
For Information

REPORT TITLE: Intersection Planning for Safety Based on Vision Zero Principles

FROM: Kealy Dedman, Commissioner of Public Works

OBJECTIVE

To provide an update on intersection planning and operation for Regional roads in keeping with Vision Zero principles, including an overview of how the traffic signal warrant process is used to help inform decision-making on road network safety.

REPORT HIGHLIGHTS

- Under the Regionally adopted framework of Vision Zero, no loss of life or injury from a collision is considered acceptable.
 - Consistent with Vision Zero principles, the Region of Peel’s approach to transportation planning and road operation prioritizes safety, rather than convenience, efficiency, or capacity, for all road users, including pedestrians, cyclists, motorists, and goods movement operators.
 - The Region’s Vision Zero Road Safety Strategic Plan (the Plan) calls for more than 100 action items focused on six emphasis areas including: intersections, aggressive driving, distracted driving, impaired driving, pedestrian collisions, and cyclist collisions.
 - Intersections were identified as a primary safety concern and the Plan identifies a range of countermeasures and alternatives to full traffic signals that can be used to improve intersection safety and increase opportunities for pedestrian and cycling crossings.
 - Signalizing intersections that do not meet warrants can lead to safety concerns; however, selecting the appropriate mix of engineering, enforcement, education, and empathy countermeasures will help the Region to achieve the goals outlined in the Plan.
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DISCUSSION

1. Policy Direction – Vision Zero

Vision Zero is an initiative that aims to eliminate traffic fatalities and injuries while increasing safe, healthy, and equitable mobility for all. It prioritizes safety over speed, convenience and cost, and accepts that the road system must be forgiving of human error. In December 2017, Region of Peel Council adopted the Vision Zero Framework, as well as the Vision Zero Road Safety Strategic Plan (Resolution 2017-990). The Plan envisions “zero fatal and injury collisions for all road users”, including pedestrians, cyclists, motorists, and goods movement operators. The Region’s Vision Zero Plan calls for a broad range of approaches including engineering, enforcement, education, and empathy to ensure the safe movement of people and goods on both our roadways and active transportation infrastructure.

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Working together with the Vision Zero framework, in February 2018, the Region of Peel adopted the Sustainable Transportation Strategy that plans for 50 per cent of all trips to be made by sustainable transportation modes by 2041 (Resolution 2018-121). The Strategy prioritizes making roads safer for vulnerable road users such as children, seniors, and cyclists, and strengthens active transportation connections and the multimodal function of Regional roads.

Together, these policies support the 2018-2022 Term of Council Priority to 'Advance Community Safety and Well-being'.

2. Regional Approach to Multi-Modal Safety

Safety considerations in road design and operations have historically focused on motor vehicles and their occupants. With a focus on multi-modal transportation, Vision Zero calls for a broad range of approaches to ensure the safe movement of people and goods on both our roadways and active transportation infrastructure. This Vision Zero Plan contains action items that address the "4-Es" of road safety: Engineering, Enforcement, Education, and Empathy.

Engineering countermeasures are changes to the physical format of the roadway to ensure safe modes of travel are available for all road users.

Enforcement countermeasures include both police and automated enforcement to increase compliance with the existing rules of the road for all users.

Education and outreach countermeasures aim to increase awareness of road safety issues, while empowering all road users to make safer choices.

Empathy countermeasures try to put one road user in the position of another, so that they understand the consequences of their actions.

The Vision Zero Road Safety Strategic Plan was created based on extensive public consultation and data analysis and contains more than one hundred action items focused on six emphasis areas including intersections, aggressive driving, distracted driving, impaired driving, pedestrian collisions, and cyclist collisions.

Examples of action items include engineering improvements such as fully protected left-turn signals, ladder crosswalks, bike signals, roundabouts, and speed limit reviews; enforcement programs such as Red Light Camera and Automated Speed Enforcement; and education programs such as the CAA's South Central Ontario's 'Worst Intersection Campaign' where drivers are provided with an opportunity to nominate intersections in urgent need of repair.

These actions, in combination with the Region's existing approach that prioritizes the multimodal function of Regional roads, will help Peel achieve both its Vision Zero goals and sustainable transportation targets.

