

Memo

Date: Wednesday, October 09, 2019

Project: Promenade Centre Secondary Plan

To: City of Vaughan

From: HDR

Subject: Collision Analysis Report

A collision analysis was completed to evaluate safety conditions as part of the Promenade Centre Secondary Plan study (PCSP). **Figure 1** illustrates the Secondary Plan study area, as well as a broader transportation analysis area for the comprehensive transportation study as part of the PCSP.

Figure 1. Study Area



A desktop review of available collision data on Regional Roads in the study area was conducted to identify any existing operational and safety issues. The results of this collision analysis will inform future Secondary Plan recommendations to mitigate further collisions.

The collision data from York Region's database covers intersection and midblock locations along Regional Roads in the study area over a 5-year period from January 2014 to December 2018. January and February 2019 data was also provided, but not included in the analysis to prevent over representation of collisions that would occur during these months since there tend to be more collisions in the winter months. It is to be noted that the data only accounts for Regional Roads and not local roads maintained by the City of Vaughan due to data accessibility. Over the 5-year period, a total of 495 collisions were recorded and assessed in this analysis.

Overview

A heatmap of all collisions within the Promenade Centre study area is shown in **Figure 2**, with colour schemes that highlight where collisions are most prominent. A high number of collisions are observed at the intersections of Bathurst Street and Clark Avenue (96 collisions), Bathurst Street and Centre Street (78 collisions), Centre Street and New Westminster Drive (65 collisions), and Bathurst Street and New Westminster Drive/Atkinson Avenue (62 collisions). The number of collisions observed at each intersection are shown in **Figure 3**.

Promenade Collision Heat Map

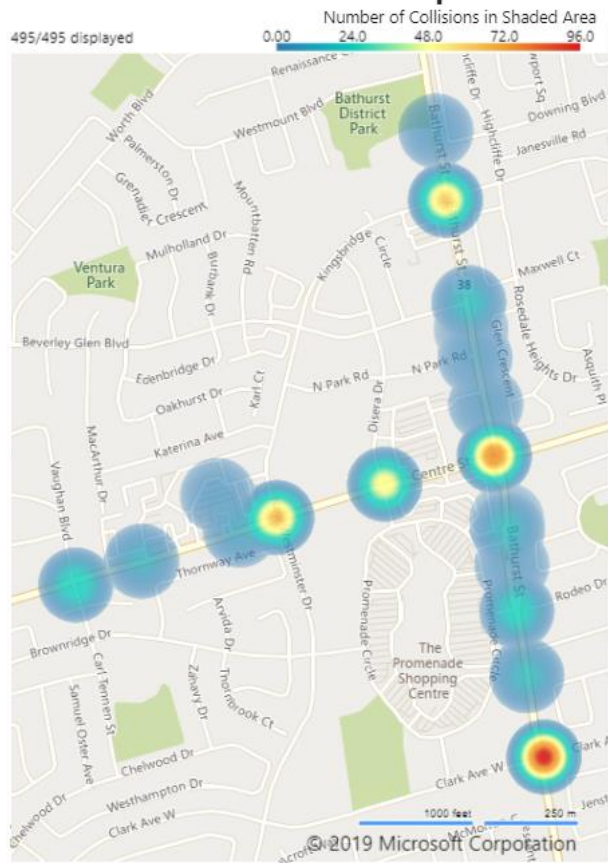


Figure 2. Promenade Centre Study Area Collision Heat Map (January 2014 to December 2018)

