APPENDIX

D TRANSPORTATION AND TRAFFIC STUDY

APPENDIX

D-3 VISION ZERO ASSESSMENT

Memo

To:	Gordon Hui (Region of Peel) and Tina Detaramani (Region of Peel)
From:	Maria King, P.Eng., John McGill, P.Eng.
Date:	October 18, 2018
File:	TP115086
cc:	Bishnu Parajuli, City of Brampton
Re:	Vision Zero Assessment of Grade-Separation Alternatives

Introduction

As requested by the Region of Peel, Wood has completed a high-level 'Vision Zero' – based assessment of the short-listed grade-separation alternative designs. The focus of the assessment is arterial-to-arterial intersections, as the remainder of the roadway segments are to be designed to similar standards (i.e. wide boulevards and multi-use pathways provided on both sides of the roadways). Per the discussions between the City, Region and Wood on October 4, 2018, the Vision Zero assessment was completed qualitatively. Completion of a quantitative safety assessment of the design alternatives would require significantly higher levels of effort (and therefore cost).

This information will be incorporated into the formal evaluation of alternatives included in Environmental Study Report for this study.

Methodology

The Vision Zero assessment was completed using the Regions' *Road Safety Strategic Plan 2018-2022* as a starting point. Each junction and mid-block section were designed to a conceptual level, and then reviewed for potential intersection, pedestrian and cycling hazards. Methods to mitigate these potential hazards were also identified, in line with the countermeasures identified in the Region's Vision Zero guidelines. In most cases, engineering design and/or changes to signal phasing could be used to primarily mitigate the risks. In certain cases, risks could not be mitigated without significant investment in additional infrastructure or property impacts (i.e. pedestrian crossings at ramps). In these instances, the hazards are assumed to be mitigated to the extent feasible, with some inherent risk remaining.

Assessment of mid-block risks is focussed on vehicular traffic, and particularly turning movements from driveways or from median openings (where and if permitted). These types of assessments typically consider exposure (distance over which the risk exists), probability (likelihood that a collision will occur), and consequence (anticipated severity), which are more accurately estimated using modelling and numerical analysis. The high level qualitative access risk analysis presented in this memorandum considers typical exposures only, as the other

factors cannot be adequately estimated. Frequency of access is likewise not considered, as this information is not currently available.

As quantitative measures of safety are not available, alternatives were assessed based on the number of safety risks noted and the ability to mitigate those risks.

Risk Assessment

The tables included in Appendix A provide an overview of the risks and potential mitigation measures for the arterial-to-arterial junctions associated with each of the short-listed grade separation alternatives. Information regarding where to find junction information related to each of the shortlisted alternatives is provided in Table 1. The qualitative assessment of road safety associated with each of the short-listed alternatives is provided in Table 2, on the following pages. Note that the assessment provides equal weighting for vehicular, pedestrian and cyclist risks, which may not align with Regional and City priorities for major arterial corridors.

Table 1: Appendix Location of Evaluation Risk Evaluation Tables for Each Short-Listed Special Policy Area 2 Design Alternative.

Short-List Alternative	Junction Location	Reference
At-Grade Solution	East-West Arterial / Arterial A2 / Coleraine Drive	Table A1
	Arterial A2 / Regional Road 50 / Major Mackenzie Drive	Table A2
Single Point Urban Interchange	East-West Arterial / Arterial A2 / Coleraine Drive	Table A2
	Arterial A2 / Regional Road 50 / Major Mackenzie Drive	Table A3
Modified Parclo A Version 3.2	East-West Arterial / Arterial A2	Table A4
	Arterial A2 / Regional Road 50 / Major Mackenzie Drive	Table A5
	Coleraine Drive / Regional Road 50	Table A6

Table 2: Vision Zero Assessment of Short-Listed Alternatives.

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo 'A' Version 3.2
Left Turn Movement Conflicts (Vehicular)	• Can be mitigated through dedicated phasing.	• Can be mitigated through dedicated phasing.	• Can be mitigated through dedicated phasing.
			