3. Intersection Safety

The Vision Zero Framework identifies intersections as a primary safety concern. The Region's Vision Zero Road Safety Strategic Plan included a comprehensive assessment of

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existing road safety conditions, extensive public consultation, and analysis of Regional and local Municipal collision data. Intersections were found to have the highest number of collisions overall, with rear-end, turning movement, and angle collisions being the most common.

Intersection safety is an area of traffic engineering where traffic is managed to avoid conflicts with other crossing, merging, and diverging streams of motorist, pedestrian, cyclist, transit, and goods movement traffic. Given the different directions of movement and many mode types, intersections typically experience higher collision rates than other roadway areas.

Intersections influence both the upstream and downstream traffic, meaning a poorly designed intersection can cause safety and efficiency problems in the larger transportation network.

More than 50 intersection safety countermeasures are identified in the Region's Vision Zero Road Safety Strategic Plan, any combination of which may be suitable to address unique safety concerns in a given area. For example:

- Fully protected left-turn signals – Vehicles can only turn left on a green arrow which reduces the probability of left-turning vehicular collisions.
- Traffic signal network progression – Traffic signal timing is coordinated to improve flow for drivers travelling the speed limit. This reduces the probability of rear-end collisions and improves air quality, travel time, and speed limit compliance.
- Ladder crosswalks – Traditional two-line crosswalks are replaced with painted bars to better identify pedestrian crossings.
- Cross-rides – A dedicated space identified by unique pavement markings for cyclists to legally ride their bikes across a roadway without dismounting.
- Smart channels – The radii for these right turn channels are straightened out for a better view of pedestrians, slower exit speeds, and an easier angle for drivers to see approaching vehicles.

In a Vision Zero jurisdiction, safety is prioritized over other factors such as cost, speed, delay, level of service, and convenience. Pedestrians want crossing locations as close to the intersection as possible to minimize deviation from the straight path; however, prioritizing safety over convenience sometimes means that pedestrians and cyclists may be required to travel outside of their straight path of travel to cross busy roadways at a safer location. The adoption and implementation of Vision Zero in a jurisdiction requires actions to promote behavioural changes in the way the decisions are made, including minimizing vehicle-to-pedestrian collisions at busy intersections by the relocation of pedestrian crossings to a more appropriate location that would provide a net safety benefit.

4. Traffic Signals and Safe Crossing Alternatives

The role of traffic signals is intended to provide alternating right-of-way at an intersection, while maximizing safety and efficiency. Alternatives to traffic signals include stop signs, yield

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signs and roundabouts. A comprehensive study of traffic conditions and physical characteristics is undertaken to determine whether traffic signals or an alternative would benefit traffic safety.

Traffic signalization is often perceived as the only solution for intersections with minor-street left-turns that experience moderate delays. Left-turn maneuvers require vehicles to wait for an appropriate gap to cross the opposing traffic as well as any pedestrian crosswalk activity. If the wait is inconvenient, other measures be considered such as restricting left-turns during certain times of day, or diverting traffic to larger intersections. Vision Zero principles dictate that convenience, efficiency, or capacity should never be prioritized over safety.

Although traffic signals can help to reduce collisions in some situations, it is important to note that signals can also increase the number of collisions in certain situations, making the intersection/network less safe for vulnerable road users such as pedestrians and cyclists. Unwarranted traffic signals can also increase traffic delay and have environmental impacts such as reduced air quality from idling vehicles. Since intersections influence both the upstream and downstream traffic, these safety and efficiency problems may be translated to other locations.

Where traffic signals do not improve intersection safety, there are other safe crossing alternatives that can be considered. For example, Pedestrian Crossovers (PXOs) and unsignalized crossings can be considered (marked by signs, pavement markings, and sometimes pedestrian-activated flashing lights). Other alternative technologies such as Intersection Pedestrian Signals (IPS) or Mid-block Pedestrian Signals (MPS) are sometimes considered to provide safe crossing opportunities where full traffic signals are not warranted. IPS and MPS are signals that create gaps in traffic and provide a pedestrian right-of-way (rather than alternating the right of way between conflicting streams of vehicle traffic as in the case of Full Traffic Signals).