Number of Collisions by Intersection

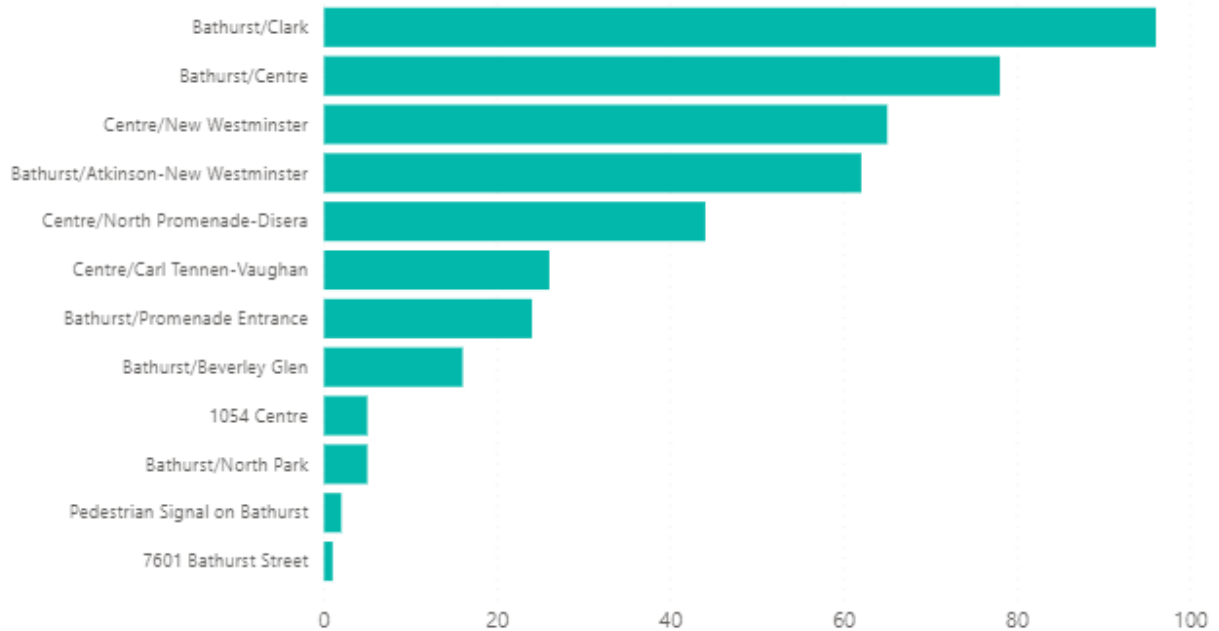
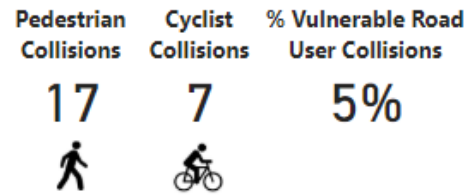
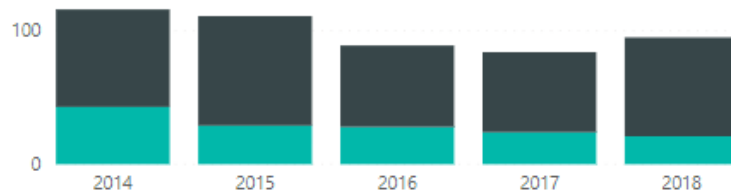


Figure 3. Collisions by Intersection (January 2014 to December 2018)

Overall collision statistics are provided in **Figure 4**. A decrease in collisions have been seen yearly since 2014, with an increase once again in 2018. Monthly collisions are highest during the winter months, which is expected due to worse road conditions. Hourly data shows collisions mostly during the PM peak hours, but are also generally high between 9 AM and 7 PM. The consistent number of collisions throughout the day is likely attributed to Promenade Mall in the study area being a recreational attraction outside of just peak hours. Vulnerable road users (pedestrians and cyclists) account for 5% of all collisions, which is higher than the 3% of collisions seen for all of Vaughan. Other external factors such as road surface, lighting, and environment conditions all show that most collisions (>70%) occur in normal conditions.

