City of Hamilton

Hamilton Rural Road Safety

Z0027620

FINAL REPORT



CIMA+ project number: Z0027620
09-March-2026 – Review 05

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Executive Summary

Rural Road Safety Context

Rural road safety presents unique challenges, including high operating speeds, mixed traffic types, limited infrastructure, and constrained opportunities for traffic calming. These conditions, combined with lower levels of enforcement, increase the likelihood that collisions, when they occur, will result in severe outcomes.

In recent years, rural areas within the City of Hamilton have experienced growing traffic volumes, increased industrial and agricultural activity, and a greater presence of vulnerable and recreational road users. This has heightened the need for a proactive and structured approach to identifying and mitigating safety risks across the rural network. The Rural Road Safety Toolbox was developed to respond to this need by providing a practical, consistent, and context sensitive decision support tool for municipal staff.

Toolbox Development Process

The toolbox was developed based on two complementary sources: a high-level environmental scan and detailed field investigations. The environmental scan, which included both a literature review and a jurisdictional review, confirmed key rural safety areas such as the prevalence of run off road collisions, curve related risks, and speed management challenges. It also identified a range of countermeasures commonly applied in other Canadian, U.S., and Australian jurisdictions. Particular consideration was given to the City of Hamilton Complete Streets Guidelines and the City's Draft Traffic Calming Policy during the development of the toolbox.

Field investigations within the City of Hamilton's rural road network played a central role in ensuring the toolbox reflects the City's specific context. These on-site reviews documented local geometric conditions, sightline constraints, roadside hazards, speed patterns, and driver behaviour, and helped identify the countermeasures most commonly implemented by the City. Together, these efforts ensured that the toolbox is evidence informed and grounded in the operational realities of Hamilton's rural road network.

Structure and Function of the Toolbox

At the core of the toolbox are diagnostic matrices organized by facility type, including road segments, signalized intersections, and unsignalized intersections, and by collision or issue type, such as single motor vehicle collisions, angle collisions, rear end collisions, speeding, or sightline issues.

Each matrix guides the user through a structured series of diagnostic questions, prompting the identification of geometric, operational, or behavioural factors contributing to observed issues. Users input information such as roadway geometry, traffic control, collision frequency, operating speeds, and roadside conditions.

Based on these inputs, the tool generates a list of recommended countermeasures. These range from low cost, easily implemented improvements, such as signage upgrades, rumble strips, delineation enhancements, or vegetation trimming, to more substantial interventions, including turn lanes, geometric modifications, or guiderail installations. The toolbox is sufficiently flexible to support both initial screening and more detailed safety reviews.

Systemic Safety Review and Case Studies

A systemic safety review of the City's rural network was conducted to validate the toolbox and to identify locations with elevated safety risk. Unlike traditional hotspot analysis, this approach evaluates the presence and magnitude of risk factors, such as AADT thresholds, roadside hazard ratings, speed limits, and horizontal curvature, to identify locations where severe collisions are more likely, even when collision frequencies are low.

This process generated a prioritized inventory of higher risk segments and intersections. From this inventory, ten case study locations were selected for field review. These case studies were then analyzed using the toolbox to test its diagnostic pathways and countermeasure recommendations.

The case studies confirmed that the toolbox provides a practical, adaptable, and technically sound framework for evaluating rural road safety concerns. Their application demonstrated how the structured diagnostic approach supports proactive, transparent, and consistent safety planning across the rural network.

Conclusions

Overall, the Rural Road Safety Toolbox provides the City with a structured and context sensitive framework for identifying, diagnosing, and addressing rural road safety concerns. By combining evidence-based research, field validated observations, and alignment with City policies and practices, the toolbox supports consistent and defensible decision making.

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1. Introduction

CIMA Canada Inc. (CIMA+) was retained by the City of Hamilton (the City) to develop a rural road safety toolbox based on the best practices and available tools for improving safety of all road users on rural roads.

Rural areas in the City of Hamilton are facing growing road safety concerns due to increased traffic volumes, excessive speeding, and a mix of road users including pedestrians, farm vehicles, and heavy trucks. The design of rural roads, which is typically straight with limited physical constraints, encourages high travel speeds that may not align with community needs or safe shared use. Safety issues are further compounded by the absence of sidewalks, limited sightlines, narrow shoulders, and roadside hazards. Ongoing and planned industrial development is expected to intensify these challenges. As traditional traffic calming measures are often impractical in rural settings, context-sensitive solutions are needed to enhance safety while maintaining road function.

The toolbox will facilitate selecting countermeasures for City's rural roads based on the findings of a collision analysis and will provide a structured approach to mitigating safety risks for all road users. The project will be carried out in the following steps:

- Conduct environmental scan including literature review and jurisdictional scan to review the practices of other jurisdictions in enhancing the road safety for rural roads
- Update Traffic Engineering Software (TES) Database by classifying the infrastructure by land use, such as urban, rural, and sub-urban
- Develop a Rural Road Safety Toolbox, including countermeasures and potential collision scenarios
- Conduct a systemic safety review of Hamilton rural roads to identify priority locations for each focus collision types
- Prepare case studies for select priority locations to conduct field investigations and assess the validity of the toolbox

The remainder of this report is organized as follows: **Section 2** presents the findings of the environmental scan, **Section 2.2** outlines the development of the Rural Road Safety Toolbox, **Section 4** details the systemic safety review process and results, and Chapter 5 provides illustrative case studies demonstrating the application of the Toolbox.

2. Environmental Scan

This section presents the environmental scan of rural road safety practices, drawing on both academic literature and jurisdictional insights. The scan aims to identify common challenges, effective countermeasures, and innovative strategies used by other municipalities to inform the development of Hamilton's Rural Road Safety Toolbox.

2.1 Literature Review

CIMA+ conducted a comprehensive literature review of the publicly available information on the state of practice for rural road safety and rural road safety toolboxes focusing Canadian and international jurisdictions (United States and Australia). As part of this we reviewed reports, publications, manuals, guidelines, journal articles, websites, and case studies focusing on the following areas. The list of documents reviewed is included in **Section 7.**

- General approach to rural road safety (rural road safety strategy, main risk factors/safety concerns, data sources used, such as collision data, public complaints, speed studies, etc.)
- Rural road safety toolbox (countermeasures, methodologies to implement countermeasures, speed management, signage, geometric improvements, enforcement strategies, etc., methodologies to develop toolbox)
- Speed management and traffic calming strategies on rural roads (measures, effectiveness, methodologies for adjustment to speed limits)
- Infrastructure and road design (enhancement to road design, e.g., improved sightlines, rumble strips, roundabouts, intersection safety countermeasures, etc.)
- Vulnerable road users (pedestrian and cyclist safety, interaction between motor vehicles and farm equipment, recreational users, such as walkers, cyclists, and runners)
- Collision analysis and risk assessment (collision data analysis, safety reviews, and identification of high-risk rural road locations)
- Use of technology and innovation (intelligent transportation systems of technology-based solutions, such as speed feedback signs and automated enforcement)
- Community engagement and public awareness (involvement of rural residents and stakeholders in road safety decision-making, education and awareness campaigns, and handling public complaints)
- Enforcement and policy measures (contribution of law enforcement, specific by-laws or policies in place to improve road safety)
- Challenges faced by municipalities (any specific issues, any successful countermeasures and methodologies, any lessons learned)

In addition to the sources mentioned above, the literature review and the development of the Safety Toolbox also incorporated documents specific to the City of Hamilton. For example, the City of Hamilton Complete Streets Guidelines (City of Hamilton, 2022) were used as a reference for countermeasures such as paved shoulders, paved shoulders with buffers, and multi-use paths physically separated from the roadway. Another key reference was the City's Draft Traffic Calming Policy (City of Hamilton, 2020), which provides guidance on traffic calming measures Hamilton's roads. The draft policy is mainly applicable to urban areas. However, some physical deflection measures may still be appropriate in certain localized contexts within rural settings, such as small hamlets, where surrounding land uses generate pedestrian activity and a lower speed environment is desired. In these situations, measures such as speed cushions, speed bumps, raised intersections, or raised crosswalks may be applied to effectively reduce vehicle speeds

This section presents the findings of the literature review in the following categories:

- Risk Factors and Countermeasures
- Strategies for community engagement
- Enforcement and policy measures
- Challenges faced by municipalities
- Methodologies to prioritize locations

2.1.1 Risk Factors and Countermeasures

Appendix A presents a detailed matrix of risk factors associated with rural roadways, with their descriptions, and countermeasures identified in the literature review (available in relevant references). The list includes a broad spectrum of risk factors under 31 categories. The associate countermeasures address a wide range of issues including operational, geometric, and infrastructure deficiencies; roadside hazards; human-factor and driver-behaviour concerns; and environmental conditions. The list also incorporates risks and countermeasures specific to different types of road users, including vulnerable road users such as pedestrians and cyclists.

This exercise, together with the field investigations conducted in the City of Hamilton, was vital for developing the toolbox, ensuring it incorporates both general best practices and locally specific countermeasures.

2.1.2 Strategies for community engagement

Improving road safety outcomes in rural areas requires active and sustained community engagement. Rural populations are overrepresented in severe collisions, and tailored interventions that reflect local realities are critical to improving safety outcomes. Community engagement strategies aim to raise awareness, empower residents, and build local ownership of safety efforts.

Targeted Local Education Campaigns

Education efforts should be directed at specific issues affecting rural road users, such as unsealed roads, wildlife hazards, and high-speed zones. Campaigns should address "at-risk" populations, particularly young male drivers, older adults, and Indigenous communities. Messaging like "rural people die in rural collisions" can personalize the risk and increase local resonance (Michael Tziotis, 2006).

Inclusive Public Health Decision-Making

Engaging rural residents in developing and distributing safety interventions ensures cultural relevance and community buy-in. Public input can inspire innovative, realistic solutions grounded in local experience (Michael Tziotis, 2006).

Indigenous Community Partnerships

Indigenous communities often face road safety challenges related to remoteness, poor infrastructure, and under-resourced services. Meaningful partnerships that value Indigenous knowledge can lead to tailored, effective solutions. Highlighting the disproportionate toll of rural collisions can help prioritise these communities in safety planning (Michael Tziotis, 2006).

'Fatal Four' Awareness

Ongoing education around the 'Fatal Four' behaviours (i.e. speeding, impaired driving, fatigue, and not wearing seatbelts) remains vital in rural settings where law enforcement presence is often limited and risky behaviours are more prevalent. Campaigns should clearly connect these behaviours to the real and present danger that rural people are dying on rural roads. Reinforcing this link can drive behaviour change and community support for enforcement (Michael Tziotis, 2006).

Action-Oriented Messaging

Campaigns should offer practical alternatives, not just highlight risks. For example, encouraging drivers to plan rest breaks or use designated drivers can make messages more actionable and reduce risky behaviour (Michael Tziotis, 2006).

Motorcycle Education Campaigns

Motorcycle-related safety efforts are another important focus area for rural road safety outreach. Education campaigns, delivered through a variety of media including posters, videos, and radio, target both motorcyclists and drivers, and typically focus on:

- **Defensive and safe riding practices**, including strategies to avoid conflicts at intersections, driveways, and while passing;
- **Driver awareness**, emphasizing the need for motorists to actively look for motorcycles, given their smaller size and lower visibility;

- **Use of protective equipment,** encouraging motorcyclists to wear proper gear to reduce injury severity; and
- **Visibility enhancements**, such as wearing bright clothing, using additional lighting, and avoiding blind spots.

These proactive campaigns can help reduce the disproportionate severity of motorcycle collisions in rural areas by raising awareness and promoting practical safety behaviours among all road users.

Professional Training for Practitioners

Rural road safety professionals need access to specialised training that reflects the unique challenges of their environments. Government-supported programs can ensure a high standard of practice and consistency in rural safety efforts (Michael Tziotis, 2006).

Multi-Stakeholder Coordination

Effective campaigns involve law enforcement, engineering, public health, judicial systems, and community stakeholders to ensure aligned messaging and broader reach (Jeffrey Bagdade, 2012).

Sustained and Integrated Campaigns

Community education alone does not produce sustained reductions in serious injuries and fatalities. However, campaigns integrated with enforcement and local engagement can reduce collisions by up to 39% (Hammond, 2018). Education should be treated as a long-term strategy, with modular programs over time being more effective than isolated efforts (Shaun Hammond, 2018).

Useful Resources:

- **Speed Education Campaign:** NHTSA's Speed Campaign Toolkit offer adaptable materials to support local initiatives and promote collaboration across community and national partners (Jeffrey Bagdade, 2012).
- **Cyclist Education and Training:** Cycling-specific safety education is also important. Programs such as CAN-BIKE Courses and Ontario's Guide to Safe Cycling teach cyclists basic handling skills, traffic rules, and hazard recognition (Shaun Hammond, 2018).
- **Defensive Driving Tips:** Municipal initiatives, such as the City of Ottawa's rural road safety webpage, provide clear, categorized guidance on common rural road hazards such as curves, gravel shoulders, slow-moving vehicles, and aggressive or distracted drivers. These resources educate road users on how to recognize these hazards and adopt defensive driving strategies in response (City of Ottawa, 2025).

- **Time is Precious Campaign**: The City of Ottawa's Time is Precious campaign features a series of ads targeting key risk behaviours—such as aggressive driving, distraction, impairment, intersection violations, and vulnerabilities faced by pedestrians, cyclists, motorcyclists, and rural road users. The campaign supports a culture of road safety by de-normalizing unsafe behaviours and raising awareness across all modes of travel.

2.1.3 Enforcement and policy measures

Strategic enforcement and supporting policies play a key role in reducing risky behaviours on rural roads. Evidence shows these efforts are most effective when combined with education and community engagement. While standalone enforcement or media and educational campaigns may have limited or even adverse impacts, integrated approaches such as pairing enforcement with public education or local outreach can yield significantly stronger outcomes. Research indicates that these combinations can reduce collisions by 13–39%, depending on the strategy used (Shaun Hammond, 2018). Achieving impact requires innovation, collaboration, and sustained commitment, particularly in rural contexts where enforcement resources are stretched over large geographic areas.

Randomized Rural Enforcement

Due to limited resources and vast geographies, rural enforcement must rely on unpredictability to maintain deterrence. Randomised patrols and checkpoints can create a perception of consistent presence even when actual coverage is limited. This approach is strengthened by messaging that rural collisions are deadly and avoidable (Michael Tziotis, 2006).

Selective Traffic Enforcement Programs (STEP)

STEP involves intensive, targeted enforcement of specific traffic safety law (e.g., seatbelt use, speeding, impaired driving) combined with public outreach, education and communication. These programs are designed to address specific behavioural issues and improve compliance across diverse road user groups through multiple channels. Effective implementation of STEP requires careful planning and strategic resource allocation to maximize impact. This targeted approach is particularly effective in rural settings, where behavioural challenges and limited enforcement capacity are more pronounced (Shaun Hammond, 2018).

Reinvesting Enforcement Revenue Locally

Dedicating a portion of traffic fine revenues should directed to support local road safety initiatives, infrastructure improvements, and evidence-based interventions. Funding research into rural collision causes can inform better policy and practice. Framing this need around the lives lost on rural roads builds a compelling case for reinvestment (Michael Tziotis, 2006).

Incorporating Police Observations into Engineering Solutions

Police officers routinely conduct patrols and are often the first to respond to traffic incidents, giving them unique, firsthand insight into local roadway conditions and driver behavior. Through their daily duties and the collision reports they complete, officers can help identify recurring patterns and high-risk locations. While not traffic engineers, their on-the-ground perspective is valuable. To make the most of this knowledge, agencies should establish a streamlined process that allows officers to regularly communicate safety concerns to traffic engineering staff. This collaboration can help flag areas needing further investigation or potential safety improvements (ITE, 2015).

Speed Enforcement Tools (NCHRP Report 500 Volume 23, 2009):

- **Increase penalties** for repeat and excessive speeding offenders to enhance deterrence.
- **Strengthen adjudication processes** for speeding citations to support consistent enforcement outcomes.
- **Apply higher fines in designated areas**, such as school zones or pedestrian-heavy corridors.
- **Raise public awareness** of penalties and enforcement activities through targeted education campaigns
- **Deploy targeted conventional enforcement** at locations with known speeding-related collision histories as well as marked patrol vehicles and radar enforcement.
- **Implement automated speed enforcement** (Lisa Wundersitz, 2019)., including:
  - **Point-to-point (average speed) cameras** in remote or rural areas, shown to reduce speeds by up to one-third.
  - **Mobile speed cameras**, offering flexible deployment in low-resource or rural contexts

Impaired Driving Enforcement Tools (Kostrzewski, H., Haskett, L. & Office Of Behavioral Safety Research, 2024)**:**

- **Alcohol Ignition Interlocks:** Prevents a vehicle from starting or being operated unless the driver provides a breath sample with a breath alcohol concentration (BrAC) lower than a pre-set level, usually .02. Interlocks typically are used as a condition of probation for Driving While Intoxicated or Impaired (DWI) offenders, to prevent them from driving while impaired by alcohol after their driver's licenses have been reinstated.
- **Publicized Sobriety Checkpoints:** law enforcement officers stop vehicles at predetermined locations to investigate whether drivers are impaired. Although sobriety checkpoints remove impaired drivers from the road, the primary purpose of checkpoints is to deter driving after drinking among the general population by increasing the perceived risk of being caught and arrested. To do this, checkpoints must be highly visible, publicized extensively, and conducted regularly, as part of an ongoing sobriety checkpoint program.

- **Driving While Intoxicated or Impaired (DWI) Courts:** DWI courts are specialized courts dedicated to changing the behavior of DWI offenders through intensive supervision and countermeasures. DWI courts have greater success in changing driver behaviors compared to traditional court processes and sanctions and can be a particularly useful countermeasure for high-risk offenders.
- **Vendor Compliance Checks:** Reduce underage alcohol sales through frequent enforcement
- **Alternative Transportation:** Promote safe alternatives methods people can use to get to and from places where they drink without having to drive.
- **Alcohol Impaired Driving Mass Media Campaigns:** Strategically target key demographics using high-frequency messaging across platforms (i.e. radio, television, print, social, and other mass media, both paid and earned). When paired with enforcement, these campaigns show stronger effectiveness

High-Visibility Seatbelt Enforcement

Short-term (typically lasting 2 weeks), highly publicized seatbelt enforcement periods, featuring checkpoints, saturation patrols, or enforcement zones, can drive higher compliance (Kostrzewski, H., Haskett, L. & Office Of Behavioral Safety Research, 2024).

2.1.4 Challenges faced by municipalities

Municipalities, particularly those with large rural road networks, often face several challenges in conducting systemic road safety reviews and implementing safety improvements. These challenges typically fall into three main categories: limited resources, data availability and quality, and operating conditions in rural contexts.

Limited Resources

A predominant challenge municipalities face is the constraint of resources, both in terms of personnel and funding. These challenges are especially acute in small or rural municipalities that must manage large geographic areas with relatively limited staff and revenue.

Several systemic issues are directly linked to these resource constraints, including:

- **The geographic dispersion of collisions**, which complicates prioritization through traditional hotspot analysis
- **Political constraints** that deprioritize rural roads with low traffic volumes despite known safety risks
- **A lack of enforcement presence** in remote areas, reducing the effectiveness of deterrent-based safety strategies

Staffing and Technical Capacity

Many municipalities operate with limited staff capacity, making it difficult to dedicate the necessary time and expertise to undertake detailed safety reviews or coordinate multi-agency road safety efforts. Rural jurisdictions may not have dedicated traffic engineers or road safety professionals, making it difficult to lead systemic safety reviews or develop capital plans for safety upgrades.

To address this, some jurisdictions engage external consultants with specialized expertise in transportation safety to lead or support project development. In other cases, academic institutions or local community organizations have contributed by offering technical input, volunteer support, or assistance with data collection and outreach. Building partnerships can help municipalities overcome staffing limitations and bring broader perspectives to road safety planning.

Funding Constraints

Limited financial resources remain a significant barrier to implementing safety interventions on rural roads. Even when safety issues are well understood and documented, municipalities often face difficulties in securing funding for the design, construction, and maintenance of necessary improvements.

In Ontario, while funding programs such as the **Road Safety Community Partnership Program** and the **Federal Road Safety Transfer Payment Program** other some support, these programs tend to focus on education, public awareness, and enforcement initiatives rather than infrastructure improvements.

Given this context, municipalities can strengthen their case for funding, whether through internal capital budgeting processes or external sources, by developing a clearly defined and evidence-based road safety improvement plan. A strong safety plan can help justify investments, secure council support, and position municipalities to take advantage of emerging funding opportunities, especially those aligned with broader provincial and federal safety priorities such as Vision Zero.

Data Availability and Quality

Reliable data is essential to conducting meaningful safety analyses, identifying systemic risks, and prioritizing interventions. Yet, municipalities often face challenges accessing or managing data such as:

- Detailed collision records (including severity and contributing factors)
- Speed data or traffic volumes on low-volume rural roads
- Road geometry, maintenance records, and asset condition information
- Local hospital or EMS records linked to roadway incidents

Where high-quality data is unavailable, municipalities may need to supplement existing sources with field assessments, road safety audits. Collaborating with provincial partners can also provide access to broader datasets and help establish more consistent data collection practices.

Establishing a long-term strategy to improve data quality—through enhanced reporting processes, better inter-agency coordination, or use of new technologies (e.g., sensors, GIS mapping), can strengthen the foundation for systemic safety planning and ongoing monitoring.

Operating Conditions in Rural Contexts

One challenge uniquely emphasized in the jurisdictional survey is the presence of high-speed rural environments with mixed traffic, which include passenger vehicles, farm machinery, commercial trucks, cyclists, and recreational users. These mixed-use conditions, combined with long travel distances and limited road geometry improvements, contribute to elevated risk levels and complicate the application of standard urban-focused countermeasures.

Addressing these risks often requires context-sensitive design solutions, such as targeted speed management strategies, dedicated signage for farm vehicles, and improved lane departure countermeasures.

2.1.5 Methodologies to Prioritize Locations

Rural road authorities face a unique set of challenges: dispersed networks, constrained budgets, and limited collision data. As highlighted in the environmental scan, including both the literature review and jurisdictional best practices, prioritizing locations for safety improvements requires a two-part approach:

1. Identifying candidate locations, and
2. Prioritizing those locations using structured, data-informed approaches.

2.1.5.1 Methods for Identifying Candidate Sites

Identifying candidate locations for safety improvement is the foundational step in any rural road safety strategy. The environmental scan revealed that jurisdictions commonly rely on a mix of data-driven tools, staff insight, and public input to screen their road networks for potential safety concerns. This section outlines five key methods used to identify candidate sites for further evaluation and prioritization.

1. Public Complaints and Community Reports

Residents and road users often raise concerns about unsafe locations through service requests, complaints, or council meetings. Though anecdotal, this feedback provides useful context, particularly for areas with underreported or low-severity collision histories. Several jurisdictions use public reports as an initial filter for site investigations or as validation for identified hotspots.

2. Internal Staff Reviews

Consultations with internal staff, including:

- Maintenance and operations teams, who are familiar with recurring field issues (e.g., drainage, sightline obstructions, road hazards, signage needs, etc.)
- Law enforcement officers, who provide context on collision causes, enforcement patterns, or driver behaviors
- Local councillors or municipal leaders, who represent public concerns and may flag community-prioritized locations

These reviews help ground the safety analysis in operational knowledge and local priorities.

3. Network Screening

Network screening involves systematically reviewing all or part of the road network to identify sites for further investigation and potential implementation of countermeasures. The intent is to identify sites expected to benefit the most from targeted, cost-effective countermeasures.

There are two broad types of network screening:

- **Reactive Screening:** Focuses on identifying sites with high collision frequency or severity based on historical collision data.
- **Proactive Screening:** Identifies locations with high-risk features based on site-specific geometric and operational attributes (also referred to as Systemic approach).

Proactive screening is especially relevant for rural roads, where collision data may be sparse or unreliable. When combined with systemic safety principles, it enables agencies to flag and rank sites that warrant further analysis or countermeasures, ensuring efficient use of resources and promoting a safer road network overall.

4. Systemic Safety Review

Systemic safety review is particularly well-suited for rural and remote areas where low traffic volumes may limit the use of collision-based analysis alone. By shifting the focus from reactive to proactive, the systemic approach supports earlier intervention, maximizes limited funding, and helps reduce the likelihood of severe collisions in areas with known risk profiles.

The analysis begins by identifying a list of contributing risk factors—such as geometric design features, roadside environment, intersection type, and traffic control characteristics—with the goal of understanding the underlying conditions that make certain locations more susceptible to serious collisions. These insights are then applied across the network to identify other sites with similar characteristics, even if those locations have not yet experienced a high number of collisions.

By focusing on the presence and magnitude of these risk factors, the systemic method enables earlier, lower-cost interventions and supports a more equitable allocation of safety resources, particularly in areas where sparse collision data might otherwise mask high-risk conditions.

Section 4 of this report provides more information on systemic safety review.

5. Predictive Network Analysis

Where sufficient data is available, predictive models can be used to estimate collision risk across the network, even in locations with limited historical data. These models may consider roadway geometry, traffic volumes, weather conditions, and land use characteristics to flag locations with a high likelihood of future collisions.

Predictive analytics can complement other screening methods and support forward-looking investment decisions.

2.1.5.2 Prioritization Methodologies

Once candidate locations are identified, a prioritization framework helps guide the selection of sites for intervention, especially when funding or capacity is limited. The following methodologies were cited based on the environmental scan:

1. Collision Rate Analysis

Collision rate analysis provides a more balanced view of safety risk by factoring in traffic exposure—helping to avoid overemphasizing high-volume corridors. Two common ways to calculate exposure include:

- For road segments: exposure is measured as vehicle-kilometres traveled (i.e., number of vehicles × segment length), and the collision rate is expressed as collisions per million vehicle-kilometres.
- For intersections: exposure is based on traffic volume entering the intersection (i.e., vehicles per day or hour), with collision rate expressed as collisions per million entering vehicles.

This method ensures that roads with lower volumes, but high relative collision risk are still flagged for attention. The high collision-rate locations are prioritized for potential safety interventions based on their relative risk exposure.

2. Cost-Benefit Assessment

This methodology prioritizes locations or projects that offer the greatest safety return on investment.

It considers the full scope of interventions required at each location and evaluates the overall benefits relative to total implementation costs. Locations are then ranked based on their return on investment (ROI) or benefit-cost ratio (BCR). The assessment includes:

- Expected collision reduction based on the type and number of countermeasures
- Total capital, operating, and maintenance costs
- Lifespan and durability of proposed improvements

Projects are ranked by benefit-cost ratio (BCR) or return on investment (ROI) to ensure limited funding is directed to high-impact improvements.

3. Scoring-Based Prioritization Models

Scoring or point-based system offers a transparent and replicable way to evaluate and rank candidate locations using multiple criteria. These models are particularly effective in contexts where decisions must balance technical analysis with stakeholder input, local priorities, and broader program goals.

The process typically begins by defining a set of evaluation criteria for each site. Common criteria include:

- Traffic exposure (e.g., traffic volume)
- Collision history (e.g., type and severity of past collisions)
- Cost-effectiveness (e.g., benefit-cost ratio)
- Expected collision reduction potential
- Implementation Timeline
- Alignment with agency or community goals

Each criterion is assigned a weight based on its relative importance. Candidate sites are then scored against each criterion, and total weighted scores are used to generate a ranked list. This structured, data-informed approach supports objective decision-making and facilitates communication across agencies and stakeholders.

In reactive network screening, scoring-based prioritization is typically driven by collision-based performance measures. These measures are selected to reflect collision patterns at specific sites, with the goal of identifying those locations most likely to benefit from cost-effective safety countermeasures.

According to the Highway Safety Manual (Highway Safety Manual, 2010), there are 13 recognized performance measures used in collision-based screening, varying in complexity and statistical rigor. The most commonly applied and effective measures include:

- **Collision Frequency** – simple count of collisions over a defined period
- **Collision Rate** – normalizes collision frequency based on exposure, such as AADT or vehicle-km traveled
- **Equivalent Property Damage Only (EPDO)** – weights collisions by severity, assigning greater value to fatal and injury collisions
- **Empirical Bayes (EB) Expected Collision Frequency –** a statistically rigorous method that combines observed collisions with predicted values from safety performance functions
- **Potential for Safety Improvement (PSI)** – difference between observed collisions and EB-expected collisions

Among these, the Empirical Bayes-adjusted measures (e.g., EB expected collision frequency and PSI) are the most statistically reliable. They adjust for regression-to-the-mean and account for differences in traffic volume, making them especially effective for fair comparison across sites.

Many agencies also apply severity weighting, such as EPDO or Relative Severity Index, and may filter candidate sites based on facility type, collision type, or operational features before applying final prioritization.

In practice, many jurisdictions develop composite scoring systems that combine collision-based performance measures with other criteria, such as cost-effectiveness, implementation feasibility, and community concerns, to create a final prioritization list.

4. Risk-Based Prioritization

This approach integrates data-driven risk identification with practical considerations such as implementation feasibility and program alignment.

Locations are first screened based on the presence and severity of observed or potential risk factors—such as sharp horizontal curves, inadequate shoulder width, roadside hazards (e.g., fixed objects, steep slopes), documented speeding issues, etc. Locations may be prioritized using:

- Equal weighting, where locations with a greater number of risk factors are ranked higher, or
- Relative weighting, where certain risk factors are given more importance based on their stronger association with severe collisions.

Once high-risk locations are identified, implementation projects at those sites are prioritized based on practical and programmatic considerations, including:

- Availability of funding and cost-benefit analysis
- Inclusion in capital or infrastructure programs
- Time and effort required to develop the project
- Expected level of stakeholder or community engagement

This two-step approach ensures that limited resources are directed to projects with both high safety potential and feasible delivery pathways.

Within the risk-based category, **systemic reviews** offer a structured network-wide method for identifying and prioritizing sites with features commonly associated with severe collisions. The prioritization process includes:

- **Identification of Focus Collision Types:** The process begins by identifying collision types most associated with fatal and serious injury outcomes on rural networks (e.g., run-off-road, head-on, or intersection-related collisions).
- **Selection of Facility Types:** These collision types are examined across different rural facility types (e.g., undivided two-lane roads, unsignalized intersections) to determine where they are most prevalent.
- **Assessment of Risk Factors:** Common roadway and environmental characteristics (e.g., high speeds, lack of clear zones, tight curves) are analyzed to identify those that are overrepresented in severe collision events.
- **Network Screening and Risk Scoring:** Each location in the network is screened and assigned a risk score based on the number and magnitude of identified risk factors. This allows for prioritization even in areas with limited or no collision history.
- **Identification of Appropriate Countermeasures:** Risk-prone locations are then matched with cost-effective countermeasures, using a systemic safety toolbox to guide intervention selection.

This enables the early identification and prioritization of sites that may not yet show up in collision statistics but share characteristics with historically high-risk locations.

2.2 Jurisdictional Scan

A jurisdictional scan was conducted through an online survey distributed to multiple agencies across Canada, the United States, Europe, and Australia. The survey aimed to gather insights into rural road safety practices that may not be documented in published literature. A full list of invited agencies and detailed survey responses is provided **Appendix A**.

A total of **13 agencies** completed the jurisdictional survey. Their responses provide valuable insights into current practices and challenges related to rural road safety and have informed the development of this toolbox. The participating agencies are listed in **Table 1**.

Table 1: Survey Participants

Country	Agencies Participated in the Survey
Australia	Queensland Department of Transport and Main Roads
Canada	BC Ministry of Transportation and Transit
Canada	City of Calgary
Canada	City of Ottawa
Canada	Halton Region
Canada	New Brunswick Department of Transportation and Infrastructure
Canada	Niagara Region
Canada	Town of Milton
Canada	York Region
United States	Montana Department of Transportation
United States	Pennsylvania Department of Transportation - Bureau of Operations
United States	South Dakota Department of Transportation
United States	Vermont Agency of Transportation

2.2.1 Jurisdictional Context and Rural Safety Concerns

Agencies were asked to describe the rural characteristics of their road networks and highlight key safety concerns. Most reported that a substantial portion of their networks are classified as rural, with the exception of the City of Calgary, City of Ottawa and the Town of Milton, where rural roads account for only 2%, 20% and 25% of their networks, respectively. The most common rural facility types reported were:

- 100% have two-lane, two-way roads
- 92% have undivided multi-lane roads
- 85% have multi-lane roads with <10 m median
- 69% have multi-lane roads with >10 m median

When asked about their top rural road safety concerns, the majority of agencies identified **speeding** and **run-off-road collisions** as primary issues. For Canadian agencies, the next most commonly cited concern was winter road safety (for 3 out of 8 Canadian agencies and 23% of respondents). Other concerns mentioned less frequently included intersection collisions, farm vehicle interactions, cyclist interactions, wildlife collisions, rear-end collisions, and driver inattention.

2.2.2 Data Sources and Risk Identification Methods

Agencies reported using a diverse set of data sources to assess rural road safety. The universally cited sources were collision data and public concerns. Other frequently referenced sources included speed studies (92%), safety audits (92%), traffic volumes (77%), systemic reviews (77%), and conflict data (23%).

To identify high-risk rural locations, most jurisdictions employ a combination of network screening and site-specific analysis. These methods are often supported by tools such as predictive safety models, collision rate analysis, and systemic safety reviews. Several agencies also highlighted the importance of staff field assessments and anecdotal reports, particularly in rural areas where granular data may be limited or unavailable. In some cases, public complaints serve as a key trigger for initiating safety reviews.

2.2.3 Countermeasures and Rural Safety Strategies

Agencies reported a wide range of countermeasures and strategies to address rural road safety concerns. Common engineering-based interventions include:

- **Enhanced signage**: Speed feedback signs, warning signs, flashing beacons, and signage for farm vehicles and wildlife, LED chevrons, and dynamic intersection warning systems
- **Intersection improvements**: Roundabouts, stop control, geometric modifications at skewed intersections and lighting upgrades
- **Roadway delineation:** Rumble strips, pavement markings, and delineators
- **Shoulder enhancements and roadside hazard removal:** Including paved shoulders, guardrails, and clear zone improvements

Some agencies also apply context-sensitive solutions, such as variable speed limits, curve warning systems, and dynamic message signs. Technologies like wildlife detection systems, road weather information systems, and automated enforcement (where permitted) are also used to enhance safety.

In addition to physical infrastructure, several jurisdictions incorporate education and enforcement strategies, particularly targeting speeding, distracted driving, and seatbelt use. These efforts are often supported by partnerships with law enforcement and public awareness campaigns.

2.2.4 Speed Management Strategies

Agencies use a combination of policy frameworks and data-driven approaches to manage rural road speeds. In Canada, most jurisdictions reference the **TAC Speed Limit Evaluation Methodology**, typically applying it in response to public requests or following roadway changes. In contrast, many U.S. agencies face state-level constraints, where adjustments require formal engineering studies or legislative approval.

Effectiveness ratings varied: some agencies rated their strategies as moderately effective (3–4), while others, like Town of Milton, rated them low (1). Montana DOT noted limited tools make effectiveness hard to assess.

Queensland DOT (Australia) reported actively reducing speed limits on many rural roads from 100 km/h to 80 km/h, guided by collision data, infrastructure risk ratings, and other contextual factors. However, due to Queensland's vast and varied geography, the effectiveness of these strategies was rated relatively low (2 out of 5).

The City of Ottawa rated its current speed management strategies as moderately effective (3 out of 5). Historically, speed limits were reviewed reactively. However, the City is now working toward a new speed zone policy that will support a more proactive approach. This upcoming policy is expected to move away from reliance on 85th percentile speeds and adopt Safe Systems principles, with greater consideration given to rural road context and gravel surface conditions.

Several agencies highlighted structured approaches, such as South Dakota's Safety and Speed Management Board and Vermont's use of 85th percentile speed studies. Others, like Niagara Region, emphasized adherence to established guidelines to avoid politically driven changes.

2.2.5 Vulnerable Road User (VRU) Safety Strategies

Approaches to VRU safety on rural roads vary widely across jurisdictions, reflecting differences in user volumes, infrastructure, and policy frameworks.

Infrastructure and Design Measures:

Several agencies, including City of Ottawa, Halton Region, BC Ministry of Transportation, Queensland, and Vermont Agency of Transportation, implement physical measures such as wide paved shoulders, shared-use paths, and enhanced signage. Additionally, Ottawa's approach also includes push buttons (PXOs) at rural intersections, roundabouts with pedestrian crossings. Others, like City of Calgary and Town of Milton, rely on minimal interventions such as "Share the Road" signs or off-street pathways near developments. Queensland also uses school bus advisory signs to alert drivers to the presence of pedestrians.

Methodologies and Warrants:

Formal warrants or methodologies for selecting VRU safety measures are limited. Only a few agencies, such as BC Ministry of Transportation and Vermont, reported using structured tools like pedestrian crossing warrants or bicycle use mapping. Queensland DOT relies on principal cycle network approach, irrespective of volumes, to identify cycling infrastructure needs. City of Ottawa also reported using ladder markings and PXO warrants at roundabouts based on OTM Book 18. Most others indicated no formal process, relying instead on case-by-case assessments or broader transportation planning updates.

Farm Vehicle Interactions:

Policies for managing interactions between farm vehicles and other road users are also inconsistent. While BC, Queensland, Pennsylvania, and Vermont have dedicated signage and guidelines, others like Halton Region and South Dakota DOT install signage only when warranted or requested.

2.2.6 Education, Enforcement, and Implementation Challenges

Education and Awareness Campaigns:

Several agencies, including BC Ministry of Transportation, Montana DOT, South Dakota DOT, and Vermont, implement public education campaigns, often in partnership with insurance agencies or safety offices. These initiatives typically focus on driver behaviors such as speeding, impaired driving, and seatbelt use. Queensland DOT emphasizes fatigue-related messaging tailored to rural areas. The City of Ottawa reported a variety of rural-focused safety initiatives, including its 'Time is Precious' campaign, ATV education programs in schools, rural police outreach events, and simulated collision awareness activities aimed at high school students. Additional details on shared initiatives are included in **Appendix A**.

In contrast, agencies like the City of Calgary and Niagara Region currently do not have rural-specific education or awareness campaigns in place.

Law Enforcement Role:

Law enforcement plays a key role in rural road safety across most jurisdictions. Activities include speed enforcement, targeted patrols, and sobriety checkpoints. Some agencies, like PennDOT, partner directly with state police to coordinate enforcement efforts. In contrast, Montana is restricted by law from using certain automated enforcement tools.

City of Ottawa coordinates rural enforcement activities through its Road Safety Unit and works closely with the Ottawa Police Service on initiatives like ATV education and red light camera enforcement.

Challenges in Rural Road Safety:

Common challenges include:

- Geographic dispersion of collisions
- Limited funding and infrastructure
- High-speed rural environments with mixed traffic
- Difficulty prioritizing rural projects due to lower collision volumes or political constraints
- The City of Ottawa additionally cited implementation barriers/guide rails such as engineering constraints, property requirements, private access management, coordination with other City programs & projects, and consultation with stakeholders.

Successful Countermeasures and Case Studies:

Several agencies reported a range of effective strategies, including:

- High Friction Surface Treatments (HFST) and Variable Speed Limit Signs (VSLS)
- Systemic applications of rumble strips (centerline and shoulder) and cable barriers/guide rails
- All-way stop controls and lane departure countermeasures
- Integration of safety edges, guardrail upgrades, and rumble strips into road resurfacing programs
- In-Service Road Safety Reviews
- Road Safety Audits are being proactively implemented on roadway design projects
- Red light camera network screening and implementation

Queensland DOT also highlighted notable success in reducing fatalities on certain shorter road segments (less than 30 km), where targeted speed reductions have eliminated recurring fatal collisions on corridors that previously averaged one fatality per year.

2.3 Conclusions of the Environmental Scan

The findings from the literature review and jurisdictional scan were highly consistent across all key themes explored in this report. The issues, methodologies, and countermeasures identified through a comprehensive review of best practices were reaffirmed by the direct input received from participating agencies. This alignment reinforces the validity of the environmental scan and confirms that the challenges faced by municipalities such as limited resources, data gaps, and the complexity of rural operating contexts, are widely recognized. Similarly, commonly recommended strategies such as rumble strips, paved shoulders, safety edges, improved signage, intersection improvements and targeted speed management interventions emerged repeatedly across both sources. These consistencies provided a strong foundation for the development of the Rural Road Safety Toolbox, ensuring it is grounded in both evidence and practical applicability across Canadian rural road contexts.

3. Rural Road Safety Toolbox

The Rural Road Safety Toolbox has been developed as a user-friendly tool to support the City of Hamilton in systematically assessing rural road safety risks and identifying context-sensitive countermeasures. The Toolbox provides a structured, data-informed process that integrates findings from the environmental scan and systemic safety review, with City-specific roadway configurations and related countermeasures identified through field investigations.

The findings of the environmental scan and the field investigation directly informed the development of the diagnostic matrices and the selection of countermeasures by identifying which countermeasures are most appropriate and effective for specific collision scenarios and contributing factors.

Designed to support engineering and operations staff, the Toolbox enables users to analyze common collision types or specific safety issues observed on Hamilton's rural road network and to diagnose underlying risk factors. Based on site-specific conditions, the tool generates targeted safety countermeasure recommendations tailored to each scenario.

It is important to note that the Rural Road Safety Toolbox is intended as a guidance and decision-support tool, not as a regulation, standard, or mandatory procedure. It is not intended to be universally applicable to all locations. Its application is expected to rely on professional engineering judgment, informed by site-specific conditions, roadway function, traffic volumes, operating environment, and the nature and magnitude of the safety concern. The decision to apply or not apply the toolbox, and the interpretation of its outputs, are intended to be based on reasonable professional judgment.

Appendix B provides a complete description of the Toolbox, including usage guidelines, the rationale behind the diagnostic questions and countermeasures for each facility type, and comprehensive lists of both diagnostic questions and countermeasures.

The following sub-sections summarize the structure used to organize the proposed framework for using the Toolbox, the diagnostic questions (decision matrices) and the types of countermeasures considered in the Toolbox.

3.1 Proposed Framework for Using the Toolbox

CIMA+ envisions the Toolbox as a practical guidance and decision-support tool for the City of Hamilton to conduct in-service road safety reviews or address specific issues (e.g., sightline concerns at an intersection or speeding along a road segment). The Toolbox is intended to assist staff in identifying potential safety issues and appropriate countermeasures; however, it is not meant to serve as a definitive solution for all situations. Rather, it is designed to support professional judgment and engineering expertise.

Figure 1 illustrates the proposed framework for using the Toolbox. The framework reflects the City's typical day-to-day processes and is structured to support staff in carrying them out effectively. The diagnostic questions included in the Toolbox are based on issues commonly observed on rural roadways and are intended to guide the assessment of safety concerns, prioritization of actions, and identification of potential countermeasures. As new issues are identified over time, the Toolbox may require refinement. Responses to individual yes/no questions should therefore be interpreted in the context of site conditions, field observations, and professional engineering judgment.

The framework begins when a safety issue is reported, typically by the general public, elected officials, or other municipal departments. The next step is to determine whether the issue is associated with a high-priority location. This assessment can draw on two resources: a) rankings generated from annual network screening and b) rankings from the systemic safety review presented later in this report. The definition of high-priority locations is subjective and depends on the City's context and available resources in a specific year. For example, top 10 locations or within the top 1% of all ranked locations.

If the issue involves a high-priority location, the City can initiate an in-service road safety review conducted by internal staff or external consultants. The Toolbox provides diagnostic questions and countermeasures to assist with this process.

If the issue does not involve a high-priority location, the Toolbox can be used to determine whether substantive safety concerns are warranted. If issues are confirmed, the Toolbox will suggest countermeasures for implementation or direct staff to further investigate. If no issues are found, no further action is required.

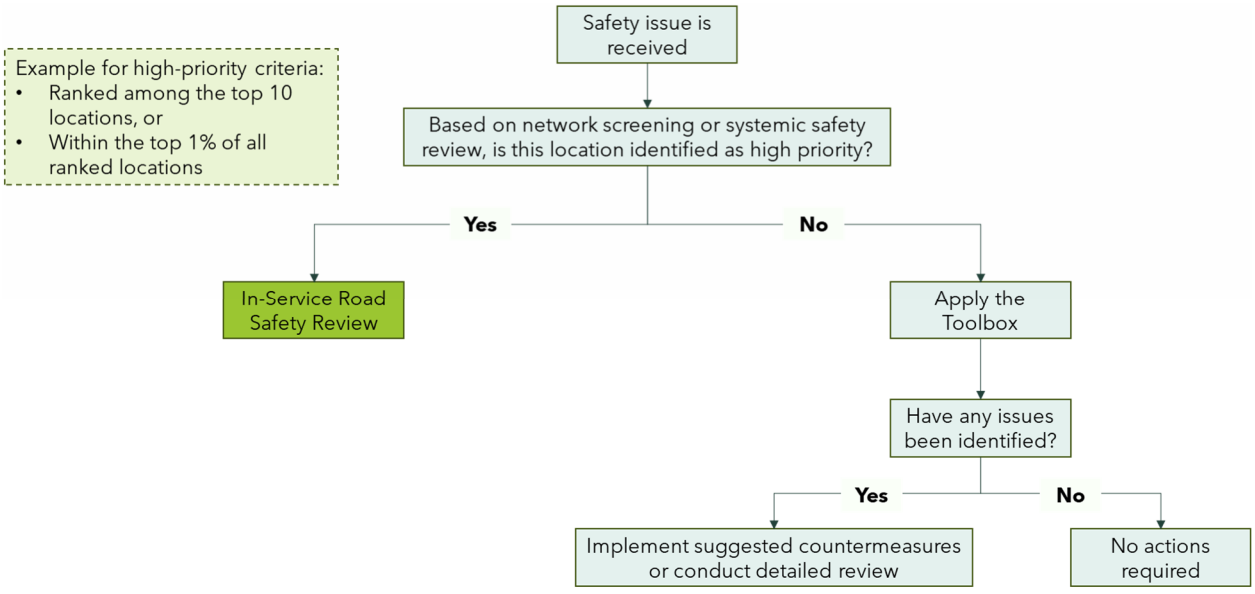


Figure 1: Proposed Framework for Using the Toolbox

3.2 Decision Matrices

At the core of the Toolbox is a set of decision matrices-structured diagnostic tools developed for each major collision type, common safety issues. These matrices are informed by literature, best practices, and engineering experience and are designed to help users trace the potential causes of collisions and identify effective countermeasures. The toolbox also provides provision based on the detailed in-service road safety review.

Each matrix follows a logical decision tree framework, guiding users through a sequence of Yes/No questions that uncover contributing factors related to roadway design, operations, and user behavior. For example, an angle collision might be attributed to either speed management issues or inadequate sight distance for left-turning vehicles—each leading to a distinct set of countermeasures.

Effective use of the Toolbox requires appropriate data and field verification. Different types of safety issues require different types of information. Depending on the diagnostic path, users may need to review collision history, analyze speed profiles, conduct sightline assessments, perform ball-bank indicator studies, or gather other relevant operational and geometric data. The diagnostic questions are therefore intended to guide not only the identification of potential issues but also the type of supporting analysis and field information required.

The user interface allows for simple, menu-driven input. Users begin by selecting from drop-down lists to specify:

- Facility Type (e.g., road segment, intersection)
- Sub-Type (e.g., two-lane rural road, stop-controlled intersection)
- Review Type (e.g., issue specific review, detailed in-service road safety review)
- Collision Type (e.g., angle, rear-end, run-off-road, head-on/approaching), or
- Issue Type (e.g., issue non-compliance, stop sign non-compliance, red light running, aggressive driving)

Based on the selected parameters, the Toolbox automatically presents a tailored set of diagnostic questions, derived from the corresponding decision matrix.

For the purpose of the Toolbox, roadway segments are defined in accordance with the segments identified in TES. Collision history for segments is evaluated considering segment length as an exposure measure to ensure consistency when comparing locations of different lengths. Intersections are generally defined to include the functional area of the intersection; however, depending on the issue under review, additional roadway length may need to be assessed based on engineering judgment. For example, speeding-related concerns or stop sign non-compliance may require review of conditions along the intersection approaches beyond the immediate functional area.

Each diagnostic scenario follows a consistent structure, as summarized in **Table 2**.

Table 2: Components of a Diagnostic Scenarios

Component	Description
Facility Type	The type of roadway facility (e.g., road segment, intersection)
Sub-Type	A more specific classification (e.g., two-lane rural segment)
Collision Type	The type of collision pattern (e.g., approaching/head-on, rear-end, angle)
Review Type	The type of review that is being undertaken (e.g., issue specific review, detailed in-service road safety review)
Issues Type	The type of safety issue observed (e.g., issue non-compliance, stop sign non-compliance, red light running, aggressive driving)
Diagnostic Questions	A series of Yes/No questions that identify underlying contributing conditions
Countermeasure(s)	Suggested safety interventions based on diagnostic answers

An example diagnostic scenario is illustrated in **Figure 2**, showing a decision tree for angle collisions. Based on the responses to the diagnostic questions, the toolbox recommends a set of countermeasures that align with the identified issues.

Comprehensive diagnostic tables covering the various collision types and safety issues are provided in **Appendix B**. These tables are organized in a structured and user-friendly format, allowing staff to easily reference the relevant diagnostic pathway for a specific issue or collision type.

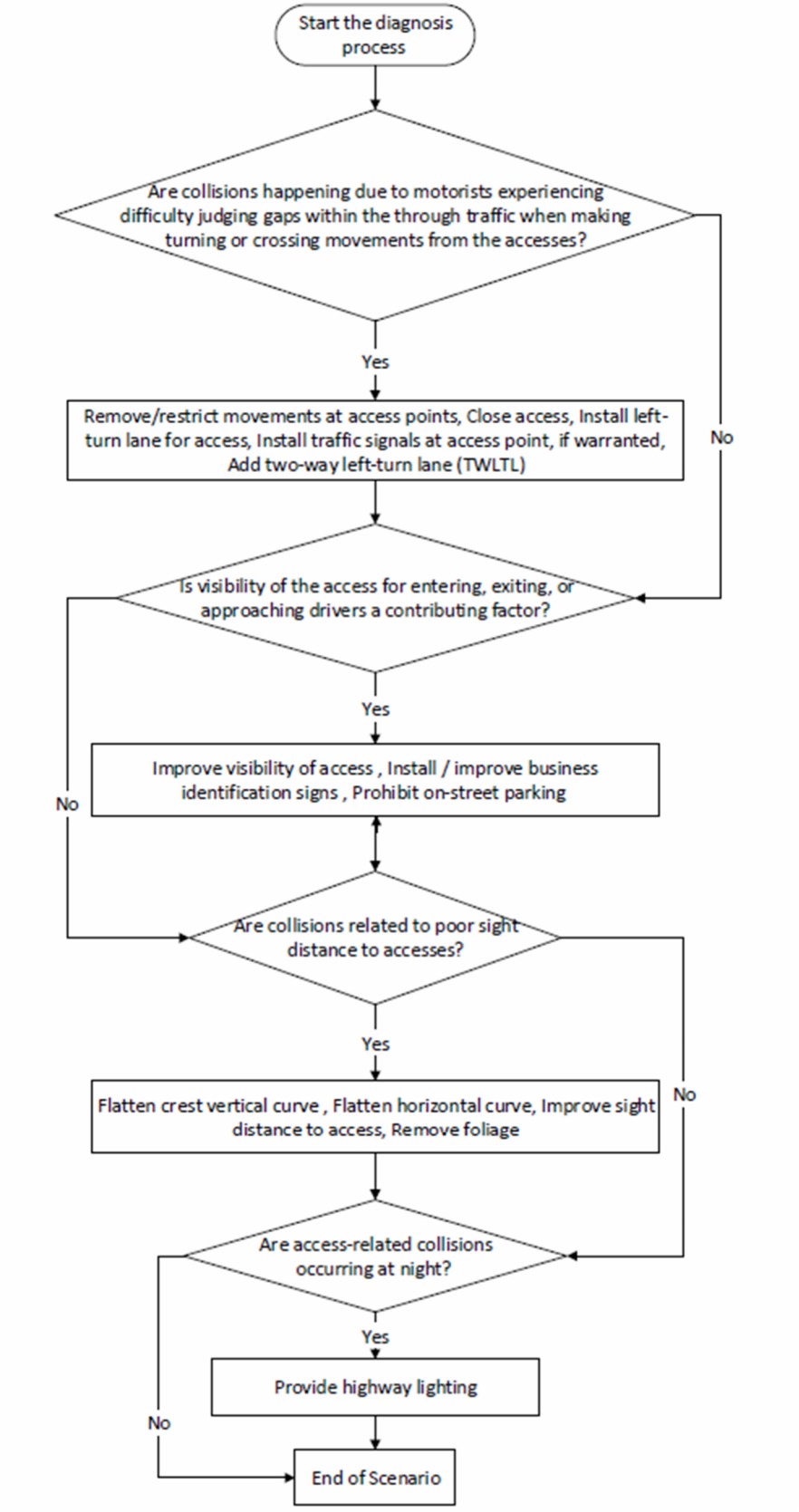


Figure 2: Diagnostic Process for Two-Lane Roadway Segment Angle Collision Scenario

3.3 List of Countermeasures

For each collision type or safety issue and associated contributing factors, the toolbox provides a comprehensive list of countermeasures. The toolbox allows flexibility to select the most appropriate countermeasure(s), recognizing that multiple factors may influence the implementation decision. For example:

- Budget constraints may limit options to low-cost, high-impact countermeasures.
- Policy directives may prioritize certain countermeasures (e.g., traffic calming, active transportation).
- Existing infrastructure may already address some contributing factors, allowing for a refined focus on additional or alternative interventions.

Toolbox suggests various alternative countermeasures indicated by the diagnostic framework, for instance, the installation of an all-way stop control at an intersection. However, these recommendations are intended as guidance, and engineering judgment must be applied to determine the feasibility, appropriateness, and context-specific implications of any countermeasure.

Each diagnostic scenario presents all relevant countermeasures, giving City staff a clear view of the available options for mitigating safety risks in a context-sensitive manner.

3.4 Collision Thresholds

One of the features of the toolbox is to recommend actions or countermeasures based on the observed frequency of collisions at a given site. Hence, it is important to have measures that indicate the level or magnitude of collisions at a location relative to overall trends across similar sites. While generic collision thresholds are available in the literature, they are often developed for urban environments and are not directly applicable to the City's rural road network. To address this, we used a data-driven approach to tailor collision thresholds specifically for the City.

The thresholds were established using four levels of collision frequency: frequent, occasional, infrequent, and rare. For each level, the corresponding collision frequency was calculated separately for different collision and facility types. Collision types were defined based on the "Issue Types" in the toolbox.

The method for establishing the thresholds relies on the average and standard deviation of collision frequency. **Figure 3** provides an example for two-way stop-controlled intersections with sightline issues. The following considerations were applied: (1) sightline issues are represented by angle and turning-movement collisions, and (2) a five-year collision history (2017–2019; 2022–2023, excluding years directly impacted by COVID-19) was used to calculate the thresholds.

Figure 3 shows that 79.8% of two-way stop-controlled intersections in the City's rural network did not experience any collisions during the five-year period, 10.0% experienced one collision, 4.3% experienced two collisions, and so on. The average (0.53) and standard deviation (1.67) were calculated, and thresholds were defined as follows:

- **Rare:** frequency below the average (0 collisions)
- **Infrequent:** frequency between [average; average + 1 standard deviation] (1–2 collisions)
- **Occasional:** frequency between [average + 1 standard deviation; average + 2 standard deviations] (3–4 collisions)
- **Frequent:** frequency above [average + 2 standard deviations] (5 or more collisions)

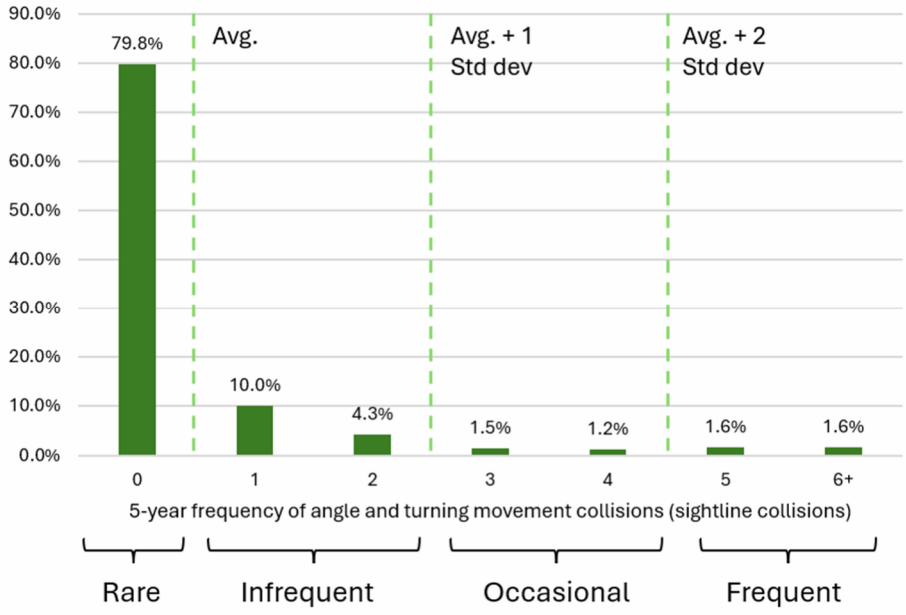


Figure 3: Method for Collision Thresholds – Two-Way Stop Controlled Intersections – Sightline Collisions

A similar process was applied to other issue and facility types, and the resulting thresholds are presented in **Table 3**. For road segments, thresholds were normalized by segment length and calculated using annual average collision frequencies (from 5-year periods). **Table 3** does not include all issue types available in the toolbox, as some associated collision types occurred too infrequently to allow reliable threshold determination – for example, speeding-related collisions at stop-controlled intersections.

It is important to note that the toolbox does not focus solely on fatal and injury collisions. While these severe collisions are of primary concern, on rural roadways the overall collision frequency is low, and fatal and serious injury collisions are even rarer, so they may not always provide sufficient information on individual locations. Many of the risk factors that contribute to severe collisions, such as speeding, limited sightlines, or operational conflicts, tend to manifest first as PDO collisions, minor collisions, or near misses. By including these lower-severity events in the analysis, the toolbox allows for the proactive identification and mitigation of potential safety issues before they result in severe outcomes, aligning with the Vision Zero approach to road safety. For some issues under specific review, collision thresholds could not be established due to extremely low occurrence; in these cases, the toolbox notes that thresholds are not available.

Table 3: Thresholds for Different Issue Types

Facility type	Issue type	Collisions involving	Detailed facility type	Unit	Category			
					Rare	Infrequent	Occasional	Frequent
Segment	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit" + any fatal or injury collisions	All	Considering 5-year collision history: annual collisions per km	0 to 0.10	0.10 to 0.30	0.30 to 0.50	> 0.50
	Roadside	Driver at-fault event is related to roadside characteristics, such as ran off road, hitting ditches, guiderail, poles, trees, among others	All		0 to 0.10	0.10 to 0.40	0.40 to 0.65	> 0.65
Unsignalized intersection	Stop non-compliance	Driver at-fault action is either "Disobeyed traffic control" or "Failed to yield right-of-way	Two-way stop	Frequency of collisions in 5-year period	0	1	2	> 2
			All-way stop		0	1	2	> 2
	Sightline	Angle or turning movement collisions	Two-way stop		0	1 or 2	3 or 4	> 4
	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit"	Two-way stop		Frequency of collision is too low to establish reasonable thresholds			
			All-way stop					
Signalized intersection	Red-light running	Angle collisions	All		0 to 3	4 to 6	7 to 9	> 9
	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit"			0	1	2	> 2

Note: For some issue types, collision thresholds could not be established due to extremely low occurrence

3.5 Speed Thresholds for Identifying Speeding Issues

Speeding remains a primary contributor to the frequency and severity of collisions on rural roadways, where limited roadside recovery areas, variable land uses, and constrained geometry significantly elevate safety risks. Speeding issues are not solely attributable to posted speed limits but reflects a complex interaction between driver behavior, roadway design, environmental context, and the level of enforcement. In rural settings, where driver expectations may not align with the design intent or functional classification of the road, elevated travel speeds can increase the likelihood and severity of collisions.

A comprehensive assessment of speeding-related safety concerns must incorporate both quantitative and qualitative indicators. This involves comparisons of posted speed limits, 85th percentile operating speeds, and the contextual consistency of the roadway's function and design. The 85th percentile speed, which is commonly referred to as the operating speed, represents the speed at or below which 85% of drivers travel under free-flow, low-volume conditions. It is widely accepted as a reliable indicator of the speed drivers feel comfortable maintaining, regardless of posted limits. In rural areas with low daily traffic volumes, such as those within the City's network, operating speeds are typically unaffected by congestion and therefore reflect natural driver behavior.

To establish thresholds for identifying speeding issues within the City's rural road network, we analyzed GPS-based connected vehicle (CV) data across the entire network. The objective was to calculate the 85th percentile speed for roads with different posted speed limits and to assess the resulting speed differential (i.e., 85th percentile speed minus the posted speed limit) in order to define appropriate speeding thresholds.

Table 4 summarizes the number of CV observations available for each posted speed limit, along with the corresponding 85th percentile speeds and speed differentials. Approximately 3,000 rural segments were included in this analysis. Provincial and private roads were excluded.

Table 4: Summary of Speed Observations

Speed Limit (km/h)	Sample Size	85th Percentile Speed	Speed Differential (km/h)
40	1,542	71	31
50	8,808	69	19
60	36,320	77	17
70	25,864	83	13
80	85,032	96	16

On roadways posted at 70 km/h and 80 km/h, the 85th percentile speeds are, on average, 15 km/h higher. For roads posted at 50 km/h and 60 km/h, the difference increases to approximately 18 km/h, and on roads posted at 40 km/h, the difference reaches as much as 31 km/h. These findings align with the concept of desired speed, which represents the speed drivers naturally adopt and maintain in unconstrained environments, often consistent with the geometric design and perceived function of the road.

It should be noted that for 40 km/h and 50 km/h roadways, the available dataset did not differentiate between surrounding land use context. Within the City, a number of roadways posted at these lower speeds traverse localized residential areas where frontage development, driveway density, on-street activity, and pedestrian presence typically contribute to lower operating speeds. Accordingly, the reported 31 km/h differential on 40 km/h roads likely reflects a subset of lower-speed facilities with limited roadside development or rural characteristics, rather than typical residential streets.

Complementary, we assessed the number of roads that would be flagged as having speeding issues under different threshold scenarios. For example, **Figure 4** presents the distribution of 85th percentile speeds for 87 roads with a posted speed limit of 60 km/h. The dashed red line represents 75 km/h (i.e., 60 km/h + 15 km/h), a threshold commonly referenced in the literature for identifying speeding concerns on 60 km/h roads. If this threshold were applied in the City, approximately 60% of the 60 km/h roads would be flagged as having speeding issues. From a practical standpoint, this suggests that the 75 km/h threshold may not be appropriate, as it would identify an excessive proportion of roads. Similar analyses were conducted for other posted speed limits and were considered in the decision-making process for establishing the final speeding thresholds.

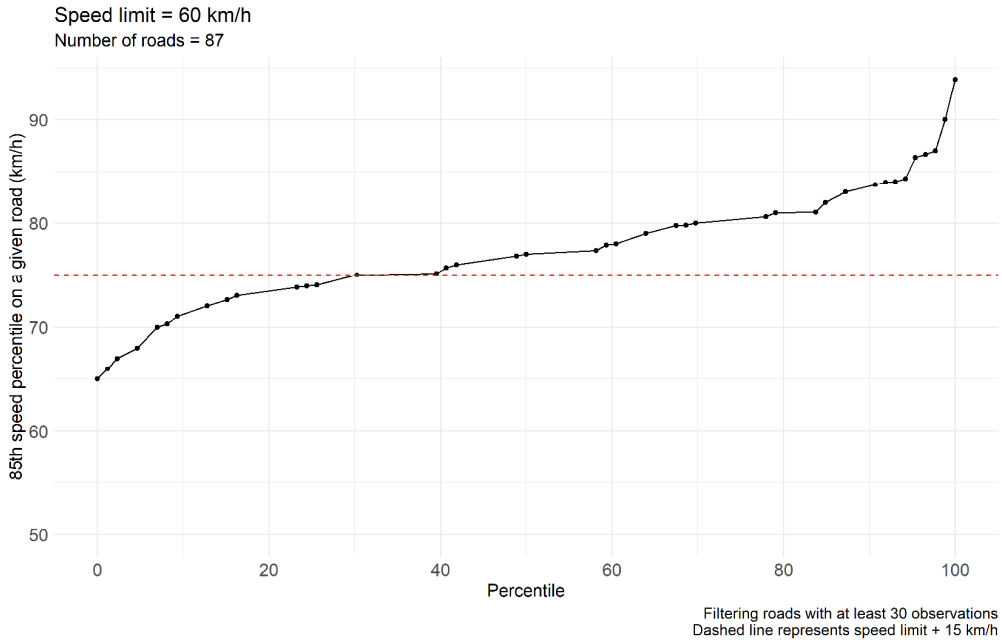


Figure 4: 85th Percentile Speed Distribution Across Roads with Speed Limit of 60km/h

For identifying road segments that warrant further investigation for speed management interventions, the following thresholds are established:

- **Speed limit of 40 km/h & 50 km/h (residential areas):** speed limit + 10 km/h
- **Speed limit of 40 km/h (non-residential areas), 50 km/h, and 60 km/h:** speed limit + 20 km/h
- **Speed limit of 70 km/h and 80 km/h:** speed limit + 15 km/h.

In addition, for locations with sharp horizontal curves where advisory speeds are posted, a threshold of 10 km/h exceeding the advisory speed was considered.

4. Systemic Safety Review

The objective of the systemic safety process is to assess the City of Hamilton's rural road network to prioritize locations for case studies based on aggregate collision trends across the City, focusing on common elements (i.e., risk factors) present at multiple sites, rather than the collision history of individual locations. The systemic safety review process consists of five steps, as shown in **Figure 5.** As the review progresses, each step of the process approaches a more micro-level assessment, by identifying sites with the highest number and/or magnitude of risk factors and ultimately providing recommendations for specific sites based on their associated risk factors.

In contrast to a traditional network screening approach, which prioritizes individual locations based primarily on observed collision frequencies or collision-based performance measures, the systemic safety review focuses on identifying and addressing risk factors that are present across the broader network. Traditional screening highlights sites with the highest historical collision, while the systemic approach seeks to proactively identify locations that share characteristics associated with elevated risk, even if their past collision history is limited. This distinction allows the systemic process to complement network screening by expanding the range of candidate sites for countermeasures and supporting a more preventative, risk-based safety strategy. The systemic safety approach is particularly suitable for rural roads, where collisions are rare, because it enables the identification of higher-risk locations that might not be apparent through collision history alone.

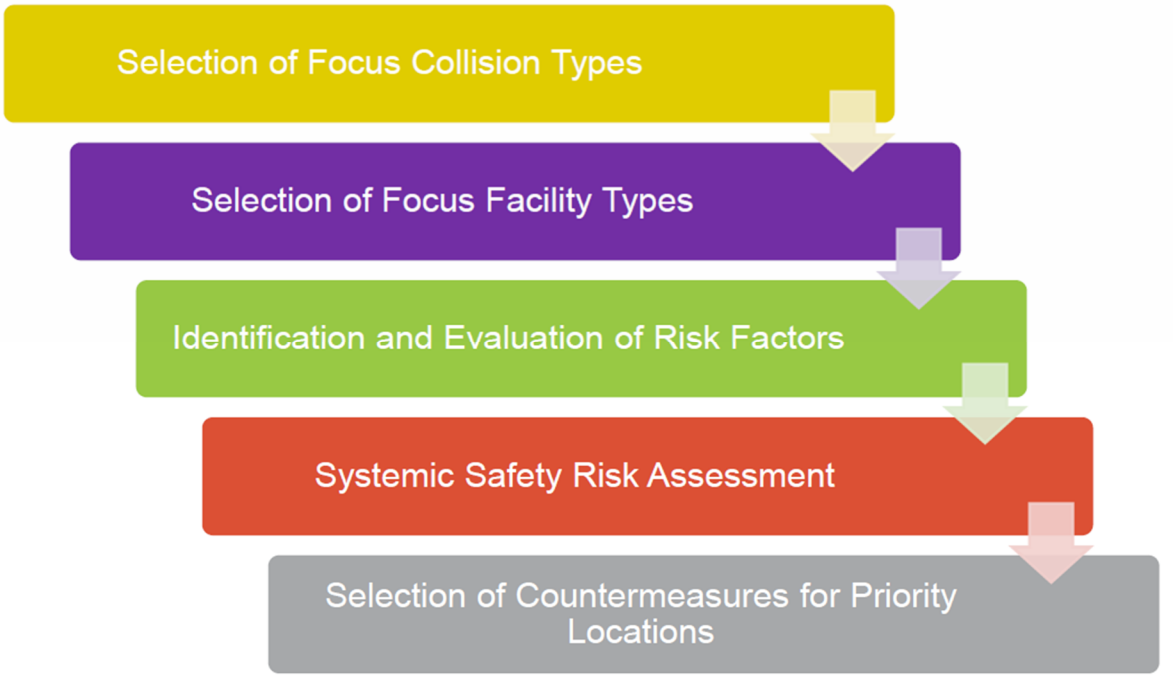


Figure 5: Systemic Safety Review Process

The first step is the selection of focus collision types that is done by conducting a jurisdiction-wide analysis of collision data to identify the collision types with the highest potential to result in fatal and injury collisions. Typical examples for rural roads include run-off-road, angle, turning movement, and rear-end collisions.

The second step is to select focus facility types. A "collision tree" diagram is often employed, in which each focus collision type identified in the previous step is broken down by different levels of facility types, which typically start by disaggregating intersection collisions from mid-block collisions. Subsequent levels of disaggregation often include road classification, control type, speed limit, among others. This allows the identification of the facility types where the focus collision types are more frequent.

The third step is the identification of risk factors by associating common characteristics with collision frequencies considering the collision and facility types previously identified. Potential risk factors suggested by FHWA include, among others: AADT, number of lanes, horizontal curvature, speed limit, presence of shoulder, roadside characteristics, etc. Preferably, these characteristics should indicate a greater potential for severe collisions to ensure that eventual countermeasures provide the best possible benefit.

The evaluation of risk factors is done by comparing the proportion of each type of facility within the jurisdiction with each of these common characteristics. Those characteristics that present a higher proportion of collisions compared with the proportion of facilities in the jurisdiction can be considered a risk factor (for example, if 10% of rural unsignalized intersections are skewed, but more than 40% of the severe rural unsignalized collisions occurred at skewed intersections, rural skewed intersection is a risk factor).

In the fourth step, once risk factors are selected, each site can be assigned a risk score based on the number and/or magnitude of risk factors present. Because sites with more risk factors (or with higher magnitudes of the same risk factor, based on relative weights) have a greater potential for collisions, this process helps assign higher priority to sites where countermeasures can provide the best possible benefit.

The final step of systemic safety review process typically involves selecting countermeasures, focusing on low-cost, high-impact interventions for implementation at candidate locations. However, this step was not undertaken as part of the systemic safety review process, as the objective of this task was to prioritize locations for the case studies. Instead, countermeasures for this study were selected based on a comprehensive range of potential scenarios that could occur on the City' rural roadways, as part of the development of Rural Road Safety Toolbox.

The following sub-sections present a summary of the City of Hamilton's rural road network and each step for the City of Hamilton's rural road network systemic safety review process for selection of locations for case studies. It should be noted that collisions occurring on provincial highways or private local roads were excluded from the analysis.

4.1 City of Hamilton Rural Road Network: Summary

The City of Hamilton's rural road network consists of 3,001 segments, representing a total length of 1,370 kilometers (**Figure 6**). In terms of road classification, 707 segments (23.6%) correspond to arterial roads, 194 segments (6.5%) to provincial highways, 669 segments (22.3%) to collector roads, and 1,431 segments (47.7%) to local roads. Posted speed limits range from 30 km/h to 100 km/h. Specifically, 3 segments (0.1%) are posted at 30 km/h, 161 (5.4%) at 40 km/h, 682 (22.7%) at 50 km/h, 673 (22.4%) at 60 km/h, 284 (9.5%) at 70 km/h, 339 (11.3%) at 80 km/h, 25 (0.8%) at 90 km/h, and 33 (1.1%) at 100 km/h. For 801 segments (26.7%), posted speed information is not available in the TES database.

In terms of intersections, there are 899 sites, including 41 signalized intersections (4.6%), 675 two-way stop intersections (75.1%), 73 all-way stop intersections (8.1%), and 110 intersections of other types, such as roundabouts and yield-controlled locations (12.2%).

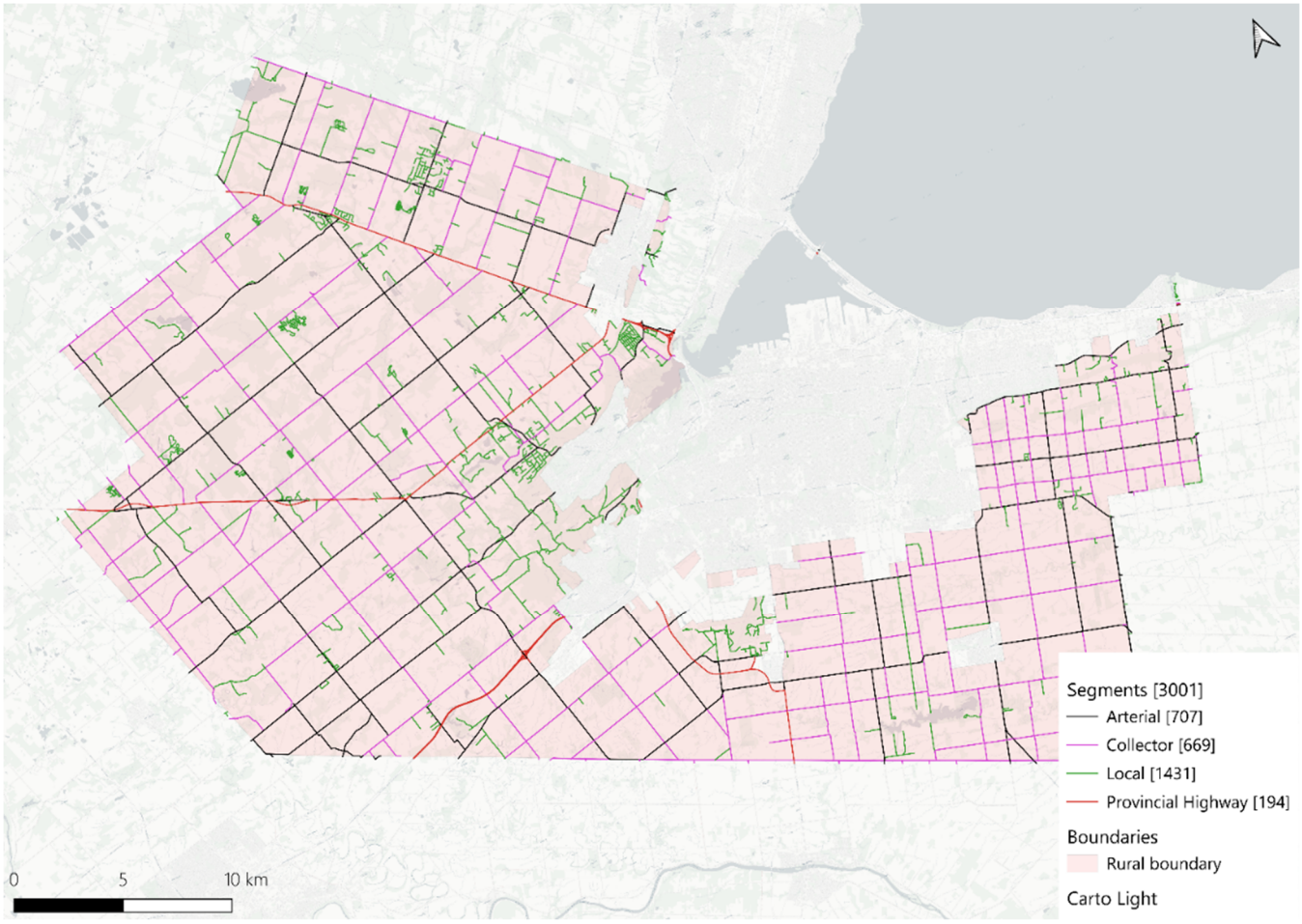


Figure 6: City of Hamilton Rural Road Network

4.2 Selection of Focus Collision Types

The selection of focus collision types was based on a review of aggregate collision data for intersections and mid-block locations on the City of Hamilton's rural roads over the ten-year period from 2014 to 2023. While systemic safety reviews typically emphasize fatal and injury collisions, a category including all collisions were also examined in this sub-section to support the selection of focus collision types. The total number of collisions was 1,424 for fatal and injury collisions, and 6,244 for all collisions.

