APPENDIX F

Existing Conditions Transportation Assessment

GANNETT FLEMING

Existing Conditions Transportation Assessment – Final Report

Stevenson Road North Environmental Assessment (EA) Study – Schedule 'C'

Date: August 23, 2023
Prepared for: City of Oshawa, 50 Centre Street South, Oshawa, ON, L1H 3Z7

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Document Revision History

Rev	Description	Prepared/ Revised By	Reviewed By	Approved By	Date Issued (M/D/Y)
R0	Draft Report	V. Nadanasiva	M. Ismatyar	T. Chow	10/4/2022
R1	Draft Final Report	V. Nadanasiva / A. Sathya	M. Ismatyar	T. Chow	11/15/2022
R2	Final Report	A. Sathya	M. Ismatyar	T. Chow	8/23/2023

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1.0 Introduction

The City of Oshawa ("City") is undertaking a Municipal Class 'Schedule C' Environmental Assessment (EA) study for Stevenson Road North. The purpose of the Class EA is to determine the future needs and justifications based on future land use and anticipate changes in traffic demand as well as identifying the environmental impacts if geometric improvements are deemed appropriate to meet future requirements. The study will also review the need for an east-west Northwood Industrial Area mid-block Type 'C' Arterial from Stevenson Road North to Oshawa/Whitby border or the justification for its removal from the City's Official Plan.

As part of the EA study, an existing conditions transportation assessment was carried out to assess traffic operations and safety of the study corridor, and to identify any operational constraints and potential safety related concerns. This report documents the analysis methodology and results of the existing conditions transportation assessment.

1.1 Study Corridor

The study corridor, Stevenson Road North from Taunton Rd West to Conlin Rd. West, is located within the Northwood Business Park's policy boundary, as shown in **Figure 1**. Currently, Stevenson Road North is a two-lane rural north-south street with a posted speed limit of 50 km/hr. There are currently no paved shoulders or sidewalks provided along the study corridor.

City's Official plan has designated Stevenson Road as a future Type 'C' Arterial, to carry lower traffic volumes with a typical ROW width of 26 to 30m. The Integrated Transportation Master Plan (ITMP, study was last completed in 2015) recommended that Stevenson Road North to be converted from a rural to 2 lane Urban Arterial by 2024.

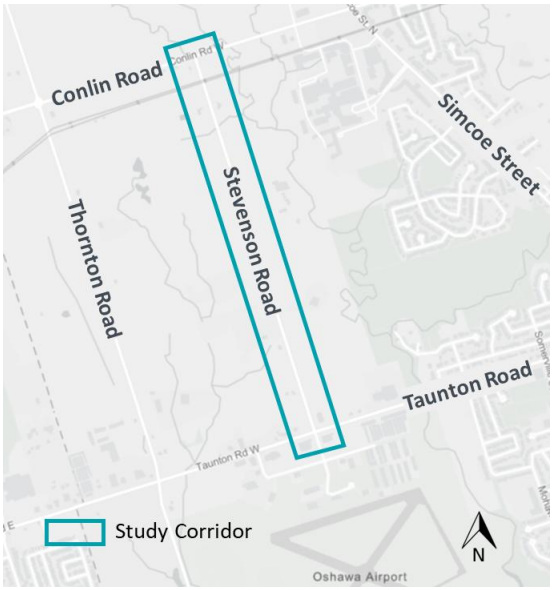

Figure 1: Study Corridor

1.2 Land Use

The land uses along the study corridor consist of commercial and residential uses including single unit family homes, car dealership, community centre, and a banquet hall. There are multiple subdivisions and commercial stores in the adjacent road network in proximity to Stevenson Road North. Moreover, the Durham College/Ontario Tech University Campus is located approximately 500m East of the study corridor.

1.3 Transit

While the study corridor itself is not serviced by Durham Region transit, there are several transit routes servicing the adjacent road network in proximity of Stevenson Road North, as presented in **Figure 2**. The existing bus services along Simcoe Street and Taunton Road provide connection to Whitby Station, Harmony Terminal, and Oshawa City Centre. Taunton Road has route 409, 901, 905, and 920. Simcoe Street is serviced by bus routes 302, 905, 915, and 920. Route Frequency is shown in **Table 1**. There is an eastbound and westbound transit facility located at the intersection of Stevenson Road and Taunton

Road. The westbound bus stop (Stop ID: 832) and the Eastbound bus stop (Stop ID:838) services route 905, 915 and 920. These transit services provide connection to the Durham College/ Ontario Tech University Campus.

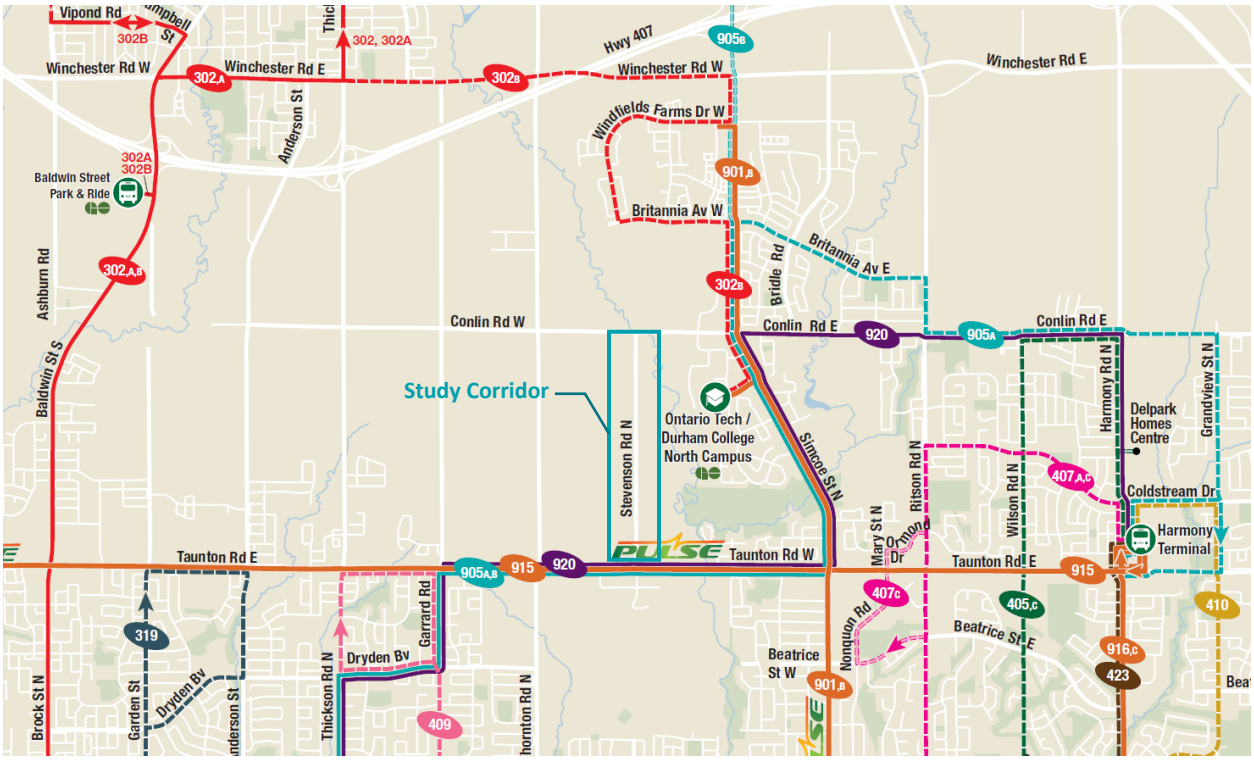

Figure 2: Durham Region Transit Map (Effective September 19, 2022)

Table 1: Transit Route Frequency

Route	Weekday			Saturday / Sunday	
	AM / PM Peak Start – 9:00 I 16:00 – 19:00	Midday 9:00 – 16:00	Evening After 19:00	Daytime Start to 19:00	Evening After 19:00
302	15 min	30 min	30 min	30 min	30 min
409	30 min	30 min	-	-	-
901	10 min	10 min	15-30 min	15 min	15-30 min
905	15-30 min	30 min	30 min	30 min	30 min
915	15 min	15 min	15 min	15 min	30 min
920	15 min	15 min	30 min	-	-

1.4 Active Transportation Network

There are currently no existing sidewalks or bike facilities along the study corridor. At the Stevenson Road and Conlin Road intersection, dedicated bike lanes are currently provided in the east-west directions. There is an existing multi-use path (MUP) along the south side of Taunton Road. This project represents an opportunity to connect the east-west cycling facilities on Taunton Road and Conlin Road.

2.0 Site Observations

A Site Visit was conducted on Wednesday, October 12, 2022, from 10am to 12:30pm. The purpose of the field investigation was to confirm road geometry (vertical and horizontal alignments), signage, delineation, pavement conditions and illumination.

Of note, the west approach of Stevenson Road and Conlin Road intersection was temporary closed for construction during the site visit. As such, Road users were directed to use Stevenson Road as they approach the intersection. Other key site observations are summarized in the following sections.

