the potential TDM measures. In fact, the inherent nature of the area and the presence of the Ontario Line and surface transit routes along both roadways adjacent to the development will make this location an excellent candidate to benefit from transit-oriented design and TDM. The area is also well served by the city cycling infrastructure network and should be able to support a higher cycling modal split.

The mixed-use nature of downtown allows for synergy and mixed-use interactions between the proposed residential towers, as well as the ancillary retail at the ground floor, and the surrounding retail-commercial and services that are in the area.

Regardless of the ability for the development to leverage TDM initiatives, the strongest TDM measure will be the fact that both residential towers will have very limited vehicular parking provided. Therefore, nearly all vehicle trips generated by the development will be pick-up/drop-off or taxi/rideshare trips. The occupancy of the buildings will be market-driven, meaning that residents who decide to purchase units in this building will want to be car-free and many will live and work in close proximity, thus relying on transit, walking, and cycling to get around.

5.11.1 Local and Regional Transit Accessibility

As already discussed, there is excellent transit coverage within the vicinity of the site even without the construction of Ontario Line. TTC surface transit is provided in the form of buses along Cosburn Avenue and Pape Avenue (in mixed traffic). Additionally, both of north-south bus routes (Route 25 and Route 81) provide direct access to the Toronto subway system along Line 2 (Pape Avenue Station). Transit stops are located directly at the intersection of Cosburn Avenue and Pape Avenue, and all stops are within 100 metres walking distance from each building.

Pape Avenue subway station is located 1.1 kilometres to the south. With Ontario Line, subway access will be directly accessible by residents from within the building. Residents of the North building will not need to leave the building to access the Ontario Line, and residents of the South building will only need to cross the west leg of the intersection to enter in the North building. Ontario Line riders will be able to transfer at Pape Avenue Station (Pape Avenue just north of Danforth Avenue).

The study area already has a fairly high non-vehicle modal split at 65% non-auto drive and this is expected to increase in general due to the increase in transit availability. The site itself will further benefit and leverage this proximity and access.

5.11.2 Transit Pass Subsidies

Residents and tenants of the buildings may be given transit pass subsidies that will further encourage the use of transit as a primary mode, and will attract those who wish to rely on transit and will utilize the transit passes. The subsidies can be provided in the form of reduced cost passes, or can be provided in the form of subsidies to residents. Details will need to be developed with the developer.

5.11.3 Real-Time Transit Information

Real-time transit service updates may be provided in the lobby area of each residential tower. The real-time displays will include arrival time for the nearest transit stops for each of the primary transit services expected to serve the development. The real-time displays could allow residents to time leaving their buildings to reduce the amount of time standing at each transit stop, thus making transit more attractive. These displays may be located in the residential lobby in the south building or in the transit lobby in the north building where they are likely to be placed regardless.

5.11.4 Pedestrian and Cycling Connections

Both buildings will be directly fronting both Cosburn Avenue and Pape Avenue and will have direct access to these streets. Internally, the residential component of the north condo tower will have access to the transit station lobby area, and there will be no need for residents to leave the building if they are destined to Ontario Line. Those in the south condo tower will only have to cross the west leg of the intersection of Cosburn Avenue and Pape Avenue if they are destined to Ontario Line.

There are dedicated bicycle lanes eastbound and westbound along Cosburn Avenue, while Pape Avenue has signs indicating a peak hour shared/HOV vehicle and bicycle lane in the northbound and southbound directions. The City's broader cycling network can be accessed from these roadways.

Bicycles are also allowed on the TTC subway system (subway and buses) outside of peak periods. Residents will be able to bring their bicycles on the subway and use them to complete the last leg of their trips, if it is conducive to their needs.

5.11.5 Bicycle Parking

The building will be equipped with long-term bicycle parking that will be available to all residents. Long-term bicycle parking ensures that residents are encouraged to own bicycles in the first place by providing them with easily accessible, secure and sheltered bicycle parking. A portion of the long-term bicycle parking can be utilized as short-term bicycle parking for visitors. The bicycle parking will be placed in safe, well lit, accessible areas at ground level. This will encourage visitors to feel cycling is a viable option.

Bikeshare is also available within the general area. There is a bikeshare station within walking distance (as discussed in **Section 5.8**), which amounts to a total bike share availability of 18 spaces within 200 metres. These will also be available for use by residents and visitors if they use the bikeshare services. Bikeshare spaces are considered usable if they are occupied or empty, as they can be used by residents or visitors when leaving the site (bicycle is available) or when returning (there is a free "dock").

5.11.6 Unbundled Resident Parking

Bundling parking spaces with unit sales, whether intended or not intended, results in the building being marketed to drivers and vehicle owners. For those who do not own vehicles and do not wish to own a parking space, these hidden costs are forced on them and at the very least result in unwanted effort required to rent out and seek a renter for the parking space in an effort to recuperate lost money.

