Appendix B TRAFFIC SAFETY PERFORMANCE

Living Arts Drive Extension Class EA: Safety Performance Assessment

Prepared for:
City of Mississauga

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Sign-off Sheet

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Executive Summary

This safety performance assessment is one component of the Living Arts Drive Extension Class EA in the City of Mississauga. The City of Mississauga is considering extending Living Arts Drive from its current terminus at Rathburn Road West to a new intersection with Centre View Drive.

This safety performance assessment thoroughly reviews collision records, human factors considerations, societal costs, road geometrics, and traffic patterns to arrive at the following conclusions and or recommendations:

1. Based on the available data reviewed, the highest-risk locations are identified, and evaluated qualitatively including human factors considerations.
2. Based on the review and the available data, Stantec concludes that there are no locations exhibiting demonstrably poor safety performance.
3. Though there was no evidenced justification for immediate safety modifications, recommendations are included to improve the overall safety performance within the study area considered during this assessment.
    a. Install cycling facilities where higher volumes of cyclists are observed, including shared lanes with a "green-painted – Skid and slip resistance painted cycling lane.
    b. Add midblock accesses into adjacent land parcels—i.e. right-in only accesses—to reduce traffic volumes, conflicting points/maneuvering, and exposure at downstream intersections.

1.0 INTRODUCTION

This safety performance assessment (the "assessment") is one component of the Living Arts Drive Extension Class EA in the City of Mississauga (the "City"). The City is considering extending Living Arts Drive from its current terminus at Rathburn Road West to a new intersection with Centre View Drive. The study area (the "Study Area") considered as part of this assessment includes the locations for which collision data was provided (please refer to Section 2.2) and those which are indicated in Figure 1 below.

