Region of Peel

In-service Road Safety Review

Dixie Road Complete Corridor Study

September 2024

The findings of this report are based on the scope of work outlined in RFP 2023-304P and does not include evaluation of any other issues beyond that scope of work (unless otherwise stated). Arcadis has performed its services in a manner consistent with the usual standard of care and expertise exercised by members of the transportation profession. No other warranty, expressed or implied, is made. This report is for the exclusive use of the client.

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1 Introduction

1.1 Study Overview

Arcadis was retained to assist the Regional Municipality of Peel in the transformation of Dixie Road between Rometown Drive and Lakeshore Road East, within the City of Mississauga, into a "complete street" that better accommodates all modes of transportation. The study will identify and recommend an implementable design solution to improve the study corridor for all road users, following a robust planning, consultation, and design process. This includes the development, evaluation, and refinement of several alternative design concepts and advancing the preferred alternative to the preliminary design phase (30%).

This report summarizes the in-service road safety review (ISSR) conducted for the corridor including an overview of process, findings, and recommendations. The recommendations from this report are intended to inform the design of Dixie Road and subsequent project phases.

1.2 Site Context

The study area is situated in the southeast end of the City of Mississauga. As illustrated in **Exhibit 1**, the study area of Dixie Road is approximately 1.6 km long, from Lakeshore Road East to Rometown Drive. The cross section of Dixie Road within the study limits consists of three travel lanes (1 northbound, 1 southbound, and a center two-way-left-turn lane) along with buffered on-road bicycle lanes on each side. The study segment of Dixie Road is classified as a Major Collector, with a posted speed limit of 50 km/h. The study area features a rail underpass located approximately 125 m north of Orchard Hill Road, which serves both freight and passenger rail lines for CN, GO, and VIA Rail.

The adjacent land use is predominantly zoned as private/public open space, with residential and commercial zoning designations at the northernmost and southernmost ends of the corridor. The study area encompasses several major trip generators, including Dixie Outlet Mall, Lakeview Golf Course, Toronto Golf Club, Lakeshore Park, Small Arms Inspection Building, and various existing condominium developments such as Fairways Condo, Exhale Condominium, and Lakeview DXE Club Condominiums, among others. For more information about these developments, please refer to the standalone ***Study Area Profile Memo***.

Exhibit 1: Study Area Map

1.3 Methodology

The methodology for this In-Service Road Safety Review (ISSR) follows the procedures outlined in the Transportation Association of Canada's Guide to In-Service Road Safety Reviews (2004). It involves a structured examination of geometric characteristics, collision history, traffic operational efficiency, road user behaviour, and traffic conflict observations, with the aim of identifying road safety issues and developing cost-effective countermeasures to address the identified concerns. The methodology associated with each stage is described within the relevant section of the report. The report is organized based on this methodology to provide a comprehensive and organized approach to evaluating and improving road safety within the study area.

2 Analysis and Preliminary Findings

This section presents information about field investigations, provides an overview of the geometric analysis of site conditions, and provides an overview of the collision analysis. Additionally, this section presents the findings of operational analysis, including the review of vehicle speed and volume data, and capacity performance. This offers insights into the operating conditions that may contribute to safety issues within the study area.

2.1 Field Investigations

Field investigations were conducted on January 11th and January 25th, 2024, to observe and document site conditions, traffic, and safety operations, as well as road user behaviour. The aim was to identify underlying factors that may relate to safety performance and link site observations to the findings from the collision and operational analysis.

The field investigations were strategically scheduled during both AM and PM peak periods. This allowed the project team to observe a range of operating conditions, including peak and off-peak traffic, as well as environmental conditions such as daylight and darkness. It is noted that in order to meet project timelines the site investigations were conducted in January, when pedestrian and cyclist traffic is typically lower compared to the busier spring, summer, and fall seasons.

The site observations were used to support identifying safety issues presented in **Section 3** and to inform the preliminary design of the corridor. For a detailed description of site conditions and observations, please refer to the ***Study Area Profile Memo***.

2.2 Geometric Analysis

A review of the key elements of existing geometry was conducted based on a desktop review of satellite imagery, Google Street View, and findings from field investigations. As mentioned, the study segment of Dixie Road is classified as a Major Collector, with a posted speed limit of 50

km/h. The design speed is assumed to be equal to the posted speed limit, 50 km/h, aligning with the recommendations of the City of Mississauga's Draft Complete Streets Guide.

Exhibit 2 provides an overview of the recommended minimum taper length and braking distance, based on the TAC Geometric Design Guide for Canadian Roads (2017), applicable to both auxiliary left- and right-turn lanes. For the purpose of calculating the minimum taper lengths, all auxiliary lanes are presumed to be 3.5 m wide. The existing geometric attributes of auxiliary lanes at the key study area intersections are summarized in **Exhibit 3**.

Tapers and parallel lanes not meeting guidelines requirements have been noted with asterisk (*). Notably, most of the parallel lanes do not comply with deceleration requirements. However, guidance from the TAC Geometric Design Guide for Canadian Roads (Chapter 9) states that in an urban environment, deceleration (up to 15 km/h) over the bay taper is normally tolerable, especially in peak-hour conditions. Despite the substandard taper and parallel lane lengths, the lack of recorded collisions associated with these geometric elements suggests that the existing geometries may be sufficient for prevailing operating conditions unless otherwise stated based on other parts of the analysis presented in the following sections (e.g., Operational Analysis - Section 2.4.3). The substandard taper and parallel lane lengths will be further reviewed and addressed during design development.

Exhibit 2: Minimum Taper Lengths and Braking Distance

Design speed (Km/h)	Left-turn lane		Right-turn with parallel lane	
	Taper (m)	Braking distance (m)	Taper (m)	Braking distance (m)
50	28	28.7	38.5	28.7

Exhibit 3: Existing Auxiliary Taper and Parallel Lane Lengths

Intersection	Left-Turn		Right-Turn	
	Taper (m)	Parallel Lane (m)	Taper (m)	Parallel Lane (m)
Dixie Road and Lakeshore Road East	Eastbound			
	25*	27*		
	Westbound			
	11*	23*		
Dixie Road and Dixie Outlet Mall South Access	Northbound		Eastbound	
	15*	20*	17*	20*
Dixie Road and Rometown Drive	Northbound			
	42	52		

Intersection	Left-Turn		Right-Turn	
	Taper (m)	Parallel Lane (m)	Taper (m)	Parallel Lane (m)
	Southbound			
	23*	27*		

During the field investigation, a qualitative review of sightlines was conducted for Dixie Road and the side streets. A desktop review of sight distance was also carried out to validate the field observations.

Based on the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (June 2017), for a design speed of 50 km/h, the required stopping sight distance on a level grade is 65 m. With respect to intersection sight distance, The TAC Geometric Design Guide for Canadian Roads specifies that for a 50 km/h design speed, a minimum intersection sight distance of 105 m and 95 m is required for left-turn and right-turn movements from a stop-controlled intersection approach, respectively. The field investigations and desktop review revealed that the available sight distance at the stopping position (i.e., behind the stop bar) on side streets (i.e., St. James Avenue, Orchard Hill Road, Larchview Trail, and Londonderry Boulevard) would not meet these requirements due to sight obstructions such as vegetation, hydro poles, and road vertical curvature along Dixie Road (**Exhibit 4**). In all these cases, drivers tend to advance and encroach the pedestrian crosswalk location (although the crosswalk is not marked) to improve their sightlines before making turning movements. Similar to the previous observations about taper and parallel lane lengths, these sight distance limitations have not manifested in the safety performance in terms of related collisions.

Exhibit 4: Sightline Observations within the Study Area

St. James Avenue and Dixie Road Intersection: *Sightlines for vehicles turning from St. James Avenue into Dixie Road are obstructed by utility poles, vegetation, and the vertical grade change on Dixie Road south of the railway underpass.*

Photo Location: on the eastbound approach of the intersection, looking north

Orchard Hill Road and Dixie Road Intersection: *Sightlines for vehicles turning from Orchard Hill Road into Dixie Road are partially obstructed by large trees on both sides and the vertical grade change on Dixie Road south of the railway underpass (for vehicles making a right turn).*

Photo Location: on the westbound approach of the intersection, looking north

Photo Location: on the westbound approach of the intersection, looking south

Larchview Trail and Dixie Road Intersection: *Sightlines for vehicles turning from Larchview Trail into Dixie Road are obstructed by vegetation and hydro poles.*

Photo Location: on the westbound approach of the intersection, looking south

Photo Location: on the westbound approach of the intersection, looking north

Londonderry Boulevard and Dixie Road Intersection: *Sightlines for vehicles turning from Londonderry Boulevard into Dixie Road are obstructed by vegetation and hydro poles.*

Photo Location: on the westbound approach of the intersection, looking south

Photo Location: on the westbound approach of the intersection, looking north

2.3 Collision Analysis

Collision data reported between 2018 and 2022 were reviewed to gain a better understanding of collision trends and patterns across the study area. In total, 38 collisions were reported, averaging 8 per year. The following subsections provide more information about the collision history, identifying collision trends and patterns across the study area, with a particular focus on Vulnerable Road Users (VRUs) and collisions resulting in fatalities or serious injuries. Vulnerable road users consist of pedestrians, school-aged children, older adults (age 55 and over), cyclists, and motorcyclists, and are road users involved in a disproportionate number of killed or seriously injured (KSI) collisions.

2.3.1 Frequency and Severity

The collision severity distribution, as shown in **Exhibit 5**, indicates that the majority of collisions (34 or 89%) resulted in Property Damage Only (PDO), while 3 collisions led to injuries, and one resulted in a fatality. Additional details about high-risk collisions are provided in later sections of this report.

Exhibit 5: Collision Severity (2018-2022)

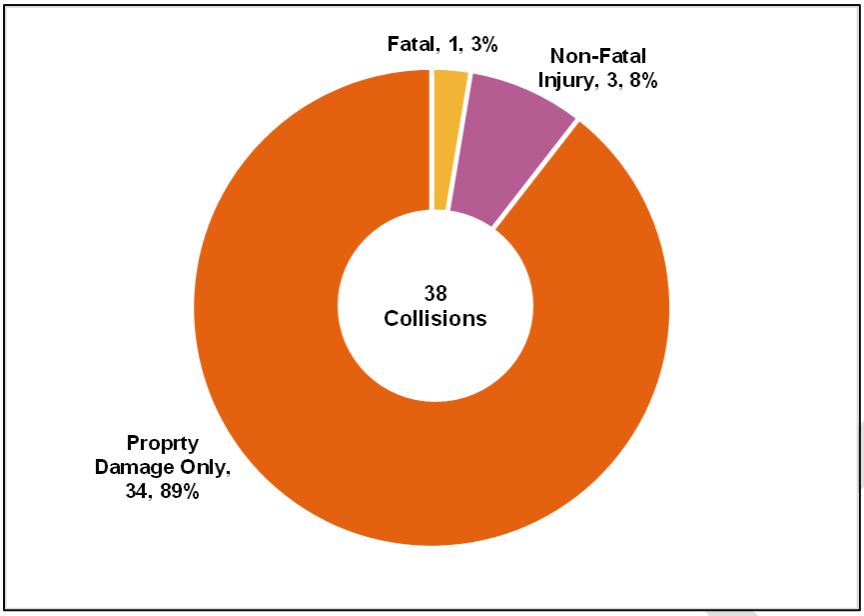
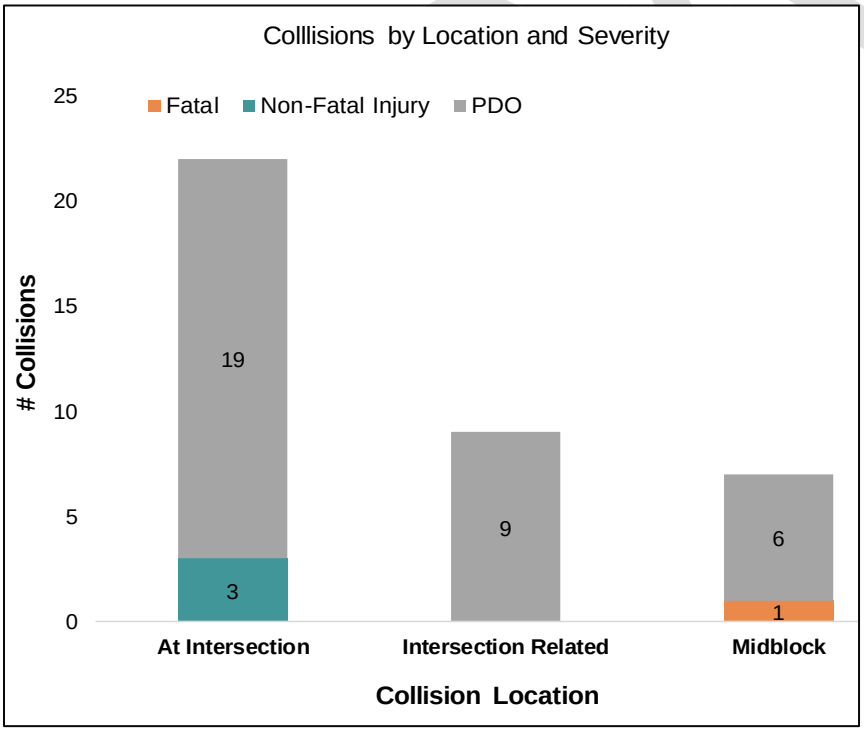