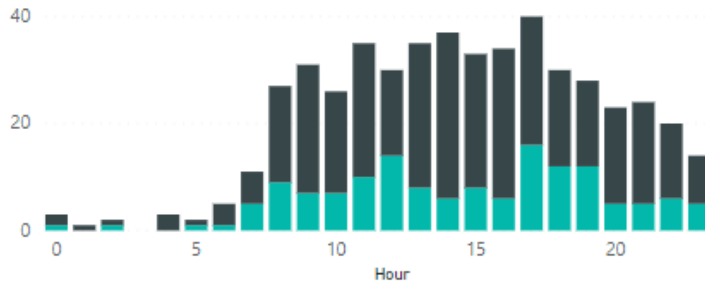
Collisions by Year and Type

Collision Type ● Injury ● PDO

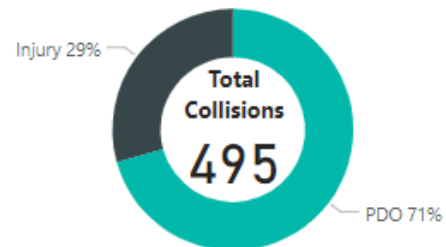


Collisions by Hour and Type

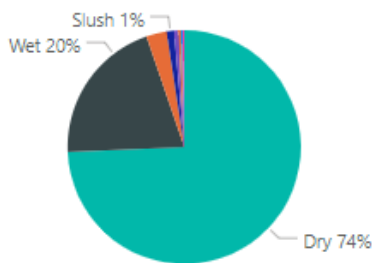
Collision Type ● Injury ● PDO



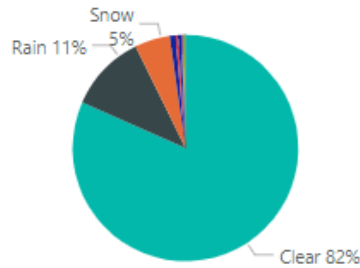
Collisions by Type



Collisions by Road Surface Condition



Collisions by Environment Conditions



Collisions by Light Conditions

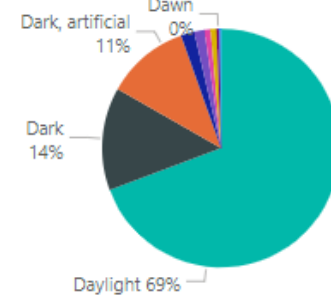


Figure 4. Key Collision Statistics in Vaughan (January 2014 to December 2018)

Figure 5 shows collision statistics regarding pedestrian and cyclists. Pedestrians and cyclists are highly vulnerable in collisions, as the data shows 100% of collisions involving these groups have resulted in injuries, compared to the 26% observed from non-active modes. A further look into the accident location for pedestrians and cyclists reveal 95% of these accidents occurring at or related to an intersection. Non-active modes also have 75% of collisions occur at intersections. As a result, collision rates for each intersection have been calculated for each intersection within the Promenade Centre study area to narrow down critical intersections for further analysis.