Therefore, unbundling further benefits the developer as well as the community because the building will automatically be marketed to and attract those who do not drive as a primary form of transportation. This theoretically reduces parking requirements for the building, reduces the amount of congestion on the surrounding road network, and allows for more efficient site design and use of the transportation network.

Unbundled parking could lead to a potential 10% to the residential parking rates.[8] Therefore, removing vehicle parking altogether is likely to have an even greater impact on the tenantry, as owning a vehicle and parking on site will not be viable. The building will be marketed and will find most interest from those who do not and have no interest in owning vehicles.

5.11.7 Car-Share Services

Car-share services are an effective way to reduce auto dependency and parking needs for both residential and non-residential developments, by providing vehicles that can be used by residents and tenants on an as-needed basis. The result is that the development will attract those who do not own vehicles and typically rely on alternative forms of transportation, thus

[8] https://www.vtpi.org/park_man.pdf

reducing the number of parking spaces required on site and attracting residents and tenants that will generally produce fewer vehicle trips, but will still occasionally require a vehicle.

For some development proposals, the City of Toronto has accepted proposals that suggest that for each car-share parking space provided on site, the development will be able to reduce the parking supply by 3 parking spaces. This is another example of the City accepting TDM measures to reduce the parking supply.

There will be six and ten carshares available at the North and South sites, respectively. Providing one to two spaces at each site will allow occasional drivers access to vehicles.

5.11.8 Summary of Transportation Demand Management

The following summarizes the measures that will support a 15% or greater reduction in single occupancy vehicle (SOV) trips as required by the Toronto Green Standard (Version 4):

- **Direct access to Ontario Line** from within the North building;
- Transit passes or subsidies provided to all residents of the building including the commercial-retail components;
- Proximity to surface transit routes along Cosburn Avenue and Pape Avenue;
- Real-time transit information;
- Location in a mixed-use city environment to promote walking trips;
- Availability carshare services; and,
- Unbundled resident parking due to no vehicle parking provision.

6 Conclusions and Recommendations

6.1 Traffic Forecasts

The Ontario Line Cosburn Station is estimated to add 2,733 walking and transit trips to the intersection. The proposed developments (North and South Sites) will add a combined total of 523 and 672 total all modes trips for the AM and PM peak hours, respectively, with a majority of these trips being pedestrian and surface transit trips destined to/from the station. The TOC's contribution to total traffic volumes is presented in **Table 29**.

Table 29: Cosburn TOC Transportation Contribution at Cosburn / Pape Intersection

Period	Pedestrian Volumes	Traffic Volume	Bicycle Volumes
AM Peak Hour	8.2%	1.6%	61.7%
PM Peak Hour	8.7%	3.7%	66.9%

The TOC will contribute less than 3.7% to total vehicle traffic volumes at the intersection under 2032 total traffic conditions. Comparatively, the TOC will generate many more pedestrian and bicycle trips as a proportion of the total intersection volume which includes pedestrians on the crosswalks and cyclists riding within the curb lane. Up to 8.7% of total pedestrian traffic will be TOC related, and up to 66.9% of total cyclist traffic will be TOC related. This is reasonable considering the TOC will drive this area to be much less vehicle-dependent and encourage active transportation.

The station contribution of total traffic volumes at the study intersection is summarized in **Table 30**Table 30. The station itself will account for approximately 70% and 60% of all the pedestrian traffic at the study intersection in the AM and PM peak hours, respectively. The west leg will carry the largest number of pedestrians – up to approximately 1,770 per hour, of which the station accounts for 1,200 per hour. The total hourly intersection pedestrian crossing volume will be in the range of 4,500 people.

Table 30: Cosburn Station Transportation Contribution at Cosburn / Pape Intersection

Period	Pedestrian Volumes
AM Peak Hour	69.7%
PM Peak Hour	59.3%

6.2 Traffic Capacity and Operations

Under existing conditions and future background conditions the study intersection is operating within acceptable thresholds and there is capacity to accommodate further traffic and non-vehicle demand growth beyond the TOC development with the inclusion of traffic generated by Ontario Line.

Under future total traffic conditions, the study intersection will continue to operate with residual capacity. The eastbound and westbound left-turn lanes have 95^{th} percentile queues which will occasionally extend beyond the available storage length by approximately two car lengths. There may be opportunities to repaint the available storage to provide more storage but this would require reducing the available parallel parking along Cosburn Avenue.

Sensitivity testing was performed to confirm that pedestrian conflicts have a marginal impact on the vehicle operations. Additionally, even if the southbound left-turn is restricted and if the eastbound and westbound approaches are reduced to single lane approaches due to potential configuration changes to support the station, the intersection will still be operating within acceptable thresholds assuming the timings are optimized according to traffic demand.

The analysis demonstrates that the TOC will have marginal impacts on traffic operations.

1.1.1 Recommended Mitigation Measures

Based on the anticipated eastbound and westbound left-turn queues, it is recommended that the queues be monitored and that storage length be extended, if feasible, to accommodate queues and prevent turn queues from blocking the adjacent through lanes. However, if the introduction of the cycle track and relocation of the westbound bus stop to the far-side stop on the west leg of the intersection then the eastbound and westbound approaches will be reduced to single lane approaches. These mitigation measures are tied to the proposed Cosburn Station and not to the TOC.