Figure 7 summarizes fatal and injury collisions by safety emphasis areas (i.e., characteristics associated with collisions), as suggested by the FHWA. **Figure 8** presents the same information, but for all collisions. Note that the percentages do not sum to 100%, as a single collision may be associated with multiple emphasis areas. The highlights from **Figure 7** and **Figure 8** are presented below:

- Mid-block and intersection emphasis areas are the top ranked for both types of severities. This was expected, as this information relates to the "location" or type of entity where the collisions occurred. There were more collisions occurring at mid-block locations (54% - 769 fatal and injury) than at intersections (46% - 655 fatal and injury).
- Aggressive drivers and distracted drivers are among the top ranked emphasis areas. These types of areas are not typically addressed through engineering interventions and are better suited for education and/or enforcement efforts.
- Boundary mid-blocks and boundary intersections refer to locations situated at the transition between rural and urban areas. Both appear at the top of the rankings for both severities. This characteristic will be further assessed as a potential risk factor later in this document.
- Run-off-road collisions appear at the top of both rankings, suggesting this collision type as a potential focus type. Other emphasis areas are also related to this type of collision, including poles, ditches, guide rails, among others.
- Speeding was an identified characteristic in 3% of fatal and injury collisions and 1% in all collisions. Given that speeding is a well-established risk factor for severe outcomes, it was still assessed as a potential risk factor in this review.
- Few collisions involving vulnerable road users (i.e., cyclists and pedestrians) were observed over the 10-year period. This is expected given the rural nature of the study area, which typically has low levels of cyclist and pedestrian activity.

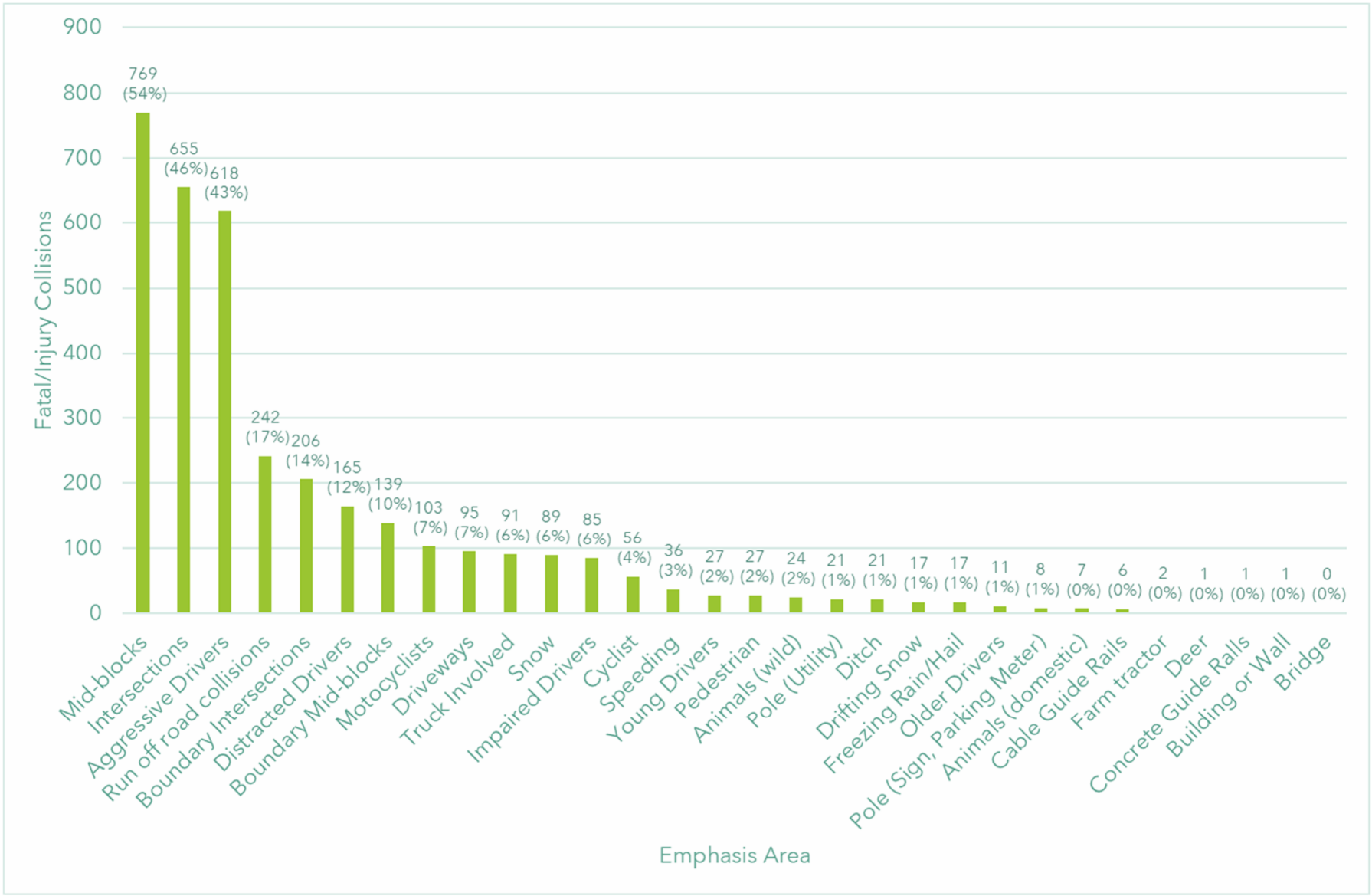


Figure 7: Fatal and Injury Collisions by FHWA Emphasis Area (2014 – 2023)

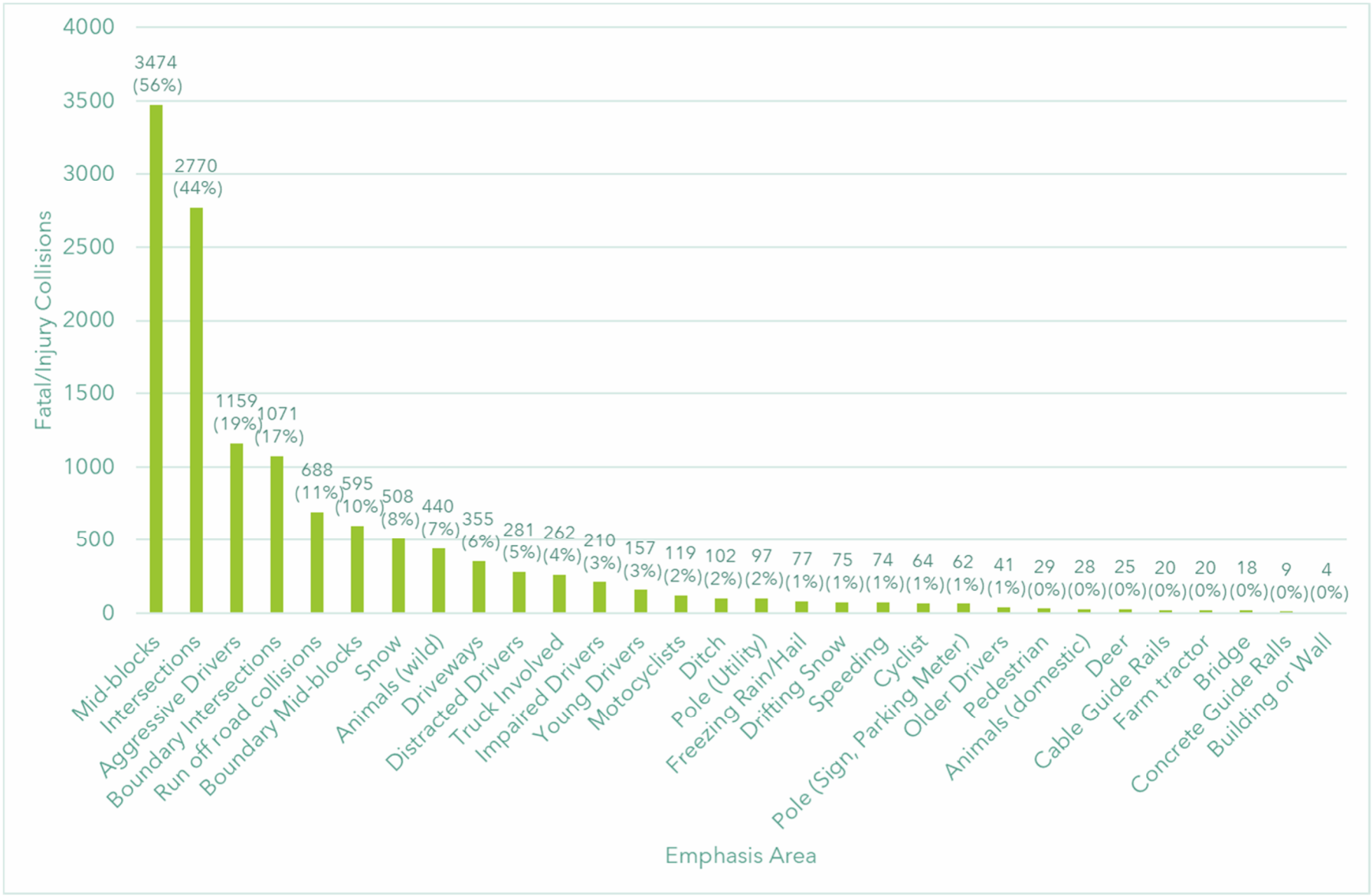


Figure 8: All Collisions by FHWA Emphasis Area (2014 – 2023)

Mid-block and intersection collisions were reviewed in more detail with respect to initial impact type, as summarized in **Table 5** (mid-blocks), **Table 6** (signalized intersections), and **Table 7** (unsignalized intersections). Intersections were divided into signalized and unsignalized categories due to the differing nature of collisions typically observed at each type of facility – namely, longitudinal collisions at signalized intersections and angled collisions at unsignalized ones – which is directly related to the selection of appropriate countermeasures.

For midblock locations (**Table 5**), "Single Motor Vehicle (SMV) – Other" is the predominant collision type for both severity levels, which was expected given the rural nature of the study area. Within this category, 49% of the collisions were directly associated with run-off-road incidents. Other notable associations include collisions with fixed objects (15%, including poles, guide rails, and trees) and animals (8%). Due to the rural characteristics of the area, SMV collisions involving pedestrians accounted for only 3.6%, while 1.2% involved cyclists.

Table 5: Mid-block Collisions by Initial Impact Type

Initial Impact Type	% Fatal and Injury	% All Collisions
SMV – Other	**54.6%**	**60.1%**
Rear end	19.2%	15.8%
Approaching head-on	9.9%	4.2%
Sideswipe	7.3%	7.3%
Turning movement	3.0%	2.0%
Angle	2.3%	3.2%
Other	2.2%	3.8%
SMV – Unattended vehicle	1.4%	3.5%

Note: total of 3,474 collisions and 769 fatal and injury collisions

For signalized intersections (**Table 6**), an expected pattern is observed: rear-end collisions are the most frequent type, likely due to the presence of signalized traffic control, which interrupts traffic flow and generates longitudinal conflicts through stop-and-go movements. However, because of their longitudinal nature – and consequently lower severity – rear-end collisions are not the most frequent in terms of fatal and injury outcomes. Instead, turning movement and angle collisions are more prominent among severe collisions. Although these types are less frequent overall, their higher severity may be attributed to higher speeds and angled impacts. Since the systemic safety review process focuses on severe collisions, turning movement and angle collisions (combined) were selected as the focus collision type for signalized intersections.

Rear-end collisions, in addition to not being top-ranked, account for only 49 fatal and injury cases – an insufficient sample for meaningful identification and evaluation of risk factors.

Table 6: Signalized Intersection Collisions by Initial Impact Type

Initial Impact Type	% Fatal and Injury	% All Collisions
Turning movement	**33.6%**	17.0%
Angle	**31.8%**	14.6%
Rear end	22.6%	49.9%
SMV other	7.8%	7.8%
Sideswipe	1.8%	7.5%
Other	0.9%	2.2%
Approaching head-on	0.9%	0.8%
Sideswipe same direction	0.5%	0.3%

Note: total of 1,099 collisions and 217 fatal and injury collisions

For unsignalized intersections (**Table 7**), angle collisions are the predominant type for both severity levels, as expected for this type of intersection. For the purpose of defining focus collision types, turning movement collisions were combined with angle collisions into a single category.

Table 7: Unsignalized Intersection Collisions by Initial Impact Type

Initial Impact Type	% Fatal and Injury	% All Collisions
Angle	**64.2%**	**43.6%**
SMV other	15.1%	21.4%
Rear end	9.8%	20.2%
Turning movement	7.1%	5.1%
Sideswipe	2.1%	5.0%
Other	1.8%	4.6%

Note: total of 1,671 collisions and 438 fatal and injury collisions

In summary, the focus collision types identified in this sub-section and used in the following steps are:

- Mid-block locations: Single Motor Vehicle (SMV) collisions.
- Signalized and unsignalized intersections: angle and turning movement collisions, combined into a single group.

4.3 Selection of Focus Facility Types

The selection of focus facility types was completed by creating "collision trees", breaking down the focus collision types into different levels for each type of facility.

Figure 9 presents the collision tree for mid-block locations, based on fatal and injury SMV – Other collisions. The percentages shown in the figure are relative to the total number of fatal and injury collisions considering all types of sites (1,424 collisions). The second level divides mid-blocks into those located in rural areas and those situated at the boundary between rural and urban areas. The third level corresponds to the road classification[1].

Overall, major arterial roads in rural areas (as opposed to boundary areas) present the highest concentration of SMV collisions at mid-block locations. If we were to strictly follow the systemic safety review process, we would assess only this type of facility. However, it was decided to also include a) major arterial roads in boundary areas, and b) segments from other classifications that experienced at least two collisions (regardless of type) over the 10-year period.

A key challenge when working with rural road segments is the limited availability of geometric and operational data. For example, roadside attributes – such as shoulder type and clear zone type – are important for explaining SMV collisions and are considered relevant risk factors for the development of the next step. In the case of the City of Hamilton, this information was not available in the existing database and had to be collected manually by CIMA+.

To optimize this data collection process by prioritizing segments that are significant both in terms of network function and collision frequency, the following criteria were used to select segments for inclusion:

- The TES database includes 2,017 road segments, excluding those classified as provincial highways or private local roads.
- The following segments were included in the analysis:
  - Major arterial segments with length of at least 500 meters[2].
  - Segments of any classification or length that experienced at least two collisions (all types and severity) during the 10-year period.
  - Segments essential to road network connectivity (e.g., a short segment that is part of a longer corridor but not captured by the two previous criteria).
- This process resulted in the selection of 1,029 road segments for the next step: the identification and evaluation of risk factors.

Figure 10 presents the collision tree for unsignalized intersections, based on fatal and injury collisions involving angle and turning movement types. The road classification shown in the figure corresponds to the major road at each intersection.

[1] Road classification available in TES.
[2] There were a significant number of roadway segments between lengths 1.0 m and 500 m with no collisions. They were not included in the analysis as it was not cost effective to collect data for these segments. The roadway segments with length less than 500 m with at least two collisions or those which were essential to road network connectivity were considered in the analysis.

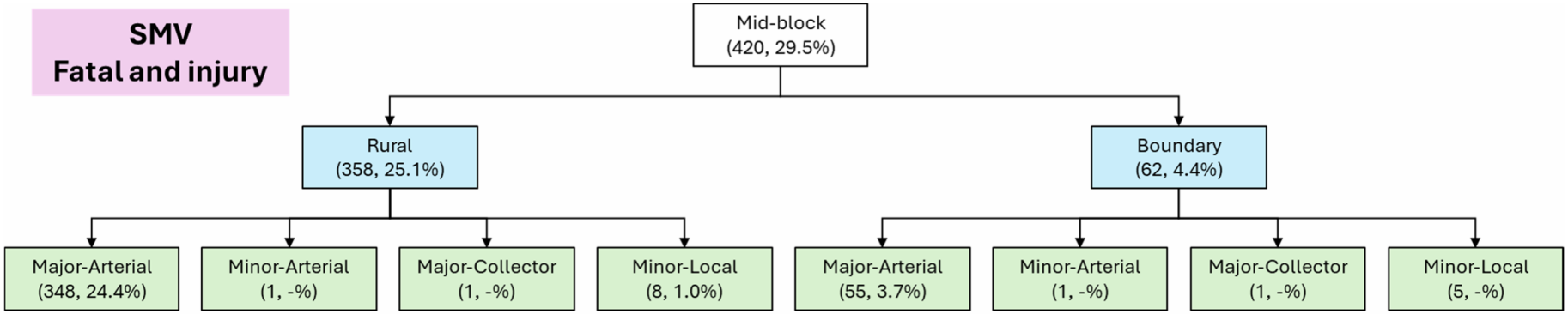


Figure 9: Mid-block Collision Tree: SMV Collisions – Fatal and Injury

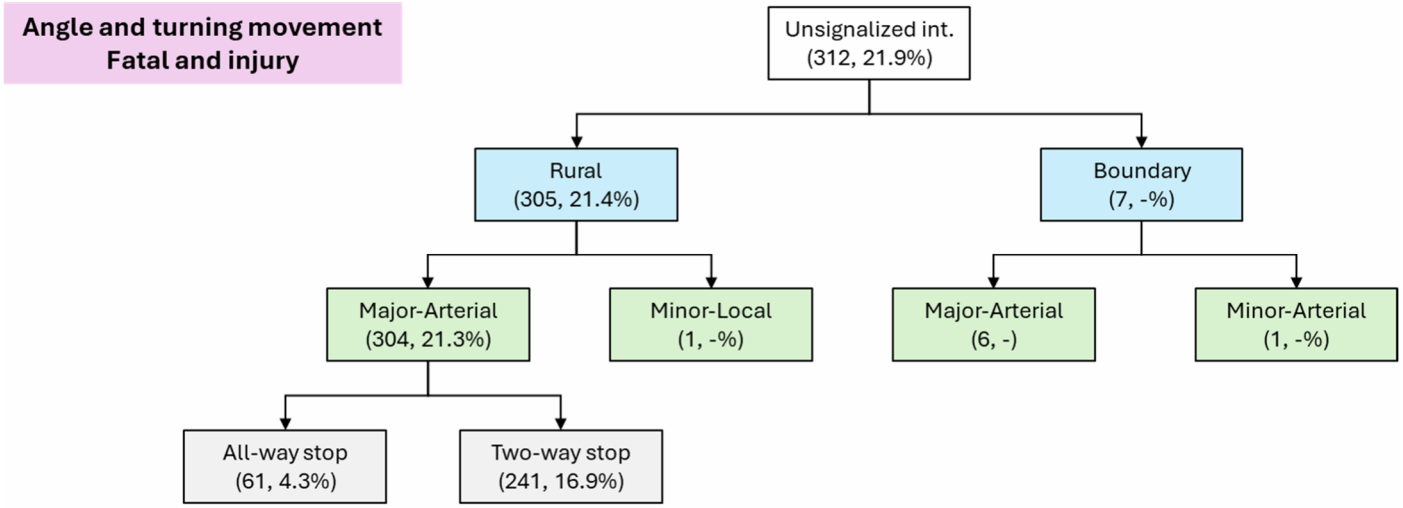


Figure 10: Unsignalized Intersections Collision Tree: Angle and Turning Movement Collisions – Fatal and Injury3

[3] Note: Minor category totals may not exactly sum to their corresponding major category values due to the omission of certain low-frequency categories or the absence of information for some collisions. For example, yield-controlled intersections were excluded because of the low frequency of collisions observed

Similarly to the observations from mid-block locations, major arterial roads in rural areas account for the majority of collisions. A fourth level of disaggregation was introduced to capture the type of traffic control at each intersection. The two-way stop group shows a considerably higher number of angle and turning movement collisions compared to the all-way stop group. However, this difference may be related to the number of intersections within each group. For this reason, the type of control was not used to define the focus facility type but was instead included as a potential risk factor.

To ensure all relevant collisions were captured in the analysis, the following criteria were applied for selecting unsignalized intersections:

- All intersections located on major arterial roads.
- Intersections on any road classification (excluding provincial and private roads) that experienced at least one collision during the 10-year period.
- This resulted in the selection of 589 unsignalized intersections.
  - In addition to the aforementioned criteria, we also visually explored maps with the locations of intersections and eliminated points that were not properly intersections, intersections that had multiple points (e.g., roundabouts with a point for each approach), among others.

Regarding signalized intersections, the TES database contains only 41 records in rural areas. Of these, 10 are located on provincial highways, and 4 could not be matched with the available intersection shapefile. This left 27 signalized intersections for assessment. Consequently – to avoid working with an even smaller sample – we decided to include all 27 intersections as focus facility types.

Figure 11 illustrates the rural boundary considered in the study, along with the locations of the facility types selected for further identification and evaluation of risk factors.

The selection of focus facility types as described in previous paragraphs was based on "focus" fatal and injury collision types. All facility types were also reviewed in the context of all fatal and injury collisions, and it was confirmed that the previously identified focus facility types remain appropriate.

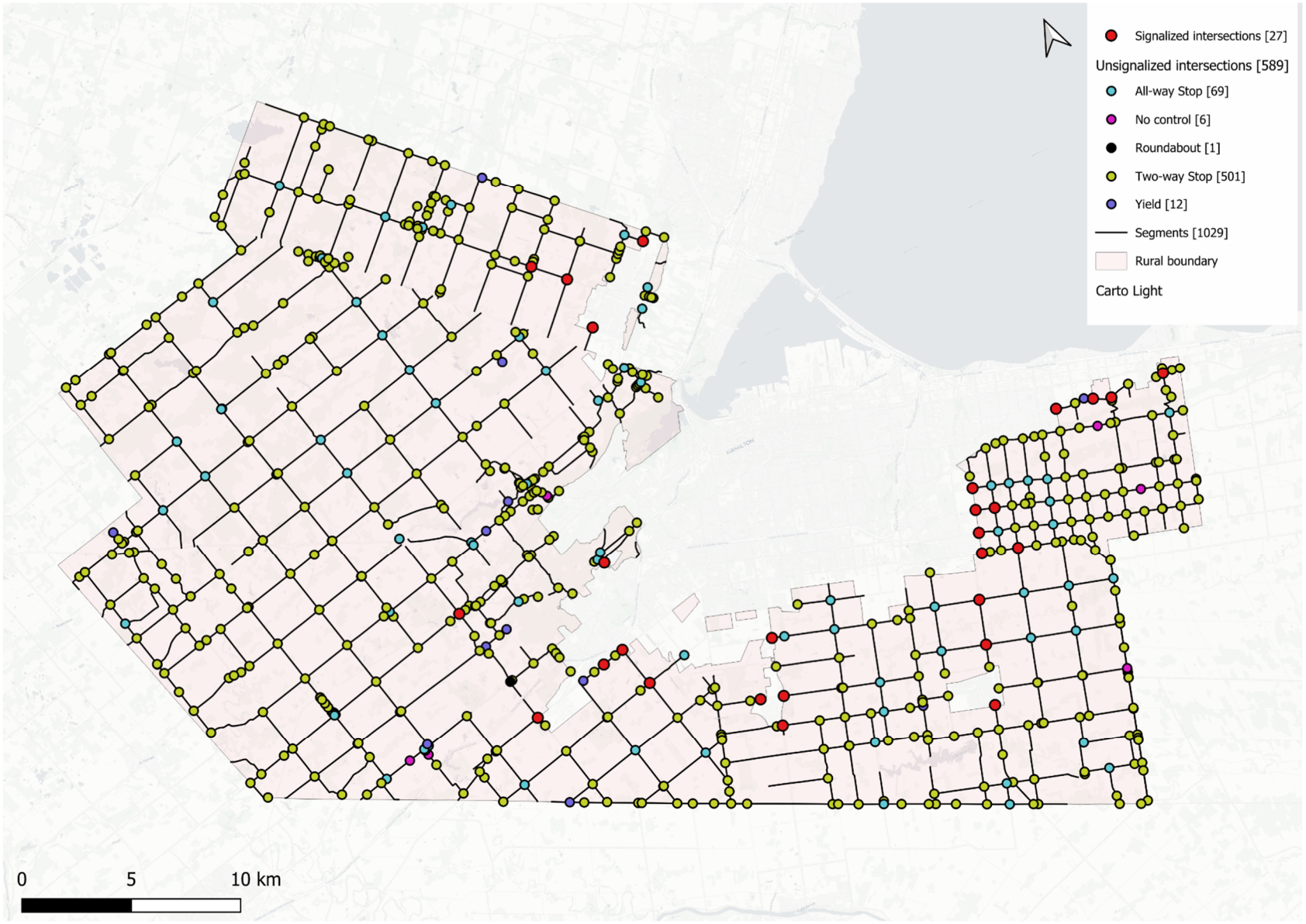


Figure 11: Map with Segments and Intersections Selected for Analysis

4.4 Identification and Evaluation of Risk Factors

This step further refines the selected focus facilities by identifying common characteristics of locations with high collision frequencies – also referred to as risk factors. For instance, the previous steps indicated a focus on angle and turning movement collisions at unsignalized intersections. This step then examines whether such collisions are over-represented at intersections with specific characteristics (e.g., four-leg versus three-leg) or within certain AADT ranges.

The details for this section – including all geometric and operational data collection, as well as the calculations used to identify the risk factors for each facility type – are presented in **Appendix C**.

4.5 Systemic Safety Risk Assessment

This section presents the development of the systemic safety risk index and its application to the study area sites, with the objective of prioritizing locations for case studies. The final sub-section includes considerations regarding the priority list of sites provided by the City of Hamilton.

4.5.1 Systemic Safety Risk Index

The ranking of high-risk sites involves identifying all selected risk factors present at each site and assigning higher priority to those with a greater number of risk factors. However, since each facility type has a limited number of risk factors, simply counting how many are present may not provide enough differentiation, potentially resulting in many sites being tied. To address this, the magnitude of each risk factor was considered. Specifically, it was defined as the difference between the proportion of focus collisions and the proportion of facilities associated with that risk factor, as summarized in **Table 8.**

By summing the magnitudes of all risk factors, the Systemic Safety Risk Index (SSRI) is calculated for each location. To give the SSRI values a more intuitive interpretation, the magnitudes were normalized so that a site exhibiting all risk factors at their highest levels would receive an SSRI of 100. For instance, based on the magnitudes presented in **Table 8**, the maximum unscaled SSRI for a mid-block location is 46.4 (10.2 + 5.6 + 2.1 + 6.1 + 7.5 + 14.9). To scale this maximum value to 100, a normalization factor of 2.15 (i.e., 100 divided by 46.4) was applied. The resulting normalized magnitudes are summarized in **Table 8**.

Table 8: Magnitude of Selected Risk Factors

Risk factor	% Focus collisions	% Facilities	Magnitude	Normalized magnitude
Mid-block: SMV collisions				
AADT: 2,000-4,000	24.4	21.9	2.5	5.4
AADT: 4,000-6,000	11.8	6.7	5.1	11.0
AADT: > 6,000	19.3	9.1	10.2	22.0
Rural-Urban boundary	12.0	6.4	5.6	12.0
Roadside hazard risk: 5 or 6	28.1	25.9	2.1	4.6
Speed limit: 70 or 80 km/h	41.8	35.8	6.1	13.1
Presence of horizontal curves	16.8	9.3	7.5	16.2
Presence of truck route	49.2	34.3	14.9	32.2
Unsignalized intersections: angle and turning movement collisions				
AADT: Major < 2,500 & Minor >= 1,000	18.5	10.6	7.9	6.3
AADT: Major >= 2,500 & Minor >= 1,000	39.6	29.2	10.4	8.3
Two-way stop: Major < 2,500 & Minor >= 1,000	14.0	6.3	7.7	6.2
Two-way stop: Major >= 2,500 & Minor >= 1,000	29.1	18.8	10.3	8.2
4-leg intersection	78.8	25.1	53.7	43.0
Speed limit on major road: 70 or 80 km/h	68.3	43.5	24.8	19.8
Proportion of "failed of give right of way" collisions: >= 25%	64.7	39.0	25.8	20.6
Signalized intersections: angle and turning movement collisions				
AADT: Major >= 10,000 & Minor >= 2,500	69.7	37.0	32.7	78.7
Rural-Urban boundary	46.5	40.7	5.7	13.8
Proportion of "failed of give right of way" collisions: >= 20%	40.1	37.0	3.1	7.5

4.5.2 Systemic Safety Screening

In this sub-section, the SSRI is applied to mid-block locations, unsignalized intersections, and signalized intersections. The top 10 rankings for each facility type, based on the previously identified focus collision types, are presented. Ranking for all sites is presented in **Appendix C**.

4.5.2.1 Mid-block Locations

Table 9 presents the SSRI results and rankings for the Top 10 mid-block locations based on risk factors associated with SMV collisions. In cases where adjacent mid-block segments share identical characteristics – and thus received the same or similar SSRI score – these segments were combined and represented as a single location. As a result, some ranked locations list more than one Geo ID.

Table 9: Systemic Safety Ranking of Mid-blocks (Top 10)

Geo ID	Description	#Lanes	Length (m)	SSRI	Rank	Frequency of FI Collisions
4533 33246 33247	WILSON ST E btwn MONTGOMERY & LOWER LIONS CLUB	2	1,902	86.9	1	20
33771 33772 54932	GARNER RD W btwn BRAITHWAITE & MUNAY LANE	2	1,861	83.8	2	4
34205	UPPER JAMES ST btwn HIGHWAY NO. 6 & WHITE CHURCH	4	409	83.8	2	1
4765 4788 46143	HIGHWAY NO. 52 N btwn JERSEYVILLE ROUNDABOUT & MINERAL SPRINGS	2	2,806	83.4	4	17
138 216 217	HIGHWAY NO. 8 btwn GLOVER & LEWIS	2	1,846	82.4	5	10
49863 49864 49866	MUD ST E btwn UPPER CENTENNIAL & FIRST	2	876	79.3	6	3
4598 4599 4600	WILSON ST W btwn HIGHWAY NO. 52 & ALBERTON	4	2,475	79.3	7	12
13688 13850 13851 13852 32904	HIGHWAY NO. 8 btwn BROCK & WEBSTER FALLS	2	754	74.9	8	1
36232 44061	YORK RD btwn RAMP YORK TO 6 SB & OLD GUELPH	2	527	74.9	8	2
23182 23184 23512	HIGHWAY NO. 52 S btwn RAMP 403 EB & WILSON	2	1,048	72.8	10	1

4.5.2.2 Unsignalized Intersections

Table 10 presents the SSRI results and rankings for the Top 10 unsignalized intersections based on risk factors associated with angle and turning movement collisions. Notably, seven intersections share the top position in the ranking, as each of these locations exhibits all identified risk factors at their maximum values.

Table 10: Systemic Safety Ranking of Unsignalized Intersections (Top 10)

Geo ID	Description	Traffic Control	SSRI	Rank	Frequency of FI Collisions
1317	CENTRE RD @ CONCESSION 8 E	Two-way Stop	100	1	8
8476	BUTTER RD W @ FIDDLER'S GREEN RD	Two-way Stop	100	1	6
1443	HIGHWAY NO. 5 W @ LYNDEN RD	Two-way Stop	100	1	6
7763	KIRK RD @ REGIONAL 56 RD	Two-way Stop	100	1	6
558	BROCK RD @ REGIONAL 97 RD	Two-way Stop	100	1	4
815	BROCK RD @ CONCESSION 4 W	Two-way Stop	95.9	6	11
2681	MUD ST E @ SECOND RD E	All-way Stop	91.8	7	13
2983	EIGHTH RD E @ MUD ST E	Two-way Stop	91.8	7	3
43207	HIGHWAY NO. 52 N @ JERSEYVILLE RD W	Roundabout	91.8	7	9
2696	HIGHLAND RD E @ TAPLEYTOWN RD	All-way Stop	91.8	7	1

4.5.2.3 Signalized Intersections

Table 11 presents the SSRI results and rankings for the Top 10 signalized intersections based on risk factors associated with angle and turning movement collisions. The small sample size and relatively similar characteristics across the signalized intersections limited the identification of multiple risk factors for this facility type. As a result, one location ranks first, presenting all risk factors at their maximum values. It is followed by eight locations tied in second place, each having the AADT and boundary area risk factors. The location ranked 10th presents only the AADT risk factor.

Table 11: Systemic Safety Ranking of Signalized Intersections (Top 10)

Geo ID	Description	SSRI	Rank	Frequency of FI Collisions
7797	UPPER JAMES ST @ WHITE CHURCH RD W	100	1	11
61	EVANS RD @ HIGHWAY NO. 5 E	92.5	2	3
1807	GLOVER RD @ HIGHWAY NO. 8	92.5	2	4

Geo ID	Description	SSRI	Rank	Frequency of FI Collisions
2679	GREEN MOUNTAIN RD E @ UPPER CENTENNIAL PY	92.5	2	9
3038	REGIONAL 56 RD @ RYMAL RD E	92.5	2	33
3042	HIGHLAND RD E @ UPPER CENTENNIAL PY	92.5	2	22
7800	AIRPORT RD E @ UPPER JAMES ST	92.5	2	27
8507	HIGHWAY NO. 52 S @ WILSON ST W	92.5	2	9
43177	MUD ST W @ UPPER CENTENNIAL PY	92.5	2	23
8332	GOVERNOR'S RD @ HIGHWAY NO. 52 N	78.7	10	5

4.5.2.4 Considerations on the List of Sites provided by The City of Hamilton

The City of Hamilton has provided CIMA+ with a list of potential locations for consideration. The list – which includes mid-block locations and unsignalized intersections – is presented in **Table 12**. The SSRI and rank for each location, based on the focus collision types for each type of facility, are also presented in the table. For mid-block locations, some entries represent long segments composed of multiple smaller segments (i.e., multiple Geo IDs). The SSRI presented in **Table 12** corresponds to the Geo ID within the segment that has the highest SSRI.

None of the suggested locations are among the top-ranked positions. Additionally, we examined the frequency of fatal and injury collisions (all types, not limited to the focus collision types) at these locations.

For mid-blocks, the suggested locations represent 108 segments within the road network (out of 1,029 considered in the analysis). The average number of fatal and injury collisions over the 10-year period for these suggested segments is 0.58. In comparison, the remaining 921 segments not identified by the City have an average of 0.70 collisions. This indicates that the suggested locations are not critical in terms of risk factors and, on average, experience a lower frequency of collisions than the other segments in the study area.

When considering the smaller segments individually (i.e., each Geo ID), some locations in the suggested list stand out in terms of collision frequency:

- Geo ID 13,444 (Centre Rd between Concession 7 & Concession 8: length = 1,831m) with 5 collisions – which represents a rank 12 based on the frequency of fatal and injury collisions.
- Geo ID 13,464 (Carlisle Rd between Highway No. 6 & Private: length = 1,623m) with 5 collisions.

- Geo ID 226 (Ridge Rd between Seventh & Sixth: length = 840m) with 4 collisions - which represents a rank 28 based on the frequency of fatal and injury collisions.

These locations will be included in the review process conducted in the next step.

Table 12: Locations for Consideration Suggested by the City of Hamilton

Location	SSRI	Rank
Mid-block locations		
Centre Rd between Campbellville Rd and Concession 5	56.3	88
White Church Rd between Carluke Road and Regional Rd 56	55.2	115
Sawmill Rd	49.8	190
Sunnyridge Rd	48.3	203
Carlisle Rd between Highway 6 and Milburough Town Line	47.7	204
Jerseyville Rd W (within Jerseyville community)	32.2	327
Fifty Rd between Ridge Rd and Highway 8	31.7	371
Ridge Road Between First Rd and Fifty Rd	22.0	400
Crooks Hollow Rd between Old Brock Rd and Highway 8	20.7	404
Dickenson Rd between Upper James St and Trinity Rd	12.0	625
Concession 2 Rd W between Woodhill Rd and Lynden Rd	0.0	799
Unsignalized intersections		
White Church Rd & Binbrook Rd	59.5	103
Harvest Rd & Ofield Rd S	43.0	122
Trinity Rd & Sawmill Rd	19.8	197
Milburough Line & Concession Rd 8 E	-	-

Note: SSRI corresponds to the Geo ID within the segment that has the highest SSRI

For unsignalized intersections, four fatal and injury collisions were reported at Harvest Rd & Ofield Rd S (Geo ID 1,724), placing this location at rank 24 based on collision frequency. This intersection will be included in the review process. The other two intersections – White Church Rd & Binbrook Rd and Trinity Rd & Sawmill Rd – experienced one and zero fatal and injury collisions, respectively.

Milburough Line & Concession Rd 8 E is not represented as an intersection in the road network shapefile (it is a sharp curve). The segments associated with this location rank 656 (Geo ID 33,210) and 799 (Geo ID 13,954) in terms of SSRI and have no reported fatal or injury collisions.

4.5.2.5 Site List for Preliminary Assessment of the Toolbox

Based on the rankings generated through the systemic safety risk process, as well as the locations suggested by the City of Hamilton that exhibited a high frequency of fatal and injury collisions, the following ten sites were selected for a preliminary assessment of the toolbox:

- Mid-block locations:
  - Wilson St E between Montgomery & Lower Lions Club (rank #1)
  - Highway No. 52 N between Jerseyville Roundabout & Mineral Springs (rank #4)
  - Highway No. 8 between Glover & Lewis (rank #5)
    - Garner Rd W between Braithwaite & Munay Lane (rank #2) was skipped because this location is already within City of Hamilton's consideration for interventions
    - Upper James St between Highway No. 6 & White Church (rank #3) was skipped due to its short length (400 meters)
  - Centre Rd between Concession 7 & Concession 8 (City of Hamilton recommendation)
  - Carlisle Rd between Highway No. 6 & Private (City of Hamilton recommendation). The segment in question terminates at a private road located midway between Highway No. 6 and Wildberry Way. For analysis purposes, the segment from Highway No. 6 to Wildberry Way will be considered
  - Ridge Rd between Seventh & Sixth (City of Hamilton recommendation)
- Unsignalized intersections:
  - Centre Rd @ Concession 8 E (rank #1) – Two-way stop control
  - Mud St E @ Second Rd E (rank #7) – All-way stop control
- Signalized intersections:
  - Upper James St @ White Church Rd W (rank #1)
  - Regional 56 Rd @ Rymal Rd E (rank #2). Among the intersections tied at rank #2, this location was selected due to its highest frequency of fatal and injury collisions

5. Pilot Case Studies

CIMA+ conducted ten case studies to support the development of the Rural Road Safety Toolbox, each involving a field visit, a description of the study area, an assessment of collision history (2014–2023), a speed study, and a summary of field observations on signage, roadway configuration, sightlines, and other factors, along with key collision-contributing elements identified on-site. The detailed assessment for each case study is presented in **Appendix D**. **Section 5.1** summarizes the main issues and potential countermeasures derived from these case studies through application of the Toolbox.

The data used for the speed study was retrieved from connected vehicle datasets recently acquired by CIMA+. This dataset includes information on vehicle position, heading, and speed. For this report, data from October 2024 was considered.

5.1 Summary of Main Issues and Potential Countermeasures: Applying the Toolbox

Table 13 summarizes the main issues identified at each location during the field investigation (**Appendix D**). The Toolbox was applied to propose countermeasures for each case study. To illustrate the Toolbox's application, two examples are presented in the following subsections: one for an intersection and another for a segment.

Table 13: Summary of Main Issues and Potential Countermeasures

Site	Main Issues	Potential Countermeasure
1: Wilson St E between Montgomery & Lower Lions Club	Limited visibility of regulatory and warning signs throughout the corridor	▪ Improve visibility of signs by trimming tree foliage
	Conspicuity of the PXO	▪ Improve sight distance by relocating pedestrian crossover elements, removing foliage or any other removable objects that may be obstructing the sightlines ▪ Install additional overhead rectangular rapid flashing beacons
	Sightline distances on Lower Lions Club Road. This issue is illustrated in the next sub-section.	▪ Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines ▪ Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance
	Roadside hazard between the curve after	▪ Conduct roadside risk assessment

Site	Main Issues	Potential Countermeasure
	Montgomery Drive and the PXO	
2: Highway No. 52 N between Jerseyville Roundabout & Mineral Springs	Sightline problems at the unsignalized intersection at Mineral Springs Road	▪ Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines ▪ Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance ▪ Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures
	Queues generated in the southbound direction by vehicles turning left into the driveway located approximately 500 meters north of the roundabout	▪ Add two-way left-turn lane (TWLTL), Install / improve left-turn lane for specific accesses, if warranted, Remove/restrict movements at access points
3: Highway No. 8 between Glover & Lewis	No main issues were identified in this location	-
4: Centre Rd between Concession 7 & Concession 8	No main issues were identified in this location	-
5: Carlisle Rd between Highway No. 6 and Wildberry	Sightline issues at Wildberry Road	▪ Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines ▪ Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance ▪ Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures
6: Ridge Rd between Seventh & Sixth	Sightline issues at Tapleytown Road and at Eighth Road E	▪ Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines ▪ Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance

Site	Main Issues	Potential Countermeasure
Expanded section between Third Road E and Eighth Road E		▪ Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures
	Curves at Eighth Road E in the approach to Ridge Road	▪ Install / improve curve ahead warning signs (OTM Book 6) ▪ Install chevron alignment signs ▪ Install advisory speed signs ▪ Install post mounted delineators ▪ Special Consideration(s): The signs installed should be strictly as per OTM Book 6, Major infrastructure improvements to be considered as part of future construction based on economic appraisal Additionally, we recommend installing a flashing beacon on the top of the stop sign at Eighth Road E, to enhance the stop sign conspicuity. It is located after a curve
	Headwalls at driveways along Ridge Road between Fifth Road E and Sixth Road E	▪ Improve traversability of objects
	Fixed objects close to the edge of the pavement across the entire study area	Use engineering judgement to delineate the roadway segment with the roadside hazards or hazards themselves. Options include: ▪ Post mounted delineators ▪ Edgeline ▪ Object markings or object marker signs for individual hazards ▪ Reduce speed limit Special Consideration(s): The decision to reduce the posted speed limit should be made based on the speeding review
7: Mud St E @ Second Rd E	Speeds in the north and south stop-controlled approaches to the intersection exceeded the threshold for identifying speeding issues	▪ Install oversize stop signs ▪ Install transverse rumble strips ▪ Install transverse pavement markings ▪ Provide Double Edge Line Markings ▪ Provide Double Centre Dividing Line Markings ▪ Targeted speed enforcement ▪ Install speed feedback sign with a regulatory speed sign Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement

Site	Main Issues	Potential Countermeasure
		markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas
8: Centre Rd @ Concession 8 E	Speeds in the east approach to the intersection (stop-controlled approach) did not exceed the threshold for identifying speeding issues but are close to it (85th percentile speed of 79 km/h, while threshold is 80 km/h). We performed the toolbox assessment for this approach.	Two sets of countermeasures are proposed by the Toolbox, the first related to "Do drivers encounter this stop-controlled intersection after traveling a long distance without encountering any other traffic control devices?" and the second to the speeding issue itself: In the eastbound, drivers encounter the stop-controlled intersection after 2.8 km without encountering any other traffic control devices: • Install stop ahead sign • Install red beacon for stop enforcement • Install oversize stop signs • Install transverse rumble strips • Install transverse pavement markings Speeding issue: • Install oversize stop signs • Install transverse rumble strips • Install transverse pavement markings • Provide Double Edge Line Markings • Provide Double Centre Dividing Line Markings • Targeted speed enforcement • Install speed feedback sign with a regulatory speed sign Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential area
9: Upper James St @ White Church Rd W	Limited visibility for left turns on Upper James Street due to a negative to no offset configuration	• Install left-turn lane • Provide slotted left turn lane • Provide protected left-turn phase • Provide protected/permissive left-turn phase • Provide positive offset of opposite left-turn lanes
10: Regional 56 Rd @ Rymal Rd E	In the northbound direction, the traffic signal is located just after a curve.	• Increase enforcement to reduce speed on intersection approach • Introduce reduced speed zone or increase the length of existing reduced speed zone • Install oversize stop signs • Install transverse pavement markings • Install transverse rumble strips

Site	Main Issues	Potential Countermeasure
		■ Change streetscape to increase stimulation of peripheral vision ■ Narrow approach lanes by using pavement markings (e.g. double edgeline markings, double centre dividing lanes, painted median, etc.) ■ Install Speed Feedback Signs ■ Gateway treatment Special Consideration(s): Applicability of different treatment options to be determined by engineering judgement. Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas Additionally, add a traffic signal ahead sign
	Limited visibility for left turns due to a negative to no offset configuration	■ Install left-turn lane ■ Provide slotted left turn lane ■ Provide protected left-turn phase ■ Provide protected/permissive left-turn phase ■ Provide positive offset of opposite left-turn lanes
	Limited visibility of the yellow and green traffic signal lenses (200mm) in the westbound approach	■ Improve visibility by removing any obstructions (low cost) ■ Install advance warning signs (low cost) ■ Install signal backplates equipped with retroreflective borders (low cost) ■ Continuous Advance Warning Beacons (medium cost) ■ Install oversize signal heads (medium cost) ■ Install active advance warning signs (high cost) ■ Introduce reduced speed zone or increase the length of existing reduced speed zone ■ Install an auxiliary signal (high cost) Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments), Reduction in speed is to be considered only after other measures have been reviewed and found unsuitable

5.1.1 Toolbox Application: Example for Intersection

Table 14 presents the interaction with the Toolbox related to the sightline issue observed at Lower Lions Club Road as part of Case Study 1 (Wilson St E between Montgomery & Lower Lions Club). The following inputs were used at the beginning of the interaction:

- Facility type: intersection.
- Sub-type: stop-controlled.
- Review type: issue specific review.
- Issue type: sightline issues.

Table 14: Toolbox Application – Sightline Issue at Lower Lions Club Road (Case Study 1)

Diagnostic Questions	Response	Countermeasures
Are there perceived concerns that deficient sightlines are contributing to safety issues at this location? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)	YES	
Is the intersection controlled by stop signs on the minor road only, with the major road operating as free flow? (Select "No" if the intersection is controlled as an all-way stop.)	YES	
Based on the most recent five-year collision data, have sightlines-related collisions occurred frequently at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 4; Occasional = 3-4; Infrequent = 1–2; Rare = 0)? (Sightlines related are defined as all angle and turning movement collisions)	NO	Comment: One turning movement collision reported between 2019 and 2023.
Based on the most recent five-year collision data, have sightlines-related collisions occurred occasionally at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 4; Occasional = 3-4; Infrequent = 1–2; Rare = 0)? (Sightlines related are defined as all angle and turning movement collisions)	NO	
Is the available departure sight triangle to the left or right adequate for a stopped driver on the minor-road approach to turn left onto the major road? (For a two-lane major roadway with grades up to 3% and passenger cars, refer to Table 9.9.4. For other cases such as multi-lane roadways or heavy vehicles, apply Case B1 guidance from pages 66–67, with appropriate grade adjustments)	NO	• Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance • Flatten crest vertical curve • Flatten horizontal curve Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction

		in speed limit or introduction of advisory speed should be done in conjunction with speed management measures, Major infrastructure improvements to be considered as part of future construction based on economic appraisal
Is the available departure sight triangle to the left adequate for a stopped driver on the minor-road approach to turn right onto the major road? (Use Table 9.9.6 for two-lane roads and passenger cars. For other scenarios, refer to Case B2 on pages 69–71, with adjustments for grade and vehicle type)	YES	
Is there a situation where left turns, right turns, or both are prohibited from a particular approach, making the crossing maneuver the only legal option?	NO	
Does the crossing maneuver require traversing more than six effective lanes, including any medians?	NO	
Are there substantial volumes of heavy vehicles crossing the highway, combined with steep departure grades that may slow vehicle acceleration while part of the vehicle remains in the intersection?	NO	
Is adequate sight distance available for drivers on the major road to turn left across opposing traffic? (This distance should be sufficient for a vehicle to clear the opposing lane, based on the design speed and calculated as per Case F – Left Turns from the Major Road, on pages 78–79 of the 2017 TAC Geometric Design Guide)	YES	
Diagnostic complete		

5.1.2 Toolbox Application: Example for Segment

Table 15 presents the interaction with the Toolbox related to the roadside issue identified on Ridge Road between Seventh Road and Sixth Road as part of Case Study 6: fixed objects close to the edge of the pavement across the entire study area. The following inputs were used at the beginning of the interaction:

- Facility type: roadway segment.
- Sub-type: two-lane.
- Review type: issue specific review.
- Issue type: roadside issues.

Table 15: Toolbox Application – Roadside Issue on Ridge Rd between Seventh & Sixth (Case Study 6)

Diagnostic Question	Response	Countermeasures / Comments
Are the roadside foreslopes within the clear zone as per desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	YES	
Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.	YES	
Can the fixed objects be redesigned so that they can be safely traversed (e.g. providing a safety slope end treatment for exposed culverts by an appropriately designed metallic grating, grading the slope of a ditch near vertical end to a recoverable slope?	NO	
Can the object be removed or relocated to an area outside of the clear zone (e.g., relocation of utility poles, or removal of trees)?	NO	
Can the object incorporate "breakaway" devices (e.g. replacing the fixed utility poles to breakaway types)?	NO	
Is an existing barrier system or guide rail (if present) of appropriate type and length of need and/or attenuation system present and/or is it in proper working order? Select no, if a barrier system or guide rail is not present.	NO	▪ Improve roadside barrier/guide rail ▪ Improve barrier/guide rail attenuation system Special Consideration(s): If barrier system is not present, conduct further review to determine the need of barrier system
Does a risk assessment support the installation of a new barrier system or guide rail (Refer to Appendix A: MTO Severity Index Tables of MTO's Roadside Design Manual to calculate risks)? (A barrier system or guide rail should only be installed if a risk assessment shows it poses less danger than the unprotected hazard, as guide rails are also hazards. The risk assessment must consider all types of hazards including foreslopes and any fixed objects within the clear zone)	NO	▪ Use engineering judgement to delineate the roadway segment with the roadside hazards or hazards themselves. Options include: post mounted delineators, edge line, object marking or object marked signs for individual hazards, and reduce posted speed limit. Special Consideration(s): The decision to reduce the posted speed limit should be made based on the speeding review
Diagnostic complete		

6. Conclusions

This report presented the development of a Rural Road Safety Toolbox for the City of Hamilton. The Toolbox was constructed based on a literature review, a jurisdictional scan, and findings from field investigations at specific locations in the City. It is a user-friendly resource designed to assist the City in identifying issues and potential countermeasures during detailed in-service road safety reviews or when assessing specific concerns at individual sites (e.g., sightline issues at a given intersection).

A complete guideline, including instructions for using the Toolbox and the rationale behind the proposed diagnostic questions and countermeasures, is provided in **Appendix B**.

In addition to the Toolbox, this report also presented a Systemic Safety Review for rural segments and intersections in the City. Field investigations were conducted at the top-ranked locations, and a comprehensive site ranking based on this review is available in **Appendix C**. This ranking provides another resource for the City to consider when prioritizing locations for interventions or when responding to road safety inquiries from the public.

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City of Hamilton

Hamilton Rural Road Safety Toolbox

Z0027620

APPENDIX

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A

Appendix A
Environmental Scan: Literature Review (Risk Factors and Countermeasures) & Jurisdictional Scan Results

Literature Review: Risk Factors and Countermeasures

Table A 1 presents a list of countermeasures identified in the literature review (available in relevant references) with their associated risk factors, brief descriptions, applicability and effectiveness, as available.

Table A 1: Risk Factors and Countermeasures Identified in the Literature Review

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
1.	Horizontal Curves prior to intersections	On the approach to an intersection a horizontal curve may reduce available stopping sight distance or the ability of a driver to maintain control if the curve is too sharp. In general, the preferred treatment when dealing with an intersection on a curve is to relocate it to a tangent section. In cases where this is not possible, the primary goal should be to maximize visibility throughout the intersection for all movements. A number of different countermeasures are available including the use of advanced warning signs and pavement markings, modifying the alignment within constraints to provide cost-effective improvements in visibility, and the removal of specific visibility obstructions (such as embankments, trees or other vegetation).	• Flatten or eliminate the horizontal curve through or approaching the intersection (25% to 40% of total collisions) • Install advance warning signs to advise drivers of the approaching traffic control measures or intersection (20% to 35% of total collisions) • Improve the lateral line of sight by removing vegetation and obstacles such as fencing, signs, utility poles and other structures from the inside of the horizontal curve (15% to 50%) • Relocate the intersection to a tangent section of roadway (up to 50% of total collisions) • Flashing beacons may be used to supplement warning signs. It should be noted that unnecessary use of warning signs on the approach to an intersection detract from the sign effectiveness and may distract the driver. Care should be taken to avoid sign clutter on the approach to an intersection. • Use reflective pavement markings that are visible at night to supplement the existing roadway signs (15% to 45%) • Reduce the posted speed limit on the approach to an intersection should only be done if a detailed engineering study indicates that such a reduction is warranted AND if suitable speed management measures are put in place to ensure effective compliance with the new speed limit.	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (NCHRP REPORT 500 Volume 7, 2004)
2.	Vertical curves on the approach to and departure from an intersection	Vertical curves can limit sightlines on the approach to and departure from an intersection. They can impact stopping sight distance, intersection sight distance, reduce intersection conspicuity, and may contribute to an increased speed differentials on the approach to an intersection. A number of countermeasures can be used to deal with this challenge. The preferred treatment is to flatten the profile of the roads at the intersection as required to achieve the needed sight distances. Other countermeasures can include warning signs, improved pavement markings, installation of traffic signals if warranted, flashing hazard beacons and so forth. In some instances, illumination may be appropriate.	• Warning signs provide drivers with advanced warning of the approaching intersection. Where the intersection is obscured by the vertical curvature of the road, supplementary “HIDDEN” tabs may be employed (20% to 35%) • Install an overhead flashing hazard beacon above the intersection, visible from all approaches. The overhead beacon should supplement the standard signs and traffic control required at an intersection • Lighting the intersection may assist drivers to locate and identify the intersection under nighttime conditions (20% to 50%) • Use reflective pavement markings that are visible at night to supplement the existing roadway signs • On the minor road, supplementary pavement markings such as transverse lines (or transverse rumble strips) that cross the travel lane on the approach to an intersection may be used to indicate to the driver that the roadway is changing ahead (40% to 60%) • If the intersection is signalized, an increase of the amber phase length may be appropriate, particularly if the approach is located on a downgrade (10% to 15%) • Adjust the approach profile to provide flatter grades (40% to 50%) • Where a combination of horizontal and vertical curves results in severe sight restrictions, consider flattening one or both curves	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011)
3.	Uncontrolled Accesses	Driveways located near intersections can create various traffic and safety issues. Queued vehicles at intersections often block access to and from nearby driveways, and vehicles attempting left turns into driveways on the far side may face further blockages, disrupting	• Move driveways to the side street if possible • Install curb to define driveway location	(Delphi-MRC, 2006) (Selby Thannikary, 2024)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
		through traffic. Drivers may try to use gaps in queues to turn in or out of driveways, which is risky due to limited visibility. Right-turning traffic near intersections can interfere with similar movements, increasing the risk of rear-end and sideswipe collisions. Additionally, vehicles entering or exiting driveways close to intersections may conflict with recently turned traffic, leading to potential rear-end or right-angle collisions. Corner driveways can also encourage drivers to shortcut around intersections, posing dangers to all road users, including pedestrians and cyclists. The distance between an intersection and a driveway is termed the corner clearance. This distance is intended to provide adequate space for turning vehicles to slow, manoeuvre, and to prevent vehicle queues from spilling back into the driveway. Agencies should work for the relocation of accesses away from intersections.	• Consolidate adjacent driveways and promote the use of internal roadway connections between adjacent developments to reduce the number of access points on major rural roads • If it is left-turning vehicles at the entrance that tend to interfere with the intersection operations, the turn could be prohibited • If the interference is coming from right-turning vehicles, countermeasure may include providing a right turn lane or prohibiting the turn • Regulating the minimum spacing of driveways on intersection approaches. • Limiting driveways on facilities intended to carry high volumes of traffic. • Regulating the minimum corner clearance. • Restricting non-commercial driveways to maximum widths: 4.25 to 7.3 metres wide (widest for farm vehicles where the design vehicle is typically a slow-moving vehicle). • Restricting commercial driveway widths to 4.25 to 4.9 metres per lane. • Driveways could be provided with wider radii in locations where there are high-speed differentials between through traffic and turning vehicles. Wider radii permit vehicles to maintain higher speeds as they exit the travel way. This solution may not be suitable in locations with significant pedestrian activity. **Considerations in Areas with Higher Active Transportation Use:** • Select the minimum practical driveway width to reduce pedestrian crossing distance • Where a driveway is four or more lanes wide, include a pedestrian refuge between entering and exiting lanes • Ensure pedestrian crossings across driveways are visible to drivers, and maintain clear sightlines by limiting obstructions such as landscaping or signage • For bike facilities crossing driveways, provide signage to alert both bicyclists and motorists of potential conflicts	(NCHRP Report 500 Volume 5, 2003)
4.	Turning movement at intersections	Left turns account for about 20% of intersection fatalities, making them a significant safety concern. Providing exclusive left-turn lanes, particularly on high-volume, high-speed roads can help reduce related collisions such as rear-end, side-swipe, and left-turn collisions. These lanes separate turning vehicles from through traffic, minimizing conflict and providing a safer space to wait for a gap in opposing traffic. However, several factors must be considered: left-turn lanes increase pedestrian crossing distances; poorly offset lanes can obstruct drivers' sightlines, increasing the risk of severe collisions; and lanes that are too short may fail to accommodate turning queues or safe deceleration, potentially worsening rear-end and side-swipe collision risks. On undivided roads, insufficient queue space may even prompt risky driver behavior, such as using opposing lanes to access the turn lane. Exclusive right-turn lanes can help reduce rear-end and sideswipe collisions by allowing right-turning vehicles to decelerate outside the main flow of through traffic, which is especially beneficial on high-volume, high-speed roads. Without a dedicated turn lane, vehicles must slow down in the through lane, increasing collision risk. However, when providing a right-turn lane, it is important to consider that longer pedestrian crossing distances can raise pedestrian exposure to traffic. Additionally, if the lane is too short, queues may spill into the through lane or fail to allow safe deceleration, potentially increasing the risk of severe collisions rather than reducing them.	• Remove left-turning vehicles from the through traffic stream by providing a left-turn lane. This will reduce conflicts with through traffic travelling in the same direction (total collisions 28% to 44%, signalized intersection collisions 20% to 35%, unsignalized intersection collisions 10% to 65%, left-turn collisions 20% to 75%) • Improve left-turn lane geometry by increasing the entrance taper and deceleration lengths (30% total collisions) • Where possible, offset opposing left turn lanes to improve sightlines for opposing vehicles • Provide Offset Right-Turn Lanes at Intersections, where right turn on major roadway obstructs the view of the minor-road driver • Remove slow-moving right-turning vehicles from the through traffic stream by providing a right-turn lane. This will reduce conflicts with through traffic travelling in the same direction • Improve right-turn lane geometry by increasing the entrance taper and deceleration lengths • Consider right-turn channelization in areas where pedestrians are not present (this is generally an urban/suburban solution) (20% to 40% total collisions) • At an unsignalized intersection traffic signals can be installed (if warranted) to accommodate heavy turning volumes (20% to 35% total collisions) • Restrict or eliminate turning maneuvers by signing, where alternative routeing means are available and reduction of particular turn maneuvers thorough other means is not practical • At signalized intersections, signal timings may be adjusted to accommodate heavy turning volumes (10% to 20%) • Provide a protected left-turn signal phase (25% to 50%)	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Bruce Corben) (NCHRP Report 500 Volume 5, 2003) (NCHRP Report 500 Volume 12, 2004) (NCHRP Report 650, 2010)

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			• Through striping to delineate the turning path, provide positive guidance to drivers turning left at signalized intersections. • Install modern roundabouts to facilitate heavy turning movements by allowing all vehicles to circulate in one direction around a central island (38% to 58%) • Provide full-width paved shoulders in intersection areas • Provide Bypass Lanes on Shoulders at T-Intersections, at low volume intersections where provision of a left-turn lane is not economical • Install protected-T intersection to reduce the potential for rear-end collisions and overturning conflicts **Conflict-Point Management Strategies**- Used primarily at four-leg intersections and Two-Way Stop-Controlled (TWSC) intersections on rural expressways. These strategies aim to improve safety by reducing, relocating, or controlling the number and type of vehicle conflict points. All options require substantial right-of-way to accommodate medians and turning radii. Common designs include: • J-turns: Replace direct left-turns/crossings from minor roads with right-turns followed by median U-turns. • Offset T-intersections: Stagger minor road approaches to create two separate T-intersections, eliminating direct crossings. • Jughandles: Require all left-turns to be made via right-hand exits and loops, removing turning vehicles from the main traffic stream. • Median U-turns (Michigan Lefts): Prohibit direct left-turns; all turns made via downstream or upstream median U-turn crossovers.	
5.	Acceleration lanes on rural roads with congestion and high speeds	Acceleration lanes are useful on rural roads with high speeds and congestion, as they provide a dedicated space for vehicles to reach highway speeds before merging with through traffic. Right-turn acceleration lanes are common at intersections, while left-turn acceleration lanes are typically found on divided highways with frequent rear-end collisions due to speed differentials. However, issues can arise if these lanes are poorly designed or absent. Long or poorly marked lanes may confuse drivers, leading them to believe there is an extra through lane. Adding acceleration lanes often requires intersection widening, which increases pedestrian crossing distances and exposure to traffic. Without acceleration lanes, the speed difference between merging and through vehicles—especially at intersections with many turning trucks—can raise collision risks.	• Provide an acceleration lane of appropriate length (40% to 60% lane change collisions • Improve pavement markings (20% to 45% for signalized intersections and 15% to 20% for unsignalized intersections for total collisions) • Provide median refuge island for pedestrians (20% to 60% of pedestrian collisions)	(Delphi-MRC, 2006) (NCHRP Report 500 Volume 5, 2003)
6.	Intersection Skews	Intersections should ideally form angles close to 90 degrees, with a generally acceptable range between 70 and 110 degrees. Angles outside this range, especially acute ones, can reduce visibility, making it harder for drivers, particularly older ones with limited mobility, to judge gaps and the speed of approaching vehicles. These skewed angles also complicate turning movements, increasing the risk of vehicles, especially heavy trucks, encroaching into opposing lanes. Additionally, wider intersections resulting from skewed layouts lead to longer crossing times for both vehicles and pedestrians, raising the risk of collisions. At obtuse angles, turning vehicles may operate at higher speeds, potentially increasing the severity of collisions.	• Where the skew angle is 60 degrees or less, the intersection should be redesigned to achieve an intersection as close to 90 degrees as possible • Eliminate the skew by realigning the intersection • Create a staggered intersection by separating the intersection into two 90 degree angle, 3-legged intersections (40% to 80% total collisions, 60% to 80% rear-end collisions, 40% to 60% turning collisions, 40% to 80% head-on collisions) • If warranted, install traffic signals. Use caution as traffic signals have the potential to reduce certain collision types (right-angle) while they may increase other types (such as rear-end collisions) (20% to 35% total collisions, 30% to 80% right-angle collisions, increase 30% to 70% rear-end collisions) **Use of Technology** • Intersection Conflict Warning System (ICWS) consisting of dynamic flashing signs and detection that provide active warning about traffic on the major road, minor road, or both roads at the intersection	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Renae kuehl, 2016) (Government of South Australia, 2024) (NCHRP Report 500 Volume 5, 2003) (NCHRP Report 500 Volume 12, 2004)

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			• Minor Road Only Warning – Vehicles on the major road are detected and activate signs that are visible to drivers on the minor road • Major Road Only Warning Signs – Vehicles on the minor road are detected and signs on the major road flash • Major and Minor Road Warning – Both major road and minor road vehicles are detected, and cross traffic is warned.	
7.	Corner Radius	The corner radius at an intersection significantly influences vehicle maneuverability, turning speeds, and pedestrian safety. Large radii accommodate smoother turns but can encourage higher vehicle speeds, increase pedestrian crossing distances, and reduce driver compliance with stop or yield signs, especially in areas with potential pedestrian activity like rural helmets. These conditions raise the risk of high-speed and vehicle-pedestrian collisions. Conversely, small corner radii, often due to physical constraints, can pose challenges for large vehicles, leading to off-tracking, shoulder damage, or encroachment into opposing lanes. Drivers may also miscommunicate their intentions or slow unexpectedly, increasing the risk of rear-end collisions or conflicts with through traffic. Both overly large and overly small radii can compromise safety for all road users.	**If the radius is too large** • If radius is too large and it results in a large paved open area in the middle of the intersection, considered a channelized island (pedestrian refuge) to guide and direct vehicles through a right-turn manoeuvre, which will reduce the risk of collisions and make the road safer for vulnerable road users (20% to 60% of pedestrian collisions) • Apply right turn channelization (20% to 40% total collisions) • Decrease corner radius to accommodate an appropriate design vehicle. • Consider the use of compound curves to minimize pedestrian crossing distances. • Use pavement markings to paint a tighter radius or a channelized lane. **If the radius is too small** • Increase corner radius to accommodate an appropriate design vehicle. Consider the use of compound curves to minimize pedestrian crossing distances (25% total collisions) • Flare the approach to the intersection to reduce conflicts between through traffic and turning vehicle and assist large trucks in negotiating the turn. It should be noted that on high-speed facilities and in situations where turning vehicles significantly impede the flow of through traffic, consideration should be given to including a right-turn auxiliary lane as part of the design. Guidance on this matter *is provided in the TAC Geometric Design Guide.* • Where a redesign is not possible or not feasible, include a speed advisory sign at the intersection for reduced speeds around the corner.	(Delphi-MRC, 2006)
8.	Cross Slope	Cross slope is essential for road surface drainage, and when two roads intersect, especially on a grade, adjustments to the cross slope may be needed to smoothly blend the minor road's profile with that of the major road. A well-designed transition improves driver comfort, reduces driver workload, and lowers collision risk. Poorly designed intersection profiles and cross sections can lead to difficult vehicle control, inadequate drainage, increased collision risk due to high driver workload, sudden cross slope changes that may cause vehicles to vault at speed, and in rural areas, potential sightline restrictions due to improper profile blending.	• Redesign and reconstruction of the intersection is the only effective countermeasure for this issue. • As an interim measure pending reconstruction of the intersection, enhanced maintenance activities may be desirable under difficult (wet or icy) conditions	(Delphi-MRC, 2006)
9.	Intersection Configuration	Intersection configuration significantly influences both the operational efficiency and safety of roadways. In rural areas, many intersections are shaped by historical travel patterns, land use, terrain, and jurisdictional boundaries, leading to a mix of conventional and legacy designs. While typical intersections usually present manageable safety challenges, legacy configurations can introduce unique and complex issues. Addressing these may require considering alternative layouts or improving driver guidance. Specific problematic configurations include skewed angles, offset intersections that encourage high speeds or complicated turning movements, multi-leg intersections that confuse unfamiliar drivers, and outdated rotary or traffic circle designs that differ from modern roundabout expectations. These setups can complicate navigation, increase driver workload, and pose safety risks, especially under growing traffic volumes.	• Installation of advance warning signs to spread information loading for drivers and provide notice of unexpected or unusual situations (20% to 35% of total collisions) • Installation of overhead flashing beacons to increase conspicuity of the intersection (may not be suitable for high skew angle intersections (30% to 50% of total collisions, 0% to 25% of right-angle collisions, 10% to 15% of rear-end collisions and left turn collisions) • Improve the skew angle of approach intersection legs where this appears appropriate and possible (30% to 50% of total collisions) • Assess the potential of a modern roundabout configuration (30% to 58% of total collisions) • Provide bypass lanes on the shoulder at T-intersections to reduce rear-end and right-angle collisions (CRF of 24% for right-angle collisions). • Grade-separated intersections can significantly reduce—or even eliminate—collision risk. However, their high construction costs may make them less feasible compared to other lower-cost alternatives	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Bruce Corben) (Government of South Australia, 2024) (NCHRP Report 500 Volume 5, 2003) (NCHRP Report 500 Volume 12, 2004)

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			• Improve pedestrian and bicycle facilities to reduce conflicts between motorists and non-motorists • Provide lane assignment signing or marking at complex intersections	
10.	Intersection Sight Distance	Intersections are high driver workload areas where providing clear sightlines is essential for safety. Adequate intersection sight distance, as outlined in the TAC Geometric Design Guide for Canadian Roads, allows drivers sufficient time to detect vehicles, make decisions, and react appropriately. Obstructions such as vegetation, buildings, fences, utility boxes, signage, road curves, and snowbanks can reduce visibility and increase collision risk, particularly at rural intersections. Additionally, snow clearing operations during winter may further contribute to sightline obstructions and compromise safety.	**Uncontrolled Intersections** • Cutting back vegetation and/or embankments, and removing/relocating walls, fences, signs or other obstructions to increase the visibility to the left and right of the intersection (as illustrated at right) (15% to 50% total collisions) • Placing two-way stop signs on the minor roadway where desired sight distance values cannot be obtained in all four approaches to the intersection (up to 60% total collisions, increase of 40% to 60% rear end collisions) **Stop-controlled Intersections** • Cutting back vegetation and/or embankments to increase the visibility to the left and right of the intersection. This is also appropriate for signalized intersections (15% to 50% total collisions) • Removing walls, fences, signs or other obstructions to increase the visibility to the left and right of the intersection (15% to 50% total collisions) • Relocating the painted stop bar closer to the intersection to provide greater sight distances for the driver. • Installing all-way stop signs (40% to 55% of total collisions) • Ensuring winter maintenance does not create unnecessary sight line obstructions. • Install Intersection Conflict Warning Systems (ICWS) with dynamic flashing signs and vehicle detection to alert drivers of approaching traffic at unsignalized intersections (17–27% reduction in occurrence and severity of collisions).	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Renae kuehl, 2016) (Government of South Australia, 2024) (NCHRP Report 500 Volume 5, 2003) (NCHRP Report 500 Volume 12, 2004)
11.	Stopping Sight Distance	Safe and efficient intersection operations rely heavily on drivers' ability to perceive and respond to potential conflicts, making sufficient sight distance critical. The minimum required sight distance is the stopping sight distance, which varies based on design speed. In complex situations, it is often desirable to provide a longer "decision sight distance" to give drivers more time to react. While trucks and buses typically require longer stopping distances due to their weight and braking characteristics, their higher driver eye height can sometimes offer better visibility, though this advantage is lost in situations with horizontal or vertical sight obstructions. Poor sight distance can prevent drivers from recognizing intersections, control measures, or queues in time to respond safely, particularly in flat rural areas where intersections may lack visual prominence.	• Increase the available stopping sight distance on a horizontal curve by removing obstructions to obtain lateral clearance (15% to 50% total collisions) • Modify horizontal and vertical alignment to obtain required sight distance (40% to 50% total collisions) • Install advance warning (20% to 30% total collisions) • Install proper pavement markings (20% to 45% at signalized intersections and 15% to 20% at unsignalized intersections) • Improve signing and delineation. • Install larger warning or regulatory signs if warranted. • Provide intersection lighting (20% to 50% nighttime collisions) • Install transverse rumble strips on the minor approach to the intersection (40% to 60% total collisions) • Install Stop Ahead sign. • Increase the size of the Stop or Stop Ahead sign. • Add a flashing red beacon or intersection control red/amber beacon. • Place actuated flashers on the top of Stop sign.	(Delphi-MRC, 2006) (Government of Alberta , 2011) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Bruce Corben)
12.	Sign and Traffic Signal Visibility	For an intersection to function safely and effectively, all signs, traffic signals, and other guidance elements must be clearly visible and easily noticeable to drivers. Inadequate visibility of these elements can significantly compromise intersection safety. Factors contributing to poor visibility include physical obstructions, overgrown vegetation, snow, faded or non-retroreflective sign faces, small sign or font sizes, excessive or cluttered signage, non-standard signs, and improper placement or mounting of signs and signals.	**Sign Visibility** • Remove obstructions (45% total collisions) • Increase the sign size if warranted. • Use larger letters on the sign.	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Government of Alberta , 2011)

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		Additionally, incorrect specification of traffic signal equipment and visual conflicts with background elements can further reduce the effectiveness of traffic control devices.	• Use of technologies such as Flashing LED Stop Signs provide increased visibility and awareness of the upcoming stop condition, especially useful at intersections with limited sight distance and a history of collisions linked to failure to stop, where enhanced sign visibility is warranted by an engineering study. • Illuminate the sign or intersection (20% to 75% nighttime collisions) • Upgrade retroreflective material used for the sign. • Add beacons on advanced warning signs if warranted (CRF of 12-58% for angle collisions) • Reduce sign clutter • Install splitter islands to allow placement of stop signs in the median (CRF of 35–45% for injury collisions) **Traffic Signal Visibility** • Install/improve advance warning devices. • Install larger signal lenses (10% to 20% total collisions) • Install lens visors. • Install back plates to enhance the contrast between the signals and their surroundings, especially effective on east-west approaches experiencing sun glare (15% to 30% left-turn collisions) • Improve location of signal or signal heads (25% to 40% total collisions) • Use additional signal heads if warranted. • Remove sight obstructions (45% total collisions) • Increase the amber phase. • Consider advance warning flashers (8% to 18% total collisions)	(Bruce Corben) (Renae kuehl, 2016) (Government of South Australia, 2024) (NCHRP Report 500 Volume 5, 2003) (NCHRP Report 500 Volume 12, 2004)
13.	Intersection Lighting	Nighttime illumination at rural intersections enhances visibility beyond what vehicle headlights can provide and signals drivers to approach with caution. While not always cost-effective to implement universally, the type and extent of lighting depend on factors such as road surface reflectivity and pedestrian presence. Full lighting uniformly illuminates the entire intersection, while partial lighting targets key decision points and hazards. In some cases, minimal "sentry" or delineation lighting is used simply to mark the intersection. Poor nighttime lighting can hinder a driver's ability to locate intersections, see traffic control devices, and detect roadside hazards or roadway curves. Inadequate or poorly designed lighting, particularly in areas with pedestrians, can create shadows that obscure people and increase collision risk.	• Install intersection lighting (20% to 50% nighttime collisions) • Identify to drivers exactly where the intersection is located, thus improving driver perception and reaction time. • Enhance a driver's available sight distance. • Improve the visibility of non-motorists (vulnerable road users). • Use signs with upgraded retroreflective sheeting. • Update pavement markings with durable finishes offering sufficient retroreflective properties or use reflective delineators on the roadside to help provide guidance to drivers.	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011)
14.	Intersection Control	Traffic flow at intersections can be managed using various control strategies, from simple two-way stop controls to full four-way traffic signals, with the appropriate method typically determined by warrant procedures. When properly selected, designed, and positioned, traffic control devices and technologies provide timely and clear guidance to drivers and pedestrians, promoting compliance and enhancing intersection safety. However, improper use of traffic control devices can lead to serious issues such as increased right-angle and turning collisions, elevated speeds, excessive delays, red-light running, and driver frustration, especially at rural intersections where unexpected signals or signs may violate driver expectations. These issues can result in reduced compliance, poor operational performance, and higher risk of severe or fatal collisions.	• Install 2-way stop control if warranted (up to 40% total collisions, increase in 40% to 60% rear-end collisions) • Convert to all-way stop control if warranted (45% to 55% total collisions) • Remove unwarranted traffic signals (30% to 55% all collisions, up to 70% rear-end collisions, up to 50% right-angle collisions) • Install traffic signal at unsignalized intersection if warranted (20% to 35% total collisions) • Install 2-way yield control if warranted (10% to 20% total collisions) • Install overhead flashing beacons • Retime adjacent signals to create gaps at stop-controlled intersections **Active Users Consideration** • Implement leading pedestrian interval (LPI) at signalized intersections with higher pedestrian volumes (3–6 second head start) • Install automatic pedestrian detection in place of push buttons at signalized intersections	(Delphi-MRC, 2006) (Government of Alberta , 2011) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (Bruce Corben) (Shaun Hammond, 2018) (NCHRP Report 500 Volume 12, 2004)

