

**TO:** Chair and Members of Transportation Standing Committee

**SUBMITTED BY:**



Jacques Dubé, Chief Administrative Officer

**DATE:** June 13, 2022

**SUBJECT:** Protected Turn Movements for Pedestrian Safety

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## **ORIGIN**

April 29, 2021 Transportation Standing Committee Motion (Item 13.1):

MOVED by Councillor Mason, seconded by Councillor Mancini

THAT the Transportation Standing Committee request a staff report, to be completed prior to the start of 2022/23 budget discussion, that outlines options for a program for establishing protected left-turn movements and protected right-turn movements at signal-controlled intersections. The program should prioritize high traffic and pedestrian volume intersections and high conflict intersections.

MOTION PUT AND PASSED

## **LEGISLATIVE AUTHORITY**

*Halifax Regional Municipality Charter*, Part XII, subsection 321(8) provides:

Subsection 321(8) The Traffic Authority for the Municipality has, with respect to highways in the Municipality, excluding those for which the Provincial Traffic Authority has authority, the powers conferred upon a traffic authority by or pursuant to the Motor Vehicle Act.

*Nova Scotia Motor Vehicle Act*, R.S.N.S. 1989, c.293, subsection 89 (1) provides:

Subsection 89(1) Subject to such authority as may be vested in the Minister, the Registrar or the Department, traffic authorities in regard to highways under their respective authority may cause appropriate signs to be erected and maintained designating business and residence districts and railway grade crossings and such other signs, markings, and traffic control signals as may be deemed necessary to direct and regulate traffic and to carry out the provisions of this act.

Section 4(g) of the Terms of Reference for the Transportation Standing Committee provides that the duties and responsibilities of the Committee include “providing input and review of road and pedestrian safety”.

### **RECOMMENDATION**

It is recommended that the Transportation Standing Committee recommend that Halifax Regional Council direct the Chief Administrative Officer to:

1. Prioritize evaluation of protected only left turns at the signalized intersections identified in the recommendations of the MicroTraffic report;
2. Prioritize evaluation of protected left and/or right turns at high vehicle and pedestrian volume signalized intersection locations in the next phase of the Strategic Road Safety Plan; and
3. Identify resource requirements (staffing, software, etc.) associated with implementing a protected only turn program for signalized intersections

### **BACKGROUND**

A presentation was made at the April 29, 2021 special meeting of the Transportation Standing Committee which outlined safety concerns for pedestrians crossing at signalized intersections. The presentation highlighted concerns specifically with conflicts between pedestrians crossing during the walk phase and vehicles turning left or right at the same time.

Most signalized intersections in HRM use protected + permitted or permitted only signal phasing to accommodate left turning traffic. During the protected phase (green arrow or flashing green arrow) only the left turning vehicles can proceed. All other movements, including pedestrians, must wait. At the end of the protected phase, at most signalized intersections, left turns are then able to continue during the permissive (green ball) phase after first yielding to on-coming traffic and pedestrians within the crosswalks. The pedestrian walk phase occurs at the same time as the permissive “green ball” phase for vehicles travelling in the same direction; however as noted above, motorists are required to yield to pedestrians in the adjacent crosswalk.

Protected only left turn signal operation occurs where the left turn vehicle movement can only proceed with a flashing green arrow. Once the protected phase ends, drivers wishing to turn left face a red signal and are not allowed to proceed until the next protected phase. With this type of operation, the pedestrian crossing phase still comes on with the parallel through traffic movement, but no left turns are permitted to happen. This type of signal operation is typically used where there is significant demand for the left turn movement and dual left turn lanes are in place or where there may be an unusual intersection configuration.

Right turning traffic at signalized intersections is also accommodated during the permissive green phase; as well as on the red phase after first coming to a stop, unless restricted by signage. Motorists must yield the right-of-way to pedestrians lawfully in the crosswalk in both scenarios.

### **DISCUSSION**

The Strategic Road Safety Plan (the Plan) includes seven emphasis areas on which to focus road safety countermeasures to reduce injury and fatal collisions and improve road safety for all road users. Pedestrian collisions are one of the emphasis areas included in the Plan.