Right Turn Movement Conflicts (Pedestrian, Cyclist, Vehicular)	• Right-on-red prohibitions can be used to partially mitigate risks at signalized intersections without right turn channels.	• Right-on-red prohibitions can be used to partially mitigate risks at signalized intersections without right turn channels. • Right turns onto Arterial A2 / Major Mackenzie Drive from Regional Road 50 are to be via stop controlled smart channels.	• Right-on-red prohibitions can be used to partially mitigate risks at East-West Arterial / Arterial A2 intersection. • Efficient traffic flow from northbound Coleraine Drive to northbound Regional Road 50 is dependent on near free-flow of this movement. Sufficiently long merge lanes can be used to address vehicular interactions. Limited ability to mitigate risks to pedestrians and cyclists beyond provision of enhanced markings and signage.
			
Weaving at ramp / bypass entrances	• No ramps. Does not apply.	• Associated with movements onto northbound and southbound	• Associated with all right turn movements at Regional Road 50

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo 'A' Version 3.2
		Regional Road 50 (two conflict zones). • Can be primarily addressed through provision of enhanced / advanced signage and sufficiently long merge lanes.	and Arterial A2 / Major Mackenzie Drive (four conflict zones), as well as left turn movements from Regional Road 50 onto Arterial A2 / Major Mackenzie Drive (two conflict zones). • Can be primarily addressed through provision of enhanced / advanced signage and sufficiently long merge lanes.
			
Weaving at ramp / bypass exits	• No ramps. Does not apply.	• Associated with movements onto northbound and southbound Regional Road 50 (two conflict zones). • Can be primarily addressed through provision of enhanced / advanced signage and sufficiently long merge lanes.	• Associated with all right turn movements at the interchange between Regional Road 50 / Arterial A2 / Major Mackenzie Drive (four conflict zones). • Can be primarily addressed through provision of enhanced / advanced signage and sufficiently long merge lanes.
			

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo 'A' Version 3.2
Congestion related collision risks (rear end collisions)	• Particularly applicable to 17 movements with LOS D or E. • Can be partially mitigated through signal progression, Traffic Demand Management techniques and ATMS.	• Particularly applicable to 10 movements with LOS D or E. • Can be partially mitigated through signal progression, Traffic Demand Management techniques and ATMS.	• Particularly applicable to three movements with LOS D or E. • Can be partially mitigated through signal progression, Traffic Demand Management techniques and ATMS.
			
Pedestrian Crossing Distances (Signalized Intersections)	• Can be partially mitigated through provision of wider refuge medians, sufficiently long pedestrian phases, and clear pavement and signage. • Total signal controlled pedestrian crossing distances of 230 m.	• Can be partially mitigated through provision of wider refuge medians, sufficiently long pedestrian phases, and clear pavement and signage. • Total signal controlled pedestrian crossing distances of 226 m.	• Can be partially mitigated through provision of wider refuge medians, sufficiently long pedestrian phases, and clear pavement and signage. • Total signal controlled pedestrian crossing distances of 178 m.
			
Uncontrolled Pedestrian and Cyclist Crossing Locations	• No uncontrolled crossing locations. Does not apply.	• Applicable to two uncontrolled crossing locations along right turn bypass lanes onto Regional Road 50 from Arterial A2 / Major Mackenzie Drive. • Limited ability to mitigate risk without signalizing the crossing	• Applicable to 10 uncontrolled crossing locations along ramps and right turn bypass lanes between Regional Road 50 / Arterial A2 / Major Mackenzie Drive and 1 crossing location of

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo 'A' Version 3.2
		location (i.e. pedestrian activated signal). • Partial mitigation of risk can be provided through provision of enhanced lighting and clear zones, ladder (crosswalk) markings and clear signage indicating pedestrians and cyclists to yield to vehicles.	two lanes at Coleraine Drive / Regional Road 50. • Limited ability to mitigate risk without signalizing the crossing locations (i.e. pedestrian activated signal), which is considered financially and operationally infeasible given the number of sites. • Partial mitigation of risk can be provided through provision of enhanced lighting and clear zones, ladder (crosswalk) markings and clear signage indicating pedestrians and cyclists to yield to vehicles.
			