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			• In the US, flashing "EYES" pedestrian signal is used remind pedestrians to look left and right while waiting or crossing. Positioned above standard pedestrian signals, this treatment aims to increase awareness and safety at crossings.	
15.	Road Signs	Road signs play an important role in providing drivers with timely information for making safe and informed decisions, offering guidance, warnings, and regulatory direction. Signing practices in Canada are standardized through the Manual on Uniform Traffic Control Devices for Canada (MUTCDC), with some provinces introducing complementary regulations that align with national standards (i.e. OTM in Ontario). The MUTCDC governs aspects such as sign format, size, placement, and wording to ensure consistency and predictability for drivers. Issues such as missing or damaged signs, non-standard or inconsistent designs, sign clutter, poor maintenance, and visibility problems due to obstructions or improper placement can reduce the effectiveness of signage, compromise safety, and hinder driver comprehension, especially when signs are misaligned, poorly lit, or mounted incorrectly.	• Understand and adhere to the design guidance provided in MUTCDC / OTM. • Ensure sign functions are relevant and necessary and that the information is updated or replaced as necessary • Illuminate intersection to improve visibility of existing signage if warranted • Ensure signage is properly located • Ensure signs exhibit appropriate retroreflective characteristics. • Verify that existing signs are still performing their required functions and conveying their message under both daytime and nighttime conditions • Ensure all signs are cleaned regularly and properly maintained • Ensure supporting structures are in sound condition • Ensure signs are not obscured by foliage or roadside installations • Mount signs at proper height and ensure signpost(s) are vertical and that the sign face is perpendicular to the driver's view • Remove sign/signal sight obstructions (45% total collisions) • Relocate signs to appropriate location (including proper distance and horizontal / vertical mounting measurements)	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (NCHRP Report 500 Volume 5, 2003)
16.	Pavement Markings	Retroreflective pavement markings are critical for guiding drivers, especially at night or during poor weather, by helping them maintain proper lane positioning and anticipate roadway features such as curves, lane drops, narrowings, and intersections. These markings are standardized under the Manual of Uniform Traffic Control Devices for Canada (MUTCDC) and often supplemented by provincial regulations (i.e. OTM in Ontario). Non-standard applications can violate driver expectations and increase collision risk. Common issues at rural intersections include worn or faded markings, insufficient retroreflectivity at night, poor coordination with signage, and inappropriate or confusing use of markings, all of which can impair a driver's ability to interpret and respond to road conditions safely. Inadequate intersection pavement markings can lead to poor lane discipline (sideswipe collisions), inappropriate stopping locations (right angle and rear-end collisions), and a variety of errors in driver judgement that generally increase the risks of collisions at the location.	• The use of more durable and visible pavement markings such as thermoplastics technologies. These can help extend the life of pavement markings and can be particularly useful in areas where traffic and seasonal wear is particularly aggressive. • Provide signs to supplement pavement markings. • Consider using retro-reflective Raised Pavement Markers (referred to as RPMs or "cat's eyes") to highlight crosswalks or to supplement centerline markings, particularly in areas of wet climate or on highly curvilinear alignments. • If RMPs are used, they should normally be recessed or of the low profile type to prevent their destruction in the course of winter maintenance operations. • Consider the use of transverse rumble strips on the minor road approaches to the intersection. (CRF of 28-35%) • Consider the use of the MUTCDC defined wider pavement markings as appropriate and warranted. • Consider the addition of pavement markings on rural intersection minor road approaches where they are not currently provided if appropriate. • Install proper pavement markings (20% to 45% total collisions at signalized intersections and 15% to 20% total collisions at unsignalized intersections) • Double the rate of pavement marking application (i.e. twice a year) (15% total collisions)	(Delphi-MRC, 2006) (Golembiewski, Intersection Safety- A Manual for Local Rural Road Owners, 2011) (NCHRP Report 500 Volume 5, 2003)
17.	Sign clutter on intersection approaches	While traffic signs are essential for providing drivers with important information, excessive signage on intersection approaches can overwhelm drivers, making it difficult to distinguish critical from non-critical messages. This sign clutter often compounded by commercial or non-traffic signs that can cause confusion, hesitation, and increased driver workload, all of which elevate the risk of collisions. Specific issues include drivers missing key control signs like STOP or YIELD, increased likelihood of sideswipe or rear-end collisions due to uncertainty, and excessive approach speeds when warning signs are overlooked. In some	• Eliminate non-critical or unnecessary road and traffic signing. • Spread signing farther apart in order to provide additional time for drivers to read, understand, and act upon critical information • Remove commercial and private signing that conflicts with and reduces the effectiveness of required road and traffic signing • Where wayfinding is complex such as at major entry points to tourist sites or destination areas, provide a slip-off and separated rest area with clear mapping and other supplemental information that may be useful to the driver.	(Delphi-MRC, 2006)

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		cases, sign clutter may also obstruct sightlines at or near intersections, further compromising safety.	• Provide adequate spacing between signs	
18.	Rail Crossings Geometry	The geometry of roadways approaching railway crossings significantly affects both safety and operational performance. Poor design can restrict sightlines, hinder vehicle maneuverability, and encourage unsafe driving behavior. Key concerns include horizontal curves that reduce visibility due to vegetation or skew angles, and vertical grades that challenge vehicle stopping and acceleration, especially for low-clearance vehicles. Superelevated track sections can also cause discomfort for occupants if not well aligned with the road. Close proximity to intersections or driveways can lead to vehicle queues blocking the tracks and increased driver confusion. Additional risks arise from obstructed sightlines caused by terrain, vegetation, or infrastructure. Furthermore, changes over time in roadway or railway characteristics, such as increased traffic volumes or higher train speeds, can compromise previously adequate crossing designs.	**Horizontal Curves** • Realign roadway to improve stopping sight distance and/or rail crossing skew angle. • Ensure warning signs and pavement markings are consistent with MUTCDC and Transport Canada Grade Crossings Standard requirements. • Where traffic engineering studies indicate the sign is warranted, installation of a “Prepare to Stop at Railway Crossing Sign” may be appropriate • Clear vegetation and remove obstacles to improve lateral sightlines on the curve • Install a grade crossing warning system if warranted. • Consider illumination of the rail crossing if warranted **Vertical Grades** • Flatten grades on the approach to the rail crossing to improve stopping sight distance • Roadway grades on the approach to a rail crossing should be as level as possible to accommodate expected vehicle operating speeds, to ensure safe acceleration crossing times for heavy vehicles required to stop at the tracks and to prevent the hang-up of low clearance vehicles. • On the approach to superelevated track sections, roadway grades can be modified to match the plane of the railway. Grades should safely accommodate the expected operating speeds for the roadway facility. • Ensure warning signs and pavement markings are consistent with MUTCDC and Transport Canada Grade Crossings Standard requirements. • Where traffic engineering studies indicate the sign is warranted, installation of a “Prepare to Stop at Railway Crossing Sign” may be appropriate. • Install a grade crossing warning system with cantilevered light units if warranted to improve rail crossing conspicuity. • Consider illumination of the rail crossing if warranted. **Close Proximity to Intersections / Driveways** • Relocate intersections and driveways a minimum of 30 m from the rail crossing. • If traffic signals create vehicle queues that extend across the rail crossing, consider pre-emption of the traffic signals by the grade crossing warning system. **Sightline Obstructions** • Remove vegetation and obstacles from within the required clear sightline area. • In the event that obstacles cannot practically be removed consider the installation of a grade crossing warning system if warranted. • Ensure advanced warning signs are consistent with MUTCDC and Transport Canada Grade Crossings Standard requirements. Where traffic engineering studies indicate the sign is warranted, installation of a “Prepare to Stop at Railway Crossing Sign” may be appropriate. • Lower train speeds. Maximum railway operating speed is an important variable in determining the required Clear Sightline Area for a rail crossing. • Install grade crossing warning system if warranted. • Obstructions within the railway right of way may also warrant a grade crossing warning system • equipped with gates. **Changing Roadway/Railway Characteristics**	(Delphi-MRC, 2006) (Bruce Corben) (NCHRP Report 500 Volume 12, 2004)

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			• Warrants for grade crossing warning systems should be reviewed to ensure appropriate warning devices are in place. • Conduct a detailed engineering study to determine if grade separation is appropriate. • Prior to making any modification to a rail crossing, a comprehensive Road/ Railway Grade Crossing Safety Assessment must be conducted to determine compliance with the requirements of applicable grade crossing regulations and the technical standards contained in Transport Canada Grade Crossings Standard. **Cyclising Considerations** • Ensure bicycle-safe rail crossings by aiming for a 90-degree angle, using smooth non-slippery surfaces (e.g., concrete), and minimizing flange gaps to improve safety and allow for slight variations in crossing angle.	
19.	Rail Crossings Warnings	Rail crossing warning devices play a critical role in alerting drivers to the presence of railway tracks and approaching trains, offering guidance, warnings, or mandatory actions. These devices are categorized as passive, such as signs and pavement markings, or active, such as flashing lights, bells, gates, and advanced warning systems. Their use is regulated by Transport Canada's Transport Canada Grade Crossings Standard requirements and relevant grade crossing regulations. The effectiveness of these devices can be compromised by limited visibility due to roadway alignment or obstructions, poor night visibility, and practical challenges in clearing sightlines. Additionally, changes in road or rail characteristics, like increased traffic or train speeds, can render existing warning systems inadequate.	• Ensure warning signs and pavement markings are consistent with MUTCDC and Transport Canada Grade Crossings Standard requirements. • Where traffic engineering studies indicate the sign is warranted, installation of a "Prepare to Stop at Railway Crossing Sign" may be appropriate. • Install grade crossing warning system if warranted. Gates may also be warranted in certain situations. • Provide cantilevered grade crossing warning light units if warranted. • Illuminate the rail crossing if warranted. • Place retroreflective tape on the back of railway crossing signs and poles. This treatment produces a strobe-like effect as approaching headlights shine through the gaps between the rail cars. • Conduct a detailed engineering study to determine if grade separation is appropriate. • Educational campaigns can help encourage drivers to pay closer attention and actively look for trains as they approach and cross rail lines.	(Delphi-MRC, 2006) (Bruce Corben)
20.	Approach Speeds and Speed Differential	Traffic speed plays a critical role in road safety at both intersections and along road segments, particularly in rural areas. While absolute speed is important for intersection design, recent research emphasizes that differences in speed between vehicles may be more influential in collision risk. The 85th percentile operating speed is commonly used for design purposes, as it reflects the speed at or below which most drivers travel. At intersections, where vehicles may decelerate, accelerate, or maintain speed depending on their actions and familiarity, large speed differentials can lead to conflict and increase collision risk. Rural intersections are especially vulnerable due to higher operating speeds, leading to a greater likelihood of severe or fatal collisions. Safety concerns include high-speed overshooting of stop bars, instability while braking on curves, reduced ability to avoid hazards, and conflicts involving slow-moving vehicles or heavy trucks entering or turning at intersections, all of which are exacerbated by excessive speed and speed variation.	Speed Management measures include: • Improved advance warning signing and/or utilize Active warning system/signage (e.g. ICWS and speed activated sign) • Transverse rumble strips to bring the driver's attention to the fact of the approaching intersection and the need to reduce speeds (40% to 60% total collisions) • Painted edge lines on the immediate approach to the intersection as a means of better communicating the presence of the intersection and the resultant need to adjust speeds. • Various patterns of pavement markings to provide improved driver perception of their speed and the need to adjust appropriately for the upcoming intersection. A variety of patterns have been used for these purposes elsewhere and caution should be used in selecting this countermeasure, since its effectiveness appears highly variable. • Enhanced, repetitive, and regular speed enforcement can play a complementary role to all of the above measures and should always be used in support of any speed management effort (27% of total collisions) • Use modern roundabouts to reduce vehicle speeds through intersections (30% to 80% head-on collisions, 30% to 80% angle collisions) • Use of geometric changes to reduce potential speed differential effects on safety through the provision of left-turn auxiliary lanes, right turn lanes, and acceleration lanes onto the major road from the minor facility as appropriate and warranted.	(Delphi-MRC, 2006) (Bruce Corben) (Government of South Australia, 2024) (Renae kuehl, 2016)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
			• Use narrow lane widths.	
21.	Roadside Hazards near Intersections	In North America, a significant portion of road fatalities (about 30%) involve collisions with fixed objects, with an additional 10% due to non-collision rollovers, highlighting the importance of roadside safety, especially at intersections. A key strategy to mitigate these risks is the concept of a "forgiving roadside," which emphasizes clear, flat recovery zones free of hazards that could cause serious injury to occupants of errant vehicles. When such zones cannot be provided, hazardous features should be made breakaway or protected with barriers, though barriers themselves can cause injuries and should be used only as a last resort. Common roadside hazards at intersections include utility poles, light standards, electrical boxes, mailboxes, steep slopes, and non-traversable ditches. Narrow or deteriorated shoulders, particularly at intersection corners, can also increase the risk of collisions by limiting drivers' ability to recover from loss-of-control situations.	Reduce the risk of run-off road incidents: • Widen roadway shoulders to provide drivers with a recovery area to perform evasive manoeuvres (15% to 30% total collisions) • Pave roadway shoulders to provide a smooth transition from the travel lane for drivers performing evasive manoeuvres (20% to 60% total collisions) • Widen and/or pave shoulders to accommodate vehicle off-tracking. Provide opportunities for the driver of a vehicle to recover and return to the roadway: • Remove obstacles and hazards from within the clear zone (45% t0 80% fixed object collisions) • Flatten steep fore slopes, back slopes and transverse slopes to a traversable cross section (10% to 20% total collisions) • Regrade ditch lines to achieve a traversable cross section. Reduce the severity of a potential collision: • Equip obstacles including signposts, light standards and utility poles with breakaway devices. (30% to 50% fixed object collisions) • As a last resort assess the cost effectiveness of shielding the obstacle with roadside barrier/guide rail or a collision cushion.	(Delphi-MRC, 2006)
22.	Large Number of Heavy Vehicles	Heavy vehicles have distinct operating characteristics compared to passenger cars, which necessitate special design considerations at intersections, especially where truck volumes are high. Their larger size and lower maneuverability often result in off-tracking during turns, leading to encroachment onto shoulders, sidewalks, or adjacent lanes. Due to slower acceleration, trucks take longer to clear intersections or merge with traffic, creating large speed differentials that increase the risk of rear-end and right-angle collisions. Heavy truck volumes also affect left-turn lane storage needs, with spillbacks into through lanes raising collision risks. Sightlines can be obstructed by large vehicles, and long overhanging loads pose hazards during turns. At night, the visibility of long trucks crossing intersections can be especially poor, increasing the chance of severe collisions.	• Corner radii should be sufficiently large to accommodate off-tracking of the selected design vehicle. Although not typically a problem at urban intersections, it is also desirable to keep the radii small to reduce pedestrian crossing distances. • Remove obstructions that limit the available intersection sight distance (15% to 50% total collisions) • If warranted, provide an acceleration lane to permit heavy vehicles to increase their speed prior to entering the through lane (40% to 60% lane change collisions, 50% to 80% rear-end collisions, 20% to 40% overtaking collisions) • Increase the left turn storage lane length to accommodate required left turn traffic volumes and vehicle mix (30% of total collisions) • Where possible, offset opposing left turn lanes to improve sightlines for opposing vehicles. • Increase corner radius (25% of total collisions)	(Delphi-MRC, 2006)
23.	Human Factor Issues at Rural Intersections	Most of the collisions at rural intersections are based on three primary factors: gap selection, intersection recognition, and conflict point management. Determining a safe and comfortable gap before executing a maneuver through an intersection presents drivers with additional burden in the form of monitoring, detection, and perception tasks. Drivers are required to observe vehicle paths and anticipate stops, estimate speed, distance, and time to arrival, detect locations of gaps in traffic streams, perceive gap size, monitor any changes in gap size, evaluate whether a gap is acceptable, and determine when to initiate their maneuvers. A failure to adequately detect and recognize an upcoming intersection may result in drivers failing to stop or yield to oncoming traffic or make risky and sudden maneuvers to enable the desired route change with less than ample time. Providing adequate sight distance, traffic control devices, and supplementary devices for drivers to detect, recognize, and identify upcoming intersections is paramount to reducing these instances. Another contributory factor to the rate of accidents at rural intersections is the management of the various conflict points. Conflict points occur at locations where traffic routinely crosses, merges, or diverges leaving these areas at higher risk for potential collisions of varying severity.	Gap Selection Aids • Provide clear sight triangles • Modify horizontal/vertical alignments on intersection approaches • Realign skewed intersections to reduce or eliminate skew • Move minor road stop bar as close to the roadway as possible • Provide offset right turn lanes • Provide offset left turn lanes • Provide intersection decision support system or another dynamic device • Roadside markers/poles (static markers at a fixed distance) • Provide left-turn acceleration lanes for merging traffic • Provide right-turn acceleration for merging traffic • Implement speed Zoning/enforcement near intersections • Widen median to provide for adequate storage	(National Cooperative highway Research Program Report 650, 2010)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
			• Add centreline, yield/stop bars, and other signage in the median • Extend left edge lines across median opening Intersection Recognition • Provide overhead control beacon reinforcing two-way stop control • Provide intersection lighting • Provide dynamic Watch For Entering Traffic When Flashing Signs • Use of a variable median width (wider in intersection vicinity) • Change median type in vicinity of the intersection • Use Stop-Ahead pavement marking and in-lane rumble strips • Provide a wider stop-bar • Provide divisional/splitter island at mouth of intersection • Provide signage/marking for prevention of wrong-way entry Conflict Point Management • Close low volume minor road intersections or implement right-in/right-out movements • Offset T-intersections (indirect minor road crossing) • J-turn intersections (indirect minor road crossing and left-turns) • Jughandle intersections • Provide left/right turn lanes or increase their length • Signalization • Roundabout	
General and Roadway Segments				
24.	Behavioural Collision Risk Factors	Behavioural collision risk factors play a critical role in the incidence and severity of collisions in rural and remote areas. Observational and correlation studies have consistently identified key contributing behaviours, such as excessive speed, driver fatigue, alcohol and cannabis use, failure to wear seatbelts, and errors in driver judgement. Particular attention is warranted for young drivers (under 25) and older drivers (over 60), who are at higher risk, as well as drivers navigating unfamiliar roads. Collision risk is also strongly influenced by underlying human factors such as lifestyle, personality traits, and attitudes, which shape both the likelihood of a collision and its severity. For example, speeding not only increases collision probability but also intensifies collision consequences, while low seatbelt usage, especially among rural males, remains a significant factor in fatal and serious injury outcomes. Fatigue, especially among shift workers and young adults, has been linked to up to 30% of fatal rural collisions, and its effects on driving ability are comparable to those of alcohol impairment. Meanwhile, alcohol remains a persistent issue, with blood alcohol concentrations over 0.08% increasing collision risk dramatically. Targeted interventions informed by these behavioural insights, such as fatigue management strategies, speed enforcement, seatbelt campaigns, and drink-driving deterrence, are essential in addressing the unique challenges of rural road safety.	• Localised education campaigns should target local road safety problems and ‘at-risk’ populations. • Local communities should be actively engaged in public health decision-making and the subsequent development and distribution of resources/interventions. • Increased resources need to be channelled into identifying unique road safety problems in Indigenous communities and harness their local knowledge to develop culturally appropriate interventions. • Ongoing ‘Fatal Four’ (i.e. speeding, drink driving, fatigue and non-seatbelt wearing), education should complement rural enforcement campaigns. • Road safety advertising should include explicit coping strategies (decision alternatives) to increase message acceptance and effectiveness. • Rural enforcement programs need to utilise randomised scheduling or deployment methods to enable low levels of police presence to achieve more widespread coverage of vast road networks. • A portion of the funds generated from traffic enforcement activities should be earmarked for rural road safety and associated research. • Road safety training programs for practitioners should be developed and encouraged by Government to ensure the professionalism of the industry.	(Lisa Wundersitz, 2019)
25.	Environmental collision risk factors	Environmental collision risk factors in rural environment are a major contributor to road trauma and are largely beyond the control of individual drivers. These regions are characterised by long travel distances, variable road surface conditions (such as gravel or poorly maintained pavements), inconsistent speed environments, and increased interaction with environmental hazards like dust, wildlife, and livestock. Poor road design elements,	• Widening and sealing of road shoulders • Proving protection around bridges and drains • Improved delineation (i.e. guideposts, line markings and chevron alignment markers) • Increased usage of tactile edge lining	(Lisa Wundersitz, 2019)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
		such as narrow lanes, unsealed or absent shoulders, poor curve delineation, and inadequate acceleration/deceleration lanes further exacerbate collision risk. A significant proportion of rural collisions are single-vehicle incidents resulting from vehicles veering off the road due to unsealed or degraded shoulders, especially on curved sections at high speeds. Additionally, roadside hazards such as trees, poles, and steep slopes greatly increase the severity of injuries when collisions occur. These environmental and infrastructural issues coupled with vehicle dependency and a diverse mix of road users underscore the critical need for road safe interventions tailored to the unique challenges of rural and remote road networks.	• Treatment of roadside hazards (e.g. trees, drains, culverts, steep embankments, etc.) • Provision of overtaking lanes • Improved road maintenance practices • Improved road surfacing • Improving signage (i.e. advisory and hazard warning signs) • Improving sight distance at intersections. • Employe speed management techniques **Animal-Vehicle Collision Countermeasure Considerations** • Animal crossing warning signage to alert drivers in areas with frequent wildlife movement; a low-cost but widely applicable measure. • Improved lighting and wider clear zones to enhance visibility of animals near the roadside, increasing driver reaction time and reducing collision likelihood. • Reduced speed limits in high-risk areas can lower impact severity and improve stopping distance. • Fencing to prevent animals from accessing the roadway, although effective, can be costly and may not be feasible for long stretches of rural roads. • Roadside detection systems that identify large animals near the roadway and activate dynamic warnings (e.g., flashing lights, picture-based signs) to alert drivers in real time. These systems are best applied at known high-frequency animal crossing zones. • Virtual fencing technologies that deter animals from approaching the roadway using GPS-enabled collars and mild stimuli (e.g., sound, vibration, or electric pulse). • Roadside deterrent devices that emit visual or audio cues triggered by approaching vehicles to discourage animals from entering the roadway. • Public education campaigns to raise driver awareness about high-risk locations, wildlife movement patterns, and recommended behaviours to avoid collisions.	
26.	Speeding Issues	Rural collisions result in a higher proportion of fatalities compared to urban collisions. This is largely due to higher operating speeds on rural highways, which—despite lower traffic volumes—often lead to more severe outcomes. The design and roadside characteristics of rural roads, such as long, flat, and open stretches, can encourage speeding. Limited enforcement in these areas means that excessive speeds may go undetected until a serious collision occurs. While reducing posted speed limits is a common response, research shows this alone is typically ineffective. A coordinated approach that combines enforcement, engineering, and education is essential to effectively manage speeds and improve safety on rural roads. Speed limits are set both by legislation and by administrative action. Default speed limits apply to all roads in a class such as rural interstates or local streets. Default limits are set by State, municipal, or, at times, Federal law. An important safety strategy involves setting appropriate speed limits using practices that take into consideration the road segment's design, vulnerable users, traffic operations, land use, and environmental conditions. A systematic evaluation of speed limit changes found consistent increases in travel speeds on rural roads where limits were raised and decreases where limits were lowered	• Use speed feedback signs to alert drivers of their actual travel speed. Effective in transition zones (e.g., entering residential or pedestrian-heavy areas). Overuse may reduce effectiveness. (CRF of 46%) • Similarly, consider dynamic curve warning systems with radar and variable message signs to alert speeding drivers and encourage safe speeds through curves • Apply optical speed bars—transverse pavement markings with decreasing spacing—to create the illusion of accelerating speed and encourage deceleration. Most effective at spot locations with known speeding issues. • Install pavement speed limit markings to reinforce posted speed limits and increase driver awareness. • Use advisory speed signs approaching horizontal curves) to recommend a safe travel speed. Warrant for use and placement should comply with MUTCD. (up to 29% collision reduction) • Modern roundabouts can be effective at improving safety by managing speeds. • Use law enforcement as a temporary measure to manage speeds; however, sustained reductions are unlikely without complementary physical measures. • Reduce posted speed limits only after an engineering study confirms the need and with supportive speed management measures to ensure compliance. • Improve lane markings including the placement of paint lines in the centre or edge of the road or between multiple travel lanes to help guide drivers / enhance existing pavement markings	(Jeffrey Bagdade, 2012) (Lisa Wundersitz, 2019) (Bruce Corben) (Ray Krammes, 2009) (Kostrzewski, H., Haskett, L. & Office Of Behavioral Safety Research, 2024) (Pascale, 2023) (Government of British Columbia, 2018) (Vermont Agency of Transportation) (NCHRP REPORT 500 Volume 7, 2004) (NCHRP Report 500 Volume 23, 2009) (NCHRP Synthesis 412, 2011)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
			by widening them (wider edge-lines) and/or using retroreflective paint, and the addition of retro-reflective road markers (i.e., cat's eyes) • Lower speed limits should be considered in areas with high levels of weaving (e.g., on multi-lane roads with frequent merging and diverging), where speed differentials and lane changes increase collision risk. • Active warning systems (e.g., Intersection Conflict Warning Systems) can alert drivers to vehicles entering from side roads, enhancing safety in high-speed environments. • Regulatory speed limit signage should be installed at the start of the speed zone and supplemented with repeater signs, in compliance with OTM guidance, to ensure driver awareness. • Where high pedestrian or cyclist activity exists—particularly where not typical of the roadside environment—a lower speed limit may be warranted, provided year-round, regular use is evident and supported by other safety factors. • Lane Narrowing with Shoulder Striping **Speed Reduction Measures for Transition Zones -** such as entrances to towns, villages, or school zones require targeted treatments to cue drivers to reduce speed. • Install advance warning signs to advise drivers of upcoming speed transitions, such as entering a town or approaching a school zone. Advance Warning Signs: Install clear signage to notify drivers of upcoming speed reductions (e.g., "Entering Community" or "School Zone Ahead"). • Lateral Shifts: Introduce slight horizontal shifts in the travel path within the transition zone to create a visual and physical cue for speed reduction. • Countdown Speed Markers: Use a sequence of speed limit signs supplemented by diagonal slash signs (three to one) to create a visual countdown to the speed change, reinforcing driver awareness. • Central Islands / Raised Medians: Narrow islands between travel lanes can either deflect vehicle paths or reduce the perceived width of the road, encouraging lower speeds. • Road or Lane Narrowings: Reduce the road width through edge line shifts, painted or raised medians, or channelization. These can signal a more constrained, lower-speed environment. • Chicanes / Horizontal Deflections: Introduce gentle curves or shifts that require drivers to adjust their trajectory, promoting natural speed reduction. *Note: Many traffic calming measures—such as gateway treatments, roundabouts, or speed tables—can also be applied effectively in transition zones. See the Traffic Calming Measures for more details.* **Traffic Calming Measures** – applicable for roads with speeds of 50 km/h or less and generally not appropriate for high-speed rural roads. When applied correctly, treatments such as lane narrowing, roundabouts, road diets, curb extensions, raised medians, and gateway features can provide long-term speed reduction benefits. Misapplication may increase collision risk. • Where appropriate apply road diets by reducing the number of lanes to create space for turn lanes, sidewalks, or cycling facilities. Applicable in rural towns or hamlets. (Potential collision reduction ranges from 29% to 53%.) • In rural areas, Lane Width Reduction should only be considered on lower-speed roads within towns or hamlets and should align with TAC or municipal guidelines (e.g., Complete Streets Design Guidelines) • Install raised medians or center islands to narrow the travel path and encourage lower speeds. This treatment is appropriate for developed rural areas. (up to 71% collision reductions).	

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference

			• Apply gateway treatments at the entrance to towns or villages from higher-speed roads. Treatments may include lane reductions, signing, surface markings, and vertical elements to signal the change in road environment. Must be designed to avoid fixed object hazards and sightline obstructions.
			• Introduce speed humps on low-speed residential or local roads experiencing high levels of speeding or cut-through traffic. (40% to 50% collision reduction)
			• Install speed tables, which provide a longer flat top than speed humps and allow for speeds of 40 to 50 km/h. Speed reductions average around 12 km/h.
			• Implement mini-roundabouts on roads with speed limits of 55 km/h or lower. These can reduce average speeds by approximately 16 km/h and are useful at minor intersections.
			• Use traffic circles at low-speed, low-volume intersections, typically in residential areas. Speed reductions of up to 24 km/h have been observed.
			• Lane narrowing with a center island using tubular markers can be effective but is susceptible to damage from winter maintenance activities.
			Enforcement & Education Strategies
			• Focus enforcement in areas and times with documented speeding issues or collision history to increase effectiveness and public support.
			• Combine targeted enforcement with public education campaigns to raise awareness and amplify deterrence (e.g., NHTSA's model).
			• Ensure speed enforcement is perceived as safety-focused, not revenue-driven, to maintain public trust and cooperation.
			• Deterrence Principles:
			  ◦ Specific deterrence: Discourage repeat offenses through direct penalties.
			  ◦ General deterrence: Influence broader driver behavior through visible enforcement presence.
			• In rural areas with limited resources, collaborate across law enforcement agencies to maintain consistent and efficient enforcement.
			• Leverage Engineering + Enforcement Partnership to identify areas where physical road changes are not feasible, and enforcement is necessary to manage speed.
			• In addition to traditional/ manual Enforcement methods, consider the use of Automated Speed Enforcement systems to detect and document violations; especially effective where staffing is limited.
			• Implement Education Campaigns to inform drivers about the risks of speeding and ongoing enforcement efforts to encourage voluntary compliance.
			• Effective campaigns involve key stakeholders—law enforcement, engineering, public health, judiciary, and key community sector—to ensure coordinated messaging and broader community impact.
			• NHTSA's Speed Campaign Toolkit offers customizable public education materials to support local speed management efforts, emphasizing collaboration with community and national partners.	

27.	Roadway Departure Risk Factor	A significant portion of rural collisions involve single vehicles unintentionally leaving the roadway, often on curves or degraded shoulders at high speeds. These incidents frequently result in severe outcomes, such as collisions with fixed objects, rollovers, or immersion—especially when roadside hazards like trees, poles, or steep slopes are present. Roadway departures are typically caused by driver error, poor weather, vehicle issues, or inadequate road design. They are particularly common on rural roads lacking clear signage, pavement	• Corridor protection consists of continuous lengths of flexible barrier/guide rail along roadsides and the median • Improve geometry of horizontal curves (CRF: up to 80%) • Improve or restore superelevation • Installing warning signs in advance of a curve help drivers adjust speed before entering a horizontal alignment. (CRF of 30%)	(Golembiewski, Roadway Departure Safety: A Manual for Local Rural Road Owners, 2011) (Lisa Wundersitz, 2019) (NCHRP Report 500 Volume 3, 2003)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
		markings, and safety features. Studies show that fixed-object collisions account for about 30% of road fatalities, with another 10% due to non-collision rollovers related to unsafe roadsides. Effective countermeasures include implement appropriate attenuation devices, improving shoulders and roadside design, enhancing signage and markings, installing rumble strips, and removing or shielding fixed hazards.	• Installing alignment delineation (chevrons) to guides drivers through curves by indicating shape and severity. (CRF of 35%) • Implement wide centre line and edge line pavement markings improve roadway visibility and definition. (CRF of 33% for centre line and 38-44% for edge line) • Provide lighting at the curve • Raised pavement markers enhance guidance in wet or low-light conditions (CRF of up to 24%) • Consider implementing centreline, shoulder and edge line rumble strips/stripes consistently along routes, not just at spot locations, if pavement conditions allow (CRF: 15–25% for center line, 10–22% for edge line). Prioritize implementation for roads with narrow/unpaved shoulder • Pavement friction treatments (e.g., epoxy overlay, micro-surfacing, chip seal) are effective at slick locations such as curves, ramps, or bridges (CRF: 40–75%). • Design/improve slopes and ditches to reduce rollover risk. • Improve design of roadside hardware (e.g., light poles, signs, bridge rails) to reduce collision severity. • Ensure Clear Zones are compliance with TAC guidelines (CRF of 13-44%) • Apply shoulder treatments, widening shoulders, paving or sealing of road shoulders, and eliminate shoulder drop-offs • Use safety edge treatment (30° taper) at pavement edges to reduce drop-off hazards. • Remove obstacles and hazards from within the clear zone. If not feasible, implement appropriate attenuation devices as well as object markers • Improve design and placement of barriers/guide rails and attenuation systems, recognizing that while these may increase collision frequency, they are effective in reducing collision severity. • Install dynamic curve warning systems with radar and variable message signs to alert speeding drivers and encourage safe speeds through curves • Where appropriate, speed reduction should be considered. • Develop and apply planting guidelines to avoid placing trees in hazardous roadside/median locations, during new construction • Implement mowing/vegetation control policies to prevent tree growth that creates visibility or fixed object hazards • Modify roadside clear zones or slopes near trees to allow Run-off-road vehicles to recover without impact.	(NCHRP Report 500 Volume 6, 2003) (NCHRP REPORT 500 Volume 7, 2004)
28.	Conflicts between Motorized and Non-motorized Users	Non-motorized users, such as pedestrians and cyclists, face elevated safety risks on rural roads, particularly where infrastructure is limited or absent. Most collisions occur at non-intersection locations on roads with unpaved shoulders and speed limits of 80 km/h or higher. Pedestrian collisions often involve individuals walking along the roadway, while cyclist incidents typically result from overtaking or merging conflicts with motor vehicles. Key contributing factors in pedestrian fatalities include driver infractions—such as failure to yield, impaired driving, speeding, and inadequate lighting. A national analysis of fatal vehicle-pedestrian collisions in Canada (2004–2006) found that failure to yield accounted for approximately 11% of fatalities, impaired drivers were involved in 9% of cases, and 7% of pedestrians were struck by speeding drivers. Recommended countermeasures include enhancing roadway lighting, restricting pedestrian access to high-speed corridors, installing driver alert systems for pedestrian presence, and improving infrastructure to reduce unintended pedestrian/cyclist conflicts. A comprehensive approach that integrates	**Addressing Crossings** • Traffic control devices (e.g., signs, beacons) can be implemented in advance of crossings to alert both motorists and non-motorized users of crossing. • In rural areas, marked crosswalks may not always be appropriate. Factors such as non-motorized user volume, vehicle speed, traffic volume, and crossing distance should be considered before marking. Recommended to conduct an engineering study before implementing crossings. • Implementing textured crossings, to enhance the visual and tactile identification of crosswalks and emphasize pedestrian priority, should be considered in built-up rural areas with higher levels of active transportation users • Consider the use of Pedestrian Hybrid Beacon (PHB), also known as High-Intensity Activated Crosswalks (HAWK), is a traffic control device designed to help pedestrians safely cross busy or higher speed roadways at midblock crossings and uncontrolled intersections	(Dan Nabors, 2012) (Lisa Wundersitz, 2019) (J. W. Hall, 2004) (Neil Arason, 2013) (Shaun Hammond, 2018) (William W. Hunter, 2006)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
		engineering, enforcement, education, and emergency response is essential to improve safety at crossings, along travel corridors, and through effective speed management.	• Ensure bicycle-safe rail crossings by aiming for a 90-degree angle, using smooth non-slippery surfaces (e.g., concrete), and minimizing flange gaps to improve safety and allow for slight variations in crossing angle. • Design driveways with right-angle connections to improve sight distance for both drivers and active users and reduce turning speeds, while balancing the need for wider turning radii to accommodate heavy and agricultural vehicles common on rural roads. • Apply access management strategies, such as managing the number, spacing, access, and direction of driveway and side street connections, providing raised medians, and limiting driveway access, to reduce conflict points and promote safer pedestrian and bicycle travel, especially on arterial or major collector roads. **Addressing Safety Along the Roadway** • Dedicated space for non-motorized users can be provided by i) Restriping existing pavement (if width allows), ii) Widening or adding shoulders, iii) Constructing a separated path alongside the roadway • To be considered walkable, shoulders should be at least 4 feet wide on both sides and include pedestrian crossings for safe access across the roadway. If designed for two-way pedestrian traffic, a minimum width of 5 feet is recommended (71% of collisions) • Edge line rumble strips and rumble stripes improve vehicle safety by preventing run-off-road collisions, but may negatively impact bicyclists and should be applied with caution in shared-use areas. • Where rumble strips are used, utilized narrow rumble strips near the lane edge to retain bicycle-friendly shoulder space. • Avoid textured pavers that compromise bicyclist safety or comfort. • Generally, considerable attention should be devoted to traffic safety in construction zones • Where possible, plan and promote separate truck and bike routes **Addressing Speed** • Speed control is often a priority in small rural communities where non-motorized travel is common. • Advance warning signs should be used to alert drivers of upcoming speed reductions. • Law enforcement alone may result in only temporary speed compliance and can be costly. • Traffic calming measures are more effective long-term solutions and may include road narrowing, roundabouts. road diets (lane reduction), curb extensions, raised medians, gateway treatments, etc. • Traffic calming is best suited to low-speed roads (≤ 60 km/h) and may not be appropriate for all rural road types; some treatments could increase collision risk if misapplied. **Improving Visibility** • Install roadway lighting where warranted, especially if nighttime or twilight collisions are a problem. • Promote educational campaigns encouraging cyclists and pedestrians to increase their visibility to motorists by using retroreflective clothing, armbands, or flashlights. **Vehicle Modifications** • Install visibility detection technologies to help vehicle drivers detect nearby vehicles, pedestrians, and cyclists. • Install truck side guards (lateral protection) to prevent pedestrians and cyclists from being pulled under heavy vehicles. However, note this device can also inhibit emergency access and maintenance ease.	

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference

			• Use warning decals on the rear of heavy vehicles to alert cyclists and other vulnerable users to avoid passing on the passenger side.
			Education
			• Public education campaigns can enhance non-motorized user safety.
			• The following are key messages to be communicated as part of the education program aimed at addressing behaviors contributing to collisions in rural areas:
			  ◦ Do not speed
			  ◦ Watch for non-motorized users
			  ◦ Walk facing traffic (reduces collision risk by 1.5 to 4 times)
			  ◦ Bike in the direction of vehicle travel
			  ◦ Be aware of dangers of cycling near Heavy vehicles
			  ◦ Wear retroreflective clothing or use a light
			  ◦ Avoid distractions while walking, biking, or driving
			Enforcement
			• Limited resources may restrict rural law enforcement's capacity for sustained enforcement.
			• Enforcement should target:
			  ◦ Specific high-risk behaviors (e.g., speeding)
			  ◦ Critical time periods (e.g., school start/dismissal, weekends in recreational areas)
			• Support strategies for enforcement:
			  ◦ Training adult school crossing guards
			  ◦ Using speed trailers and feedback signs in areas with excessive speeding
			• Studies show alcohol impairment is a major factor in rural pedestrian collisions. Targeted enforcement campaigns should focus on known high-risk locations and times.
			Emergency Service
			• Emergency Services include quick response to collision locations and attention to victims to minimize the severity of the collision
			• Improve emergency response capability by:
			  ◦ Expanding cell phone coverage
			  ◦ Enabling GPS-assisted location tracking
			  ◦ Involving emergency personnel in planning and implementation of safety strategies	

29.	Vulnerable Road Users (Pedestrians, Cyclists and Motorcyclist)	Pedestrian and cyclist safety on rural roads is a significant concern due to higher vehicle speeds, limited visibility, and a general lack of dedicated infrastructure such as sidewalks, bike lanes, or lighting. These roads often have narrow shoulders or none, forcing vulnerable road users to share space with fast-moving traffic. Additionally, rural drivers may not expect to encounter pedestrians or cyclists, further increasing risk. Addressing these issues requires targeted safety measures such as paved shoulders, improved signage, reduced speed zones in high-use areas, and community awareness campaigns.	**Case Studies** • Elmira, Ontario - Use of a pedestrian refuge islands, sidewalk, and 1.5 m-wide on-road cycling and horse and buggy lanes on Church Street within the built-up at an intersection approach. The wider than 1.5 m lane can encourage illegal parking, • Thunder Bay – Arundel Street in Thunder Bay was installed with multi-use path with a 0.5 m buffer and reflective flexi posts on a two-lane two-way roadway Other Countermeasures • Crosswalk Visibility Enhancements • Leading Pedestrian Intervals at signalized intersections • Road diets (Roadway Reconfigurations) • Bicycle Lanes • Rectangular Rapid Flashing Beacons • Median and Pedestrian Refuge Islands	(Backgrounder: Rural Complete Streets, 2016) (FHWA-SA-24-005 Proven Safety Countermeasures in Rural Communities, 2021) (City of Ottawa, 2024)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
			Motorcyclist • Install warning signage targeted towards motorcyclists in locations where uneven or compromised road surface conditions exist • Limit the use of transverse rumble strips since they can destabilize motorcycle riders • Use of high friction surface treatment in specific near curves, ramps, and hilly segments • Implement road safety edges and paved shoulders • Implement additional warning signs in construction zones warning motorcyclists of compromised road surface conditions and debris on the roadway	
30.	Head-on Collision Risk Factor	Head-on collisions often result from either inadvertent driver actions—such as roadway departures or deliberate maneuvers, such as unsafe passing on two-lane roads. These collisions are disproportionately represented on undivided, rural two-lane roads, particularly along tangent segments. While the higher frequency on tangents may be partly attributed to their greater overall length compared to curves, both roadway types present significant safety concerns and warrant targeted interventions. Prevention strategies aim to keep vehicles from encroaching into opposing lanes and to minimize the likelihood of crashing into an oncoming vehicle when encroachment occurs. Countermeasures include centerline rumble strips, widened centerlines, and physical separation where feasible.	• Install centerline rumble strips for two-lane roads • Install profiled thermoplastic strips for centerlines • Provide wider cross sections on two-lane roads • Provide center two-way, left-turn lanes for four- and two-lane roads • Reallocate total two-lane roadway width (lane and shoulder) to include a narrow “buffer median” • Use alternating passing lanes or four-lane sections at key locations • Install median barriers/guide rails for narrow-width medians on multilane roads.	(NCHRP Report 500 Volume 4, 2003)

31.	Rural Two-lane Curves	Horizontal curves along two-lane two-way roadways are of particular interest because they have been particularly correlated with overall increased collision occurrence. Most collisions along curves involve lane departures. Curve-related collisions have several causes including roadway and driver factors. Environmental factors, such as the roadway surface condition, and vehicle factors, such as the centre of gravity, will have an impact on a driver’s ability to safely negotiate a curve. Degree of curve or radius of curve is the roadway factor most cited in the literature as having an impact on collision risk.	• Improvements to advance curve warning signs and advisory speed signs, including bright orange flags, new chevrons/oversized chevrons, horizontal arrows, post-mounted delineators, and upgrading signs with fluorescent yellow sheeting with the following safety effectiveness.
			  ◦ The CMF for advisory speed signs is 0.70 for serious injury/minor injury collisions and for property damage collisions is 0.92.
			  ◦ The CMF for combination of horizontal alignment/advisory speed signs is 0.87 for serious injury/minor injury collisions and for property damage collisions is 0.71.
			  ◦ The CMF for Chevrons and curve warning signs is 0.59 for all collisions and 0.56 for run-off-the-road collisions
			  ◦ The CMF for new fluorescent curve signs is 0.82 for head-on collisions and 0.66 for nighttime collisions
			• Widen or add paved shoulders through the curve, where shoulders are missing or narrow
			  ◦ The CMF for installation of shoulder is 0.91 and for paving shoulders is 0.85 for all collisions
			  ◦ Separate CMF for widening of shoulders to different widths are also available
			• Reflective barrier/guide rail delineation on any guide rails along the curve
			• Installing high friction pavement (pavement grooving in concrete surfaces, and use of high-friction surface treatment using specific binder/aggregate to increase the coefficient of friction) to improve skid resistance for dry and wet pavement conditions. The CMF for improving pavement friction is 0.59 to 1.27 for all collisions and 0.70 for single vehicle collisions.
			• Raised pavement markers (RPM) in the centre of curve or along the roadway edge for delineating the curve as well as providing a tactile warning for alerting drivers that they have crossed the lane edge. The CMF for snow plowable permanent RPM is 0.67 to 1.13
			• Install wider edge line (20 cm) markings. The CMF is 0.89 for fatal and injury collisions on rural principal arterials
			• Transverse pavement markings, which can include optical speed bars, transverse line, converging chevrons, and herringbones
				(Shauna Hallmark, 2013)

ID	Risk Factors	Description / Applicability	Countermeasures (Potential Collision Reduction)	Reference
			• Install vertical delineators or post-mounted delineators (flexible) along the roadside to provide additional delineation • Edgeline and centreline rumble strips which provide audible and vibratory alerts to drivers when their vehicle depart the travel lane and notify drivers that steering correction is needed. A CMF for centreline rumble strips on rural two-lane roadways is 0.87 for all collisions and for edge-line rumble strips is 0.86 • On-pavement curve signing showing a white curve sign in advance of the curve • Flashing beacons that operate in a flashing mode with the curve warning signs providing notice to drivers that conditions are changing ahead • Dynamic curve warning signs, such as advisory speed feedback signs • In-pavement lighting for delineating horizontal curves	

Jurisdictional Scan Results

Table A 2: Jurisdictional Overview and Key Safety Concerns

Agency	Country	% of Rural Roads in Network	Range of posted speed limit within the jurisdiction	Facility types in Jurisdiction	Top three rural road safety concerns
Queensland Department of Transport and Main Roads	Australia	93%	10-110km/h	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Rear End Collisions
BC Ministry of Transportation and Transit	Canada	85%	30 km/h - 120 km/h	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Winter safety
City of Calgary	Canada	Less than 2%, almost exclusively on the city outskirts. we have over 17,000 lane km of roads under our jurisdiction.	50 to 90 for rural, urban is 40 to 80 excluding playgrounds	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions
City of Ottawa	Canada	20%	30 km/h to 100 km/h	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Wild animal collisions
Halton Region	Canada	40%	40 to 80 km/h	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median)	• Speeding • Run-off road collisions • Winter safety
New Brunswick Department of Transportation and Infrastructure	Canada	We have over 18000 kms of roads in the province. A large majority of these would be rural considering that our volumes are lower here.	50 to 110 km/h, school zones or other are 30	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Driver inattention
Niagara Region	Canada	Approximately 65% by lane-km	40-80 km/hr. most rural roads posted between 50-80 km/hr. 40 km/hr only in school areas within community safety zones (generally urban).	• Two-lane two-way roads	• Speeding • Run-off road collisions • Winter safety
Town of Milton	Canada	25%	Most are 70 km/h, the speeds are reduced to 60 km/h when entering a hamlet	• Two-lane two-way roads	• Speeding • Farm vehicle interactions • Cyclists
York Region	Canada	40%	40 km/h to 80 km/h	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median)	• Speeding • Run-off road collisions
Montana DOT	Us	90%	45-80 mph	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Wild animal collisions

Agency	Country	% of Rural Roads in Network	Range of posted speed limit within the jurisdiction	Facility types in Jurisdiction	Top three rural road safety concerns
Pennsylvania DOT	Us	As of august 2023, rural roads are 60.24% of the total linear miles of state-owned highways in Pennsylvania. in 2023 rural roads accounted for 32.10% of the total daily vehicle miles traveled.	The speed limit range for roadways in PA is 25 miles per hour to 70 miles per hour. speed limits over 55 miles per hour are only applied to interstates and freeways as designated by PennDOT.	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Run-off road collisions • Clear zone • relocation of roadside hazards like utility poles.
South Dakota DOT	Us	94% of 7800 centerline miles	20-80	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Intersections •
Vermont Agency of Transportation	Us	Vermont's roadway network includes 15,758 miles as of 2025. the state maintains approximately 17% of the roads of which about 90% are rural.	25-65	• Two-lane two-way roads • Multi-lane roads (undivided) • Multi-lane roads (divided with less than 10 m median) • Multi-lane roads (divided with more than 10 m median)	• Speeding • Run-off road collisions • Intersections

Table A 3: Data Sources and Methods for Identifying Rural Safety Issues

Agency	Country	Data sources for rural safety concerns	Common Rural Safety Countermeasures & Speed Strategies	Common Rural Road Safety Technologies	Methods/Tools to Identify High-Risk for the implementation of countermeasures
Queensland DOT	Australia	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	At townships, having township entry treatments to help manage speeds. On curves, have Curve Alignment Markers (CAMs) and advisory speeds. Audio tactile line markings. Roadside barriers/guide rails. Roadside hazard removal. Wide Centreline Treatment. Speed drops where appropriate. Intersection warning signs. Point to Point cameras. Travis signs (i.e. "Two-Way Traffic Ahead" sign). Widened shoulders, etc.	Speed warning signs (vehicle activated signs). Trailer speed cameras point to point speed cameras	• AusRAP - Australian Risk Assessment Model • QRAM - Queensland Risk Assessment Model (using collision data and AusRAP data) • ECL - Emerging Collision Locations
BC MOTI	Canada	• Collision data • Conflict data • Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	Enhance signage, variable speed limit system, speed reader board, roadside barrier/guide rails, intersection improvement, rumble strips, breakaway devices on roadside, led chevrons, vehicle activated curve warning sign, High Friction Surface Treatment (HFST), roadside delineation, roundabouts, wildlife detection system.	Overhead flashing warning, variable speed limit system, speed reader board, led chevrons, vehicle activated curve warning sign, wildlife detection system, cyclist warning system in tunnels and narrow bridges, road weather information system, ice detection system, fog detection system, avalanche detection system	• Network screening, • use of collision rates and collision prediction models to identify collision prone locations, identification of locations with certain types of collision proneness and over-representation, • systemic safety reviews, • public complaints, • staff reviews.
City of Calgary	Canada	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits	Advance Warning Flashers (AWF) for signalized corridors on the city outskirts	Automated enforcement for red light and speed violations	• Network screening mainly (not limited to rural roads, but citywide)
City of Ottawa	Canada	• Collision data • Conflict data	Signage, pavement markings, speed feedback signs, Safety Edges, rumble strips, guardrails,	Automated speed enforcement, flashing beacons	• Network screening (e.g., red light cameras, protected left turns, signage, pavement markings)

Agency	Country	Data sources for rural safety concerns	Common Rural Safety Countermeasures & Speed Strategies	Common Rural Road Safety Technologies	Methods/Tools to Identify High-Risk for the implementation of countermeasures
		• Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	gravel shoulder maintenance (to address shoulder drop), streetlighting enhancements, rural curve enhancements, flashing beacons, geometric modification at skewed intersections, ATV education & outreach, automated speed enforcement		• Systemic safety reviews (e.g., rural skewed intersections) • Public complaints (e.g., guardrail)
Halton Region	Canada	• Collision data • Conflict data • Speed studies • Public concerns • Safety audits • Systemic reviews	- speed feedback signs - removal of roadside hazards - barriers/guide rails - centreline rumble strips - cat eyes road reflectors - paved shoulders - enhanced signage - intersection improvements (where justified) - roundabouts - enhanced pavement markings - 4-way overhead flashing beacons (red on approaches required to stop, amber on free flow approaches) - roundabouts (also, roundabouts are always reviewed for consideration when an intersection is warranted for signals) - sightline improvements	Speed feedback signs and Portable Variable Message Signs trailers	• Network screening • Public complaints • Staff reviews • Systemic safety reviews if high-risk locations are identified via network screening
New Brunswick DOTI	Canada	• Collision data • Speed studies • Traffic volumes • Public concerns • Systemic reviews	Brush cutting for improved sight, signage, intersection improvements	--	• Staff reviews, • Public input, • Prioritization
Niagara Region	Canada	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits	Speed feedback signs primarily. edge line rumble strips applied in selected locations. farm/slow moving vehicle signage in active farming areas. rural road design standards of 1.5m paved shoulders.	None currently. Automated Speed Enforcement (ASE) in Niagara primarily within urban areas.	Network screening used to drive locations for in-service road safety reviews across regional road network. Result is focus is primarily on urban locations. Most rural road safety issues identified through public/Councillor complaints.
Town of Milton	Canada	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits	We use driver feedback boards on a 2 week rotational basis. we will be looking at installing some passive traffic calming measures (pavement bars) this summer on a few of our rural roads	No technology used	• Network screening, • Public complaints, • Staff reviews
York Region	Canada	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits	■ Speed feedback signs, road narrowing, roundabouts, enhanced signage e.g. hamlet gateway warning signs	--	• Network screening and • Systemic safety review
Montana DOT	US	• Collision data • Public concerns • Safety audits • Systemic reviews	Paved shoulders, centerline and shoulder rumble strips, roundabouts, delineation, high tension median cable barrier/guide rails.	None - fyi Montana law bars the use of automated enforcement	Primarily network screening and systemic safety analysis.

Agency	Country	Data sources for rural safety concerns	Common Rural Safety Countermeasures & Speed Strategies	Common Rural Road Safety Technologies	Methods/Tools to Identify High-Risk for the implementation of countermeasures
Pennsylvania DOT	US	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	For segments we use rumble strips (both centerline and edge-line/shoulder), clear-zone improvements (removal of roadside hazards, installation of recoverable shoulders, etc.), horizontal curve enhancements (high friction surface treatments, shoulder widening, pavement marking enhancements, enhanced curve warning or chevron alignment signs). for intersections low-cost countermeasures such as signage enhancements and pavement marking enhancements are commonly installed. use of our intersection control evaluation policy is encouraged when a location shows an excess of collisions on our network screening to evaluate alternative configurations. at more moderate costs we see countermeasures like re-alignments to eliminate intersection skew, sight distance improvement via earthwork (grading), and alternative intersection designs. attached to question 8 is our highway safety program guide. chapter 5 contains details on recommended countermeasures for various collision types. while it is not specific to rural roads many of these are applied on rural roads.	There are none that are commonly used, however several intersection conflict warning systems are installed throughout the state. there are several sequential chevrons installations. PennDOT has several trailer mounted speed feedback devices which are rotated throughout the state. many other countermeasures to address rural road safety.	Our primary method is network screening. in pa we screen our roadway network using design level safety performance functions which consider the facility type, traffic data, and adjustment factors for roadway characteristics (access density, curve density, roadside hazard rating, and more dependent on the facility type). We leverage systemic screenings to address specific collision types and risk factors. Field reviews are completed on an as need basis, usually when attempting to move forward with a project. PennDOT has a system in place for public concerns. Most of the items addressed are traditionally considered maintenance such as potholes, drainage issues, and vegetation overgrowth. These items can impact safety and are typically addressed asap.
South Dakota DOT	US	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	Wide shoulders, centerline and edgeline/shoulder rumble strips, enhanced curve signing, wide clear zone, speed feedback signs on curves, intersection improvements such as signing, transverse rumble strips, fixing skew angles, alternative intersection types.	Variable speed limits, radar speed feedback signs.	Network screening for overrepresentation of collisions plus network predictive analysis for potential high-risk locations.
Vermont Agency of Transportation	US	• Collision data • Speed studies • Traffic volumes • Public concerns • Safety audits • Systemic reviews	Enhanced signage, intersection improvements, rumble strips, paved shoulders, roadside hazard removal, guardrail, roundabouts, pavement markings, delineators, safetyedge (a 30-degree angle placed at the edge of newly installed asphalt).	We used in the past dynamic intersection warning systems. we allow via permit local municipalities to install speed feedback signs.	• Network screening, • Systemic safety screening, • Staff reviews of public complaints.

Table A 4: Speed Management Strategies

Agency	Country	Does your jurisdiction regularly review or adjust speed limits on rural roads? If yes, what factors does your jurisdiction consider when setting and/or adjusting speed limits on rural roads (e.g., road geometry, land use, traffic volumes, presence of vulnerable road users, collision history, etc.)?	Speed Strategy Effectiveness (1–5) (1 = not effective, 5 = very effective).	Does your jurisdiction have any experience or practices related to adjusting speed limits on rural roads? If yes, please provide a brief description of your approach or any relevant examples.
Queensland DOT	Australia	Yes, using: Collision Data Infrastructure Risk Rating Speed Data Other considerations - such as schools, grade, townships, intersections.	2	Yes, we have had a lot of 100km/h roads reduced to 80km/h where the collision rate particularly lent itself to reducing this.
BC MOTI	Canada	No, but adjust speed limits based on request and specific needs or changes to the road environment.	3	Yes, the ministry adjusts speed limits based on changing needs.
City of Calgary	Canada	No	3	No
City of Ottawa	Canada	Currently this is done reactively; however, with the adoption of a new speed zone policy, this will change to proactively utilizing data/Safe systems approach and pivoting away from 85th percentile speeds.	3	A great deal of experience. However, currently there is no rural-specific policy/justification/context in the existing speed zone policy. The new speed zone policy will consider both rural context as well as surface (gravel).
Halton Region	Canada	Speeds are reviewed using tac speed limit evaluation methodology		Tac speed limit evaluation methodology
New Brunswick DOTI	Canada	--	3	Our speed limits are typically applied consistently so that the public knows what to expect. School, community, geometric deficiencies zones are reduced.
Niagara Region	Canada	Recent update to Niagara's speed limit policy re-affirmed use of tac guidelines for determining speeds on all regional road segments. review rural road speed limits on a request basis.	2	Per above, we recently reaffirmed via council policy our practice of following tac, in attempt to avoiding artificial lowering of speed limits based on complaints or political requests. that said, there are examples across the region where limits have been lowered below tac recommendations in past, and we are not looking to adjust those if already in place. time will tell if attempt to re-enforce tac adherence will be effective.
Town of Milton	Canada	No	1	We were asked to review the rural speed limits many years ago, and did not support lowering them from 80 to 70, but council overturned our recommendation, and they were reduced to 70 km/h
York Region	Canada	Road geometry, lane use, presence of vulnerable road users, hamlet, etc.	3	
Montana DOT	US	Limited ability to alter speed limit in Montana. set by state law, speed studies do allow some variance. here is information on that process. https://www.mdt.mt.gov/visionzero/roads/speed-limits.aspx	Effectiveness hard to rate due to limited strategies.	See website link in #12 for more information. also - did not answer #13 - it's difficult to rate effectiveness of speed management strategies as we have few to utilize.
Pennsylvania DOT	US	No, the method by which our speed limits are set in pa is codified in state law. we do perform studies on roads that have projects which may impact the safe speed, or if a study is initiated by a local government. we have found changes to speed limits need to be addressed on a contextual level, not just installing a new sign. see **PennDOT publication 46, 212 and title 75**.	4	We have a traffic engineering study form for setting speed restrictions (te-101) which applies to all area types. for a speed restriction to be effective there has to be a contextual element that encourages the driver to comply with the new speed restriction.
South Dakota DOT	US	I am not sure if we necessarily regularly review, but we do review as necessary based on the listed criteria as well as speed study data. we have committee called the safety and speed management board that meets monthly to discuss any locations needing review and discussion.	4	Yes. speed studies and 85th percentile speed have been the historical way to come up with recommending speed limit studies, however we have added the safety and speed management board and that team has been using NCHRP 966 tool to take into consideration. ultimately, the department gives a recommendation and the state transportation commission has the final say on the ruling.

Agency	Country	Does your jurisdiction regularly review or adjust speed limits on rural roads? If yes, what factors does your jurisdiction consider when setting and/or adjusting speed limits on rural roads (e.g., road geometry, land use, traffic volumes, presence of vulnerable road users, collision history, etc.)?	Speed Strategy Effectiveness (1–5) (1 = not effective, 5 = very effective).	Does your jurisdiction have any experience or practices related to adjusting speed limits on rural roads? If yes, please provide a brief description of your approach or any relevant examples.
Vermont Agency of Transportation	US	Road geometry, land use, traffic volumes, presence of vulnerable road users, collision history, 85th percentile speed		Speed limits must, by law and in accordance to the federal manual on uniform traffic control devices (MUTCD), be set on the basis of an engineering study. the study will take into account the current speeds, particularly the 85th percentile speed, which is the speed below which 85 percent of the drivers are traveling. in a sense, drivers vote with their right foot. the speed limit should be set at the 85th percentile speed, rounded to the nearest 5 mph, unless there are other factors that necessitate a different speed limit (hazards that drivers are not perceiving correctly, for which other mitigation measures have already been implemented or are not feasible). such factors include roadway geometry such as curves or limited sight distance, parking or pedestrian activity, or a high occurrence of collisions related to excess speed. other mitigation measures could include improving sight distance, adding warning signs, increasing enforcement activities, installation of radar speed feedback signs, restricting parking, or improving pedestrian facilities. an engineering study can result in a recommendation to raise the speed limit, based on the prevailing speeds and an absence of collision history due to excessive speed.

Table A 5: Vulnerable Road Users Rural Road Safety Strategies

Agency	Country	How does your jurisdiction address safety for vulnerable road users (i.e., pedestrians, cyclists, and recreational users) on rural roads?	Given the low volumes of vulnerable road users on rural roads, does your jurisdiction have any specific warrants or methodology for selecting measures to enhance the safety of pedestrians and cyclists? Please describe your approach or indicate if none are in place.	Does your jurisdiction have any specific policies, guidelines, or signage used to manage interactions between farm vehicles and other vehicles?
Queensland DOT	Australia	Wider shoulders for cyclists, and warning signs about their presences. School bus advisory signs to warn of pedestrians being present.	No, we use a principal cycle network approach, irrespective of volumes, to identify the need.	There is some signage permanently in place about trucks using certain sections of roads. During cane season temporary signage is put in place warning of the trucks being about, as well as the cane trains. There is signage and guidance related to the cane trains.
BC MOTI	Canada	We refer to the BC active transportation design guide. This document is available online and is currently being updated.	The ministry has warrants for pedestrian crossing. This can be found in the pedestrian crossing control guide (available online) which is being updated.	The ministry has signage specific for slow moving farm equipment vehicle. (sign catalogue is available online).
City of Calgary	Canada	We try to provide off-street active modes facilities (mainly pathways) where there are developments next to rural roads.	None	None
City of Ottawa	Canada	Paved shoulders, installation of push buttons at rural intersections, roundabouts with PXOs, signage, school zones, streetlighting, education.	Ladder marking warrants, PXO warrants at roundabouts (OTM Book 18)	No specific policies, guidelines or signage. The City of Ottawa uses OTM guidelines.
Halton Region	Canada	Paved shoulders through state-of-good repair resurfacing projects - PXOs where warranted/justified - enhanced signage and pavement markings	No methods in place	None

Agency	Country	How does your jurisdiction address safety for vulnerable road users (i.e., pedestrians, cyclists, and recreational users) on rural roads?	Given the low volumes of vulnerable road users on rural roads, does your jurisdiction have any specific warrants or methodology for selecting measures to enhance the safety of pedestrians and cyclists? Please describe your approach or indicate if none are in place.	Does your jurisdiction have any specific policies, guidelines, or signage used to manage interactions between farm vehicles and other vehicles?
New Brunswick DOTI	Canada	Our draft policy does not allow official trails on roads with speeds at 70km/h or more. Municipalities manage their own facilities.	When there is an official trail, we do allow for a paved shoulder on both sides of the road. **Guidelines for Shoulder Treatment shared.**	--
Niagara Region	Canada	We don't have anything specific for VRUs on rural roads, though each identified as emphasis areas under our road safety plan separately. our largest area of focus will be revising our active transportation network through an upcoming update to our TMP, which will reaffirm what rural roads should be prioritized for at infrastructure. 1.5m paved shoulder with edge marking.	None, specific to rural roads.	"caution slow moving vehicles with symbol applied in selected areas.
Town of Milton	Canada	We really don't have anything in place other than the installation of share the road sign	No	We at times may install a farm vehicle warning sign
York Region	Canada		Hamlet gateway sign	
Montana DOT	US	Case by case basis. in one instance, to remove pedestrians from using the highway bridge, a separate path & bridge were built. Wider shoulders are another option.	No warrants or methodology have been developed.	No
Pennsylvania DOT	US	In pa the focus for VRU safety is mainly targeted at urban areas due to the collision history. in pa 96% of VRU collisions between 2015 and 2021 (excludes 2020 due to covid-19 lock downs) occurred in urban areas while the remaining 4% occurred in rural areas. throughout rural pa we have a large population of plain people communities. design guidance for areas with plain people communities was added to PennDOT publication 13: contextual roadway design which address specific needs these communities may have such as wider shoulders. we have also included a countermeasure toolkit in chapter 6 of our VRU assessment which includes guidance on deployment of certain countermeasures based on area type. lastly, rural pa is home to many trail crossings which receive VRU enhancements to increase awareness of hikers and cyclist which maybe crossing.	There are currently no specific warrants for selecting measures to enhance the safety of VRUs on rural roads. Provided the Pennsylvania a- VRU Safety Assessment Report	There is no specific guidance. however, PennDOT approves the use of w11-5: farm machinery warning sign to warn of unexpected or frequent crossing of farm equipment. we require farm equipment to have "slow moving vehicles" emblem displayed on the back. we also have the plain people community (Amish) signs and the horse and buggy operators guide which is not required to operate a horse and buggy.
South Dakota DOT	US	The department uses high visibility signing primarily for rural crossings. if it is determined more is needed due to a high volume crossing on a rural road (this is very rare in South Dakota) then we would review it on a case-by-case basis. however, there are cases when pedestrian usage is relatively high on the side of the road rather than crossing that has led to shared use paths and/or lighting.	Not specific warrants. there are rare cases where high bicycle usage has led to the dot not installing shoulder rumble strips. the department has tap grants communities can apply for to get shared use paths, which is the most effective way to improve VRUs on rural roads.	I am not aware of anything. if there is a relatively high amount of farm and/or truck traffic entering a highway, appropriate signing is installed.
Vermont Agency of Transportation	US	By providing 3-4 foot shoulders when feasible on paving projects, instituting a 4ft passing law, street sweeping in the spring. by providing grants to municipalities for infrastructure projects that improve access and safety for bicyclists and pedestrians through the planning, design, and construction of infrastructure projects.	We developed a map identifying which roads in the state have the highest bicycle use. those roads are prioritized for street sweeping and shoulder widening. the map was developed using crowd sourced data and recreational datasets. https://vtrans.vermont.gov/planning/bikeplan	Cattle crossing/farm machinery signs are installed upon request of the farmer and should be removed when obsolete. they may be displayed seasonally as the farmer may agree to remove the sign and post from the anchor for storage during the off-season, and install a delineator with post to protect the anchor. we use the static sign from the MUTCD w11-5

Table A 6: Challenges, Best Practices, and Recommendations from Jurisdictions

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
Queensland DOT	They are investigated by an officer and responded to.	Impacted locals are engaged/informed of the upcoming changes.	Mainly fatigue related ones.	both TMR and police enforce speeds on rural roads.	The length of the network, the differing pillars of the safe system, and the communities' expectations. With big distances in Queensland, dropping speeds is not always the option, and we have a lot of unsealed roads.	There have been a number of instances, where for shorter roads (less than 30km) speed drops have occurred that have effectively removed all fatal collisions from roads which regularly had a fatal a year, such as Glasshouse Mountain Road, Caboolture-Bribe Island Road, Nambour-Bli Bli Road, Yandina-Coolum Road, Eumundi-Noosa Road.	
BC MOTI	Local district is the first point of contact and may review the issue in consultation with traffic engineering and or highway safety. further actions depend on the outcome of the initial review.	Engagement is on a case-by-case basis depending on the scale and impact to residents.	The ministry works in partnership with ICBC to deliver educational and awareness campaign. the ministry also has its own social media team that put out information on a regular basis.	Everything related to MVA infractions.	Funding, lack of electrical power in some locations, changing weather, enforcement	High Friction Surface Treatment (HFST), Variable speed limit signs (VSLS	
City of Calgary	We respond to public inputs via 311 and councillor's office, news media and other channels	We do not have specific measures to engage rural residents	None	Same role citywide, we're not aware of specific law enforcement campaigns for rural road safety	As the city expands, we may be incorporating lands from adjacent rural counties and will need to adjust our practices to specifically address rural road safety. currently, this is not a priority for us as rural roads represent a negligible portion of our network.	Not at this time	The provincial agencies (BC MOTI, MTO, SASK ministry of highways, etc.) would be best suited to answer concerns with rural road safety.

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
City of Ottawa	Conduct safety reviews and warrants (e.g., traffic signal warrants, guardrail warrants).	Agriculture and Rural Affairs Committee, Rural Summit 2024, public consultation (engage.ottawa.ca website, feedback surveys, virtual or in-person public information sessions)	• The City of Ottawa's 'Time is Precious' ad campaign features Rural Road Safety ads throughout the month of May. Ads can be found on the 'Time is precious' ad campaign website. • ATV Education and Public Outreach, including ATV training and snowmobile safety presentations to schools in rural areas. • Bike rodeos hosted by rural ward councillors • Police Week events in rural areas • Toe Tag Event at Osgoode High School, where Ottawa Police, Paramedics and Fire Services collaborated with Safer Roads Ottawa to reenact a drunk driving accident to the students and show them the consequences of impaired driving (see CTV news article) See Safer Roads Ottawa Program for Events, Awareness Campaigns, and Community Tool Kit.	The Road Safety Unit provides lists of locations of concern to Ottawa Police Services. For the Operation Clear Track initiative, OPS officers perform traffic stops to remind drivers not to stop on railway tracks at railroad crossings. ATV Education and Outreach: Road Safety Unit partnered with Ottawa Police Services and OFATV to deliver presentations to rural high schools and middle schools and educated them on proper use of the ATVS.	Given the vast and dispersed rural road network, it is challenging to identify and prioritize high-risk locations and secure funding for network-wide safety improvements. In terms of implementation, challenges include engineering constraints, property requirements, private access management, coordination with other City programs & projects, and consultation with stakeholders.	• Rumble strips, Safety Edges, and guardrail improvements have been incorporated into the road resurfacing program. • In-Service Road Safety Reviews • Road Safety Audits are now proactively implemented on City-led roadway design projects • Red light camera network screening and implementation	• City of Ottawa Road Safety Action Plan • City of Ottawa Road Safety • City of Ottawa Design Guidelines for Rural Villages • The City of Ottawa has developed a Motorcycle Safety Strategy, which includes recommendations for curved road segments on rural roads. Document has been provided.

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
Halton Region	Intersection/road segment is reviewed in field to determine existing conditions - traffic data (collisions, volumes, vehicle class, speeds, etc.) are reviewed - engineering judgment using data above relative to the nature of the complaint/concern - consultant reviews if deemed necessary	Road safety decisions are communicated directly to the resident/stakeholder that initiated the request to review - if councillor is involved, decisions are also communicated to the councillor so they can keep residents/stakeholders apprised during their town hall/community meetings - social media broadcasts may be used	None	Law enforcement is critical to achieving greater speed and stop compliance.	- as we are regional, all of our rural roads are arterial with high design speeds and mixed traffic. - limit traffic calming measures due to arterial roads - upkeep of vegetation removal / sightlines improvements during peak growing season (late spring to early fall).		
New Brunswick DOTI	Complaints are directed to our Minister, Operations email, or local Districts for response. If there is an action it is assigned to the appropriate branch to respond and investigate.	If within a municipality, we meet with them. An open meeting may be held if it is a large change. Otherwise, a sign is often placed indicating a change.	None that I am aware of. On larger projects we post information on our website and the municipalities'.	RCMP patrol our roads outside of most municipalities. Local police have speed traps occasionally, enforcing red-light and other violations. In problem areas temporary speed warning signs are installed. The RCMP provide us with collision data.	Funding and resources are a big one. The other hurdles would be property, environmental, utilities.	Restricting the width of driveway openings, maintain striping and brush cutting	
Niagara Region	Road safety team has internal project management portal (WRIKE) that is used to log and track all road safety complains.	Engagement typically conducted through EA process.	None currently. One will be developing over coming year as part of road safety plan.	Niagara regional police have an “Enforcement hotline” for road safety complaints.	1. majority of fi collisions occur on denser urban arterial roads, which drives our focus and investment. 2. can be harder to target specific locations for countermeasures serious collisions on rural roads are spread out over much larger geographic area		Look forward to the end result. I think that traffic calming/countermeasures for rural roads is a bit of an underdeveloped area of practice, and expect it to be a similar area of focus when we look to develop our own traffic calming guidelines later this year.
Town of Milton	We will review the roadway, conduct 24 hour speed studies, complete a collision analysis and do a TMC if required - depends on the nature of the complaint	PIC’s, attending community rural meetings, surveys	We make use of roadside signage for our safety campaign, use outdoor signs located outside of community centres	Our regional police will conduct speed enforcement for us. we have a great relationship with them. we will send them a detained letter and attachment with the speeds and times etc. so they can make the best use of their time.	Alot of our rural roads are commuter roads so only busy during the am and pm peak periods. cyclists use our roads a lot on the weekend as well	No	Would be interested in the results of this study and would love to see the safety toolbox when completed

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
York Region				York regional police conduct targeted enforcement			
Montana DOT	Yes	During project development, MDT engages the public with written notice for comments and/or holds project or corridor specific public meetings.	Our planning department has a media contract to educate the public on traffic safety. many of these are rural road related (occupant restraint, impaired driving, distraction, etc)	N/a - Montana law prohibits these types of countermeasures.	Long distant driving, high rural speeds, lack of seat belt use, EMS travel time to/from collision site	Systemic applications have been successful in addressing the randomness of collisions. we developed thresholds and rational for initial centerline rumble strip installation (approximately 3000 miles) and high-tension median cable barrier/ guide rail. by using data to determine the locations for installation, our agency was able to spread our limited financial resources further.	No.

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
Pennsylvania DOT	Public concerns on rural roads are addressed by traffic unit in the engineering district that the concern is located in. certain concerns such as obstructed/missing signs or potholes are addressed asap with maintenance personal, while other concerns may require a study, or field investigations to properly address.	Stakeholders (law enforcement, ems, public health, planning organization, others) and the public are engaged in the preparation of our strategic highway safety plan and its appendix the VRU safety assessment. these documents identify priority emphasis areas and strategies to improve the safety outcomes in the areas. stakeholders, businesses and the public are engaged during the planning, design and construction phases during major safety projects via public meeting, and other outreach during site visits.	Most of our education and media campaign revolve around targeted collision types or road user behaviors, not the area type. for instance, the "be safe pa" campaign focused on speeding, seat belts usage, distracted driving, and impaired driving. the campaign involved radio advertisement, digital (google ads) advertisement, and social media. we have safety press officers throughout the state which organize and participate in school outreach programs, host media events to help educate road users on safety messages and support local safety programs. while these programs may not focus directly on rural roads the materials and messages that are distribute apply to users of our rural road system.	PennDOT partners with and administers highway safety funding to the Pennsylvania State Police (PSP) and local law enforcement agencies to enable targeted traffic enforcement efforts. this includes but is not limited to speeding, aggressive driving, distracted driving, impaired driving, and occupant protection.	Pa has a vast rural road network and at times it becomes difficult to get the required buy-in from shareholders to prioritize rural projects that will have good return on investment. we have many shareholders that would choose a more in-depth spot specific treatment over systemic options that are more cost effective at reducing fatalities and serious injury collisions. planning level analysis such as the network screening help to bring more attention to rural locations that have safety concerns and systemic risk assessments help to inform the creation of good systemic projects. we also see more typical challenges such as available funding, aging infrastructure, politics in project selection, and revolving staff which creates gaps in expertise required for safety analysis and project section.	PennDOT recently partnered with Pennsylvania state university to develop collision modification factors for high friction surface treatments, and high-tension cable median barriers/guide rails. we found great success with HFST in both rural, and urban setting for horizontal curves, and for treating intersection approaches. htcmb has shown great returns in reducing high severity cross over collisions on our divided highways.	