Exhibit 6 presents collision severity by location. As shown, 58% (or 22) of collisions occurred at intersections, including the three non-fatal injury collisions. Midblock collisions accounted for 18% (or 7 collisions), including the one fatal collision that occurred within the study area. More information about high-risk and severe collisions is provided in **Section 2.3.5.**

Exhibit 6: Collisions by Location and Severity (2018-2022)

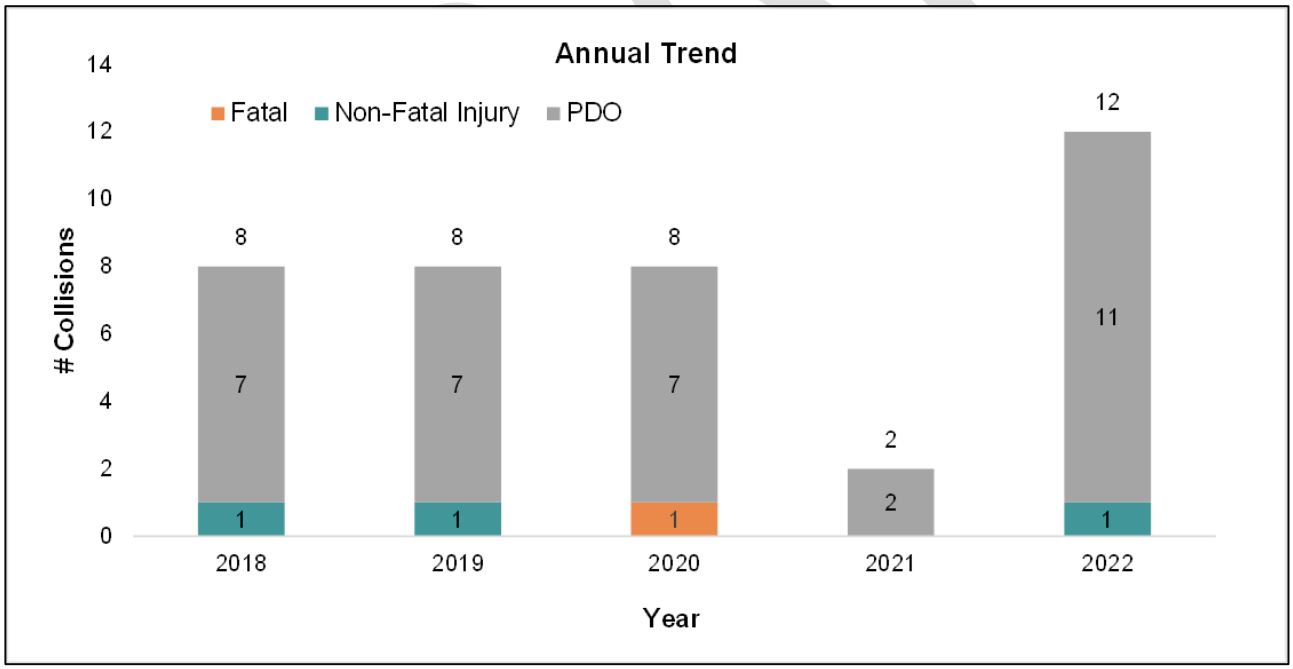


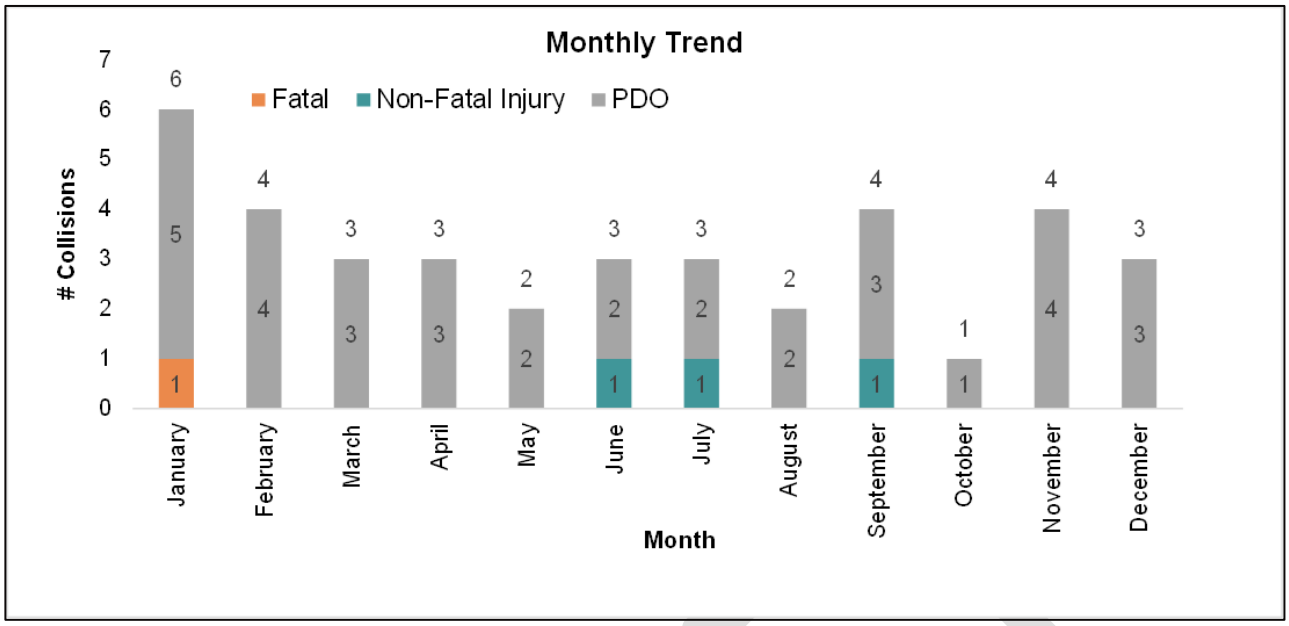
2.3.2 Temporal Trends

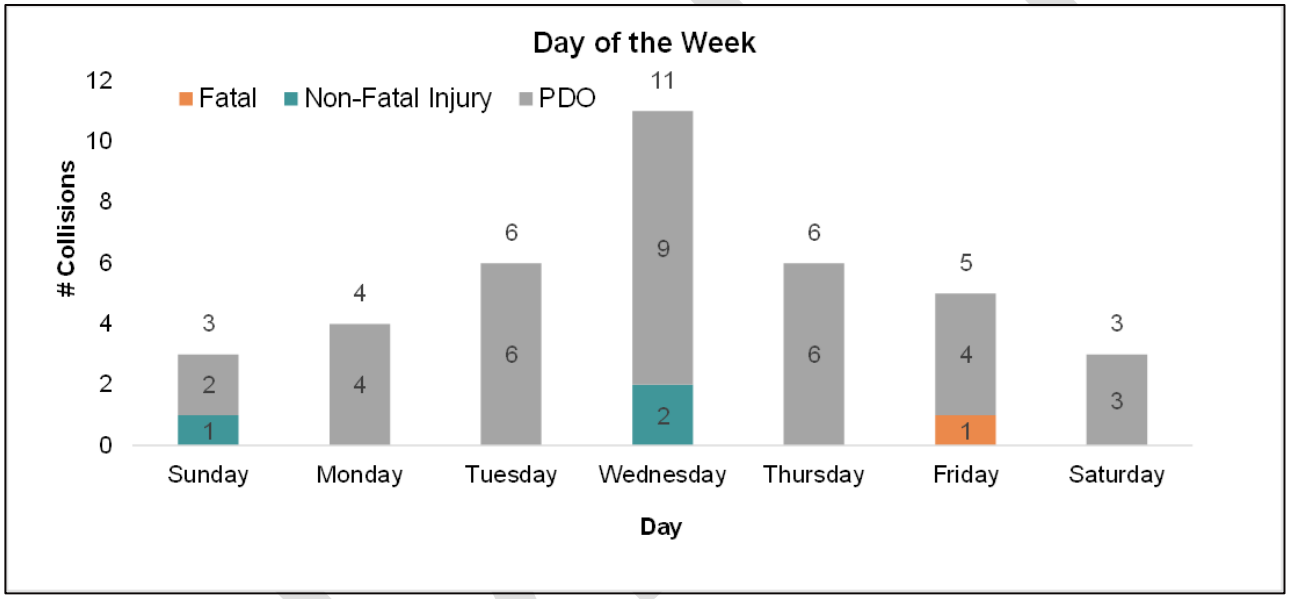
Collision temporal trends refer to patterns or changes over time, illustrating how collision frequencies vary across different time periods such as years, months, days, and hours. Temporal trends in reported collisions are summarized in **Exhibit 7**. The distributions indicate the following:

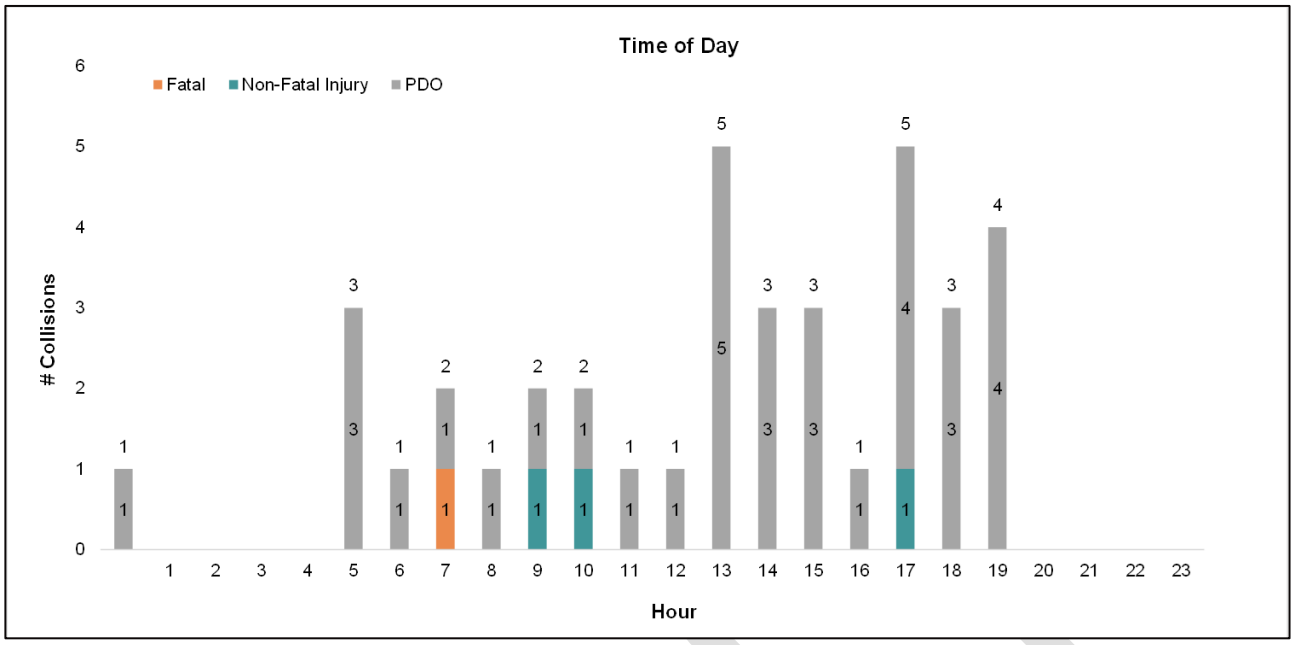
- Annual collision frequency showed a steady trend between 2018 and 2020, with 8 collisions per year. This frequency dropped to 2 collisions in 2021 but increased again to 12 collisions in 2022. Notably, despite collisions occurring in 2018, 2019, 2020, and 2022 distributed over several months, the two collisions reported in 2021 occurred in December, with no other collisions reported throughout the year. There is no available information to explain the drop of collision frequency in 2021.
- There is a relative increase in collision frequency during the fall and winter months, suggesting a potential association with weather conditions.
- The number of collisions is highest on weekdays, particularly Wednesday, compared to weekends. This observation could be attributed to higher traffic volumes during weekdays compared to weekends.
- There are peaks in collision frequency between 1 pm and 2 pm, and between 5 pm and 6 pm, indicating increased collision occurrences during periods aligning with commuter patterns during midday and PM periods.

Exhibit 7: Temporal Collision Trends (2018-2022)




Monthly Trend
Fatal
Non-Fatal Injury
PDO
Collisions
Month
January
February
March
April
May
June
July
August
September
October
November
December


Day of the Week
Fatal
Non-Fatal Injury
PDO
Collisions
Day
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

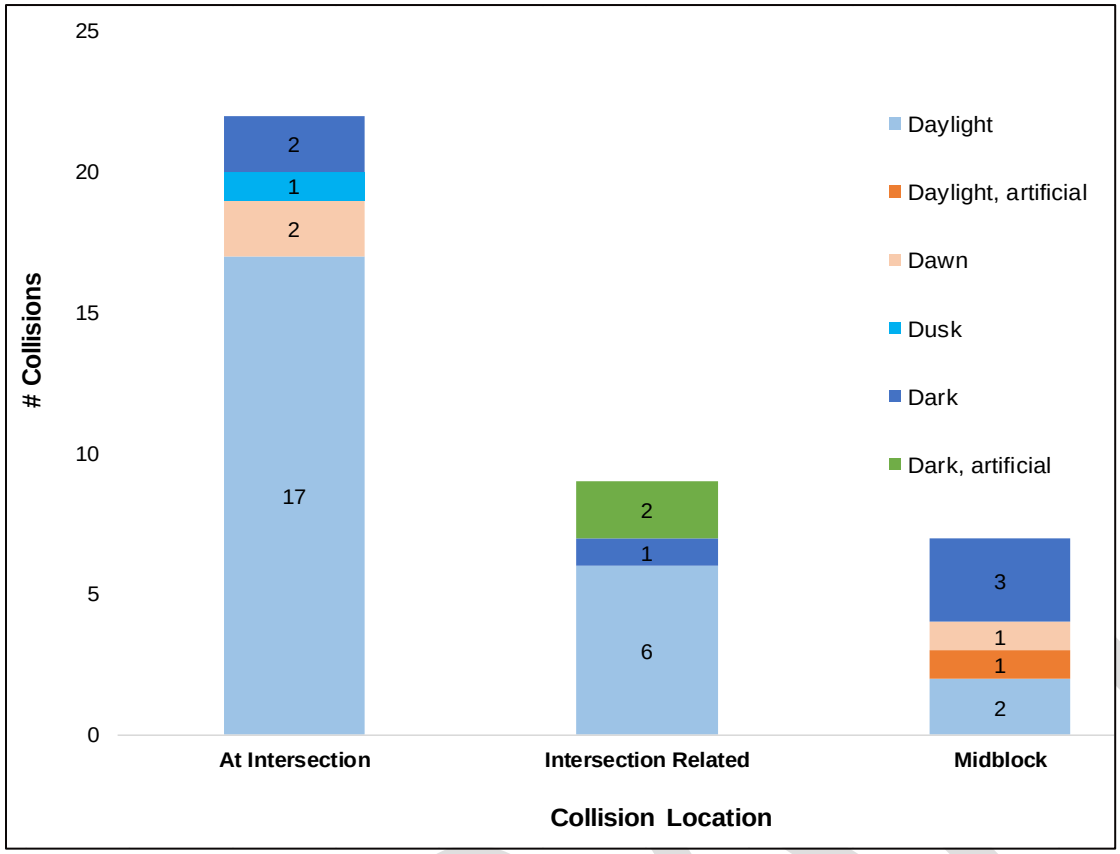


2.3.3 Environmental Trends

Analysis of environmental conditions revealed that two PDO collisions occurred during snowy conditions, one PDO collision occurred during rainy conditions, and one PDO collision occurred during windy conditions, while the majority of collisions (34 or 89%) occurred in clear conditions. As for light conditions, six PDO collisions occurred during dark conditions. These findings indicate that all collisions occurring in snowy or dark conditions are of low severity and do not involve pedestrians or cyclists.

Exhibit 8 shows the distribution of collisions by location and light conditions. Overall, 66% of the (or 25 collisions) occurred in daylight conditions, and 16% (or 6 collisions) occurred in dark conditions. A smaller number of collisions occurred under other light conditions, including dawn, dusk, and daylight/dark artificial lighting. Of the 6 collisions that occurred in dark conditions, 3 occurred at midblock segments, 2 at intersections, and 1 was intersection-related. The fatal collision within the study area occurred in dawn light conditions, while the 3 non-fatal injury collisions occurred in daylight conditions.

Exhibit 8: Collisions by Location and Light Conditions (2018-2022)



2.3.4 Collision Impact Type

Exhibit 9 shows the distribution of all collisions by impact type. Among all collisions, there were 13 (34%) rear-end collisions (including a cyclist collision that resulted in injury), 10 (26%) turning movement collisions, 7 (18%) sideswipe collisions, 5 (13%) Single Motor Vehicle (SMV) collisions (including a pedestrian collision that resulted in a fatality), 2 (5%) approaching collisions, and 1 (3%) angle collision.

Exhibit 9: Collisions by Impact Type (2018-2022)

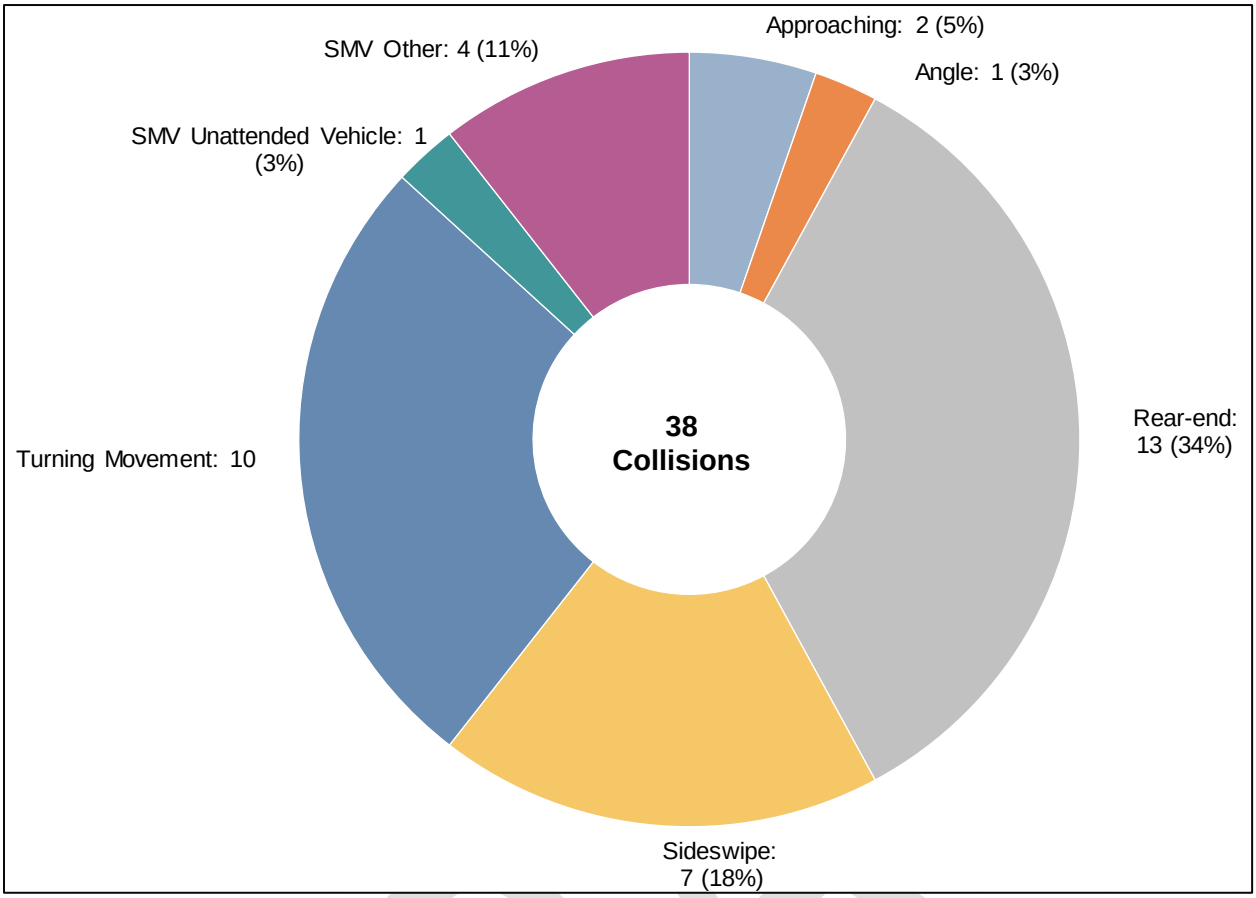


Exhibit 10 illustrates the distribution of all collisions by impact type and severity. As for fatal (1) and injury collisions (3), one Single Motor Vehicle collision involved a pedestrian and led to a fatality. Additionally, two rear-end collisions resulted in injuries: one involved a cyclist, and the other collision involved two vehicles. Also, an angle collision resulted in injury. The remaining collisions resulted in property damage only.

Exhibit 11 shows the distribution of collisions by location and impact type. At intersections, rear-end collisions (12) were predominant, followed by turning movements (8) and sideswipe collisions (7). Collisions along midblock segments included two turning movement collisions, three Single Motor Vehicle (SMV) collisions (including a pedestrian collision that resulted in a fatality), one rear-end collision, and one approaching collision.