5. Signal Warrants

In certain situations, traffic signals can be used as an intersection safety countermeasure. Engineering standards and guidelines help to identify those situations. The industry standard and Regional Council-adopted practice for placing intersection signals is the Ontario Traffic Manual (OTM) traffic signal warrant process. This process considers factors such as intersection configuration, vehicle volume, pedestrian volumes, speed limits, area population, delays, collision history, and pedestrian crossing opportunities to determine when intersection safety would benefit from a traffic signal.

In a comprehensive review of traffic signal warrants prepared for the Region of Peel, the OTM traffic signal warrant process was found to provide a comprehensive analysis designed to accommodate real-life issues and better responsiveness and flexibility compared to other warrant methodologies. Use of the OTM traffic signal warrant process is affirmed through Resolution 2012-382 for Regional intersections and is reflected in By-law 75-2012.

Traffic signal warrant methodologies ensure a consistent and reliable approach to decision-making that prioritizes intersection safety; however, they are used in conjunction with engineering judgment because each intersection has unique characteristics.

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6. Special Circumstances

In special circumstances, the OTM warrant process may not indicate that signals are required at an intersection based on the factors it considers. Special cases are those having unique factors beyond those already addressed in the OTM warrant system. In these cases, a consistent criteria is used to identify and accommodate unique circumstances; note that this approach does not simply relax the thresholds of the existing OTM warrant process, but rather considers these unique factors within a technical analysis.

In situations that do not warrant signalization, the best way to protect vulnerable road users is to investigate the use of alternative traffic safety countermeasures such as those discussed above in Section 3, or other alternatives and measures addressed in the Region's Vision Zero Road Safety Strategic Plan. When receiving traffic signal requests related to vulnerable road users, it is important that Regional staff use a holistic approach to analyze intersections and determine the most appropriate traffic safety countermeasure based on location-specific circumstances. This approach will provide the best protection for all road users, including pedestrians, cyclists, motorists and goods movement operators.

RISK CONSIDERATIONS

1. Safety Risk

The Region of Peel has adopted the Vision Zero framework that prioritizes safety over convenience, speed and cost with a vision for zero fatal and injury collisions for all road users. Given this direction, staff make roadway infrastructure decisions and recommendations with safety held paramount. The impacts of installing unjustified signals can include increased collisions, an infiltration of traffic to surrounding streets, undesirable environmental impacts and an increase in disobedience to signal indications or risky driving decisions. To mitigate this risk, the OTM warrant process helps to inform consistent and reliable decision-making. Alternative solutions such as PXOs, roundabouts and/or restricted vehicle movements can provide safe alternatives to vulnerable road users in circumstances where signals do not provide an overall safety benefit.

2. Legal Risk

Regional staff should continue to use the industry standard and Regional Council-adopted practice of following the Ontario Traffic Manual traffic signal warrant process. Deviation from industry best practices is not recommended as this has the potential to create additional liability concerns.

FINANCIAL IMPLICATIONS

The costs of signalizing an intersection can vary depending on intersection size and type. Depending on the cross-section, the cost of installing a permanent signal at a typical intersection can range between \$300,000 and \$450,000. Ongoing annual maintenance costs are approximately \$8,500. The cost of a typical pedestrian-only signal is approximately \$200,000, with annual maintenance costs of just under \$3,000. Vision Zero principles prioritize

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safety over costs; however, funding for signalization may provide greater safety benefit if spent on alternative safety countermeasures.

CONCLUSION

The Region of Peel's approach to intersection planning and operations is in alignment with the Regionally adopted Vision Zero framework. Safety is prioritized over convenience for the benefit of all road users, including pedestrians, cyclists, motorists and goods movement operators. With road users all moving in conflicting directions, traffic collision rates are typically higher at intersections as compared to other roadway areas.

The Region's Vision Zero Road Safety Strategic Plan identifies a range of countermeasures and alternatives to full traffic signals that can be used to improve intersection safety and increase opportunities for pedestrian and cycling crossings. Consistent with industry best practice, Regional staff use the Ontario Traffic Manual to support decision-making regarding the addition of traffic signals; however, special circumstances can exist where factors not considered in the OTM Manual require engineering judgement to be applied on a case-by-case basis. Signalizing intersections that do not meet warrants can lead to safety concerns; however, selecting the appropriate mix of engineering, enforcement, education and empathy countermeasures will help the Region to achieve the goals outlined in the Vision Zero Road Safety Strategic Plan and Sustainable Transportation Strategy.

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