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
South Dakota DOT	There are a variety of ways concerns can be brought to the department, whether through the governor, department secretary, field offices, the highway safety engineer, etc. generally, the highway safety engineer or other safety staff will review the collision history and any geometrics that may be of concern and work with field staff to do any extra analysis that may be necessary (sight distance, etc). any recommendations for changes can simply be made (if any are deemed necessary), or if it is more complex, a road safety audit can be set up. the department will at a certain point reach back out to the concerned.	Depends on the situation. if it is a safety project (or other type of project of significance that will be looking to improve safety) during planning, the department will have stakeholder and public meetings. during this time, stakeholders and the general public can see the options being discussed and give input. generally if it is smaller improvements, a concerned citizen would likely be contacted, as well as nearby stakeholders could be. social media and legacy media sources are used in cases of a major change such as a change from two way stop control to all way stop control. dms and other signing will also go out in advance to alert them of the change.	Yes. the department typically focuses on infrastructure campaigns for things like ddis, roundabouts, etc that may be new as well as things like don't crowd the plow. the department of public safety's office of highway safety does most of the public education on driver safety.	Speed enforcement, other traffic violations, saturation patrols, sobriety checkpoints.	The state as a whole has roughly 80,000 miles and most of our fatalities happen at generally random locations. the dot is the owner of approximately 7,800 of those miles but works to improve safety through the entire state. with so many miles and the randomness of severe collision locations, it is difficult to make as much impact as we would like. therefore, we put the biggest dollar projects on the highest volume roads and spread smaller cost projects on as many miles as we can.	South Dakota has won awards for our implementation of high friction surface treatment to reduce winter road collisions on curves. the following report is from 2015, but we have continued to use this countermeasure to great success. https://www.fhwa.dot.gov/innovation/grants/projects/sd_2015_finalreport.pdf	

Agency	How does your jurisdiction manage and respond to public complaints or concerns relating to rural road safety?	How does your jurisdiction engage rural residents and stakeholders when making road safety decisions?	Does your jurisdiction implement any educational or awareness campaigns focused on rural road safety?	What role does law enforcement play in your jurisdiction relating to rural road safety?	What challenges does your jurisdiction face in improving rural road safety?	Successful Countermeasures / Case Studies	Other Suggestions for Hamilton's Rural Road Safety Toolbox?
Vermont Agency of Transportation	We have four regional investigators divided into four parts of the states. they respond to original public concerns. they perform traffic investigations and try to mitigate issues with signs and markings.	We have on-site meetings or public meetings as part of the design process.	We have campaigns on behavioral safety https://shso.vermont.gov/content/media	They conduct enforcement related to speed, distracted driving, impaired driving, seat belt use.		We implement systemic countermeasures related to lane departure and intersection collisions with our paving projects. we implemented all-way stop control at a few intersections and saw an overall 54% reduction in collisions. we have a 20% reduction in collisions on roads with centerline rumble stripes.	We have a lane departure countermeasure matrix (https://vtrans.vermont.gov/document/ldrtmitigationmatrix) that is associated with a risk-based screening https://experience.arcgis.com/experience/8fbf1219c6974c12a3cc545b80fc1ba0/page/main-page). we also have a speed management toolbox that was developed for us by uvm https://vtrans.vermont.gov/sites/aot/files/research/20230606%20toolbox.pdf related to question 18: we use national guidance rather than vtrans specific bike ped design manuals. however, there is an vtrans complete streets guidance (https://vtrans.vermont.gov/sites/aot/files/highway/documents/publications/2023%20cs%20guide%20v.7%20-%20final.pdf). vtrans ped crossing guide https://vtrans.vermont.gov/sites/aot/files/highway/documents/ltf/vtrans%20ped%20crossing%20guide%20august%202019%20update.pdf

Table A 7: Jurisdictions Invited to Participate in the Survey

ID	Jurisdiction			ID	Jurisdiction	ID	Jurisdiction	ID	Jurisdiction		
1	City of Ottawa	7	Halton Region	13	Québec	19	New York State DOT	25	Kansas DOT	31	Minnesota
2	City of London	8	Peel Region	14	Manitoba Infrastructure	20	Ohio DOT	26	Nebraska DOT	32	Queensland, Australia
3	City of Edmonton	9	Ontario Ministry of Transportation	15	Alberta Transportation	21	Wisconsin DOT	27	Idaho DOT	33	England
4	City of Halifax	10	Nova Scotia	16	Yukon	22	Connecticut DOT	28	Montana DOT	34	Illinois DOT
5	City of Regina	11	Nova Scotia Transportation & Infrastructure Renewal	17	NT	23	Michigan DOT	29	North Dakota	35	Minnesota Department of Transportation

ID	Jurisdiction			ID	Jurisdiction	ID	Jurisdiction	ID	Jurisdiction		
6	Region of Durham	12	New Brunswick Department of Transportation and Infrastructure	18	New Hampshire DOT	24	Maine DOT	30	Missouri		

B

Appendix B Rural Road Safety Toolbox

Overview

The Rural Road Safety Toolbox has been developed as a user-friendly tool to support the City of Hamilton in systematically assessing rural road safety risks and identifying context-sensitive countermeasures. The Toolbox provides a structured, data-informed process that integrates findings from the environmental scan and systemic safety review, with City-specific roadway configurations and related countermeasures identified through field investigations.

The findings of the environmental scan and the field investigation directly informed the development of the diagnostic matrices and the selection of countermeasures by identifying which treatments are most appropriate and effective for specific collision scenarios and contributing factors.

Designed to support engineering and operations staff, the Toolbox enables users to analyze common collision types or safety issues observed on Hamilton's rural road network and to diagnose underlying risk factors. Based on site-specific conditions, the tool generates targeted safety countermeasure recommendations tailored to each scenario.

It is important to note that the Rural Road Safety Toolbox is intended as a guidance and decision-support tool, not as a regulation, standard, or mandatory procedure. It is not intended to be universally applicable to all locations. Its application is expected to rely on professional engineering judgment, informed by site-specific conditions, roadway function, traffic volumes, operating environment, and the nature and magnitude of the safety concern. The decision to apply or not apply the toolbox, and the interpretation of its outputs, are intended to be based on reasonable professional judgment.

Proposed Framework for Using the Toolbox

CIMA+ envisions the Toolbox as a practical guidance and decision-support tool for the City of Hamilton to conduct in-service road safety reviews or address specific issues (e.g., sightline concerns at an intersection or speeding along a road segment). The Toolbox is intended to assist staff in identifying potential safety issues and appropriate countermeasures; however, it is not meant to serve as a definitive solution for all situations. Rather, it is designed to support professional judgment and engineering expertise.

Figure B 1 illustrates the proposed framework for using the Toolbox. The framework reflects the City's typical day-to-day processes and is structured to support staff in carrying them out effectively. The diagnostic questions included in the Toolbox are based on issues commonly observed on rural roadways and are intended to guide the assessment of safety concerns, prioritization of actions, and identification of potential countermeasures. As new issues are identified over time, the Toolbox may require refinement. Responses to individual yes/no questions should therefore be interpreted in the context of site conditions, field observations, and professional engineering judgment.

The framework begins when a safety issue is reported, typically by the general public or other municipal departments. The next step is to determine whether the issue is associated with a high-priority location. This assessment can draw on two resources: a) rankings generated from network screening and b) rankings from the systemic safety review presented later in this report. The definition of high-priority locations is subjective and depends on the City's context and available resources in a specific year. For example, top 10 locations or within the top 1% of all ranked locations.

If the issue involves a high-priority location, it should already be on the City's radar for a future detailed investigation (i.e., an in-service road safety review). The Toolbox provides diagnostic questions and countermeasures to assist with this process.

If the issue does not involve a high-priority location, the Toolbox can be applied to determine whether actual safety concerns exist. If issues are confirmed, the Toolbox will suggest countermeasures for implementation or further investigation. If no issues are found, no further action is required.

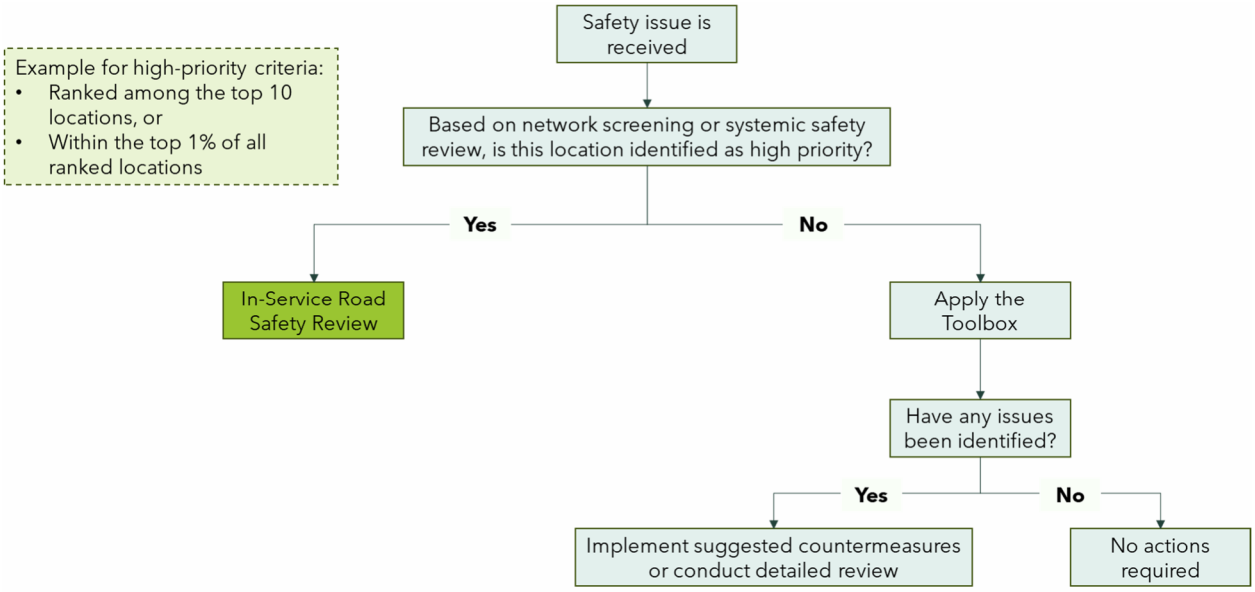


Figure B 1: Proposed Framework for Using the Toolbox

Collision Thresholds

One of the features of the toolbox is to recommend actions or countermeasures based on the observed frequency of collisions at a given site. Hence, it is important to have measures that indicate the level or magnitude of collisions at a location relative to overall trends across similar sites. While generic collision thresholds are available in the literature, they are often developed for urban environments and are not directly applicable to the City's rural road network. To address this, we used a data-driven approach to tailor collision thresholds specifically for the City.

The thresholds were established using four levels of collision frequency: frequent, occasional, infrequent, and rare. For each level, the corresponding collision frequency was calculated separately for different collision and facility types. Collision types were defined based on the "Issue Types" in the toolbox.

The method for establishing the thresholds relies on the average and standard deviation of collision frequency. **Figure B 2** provides an example for two-way stop-controlled intersections with sightline issues. The following considerations were applied: (1) sightline issues are represented by angle and turning-movement collisions, and (2) a five-year collision history (2017–2019; 2022–2023, excluding years directly impacted by COVID-19) was used to calculate the thresholds.

Figure B 2 shows that 79.8% of two-way stop-controlled intersections in the City's rural network did not experience any collisions during the five-year period, 10.0% experienced one collision, 4.3% experienced two collisions, and so on. The average (0.53) and standard deviation (1.67) were calculated, and thresholds were defined as follows:

- **Rare:** frequency below the average (0 collisions)
- **Infrequent:** frequency between [average; average + 1 standard deviation] (1–2 collisions)
- **Occasional:** frequency between [average + 1 standard deviation; average + 2 standard deviations] (3–4 collisions)
- **Frequent:** frequency above [average + 2 standard deviations] (5 or more collisions)

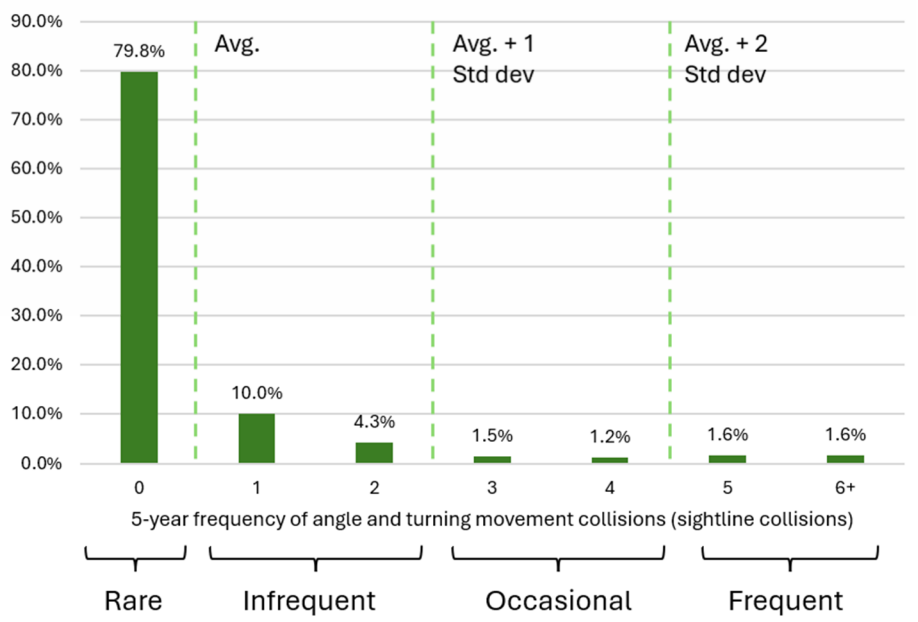


Figure B 2: Method for Collision Thresholds – Two-Way Stop Controlled Intersections – Sightline Collisions

A similar process was applied to other issue and facility types, and the resulting thresholds are presented in **Table B 1**. For road segments, thresholds were normalized by segment length and calculated using annual average collision frequencies (from 5-year periods). **Table B 1** does not include all issue types available in the toolbox, as some associated collision types occurred too infrequently to allow reliable threshold determination – for example, speeding-related collisions at stop-controlled intersections.

It is important to note that the toolbox does not focus solely on fatal and injury collisions. While these severe collisions are of primary concern, on rural roadways the overall collision frequency is low, and fatal and serious injury collisions are even rarer, so they may not always provide sufficient information on individual locations. Many of the risk factors that contribute to severe collisions, such as speeding, limited sightlines, or operational conflicts, tend to manifest first as PDO collisions, minor collisions, or near misses. By including these lower-severity events in the analysis, the toolbox allows for the proactive identification and mitigation of potential safety issues before they result in severe outcomes, aligning with the Vision Zero approach to road safety. For some issues under specific review, collision thresholds could not be established due to extremely low occurrence; in these cases, the toolbox notes that thresholds are not available.

Table B 1: Thresholds for Different Issue Types

Facility type	Issue type	Collisions involving	Detailed facility type	Unit	Category			
					Rare	Infrequent	Occasional	Frequent
Segment	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit" + any fatal or injury collisions	All	Considering 5-year collision history: annual collisions per km	0 to 0.10	0.10 to 0.30	0.30 to 0.50	> 0.50
	Roadside	Driver at-fault event is related to roadside characteristics, such as ran off road, hitting ditches, guiderail, poles, trees, among others	All		0 to 0.10	0.10 to 0.40	0.40 to 0.65	> 0.65
Unsignalized intersection	Stop non-compliance	Driver at-fault action is either "Disobeyed traffic control" or "Failed to yield right-of-way	Two-way stop	Frequency of collisions in 5-year period	0	1	2	> 2
			All-way stop		0	1	2	> 2
	Sightline	Angle or turning movement collisions	Two-way stop		0	1 or 2	3 or 4	> 4
	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit"	Two-way stop		Frequency of collision is too low to establish reasonable thresholds			
			All-way stop					
Signalized intersection	Red-light running	Angle collisions	All		0 to 3	4 to 6	7 to 9	> 9
	Speeding	Driver at-fault action is either "Speed too fast for condition" or "Exceeding speed limit"			0	1	2	> 2

Note: For some issue types, collision thresholds could not be established due to extremely low occurrence

Speed Threshold for Identifying Speeding Issues

Speeding remains a primary contributor to the frequency and severity of collisions on rural roadways, where limited roadside recovery areas, variable land uses, and constrained geometry significantly elevate safety risks. Speeding issues are not solely attributable to posted speed limits but reflects a complex interaction between driver behavior, roadway design, environmental context, and the level of enforcement. In rural settings, where driver expectations may not align with the design intent or functional classification of the road, elevated travel speeds can increase the likelihood and severity of collisions.

A comprehensive assessment of speeding-related safety concerns must incorporate both quantitative and qualitative indicators. This involves comparisons of posted speed limits, 85th percentile operating speeds, and the contextual consistency of the roadway's function and design. The 85th percentile speed, which is commonly referred to as the operating speed, represents the speed at or below which 85% of drivers travel under free-flow, low-volume conditions. It is widely accepted as a reliable indicator of the speed drivers feel comfortable maintaining, regardless of posted limits. In rural areas with low daily traffic volumes, such as those within the City's network, operating speeds are typically unaffected by congestion and therefore reflect natural driver behavior.

To establish thresholds for identifying speeding issues within the City's rural road network, we analyzed GPS-based connected vehicle (CV) data across the entire network. The objective was to calculate the 85th percentile speed for roads with different posted speed limits and to assess the resulting speed differential (i.e., 85th percentile speed minus the posted speed limit) in order to define appropriate speeding thresholds.

Table B 2 summarizes the number of CV observations available for each posted speed limit, along with the corresponding 85th percentile speeds and speed differentials. Approximately 3,000 rural segments were included in this analysis. Provincial and private roads were excluded.

Table B 2: Summary of Speed Observations

Speed Limit (km/h)	Sample Size	85th Percentile Speed	Speed Differential (km/h)
40	1,542	71	31
50	8,808	69	19
60	36,320	77	17
70	25,864	83	13
80	85,032	96	16

On roadways posted at 70 km/h and 80 km/h, the 85th percentile speeds are, on average, 15 km/h higher. For roads posted at 50 km/h and 60 km/h, the difference increases to approximately 18 km/h, and on roads posted at 40 km/h, the difference reaches as much as 31 km/h. These findings align with the concept of desired speed, which represents the speed drivers naturally adopt and maintain in unconstrained environments, often consistent with the geometric design and perceived function of the road.

It should be noted that for 40 km/h and 50 km/h roadways, the available dataset did not differentiate between surrounding land use context. Within the City, a number of roadways posted at these lower speeds traverse localized residential areas where frontage development, driveway density, on-street activity, and pedestrian presence typically contribute to lower operating speeds. Accordingly, the reported 31 km/h differential on 40 km/h roads likely reflects a subset of lower-speed facilities with limited roadside development or rural characteristics, rather than typical residential streets.

Complementary, we assessed the number of roads that would be flagged as having speeding issues under different threshold scenarios. For example, **Figure B 3** presents the distribution of 85th percentile speeds for 87 roads with a posted speed limit of 60 km/h. The dashed red line represents 75 km/h (i.e., 60 km/h + 15 km/h), a threshold commonly referenced in the literature for identifying speeding concerns on 60 km/h roads. If this threshold were applied in the City, approximately 60% of the 60 km/h roads would be flagged as having speeding issues. From a practical standpoint, this suggests that the 75 km/h threshold may not be appropriate, as it would identify an excessive proportion of roads. Similar analyses were conducted for other posted speed limits and were considered in the decision-making process for establishing the final speeding thresholds.

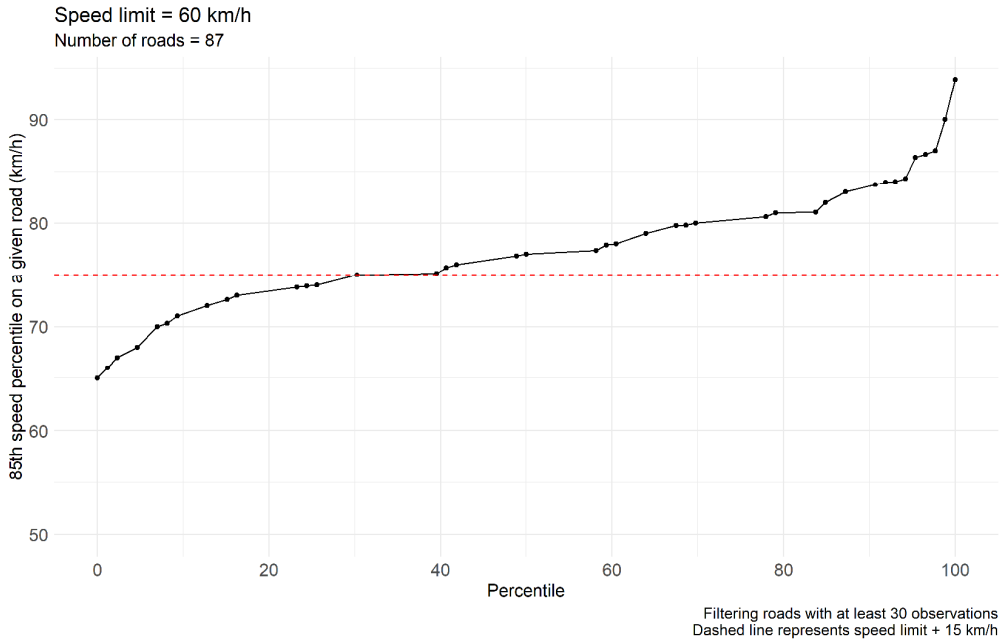


Figure B 3: 85th Percentile Speed Distribution Across Roads with Speed Limit of 60km/h

For identifying road segments that warrant further investigation for speed management interventions, the following thresholds are established for two-lane two-way roadway segments:

- **Speed limit of 40 km/h & 50 km/h (residential areas):** speed limit + 10 km/h
- **Speed limit of 40 km/h & 50 km/h (non-residential areas), and 60 km/h:** speed limit + 20 km/h
- **Speed limit of 70 km/h and 80 km/h:** speed limit + 15 km/h.

In addition, for locations with sharp horizontal curves where advisory speeds are posted, a threshold of 10 km/h exceeding the advisory speed was considered.

For all multi-lane roadways, a threshold of 15 km/h was used.

Usage Guidelines

The first step in using the Toolbox is to define the analysis context. Complete the fields in cells B2 to B5 according to the type of analysis being conducted:

- Cell B2: Facility type
- Cell B3: Sub-type
- Cell B4: Review type
- Cell B5: Collision or issue type

Two types of review are available:

- Detailed in-service road safety review: provides comprehensive assessment of a given segment or intersection based on a specific collision type
- Issue specific review: provides tailored assessment for a particular issue (e.g., speeding or stop sign non-compliance)

The second step is to run the diagnostic and navigate through the diagnostic questions. Five buttons on the left side of the screen are used for this process:

- Start Diagnostic: Click after filling out cells B2 to B5 to display the first diagnostic question
- Yes and No: Use these buttons to answer the current diagnostic question. The user should answer Yes/No until the message “Diagnostic complete” is displayed in the screen
- Go Back: Reverses actions in the following order: countermeasure → answer → question. This allows the user to adjust answers without restarting the entire process. It functions similarly to the “Ctrl + Z” command
- Reset Diagnostic: Restarts the diagnostic from scratch

The third and optional step is to export the diagnostic (i.e., questions, responses, and countermeasures) to a Microsoft Word document. To do this, right-click the Main sheet in Excel and select "Export Diagnostic to Word". This will automatically generate and open a Word document containing the diagnostic table.

Alternatively, the user can export the decision matrix associated with a specific facility type, sub-type, review type, and collision/issue type. It includes all questions, countermeasures, and the logic behind the questions. To do so, right-click the Main sheet and select "Export Questions_Countermeasures (by selection)".

Toolbox: Rationale Behind It

This section outlines the rationale behind the development of the Toolbox. It provides details for each facility type, sub-type, review type, and applicable collision/issue type, along with a complete list of diagnostic questions and countermeasures for each. The diagnostic tables can also be printed directly from the toolbox.

Roadway Segment, Two-lane, Detailed Review

Single Motor Vehicle Collisions

The contributing factors to single motor vehicle collisions on rural highways involve geometrical, operational and environmental factors. These types of collisions often involve vehicles leaving the roadway due to factors such as excessive speed, poor surface conditions, or geometric inconsistencies. Therefore, it is essential to consider elements such as roadside, shoulder width, edge drop-offs, lane width, surface maintenance, sightline adequacy, and the roadside. These features impact vehicle stability and driver control, especially under adverse conditions.

A significant proportion of SMV collisions result in impacts with roadside hazards. To address this, the evaluation should consider the importance of clear zone compliance, presence and placement of fixed objects, barrier/guide rail systems, and the potential for slope recovery. The objective is to assess whether the roadside environment contributes to collision severity or allows for safe vehicle recovery.

The considerations such as traversable slopes, breakaway supports, and barrier/guide rail need or condition are evaluated by established roadside safety standards, including those in the MTO Roadside Design Manual and TAC Guide to Geometric Design of Canadian Roadways.

Clear zones are the unobstructed, traversable area provided beyond the edge of the through travelled way for use by errant vehicles. The clear zone includes shoulders, auxiliary lanes that do not function as through lanes, recoverable and non-recoverable slopes with a clear run-out area. The desirable clear zone values are a function of traffic volumes, design speeds, and roadside geometry. For more information on desirable clear zone values, and further information, refer to the above noted publications.

Fixed objects present within the clear zone are considered roadside hazards and should be treated appropriately. The possible measures include the following in order of preference/priority:

- Removal of the hazard,
- Relocate the hazard outside of the clear zone,
- Minimize the hazard by making it traversable or, in the case of sign supports and posts, by using breakaway devices,
- Shield the hazard with barriers/guide rails or collision cushions, and
- In the absence of other options, improve awareness of the hazard through delineation or other warning devices. [1]

Roadside embankment slopes play a critical role in the safe recovery of errant vehicles that leave the roadway. Recoverable slopes are defined as earth embankment slopes 4:1 or flatter. A non-recoverable slope is defined as one which is traversable, but from which most motorists will be unable to stop or to return to the roadway easily. Vehicles on such slopes typically can be expected to reach the bottom. Further to this, non-recoverable slopes between 3:1 and 4:1 may fall into this category. Critical slopes are defined as foreslopes steeper than 3:1, with an increased probability of errant vehicles overturning.

The roadside within the clear zone should be kept free from any hazards including fixed objects and undesirable embankment slopes. If practically feasible, the hazards should be removed/relocated, slope flattening should be considered, and/or the slopes should be protected by guide rails.

It is recognized that many rural roads within the City were constructed at a time when roadside safety standards were either not yet established or not consistently applied, due to limited awareness of roadside safety principles. Applying current standards uniformly to these legacy roads is not always practical. It is also important to recognize that installing roadside barriers/guide rails is not inherently a safer solution, as they can pose hazards if not warranted.

[1] MTO Roadside Safety Manual, 2020, Section 3.1.4, pg. 3-9.

Before installing a guide rail, it is essential to assess whether it would reduce overall risk or potentially introduce a greater hazard than the object it is intended to shield. For instance, fixed objects such as isolated trees or utility poles located within the clear zone may not be feasible to remove or relocate. In some cases, protecting them with a guide rail may increase risk rather than mitigate it.

Therefore, locations requiring attention should be evaluated using a risk-based approach, such as the methodology outlined in the MTO Roadside Safety Manual.

Many run-off-road incidents are concentrated around curves where operating speeds exceed what the geometry safely accommodates. The rationale included the need to assess curve radii, alignment consistency, advisory speed signage, superelevation design, and pavement condition at these locations. These features influence vehicle dynamics and driver expectation. Emphasis should be placed on ensuring curves are appropriately marked, transitions are smooth, and geometric design matches the posted speeds. Situations where curves follow a formerly tangential alignment or lack visual cues should be considered due to the higher potential for driver misjudgment.

Operating speed is a major risk factor in SMV collisions. The posted speed limits should be consistent with the segment's design and context. Consideration should be given to roadside environment, access density, presence of vulnerable users, and geometric consistency with surrounding roadways. This is particularly relevant in areas with complex terrain, such as the Hamilton Escarpment Conservation Area, or locations with abrupt speed transitions. The posted speeds must be consistent with the TAC Guide for Establishing Speed Limits. Ensuring advisory speeds supported by ball-bank studies within the critical curves should an important consideration.

The City of Hamilton rural roadways have different contexts, such as the Hamilton Escarpment Conservation Area, standard rural highways, and in some cases residential zones. In some cases, especially in Hamilton Escarpment Conservation Area, the roadways are characterized by tight curves, and steep grades. These should have different approaches to speed management. The speed transition zones should be properly implemented in accordance with OTM Book 5, and the speed limits should reflect the roadway function and adjacent land uses. Guidance for reviewing speeding issues in the context of these varying roadway environments is provided separately.

Table B 3 presents the decision matrix employed in the toolbox. It presents the question ID, the question itself, the next question if response is yes (IF YES NEXT) and the associated countermeasures (YES CM), and the next question if response is no (IF NO NEXT) and the associated countermeasures (NO CM).

The table allows the user to navigate through the entire decision process within the toolbox.

Table B 3: Decision Matrix – Roadway Segment – Two-Lane – SMV Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
1	Are run-off-road collisions widely distributed throughout the road section? (Review collision history to determine if speed as a contributing factor, determine collision severities)	2	• Install continuous milled-in shoulder (or edgeline) rumble strips • Install centerline rumble strips • (917) Delineate the lane by providing edge line • (918) Reduce operating speeds for reduced collision severity (Conduct speeding review considering the roadway context and apply mitigation measures) Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	2	
2	Are collisions occurring in sections where there are shoulder-edge drop-offs greater than 5 cm?	3	• (3) Remove shoulder-edge drop-offs • (908) Install Safety Edge Treatment	3	
3	Are the travel lanes widths less than the design standards (Refer to Table 4.2.1 and Table 4.2.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with shoulder widths)?	4	• (4) Adjust lane and shoulder widths to meet with standards and/or adjust speed limit to be consistent with the available widths	4	
4	Is the shoulder surface in a well-maintained state?	5		5	• (5) Maintain surface of shoulder and/or change shoulder type to a fully paved shoulder
5	Is the shoulder width consistent with design standards (Refer to Section 4.4.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with lane widths)?	6		6	• (6) Adjust lane and shoulder widths to meet with standards and/or adjust speed limit to be consistent with the available widths
6	Are collisions occurring at night?	7	• (7) Improve visibility/retroreflectivity of pavement markings	13	
7	Is illumination warranted (Conduct illumination warrants as per TAC Guide for Design of Roadway Lighting / MTO's Highway Illumination Methodology)?	13	• (8) Provide roadway lighting	13	
8	Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's	9		15	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.				
9	Can the fixed objects be redesigned so that they can be safely traversed (e.g. providing a safety slope end treatment for exposed culverts by an appropriately designed metallic grating, grading the slope of a ditch near vertical end to a recoverable slope?	15	• (9) Improve traversability of object	10	
10	Can the object be removed or relocated to an area outside of the clear zone (e.g., relocation of utility poles, or removal of trees)?	15	• (10) Relocate object outside of clear zone • (11) Remove object • (12) Widen Clear Zone	11	
11	Can the object incorporate "breakaway" devices (e.g. replacing the fixed utility poles to breakaway types)?	15	• (13) Incorporate breakaway device	12	
12	Is an existing barrier system or guide rail (if present) of appropriate type and length of need and/or attenuation system present and/or is it in proper working order? Select no, if a barrier system or guide rail is not present. For guidance on Length of Need requirements, refer to MTO's Roadside Design Manual July 2023.	15		461	• (14) Improve roadside barrier/guide rail • (15) Improve barrier/guide rail attenuation system Special Consideration(s): If barrier system is not present, conduct further review to determine the need of barrier system
13	Are the roadside foreslopes within the clear zone as per desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	8		462	
14	Can the foreslopes be upgraded to the desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	15	• (16) Flatten side slopes	461	
15	Are run-off-road collisions clustered around particular curves?	16	• (17) Install / improve curve ahead warning signs (OTM Book 6) • (18) Widen lane through curve • (19) Flatten horizontal curve Special Consideration(s): The signs installed should be strictly as per OTM Book 6, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	24	
16	Are traffic volumes greater than 5,000 veh/day?	17		18	
17	Do the curves in question have a radius more than 500 m?	18	• (20) Install raised pavement markers (on roads with radius > 500 m and ADT > 5,000 vpd)	18	
18	Are the collisions in curves associated with the operating speeds?	466	• (1071) Conduct Speeding Review For the Roadway Segment	19	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
19	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	20	• (17) Install / improve curve ahead warning signs (OTM Book 6) • (24) Install chevron alignment signs • (25) Install advisory speed signs • (1077) Install post mounted delineators Special Consideration(s): The signs installed should be strictly as per OTM Book 6	20	
20	Are collisions related to poor sight distance to accesses beyond the curves? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	21	• (26) Flatten crest vertical curve • (19) Flatten horizontal curve • (27) Improve sight distance to access • (28) Remove foliage • (29) Remove/restrict movements at access points Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	21	
21	Is the curve at a location where there is evidence (i.e., a road with streetlights, telephone poles, signs, etc.) of a former tangential continuation, leading to drivers being surprised that the main road curves?	22	• (24) Install chevron alignment signs • (17) Install / improve curve ahead warning signs (OTM Book 6) • (30) Obstruct line of sight to the former tangential alignment Special Consideration(s): The signs installed should be strictly as per OTM Book 6	22	
22	Does the asphalt at the curve, where the target collisions were recorded, show noticeable signs of deterioration, water ponding, ice build-up, or look "polished" in appearance?	23	• (31) Improve pavement friction • (32) Maintain surface of lanes • (33) Improve drainage patterns or structures • (34) Apply preventive salting or chemical anti-icing • (35) Raise standard for winter maintenance Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	23	
23	Is the superelevation along the curve in accordance to design standards? (Refer to Section 3.2 of TAC Geometric Design Guide for Canadian Roadways for superelevation requirements)	24		24	• (36) Improve curve superelevation

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
24	Are there signs of wildlife along the roadway segment? (Review collision history for wild animal collisions, conduct warrants for Deer or Moose Crossing Signs as per OTM Book 6)	25	• (37) Install fencing and underpasses • (38) Install animal warning signs • (39) Install activated warning signs Special Consideration(s): More advance treatments should be implemented based on economic appraisal, Install Deer Crossing or Moose Crossing signs, if they are warranted	25	
25	Are high operating speeds contributing to collisions?	26	• (1071) Conduct Speeding Review For the Roadway Segment	27	
26	Are animal collisions occurring at night?	27	• (41) Driver education on high beam use and Night Danger Tab Signs	27	
27	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	28	• (31) Improve pavement friction • (32) Maintain surface of lanes • (33) Improve drainage patterns or structures • (34) Apply preventive salting or chemical anti-icing • (35) Raise standard for winter maintenance Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	END	
28	Is the cross-fall less than a minimum of 2%?	29	• (42) Improve cross slope	29	
29	Is the longitudinal grade less than a minimum of 0.5% provided?	END	• (43) Improve longitudinal grade	End	
461	Does a risk assessment support the installation of a new barrier system or guide rail (Refer to Appendix A: MTO Severity Index Tables of MTO's Roadside Design Manual to calculate risks)? (A barrier system or guide rail should only be installed if a risk assessment shows it poses less danger than the unprotected hazard, as guide rails are also hazards. The risk assement must consider all types of hazards including foreslopes and any fixed objects within the clear zone)	15	• (913) Install roadside barrier/guide rail • (914) Install barrier/guide rail attenuation system	15	• (915) Use engineering judgement to delineate the roadway segment with the roadside hazards or hazards themselves. Options include: post mounted delineators, edge line, object markings or object marker signs for individual hazards • (916) Reduce posted speed limit Special Consideration(s): The decision to reduce the posted speed limit should be made based on the speeding review
462	Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's	12		14	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.				
466	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	19		19	• (924) Install / improve curve ahead warning signs (OTM Book 6)
475	Are chevrons provided as needed?	26		26	• (24) Install chevron alignment signs

Angle Collisions

Angle collisions at accesses on rural highways are often influenced by a combination of factors, including difficulty in gap judgment, limited visibility and sight distance, and inadequate lighting. In high-speed rural environments, drivers entering or crossing the main roadway may struggle to judge safe gaps in through traffic, particularly when approach speeds are high despite low volumes. This challenge can lead to operational safety issues that may require countermeasures such as auxiliary turn lanes, or access consolidation.

Visibility is another important factor. When accesses are obscured by vegetation, curves, grades, or roadside features, drivers may not recognize conflict points in time to react appropriately. Ensuring mutual visibility between entering and through drivers is essential for safe decision-making.

Adequate sight distance must also be maintained at rural accesses to support safe maneuvers. Sight distance should be evaluated against standards such as Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads. Where deficiencies exist, improvements such as regrading, relocation, or signage upgrades may be warranted.

Nighttime conditions can compound safety issues at rural accesses. If collisions are occurring during dark conditions, it may indicate a need for improved illumination, reflective signage, or enhanced delineation to increase access visibility and reduce collision risk.

Table B 4 presents the decision matrix employed in the toolbox.

Table B 4: Decision Matrix – Roadway Segment – Two-Lane – Angle Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
99	Are collisions occurring because motorists are experiencing difficulty judging gaps within the through traffic when making turning or crossing movements from the accesses?	100	• (157) Remove/restrict movements at access points • (158) Close access • (159) Install / improve left-turn lane for specific accesses, if warranted • (160) Install traffic signals at access point, if warranted • (161) Add two-way left-turn lane (TWLTL)	100	
100	Is visibility of the access for entering, exiting, or approaching drivers a contributing factor?	101	• (162) Improve visibility of access • (163) Install / improve hidden driveway signs • (164) Prohibit on-street parking	101	
101	Are collisions related to poor sight distance to accesses? (Sight distance requirements should be assessed in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads)	102	• (165) Flatten crest vertical curve • (166) Flatten horizontal curve • (167) Improve sight distance to access • (168) Remove foliage Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	102	
102	Are access related collisions occurring at night?	END	• (169) Provide roadway lighting	END	

Approaching Collisions

Approaching collisions on rural highways are influenced by geometric, operational, human, and environmental factors. An important step is determining whether collisions are clustered at specific locations, helping to distinguish systemic issues from localized hazards. Driver fatigue, distraction, impairment, or vehicle failure can result in unintentional lane departures and head-on conflicts, particularly in rural areas. Recognizing these behavioral and mechanical factors is essential to identifying operational deficiencies that may not stem directly from roadway design.

Lane and shoulder geometry play an important role in vehicle control and recovery. Narrow lanes, inadequate shoulder width, and poorly maintained edges with drop-offs increase the risk of lane departures and unsafe recovery, especially at high speeds. Overcorrection after leaving the road can result in head-on collisions. Evaluating compliance with TAC Geometric Design Guide for Canadian Roads is necessary to ensure that roadway supports safe operation and provide adequate recovery space.

Overtaking maneuvers are another major contributor to head-on collisions. Where passing zones are missing, poorly marked, or unsupported by adequate sight distance, drivers may attempt risky passes out of frustration, particularly in areas with slow-moving traffic, steep grades, or heavy truck volumes. Evaluating passing zone design and identifying the need for climbing or passing lanes are critical to reducing unsafe overtaking behavior.

Environmental conditions such as wet pavement, poor drainage, and nighttime visibility issues contribute significantly to loss-of-control incidents. Surface deterioration, water ponding, ice buildup, and polished pavement reduce traction and impair driver control. Assessments should also consider whether cross-fall and longitudinal grades support adequate drainage. Illumination and surface quality are important factors in understanding collision risks under low-friction or low-visibility conditions.

Speed is a major risk factor. Posted speed limits must be consistent with the roadway's design, operating conditions, and context. This includes evaluating geometric consistency, roadside environment, access density, and vulnerable user presence. Special attention is required in complex areas like the Hamilton Escarpment Conservation Area or locations with abrupt transitions, where speed limits must align with TAC's Guide for Establishing Posted Speed Limits and be supported by ball-bank study results for critical curves.

Hamilton's rural roadway network varies in context, including conservation areas, standard rural highways, and residential zones. In areas such as the Hamilton Escarpment Conservation Area, which feature tight curves and steep grades, speed management approaches should differ accordingly. Transition zones must be properly implemented with appropriate signage as per OTM Book 5, and speed limits should reflect adjacent land use and roadway function. Context-sensitive guidance for these environments is addressed separately.

Approaching collisions frequently occur on curves where speeds exceed safe limits for the geometry. Curve-specific assessments should include radii, volumes, signage, surface condition, superelevation, and sight distance to downstream accesses. Ball-bank study compliance is also important. Identifying whether collisions are clustered at curves helps reveal if design inconsistencies or speed misjudgments are contributing factors.

In areas without dedicated bicycle facilities, drivers may enter opposing lanes to pass cyclists, increasing the risk of head-on collisions. Addressing shared space issues requires considering all road users. Mitigation may include providing paved shoulders, appropriate signage, or operational policies to reduce conflicts and improve safety for vulnerable users.

Table B 5 presents the decision matrix employed in the toolbox.

Table B 5: Decision Matrix – Roadway Segment – Two-Lane – Approaching Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
70	Are approaching collisions widely distributed throughout the road section?	71	• (114) Install centerline rumble strips • (115) Provide a median Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	71	
71	Is there evidence of drivers leaving their travel lane due to unintentional movements, such as driver conditions (e.g., fatigue, inattentiveness, impaired ability), driver distraction, or vehicle failure?	72	• (114) Install centerline rumble strips • (115) Provide a median Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	73	
72	Are the travel lanes widths less than the design standards (Refer to Table 4.2.1 and Table 4.2.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with shoulder widths)?	73	• (116) Adjust lane widths to meet with standards and/or adjust speed limit to be consistent with the available widths	73	
73	Are approaching collisions occurring when drivers overcorrect after leaving the right side of the road?	74	• (117) Install continuous milled-in shoulder (or edgeline) rumble strips Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	77	
74	Are collisions occurring in sections where there are shoulder-edge drop-offs greater than 5 cm?	75	• (118) Remove shoulder-edge drop-offs • (909) Install Safety Edge Treatment	75	
75	Is the shoulder surface in a well-maintained state?	76		76	• (119) Maintain surface of shoulder
76	Is the shoulder width consistent with design standards (Refer to Section 4.4.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with lane widths)?	77		77	• (120) Widen shoulder and/or change shoulder type

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
77	Have there been collisions involving vehicles attempting to pass/overtake another vehicle?	78		80	
78	Are existing passing zones clearly marked with striping and signing?	79		79	• (121) Install or improve visibility of passing zone or no passing zone signs
79	Do passing zones meet current standards for sight distance requirements? (Refer to Section 2.2.4 of TAC Geometric Design Guide for Canadian Roads)?	80		80	• (122) Update passing zone to current standards • (123) Eliminate passing zone
80	Is there a situation (e.g. existing or future traffic volumes, or presence of slow moving vehicles, or heavy trucks may be causing excessive delays and prompting drivers attempting to pass by entering the opposing lanes) where a passing is warranted in one or both directions but not provided?	81	• (124) Install passing lane in one direction or implement 2+1 lane configuration • (125) Install passing lane in both directions or implement 2+2 lane configuration	81	
81	Is there a vertical upgrade with traffic composition and operational characteristics to warrant a climbing lane?	82	• (126) Install truck climbing lane Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	82	
82	Are collisions occurring at night?	83	• (127) Improve visibility/retroreflectivity of pavement markings	84	
83	Is illumination warranted (Conduct illumination warrants as per TAC Guide for Design of Roadway Lighting / MTO's Highway Illumination Methodology)?	84	• (128) Provide roadway lighting	84	
84	Are there perceived concerns or evidence that vehicle speeds are contributing to approaching collisions?	85	• (1045) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	85	
85	Does the asphalt on the segment show noticeable signs of deterioration or look "polished" in appearance?	86	• (137) Improve pavement friction • (138) Maintain surface of lanes	86	
86	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	87	• (139) Improve drainage patterns or structures	89	
87	Is the cross-fall a minimum of 2%?	88		88	• (140) Improve cross slope
88	Is a minimum longitudinal grade of 0.5% provided?	89		89	• (141) Improve longitudinal grade
89	Are approaching collisions clustered around particular curves?	90		98	
90	Are traffic volumes greater than 5,000 veh/day?	91		92	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
91	Do the curves in question have a radius more than 500 m?	92	• (142) Install raised pavement markers (on roads with radius > 500 m and ADT > 5,000 vpd)	92	
92	Are the collisions in curves associated with the operating speeds?	93	• (1045) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	93	
93	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	94	• (146) Install chevrons • (147) Install advisory speed signs	94	
94	Are collisions related to poor sight distance to accesses beyond the curves? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	95	• (148) Flatten crest vertical curve • (149) Flatten horizontal curve • (150) Improve sight distance to access • (151) Install centerline rumble strips Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	95	
95	Does the asphalt at the curve, where the target collisions were recorded, show noticeable signs of deterioration, water ponding, ice build-up, or look "polished" in appearance?	96	• (152) Maintain surface of lanes • (153) Apply preventive salting or chemical anti-icing • (154) Raise standard for winter maintenance	96	
96	Is the superelevation along the curve in accordance to design standards? (Refer to Section 3.2 of TAC Geometric Design Guide for Canadian Roadways for superelevation requirements)	97		97	• (155) Improve curve superelevation
97	Is the roadway surface deteriorated and lacking sufficient skid resistance, making it difficult for drivers to negotiate a curve? This can be verified by the presence of water ponding or a polished surface.	98	• (152) Maintain surface of lanes • (153) Apply preventive salting or chemical anti-icing • (154) Raise standard for winter maintenance	98	
98	Do bicyclists share the road space with vehicular traffic due to the lack of a dedicated bicycle facility, frequently	END	• (156) Install bicycle facilities as applicable (bike lanes, multi-use path, raised cycle	END	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	causing vehicles to enter the opposing traffic lane to pass the bicycle, thereby creating the potential for approaching collisions?		tracks, bicycle route with paved shoulder, etc.)		

Rear End Collisions

Rear-end collisions often occur when a driver unexpectedly slows or stops and the following vehicle cannot react in time. This is particularly common near accesses and driveways where turning movements may not be anticipated. Contributing factors include poor visibility and inadequate approach or departure sight distance, which may prevent drivers from detecting slow or turning vehicles. These issues should be assessed against the TAC Geometric Design Guide for Canadian Roadways to determine whether geometric improvements or access management strategies are warranted.

Collisions frequently involve vehicles turning left or right into accesses. These movements become riskier when gaps in traffic are limited or when following drivers fail to perceive the turn in time. Nighttime conditions can further reduce visibility and driver awareness, especially in areas lacking proper lighting or delineation. Identifying collisions that occur under these conditions can help determine the need for lighting enhancements and improved access visibility.

On-street parking introduces reversing and turning maneuvers that may disrupt traffic and lead to rear-end collisions, particularly near access points. During peak periods, congestion and reduced levels of service can cause frequent braking and close following distances, increasing the likelihood of rear-end collisions. Evaluating traffic dynamics and parking-related conflicts is essential to understanding these risks.

Inadequate or non-compliant signage and pavement markings can leave drivers unprepared for slowdowns or turns, especially near accesses or intersections. Proper signage and markings in accordance with OTM guidelines are critical for informing drivers and reducing the chance of sudden braking. A review of these elements is necessary to ensure they effectively communicate upcoming roadway conditions.

Pedestrians crossing at undesignated or uncontrolled locations can also cause vehicles to stop unexpectedly, creating rear-end collision risks. This is especially relevant in rural areas transitioning to residential or semi-urban environments. Assessing pedestrian activity and crossing patterns can help identify where additional controls or infrastructure may be needed.

Road surface conditions significantly influence braking ability. Issues such as polished pavement, water ponding, ice buildup, insufficient cross-fall, or inadequate longitudinal grade can all reduce traction. These environmental and maintenance factors should be assessed to ensure safe deceleration, particularly under adverse conditions.

Rear-end collisions near railway crossings may occur due to limited sight distance, poor signage, or abrupt surface changes. Bumps or uneven pavement can cause drivers to brake suddenly, while inadequate advance warnings may not provide sufficient reaction time. Evaluating approach speeds, signage, and surface conditions at these locations helps determine the need for safety improvements.

Table B 6 presents the decision matrix employed in the toolbox.

Table B 6: Decision Matrix – Roadway Segment – Two-Lane – Rear End Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
52	Are there any accesses and driveways where motorists may be surprised by a vehicle exiting or when a through vehicle unexpectedly slows down to turn into an access?	53		57	
53	Is the sight distance to or at the access/driveway inadequate for entering, exiting, or approaching motorists, potentially contributing to collisions? (Refer to Section 9.9 of TAC Geometric Design Guide for Canadian Roads to review approach and departure sight distance)	54	• (82) Improve visibility of access • (83) Improve sight distance to access (remove foliage, remove on-street parking, remove snow storage, clear right of way encroachments, flatten horizontal curve, flatten vertical curve) • (84) Install hidden driveway signs for accesses • (85) Improve legibility of hidden driveway signs • (86) Close access Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	54	
54	Do collisions involve left-turns into or out of an access?	55	• (87) Add two-way left-turn lane (TWLTL) • (88) Install / improve left-turn lane for specific accesses, if warranted • (90) Remove/restrict movements at access points	56	
55	Do collisions involve right-turns into or out of an access?	56	• (89) Install/improve right-turn lane at accesses, if warranted • (90) Remove/restrict movements at access points	57	
56	Are access related collisions occurring at night?	57	• (91) Provide roadway lighting	57	
57	Does the presence of on-street parking lead to reversing, entering, and exiting maneuvers that could potentially contribute to collisions?	58	• (92) Prohibit on-street parking	58	
58	During rush hours, is the level of service poor, resulting in vehicles following too closely, slowing down, or stopping under congested conditions, thereby increasing the potential for conflicts?	59	• (93) Add passing lane or implement 2+1 lane configuration • (94) Improve traffic operations by adding capacity	59	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
59	Do the provided signs and pavement markings fail to comply with OTM's requirements? Adequate signage and pavement markings should offer guidance to road users so they can react promptly to the need for stopping, and slowing down.	60	• (95) Improve signage and pavement markings in compliance with OTM • (96) Improve visibility/retroreflectivity of pavement markings and signs.	60	
60	Are pedestrians crossing at undesignated locations or without the right of way, potentially causing vehicles to suddenly stop and conflict with following vehicles?	61	• (97) Install controlled pedestrian crossing treatment at midblock (Pedestrian Crossover or Midblock Pedestrian Signal), as applicable • (98) Install pedestrian warning signs • (99) Pedestrian education on crossing with right of way	61	
61	Does the asphalt on the segment show noticeable signs of deterioration or look "polished" in appearance?	62	• (100) Improve pavement friction • (101) Maintain surface of lanes	62	
62	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	63	• (102) Improve drainage patterns or structures • (103) Apply preventive salting or chemical anti-icing	65	
63	Is the cross fall less than a minimum of 2%?	64	• (104) Improve cross slope	64	
64	Is a minimum longitudinal grade of 0.5% provided?	65		65	• (105) Improve longitudinal grade
65	Are collisions related to railway crossings?	66		522	
66	Are collisions related to poor sight distance to the railway crossing? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	67	• (106) Improve sight distance to road-rail grade crossing • (107) Install railway crossing warning signs in compliance with Transport Canada requirements	67	
67	Is the appropriate type of warning system installed at the railway crossing? (Refer to the latest update of Transport Canada Grade Crossings Standards)	68		68	• (108) Review and install appropriate railway warning system as per Transport Canada requirements
68	Are the collisions occurring due to extensive bump at the railway crossing?	69	• (109) Install bump ahead, and bump signs as per OTM Book 6 • (110) Remove the bump	69	
69	Are collisions occurring due to high operating speed approaching to the railway crossing?	522	• (111) Install transverse rumble strips • (112) Targeted speed enforcement • (113) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	522	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts		
522	Are collisions related to a pedestrian crossover?	523		END	
523	Are all necessary infrastructure elements (i.e., signs, pavement markings, and flashing beacons) for the pedestrian crossover properly installed? Refer to OTM Book 15 for determining the appropriate type of pedestrian crossing treatment.	524		524	• (1082) Install infrastructure elements of the pedestrian crossover as per OTM Book 15
524	Are collisions related to poor sight distance to the pedestrian crossover? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	525	• (1083) Improve sight distance by relocating pedestrian crossover elements, removing foliage or any other any removable objects that may be obstructing the sightlines	525	
525	Is the provided pedestrian crossover conspicuous to the road users?	526		526	• (1084) Upgrade the pedestrian crossover to the next higher level • (1085) Install additional overhead rectangular rapid flashing beacons
526	Are collisions occurring due to high operating speed approaching to the pedestrian crossover?	END	• (1086) Install transverse pavement markings • (111) Install transverse rumble strips • (112) Targeted speed enforcement • (113) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures) Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts	END	

Bicyclist Collisions

In rural areas, the absence of dedicated cycling facilities often forces bicyclists to share space with motor vehicles, increasing the risk of sideswipe and overtaking-related collisions. This risk is heightened when cyclists must ride in travel lanes or on poorly maintained shoulders. The assessment should consider whether the available space is adequate and safe for cyclists, especially in high-speed environments where proximity to traffic poses added danger.

A lack of physical separation between cyclists and traffic, particularly on roads with high speeds or frequent truck traffic, significantly reduces safety margins. Close-passing vehicles, limited room for evasive action, and cyclist discomfort all contribute to elevated collision risks. Identifying these conditions helps support the need for infrastructure improvements such as wider shoulders, buffered lanes, or separated facilities.

High vehicle speeds further increase collision risk by reducing driver reaction time and lengthening stopping distances. On roads without protected turning or crossing options, cyclists making left turns or crossing travel lanes are especially vulnerable. Evaluating speed-related risks and overtaking behavior can help determine the need for measures like signage, crossing facilities, or traffic calming.

Nighttime conditions create visibility challenges that heighten the risk of bicycle collisions, particularly near driveways or rural accesses where turning vehicles may not see cyclists. Collisions in dark conditions indicate a potential need for improved lighting, reflective treatments, and signage to enhance visibility and alert drivers to cyclist presence.

Improperly placed or poorly maintained rumble strips can pose serious hazards to cyclists, especially in wet or icy conditions, by causing skidding or loss of control. Inadequate signage and pavement markings for bicycle facilities further reduce safety by limiting driver awareness and cyclist guidance. Reviewing the placement of rumble strips and the clarity of markings is essential to ensure safe conditions for all road users.

Table B 7 presents the decision matrix employed in the toolbox.

Table B 7: Decision Matrix – Roadway Segment – Two-Lane – Bicyclist Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
30	Are bicyclists sharing space with vehicular traffic in rural environments due to the absence of dedicated cycling facilities?	31	• (44) Install bicycle warning signs and/or share the road signs • (45) Install bicycle facilities as applicable (bike lanes, multi-use path, raised cycle tracks, bicycle route with paved shoulder, etc.)	31	
31	Are bicyclists riding in the travel lane due to the poor condition of the paved shoulder or bike lane?	32	• (46) Maintain surface of shoulder and /or bike lane	32	
32	Are bicyclists riding very close to vehicular traffic due to the absence of a buffer between the bike facility and the travel lane?	33	• (47) Widen shoulder and/or change shoulder type from gravel to paved • (48) Install a buffer between the high-speed traffic and Bicycle lane	33	
33	Are bicyclists riding very close to high-speed traffic, including heavy vehicles?	34	• (48) Install a buffer between the high speed traffic and Bicycle lane • (49) Implement off-road bicycle facility	34	
34	Are bicyclists at risk due to high motor vehicle speeds, such as difficulty sharing the roadway, unsafe overtaking by vehicles, or increased severity of potential conflicts?	35	• (1046) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	35	
35	Are there conditions where bicyclists unexpectedly make left turns, entering a vehicle's path, leaving insufficient time for the motorist to react and stop to avoid a collision?	36	• (58) Install bicycle warning signs • (59) Install pedestrian/bicycle crossing	36	
36	Are bicyclists crossing the road without the right of way due to the lack of a dedicated cycling crossing facility?	37	• (60) Install midblock traffic signals (with pedestrian/bicycle signals, where warranted)	37	
37	Are bicycle collisions occurring at night?	38	• (61) Driver education on speed and high beam use	39	
38	Does the darkness of night pose difficulties for drivers to see conflicting cyclists, such as drivers turning right across a multi-use path at a driveway?	39	• (62) Bicyclist education on visibility at night	40	
39	Are rumble strips causing bicycles to skid?	40	• (63) Utilize narrow rumble strips near the lane edge to retain bicycle-friendly shoulder space Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to	40	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			evaluate the cost-effectiveness of the treatment		
40	Are the bicycle facilities not provided with appropriate signage and pavement markings? (Refer to OTM Book 18 for guidance)	END	• (64) Review and upgrade signage and pavement markings	END	

Pedestrian Collisions

Pedestrian vulnerability on rural roadways is a result of contributing factors such as design gaps, high vehicular speeds, limited visibility, and land use context. In the absence of controlled pedestrian facilities, like pedestrian crossovers or midblock pedestrian signals (intersection pedestrian signals on intersections) pedestrians often cross without the right of way. Even where such facilities exist, informal crossings may still occur if they are poorly located or fail to align with pedestrian desire lines. This is especially common on rural roadways with commercial activities, such as on-street parking or destinations on both sides of the road. The assessment should determine whether existing infrastructure unintentionally encourages unsafe crossings. Any new crossing treatment must comply with warrants outlined in OTM Book 15.

High vehicular speeds substantially increase the risk and severity of pedestrian collisions, particularly where no crossing facilities or speed management measures are in place. Drivers have less time to react and longer stopping distances at higher speeds, making it difficult to yield to pedestrians. These risks are most pronounced near schools, community safety zones, and hamlets, where posted and operating speeds may exceed levels appropriate for vulnerable road users.

The lack of continuous sidewalks or dedicated pedestrian paths on rural roads forces pedestrians to walk along shoulders or in travel lanes, exposing them to fast-moving vehicles. These conditions are especially hazardous in areas with narrow lanes, limited right-of-way, or the presence of heavy trucks. The assessment should consider whether infrastructure gaps are contributing to increased exposure and sideswipe risks for pedestrians.

Nighttime conditions further elevate pedestrian safety concerns. Poor lighting, obstructed sightlines, and driver expectations can make it difficult to detect pedestrians walking or crossing the road, particularly at midblock locations, driveways, or where trails intersect roadways. The assessment should identify locations where visibility challenges may be compromising pedestrian safety after dark.

School and community safety zones require special attention due to the presence of children and other vulnerable users. These zones legally permit reduced speed limits and speed cameras, but safety depends on proper implementation. The assessment should verify whether speed zones are correctly established and enforced, and whether safe, well-located crossing facilities are provided within school frontages. The combination of high speeds and missing pedestrian infrastructure can lead to unsafe conditions in these critical areas.

Table B 8 presents the decision matrix employed in the toolbox.

Table B 8: Decision Matrix – Roadway Segment – Two-Lane – Pedestrian Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
41	Do pedestrians cross the road without right of way due to the absence of controlled pedestrian crossing facilities?	42	• (65) Install controlled pedestrian crossing treatment at midblock (Pedestrian Crossover or Midblock Pedestrian Signal), as applicable • (66) Install pedestrian warning signs (with or without amber flashing beacons) Special Consideration(s): Conduct warrants and confirm suitability of installing a controlled pedestrian crossing treatment considering factors, such as sightlines, operating speeds, and other safety considerations as per OTM Book 15	42	
42	Do pedestrians cross the road without right of way even in the presence of controlled pedestrian facilities?	43	• (67) Pedestrian education on crossing with right of way	43	
43	Are there any conditions or factors that encourage pedestrians cross the road without right of way at multiple points (e.g., presence of on-street parking on both sides of a commercial street, or a popular crossing point, such as an eating place on the other side of the road opposite to a commercial establishment)?	44	• (65) Install controlled pedestrian crossing treatment at midblock (Pedestrian Crossover or Midblock Pedestrian Signal), as applicable • (66) Install pedestrian warning signs (with or without amber flashing beacons) • (67) Pedestrian education on crossing with right of way • (81) Implement community safety zone Special Consideration(s): Conduct warrants and confirm suitability of installing a controlled pedestrian crossing treatment considering factors, such as sightlines, operating speeds, and other safety considerations as per OTM Book 15	44	
44	Are pedestrians at risk due to high vehicular speeds, such as difficulty crossing the roadway, inability of drivers to stop in time, or increased severity of potential conflicts, particularly in areas lacking designated pedestrian crossings or speed management measures?	45	• (1047) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	45	
45	Do pedestrians walk on the road in the absence of sidewalks?	46	• (66) Install pedestrian warning signs (with or without amber flashing beacons) • (77) Provide sidewalk along the roadside	46	
46	Is there any situation that the darkness of night pose difficulties for drivers to see pedestrians, such as drivers	47	• (68) Pedestrian education on visibility at night	47	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	turning right across a multi-use path or a sidewalk at a driveway?				
47	Is there any situation that the location of pedestrian activity unexpected for drivers?	48	• (66) Install pedestrian warning signs (with or without amber flashing beacons)	48	
48	Is there any situation that the sight distance to a dedicated midblock pedestrian crossing facility insufficient? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	49	• (78) Improve sightlines for drivers and pedestrians by removing foliage, adjusting street furniture and other objects along the roadway, or adjusting the location of the crosswalk	49	
49	Is there any situation that the absence of appropriate controlled pedestrian crossing facility within a school zone creating unsafe environment?	50	• (79) Install controlled pedestrian crossing treatment or a supervised school crossing, as applicable	50	
50	Is there any situation that the required school speed zone not been established appropriately?	51	• (80) Implement school speed zone	51	
51	Are the vehicle operating speeds higher within a school zone or a community safety zone?	End	• (76) Reduce posted speed limit • (70) Install automated speed enforcement cameras • (75) Targeted speed enforcement	End	

Roadway Segment, Two-lane, Specific Issue Review

Speeding Issues

Given the observations presented in **Section Speed Threshold for Identifying Speeding Issues**, it is evident that many roads are being operated at speeds higher than intended by their posted limits. While the TAC Guide for Establishing Posted Speed Limits may support higher limits on certain roads, particularly those posted at or below 60 km/h but geometrically like higher-speed facilities, the City's review must also account for the safety sensitivity of corridors with vulnerable users, higher access density, and built-up or environmentally constrained areas.

To identify road segments that warrant speed management interventions, thresholds were established based on observed discrepancies. For two-lane two-way roads with posted speed limits of 40 and 50 km/h in non residential areas, mitigation measures should be considered when the 85th percentile speed exceeds the posted limit by more than 20 km/h and in residential areas, a threshold of 10 km/h exceeding the posted speed limit was considered. For roads with posted speed of 60 km/h, a threshold of 20 km/h was established. For roads with posted speed limits of 70 or 80 km/h, the threshold should be when the 85th percentile speed exceeds the posted limit by more than 15 km/h. For locations with sharp horizontal curves where advisory speeds are posted, a threshold of 10 km/h exceeding the advisory speed was considered. This approach ensures that mitigation efforts are guided by actual driver behavior and contextual risk, rather than relying solely on posted limits.

Rural roads often transition through areas with varying contexts such as agricultural lands, conservation areas, or residential zones. In areas like the Hamilton Escarpment, curvilinear alignments and steep grades do not support high speeds, while residential areas with frequent accesses or pedestrian activity require conservative speed management. Thus, speed limits must be context-sensitive and reflect adjacent land use and roadway function.

Horizontal curves present unique challenges when geometric alignment does not align with driver expectations. If curves are linked to speed-related collisions or if operating speeds exceed advisory speeds, targeted measures, such as chevron signs, advisory speed postings, or ball-bank studies, may be required. Similarly, in reduced speed zones near hamlets or residential areas, transitions must follow OTM Book 5 guidance, with adequate signage and length to influence driver behavior effectively.

Establishing appropriate speed limits on rural roads is not solely based on statutory values. It involves a comparison with similar roadways, consideration of roadside development and access density, and consistency with TAC Guide for Establishing Posted Speed Limits.

Historical collision data is essential in diagnosing speed-related concerns. The diagnostic approach uses defined frequency categories including frequent, occasional, infrequent, rare, to prioritize mitigation. Community complaints, particularly from residents or agricultural operators, also serve as valid indicators of safety issues, especially where speeding affects gap judgment or turning movements at stop-controlled intersections. These situations warrant targeted speed management interventions.

From a speed perspective, the City's roadways are categorized into the following speed ranges in support of the Rural Road Safety Toolbox:

To guide the application of appropriate speed management measures, it is important to recognize that rural roadways across the city vary in design, context, and operating characteristics. These include differences in prevailing speeds, geometric conditions such as straight versus curvilinear segments (particularly within the Hamilton Escarpment Conservation Areas), the presence of reduced speed zones, and localized residential areas. Accordingly, the City's rural roadways have been categorized into distinct groups based on these contextual factors. For each category, applicable speed mitigation measures frameworks are outlined in **Table B 9.**

Table B 9: Speed Management Measure for Different Types of Speed Zone

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
Roadways with Speed Limits 70 km/h & 80 km/h			
Standard roadway segment with perceived safety issues	Any operating speed (>Posted + 15 km/h & <Posted + 15 km/h)	Frequent	• Speed Feedback Signs • Targeted Speed Enforcement • Oversize Speed Limit Signs • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings • Single Centre Dividing Line Markings • Pavement Speed Limit Markings • Wider Edge Lines • Single-lane Roundabout
	>Posted + 15 km/h	Occasional	• Targeted Speed Enforcement • Oversize Speed Limit Signs
	> Posted + 15 km/h	Infrequent	• No Action
	<Posted + 15 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
			• Single Centre Dividing Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Oversize Warning Signs • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed +15 km/h	-	• Install Speed Feedback Signs • Targeted Speed Enforcement • Oversize Speed Limit Signs • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Wider Edge Lines
Roadways with Speed Limit 60 km/h			
Reduced Speed Zone with perceived safety issues	Any operating speed (>Posted + 20 km/h & <Posted + 20 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings • Single Centre Dividing Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Gateway Treatment • Single-lane Roundabout • Install a narrow median between travel lanes at the entrance • Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement
	> Posted + 20 km/h	Infrequent	• No Action
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Standard roadway segment within Hamilton	Any operating speed (>Posted + 20 km/h &	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
Escarpment Area with perceived safety issues	<Posted + 20 km/h)		• Single Centre Dividing Line Markings • Single Edge Line Markings • Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement
	> Posted + 20 km/h	Infrequent	• No Action
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Oversize Warning Signs • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed +20 km/h		• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Wider Edge Lines
Standard roadway segment not in Hamilton Escarpment Area with perceived safety issues	Perceived speeding issues	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings • Single Centre Dividing Line Markings • Vertical centreline treatment • Single-lane Roundabout • Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement • Vertical centreline treatment

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
	> Posted + 20 km/h	Infrequent	• No Action
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Oversize Warning Signs • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed + 20 km/h	-	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Wider Edge Lines
Roadways with Speed Limit 40 & 50 km/h			
Reduced Speed Zone with perceived safety issues	Any operating speed (>Posted + 20 km/h & <Posted + 20 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings • Single Centre Dividing Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Gateway Treatment • Single-lane Roundabout • Install a narrow median between travel lanes at the entrance • Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement
	> Posted + 20 km/h	Infrequent	• No Action

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Standard roadway segment within Hamilton Escarpment Area with perceived safety issues	Any operating speed (>Posted + 20 km/h & <Posted + 20 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement
	> Posted + 20 km/h	Infrequent	• No Action
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed +20 km/h		• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Wider Edge Lines
Standard roadway segment not in Hamilton Escarpment Area with perceived safety issues	Any operating speed (>Posted + 20 km/h & <Posted + 20 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Edge Line Markings • Double Centre Dividing Line Markings • Single Edge Line Markings • Single Centre Dividing Line Markings • Vertical centreline treatment • Single-lane Roundabout

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
			• Pavement Speed Limit Markings • Wider Edge Lines
	>Posted + 20 km/h	Occasional	• Targeted Speed Enforcement • Vertical centreline treatment
	> Posted + 20 km/h	Infrequent	• No Action
	<Posted + 20 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed +20 km/h	-	• Install Speed Feedback Signs • Targeted Speed Enforcement • Double Centre Dividing Line Markings • Single Centre Dividing Line Markings • Single Edge Line Markings • Wider Edge Lines
Standard Roadway Segment (localized residential area / rural settlement roads)	Any operating speed (>Posted + 10 km/h & <Posted + 10 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Single Centre Dividing Line Markings • Single Edge Line Markings • Install Speed Cushions • Wider Edge Lines
	>Posted + 10 km/h	Occasional/Infrequent	• Targeted Speed Enforcement • Vertical centreline treatment • Install speed cushions

Table B 10 presents the decision matrix employed in the toolbox.

Table B 10: Decision Matrix – Roadway Segment – Two-Lane – Speeding Issues

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
1	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding-related collisions, complaints from residents or agricultural vehicle operators, difficulty judging safe gaps for turning or entering/exiting accesses (particularly at stop-controlled intersections), or any other observed or reported speed-related concerns?	2		End	• (929) No Action Required
2	Is the speed limit 70 km/h or higher (includes the roadways with a posted speed of 70 km/h and 80 km/h)?	3		12	
3	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	4	• (930) Reduce posted speed limit	4	
4	Are the operating speeds (85th percentile speeds) more than 15 km/h higher than the posted speed limit?	5		5	
5	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	7	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (933) Install Oversize Speed Limit Signs • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1405) Install single-lane roundabout • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The placement and frequency of speed limit signs must be as per OTM Book 5, The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Major intersection upgrades would require a feasibility study	6	
6	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most	381		End	• (929) No Action Required

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)				
7	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	8		End	
8	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	9		9	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
9	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	10	• (938) Install chevron alignment signs • (939) Install advisory speed signs	11	
10	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (943) Install oversize warning signs • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	End	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
11	Are the operating speeds within the curves (85th percentile speeds) more than 15 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (933) Install Oversize Speed Limit Signs • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The placement and frequency of speed limit signs must be as per OTM Book 5, The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
12	Is the speed limit 60 km/h?	13		41	
13	Does the roadway segment fall within a reduced speed zone or a designated speed transition area?	14		20	
14	Is the speed transition implemented appropriately (i.e., transitional speed limits in intervals of 20 km/h or less, and signage as per OTM Book 5)?	15		15	• (946) Improve the transition zone signage as per OTM Book 5
15	Is the reduced posted speed more than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	16	• (930) Reduce posted speed limit	16	
16	Is the reduced speed zone of appropriate length as per OTM Book 5?	17		17	• (947) Increase the length of existing reduced speed zones as per OTM Book 5
17	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	18		18	
18	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips	19	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			• (945) Implement gateway treatment • (1405) Install single-lane roundabout • (1406) Install a narrow road median between travel lanes at the entrance to a speed transition zone or reduced speed zone • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment, Major intersection upgrades would require a feasibility study		
19	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	382		End	• (929) No Action Required
20	Is the subject roadway segment entirely posted at 60 km/h, rather than being a reduced speed zone on a higher-speed roadway?	21		End	
21	Does the roadway segment lie within the Hamilton Escarpment Conservation Area, and is it characterized by a curvilinear alignment and steep vertical grades?	22		31	
22	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collisions involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	23	• (930) Reduce posted speed limit	23	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
23	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	24		24	
24	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	26	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	25	
25	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	383		383	
26	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	27		End	
27	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	28		28	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
28	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	29	• (938) Install chevron alignment signs • (939) Install advisory speed signs	30	
29	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings	30	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			• (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (943) Install oversize warning signs • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
30	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
31	Is the roadway segment a standard roadway and not part of the Hamilton Escarpment Conservation Area, which is characterized by curvilinear alignment and steep vertical grades?	32		End	
32	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within	33	• (930) Reduce posted speed limit	33	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits				
33	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	34		34	
34	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	36	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (948) Install vertical centreline treatment • (1405) Install single-lane roundabout • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Major intersection upgrades would require a feasibility study	35	
35	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	384		End	• (929) No Action Required
36	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	37		End	
37	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	38		38	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
38	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron	39	• (938) Install chevron alignment signs • (939) Install advisory speed signs	40	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	alignment signs, and the correct type of curve warning signs)?				
39	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (943) Install oversize warning signs • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	40	
40	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
41	Is the speed limit 50 km/h?	42		75	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
42	Does the roadway segment fall within a reduced speed zone or a designated speed transition area?	43		49	
43	Is the speed transition implemented appropriately (i.e., transitional speed limits in intervals of 20 km/h or less, and signage as per OTM Book 5)?	44		44	• (946) Improve the transition zone signage as per OTM Book 5
44	Is the reduced posted speed more than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collisions involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	45	• (930) Reduce posted speed limit	45	
45	Is the reduced speed zone of appropriate length as per OTM Book 5?	46		46	• (947) Increase the length of existing reduced speed zones as per OTM Book 5
46	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	47		47	
47	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (945) Implement gateway treatment • (1405) Install single-lane roundabout • (1406) Install a narrow road median between travel lanes at the entrance to a speed transition zone or reduced speed zone • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius	48	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment, Major intersection upgrades would require a feasibility study		
48	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	385		385	
49	Is the subject roadway segment entirely posted at 50 km/h, rather than being a reduced speed zone on a higher-speed roadway?	50		End	
50	Does the roadway segment lie within the Hamilton Escarpment Conservation Area, and is it characterized by a curvilinear alignment and steep vertical grades?	51		60	
51	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collisions involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	52	• (930) Reduce posted speed limit	52	
52	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	53		53	
53	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	55	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	54	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
54	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	55		55	
55	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	56		End	
56	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	57		57	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
57	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	58	• (938) Install chevron alignment signs • (939) Install advisory speed signs	59	
58	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise	59	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
59	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
60	Is the roadway segment a standard roadway and not part of the Hamilton Escarpment Conservation Area, which is characterized by curvilinear alignment and steep vertical grades?	61		70	
61	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	62	• (930) Reduce posted speed limit	62	
62	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	63		63	
63	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	65	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (933) Install Oversize Speed Limit Signs • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (948) Install vertical centreline treatment • (1405) Install single-lane roundabout • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The placement and frequency of speed limit signs must be as per OTM	64	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			Book 5, The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Major intersection upgrades would require a feasibility study		
64	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	387		End	• (929) No Action Required
65	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	66		End	
66	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	67		67	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
67	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	68	• (938) Install chevron alignment signs • (939) Install advisory speed signs	69	
68	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design	69	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
69	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.	End	
70	Is the roadway segment within a localized residential area?	71		End	
71	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	72	• (930) Reduce posted speed limit	72	
72	Are the operating speeds (85th percentile speeds) greater than 10 km/h higher than the posted speed limit?	73		73	
73	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (949) Install Speed Cushions • (1411) Wider Edge Lines	74	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	with all fatal and injury collisions, regardless of the documented contributing factors)		Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)		
74	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	388		End	
75	Is the speed limit 40 km/h?	76		End	
76	Does the roadway segment fall within a reduced speed zone or a designated speed transition area?	77		83	
77	Is the speed transition implemented appropriately (i.e., transitional speed limits in intervals of 20 km/h or less, and signage as per OTM Book 5)?	78		78	• (946) Improve the transition zone signage as per OTM Book 5
78	Is the reduced posted speed more than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	79	• (930) Reduce posted speed limit	79	
79	Is the reduced speed zone of appropriate length as per OTM Book 5?	80		80	• (947) Increase the length of existing reduced speed zones as per OTM Book 5
80	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	81		81	
81	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (945) Implement gateway treatment	82	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			• (1405) Install single-lane roundabout • (1406) Install a narrow road median between travel lanes at the entrance to a speed transition zone or reduced speed zone • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment, Major intersection upgrades would require a feasibility study		
82	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	389		End	
83	Is the subject roadway segment entirely posted at 40 km/h, rather than being a reduced speed zone on a higher-speed roadway?	84		End	
84	Does the roadway segment lie within the Hamilton Escarpment Conservation Area, and is it characterized by a curvilinear alignment and steep vertical grades?	85		94	
85	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	86	• (930) Reduce posted speed limit	86	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
86	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	87		87	
87	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	89	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	88	
88	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	390		390	
89	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	90		End	
90	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	91		91	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
91	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	92	• (938) Install chevron alignment signs • (939) Install advisory speed signs	93	
92	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings	93	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
			• (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
93	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
94	Is the roadway segment a standard roadway and not part of the Hamilton Escarpment Conservation Area, which is characterized by curvilinear alignment and steep vertical grades?	95		104	
95	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within	96	• (930) Reduce posted speed limit	96	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits				
96	Are the operating speeds (85th percentile speeds) greater than 20 km/h higher than the posted speed limit?	97		97	
97	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	99	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (934) Provide Double Edge Line Markings • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (948) Install vertical centreline treatment • (1405) Install single-lane roundabout • (1407) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Major intersection upgrades would require a feasibility study	98	
98	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	391		End	• (929) No Action Required
99	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	100		End	
100	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	101		101	• (937) Install/Improve Curve Warning Signs (OTM Book 6)
101	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron	102	• (938) Install chevron alignment signs • (939) Install advisory speed signs	103	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	alignment signs, and the correct type of curve warning signs)?				
102	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (931) Install Speed Feedback Signs • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (941) Install transverse pavement markings • (942) Install transverse rumble strips • (944) Install amber flashing beacons on top of advisory speed signs • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves), Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	103	
103	Are the operating speeds within any curves (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (935) Provide Double Centre Dividing Line Markings • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	End	
104	Is the roadway segment within a localized residential area within a rural settlement road?	105		End	
105	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency	106	• (930) Reduce posted speed limit	106	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
	(considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits				
106	Are the operating speeds (85th percentile speeds) greater than 10 km/h higher than the posted speed limit?	107		107	
107	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	End	• (931) Install Speed Feedback Signs • (932) Targeted speed enforcement • (936) Provide Centre Dividing Line Markings • (940) Provide Edge Line Markings • (948) Install vertical centreline treatment • (949) Install Speed Cushions • (1411) Wider Edge Lines Special Consideration(s): The decision on the use of double or single, centre or edge, line markings should be based on the review of the lane widths and shoulder (refer to TAC Geometric Design Guide for Canadian Roadways Section 4.2 Lane Widths and Section 3.2.5 Lane Widening on Curves)	108	
108	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	392		End	
381	Are the operating speeds (85th percentile speeds) more than 15 km/h higher than the posted speed limit?	7	• (932) Targeted speed enforcement • (933) Install Oversize Speed Limit Signs Special Consideration(s): The placement and frequency of speed limit signs must be as per OTM Book 5	End	• (929) No Action Required
382	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (932) Targeted speed enforcement	End	• (929) No Action Required
383	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	26	• (932) Targeted speed enforcement	26	
384	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	36	• (932) Targeted speed enforcement • (948) Install vertical centreline treatment	End	• (929) No Action Required
385	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (932) Targeted speed enforcement	End	

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
386	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	55	• (932) Targeted speed enforcement	55	
387	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	65	• (932) Targeted speed enforcement • (948) Install vertical centreline treatment	End	• (929) No Action Required
388	Are the operating speeds (85th percentile speeds) more than 10 km/h higher than the posted speed limit?	End	• (932) Targeted speed enforcement • (948) Install vertical centreline treatment • (949) Install Speed Cushions	End	
389	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	End	• (932) Targeted speed enforcement	End	
390	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	89	• (932) Targeted speed enforcement	89	
391	Are the operating speeds (85th percentile speeds) more than 20 km/h higher than the posted speed limit?	99	• (932) Targeted speed enforcement • (948) Install vertical centreline treatment	End	• (929) No Action Required
392	Are the operating speeds (85th percentile speeds) more than 10 km/h higher than the posted speed limit?	108	• (932) Targeted speed enforcement • (948) Install vertical centreline treatment • (949) Install Speed Cushions	End	

Sightline Issues

Sight distance is a fundamental element of rural road safety, especially given the typically high operating speeds, limited lighting, and variable topography. The first step in assessing potential sightline issues involves determining whether there are perceived concerns that visibility limitations are contributing to safety risks. These concerns may arise from resident complaints, field observations, or recurring driver behavior and serve as initial indicators that visibility may be insufficient for safe maneuvering. Evaluating these concerns using the 2017 TAC Geometric Design Guide for Canadian Roads provides a framework aligned with national best practices.