2.1 Pavement Conditions

The study corridor has a two-lane cross section with unpaved shoulders. A solid yellow centerline runs along the corridor for its entirety. Pavement markings on the travel lanes throughout the corridor were observed to be in poor condition. Cracks in pavement can be seen at sporadic locations along Stevenson Road. Examples of the observed pavement conditions are presented in **Figure 3** and **Figure 4**

Figure 3: Cracks in Pavement on NB Lane, approx. 90m north of Taunton

Figure 4: Cracks and Hole in Pavement on NB Lane, approx. 1.1 km south of Conlin

2.2 Signage

A review of regulatory, warning and guide signs were conducted within the functional area of the study corridor. The signage within the study area were generally found to be in good condition, appropriate and clearly visible to road users. Key signage along Stevenson Road was checked against OTM Book 5, OTM Book 6, and OTM Book 8 for conformance, as summarized below.

- **Regulatory Signage (OTM Book 5)**
  - Stop Sign: Stop sign exists on the south approach at Conlin Road which is a minor-stop controlled. No deficiencies were observed.
  - Speed Control Sign: Posted speed limit signs (maximum 50) are adequate and present. During the desktop review, it was noted a posted speed sign approximately 180m north of Taunton Road for the northbound direction was only *partially* visible due to vegetation based on Google Streetview dated in July 2021 (refer to **Figure 5**). The visibility of the subject sign was reviewed during the site visit conducted in October, and no visibility issues was noted, as shown in **Figure 6**. Vegetation control can be considered to trim any over-extended branches or brushes that may obstruct the sign visibility, especially during the summer.

Figure 5: Posted Speed Sign, approx.180m north of Taunton (Source: Google Streetview, July 2021)

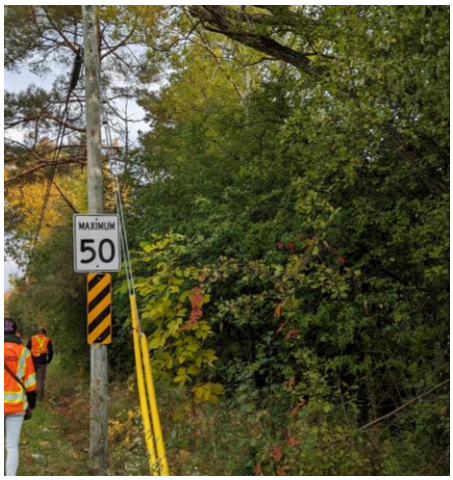

Figure 6: Posted Speed Sign, approx.180m north of Taunton (Source: Site Visit, Oct 12, 2022)

  - No-Parking Sign: No-parking signs exist in the south approaches of Stevenson Road / Taunton Road and Stevenson Road / Conlin Road intersections. These signs were noted to be appropriately placed and no deficiencies were observed.
  - Lane Designation Signs: left turn only, straight through or left turn and right turn only signs were noted at the two study intersections. These signs were noted to be appropriately placed and no deficiencies were observed.

- **Warning Signage (OTM Book 6)**
  - Stop Ahead Sign: This warning signs exist in advance of the stop sign at the Stevenson Road and Conlin intersection. As per OTM Book 6, the Stop Ahead sign is classified as a Condition B warning sign for which a potential or actual stop is required. As such, a minimum advance placement of the warning sign is required. OTM Book 6 states that a Condition B warning sign with a posted (initial) speed of 50 km/hr and a final speed of 0 km/hr must have a minimum advance distance of 140 metres. This condition is met at the Stevenson Road and Conlin intersection.
  - Object Marker Sign: Object maker signs are used to mark hydro poles and signposts throughout the study corridor and intersections. These signs were noted to be appropriately placed and no deficiencies were observed.

- **Cycling Facility (OTM Book 18)**
  - Shared Use Lane / Single File Sign: Multiple Shared Use Lane Single File signs (Wc-24 OTM) with supplementary tabs exist along the study corridor. These signs were noted to be appropriately placed and no deficiencies were observed. These signs are important to alert drivers about the presence of cyclists especially an increased cycling demand is expected due to the temporary road closure west of the Stevenson Road and Conlin Road intersection.

- **Guide Signage (OTM Book 8)**
  - Street Name Sign: Street name signs exist at both intersections and are in good conditions. It was noted that the visibility of the standard-size street name sign at Stevenson and Conlin Road intersection might not be adequate given the large intersection footprint. An Off-Road Low-Speed Roadway Identification sign can be considered on Conlin Road to provide guidance in advance of the intersection.

2.3 Sightlines

A crest vertical curve can be observed within the northern section of the study corridor, as depicted in **Figure 7.** A qualitative review of the sightlines along Stevenson Road and its intersections with driveway accesses were conducted and there were no impediments identified for road users. The sightline at the existing driveway accesses appeared to be adequate approaching this vertical curve. Nevertheless, sight stopping distances should be reviewed for any future driveway accesses along the study corridor to ensure that the required sight distance is provided. Since Stevenson Road is proposed for a design speed of 70km/hr, a minimum stopping sight distance of 105 metres should be provided on crest vertical curves according to Section 3.3.3 of the TAC guideline.

Figure 7: Crest Vertical Curve on Stevenson Rd, Looking North approx. 500m South of Conlin Road

2.4 Streetlighting

It was noted that illumination is provided on the west side in the southern section of the study corridor, from Taunton Road to approximately 1.3km north of the intersection. The northern section of the study corridor is not currently illuminated.

2.5 Traffic Operations

Traffic demand in the southbound direction was observed to be higher than expected compares to historical traffic data. This is likely attributed to the diverted traffic from Conlin Road due to the temporary road closure. No other issues were observed with respect to delays or queues. No excessive driver speeds were observed during the site visit. No pedestrians were observed during the site visit. Two cyclists were observed traveling in the southbound direction.

3.0 Existing Traffic Analysis

This section documents the results of the existing intersection capacity analysis for weekday AM and PM peak hours. The study area for the existing traffic analysis is bound by Thickson Road to the west, Simcoe Street to the east, Conlin Road to the north, and Taunton Road to the south. The study intersections are shown in **Figure 8**.

The intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) methodology published by the Transportation Research Board National Research Council. The Synchro analysis was conducted based on the Region's standards as documented in Chapter 9 of the Design Specifications for Traffic Control Devices, Pavement Marking, Signage and Roadside Protection. The roundabout at Conlin Road and Thornton Road was analyzed using the Junction 10 Software, ARCADY.

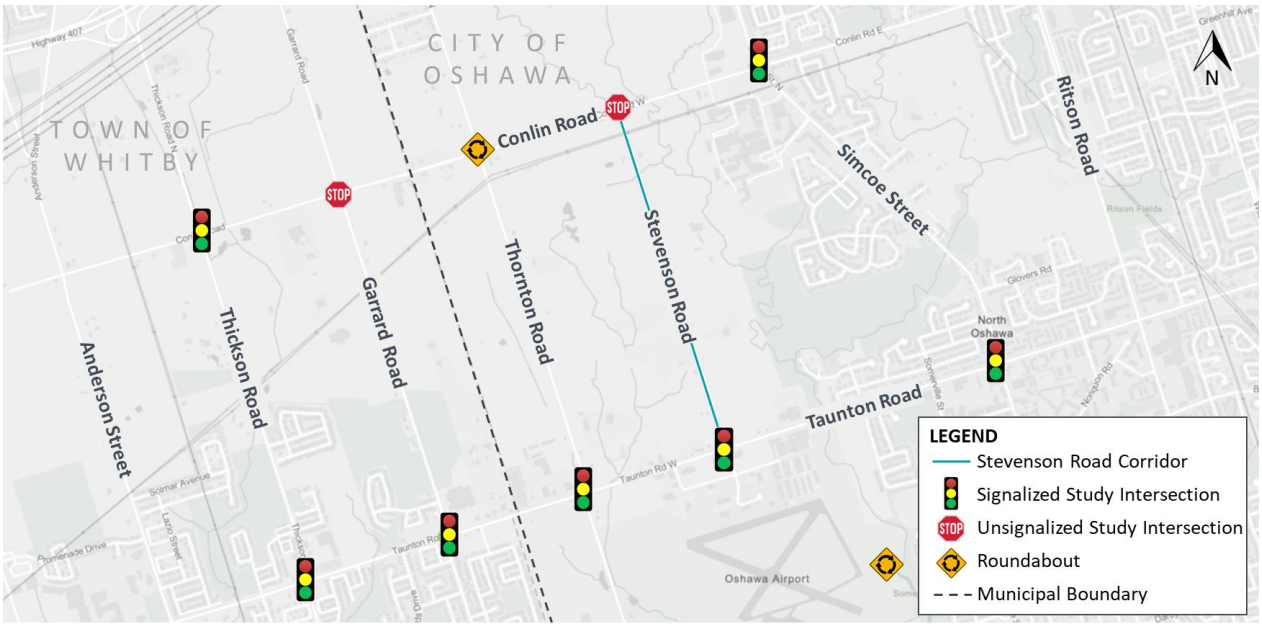

Figure 8. Study Intersections

3.1 Data Collection and Review

TraffMobility obtained existing traffic data from the Region and City, including Turning Movement Counts ("TMCs"), 24-hour Automatic Traffic Recorder ("ATR") data, signal timing plans, and collision data.