Since the adoption of the Strategic Road Safety Plan staff have focused significant effort on implementing countermeasures to improve the safety of all road users, including pedestrians. Improvements have included:

- installation of 31 Rectangular Rapid Flashing Beacons (RRFBs) at marked crosswalks;
- installation of Leading Pedestrian Intervals (LPI) at 45 intersections;
- expansion of the implementation of Right Turn on Red (RTOR) restrictions to nine new locations;
- expansion of the advance yield lines pilot at multi-lane RA-5 crosswalks to a total of 12 locations with 5 planned for installation in 2022; and
- increasing the number of installations of accessible pedestrian signals to 99, with 15 planned for implementation in 2022

The baseline collision data for pedestrian fatal and injury collisions identified in the Plan (i.e., the average of all 2018 and 2019 pedestrian collisions occurring within the road right-of-way) is four and 130, respectively. Pedestrian safety countermeasures have contributed to a reduced number of fatal and injury pedestrian collisions since 2019. Fatal pedestrian collisions totalled two in 2020 and three in 2021. The number of Injury pedestrian collisions were 96 in 2020 and 125 in 2021.

Staff regularly receive requests for protected turn movements at signalized intersections as a means to further improve pedestrian safety. Implementing protected only turning movements requires more than simple programming of the traffic signals. A blanket approach to implementing protected only turning movements (both left and right turns) at signalized intersections would have significant infrastructure requirements and financial implications depending on the existing conditions at a particular location. This approach also has the potential for widespread network operational issues, and increased delays to pedestrians, cyclists, and transit which could lead to other unsafe behaviours by road users and ultimately additional safety issues. Therefore, it is important to understand the nature of the collisions and near misses occurring at signalized intersections in general as well as at each location to identify and prioritize countermeasures appropriate for a particular location that will result in the most benefit.

A review of the pedestrian collisions occurring at intersections since 2018 provides the data required to make strategic decisions on where road safety improvements will have the greatest impact in reducing injury and fatal collisions, and to improve pedestrian safety.

Analysis of closed pedestrian collision reports occurring from January 1, 2018 to December 31, 2021 identified 356 fatal and injury pedestrian collisions occurring at intersections over the 4-year period. About half of these (179), were identified as occurring at signalized intersections. A review of the details of these collisions indicated 145 involved vehicles turning at the intersection; 98 attributed to left turn vehicle movements and 47 attributed to right turn movements. The right turn collisions include both right turn on green as well as right turn on red. Not all collision reports included the detail to determine if the collision occurred during the green signal or as a right turn on red, therefore it was not possible to provide separate numbers for these occurrences. Collisions without sufficient detail provided in the reports to determine whether turning movements were a factor; or had been attributed to factors other than turning movements accounted for the remaining 34 of the 179. Appendix A includes a summary of signalized intersections with pedestrian collisions involving turning movements.

Not unexpectedly, locations with an existing pedestrian injury collision history tend to be those with higher pedestrian and/or vehicle volumes. Focusing first on the pedestrian collisions associated with left turn movements, a total of 68 signalized intersections were identified as having at least one pedestrian collision of this type. Of the 68 intersections where a collision involving a left turning vehicle occurred, 17 were identified as experiencing two or more of these collisions. The highest number of pedestrian collisions involving left turning vehicles at any one signalized location is four.

As stated above the distinction of right turn collisions on red vs. right turn on green is not always provided in the collision reports, making this a more difficult movement on which to form the basis of infrastructure upgrades. A program to evaluate locations for implementation of protected only turns should begin with evaluating those intersections identified with more than 1 pedestrian collision involving left turning