Geometric and operational conditions, such as sharp curves, steep grades, roadside obstructions, and high speeds, can further reduce visibility even where minimum sight distance standards are met. These factors often interact, increasing safety risks in locations where driver response time is already constrained.

The assessment should verify whether stopping sight distance (SSD) and passing sight distance (PSD) meet TAC requirements. SSD is essential for safe braking at curves, intersections, or railway crossings, while PSD ensures drivers can complete passing maneuvers without risking head-on collisions. Both require clear visibility adjusted for grade and road geometry.

At intersections and driveways, especially where left turns are made across opposing traffic, sight distance must be sufficient for drivers to judge safe gaps. If sightlines are obstructed by vegetation, alignment, or other roadside features, the potential for angle or turning collisions increases. These locations should be assessed with reference to TAC's design cases to ensure adequate visibility and safe operation.

For the purposes of this toolbox, the term “access” refers primarily to public road intersections and major private accesses (e.g., commercial, industrial, institutional, or multi-unit residential accesses), where traffic volumes, exposure, and conflict potential are more comparable to roadway intersections. While the fundamental principles of sight distance apply to all access points – including low-density residential driveways – the diagnostic scenarios and countermeasures presented herein are not intended to be directly applied to individual low-volume residential driveways.

Sightline concerns at residential driveways are acknowledged as common; however, mitigation in these cases should be scaled and proportionate to the substantially lower traffic volumes and exposure. In most situations, appropriate responses will be limited to localized measures such as vegetation management, removal of obstructions within sight triangles, minor driveway geometry adjustments, or the installation of hidden driveway warning signs. Higher-order intersection treatments are generally not warranted unless a documented and demonstrable safety concern exists. **Table B 11** presents the decision matrix employed in the toolbox.

Table B 11: Decision Matrix – Roadway Segment – Two-Lane – Sightline Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
140	Are there perceived concerns that deficient sightlines are contributing to safety issues at this location? (There may be single motor vehicle collisions related to poor sight distance to accesses beyond the curves, collisions related to inadequate passing zone, pedestrians and cyclists related collisions associated with deficient sight distance) (Sight distance requirements should be evaluated in accordance with Section 2.5 of the 2017 TAC Geometric Design Guide for Canadian Roads.)	141		End	• (968) No Action Required
141	Based on the most recent five-year collision data, have any sightlines related collisions occurred at this intersection? (e.g. single motor vehicle collisions related to poor sight distance to accesses beyond the curves, pedestrians and cyclists related collisions associated with deficient sight distance)	144		144	
144	Are there any locations within the roadway segment where the available stopping sight distance is below the minimum required? (Stopping sight distance must conform to Section 2.5.3 of the 2017 TAC Geometric Design Guide, with adjustments for grade. Examples of critical locations include horizontal and vertical curves, railway crossings, sight distance to accesses or intersections beyond curves, pedestrian or cyclist crossings, and approaches to intersections or traffic control devices.)	145	• (970) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (971) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures	145	
145	Are there any locations within the roadway segment where passing is permitted but the available passing sight distance is below the minimum required? (Passing sight distance must meet the requirements of Section 2.5.4 of the 2017 TAC Geometric Design Guide, with adjustments for grade. Examples of critical locations to assess include curves, approaches to intersections or accesses, and locations where sight distance is restricted due to geometry or roadside features.)	146	• (972) Introduce, extend, or refine no passing zone	146	
146	Are there any intersections or driveways where the available sight distance is insufficient for drivers to safely turn left across opposing traffic? (This distance should allow a vehicle to clear opposing traffic lanes	End	• (970) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines	End	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	based on the design speed, as per Case F – Left Turns from the Major Road, outlined on pages 78–79 of the 2017 TAC Geometric Design Guide for Canadian Roads.)		• (971) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures		

Pedestrian Issues

Please refer to decision matrix presented in **Table B 8.**

Bicyclist Issues

Please refer to decision matrix presented in **Table B 7.**

Roadside Issues

Table B 12 presents the decision matrix employed in the toolbox for roadside issues.

Aggressive Driving

Table B 13 presents the decision matrix employed in the toolbox for aggressive driving.

Truck Related Issues

Table B 14 presents the decision matrix employed in the toolbox for truck related issues.

Table B 12: Decision Matrix – Roadway Segment – Two-Lane – Roadside Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
304	Are the roadside foreslopes within the clear zone as per desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	305		312	
305	Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.	306		End	
306	Can the fixed objects be redesigned so that they can be safely traversed (e.g. providing a safety slope end treatment for exposed culverts by an appropriately designed metallic grating, grading the slope of a ditch near vertical end to a recoverable slope?	End	• (1242) Improve traversability of object	307	
307	Can the object be removed or relocated to an area outside of the clear zone (e.g., relocation of utility poles, or removal of trees)?	End	• (1243) Relocate object outside of clear zone • (1244) Remove object • (1245) Widen Clear Zone	308	
308	Can the object incorporate "breakaway" devices (e.g. replacing the fixed utility poles to breakaway types)?	End	• (1246) Incorporate breakaway device	309	
309	Is an existing barrier system or guide rail (if present) of appropriate type and length of need and/or attenuation system present and/or is it in proper working order? Select no, if a barrier system or guide rail is not present.	End		311	• (1247) Improve roadside barrier/guide rail • (1248) Improve barrier/guide rail attenuation system Special Consideration(s): If barrier system is not present, conduct further review to determine the need of barrier system
310	Can the foreslopes be upgraded to the desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	End	• (1249) Flatten side slopes	311	
311	Does a risk assessment support the installation of a new barrier system or guide rail (Refer to Appendix A: MTO Severity Index Tables of MTO's Roadside Design Manual to calculate risks)? (A barrier system or guide rail should only be installed if a risk assessment shows it poses less danger than the unprotected hazard, as guide rails are also hazards. The risk assessment must consider all types of hazards including foreslopes and any fixed objects within the clear zone)	End	• (1250) Install roadside barrier/guide rail • (1251) Install barrier/guide rail attenuation system	End	• (1252) Use engineering judgement to delineate the roadway segment with the roadside hazards or hazards themselves. Options include post mounted delineators, edge line, object markings or object marker signs for individual hazards • (1253) Reduce posted speed limit Special Consideration(s): The decision to reduce the posted speed limit should be made based on the speeding review

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
312	Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.	309		310	

Table B 13: Decision Matrix – Roadway Segment – Two-Lane – Aggressive Driving

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
322	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding-related collisions, complaints from residents or agricultural vehicle operators, difficulty judging safe gaps for turning or entering/exiting accesses (particularly at stop-controlled intersections), or any other observed or reported speed-related concerns?	323	• (1265) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	323	
323	Is there high-speed variability between vehicles (e.g., large speed differences between faster and slower vehicles) that may contribute to tailgating, risky passing, or driver frustration?	324	• (1266) Leave Space / No Tailgating Warning Signs • (1267) Enforcement campaigns focused on aggressive driving behaviours • (1268) Public education and community-based awareness initiatives	324	
324	Are unsafe passing manoeuvres occurring frequently (e.g., passing in no-passing zones, limited sight distance, curves, crests, or near intersections/driveways, passing-related collisions or near-misses evident in the collision data or through local knowledge, e.g., head-on, sideswipe, or run-off-road collisions following passing attempts)?	325	• (1269) Provide Double Centre Dividing Line Markings • (1270) Conduct the review of sightline issues • (1271) Introduce, extend, or refine no passing zone • (1272) Install truck climbing lane • (1273) Add passing lane or implement 2+1 lane configuration • (1274) Install continuous milled-in shoulder (or edgeline) rumble strips • (1275) Install centerline rumble strips Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts,	325	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
325	Are there roadway or traffic conditions (e.g., slow-moving agricultural vehicles, trucks, cyclists) that may be triggering aggressive driving behaviours such as speeding, risky passing, or intimidation?	326	• (1277) Provide pull-off areas for slow moving vehicles • (1278) Provide turnouts or lay-bys in corridors with frequent platooning • (1279) Provide time-of-day restrictions or guidance for agricultural equipment (where feasible) • (1280) Provide advance warning for farm vehicles	326	
326	Does the roadway geometry or cross-section (e.g., narrow lanes/shoulders, presence of inconsistent curves and tangent sections, limited sight distance, lack of passing opportunities) contribute to driver impatience or aggressive behaviour?	End	• (1276) Widen shoulder and/or change shoulder type from gravel to paved • (1275) Install centerline rumble strips • (1281) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (1282) Flatten horizontal curve • (1283) Flatten crest vertical curve • (1284) Enhanced delineation (chevrons, curve warning signs, enhanced edge lines) Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	End	

Table B 14: Decision Matrix – Roadway Segment – Two-Lane – Truck Related Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
346	Do heavy trucks operate at substantially lower speeds than general traffic, resulting in platooning, driver frustration, or frequent passing attempts?	347	• (1326) Install truck climbing lane • (1327) Introduce, extend, or refine no passing zone • (1328) Provide advance warning signs for slow-moving vehicles • (1329) Install centerline rumble strips	347	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment		
347	Are unsafe passing manoeuvres involving trucks occurring frequently (e.g., passing in no-passing zones, limited sight distance, or near curves and crests)?	348	• (1326) Install truck climbing lane • (1327) Introduce, extend, or refine no passing zone • (1328) Provide advance warning signs for slow-moving vehicles • (1329) Install centerline rumble strips Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	348	
348	Do trucks encroach into opposing lanes or shoulders due to narrow lane widths, limited shoulder width, or horizontal alignment constraints?	349	• (1330) Adjust lane and shoulder widths to meet with standards and/or adjust speed limit to be consistent with the available widths • (1331) Improve curve superelevation • (1332) Widen lane through curve • (1333) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines	349	
349	Are there long or steep grades where truck braking, downhill speeds, or runaway risk are a safety concern?	350	• (1334) Truck advisory speed signs on downgrades • (1335) Enhanced downgrade warning signing • (1336) Engine brake usage signage (where appropriate)	350	
350	Do truck turning movements at intersections, driveways, or farm accesses result in sudden braking,	351	• (1337) Driveway consolidation or access spacing improvements or access relocation	351	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	queue formation, or encroachment into opposing lanes?		• (1338) Increase the length of left and right turn lanes • (1339) Implement dedicated left-turn and right-turn lanes • (1353) Improved intersection geometry for truck turning paths • (1354) Advance warning signs for truck turning activity		
351	Is there evidence of truck route violations, weight violations, or use of unsuitable roads by trucks, contributing to safety concerns?	352	• (1340) Targeted enforcement of truck route and weight restrictions • (1341) Weigh-in-motion or portable inspection programs • (1342) Improved truck route signing and wayfinding	352	
352	Are heavy trucks observed following passenger vehicles at insufficient headways, particularly in advance of intersections, driveways, or access points?	353	• (1338) Increase the length of left and right turn lanes • (1339) Implement dedicated left-turn and right-turn lanes • (1343) Provide separate truck turn lanes where truck turning volumes are high • (1349) Speed feedback signs upstream of frequent turning locations • (1369) Maintain safe distance signing • (1371) Targeted enforcement for truck tailgating	353	
353	Do rear-end collisions or near-misses occur where passenger or other vehicles slow or stop to make left turns, and following trucks are unable to decelerate comfortably?	354	• (1344) Install left-turn lane • (1346) Advance Vehicle Turning Ahead or Trucks Turning warning signs • (1347) Install intersection warning signs as per OTM Book 6 • (1348) Use dynamic warning signs where turning activity is intermittent but high-risk • (1349) Speed feedback signs upstream of frequent turning locations • (1350) Install transverse pavement markings upstream of turning areas	354	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
354	Do trucks frequently approach right-turning passenger or other vehicles at high speed, resulting in sudden braking, encroachment into adjacent lanes, or shoulder use?	355	• (1345) Install right-turn lane • (1346) Advance Vehicle Turning Ahead or Trucks Turning warning signs • (1347) Install intersection warning signs as per OTM Book 6 • (1348) Use dynamic warning signs where turning activity is intermittent but high-risk • (1349) Speed feedback signs upstream of frequent turning locations • (1350) Install transverse pavement markings upstream of turning areas	355	
355	Are deceleration lengths, auxiliary lanes, or turn-lane storage lengths insufficient for trucks, increasing the likelihood of tailgating or rear-end conflicts?	356	• (1338) Increase the length of left and right turn lanes	356	
356	Do closely spaced accesses or intersections limit trucks' ability to anticipate turning vehicles and adjust speed gradually?	357	• (1337) Driveway consolidation or access spacing improvements or access relocation • (1349) Speed feedback signs upstream of frequent turning locations • (1350) Install transverse pavement markings upstream of turning areas • (1351) Convert full-movement accesses to directional or right-in/right-out • (1352) Provide shared access points for adjacent properties	357	
357	Do limited sight distance, crest curves, or horizontal curves reduce truck drivers' ability to anticipate turning vehicles, increasing the likelihood of tailgating or sudden braking?	End	• (1333) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (1355) Conduct the review of sightline issues	End	

Roadway Segment, Multi-lane, Detailed Review

The rationale for SMV, angle, approaching, rear-end, bicyclist, and pedestrian collisions on multi-lane segments is the same as for the two-lane configuration (see previous sections).

Sideswipe collisions were added to the Toolbox for multi-lane segments and are discussed below.

Sideswipe Collisions

Sideswipe collisions on rural multi-lane roadway segments typically occur when two vehicles traveling in the same direction come into lateral conflict, often during lane changes or when a vehicle unintentionally drifts out of its lane. These collisions may result from intentional maneuvers executed in constrained conditions or from unintentional deviations due to driver error, distraction, impairment, or adverse roadway or environmental factors.

The assessment should begin by identifying whether sideswipe collisions are dispersed throughout the corridor or concentrated at specific locations. A corridor-wide pattern may point to systemic design deficiencies, such as narrow travel lanes or inconsistent shoulder widths. In contrast, location-specific clusters may indicate localized risks, such as sharp curves, high-access density, or problematic intersections. Lane departures linked to driver fatigue, distraction, or impaired ability may be further aggravated by inadequate lane widths or substandard cross-sections that fall short of the design standards outlined in the TAC Geometric Design Guide for Canadian Roads. Insufficient lateral clearance can make safe lane changes or evasive maneuvers difficult, particularly at high speeds.

Environmental and surface conditions are also critical considerations. Sideswipe collisions occurring during darkness or wet weather may indicate poor surface conditions or inadequate lighting. Polished asphalt surfaces, water ponding, or ice buildup can reduce skid resistance, making it harder for drivers to maintain lane control. The assessment should therefore evaluate whether the roadway meets illumination warrants and whether the drainage system is functioning effectively. Inadequate cross-fall or longitudinal grades may prevent proper water runoff, leading to hazardous conditions that contribute to loss of control.

Curved roadway segments present additional risk factors. Excessive speeds, insufficient curve radii, inadequate superelevation, and missing or poorly implemented curve signage can all increase the likelihood of lane departure and sideswipe collisions. The assessment should determine whether curves warrant advisory speeds based on ball-bank studies, and whether signs, delineators, and chevrons are in place as per OTM Book 6. A lack of adequate stopping sight distance to downstream access points, especially beyond curves, can also prompt sudden lane changes or hesitation, further elevating collision risk.

The presence of cyclists on rural multi-lane roads without dedicated cycling infrastructure may increase the frequency of lane changes by motor vehicles attempting to overtake them. This interaction, especially on high-speed corridors with limited lateral clearance, can heighten the risk of sideswipe collisions and should be considered during the evaluation.

Table B 15 presents the decision matrix employed in the toolbox.

Table B 15: Decision Matrix – Roadway Segment – Multi-Lane – Sideswipe Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
200	Are sideswipe same direction collisions widely distributed throughout the road section?	201		201	
201	Is there evidence of drivers leaving their travel lane due to unintentional movements, such as driver conditions (e.g., fatigue, inattentiveness, impaired ability), driver distraction, or vehicle failure?	202	• (333) Install centerline rumble strips • (335) Install continuous milled-in shoulder (or edgeline) rumble strips Special Consideration(s): Rumble strips should not be installed within 200 m radius of any residential development due to their noise impacts, conduct a benefit-cost analysis to evaluate the cost-effectiveness of the treatment	202	
202	Are the travel lanes widths less than the design standards (Refer to Table 4.2.1 and Table 4.2.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with shoulder widths)?	203	• (334) Adjust lane widths to meet with standards and/or adjust speed limit to be consistent with the available widths	203	
203	Are collisions occurring at night?	204	• (336) Improve visibility/retroreflectivity of pavement markings	205	
204	Is illumination warranted (Conduct illumination warrants as per TAC Guide for Design of Roadway Lighting / MTO's Highway Illumination Methodology)?	205	• (337) Provide roadway lighting	205	
205	During rush hours, is the level of service poor, resulting in vehicles following too closely, slowing down, or stopping under congested conditions, thereby increasing the potential for conflicts?	206	• (351) Improve traffic operations by adding capacity	206	
206	Are high operating speeds contributing to collisions?	207	• (1095) Reduce operating speeds for reduced collision severity (Conduct speeding review considering the roadway context and apply mitigation measures)	207	
207	Does the asphalt on the segment show noticeable signs of deterioration or look "polished" in appearance?	208	• (346347) 346347	208	
208	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	209	• (348) Improve drainage patterns or structures	211	
209	Is the cross-fall a minimum of 2%?	210		210	• (349) Improve cross slope
210	Is a minimum longitudinal grade of 0.5% provided?	211		211	• (350) Improve longitudinal grade
211	Are sideswipe collisions clustered around particular curves?	212		220	
212	Are traffic volumes greater than 5,000 veh/day?	213		214	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
213	Do the curves in question have a radius more than 500 m?	214	• (1096) Install raised pavement markers (on roads with radius > 500 m and ADT > 5,000 vpd)	214	
214	Are the collisions in curves associated with the operating speeds?	215	• (1095) Reduce operating speeds for reduced collision severity (Conduct speeding review considering the roadway context and apply mitigation measures)	215	
215	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	216	• (356) Install chevrons • (357) Install advisory speed signs	216	
216	Are collisions related to poor sight distance to accesses beyond the curves? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	217	• (358) Flatten crest vertical curve • (359) Flatten horizontal curve • (360) Improve sight distance to access Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	217	
217	Does the asphalt at the curve, where the target collisions were recorded, show noticeable signs of deterioration, water ponding, ice build-up, or look "polished" in appearance?	218	• (361) Maintain surface of lanes • (362) Apply preventive salting or chemical anti-icing • (363) Raise standard for winter maintenance	218	
218	Is the superelevation along the curve in accordance to design standards? (Refer to Section 3.2 of TAC Geometric Design Guide for Canadian Roadways for superelevation requirements)	219		219	• (364) Improve curve superelevation
219	Is the roadway surface deteriorated and lacking sufficient skid resistance, making it difficult for drivers to negotiate a curve? This can be verified by the presence of water ponding or a polished surface.	220	• (361) Maintain surface of lanes • (362) Apply preventive salting or chemical anti-icing • (363) Raise standard for winter maintenance	220	
220	Do bicyclists share the road space with vehicular traffic due to the lack of a dedicated bicycle facility, frequently causing vehicles to change lane to pass the bicycle, thereby creating the potential for sideswipe collisions?	END	• (365) Install bicycle facilities as applicable (bike lanes, multi-use path, raised cycle tracks, bicycle route with paved shoulder, etc.)	END	

Roadway Segment, Multi-lane, Specific Issue Review

For multi-lane roads, only the decision matrix for speeding issues differs from the two-lane matrix. For other issues, the decision matrices are very similar – and in some cases identical – so they are not included in this document. Users may extract the relevant decision matrices from the toolbox if needed.

Speeding Issues

The review of speeding issues on rural multi-lane roadways generally follows the same principles applied to rural two-lane two-way facilities. Both roadway types typically operate with limited access control, accommodate mixed vehicle types, consist of long uninterrupted segments, and function under driver expectancy of continuous flow. Common speed-related concerns include variability in operating speeds, elevated run-off-road collision risk, and the influence of horizontal and vertical alignment on driver behaviour.

The key distinctions for rural multi-lane roadways relate primarily to operational characteristics rather than fundamental safety principles. Multi-lane facilities provide greater passing opportunities and generally operate at higher and more uniform speeds. They also tend to have more consistent posted speed limits across longer distances. However, these roadways may experience greater speed differentials between adjacent lanes, increased lane-changing activity, and wider cross-sections, all of which can influence collision patterns and speed management considerations.

Within the City, rural multi-lane roadways are relatively limited in number and exhibit broadly similar design and operating characteristics. As a result, the diagnostic framework for speed-related issues on these facilities is more streamlined than that for rural two-lane roadways.

Like two-lane two-way roadways, for identifying road segments that warrant further investigation for speed management interventions, the thresholds were established. For all multi-lane roadways, a threshold of 15 km/h was used. Speed mitigation measure framework for multi-lane roadway is outlined in **Table B 16.**

Table B 16: Speed Management Measure for Different Types of Speed Zone

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
Reduced Speed Zone with perceived safety issues	Any operating speed (>Posted + 15 km/h & <Posted + 15 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Oversize Speed Limit Signs • Double Edge Line Markings • Pavement Speed Limit Markings • Wider Edge Lines • Transverse Pavement Markings • Transverse Rumble Strips

Segment Type	Operating Speed	Collision Threshold	Potential Speed Management Measures
			• Change Streetscape • Gateway Treatment • Multi-lane Roundabout • Install a narrow median between travel lanes at the entrance
	>Posted + 15 km/h	Occasional	• Targeted Speed Enforcement • Install Oversize Speed Limit Signs
	> Posted + 15 km/h	Infrequent	• No Action
	<Posted + 15 km/h	Occasional/Infrequent	• No Action
Standard Roadway Segment	Any operating speed (>Posted + 15 km/h & <Posted + 15 km/h)	Frequent	• Install Speed Feedback Signs • Targeted Speed Enforcement • Oversize Speed Limit Signs • Double Edge Line Markings • Pavement Speed Limit Markings • Wider Edge Lines • Multi-lane Roundabout
	>Posted + 15 km/h	Occasional	• Targeted Speed Enforcement • Oversize Speed Limit Signs
	> Posted + 15 km/h	Infrequent	• No Action
	<Posted + 15 km/h	Occasional/Infrequent	• No Action
Curve with advisory speed with perceived safety issues	> Advisory +10 km/h	-	• Install Speed Feedback Signs • Oversize Speed Limit Signs • Double Edge Line Markings • Transverse Pavement Markings • Transverse Rumble Strips • Oversize Warning Signs • Amber Flashing Beacons on Top of Advisory Speed Signs • Wider Edge Lines
Curve without advisory speed with perceived safety issues	>Posted Speed +15 km/h		• Install Speed Feedback Signs • Targeted Speed Enforcement • Wider Edge Lines • Oversize Speed Limit Signs • Double Edge Line Markings

Table B 17 presents the decision matrix employed in the toolbox.

Table B 17: Decision Matrix – Roadway Segment – Multi-Lane – Speeding Issues

Question ID	Question	IF_YES_ NEXT	YES_CM	IF_NO_ NEXT	NO_CM
206	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding-related collisions, complaints from residents or agricultural vehicle operators, difficulty judging safe gaps for turning or entering/exiting accesses (particularly at stop-controlled intersections), or any other observed or reported speed-related concerns?	207		End	• (1049) No Action Required
207	Does the roadway segment fall within a reduced speed zone or a designated speed transition area?	208		215	
208	Is the speed transition implemented appropriately (i.e., transitional speed limits in intervals of 20 km/h or less, and signage as per OTM Book 5)?	209		209	• (1061) Improve the transition zone signage as per OTM Book 5
209	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	210	• (1060) Reduce posted speed limit	210	
210	Is the reduced speed zone of appropriate length as per OTM Book 5?	211		211	• (1062) Increase the length of existing reduced speed zones as per OTM Book 5
211	Are the operating speeds (85th percentile speeds) greater than 15 km/h higher than the posted speed limit?	212		212	
212	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	221	• (1050) Install Speed Feedback Signs • (1051) Targeted speed enforcement • (1052) Install Oversize Speed Limit Signs • (1053) Provide Double Edge Line Markings • (1410) Install pavement speed limit markings • (1411) Wider Edge Lines • (1063) Install transverse pavement markings • (1064) Install transverse rumble strips • (1065) Change streetscape to increase stimulation of peripheral vision • (1066) Implement gateway treatment • (1408) Install multilane roundabout	213	

			• (1409) Install a narrow road median between travel lanes at the entrance to a speed transition zone or reduced speed zone Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas., Applicability of different treatment options to be determined by engineering judgement, Major intersection upgrades would require a feasibility study		
213	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	214		End	
214	Are the operating speeds (85th percentile speeds) greater than 15 km/h higher than the posted speed limit?	215	• (1051) Targeted speed enforcement • (1052) Install Oversize Speed Limit Signs	End	
215	Is the subject roadway segment a standard segment, rather than being a reduced speed zone?	216		End	
216	Is the posted speed higher than the appropriate speed limit for this roadway segment? Evaluate based on consistency (considering access density, roadside environment, and comparing collision rates involving speeding related locations with similar locations) with similar roadways within the City of Hamilton, and TAC Guide for Establishing Posted Speed Limits	217	• (1060) Reduce posted speed limit	217	
217	Are the operating speeds (85th percentile speeds) greater than 15 km/h higher than the posted speed limit?	218		218	
218	Based on the most recent five-year average collision data, have speed-related collisions occurred frequently at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent =	221	• (1050) Install Speed Feedback Signs • (1051) Targeted speed enforcement • (1052) Install Oversize Speed Limit Signs • (1053) Provide Double Edge Line Markings • (1408) Install multilane roundabout	219	

	0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)		• (1410) Install pavement speed limit markings • (1411) Wider Edge Lines Special Consideration(s): Major intersection upgrades would require a feasibility study		
219	Based on the most recent five-year average collision data, have speed-related collisions occurred occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 0.50; Occasional = 0.30–0.50; Infrequent = 0.10–0.30; Rare = 0–0.10.)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	220		End	
220	Are the operating speeds (85th percentile speeds) greater than 15 km/h higher than the posted speed limit?	221	• (1051) Targeted speed enforcement • (1052) Install Oversize Speed Limit Signs	End	
221	Are there any specific curves along the roadway segment where vehicle speeds are perceived to contribute to safety concerns, such as speed-related collisions, difficulties in maintaining control, or complaints from road users?	393		End	
393	Are appropriate curve warning signs meeting OTM Book 6 requirements installed at the curves within the roadway segment?	394		394	• (1056) Install/Improve Curve Warning Signs (OTM Book 6)
394	Do the curves in question require advisory speed based on ball-bank studies (Conduct ball-bank study based on Traffic Engineering Handbook 7th Edition, 2016 and refer to OTM Book 6 for installation of post mounted delineators, chevron alignment signs, and the correct type of curve warning signs)?	395	• (1057) Install chevron alignment signs • (1058) Install advisory speed signs	396	
395	Are the operating speeds within the curve (85th percentile speeds) more than 10 km/h higher than the advisory speed?	End	• (1050) Install Speed Feedback Signs • (1052) Install Oversize Speed Limit Signs • (1053) Provide Double Edge Line Markings • (1411) Wider Edge Lines • (1063) Install transverse pavement markings • (1064) Install transverse rumble strips • (1413) Install oversize warning signs • (1414) Install amber flashing beacons on top of advisory speed signs	396	

			Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.		
396	Are the operating speeds within any curves (85th percentile speeds) more than 15 km/h higher than the posted speed limit?	End	• (1050) Install Speed Feedback Signs • (1051) Targeted speed enforcement • (1052) Install Oversize Speed Limit Signs • (1053) Provide Double Edge Line Markings • (1411) Wider Edge Lines	End	

Stop-Controlled Intersections, Detailed Review

Angle Collisions

Angle collisions at rural stop-controlled intersections occur when vehicles from the stop-controlled approaches enter or cross the path of through traffic, leading to conflicts at right angles. These collisions can be influenced by vehicle approach speeds, visibility conditions, driver gap-acceptance behavior, and the physical and operational characteristics of the intersection. The first step in assessing risk is to determine whether high operating speeds on the through road are a contributing factor. Excessive speeds reduce the available gap for turning or crossing vehicles and increase the severity of any resulting collisions.

The physical condition of the roadway surface on the approach to the intersection is also a critical factor. Deteriorated pavement, polished surfaces, or drainage deficiencies such as water ponding or ice buildup can reduce tire traction and increase stopping distances. Proper drainage design, including a minimum cross-fall of 2% and a longitudinal grade of at least 0.5%, is essential for maintaining skid resistance. Conversely, steep downgrades exceeding 3% can make it more difficult for approaching vehicles to stop, especially in adverse weather, and should be evaluated as a potential contributing factor.

Driver decision-making and traffic control type also play role in angle collision risk. Difficulty in judging safe gaps in the presence of high-speed through traffic is a frequent cause of collisions. An evaluation should consider whether the current stop control is appropriate or whether a higher level of control, such as all-way stop or signalization, may be warranted. Evidence of stop sign violations, whether due to intentional non-compliance or failure to detect the sign should be reviewed, as these issues may stem from visibility obstructions such as horizontal or vertical curves, foliage, or roadside objects. Ensuring adequate advance notice for unfamiliar drivers is crucial.

Intersection visibility, both during the day and at night, is another key element in reducing angle collisions. Inadequate illumination can make the intersection and its control devices less conspicuous, while geometric constraints or roadside obstructions may limit the available intersection sight distance. Any deficiencies in sight triangles, skewed configurations, or other design-related obstructions should be reviewed against the TAC Geometric Design Guide of Canadian Roads. Additionally, compliance with Ontario Traffic Manual (OTM) standards for signage and pavement markings must be verified, as inadequate or non-compliant devices can impact driver awareness and reaction time.

Other factors such as sign clutter, nearby commercial activity, or on-street parking may contribute to driver distraction and reduce the effectiveness of traffic control devices. Poor visibility of critical warning or regulatory signs, including stop and intersection warning signs, should be addressed promptly to ensure that approaching drivers have sufficient time to perceive, react, and stop safely.

Table B 18 presents the decision matrix employed in the toolbox.

Table B 18: Decision Matrix – Stop-Controlled Intersection – Angle Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
344	Are angle collisions at the stop-controlled intersection occurring due to high approach operating speeds?	345	• (1097) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	345	
345	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	346	• (629) Improve pavement friction • (630) Maintain surface of lanes	346	
346	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	347	• (631) Apply preventive salting or chemical anti-icing • (632) Improve drainage patterns or structures • (633) Maintain or clean out drainage structures/outlets • (634) Clean out or re-grade ditches	349	
347	Is the cross-fall a minimum of 2%?	348		348	• (635) Improve cross slope
348	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	349		349	• (636) Improve longitudinal grade
349	Is there a downgrade exceeding 3% on the approach to the intersection?	350	• (629) Improve pavement friction • (637) Install intersection warning signs as per OTM Book 6 • (638) Flatten crest vertical curve Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	350	
350	Are collisions at two-way stop control intersections happening due to motorists experiencing difficulty judging gaps within the through traffic when making turning or crossing movements?	351	• (624) Introduce reduce speed zone or increase the length of existing reduced speed zone on the major road • (637) Install intersection warning signs as per OTM Book 6 • (648) Install / improve roadway identification signs (advance and turn-off) • (649) Install/improve intersection lighting • (650) Install intersection conflict warning system consisting of dynamic flashing signs and detection that provide active warning	351	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			about traffic on the major road, minor road, or both roads at the intersection • (660) Install all-way stop control, if warranted as per OTM Book 5 • (1100) Provide bypass / slip lanes on the shoulder at T-intersection Special Consideration(s): Conduct speeding review for the major roadway segment, The roadway identification signs to conform OTM Book 8, Conduct illumination warrants		
351	Is the stop control installed at the intersection deemed appropriate (e.g., traffic signal may be warranted, or all-way stop control)?	352		352	• (639) Install traffic signals, if warranted as per OTM Book 12 • (660) Install all-way stop control, if warranted as per OTM Book 5 • (627) Install multilane roundabout • (628) Install single-lane roundabout Special Consideration(s): Major intersection upgrades would require a feasibilty study
352	Is there any evidence indicating violations of the stop sign?	353	• (1098) Conduct stop sign non compliance review and apply mitigation measures, if necessary	353	
353	Is the stop sign not adequately visible to approaching drivers, which can be due to curvature, foliage, or any other objects, to allow unfamiliar drivers sufficient time to notice the stop sign and make a comfortable stop?	354	• (645) Remove foliage • (646) Remove or relocate objects obstructing the stop sign • (641) Install stop ahead sign • (640) Relocate stop sign • (643) Install oversize stop signs • (642) Install red beacon for stop sign reinforcement • (1101) Install amber beacon on top of stop ahead sign • (644) Install supplementary stop sign on left side • (661) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road)	354	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Conduct stop non compliance and sightline review and use engineering judgement for determining the best treatment		
354	Is the intersection not adequately visible to approaching drivers (during the daytime and nighttime)?	355	• (649) Install/improve intersection lighting • (637) Install intersection warning signs as per OTM Book 6 • (648) Install / improve roadway identification signs (advance and turn-off) • (661) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road) Special Consideration(s): Conduct illumination warrants, The roadway identification signs to conform OTM Book 8	355	
355	Are collisions occurring at night?	356	• (659) Improve visibility/retroreflectivity of pavement markings and signs	356	
356	Is illumination present and properly installed?	357		357	• (649) Install/improve intersection lighting Special Consideration(s): Conduct illumination warrants
357	Is the intersection failing to meet intersection sight distance requirements due to obstruction in sight triangles, presence of horizontal or vertical curves, or intersection configuration, such as a skewed intersection? (Conduct sightline review of the intersection using the toolbox)	358	• (1099) Conduct stop-controlled intersection sightlines review and apply mitigation measures, if necessary	358	
358	Do the signs and pavement markings provided fail to comply with OTM's requirements?	359	• (657) Improve signage and pavement markings in compliance with OTM	359	
359	Are there any factors contributing to driver distraction at the intersection (e.g., sign clutter, on-street parking, commercial places, etc.)	458	• (657) Improve signage and pavement markings in compliance with OTM • (658) Remove sign clutter and sources of driver distraction	458	
458	Are collisions related to poor visibility of specific signs, such as stop sign, intersection signs, or any other warning signs?	END	• (905) Install beacons on advanced warning signs	END	

Turning Movement Collisions

Turning movement collisions at rural stop-controlled intersections occur when drivers from the stop-controlled approaches attempt left or right turns across or into the path of through traffic. These collisions are influenced by a combination of vehicle approach speeds, roadway surface conditions, visibility, and driver decision-making. High approach operating speeds on the through road can significantly reduce the time available for turning drivers to safely accept gaps, increasing the likelihood of conflicts. Where pavement conditions are poor, such as polished surfaces, cracking, or rutting, drivers may have difficulty stopping or controlling their vehicles, particularly if water ponding, ice buildup, or inadequate drainage are present. Proper drainage and surface design, including a minimum 2% cross-fall and at least a 0.5% longitudinal grade, are essential for maintaining skid resistance, while steep downgrades exceeding 3% on the approach can make stopping more difficult.

Gap judgment is another contributing factor in turning movement collisions. Drivers may misjudge the speed or distance of oncoming traffic due to limited sight distance, roadway curvature, or vertical grade changes. In these cases, the appropriateness of the current traffic control should be evaluated. Some locations may require enhanced control, such as all-way stop or signalization, based on traffic volumes, speeds, and collision history. Evidence of stop sign violations should also be considered, as they may point to issues with driver compliance, sign visibility, or placement.

Visibility to both the stop sign and the intersection itself is important for enabling unfamiliar drivers to make safe turning decisions. Curvature, foliage, roadside objects, or skewed intersection geometry can obscure the view of either the stop control or approaching traffic. Inadequate illumination at night can further reduce the visibility of traffic control devices, intersection geometry, and other road users, increasing the potential for turning conflicts. Intersection sight distance should be reviewed in accordance with TAC Geometric Design Guide for Canadian Roads criteria to ensure that drivers can see and react appropriately to opposing traffic.

Intersection design and layout also play a role. The absence of dedicated left-turn lanes can cause turning vehicles to block through lanes, creating sudden speed changes and unexpected conflicts. Sight restrictions caused by median vegetation, opposing left-turn vehicle placement due to negative offset, or geometric features can further limit a driver's ability to see approaching through traffic, especially on curves or grades. Compliance with OTM requirements for signs and pavement markings should be verified to ensure drivers receive clear and consistent guidance.

Factors such as sign clutter, nearby commercial activity, or on-street parking can contribute to driver distraction and reduce awareness of turning vehicles or changing traffic conditions. Poor visibility of regulatory and warning signs, particularly stop control and intersection warning signs, can increase the likelihood of driver error and contribute to turning movement collisions.

Table B 19 presents the decision matrix employed in the toolbox.

Table B 19: Decision Matrix – Stop-Controlled Intersection – Turning Movement Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
360	Are turning movement collisions at the stop-controlled intersection occurring due to high approach operating speeds?	361	• (1102) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	361	
361	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	362	• (671) Improve pavement friction • (672) Maintain surface of lanes	362	
362	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	363	• (673) Apply preventive salting or chemical anti-icing • (674) Improve drainage patterns or structures • (675) Maintain or clean out drainage structures/outlets • (676) Clean out or re-grade ditches	366	
363	Is the cross-fall a minimum of 2%?	364		364	• (677) Improve cross slope
364	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	365		365	• (678) Improve longitudinal grade
365	Is there a downgrade exceeding 3% on the approach to the intersection?	366	• (671) Improve pavement friction • (679) Install intersection warning signs as per OTM Book 6 • (680) Flatten crest vertical curve Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	366	
366	Are collisions at two-way stop control intersections happening due to motorists experiencing difficulty judging gaps within the through traffic when making turning or crossing movements?	367	• (666) Introduce reduce speed zone or increase the length of existing reduced speed zone on the major road • (679) Install intersection warning signs as per OTM Book 6 • (690) Install / improve roadway identification signs (advance and turn-off) • (691) Install/improve intersection lighting • (692) Install intersection conflict warning system consisting of dynamic flashing signs and detection that provide active warning	367	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			about traffic on the major road, minor road, or both roads at the intersection • (702) Install all-way stop control, if warranted as per OTM Book 5 • (1105) Provide bypass / slip lanes on the shoulder at T-intersection Special Consideration(s): Conduct speeding review for the major roadway segment, The roadway identification signs to conform OTM Book 8, Conduct illumination warrants		
367	Is the stop control installed at the intersection deemed appropriate (e.g., traffic signal may be warranted, or all-way stop control)?	368		368	• (702) Install all-way stop control, if warranted as per OTM Book 5 • (681) Install traffic signals, if warranted as per OTM Book 12 • (669) Install multilane roundabout • (670) Install single-lane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study
368	Is there any evidence indicating violations of the stop sign?	369	• (1103) Conduct stop sign non compliance review and apply mitigation measures, if necessary	369	
369	Is the stop sign not adequately visible (from stopping sight distance) to approaching drivers, which can be due to curvature, foliage, or any other objects, to allow unfamiliar drivers sufficient time to notice the stop sign and make a comfortable stop? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	370	• (687) Remove foliage • (688) Remove or relocate objects obstructing the stop sign • (683) Install stop ahead sign • (682) Relocate stop sign • (685) Install oversize stop signs • (684) Install red beacon for stop sign reinforcement • (1106) Install amber beacon on top of stop ahead sign • (686) Install supplementary stop sign on left side • (703) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road)	370	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Conduct stop non compliance and sightline review and use engineering judgement for determining the best treatment		
370	Is the intersection not adequately visible to approaching drivers from a sufficient distance during the daytime and nighttime considering complexity of the intersection (stopping or decision sight distance)? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements and Section 2.5.5 for decision sight distance)	371	• (691) Install/improve intersection lighting • (679) Install intersection warning signs as per OTM Book 6 • (690) Install / improve roadway identification signs (advance and turn-off) • (703) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road) Special Consideration(s): Conduct illumination warrants, The roadway identification signs to conform OTM Book 8	371	
371	Are collisions occurring at night?	372	• (701) Improve visibility/retroreflectivity of pavement markings and signs	372	
372	Is illumination present and properly installed?	373		373	• (691) Install/improve intersection lighting Special Consideration(s): Conduct illumination warrants
373	Is the intersection failing to meet intersection sight distance requirements due to obstruction in sight triangles, presence of horizontal or vertical curves, or intersection configuration, such as a skewed intersection? (Conduct sightline review of the intersection using the toolbox)	374	• (1104) Conduct stop-controlled intersection sightlines review and apply mitigation measures, if necessary	374	
374	Do the signs and pavement markings provided fail to comply with OTM's requirements?	375	• (699) Improve signage and pavement markings in compliance with OTM	375	
375	Are there any factors contributing to driver distraction at the intersection (e.g., sign clutter, on-street parking, commercial places, etc.)	376	• (699) Improve signage and pavement markings in compliance with OTM • (700) Remove sign clutter and sources of driver distraction	376	
376	Does the intersection lack a dedicated left-turn lane?	377	• (704) Install / improve left-turn lane	377	
377	Is there evidence that motorists are unable to see opposing through traffic for the required sight distance, possibly due to obstructions within the median, horizontal curvature approaching the intersection, vertical grade approaching the intersection, or negative	459	• (656) Remove foliage • (705) Provide positive offset of opposite left-turn lanes • (693) Flatten crest vertical curve • (694) Flatten horizontal curve	459	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	offsets on the opposing intersection approaches, leading to turning movement collisions?		Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal		
459	Are collisions related to poor visibility of specific signs, such as stop sign, intersection signs, or any other warning signs?	END	• (906) Install beacons on advanced warning signs	END	

Single Motor Vehicle Collisions

Single motor vehicle collisions at rural stop-controlled intersections occur when a driver loses control and departs the roadway due to a combination of roadway design, roadside environment, operating speed, and driver error. These incidents can be influenced by shoulder-edge drop-offs (exceeding 5 cm), poorly maintained shoulder surfaces, or shoulder widths below design standards outlined in the TAC Geometric Design Guide for Canadian Roads. Inadequate shoulders can limit a driver's ability to recover after an evasive maneuver or a drift, particularly at higher operating speeds or when traction is reduced. Surface conditions such as wet pavement, ice buildup, or water ponding, which are linked to insufficient drainage, can also contribute to loss-of-control events, making the assessment of drainage structures and roadway slopes essential.

The roadside environment is an important factor in both the likelihood and severity of single-vehicle collisions. Roadside obstacles, such as fixed objects within the clear zone, including trees, utility poles, culvert ends, and steep ditch slopes, can present serious hazards when drivers leave the roadway. The MTO Roadside Design Manual provides clear zone values and foreslope criteria, adjusted for curvature and fill height, which help determine whether roadside conditions meet recoverable slope standards. Roadside mitigation treatment in order of preference are as follows:

1. Remove the obstacle;
2. Relocate the obstacle to a location to reduce the probability of it being impacted
3. Redesign the obstacle so that it can be safely traversed;
4. Reduce the impact severity of the obstacle by using an appropriate breakaway design;
5. Shield the obstacle with a barrier/guide rail system or collision cushion;
6. Delineate the obstacle, if the above mitigation measures are not appropriate; and
7. Reduce the posted speed.

Where barriers or guide rails are present, their type, length of need, and maintenance condition must be evaluated to ensure they provide the intended protection.

Visibility and intersection approach characteristics also play a significant role. Single-vehicle collisions may be more likely if the intersection is located on a horizontal or vertical curve, or if trees, embankments, buildings, or other roadside features obscure the view of the intersection. Adequate stopping and decision sight distance is necessary to allow drivers, particularly unfamiliar ones, to recognize the intersection layout, read guide or regulatory signs, and adjust their speed accordingly. Poor sight distance to the intersection or to traffic control devices can lead to late or abrupt maneuvers, increasing the risk of roadway departure.

Nighttime conditions can amplify risk if illumination is absent, insufficient, or improperly installed. Illumination warrants, as defined in the TAC Guide for the Design of Roadway Lighting and MTO methodologies, should be reviewed to determine whether lighting would improve driver detection of the intersection, roadside hazards, and other road users. A thorough assessment of these factors ensures that both the causes of single-vehicle collisions and potential countermeasures are systematically identified.

Table B 20 presents the decision matrix employed in the toolbox.

Table B 20: Decision Matrix – Stop-Controlled Intersection – Single Motor Vehicle Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
414	Are collisions occurring where there are shoulder-edge drop-offs greater than 5 cm?	415	• (790) Remove shoulder-edge drop-offs • (912) Install Safety Edge Treatment	415	
415	Is the shoulder surface in a well-maintained state?	416		416	• (791) Maintain surface of shoulder
416	Is the shoulder width consistent with design standards (Refer to Section 4.4.2 of Chapter 4 of TAC Geometric Design Guide for Canadian Roads and review with lane widths)?	417		417	• (792) Widen shoulder and/or change shoulder type
417	Are collisions occurring at night?	418	• (793) Improve visibility/retroreflectivity of pavement markings	418	
418	Is illumination warranted (Conduct illumination warrants as per TAC Guide for Design of Roadway Lighting / MTO's Highway Illumination Methodology)?	424	• (794) Install / improve intersection lighting	424	
419	Are there fixed objects located within the clear zone (e.g., trees, utility poles, culvert ends, headwalls, ditches with a near vertical end at a driveway, etc.)? For desired clear zone values, refer to Chapter 2.3.1 of MTO's Roadside Design Manual July 2023. Clear zone values should be adjusted for curvature.	420		426	
420	Can the fixed objects be redesigned so that they can be safely traversed (e.g. providing a safety slope end treatment for exposed culverts by an appropriately designed metallic grating, grading the slope of a ditch near vertical end to a recoverable slope?	426	• (795) Improve traversability of object	421	
421	Can the object be removed or relocated to an area outside of the clear zone (e.g., relocation of utility poles, or removal of trees)?	426	• (796) Relocate object outside of clear zone • (797) Remove object • (798) Widen Clear Zone	422	
422	Can the object incorporate "breakaway" devices (e.g. replacing the fixed utility poles to breakaway types)?	426	• (799) Incorporate breakaway device	423	
423	Is an existing barrier system or guide rail (if present) of appropriate type and length of need and/or attenuation system present and/or is it in proper working order? Select no, if a barrier system or guide rail is not present.	426		533	• (800) Improve roadside barrier/guide rail • (801) Improve barrier attenuation system/guide rail Special Consideration(s): If barrier system is not present, conduct further review to determine the need of barrier system
424	Are the roadside foreslopes within the clear zone as per desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	419		532	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
425	Can the foreslopes be upgraded to the desirable values as per the fill height (refer to Table 2-4 of MTO's Roadside Design Manual)?	426	• (802) Flatten side slopes	426	
426	Are high operating speeds contributing to collisions?	427	• (1109) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	427	
427	Are collisions occurring at night?	428	• (814) Install / improve intersection lighting • (815) Install sign with higher retroreflectivity	428	
428	Is illumination present and properly installed?	429		429	• (822) Install / improve intersection lighting
429	Is the intersection on a horizontal and/or vertical curve that limits the visibility of the intersection?	430	• (812) Flatten crest vertical curve • (813) Flatten horizontal curve • (876) Relocate the intersection to a tangent section • (1110) Reduce posted speed limit Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, The decision to reduce the posted speed limit should be made based on the speeding review	430	
430	Is the visibility of the intersection reduced due to roadside features (e.g. trees, embankment) or adjacent land use (e.g., buildings, fences, crops)?	431	• (816) Improve sight distance to intersection • (817) Improve sight triangles at intersection	431	
431	Can the street name, guide, or turn restriction signs be read at a distance from the intersection equivalent to the stopping sight distance? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	432		432	• (818) Remove foliage • (816) Improve sight distance to intersection • (819) Install signs with larger letter heights • (820) Install roadway identification signs (advance and turn-off signs) as per OTM Book 8
432	Are unfamiliar drivers able to see and comprehend the layout and configuration of the intersection geometry from a sufficient distance considering complexity of the intersection (stopping or decision sight distance)? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements and Section 2.5.5 for decision sight distance)	433		433	• (816) Improve sight distance to intersection • (821) Improve visibility/retroreflectivity of pavement markings

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
433	Are collisions related to poor sight distance to intersection? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	434	• (818) Remove foliage • (826) Install advance warning signs • (817) Improve sight triangles at intersection • (825) Improve sight distance to intersection • (812) Flatten crest vertical curve • (813) Flatten horizontal curve Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	434	
434	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	END	• (827) Improve drainage patterns or structures • (828) Maintain or clean out drainage structures/outlets • (829) Apply preventive salting or chemical anti-icing • (830) Clean out or re-grade ditches • (831) Improve snow storage or snow removal	END	

Rear End Collisions

Rear-end collisions at rural stop-controlled intersections occur when following drivers are unable to anticipate or respond in time to a lead vehicle slowing or stopping for an intersection or turning movement. These collisions can involve through vehicles encountering turning vehicles, vehicles entering or exiting nearby accesses, or traffic slowing unexpectedly within the intersection's functional area. High approach operating speeds, especially when combined with inadequate sight distance or insufficient advance warning, can worsen the likelihood of such collisions. Evaluating whether turning movements are a common factor helps identify if additional turn lanes, better gap acceptance, or changes to traffic control may be needed.

Visibility of the stop sign and the intersection itself is an important contributing factor. Curvature, foliage, roadside features, or even the sun's position on east–west approaches can make the stop sign less visible or less conspicuous against its background. Reduced visibility of the intersection, whether during the day or at night, limits driver reaction time. Illumination should therefore be reviewed to determine if it meets warrant criteria and is functioning properly. Likewise, legibility of street name, guide, and regulatory signs from the required stopping sight distance helps ensure that unfamiliar drivers have enough time to understand the intersection layout and adjust their speed accordingly.

Roadway alignment, geometry, and condition also play a role. Horizontal or vertical curves that limit sight distance, downgrades greater than 3%, or insufficient cross-fall and longitudinal grade can all increase stopping distances and collision risk. Poor surface conditions, water ponding, ice buildup, or deteriorated pavement at the approach can further reduce available friction, making it more difficult for vehicles to stop in time. Adequate drainage and pavement maintenance are therefore critical safety considerations.

Access management within the functional area of the intersection is another factor. Driveways and minor road connections near the stop-controlled intersection can cause unexpected slowing or turning movements on the major road, leading to rear-end collisions. Assessing whether these collisions occur during nighttime conditions, involve inadequate gaps, or are related to limited sight distance to accesses helps determine whether access relocation, closure, or improved signing and marking is warranted.

Geometric factors related to turning movements, such as insufficient corner radius for the design vehicle, can cause through vehicles to slow abruptly when turning traffic encroaches into their lane. This, along with inadequate right-turn or left-turn sight distances for vehicles on both major and minor roads, can create hesitation and unpredictable vehicle movements. Addressing these design, visibility, and operational factors together provides a comprehensive approach to reducing rear-end collisions at rural stop-controlled intersections.

Table B 21 presents the decision matrix employed in the toolbox.

Table B 21: Decision Matrix – Stop-Controlled Intersection – Rear End Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
378	Do rear end collisions involve turning vehicles?	379	• (706) Install / improve left-turn lane • (707) Install / improve right-turn lane • (898) Provide bypass / slip lanes on the shoulder at T-intersection • (708) Install multilane roundabout • (716) Install single-lane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	379	
379	Are rear end collisions at the stop-controlled intersection occurring due to high operating speeds?	380	• (1111) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	380	
380	Is the stop sign not adequately visible (from stopping sight distance) to approaching drivers, which can be due to curvature, foliage, or any other objects, to allow unfamiliar drivers sufficient time to notice the stop sign and make a comfortable stop? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	381	• (731) Remove foliage • (757) Improve sight distance to stop sign • (717) Install stop ahead signs • (728) Improve sight distance to intersection • (762) Add or improve stop line marking • (763) Relocate stop sign closer to driver's line of sight Special Consideration(s): Conduct stop sign non-compliance review	381	
381	Is the stop sign conspicuous against the background in which it is seen?	382		382	• (763) Relocate stop sign closer to driver's line of sight • (720) Adjust angle or orientation of stop sign • (762) Add or improve stop line marking • (719) Install oversize stop signs • (1112) Install supplementary stop sign on left side • (721) Replace damaged or faded signs • (722) Remove or relocate other lower priority signs • (718) Install red beacon for stop sign reinforcement • (723) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road)

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
					Special Consideration(s): Conduct stop non compliance and sightline review and use engineering judgement for determining the best treatment
382	Are there more collisions than might be expected based on volumes occurring at night?	383	• (726) Install / improve intersection lighting • (727) Install sign with higher retroreflectivity	383	
383	Is illumination present and properly installed?	384		384	• (735) Install / improve intersection lighting
384	Is the intersection on a horizontal and/or vertical curve that limits the visibility of the intersection?	385	• (724) Flatten crest vertical curve • (725) Flatten horizontal curve • (875) Relocate the intersection to a tangent section Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	385	
385	Is the orientation of the approach to the intersection on an east-west alignment, making visibility of the stop sign difficult against the rising or setting sun?	386	• (723) Install overhead red/amber flashing beacons (red facing the side road(s) and the amber facing the main road) • (718) Install red beacon for stop sign reinforcement	386	
386	Is the visibility of the intersection reduced due to roadside features (e.g. trees, embankment) or adjacent land use (e.g., buildings, fences, crops)?	387	• (728) Improve sight distance to intersection • (729) Improve sight triangles at intersection	387	
387	Can the street name, guide, or turn restriction signs be read at a distance from the intersection equivalent to the stopping sight distance? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	388		388	• (731) Remove foliage • (728) Improve sight distance to intersection • (732) Install signs with larger letter heights • (733) Install roadway identification signs (advance and turn-off signs) as per OTM Book 8
388	Are unfamiliar drivers able to see and comprehend the layout and configuration of the intersection geometry from a sufficient distance considering complexity of the intersection (stopping or decision sight distance)? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements and Section 2.5.5 for decision sight distance)	389		389	• (728) Improve sight distance to intersection • (734) Improve visibility/retroreflectivity of pavement markings
389	Are there rear-end collisions occurring in relation to accesses within the functional area of the intersection?	390	• (871) Move driveways to the side street if possible	390	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (872) Consolidate adjacent driveways		
390	Are collisions related to poor sight distance to accesses? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	391	• (724) Flatten crest vertical curve • (725) Flatten horizontal curve • (731) Remove foliage • (744) Improve sight distance to access • (745) Install advance warning signs • (739) Move access further from intersection • (740) Close access Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	391	
391	Do collisions involve vehicles turning into or out of accesses?	392	• (738) Restrict movements to right-in and right-out at the access using channelizing island • (739) Move access further from intersection • (740) Close access • (741) Install / improve left-turn lane for specific accesses, if warranted • (742) Install/improve right-turn lane at accesses, if warranted • (743) Install median on intersection approach to eliminate left-turning maneuvers at • (744) Improve sight distance to access Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	392	
392	Are access related collisions occurring at night?	393	• (726) Install / improve intersection lighting • (734) Improve visibility/retroreflectivity of pavement markings	393	
393	Are there rear-end collisions occurring on a downgrade greater than 3%?	394	• (745) Install advance warning signs • (724) Flatten crest vertical curve • (746) Improve pavement friction Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	394	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
394	Are the rear-end collisions related to turning vehicles on the major road?	395	• (706) Install / improve left-turn lane • (707) Install / improve right-turn lane	395	
395	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	396	• (746) Improve pavement friction • (747) Maintain surface of lanes	399	
396	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	397	• (748) Improve drainage patterns or structures • (749) Maintain or clean out drainage structures/outlets • (750) Apply preventive salting or chemical anti-icing • (751) Clean out or re-grade ditches • (754) Improve snow storage or snow removal	397	
397	Is the cross-fall a minimum of 2%?	398		398	• (752) Improve cross slope
398	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	399		399	• (753) Improve longitudinal grade
399	Is right-turn sight distance adequate? (Use Table 9.9.6 for two-lane roads and passenger cars. For other scenarios, refer to Case B2 on pages 69–71, with adjustments for grade and vehicle type.)	400		400	• (730) Correct right-of-way encroachments • (729) Improve sight triangles at intersection • (754) Improve snow storage or snow removal • (756) Install acceleration lane on major road • (731) Remove foliage
400	Is left-turn sight distance adequate? (For a two-lane major roadway with grades up to 3% and passenger cars, refer to Table 9.9.4. For other cases such as multi-lane roadways or heavy vehicles, apply Case B1 guidance from pages 66–67, with appropriate grade adjustments.)	401		401	• (731) Remove foliage • (729) Improve sight triangles at intersection • (728) Improve sight distance to intersection • (758) Install hidden intersection warning sign • (730) Correct right-of-way encroachments • (706) Install / improve left-turn lane • (756) Install acceleration lane on major road
401	Are rear-end collisions occurring due to inadequate gaps?	402	• (759) Install traffic control signals, if warranted • (760) Install all-way stop control, if warranted as per OTM Book 5 • (716) Install single-lane roundabout • (708) Install multilane roundabout • (760) Install all-way stop control, if warranted as per OTM Book 5	402	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Major intersection upgrades would require a feasibilty study		
402	Do rear-end collisions involve left-turning vehicles on the major road?	403	• (706) Install / improve left-turn lane	403	
403	Do rear-end collisions involve right-turning vehicles on the minor road?	454	• (707) Install / improve right-turn lane • (898) Provide bypass / slip lanes on the shoulder at T-intersection	454	
454	Is the corner radius too small to accommodate an appropriate design vehicle causing conflicts between through traffic and turning vehicle	460	• (895) Flare the approach to the intersection to reduce conflicts between through traffic and turning vehicle and assist large trucks in negotiating the turn • (896) Increase the corner radius to accommodate an appropriate design vehicle	460	
460	Are collisions related to poor visibility of specific signs, such as stop sign, intersection signs, or any other warning signs?	END	• (907) Install beacons on advanced warning signs	END	

Sideswipe Collisions

Sideswipe collisions at rural stop-controlled intersections typically occur when vehicles traveling in the same direction come into lateral contact, often during lane changes, avoidance maneuvers, or when turning movements require encroachment into adjacent lanes. The presence or absence of dedicated turn lanes is an important factor, as insufficient space for turning vehicles can cause through traffic to make abrupt lateral movements, increasing the potential for conflicts. High operating speeds further reduce the margin for safe maneuvering, making minor steering adjustments more hazardous and increasing the severity of any resulting collisions.

Visibility and driver comprehension of the intersection layout are also important considerations. If street name, guide, or turn restriction signs cannot be read from a distance equal to the stopping sight distance, or if unfamiliar drivers are unable to clearly understand the intersection geometry from afar, last-minute lane changes or hesitation can occur. These conditions can contribute to sideswipe collisions, especially in complex or unconventional intersection layouts. Adequate advance warning and legibility of traffic control information help reduce sudden lane shifts that may cause such collisions.

Lighting conditions can also play a role, particularly if more collisions are occurring at night than would be expected based on traffic volumes. Poor or absent illumination can reduce a driver's ability to detect other vehicles, lane markings, or turning movements, increasing the risk of lateral conflicts. Evaluating whether intersection lighting meets TAC Guide for the Design of Roadway Lighting and MTO methodologies, ensures that night-time visibility is sufficient for all road users.

Access management within the functional area of the intersection is another important factor. Driveways or entrances near the stop-controlled approaches can create turning conflicts that prompt sudden lane changes. Poor sight distance to accesses, as defined in the TAC Geometric Design Guide for Canadian Roads, may cause drivers to take evasive action, resulting in sideswipe collisions. When these collisions involve vehicles entering or exiting accesses, particularly at night when visibility is reduced, it suggests a need for improved access location, control, or lighting to mitigate risks.

Table B 22 presents the decision matrix employed in the toolbox.

Table B 22: Decision Matrix – Stop-Controlled Intersection – Sideswipe Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
404	Are there dedicated turn lanes?	405		405	• (764) Install / improve left-turn lane • (765) Install right-turn lane
405	Are sideswipe collisions at the stop-controlled intersection occurring due to high approach operating speeds?	406	• (1113) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	406	
406	Can the street name, guide, or turn restriction signs be read at a distance from the intersection equivalent to the stopping sight distance? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	407		407	• (774) Remove foliage • (775) Improve sight distance to intersection • (776) Install signs with larger letter heights • (777) Install roadway identification signs (advance and turn-off signs) as per OTM Book 8 Special Consideration(s): Conduct sightlines review
407	Are unfamiliar drivers able to see and comprehend the layout and configuration of the intersection geometry from a sufficient distance considering complexity of the intersection (stopping or decision sight distance)? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements and Section 2.5.5 for decision sight distance)	408		408	• (775) Improve sight distance to intersection • (778) Improve visibility/retroreflectivity of pavement markings Special Consideration(s): Conduct sightlines review
408	Are there more collision than might be expected based on volumes occurring at night?	409	• (779) Install sign with higher retroreflectivity • (780) Replace damaged or faded signs	409	
409	Is illumination present and properly installed?	410		410	• (781) Install / improve intersection lighting
410	Are there sideswipe collisions occurring in relation to accesses within the functional area of the intersection?	411	• (873) Move driveways to the side street if possible • (874) Consolidate adjacent driveways • (881) Regulating the minimum spacing of driveways on intersection approaches Special Consideration(s): Any adjustment to accesses would require consultation with the property owners	411	
411	Are collisions related to poor sight distance to accesses? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	412	• (787) Flatten crest vertical curve • (788) Flatten horizontal curve • (774) Remove foliage • (789) Improve sight distance to access	412	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal, Conduct sightlines review		
412	Do collisions involve vehicles turning into or out of accesses?	413	• (784) Restrict movements to right-in and right-out at the access using channelizing island • (785) Move access further from intersection • (786) Close access • (773) Install median on intersection approach to eliminate left-turning maneuvers at access Special Consideration(s): Any adjustment to accesses would require consultation with the property owners, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	413	
413	Are access related collisions occurring at night?	END	• (781) Install / improve intersection lighting	END	

Bicycle Collisions

Bicycle collisions at rural stop-controlled intersections occur from a combination of infrastructure deficiencies, visibility limitations, and driver or cyclist behavior. The presence of appropriate bicycle facilities, such as dedicated lanes, clear pavement markings, and regulatory or warning signage consistent with OTM Book 18, can be a fundamental factor. When these elements are missing, unclear, or improperly maintained, motorists may be less aware of cyclists, and cyclists may have limited guidance on safe positioning or crossing paths through the intersection.

The ability of cyclists to cross the roadway safely is also an important consideration. Rural intersections can feature high approach speeds, wide crossing distances, and long gaps between safe crossing opportunities, particularly on major roads with heavy or fast-moving traffic. If cyclists experience frequent difficulty finding adequate gaps to cross, this may increase the likelihood of risky maneuvers, hesitation in live traffic, or collisions with approaching vehicles.

Lighting and nighttime visibility play a significant role as well. If bicycle collisions occur disproportionately at night, it may indicate inadequate intersection illumination or insufficient visibility of cyclists due to environmental conditions, poor reflective treatments, or lack of lighting on the cyclists themselves. Evaluating whether lighting meets TAC Guide for the Design of Roadway Lighting and MTO methodologies helps determine if improved nighttime visibility could reduce collision risks.

Sight distance is another essential factor, particularly for interactions between cyclists and turning or crossing vehicles. If sight lines are obstructed, by vegetation, buildings, embankments, or roadside features, drivers may have insufficient time to detect and respond to approaching cyclists, and cyclists may be unable to assess the intentions of approaching vehicles. Sign distance should be reviewed for its compliance with TAC Geometric Design Guide for Canadian Roads Section 9.9.2.2.

If the intersection is located within a school zone, the risk to child cyclists is heightened due to their lower riding experience, variable behavior, and greater vulnerability. In such cases, compliance with school zone traffic control requirements and additional cyclist protection measures may be necessary to ensure safety.

Table B 23 presents the decision matrix employed in the toolbox.

Table B 23: Decision Matrix – Stop-Controlled Intersection – Bicyclist Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
435	Are appropriate bicycle lanes, signage, and pavement markings provided at the intersection as per OTM Book 18?	436		436	• (832) Use dashed longitudinal lines to indicate vehicular lane change area • (833) Provide appropriate bicycle lanes, signage, and pavement markings as per OTM Book 18 • (834) Widen vehicle lane to accommodate bicycles • (835) Implement paved shoulder in the intersection area to accommodate bicycles
436	Do bicyclists have difficulty crossing the road?	437	• (843) Install bicycle warning signs • (836) Install a dedicated bicycle crossride or a pedestrian crosswalk where bicyclists can cross as pedestrians	437	
437	Are bicycle collisions occurring at night?	438	• (837) Bicyclist education on visibility at night • (838) Install / improve intersection lighting • (839) Driver education on speed and high beam use • (840) Increase enforcement to reduce speed on intersection approach	438	
438	Are sight triangles in accordance with standards and clear of sight obstructions? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)	439		439	• (842) Improve sight triangles at intersection Special Consideration(s): Conduct sightlines review
439	Is the intersection located within a school zone?	END	• (841) Implement school speed zone	END	

Pedestrian Collisions

Pedestrian collisions at rural stop-controlled intersections occur when roadway design, traffic control, and operating conditions fail to provide adequate protection for pedestrians. The first consideration is whether pedestrians are at measurable risk at the location, which involves assessing both the presence of pedestrian activity and the degree of conflict with vehicular traffic. This risk increases when intersections lack continuous pedestrian infrastructure, such as sidewalks on the approaches, forcing pedestrians to walk along the shoulder or travel lanes, and when controlled pedestrian crossing facilities are absent, leading to frequent crossings without the right of way.

Accessibility features, such as curb ramps in pedestrian waiting areas, are also essential to ensure that all pedestrians, including those with mobility challenges, can cross safely and efficiently. Locations within school zones require particular attention, as children have less predictable behavior and lower gap acceptance, making them more vulnerable to collisions. In such areas, additional traffic calming or crossing enhancements may be necessary.

The time of day is another important factor. If pedestrian collisions are occurring disproportionately at night, it may suggest insufficient roadway or intersection illumination, inadequate pedestrian visibility, or both. Sight triangles must be assessed for each quadrant of the intersection in accordance with TAC Section 9.9.2.2, with adjustments for grade and skew as per Section 9.9.2.4. Any obstructions within the sight triangles, such as vegetation, embankments, or roadside objects, can prevent drivers from seeing pedestrians in time to react, particularly on approaches with high operating speeds.

The absence of marked crosswalks can make pedestrian activity less predictable for drivers, especially in rural contexts where they may not expect to encounter frequent crossings. Unexpected pedestrian activity combined with high vehicle operating speeds creates situations where drivers have limited time to yield, increasing collision potential. Furthermore, intersection geometry can also play a role. For example, a horizontal curve before the crossing location may obscure the pedestrian from a driver's view until it is too late to stop safely.

Table B 24 presents the decision matrix employed in the toolbox.

Table B 24: Decision Matrix – Stop-Controlled Intersection – Pedestrian Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
440	Are pedestrians at risk at the intersection?	441		441	
441	Are there pedestrian sidewalks on the intersection approaches?	442		442	• (844) Install sidewalk along intersection approach
442	Do pedestrians cross the road without right of way due to the absence of controlled pedestrian crossing facilities?	443	• (845) Install controlled pedestrian treatment as per OTM Book 15 • (866) Install an uncontrolled pedestrian crossing treatment with signage for pedestrians to give yield to vehicular traffic (OTM Book 15)	443	
443	Are there appropriate curb ramps in the pedestrian waiting area?	444		444	• (846) Install appropriate curb ramps with tactile plates
444	Is the intersection located within a school zone?	445	• (846) Install appropriate curb ramps with tactile plates • (847) Provide marked school crosswalk (OTM Book 15) with crossing guard • (848) Implement school speed zone	445	
445	Are pedestrian collisions occurring at night?	446	• (850) Install/improve intersection lighting	446	
446	Are sight triangles in accordance with standards and clear of sight obstructions? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)	447		447	• (849) Improve sight triangles at intersection Special Consideration(s): Conduct sightlines review
447	Are the marked crosswalks not available at the intersection?	448	• (851) Install marked crosswalk at the controlled approaches (marked crosswalks are not permitted on uncontrolled approaches)	448	
448	Is the location of pedestrian activity unexpected for drivers?	449	• (852) Install pedestrian warning signs • (853) Install pedestrian warning signs with flashing beacons for locations with higher pedestrian activity	449	
449	Are pedestrians at risk due to high operating speeds at the intersection approach?	450	• (1114) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	450	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
450	Does the intersection geometry or other features present result in obstructing the visibility of pedestrians in the crosswalk at an intersection? As an example, a horizontal curve immediately before a pedestrian crossing location may limit the sight lines.	END	• (861) Flatten crest vertical curve • (862) Flatten horizontal curve • (863) Remove foliage • (864) Move the crosswalk to another controlled approach • (865) Improve sight distance to intersection Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	END	

Stop-Controlled Intersections, Specific Issue Review

Stop-Controlled Non-Compliance

The assessment of stop sign non-compliance should not be viewed solely as a behavioral issue but rather as one influenced by a range of operational and contextual factors that may affect safety at stop-controlled intersections. The first step involves determining whether non-compliance is perceived as contributing to safety concerns. This includes reviewing reported collisions involving failure to yield or disobey traffic control, resident complaints, or observed driver behavior. These qualitative indicators help flag locations where driver behavior may not align with regulatory stop controls, warranting further investigation.

Collision data is essential for quantifying the extent of the issue. By classifying the frequency of stop sign-related collisions over a five-year period, frequent (3 or more collisions), occasional (2 collisions), infrequent (1 collision), or rare (0 collisions), the assessment can distinguish between systemic problems and isolated occurrences. This approach helps prioritize interventions based on the level of safety risk. These thresholds are consistent with the guidelines provided in TAC Guide for In-service Road Safety Reviews.

Compliance studies based on field observation provide an objective understanding of driver behavior. Industry practice recommends observing a minimum of 50 vehicles per approach. Compliance levels are categorized as acceptable (≥ 85% come to a full stop), moderate concern (65–85%), or high concern (< 65%). These thresholds support a consistent evaluation of the severity of non-compliance and help identify whether it reflects broader operational issues.

Non-compliance is often influenced by factors beyond driver intent. High operating speeds on either the major or minor road can reduce compliance and increase the severity of potential conflicts. In addition, restricted sightlines caused by curves, vegetation, or other obstructions may limit a driver's ability to perceive the intersection or stop sign in time. Including these factors in the assessment helps determine whether the intersection's design or environment is contributing to the issue.

Driver awareness of the stop sign itself is fundamental to compliance. Poor visibility due to sign placement, lack of advance warning, or physical obstructions can lead to unintentional violations. The assessment should identify any visibility constraints that may require corrective actions such as improved sign placement, increased conspicuity, or vegetation clearing. Addressing these deficiencies is an important step toward improving compliance and reducing collision risk.

Table B 25 presents the decision matrix employed in the toolbox.

Table B 25: Decision Matrix – Stop-Controlled Intersection – Stop Control Non-Compliance Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
109	Are there perceived concerns that stop sign non-compliance is contributing to safety issues at this location (e.g., reported collisions involving failure to yield or disobey traffic control, resident complaints, or observed driver behavior)?	110		End	• (950) Continue monitoring; no further action recommended at this time
110	Has a compliance study been conducted using field observations (minimum 50 vehicles per approach)?	111		111	• (951) Conduct a stop compliance study
111	Is the observed stop sign compliance acceptable (≥ 85% of vehicles come to a complete stop; < 15% fail to stop including rolling and no stops)?	112		116	
112	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred frequently at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	380		113	
113	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred occasionally at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	114		End	
114	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (957) Install supplementary stop sign on left side • (958) Remove foliage • (959) Remove or relocate objects obstructing the stop sign	End	• (956) Install oversize stop signs • (955) Install red beacon for stop sign reinforcement
115	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (958) Remove foliage	End	• (950) Continue monitoring; no further action recommended at this time

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (959) Remove or relocate objects obstructing the stop sign • (962) Install stop bar • (1402) Install Tiger Tail signs with the stop control signs		
116	Is the observed stop sign compliance at a moderate concern level (65–85% full stop; 15–35% fail to stop including rolling + no stops)?	117		121	
117	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred frequently at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	380		118	
118	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred occasionally at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	119		120	
119	Are there other contributing factors, based on traffic operations and collision history, such as high operating speeds on the major or minor roads, limited intersection sight distance, or restricted sightlines along the major road that may be affecting safety at the intersection?	End	• (952) Conduct in-service road safety review	120	
120	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (957) Install supplementary stop sign on left side • (958) Remove foliage • (959) Remove or relocate objects obstructing the stop sign	End	• (956) Install oversize stop signs • (955) Install red beacon for stop sign reinforcement

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
121	Is the observed stop sign compliance at a high concern level (< 65% full stop or > 35% of vehicles fail to stop)?	122		End	
122	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred frequently at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	124		123	
123	Based on the most recent five-year collision data, have stop non-compliance-related collisions occurred occasionally at this location (Frequency is defined as the total number of stop non-compliance-related collisions over the past five years: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Stop non-compliance-related collisions are defined as all collisions involving failed to yield right-of-way or disobeyed traffic control contributing factors)	125		125	
124	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (958) Remove foliage • (959) Remove or relocate objects obstructing the stop sign • (962) Install stop bar • (957) Install supplementary stop sign on left side • (963) Install amber beacon on top of stop ahead sign	End	• (1402) Install Tiger Tail signs with the stop control signs • (961) Install/improve intersection lighting • (955) Install red beacon for stop sign reinforcement • (956) Install oversize stop signs • (960) Increase enforcement to reduce stop sign violation • (963) Install amber beacon on top of stop ahead sign
125	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (958) Remove foliage • (959) Remove or relocate objects obstructing the stop sign • (962) Install stop bar • (957) Install supplementary stop sign on left side	End	• (1402) Install Tiger Tail signs with the stop control signs • (961) Install/improve intersection lighting • (955) Install red beacon for stop sign reinforcement • (956) Install oversize stop signs • (960) Increase enforcement to reduce stop sign violation

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (963) Install amber beacon on top of stop ahead sign		• (963) Install amber beacon on top of stop ahead sign
380	Are there visibility constraints (e.g., due to horizontal/vertical curvature, obstructions like vegetation) that may limit driver awareness of the stop sign?	End	• (953) Relocate stop sign • (954) Install stop ahead sign • (957) Install supplementary stop sign on left side • (958) Remove foliage • (959) Remove or relocate objects obstructing the stop sign	End	• (956) Install oversize stop signs • (955) Install red beacon for stop sign reinforcement

Stop-Controlled Sightline Issues

Sight distance is a fundamental element in the safety of rural stop-controlled intersections, particularly where high-speed traffic and limited visibility intersect with driver decision-making. The initial step in assessing sightline issues involves identifying perceived safety concerns, such as local complaints, observed driver hesitation or risky maneuvers, or visibility limitations in one or more quadrants of the intersection. These qualitative indicators help highlight locations where drivers may not have sufficient visibility to detect and respond to conflicting vehicles, cyclists, or pedestrians. Sightline evaluations should follow the guidance in Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, with attention to skew angles and vertical grades as outlined in Section 9.9.2.4.

Collision history offers objective validation of perceived risks and supports prioritization. By categorizing sightline-related collisions, particularly turning movement and angle collisions, into categories as discussed before (frequent, occasional, infrequent, or rare) over a five-year period, enables differentiate between isolated incidents and systemic safety concerns and prioritize mitigation measures accordingly. This structured evaluation supports targeted safety improvements by focusing on intersections with recurring visibility-related collisions.

The type of traffic control at the intersection plays an important role in determining required sight distances. Many rural intersections are controlled by stop signs on minor roads, requiring drivers to find safe gaps in the through traffic on the major road. In such cases, the adequacy of departure sight triangles for left and right turns, as well as crossing movements, must be reviewed. The TAC Guide provides design criteria and reference tables (e.g., Tables 9.9.4, 9.9.6, and Cases B1 to B3) to help ensure that drivers have clear visibility to make informed decisions under typical operating conditions.