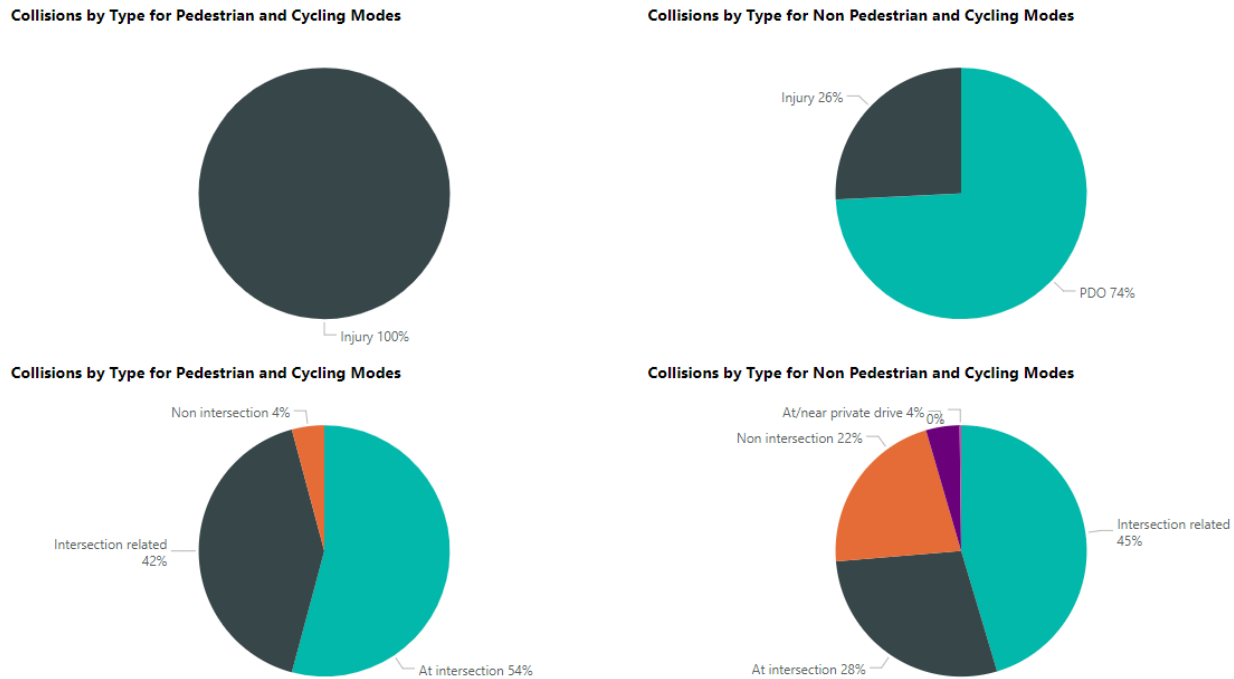


Figure 5. Collision Statistics for pedestrians and cyclists, and other modes (January 2014 to December 2018)

Average Collision Rates

Average collision rates per intersection and average collision rates per-1km sections were calculated to identify any critical locations that would not have been otherwise identified due to lower absolute number of collisions. These rates were calculated by using the following equations:

- Average collision rate per intersection:

$$\begin{aligned} & \text{Average Collision Rate Per Intersection} \\ &= \frac{\text{Number of Collisions within } X \text{ years} \times 1,000,000 \text{ vehicles}}{\text{Existing AADT} \times 365 \text{ Days} \times X \text{ years}} \end{aligned}$$

- Average collision rate per segment:

$$\begin{aligned} & \text{Average Collision Rate Per Segment} \\ &= \frac{\text{Number of Collisions within } X \text{ years} \times 1,000,000 \text{ vehicles}}{\text{Existing AADT} \times 365 \text{ Days} \times X \text{ years} \times \text{Length of the Segment}} \end{aligned}$$

AADT was approximated through PM link volumes developed from the Promenade Subarea Model through the following generally industry accepted practice:

$$\text{AADT Approximation} = \sum \text{All Volumes into Intersection} \times 8$$

The collision rate for each intersection and segment has been calculated and provided in **Table 1** and **Table 2**, respectively.

Table 1. Average Collision Rates of Intersections in Promenade Centre Study Area

Intersection	Total Collisions (2014 2018)	2019 AADT	5 Year Collision Rate	Average Collision Rate
Bathurst and Clark	96	84600	3.11	0.62
Bathurst and Centre	78	68400	3.12	0.62
Centre and New Westminster	65	59400	2.99	0.60
Bathurst and Atkinson-New Westminster	62	71100	2.39	0.48
Centre and North Promenade-Disera	44	45200	2.66	0.53
Centre and Carl Tennen-Vaughan	26	41700	1.71	0.34
Bathurst and Promenade	24	56600	1.16	0.23
Bathurst and Beverly Glen	16	50000	0.88	0.18
Bathurst and North Park	5	48300	0.28	0.06
1054 Centre	5	40700	0.34	0.07
Bathurst and North Promenade	2	56700	0.10	0.02
Bathurst and 7601 Bathurst Street	1	46400	0.06	0.01