Detailed impacts and potential mitigation measures have been explored through the report **Ontario Line Cosburn Station Transportation Impact Study (Ontario Line Technical Advisor, January 28, 2022)**. The report is being updated in parallel to this study.

Due to the large number of pedestrian trips generated by the station, the Cosburn Station TIS study includes a multi-modal level of service analysis following the City of Ottawa MMLOS, methodology which focuses on available infrastructure, as well as the Fruin pedestrian level of service analysis methodology, through static calculations at the sidewalks and transit waiting areas, to determine potential hotspots. The analysis in the Station TIS Study was performed using 2041 station transfer volumes, and therefore is indicative of the potential impacts from the continuing growth of pedestrians related to the station. The pedestrian traffic generated by the TOC will be using the station, however, that pedestrian traffic will remain relatively constant after 100% occupancy, and a minor component of the overall station demand.

Some options for localized improvements were discussed for consideration, such as increasing sidewalk widths or increasing sidewalk areas by removing street furniture, as well as widening crosswalk widths or providing "intersection bulbs" where feasible. The opportunity to relocate the northbound and westbound surface bus stops to far-side stops is also under consideration. However, in light of the existing urban context and constraints in the study area, there were limited opportunities for infrastructure improvements and substantial mitigation measures. Additional recommendations included the need for monitoring pedestrian demand levels after the station is open and operating.

6.3 Transit

In addition to vehicular trips, transit demand was generated using the person trips method. Transit demand generated by the subject development was distributed onto the surrounding transit network, and to the future Ontario Line Cosburn Station and has accounted for future passenger transfers between Ontario Line and existing surface transit, as well as walk-in trips to Ontario Line, under future background traffic conditions.

6.4 Parking

The vehicular parking requirements based on By-law 569-2013 are 310 and 346 for the North and South Sites, respectively, but the sites propose 6 and 8 shared parking spaces for visitors to the residential and retail components. However, this by-law is not in-force as of November 2022 and the vehicle parking requirements have been replaced by By-law 89-2022. Based on By-law 89-2022, which eliminated minimum parking rates for most land uses in the City, visitor parking should be at least 17 for the north site, and 18 for the south site, respectively and there is a parking deficiency of 11 and 10 for the north and south sites, respectively. In terms of accessible parking, the deficiency is 7 spaces and 9 spaces for the north and south sites, respectively. The deficiency is a result of the constrained site area.

The buildings will be marketed to those who do not own vehicles and wish to rely on other alternative modes of travel. Residents who do wish to own vehicles rent their own private parking spaces from nearby lots or from other condominium owners who have spaces but do not use them. There are several websites that provide listings of available rental and sublet agreements of privately owned parking spaces. This will always remain an option for residents and allows for efficient use of the existing supply that may otherwise be underutilized.

The bicycle parking requirements based on By-law 569-2013 are 300 and 322 for the North and South Sites, respectively. The bicycle parking provided at both sites is in surplus compared to the requirement and will serve all anticipated needs, and may be reallocated to retail visitors or short-term residential visitors depending on the observed demand for residential long-term bicycle parking.

6.5 Loading

The loading configuration will be in compliance for the north site and short one Type 'B' loading space for the south site, but both sites will be equipped with a single Type 'G' loading space. The retail components of each site will need to coordinate with the residential component to ensure that the loading space is not double booked. The swept path analysis has been shown for both northbound-only and southbound-only operations due to the narrow width of the driveway. The direction of the laneway will be determined based on the station plaza design and the location of the Wheel-Trans spot.

Appendix A:

Signal Timing

LOCATION:	**Pape Ave & Cosburn Ave**	*DISTRICT:*	**Toronto & East York**
MODE/COMMENT:	**FXT with 2-Wire Polara APS & LPI**	*COMPUTER SYSTEM:*	**TransSuite**
TCS:	**669**	*CONTROLLER/CABINET TYPE:*	**Peek ATC-1000 / TS2T1**
PREPARED/CHECKED BY:	**Parsons/MR**	*CONFLICT FLASH:*	**Red & Red**
PREPARATION DATE:	**September 11, 2018**	*DESIGN WALK SPEED:*	**1.0 m/s (FDW based on full crossing at 1.2 m/s)**
IMPLEMENTATION DATE:	**September 20, 2018**	*CHANNEL/DROP:*	**5002/04**
		CONTROLLER FIRMWARE:	**3.018.1.2976**