3.1.1 Traffic Counts

Durham Region and City of Oshawa has provided available historic turning moment counts for the study intersections between 2011 and 2021. **Table 2** shows a summary of the latest traffic counts received and a copy of the turning movement counts are provided in **Appendix A.**

Additionally, 24-hour ATR data was provided by the Region for three locations along Simcoe Street and one location along Taunton Road. The three ATR locations on Simcoe Street are 50m north of Eastwood Avenue North, 200m south of Conlin Road, and 325m north of Taunton Road. The ATR count location on Taunton Road is 200m east of Thickson Road.

Table 2: Turning Movement Counts Summary

Intersection	Count Date	Source
Thickson Road at Conlin Road	October 17th, 2018	Region
Garrard Road at Conlin Road	June 13th, 2018	Traffic Study (Ontario Traffic Inc.)
Thornton Road at Conlin Road	October 7th, 2020	City
Stevenson Road at Conlin Road	October 7th, 2020	City
Simcoe Street at Conlin Road	May 23rd, 2018	Region
Thickson Road at Taunton Road	May 31st, 2018	Region
Garrard Road at Taunton Road	November 7th, 2017	Region
Thornton Road at Taunton Road	May 10th, 2016	Region
Stevenson Road at Taunton Road	October 17th, 2018	Region
Simcoe Street at Taunton Road	June 8th, 2017	Region

3.1.2 Signal Timing Plans

The signal timing plans for the study intersections were also provided by the Region. The existing signal timing plans are included in **Appendix B**.

3.2 Baseline (2022) Volumes

Since the dates of the traffic counts vary, we reviewed background reports and historical data for the study intersections to determine if an adjustment factor is required to interpolate the volumes to represent the existing condition (2022). As a result, a compound growth rate of 1% per annum was established based on the available data and applied to historical counts to estimate the baseline (2022) traffic volumes. The growth rate was estimated using weekday AM and weekday PM historical turning movement counts at study intersections as summarized in **Table 3**.

Table 3: Growth Rate Summary

Corridor	CAGR	
	Weekday AM	Weekday PM
Conlin Road / Thickson Road	4.49%	0.29%
Conlin Road / Simcoe Street	0.25%	0.21%
Taunton Road / Thickson Road	3.34%	2.45%
Taunton Road / Garrard Road	-0.59%	0.00%
Taunton Road / Thornton Road	1.47%	1.74%
Taunton Road / Stevenson Road	0.31%	-1.65%
Taunton Road / Simcoe Street	1.14%	1.87%
Average	**1.49%**	**0.70%**
	1.09%	

Note: CAGR - Compound annual growth rate

The intersection counts conducted during the pandemic (i.e., year 2020) were adjusted to the higher link volumes between adjacent study intersections to represent pre-pandemic conditions. Existing intersection operations were analyzed using the lane configurations illustrated in **Figure 9,** and the existing adjusted traffic volumes shown in **Figure 10**.