Table 2. Average Collision Rates of Segments in Promenade Centre Study Area

Segment	Total Collisions (2014 2018)	2019 AADT	5 Year Collision Rate	Average Collision Rate	Segment Length (m)
Bathurst @ Clark & East Promenade	15	27000	3.75	0.75	400
Bathurst @ 7601 Bathurst & Centre	12	23200	8.48	1.70	170
Centre @ Carl Tennen & 1054 Centre	12	18900	5.49	1.10	320
Centre @ 1054 Centre & New Westminster	9	20300	8.18	1.64	150
Bathurst @ Beverly Glen & Atkinson-New Westminster	6	23500	1.93	0.39	360
Bathurst @ Centre and North Park	5	22300	2.72	0.54	230
Centre @ new Westminster & North Promenade-Disera	5	17200	2.76	0.55	290
Bathurst @ East Promenade & Pedestrian Signal	4	23000	1.66	0.33	290
Centre @ Bathurst & North Promenade-Disera	2	13700	1.33	0.27	300
Bathurst @ North Park & Beverly Glen	1	23500	0.51	0.10	230

Intersections with high average collision rates were found to also have a corresponding high number of collisions in the past 5 years, thus no particular issues were determined through this high level analysis.

Two segments were identified to have high collision rates above 2.50: Bathurst Street between 7601 Bathurst and Centre Street, and Centre Street between 1054 Centre and New

Westminster Drive. Though other segments have high collision rates above 1.0, the aforementioned segments have significant high collision rates considering its short road segment. A more detailed analysis will be completed for these two segments to identify potential problem areas.

Detailed Collision Analysis

Impact types at specific locations have been analyzed to identify potential geometric or other location specific conditions that could contribute to particular collisions.

Data Summary by Impact Type

All impact types for intersections have been summarized in **Figure 6**, with an overall intersection summary located at the bottom. Any anomalies will be identified and further discussed.