Some intersections present unique challenges, such as legal restrictions on turning movements or crossing distances that span more than six effective lanes (including medians). These conditions increase the time drivers remain exposed within the intersection, particularly for heavy vehicles or when departure grades delay acceleration. In such contexts, it is critical to evaluate whether crossing sight distances meet the standards outlined in TAC's Case B3, ensuring safety under more demanding operational scenarios.

Even in all-way stop-controlled intersections, sightlines between stopped vehicles are important for safe and predictable right-of-way decisions. Drivers should be able to see other vehicles arriving at and stopped on opposing approaches. Similarly, for intersections where left-turns are permitted from the major road, drivers need adequate visibility of opposing traffic to complete the maneuver safely. These evaluations should be based on the criteria outlined in Case F of the TAC Geometric Design Guide.

Table B 26 presents the decision matrix employed in the toolbox.

Table B 26: Decision Matrix – Stop-Controlled Intersection – Sightline Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
126	Are there perceived concerns that deficient sightlines are contributing to safety issues at this location? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)	127		End	• (964) No Action Required
127	Is the intersection controlled by stop signs on the minor road only, with the major road operating as free flow? (Select "No" if the intersection is controlled as an all-way stop.)	128		137	
128	Based on the most recent five-year collision data, have sightlines-related collisions occurred frequently at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 4; Occasional = 3-4; Infrequent = 1–2; Rare = 0)? (Sightlines related are defined as all angle and turning movement collisions)	130	• (1399) Install all-way stop control, if warranted as per OTM Book 5 Special Consideration(s): The feasibility of installing all-way stop control must be reviewed based on OTM Book 5	129	
129	Based on the most recent five-year collision data, have sightlines-related collisions occurred occasionally at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 4; Occasional = 3-4; Infrequent = 1–2; Rare = 0)? (Sightlines related are defined as all angle and turning movement collisions)	130	• (1399) Install all-way stop control, if warranted as per OTM Book 5 Special Consideration(s): The feasibility of installing all-way stop control must be reviewed based on OTM Book 5	130	
130	Is the available departure sight triangle to the left or right adequate for a stopped driver on the minor-road approach to turn left onto the major road? (For a two-lane major roadway with grades up to 3% and passenger cars, refer to Table 9.9.4. For other cases such as multi-lane roadways or heavy vehicles, apply Case B1 guidance from pages 66–67, with appropriate grade adjustments.)	131		131	• (966) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (967) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance • (1400) Flatten crest vertical curve • (1401) Flatten horizontal curve Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
					should be done in conjunction with speed management measures, Major infrastructure improvements to be considered as part of future construction based on economic appraisal
131	Is the available departure sight triangle to the left adequate for a stopped driver on the minor-road approach to turn right onto the major road? (Use Table 9.9.6 for two-lane roads and passenger cars. For other scenarios, refer to Case B2 on pages 69–71, with adjustments for grade and vehicle type.)	132		132	• (966) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (967) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance • (1400) Flatten crest vertical curve • (1401) Flatten horizontal curve Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjunction with speed management measures, Major infrastructure improvements to be considered as part of future construction based on economic appraisal
132	Is there a situation where left turns, right turns, or both are prohibited from a particular approach, making the crossing maneuver the only legal option?	135		133	
133	Does the crossing maneuver require traversing more than six effective lanes, including any medians?	135		134	
134	Are there substantial volumes of heavy vehicles crossing the highway, combined with steep departure grades that may slow vehicle acceleration while part of the vehicle remains in the intersection?	135		136	
135	Is the available departure sight triangle adequate for a stopped driver on the minor-road approach to complete a crossing maneuver across the major road? (Evaluate using Case B3 – Crossing Maneuver from the Minor Road, as described on page 72 of the 2017 TAC Geometric Design Guide.)	136		136	• (966) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (967) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance • (1400) Flatten crest vertical curve • (1401) Flatten horizontal curve

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
					Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjuction with speed management measures, Major infrastructure improvements to be considered as part of future construction based on economic appraisal
136	Is adequate sight distance available for drivers on the major road to turn left across opposing traffic? (This distance should be sufficient for a vehicle to clear the opposing lane, based on the design speed and calculated as per Case F – Left Turns from the Major Road, on pages 78–79 of the 2017 TAC Geometric Design Guide.)	End		End	• (966) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (967) Adjust speed limit (or introduce advisory speed in case of curvature) to be consistent with the sight distance • (1400) Flatten crest vertical curve • (1401) Flatten horizontal curve Special Consideration(s): Speed limit to be adjusted only if other methods to improve sightlines are not readily available, reduction in speed limit or introduction of advisory speed should be done in conjuction with speed management measures, Major infrastructure improvements to be considered as part of future construction based on economic appraisal
137	Based on the most recent five-year collision data, have sightlines-related collisions occurred frequently at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 6; Occasional = 5-6; Infrequent = 2–4; Rare = 0-1)? (Sightlines related are defined as all angle and turning movement collisions)	139		138	
138	Based on the most recent five-year collision data, have sightlines-related collisions occurred occasionally at this location (Frequency is defined as the total number of sightlines-related collisions over the past five years: Frequent = more than 6; Occasional = 5-6; Infrequent = 2–4; Rare = 0-1)? (Sightlines related are defined as all angle and turning movement collisions)	139		139	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
139	Is the first stopped vehicle on each approach visible to the drivers of the first stopped vehicles on the other approaches? (This ensures that drivers have clear awareness of the presence and order of other vehicles, supporting safe and predictable right-of-way decision-making.)	End		End	• (966) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines

Stop-Controlled Speeding

Speeding is a primary contributor to the frequency and severity of collisions at rural stop-controlled intersections, particularly where high operating speeds on the major road intersect with driver decision-making on the stop-controlled minor approach. Safety at these intersections is shaped by the interaction between vehicle speeds, available sight distance, visibility of traffic control devices, and driver behavior.

The first step involves determining whether speeding is perceived as contributing to safety concerns. This includes reviewing resident complaints, reported speed-related collisions, difficulty for turning drivers to judge safe gaps, or pedestrian safety issues. These qualitative indicators help pinpoint intersections where vehicle speeds may be compromising safety or where operational conditions do not align with driver expectations.

Understanding where speed-related issues occur, whether on the major free-flowing road or on the stop-controlled approaches, is essential. High speeds on the major road reduce the time gap available for turning or crossing vehicles, increasing the risk of angle and turning movement collisions. On the other hand, if speed concerns are also present on the minor road approaches, they may contribute to poor stopping behavior or failure to comply with stop control, especially in cases where the intersection is preceded by a long, uninterrupted stretch of roadway. In such cases, drivers may approach the stop sign at higher-than-expected speeds, particularly if they are not visually cued by roadside features or other control devices.

In addition, field observations of driver behavior, such as frequent rolling stops, failure to stop completely, or visible difficulty in judging gaps, can be indicative of both speed and sightline-related problems.

Sight distance to the stop sign is another key consideration, especially when drivers are traveling at higher speeds and need more distance to detect and respond to control devices. For road approaches with posted speeds of 60 km/h or higher, the stop sign should be visible from at least the decision sight distance (155 m for 60 km/h, 185 m for 70 km/h, 225 m for 80 km/h). If operating speeds (85th percentile) exceed posted limits at these distances, and the stop sign is not clearly visible, drivers may not have adequate time to perceive the intersection and decelerate safely. This combination of limited sight distance and high operating speed increases the risk of collisions or late responses.

The same principles apply to lower-speed approaches (posted 50 km/h or less), where the decision sight distances are shorter (125 m for 50 km/h, 95 m for 40 km/h), but the expectation for full compliance is higher due to the constrained environment and greater presence of vulnerable users. If operating speeds exceed posted limits and stop signs lack adequate visibility, drivers may make abrupt or unsafe maneuvers, elevating the risk of collisions involving turning vehicles or vulnerable road users.

Table B 27 presents the decision matrix employed in the toolbox.

Pedestrian Issues

Table B 28presents the decision matrix employed in the toolbox for pedestrian issues.

Bicyclist Issues

Table B 29 presents the decision matrix employed in the toolbox for bicyclist issues.

Aggressive Driving

Table B 30 presents the decision matrix employed in the toolbox for aggressive driving issues.

Offset Intersections

Table B 31 presents the decision matrix employed in the toolbox for offset intersection issues.

Table B 27: Decision Matrix – Stop-Controlled Intersection – Speeding Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
179	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding-related collisions, complaints from residents, difficulty judging safe gaps for turning traffic, dangerous situations for pedestrians or any other observed or reported speed-related concerns?	180		End	• (1008) No Action Required
180	Are the speed-related issues observed along the major road operating as free-flow?	181	• (1005) Conduct Speeding Review For the Roadway Segment Special Consideration(s): Use the tool to conduct a detailed speeding review of the roadway segment	181	
181	Are the speed-related issues observed along any stop-controlled approaches?	182		End	• (1008) No Action Required
182	Are there any stop non-compliance issues observed through drivers frequently fail to come to a complete stop or roll through the stop sign?	183	• (1006) Conduct the stop non compliance review Special Consideration(s): Use the tool to conduct a detailed review for each of the concerned stop-controlled approach separately	183	
183	Are there any observed sight line issues observed through drivers facing difficulty in making turning and crossing maneuvers?	184	• (1007) Conduct the review of sightline issues Special Consideration(s): Use the tool to conduct a detailed sightline issues review separately	184	
184	Based on the most recent five-year collision data, have any speed-related collisions occurred at this intersection? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	185		End	• (1008) No Action Required
185	Is the approach speed limit 60 km/h or higher (includes the roadways with a posted speed of 60 km/h, 70 km/h and 80 km/h)?	186		189	
186	Do drivers encounter this stop-controlled intersection after traveling a long distance without encountering any other traffic control devices?	187	• (1009) Install stop ahead sign • (1010) Install red beacon for stop sign reinforcement • (1011) Install oversize stop signs • (1012) Install transverse rumble strips • (1013) Install transverse pavement markings	187	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.		
187	Is the stop sign placed at a location where sight lines to the sign are less than the decision sight distance (225 m at 80 km/h, 185 m for 70 km/h, and 155 m for 60 km/h)?	188	• (1016) Install supplementary stop sign on left side • (1017) Improve sightlines to stop sign	188	
188	Are the operating speeds (85th percentile) measured at a distance equal to the decision sight distance (225 m for 80 km/h, 185 m for 70 km/h, and 155 m for 60 km/h) greater than the posted speed limit?	End	• (1011) Install oversize stop signs • (1012) Install transverse rumble strips • (1013) Install transverse pavement markings • (1014) Provide Double Edge Line Markings • (1015) Provide Double Centre Dividing Line Markings • (1018) Targeted speed enforcement • (1019) Install speed feedback sign with a regulatory speed sign Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.	End	• (1011) Install oversize stop signs • (1012) Install transverse rumble strips • (1013) Install transverse pavement markings • (1014) Provide Double Edge Line Markings • (1015) Provide Double Centre Dividing Line Markings Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.
189	Is the approach speed limit 50 km/h or less (includes the roadways with a posted speed of 40 km/h, and 50 km/h)?	190		End	
190	Do drivers encounter this stop-controlled intersection after traveling a long distance without encountering any other traffic control devices?	191	• (1009) Install stop ahead sign • (1012) Install transverse rumble strips • (1013) Install transverse pavement markings Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.	191	
191	Is the stop sign placed at a location where sight lines to the sign are less than the decision sight distance (95 m at 40 km/h, and 125 m for 50 km/h)?	192	• (1016) Install supplementary stop sign on left side • (1017) Improve sightlines to stop sign	192	
192	Are the operating speeds (85th percentile) measured at a distance equal to the decision sight distance (95 m at	End	• (1012) Install transverse rumble strips • (1013) Install transverse pavement markings	End	• (1012) Install transverse rumble strips • (1013) Install transverse pavement markings

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	40 km/h, and 125 m for 50 km/h) greater than the posted speed limit?		• (1014) Provide Double Edge Line Markings • (1015) Provide Double Centre Dividing Line Markings • (1018) Targeted speed enforcement • (1020) Install vertical centreline treatment Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.		• (1014) Provide Double Edge Line Markings • (1015) Provide Double Centre Dividing Line Markings • (1020) Install vertical centreline treatment Special Consideration(s): Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.

Table B 28: Decision Matrix – Stop-Controlled Intersection – Pedestrian Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
260	Are pedestrians at risk at the intersection?	261		261	
261	Are there pedestrian sidewalks on the intersection approaches?	262		262	• (1171) Install sidewalk along intersection approach
262	Do pedestrians cross the road without right of way due to the absence of controlled pedestrian crossing facilities?	263	• (1172) Install controlled pedestrian treatment as per OTM Book 15 • (1173) Install an uncontrolled pedestrian crossing treatment with signage for pedestrians to give yield to vehicular traffic (OTM Book 15)	263	
263	Are there appropriate curb ramps in the pedestrian waiting area?	264		264	• (1174) Install appropriate curb ramps with tactile plates
264	Is the intersection located within a school zone?	265	• (1174) Install appropriate curb ramps with tactile plates • (1175) Provide marked school crosswalk (OTM Book 15) with crossing guard • (1176) Implement school speed zone	265	
265	Are pedestrian collisions occurring at night?	266	• (1178) Install/improve intersection lighting	266	
266	Are sight triangles in accordance with standards and clear of sight obstructions? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design	267		267	• (1177) Improve sight triangles at intersection Special Consideration(s): Conduct sightlines review

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)				
267	Are the marked crosswalks not available at the intersection?	268	• (1179) Install marked crosswalk at the controlled approaches (marked crosswalks are not permitted on uncontrolled approaches)	268	
268	Is the location of pedestrian activity unexpected for drivers?	269	• (1180) Install pedestrian warning signs • (1181) Install pedestrian warning signs with flashing beacons for locations with higher pedestrian activity	269	
269	Are pedestrians at risk due to high operating speeds at the intersection approach?	270	• (1182) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	270	
270	Does the intersection geometry or other features present result in obstructing the visibility of pedestrians in the crosswalk at an intersection? As an example, a horizontal curve immediately before a pedestrian crossing location may limit the sight lines.	END	• (1183) Flatten crest vertical curve • (1184) Flatten horizontal curve • (1185) Remove foliage • (1186) Move the crosswalk to another controlled approach • (1187) Improve sight distance to intersection Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	END	

Table B 29: Decision Matrix – Stop-Controlled Intersection – Bicyclist Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
299	Are appropriate bicycle lanes, signage, and pavement markings provided at the intersection as per OTM Book 18?	300		300	• (1230) Use dashed longitudinal lines to indicate vehicular lane change area • (1231) Provide appropriate bicycle lanes, signage, and pavement markings as per OTM Book 18 • (1232) Widen vehicle lane to accommodate bicycles

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
					• (1233) Implement paved shoulder in the intersection area to accommodate bicycles
300	Do bicyclists have difficulty crossing the road?	301	• (1241) Install bicycle warning signs • (1234) Install a dedicated bicycle crossride or a pedestrian crosswalk where bicyclists can cross as pedestrians	301	
301	Are bicycle collisions occurring at night?	302	• (1235) Bicyclist education on visibility at night • (1236) Install / improve intersection lighting • (1237) Driver education on speed and high beam use • (1238) Increase enforcement to reduce speed on intersection approach	302	
302	Are sight triangles in accordance with standards and clear of sight obstructions? (Sight distance requirements should be assessed for each quadrant of each stop-controlled approach in accordance with Section 9.9.2.2 of the 2017 TAC Geometric Design Guide for Canadian Roads, considering the influence of grades and skew as per Section 9.9.2.4.)	303		303	• (1240) Improve sight triangles at intersection Special Consideration(s): Conduct sightlines review
303	Is the intersection located within a school zone?	END	• (1239) Implement school speed zone	END	

Table B 30: Decision Matrix – Stop-Controlled Intersection – Aggressive Driving Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
340	Based on collision data or field observations, are rolling stops or stop-sign violations occurring frequently (e.g., angle collisions, near-misses, enforcement concerns)?	341	• (1315) Conduct the review for stop sign non compliance at the intersection	341	
341	Are high approach speeds contributing to aggressive interactions, or risky crossing behaviour?	342	• (1316) Conduct the review for speeding at the intersection	342	
342	Are restricted sightlines (vegetation, horizontal/vertical alignment, roadside features) contributing to driver frustration and risky manoeuvres?	343	• (1317) Conduct the review for sightlines at the intersection	343	
343	Are pedestrians, and cyclists, or form vehicles exposed to aggressive yielding behaviour (e.g., vehicles not stopping or accelerating through gaps)?	344	• (1318) Conduct the review for pedestrian issues at the intersection • (1319) Conduct the review of bicycle issues at the intersection	344	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
344	Are drivers accepting unsafe gaps or forcing their way into traffic, indicating impatience or aggressive decision-making?	345	• (1322) Implement dedicated left-turn and right-turn lanes	345	
345	Is there evidence of driver confusion regarding right-of-way, inconsistent control, or non-standard intersection layout contributing to aggressive behaviour?	End	• (1323) Install traffic signals, if warranted as per OTM Book 12 • (1324) Install multilane roundabout • (1325) Install single-lane roundabout	End	

Table B 31: Decision Matrix – Stop-Controlled Intersection – Offset Intersection Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
370	Is the four-legged intersection offset by more than 1.5 m and less than the minimum spacing required (e.g. 40 m for local-to-local intersections, greater distances may be required based on traffic requirements) to function as two independent T-intersections, creating ambiguous priority or unexpected manoeuvres?	371	• (1382) Conduct traffic analysis to identify operational problem	End	
371	Does the collision history show angle, turning, pedestrian, or sideswipe collisions consistent with offset-related conflict patterns?	372	• (1383) Conduct in-service road safety review • (1384) Realign approaches to form a true four-leg or two clear T-intersections • (1385) Increase spacing to meet functional T-intersection requirements • (1386) Convert to a single, simplified intersection form (e.g., roundabout, signalized)	372	
372	Do left-turn movements from opposing approaches overlap or cross paths, increasing the likelihood of angle, turning, or sideswipe collisions?	373	• (1386) Convert to a single, simplified intersection form (e.g., roundabout, signalized) • (1387) Prohibit selected left-turn movements • (1388) Channelize left-turn paths to reduce conflict	373	
373	Does the offset geometry create additional conflict points, staggered stop lines, or unclear yielding expectations for drivers, pedestrians, or cyclists?	374	• (1389) Improve lane assignment clarity and signing • (1390) Reduce the number of decision points through geometric reconfiguration	374	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
374	Are pedestrians or cyclists required to cross wide, skewed, or poorly defined crossings, or negotiate multiple staged conflicts due to the offset alignment?	375	• (1391) Shorten and realign pedestrian crossings • (1392) Provide refuge islands or median protection • (1393) Consider roundabout with pedestrian-specific design treatments	375	
375	Does the offset configuration restrict intersection sight distance, particularly for left-turning, crossing, or pedestrian movements?	376	• (1394) Remove or relocate obstructions (vegetation, utilities, roadside features) • (1395) Adjust stop bar locations • (1396) Improve advance warning signing and pavement markings • (1397) Modify horizontal or vertical alignment where feasible	376	
376	Do approach speeds remain high or inconsistent, increasing the severity of conflicts introduced by the offset geometry?	377	• (1398) Conduct the speeding review for the intersection approach and apply mitigation measures, if necessary	377	
377	Does the offset intersection experience queuing, blocking of opposing approaches, particularly during peak periods?	378	• (1386) Convert to a single, simplified intersection form (e.g., roundabout, signalized)	378	
378	Is the spacing between offset approaches insufficient given the functional classification and operating speeds of the intersecting roadways?	379	• (1386) Convert to a single, simplified intersection form (e.g., roundabout, signalized)	379	
379	Would an alternative intersection form (e.g., roundabout) better align with traffic volumes, speed environment, and multimodal needs?	End	• (1386) Convert to a single, simplified intersection form (e.g., roundabout, signalized)	End	

Signalized Intersections, Detailed Review

Angle Collisions

Angle collisions at signalized intersections occur due to conflicts between crossing traffic streams, turning vehicles, and through movements, particularly when driver decision-making is affected by inadequate traffic control, limited visibility, or high approach speeds. The first step in assessment is to determine whether the traffic signal is warranted under OTM Book 12 warrants. If the signal is unwarranted, driver expectations may not align with the control, increasing the potential for conflict. Even where warranted, inadequate visibility or conspicuity of signal heads and insufficient clearance intervals can reduce a driver's ability to respond appropriately, especially at higher speeds or in complex intersection layouts.

Operational factors are important. The presence, design, and storage capacity of dedicated left-turn lanes influence conflict patterns. Insufficient storage or poor channelization can result in vehicles blocking through lanes or accepting risky gaps during amber or clearance intervals. Coordination with nearby signals is also important, as poor progression can cause unexpected stops, driver frustration, and red-light running. This is particularly relevant for intersections located near freeway exits, where speed adaptation effects and speed differentials between drivers from different origins may contribute to collision risk.

Geometric and surface conditions, such as downgrades exceeding 3%, substandard cross-fall or longitudinal grade, deteriorated pavement, or water ponding and ice buildup, can impair stopping ability. Poor illumination may further increase risks, particularly at night. Sight distance limitations, caused by negative offsets, curvature, grade changes, or obstructions, can impair a driver's ability to judge gaps for turning or crossing movements. Poor compliance with OTM requirements for signing and pavement markings can compound these risks.

Patterns such as reliance on the yellow phase to complete turns or queues preventing clearance during the green phase indicate potential capacity or timing deficiencies. Addressing operational, geometric, and environmental factors collectively provides the best opportunity to reduce angle collisions.

Table B 32 presents the decision matrix employed in the toolbox.

Table B 32: Decision Matrix – Signalized Intersection – Angle Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
221	Is there a lack of justification for the existing traffic signal? (Refer to OTM Book 12 for traffic signal warrants)	222	• (366) Remove unwarranted traffic signal	222	
222	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	223	• (369) Install oversize signal heads • (371) Install signal backplates equipped with retroreflective borders • (370) Introduce reduced speed zone or increase the length of existing reduced speed zone • (367) Install advance warning signs • (368) Install active advance warning signs Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12	223	
223	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	224	• (372) Improve change plus clearance interval • (373) Improve signal timing	224	
224	Is there a dedicated left-turn lane?	225	• (400) Provide protected left-turn phase • (401) Provide protected/permissive left-turn phase	225	• (398) Install / improve left-turn lane
225	Are collisions happening due to drivers experiencing difficulty in making stop-or-go decisions when the traffic signal turns amber?	226	• (372) Improve change plus clearance interval • (373) Improve signal timing • (374) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12	226	
226	Are adjacent signalized intersections within 800 m of this intersection?	227	• (375) Provide or improve signal coordination	227	
227	Is the signal at this intersection coordinated with preceding signalized intersections along the corridor?	228		228	• (375) Provide or improve signal coordination
228	Is there any evidence of red light running?	229	• (376) Install cameras to detect red-light running • (377) Increase enforcement to reduce red-light running Special Consideration(s): Conduct red light running review	229	
229	Are angle collisions at the signalized intersection occurring due to high approach operating speeds?	230	• (1115) Reduce operating speeds at the intersection approach (Conduct speeding	230	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			review considering the roadway context and apply mitigation measures)		
230	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	231	• (388) Maintain surface of lanes • (389) Improve pavement friction	231	
231	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	232	• (390) Apply preventive salting or chemical anti-icing • (391) Improve drainage patterns or structures • (392) Maintain or clean out drainage structures/outlets • (393) Clean out or re-grade ditches	234	
232	Is the cross-fall a minimum of 2%?	233		233	• (394) Improve cross slope
233	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	234		234	• (395) Improve longitudinal grade
234	Is there a downgrade exceeding 3% on the approach to the intersection?	235	• (389) Improve pavement friction	235	
235	Are there any factors contributing to driver distraction at the intersection (e.g., sign clutter, on-street parking, commercial places, etc.)	236	• (396) Improve signage and pavement markings in compliance with OTM • (397) Remove sign clutter and sources of driver distraction	236	
236	Are collisions happening due to motorists experiencing difficulty judging gaps within the through traffic when making turning or crossing movements?	237	• (398) Install / improve left-turn lane • (399) Provide slotted left turn lane • (400) Provide protected left-turn phase • (401) Provide protected/permissive left-turn phase • (402) Provide positive offset of opposite left-turn lanes Special Consideration(s): Major intersection upgrades would require a feasibility study	237	
237	Is the intersection inadequately illuminated?	238	• (403) Install / improve intersection lighting	238	
238	Is the intersection failing to meet sight distance requirements due to presence of horizontal or vertical curves? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	239	• (407) Improve sight distance to intersection • (406) Install auxiliary signals • (368) Install active advance warning signs • (404) Flatten crest vertical curve • (405) Flatten horizontal curve	239	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Conduct sightline review, Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major infrastructure improvements to be considered as part of future construction based on economic appraisal		
239	Do the signs and pavement markings provided fail to comply with OTM's requirements?	240	• (396) Improve signage and pavement markings in compliance with OTM	240	
240	Is this the first signalized intersection following a freeway exit?	241		242	
241	Is traffic on the intersection approach coming from the freeway traveling at higher speeds than traffic not originating from the direction of the freeway (causing speed differential)?	242	• (1115) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	242	
242	Is the road design such that it encourages higher speeds than the posted speed?	243	• (1115) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	243	
243	Are vehicles approaching the intersection and queuing on a downgrade greater than 3%?	244	• (367) Install advance warning signs • (368) Install active advance warning signs • (373) Improve signal timing • (389) Improve pavement friction • (404) Flatten crest vertical curve Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	244	
244	Are drivers typically finding gaps only during the yellow phase to make their left-turn and there are at least 3 vehicles waiting to turn left at the start of each green interval and vehicles are not able to clear except during the clearance intervals	245	• (373) Improve signal timing • (381) Install single-lane roundabout • (382) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	245	
245	Is there a dedicated left-turn lane?	246	• (400) Provide protected left-turn phase • (401) Provide protected/permissive left-turn phase	246	• (398) Install / improve left-turn lane

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
246	Is the available sight distance insufficient for left-turning drivers to see opposing through vehicles? The limited sight distance may be due to negative offsets, curvature, or grade. (Refer to Case F – Left Turns from the Major Road, pages 78–79 of Section 9.9.2.2 of the 2017 TAC Geometric Design Guide)	247	• (399) Provide slotted left turn lane • (400) Provide protected left-turn phase • (401) Provide protected/permissive left-turn phase • (402) Provide positive offset of opposite left-turn lanes • (408) Implement split phase signal timing • (407) Improve sight distance to intersection • (381) Install single-lane roundabout • (382) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study, Conduct sightline review	247	
247	Do recorded collisions involve left-turns into or out of an access present within the functional area of a signalized intersection?	248	• (409) Restrict movements to right-in and right-out at the access using channelizing island • (410) Close Access • (411) Install median on intersection approach to eliminate left-turning maneuvers at access • (399) Provide slotted left turn lane • (412) Increase length of left-turn lane • (413) Move access further from intersection • (867) Move driveways to the side street if possible • (869) Consolidate adjacent driveways • (877) Regulating the minimum spacing of driveways on intersection approaches • (882) Regulating the minimum corner clearance Special Consideration(s): Major intersection upgrades would require a feasibility study, Any adjustment to accesses would require consultation with the property owners	END	
248	Is visibility of the access for entering, exiting, or approaching drivers a contributing factor?	249	• (414) Improve visibility of access	248	
249	Are collisions related to poor sight distance to accesses? (Refer to Section 2.5.2 of TAC Geometric	250	• (415) Improve sight distance to access • (416) Remove foliage	250	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	Design Guide for Canadian Roadways for Stopping Sight Distance requirements)		• (417) Install / improve hidden driveway signs		
250	Are access related collisions occurring at night?	455	• (418) Install / improve intersection lighting	455	
455	Are collisions related to poor visibility of specific signs, such as lane control signs, lane designation signs, or any other signs?	END	• (899) Improve visibility of signs by providing larger signs and/or enhancing their retroreflectivity • (900) Install flashing LED Stop Signs or LED blank out signs	END	

Turning Movement Collisions

Turning movement collisions at signalized intersections occur when drivers misjudge gaps, fail to yield, or experience difficulty executing turns under prevailing traffic, geometric, and operational conditions. The assessment begins with determining whether the traffic signal is warranted under OTM Book 12 warrants, as inappropriate or unnecessary signalization can create unexpected driver behavior and conflict points. Signal head visibility, conspicuity, and clearance interval adequacy are then reviewed, as deficiencies can result in hesitation, risky gap acceptance, or red-light running.

Geometric features such as the presence and adequacy of dedicated turn lanes, appropriate corner radii, and suitable channelization are important to safe and efficient turning operations. Where turn lanes are absent or undersized, queues may spill into through lanes, increasing collision likelihood. Field observations of gap acceptance are valuable, particularly where high opposing approach speeds, underestimated vehicle speeds, or heavy traffic volumes are present. Sight distance limitations, whether from negative offsets, curvature, grade, or obstructions, further elevate the potential for conflicts.

Operational and environmental considerations include approach grades over 3%, high approach speeds, pavement deterioration, water ponding, or ice buildup. Lighting adequacy and compliance with OTM signing and marking requirements are also reviewed. Patterns such as reliance on the yellow phase to complete turns or persistent queues preventing clearance during the green phase suggest potential capacity or timing issues. Addressing these factors collectively supports safer turning movements.

Table B 33 presents the decision matrix employed in the toolbox.

Table B 33: Decision Matrix – Signalized Intersection – Turning Movement Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
251	Is there a lack of justification for the existing traffic signal? (Refer to OTM Book 12 for traffic signal warrants)	252	• (419) Remove unwarranted traffic signal	252	
252	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	253	• (422) Install oversize signal heads • (424) Install signal backplates equipped with retroreflective borders • (420) Install advance warning signs • (421) Install active advance warning signs • (423) Introduce reduced speed zone or increase the length of existing reduced speed zone Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12	253	
253	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	254	• (425) Improve change plus clearance interval • (426) Improve signal timing	254	
254	Does the intersection lack a dedicated left-turn lane?	255	• (451) Install / improve left-turn lane	255	• (453) Provide protected left-turn phase • (454) Provide protected/permissive left-turn phase
255	Is the provided traffic signal system insufficient for accommodating left-turning traffic at the intersection (e.g. drivers may be finding gaps only during the amber phase to make their left-turn)?	256	• (426) Improve signal timing • (453) Provide protected left-turn phase • (454) Provide protected/permissive left-turn phase • (461) Implement split phase signal timing	256	
256	Are collisions happening due to drivers experiencing difficulty in making stop-or-go decisions when the traffic signal turns amber?	257	• (425) Improve change plus clearance interval • (426) Improve signal timing • (427) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12	257	
257	Have the required signs targeting left-turning/U-turning traffic not been provided as necessary?	258	• (428) Provide no left turn and/or no U-turn signs as required	258	
258	Is there any evidence of red light running?	259	• (429) Install cameras to detect red-light running • (430) Increase enforcement to reduce red-light running	259	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Conduct red light running review		
259	Are turning movement collisions at the signalized intersection occurring due to high approach operating speeds?	260	• (1116) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	260	
260	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	261	• (441) Maintain surface of lanes • (442) Improve pavement friction	261	
261	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	262	• (443) Apply preventive salting or chemical anti-icing • (444) Improve drainage patterns or structures • (445) Maintain or clean out drainage structures/outlets • (446) Clean out or re-grade ditches	264	
262	Is the cross-fall a minimum of 2%?	263		263	• (447) Improve cross slope
263	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	264		264	• (448) Improve longitudinal grade
264	Is there a downgrade exceeding 3% on the approach to the intersection?	265	• (442) Improve pavement friction	265	
265	Based on field observations, are left-turning drivers unable to safely accept gaps, given the potential high speeds of approaching traffic, possible underestimation of vehicle speeds by left-turning drivers, and challenges posed by high volumes of turning and through traffic?	266	• (423) Introduce reduced speed zone or increase the length of existing reduced speed zone • (453) Provide protected left-turn phase • (454) Provide protected/permissive left-turn phase • (461) Implement split phase signal timing	266	
266	Is the available sight distance insufficient for left-turning drivers to see opposing through vehicles? The limited sight distance may be due to negative offsets, curvature, or grade. (Refer to Case F – Left Turns from the Major Road, pages 78–79 of Section 9.9.2.2 of the 2017 TAC Geometric Design Guide)	267	• (451) Install / improve left-turn lane • (452) Provide slotted left turn lane • (453) Provide protected left-turn phase • (454) Provide protected/permissive left-turn phase • (455) Provide positive offset of opposite left-turn lanes	267	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			Special Consideration(s): Major intersection upgrades would require a feasibility study, Conduct sightline review		
267	Is the intersection inadequately illuminated?	268	• (456) Install / improve intersection lighting	268	
268	Is the intersection failing to meet sight distance requirements due to presence of horizontal or vertical curves?	269	• (460) Improve sight distance to intersection • (459) Install auxiliary signals • (421) Install active advance warning signs • (457) Flatten crest vertical curve • (458) Flatten horizontal curve Special Consideration(s): Conduct sightline review, Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	269	
269	Do the signs and pavement markings provided fail to comply with OTM's requirements?	270	• (449) Improve signage and pavement markings in compliance with OTM • (450) Remove sign clutter and sources of driver distraction	270	
270	Are vehicles approaching the intersection and queuing on a downgrade greater than 3%?	271	• (426) Improve signal timing • (420) Install advance warning signs • (442) Improve pavement friction • (421) Install active advance warning signs • (457) Flatten crest vertical curve Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	271	
271	Are drivers typically finding gaps only during the yellow phase to make their left-turn and there are at least 3 vehicles waiting to turn left at the start of each green interval and vehicles are not able to clear except during the clearance intervals	272	• (426) Improve signal timing • (434) Install single-lane roundabout • (435) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	272	
272	Is the available sight distance insufficient for right-turning drivers to see the approaching traffic from the left? (Refer to Case B2 of Section 9.9.2.3, pages 69–71	451	• (462) Implement no right turn on red regulation	451	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	of the 2017 TAC Geometric Design Guide, with adjustments for grade and vehicle type)				
451	Is the corner radius too large resulting in a large paved open area in the middle of the intersection increasing the risk of collisions	456	• (888) Decrease corner radius to accommodate an appropriate design vehicle • (891) Use pavement markings and bollards to reduce the radius or a channelized lane • (887) Consider a channelized island (pedestrian refuge) to guide and direct vehicles through a right turn manoeuvre Special Consideration(s): Major intersection upgrades would require a feasibility study	456	
456	Are collisions related to poor visibility of specific signs, such as lane control signs, lane designation signs, or any other signs?	END	• (901) Improve visibility of signs by providing larger signs and/or enhancing their retroreflectivity • (902) Install flashing LED Stop Signs or LED blank out signs	END	

Rear End Collisions

Rear-end collisions at signalized intersections occur when a following driver cannot stop in time for a slowing or stopped vehicle ahead. Contributing factors include decision-making challenges, high approach speeds, inadequate signal visibility, geometric constraints, and operational deficiencies. The first step is to determine whether the signal is warranted under OTM Book 12. An unwarranted or poorly coordinated signal, especially if within 800 m of another, may cause unnecessary stops or erratic responses. The adequacy of amber and clearance intervals is important, as those that are too short or improperly set can cause abrupt braking.

Capacity and lane configuration are reviewed to determine whether left- and right-turn lanes, storage lengths, and taper designs meet TAC Geometric Design Guide standards. Intersections at or near capacity can experience spillback into through lanes, increasing the likelihood of sudden deceleration. Locations such as the first signal after a freeway exit or after long uninterrupted segments require particular attention due to higher approach speeds and speed differentials.

Visibility, guidance, and environmental factors are also assessed. Signal heads must meet OTM visibility and conspicuity requirements, with consideration for alignment, curves, or sun glare. Adequate stopping and decision sight distance is essential, especially for unfamiliar drivers or approaches with horizontal or vertical curvature. Pavement condition, cross-fall, grade, and the presence of water, ice, or steep downgrades are reviewed for their effect on stopping distance. Lighting adequacy is examined where collisions occur at night. Access management is considered, as turning traffic from nearby driveways can cause unexpected speed changes in through lanes.

Table B 34 presents the decision matrix employed in the toolbox.

Table B 34: Decision Matrix – Signalized Intersection – Rear End Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
273	Are rear-end collisions occurring because drivers are having difficulty making the stop-or-go decisions when the signal turns amber?	274	• (469) Improve signal timing • (466) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12	274	
274	Is there a lack of justification for the existing traffic signal? (Refer to OTM Book 12 for traffic signal warrants)	275	• (463) Remove unwarranted traffic signal	275	
275	Are adjacent signalized intersections within 800 m of this intersection?	276	• (464) Provide or improve signal coordination	276	
276	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	277	• (465) Improve change plus clearance interval • (469) Improve signal timing	277	
277	Do the drivers encounter this signalized intersection after a long distance of travel?	278	• (467) Install advance warning signs • (468) Install active advance warning signs Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12	278	
278	Does this intersection operate at capacity and demonstrate saturation and associated queuing related collisions during different periods of the day?	279	• (469) Improve signal timing • (470) Install single-lane roundabout • (471) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibilty study	279	
279	Are dedicated left and right turn lanes warranted? (Refer to Chapter 9 of TAC Geometric Design Guide of Canadian Roads for warrants)	280		282	
280	Are the warranted dedicated left and right-turn lanes provided?	281		281	• (472) Install / improve left-turn lane • (473) Install right-turn lane • (474) Install channelized right-turn lane
281	Do the provided dedicated left and right turn lanes have sufficient capacity , storage lengths and design (parallel and taper)? (Conduct capacity analysis and review the lengths of left and right turn lanes considering the guidelines in Chapter 9 of TAC Geometric Design Guide of Canadian Roads)	282		282	• (475) Improve capacity, storage lengths, and design of left and right turn lanes • (477) Install dual left-turn lane
282	Do the through lanes have sufficient capacity? (Conduct capacity analysis)	283		283	• (476) Install additional through lanes
283	Do the through lanes block the turning lanes?	284	• (478) Increase the length of left and right turn lanes	284	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (476) Install additional through lanes		
284	Is the provided traffic signal system insufficient for accommodating left-turning traffic at the intersection (e.g. drivers may be finding gaps only during the amber phase to make their left-turn)?	285	• (469) Improve signal timing • (479) Provide protected left-turn phase • (480) Provide protected/permissive left-turn phase • (481) Implement split phase signal timing • (482) Provide protected right-turn phase • (486) Install single-lane roundabout • (487) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	285	
285	Are rear end collisions at the signalized intersection occurring due to high approach operating speeds?	286	• (1117) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	286	
286	Is this the first signalized intersection following a freeway exit?	287		288	
287	Is traffic on the intersection approach coming from the freeway traveling at higher speeds than traffic not originating from the direction of the freeway (causing speed differential)?	288	• (1117) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	288	
288	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	289	• (498) Install oversize signal heads • (501) Install brighter signal indications • (500) Install signal backplates equipped with retroreflective borders • (499) Introduce reduced speed zone or increase the length of existing reduced speed zone • (497) Install active advance warning signs Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12	289	
289	Is the intersection failing to meet sight distance requirements due to presence of horizontal or vertical curves and/or negative offsets of opposing left -turn lanes?	290	• (508) Remove foliage • (505) Improve sight distance to intersection • (507) Install advance warning signs • (504) Install auxiliary signals	290	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (506) Install active advance warning signs • (540) Provide positive offset of opposite left-turn lanes • (480) Provide protected/permissive left-turn phase • (481) Implement split phase signal timing • (482) Provide protected right-turn phase • (502) Flatten crest vertical curve • (503) Flatten horizontal curve Special Consideration(s): Conduct sightline review, Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major intersection upgrades would require a feasibility study, Major infrastructure improvements to be considered as part of future construction based on economic appraisal		
290	Is the orientation of the approach to the signals on an east-west alignment, making visibility of the signals difficult against the rising or setting sun?	291	• (500) Install signal backplates equipped with retroreflective borders • (498) Install oversize signal heads • (501) Install brighter signal indications	291	
291	Can the street name, guide, or turn restriction signs be read at a distance from the intersection equivalent to the stopping sight distance? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	292		292	• (508) Remove foliage • (505) Improve sight distance to intersection • (509) Install signs with larger letter heights • (510) Install oversize street name signs • (511) Install roadway identification signs (advance and turn-off signs) as per OTM Book 8 Special Consideration(s): Conduct sightline review
292	Is the stop line conspicuous at a distance that allows drivers to stop comfortably? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	293		293	• (512) Enhance visibility of stop line
293	Are unfamiliar drivers able to see and comprehend the layout and configuration of the intersection geometry from a sufficient distance considering complexity of the intersection (stopping or decision sight distance)?	294		294	• (513) Install intersection lane control signs (e.g. turn control / lane designation signs) • (514) Improve visibility/retroreflectivity of pavement markings

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	(Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)				• (515) Install sign with higher retroreflectivity
294	Are there more collision than might be expected based on volumes occurring at night?	295	• (515) Install sign with higher retroreflectivity • (516) Replace damaged or faded signs • (517) Install/improve intersection lighting	295	
295	Is the intersection inadequately illuminated?	296	• (517) Install/improve intersection lighting	296	
296	Are there rear-end collisions occurring in relation to accesses within the functional area of the intersection?	297	• (868) Move driveways to the side street if possible • (870) Consolidate adjacent driveways • (878) Regulating the minimum spacing of driveways on intersection approaches • (883) Regulating the minimum corner clearance Special Consideration(s): Any adjustment to accesses would require consultation with the property owners	300	
297	Are collisions related to poor sight distance to accesses? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	298	• (518) Improve visibility of access • (519) Improve sight distance to access (remove foliage, remove on-street parking, remove snow storage, clear right of way encroachments, flatten horizontal curve, flatten vertical curve) • (520) Install hidden driveway signs for accesses • (521) Improve legibility of hidden driveway signs Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	298	
298	Do collisions involve vehicles turning into or out of accesses?	299	• (522) Close access • (523) Install / improve left-turn lane for specific accesses, if warranted • (524) Install/improve right-turn lane at accesses, if warranted	299	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (525) Remove/restrict movements at access points • (526) Move access further from intersection • (527) Install median on intersection approach to eliminate left-turning maneuvers at access Special Consideration(s): Any adjustment to accesses would require consultation with the property owners, Major infrastructure improvements to be considered as part of future construction based on economic appraisal		
299	Are access related collisions occurring at night?	300	• (517) Install/improve intersection lighting	300	
300	Are vehicles approaching the intersection and queuing on a downgrade greater than 3%?	301	• (467) Install advance warning signs • (469) Improve signal timing • (468) Install active advance warning signs • (502) Flatten crest vertical curve • (503) Flatten horizontal curve • (528) Improve pavement friction Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12, Major infrastructure improvements to be considered as part of future construction based on economic appraisal	301	
301	Has the road surface at the intersection approach deteriorated to the extent that a vehicle may have difficulty in stopping?	302	• (528) Improve pavement friction • (529) Maintain surface of lanes	302	
302	Is there water ponding or ice-buildup on the roadway or in the area of catch basins, culverts, or other drainage structures, which may be related to the collisions?	303	• (530) Improve drainage patterns or structures • (531) Maintain or clean out drainage structures/outlets • (532) Apply preventive salting or chemical anti-icing • (533) Clean out or re-grade ditches	303	
303	Is the cross-fall a minimum of 2%?	304		304	• (534) Improve cross slope
304	Is a minimum longitudinal grade of 0.5% provided within the intersection area?	305		305	• (535) Improve longitudinal grade

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
305	Is the available sight distance sufficient for right-turning drivers to see the approaching traffic from the left? (Refer to Case B2 of Section 9.9.2.3, pages 69–71 of the 2017 TAC Geometric Design Guide, with adjustments for grade and vehicle type)	453		453	• (536) Prohibit right-turn-on-red • (537) Improve sight triangles at intersection • (538) Install acceleration lane on major road • (539) Correct right-of-way encroachments
453	Is the corner radius too small to accommodate an appropriate design vehicle causing conflicts between through traffic and turning vehicle	457	• (893) Flare the approach to the intersection to reduce conflicts between through traffic and turning vehicle and assist large trucks in negotiating the turn • (894) Increase the corner radius to accommodate an appropriate design vehicle	457	
457	Are collisions related to poor visibility of specific signs, such as lane control signs, lane designation signs, or any other signs?	END	• (1118) Improve visibility of signs by providing larger signs and/or enhancing their retroreflectivity • (1119) Install flashing LED Stop Signs or LED blank out signs	END	

Sideswipe Collisions

Sideswipe collisions at signalized intersections occur when two vehicles traveling in the same direction come into lateral conflict, often during lane changes, merging, or turning. These can result from inadequate lane discipline, limited maneuvering space, unclear lane use guidance, or speed differentials between lanes. The first step is to assess whether the intersection operates at or near capacity, as high volumes and frequent queues can increase lane-changing pressure. Poor clearance intervals or signal coordination, particularly where nearby signals are within 800 m, may lead to abrupt lane changes as drivers attempt to clear the intersection.

Lane configuration adequacy is important. Where warranted turn lanes are missing, undersized, or poorly designed, turning vehicles may decelerate or change lanes within through traffic, increasing conflict risk. Capacity analysis of through lanes helps identify whether spillback blocks turn lanes. Locations near freeway exits or approached after long travel segments may experience higher approach speeds and speed differentials that heighten sideswipe risk.

Vehicle type and geometry are also considered. Heavy vehicles making right turns may encroach into adjacent lanes if corner radii are insufficient for the applicable design vehicle, especially where right-turn truck volumes are high. Sight distance to accesses within the functional area must be sufficient to avoid sudden lane changes caused by vehicles entering or leaving driveways.

Visibility, guidance, and environmental conditions are reviewed to ensure OTM-compliant signing and markings provide clear lane-use information. Lighting adequacy and intersection geometry should allow drivers to recognize and react to lane change needs in time, reducing nighttime collision risk.

Table B 35 presents the decision matrix employed in the toolbox.

Table B 35: Decision Matrix – Signalized Intersection – Sideswipe Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
306	Does this intersection operate at capacity and demonstrate saturation and associated queuing related collisions during different periods of the day?	307	• (541) Improve signal timing • (542) Install single-lane roundabout • (543) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	307	
307	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	308	• (544) Improve change plus clearance interval • (541) Improve signal timing	308	
308	Are adjacent signalized intersections within 800 m of this intersection?	309	• (546) Provide or improve signal coordination	309	
309	Is the provided traffic signal system insufficient for accommodating left-turning traffic at the intersection (e.g. drivers may be finding gaps only during the amber phase to make their left-turn)?	310	• (541) Improve signal timing • (547) Provide protected left-turn phase • (548) Provide protected/permissive left-turn phase • (549) Implement split phase signal timing • (550) Provide protected right-turn phase • (542) Install single-lane roundabout • (543) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibility study	310	
310	Do the drivers encounter this signalized intersection after a long distance of travel?	311	• (551) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12 • (552) Install advance warning signs • (553) Install active advance warning signs Special Consideration(s): Criteria for active advance warnings signs should be reviewed as per OTM Book 12	311	
311	Are dedicated left and right turn lanes warranted? (Refer to Chapter 9 of TAC Geometric Design Guide of Canadian Roads for warrants)	312		314	
312	Are the warranted dedicated left and right-turn lanes provided?	313		313	• (554) Install / improve left-turn lane • (555) Install right-turn lane • (556) Install channelized right-turn lane
313	Do the provided dedicated left and right turn lanes have sufficient capacity , storage lengths and design (parallel and taper)? (Conduct capacity analysis and review the lengths of left and right turn lanes	314		314	• (557) Improve capacity, storage lengths, and design of left and right turn lanes • (558) Install dual left-turn lane

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	considering the guidelines in Chapter 9 of TAC Geometric Design Guide of Canadian Roads)				Special Consideration(s): Major intersection upgrades would require a feasibilty study
314	Do the through lanes have sufficient capacity? (Conduct capacity analysis)	315		315	• (559) Install additional through lanes
315	Do the through lanes block the turning lanes?	316	• (559) Install additional through lanes • (560) Increase the length of left and right turn lanes	316	
316	Are sideswipe collisions at the signalized intersection occurring due to high approach operating speeds?	317	• (1120) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	317	
317	Is this the first signalized intersection following a freeway exit?	318		319	
318	Is traffic on the intersection approach coming from the freeway traveling at higher speeds than traffic not originating from the direction of the freeway (causing speed differential)?	319	• (1120) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	319	
319	Can the street name, guide, or turn restriction signs be read at a distance from the intersection equivalent to the stopping sight distance? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	320		320	• (574) Improve sight distance to intersection • (575) Remove foliage • (576) Install signs with larger letter heights • (577) Install oversize street name signs • (578) Install roadway identification signs (advance and turn-off signs) as per OTM Book 8
320	Are unfamiliar drivers able to see and comprehend the layout and configuration of the intersection geometry from a sufficient distance considering complexity of the intersection (stopping or decision sight distance)? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements and Section 2.5.5 for decision sight distance)	321		321	• (545) Install intersection lane control signs (e.g. turn control / lane designation signs) • (579) Improve visibility/retroreflectivity of pavement markings • (580) Install sign with higher retroreflectivity
321	Are there more collision than might be expected based on volumes occurring at night?	322	• (580) Install sign with higher retroreflectivity • (581) Replace damaged or faded signs • (582) Install/improve intersection lighting	322	
322	Is the intersection inadequately illuminated?	323	• (582) Install/improve intersection lighting	323	
323	Are there collisions involving heavy vehicles turning right at the intersection?	324	• (583) Confirm turning template for the design vehicle and improve geometry	324	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (564) Install single-lane roundabout • (565) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibilty study		
324	Does the current corner radius facilitate the applicable design vehicle to make a right-turn from the through road curb lane into the crossing road curb lane?	325		325	• (583) Confirm turning template for the design vehicle and improve geometry • (584) Increase corner radius • (585) Increase the width of the receiving lane • (564) Install single-lane roundabout • (565) Install multilane roundabout Special Consideration(s): Major intersection upgrades would require a feasibilty study
325	Is the right-turning truck volume larger than at comparable locations?	326	• (550) Provide protected right-turn phase • (547) Provide protected left-turn phase	326	
326	Are there sideswipe collisions occurring in relation to accesses within the functional area of the intersection?	327	• (879) Regulating the minimum spacing of driveways on intersection approaches • (884) Regulating the minimum corner clearance	END	
327	Are collisions related to poor sight distance to accesses? (Refer to Section 2.5.2 of TAC Geometric Design Guide for Canadian Roadways for Stopping Sight Distance requirements)	328	• (586) Improve visibility of access • (587) Improve sight distance to access (remove foliage, remove on-street parking, remove snow storage, clear right of way encroachments, flatten horizontal curve, flatten vertical curve) • (588) Install hidden driveway signs for accesses • (589) Improve legibility of hidden driveway signs Special Consideration(s): Major infrastructure improvements to be considered as part of future construction based on economic appraisal	328	
328	Do collisions involve vehicles turning into or out of accesses?	329	• (590) Close access • (591) Install / improve left-turn lane for specific accesses, if warranted • (592) Install/improve right-turn lane at accesses, if warranted	329	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (593) Remove/restrict movements at access points • (594) Move access further from intersection • (595) Install median on intersection approach to eliminate left-turning maneuvers at access Special Consideration(s): Major intersection upgrades would require a feasibilty study		
329	Are access related collisions occurring at night?	330	• (582) Install/improve intersection lighting	330	
330	Do the provided signs and pavement markings fail to comply with OTM's requirements? Adequate signage and pavement markings should offer guidance to road users so they can react promptly to the need for stopping, and slowing down.	END	• (596) Improve signage and pavement markings in compliance with OTM	END	

Bicycle Collisions

Bicycle collisions at signalized intersections occur due to conflicts between cyclists and motor vehicles during turning, merging, or crossing. Contributing factors include the presence and quality of cycling facilities, speed environment, visibility, and control device clarity. The assessment begins by confirming whether bicycle lanes, signage, and pavement markings are provided in accordance with OTM Book 18. Clear, well-maintained facilities guide cyclists through intersections, alert motorists to their presence, and reduce unpredictable movements.

Operational factors include cyclist crossing difficulty, which may indicate signal phasing issues, insufficient crossing time, or poor alignment between approach facilities and crossing points. Inadequate accommodation can lead to hesitation, unsafe gap acceptance, or encroachment into vehicle paths. Nighttime collision patterns prompt a review of lighting adequacy to ensure cyclists are visible and motorists have sufficient time to react.

Sight triangles must meet TAC Geometric Design Guide for Canadian Roads and be free of obstructions so cyclists and motorists can detect each other in time. Intersections in school zones warrant particular attention due to the likelihood of young or less experienced cyclists. High approach operating speeds reduce drivers' ability to yield and increase collision severity, making speed management an important consideration.

Table B 36 presents the decision matrix employed in the toolbox.

Table B 36: Decision Matrix – Signalized Intersection – Bicyclist Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
331	Are appropriate bicycle lanes, signage, and pavement markings provided at the intersection as per OTM Book 18?	332		332	• (596) Improve signage and pavement markings in compliance with OTM • (597) Use dashed longitudinal lines to indicate vehicular lane change area • (598) Provide appropriate bicycle lanes, signage, and pavement markings as per OTM Book 18 • (600) Widen vehicle lane to accommodate bicycles • (601) Implement paved shoulder in the intersection area to accommodate bicycles
332	Do bicyclists have difficulty crossing the road?	333	• (599) Install bicycle warning signs • (602) Install a dedicated bicycle crossride or a pedestrian crosswalk where bicyclists can cross as pedestrians	333	
333	Are bicycle collisions occurring at night?	334	• (603) Bicyclist education on visibility at night • (604) Install / improve intersection lighting • (605) Driver education on speed and high beam use • (606) Increase enforcement to reduce speed on intersection approach	334	
334	Are sight triangles in accordance with standards and clear of sight obstructions? (Refer to Section 9.9.2 of TAC Geometric Design Guide for Canadian Roadways for sight triangles)	335		335	• (608) Improve sight triangles at intersection Special Consideration(s): Conduct sightline review
335	Is the intersection located within a school zone?	534	• (607) Implement school speed zone	534	
534	Are bicyclists at risk due to high operating speeds at the intersection approach?	END	• (1121) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	END	

Pedestrian Collisions

Pedestrian collisions at signalized intersections are often linked to inadequate crossing facilities, poor visibility, high approach speeds, or design elements that increase exposure. Assessment begins with determining whether pedestrians are at risk based on observed patterns, pedestrian volumes, and conflict points. Sidewalk continuity is important, as gaps may force pedestrians into the roadway. Encroachment into the roadway while waiting to cross or board transit may indicate inadequate waiting space or curbside design.

Crossing controls, including pedestrian signals, marked crosswalks, and curb ramps, are reviewed for adequacy, particularly for accessibility. School zones require additional measures due to the vulnerability and unpredictability of child pedestrians.

Sight triangles must meet TAC Geometric Design Guide for Canadian Roads and be clear of obstructions to ensure mutual visibility between pedestrians and drivers. Large corner radii can increase turning speeds and pedestrian crossing distances, elevating risk. High approach speeds reduce yielding likelihood and increase collision severity. Nighttime collisions prompt review of lighting adequacy to improve pedestrian visibility. A comprehensive review of pedestrian facilities, geometry, speed environment, and visibility is important for identifying and mitigating risks.

Table B 37 presents the decision matrix employed in the toolbox.

Table B 37: Decision Matrix – Signalized Intersection – Pedestrian Collisions

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
336	Are pedestrians at risk at the intersection?	337		End	
337	Are there pedestrian sidewalks on the intersection approaches?	338		338	• (609) Install sidewalk along intersection approach
338	Do pedestrians encroach onto the road while waiting to cross or waiting to board transit?	339	• (610) Provide/increase pedestrian storage area • (611) Relocate transit stops	339	
339	Are there pedestrian signals and/or marked crosswalks at the intersection?	340		340	• (612) Install marked crosswalk • (613) Install pedestrian signal heads • (614) Install pedestrian-actuated signals
340	Are there appropriate curb ramps in the pedestrian waiting area?	341		341	• (615) Install appropriate curb ramps with tactile plates
341	Is the intersection located within a school zone?	342	• (616) Provide marked crosswalk with crossing guard • (613) Install pedestrian signal heads • (614) Install pedestrian-actuated signals • (615) Install appropriate curb ramps with tactile plates • (617) Implement school speed zone	342	
342	Are pedestrian collisions occurring at night?	343	• (619) Install/improve intersection lighting	343	
343	Are sight triangles in accordance with standards and clear of sight obstructions? (Refer to Section 9.9.2 of TAC Geometric Design Guide for Canadian Roadways for sight triangles)	452		452	• (618) Improve sight triangles at intersection Special Consideration(s): Conduct sightline review
452	Is the corner radius too large resulting in a large paved open area in the middle of the intersection increasing the risk of collisions	535	• (889) Consider the use of compound curves to minimize pedestrian crossing distance • (890) Use pavement markings and bollards to reduce the radius or a channelized lane • (892) Consider a channelized island (pedestrian refuge) to guide and direct vehicles through a right turn manoeuvre	535	
535	Are pedestrians at risk due to high operating speeds at the intersection approach?	END	• (1122) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	END	

Signalized Intersections, Specific Issue Review

Red-light Running

Red light running is a primary safety concern at rural signalized intersections, often contributing to severe angle-type collisions. The first step involves determining whether red light running is perceived as a safety concern. This includes reviewing resident complaints, reported collisions involving disobedience to traffic signals, or observed violations. These qualitative indicators help flag intersections where driver compliance may be low, prompting a need for deeper investigation. Contributing factors may include poor visibility of signal heads, driver distraction or inattention, and willful non-compliance, particularly under low-volume conditions.

Collision data is essential for quantifying the extent of the issue. By classifying the frequency of red light running related collisions over a five-year period with a focus on angle collisions associated with red light violations, helps distinguish between isolated events and recurring problems. Categorizing the frequency of such collisions into categories as frequent (10 or more collisions), occasional (7-9 collisions), infrequent (4-6 collisions), or rare (0-3 collisions), enables differentiate between isolated incidents and systemic safety concerns and prioritize mitigation measures accordingly.

Operational and geometric conditions at the intersection influence red light running. High operating speeds reduce decision-making time for drivers approaching the signal. Poor signal conspicuity, horizontal curvature at approaches, or lack of exclusive turning lanes can worsen the issue. Signals placed without proper justification or lacking coordination with adjacent intersections can create inconsistent driver expectations, particularly if other signals exist within shorter distances. Drivers may also experience difficulty making stop-or-go decisions during the amber phase if clearance intervals are not appropriately set, as per OTM Book 12, considering speed, cross-section, and vehicle types.

Several environmental and behavior factors may further contribute to red light running. Signal visibility may be compromised by cluttered visual environments, such as commercial signage, on-street parking, or dense urban features, leading to distraction. In rural settings, pre-timed (non-actuated) signals can cause unnecessary delays during off-peak hours, prompting drivers to run red lights out of frustration. When driver behavior aligns with poor signal visibility or inadequate timing, the risk of violations and resulting collisions increases, justifying the need for both engineering and behavior countermeasures.

Table B 38 presents the decision matrix employed in the toolbox.

Table B 38: Decision Matrix – Signalized Intersection – Red-Light Running Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
147	Are there perceived concerns that red light running is contributing to safety issues at this location (e.g., reported collisions involving disobedience to traffic control devices, complaints from residents, or observed violations)? Potential contributing factors may include poor signal visibility, driver distraction or inattention, or willful non-compliance.	148		End	• (973) No Action Required
148	Has an on-site eight-hour red light violations study been conducted at this location?	149		149	• (974) Conduct a red light violations study
149	Are observed red light violations minimal (i.e., fewer than two violations) during a typical eight-hour red light violation study?	150		153	
150	Based on the most recent five-year collision data, have red light violation related collisions occurred frequently at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional = 7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)	152		151	
151	Based on the most recent five-year collision data, have red light violation related collisions occurred occasionally at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional = 7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)	157		End	• (973) No Action Required
152	Are there other factors, based on traffic operations, intersection geometrics, and collision history, such as high operating speeds, traffic congestion, curvature at approaches, lack of turning lanes, may be affecting safety at the intersection?	End	• (975) Conduct in-service road safety review	157	
153	Are red light violations observed at a moderate level (i.e., two or three violations) during a typical eight-hour red light violation study?	154	• (1003) Conduct periodic police enforcement of red light	166	
154	Based on the most recent five-year collision data, have red light violation related collisions occurred frequently at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional =	156		155	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)				
155	Based on the most recent five-year collision data, have red light violation related collisions occurred occasionally at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional = 7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)	157		End	
156	Are there other factors, based on traffic operations, intersection geometrics, and collision history, such as high operating speeds, traffic congestion, curvature at approaches, lack of turning lanes, may be affecting safety at the intersection?	End	• (975) Conduct in-service road safety review	157	
157	Is there a lack of justification for the existing traffic signal?	158	• (976) Remove unwarranted traffic signal	158	
158	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	159	• (977) Improve visibility by removing any obstructions (low cost) • (978) Install advance warning signs (low cost) • (979) Install signal backplates equipped with retroreflective borders (low cost) • (980) Continuous Advance Warning Beacons (medium cost) • (981) Install oversize signal heads (medium cost) • (982) Install active advance warning signs (high cost) • (983) Introduce reduced speed zone or increase the length of existing reduced speed zone • (984) Install an auxiliary signal (high cost) Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments), Reduction in speed is to be considered only after other measures have been reviewed and found unsuitable	159	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
159	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	160	• (985) Improve change plus clearance interval • (986) Improve signal timing	160	
160	Are collisions happening due to drivers experiencing difficulty in making stop-or-go decisions when the traffic signal turns amber?	161	• (985) Improve change plus clearance interval • (986) Improve signal timing • (987) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12	161	
161	Are adjacent signalized intersections within 800 m of this intersection?	162	• (375) Provide or improve signal coordination	163	
162	Is the signal at this intersection coordinated with preceding signalized intersections along the corridor?	163		163	• (375) Provide or improve signal coordination
163	Are the operating speeds (85th percentile speeds) on the intersection approach more than 15 km/h higher than the posted speed limit?	164	• (1048) Conduct the speeding review for the intersection approach and apply mitigation measures, if necessary	164	
164	Are there any factors contributing to driver distraction at the intersection (e.g., sign clutter, on-street parking, commercial places, etc.)	165	• (1000) Improve signage and pavement markings in compliance with OTM • (1001) Remove sign clutter and sources of driver distraction	165	
165	Is the traffic signal pre-timed (non-actuated), potentially leading to unnecessary delays and increased likelihood of red light running, particularly during low-volume periods?	End	• (1002) Use actuated signals instead of pre-timed signals	End	
166	Are red light violations observed at a high level (i.e., four or more violations) during a typical eight-hour red light violation study?	167	• (1003) Conduct periodic police enforcement of red light • (1004) Install cameras to detect red-light running Special Consideration(s): Red light cameras are to be considered only after all other measures have been exhausted without success	End	
167	Based on the most recent five-year collision data, have red light violation related collisions occurred frequently at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional = 7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)	169		168	
168	Based on the most recent five-year collision data, have red light violation related collisions occurred	170		170	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
	occasionally at this location (Frequency is defined as the total number of red light violation related collisions over the past five years: Frequent = more than 9; Occasional = 7-9; Infrequent = 4–6; Rare = 0-3)? (Red light violation related collisions are defined as all angle collisions)				
169	Are there other factors, based on traffic operations, intersection geometrics, and collision history, such as high operating speeds, traffic congestion, curvature at approaches, lack of turning lanes, may be affecting safety at the intersection?	End	• (975) Conduct in-service road safety review	170	
170	Is there a lack of justification for the existing traffic signal?	171	• (976) Remove unwarranted traffic signal	171	
171	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	172	• (977) Improve visibility by removing any obstructions (low cost) • (978) Install advance warning signs (low cost) • (979) Install signal backplates equipped with retroreflective borders (low cost) • (980) Continuous Advance Warning Beacons (medium cost) • (981) Install oversize signal heads (medium cost) • (982) Install active advance warning signs (high cost) • (983) Introduce reduced speed zone or increase the length of existing reduced speed zone • (984) Install an auxiliary signal (high cost) Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicabilty of treatments), Reduction in speed is to be considered only after other measures have been reviewed and found unsuitable	172	
172	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	173	• (985) Improve change plus clearance interval • (986) Improve signal timing	173	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
173	Are collisions happening due to drivers experiencing difficulty in making stop-or-go decisions when the traffic signal turns amber?	174	• (985) Improve change plus clearance interval • (986) Improve signal timing • (987) Add long distance detection (dilemma detection) or improve the existing long distance detection as per OTM Book 12	174	
174	Are adjacent signalized intersections within 800 m of this intersection?	175	• (988) Provide or improve signal coordination	175	
175	Is the signal at this intersection coordinated with preceding signalized intersections along the corridor?	176		176	
176	Are the operating speeds (85th percentile speeds) on the intersection approach more than 15 km/h higher than the posted speed limit?	177	• (1048) Conduct the speeding review for the intersection approach and apply mitigation measures, if necessary	177	
177	Are there any factors contributing to driver distraction at the intersection (e.g., sign clutter, on-street parking, commercial places, etc.)	178	• (1000) Improve signage and pavement markings in compliance with OTM • (1001) Remove sign clutter and sources of driver distraction	178	
178	Is the traffic signal pre-timed (non-actuated), potentially leading to unnecessary delays and increased likelihood of red light running, particularly during low-volume periods?	End	• (1002) Use actuated signals instead of pre-timed signals	End	

Speeding Issues

Speeding is a primary factor in the frequency and severity of collisions at rural signalized intersections. The first step involves determining whether the speeding is perceived as a safety concern. This may include community complaints, reported collisions involving speed, driver difficulty in judging gaps for left turns or crossings, and pedestrian exposure risks. These qualitative indicators help provide valuable insight into whether vehicle speeds may be misaligned with the intended operation of the intersection or surrounding environment.

Collision data is essential for quantifying the extent of the issue. Classifying the frequency of speed-related collisions over a five-year period, helps distinguish between isolated events and recurring problems. Categorizing the frequency of such collisions into categories as frequent (3 or more collisions), occasional (2 collisions), infrequent (1 collision), or rare (0 collisions), enables differentiate between isolated incidents and systemic safety concerns and prioritize mitigation measures accordingly.

The operating environment impacts driver behavior. Long, uninterrupted roadway segments before a signalized intersection can lead drivers to build up speed, especially when no intermediate control devices or visual cues are present. For approaches with posted speeds of 60 km/h or more, it becomes important to assess whether the 85th percentile operating speeds exceed posted limits at a distance equal to the decision sight distance (155 m for 60 km/h, 185 m for 70 km/h, and 225 m for 80 km/h). Elevated speeds in such scenarios reduce the time available for drivers to perceive, process, and respond to changing traffic signals, thereby increasing red-light running and rear-end collision risks. The same principles apply to lower-speed approaches (posted 50 km/h or less), where the decision sight distances are shorter (125 m for 50 km/h, 95 m for 40 km/h), but the expectation for full compliance is higher due to the constrained environment and greater presence of vulnerable users.

Another important consideration is whether traffic signal heads are visible and conspicuous from a distance recommended by OTM Book 12. Inadequate signal visibility, due to poor placement, background clutter, or lack of advance signage, can compromise driver awareness and lead to late decisions at high speeds.

Table B 39 presents the decision matrix employed in the toolbox.

Table B 39: Decision Matrix – Signalized Intersection – Speeding Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
193	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding related collisions, complaints from residents, difficulty judging safe gaps for turning traffic, dangerous situations for pedestrians or any other observed or reported speed-related concerns?	194		End	
194	Based on the most recent five-year average collision data, have speed-related collisions occurred at least occasionally at this location (Frequency is defined as the average number of speed-related collisions per kilometre per year over the most recent five-year period: Frequent = more than 2; Occasional = 2; Infrequent = 1; Rare = 0)? (Speed-related collisions are defined as collisions where speed is recorded as a contributing factor, together with all fatal and injury collisions, regardless of the documented contributing factors)	195		End	
195	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	196	• (1021) Improve visibility by removing any obstructions (low cost) • (1022) Install advance warning signs (low cost) • (1023) Install signal backplates equipped with retroreflective borders (low cost) • (1024) Continuous Advance Warning Beacons (medium cost) • (1025) Install oversize signal heads (medium cost) • (1026) Install active advance warning signs (high cost) • (1027) Introduce reduced speed zone or increase the length of existing reduced speed zone • (1028) Install an auxiliary signal (high cost) Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments), Reduction in speed is to be considered only	196	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			after other measures have been reviewed and found unsuitable		
196	Is the approach speed limit 60 km/h or higher (includes the roadways with a posted speed of 60 km/h, 70 km/h and 80 km/h)?	197		199	
197	Do drivers encounter this signalized intersection after traveling a long distance without encountering any other traffic control devices?	198	• (1022) Install advance warning signs (low cost) • (1024) Continuous Advance Warning Beacons (medium cost) • (1026) Install active advance warning signs (high cost) • (1123) Implement rest in red signal timing operation during night Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments)	198	
198	Are the operating speeds (85th percentile) measured at a distance equal to the decision sight distance (225 m for 80 km/h, 185 m for 70 km/h, and 155 m for 60 km/h) greater than the posted speed limit?	End	• (1029) Increase enforcement to reduce speed on intersection approach • (1030) Introduce reduced speed zone or increase the length of existing reduced speed zone • (1031) Install oversize stop signs • (1032) Install transverse pavement markings • (1033) Install transverse rumble strips • (1034) Change streetscape to increase stimulation of peripheral vision • (1035) Narrow approach lanes by using pavement markings (e.g., double edgeline markings, double centre dividing lanes, painted median, etc.) • (1036) Install Speed Feedback Signs • (1037) Implement gateway treatment • (1123) Implement rest in red signal timing operation during night Special Consideration(s): Applicability of different treatment options to be determined by engineering judgement, Install only one	End	• (1031) Install oversize stop signs • (1035) Narrow approach lanes by using pavement markings (e.g., double edgeline markings, double centre dividing lanes, painted median, etc.) • (1036) Install Speed Feedback Signs Special Consideration(s): Applicability of different treatment options to be determined by engineering judgement

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.		
199	Is the approach speed limit 50 km/h or less (includes the roadways with a posted speed of 40 km/h, and 50 km/h)?	200		End	
200	Do drivers encounter this signalized intersection after traveling a long distance without encountering any other traffic control devices?	201	• (1022) Install advance warning signs (low cost) • (1024) Continuous Advance Warning Beacons (medium cost) • (1026) Install active advance warning signs (high cost) • (1123) Implement rest in red signal timing operation during night Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments)	201	
201	Are the traffic signal heads lacking visibility or conspicuity from a distance recommended by OTM Book12?	202	• (1021) Improve visibility by removing any obstructions (low cost) • (1022) Install advance warning signs (low cost) • (1023) Install signal backplates equipped with retroreflective borders (low cost) • (1024) Continuous Advance Warning Beacons (medium cost) • (1025) Install oversize signal heads (medium cost) • (1028) Install an auxiliary signal (high cost) Special Consideration(s): Use higher-cost treatments only if lower-cost and medium-cost options are unlikely to be effective (apply OTM guidance to review applicability of treatments)	202	
202	Are the operating speeds (85th percentile) measured at a distance equal to the decision sight distance (95 m at 40 km/h, and 125 m for 50 km/h) greater than the posted speed limit?	End	• (1029) Increase enforcement to reduce speed on intersection approach • (1032) Install transverse pavement markings • (1033) Install transverse rumble strips	End	• (1035) Narrow approach lanes by using pavement markings (e.g., double edgeline markings, double centre dividing lanes, painted median, etc.) • (1036) Install Speed Feedback Signs

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (1035) Narrow approach lanes by using pavement markings (e.g., double edgeline markings, double centre dividing lanes, painted median, etc.) • (1036) Install Speed Feedback Signs • (1123) Implement rest in red signal timing operation during night Special Consideration(s): Applicability of different treatment options to be determined by engineering judgement, Install only one treatment from transverse rumble strips and transverse pavement markings, with preference for rumble strips, provided they are not installed within 200 m of residential areas.		Special Consideration(s): Applicability of different treatment options to be determined by engineering judgement

Sightline Issues

Sight distance is a fundamental element in driver decision-making at rural signalized intersections, where speeds are often higher, geometric constraints are more prevalent, and visibility may be impaired by terrain, curvature, or offset alignment. The first step involves identifying whether there are perceived concerns about insufficient sightlines affecting safety. These may arise from observed near-misses, collisions involving turning movements, or complaints related to limited visibility of conflicting traffic. These concerns often point to operational risks that warrant further investigation using criteria from the TAC Geometric Design Guide for Canadian Roads.

One specific area of concern is the visibility available to drivers executing a right turn on red. For locations where this movement is permitted, drivers must be able to see oncoming traffic from their stopped position at the stop bar. If this departure sight distance is inadequate, especially due to curvature, obstructions, or grade differences, drivers may underestimate oncoming speeds or gaps, increasing the risk of collisions. Evaluating this scenario using Case B2 from Section 9.9.2.3 of TAC Geometric Design Guide for Canadian Road ensures that the analysis considers appropriate design parameters, including adjustments for grade and vehicle type. If right turns on red are prohibited, this risk is avoided.

Another sightline issue arises for drivers making unprotected left turns across opposing traffic. In these cases, limited visibility can hinder a driver's ability to accurately judge the speed and position of oncoming vehicles, particularly if there is no dedicated signal phase for left turns. This is especially relevant on roads with horizontal curvature or when vertical grades reduce line-of-sight across the intersection, or the opposing left turn lanes are at negative offsets. This should be evaluated based on whether sightlines meet the standards outlined in Case F – Left Turns from the Major Road in Section 9.9.2.2 of the TAC Guide. This ensures that the assessment reflects safe gap acceptance and supports signal phasing or geometric modifications if warranted.

Table B 40 presents the decision matrix employed in the toolbox.

Table B 40: Decision Matrix – Signalized Intersection – Sightline Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
203	Are there perceived concerns that deficient sightlines are contributing to safety issues at this location (e.g., insufficient sight distance for right-turning drivers on red, or for left-turning drivers to see opposing through vehicles)? Potential contributing factors may include negative offsets, horizontal curvature, or roadway grades. (Sight distance requirements should be assessed in accordance with Section 9.9.2.3 of the 2017 TAC Geometric Design Guide for Canadian Roads.)	204		End	
204	Is the available departure sight distance to the left adequate for a vehicle stopped at the stop bar of an approach where right turn on red is permitted? (Refer to Case B2 of Section 9.9.2.3, pages 69–71 of the 2017 TAC Geometric Design Guide, with adjustments for grade and vehicle type. If right turn on red is prohibited, select "No.")	205		205	• (1038) Improve sight distance by removing foliage or any other any removable objects that may be obstructing the sightlines • (1039) Implement no right turn on red regulation
205	Is the available sight distance insufficient for left-turning drivers to see opposing through vehicles on an approach where the left-turn movement is not fully protected? (Refer to Case F – Left Turns from the Major Road, pages 78–79 of Section 9.9.2.2 of the 2017 TAC Geometric Design Guide. If the left turn movement is fully protected, select "No.")	End	• (1040) Install / improve left-turn lane • (1041) Provide slotted left turn lane • (1042) Provide protected left-turn phase • (1043) Provide protected/permissive left-turn phase • (1044) Provide positive offset of opposite left-turn lanes	End	

Pedestrian Issues

Table B 41 presents the decision matrix employed in the toolbox for pedestrian issues.

Bicyclist Issues

Table B 42 presents the decision matrix employed in the toolbox for bicyclist issues.

Aggressive Driving

Table B 43 presents the decision matrix employed in the toolbox for aggressive driving issues.