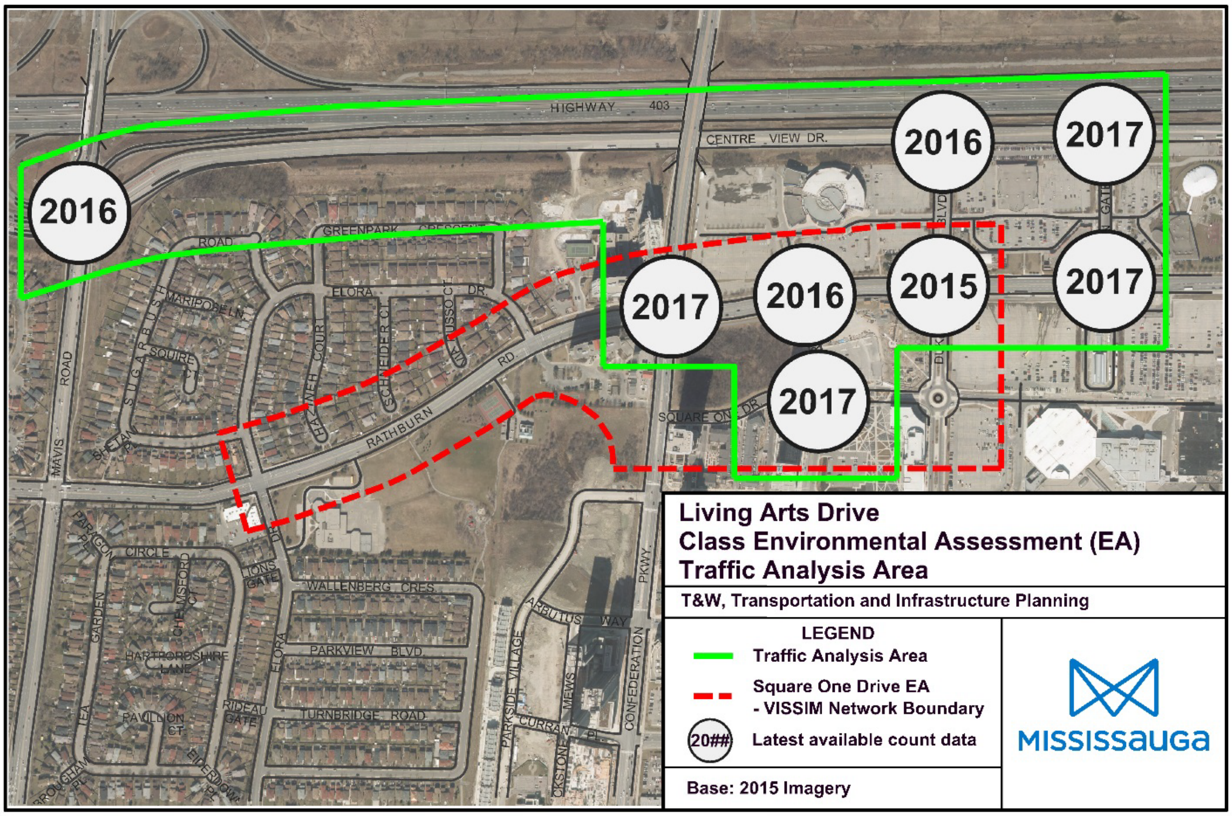

Figure 1: Study Area

The existing Living Arts Drive, is a 2-lane, north-south roadway with dedicated turning lanes. It has a posted speed limit of 50 km/h, and is classified as a Minor Collector road.

The scope of this assessment includes two main parts:

- Review of past safety performance based on collision records; and,
- A desktop-based safety review of vehicle speeds, human factors principles, roadside safety considerations, access management opportunities, and pedestrian and cyclist operations.

2.0 REVIEW OF COLLISION RECORDS

2.1 METHODOLGY

The collision records are first screened using a categorical review (i.e., descriptions of collision characteristics and collision severity). Second, a quantitative evaluation weights collision frequency by severity using societal costs of collisions. The societal cost of collisions is calculated and is followed by reviewing pertinent human factors considerations. Roadside safety (i.e., the risk of infrastructure in the boulevard and beyond the right-of-way) is not applicable to this type of analysis since there is no data to suggest that is a significant contributing factor to the current collision experience.

2.2 LOCATIONS

Collision records were provided by the City for the following intersections:

1. Rathburn Road West at Living Arts Drive, at Duke of York Boulevard, Station Gate Road, and Confederation Parkway;
2. Centre View Drive at Duke of York Boulevard, Station Gate Road, and Mavis Road; and
3. Duke of York Boulevard at Square One Drive.

Collision records provided for midblock locations include:

4. Centre View Drive between Mavis Road to east of Station Gate;
5. Duke of York Boulevard from the access north of Rathburn Road West to Square One Drive;
6. Rathburn Road West between Elora Drive and the access east of Station Gate Road; and
7. Station Gate Road between Rathburn Road West and the midblock access to the north.

2.3 DATA ATTRIBUTES

Collision severity is categorized as fatal (F), non-fatal injuries (NFI), or property-damage-only (PDO). It is also noted whether pedestrians and cyclists were involved.

There are minimal details about the boundaries of midblock segments. Theoretically, midblock segments are defined as the roadway outside the geometric area of influence of intersections, i.e. the portion of the road that matches a typical cross-section and beyond any auxiliary lanes. There are several challenges when considering the lengths of midblock segments:

1. In a downtown environment, and in consideration of the effects of traffic congestion that sometimes extend the functional intersection area, it is difficult to accurately determine midblock segment lengths;
2. Due to the short segment lengths—typically 40 to 300 metres—the uncertainty in segment length can strongly influence the magnitude of results; and
3. Intersection collisions are occasionally attributed to midblock locations, as there are often intersection-related causal factors.

Therefore, the finer collision details of midblock segment lengths are not analyzed further.

2.4 MEASURING ROAD SAFETY

2.4.1 Societal collision costs

'Road safety' is the quantified measure of the risk of harm to road users. The modern science of road safety applies statistical and economic methods to calculate and quantify safety performance.

One central element to road safety analysis is applying societal costs of collisions to provide an economic context against which to compare conventional cost considerations (design, construction, operations, maintenance, etc.).

Several jurisdictions have completed collision cost studies; the most relevant figures are sourced from a 2007 report prepared by Transport Canada for the Province on Ontario [1], and are listed in Table 1. To bring these costs to present value, the 2007 costs were multiplied by the relative increase to the Consumer Price Index [2], which was found to be 18.9 % [3].