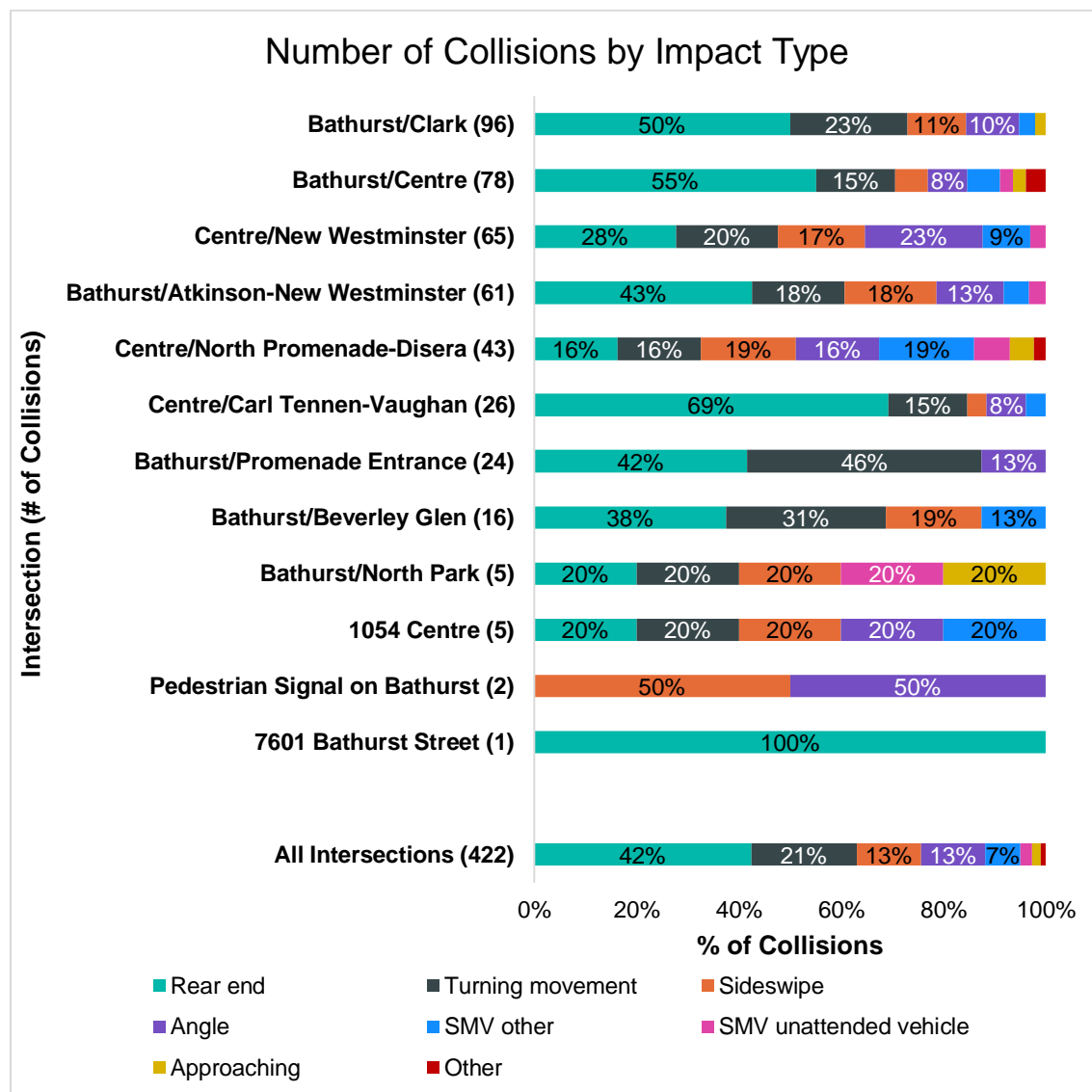


Figure 6. Impact Type by Intersection (2014-2018)

The following observations are noted:

1. **Rear end collisions** account for 40% of all intersection collisions, with 50% of these collisions being a result of following too closely. It is unlikely that environmental considerations are a contributing factor as most collisions occurred during clear and dry conditions.
2. **Centre Street and New Westminster Drive** exhibits a high number of angle collision. A common reason for these collisions include drivers disobeying traffic control, which contributed to 50% of these collisions. A strong correlation between angle collisions and external factors could not be determined as most collisions occurred during acceptable road and environment conditions. A Google Streetview of this intersection shows acceptable sightline conditions and grade. It is to be noted that construction has been ongoing along Centre Street since 2017, which could have induced irresponsible driving behaviour due to reduced lanes. However, a high number of angle collisions still occurred pre-construction. This intersection should be continually monitored in the future to identify any patterns that emerge that may lead to increased angle collisions.
3. **Centre Street and North Promenade/Disera Drive** has a high number of Single-motor-vehicle collisions, comprising of 18% of all collisions at this intersection compared to the 7% for all intersections in general. These collisions typically includes those involving pedestrians, which may be attributed to the higher pedestrian volumes at this intersection.
4. **Centre Street and Carl-Tennen Street/Vaughan Boulevard** has a high number of rear-end collisions, with 44% of collisions being a result of following too close. A third of these collisions occurred during non-clear road conditions, which may have been a contributing factor.
5. **Bathurst Street and East Promenade** exhibits a high number of turning movement collisions. Many of these collisions are from the westerly and northerly movements, which correspond with left turn movements entering and exiting Promenade Mall. A common cause of turning movement collisions include insufficient vehicle clearance intervals at intersections. Although adequate clearance time is provided for the eastbound left turning movement (3.5 seconds), more time may be needed for the northbound left turning movement (1 second).

The two segments identified with high collision rates based on their relative short segments were also further analyzed to identify potential problems. **Figure 7** provides a breakdown of impact types.