Exhibit 10: Collisions by Impact Type and Severity (2018-2022)

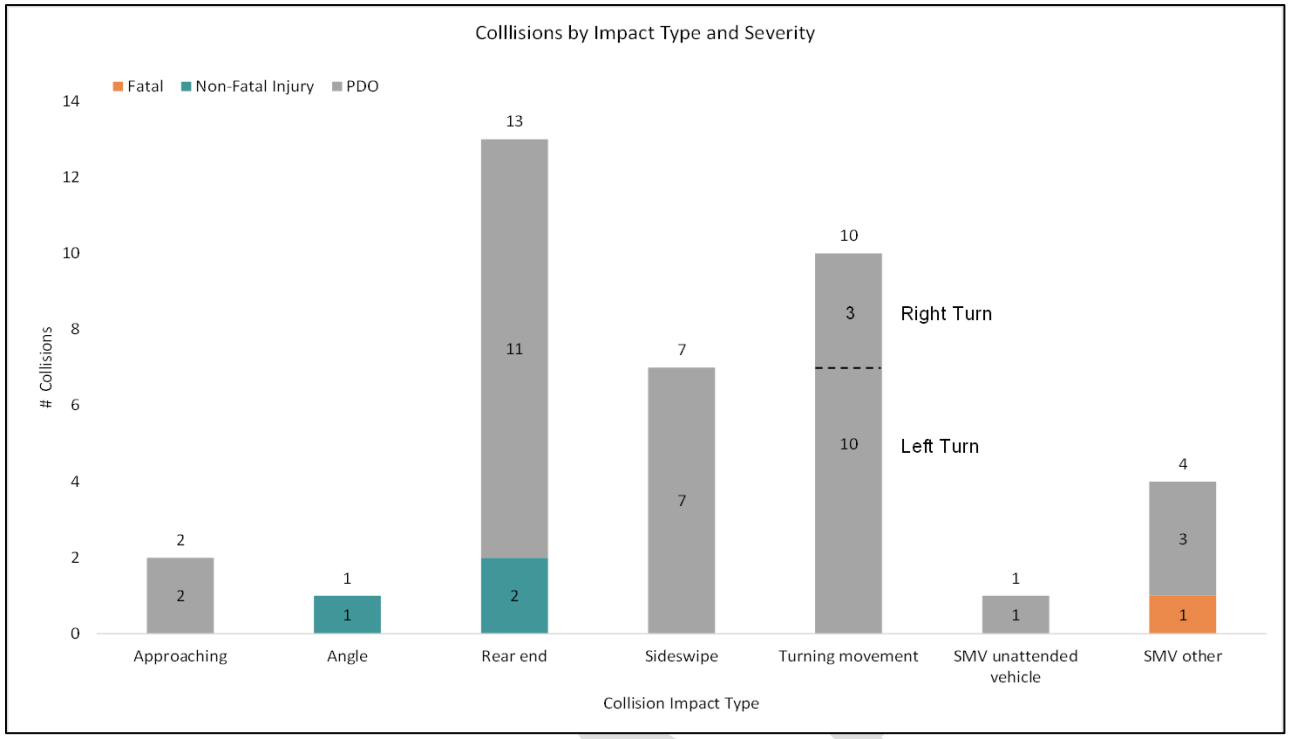
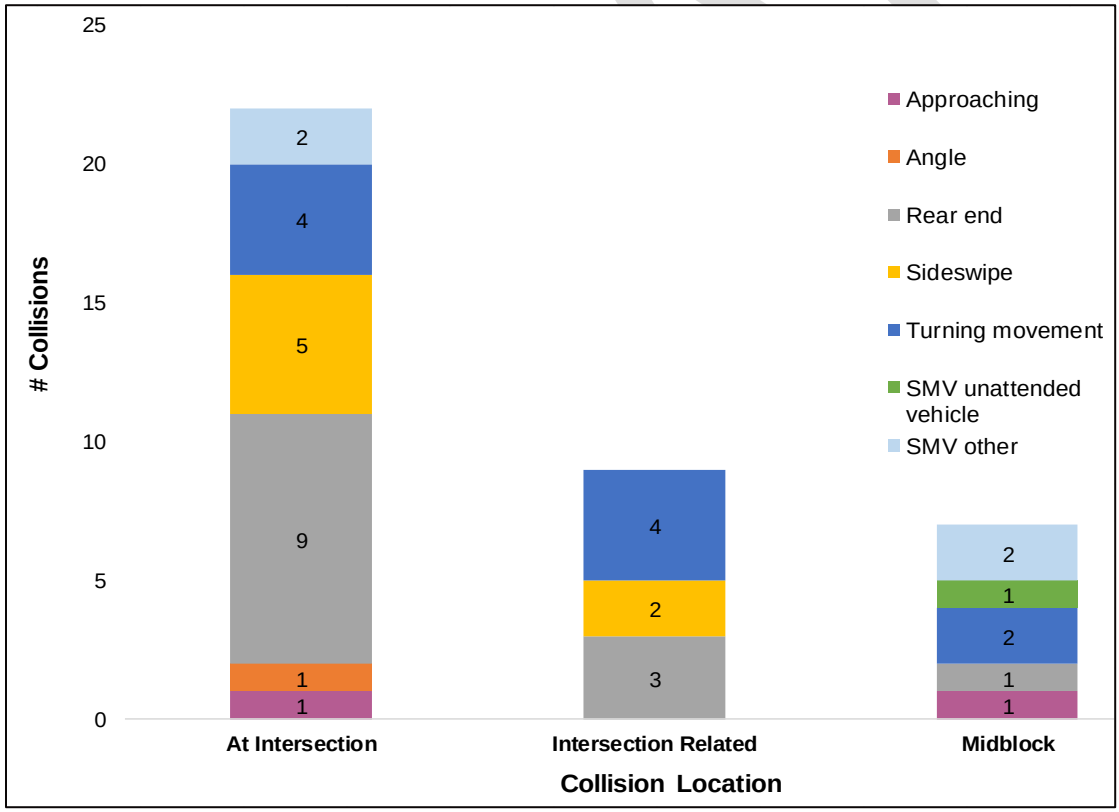


Exhibit 11: Collisions by Location and Impact Type (2018-2022)



2.3.5 Review of High-Risk Collisions

The Region of Peel has developed a Road Safety Strategic Plan (RSSP) that aligns with the Vision Zero framework, reflecting Peel Region's commitment to addressing road collisions resulting in injury or death. Aligning with these objectives, fatal and injury collisions, and those involving VRUs, were closely examined to understand underlying causes and potential risk factors contributing to collision occurrences, especially for more severe collisions. **Exhibit 12** provides a summary of high-risk collisions recorded within the study area.

Exhibit 12: Summary of High-Risk Collisions (2018-2022)

Location	Year	Collision Details
Dixie Road between Orchard Hill Road and a Private Access	2020	A southbound vehicle drifted into the bicycle lane, colliding with a user of a motorized mobility scooter in the southbound bike lane. The collision resulted in a fatality. Although not recorded in the collision data attributes, subsequent investigations revealed to the media that the car was traveling about 20 km/h faster than the posted speed limit[1].
Dixie Road and Rometown Drive	2022	A southbound vehicle, performing an improper turn, rear-ended a southbound cyclist turning right, resulting in a non-fatal injury.
Dixie Road and Lakeshore Road East	2018	A westbound driver failed to stop and rear-ended another vehicle that was stopped and waiting at the intersection, resulting in a non-fatal injury.
Same as above	2019	A southbound dump truck traveling through the intersection failed to obey traffic control and collided with a westbound vehicle, resulting in a non-fatal injury.

As illustrated, major contributing factors to occurrences of more severe collisions within the study area involve instances of drivers disobeying traffic control devices and improper driving (i.e., improper turns, speeding, etc.). More details on speeding are provided in Section 2.4.2.

2.3.6 Collision Spatial Distribution

The spatial distribution of collisions was analyzed to determine key locations for collision concentrations. **Exhibit 13** shows the locations and severity types of collisions that occurred within the study area. **Exhibit 14** provides a summary of the number of collisions, severity, and impact types of collisions that occurred at these key locations. As shown, the key locations where 74% of

[1] https://www.pressreader.com/canada/toronto-star/20230128/281663964144799?srsltid=AfmBOopE4-m-odhJPxV61ZQPbVd45Al36Fk0K6BNIGO4uGxYXBy49g4b

all collisions occurred include the intersections of Dixie Road and Lakeshore Road East (19 or 50%) and Dixie Road and Rometown Drive (9 or 24%). Collision diagrams of these locations were developed and are presented in **Exhibit 15** and **Exhibit 16**.

Based on the information presented in these exhibits and the review of collision data details, the systemic trends observed at these locations are as follows:

- The most prominent collisions at these locations were rear-end, sideswipe, and turning movement collisions, with most resulting in property damage only.
- Two of the rear-end collisions at Dixie Road and Lakeshore Road East Intersection involved injuries, as explained in Exhibit 12. Two of the other PDO rear-end collisions involved a vehicle reversing or changing lanes, potentially contributing to the collision occurrence.
- Three sideswipe collisions at Dixie Road and Lakeshore Road East Intersection involved a vehicle making a right turn, and one involved a vehicle making a U-Turn.
- All turning movement collisions resulted in property damage only, involving 7 left-turns and 3 right-turns. Three of the left-turn-related collisions and one of the right-turn-related collisions involved a vehicle failing to yield the right of way, making an improper turn, or lane change.

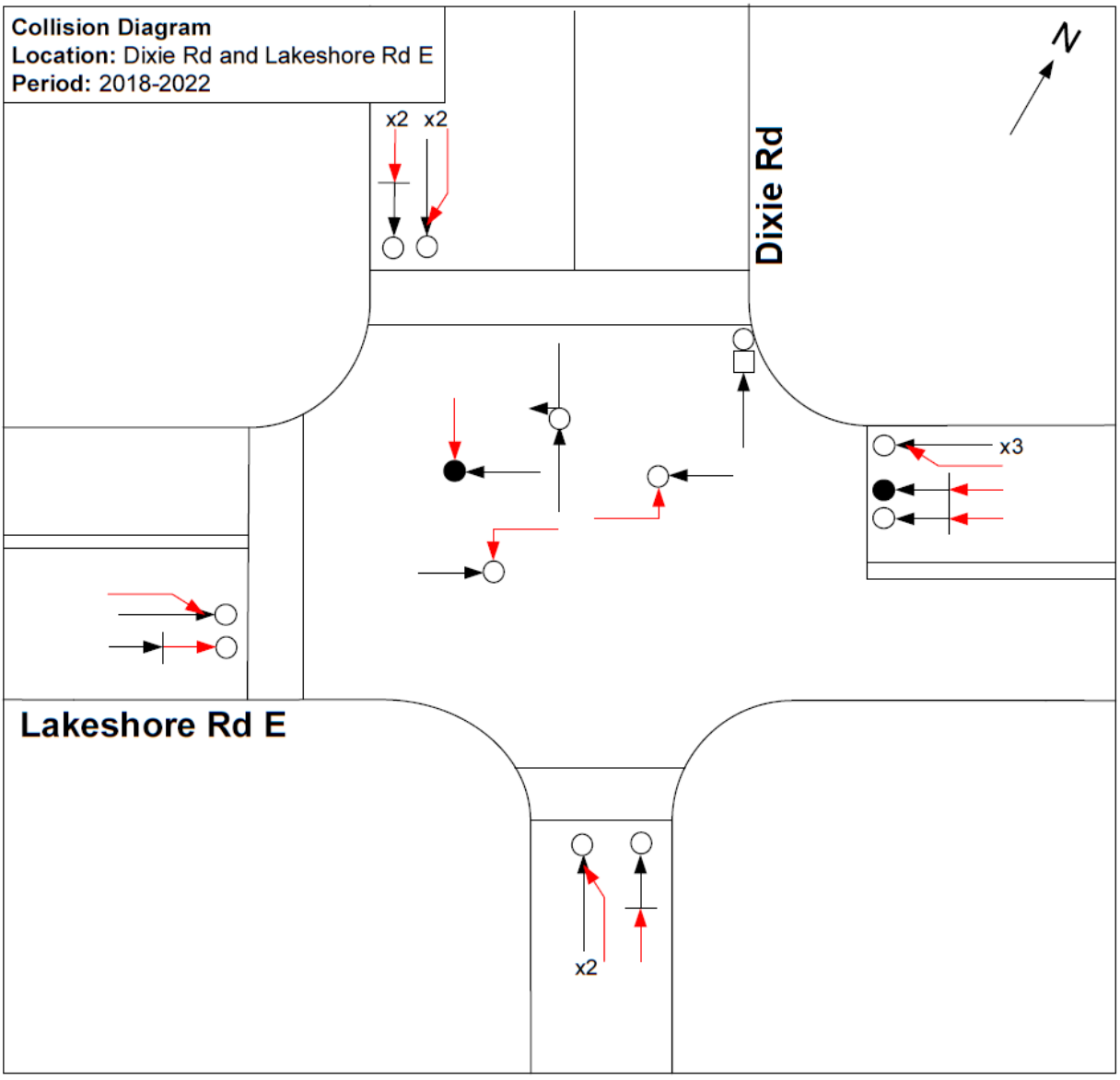
Exhibit 13: Collision Location and Severity (2018-2022)