N ↑

NEMA Phase			OFF All Other Times	AM 06:30-09:30 M-F	PM 15:00-19:00 M-F	NGHT 23:00-6:30 Daily	WKND 10:00-19:00 Sat & Sun	DVP Closure	Phase Mode (Fixed/Demanded or Callable)	Remarks
	Local Plan		Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 5	Pattern 16		
	Split Table		Split 1	Split 2	Split 3	Split 4	Split 5	Split 16		
1 NOT USED	WLK									Pedestrian Minimums: EWWK = 7 sec, EWFD = 13 sec; NSWK = 7 sec, NSFD = 12 sec
	FDW									APS on during full NSWK & EWWK when activated by push buttons
	MIN									Extended Push Activation = 3 secs
	MAX1									NS Leading Pedestrian Interval - NSWK comes up 5 seconds before NS vehicle green.
	AMB									
	ALR									
	SPLIT									
2 Pape Ave.	WLK DLY	5							Fixed	
	WLK	7							Split shown includes 5 sec of NS LPI	
	FDW	12								
	MIN	14								
	MAX1	37								
	AMB	3								
	ALR	3								
	SPLIT		43	53	53	43	43	50		
3 NOT USED	WLK									
	FDW									
	MIN									
	MAX1									
	AMB									
	ALR									
	SPLIT									
4 Cosburn Ave.	WLK	7							Fixed	
	FDW	13								
	MIN	20								
	MAX1	21								
	AMB	4								
	ALR	2								
	SPLIT		27	27	27	27	27	30		
5 NOT USED	WLK									
	FDW									
	MIN									
	MAX1									
	AMB									
	ALR									
	SPLIT									
6 Pape Ave.	WLK DLY	5							Fixed	
	WLK	7							Split shown includes 5 sec of NS LPI	
	FDW	12								
	MIN	14								
	MAX1	37								
	AMB	3								
	ALR	3								
	SPLIT		43	53	53	43	43	50		
7 NOT USED	WLK									
	FDW									
	MIN									
	MAX									
	AMB									
	ALR									
	SPLIT									
8 Cosburn Ave.	WLK	7							Fixed	
	FDW	13								
	MIN	20								
	MAX1	21								
	AMB	4								
	ALR	2								
	SPLIT		27	27	27	27	27	30		
	CL		70	80	80	70	70	80		
	OF		68	60	63	19	67	22		

NOTES:

Appendix B:

Synchro Output

(HCM 2000 Report and Queues Report)

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	55	171	139	293	545	568
v/c Ratio	0.32	0.40	0.55	0.67	0.36	0.38
Control Delay	28.9	25.0	33.8	33.0	8.2	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.9	25.0	33.8	33.0	8.2	8.7
Queue Length 50th (m)	6.6	19.4	17.8	37.7	21.6	24.0
Queue Length 95th (m)	16.7	36.4	35.9	63.9	32.4	35.3
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	173	432	255	440	1494	1489
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.40	0.55	0.67	0.36	0.38

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	136	23	129	231	42	9	421	76	25	465	38
Future Volume (vph)	51	136	23	129	231	42	9	421	76	25	465	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.96		1.00	0.96			0.94			0.96	
Flpb, ped/bikes	0.85	1.00		0.82	1.00			1.00			0.99	
Frt	1.00	0.98		1.00	0.98			0.98			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1439	1509		1427	1539			2588			2683	
Flt Permitted	0.41	1.00		0.60	1.00			0.94			0.91	
Satd. Flow (perm)	619	1509		908	1539			2443			2448	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	55	146	25	139	248	45	10	453	82	27	500	41
RTOR Reduction (vph)	0	8	0	0	8	0	0	14	0	0	6	0
Lane Group Flow (vph)	55	163	0	139	285	0	0	531	0	0	562	0
Confl. Peds. (#/hr)	205		178	178		205	243		163	163		243
Confl. Bikes (#/hr)			5			2			4			5
Heavy Vehicles (%)	8%	8%	8%	5%	5%	5%	9%	9%	9%	8%	8%	8%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.5	22.5		22.5	22.5			48.5			48.5	
Effective Green, g (s)	22.5	22.5		22.5	22.5			48.5			48.5	
Actuated g/C Ratio	0.28	0.28		0.28	0.28			0.61			0.61	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	174	424		255	432			1481			1484	
v/s Ratio Prot		0.11			c0.19							
v/s Ratio Perm	0.09			0.15				0.22			c0.23	
v/c Ratio	0.32	0.38		0.55	0.66			0.36			0.38	
Uniform Delay, d1	22.7	23.2		24.4	25.4			7.9			8.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	4.7	2.6		8.1	7.7			0.7			0.7	
Delay (s)	27.4	25.8		32.5	33.1			8.6			8.8	
Level of Service	C	C		C	C			A			A	
Approach Delay (s)		26.2			32.9			8.6			8.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	72	320	95	151	625	605
v/c Ratio	0.29	0.71	0.59	0.36	0.44	0.42
Control Delay	26.4	35.5	42.9	22.2	9.3	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	35.5	42.9	22.2	9.3	9.2
Queue Length 50th (m)	8.5	42.3	12.4	15.3	27.7	26.6
Queue Length 95th (m)	19.5	#76.2	#33.0	30.7	40.6	38.8
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	250	449	160	425	1436	1456
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.71	0.59	0.36	0.44	0.42