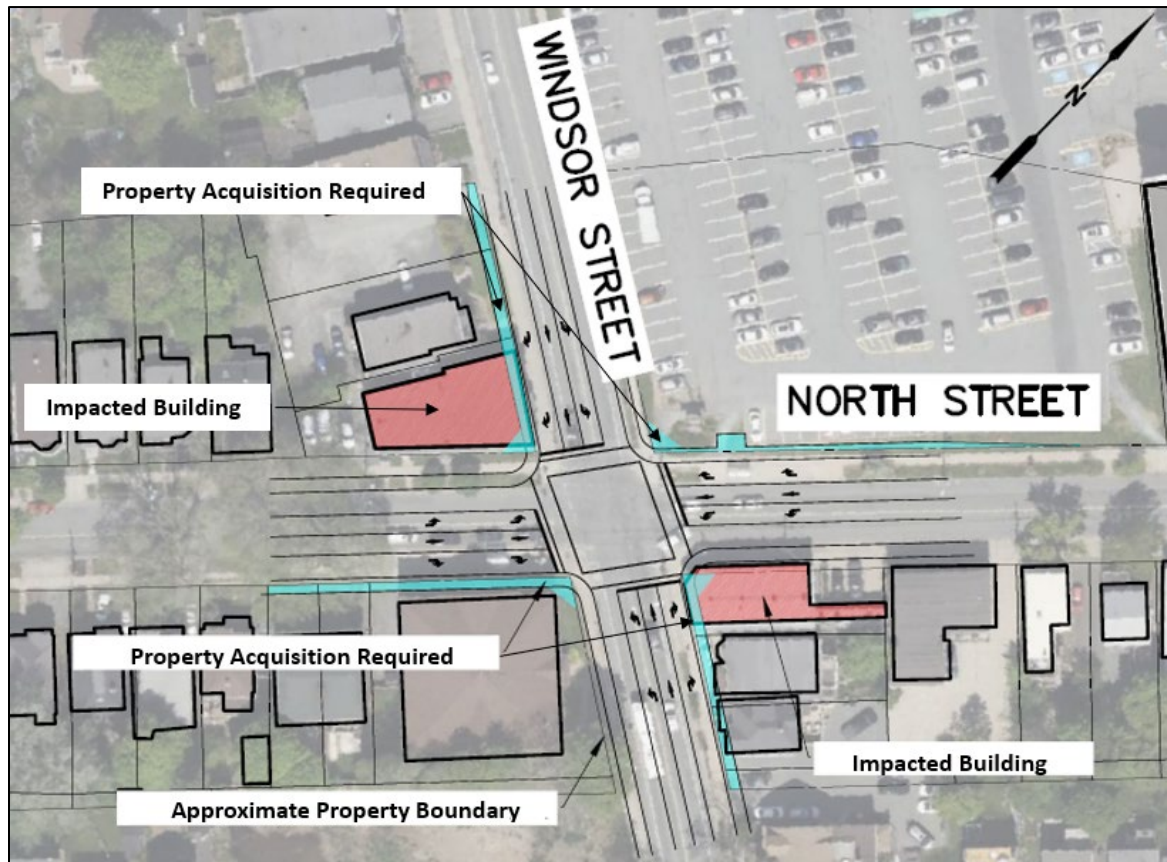
movements. Suitable locations identified for protected only left turn movements can, at that time, also be considered for ways to improve the safety of the right turn movements. Alternatively, in locations where there is a known right turn conflict identified for intersection improvements, modifications to improve the safety of the left turn can also be considered.

A program to implement protected only left (and/or right) turns at signalized intersections would involve significant staff and budgetary resources given the level of analysis and design required depending on the location. Most signalized intersections do not currently have the required infrastructure in place to support additional signal phases. These requirements include additional signal heads and signal poles; additional wiring, and in some cases new traffic signal cabinets, to enable separate signal phases. In most locations, there would also be insufficient lanes to accommodate splitting out the vehicle turning movements or, where some of these lanes do exist, insufficient storage length to accommodate the increased vehicle queuing that would occur. There would be a significant amount of planning, design, potential land acquisition, and construction required to accommodate the necessary infrastructure to implement protected only turn movements at these locations.

The cost of implementing protected only turn movements would vary significantly depending on the location and existing infrastructure. On intersection approaches where there are already separated turning lanes with sufficient storage and the signal infrastructure can mostly support additional phases, the cost of upgrading that approach to a protected only left or right turn may be mainly associated with the installation of additional signal heads and wiring. In that case the cost may be in the range of \$5,000 to \$10,000 per approach. A cursory review of the Dunbrack Street at Lacewood Drive intersection, for example, indicates the Dunbrack Street approaches have potential as lower-cost locations to implement protected only left turn phases if the storage length was confirmed adequate. Operational analysis and design would confirm actual upgrade costs.