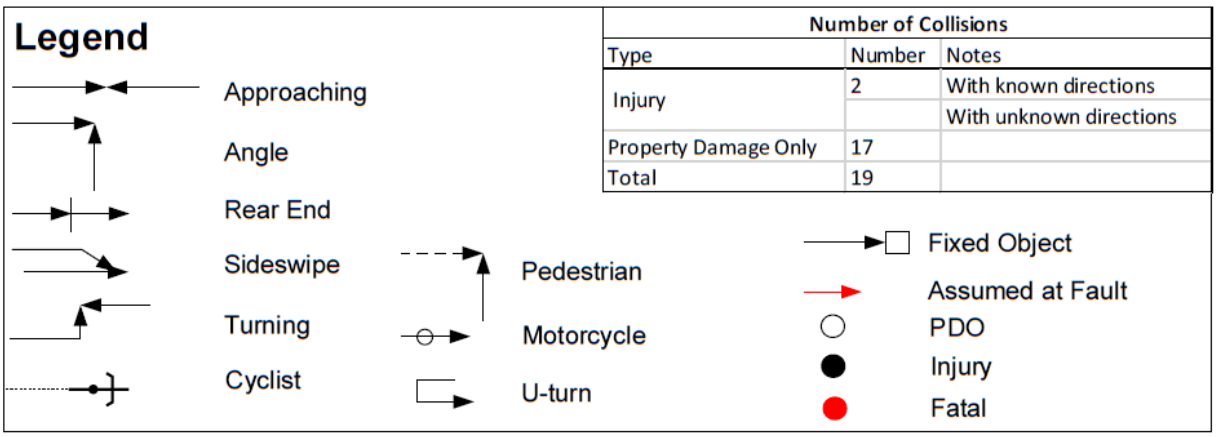
Exhibit 14: Collision Frequency, Severity, and Impact Type at Key Locations (2018-2022)

Location	Collision Frequency & Severity				Impact Types
	Fatal	Injury	PDO	Total	
Dixie Road and Lakeshore Road East		2	17	19	Rear-end (6) Sideswipe (6) Turning Movement (4) Angle (1), SMV (1), Approaching (1)

Location	Collision Frequency & Severity				Impact Types
	Fatal	Injury	PDO	Total	
Dixie Road and Rometown Drive		1	8	9	Rear-end (6) Turning Movement (2) SMV (1)
Dixie Road between Lakeshore Road East and Saint James Avenue			3	3	Turning Movement (2) SMV Unattended Vehicle (1)
Dixie Road between Larchview Trail and A Private Access			2	2	Rear-end (1) SMV (1)
Dixie Road between Orchard Hill Road and A Private Access	1			1	SMV (Pedestrian)
Dixie Road and Larchview Trail			1	1	Turning Movement (1)
Dixie Road and Londonderry Boulevard			1	1	Turning Movement (1)
Dixie Road and Saint James Avenue			1	1	Sideswipe (1)
Dixie Road between Larchview Trail and Londonderry Boulevard			1	1	Approaching (1)

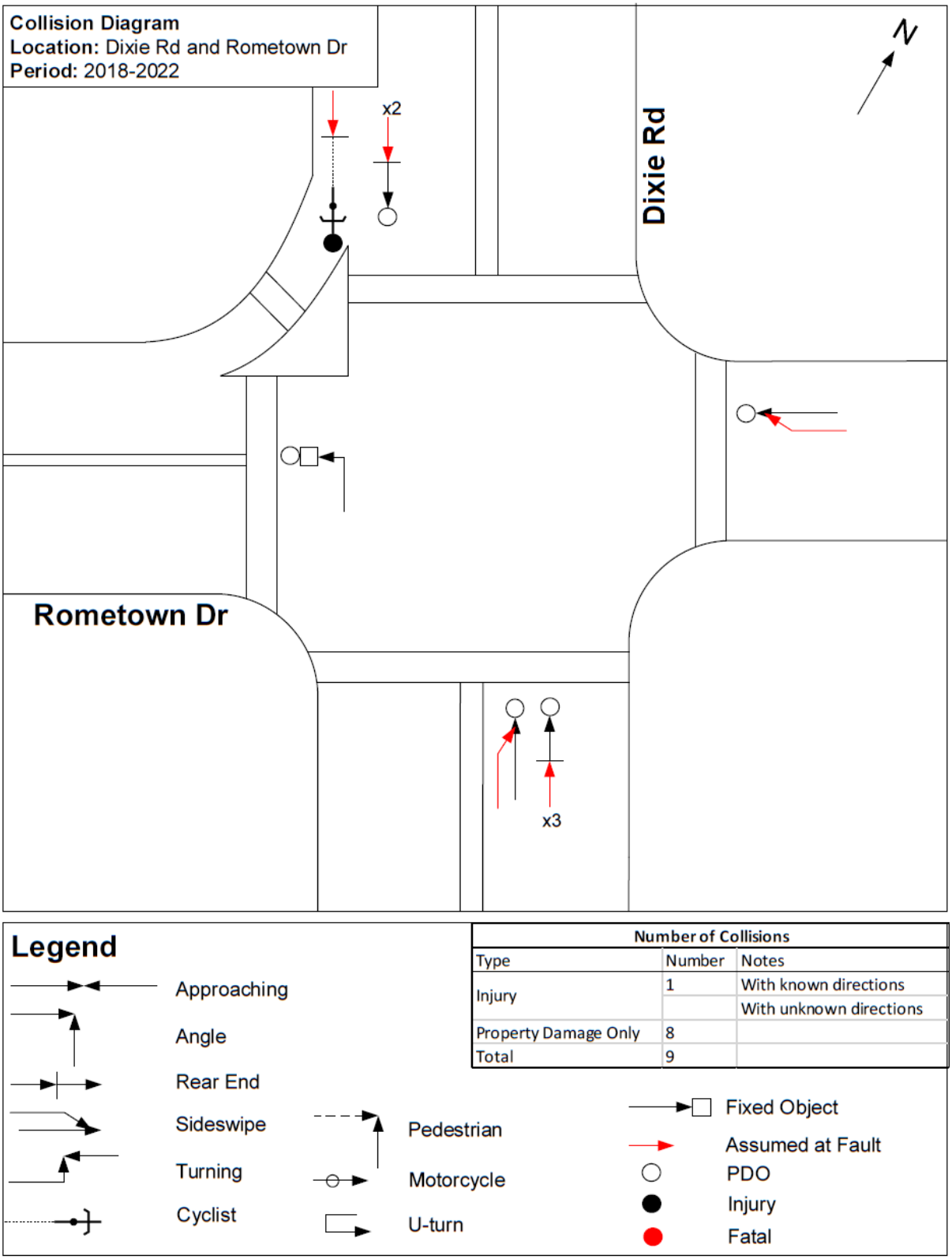
Exhibit 15: Collision Diagram - Dixie Road and Lakeshore Road East





Number of Collisions		
Type	Number	Notes
Injury	2	With known directions
		With unknown directions
Property Damage Only	17	
Total	19	

Exhibit 16: Collision Diagram - Dixie Road and Rometown Drive



Number of Collisions		
Type	Number	Notes
Injury	1	With known directions
		With unknown directions
Property Damage Only	8	
Total	9	

2.4 Operational Analysis

An operational analysis was conducted to assess the characteristics of the study area, including traffic volumes and vehicle classification distribution, vehicle operating speeds, and capacity performance of study intersections. Measures such as level of service, volume/capacity ratios, and queuing were used to evaluate the capacity performance of study intersections. The findings of this analysis are summarized below.

2.4.1 Traffic Volumes and Vehicle Classification

Traffic volume, speed, and vehicle classification data were collected by the Region using Automatic Traffic Recorders (ATR) at midblock locations along the study area of Dixie Road. Data was collected at two locations: one 400m north of Lakeshore Road (referred to as Counter #1) and another 1.27 km north of Lakeshore Road (referred to as Counter #2). The data collection covered a 24-hour period for three consecutive weekdays at both counters, from Tuesday, May 14, 2024, to Thursday, May 16, 2024, at Counter #1, and from Tuesday, May 07, 2024, to Thursday, May 09, 2024, at Counter #2.

A review of vehicular volume and speed data was conducted to provide a comprehensive understanding of traffic volumes, classifications, and speeds in the study area, enabling a thorough analysis of the existing traffic conditions. The analysis revealed the following:

- Dixie Road experiences an average daily traffic volume of approximately 14,300 vehicles in both directions, with a minor difference between the total volumes counted at the two locations (approximately 2% more at Counter #2).
- The directional split of traffic is almost equal (i.e., 51% northbound and 49% southbound) with minor differences between the two counters (less than 1%).
- The predominant category of vehicles is Class-2 vehicles (passenger cars), accounting for 83.8% of the vehicle mix. This was followed by Class-3 vehicles (two-axle, four-tire vehicles), constituting 11.9% of the total volume, followed by Class-5 vehicles (two-axle, six-tire single units) at 2.5%.

2.4.2 Vehicle Operating Speeds

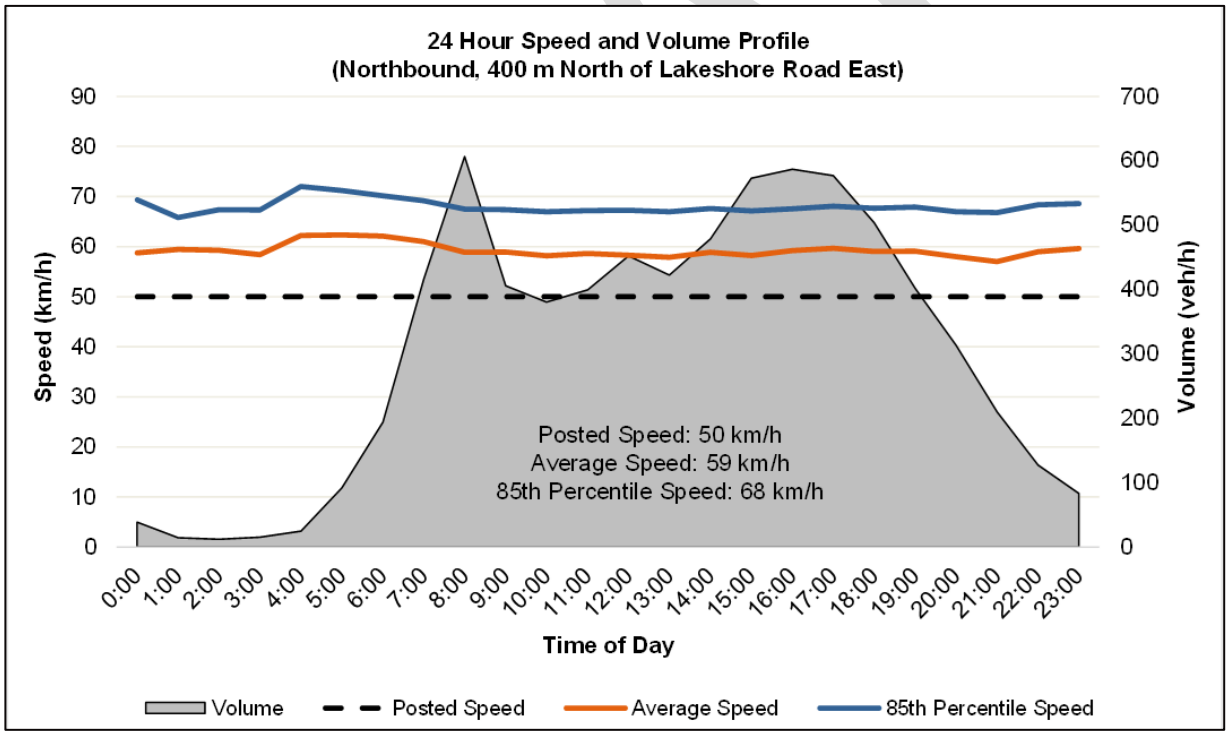
Vehicle operating speeds and traffic volumes were also analyzed using speed-volume data collected along Dixie Road. The 24-hour speed-volume profiles of the section at Counter #1 (400m north of Lakeshore Road East) and at Counter #2 (1.27 km north of Lakeshore Road East) are shown in **Exhibit 17** and **Exhibit 18**, respectively, to illustrate the observed trends.