Table 1: Societal costs of collisions by severity

Collision Severity	Societal Cost	
	2007 Dollars	2017 Dollars
Fatal	$15,700,000	$18,667,000
NFI	$82,000	$97,000
PDO	$8,000	$10,000

* Note: figures have been rounded to the nearest $1,000

2.4.2 Severity-weighted collision frequency

Subsequent analysis presents cost-weighted equivalent non-fatal-injury (eNFI) collisions as a useful measure of evaluating overall safety performance. Given the relatively low quantity of collision data, the single recorded fatality is considered as a NFI collision for numerical analysis purposes (F+NFI collisions are normally combined in collision models).

2.4.3 Exposure

Ideally, road safety analyses include a measure of exposure to risk, commonly by traffic volume and by midblock segment length. However, traffic volumes are not available for every road segment and intersection, and accurate midblock segment lengths cannot be determined. Therefore, instead of calculating whether intersections and midblock segments are above or below what would be predicted based on traffic volumes, the total magnitude of collisions is evaluated to determine where the greatest societal costs of collisions are occurring.

2.5 CATEGORICAL REVIEW

The categorical review summarizes collision characteristics and determines the locations with the worst safety performance that will be analyzed in greater detail.

2.5.1 Study period totals

Collision records were provided for approximately 3.2 years. Over this time, there were 149 total collisions for the 8 intersections and 13 midblock segments.

2.5.2 Road users

Table 2 breaks down collisions by road user. Though vulnerable road users only account for 9% of the total collision frequency, they represent 51% of the severity-weighted collision experience.

Table 2: eNFI and total collisions per year by road user

	Motor vehicle	Pedestrian	Cyclist
eNFI/yr	5.9	5.1	1.1
%eNFI	49%	42%	9%
TOT/yr	35.9	1.9	0.6
%TOT	93%	5%	2%

2.5.3 Frequency, severity, and location

The frequency of each severity of collision is at each location is detailed in Table 3 on the following page. The three highlighted locations account for 56% of the collision experience:

1. The midblock segment between the intersection of Rathburn Road West and Duke of York Boulevard, and the access located to the north of this intersection;
2. The intersection of Rathburn Road West at Confederation Parkway; and
3. The intersection of Rathburn Road West at Duke of York Boulevard.

The worst and third-worst locations are adjacent to each other, and include the only recorded fatality—a pedestrian—in the collision data provided. Intersection collisions account for 60% of the total collision experience in the Study Area.

Table 3: Collision frequency and severity per location

Location			F	NFI	PDO	TOT	eNFI	eNFI/yr
Intersections	Rathburn Rd. W	Living Arts Dr.		2	5	7	2.5	0.79
		Duke of York Blvd.	1	3	19	23	6.0	1.86
		Station Gate Rd.		3	4	7	3.4	1.07
		Confederation Pkwy.		4	25	29	6.6	2.06
	Centre View Dr.	Duke of York Blvd.		3	3	6	3.3	1.03
		Station Gate Rd.		1	1	2	1.1	0.34
		Mavis Rd.		0	3	3	0.3	0.10
	Duke of York Blvd.	Square One Dr.		0	1	1	0.1	0.03
Midblock segments	Centre View Dr.	Mavis Rd. to 300m E of Mavis Rd.		1	4	5	1.4	0.44
		300m E of Mavis Rd. to Confederation Pkwy. overpass		0	10	10	1.0	0.32
		Duke of York Blvd. to Confederation Pkwy. overpass		1	0	1	1.0	0.31
		Station Gate Rd. to 300m E of Station Gate Rd.		0	1	1	0.1	0.03
		Station Gate Rd. to Duke of York Blvd.		1	1	2	1.1	0.34
	Duke of York Blvd.	Rathburn Rd. W to private driveway N. of Rathburn Rd. W		6	30	36	9.1	2.84
		Rathburn Rd. W to roundabout		0	2	2	0.2	0.06