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	267	40	91	106	39	22	469	108	42	507	32
Future Volume (vph)	69	267	40	91	106	39	22	469	108	42	507	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.96		1.00	0.91			0.91			0.97	
Flpb, ped/bikes	0.75	1.00		0.84	1.00			0.99			0.99	
Frt	1.00	0.98		1.00	0.96			0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1326	1576		1476	1454			2565			2764	
Flt Permitted	0.64	1.00		0.37	1.00			0.92			0.86	
Satd. Flow (perm)	891	1576		570	1454			2359			2393	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	72	278	42	95	110	41	23	489	112	44	528	33
RTOR Reduction (vph)	0	6	0	0	17	0	0	6	0	0	4	0
Lane Group Flow (vph)	72	314	0	95	134	0	0	619	0	0	601	0
Confl. Peds. (#/hr)	290		293	293		290	388		220	220		388
Confl. Bikes (#/hr)			2			6			2			2
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	5%	5%	5%	5%	5%	5%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.5	22.5		22.5	22.5			48.5			48.5	
Effective Green, g (s)	22.5	22.5		22.5	22.5			48.5			48.5	
Actuated g/C Ratio	0.28	0.28		0.28	0.28			0.61			0.61	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	250	443		160	408			1430			1450	
v/s Ratio Prot		c0.20			0.09							
v/s Ratio Perm	0.08			0.17				c0.26			0.25	
v/c Ratio	0.29	0.71		0.59	0.33			0.43			0.41	
Uniform Delay, d1	22.5	25.8		24.8	22.8			8.4			8.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.9	9.2		15.2	2.2			1.0			0.9	
Delay (s)	25.4	35.0		40.0	24.9			9.4			9.2	
Level of Service	C	C		D	C			A			A	
Approach Delay (s)		33.2			30.7			9.4			9.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	65	199	158	332	616	642
v/c Ratio	0.27	0.33	0.48	0.54	0.57	0.60
Control Delay	18.9	17.6	23.1	20.7	17.7	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	17.6	23.1	20.7	17.7	18.6
Queue Length 50th (m)	6.3	19.7	16.9	35.3	39.7	42.9
Queue Length 95th (m)	15.6	35.0	34.6	59.3	58.3	62.6
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	245	610	328	620	1081	1076
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.33	0.48	0.54	0.57	0.60

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	155	30	147	259	50	14	470	89	33	519	46
Future Volume (vph)	60	155	30	147	259	50	14	470	89	33	519	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.93		1.00	0.91			0.90			0.93	
Flpb, ped/bikes	0.72	1.00		0.70	1.00			0.99			0.99	
Frt	1.00	0.98		1.00	0.98			0.98			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1211	1459		1223	1465			2458			2582	
Flt Permitted	0.46	1.00		0.61	1.00			0.93			0.89	
Satd. Flow (perm)	586	1459		783	1465			2293			2297	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	167	32	158	278	54	15	505	96	35	558	49
RTOR Reduction (vph)	0	0	0	0	7	0	0	6	0	0	0	0
Lane Group Flow (vph)	65	199	0	158	325	0	0	610	0	0	642	0
Confl. Peds. (#/hr)	1227		620	620		1227	1465		523	523		1465
Confl. Bikes (#/hr)			13			8			10			13
Heavy Vehicles (%)	8%	8%	8%	5%	5%	5%	9%	9%	9%	8%	8%	8%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	33.5	33.5		33.5	33.5			37.5			37.5	
Effective Green, g (s)	33.5	33.5		33.5	33.5			37.5			37.5	
Actuated g/C Ratio	0.42	0.42		0.42	0.42			0.47			0.47	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	245	610		327	613			1074			1076	
v/s Ratio Prot		0.14			c0.22							
v/s Ratio Perm	0.11			0.20				0.27			c0.28	
v/c Ratio	0.27	0.33		0.48	0.53			0.57			0.60	
Uniform Delay, d1	15.2	15.7		16.9	17.4			15.4			15.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.6	1.4		5.0	3.3			2.2			2.4	
Delay (s)	17.8	17.1		22.0	20.6			17.6			18.1	
Level of Service	B	B		C	C			B			B	
Approach Delay (s)		17.3			21.1			17.6			18.1	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	83	364	110	175	703	683
v/c Ratio	0.32	0.62	0.48	0.34	0.62	0.60
Control Delay	21.7	25.6	27.5	18.7	17.2	16.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.7	25.6	27.5	18.7	17.2	16.8
Queue Length 50th (m)	8.7	43.8	12.4	17.2	45.1	43.3
Queue Length 95th (m)	20.1	71.5	28.2	32.3	66.0	63.2
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	262	590	228	521	1127	1138
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.62	0.48	0.34	0.62	0.60