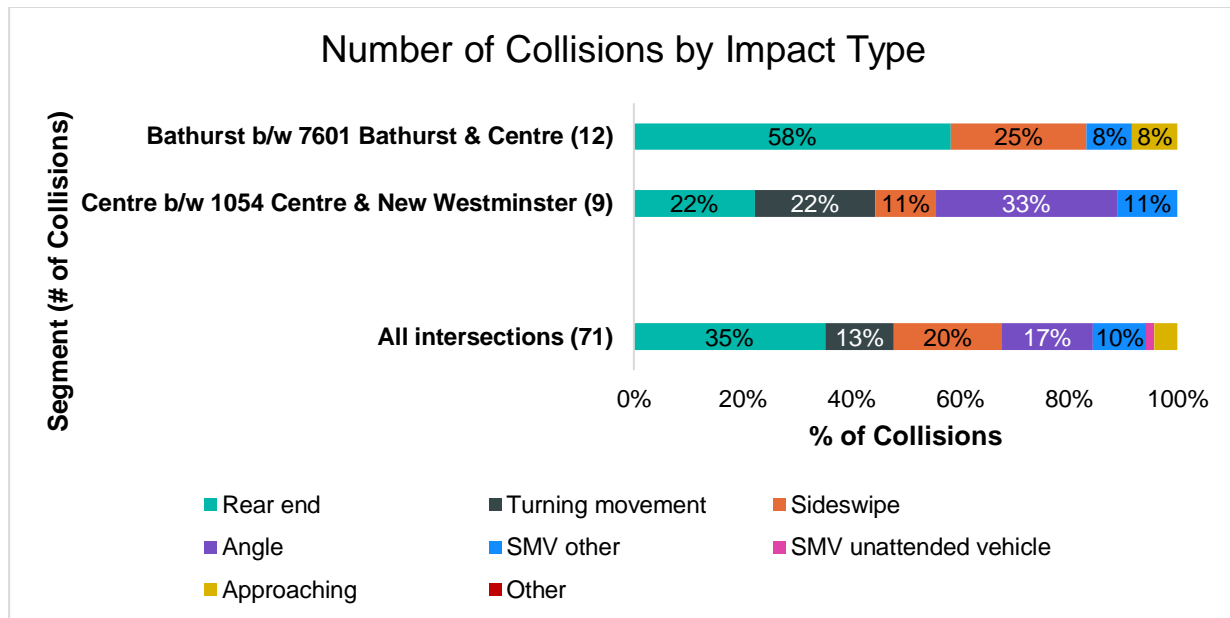


Figure 7. Impact Type by Segment (2014-2018)

Bathurst Street between 7601 Bathurst & Centre Street has a high number of rear-end collisions. Rear end collisions usually occur from leading vehicles suddenly stopping, causing collisions from trailing vehicles. It is unlikely environmental conditions are a contributing factor as 80% of collisions occurred during clear road conditions. Common causes for vehicles stopping include pedestrian crossings and side-street traffic from accesses, which both features exist immediately south of this segment near the access to 7601 Bathurst Street. A re-evaluation of the traffic control at this location may be required to determine if this location is operating adequately based on traffic and safety conditions present day.

Centre Street between 1054 Centre & New Westminster Drive exhibits a high number of angle collisions. A gas station is located within this segment, with left turns permitted to allow eastbound vehicles to enter and exit from Centre Street. With 1054 Centre Street and New Westminster Drive each being less than 150m away, there may be limited gaps for left turning vehicles. This may lead to irresponsible driving behaviors when making left turn movements, leading to increased angle collisions.

Next Steps

Next steps to address safety concerns should include:

- Conduct site investigation, if feasible, at the following locations:
 - Centre Street and New Westminster Drive
 - Centre Street and North Promenade-Disera Drive
 - Centre Street and Carl-Tennen Street/Vaughan Boulevard
 - Bathurst Street and East Promenade
 - Bathurst Street between 7601 Bathurst & Centre Street
- Determine improvements to enhance the safety at key locations; and,
- Prioritize the potential for safety improvements

- Further improve pedestrian and cyclist environment to increase safety for vulnerable users