The cost of modifications would increase significantly for intersections where new signal equipment is required and each approach requires substantial construction, as well as land acquisition for road widening. An example of these types of locations is North Street at Windsor Street where widening would be required on each intersection approach to provide separated turn lanes; and the existing signal infrastructure likely cannot support the additional signal phases. Cost estimates based on recent tenders for similar work indicate a full signal upgrade to be in the range of \$300,000, for signal equipment only. Added to that amount is the cost for widening on the approaches. Depending on the length of queue storage needed, as well as impacts to drainage and other existing infrastructure (i.e. bus stops and sidewalk, etc.), the cost for road widening on a single intersection approach could be in the range of \$150,000-\$200,000. If looking at all approaches, the total construction estimate including the signal upgrade, may be over \$1,000,000. This estimate excludes any property acquisition that is also required for widening. A conceptual design of protected only left and right turns at the intersection of North Street and Windsor St is included in Figure 1 to provide an idea of the additional right-of-way required at the intersection and level of property impacts protected only turn considerations would have. Note these impacts would spread further from the intersection than what is shown to accommodate the transitions to wider approaches.

Traffic Management staff have begun identifying a list of initial candidate locations where protected only left turn movements could be considered. These locations are based on our existing pedestrian collision data, recognizing that these are the locations with increased interactions between higher vehicle and pedestrian volumes. Initially, the work could involve identifying the locations where most of the infrastructure is in place; as these have potential to move forward sooner than those locations requiring significant design and construction resources. The next step could involve determining the feasibility of implementing protected only left turns at the remaining priority locations.

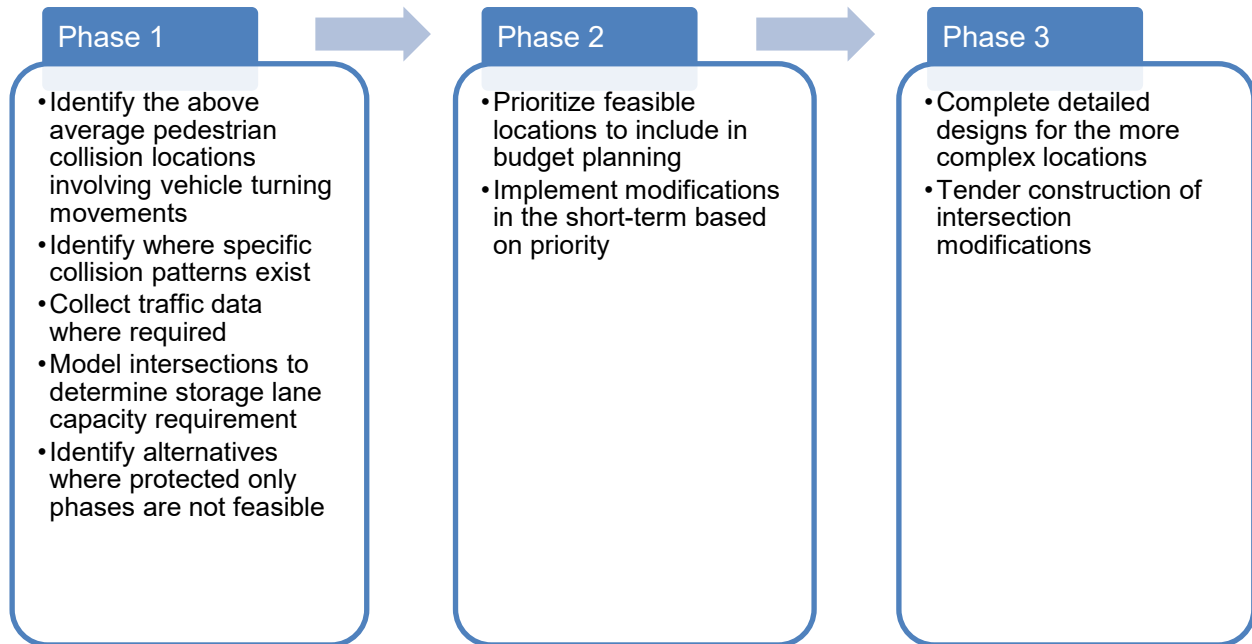


**Figure 1: North Street at Windsor St – Conceptual Protected only Turn Design**

In all situations, the operational analysis would be required to fully understand the impacts on the road network. The evaluations would require turning movement data and pedestrian counts as input to the intersection analysis. The turning lane storage requirements identified in the analysis would be used as input to developing cost estimates related to the extent of road widening and property acquisition required on each intersection approach.