As previously mentioned, the posted speed limit is 50 km/h. As illustrated, the 85th percentile speed ranged from 60 km/h to 71 km/h for both travel directions, exceeding the posted speed limit by 10

km/h to 21 km/h. Based on the data presented in the exhibits and the review of speed data, the following conclusions can be drawn for each location:

- **At Counter #1 (400 m north of Lakeshore Road East):** The 85th percentile operating speed along this section exceeded the posted speed limit by 18 km/h (northbound) and 21 km/h (southbound). Additionally, 4.4% of vehicles in the northbound direction and 15% of vehicles in the southbound direction were recorded driving at speeds of 71 km/h or higher (21 km/h above the speed limit). Operating speeds, though elevated, remained relatively consistent throughout the day, with higher speeds overnight (between 11:00 PM and 4:00 AM). **Exhibit 17** indicates spikes in traffic volumes for both travel directions during the AM peak and PM peak periods, both associated with a slight reduction in operating speeds.
- **At Counter #2 (1.27 km north of Lakeshore Road East):** The 85th percentile operating speed along this section exceeded the posted speed limit by 10 km/h (northbound) and 18 km/h (southbound). Additionally, 1.1% of vehicles in the northbound direction and 6% of vehicles in the southbound direction were recorded driving at speeds of 71 km/h or higher (21 km/h above the speed limit). Operating speeds, though elevated, remained relatively consistent throughout the day, with higher speeds overnight (between 11:00 PM and 4:00 AM). **Exhibit 18** indicates spikes in traffic volumes for both travel directions during the AM peak and PM peak periods, both associated with a slight reduction in operating speeds.

Exhibit 17: Vehicle Operating Speeds at Counter #1 (400 m North of Lakeshore)



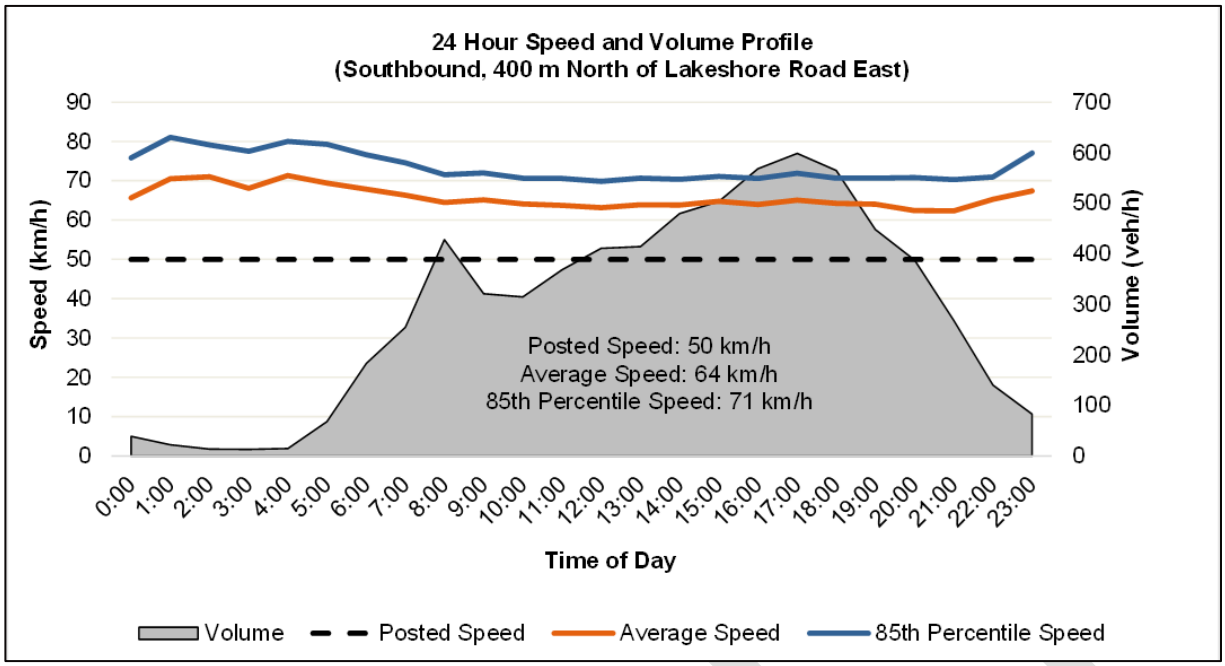
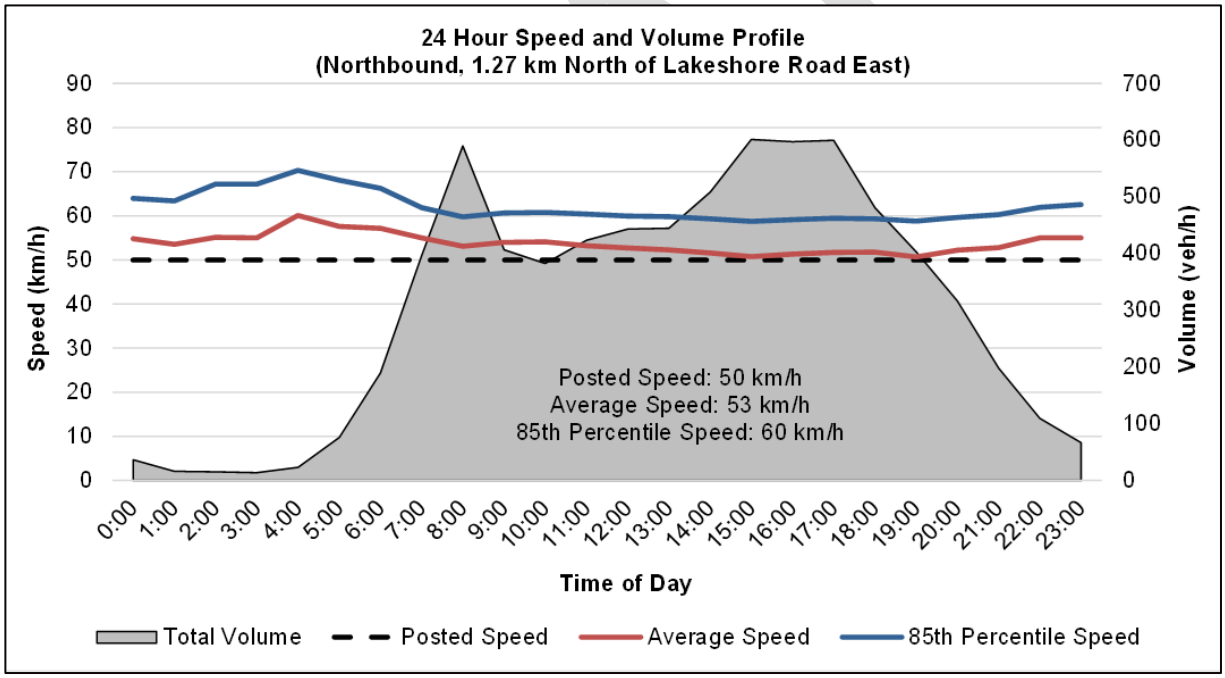
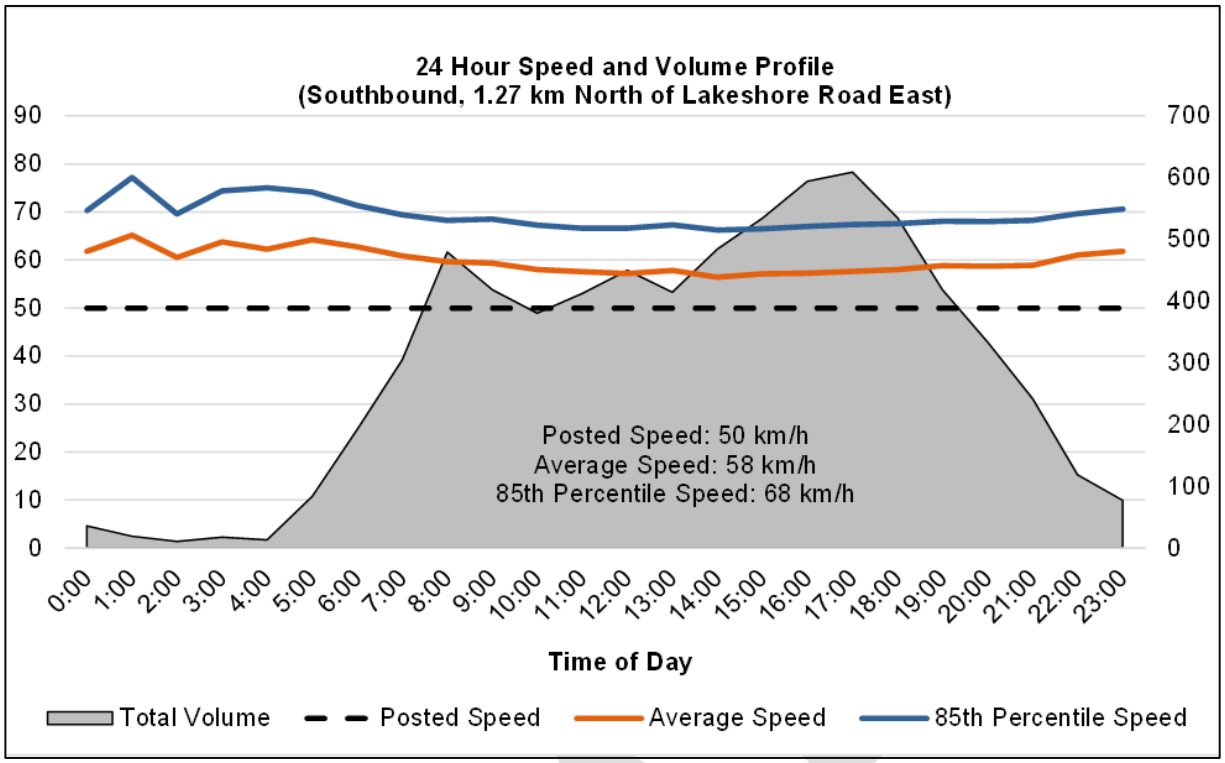


Exhibit 18: Vehicle Operating Speeds at Counter #2 (1.27 km North of Lakeshore)





Overall, similar speeding trends are observed at the two locations. However, operating speeds are notably higher in the northbound direction at Counter #1 (68 km/h) compared to Counter #2 (60 km/h). This is intuitive, as at Counter #1, drivers pass the underpass and traverse a section surrounded by open space (a less constrained environment, potentially encouraging speeding), compared to Counter #2, where drivers approach a section of Dixie Road with closely spaced intersections starting at Larchview Trail. The high operating speed of 71 km/h at Counter #1 in the southbound direction can be attributed to the downgrade approaching the underpass.