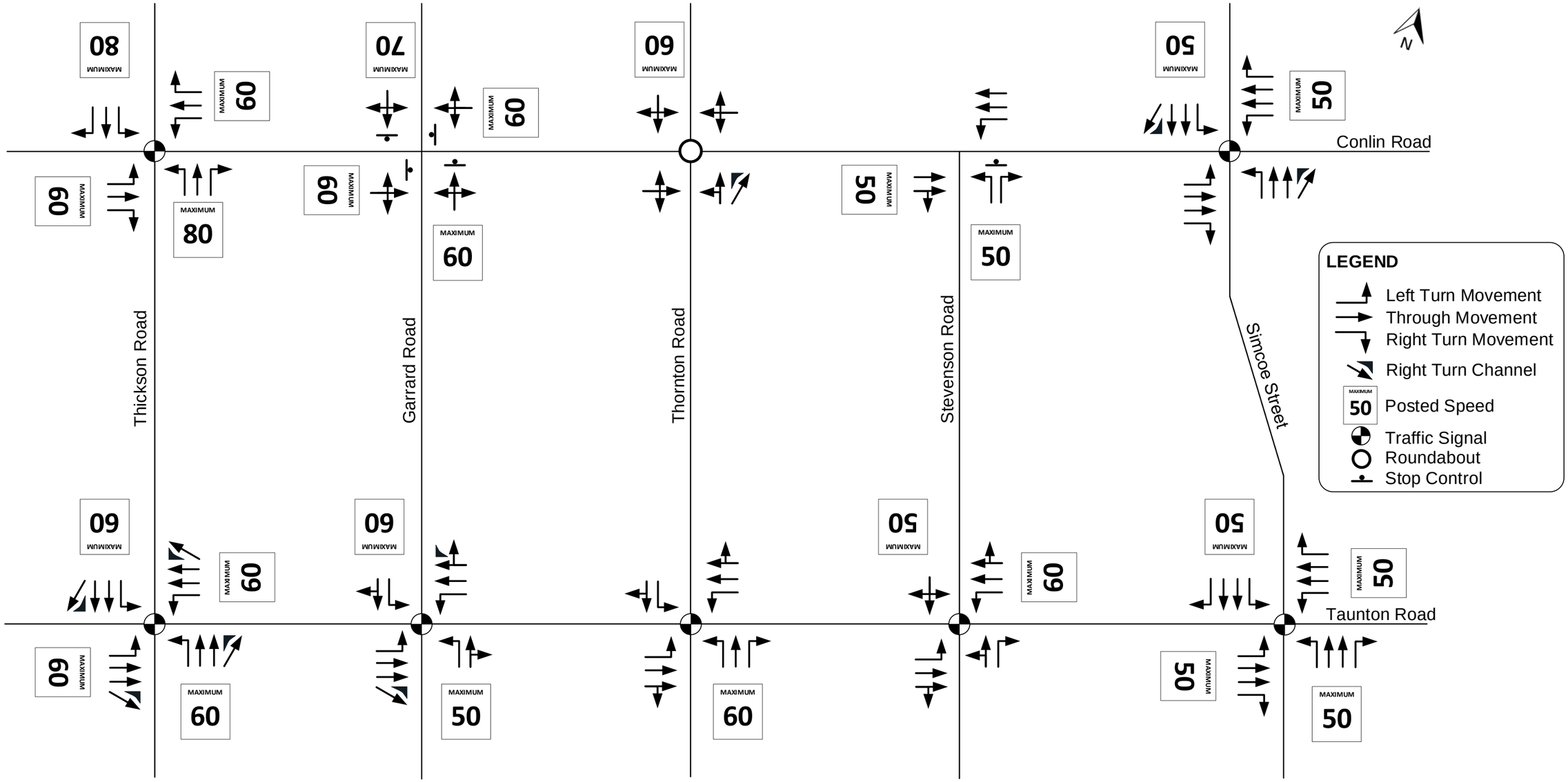

Figure 9. Existing Road Network

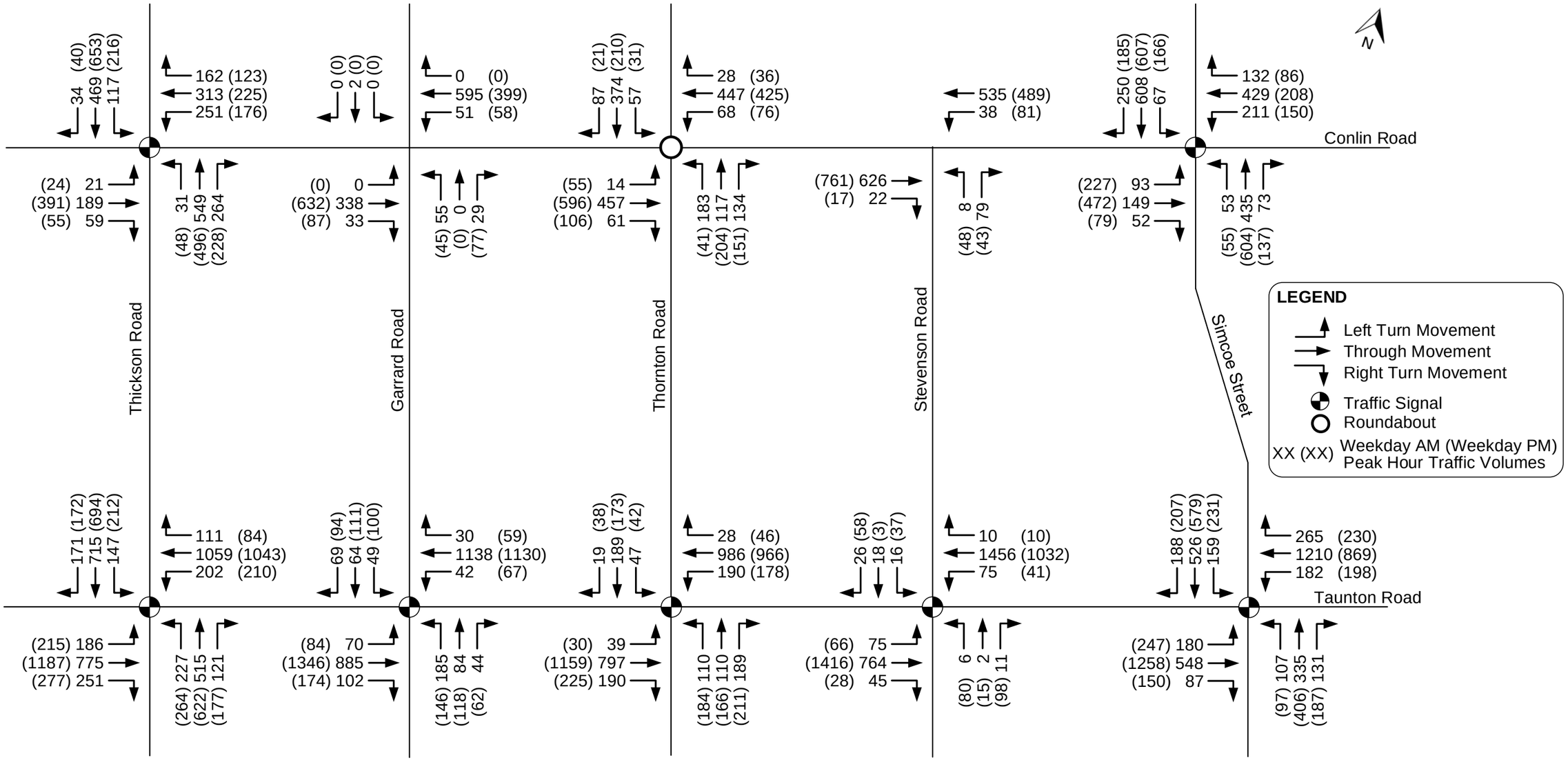

Figure 10. Existing (2022) Adjusted Traffic Volumes

3.3 Intersection Capacity Analysis

Intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) 2000 methodology published by the Transportation Research Board National Research Council. Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network considering the spacing, interaction, queues and operations between intersections.

Intersection operations performance metrics are reported in terms of Level of Service (LOS), delays, v/c ratios, and 95th percentile queues. Level of service is based on the average control delay per vehicle for a given movement. Delay 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. **Table 4** summarizes the LOS criteria for signalized and unsignalized intersections.

Table 4: Intersection Level of Service Criteria

	Average Control Delay per Vehicle (second / vehicle)	
Level of Service	**Signalized Intersection**	**Unsignalized Intersection**
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

The following synchro parameters were adjusted based on the Region's "*Design Specifications for Traffic Control Devices, Pavement Markings, Signage and Roadside Protection*" guidelines:

- Lane Widths
  - 3.50 m for through movements
  - 3.25 m for turning movements

Peak hour factors ("PHFs") were calculated based on existing traffic counts. A default PHF value of 0.92 was used for study intersections where 15-minute data aggregates were not available. As previously mentioned, existing intersection operations were analyzed using the lane configurations illustrated in **Figure 9** and the existing adjusted traffic volumes shown in **Figure 10**. The overall signalized intersection operations results are provided in **Table 5.**

Detailed results are provided in **Appendix C.**

Critical movements were identified based on the following criteria:

- Where the v/c ratio for a movement is equal or greater than 0.90; and/or,
- Where the LOS for a movement is 'F'.

Table 5: Existing Conditions Intersection Operations

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (m)	LOS	Delay (s)	v/c	95th Percentile Queue (m)	
Airport Boulevard/Stevenson Road North at Taunton Road West (Signalized)									
Overall	A	6	0.57	-	B	11	0.58	-	-
EBL	B	10	0.30	<7	A	1	0.18	<7	100
EBTR	A	2	0.36	17	A	5	0.59	180	>250
WBL	A	1	0.15	< 7	A	3	0.17	< 7	135
WBTR	A	6	0.62	141	A	10	0.44	119	>200
NBTL	D	43	0.07	<7	D	53	0.62	35	>50
NBR	D	43	0.01	< 7	D	43	0.07	14	>50
SBLTR	D	40	0.33	20	D	45	0.29	23	>100
Simcoe Street North & Taunton Road West at Taunton Road East (Signalized)									
Overall	D	46	0.78	-	D	39	0.86	-	-
EBL	D	45	0.75	57	E	56	0.83	67	125
EBT	D	35	0.44	67	D	44	**0.96**	181	>300
*EBR	**B**	14	0.15	19	C	27	0.16	21	25
WBL	C	23	0.55	33	E	62	**0.91**	69	180
WBT	**F**	88	**1.09**	193	C	34	0.72	110	>300
WBR	C	29	0.40	46	C	27	0.31	37	15
NBL	C	23	0.38	24	C	26	0.37	24	55
NBT	C	28	0.35	40	C	34	0.43	53	>150
NBR	C	26	0.10	13	C	32	0.25	30	15
SBL	B	14	0.46	17	D	35	0.70	54	60
SBT	B	18	0.52	27	D	37	0.60	77	>150
SBR	A	6	0.17	<7	C	32	0.25	30	30
Simcoe Street North & Conlin Road at Conlin Road East (Signalized)									
Overall	C	26	0.48	-	C	25	0.55	-	-
EBL	C	23	0.33	20	C	24	0.54	48	110
EBT	C	25	0.15	20	C	30	0.46	56	>150
EBR	C	24	0.04	<7	C	25	0.06	8	70
WBL	B	18	0.43	41	C	23	0.49	32	150
WBT	C	23	0.34	47	C	26	0.21	26	>200

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (m)	LOS	Delay (s)	v/c	95th Percentile Queue (m)	
WBR	C	21	0.10	12	C	25	0.06	9	155
NBL	B	17	0.21	11	B	18	0.19	12	100
NBT	C	21	0.40	41	C	26	0.50	67	>150
*NBR	**A**	2	0.14	<7	C	21	0.10	12	95
SBL	B	20	0.22	16	B	19	0.54	31	220
SBT	C	29	0.55	71	C	25	0.48	67	>100
SBR	C	24	0.19	17	C	21	0.14	14	110
Thornton Road North at Taunton Road West (Signalized)									
Overall	B	14	0.66	-	C	28	0.92	-	-
EBL	B	10	0.23	8	B	13	0.15	<7	155
EBTR	B	12	0.68	93	C	24	0.87	137	>200
WBL	B	16	0.60	21	E	75	0.80	58	100
WBTR	A	3	0.52	7	A	4	0.51	27	>200
NBL	C	32	0.51	29	**F**	101	**0.99**	69	110
NBT	C	29	0.25	30	D	36	0.41	51	>150
NBR	C	28	0.13	15	C	33	0.15	18	>150
SBL	D	36	0.24	18	D	41	0.25	19	40
SBTR	D	46	0.70	60	D	55	0.76	69	>250
Garrard Road at Taunton Road East (Signalized)									
Overall	B	11	0.60	-	B	15	0.64	-	-
EBL	A	7	0.36	<7	A	9	0.39	9	110
EBT	A	3	0.42	22	A	7	0.57	68	>200
EBR	A	0	0.08	<7	A	7	0.12	<7	105
WBL	A	4	0.13	<7	A	9	0.36	12	110
WBTR	A	6	0.54	87	A	6	0.52	53	>150
NBL	D	51	0.78	**54**	**F**	81	0.89	**51**	30
NBTR	C	33	0.30	30	D	40	0.47	46	>100
SBL	C	33	0.21	16	D	42	0.53	33	75
SBTR	C	33	0.28	27	D	42	0.56	51	>100
Thickson Road at Taunton Road East (Signalized)									
Overall	D	38	0.96	-	D	48	0.99	-	-

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (m)	LOS	Delay (s)	v/c	95th Percentile Queue (m)	
EBL	D	54	0.88	61	E	72	**0.96**	74	135
EBT	C	31	0.69	92	D	41	**0.90**	167	>200
EBR	C	24	0.23	23	C	23	0.19	17	115
WBL	D	41	0.86	29	**F**	81	**0.99**	76	140
WBT	D	49	**0.99**	159	D	42	0.79	140	190
WBR	B	15	0.09	<7	D	54	0.06	18	115
NBL	D	53	**0.90**	66	**F**	89	**1.02**	93	130
NBT	C	29	0.49	60	D	47	0.79	90	>200
NBR	C	24	0.10	13	C	34	0.13	18	95
SBL	C	25	0.51	31	D	38	0.75	51	135
SBT	D	40	0.79	93	D	52	0.87	108	>120
SBR	C	27	0.13	16	C	33	0.12	17	80
Thickson Road at Conlin Road (Signalized)									
Overall	C	21	0.78	-	C	25	0.87	-	-
EBL	B	19	0.09	8	B	18	0.07	9	40
EBT	C	21	0.36	41	C	25	0.66	89	>100
EBR	B	19	0.04	<7	B	18	0.04	<7	25
WBL	D	40	0.82	75	E	60	0.89	68	70
WBT	C	24	0.59	68	C	20	0.38	49	>100
WBR	B	19	0.11	13	B	18	0.08	12	40
NBL	B	13	0.09	9	B	18	0.26	14	115
NBT	C	24	0.78	118	C	27	0.77	101	>150
NBR	B	14	0.20	14	B	17	0.20	17	>150
SBL	B	13	0.42	16	C	27	0.76	31	115
SBT	B	13	0.54	76	C	22	0.79	122	>150
SBR	A	9	0.02	<7	B	11	0.03	<7	20
Stevenson Road North at Conlin Road (Unsignalized)									
EBT	-	0	0.26	<7	-	0	0.33	<7	>100
EBTR	-	0	0.15	<7	-	0	0.18	<7	80
WBL	A	1	0.05	<7	B	10	0.11	<7	35
WBT	-	0	0.17	<7	-	0	0.16	<7	>100