A proposed approach to identifying priority locations for the implementation of a protected only turns program is outlined in Figure 2. Each phase requires significant time and staff resources. It is recommended the identification of priority locations for protected only turns be a key part of the next phase of the Strategic Road Safety Plan. Resource requirements (staffing, software, etc.) to conduct the activities in each phase will need to be identified prior to the 2023/2024 budget planning process in order to carry out this work.

Depending on the number of feasible locations identified, it is anticipated that additional budget requests for new signal infrastructure could continue to grow year after year to accommodate a protected only turns program. As noted above the cost and complexity of implementing protected only turn movements would vary significantly from one location to another depending on existing infrastructure and upgrade requirements. The budget request increases would become more significant moving into potential implementation of protected only turns at the more complex locations requiring significant design and construction.



**Figure 2: Protected Turns Program - Phased Approach Activities**

It should also be noted that Traffic Management staff are currently undergoing review of the recommendations from the MicroTraffic report of signalized intersections which had been identified as higher risk locations. The MicroTraffic study used video analytics to identify near misses and potential conflicts at 10 signalized intersections. The recommendations from the study are based on improved safety for not only pedestrians, but all road users. Recommendations for seven locations include consideration of protected only left turn phases. These locations include:

- Dunbrack Street and Lacewood Drive;
- Glendale Avenue and Cobequid Road;
- Joseph Howe Drive and Bayers Road;
- Lacewood Drive and Parkland Drive;
- Oxford Street and Chebucto Road;
- Portland Street and Eisener Boulevard; and
- Spring Garden Road and South Park Street

Review of the feasibility of implementing protected only left turn phases at any of the locations recommended for consideration by MicroTraffic is expected to continue through fall 2022. The intersection of Dunbrack Street and Lacewood Drive appears to have most of the elements required to support the implementation of protected only turn-movements, so it will be prioritized for assessment.

The prioritization of any locations moving forward as a project would be based on collision history and evidence of near misses; as well as vehicle and pedestrian volumes. As an example, Traffic Management had brought forward a project to include protected only left turn phases at the intersection of Connaught Ave and Almon St due to on-going vehicle collisions of the same type related to geometric deficiencies. The upgrades are currently in the detailed design phase and involve a full replacement / upgrade of the traffic signal equipment in order to accommodate the addition of the protected only left turn signal phasing; along with changes to the lane configuration on both Connaught Ave approaches. Similarly, the intersection of Oxford Street at Jubilee Road will be brought forward during the next budget cycle for a signal upgrade to facilitate the addition of a protected only right turn phase in conjunction with the new right turn on red restriction recently implemented.

Going through this phased approach will identify locations which are not feasible to include protected only turn movements. Locations where investments have already been made to transit priority or cycling facilities, for example, have allocated significant right-of-way space to those improvement measures. This is right-of-way space which, in a protected only turn scenario, could have been used to split out the shared turn lanes on the intersection approaches. The southbound approach on South Park Street at Spring Garden Rd, for example, has already been converted from separated turn lanes to a shared through and right turn lane to accommodate the protected bike lanes. The left turn storage was also significantly reduced through the bike lane project. Figure 3 shows a conceptual plan of the impacts of protected only turns at the intersection of South Park Street and Spring Garden Rd. This indicates the new protected bike lane would need to be relocated, resulting in a significant loss of the existing treed boulevard space on the west side of South Park Street; impacts to the new streetscape design of Spring Garden Road; reduced sidewalk width; and insufficient space on the southeast corner to accommodate the signal infrastructure required for protected only signal phasing. Proceeding with a plan for protected only turns at this location conflict with other council priorities related to the Integrated Mobility Plan, HalifACT, and the Active Transportation Priorities Plan.