Exposure risk associated with mid-	• Left turn movements at median breaks would require crossing of 3 lanes of vehicular traffic on Arterial A2 and two lanes of traffic on Coleraine Drive.	• Left turn movements at median breaks would require crossing of 3 lanes of vehicular traffic on Arterial A2 and two lanes of traffic on Coleraine Drive.	• Left turn movements at median breaks would require crossing of 2 lanes of vehicular traffic on Arterial A2 and 3-4 lanes of traffic on Coleraine Drive.

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo ‘A’ Version 3.2
block access to adjacent development[1]	• Would involve significant volumes of heavy vehicles along both corridors, with the greatest proportion on Coleraine Drive (logistical / warehousing / transportation land uses). • While risks could be mitigated through prohibition of mid-block left turn movements (INT8), this may result in increased demand for U-turns at intersections.	• Would involve significant volumes of heavy vehicles along both corridors, with the greatest proportion on Coleraine Drive (logistical / warehousing / transportation land uses). • While risks could be mitigated through prohibition of mid-block left turn movements (INT8), this may result in increased demand for U-turns at intersections.	• Would involve significant volumes of heavy vehicles along both corridors, with the greatest proportion on Coleraine Drive (logistical / warehousing / transportation land uses). • While risks could be mitigated through prohibition of mid-block left turn movements (INT8), this may result in increased demand for U-turns at intersections.
			
Overall Evaluation	• Most significant safety concerns are associated with congestion and significant crossing distances. • Mitigations techniques are available to the City/Region to address these concerns.	• Most significant safety concerns are associated with congestion, significant crossing distances and two uncontrolled pedestrian / cyclist crossing locations. • Mitigations techniques are available to the City/Region to primarily address these concerns.	• Most significant safety concerns are associated with weaving and merging at ramps and bypass lanes, as well as the number of uncontrolled pedestrian crossing locations at right turn channels (Coleraine Drive at Regional Road 50) and at the ramps/bypass lanes at the interchange.

[1] Note this is not addressed in the tables provided in Appendix A.

	Short-Listed Design Alternative for Special Policy Area 2		
Identified Potential Risks (Reference Appendix A)	Alternative 1 At-Grade Intersections	Alternative 2 Single Point Urban Interchange	Alternative 3.2 Modified Parclo 'A' Version 3.2
			• Mitigation techniques are available to address issues with weaving and merging. • Limited ability to fully address issues associated with uncontrolled pedestrian /cyclist crossings.
	Most Preferred	**Neutral**	**Least Preferred**

Based on the qualitative assessed number of potential risks, and available tools to mitigate those risks, the results of the overall ranking of alternatives as follows:

Most Preferred Overall Solution: At-Grade Intersections

- Most significant safety concerns are associated with congestion (potential rear-end collisions) and significant pedestrian crossing distances.
- Mitigation techniques are available to the City/Region to address these concerns.

Least Preferred Overall Solution: Modified Parclo 'A' Version 3.2

- Most significant safety concerns are associated with weaving and merging at ramps and bypass lanes at the interchange, as well as the 12 uncontrolled pedestrian crossing locations either at right turn channels (Coleraine Drive at Regional Road 50) or at the ramps/bypass lanes at the interchange.
- Mitigation techniques are available to address issues with weaving and merging. Limited ability to fully address issues associated with uncontrolled pedestrian /cyclist crossings, particularly as traffic volumes increase

Appendix A: Risk Tables

Table A1: Junction of East-West Arterial / Arterial A2 / Coleraine Drive (Alternatives 1 and 2)