Table B 41: Decision Matrix – Signalized Intersection – Pedestrian Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
250	Are pedestrians at risk at the intersection?	251		End	
251	Are there pedestrian sidewalks on the intersection approaches?	252		252	• (1156) Install sidewalk along intersection approach
252	Do pedestrians encroach onto the road while waiting to cross or waiting to board transit?	253	• (1157) Provide/increase pedestrian storage area • (1158) Relocate transit stops	253	
253	Are there pedestrian signals and/or marked crosswalks at the intersection?	254		254	• (1159) Install marked crosswalk • (1160) Install pedestrian signal heads • (1161) Install pedestrian-actuated signals
254	Are there appropriate curb ramps in the pedestrian waiting area?	255		255	• (1162) Install appropriate curb ramps with tactile plates
255	Is the intersection located within a school zone?	256	• (1160) Install pedestrian signal heads • (1161) Install pedestrian-actuated signals • (1162) Install appropriate curb ramps with tactile plates • (1163) Provide marked crosswalk with crossing guard • (1164) Implement school speed zone	256	
256	Are pedestrian collisions occurring at night?	257	• (1166) Install/improve intersection lighting	257	
257	Are sight triangles in accordance with standards and clear of sight obstructions?	258		258	• (1165) Improve sight triangles at intersection Special Consideration(s): Conduct sightline review
258	Is the corner radius too large resulting in a large paved open area in the middle of the intersection increasing the risk of collisions	259	• (1167) Consider the use of compound curves to minimize pedestrian crossing distance • (1168) Use pavement markings and bollards to reduce the radius or a channelized lane • (1169) Consider a channelized island (pedestrian refuge) to guide and direct vehicles through a right turn manoeuvre	259	
259	Are pedestrians at risk due to high operating speeds at the intersection approach?	END	• (1170) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	END	

Table B 42: Decision Matrix – Signalized Intersection – Bicyclist Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
293	Are appropriate bicycle lanes, signage, and pavement markings provided at the intersection as per OTM Book 18?	294		294	• (1216) Improve signage and pavement markings in compliance with OTM • (1217) Use dashed longitudinal lines to indicate vehicular lane change area • (1218) Provide appropriate bicycle lanes, signage, and pavement markings as per OTM Book 18 • (1220) Widen vehicle lane to accommodate bicycles • (1221) Implement paved shoulder in the intersection area to accommodate bicycles
294	Do bicyclists have difficulty crossing the road?	295	• (1219) Install bicycle warning signs • (1222) Install a dedicated bicycle crossride or a pedestrian crosswalk where bicyclists can cross as pedestrians	295	
295	Are bicycle collisions occurring at night?	296	• (1223) Bicyclist education on visibility at night • (1224) Install / improve intersection lighting • (1225) Driver education on speed and high beam use • (1226) Increase enforcement to reduce speed on intersection approach	296	
296	Are sight triangles in accordance with standards and clear of sight obstructions?	297		297	• (1228) Improve sight triangles at intersection Special Consideration(s): Conduct sightline review
297	Is the intersection located within a school zone?	298	• (1227) Implement school speed zone	298	
298	Are bicyclists at risk due to high operating speeds at the intersection approach?	END	• (1229) Reduce operating speeds at the intersection approach (Conduct speeding review considering the roadway context and apply mitigation measures)	END	

Table B 43: Decision Matrix – Signalized Intersection – Aggressive Driving Issues

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
332	Are there perceived concerns that red light running is contributing to safety issues at this location (e.g., reported collisions involving disobedience to traffic control devices, complaints from residents, or observed violations)?	333	• (1300) Conduct the review for red light running at the intersection	333	
333	Are there perceived concerns that vehicle speeds are contributing to safety issues, such as reported speeding related collisions, complaints from residents, difficulty judging safe gaps for turning traffic, dangerous situations for pedestrians or any other observed or reported speed-related concerns?	334	• (1314) Reduce operating speeds (Conduct speeding review considering the roadway context and apply relevant mitigation measures)	334	
334	Is the clearance interval insufficient and inappropriate based on OTM Book 12 considering cross section, the design vehicle, and the posted speed?	335	• (1303) Improve change plus clearance interval • (1304) Improve signal timing	335	
335	Do vehicles accelerate aggressively on green or late yellow (e.g., high-speed entries, squealing tires, abrupt lane changes), indicating impatience or risk-taking behaviour?	336	• (1304) Improve signal timing • (1305) Provide or improve signal coordination • (1306) Optimize left turn phasing	336	
336	Is queue jumping, last-second lane changing, or misuse of turn lanes observed frequently, particularly during peak periods?	337	• (1307) Improve lane assignment clarity with pavement markings and overhead signs • (1308) Implement solid lane lines or extended solid markings near conflict areas • (1309) Restrict late lane changes using pavement markings • (1310) Extend or reconfigure turn lanes to reduce queue spillback	337	
337	Do drivers enter the intersection when downstream queues prevent clearing (blocking the intersection), contributing to aggressive interactions and conflicts?	338	• (1311) Do Not Block Intersection signage and enforcement • (1312) Improve downstream storage capacity or access management	338	
338	Are drivers failing to yield to pedestrians or cyclists during permissive phases or right turns on red, suggesting aggressive or inattentive behaviour?	339	• (1301) Conduct the review for pedestrian issues at the intersection • (1302) Conduct the review of bicycle issues at the intersection	339	
339	Do high delays, long cycle lengths, or poor progression appear to be contributing to driver frustration and aggressive behaviour?	End	• (1313) Improve traffic operations by adding capacity	End	

Question ID	Question	IF YES NEXT	YES CM	IF NO NEXT	NO CM
			• (1303) Improve change plus clearance interval • (1304) Improve signal timing • (1305) Provide or improve signal coordination • (1306) Optimize left turn phasing		

C

Appendix C
Systemic Safety Review: Identification and Evaluation of Risk Factors & Ranking

Identification and Evaluation of Risk Factors

This section presents in detail the third step in the systemic safety review process. After the identification of the focus collision types and focus facility types, this step presents the identification of common characteristics of locations with high collision frequencies – characteristics that are also referred to as risk factors. For instance, the previous steps indicated a focus on angle and turning movement collisions at unsignalized intersections. This step then examines whether such collisions are over-represented at intersections with specific characteristics (e.g., four-leg versus three-leg) or within certain AADT ranges.

This section begins by summarizing the geometric and operational information collected for potential use as risk factors. It then presents the identification and evaluation of risk factors for mid-block locations, unsignalized intersections, and signalized intersections.

Collection of Geometric and Operational Information

To support the identification and evaluation of risk factors, a wide range of geometric and operational attributes were reviewed. **Table C 1** summarizes the availability of each variable and the approach taken when data was not readily available. Some attributes were available for a portion of sites directly from the TES database, such as area type (rural /urban), AADT, number of lanes, intersection type, and traffic control. Others had to be extracted from shapefiles available in the City of Hamilton Open Data Portal (e.g., lighting, turn lanes). In several cases, manual review using street view imagery was required, such as for shoulder type and roadside characteristics. For more complex variables like sightline issues – difficult to assess remotely – we used a proxy based on driver actions in collision records. Additional details are presented in **Table C 1**.

Table C 1: Summary of Geometric and Operation Information

Risk factor	Available in TES?	Observation
AADT	Partially	AADT data was initially available for: a) 330 of the 1,029 segments, b) 112 of the 589 unsignalized intersections, and c) all 27 signalized intersections. After a visual assessment of adjacent segments and intersections that could reasonably inherit AADT values from nearby segments, the sample was expanded to a total of 801 segments and 226 unsignalized intersections. AADT is extrapolated for the year of 2024 at all sites
Number of lanes	Partially	Missing information was obtained from manual review using street view imagery
Intersection type	Partially	It refers to 3-leg, 4-leg, roundabouts, among others. Missing information was obtained from manual review using street view imagery

Risk factor	Available in TES?	Observation
Traffic control	Partially	It refers to two-way stop control, all-way stop control, among others. Missing information was obtained from manual review using street view imagery
Speed limit	Yes	-
Presence of truck route	Yes	-
Presence of lighting	No	Retrieved from the "Street light poles and luminaires" shapefile available in the City of Hamilton Open Data Portal
Presence of right turn or left turn lanes	No	Retrieved from the "Traffic pavement marking symbols" shapefile available in the City of Hamilton Open Data Portal
Presence of horizontal curve	No	Indirectly obtained from the road network shapefile. Segment "straightness" was measured by calculating the ratio between the actual segment length and the straight-line distance between its start and end points. A ratio greater than 1.02 was used as a threshold to indicate the presence of curves
Type of shoulder	No	Manually extracted from street view images for the 1,029 segments. Includes "no shoulder", "gravel shoulder", and "paved shoulder"
Roadside characteristics (segments)	No	Manually extracted from street view images for the 1,029 segments. It was based on the roadside hazard risk rating proposed by FHWA[2]. Roadside hazard is ranked on a seven-point categorical scale from 1 (best) to 7 (worst) considering extension of clear zones, presence of fixed objects (poles and/or trees), sideslope, among others
Sightline issues (intersections)	No	Sightline quality is an important variable for explaining angle and turning movement collisions at intersections. However, it is difficult to assess reliably using street view imagery. To address this limitation, we used a proxy indicator to identify intersections with potential sightline issues. Specifically, we calculated the proportion of angle and turning movement collisions at each site that involved a driver action coded as "failed to give right of way." We believe that a high proportion of such cases may be indicative of underlying sightline problems

[2] Available on Appendix D - Prediction of the Expected Safety Performance of Rural Two-Lane Highways, month 2010 - FHWA-RD-99-207

Mid-block: SMV Collisions

The following variables were considered as potential risk factors: AADT, mid-block location in rural versus rural-urban boundary areas, type of shoulder, roadside hazard risk rating, speed limit, presence of horizontal curves, and presence of truck routes. Among these, only shoulder type did not prove to be a relevant risk factor. The remaining variables are discussed in the subsequent sub-sections.

AADT

Figure C 1 presents the evaluation of AADT as a risk factor. The gray column represents the percentage of facilities (mid-block locations in this case) within each AADT range category. The light green column represents the percentage of SMV – Other collisions (fatal and injury) for each category, which is the focus collision type identified in previous sections. Fatal and injury collisions for all types of collisions (dark green column) are also shown as a complement, although the analysis focuses on the focus collision type.

The identification of risk factors consists of detecting categories where overrepresentation of collisions over facilities is observed – that is, where the light green column is taller than the gray column. In the case of AADT, we observe an overrepresentation of SMV collisions for values greater than 2,000. Additionally, as expected, this overrepresentation increases with higher AADT. As a result, each of the three higher AADT categories (i.e., 2,000–4,000, 4,000–6,000, and >6,000) is treated as a separate risk factor and will be used in the calculation of the Systemic Safety Risk Index for prioritizing locations in the next step.

As discussed in **Section Collection of Geometric and Operational Information**, AADT is not available for some mid-block locations. These sites were grouped into a separate category ("No info available"). The pattern observed for this category is similar to the "< 1,000" AADT category, where the percentage of facilities exceeds the percentage of SMV collisions. This suggests that, on average, sites where AADT data is not available are associated with fewer collisions. This was somewhat expected, based on the assumption that AADT data collection would be prioritized for sites considered more "important" in terms of connectivity or safety. In conclusion, the lack of AADT data for these sites appears to have minimal impact on the identification of relevant risk factors – and, by extension, on the prioritization of sites for the development of countermeasures.

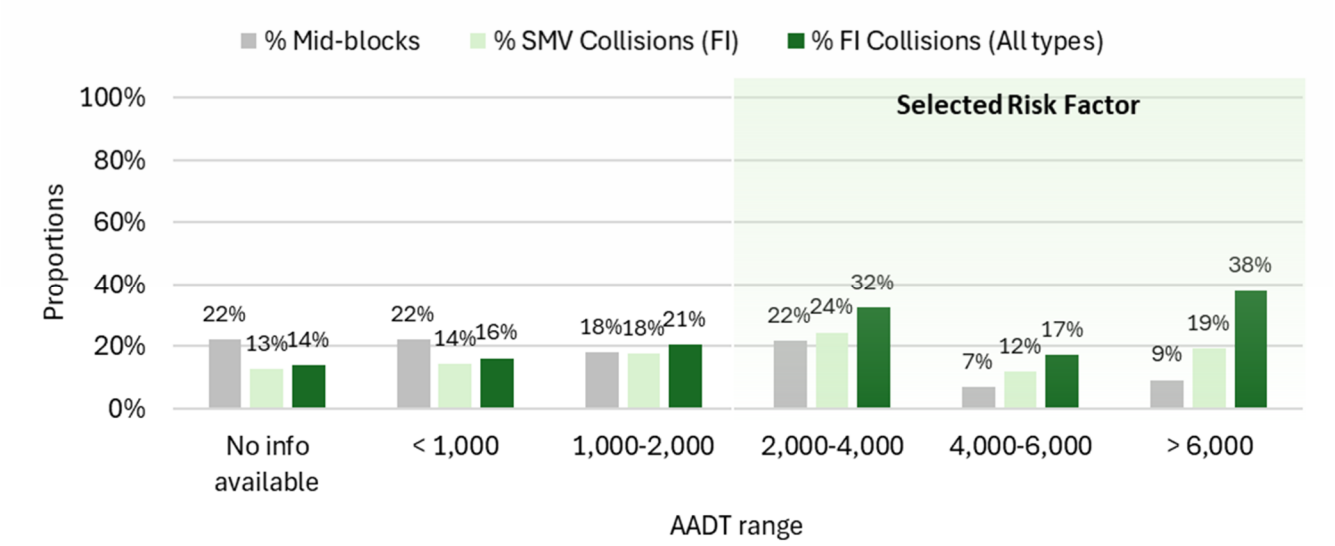


Figure C 1: Mid-block Risk Factor – AADT

Rural versus Rural-Urban Boundary

Figure C 2 presents the evaluation of area type as a risk factor. It is observed that mid-block locations in rural-urban boundary areas are, on average, associated with more collisions than those in rural areas. Therefore, the rural-urban boundary was considered a risk factor.

One may argue that this factor is correlated with AADT (which is likely true), and that the overrepresentation shown in **Figure C 2** is driven by higher exposure in boundary areas rather than by the area type itself. To assess this, we tested the effect of area type while controlling for different AADT ranges and observed similar patterns to those in **Figure C 2**. This increases our confidence that boundary areas are a risk factor on their own, rather than merely acting as a proxy for other features such as exposure levels.

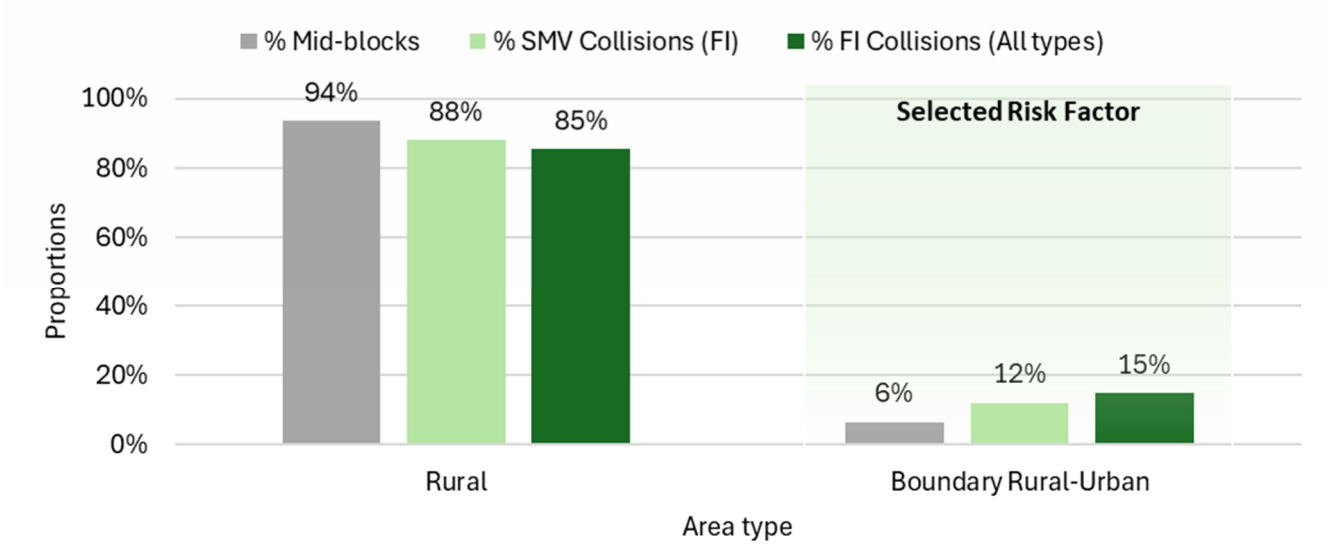


Figure C 2: Mid-block Risk Factor – Rural versus Rural-Urban Boundary

Roadside Hazard Risk Rating

Figure C 3 presents the evaluation of the FHWA roadside hazard risk rating[2] as a risk factor. Category 1 represents the best roadside condition, with wide clear zones and flatter sideslopes, resulting in a recoverable situation. Category 6 – the worst observed in the study area (noting that the full scale includes seven categories) – represents a non-recoverable condition, with clear zones less than 1.50 meters, a sideslope ratio of approximately 1:2, no guardrail, and exposure to fixed objects within 0 to 2 meters of the pavement edgeline.

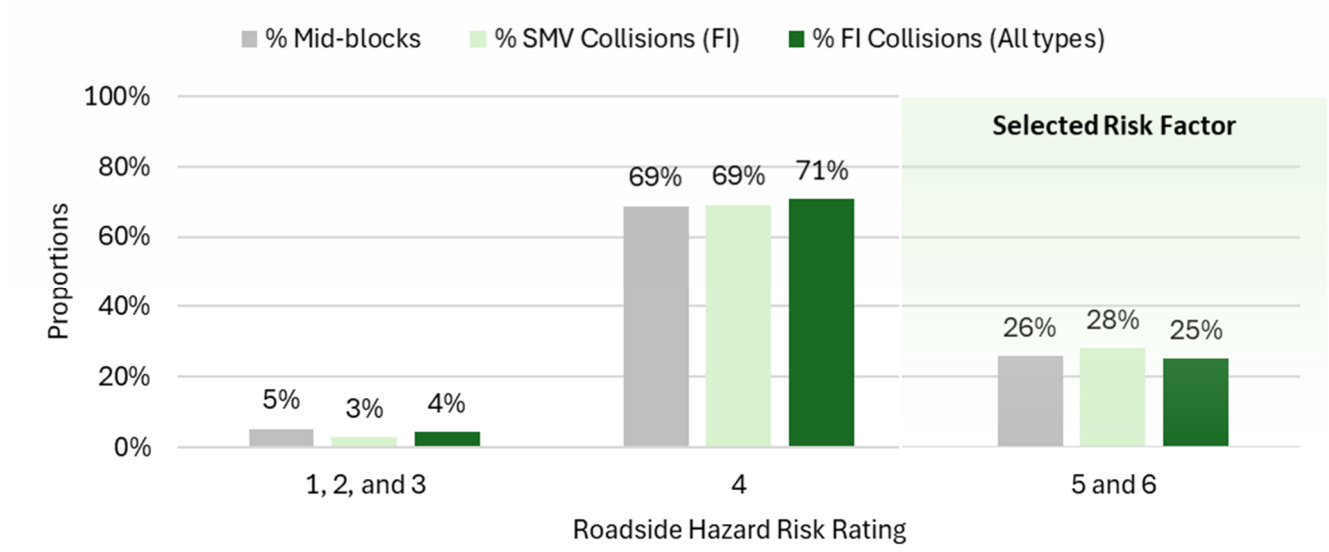


Figure C 3: Mid-block Risk Factor – Roadside Hazard Risk Rating

A total of 69% of the mid-block locations fall under hazard risk rating 4. This category typically corresponds to clear zones between 1.5 and 3.0 meters, sideslope ratios of about 1:3 to 1:4, and possible exposure to fixed objects located approximately 3 meters from the pavement edge. These conditions create a marginally forgiving environment, though they present a higher risk of roadside collisions compared to better-rated segments.

The overrepresentation of SMV collisions is within expectations, with higher hazard ratings being associated with more collisions. However, we were anticipating more notable differences between categories in terms of overrepresentation. We hypothesize that this did not occur due to the existence of other attributes that were not taken into consideration. For example, we considered a 10-year collision history but obtained roadside characteristics for recent dates (imagery from 2023 or 2024). It is possible that roadside conditions were improved at locations that experienced a high frequency of collisions throughout the years. This would not be captured by the analysis and could falsely associate sites with better ratings to high frequencies of collisions (e.g., a site that had its roadside improved from rating 6 to 4 in 2021, for example).

We tried controlling for AADT by performing the analysis in **Figure C 3** for different AADT ranges, but similar results were obtained.

Speed Limit

Figure C 4 presents the evaluation of speed limit as a risk factor. Speed limits of 70 km/h and 80 km/h were identified as risk factors.

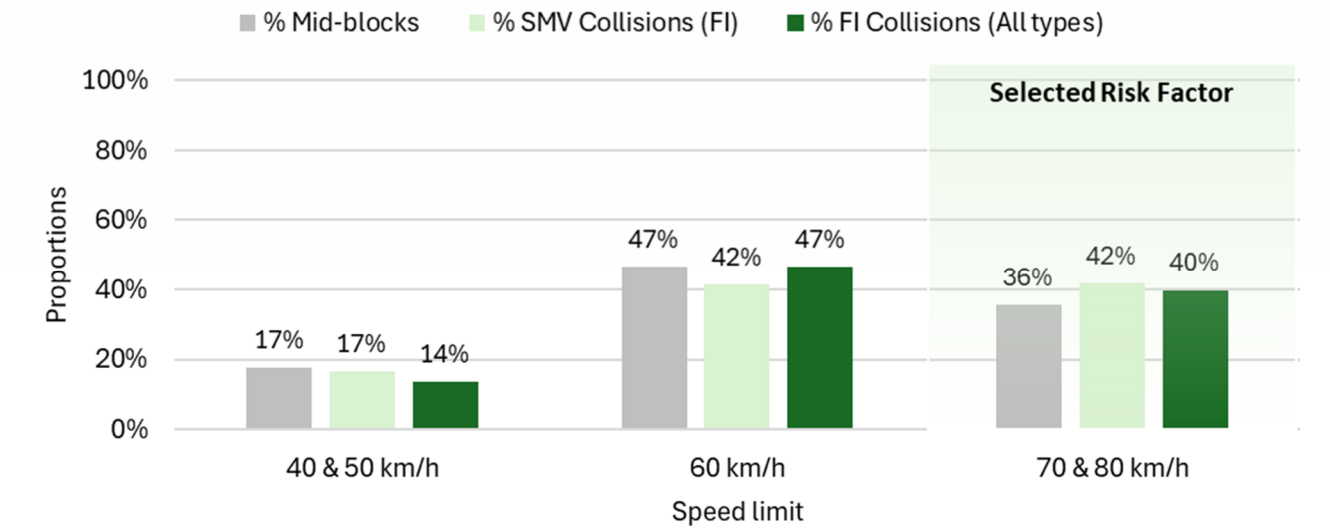


Figure C 4: Mid-block Risk Factor – Speed Limit

Presence of Horizontal Curves

Figure C 5 presents the evaluation of the presence of horizontal curves as a risk factor. As expected, segments with horizontal curves are associated with higher frequencies of SMV collisions and were therefore considered a risk factor. As a reminder, this variable was derived by measuring the "straightness" of each segment, calculated as the ratio between the actual segment length and the straight-line distance between its start and end points.

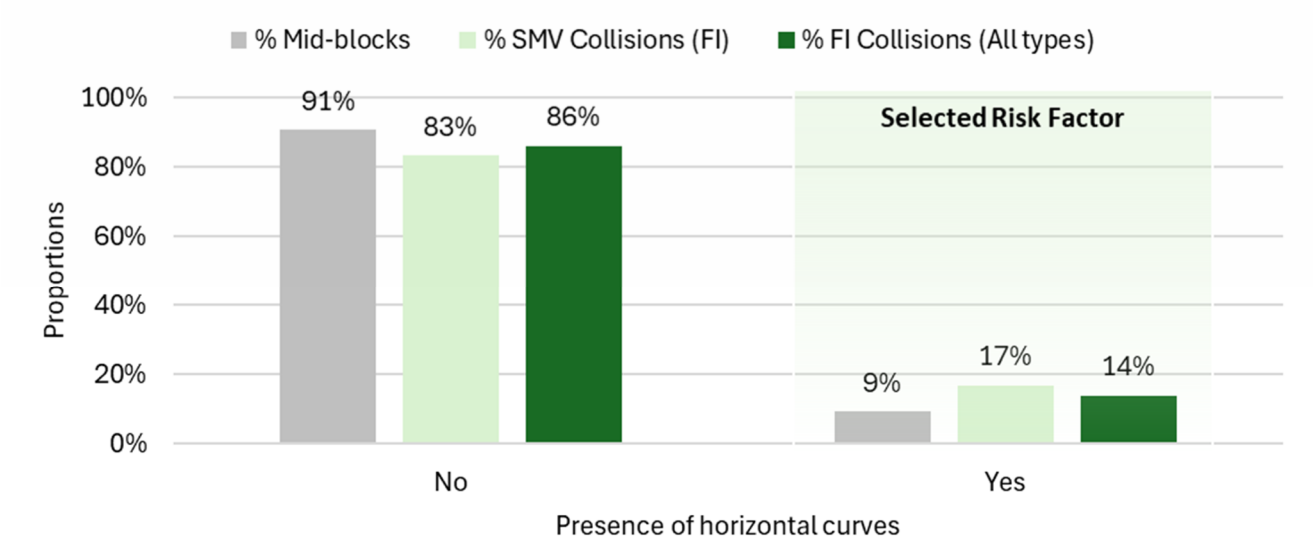


Figure C 5: Mid-block Risk Factor – Presence of Horizontal Curves

Presence of Truck Route

Figure C 6 illustrates the presence of truck routes as a risk factor. Similarly to the analysis conducted for rural versus rural-urban boundary, we controlled for AADT and observed similar patterns to those shown in **Figure C 6**, reinforcing the consideration of truck routes as a risk factor.

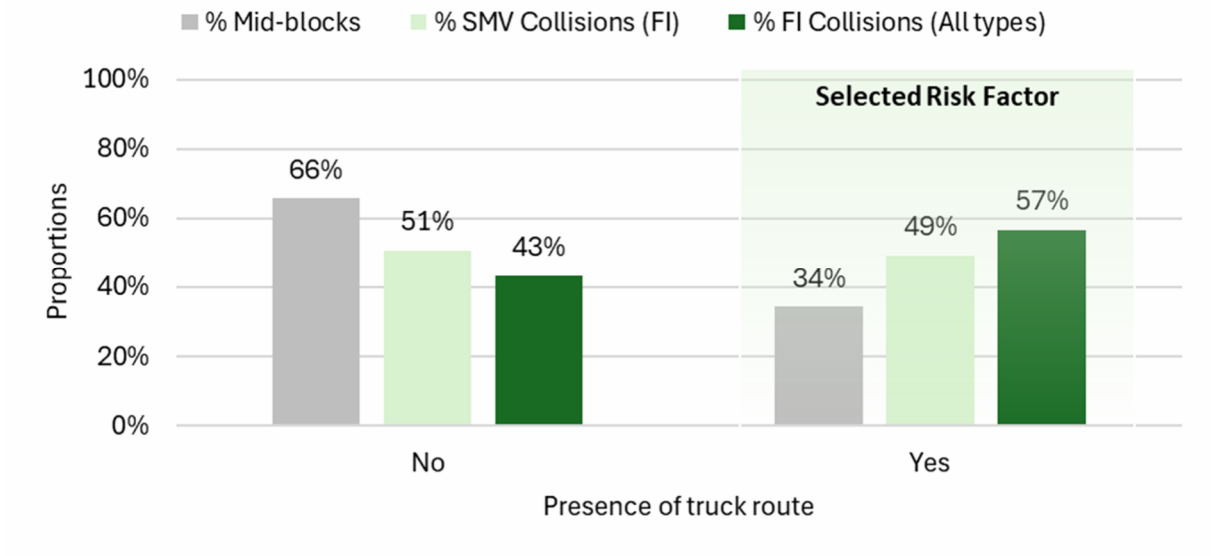


Figure C 6: Mid-block Risk Factor – Presence of Truck Routes

Unsignalized Intersections: Angle and Turning Movement Collisions

The following variables were considered as potential risk factors: AADT (major and minor roads), intersection location in rural versus rural-urban boundary areas, type of control, type of intersection (i.e., number of legs), presence of lighting, presence of left turn or right turn lane, speed limit, and potential sightline issues. Among these, rural boundary, presence of lighting, and presence of left turn or right turn lane did not prove to be a relevant risk factor. The remaining variables are discussed in the subsequent sub-sections.

AADT: Major and Minor Roads

Figure C 7 presents an overview of the total AADT (i.e., major plus minor) at unsignalized intersections. Unlike mid-block locations – where AADT was unavailable for only 22% of the sites – 62% of unsignalized intersections lack AADT data. Although this is a substantial proportion, **Figure C 7** shows that only 15% of angle and turning movement collisions and 18% of all fatal and injury collisions occurred at these sites. This supports a conclusion similar to that drawn for mid-block locations without AADT: the absence of AADT data at these intersections likely has minimal impact on identifying relevant risk factors – and, by extension, on prioritizing sites for case studies.

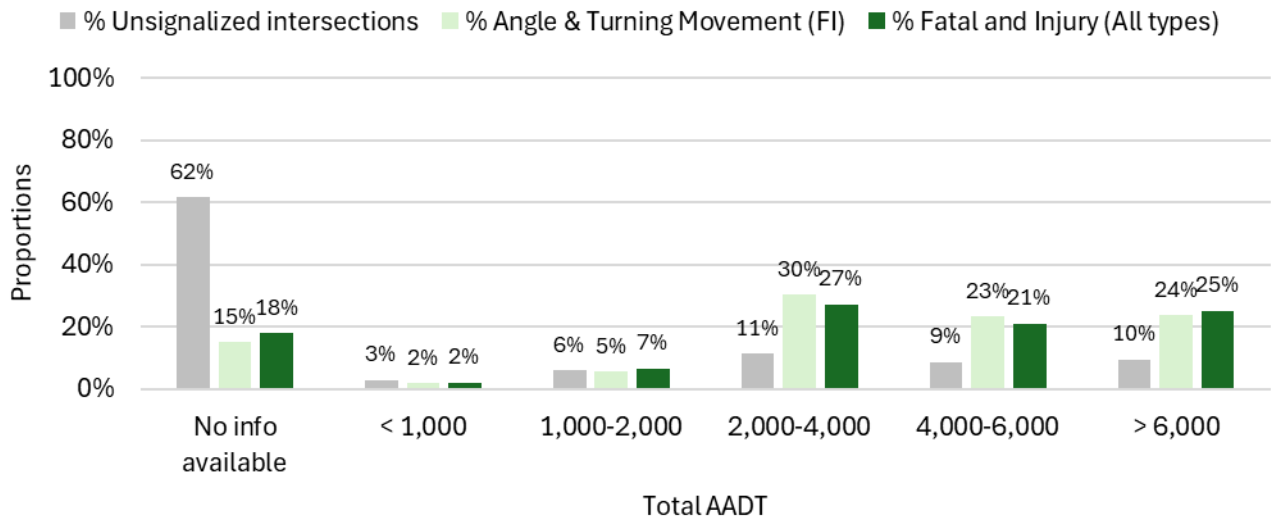


Figure C 7: Unsignalized Intersections – Total AADT Overview

Figure C 8 presents the evaluation of AADT – categorized for major and minor roads – as a risk factor. This differentiation helps better understand how traffic volume is distributed across intersection approaches and is commonly used in intersection assessments. The analysis shows that intersections where the minor road volume exceeds 1,000 vehicles are associated with a higher frequency of collisions and are therefore considered risk factors. The percentages shown in **Figure C 8** exclude collisions and facilities where AADT is not available.

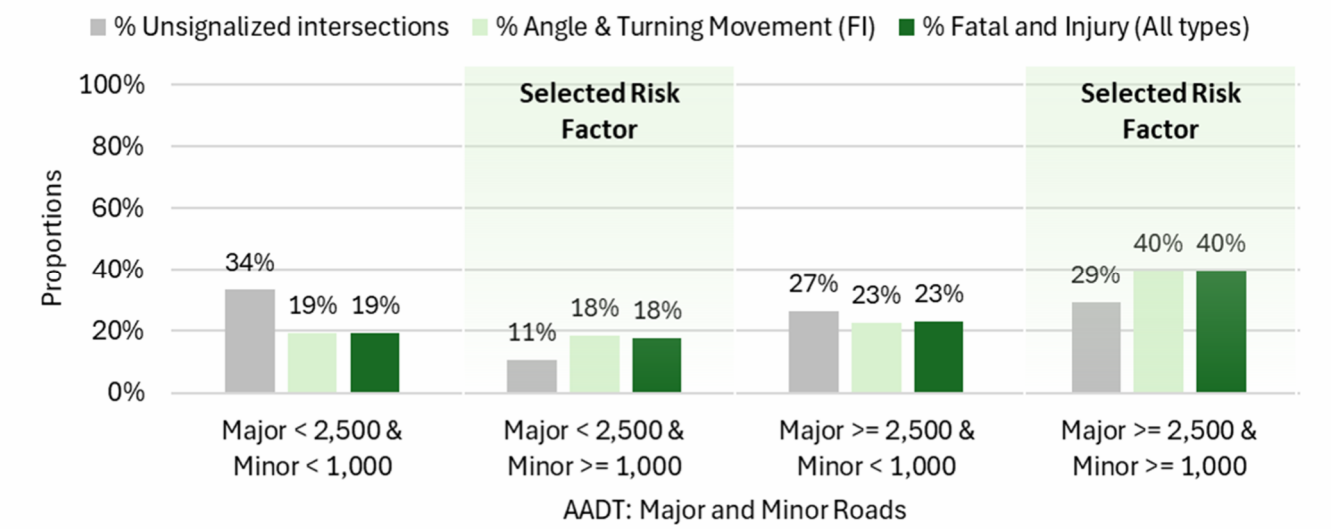


Figure C 8: Unsignalized Intersection Risk Factor – AADT: Major and Minor Roads

Type of Control

Figure C 9 presents the evaluation of type of control as a risk factor. We initially assessed this variable on its own (without controlling for exposure), but the results were counterintuitive. For example, the all-way stop control was assessed has having greater risk as compared to two-way stop control. This happened because, the all-way stop control intersections have more AADT. As an alternative, we incorporated AADT classification into the analysis to obtain more controlled results, given that type of control is expected to correlate with AADT. It was observed that two-way stop control is a risk factor when the minor road AADT exceeds 1,000 vehicles (high category). As before, the percentages exclude collisions and facilities without AADT data.

We acknowledge two limitations with this approach: 1) type of control is not assessed for sites where AADT is unavailable, and 2) the effect of AADT is somewhat considered twice – once here and again in the previous section. These are broader limitations of the systemic safety review process.

Other than all-way and two-way stop control, only one site had yield control and another had a roundabout with AADT data. These were excluded from the analysis, as a sample size of one would not yield meaningful results.

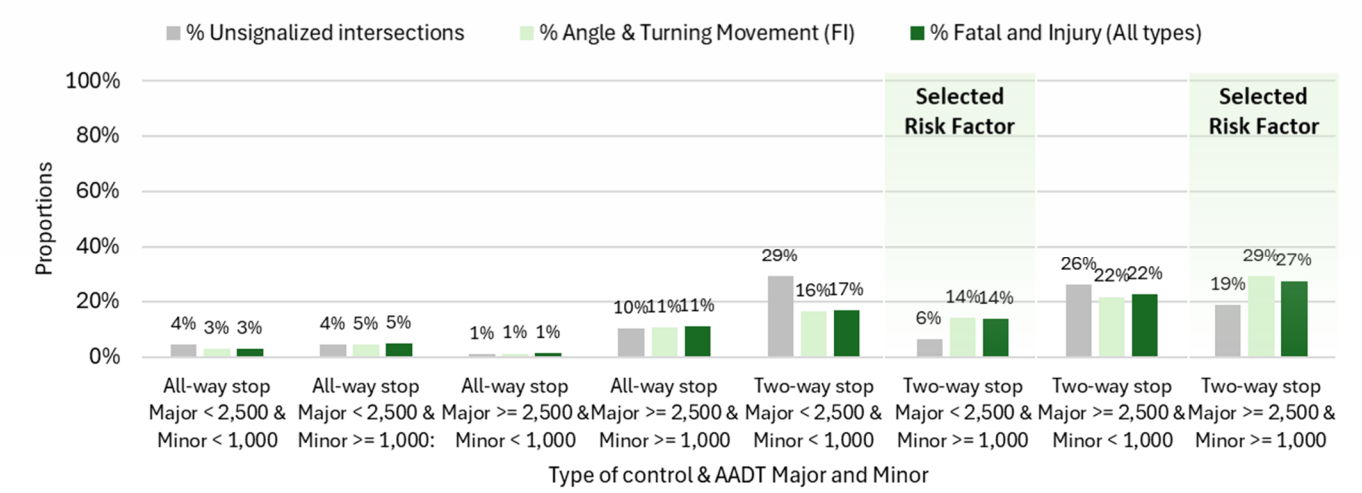


Figure C 9: Unsignalized Intersection Risk Factor – Type of Control

Type of Intersection: Number of Legs

Figure C 10 presents the evaluation of intersection type (based on the number of legs) as a risk factor. A clear predominance of angle and turning movement collisions is observed at 4-leg intersections compared to 3-leg intersections. We also performed this analysis while controlling for exposure and obtained similar results.

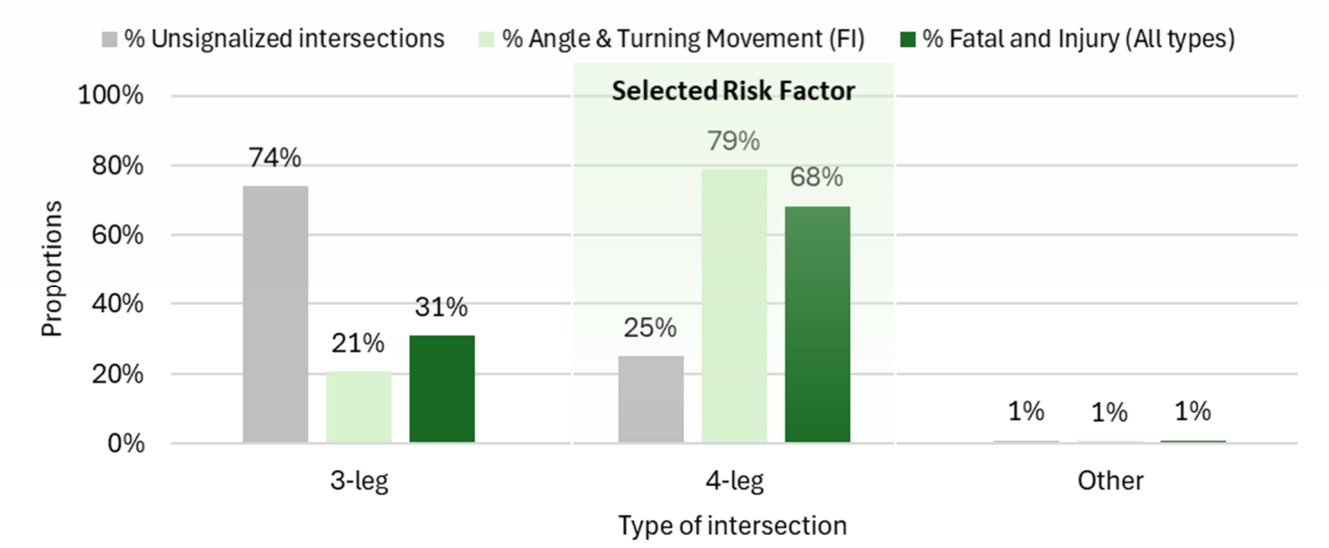


Figure C 10: Unsignalized Intersection Risk Factor – Type of Intersection

Speed Limit

Figure C 11 presents the evaluation of speed limit as a risk factor. Speed limits of 70 km/h and 80 km/h were identified as risk factors.

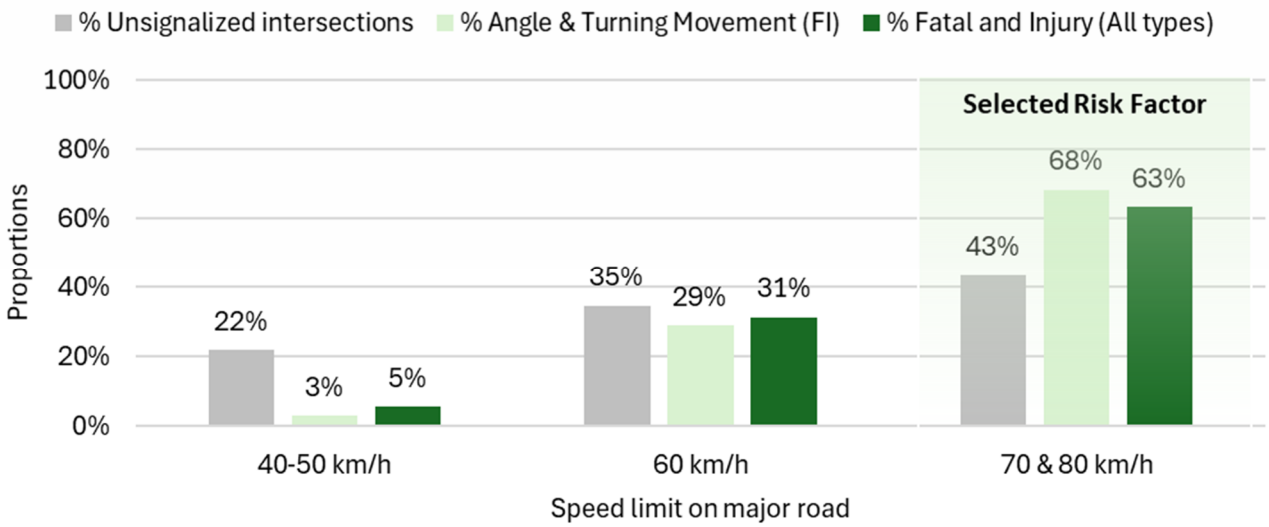


Figure C 11: Unsignalized Intersection Risk Factor – Speed Limit on Major Road

Potential Sightline Issues

Sightline issues at intersections are a common risk factor for angle and turning movement collisions. As discussed in **Section Collection of Geometric and Operational Information**, directly measuring sightline distances is difficult to perform remotely, and field collection of this information was beyond the scope of this project. To address this limitation, we proposed using the proportion of angle and turning movement collisions attributed to the "fail to give right of way" driver action as a proxy indicator for identifying sites with potential sightline issues.

Figure C 12 presents the assessment of this proxy. The analysis is broken down into two categories: sites where less than 25% of angle and turning movement collisions were due to "fail to give right of way," and sites where this proportion is 25% or higher. The percentages shown in the figure are based only on facilities that recorded at least one angle or turning movement collision.

It is observed that collisions are overrepresented at locations where a higher share of drivers failed to yield the right of way. In other words, sites with a higher proportion of these driver actions tend to have more such collisions, even though they represent a smaller share of all facilities. This suggests that the proposed proxy may be a reasonable way to flag intersections with potential sightline issues in the absence of direct field measurements.

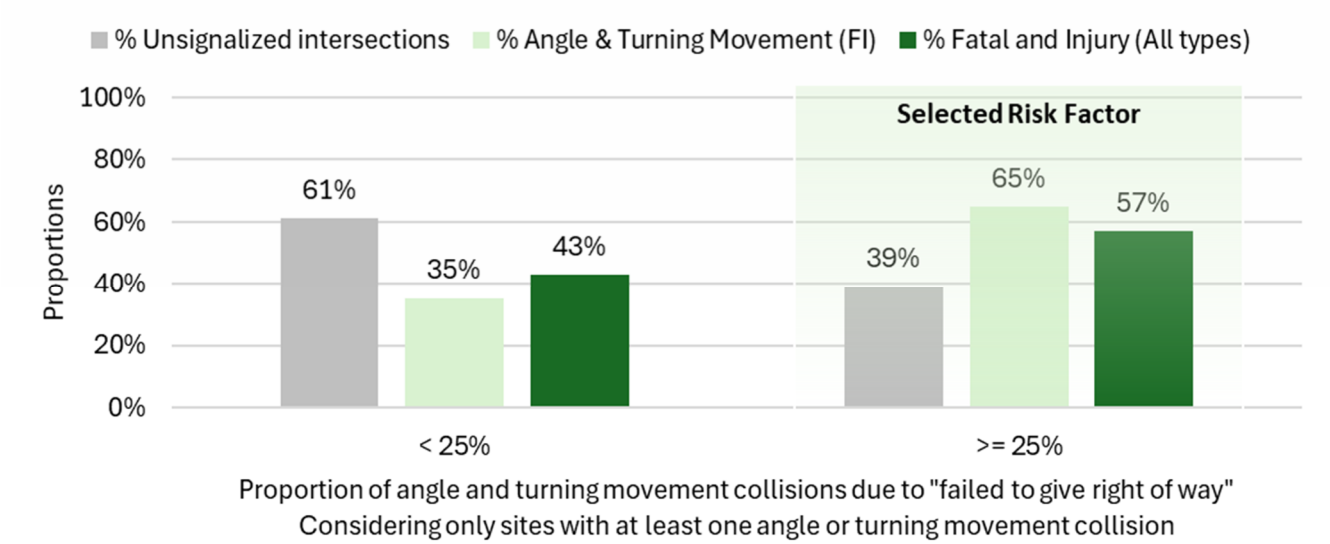


Figure C 12: Unsignalized Intersection Risk Factor – Potential Sightline Issues

Signalized Intersections: Angle and Turning Movement Collisions

The same set of variables considered for unsignalized intersections was also tested for signalized intersections. However, due to the small sample size (27 sites) and the relative similarity among them (e.g., 26 of the 27 intersections were four-legged and all had lighting), we were not able to identify meaningful correlations between collisions and several risk factors (such as, speed limit, and presence of left turn and right turn lane). AADT (for major and minor roads), rural-urban boundary, and potential sightline issues emerged as relevant factors and are discussed in the following sub-sections.

AADT: Major and Minor Roads

AADT was available for all 27 signalized intersections considered in the study area. **Figure C 13** presents the evaluation of AADT – categorized for major and minor roads – as a risk factor. Intersections where both major and minor roads AADT values are high were identified as a risk factor.

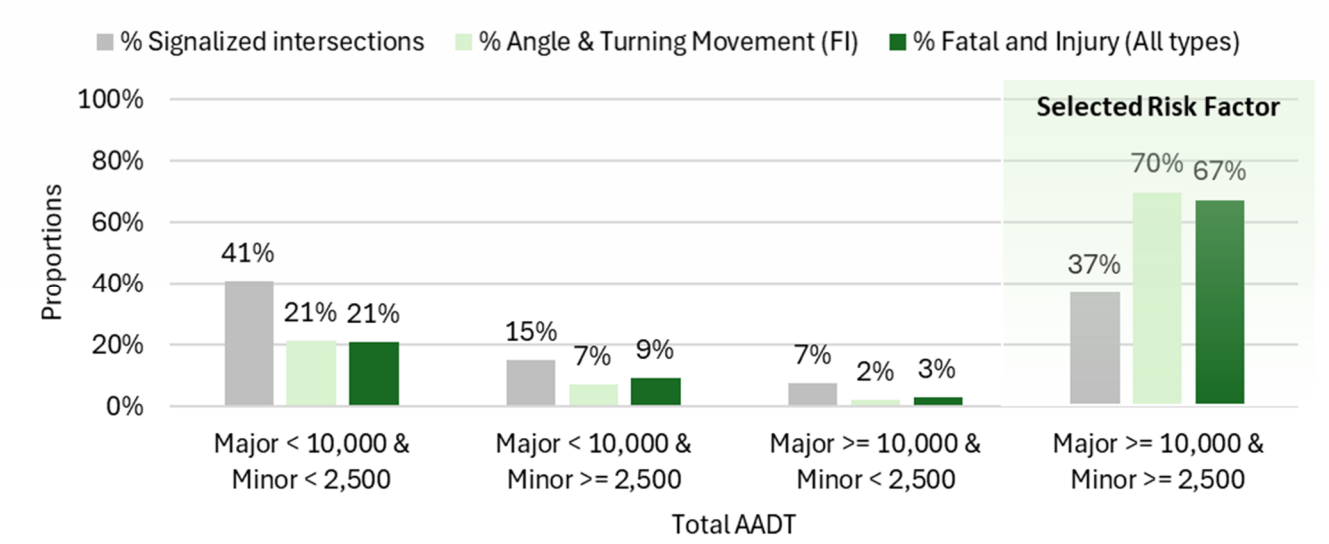


Figure C 13: Signalized Intersection Risk Factor – AADT: Major and Minor Roads

Rural versus Rural-Urban Boundary

Figure C 14 presents the evaluation of area type as a risk factor. It is observed that signalized intersections in rural-urban boundary areas are, on average, associated with more collisions than those in rural areas. Therefore, the rural-urban boundary was considered a risk factor.

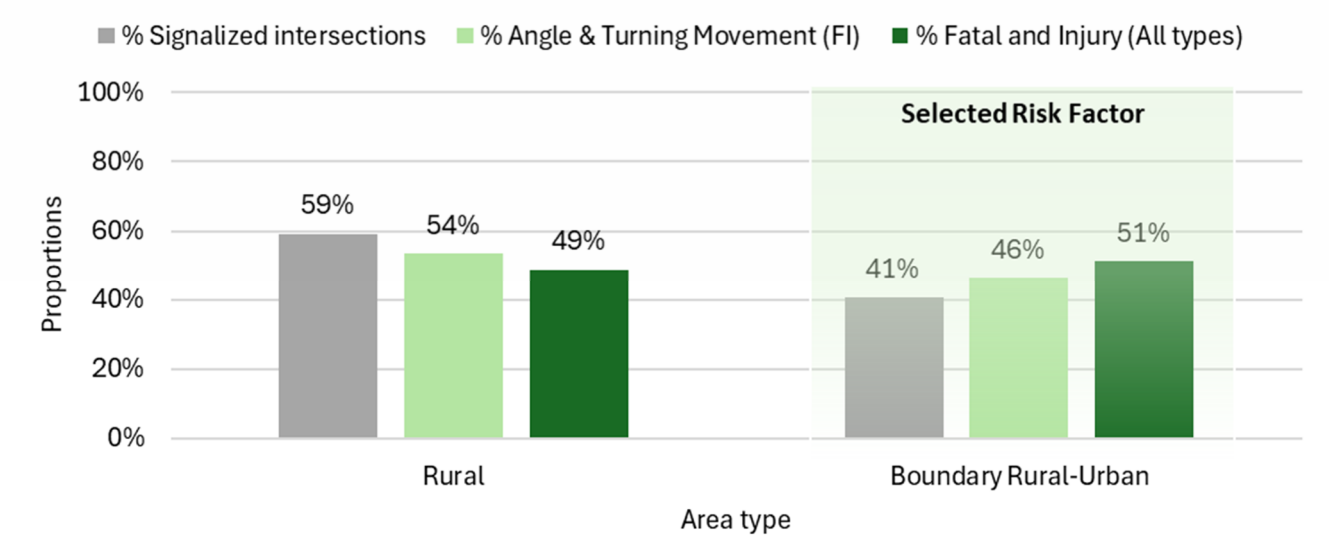


Figure C 14: Signalized Intersection Risk Factor – Rural versus Rural-Urban Boundary

Potential Sightline Issues

The same proxy indicator used for unsignalized intersections was applied to signalized intersections to identify sites with potential sightline issues. The threshold between categories was adjusted from 25% to 20% to achieve a more balanced distribution of facilities across the two groups. Since all signalized intersections had at least one angle or turning movement collision, all sites were included in this analysis.

Figure C 15 shows that collisions are overrepresented at locations where a higher proportion of drivers failed to yield the right of way. This finding suggests the presence of potential sightline issues at these sites, and the category was therefore considered a risk factor.

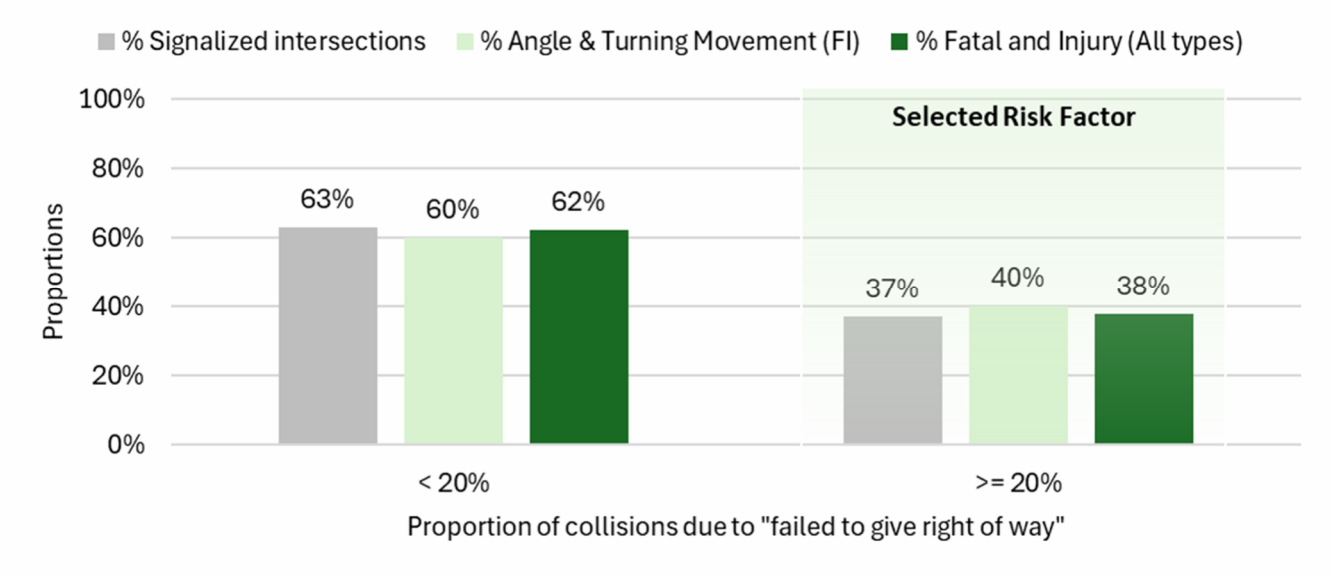


Figure C 15: Signalized Intersection Risk Factor – Potential Sightline Issues

The tables below present the systemic safety review rankings for all sites considered in the study: a) mid-block (**Table C 2**), b) unsignalized intersections (**Table C 3**), and c) signalized intersections (**Table C 4**). For mid-block locations, the ranking considers each Geo ID individually, rather than grouping adjacent locations as was done in the main report.

Ranking: Mid-block

Table C 2: Systemic Safety Review Ranking – Mid-block Locations

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
33246	WILSON ST E btwn MONTGOMERY & TOP OF ESCARPMENT	22.0	12.0	4.6	0.0	16.2	32.2	86.9	1	4
33771	GARNER RD W btwn BRAITHWAITE & PANABAKER	22.0	12.0	4.6	13.1	0.0	32.2	83.8	2	1
34205	UPPER JAMES ST btwn HIGHWAY NO. 6 & WHITE CHURCH	22.0	12.0	4.6	13.1	0.0	32.2	83.8	2	1
46143	HIGHWAY NO. 52 N btwn HIGHWAY NO. 52 JERSEYVILLE ROUNDABOUT & POWER LINE	22.0	0.0	0.0	13.1	16.2	32.2	83.4	4	7
4788	HIGHWAY NO. 52 N btwn MINERAL SPRINGS & POWER LINE	22.0	0.0	0.0	13.1	16.2	32.2	83.4	4	6
216	HIGHWAY NO. 8 btwn MCNEILLY & PRIVATE	22.0	12.0	0.0	0.0	16.2	32.2	82.4	6	0
4598	WILSON ST W btwn HIGHWAY NO. 52 & PRIVATE	22.0	12.0	0.0	13.1	0.0	32.2	79.3	7	6
54932	GARNER RD W	22.0	12.0	0.0	13.1	0.0	32.2	79.3	7	2
49863	MUD ST E btwn MUD & UPPER CENTENNIAL	22.0	12.0	0.0	13.1	0.0	32.2	79.3	7	1
33772	GARNER RD W btwn HAMILTON & PANABAKER	22.0	12.0	0.0	13.1	0.0	32.2	79.3	7	1
49864	MUD ST E btwn MUD & UPPER CENTENNIAL	22.0	12.0	0.0	13.1	0.0	32.2	79.3	7	1
36232	YORK RD btwn NEWMAN & OLD GUELPH	22.0	0.0	4.6	0.0	16.2	32.2	74.9	12	1
32904	HIGHWAY NO. 8 btwn HILLCREST & TOP OF ESCARPMENT	22.0	0.0	4.6	0.0	16.2	32.2	74.9	12	1
13688	HIGHWAY NO. 8 btwn SPRINGHILL & WEBSTERS FALLS	22.0	0.0	4.6	0.0	16.2	32.2	74.9	12	0
23184	HIGHWAY NO. 52 S btwn RAMP 52 NB TO 403 EB & WILSON	11.0	12.0	4.6	13.1	0.0	32.2	72.8	15	1
24054	BINBROOK RD btwn WESTBROOK & WOODBURN	11.0	0.0	0.0	13.1	16.2	32.2	72.4	16	8
52937	REGIONAL ROAD 56 btwn CORLIS & HALL	11.0	0.0	0.0	13.1	16.2	32.2	72.4	16	2
4570	HIGHWAY NO. 52 N btwn MINERAL SPRINGS & PRIVATE	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	5
33247	WILSON ST E btwn PRIVATE & TOP OF ESCARPMENT	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	4
46142	HIGHWAY NO. 52 S btwn HIGHWAY NO. 52 JERSEYVILLE ROUNDABOUT & RAMP 52 SB TO 403 WB	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	3
4599	WILSON ST W btwn ALBERTON & PRIVATE	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	2
4612	WILSON ST W btwn FERGUSON & SUNNYRIDGE	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	1
23180	HIGHWAY NO. 52 S btwn RAMP 403 WB TO 52 & RAMP 52 SB TO 403 WB	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	0
52912	REGIONAL ROAD 20 btwn PRIVATE & TAPLEYTOWN	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	0
52911	REGIONAL ROAD 20 btwn FIFTH & PRIVATE	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	0
52922	REGIONAL ROAD 20 btwn CHAPEL HILL & SOUTH TOWNLINE	22.0	0.0	4.6	13.1	0.0	32.2	71.8	18	0
52949	REGIONAL ROAD NO. 97 btwn FOREMAN & PRIVATE	5.4	0.0	4.6	13.1	16.2	32.2	71.4	27	1
43663	GOVERNOR'S RD btwn GOVERNOR'S & OLD GOVERNOR'S	5.4	0.0	4.6	13.1	16.2	32.2	71.4	27	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
43662	GOVERNOR'S RD btwn GOVERNOR'S & OLD HIGHWAY NO. 99	5.4	0.0	4.6	13.1	16.2	32.2	71.4	27	0
9839	YORK RD btwn SOVEREIGN & VALLEY	22.0	0.0	0.0	0.0	16.2	32.2	70.3	30	9
4667	FIDDLER'S GREEN RD btwn FIDDLER'S GREEN & GARNER	11.0	12.0	0.0	13.1	0.0	32.2	68.3	31	7
52930	REGIONAL ROAD 56 btwn KIRK & WINDWOOD	11.0	12.0	0.0	13.1	0.0	32.2	68.3	31	5
4693	TRINITY RD S btwn CLAYBAR & WILSON	11.0	12.0	0.0	13.1	0.0	32.2	68.3	31	0
13762	HIGHWAY NO. 52 btwn CONCESSION 2 & PRIVATE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	8
48493	HIGHWAY NO. 52 btwn CONCESSION 2 & HIGHWAY NO. 5 NO. 8 NO. 52 ROUNDABOUT	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	5
4765	HIGHWAY NO. 52 N btwn POWER LINE & POWER LINE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	4
4600	WILSON ST W btwn ALBERTON & ALBERTON	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	4
52923	REGIONAL ROAD 20 btwn CHAPEL HILL & WESTBROOK	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	3
52913	REGIONAL ROAD 20 btwn FIRST & PRIVATE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	3
52914	REGIONAL ROAD 20 btwn PRIVATE & SECOND	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	2
39981	WILSON ST W btwn COLBORNE & SUNNYRIDGE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	2
49866	MUD ST E btwn FIRST & MUD	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
4614	WILSON ST W btwn ALBERTON & DUNMARK	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
33030	ELEVENTH RD E btwn GREEN MOUNTAIN & MAJOR ROAD BRIDGE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
52915	REGIONAL ROAD 20 btwn SECOND & THIRD	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
52910	REGIONAL ROAD 20 btwn PRIVATE & WOODBURN	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
52921	REGIONAL ROAD 20 btwn PRIVATE & SOUTH TOWNLINE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	1
52917	REGIONAL ROAD 20 btwn TAPLEYTOWN & THIRD	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	0
52919	REGIONAL ROAD 20 btwn FIFTH & WOODBURN	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	0
4613	WILSON ST W btwn DUNMARK & FERGUSON	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	0
33029	ELEVENTH RD E btwn MAJOR ROAD BRIDGE & MUD	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	0
52916	REGIONAL ROAD 20 btwn PRIVATE & PRIVATE	22.0	0.0	0.0	13.1	0.0	32.2	67.3	34	0
48492	HIGHWAY NO. 8 btwn HIGHWAY NO. 5 & PRIVATE	5.4	0.0	0.0	13.1	16.2	32.2	66.8	53	3
13691	BROCK RD btwn BROCK & HIGHWAY NO. 5	5.4	0.0	0.0	13.1	16.2	32.2	66.8	53	1
14904	KIRKWALL RD btwn CONCESSION 6 & PRIVATE	5.4	0.0	0.0	13.1	16.2	32.2	66.8	53	0
138	HIGHWAY NO. 8 btwn LEWIS & MCNEILLY	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	7
22834	HIGHWAY NO. 8 btwn GLOVER & MCDONALDS	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	5
35304	HIGHWAY NO. 8 btwn MCDONALDS & PRIVATE	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	4
52925	REGIONAL ROAD 56 btwn CEMETERY & GUYATT	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	3
35303	HIGHWAY NO. 8 btwn JONES & PRIVATE	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	3
217	HIGHWAY NO. 8 btwn GLOVER & PRIVATE	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	3
234	HIGHWAY NO. 8 btwn PRIVATE & REGALVIEW	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	2

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
23460	GARNER RD W btwn BRAITHWAITE & FIDDLER'S GREEN	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	0
52920	REGIONAL ROAD 20 btwn HARBINGER & REGIONAL ROAD 56	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	0
111	HIGHWAY NO. 8 btwn JONES & PRIVATE	22.0	12.0	0.0	0.0	0.0	32.2	66.2	56	0
13910	HIGHWAY NO. 5 W btwn HARRISBURG & TROY	0.0	0.0	0.0	13.1	16.2	32.2	61.4	66	0
13812	SAFARI RD btwn HIGHWAY NO. 8 & SHEFFIELD	0.0	0.0	0.0	13.1	16.2	32.2	61.4	66	0
52950	REGIONAL ROAD NO. 97 btwn COOPER & OLD BEVERLY	11.0	0.0	4.6	13.1	0.0	32.2	60.8	68	0
52938	REGIONAL ROAD 56 btwn HALDIBROOK & HALL	11.0	0.0	4.6	13.1	0.0	32.2	60.8	68	0
23512	HIGHWAY NO. 52 S btwn RAMP 403 EB TO 52 & RAMP 52 NB TO 403 EB	11.0	0.0	4.6	13.1	0.0	32.2	60.8	68	0
23182	HIGHWAY NO. 52 S btwn RAMP 403 EB TO 52 & RAMP 52 SB TO 403 EB	11.0	0.0	4.6	13.1	0.0	32.2	60.8	68	0
52933	REGIONAL ROAD 56 btwn MAJOR ROAD BRIDGE & PRIVATE	11.0	0.0	4.6	13.1	0.0	32.2	60.8	68	0
9897	GOVERNOR'S RD btwn PRIVATE & RIDGEWOOD	11.0	12.0	4.6	0.0	0.0	32.2	59.7	73	2
39796	SYDENHAM RD btwn MAJOR ROAD BRIDGE & TOP OF ESCARPMENT	11.0	12.0	4.6	0.0	0.0	32.2	59.7	73	1
52934	REGIONAL ROAD 56 btwn GOLF CLUB & MAJOR ROAD BRIDGE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	13
4533	WILSON ST E btwn LOWER LIONS CLUB & PRIVATE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	12
35253	WILSON ST E btwn FILMAN & PRIVATE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	7
32605	HIGHWAY NO. 52 btwn GOVERNOR'S & MAJOR ROAD BRIDGE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	5
4799	HIGHWAY NO. 52 N btwn GOVERNOR'S & PRIVATE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	4
32903	HIGHWAY NO. 8 btwn RAILWAY BRIDGE & TOP OF ESCARPMENT	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	1
35252	WILSON ST E btwn PRIVATE & PRIVATE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	1
32607	HIGHWAY NO. 52 btwn END OF BRIDGE & START OF BRIDGE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	0
232	HIGHWAY NO. 8 btwn PRIVATE & PRIVATE	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	0
13851	HIGHWAY NO. 8 btwn HIGHWAY NO. 8 & WEBSTERS FALLS	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	0
13852	HIGHWAY NO. 8 btwn HILLCREST & SPRINGHILL	22.0	0.0	4.6	0.0	0.0	32.2	58.7	75	0
4762	GOVERNOR'S RD btwn OLD GOVERNOR'S & OLD GOVERNOR'S	5.4	0.0	4.6	0.0	16.2	32.2	58.3	86	0
4769	GOVERNOR'S RD btwn HIGHWAY NO. 52 & OLD GOVERNOR'S	5.4	0.0	4.6	0.0	16.2	32.2	58.3	86	0
13444	CENTRE RD btwn CONCESSION 7 & CONCESSION 8	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	5
52936	REGIONAL ROAD 56 btwn KIRK & MAJOR ROAD BRIDGE	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	4
24102	MUD ST E btwn EAST TOWNLINE & PURDY	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	2
52927	REGIONAL ROAD 56 btwn CORLIS & PRIVATE	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	2
4666	FIDDLER'S GREEN RD btwn BOOK & FIDDLER'S GREEN	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	1
252	MUD ST E btwn ELEVENTH & PRIVATE	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	1
13639	COOPER RD btwn CONCESSION 10 & GORE	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	0
206	MUD ST E btwn ALPHA & SECOND	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	0
290	MUD ST E btwn FIRST & SECOND	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
40921	BISMARK RD btwn CITY LIMITS & WESTBROOK	11.0	0.0	0.0	13.1	0.0	32.2	56.3	88	0
9900	GOVERNOR'S RD btwn PRIVATE & WEIRS	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	3
13343	CENTRE RD btwn CONCESSION 11 & PRIVATE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	3
52942	REGIONAL ROAD NO. 97 btwn HOODS & MIDDLETOWN	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	2
9925	GOVERNOR'S RD btwn BINKLEY & PRIVATE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	1
32715	HIGHWAY NO. 5 W btwn HUNTER & MAJOR ROAD BRIDGE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	1
52944	REGIONAL ROAD NO. 97 btwn COOPER & KIRKWALL	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
4771	GOVERNOR'S RD btwn PRIVATE & RAILWAY	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
4571	GOVERNOR'S RD btwn BINKLEY & OLD GOVERNOR'S	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
4575	GOVERNOR'S RD btwn OLD HIGHWAY NO. 99 & SLOTE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
33991	GOVERNOR'S RD btwn MAJOR ROAD BRIDGE & WEIR	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
33990	GOVERNOR'S RD btwn MAJOR ROAD BRIDGE & WEIR	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
13746	HIGHWAY NO. 8 btwn PRIVATE & PRIVATE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
13907	HIGHWAY NO. 5 W btwn PRIVATE & TROY	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
32714	HIGHWAY NO. 5 W btwn END OF BRIDGE & START OF BRIDGE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
32716	HIGHWAY NO. 5 W btwn MAJOR ROAD BRIDGE & PRIVATE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
33032	TAPLEYTOWN RD btwn MAJOR ROAD BRIDGE & MUD	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
33989	GOVERNOR'S RD btwn END OF BRIDGE & START OF BRIDGE	5.4	0.0	4.6	13.1	0.0	32.2	55.2	98	0
1218	BINBROOK RD btwn HENDERSHOT & SOUTHBROOK	11.0	12.0	0.0	0.0	0.0	32.2	55.2	115	3
55088	PARKSIDE DR	11.0	12.0	0.0	0.0	0.0	32.2	55.2	115	1
33585	WHITE CHURCH RD W btwn HAMPTON BROOK & UPPER JAMES	11.0	12.0	0.0	0.0	0.0	32.2	55.2	115	1
4913	OLD DUNDAS RD btwn LIONS CLUB & MONTGOMERY	22.0	12.0	4.6	0.0	16.2	0.0	54.7	118	2
52935	REGIONAL ROAD 56 btwn GUYATT & MAJOR ROAD BRIDGE	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	5
35251	WILSON ST E btwn LOWER LIONS CLUB & PRIVATE	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	2
32606	HIGHWAY NO. 52 btwn MAJOR ROAD BRIDGE & PRIVATE	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	2
277	MUD ST E btwn TAPLEYTOWN & THIRD	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	2
41761	HIGHWAY NO. 8 btwn BRIDGMAN & MAIN	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	1
52918	REGIONAL ROAD 20 btwn FIRST & HARBINGER	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	1
13529	SYDENHAM RD btwn HARVEST & ROCK CHAPEL	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	1
44061	YORK RD btwn NEWMAN & RAMP YORK TO 6 SB	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	1
233	HIGHWAY NO. 8 btwn PRIVATE & PRIVATE	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	0
13850	HIGHWAY NO. 8 btwn BROCK & HIGHWAY NO. 8	22.0	0.0	0.0	0.0	0.0	32.2	54.2	119	0
13400	PARKSIDE DR btwn BOULDING & ROBSON	5.4	12.0	4.6	0.0	0.0	32.2	54.1	129	0
52952	REGIONAL ROAD NO. 97 btwn LENNON & VALENS	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	5