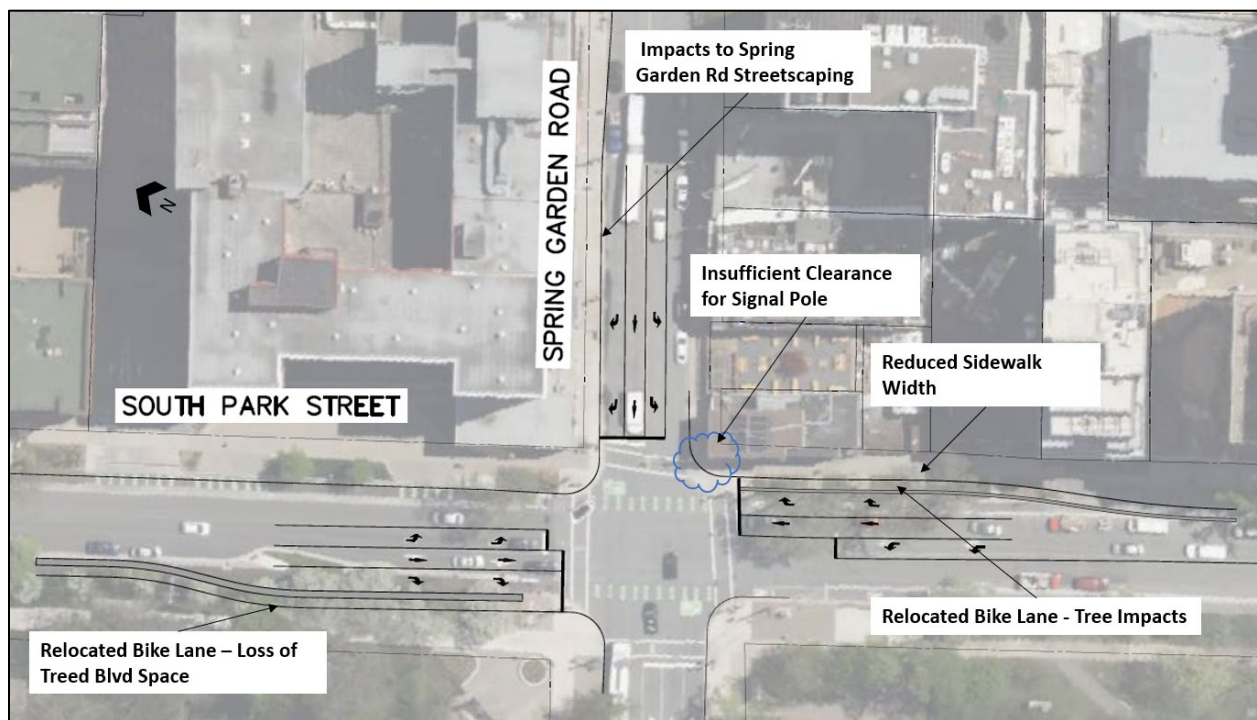


Figure 3: Spring Garden Rd/South Park St - Conceptual Protected Only Turn Design

Alternatives will be reviewed through this process. In locations where there is only a permitted turn phase the option to incorporate a protected + permissive phase may exist where a protected only phase is not feasible. Similarly, in locations where we currently have a protected + permissive phase, there may be opportunity to lengthen the signal time associated with the protected phase. In both of these options, significantly more left turning traffic would clear the intersection while not in conflict with the adjacent walk phase. If the left turn volume can, for the most part, be serviced during the protected phase this effectively reduces the level of potential conflict with pedestrians crossing during the walk signal.