Description				
• At-grade intersection. • Northbound direction comprised of two through lanes, shared right and single left turn lanes. • Southbound direction comprised of two through lanes, single right turn and dual left turn lanes. • Eastbound direction comprised of three through lanes, single right turn and single left turn lanes. • Westbound direction comprised of three through lanes, single right turn and single left turn lanes. • Medians provided on all roadways (minimum width of 1.5 m) • Multi-use pathways provided on all approaches. • Pedestrian signals to be provided for all through-movements.				
Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Conflict between three lanes of through-moving vehicles/pedestrians/cyclists and left turning vehicles (turning movement)	Intersection Pedestrian Cyclist	Can be mitigated.	INT3 – Fully protected Phasing
2	Conflict between through moving vehicles/pedestrians/cyclists and right turning vehicles (turning movement)	Intersection Pedestrian Cyclist	Can be partially mitigated (uncommon to remove permissions for right-on-red)	INT9 – Right turn on red prohibition
3	Long pedestrian/cyclist crossing distances with only minor refuge at median bullnose (1.5 m width). Estimated total crossing distances and required crossing times (0.8 m/s) for each approach are as follows: Arterial A2 – 29.5 m (37 s) East-West Arterial / Coleraine Drive – 26 m (33 s) Total crossing distance through intersection = 111 m	Pedestrian Cyclist	Can be partially mitigated.	INT – Widen median to provide pedestrian refuge. INT15 – Ladder crosswalks PED3 – Pedestrian countdown signals PED8 – Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhances bicycle signage
4	Increased collision risk due to congestion at intersection (rear end collisions).	Intersection	Can be partially mitigated.	INT1 – Traffic signal network progression INT2 – Advanced traffic management systems (ATMS)

Table A2: Junction of Arterial A2 / Regional Road 50 / Major Mackenzie Drive (Alternative 1)

Location Description				
• At-grade intersection. • All directions comprised of three through lanes, single right turn lane, and single left turn lane. • Medians provided on all roadways (minimum width of 1.5 m) • Multi-use pathways provided on all approaches. • Pedestrian signals to be provided for all through-movements.				
Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Conflict between three lanes of through-moving vehicles/pedestrians/cyclists and left turning vehicles (turning movement)	Intersection Pedestrian Cyclist	Can be mitigated.	INT3 – Fully protected Phasing
2	Conflict between through moving vehicles/pedestrians/cyclists and right turning vehicles (turning movement)	Intersection Pedestrian Cyclist	Can be partially mitigated (uncommon to remove permissions for right-on-red)	INT9 – Right turn on red prohibition
3	Long pedestrian/cyclist crossing distances with only minor refuge at median bullnose (1.5 m width). Estimated total crossing distances and required crossing times (0.8 m/s) for each approach are as follows: Arterial A2/Major Mackenzie Drive – 29.5 m (37 s) Regional Road 50 – 29.5 m (37 s) Total crossing distance through intersection = 118 m	Pedestrian Cyclist	Can be partially mitigated.	INT – Widen median to provide pedestrian refuge. INT15 – Ladder crosswalks PED3 – Pedestrian countdown signals PED8 – Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhances bicycle signage
4	Increased collision risk due to congestion at intersection (rear end collisions).	Intersection	Can be partially mitigated.	INT1 – Traffic signal network progression INT2 – Advanced traffic management systems (ATMS)

Table A3: Single Point Urban Interchange (Arterial A2 / Regional Road 50 / Major Mackenzie Drive (Alternative 2)

Location Description				
• Grade separated intersection. • All directions comprised of three through lanes, single right turn lane, and single left turn lane. • Right and left turns merge into a single lane on approach to Regional Road 50. • Through lanes do not intersect (grade separated). • Medians provided on all roadways (minimum width of 1.5 m) • Multi-use pathways provided on all approaches. • Left turns permitted on dedicated signal phase only. • Right turns designed as smart channels onto Arterial A2 / Major Mackenzie Drive. • Right turns onto Regional Road 50 to be provided with a sufficiently long merge lane. • Pedestrian signals to be provided for all movements at the at-grade signalized intersection (total combined crossing distance of approximately 115 m). • Four non-signalized pedestrian crossings required - two at end of smart channels (stop controlled), two along right turn by-pass lanes (yield controlled).				
Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Weaving at entrance to combined left/right turn channel off of Regional Road 50. Channel to be designed with sufficiently long merging segment.	Intersection	Can be partially mitigated.	INT13 – Signage enhancements INT16 – Enhanced pavement markings INT21 – Street lighting Improvements
2	Merging at combined left/right entrance channel onto Regional Road 50. Channel to be designed with sufficiently long merging segment.	Intersection	Can be partially mitigated.	INT13 – Signage enhancements INT16 – Enhanced pavement markings INT21 – Street lighting Improvements
3	Stop controlled pedestrian crossing across right turn lanes (smart channel) onto Arterial A2/ Regional Road 50. Total combined crossing width of approximately 20 m.	Pedestrian Cyclist	Minimal risk.	PED7 – Enhanced pedestrian signage PED8 – Enhanced pedestrian pavement markings CYC4 – Enhanced bicycle signage CYC5 – Enhanced cyclist pavement markings
4	Yield-controlled pedestrian crossings across right turn channel on the two approaches to Regional Road 50. Total combined crossing width of approximately 10 m.	Pedestrian Cyclist	Limited ability to mitigate risk without signalizing the crossing location.	PED3 – Pedestrian countdown signals and pedestrian signal facilities PED7 – Enhanced pedestrian signage PED8 - Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhanced bicycle signage CYC5 – Enhanced cyclist pavement markings
5	Increased collision risk due to congestion at intersection (rear end collisions).	Intersection	Can be partially mitigated.	INT1 – Traffic signal network progression INT2 – Advanced traffic management systems (ATMS)