2.4.3 Capacity Analysis Findings

A capacity assessment of the study intersections was conducted using Synchro 11.0. Detailed capacity analyses for both signalized and unsignalized intersections under existing conditions are provided in the ***Transportation and Traffic Study Report***.

In summary, the majority of movements operate below capacity levels, at acceptable operational conditions as per Region of Peel guidelines, except for the following movements:

- **Dixie Road and Lakeshore Road East:** Southbound left turn during the AM and PM peak periods.
- **Dixie Road and Dixie Outlet Mall South Access:** Shared eastbound left-through in the AM peak period.
- **Dixie Road and Rometown Drive:** Eastbound left turn in the PM peak period.

Most of these movements operate at LOS E. However, the v/c ratios and 95th percentile queues are under critical thresholds. This LOS "E" can be attributed to the signal delay caused for these movements, which can be due to providing more green time for northbound and southbound movements, that operate well under critical conditions, at the expense of green time for the left turn movements at these intersections.

Additionally, the 95th percentile queue length at the intersection of Dixie Road and Lakeshore Road East for the eastbound left turn movement in the AM period (45 m) slightly exceeds the available storage length (42 m). The 95th percentile queue length for the same movement in the PM period (93 m) largely exceeds the available storage length (42 m).

All unsignalized intersections within the study area operate below critical conditions.

3 Issues and Recommendations

This section presents identified safety issues and recommendations for the study area of Dixie Road, with a focus on addressing issues and providing recommendations that aim to improve the safety and mobility of vulnerable road users. Issues were identified by cross-checking findings from different analysis sources, including collision review, traffic data analysis, and field investigations.

3.1 Identified Safety Issues

3.1.1 Historical collisions

Overall, the majority of collisions (34 or 89%) resulted in Property Damage Only, while 3 collisions led to injuries, and one resulted in a fatality. Two of the injury collisions were vehicle-to-vehicle collisions and occurred at the Dixie Road and Lakeshore Road East intersection. The third injury collision occurred at the Dixie Road and Rometown Drive intersection and involved a cyclist. This collision can be attributed to an improper turn made by a southbound driver who rear-ended a southbound cyclist turning right, resulting in a non-fatal injury. As per the available data, the collision seems to have occurred at the right turn channel that has already been removed. The fatal collision that occurred in 2020 on Dixie Road between Orchard Hill Road and a private access involved a pedestrian where a southbound vehicle drifted into the bicycle lane, colliding with a user of a motorized mobility scooter in the southbound bike lane. While media releases indicate that the driver was speeding about 20 km/h above the speed limit, the severity of the collision also indicates the importance of physical separation of bike lanes from motor vehicles.

While there are no significant patterns of severe collisions within the study area, even a few fatal and serious injury collisions are unacceptable and warrant attention, particularly in the context of Vision Zero. The following sections summarize the potential causes and risk areas to be managed through this study.

3.1.2 Speeding

Both speed data and field investigations confirm that **speeding is a notable issue along Dixie Road**. As previously mentioned, the 85th percentile speeds ranged from 60 km/h to 71 km/h in both travel directions, exceeding the posted speed limit by 10 km/h to 21 km/h. At Counter #1 (400 m north of Lakeshore Road East), 4.4% of northbound vehicles and 15% of southbound vehicles were recorded traveling at speeds of 71 km/h or higher, which is 21 km/h above the speed limit. Similarly, at Counter #2 (1.27 km north of Lakeshore Road East), 1.1% of northbound vehicles and 6% of southbound vehicles were recorded traveling at speeds of 71 km/h or higher, also 21 km/h above the speed limit.

Speeding not only increases the risk of collisions but also impacts the safety and comfort of vulnerable road users. Higher vehicle speeds reduce the reaction time for drivers and increase the severity of crashes, creating challenging conditions for vulnerable road users to navigate the roadway safely.

3.1.3 Pedestrian facilities

This issue category consists of a subset of issues related to safety concerns with respect to pedestrian facilities as follows:

Lack of controlled pedestrian crossings

The study area currently features three controlled pedestrian crossings at the signalized intersections of Dixie Road at Lakeshore Road East, Dixie Outlet Mall South Access, and Rometown Drive. The distance between Lakeshore Road East and Dixie Outlet Mall South Access is approximately 1480 m, over which there are multiple trip generators, including Lakeview Golf Course (1190 Dixie Road), Toronto Golf Club (1305 Dixie Road), and Fairways Condo (1400 Dixie Road). Among these, Fairways Condo is a major trip generator, particularly for pedestrians. Residents of Fairways Condo who would like to cross Dixie Road at a formal crossing must walk either 380 m to cross at Dixie Outlet Mall South Access or 1100 m to cross at Lakeshore Road East. These relatively long distances to formal crossings encourage risky behavior, including midblock crossings, which significantly impact pedestrian safety and increase the risk of collisions.

Lack of tactile walking surface indictors

During field investigations, the lack of tactile walking surface indicators (TWSIs) was observed at several locations along Dixie Road. At some locations where TWSIs are provided, they are not aligned with crosswalks. These issues pose safety concerns for individuals with visual impairments, making it difficult for them to locate and stay within the designated pedestrian crossing area, thereby increasing their risk of being struck by vehicles. This issue also has a social impact, as individuals with visual impairments can feel socially excluded and isolated. The lack of

tactile walking surface indicators was observed at the following intersections (**Exhibit 19**). For more details, please refer to the ***Study Area Profile Memo***.

- Dixie Road at Lakeshore Road East: Northwest and northeast corners
- Dixie Road at Rometown Drive: TWSIs are missing on the southeast corner. Additionally, on the southwest corner, TWSIs are not aligned with the crosswalks. Furthermore, it seems that the southeast sidewalk has recently been widened, with a new depressed curb and TWSI located far from the intersection.

Exhibit 19: Misaligned Tactile Walking Surface Indicators at Rometown Drive

TWSIs are not aligned with crosswalks

Photo Location: Dixie Road at Rometown Drive, Southwest corner, looking east

TWSI in the southeast corner located far from the intersection

Photo Location: Dixie Road at Rometown Drive, Southeast corner, looking south

Absence of crosswalks on side streets

There are currently no crosswalks on side streets including Larchview Trail, Orchard Hill Road, and Saint James Avenue. Additionally, at the intersection of Dixie Road and Rometown Drive, there is no painted crosswalk on the west leg (**Exhibit 20**).

Exhibit 20: Examples of Locations with Missing Crosswalks

Absence of crosswalk on Larchview Trail & Presence of pedestrian pathway marks showing pedestrian desire line on the east side of Dixie Road

Photo Location: Dixie Road at Larchview Trail, Northeast corner, looking south

Absence of a painted crosswalk on the west leg

Photo Location: Dixie Road at Rometown Drive, Southwest corner, looking north

Absence of accessible pedestrian signals

All pedestrian crossings along the corridor lack accessible pedestrian signals. An illustrative example of missing accessible pedestrian signals at Lakeshore Road East is provided in **Exhibit 21**.

Exhibit 21: An Example Location with Missing Accessible Pedestrian Signals

Absence of Accessible Pedestrian Signals (standard pushbuttons are used)

Photo Location: Dixie Road at Lakeshore Road East, Southwest corner, looking east

Localized issues in pedestrian facilities

1. The following issues were noted at the rail underpass (**Exhibit 22)**. The pedestrian facilities will be upgraded in Summer 2024 through upcoming rail underpass construction.
   - Sidewalks are generally poor, narrow, damaged at some locations, and uneven, which represents a tripping safety hazard.
   - Parts of the railings are missing, with water pooling.
   - Low-hanging tree branches above the retaining wall encroach on the right-of-way and require pedestrians to duck under or dodge branches while walking this section, occasionally forcing pedestrians into the clear zone, reducing their safety and increasing the risk of collisions.

Exhibit 22: Issues with Pedestrian Facilities at the Rail Underpass

Uneven and damaged sidewalk near the railing on the west side of Dixie Road

Photo Location: West side, ~45 m from underpass, looking north

Missing railing sections on the west side of Dixie Road, with multiple instances of pooling

Photo Location: West side, adjacent to underpass, looking north

Low-hanging branches

Photo Location: West side, ~50 m downstream of underpass, looking north

2. The sidewalk on the southeast side of the intersection of Dixie Road at Orchard Hill Road abruptly ends creating a safety hazard for pedestrians (**Exhibit 23**).

Exhibit 23: End of Sidewalk at Orchard Hill Road

Southeast sidewalk abruptly ends

Photo Location: Dixie Road at Orchard Hill Road, southeast corner, looking east

3. Low visibility (dark conditions) was observed at Fairways Condo (1400 Dixie Road). As shown below, there is no streetlighting on the east side of the intersection where this access meets Dixie Road.

Exhibit 24: Low Visibility at Fairways Condo

Photo location: North side of intersection, looking south

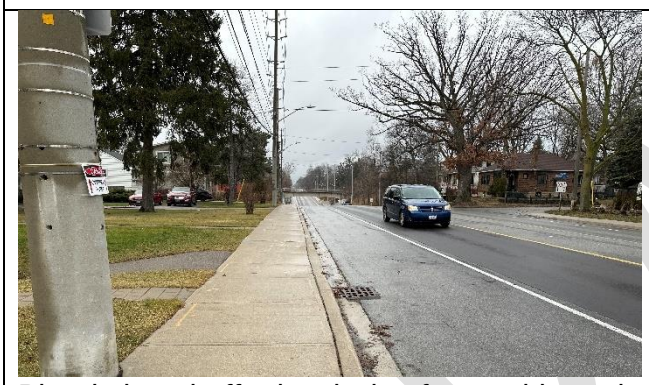
3.1.4 Cycling facilities

The following issues were observed during field investigations:

- At some locations, bicycle lane markings are discontinued, or the bicycle lane buffer is missing or faded (**Exhibit 25**).
- At Dixie Road at Mall South Access, the cycling route on the west side of Dixie Road is broken and uneven as it crosses over a decommissioned sidewalk, with the presence of confusing or overlapping pavement markings, where the pre-Dixie Mall Outlet redevelopment bicycle lane tie-in directly straddles the vehicle path of travel (**Exhibit 26**).
- These issues significantly impact the safety of cyclists – Uneven cyclist paths present tripping hazards. Discontinuous or poorly marked lanes can lead to road user confusion and unsafe conditions. The absence of clear and visible lane markings reduces the predictability of cyclist movements, increasing the risk of collisions. Furthermore, poor retroreflection reduces the visibility of bicycle lanes during low-light conditions, making it more difficult for drivers to see and avoid cyclists, thereby increasing the likelihood of collisions in dark conditions.
- The lack of physical separation of the cycle route from motor vehicle travel lanes represents a safety concern, considering the speeding behavior observed along the study area and the issues observed in existing cyclist facilities. When a collision involves a cyclist occurs and there is no physical separation between the cycling lane and vehicle travel lane, the severity of the collision significantly increases. This can be exemplified by the fatal collision that occurred in 2020, where a southbound vehicle drifted into the bicycle lane, colliding with a user of a motorized mobility scooter in the southbound bike lane.