In addition to evaluating for potential protected turn movements, many of the signalized locations identified with pedestrian collisions attributed to turning vehicle movements already have, or are being considered for, other pedestrian safety countermeasures. Leading pedestrian intervals currently exist at 45 locations with 20 additional locations planned to be added during 2022/2023. Traffic Management also considers other modifications to signal phasing to reduce conflict between pedestrians and turning vehicles, such as delayed walk signals and extended all-red phases. The level of effectiveness of these countermeasures is

still being evaluated. At many t-intersections where leading pedestrian intervals have been introduced, early evidence indicates this countermeasure has been working to address previous collision patterns. Implementation and evaluation of these types of countermeasures will continue in conjunction with developing a program for implementing protected only turn movements where appropriate.

### **FINANCIAL IMPLICATIONS**

It is expected that the evaluation and planning components of Phase 1 and Phase 2 would be undertaken by internal Traffic Management staff resources. Traffic Management staff resources are currently strained given the other council priorities associated with implementing the Integrated Mobility Plan, The Active Transportation Priorities Plan, the Strategic Road Safety Plan, the Traffic Calming Policy, as well as reviewing and responding to general traffic operations and safety requests. Additional staff resources are expected to be identified for 2023/2024 budget considerations to allow for this additional workload.

Phase 2 and Phase 3 implementation is not budgeted at this time. Upon completion of Phase 2 intersection operational evaluations and prioritization, the budget will be identified for Regional Council's consideration as part of the Capital Budget process. Upon completion of Phase 3 detailed design work and prioritization the budget will be identified for Regional Council's consideration as part of the Capital Budget process.

### **RISK CONSIDERATION**

No risk considerations were identified. Risks may be identified and addressed as we move through the implementation phases of the program.

### **COMMUNITY ENGAGEMENT**

No community engagement was required.

### **ENVIRONMENTAL IMPLICATIONS**

There are no environmental implications identified with this report. Environmental implications will be considered during the feasibility reviews for individual signalized locations.

### **ALTERNATIVES**

The Transportation Standing Committee may recommend that Regional Council direct the CAO to investigate other options, such as signal timing or phasing changes, turn restrictions, etc., as a means to reduce potential vehicle / pedestrian conflict as an alternative to protected only turn movements.

### **ATTACHMENTS**

Appendix A – Pedestrian Collisions Involving Turning Movements at Signalized Intersections

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A copy of this report can be obtained online at [halifax.ca](http://halifax.ca) or by contacting the Office of the Municipal Clerk at 902.490.4210.

Report Prepared by: Jill Morrison P.Eng. Supervisor Traffic Services 902-490-5018



## Pedestrian Collisions Involving Turning Movements at Signalized Intersections (Fatal and Injury Jan 2018 – Dec 2021)

Location 1	Location 2	Number of Left Turn Collisions	Number of Right Turn Collisions	Countermeasures: Implemented or Underway
Herring Cove Rd	Dentith Rd	4	0	LPI Installed
Wyse Rd	Albro Lake Rd	4	0	LPI Installed
Victoria Rd	Albro Lake Rd	4	0	
Inglis St	Tower Rd	4	0	LPI Installed
Beaverbank Rd	Glendale Ave	3	0	LPI Installed
Bedford Highway	Convoy Run	3	0	LPI Installed
Joseph Howe Dr	Bayers Rd	3	0	
North St	Gottingen St	3	0	Signal Timing Adjustment
South Park St	Morris St	3	0	LPI Installed NRTOR Installed
Sackville St	Brunswick St	2	1	LPI Pending
Joseph Howe Dr	Mumford Ave	2	0	LPI Installed
Quinpool Rd	Robie St	2	0	
Cogswell St	Brunswick St	2	0	LPI Pending
Alderney Dr	Ochterloney St	2	0	LPI Installed
Victoria Rd	Thistle St	2	0	LPI Installed
Windsor St	North St	2	0	
Bell Rd	Trollope St	2	0	
Mumford Rd	HSC Access	1	2	LPI Installed
Main St	Hartlen St	1	2	LPI Installed
Oxford St	Jubilee Rd	1	2	LPI Installed NRTOR Installed
Chain Lake Dr	Civic 201 Driveway	1	1	
Herring Cove Rd	Williams Lake Rd	1	1	LPI Installed
Oxford St	Chebucto Rd	1	1	LPI Pending
Sackville Dr	Riverside Dr	1	1	LPI Pending
Lacewood Dr	Willett St	1	1	LPI Installed
Titus St	Main Ave	1	1	
Chebucto Rd	Connaught Ave	1	1	
Spring Garden Rd	Barrington St	1	1	LPI Installed
South Park St	Spring Garden Rd	1	1	LPI Installed NRTOR Installed
Spring Garden Rd	Summer St	1	1	LPI Installed
Bedford Highway	Rocky Lake Dr	1	0	
Young St	Kempt Rd	1	0	LPI Installed