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (m)	LOS	Delay (s)	v/c	95th Percentile Queue (m)	
NBL	C	1	0.04	<7	**F**	51	0.41	14	50
NBR	B	4	0.13	<7	B	12	0.08	<7	>100
Garrard Road at Conlin Road (Unsignalized)									
EBLTR	C	15	0.58	-	**F**	**80**	**1.09**	-	>100
WBLTR	E	41	0.94	-	C	21	0.73	-	>100
NBLTR	B	11	0.17	-	B	12	0.24	-	>80
SBLTR	A	10	0.00	-	A	10	0.00	-	>100

*Results for these movements are based on Synchro's Lanes, Volumes, Timings output

3.4 Roundabout Analysis

Thornton Road North and Conlin Road is a single-lane roundabout with a bypass lane for right-turning vehicles at the south leg (northbound direction). The operational performance of the roundabout was analyzed using the ARCADY software. ARCADY adopts an empirical methodology to determine the capacity, queues and delays based on various geometric parameters such as entry width, effective flare length, inscribed circle diameter, etc. In addition, a 10% capacity reduction was applied to account for driver unfamiliarity at roundabouts in North America based on industry's standard (e.g. MTO's Traffic Impact Studies Guidelines, 2021). The ARCADY analysis results are summarized in **Table 6**, and the detailed ARCADY report is included in **Appendix D**.

The ARCADY analysis indicates that all approaches at the roundabout is operating at LOS A during both AM and PM peak-hour, except for the south approach (AM peak-hour) and east approach (PM Peak hour) which operates at LOS B. The highest average delay per arriving vehicle is 13 seconds for the east approach during the PM peak-hour. The v/c ratios for all approaches are equal to or less than 0.77 for both peak hours.

Table 6: Roundabout Performance at Thornton Road North and Conlin Road

Approach	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th Percentile Queue (Veh)	LOS	Delay (s)	v/c	95th Percentile Queue (Veh)	
Thornton Road North at Conlin Road (Roundabout)									
West	A	7	0.54	1.7	A	7	0.57	1.5	>100
South	B	10	0.63	3.7	A	5	0.31	1.8	>100
East	A	9	0.59	2.6	B	13	0.77	14.7	>100
North	A	5	0.33	2.0	A	6	0.31	1.8	>100

Note: LOS – level of service, v/c – volume to capacity ratio.

A diagram showing the overall LOS and critical movements at all study intersections are presented in **Figure 11**.

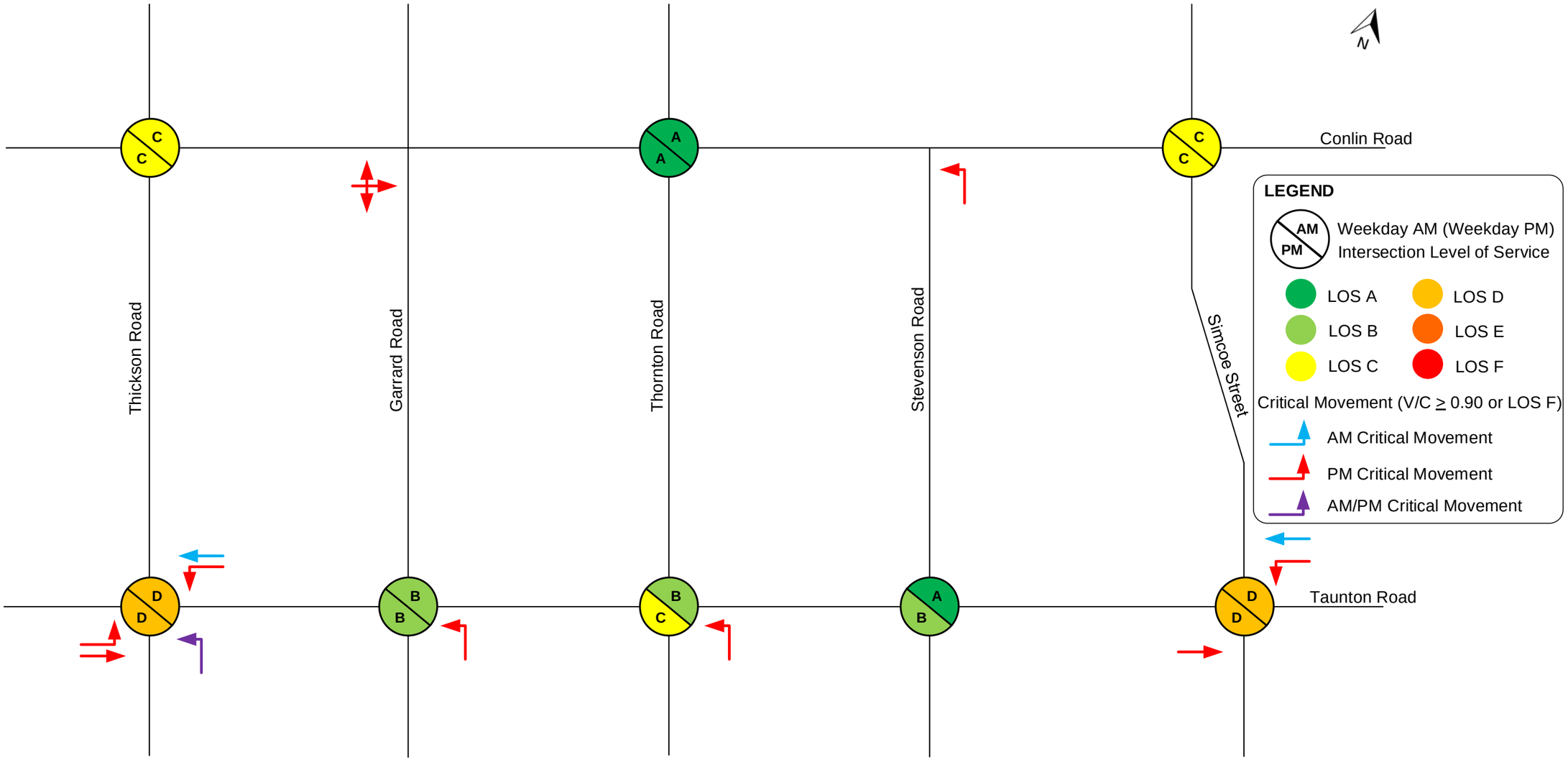

Figure 11: Level of Service and Critical Movements

The traffic analysis results indicate that all movements are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under existing conditions except for following movements:

- Simcoe Street at Taunton Road
  - Westbound Through movement during the weekday AM peak hour
  - Eastbound Through and Westbound Left movements during the weekday PM peak hour
- Thornton Road at Taunton Road
  - Northbound Left movement during the weekday PM peak hour
- Garrard Road at Taunton Road
  - Northbound Left movement during the weekday PM peak hour
- Thickson Road at Taunton Road
  - Westbound Through and Northbound Left movement during the weekday AM peak hour
  - Eastbound Left, Eastbound Through, Westbound Left and Northbound Left movements during the weekday PM peak hour
- Stevenson Road at Conlin Road
  - Northbound Left movement during the weekday PM hour
- Garrard Road at Conlin Road
    - Eastbound Left-Through-Right movement during the weekday PM peak hour

Moreover, the analysis results in **Table 5** also indicate that the 95th percentile queues can be accommodated within the available storage during the weekday AM and weekday PM peak hours under existing conditions except the following movements:

- Garrard Street at Taunton Road
  - Northbound Left movement during the weekday AM and weekday PM peak hour

4.0 Safety Assessment

A collision analysis was carried out to identify any patterns with respect to collision type, direction, severity, and other contributing factors. These collision analysis findings provide an understanding of the overall safety performance of the study corridor, for intersections and midblock segment.

4.1 Collision Analysis

The collision analysis was conducted using the most recent five years (January 2017 to October 2022) collision records from the Durham Region's database. A copy of the collision data is provided in **Appendix E**. The collision data contains information on the impact type, severity, time and date of the collision, direction of travel, surface condition, vehicle type, lighting conditions and the environmental conditions.

4.1.1 Collision by Severity and Year

The total number of collisions by severity and year is summarized in **Table 7** and **Figure 12**. The study corridor experienced an annual average of 3.8 collisions each year over a five-year period. Of the 19 collisions, nine (or 47%) resulted in property damage only (PDO), and 10 (or 53%) non-fatal injuries. No fatal collision was recorded.

Table 7. Collision by Year and Severity

	2017	2018	2019	2020	2022	Total	Percentage
Non-fatal Injury	1	1	2	2	4	**10**	**53%**
P.D. only	2	2	2	1	2	**9**	**47%**
Total	3	3	4	3	6	**19**	**100%**
Percentage	**16%**	**16%**	**21%**	**16%**	**32%**	**100%**	

The study corridor experienced a 50% increase of collision in 2022 compares to previous years (2017, 2018 and 2020), which could be attributed to the increased traffic exposure along Stevenson Road due to the traffic diversion from the ongoing construction along Conlin Road. The construction works at Conlin Road started in June 2022 and is expected to be completed late 2023. No collisions were recorded in 2021.