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	300	49	106	121	47	28	523	124	51	565	39
Future Volume (vph)	80	300	49	106	121	47	28	523	124	51	565	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.94		1.00	0.85			0.88			0.95	
Flpb, ped/bikes	0.59	1.00		0.81	1.00			0.99			0.98	
Frt	1.00	0.98		1.00	0.96			0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1039	1549		1421	1351			2465			2685	
Flt Permitted	0.63	1.00		0.40	1.00			0.90			0.83	
Satd. Flow (perm)	688	1549		599	1351			2226			2248	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	83	312	51	110	126	49	29	545	129	53	589	41
RTOR Reduction (vph)	0	0	0	0	7	0	0	2	0	0	0	0
Lane Group Flow (vph)	83	364	0	110	168	0	0	701	0	0	683	0
Confl. Peds. (#/hr)	1399		623	623		1399	1494		582	852		1494
Confl. Bikes (#/hr)			9			13			8			9
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	5%	5%	5%	5%	5%	5%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Effective Green, g (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Actuated g/C Ratio	0.38	0.38		0.38	0.38			0.51			0.51	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	262	590		228	515			1126			1138	
v/s Ratio Prot		c0.24			0.12							
v/s Ratio Perm	0.12			0.18				c0.31			0.30	
v/c Ratio	0.32	0.62		0.48	0.33			0.62			0.60	
Uniform Delay, d1	17.4	20.0		18.8	17.5			14.2			14.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	3.2	4.8		7.1	1.7			2.6			2.3	
Delay (s)	20.6	24.8		25.9	19.2			16.8			16.4	
Level of Service	C	C		C	B			B			B	
Approach Delay (s)		24.0			21.8			16.8			16.4	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	65	204	162	340	628	649
v/c Ratio	0.26	0.33	0.49	0.53	0.62	0.62
Control Delay	18.0	16.9	22.6	20.2	19.5	19.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	16.9	22.6	20.2	19.5	19.7
Queue Length 50th (m)	6.1	19.8	17.1	35.9	42.6	44.8
Queue Length 95th (m)	15.2	35.1	35.1	60.0	62.9	65.2
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	253	627	332	638	1020	1048
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.33	0.49	0.53	0.62	0.62

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	159	31	151	266	50	21	471	92	33	525	46
Future Volume (vph)	60	159	31	151	266	50	21	471	92	33	525	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.93		1.00	0.91			0.90			0.93	
Flpb, ped/bikes	0.72	1.00		0.69	1.00			0.99			0.99	
Frt	1.00	0.98		1.00	0.98			0.98			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1217	1453		1207	1469			2437			2585	
Flt Permitted	0.46	1.00		0.61	1.00			0.91			0.89	
Satd. Flow (perm)	587	1453		770	1469			2230			2297	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	171	33	162	286	54	23	506	99	35	565	49
RTOR Reduction (vph)	0	0	0	0	5	0	0	4	0	0	0	0
Lane Group Flow (vph)	65	204	0	162	335	0	0	624	0	0	649	0
Confl. Peds. (#/hr)	1272		680	680		1272	1669		555	555		1669
Confl. Bikes (#/hr)			32			25			22			36
Heavy Vehicles (%)	8%	8%	8%	5%	5%	5%	9%	9%	9%	8%	8%	8%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			36.5			36.5	
Effective Green, g (s)	34.5	34.5		34.5	34.5			36.5			36.5	
Actuated g/C Ratio	0.43	0.43		0.43	0.43			0.46			0.46	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	253	626		332	633			1017			1048	
v/s Ratio Prot		0.14			c0.23							
v/s Ratio Perm	0.11			0.21				0.28			c0.28	
v/c Ratio	0.26	0.33		0.49	0.53			0.61			0.62	
Uniform Delay, d1	14.6	15.1		16.4	16.8			16.4			16.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.4	1.4		5.1	3.2			2.8			2.7	
Delay (s)	17.0	16.4		21.4	19.9			19.2			19.2	
Level of Service	B	B		C	B			B			B	
Approach Delay (s)		16.6			20.4			19.2			19.2	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	86	377	119	185	730	701
v/c Ratio	0.33	0.64	0.54	0.35	0.68	0.62
Control Delay	22.0	26.4	30.4	19.2	19.0	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	26.4	30.4	19.2	19.0	17.2
Queue Length 50th (m)	9.1	45.9	13.8	18.6	49.2	45.1
Queue Length 95th (m)	20.7	74.8	31.5	34.4	72.8	65.8
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	261	586	220	526	1067	1132
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.64	0.54	0.35	0.68	0.62