Table A4: Junction of East-West Arterial at Arterial A2 (Alternative 3.2)

Location Description				
• At-grade intersection. • Northbound direction comprised of two through lanes (4 lane cross-section), one becomes a left turn lane and one becomes a right turn. • No southbound approach. • Eastbound direction comprised of two through lanes and single right turn lane. • Westbound direction comprised of two through lanes and dual left turn lanes. • Medians provided on all roadways (minimum width of 1.5 m) • Multi-use pathways provided on all approaches. • Pedestrian signals to be provided for all through-movements.				
Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Conflict between through-moving pedestrians and cyclists and vehicles turning right/left only off of East-West Arterial.	Intersection Pedestrian Cyclist	Can be mitigated.	INT 3 – Fully protected pedestrian phasing
2	Conflict between through moving vehicles/pedestrians/cyclists and right turning vehicles (turning movement)	Intersection Pedestrian Cyclist	Can be partially mitigated (uncommon to remove permissions for right-on-red)	INT 9 – Right turn on red prohibition
3	Long pedestrian/cyclist crossing distances with only minor refuge at median bullnose (1.5 m width). Estimated total crossing distances and required crossing times (0.8 m/s) for each approach are as follows: East-West Arterial - 15.5 m (20 s) Arterial A2 – 26 m (33 s) Total crossing distance through intersection = 67.5 m.	Pedestrian Cyclist	Can be partially mitigated.	INT – Widen median to provide pedestrian refuge. INT15 – Ladder crosswalks PED3 – Pedestrian countdown signals PED8 – Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhances bicycle signage

Table A5: Modified Parclo 'A' Interchange (Arterial A2 / Coleraine Drive / Regional Road 50 / Major Mackenzie Drive) (Alternative 3.2)

Location Description

- Grade-separated intersection.
- All directions comprised of three through lanes.
- Through lanes do not intersect (grade separated).
- Left turns permitted for north and southbound traffic only (via loop ramp). No left turns permitted for east or westbound traffic.
- Right turn by-passes provided for all directions.
- Multi-use pathways provided on all approaches
- No left turns permitted for any pedestrian or cyclist movements.
- 10 yield-controlled and 2 stop controlled pedestrian/cyclists crossings required - all along ramps or right turn by-pass lanes (single lane crossing only).
- Right turns to be provided with a sufficiently long departure and merge lanes.

Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Weaving at entrances to right turn bypasses/ramps. Channels to be designed with sufficiently long merging segment.	Intersection	Can be partially mitigated.	INT13 – Signage enhancements INT16 – Enhanced pavement markings INT21 – Street lighting Improvements
2	Merging at terminals of right turn bypasses/ramps. Channels to be designed with sufficiently long merging segment.	Intersection	Can be partially mitigated.	INT13 – Signage enhancements INT16 – Enhanced pavement markings INT21 – Street lighting Improvements
3	Weaving at entrances to left turn ramps (Regional Road 50 onto Major Mackenzie/Arterial A2 only). Channels to be designed with sufficiently long merging segment.	Intersection	Can be partially mitigated.	INT13 – Enhanced signage INT16 – Enhanced pavement markings INT21 – Street lighting Improvements
4	Entrance from left turn ramps from Regional Road 50 onto Major Mackenzie Drive / Arterial A2 (angle of approach to be maximized).	Intersection Pedestrian Cyclist	Can be partially mitigated.	INT13 – Enhanced signage INT21 – Enhanced street lighting INT22 – Sightline clearing / sight distance improvements. PED 7 – Enhanced pedestrian signage PED 8 - Enhanced pedestrian pavement markings CYC4 – Enhanced bicycle signage CYC5 – Enhanced cyclist pavement markings
5	10 uncontrolled pedestrian/cyclist crossings at interchange (total approximate crossing distance of approximately 65 m). Additional 30 m of potential stop-controlled crossing locations at terminus of left-turn ramps from Regional Road 50 onto Arterial A2 / Major Mackenzie Drive.	Intersection Pedestrian Cyclist	Limited ability to mitigate risk without signalizing the crossing locations.	PED3 – Pedestrian countdown signals and pedestrian signal facilities PED7 – Enhanced pedestrian signage PED8 - Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhanced bicycle signage CYC5 – Enhanced cyclist pavement markings
6	Lack of means of making a left hand turn onto Regional Road 50 / Coleraine Drive could result in an increase in U-turns at next adjacent signalized intersection.	Intersection	Can be mitigated.	INT11 - U-turns prohibition. INT14 – signage enhancements (wayfinding)

7	Lack of a designated means of making a left hand turn for cyclists or pedestrians could result in individuals making illegal crossings (jay-walking).	Intersection Pedestrian Cyclist	Risk could be mitigated.	Install median fencing to deter jaywalking.

Table A6: Junction of Coleraine Drive / Regional Road 50 (Alternative 3.2)

Location Description				
• At-grade intersection. • Northbound direction comprised of four through lanes (7 lane cross-section), one becomes a dedicated right and one becomes a shared through/right (dual right turn channel provided). • Southbound direction comprised of three through lanes (7 lane cross-section) and one left turn lane. • No eastbound approach to the intersection. • Westbound direction comprised of two through lanes (4 lane cross-section). Through lanes become left turn lanes and a right turn lane is provided. • Medians provided on all roadways (minimum width of 1.5 m) • Multi-use pathways provided on all approaches. • Pedestrian signals to be provided for all through-movements.				
Risk #	Description of Identified Potential Risk	Vision Zero Risk Category(s)	Measure of Risk	Potential Vision Zero Countermeasures
1	Conflict between through-moving pedestrians and cyclists and vehicles turning right/left only off of Regional Road 50.	Intersection Pedestrian Cyclist	Can be mitigated.	INT 3 – Fully protected pedestrian phasing
2	Conflict between through moving vehicles/pedestrians/cyclists and right turning vehicles (turning movement) off of Regional Road 50 onto northbound Coleraine Drive.	Intersection Pedestrian Cyclist	Can be partially mitigated (uncommon to remove permissions for right-on-red)	INT 9 – Right turn on red prohibition
3	Conflict between dual right free flow lanes (channelized) from northbound Coleraine Drive onto Regional Road 50.	Intersection Pedestrian Cyclist	Significant risk under current design (channelized dual rights).	INT - Modify design to remove channelized right turn lanes. INT9 – Right turn on red prohibition. INT 15 – Ladder crosswalks INT19 – Raise the crossing location. CYC4 – Enhances bicycle signage
4	Long pedestrian/cyclist crossing distances with only minor refuge at median bullnose (1.5 m width). Estimated total crossing distances and required crossing times (0.8 m/s) for each approach are as follows: Coleraine Drive - 26 and 42 m (33-53 s) Regional Road 50 – 42 m (53 s) Total combined crossing distances = 110 m.	Pedestrian Cyclist	Can be partially mitigated.	INT 15 – Ladder crosswalks PED 3 – Pedestrian countdown signals PED 8 – Enhanced pedestrian pavement markings CYC2 – Bicycle signals and cross-rides CYC4 – Enhances bicycle signage