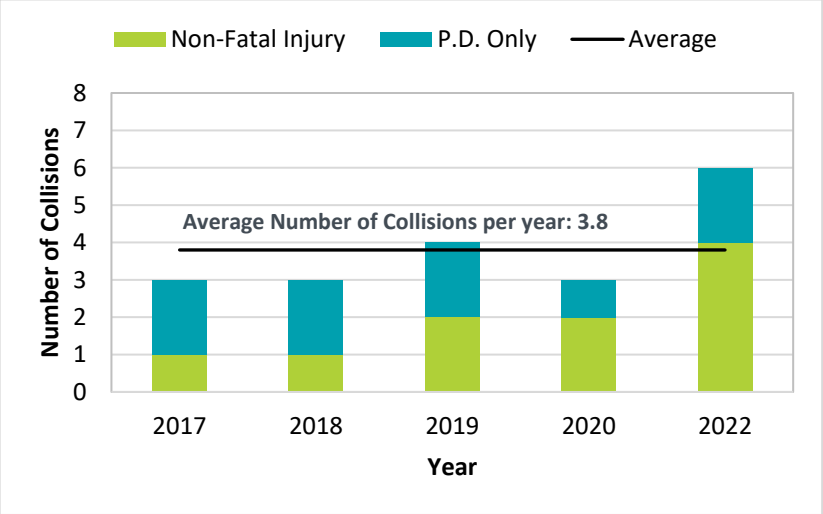

Figure 12. Collision by Severity and Year

4.1.2 Collision by Month, Day of the Week and Time of the Day

Collisions by month and day of the week are shown in **Figure 13** and **Figure 14**. The majority of collisions occurred on Monday through Friday, which correlates with typical commuter traffic demand. There are no observable trends in the analysis per month.

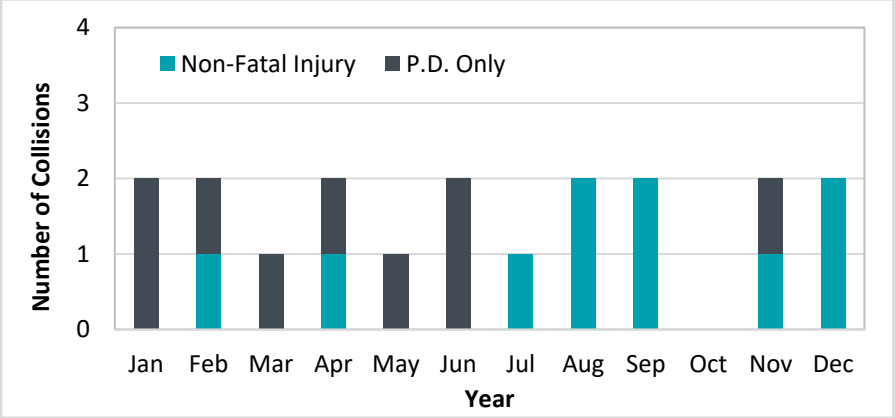

Figure 13. Collisions by Severity and Month

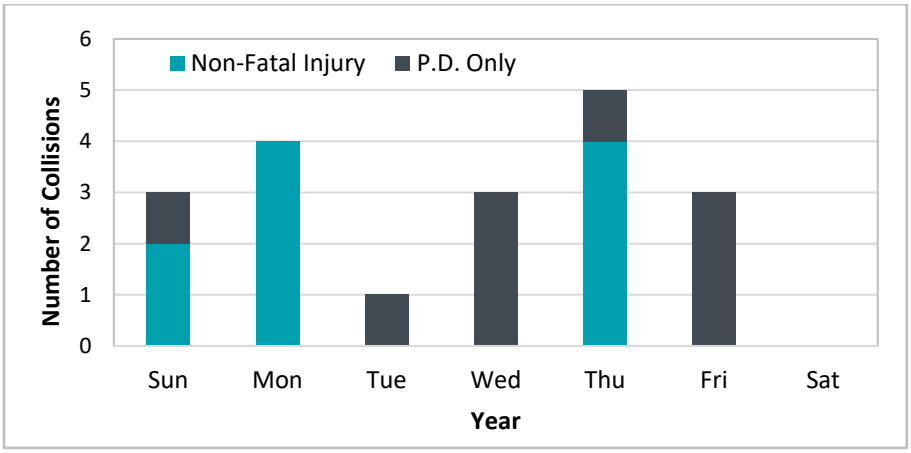

Figure 14. Collisions by Severity and Day of the Week

The analysis results for the number of collisions by hour is shown in **Figure 15**. Higher proportions of collisions can be observed throughout the day between 9:00 AM to 6:00 PM. This corresponds to the typical working hours of most commuters and does not point to any underlying trend.

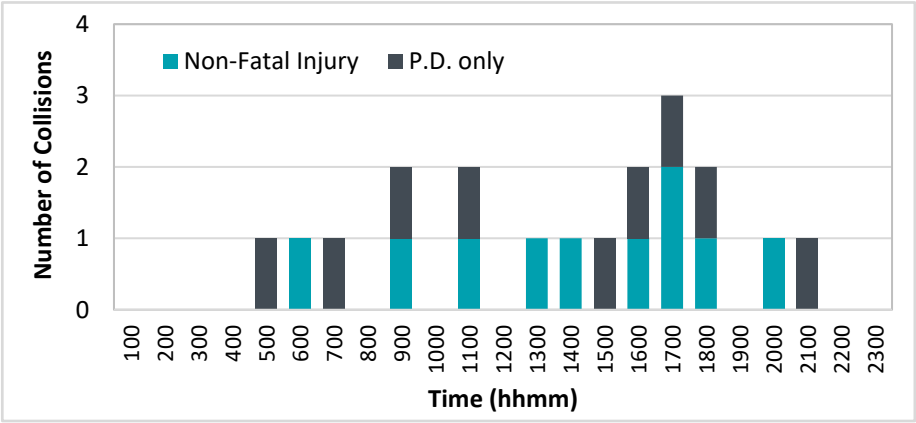

Figure 15. Collisions by Severity and Time of the Day

4.1.3 Collision by Impact Type

The total number of reported collisions by impact type is summarized in **Figure 16**. As shown, rear-end (47% or 9 out of 19) and angle or turning collisions (37% or 7 out of 19) are the predominant impact types along Stevenson Road.

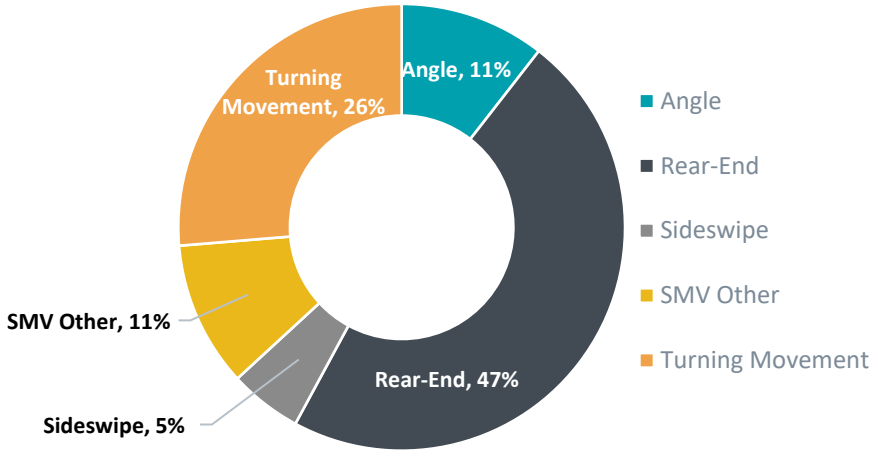

Figure 16. Collisions by Impact Type

4.1.4 Collision by Environment and Light Conditions

The historical collision data was also analyzed based on environment and light conditions. The analysis revealed that majority of the collisions occurred during clear (68%) and daylight (79%) conditions. No particular patterns can be identified.

4.1.5 Collision Involving Vulnerable Road User

Within the five-year analysis period, two collisions at Stevenson Road and Taunton Road involved vulnerable road users, one of which was an angled collision between a motorized vehicle travelling northbound and a cyclist travelling westbound, which resulted in non-fatal injuries. The second collision involved a pedestrian who was struck by a vehicle making an eastbound left turn.

4.1.6 Intersection-related Collisions

Since majority (18 out of 19) collisions occurred at the Stevenson Road and Taunton Road intersection, these collisions were further investigated to identify any additional patterns or trends. A collision diagram, as presented in **Figure 17**, was prepared to assist with the analysis**.**

As shown, approximately 67% (12 out of 18) of the intersection-related collisions included a westbound vehicle. The predominant impact types for these collisions were rear-end or angle / turning collisions. The common contributing factors for these types of collisions are typically due to insufficient clearance times, drivers speeding too fast for condition and/or misjudging gaps for making turning movements. Based on the available data, further analysis was conducted to review the clearance time at the Taunton intersection to determine any deficiencies in the existing signal timings, as discussed in **section 4.2**.