Table 4: Collision frequency and severity per location

Location			F	NFI	PDO	TOT	eNFI	eNFI/yr
Midblock segments	Rathburn Rd. W	Confederation Pkwy. To Elora Dr.		0	1	1	0.1	0.03
		Living Arts Dr. to Confederation Pkwy.		0	3	3	0.3	0.10
		Duke of York Blvd. to driveway E of Duke of York Blvd.		0	4	4	0.4	0.13
		Duke of York Blvd. to driveway W of Duke of York Blvd.		0	2	2	0.2	0.06
		Station Gate Rd. to driveway E of Station Gate Rd.		0	1	1	0.1	0.03
	Station Gate Rd.	Rathburn Rd. W to driveway N of Rathburn Rd. W		0	3	3	0.3	0.10
Total			1	25	123	149	38.7	12.1
Annual average			0.3	7.8	38.4	46.6	12.1	**3.8**

On average, there are slightly less than 4 equivalent non-fatal-injury collisions per year in the Study Area.

2.6 SUMMARY OF CATEGORICAL REVIEW

The intersection of Rathburn Road West at Living Arts Drive is not a top-ranking safety concern, and past collision experience would not reflect future safety performance at this location if the road is extended north to Centre View Drive.

The top three locations of concern—Rathburn Road West at Confederation Parkway, at Duke of York Boulevard, and at the midblock segment immediately to the north of Duke of York—are studied in greater detail in the next section.

Other safety trends of the local network cannot be determined due to insufficient data quantity and quality.

3.0 REVIEW OF HIGH-RISK LOCATIONS

3.1 COLLISION TYPES & CHARACTERISTICS

Additional trends appear when collision records at the highest-risk locations are reviewed.

At the intersection of Confederation Drive and Rathburn Road West, 57% of collisions are turning-movement collisions, and 82% are initiated by northbound or southbound drivers.

At the intersection of Rathburn Road West at Duke of York Boulevard, turning-movement and angle collisions represent 39% and 30% of collisions, respectively. Eastbound or westbound drivers initiate 70% of collisions.

Collisions at the midblock segment north of Rathburn Road West on Duke of York Boulevard totaled 53% and 40% for angle and turning-movement incidents, respectively. The majority—68%—of collisions are initiated by southbound and northbound traffic; the east-west collisions represent vehicles entering and exiting the midblock access.

3.2 TRAFFIC FACTORS

Insufficient traffic data was available to review traffic-related factors in detail, though some general observations can be made as follows:

- Roads with more lanes experience more collisions relative to the crossing road with fewer lanes;
- Pedestrian and cyclist traffic volumes are relatively high at all three locations due to the proximity to the City Centre Transit Terminal, Sheridan College, and Square One Shopping Centre; and
- The intersection and road network layouts indicate a notable percentage of turning traffic, which is proportional to collision frequency.

3.3 GEOMETRIC FACTORS

There do not appear to be any intersection design elements that contravene conventional design guidelines and standards.

3.4 HUMAN FACTORS

Though there do not appear to be any geometric design elements that contravene conventional design guidelines and standards, several design elements do not conform to specific human factors principles and/or are not the optimal values from a safety performance perspective, despite falling within the otherwise acceptable design domain.

3.4.1 Intersection of Confederation Parkway and Rathburn Road West

There is a downgrade (southbound) approaching the intersection of Confederation Parkway and Rathburn Road West. The closest upstream intersection is 750 metres north, which is the longest distance between any two intersections in the broader area. As Confederation Parkway passes over both Highway 403 and Centre View Drive, the long span and free-flow traffic would naturally operate at higher speeds approaching Rathburn Road West.

There are no right-turn lanes on any approaches, which creates conflicts with through traffic (rear-end conflicts as well as lane change conflicts), as well as with the northbound and southbound cycling lanes.

This intersection is likely where southbound cyclists desire to turn left since it would be the shortest distance to several important destinations in downtown Mississauga, including Square One Shopping Centre, other commercial developments in the area, and Sheridan College. There are no facilities for cycling traffic turning onto Rathburn Road West.