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	309	53	114	131	47	43	529	129	51	579	43
Future Volume (vph)	83	309	53	114	131	47	43	529	129	51	579	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.94		1.00	0.86			0.87			0.94	
Flpb, ped/bikes	0.60	1.00		0.81	1.00			0.98			0.99	
Frt	1.00	0.98		1.00	0.96			0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1056	1539		1422	1367			2442			2683	
Flt Permitted	0.62	1.00		0.39	1.00			0.86			0.83	
Satd. Flow (perm)	685	1539		578	1367			2107			2239	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	86	322	55	119	136	49	45	551	134	53	603	45
RTOR Reduction (vph)	0	0	0	0	6	0	0	1	0	0	0	0
Lane Group Flow (vph)	86	377	0	119	179	0	0	729	0	0	701	0
Confl. Peds. (#/hr)	1434		678	678		1434	1770		609	609		1770
Confl. Bikes (#/hr)			39			29			21			29
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	5%	5%	5%	5%	5%	5%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Effective Green, g (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Actuated g/C Ratio	0.38	0.38		0.38	0.38			0.51			0.51	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	261	586		220	521			1066			1133	
v/s Ratio Prot		c0.25			0.13							
v/s Ratio Perm	0.13			0.21				c0.35			0.31	
v/c Ratio	0.33	0.64		0.54	0.34			0.68			0.62	
Uniform Delay, d1	17.5	20.3		19.3	17.6			14.9			14.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	3.4	5.4		9.2	1.8			3.6			2.5	
Delay (s)	20.9	25.7		28.5	19.4			18.5			16.7	
Level of Service	C	C		C	B			B			B	
Approach Delay (s)		24.8			23.0			18.5			16.7	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	65	204	162	340	628	649
v/c Ratio	0.26	0.33	0.56	0.54	0.65	0.62
Control Delay	18.0	17.0	26.1	20.8	20.6	19.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	17.0	26.1	20.8	20.6	19.8
Queue Length 50th (m)	6.1	19.9	17.8	36.9	44.0	44.8
Queue Length 95th (m)	15.2	35.3	38.1	61.2	65.3	65.4
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	253	614	290	633	973	1042
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.33	0.56	0.54	0.65	0.62

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	159	31	151	266	50	21	471	92	33	525	46
Future Volume (vph)	60	159	31	151	266	50	21	471	92	33	525	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.91		1.00	0.91			0.86			0.93	
Flpb, ped/bikes	0.72	1.00		0.61	1.00			0.99			0.98	
Frt	1.00	0.98		1.00	0.98			0.98			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1217	1425		1057	1469			2332			2573	
Flt Permitted	0.46	1.00		0.61	1.00			0.91			0.89	
Satd. Flow (perm)	587	1425		674	1469			2134			2287	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	171	33	162	286	54	23	506	99	35	565	49
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	204	0	162	340	0	0	628	0	0	649	0
Confl. Peds. (#/hr)	3000		3000	3000		3000	3000		3000	3000		3000
Confl. Bikes (#/hr)			32			25			22			36
Heavy Vehicles (%)	8%	8%	8%	5%	5%	5%	9%	9%	9%	8%	8%	8%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			36.5			36.5	
Effective Green, g (s)	34.5	34.5		34.5	34.5			36.5			36.5	
Actuated g/C Ratio	0.43	0.43		0.43	0.43			0.46			0.46	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	253	614		290	633			973			1043	
v/s Ratio Prot		0.14			0.23							
v/s Ratio Perm	0.11			c0.24				c0.29			0.28	
v/c Ratio	0.26	0.33		0.56	0.54			0.65			0.62	
Uniform Delay, d1	14.6	15.1		17.0	16.8			16.8			16.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.4	1.5		7.6	3.2			3.3			2.8	
Delay (s)	17.0	16.6		24.6	20.1			20.1			19.3	
Level of Service	B	B		C	C			C			B	
Approach Delay (s)		16.7			21.5			20.1			19.3	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	86	377	119	185	730	701
v/c Ratio	0.33	0.65	0.58	0.36	0.72	0.62
Control Delay	22.0	26.9	33.5	20.2	20.3	17.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	26.9	33.5	20.2	20.3	17.3
Queue Length 50th (m)	9.1	46.1	14.0	19.7	50.7	45.2
Queue Length 95th (m)	20.7	75.4	#36.0	35.6	75.8	66.1
Internal Link Dist (m)		102.9		89.4	70.5	70.6
Turn Bay Length (m)	15.0		15.0			
Base Capacity (vph)	261	576	205	521	1016	1126
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.65	0.58	0.36	0.72	0.62