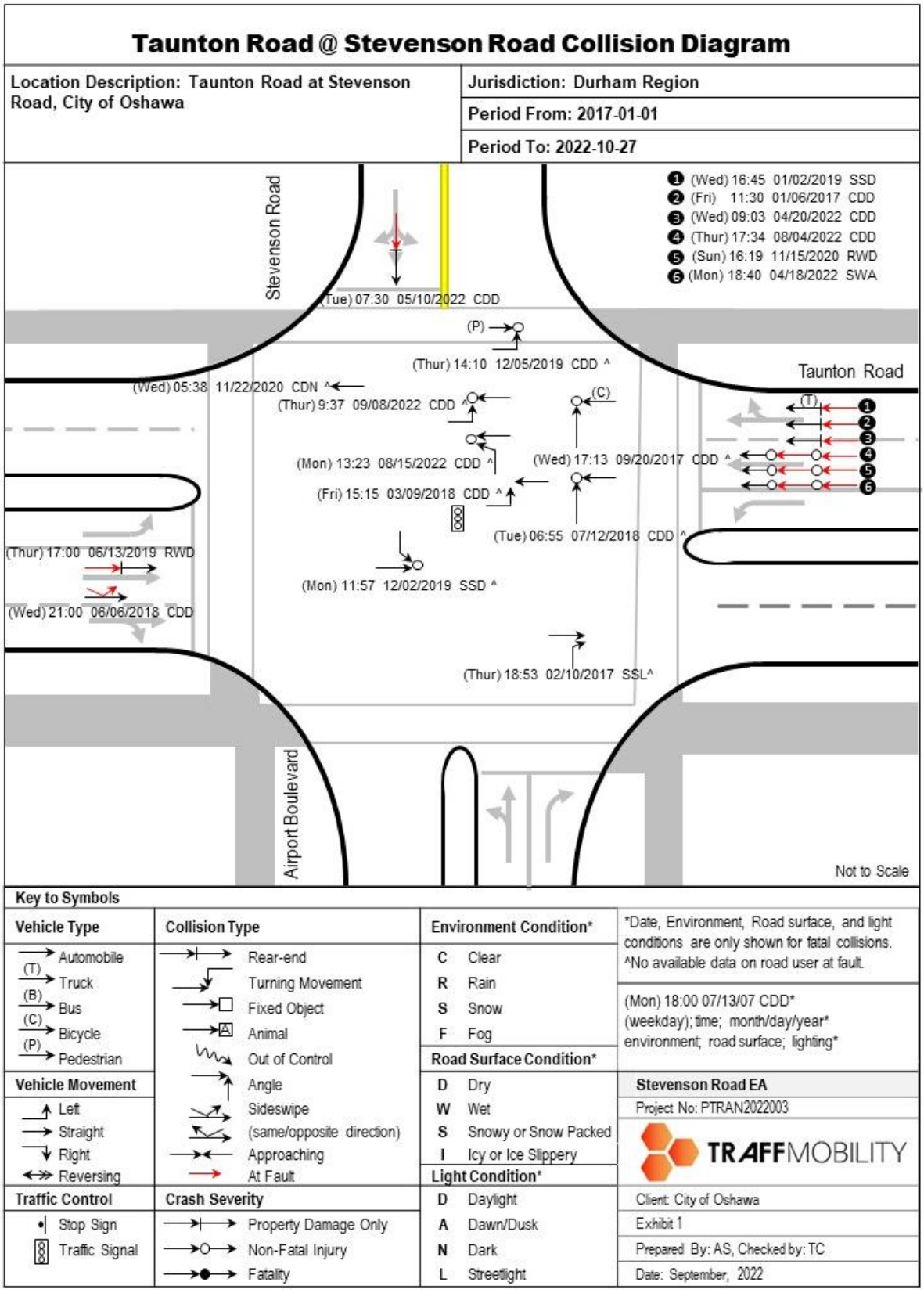

Figure 17. Collision Diagram - Stevenson Road at Taunton Road

4.2 Clearance Time Review

Existing vehicle and pedestrian clearance times were reviewed at Stevenson Road and Taunton Road intersection to ensure that the road users are provided with adequate time to stop or cross an intersection at the end of the green phase. All-red, amber, and pedestrian clearance times were calculated based on requirements outlined in the Region's guidelines. The clearance distances for vehicles and pedestrians were measured using an aerial image. An average passenger vehicle length of six (6) metres and a walking speed of 1.0 m/s were used to calculate the required clearance times as per the Region's guidelines. The results of the vehicle and pedestrian clearance time analysis are summarized in **Table 8** and **Table 9**, respectively. Detailed clearance time calculations are provided in **Appendix F**.

Table 8: Vehicle Clearance - Stevenson Road at Taunton Road

Source	Eastbound / Westbound			Northbound / Southbound		
	Amber	All Red	Clearance	Amber	All Red	Clearance
Region's Synchro Guidelines	4.2	2.1	6.3	3.7	2.4	6.2
Existing Signal Timing Plan	4.2	2.1	6.3	3.8	2.4	6.2
Difference	-	-	-	0.1	-	-

Table 9: Pedestrian Clearance - Stevenson Road at Taunton Road

Source	Eastbound / Westbound			Northbound / Southbound		
	WALK	FDW	Total	WALK	FDW	Total
Region's Synchro Guidelines	7	17	30	7	17	24
Existing Signal Timing Plan	7	18	25	7	18	25
Difference	-	1	1	-	1	1

The results indicate that the existing vehicular and pedestrian clearance times at the intersection of Stevenson Road and Taunton Road are sufficient.

5.0 Multi-modal Level of Service

This section will document the analysis of the existing multi-modal environment along Stevenson Road between Conlin Road and Taunton Road. The purpose is to determine the LOS experienced by users of different modes along street segments and at intersections. The goal is to understand the existing performance for all modes along the study corridor and the defined MMLOS targets, and to inform the development of design improvements within the available right-of-way.

5.1 Multi-modal Level of Service Evaluation Methodology

The Multi-modal Level of Service (MMLOS) methodology is based on the Ontario Traffic Council's (OTC) MMLOS guidelines and analysis tool (2022). As this study is at the corridor planning / functional design stage, the guidelines intend to inform the design development process based on modal priorities and align the proposed cross-section or alternative design to reflect municipal goals and policies.

The OTC MMLOS analysis process can be summarized into the following steps:

1. Define the type of study and study area
2. Identify MMLOS targets for the street type
3. Adjust the LOS targets according to Planning and Strategic Policy directions and unique circumstances, if applicable
4. Complete the MMLOS analysis for each mode using the analysis tool developed by OTC
5. Compare the results of the analysis to inform design and identify trade-offs
6. Re-assess the MMLOS for the proposed design alternatives and compare with defined LOS targets

The performance measures for evaluating MMLOS are presented in **Table 10**.

Table 10: Summary of Intersection and Segment Measures

Walking	Cycling	Transit	Trucks	Cars
Segments				
Pedestrian Facility Width	Bike Facility Width per Direction	Transit Facility Type	Width of Curb Lane	Mid-block V/C Ratio
Pedestrian Buffer Width	Bike Buffer Width	Presence of Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
Maximum Distance Between Controlled Crossings	Conflicts with Other Modes	Pedestrian Level of Service (as a measure of Passenger Access)		
Signalized Intersections				
Enhanced Pedestrian Measures	Enhanced Bicycle Measures	Presence of Transit Priority Measures	Average Effective Turning Radius	Percentage of Turning Movements with Dedicated Lanes
Average Effective Turning Radius	Average Effective Turning Radius			
Signal Cycle Length[1]	Signal Cycle Length[1]	Transit Movement Delay[1]	Car Level of Service[1]	Intersection Delay[1]

Walking	Cycling	Transit	Trucks	Cars
Number of Uncontrolled Conflicts[1]	Number of Uncontrolled Conflicts[1]	Pedestrian Level of Service[1]		
Unsignalized Intersections				
Marked Controlled Crossings	Presence of Bike Facilities	Pedestrian Level of Service	Average Effective Turning Radius	
Average Crossing Distance	Requirements to Stop			
Average Effective Turning Radius	Average Effective Turning Radius			
		Transit Movement Delay[1]	Car Level of Service[1]	Intersection Delay[1]

[1] These Measures are considered ONLY when completing operational analysis (OTC, 2021).

5.2 Multi-modal Level of Service Results

Following the Ontario Traffic Council (OTC) Multi-Modal Level of Service guidelines and analysis tool provided by OTC, the existing MMLOS for Stevenson Road is presented in **Table 11**. LOS scores that cannot be obtained are marked as "n/a". The completed analysis from the OTC MMLOS tool is provided in **Appendix F**.