3.4.2 Duke of York Boulevard and intersection with Rathburn Road West

There are no right-turn lanes on the westbound and northbound approaches, which creates conflicts with through traffic. Pedestrian and cyclist activity is likely higher at this location given its proximity to major destinations (Square One Shopping Centre, the City Centre Transit Terminal, Sheridan College, and other commercial developments in downtown Mississauga).

As illustrated in Figure 2, the rightmost southbound lane on Duke of York Boulevard becomes a right-turn-only lane without any transition in alignment from the upstream through lane, and is aligned directly with the through lane south of the intersection despite being a right-turn lane.

Figure 2: Duke of York Blvd. looking south toward Rathburn Rd. W.

Other human-factors-related comments are common to the whole Study Area and are detailed in the following general observations.

3.4.3 General observations

3.4.3.1 Intersection signalization

There is only one signal head per through movement, which can cause some lane choice confusion for motorists. There are no black backplates or reflective tape to increase signal head conspicuity. Signal heads are located on the downstream side of intersections, which can cause motorists to focus their attention away from conflict areas on the near-side of the intersections.

3.4.3.2 Intersection lighting

Intersections appear to have some minor/additional lighting. Light standard placement is centered on, or very near, crosswalk and stop bar locations.

3.4.3.3 Access management

The roads in the Study Area have a high degree of access control with midblock turning traffic using a small number of midblock accesses – generally only one per block at most. The high degree of access management increases the car-centric feel of the road network, and increases the volume of turning traffic at intersections.

3.4.3.4 Active transportation

Active transportation design strategies not only improve the environment for pedestrians and cyclists, they also indicate a change in roadway setting to motorists.

Pedestrian crosswalks begin and terminate on the intersection curb radii rather than offset to a location at the end or past the intersection curb radii. This creates longer crossing distances and brings pedestrian conflict points closer to other conflict points within/adjacent to the intersection, and to areas of higher motorist workload. The result is also a more car-centric environment that prioritizes queue storage. Pedestrian facilities appear to meet conventional standards rather than pedestrian-first strategies, i.e. no raised crosswalks, raised intersections, change in road surfacing material, overhead lighting, etc.

There are no pavement markings or coloured lanes for cyclists through conflict zones: cyclists are therefore less conspicuous, and the road environment feels less like the downtown environment that is desired in the area and that conforms to the Downtown 21 Master Plan (2010). This plan favours and encourages development of a multi-modal transportation system to create a livable, compact, and accessible downtown, and indicates that active transportation should be prioritized when designing new roadways. Thus, creating a comprehensive cycling network as part of the multi-modal transportation system as encouraged by the Downtown 21 Master Plan, and defined in the Mississauga Cycling Master Plan (2010), would provide some safety (and mobility) benefits to cyclists.

3.4.4 Speed choice

Numerous factors support the choice of a relatively high rate of speed by motorists, including:

- alignments which are primarily tangential;
- roadway profiles which are primarily flat;
- a high degree of access management;
- standard treatments for pedestrian facilities (crosswalks) and limited dedicated accommodation for cyclists;
- roadways with more than one through lane;
- the desire to travel through signalized intersections before the end of the green phase; and
- downstream/farside traffic signal placement.

Despite some limitations in data quality and quantity, the physical and geometric characteristics of the road network indicate that operating speeds can sometimes be excessive and that average operating speeds are higher than desirable in a setting with notable and growing active transportation use.

4.0 CONCLUSIONS & RECOMMENDATIONS

4.1 CONCLUSION

Based on the foregoing assessment and the available data reviewed, Stantec concludes that there are no locations exhibiting poor safety performance.

4.2 RECOMMENDATIONS

To improve safety performance, Stantec recommends that the City consider the following improvement opportunities:

1. Study the possibility of reassigning road space for active transportation facilities;
2. When modifying traffic signals for non-safety reasons, consider:
    a. Adding a signal head for each through lane; and
    b. Add black backplates and reflective tape to signal heads.
    c. Install cycling facilities where higher volumes of cyclists are observed, including shared lanes with a green-painted cycling lane where feasible; and
    d. Add midblock accesses into adjacent land parcels—i.e. right-in only accesses—to reduce traffic volumes and conflicting points/maneuvering, and exposure at downstream intersections.