Exhibit 25: Discontinued or Missing Bicycle Lane Markings

Bicycle lane markings are discontinued through the intersection
Photo Location: Dixie Road at Toronto Golf Club Access, south side of the intersection, looking north



Bicycle lane buffer is missing for southbound traffic approaching the intersection
Photo Location: Dixie Road at St. James Avenue, northwest corner, looking north

Bicycle lane buffer is missing on both sides between Orchard Hill Road and Lakeview Golf Course Access
Photo Location: West side of Dixie Road, approximately 50m from the underpass, looking north

Exhibit 26: Issues with Cyclist Facilities at Dixie Road at Mall South Access

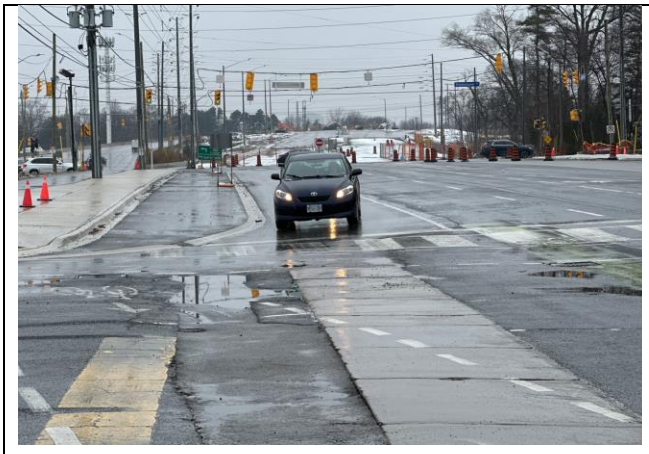


Photo Location: Dixie Road at Mall South Access, southwest corner, looking north

Photo Location: Dixie Road at Mall South Access, southwest corner, looking north

Broken and uneven cycling route with overlapping pavement markings

3.1.5 Aggressive turning movements

Aggressive turning movements were observed at the intersections of Dixie Road at Dixie Mall South Access and Lakeshore Road East as follows:

Dixie Road at Dixie Mall South Access:

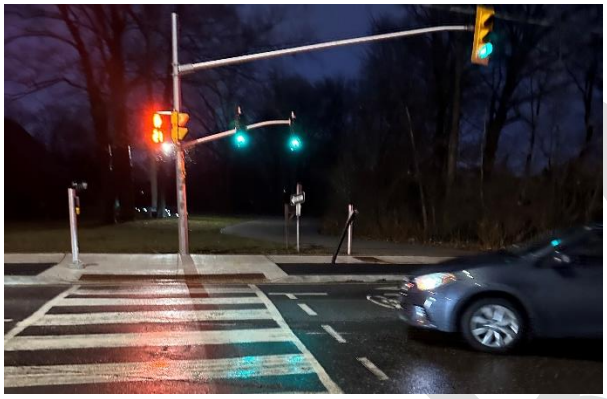
- Some drivers were observed making southbound right turns without stopping on a red signal or yielding to pedestrians;
- Some drivers were observed making eastbound left-turning without yielding to pedestrians crossing Dixie Road until their vehicles reached the crosswalk.

These issues are illustrated in **Exhibit 27**. These aggressive turning behaviors have significant safety implications. Drivers failing to yield to pedestrians while turning intimidate pedestrians and greatly increase the risk of collisions. Such behaviour compromises the safety and comfort of pedestrians, discouraging walking and potentially increasing midblock crossings where pedestrians may try to avoid these complex interactions and look for gaps in through traffic to cross the Dixie Road.

Exhibit 27: Aggressive Turning Behaviour at Dixie Road & Mall South Access Intersection

Aggressive turning behaviour (southbound right turning vehicles)

Photo Location: Dixie Road at Mall South Access, Southwest corner, looking north



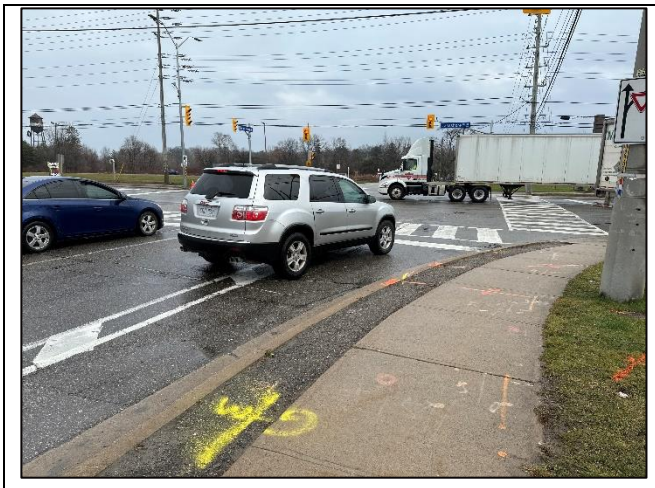
Aggressive turning behaviour (eastbound left turning vehicles)

Photo Location: Dixie Road at Mall South Access, North side crosswalk, looking east

Dixie Road at Lakeshore Road East:

- The large turning radius at the southbound right approach encourages drivers to encroach the bicycle lane while turning on both red and green phases (**Exhibit 28**).

Exhibit 28: Aggressive Turning Behaviour at Dixie Road & Lakeshore Road East



Southbound drivers encroaching the bicycle lane while turning right

Photo location: Dixie Road at Lakeshore Road East, Northwest corner, looking south

3.1.6 Sight distance limitations

As discussed in Section 2.2, field investigations and a desktop review of sightlines revealed that the available sightline at the stopping position on side streets, including St. James Avenue, Orchard Hill Road, Larchview Trail, and Londonderry Boulevard, is obstructed due to vegetation, hydro poles, or the road's vertical curvature along Dixie Road. Drivers were observed advancing and encroaching into the pedestrian crosswalk location (although the crosswalk is not marked) to improve their sightlines before making turning movements. While these sight distance limitations have not resulted in recorded collisions, they should be considered during the design stage as discussed in the next section.

3.2 Recommendations

In recent years, more attention has been given to the importance of creating streets and roads that cater to the safety and accessibility of all users, not just motorists. This approach, referred to as “Complete Streets”, aims to create a well-balanced transportation system that accommodates the needs of all users, including pedestrians, cyclists, and public transit passengers, as well as motorists.

This makes the in-service road safety review of Dixie Road follow a vulnerable road user-centric approach. Therefore, the recommendations provided in this section prioritize the needs of underserved road users, such as pedestrians and cyclists, by proposing a select set of recommendations that address identified issues. These countermeasures aim to improve safety,

convenience, and comfort for these road users, regardless of whether the issues have resulted in collisions.

The following summarizes the safety study recommendations:

Exhibit 29: Study Recommendations

Issue 1: Speeding	
Countermeasure	Benefits
Traffic calming or reducing lane width	• Reclaimed space can be dedicated to other road users as part of design options for Dixie Road • Reduction of the road or lane width results in lower vehicle operating speeds • Reduction in speed fosters a more inviting and safer environment for pedestrians and cyclists
Targeted police enforcement	• The presence of enforcement may increase speed adherence
Permanent automated speed enforcement	• Consistent speed enforcement may increase speed adherence over time • Lower ongoing enforcement costs compared to traditional enforcement
Issue 2: Pedestrian facilities	
2a. Lack of controlled pedestrian crossings	
Countermeasure	Benefits
Explore the feasibility of adding a controlled crossing at Fairways Condo (1400 Dixie Road) as part of the design stage.	• Providing formal crossings at reasonable distances improves pedestrian safety, comfort, convenience, and walkability. • Reduces the likelihood of midblock crossings, thereby help reduce the risk of pedestrian-vehicle collisions • Enhances the connectivity of the pedestrian network, promoting more walking and less reliance on motor vehicles • Supports a more equitable distribution of safe crossing points along the corridor.
2b Lack of tactile walking surface indictors	
Countermeasure	Benefits
Install tactile walking surface indicators (TWSIs) at all	• Improving safety for visually impaired pedestrians

pedestrian crossings (i.e., at siganlized intersections). Ensure proper alignment with crosswalks.	• Promotes inclusivity and accessibility by ensuring that all pedestrians, regardless of visual ability, can navigate the crossing safely • Improves overall pedestrian infrastructure by aligning with best practices and standards
2c Absence of crosswalks on side streets	
Countermeasure	Benefits
Install marked crosswalks across side streets where they are missing, including Larchview Trail, Orchard Hill Road, and St James Avenue.	• Improves pedestrian safety by providing designated crossing areas • Increases pedestrian visibility, especially during low-light conditions
2d Absence of accessible pedestrian signals	
Countermeasure	Benefits
Install accessible pedestrian signals (APS) at all signalized crossings	• Enhances safety for visually impaired pedestrians by providing audible and tactile cues • Improves overall accessibility and inclusivity of the pedestrian network • Reduces potential pedestrian confusion at crossings
2f Localized issues in pedestrian facilities	
Countermeasure	Benefits
At the rail underpass: Repair and upgrade sidewalks Address uneven and damaged sections Replace missing railings Trim low-hanging tree branches	• Improves pedestrian safety by eliminating tripping hazards and preventing falls • Reduces the risk of collisions by ensuring clear and unobstructed paths • Provides a more comfortable and accessible walking environment for pedestrians
At Dixie Road and Orchard Hill Road: Address the abrupt end of the sidewalk	• Eliminates a safety hazard by providing a continuous and accessible pedestrian route • Enhances connectivity and ensures safe access to and from the intersection • Improves pedestrian comfort and reduces the risk of collisions

Issue 3: Cycling facilities	
Countermeasure	Benefits
Repaint and maintain bicycle lane/buffer markings	• Improve visibility and safety for cyclists • Improves driver awareness of bicycle lanes
Repair uneven and broken cycling routes (i.e., at problematic locations like Dixie Road at Mall South Access)	• Reduces tripping hazards for cyclists • Improves the comfort and safety of cycling routes and reduces the likelihood of collisions
Explore implementing physical separation between bicycle lanes and motor vehicle lanes	• Enhances safety by providing a physical buffer between cyclists and motor vehicles • Reduces collision severity and frequency by creating a dedicated space for cyclists
Issue 4: Aggressive turning movements	
Countermeasure	Benefits
Implement Leading Pedestrian Interval (LPI) for pedestrians using the crosswalks on the north and west approaches of Dixie Road at Dixie Mall South Access intersection	• Improves pedestrian visibility • Reinforces VRUs right-of-way over turning vehicles • Particularly helpful for older pedestrians, as they may take longer to occupy the crosswalk
Curb radius reductions and rightsizing of intersection corners at: Dixie Road at Dixie Mall South Access intersection (northwest corner) Dixie Road at Lakeshore Road East (northwest corner) *(The need for truck aprons should be evaluated at*	• Reduces the speed of turning vehicles • Reduces pedestrian crossing distances and their exposure to vehicles on the roadway • Improves visibility between all road users • Increased storage space for people waiting to cross

locations with frequent truck turns)	
Issue 5: Sight distance limitations	
Countermeasure	Benefits
Trim street trees / remove sight line obstructions at intersections of Dixie Road at St. James Avenue, Orchard Hill Road, Larchview Trail, and Londonderry Boulevard	• Improves sight distance and reduces the need for drivers to encroach into pedestrian areas • Improves overall safety by providing clear sightlines

4 Summary and Conclusions

The scope of this task was to conduct an in-service safety review of the study area to support the preliminary design of Dixie Road as a Complete Street. This review involved analyzing collision data, traffic data, and findings from field investigations to identify safety issues and propose measures accordingly.

Overall, most collisions resulted in property damage only, while three collisions led to injuries, and one resulted in a fatality. While there are no significant patterns of severe collisions within the study area, even a few fatal and serious injury collisions are unacceptable and warrant attention, particularly in the context of Vision Zero. Identified risk areas include speeding, issues with pedestrian and cycling facilities, aggressive turning movements, and sight distance limitations. The design alternatives of Dixie Road should take these issues into account along with the recommendations provided in the previous section.

In conclusion, providing a safe, convenient, and comfortable transportation system for vulnerable road users on Dixie Road requires more than just implementing countermeasures at locations where collisions have occurred. The Safe System Approach emphasizes addressing safety issues based on risk factors rather than solely on past collision history. This approach recognizes that historical collisions are not the only indicators of safety issues on a roadway. Instead, it focuses on identifying and addressing risk factors that can contribute to collisions, such as high operating speeds, inadequate pedestrian crossings, insufficient bicycle infrastructure, aggressive driver behavior, and poor visibility. By addressing these risk factors, the Safe System Approach aims to prevent collisions from occurring in the first place, rather than merely reacting to them after they happen. This results in a more proactive and effective strategy for improving road safety.