Cobequid Rd	Glendale Ave	1	0	
Bedford Highway	Kearney Lake Rd	1	0	LPI Installed
Lacewood Dr	Thomas Raddall Dr	1	0	LPI Pending
Lacewood Drive	Sobeys Driveway	1	0	LPI Installed
Dunbrack St	Lacewood Dr	1	0	
Main Ave	Willett St	1	0	
Dutch Village Rd	Titus Ave	1	0	
Joseph Howe	Scot St	1	0	LPI Installed
Bayers Rd	Romans Ave	1	0	
Chebucto Rd	Mumford Rd	1	0	
Herring Cove Rd	Cowie Hill Rd	1	0	
Wright Ave	Joseph Zatsman Dr	1	0	
Countryview Dr	McClure Cl	1	0	
Waverley Rd	Montebello Dr	1	0	LPI Installed
Cole Harbour Rd	Forest Hills Pkwy	1	0	
Forest Hills Pkwy	Flying Cloud Dr (N)	1	0	
Mt Edward Rd	Woodlawn Rd	1	0	LPI Pending
Baker Dr	Basswood Run	1	0	LPI Installed
Pleasant St	Atlantic St	1	0	LPI Installed
Pleasant St	Acadia St	1	0	LPI Installed
Ochterloney St	Maple St	1	0	LPI Installed
Alderney Dr	Portland St (E)	1	0	
Victoria Rd	Nantucket	1	0	
Victoria Rd	Primrose St	1	0	LPI Installed
Woodland Ave	Lancaster Dr	1	0	
Young St	Gottingen St	1	0	
Almon St	Agricola St	1	0	
Barrington St	Niobe Gate	1	0	LPI Pending
Almon St	Connaught Ave	1	0	Protected Left pending (Connaught approaches)
Almon St	Windsor St	1	0	LPI Installed
Oxford St	North St	1	0	
Gottingen St	Brunswick St	1	0	LPI Pending NRTOR Pending
South St	South Park St	1	0	NRTOR Installed
Robie St	Jubilee Rd	1	0	

Robie St	Spring Garden Rd	1	0	
Robie St	University Ave	1	0	
Quinpool Rd	Oxford St	0	4	LPI Installed NRTOR Pending
Hammonds Plains Rd	Basinview Dr	0	2	
Portland St	Pleasant St	0	2	LPI Installed NRTOR Pending
Quinpool Rd	Connaught Ave	0	2	
Main St	Gordon Ave	0	1	
Prince Albert Rd	Hawthorne Ave	0	1	LPI Pending NRTOR Installed
Braemar Dr	Superstore Driveway	0	1	
Forest Hills Pkwy	Main Street	0	1	
Main Street	Panavista Dr	0	1	
Portland St	Eisener Blvd	0	1	
Alderney Dr	Portland St (W)	0	1	LPI Installed
Wyse Rd	Boland Rd	0	1	LPI Installed NRTOR Installed
Victoria Rd	Woodland Ave	0	1	
Beaverbank Rd	Sackville Dr	0	1	
Kearney Lake Dr	Parkland Dr	0	1	
Dunbrack St	Knightsridge Dr	0	1	
Lacewood Dr	Fairfax Dr	0	1	LPI Pending
Dunbrack St	Willett St	0	1	LPI Pending
Mumford Rd	Romans Ave	0	1	LPI Installed
Joseph Howe	3601 Driveway	0	1	
Bayers Rd	7501 Driveway	0	1	
Robie St	Young St	0	1	
Sackville St	Bell Rd	0	1	NRTOR Installed LPI Installed Signal Timing Adjustment
Robie St	Inglis St	0	1	LPI Pending

Closed Collision reports as of May 25, 2022