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	309	53	114	131	47	43	529	129	51	579	43
Future Volume (vph)	83	309	53	114	131	47	43	529	129	51	579	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00		1.00	1.00			*0.80			*0.80	
Frpb, ped/bikes	1.00	0.92		1.00	0.86			0.83			0.94	
Flpb, ped/bikes	0.60	1.00		0.76	1.00			0.98			0.98	
Frt	1.00	0.98		1.00	0.96			0.97			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1056	1512		1328	1367			2329			2670	
Flt Permitted	0.62	1.00		0.39	1.00			0.86			0.83	
Satd. Flow (perm)	685	1512		539	1367			2010			2229	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	86	322	55	119	136	49	45	551	134	53	603	45
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	86	377	0	119	185	0	0	730	0	0	701	0
Confl. Peds. (#/hr)	3000		3000	3000		3000	3000		3000	3000		3000
Confl. Bikes (#/hr)			39			29			21			29
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	5%	5%	5%	5%	5%	5%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Effective Green, g (s)	30.5	30.5		30.5	30.5			40.5			40.5	
Actuated g/C Ratio	0.38	0.38		0.38	0.38			0.51			0.51	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	261	576		205	521			1017			1128	
v/s Ratio Prot		c0.25			0.14							
v/s Ratio Perm	0.13			0.22				c0.36			0.31	
v/c Ratio	0.33	0.65		0.58	0.36			0.72			0.62	
Uniform Delay, d1	17.5	20.4		19.7	17.7			15.3			14.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	3.4	5.7		11.5	1.9			4.4			2.6	
Delay (s)	20.9	26.1		31.1	19.6			19.7			16.8	
Level of Service	C	C		C	B			B			B	
Approach Delay (s)		25.1			24.1			19.7			16.8	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	269	502	628	649
v/c Ratio	0.45	0.88	0.80	0.67
Control Delay	15.2	36.9	32.1	25.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	15.2	36.9	32.1	25.4
Queue Length 50th (m)	24.2	63.4	52.3	50.7
Queue Length 95th (m)	43.1	#124.7	#84.8	72.1
Internal Link Dist (m)	102.9	89.4	70.5	70.6
Turn Bay Length (m)				
Base Capacity (vph)	594	571	785	966
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.45	0.88	0.80	0.67

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	159	31	151	266	50	21	471	92	0	558	46
Future Volume (vph)	60	159	31	151	266	50	21	471	92	0	558	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		1.00			1.00			*0.80			*0.80	
Frpb, ped/bikes		0.93			0.94			0.86			0.93	
Flpb, ped/bikes		0.95			0.89			0.99			1.00	
Frt		0.98			0.99			0.98			0.99	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1383			1345			2334			2621	
Flt Permitted		0.82			0.81			0.91			1.00	
Satd. Flow (perm)		1146			1101			2131			2621	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	171	33	162	286	54	23	506	99	0	600	49
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	269	0	0	502	0	0	628	0	0	649	0
Confl. Peds. (#/hr)	3000		3000	3000		3000	3000		3000	3000		3000
Confl. Bikes (#/hr)			32			25			22			36
Heavy Vehicles (%)	8%	8%	8%	5%	5%	5%	9%	9%	9%	8%	8%	8%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		41.5			41.5			29.5			29.5	
Effective Green, g (s)		41.5			41.5			29.5			29.5	
Actuated g/C Ratio		0.52			0.52			0.37			0.37	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		594			571			785			966	
v/s Ratio Prot											0.25	
v/s Ratio Perm		0.23			c0.46			c0.29				
v/c Ratio		0.45			0.88			0.80			0.67	
Uniform Delay, d1		12.1			17.0			22.6			21.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		2.5			17.4			8.4			3.7	
Delay (s)		14.6			34.4			31.0			24.9	
Level of Service		B			C			C			C	
Approach Delay (s)		14.6			34.4			31.0			24.9	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	463	304	730	701
v/c Ratio	0.83	0.78	0.80	0.56
Control Delay	35.3	35.7	26.8	18.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	35.3	35.7	26.8	18.1
Queue Length 50th (m)	60.1	38.0	56.8	46.7
Queue Length 95th (m)	#112.4	#80.1	#86.6	65.7
Internal Link Dist (m)	102.9	89.4	70.5	70.6
Turn Bay Length (m)				
Base Capacity (vph)	559	392	915	1245
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.83	0.78	0.80	0.56

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	309	53	114	131	47	43	529	129	0	630	43
Future Volume (vph)	83	309	53	114	131	47	43	529	129	0	630	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		1.00			1.00			*0.80			*0.80	
Frpb, ped/bikes		0.94			0.91			0.83			0.94	
Flpb, ped/bikes		0.95			0.92			0.98			1.00	
Frt		0.98			0.98			0.97			0.99	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1450			1346			2331			2731	
Flt Permitted		0.89			0.66			0.86			1.00	
Satd. Flow (perm)		1298			911			2008			2731	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	86	322	55	119	136	49	45	551	134	0	656	45
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	463	0	0	304	0	0	730	0	0	701	0
Confl. Peds. (#/hr)	3000		3000	3000		3000	3000		3000	3000		3000
Confl. Bikes (#/hr)			39			29			21			29
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	5%	5%	5%	5%	5%	5%
Parking (#/hr)		0	0		0	0						
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		34.5			34.5			36.5			36.5	
Effective Green, g (s)		34.5			34.5			36.5			36.5	
Actuated g/C Ratio		0.43			0.43			0.46			0.46	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		559			392			916			1246	
v/s Ratio Prot											0.26	
v/s Ratio Perm		c0.36			0.33			c0.36				
v/c Ratio		0.83			0.78			0.80			0.56	
Uniform Delay, d1		20.1			19.4			18.6			15.9	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		13.3			13.9			7.2			1.8	
Delay (s)		33.4			33.4			25.7			17.8	
Level of Service		C			C			C			B	
Approach Delay (s)		33.4			33.4			25.7			17.8	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			