Table 11: Multi-Modal Level of Service Evaluation

Type of Study	Planning Project – Environmental Assessment		
Mode	Target LOS	Existing LOS	Planned Target LOS
Stevenson Road at Taunton Road (Intersection)			
Area Type	Neighbourhood Connector		Neighbourhood Connector
Pedestrian	E	D	E
Cycling	D	N/A	D
Transit	B	D	B
Truck	D	B	D
Cars	D	B	D
Stevenson Road at Conlin Road (Intersection)			
Area Type	Rural Connector		Industrial Boulevard
Pedestrian	E	F	D
Cycling	E	N/A	D
Transit	N/A[1]	N/A	D
Truck	D	A	B
Cars	D	E	E
Stevenson Road (Segment)			
Area Type	Rural Connector		Industrial Boulevard
Pedestrian	E	N/A	D
Cycling	E	N/A	D
Transit	N/A	N/A	D

Type of Study	Planning Project – Environmental Assessment		
Mode	Target LOS	Existing LOS	Planned Target LOS
Truck	D	C	B
Cars	D	A	E

[1] Rural roads typically do not serve as transit route corridors where buses stop, which is what the Transit LOS is based on (OTC, 2021).

The signalized intersection at Taunton Road meets the target level of service for all modes except for transit and cycling. Even though there is an existing multiuse path on the southside of Taunton Road, such bike facility does not contribute to the level of accommodation provided to cyclists for the *intersection*. The gradation metric for enhanced bicycle measures at an intersection considers any design treatments that help facilitate the movements of cyclists through an intersection beyond the presence of a basic bike facility (i.e. multiuse path), which may include (but are not limited to) cross rides, green conflict markings, dedicated intersection features, protected intersection features, bicycle signal heads, leading bike intervals (LBIs) and protected phases.

Furthermore, the transit mode does not meet the MMLOS target due to the lack of transit priorities (i.e. transit signal priority, queue jump lanes, transit lanes) at all approaches for the Stevenson Road and Taunton Road intersection.

For the unsignalized intersection at Conlin Road, the pedestrian mode does not meet the LOS target mainly due to the long crossing distance (approx. 24.5m) and the discontinuity of sidewalk in the west and south approaches. A LOS score cannot be obtained for the cycling mode at this intersection since it failed one of the related active transportation design check questions (lack of intersection design feature to facilitate the crossing of cyclists such as bike boxes and queuing spaces). For the Stevenson Road segment, both cars and trucks meet the requirements, but LOS scores cannot be obtained for the pedestrian and cycling modes due to the absence of active transportation facilities.

There are opportunities to improve the active transportation network continuity on Stevenson Road by connecting with the existing MUP and bike lanes at Taunton Road and Conlin Road, respectively. During the future study phases, the design alternatives on Stevenson Road will be evaluated against the planned target LOS to determine the design impacts to the multi-modal environment, and to inform the final recommended design.

6.0 Conclusions

An existing conditions transportation assessment was completed to assess traffic operations and safety of the study corridor to identify any operational constraints and potential safety related concerns. The assessment findings are summarized in the following sections.

6.1 Existing Transportation Network and Operations

An assessment of the existing transportation network and traffic operations was carried out on a transportation network bounded by Thickson Road to the west, Simcoe Street to the east, Conlin Road to the north and Taunton Road to the south and the key finds are:

- The analysis results indicate that all study intersections are operating with acceptable level of service during the weekday AM and weekday PM peak hours under existing conditions, except for the critical moments summarized in **Table 12**.

Table 12: Critical Movements under Existing Conditions

Intersection / Movement	AM Peak Hour				PM Peak Hour				Available Storage (m)
	LOS	Delay (s)	v/c	95th %tile Queue (m)	LOS	Delay (s)	v/c	95th %tile Queue (m)	
Simcoe Street North at Taunton Road West/Taunton Road East (Signalized)									
EBT	D	35	0.44	67	D	44	**0.96**	181	>300
WBL	C	23	0.55	33	E	62	**0.91**	69	180
WBT	**F**	88	**1.09**	193	C	34	0.72	110	>300
Thornton Road North at Taunton Road West (Signalized)									
NBL	C	32	0.51	29	**F**	101	**0.99**	69	110
Garrard Road at Taunton Road East (Signalized)									
NBL	D	51	0.78	**54**	**F**	81	0.89	**51**	30
Thickson Road at Taunton Road East (Signalized)									
EBL	D	54	0.88	61	E	72	**0.96**	74	135
EBT	C	31	0.69	92	D	41	**0.90**	167	>200
WBL	D	41	0.86	29	**F**	81	**0.99**	76	140
WBT	D	49	**0.99**	159	D	42	0.79	140	190
NBL	D	53	**0.90**	66	**F**	89	**1.02**	93	130
Stevenson Road North at Conlin Road (Unsignalized)									
NBL	C	1	0.04	<7	**F**	51	0.41	14	50
Garrard Road at Conlin Road (Unsignalized)									
EBLTR	**C**	15	0.58	-	**F**	80	**1.09**	-	>100

Note: LOS – level of service, v/c – volume to capacity ratio

6.2 Safety Assessment

A collision analysis was conducted for the study corridor, along Stevenson Road North from Taunton Road to Conlin Road to identify any safety-related constraints and opportunities.

Overall, the study corridor experienced an average of 3.6 collisions per year. Within the five-year analysis period (2017-2022), a total of 19 collisions were recorded along Stevenson Road and none resulted in fatalities. Rear-end (47% or 9 out of 19) and angle or turning collisions (37% or 7 out of 19) were the predominant impact types along Stevenson Road.

Majority (18 out of 19) of the collisions occurred at the signalized intersection of Stevenson Road and Taunton Road. It was noted that two collisions at Stevenson Road and Taunton Road involved vulnerable road users, one of which was a collision between a motorized vehicle and a cyclist, and one which involved a motorized vehicle colliding with a pedestrian while making an eastbound left turn.

Existing vehicle and pedestrian clearance times were further reviewed at Stevenson Road and Taunton Road intersection to confirm that the road users are being provided with adequate time to stop or cross an intersection at the end of the green phase.

6.3 Multi-modal Level of Service Assessment

The existing multi-modal environment along the study corridor was evaluated based on the Ontario Traffic Council's (OTC) MMLOS guidelines and analysis tool (2022). The signalized intersection at Taunton Road meets the target level of service for all modes except for cycling given the absence of bike facilities. Of note, the existing MUP on the southside of Taunton Road does not contribute to the level of accommodation provided to cyclists for the *intersection* based on gradation metrics in the guidelines.

For the unsignalized intersection at Conlin Road, the pedestrian mode does not meet the LOS target mainly due to the long crossing distance and the discontinuity of sidewalk facility in the west and south approaches. A LOS score cannot be obtained for the cycling mode at this intersection since it lacks intersection design feature to facilitate movement for cyclists (e.g. bike boxes, queuing space). For the Stevenson Road segment, both cars and trucks meet the requirements, but LOS scores cannot be obtained for the pedestrian and cycling modes due to the absence of active transportation facilities.

In summary, there are opportunities to improve the active transportation network continuity on Stevenson Road by connecting with the existing MUP and bike lanes at Taunton Road and Conlin Road, respectively. During the future study phases, the design alternatives will be evaluated against the same MMLOS scoring criteria to determine the design impacts to the multi-modal environment, and to inform the final recommended design.

6.4 Site Observations

A Site Visit was conducted on Wednesday, October 12, 2022, from 10am to 12:30pm. The purpose of the field investigation was to confirm road geometry (vertical and horizontal alignments), signage, delineation, pavement conditions and illumination. Key site observations and potential mitigation measures are summarized below.

- Pavement markings on the travel lanes throughout the corridor were observed to be in poor condition. Cracks in pavement can be observed at multiple locations along the study corridor. Sample photos are provided in the report. *The pavement condition can be improved through the City's regular road maintenance program including crack sealing and resurfacing projects.*

- The signage within the study area were generally found to be in good condition, appropriate and clearly visible to road users, with the following exceptions:
    - A posted speed sign approximately 180m north of Taunton Road for the northbound direction was noted to be only partially visible due to vegetation based on Google Streetview dated in July 2022. *No sign visibility issue was noted during the site visit; however, vegetation control can be considered to trim any over-extended branches or brushes that may obstruct the sign visibility, especially during the summer months.*
    - It was noted that the visibility of the standard-size street name sign at Stevenson and Conlin Road intersection might not be adequate given this is a large intersection. *The installation of an Off-Road Low-Speed Roadway Identification sign can be considered on Conlin Road to provide guidance in advance of the intersection.*
- A high-level sightline review along Stevenson Road and its intersections with driveway accesses were conducted and there were no impediments identified for road users. A crest vertical curve can be observed within the northern section of the study corridor, approximately 500m south of Conlin Road. However, the sightline at the existing driveway accesses appeared to be adequate approaching this vertical curve. *The sight stopping distances should be reviewed for any future driveway accesses along the study corridor to ensure that the required sight distance is provided. Since Stevenson Road is proposed for a design speed of 70km/hr, a minimum stopping sight distance of 105 metres should be provided on crest vertical curves according to Section 3.3.3 of the TAC guideline.*

TRAFFMOBILITY

Attachment A

Existing Traffic Counts

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca

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Attachment B

Existing Signal Timing

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca

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Attachment C

Synchro Reports

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca

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Attachment D

ARCADY Roundabout Analysis Results

This document is available upon request.

Please contact Engineering Services at
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Attachment E

Historical Collision Data

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca

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Attachment F

Clearance Time Calculation

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca

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Attachment G

Multi-modal Level of Service Analysis Results

This document is available upon request.

Please contact Engineering Services at
engineering@oshawa.ca