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
37482	CAMPBELLVILLE RD btwn CENTRE & CHESSWOOD	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	4
4665	FIDDLER'S GREEN RD btwn BOOK & BUTTER	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	4
52946	REGIONAL ROAD NO. 97 btwn PRIVATE & VALENS	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	4
262	MUD ST E btwn EIGHTH & SEVENTH	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	4
4591	TRINITY RD S btwn BUTTER & SAWMILL	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	3
4711	GOVERNOR'S RD btwn HOWARD & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	3
13924	HIGHWAY NO. 5 W btwn LYNDEN & WOODHILL	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	3
52953	REGIONAL ROAD NO. 97 btwn BROCK & MIDDLETOWN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
13640	COOPER RD btwn CONCESSION 10 & REGIONAL RD NO. 97	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
261	MUD ST E btwn SEVENTH & SIXTH	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
13603	BROCK RD btwn BROCK & CONCESSION 4	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
13347	CENTRE RD btwn CONCESSION 10 & CONCESSION 11	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
13577	BROCK RD btwn CONCESSION 6 & SAFARI	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
49222	TRINITY RD S btwn BOOK & BUTTER	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
13606	BROCK RD btwn CONCESSION 5 & CONCESSION 6	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	2
4632	LYNDEN RD btwn INDIAN & POWER LINE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4772	GOVERNOR'S RD btwn KITCHENS & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4649	GOVERNOR'S RD btwn HARRISBURG & WEIR	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
52945	REGIONAL ROAD NO. 97 btwn VALENS & VALENS	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
1210	BINBROOK RD btwn WOODBURN & WOODBURN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4664	FIDDLER'S GREEN RD btwn BUTTER & CARLUKE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4710	GOVERNOR'S RD btwn FIELD & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
33034	MUD ST E btwn FIFTH & MAJOR ROAD BRIDGE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4582	CARLUKE RD W btwn SAWMILL & SHAVER	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
4709	GOVERNOR'S RD btwn FIELD & KITCHENS	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
13765	HIGHWAY NO. 5 W btwn ORKNEY & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
13919	HIGHWAY NO. 5 W btwn PRIVATE & WOODHILL	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
250	MUD ST E btwn NINTH & TENTH	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
13771	HIGHWAY NO. 5 W btwn ORKNEY & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
52951	REGIONAL ROAD NO. 97 btwn BROCK & HIGHWAY NO. 6	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	1
263	MUD ST E btwn EIGHTH & NINTH	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13433	CENTRE RD btwn CONCESSION 6 & HUISMAN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
36305	CAMPBELLVILLE RD btwn HIGHWAY NO. 6 & MAJOR ROAD BRIDGE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
270	MUD ST E btwn FIFTH & SIXTH	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13571	SAFARI RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13905	HIGHWAY NO. 5 W btwn HUNTER & LYNDEN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
4652	GOVERNOR'S RD btwn BETHEL CHURCH & HARRISBURG	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13442	CENTRE RD btwn CONCESSION 7 & HUISMAN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
48481	HIGHWAY NO. 5 W btwn HIGHWAY NO. 5 NO. 8 NO. 52 ROUNDABOUT & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
51516	BROCK RD btwn CONCESSION 5 & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
52943	REGIONAL ROAD NO. 97 btwn BROCK & HIGHWAY NO. 6	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
52948	REGIONAL ROAD NO. 97 btwn HOODS & LENNON	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
276	MUD ST E btwn GILMAN & THIRD	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13795	KIRKWALL RD btwn CONCESSION 5 & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
51517	BROCK RD btwn CONCESSION 4 & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13747	HIGHWAY NO. 8 btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13879	HIGHWAY NO. 8 btwn MIDDLETOWN & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
37481	CAMPBELLVILLE RD btwn CHESSWOOD & MAJOR ROAD BRIDGE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
275	MUD ST E btwn ALPHA & GILMAN	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
4646	GOVERNOR'S RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
4647	GOVERNOR'S RD btwn PRIVATE & WEIR	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13574	SAFARI RD btwn BROCK & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13772	HIGHWAY NO. 5 W btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
13796	KIRKWALL RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
14887	KIRKWALL RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
14893	KIRKWALL RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
33031	TAPLEYTOWN RD btwn HIGHLAND & MAJOR ROAD BRIDGE	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
52947	REGIONAL ROAD NO. 97 btwn HOODS & HOODS	5.4	0.0	0.0	13.1	0.0	32.2	50.7	130	0
292	RIDGE RD btwn PRIVATE & UPPER CENTENNIAL	22.0	12.0	0.0	0.0	16.2	0.0	50.2	189	1
13927	LYNDEN RD btwn CONCESSION 2 & HIGHWAY NO. 5	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	2
13476	BROCK RD btwn CONCESSION 8 & PRIVATE	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	1
33005	SAFARI RD btwn MAJOR ROAD BRIDGE & MIDDLETOWN	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	1
33006	SAFARI RD btwn MAJOR ROAD BRIDGE & WESTOVER	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	1
4579	SAWMILL RD btwn BRANT COUNTY RD 22 & TRINITY	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	1
13737	SAFARI RD btwn KIRKWALL & PRIVATE	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	0
13781	SAFARI RD btwn PRIVATE & PRIVATE	0.0	0.0	4.6	13.1	0.0	32.2	49.8	190	0
33015	PARKSIDE DR btwn BOULDING & RAILWAY LINE	5.4	12.0	0.0	0.0	0.0	32.2	49.6	197	1
33013	PARKSIDE DR btwn CHURCHILL & MAJOR ROAD BRIDGE	5.4	12.0	0.0	0.0	0.0	32.2	49.6	197	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
53646	PARKSIDE DR btwn AVONSYDE & SPRING CREEK	5.4	12.0	0.0	0.0	0.0	32.2	49.6	197	1
37524	PARKSIDE DR btwn ROBSON & SPRING CREEK	5.4	12.0	0.0	0.0	0.0	32.2	49.6	197	0
53647	PARKSIDE DR btwn AVONSYDE & EVANS	5.4	12.0	0.0	0.0	0.0	32.2	49.6	197	0
121	FIFTY RD btwn BARTON & HIGHWAY NO. 8	0.0	12.0	4.6	0.0	0.0	32.2	48.7	202	2
23193	SUNNYRIDGE RD btwn MAJOR ROAD BRIDGE & WILSON	0.0	0.0	0.0	0.0	16.2	32.2	48.3	203	1
34208	WHITE CHURCH RD W btwn HAMPTON BROOK & MAJOR ROAD BRIDGE	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	2
13969	CENTRE RD btwn CONCESSION 8 & PROGRESTON	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	2
13390	CARLISLE RD btwn ALDERSON & PROGRESTON	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	1
13337	CARLISLE RD btwn ALDERSON & CREEKVIEW	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	0
32828	BROCK RD btwn END OF BRIDGE & START OF BRIDGE	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	0
32830	BROCK RD btwn HARVEST & MAJOR ROAD BRIDGE	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	0
23408	CARLISLE RD btwn PRIVATE & PROGRESTON	11.0	0.0	4.6	0.0	0.0	32.2	47.7	204	0
251	MUD ST E btwn ELEVENTH & TENTH	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
13602	CONCESSION 5 W btwn BROCK & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
13739	KIRKWALL RD btwn PRIVATE & SAFARI	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
13475	BROCK RD btwn PRIVATE & REGIONAL RD NO. 97	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
34305	ELEVENTH RD E btwn GREEN MOUNTAIN & RAILWAY LINE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
33966	CONCESSION 5 W btwn MOFFAT & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	2
1211	BINBROOK RD btwn HENDERSHOT & WOODBURN	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
4633	LYNDEN RD btwn INDIAN & JERSEYVILLE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
4590	SAWMILL RD btwn BRANT COUNTY RD 22 & CARLUKE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13578	SAFARI RD btwn BROCK & MIDDLETOWN	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13614	SAFARI RD btwn VALENS & WESTOVER	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13745	SAFARI RD btwn COOPER & SEATON	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13532	SAFARI RD btwn VALENS & VALENS	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13715	CONCESSION 5 W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13823	SHEFFIELD RD btwn CONCESSION 6 & OLD HIGHWAY NO. 8	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13909	HIGHWAY NO. 5 W btwn TROY & WEIR	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
33967	CONCESSION 5 W btwn MOFFAT & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	1
13630	KIRKWALL RD btwn CONCESSION 8 & REGIONAL RD NO. 97	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
14905	KIRKWALL RD btwn CONCESSION 6 & SAFARI	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13738	SAFARI RD btwn COOPER & KIRKWALL	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13908	HIGHWAY NO. 5 W btwn SHEFFIELD & TROY	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13610	CONCESSION 5 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13615	WESTOVER RD btwn CONCESSION 6 & SAFARI	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13933	SHEFFIELD RD btwn CONCESSION 5 & NORMAN	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13357	CENTRE RD btwn MOUNTSBERG & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
34306	ELEVENTH RD E btwn RAILWAY LINE & SMITH	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
34392	HIGHWAY NO. 8 btwn MIDDLETOWN & NEFF'S	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
37	ELEVENTH RD E btwn RIDGE & SMITH	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13733	SAFARI RD btwn PRIVATE & VALENS	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13810	SAFARI RD btwn SEATON & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13811	SAFARI RD btwn SHEFFIELD & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13822	SHEFFIELD RD btwn CONCESSION 6 & NORMAN	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13891	CONCESSION 4 W btwn SHEFFIELD & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13931	SHEFFIELD RD btwn CONCESSION 5 & PATRICK	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13708	CONCESSION 5 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13714	CONCESSION 5 W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13716	CONCESSION 5 W btwn PRIVATE & WESTOVER	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13720	WESTOVER RD btwn CONCESSION 4 & CONCESSION 5	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
13932	SHEFFIELD RD btwn CONCESSION 4 & PATRICK	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
34391	HIGHWAY NO. 8 btwn NEFF'S & PRIVATE	0.0	0.0	0.0	13.1	0.0	32.2	45.3	211	0
23382	EVANS RD btwn HIGHWAY NO. 5 & HUBBERT	0.0	12.0	0.0	0.0	0.0	32.2	44.2	251	4
33012	YORK RD btwn RAILWAY BRIDGE & VALLEY	0.0	12.0	0.0	0.0	0.0	32.2	44.2	251	2
55089	PARKSIDE DR	0.0	12.0	0.0	0.0	0.0	32.2	44.2	251	1
5439	OLD DUNDAS RD btwn LOWER LIONS CLUB & OLD ANCASTER	11.0	12.0	4.6	0.0	16.2	0.0	43.7	254	0
13665	SYDENHAM RD btwn FALLSVIEW & SYDENHAM	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	3
20588	GOVERNOR'S RD btwn PRIVATE & SULPHUR SPRINGS	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	1
13328	CARLISLE RD btwn MILBUROUGH & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	1
32994	CENTRE RD btwn CARLISLE & MAJOR ROAD BRIDGE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	1
9898	GOVERNOR'S RD btwn PRIVATE & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	1
13838	SYDENHAM RD btwn FALLSVIEW & GLENDRUMMOND	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
22970	CARLISLE RD btwn PARKSHORE & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
1432	HALDIBROOK RD btwn PRIVATE & TRIMBLE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
13849	BROCK RD btwn HIGHWAY NO. 8 & KIRBY	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
13339	CARLISLE RD btwn CENTRE & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
13438	CONCESSION 6 E btwn CENTRE & GARDEN	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
13837	SYDENHAM RD btwn GLENDRUMMOND & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13334	CARLISLE RD btwn PRIVATE & PRIVATE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
13466	CENTRE RD btwn BLUEHERON & PROGRESTON	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
22971	CARLISLE RD btwn FLAMBOROUGH HILLS & PARKSHORE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
32993	CENTRE RD btwn MAJOR ROAD BRIDGE & MEANDER CLOSE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
39598	CARLISLE RD btwn PRIVATE & RAILWAY LINE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
39599	CARLISLE RD btwn PRIVATE & RAILWAY LINE	11.0	0.0	0.0	0.0	0.0	32.2	43.2	255	0
33071	RIDGE RD btwn MAJOR ROAD BRIDGE & PRIVATE	22.0	0.0	4.6	0.0	16.2	0.0	42.7	273	2
13372	CENTRE RD btwn CARLISLE & GEORGE	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	1
9899	GOVERNOR'S RD btwn SULPHUR SPRINGS & WEIRS	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
47425	HIGHWAY NO. 8 btwn KIRBY & MARSHBORO	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
13449	CENTRE RD btwn GEORGE & WARREN	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
32992	CARLISLE RD btwn MAJOR ROAD BRIDGE & WILDBERRY	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
33033	MUD ST E btwn MAJOR ROAD BRIDGE & TAPLEYTOWN	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
4763	GOVERNOR'S RD btwn OLD GOVERNOR'S & SLOTE	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
33014	PARKSIDE DR btwn MAJOR ROAD BRIDGE & RAILWAY LINE	5.4	0.0	4.6	0.0	0.0	32.2	42.1	274	0
13741	COOPER RD btwn HIGHWAY NO. 8 & SAFARI	5.4	0.0	4.6	13.1	16.2	0.0	39.2	282	0
1488	BINBROOK RD btwn BINBROOK & TRINITY CHURCH	22.0	0.0	0.0	0.0	16.2	0.0	38.2	283	1
13464	CARLISLE RD btwn HIGHWAY NO. 6 & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	5
13528	SYDENHAM RD btwn HIGHWAY NO. 5 & ROCK CHAPEL	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	5
13861	BROCK RD btwn HARVEST & TAYLOR	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13560	CONCESSION 5 W btwn MILLGROVE SIDEROAD & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13557	CONCESSION 6 E btwn HIGHWAY NO. 6 & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13874	HIGHWAY NO. 8 btwn MARSHBORO & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13454	CARLISLE RD btwn CENTRE & WILLIAM	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13455	CARLISLE RD btwn WILDBERRY & WILLIAM	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13877	HIGHWAY NO. 8 btwn MOUNTAIN VIEW & ROSEBOUGH	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
328	TAPLEYTOWN RD btwn PRIVATE & REGIONAL RD 20	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
13860	BROCK RD btwn HIGHWAY NO. 5 & TAYLOR	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	1
4770	GOVERNOR'S RD btwn HIGHWAY NO. 52 & RAILWAY	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
4715	GOVERNOR'S RD btwn HOWARD & LYNDEN	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
1217	BINBROOK RD btwn HENDERSHOT & HENDERSHOT	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13636	GORE RD btwn COOPER & WELLINGTON RD 35	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
4714	GOVERNOR'S RD btwn LYNDEN & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13440	CONCESSION 6 E btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13873	HIGHWAY NO. 8 btwn CROOKS HOLLOW & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
32862	CENTRE RD btwn CONCESSION 10 & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
208	RIDGE RD btwn BRAND & ELEVENTH	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13439	CONCESSION 6 E btwn GARDEN & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13345	CENTRE RD btwn WILLIAM & WOODEND	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
32991	CARLISLE RD btwn MAJOR ROAD BRIDGE & PRIVATE	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13846	HIGHWAY NO. 8 btwn MOUNTAIN VIEW & PARK	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13847	HIGHWAY NO. 8 btwn HIGHWAY NO. 8 & PARK	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13848	HIGHWAY NO. 8 btwn BROCK & HIGHWAY NO. 8	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13450	CENTRE RD btwn WARREN & WILLIAM	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
32861	CENTRE RD btwn MAJOR ROAD BRIDGE & WOODEND	5.4	0.0	0.0	0.0	0.0	32.2	37.6	284	0
13872	HIGHWAY NO. 8 btwn CROOKS HOLLOW & WEIRS	0.0	0.0	4.6	0.0	0.0	32.2	36.7	312	0
23381	EVANS RD btwn HUBBERT & PARKSIDE	0.0	0.0	4.6	0.0	0.0	32.2	36.7	312	0
32974	WHITE CHURCH RD W btwn MAJOR ROAD BRIDGE & WHITE CHURCH	0.0	0.0	4.6	0.0	0.0	32.2	36.7	312	0
32995	CARLISLE RD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	0.0	0.0	32.2	36.7	312	0
47	ELEVENTH RD E btwn HIGHLAND & MUD	22.0	0.0	0.0	13.1	0.0	0.0	35.1	316	0
1308	TRINITY CHURCH RD btwn GOLF CLUB & PRIVATE	22.0	12.0	0.0	0.0	0.0	0.0	34.0	317	2
54717	TWENTY RD E btwn MILES RD & NEBO RD	22.0	12.0	0.0	0.0	0.0	0.0	34.0	317	1
1232	BINBROOK RD btwn BINBROOK & FLETCHER	22.0	12.0	0.0	0.0	0.0	0.0	34.0	317	0
36848	BOOK RD E btwn HIGHWAY NO. 6 & SOUTHCOTE	22.0	12.0	0.0	0.0	0.0	0.0	34.0	317	0
13799	CONCESSION 5 W btwn HIGHWAY NO. 8 & KIRKWALL	0.0	0.0	4.6	13.1	16.2	0.0	33.8	321	1
39921	CONCESSION 6 W btwn LOCKIE & SAGER	0.0	0.0	4.6	13.1	16.2	0.0	33.8	321	0
39923	CONCESSION 5 W btwn CONCESSION 5 & SAGER	0.0	0.0	4.6	13.1	16.2	0.0	33.8	321	0
4554	SULPHUR SPRINGS RD btwn MINERAL SPRINGS & WOODVIEW	0.0	12.0	4.6	0.0	16.2	0.0	32.7	324	5
13956	KING RD btwn MOUNTAIN BROW & TOP OF ESCARPMENT	0.0	12.0	4.6	0.0	16.2	0.0	32.7	324	2
5362	FILMAN RD btwn END & PRIVATE	0.0	12.0	4.6	0.0	16.2	0.0	32.7	324	1
4580	CARLUKE RD W btwn FIDDLER'S GREEN & SHAVER	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	5
39274	HIGHWAY NO. 8 btwn BRIDGMAN & FIFTY	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
32865	CENTRE RD btwn CONCESSION 5 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
13792	WOODHILL RD btwn CONCESSION 4 & HIGHWAY NO. 5	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
22355	CARLUKE RD E btwn CARLUKE & FIDDLER'S GREEN	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
33986	LYNDEN RD btwn CONCESSION 2 & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
13790	WOODHILL RD btwn PRIVATE & WOODHILL	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	2
32866	CENTRE RD btwn CONCESSION 6 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
4631	LYNDEN RD btwn POWER LINE & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
13601	CONCESSION 5 W btwn BROCK & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
13683	CONCESSION 5 W btwn HIGHWAY NO. 6 & PALMER	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
4622	JERSEYVILLE RD W btwn LYNDEN & RUSSELL	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
4641	JERSEYVILLE RD W btwn LYNDEN & PARSONAGE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
1499	BLACKHEATH RD btwn HALDIBROOK & HALL	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
13559	CONCESSION 5 W btwn LEWIS & MILLGROVE SIDEROAD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
22357	CARLUKE RD E btwn CARLUKE & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
34209	WHITE CHURCH RD W btwn MAJOR ROAD BRIDGE & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
39966	JERSEYVILLE RD W btwn JERSEYVILLE & RONALD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	1
13576	BROCK RD btwn PRIVATE & SAFARI	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
4630	LYNDEN RD btwn GOVERNOR'S & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13358	CENTRE RD btwn CAMPBELLVILLE & MOUNTSBERG	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
32969	OLD HIGHWAY NO. 8 btwn MAJOR ROAD BRIDGE & SHEFFIELD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
247	GREEN MOUNTAIN RD E btwn ELEVENTH & ELEVENTH	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
278	TAPLEYTOWN RD btwn HIGHLAND & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13291	BROCK RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
4616	JERSEYVILLE RD W btwn RUSSELL & SUNNYRIDGE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
4625	SUNNYRIDGE RD btwn MAPLE & POPLAR	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
4640	JERSEYVILLE RD W btwn PARSONAGE & RONALD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13564	CONCESSION 5 W btwn CAREY & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13569	SAFARI RD btwn EDGEWOOD & HIGHWAY NO. 6	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13719	WESTOVER RD btwn CONCESSION 5 & CONCESSION 6	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13721	WESTOVER RD btwn CONCESSION 4 & SODOM	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13819	OLD HIGHWAY NO. 8 btwn SETTLERS & SHEFFIELD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13820	OLD HIGHWAY NO. 8 btwn SHEFFIELD & SHEFFIELD	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13972	HIGHWAY NO. 8 btwn PRIVATE & WEIRS	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
1430	HALDIBROOK RD btwn REGIONAL RD 56 & TRIMBLE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13290	BROCK RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13292	BROCK RD btwn CONCESSION 8 & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13558	CONCESSION 5 W btwn LEWIS & PALMER	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13561	CONCESSION 5 W btwn CAREY & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13565	CONCESSION 5 W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
13685	KIRKWALL RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13789	WOODHILL RD btwn HIGHWAY NO. 8 & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
14885	KIRKWALL RD btwn CONCESSION 8 & PRIVATE	0.0	0.0	0.0	0.0	0.0	32.2	32.2	327	0
211	FIFTY RD btwn ELEVENTH & PRIVATE	11.0	0.0	4.6	0.0	16.2	0.0	31.7	371	2
41	EIGHTH RD E btwn PRIVATE & RIDGE	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
13901	WEIR RD btwn CONCESSION 2 & GOVERNOR'S	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
13801	CONCESSION 6 W btwn HIGHWAY NO. 8 & PRIVATE	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
4797	AIRPORT RD btwn BUTTER & GLANCASTER	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
39909	CONCESSION 7 W btwn CONCESSION 7 & MCLEAN	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
33886	CHAPEL HILL RD btwn REGIONAL RD 20 & SOUTH TOWNLINE	0.0	0.0	0.0	13.1	16.2	0.0	29.3	372	0
32737	TRINITY CHURCH RD btwn GUYATT & MAJOR ROAD BRIDGE	22.0	0.0	4.6	0.0	0.0	0.0	26.6	378	2
1223	KIRK RD btwn REGIONAL RD 56 & TRIMBLE	22.0	0.0	4.6	0.0	0.0	0.0	26.6	378	0
408	MCNEILLY RD btwn PRIVATE & TOP OF ESCARPMENT	5.4	0.0	4.6	0.0	16.2	0.0	26.1	380	4
22718	FIFTY RD btwn RESERVOIR PARK & TOP OF ESCARPMENT	5.4	0.0	4.6	0.0	16.2	0.0	26.1	380	2
400	FIFTY RD btwn CONCESSION & RESERVOIR PARK	5.4	0.0	4.6	0.0	16.2	0.0	26.1	380	1
39590	PARKSIDE DR btwn EVANS & MILBUROUGH	5.4	0.0	4.6	0.0	16.2	0.0	26.1	380	0
13314	CAMPBELLVILLE RD btwn CENTRE & PRIVATE	11.0	0.0	0.0	13.1	0.0	0.0	24.1	384	5
1245	AIRPORT RD E btwn MILES & NEBO	11.0	0.0	0.0	13.1	0.0	0.0	24.1	384	5
13315	CAMPBELLVILLE RD btwn MILBUROUGH & PRIVATE	11.0	0.0	0.0	13.1	0.0	0.0	24.1	384	2
1244	AIRPORT RD E btwn NEBO & TRINITY CHURCH	11.0	0.0	0.0	13.1	0.0	0.0	24.1	384	1
32734	NEBO RD btwn DICKENSON & MAJOR ROAD BRIDGE	11.0	12.0	0.0	0.0	0.0	0.0	23.0	388	2
289	GREEN MOUNTAIN RD E btwn FIRST & UPPER CENTENNIAL	11.0	12.0	0.0	0.0	0.0	0.0	23.0	388	1
1385	WHITE CHURCH RD E btwn FERRIS & UPPER JAMES	11.0	12.0	0.0	0.0	0.0	0.0	23.0	388	0
1358	TRINITY CHURCH RD btwn AIRPORT & BINBROOK	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	4
32735	NEBO RD btwn AIRPORT & MAJOR ROAD BRIDGE	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	3
32736	TRINITY CHURCH RD btwn DICKENSON & MAJOR ROAD BRIDGE	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
13676	HARVEST RD btwn SYDENHAM & SYDENHAM	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
65	THIRD RD E btwn HIGHLAND & MUD	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
83	FIRST RD E btwn HIGHLAND & REGIONAL RD 20	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
64	THIRD RD E btwn HIGHLAND & REGIONAL RD 20	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
66	THIRD RD E btwn GILANNA & MUD	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
68	THIRD RD E btwn GREEN MOUNTAIN & PRIVATE	22.0	0.0	0.0	0.0	0.0	0.0	22.0	391	0
4690	JERSEYVILLE RD W btwn PRIVATE & SHAVER	5.4	12.0	4.6	0.0	0.0	0.0	22.0	400	3
39380	RIDGE RD btwn DEWITT & PRIVATE	5.4	12.0	4.6	0.0	0.0	0.0	22.0	400	0
39381	RIDGE RD btwn DEWITT & TAPLEYTOWN	5.4	12.0	4.6	0.0	0.0	0.0	22.0	400	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
20305	EIGHTH RD E btwn RIDGE & TOP OF ESCARPMENT	5.4	0.0	0.0	0.0	16.2	0.0	21.6	403	0
4562	SULPHUR SPRINGS RD btwn MINERAL SPRINGS & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	3
4912	OLD DUNDAS RD btwn LIONS CLUB & LOWER LIONS CLUB	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	3
33072	RIDGE RD btwn FIRST & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
9832	VALLEY RD btwn PATTERSON & YORK	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
33214	MINERAL SPRINGS RD btwn GRAVEL PIT & MARTIN	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
32438	WEIRS LN btwn RAILWAY BRIDGE & TOP OF ESCARPMENT	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
9830	OLD GUELPH RD btwn HARMER & HOMESTEAD	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
13865	CROOKS HOLLOW RD btwn CRAMER & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
13367	CENTRE RD btwn CONCESSION 14 & CONCESSION 14	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
30804	WEIR RD btwn MISENER & POWER LINE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
32891	PATTERSON RD btwn VALLEY & WESLEY	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
5015	LIONS CLUB RD btwn ARTABAN & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
9909	OLD GUELPH RD btwn HOME & PATTERSON	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
32785	NORMAN RD btwn MINOR ROAD BRIDGE & SHEFFIELD	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
13586	CONCESSION 10 W btwn FOREMAN & VALENS	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	1
20245	CENTRE RD btwn CONCESSION 14 & PUSLINCH TOWNLINE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
54466	SULPHUR SPRINGS RD btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
32754	SULPHUR SPRINGS RD btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
39940	HARRISBURG RD btwn GOVERNOR'S & HARRISBURG	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
4569	MINERAL SPRINGS RD btwn PRIVATE & SULPHUR SPRINGS	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
13668	ROCK CHAPEL RD btwn PRIVATE & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
13967	SNAKE RD btwn SNAKE & SNAKE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
32718	TRIMBLE RD btwn HALL & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
32765	CONCESSION 2 W btwn MAJOR ROAD BRIDGE & WEIR	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
4767	OLD GOVERNOR'S RD btwn GOVERNOR'S & INKSETTER	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
13895	CONCESSION 2 W btwn PRIVATE & PRIVATE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
23669	COLLINSON RD btwn BROCK & HIGHWAY NO. 5	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
32832	CROOKS HOLLOW RD btwn HIGHWAY NO. 8 & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
39898	SEATON RD btwn SAFARI & SEATON	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
43643	OLD GOVERNOR'S RD btwn GOVERNOR'S & OLD GOVERNOR'S	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
44073	PLAINS RD W btwn EDGEMOOR & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	16.2	0.0	20.7	404	0
13920	WOODHILL RD btwn CONCESSION 2 & HIGHWAY NO. 5	5.4	0.0	0.0	13.1	0.0	0.0	18.5	435	2
1189	GUYATT RD btwn FLETCHER & TRINITY CHURCH	5.4	0.0	0.0	13.1	0.0	0.0	18.5	435	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
1222	KIRK RD btwn LAIDMAN & TRIMBLE	5.4	0.0	0.0	13.1	0.0	0.0	18.5	435	0
13742	COOPER RD btwn PRIVATE & SAFARI	5.4	0.0	0.0	13.1	0.0	0.0	18.5	435	0
32803	MIDDLETOWN RD btwn CONCESSION 5 & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	3
13361	CENTRE RD btwn CAMPBELLVILLE & CONCESSION 14	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	2
32797	CONCESSION 8 W btwn KIRKWALL & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	1
1356	TRIMBLE RD btwn HALDIBROOK & HALL	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	1
13778	CONCESSION 4 W btwn HIGHWAY NO. 8 & THOMPSON	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	1
13740	CONCESSION 6 W btwn KIRKWALL & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13782	CONCESSION 5 W btwn KIRKWALL & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32802	CONCESSION 8 W btwn MAJOR ROAD BRIDGE & VALENS	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32805	CONCESSION 6 W btwn MAJOR ROAD BRIDGE & MIDDLETOWN	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13312	MILBUROUGH LI btwn CAMPBELLVILLE & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13730	VALENS RD btwn CONCESSION 6 & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13734	CONCESSION 6 W btwn VALENS & VALENS	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13726	CONCESSION 5 W btwn PRIVATE & VALENS	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32801	CONCESSION 8 W btwn MAJOR ROAD BRIDGE & WESTOVER	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32967	EIGHTH RD E btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
34230	BUTTER RD E btwn AIRPORT & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
39593	MILBUROUGH LI btwn PRIVATE & RAILWAY LINE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
40721	WESTBROOK RD btwn CONCESSION 1 & HALL	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
45081	HALL RD btwn REGIONAL RD 56 & TRIMBLE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13707	MIDDLETOWN RD btwn CONCESSION 4 & CONCESSION 5	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13724	CONCESSION 5 W btwn PRIVATE & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13725	CONCESSION 5 W btwn PRIVATE & VALENS	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
13800	CONCESSION 6 W btwn PRIVATE & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
23871	CONCESSION 8 W btwn GLENARIFF & PRIVATE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32477	WESTBROOK RD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32772	CONCESSION 4 W btwn HUNTER & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32790	CONCESSION 5 W btwn MAJOR ROAD BRIDGE & SAGER	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32792	CONCESSION 6 W btwn MAJOR ROAD BRIDGE & SAGER	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
32804	MIDDLETOWN RD btwn CONCESSION 6 & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
34227	GLANCASTER RD btwn AIRPORT & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
40781	WESTBROOK RD btwn CONCESSION 1 & HALL	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
40801	WESTBROOK RD btwn BELL & CONCESSION 2	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
40821	WESTBROOK RD btwn CONCESSION 2 & GREEN	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
40822	WESTBROOK RD btwn GREEN & MAJOR ROAD BRIDGE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
41421	SOUTH TOWNLINE RD btwn NINTH & SOUTH GRIMSBY ROAD TWENTY-ONE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
41441	YOUNG ST btwn NINTH & SOUTH GRIMSBY ROAD TWENTY-ONE	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
43706	BOOK RD W btwn ALBERTON & BOOK	0.0	0.0	4.6	13.1	0.0	0.0	17.6	439	0
46037	TWENTY RD E btwn GRETI & MILES	5.4	12.0	0.0	0.0	0.0	0.0	17.4	476	2
221	MCNEILLY RD btwn HIGHWAY NO. 8 & LACOMA	5.4	12.0	0.0	0.0	0.0	0.0	17.4	476	2
329	HIGHLAND RD E btwn FIRST & UPPER CENTENNIAL	5.4	12.0	0.0	0.0	0.0	0.0	17.4	476	0
227	GLOVER RD btwn END & HIGHWAY NO. 8	5.4	12.0	0.0	0.0	0.0	0.0	17.4	476	0
35488	FLETCHER RD btwn BLUE MOUNTAIN & GOLF CLUB	5.4	12.0	0.0	0.0	0.0	0.0	17.4	476	0
4634	INDIAN TL btwn LYNDEN & MISENER	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	2
5460	OLD HIGHWAY NO. 99 btwn BINKLEY & GOVERNOR'S	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	2
13957	FALLSVIEW RD E btwn OFIELD & PRIVATE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	2
33215	MINERAL SPRINGS RD btwn BINKLEY & SLOTE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	1
35891	ALGONQUIN AV btwn DECKER & THORNCREST	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	1
5072	SLOTE RD btwn MINERAL SPRINGS & POWER LINE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	1
32549	BETHEL CHURCH RD btwn GOVERNOR'S & POWER LINE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	1
4764	POWER LINE RD E btwn HIGHWAY NO. 52 & POWER LINE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	1
1491	WHITE CHURCH RD E btwn TRINITY CHURCH & WHITE CHURCH	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
13748	INKSETTER RD btwn CONCESSION 2 & PRIVATE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32997	GREEN SPRING RD btwn CONCESSION 8 & RAILWAY BRIDGE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
13915	PATRICK RD btwn SAGER & SHEFFIELD	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32750	INKSETTER RD btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32766	CONCESSION 2 W btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32886	ROCK CHAPEL RD btwn MAJOR ROAD BRIDGE & VALLEY	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
4635	PARSONAGE RD btwn END & JERSEYVILLE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
14889	SETTLERS RD btwn CONCESSION 5 & DECKERS	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
30383	SETTLERS RD btwn CONCESSION 6 & OLD HIGHWAY NO. 8	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
30803	MISENER RD btwn INDIAN & WEIR	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32812	SODOM RD btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	16.2	0.0	16.2	481	0
32708	MILES RD btwn DICKENSON & MAJOR ROAD BRIDGE	11.0	0.0	4.6	0.0	0.0	0.0	15.6	501	0
1249	NEBO RD btwn CHIPPEWA & WHITE CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	3
13608	CONCESSION 6 W btwn BROCK & EDGEWOOD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
32775	SAGER RD btwn CONCESSION 5 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
272	HIGHLAND RD E btwn FIFTH & SIXTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
33038	TAPLEYTOWN RD btwn MAJOR ROAD BRIDGE & POWERLINE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
265	HIGHLAND RD E btwn EIGHTH & SEVENTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
44462	HALDIBROOK RD btwn GLANCASTER & MINES	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
49224	BOOK RD W btwn ALBERTON & TRINITY	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	2
44461	HALDIBROOK RD btwn HIGHWAY NO. 6 & MINES	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
32529	HALDIBROOK RD btwn ABBEY & STONEMAN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
33037	TAPLEYTOWN RD btwn GREEN MOUNTAIN & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
46465	AIRPORT RD W btwn CENTRE & GLANCASTER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
1214	KIRK RD btwn HENDERSHOT & WOODBURN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
32896	ALBERTON RD btwn MAJOR ROAD BRIDGE & WILSON	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
33130	ELEVENTH RD E btwn HIGHLAND & YOUNG	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
264	HIGHLAND RD E btwn SEVENTH & SIXTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
13700	MIDDLETOWN RD btwn CONCESSION 4 & SODOM	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
13736	CONCESSION 6 W btwn KIRKWALL & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
13831	CONCESSION 7 W btwn MCLEAN & SAGER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
13913	SAGER RD btwn HIGHWAY NO. 5 & HOWELL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
32654	HALL RD btwn MAJOR ROAD BRIDGE & TRIMBLE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
32774	SAGER RD btwn MAJOR ROAD BRIDGE & PATRICK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
63	FIFTH RD E btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
1212	WOODBURN RD btwn BINBROOK & KIRK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
1215	WOODBURN RD btwn BELL & KIRK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
13623	VALENS RD btwn CONCESSION 8 & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
32480	WESTBROOK RD btwn HALL & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
40761	WESTBROOK RD btwn CONCESSION 1 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	1
1297	GUYATT RD btwn FLETCHER & REGIONAL RD 56	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13928	LYNDEN RD btwn AINSLEY & CONCESSION 4	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
239	TAPLEYTOWN RD btwn POWERLINE & RIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
266	HIGHLAND RD E btwn EIGHTH & NINTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1235	KIRK RD btwn FLETCHER & TRINITY CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13609	CONCESSION 6 W btwn BROCK & MIDDLETOWN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13732	VALENS RD btwn CONCESSION 6 & SAFARI	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13805	LYNDEN RD btwn AINSLEY & CONCESSION 5	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13939	SAGER RD btwn CONCESSION 5 & NORMAN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
31309	CONCESSION 7 W btwn OLD HIGHWAY NO. 8 & SAGER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
41021	WESTBROOK RD btwn BINBROOK & GOODALE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1194	HALL RD btwn SINCLAIRVILLE & WOODBURN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13304	CONCESSION 6 W btwn EDGEWOOD & HIGHWAY NO. 6	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13617	CONCESSION 8 W btwn PRIVATE & WESTOVER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13619	VALENS RD btwn CONCESSION 8 & REGIONAL RD NO. 97	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13735	CONCESSION 6 W btwn PRIVATE & VALENS	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13768	ORKNEY RD btwn HIGHWAY NO. 5 & HIGHWAY NO. 8	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13804	LYNDEN RD btwn CONCESSION 5 & HIGHWAY NO. 8	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
23870	CONCESSION 8 W btwn GLENARIFF & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1206	KIRK RD btwn WESTBROOK & WOODBURN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1253	TYNESIDE RD btwn CHIPPEWA & WHITE CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13717	CONCESSION 5 W btwn PRIVATE & WESTOVER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13832	SAGER RD btwn CONCESSION 6 & CONCESSION 7	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13936	SAGER RD btwn CONCESSION 6 & NORMAN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32481	WESTBROOK RD btwn HALL & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32770	LYNDEN RD btwn CONCESSION 4 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32798	CONCESSION 8 W btwn COOPER & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32806	CONCESSION 6 W btwn MAJOR ROAD BRIDGE & WESTOVER	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
39910	CONCESSION 7 W btwn CONCESSION 7 & MAPLE MANOR	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
50	TENTH RD E btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
58	SIXTH RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
59	SIXTH RD E btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
97	EIGHTH RD E btwn HIGHLAND & SOUTH TOWNLINE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
242	HIGHLAND RD E btwn EAST TOWNLINE & ELEVENTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
253	HIGHLAND RD E btwn NINTH & TENTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
280	TAPLEYTOWN RD btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1208	BELL RD btwn BERRY & WOODBURN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1209	BELL RD btwn BERRY & WESTBROOK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1213	KIRK RD btwn WOODBURN & WOODBURN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13296	CONCESSION 8 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13743	COOPER RD btwn CONCESSION 8 & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13912	SAGER RD btwn CONCESSION 4 & HOWELL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13916	CONCESSION 4 W btwn SAGER & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13918	SAGER RD btwn CONCESSION 4 & PATRICK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
22949	WESTBROOK RD btwn BELL & KIRK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
34229	BUTTER RD E btwn FIDDLER'S GREEN & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
39892	CONCESSION 8 W btwn COOPER & MORRISON	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40281	HALDIBROOK RD btwn MILES & TYNESIDE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40321	HALDIBROOK RD btwn ABBEY & TYNESIDE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40362	HALDIBROOK RD btwn MOORES & TRINITY CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
51	TENTH RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
52	TENTH RD E btwn END & HIGHLAND	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
54	SEVENTH RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
55	EIGHTH RD E btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
56	EIGHTH RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
57	SIXTH RD E btwn HIGHLAND & SOUTH TOWNLINE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
61	FIFTH RD E btwn HIGHLAND & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
62	FIFTH RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
99	NINTH RD E btwn HIGHLAND & SOUTH TOWNLINE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
255	HIGHLAND RD E btwn ELEVENTH & TENTH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1193	HALL RD btwn BERRY & SINCLAIRVILLE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1202	HALL RD btwn BERRY & WESTBROOK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1345	TRINITY CHURCH RD btwn HALDIBROOK & HALL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1398	GLANCASTER RD btwn CARLUKE & CHIPPEWA	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1429	HALDIBROOK RD btwn BLACKHEATH & HARRISON	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1461	WOODBURN RD btwn BELL & HALL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13302	CONCESSION 4 W btwn HUNTER & LYNDEN	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13622	VALENS RD btwn PRIVATE & SAFARI	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13727	VALENS RD btwn CONCESSION 4 & CONCESSION 5	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13728	VALENS RD btwn CONCESSION 5 & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13729	VALENS RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13779	CONCESSION 4 W btwn PRIVATE & THOMPSON	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13780	CONCESSION 4 W btwn PRIVATE & WOODHILL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13794	CONCESSION 4 W btwn LYNDEN & WOODHILL	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
13934	CONCESSION 5 W btwn SETTLERS & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
14636	CONCESSION 5 W btwn LYNDEN & SETTLERS	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
22938	WESTBROOK RD btwn BELL & KIRK	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
32528	HALDIBROOK RD btwn STONEMAN & TRINITY CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32646	BERRY RD btwn BELL & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32647	BERRY RD btwn HALL & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32706	TRINITY CHURCH RD btwn END & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32707	TRINITY CHURCH RD btwn HALL & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32769	LYNDEN RD btwn HIGHWAY NO. 5 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32773	CONCESSION 4 W btwn MAJOR ROAD BRIDGE & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32789	CONCESSION 5 W btwn MAJOR ROAD BRIDGE & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32791	CONCESSION 6 W btwn MAJOR ROAD BRIDGE & SHEFFIELD	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32897	ALBERTON RD btwn BOOK & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
32966	EIGHTH RD E btwn GREEN MOUNTAIN & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
34228	GLANCASTER RD btwn MAJOR ROAD BRIDGE & WHITE CHURCH	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40363	HALDIBROOK RD btwn HARRISON & MOORES	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40741	WESTBROOK RD btwn CONCESSION 1 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
40981	WESTBROOK RD btwn CONCESSION 3 & GOODALE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
41041	WESTBROOK RD btwn CONCESSION 3 & GOODALE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
41401	SOUTH TOWNLINE RD btwn EIGHTH & SOUTH GRIMSBY ROAD TWENTY-ONE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
41461	YOUNG ST btwn EIGHTH & SOUTH GRIMSBY ROAD TWENTY-ONE	0.0	0.0	0.0	13.1	0.0	0.0	13.1	502	0
1310	DICKENSON RD E btwn MILES & NEBO	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	1
1314	ENGLISH CHURCH RD E btwn MILES & UPPER JAMES	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	1
1270	AIRPORT RD E btwn PRIVATE & UPPER JAMES	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	1
1320	DICKENSON RD E btwn FRENCH & UPPER JAMES	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	0
1305	DICKENSON RD E btwn GLOVER & NEBO	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	0
228	JONES RD btwn END & HIGHWAY NO. 8	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	0
34268	LEWIS RD btwn END & HIGHWAY NO. 8	0.0	12.0	0.0	0.0	0.0	0.0	12.0	625	0
1256	AIRPORT RD E btwn MILES & PRIVATE	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	3
1254	MILES RD btwn AIRPORT & ENGLISH CHURCH	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	3
1315	MILES RD btwn DICKENSON & TWENTY	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	2
1237	WHITE CHURCH RD E btwn NEBO & TISDALE	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	2
1246	WHITE CHURCH RD E btwn NEBO & TYNESIDE	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	2
1455	MILES RD btwn COMMUNITY BNDRY & TWENTY	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	0
13437	CONCESSION 6 E btwn CENTRE & JOHN MARTIN	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	0
1431	HALDIBROOK RD btwn BLACKHEATH & REGIONAL RD 56	11.0	0.0	0.0	0.0	0.0	0.0	11.0	632	0
32709	MILES RD btwn ENGLISH CHURCH & MAJOR ROAD BRIDGE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	5

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
1234	KIRK RD btwn FLETCHER & HARRISON	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	3
240	RIDGE RD btwn PRIVATE & THIRD	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	2
9829	OLD GUELPH RD btwn HARMER & YORK	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	1
32889	VALLEY RD btwn COMMUNITY BNDRY & TOP OF ESCARPMENT	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	1
13463	CONCESSION 8 W btwn HIGHWAY NO. 6 & PRIVATE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
241	RIDGE RD btwn PRIVATE & SECOND	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
301	RIDGE RD btwn PRIVATE & TENTH	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
388	RIDGE RD btwn PRIVATE & THIRD	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
13473	CONCESSION 8 W btwn PRIVATE & PRIVATE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
46144	JERSEYVILLE RD W btwn BONHAM & HIGHWAY NO. 52 JERSEYVILLE ROUNDABOUT	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
13452	WILLIAM ST btwn ELDERBERRY & PRIVATE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
4691	JERSEYVILLE RD W btwn PADDY GREENE & PRIVATE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
4692	JERSEYVILLE RD W btwn PADDY GREENE & PRIVATE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
32444	WESTBROOK RD btwn END OF BRIDGE & START OF BRIDGE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
43961	MILBUROUGH LI btwn NO. 1 SIDEROAD & PARKSIDE	5.4	0.0	4.6	0.0	0.0	0.0	10.0	640	0
13394	ROBSON RD btwn CONCESSION 5 & PARKSIDE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	5
226	RIDGE RD btwn SEVENTH & SIXTH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	4
1467	TRINITY CHURCH RD btwn AIRPORT & GUYATT	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	4
36847	BOOK RD E btwn FIDDLER'S GREEN & HIGHWAY NO. 6	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	3
1495	HENDERSHOT RD btwn GOLF CLUB & REGIONAL RD 20	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
32989	FLETCHER RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
75	FIRST RD E btwn HIGHLAND & MUD	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
1250	NEBO RD btwn AIRPORT & WHITE CHURCH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
283	HIGHLAND RD E btwn TAPLEYTOWN & THIRD	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
1307	TRINITY CHURCH RD btwn DICKENSON & GOLF CLUB	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	2
236	RIDGE RD btwn FIFTH & SIXTH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
237	RIDGE RD btwn FIFTH & TAPLEYTOWN	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
32990	FLETCHER RD btwn GUYATT & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
268	GREEN MOUNTAIN RD E btwn FIFTH & SIXTH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
273	GREEN MOUNTAIN RD E btwn SECOND & THIRD	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
4662	BOOK RD W btwn FIDDLER'S GREEN & FIDDLER'S GREEN	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
32447	WESTBROOK RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
32863	CONCESSION 5 E btwn CENTRE & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
274	GREEN MOUNTAIN RD E btwn TAPLEYTOWN & THIRD	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13541	CONCESSION 5 E btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
40221	HALDIBROOK RD btwn MCCLUNG & MILES	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	1
73	FIRST RD E btwn GREEN MOUNTAIN & RIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
209	RIDGE RD btwn ELEVENTH & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13542	CONCESSION 5 E btwn HIGHWAY NO. 6 & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13590	GORE RD btwn FOREMAN & WELLINGTON RD 35	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
74	FIRST RD E btwn GREEN MOUNTAIN & MUD	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1188	FLETCHER RD btwn CEMETERY & GUYATT	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1239	CHIPPEWA RD E btwn NEBO & TISDALE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
4672	BOOK RD W btwn COURTLAND & SHAVER	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
218	RIDGE RD btwn EIGHTH & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
32890	VALLEY RD btwn ROCK CHAPEL & TOP OF ESCARPMENT	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
120	FIFTY RD btwn COKERS & HIGHWAY NO. 8	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
225	RIDGE RD btwn PRIVATE & SEVENTH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13425	BEEFORTH RD btwn CONCESSION 5 & CONCESSION 6	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
32440	WESTBROOK RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
33206	MCNEILLY RD btwn LACOMA & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1229	KIRK RD btwn HARRISON & REGIONAL RD 56	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1303	GOLF CLUB RD btwn PRIVATE & TRINITY CHURCH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
213	RIDGE RD btwn PRIVATE & TENTH	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
4663	BOOK RD W btwn COURTLAND & FIDDLER'S GREEN	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
223	RIDGE RD btwn EIGHTH & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13431	CONCESSION 5 E btwn CENTRE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13472	CONCESSION 8 W btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13474	CONCESSION 8 W btwn BROCK & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
32445	WESTBROOK RD btwn MAJOR ROAD BRIDGE & REGIONAL RD 20	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
33035	GREEN MOUNTAIN RD E btwn MAJOR ROAD BRIDGE & TAPLEYTOWN	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
33210	CONCESSION 8 E btwn MILBUROUGH & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
40241	HALDIBROOK RD btwn FERRIS & MCCLUNG	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1299	GOLF CLUB RD btwn FLETCHER & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
1484	CHIPPEWA RD E btwn NEBO & TYNESIDE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
214	RIDGE RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
215	RIDGE RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
224	RIDGE RD btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13436	CONCESSION 6 E btwn JOHN MARTIN & JOHN MARTIN	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13453	WILLIAM ST btwn CARLISLE & ELDERBERRY	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
13471	CONCESSION 8 W btwn PRIVATE & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
4700	JERSEYVILLE RD W btwn BONHAM & PRIVATE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
32439	WESTBROOK RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
33036	GREEN MOUNTAIN RD E btwn FIFTH & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
39602	CONCESSION 6 E btwn JOHN MARTIN & RAILWAY LINE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
39603	CONCESSION 6 E btwn PRIVATE & RAILWAY LINE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
41241	WESTBROOK RD btwn 16 & 20	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
41261	WESTBROOK RD btwn 20 & MAJOR ROAD BRIDGE	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
41301	WESTBROOK RD btwn 16 & 20	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
41321	WESTBROOK RD btwn 16 & GUYATT	5.4	0.0	0.0	0.0	0.0	0.0	5.4	656	0
9901	WEIRS LN btwn GOVERNOR'S & JOHNSTON	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	2
9924	WEIRS LN btwn COMMUNITY BNDRY & JOHNSTON	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13904	CONCESSION 2 W btwn LYNDEN & WEIR	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13626	FOREMAN RD btwn CONCESSION 10 & REGIONAL RD NO. 97	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
32686	GOLF CLUB RD btwn FLETCHER & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
32758	WOODHILL RD btwn CONCESSION 2 & RAILWAY BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
46961	CONCESSION 10 W btwn HIGHWAY NO. 6 & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13581	MIDDLETOWN RD btwn CONCESSION 8 & SAFARI	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
33650	CONCESSION 12 E btwn CENTRE & NEEDLEPINE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
43642	OLD GOVERNOR'S RD btwn INKSETTER & OLD GOVERNOR'S	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
5349	PADDY GREENE RD btwn JERSEYVILLE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13512	MADDAUGH RD btwn GORE & HIGHWAY NO. 6	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13657	PATTERSON RD btwn LILLIAN & OLD GUELPH	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
32569	MILBUROUGH LI btwn NO. 3 SIDEROAD & STEELES	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
50324	FIELD RD btwn ADELAIDE & POWER LINE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	1
13514	GORE RD btwn LENNON & MADDAUGH	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32710	DICKENSON RD E btwn MAJOR ROAD BRIDGE & MILES	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32673	OLD GUELPH RD btwn HOMESTEAD & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
40021	ALBERTON RD btwn ALBERTON & BOOK	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13458	CONCESSION 8 E btwn HIGHWAY NO. 6 & NEPTUNE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
22344	SULPHUR SPRINGS RD btwn COMMUNITY BNDRY & GOVERNOR'S	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13516	LENNON RD btwn CONCESSION 10 & GORE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13585	GORE RD btwn PRIVATE & VALENS	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32998	GREEN SPRING RD btwn PROGRESTON & RAILWAY BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4673	BOOK RD W btwn SHAVER & SHAVER	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4857	LOWER LIONS CLUB RD btwn OLD DUNDAS & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
9828	OLD GUELPH RD btwn PRIVATE & YORK	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13580	CONCESSION 8 W btwn MIDDLETOWN & MIDDLETOWN	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13684	GORE RD btwn SIDEROAD 25 & VALENS	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13982	HUNTER RD btwn CONCESSION 4 & HIGHWAY NO. 5	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
14899	OFIELD RD N btwn HIGHWAY NO. 5 & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
31308	OLD HIGHWAY NO. 8 btwn CONCESSION 7 & SAFARI	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32822	CONCESSION 4 W btwn MAJOR ROAD BRIDGE & WESTOVER	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4517	SLOTE RD btwn GOVERNOR'S & MINERAL SPRINGS	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4627	POWER LINE RD W btwn FIELD & LYNDEN	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4798	MINERAL SPRINGS RD btwn BINKLEY & GRAVEL PIT	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
5016	LIONS CLUB RD btwn ARTABAN & OLD DUNDAS	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13306	MILBUROUGH LI btwn CONCESSION 11 & STEELES	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13307	CONCESSION 11 E btwn MILBUROUGH & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13309	MILBUROUGH LI btwn CAMPBELLVILLE & MOUNTSBERG	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13322	WYATT RD btwn CONCESSION 6 & CONCESSION 7	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13540	GORE RD btwn SIDEROAD 20 & SIDEROAD 25	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13584	WESTOVER RD btwn CONCESSION 8 & END	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13587	VALENS RD btwn CONCESSION 10 & REGIONAL RD NO. 97	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13704	SODOM RD btwn MIDDLETOWN & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13964	VALENS RD btwn CONCESSION 10 & GORE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
23679	MOUNTSBERG RD btwn MILBUROUGH & TIMBERRUN	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32739	FERRIS RD btwn LEEMING & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
33089	MILBUROUGH LI btwn DERRY & RAILWAY LINE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
36304	GORE RD btwn HIGHWAY NO. 6 & MADDAUGH	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
38	TENTH RD E btwn GREEN MOUNTAIN & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
245	GREEN MOUNTAIN RD E btwn TENTH & TENTH	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
1332	HARRISON RD btwn HALL & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4508	BUTTER RD E btwn AIRPORT & SOUTHCOTE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4659	SOUTHCOTE RD btwn BUTTER & SOUTHCOTE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
219	RIDGE RD btwn EIGHTH & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
222	RIDGE RD btwn EIGHTH & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4858	LOWER LIONS CLUB RD btwn LOUISE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
4859	LOWER LIONS CLUB RD btwn LOUISE & WILSON	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13298	KERNS RD btwn CITY LIMITS & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13308	MILBUROUGH LI btwn MOUNTSBERG & NO. 3 SIDEROAD	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
1183	RIDGE RD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13371	MADDAUGH RD btwn CONCESSION 14 & HIGHWAY NO. 6	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13835	FALLSVIEW RD E btwn PRIVATE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
13863	MOXLEY RD btwn END & OLD BROCK	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
22345	SULPHUR SPRINGS RD btwn COMMUNITY BNDRY & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
22790	BINKLEY RD btwn COMMUNITY BNDRY & MINERAL SPRINGS	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
23678	MOUNTSBERG RD btwn GLENRON & TIMBERRUN	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32748	INKSETTER RD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32816	SODOM RD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32821	CONCESSION 4 W btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32846	CONCESSION 11 E btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32659	JERSEYVILLE RD W btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32660	JERSEYVILLE RD W btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
32661	JERSEYVILLE RD W btwn ALBERTON & MAJOR ROAD BRIDGE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
39208	CRAMER RD btwn CROOKS HOLLOW & END	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
40121	SAWMILL RD btwn MAJOR ROAD BRIDGE & ONONDAGA SENECA TOWNLINE	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
45061	CONCESSION 5 W btwn AINSLEY & END	0.0	0.0	4.6	0.0	0.0	0.0	4.6	721	0
1341	MILES RD btwn CHIPPEWA & HALDIBROOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	3
32985	WHITE CHURCH RD E btwn MAJOR ROAD BRIDGE & TYNESIDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	3
32685	GOLF CLUB RD btwn MAJOR ROAD BRIDGE & REGIONAL RD 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	3
13546	CONCESSION 4 W btwn HIGHWAY NO. 6 & MILLGROVE SIDEROAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
72	SECOND RD E btwn GREEN MOUNTAIN & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
1338	CHIPPEWA RD E btwn FERRIS & HIGHWAY NO. 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
1294	GUYATT RD btwn WESTBROOK & WOODBURN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
1380	GOLF CLUB RD btwn HENDERSHOT & REGIONAL RD 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
1463	GOLF CLUB RD btwn HENDERSHOT & WOODBURN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13342	GORE RD btwn LENNON & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
52552	SHAVER RD btwn BOOK & OSPREY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
1296	GUYATT RD btwn HENDERSHOT & REGIONAL RD 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13686	FALLSVIEW RD E btwn PRIVATE & SYDENHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13699	CONCESSION 4 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13709	CONCESSION 4 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13750	CONCESSION 2 W btwn HIGHWAY NO. 52 & INKSETTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
32859	CONCESSION 10 E btwn CENTRE & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
41161	WESTBROOK RD btwn CONCESSION 5 & GUYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
70	SECOND RD E btwn HIGHLAND & MUD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13550	MILLGROVE SIDEROAD btwn CONCESSION 4 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13563	CONCESSION 7 E btwn HIGHWAY NO. 6 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
47063	CONCESSION 2 W btwn ORKNEY & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	2
13318	MILBUROUGH LI btwn CONCESSION 6 & CONCESSION 7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13575	CONCESSION 8 W btwn BROCK & MIDDLETOWN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1259	WHITE CHURCH RD E btwn FERRIS & MILES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1257	MILES RD btwn AIRPORT & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
4589	SHAVER RD btwn BUTTER & CARLUKE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13592	CONCESSION 4 W btwn MILLGROVE SIDEROAD & OFIELD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
22724	WEIRS LN btwn HIGHWAY NO. 8 & TOP OF ESCARPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
256	GREEN MOUNTAIN RD E btwn PRIVATE & SIXTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1422	HALDIBROOK RD btwn FERRIS & HIGHWAY NO. 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
4727	FIDDLER'S GREEN RD btwn CARLUKE & GLANCASTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13591	MILLGROVE SIDEROAD btwn CONCESSION 4 & HIGHWAY NO. 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32845	CONCESSION 11 E btwn HIGHWAY NO. 6 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1313	ENGLISH CHURCH RD E btwn END & MILES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13350	CONCESSION 10 E btwn CENTRE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13360	CONCESSION 7 E btwn GARDEN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13530	ROCK CHAPEL RD btwn HIGHWAY NO. 5 & VALLEY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1350	HARRISON RD btwn KIRK & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
4644	WEIR RD btwn GOVERNOR'S & POWER LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13348	CONCESSION 10 E btwn MILBUROUGH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13675	HARVEST RD btwn PRIVATE & SYDENHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
23194	ALBERTON RD btwn JERSEYVILLE & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
41201	WESTBROOK RD btwn BINBROOK & CONCESSION 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
284	HIGHLAND RD E btwn PRIVATE & TAPLEYTOWN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1216	HENDERSHOT RD btwn BINBROOK & GUYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
1337	LEEMING RD btwn END & HIGHWAY NO. 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
4509	BUTTER RD W btwn PRIVATE & SHAVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32711	DICKENSON RD E btwn FRENCH & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13305	MILBUROUGH LI btwn CONCESSION 10 & CONCESSION 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13324	CONCESSION 7 E btwn PRIVATE & WYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13447	CONCESSION 8 E btwn MERCURY & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13573	EDGEWOOD RD btwn CONCESSION 6 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13633	CONCESSION 10 W btwn FOREMAN & PIONEER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13880	CONCESSION 2 W btwn MIDDLETOWN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32745	HENDERSHOT RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32746	HENDERSHOT RD btwn GUYATT & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32852	MOUNTSBERG RD btwn HIGHWAY NO. 6 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1263	FERRIS RD btwn CHIPPEWA & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
1481	FERRIS RD btwn HALDIBROOK & LEEMING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13320	CONCESSION 6 E btwn BEEFORTH & WYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
13551	MILLGROVE SIDEROAD btwn PRIVATE & SHELTONS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
34717	ORKNEY RD btwn GATEPOST & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
39597	CONCESSION 8 E btwn GREEN SPRING & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
39606	CONCESSION 7 E btwn CENTRE & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	1
32757	WOODHILL RD btwn GOVERNOR'S & RAILWAY BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4618	JERSEYVILLE RD W btwn ALBERTON & FIELD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4674	BOOK RD W btwn PRIVATE & SHAVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13517	LENNON RD btwn CONCESSION 10 & REGIONAL RD NO. 97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13607	CONCESSION 4 W btwn BROCK & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
31144	WOODBURN RD btwn GOLF CLUB & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
69	SECOND RD E btwn GREEN MOUNTAIN & MUD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
288	GREEN MOUNTAIN RD E btwn FIRST & SECOND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1295	WOODBURN RD btwn BINBROOK & GUYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13718	CONCESSION 4 W btwn VALENS & WESTOVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13897	HARRISBURG RD btwn CONCESSION 2 & HIGHWAY NO. 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33003	CONCESSION 10 E btwn HIGHWAY NO. 6 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33187	TRINITY CHURCH RD btwn END & KIRK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
71	SECOND RD E btwn HIGHLAND & REGIONAL RD 20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1260	MILES RD btwn CHIPPEWA & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
4705	POWER LINE RD W btwn FIELD & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1236	WHITE CHURCH RD E btwn TISDALE & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13826	SHEFFIELD RD btwn CEDAR COVE & SAFARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13942	CONCESSION 2 W btwn LYNDEN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33992	ORKNEY RD btwn GOVERNOR'S & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
44	FIFTH RD E btwn PRIVATE & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
246	GREEN MOUNTAIN RD E btwn ELEVENTH & TENTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1219	HENDERSHOT RD btwn BINBROOK & KIRK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1243	TRINITY CHURCH RD btwn BINBROOK & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1248	CHIPPEWA RD E btwn MILES & TYNESIDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1293	GUYATT RD btwn HENDERSHOT & WOODBURN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1396	GLANCASTER RD btwn BUTTER & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1462	GOLF CLUB RD btwn PRIVATE & WOODBURN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4587	BUTTER RD W btwn FIDDLER'S GREEN & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4588	SHAVER RD btwn BOOK & BUTTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13295	ORKNEY RD btwn HIGHWAY NO. 5 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13310	MOUNTSBERG RD btwn CENTRE & GLENRON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13326	MILBUROUGH LI btwn CARLISLE & DERRY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4592	SAWMILL RD btwn MULLIGAN & TRINITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13465	EDGEWOOD RD btwn HIGHWAY NO. 6 & SAFARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13552	MILLGROVE SIDEROAD btwn PRIVATE & SHELTONS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13597	CONCESSION 4 W btwn OFIELD & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13600	CONCESSION 4 W btwn BROCK & MOXLEY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13839	HARVEST RD btwn OFIELD & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13954	MILBUROUGH LI btwn BRYN MAWR & CONCESSION 8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
14034	ACREDALE DR btwn CULLUM & FLAMBOROUGH HILLS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
14903	OFIELD RD S btwn FALLSVIEW & HARVEST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
24105	CONCESSION 2 W btwn WEIR & WEIR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32738	FERRIS RD btwn CHIPPEWA & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
47062	CONCESSION 2 W btwn HIGHWAY NO. 52 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
52924	WOODBURN RD btwn MAJOR ROAD BRIDGE & REGIONAL ROAD 20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
42	FIFTH RD E btwn GREEN MOUNTAIN & POWERLINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
43	FIFTH RD E btwn POWERLINE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
94	THIRD RD E btwn PRIVATE & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
244	GREEN MOUNTAIN RD E btwn PRIVATE & TENTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
281	HIGHLAND RD E btwn FIRST & SECOND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
282	HIGHLAND RD E btwn SECOND & THIRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1242	TRINITY CHURCH RD btwn CHIPPEWA & WHITE CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1262	CHIPPEWA RD E btwn FERRIS & MILES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1336	LEEMING RD btwn FERRIS & HIGHWAY NO. 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1342	TYNESIDE RD btwn PRIVATE & WALKERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1348	HARRISON RD btwn HALDIBROOK & HALL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1349	HALL RD btwn BLACKHEATH & HARRISON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4586	BUTTER RD W btwn SHAVER & TRINITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4629	POWER LINE RD W btwn PRIVATE & WEIR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4706	FIELD RD btwn GOVERNOR'S & POWER LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4795	BUTTER RD W btwn SAWMILL & TRINITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13321	MILBUROUGH LI btwn BRITANNIA & CONCESSION 7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13368	PUSLINCH TOWNLINE RD btwn CENTRE & VICTORIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4584	SAWMILL RD btwn CARLUKE & SHAVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13434	CONCESSION 6 E btwn BEEFORTH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4617	JERSEYVILLE RD W btwn SUNNYRIDGE & UNION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13445	CONCESSION 7 E btwn CENTRE & GARDEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13519	CONCESSION 10 W btwn LENNON & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13572	EDGEWOOD RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13637	CONCESSION 10 W btwn COOPER & PIONEER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13722	CONCESSION 6 W btwn VALENS & WESTOVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13884	MIDDLETOWN RD btwn CONCESSION 2 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13921	CONCESSION 2 W btwn BEVERLYGLEN & WOODHILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32547	POWER LINE RD W btwn CITY LIMITS & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13923	CONCESSION 2 W btwn PRIVATE & WOODHILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13941	CONCESSION 2 W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32951	SAWMILL RD btwn MAJOR ROAD BRIDGE & SHAVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33051	WOODBURN RD btwn GUYATT & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33105	MILLGROVE SIDEROAD btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
34308	TENTH RD E btwn RAILWAY LINE & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
37703	CONCESSION 14 E btwn MCCRAE STATION & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
39605	CONCESSION 5 E btwn RAILWAY LINE & ROBSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
43704	FERGUSON RD btwn FERGUSON & VANDERLIP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
44142	STONEY CREEK / WEST LINCOLN TOWNLINE RD btwn CONCESSION 7 & PURDY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
46843	POWER LINE RD W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
46962	CONCESSION 10 W btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
67	THIRD RD E btwn GILANNA & GREEN MOUNTAIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
257	GREEN MOUNTAIN RD E btwn EIGHTH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
258	GREEN MOUNTAIN RD E btwn EIGHTH & EIGHTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
259	GREEN MOUNTAIN RD E btwn EIGHTH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
271	HIGHLAND RD E btwn FIFTH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
360	SMITH RD btwn ELEVENTH & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1190	GOLF CLUB RD btwn PRIVATE & WESTBROOK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1200	SINCLAIRVILLE RD btwn BARLOW & HALL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1238	CHIPPEWA RD E btwn TISDALE & TRINITY CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1333	CHIPPEWA RD W btwn CHIPPEWA & GLANCASTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1346	HALL RD btwn HARRISON & TRINITY CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1397	GLANCASTER RD btwn AIRPORT & BUTTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1419	GLANCASTER RD btwn CHIPPEWA & FIDDLER'S GREEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1420	GLANCASTER RD btwn FIDDLER'S GREEN & NORSWORTHY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1421	GLANCASTER RD btwn HALDIBROOK & NORSWORTHY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4518	POWER LINE RD E btwn POWER LINE & SLOTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4583	SHAVER RD btwn CARLUKE & SAWMILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4766	POWER LINE RD W btwn HIGHWAY NO. 52 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13319	CONCESSION 6 E btwn MILBUROUGH & WYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13323	CONCESSION 7 E btwn MILBUROUGH & WYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13331	CONCESSION 8 E btwn GREEN SPRING & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13333	CONCESSION 8 E btwn CENTRE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13341	PROGRESTON RD btwn CENTRE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
1306	DICKENSON RD E btwn GLOVER & TRINITY CHURCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13354	CONCESSION 11 E btwn CENTRE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13366	CONCESSION 14 E btwn CENTRE & MADDAUGH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13369	PUSLINCH TOWNLINE RD btwn MADDAUGH & VICTORIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13370	MADDAUGH RD btwn CONCESSION 14 & PUSLINCH TOWNLINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13428	CONCESSION 5 E btwn BEEFORTH & CONCESSION 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13446	CONCESSION 8 E btwn CENTRE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
13457	CONCESSION 8 E btwn MERCURY & NEPTUNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4698	SAWMILL RD btwn HALDIBROOK & NORSWORTHY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13518	GORE RD btwn PRIVATE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13588	FOREMAN RD btwn CONCESSION 10 & GORE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13599	CONCESSION 4 W btwn MOXLEY & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13667	ROCK CHAPEL RD btwn PRIVATE & SYDENHAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13749	CONCESSION 2 W btwn INKSETTER & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13769	CONCESSION 5 W btwn AINSLEY & HIGHWAY NO. 8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13815	SEATON RD btwn HIGHWAY NO. 8 & SAFARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
4793	SAWMILL RD btwn BUTTER & MULLIGAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13948	CONCESSION 2 W btwn BEVERLYGLEN & ORKNEY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
13951	ORKNEY RD btwn BEVERLYGLEN & CONCESSION 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
14888	SETTLERS RD btwn CONCESSION 6 & DECKERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
14900	OFIELD RD N btwn CONCESSION 4 & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
23195	ALBERTON RD btwn MAJOR ROAD BRIDGE & WILSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
30304	WESTOVER RD btwn END & SAFARI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32448	WESTBROOK RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32717	TRIMBLE RD btwn KIRK & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32786	NORMAN RD btwn MINOR ROAD BRIDGE & SAGER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32813	SODOM RD btwn MAJOR ROAD BRIDGE & WESTOVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32819	CONCESSION 4 W btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32820	CONCESSION 4 W btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32825	MIDDLETOWN RD btwn HIGHWAY NO. 5 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32853	MOUNTSBERG RD btwn CENTRE & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32860	CONCESSION 10 E btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
32892	DUNMARK RD btwn MAJOR ROAD BRIDGE & WILSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33004	CONCESSION 10 E btwn MAJOR ROAD BRIDGE & PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33049	WOODBURN RD btwn GOLF CLUB & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33050	WOODBURN RD btwn MAJOR ROAD BRIDGE & RIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33106	MILLGROVE SIDEROAD btwn CONCESSION 5 & MAJOR ROAD BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33107	MILLGROVE SIDEROAD btwn END OF BRIDGE & START OF BRIDGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33211	MILBUROUGH LI btwn BRITANNIA & BRYN MAWR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
33993	ORKNEY RD btwn BEVERLYGLEN & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
34307	TENTH RD E btwn PRIVATE & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)								Frequency of FI Collisions
		AADT	Boundary	Roadside	Speed limit	Horizontal curves	Truck route	SSRI	Rank SSRI	
34346	FERGUSON RD btwn VANDERLIP & WILSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
34716	ORKNEY RD btwn CONCESSION 2 & GATEPOST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
35278	GARDEN LN btwn CONCESSION 6 & CONCESSION 7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
39596	CONCESSION 8 E btwn PRIVATE & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
39604	CONCESSION 5 E btwn MAJOR ROAD BRIDGE & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
39607	CONCESSION 7 E btwn PRIVATE & RAILWAY LINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
40041	SAWMILL RD btwn BUTTER & LOST MILE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
40101	SAWMILL RD btwn NORSWORTHY & ONONDAGA SENECA TOWNLINE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
40181	TYNESIDE RD btwn HALDIBROOK & WALKERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
41141	WESTBROOK RD btwn BINBROOK & CONCESSION 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
41181	WESTBROOK RD btwn CONCESSION 5 & GUYATT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
41561	EAST TOWNLINE RD btwn CONCESSION 7 & HIGHLAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
41581	EAST TOWNLINE RD btwn CONCESSION 7 & PURDY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
49223	BOOK RD W btwn PRIVATE & TRINITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0
50323	FIELD RD btwn ADELAIDE & JERSEYVILLE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799	0

Ranking: Unsignalized Intersections

Table C 3: Systemic Safety Review Ranking – Unsignalized Intersections

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
1317	CENTRE RD @ CONCESSION 8 E	8.3	8.2	43.0	19.8	20.6	100.0	1	8
8476	BUTTER RD W @ FIDDLER'S GREEN RD	8.3	8.2	43.0	19.8	20.6	100.0	1	6
1443	HIGHWAY NO. 5 W @ LYNDEN RD	8.3	8.2	43.0	19.8	20.6	100.0	1	6
7763	KIRK RD @ REGIONAL 56 RD	8.3	8.2	43.0	19.8	20.6	100.0	1	6
558	BROCK RD @ REGIONAL 97 RD	8.3	8.2	43.0	19.8	20.6	100.0	1	4
815	BROCK RD @ CONCESSION 4 W	6.3	6.2	43.0	19.8	20.6	95.9	6	11
2681	MUD ST E @ SECOND RD E	8.3	0.0	43.0	19.8	20.6	91.8	7	13
2983	EIGHTH RD E @ MUD ST E	8.3	0.0	43.0	19.8	20.6	91.8	7	3
43207	HIGHWAY NO. 52 N @ JERSEYVILLE RD W	8.3	0.0	43.0	19.8	20.6	91.8	7	9
2696	HIGHLAND RD E @ TAPLEYTOWN RD	8.3	0.0	43.0	19.8	20.6	91.8	7	1
2974	ELEVENTH RD E @ MUD ST E	6.3	0.0	43.0	19.8	20.6	89.7	11	13
783	BROCK RD @ CONCESSION 5 W	6.3	0.0	43.0	19.8	20.6	89.7	11	5
2694	FIFTH RD E @ MUD ST E	0.0	0.0	43.0	19.8	20.6	83.4	13	6
7818	HALL RD @ REGIONAL 56 RD	0.0	0.0	43.0	19.8	20.6	83.4	13	6
1429	CONCESSION 5 W @ KIRKWALL RD	0.0	0.0	43.0	19.8	20.6	83.4	13	5
3007	MUD ST E @ THIRD RD E	0.0	0.0	43.0	19.8	20.6	83.4	13	5
8603	BUTTER RD W @ TRINITY RD S	0.0	0.0	43.0	19.8	20.6	83.4	13	4
8336	CONCESSION 2 W @ HIGHWAY NO. 52	0.0	0.0	43.0	19.8	20.6	83.4	13	4
40797	ELEVENTH RD E @ HIGHLAND RD E	0.0	0.0	43.0	19.8	20.6	83.4	13	4
3027	HIGHLAND RD E @ SIXTH RD E	0.0	0.0	43.0	19.8	20.6	83.4	13	4
565	CENTRE RD @ CONCESSION 11 E	0.0	0.0	43.0	19.8	20.6	83.4	13	3
38105	CENTRE RD @ CONCESSION 7 E	0.0	0.0	43.0	19.8	20.6	83.4	13	2
1248	CENTRE RD @ MOUNTSBERG RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
485	CONCESSION 10 W @ COOPER RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
2121	CONCESSION 4 W @ WESTOVER RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
782	CONCESSION 5 W @ MIDDLETOWN RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
786	CONCESSION 5 W @ WESTOVER RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
2135	HIGHWAY NO. 8 @ MIDDLETOWN RD	0.0	0.0	43.0	19.8	20.6	83.4	13	2
2118	CONCESSION 4 W @ MIDDLETOWN RD	0.0	0.0	43.0	19.8	20.6	83.4	13	1
2196	CONCESSION 6 W @ KIRKWALL RD	0.0	0.0	43.0	19.8	20.6	83.4	13	1

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
8588	GLANCASTER RD @ WHITE CHURCH RD W	0.0	0.0	43.0	19.8	20.6	83.4	13	1
3028	MUD ST E @ SIXTH RD E	0.0	0.0	43.0	19.8	20.6	83.4	13	1
775	SAFARI RD @ WESTOVER RD	0.0	0.0	43.0	19.8	20.6	83.4	13	1
3004	FIFTH RD E @ GREEN MOUNTAIN RD E	0.0	0.0	43.0	19.8	20.6	83.4	13	0
1731	BARTON ST @ FIFTY RD	8.3	8.2	43.0	0.0	20.6	80.2	35	1
8516	BOOK RD W @ TRINITY RD S	8.3	8.2	43.0	19.8	0.0	79.4	36	6
1437	HIGHWAY NO. 5 W @ WOODHILL RD	8.3	8.2	43.0	19.8	0.0	79.4	36	3
7828	HALDIBROOK RD @ REGIONAL 56 RD	8.3	8.2	43.0	19.8	0.0	79.4	36	1
8680	BINBROOK RD @ WESTBROOK RD	8.3	8.2	43.0	19.8	0.0	79.4	36	0
3045	HIGHLAND RD E @ SECOND RD E	6.3	6.2	43.0	0.0	20.6	76.0	40	11
7803	CHIPPEWA RD E @ NEBO RD	6.3	6.2	43.0	19.8	0.0	75.3	41	4
2982	EIGHTH RD E @ HIGHLAND RD E	6.3	6.2	43.0	19.8	0.0	75.3	41	0
1308	CARLISLE RD @ CENTRE RD	8.3	0.0	43.0	0.0	20.6	71.9	43	1
7782	NEBO RD @ WHITE CHURCH RD E	8.3	0.0	43.0	19.8	0.0	71.1	44	8
7783	AIRPORT RD E @ NEBO RD	8.3	0.0	43.0	19.8	0.0	71.1	44	6
1306	CENTRE RD @ CONCESSION 10 E	8.3	0.0	43.0	19.8	0.0	71.1	44	2
7829	BLACKHEATH RD @ HALDIBROOK RD	8.3	0.0	43.0	19.8	0.0	71.1	44	1
3003	GREEN MOUNTAIN RD E @ TAPLEYTOWN RD	8.3	0.0	43.0	19.8	0.0	71.1	44	1
2952	ELEVENTH RD E @ RIDGE RD	8.3	0.0	43.0	19.8	0.0	71.1	44	0
2695	MUD ST E @ TAPLEYTOWN RD	8.3	0.0	43.0	19.8	0.0	71.1	44	0
8591	CARLUKE RD W @ FIDDLER'S GREEN RD	6.3	0.0	43.0	19.8	0.0	69.1	51	4
7754	FLETCHER RD @ GUYATT RD	6.3	0.0	43.0	19.8	0.0	69.1	51	3
1403	BROCK RD @ CONCESSION 8 W	6.3	0.0	43.0	19.8	0.0	69.1	51	1
755	BROCK RD @ SAFARI RD	6.3	0.0	43.0	19.8	0.0	69.1	51	1
3046	HIGHLAND RD E @ THIRD RD E	0.0	0.0	43.0	0.0	20.6	63.6	55	7
38616	MILES RD @ WHITE CHURCH RD E	0.0	0.0	43.0	0.0	20.6	63.6	55	6
1745	HIGHWAY NO. 8 @ LEWIS RD	0.0	0.0	43.0	0.0	20.6	63.6	55	3
1266	CARLISLE RD @ MILBUROUGH LI	0.0	0.0	43.0	0.0	20.6	63.6	55	2
8480	BUTTER RD W @ SHAVER RD	0.0	0.0	43.0	0.0	20.6	63.6	55	1
35742	CHIPPEWA RD E @ FERRIS RD	0.0	0.0	43.0	0.0	20.6	63.6	55	1
7923	GOVERNOR'S RD @ PIRIE DR	0.0	0.0	43.0	0.0	20.6	63.6	55	1
1270	CARLISLE RD @ PROGRESTON RD	0.0	0.0	43.0	0.0	20.6	63.6	55	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
756	BROCK RD @ CONCESSION 6 W	0.0	0.0	43.0	19.8	0.0	62.8	63	5
1250	CAMPBELLVILLE RD @ CENTRE RD	0.0	0.0	43.0	19.8	0.0	62.8	63	5
8566	HARRISBURG RD @ SAGER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	4
2249	CONCESSION 5 W @ VALENS RD	0.0	0.0	43.0	19.8	0.0	62.8	63	3
8473	AIRPORT RD W @ GLANCASTER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	2
7834	HALDIBROOK RD @ TYNESIDE RD	0.0	0.0	43.0	19.8	0.0	62.8	63	2
8320	BINKLEY RD @ GOVERNOR'S RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
1245	CAMPBELLVILLE RD @ MILBUROUGH LI	0.0	0.0	43.0	19.8	0.0	62.8	63	1
8531	CONCESSION 2 W @ LYNDEN RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
40238	CONCESSION 4 W @ WOODHILL RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
1454	CONCESSION 5 W @ SAGER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
3026	FIFTH RD E @ HIGHLAND RD E	0.0	0.0	43.0	19.8	0.0	62.8	63	1
8532	GOVERNOR'S RD @ WOODHILL RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
2197	KIRKWALL RD @ SAFARI RD	0.0	0.0	43.0	19.8	0.0	62.8	63	1
2989	MUD ST E @ TENTH RD E	0.0	0.0	43.0	19.8	0.0	62.8	63	1
8518	ALBERTON RD @ BOOK RD W	0.0	0.0	43.0	19.8	0.0	62.8	63	0
7746	BERRY RD @ HALL RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
7802	CHIPPEWA RD E @ TYNESIDE RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
33855	CONCESSION 2 W @ WEIR RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
43317	CONCESSION 2 W @ WOODHILL RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
1432	CONCESSION 5 W @ LYNDEN RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
1449	CONCESSION 5 W @ SHEFFIELD RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
1453	CONCESSION 6 W @ SAGER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
1447	CONCESSION 6 W @ SHEFFIELD RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
784	CONCESSION 6 W @ WESTOVER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2198	CONCESSION 8 W @ COOPER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2163	CONCESSION 8 W @ KIRKWALL RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2157	CONCESSION 8 W @ WESTOVER RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2214	COOPER RD @ SAFARI RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2969	EAST TOWN LI @ MUD ST E	0.0	0.0	43.0	19.8	0.0	62.8	63	0
43291	EDGEWOOD RD @ SAFARI RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
8334	GOVERNOR'S RD @ KITCHENS RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
8569	GOVERNOR'S RD @ WEIR RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
3002	GREEN MOUNTAIN RD E @ SIXTH RD E	0.0	0.0	43.0	19.8	0.0	62.8	63	0
43314	HALL RD @ TRIMBLE RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
8562	HIGHWAY NO. 5 W @ SHEFFIELD RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
34878	LYNDEN RD @ POWER LINE RD W	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2978	MUD ST E @ NINTH RD E	0.0	0.0	43.0	19.8	0.0	62.8	63	0
2999	POWERLINE RD @ TAPLEYTOWN RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
8678	REGIONAL 9A RD @ WESTBROOK RD	0.0	0.0	43.0	19.8	0.0	62.8	63	0
7270	DICKENSON RD E @ NEBO RD	8.3	8.2	43.0	0.0	0.0	59.5	103	5
7776	BINBROOK RD @ FLETCHER RD	8.3	8.2	43.0	0.0	0.0	59.5	103	2
7770	BINBROOK RD @ TRINITY CHURCH RD	8.3	8.2	43.0	0.0	0.0	59.5	103	1
7921	GOVERNOR'S RD @ SULPHUR SPRINGS RD	8.3	8.2	43.0	0.0	0.0	59.5	103	1
9817	REGIONAL 20 RD @ WESTBROOK RD	8.3	8.2	0.0	19.8	20.6	57.0	107	3
484	COOPER RD @ REGIONAL 97 RD	8.3	8.2	0.0	19.8	20.6	57.0	107	3
478	KIRKWALL RD @ REGIONAL 97 RD	8.3	8.2	0.0	19.8	20.6	57.0	107	1
2682	FIRST RD E @ GREEN MOUNTAIN RD E	8.3	0.0	43.0	0.0	0.0	51.3	110	4
738	OLD GUELPH RD @ YORK RD	8.3	0.0	43.0	0.0	0.0	51.3	110	4
6559	MILES RD @ TWENTY RD E	8.3	0.0	43.0	0.0	0.0	51.3	110	3
8550	GOVERNOR'S RD @ LYNDEN RD	8.3	0.0	43.0	0.0	0.0	51.3	110	2
7703	DICKENSON RD E @ MILES RD	8.3	0.0	43.0	0.0	0.0	51.3	110	1
3043	FIRST RD E @ HIGHLAND RD E	8.3	0.0	43.0	0.0	0.0	51.3	110	1
2683	GREEN MOUNTAIN RD E @ SECOND RD E	8.3	0.0	43.0	0.0	0.0	51.3	110	1
2101	BROCK RD @ OLD BROCK RD	8.3	0.0	43.0	0.0	0.0	51.3	110	0
3008	GREEN MOUNTAIN RD E @ THIRD RD E	8.3	0.0	43.0	0.0	0.0	51.3	110	0
518	CONCESSION 5 W @ MILLGROVE SR	6.3	0.0	43.0	0.0	0.0	49.3	119	1
7729	GOLF CLUB RD @ WOODBURN RD	6.3	0.0	43.0	0.0	0.0	49.3	119	1
7731	GUYATT RD @ HENDERSHOT RD	6.3	0.0	43.0	0.0	0.0	49.3	119	1
521	CONCESSION 4 W @ MILLGROVE SR	0.0	0.0	43.0	0.0	0.0	43.0	122	4
1724	HARVEST RD @ OFIELD RD S	0.0	0.0	43.0	0.0	0.0	43.0	122	4
7264	FLETCHER RD @ GOLF CLUB RD	0.0	0.0	43.0	0.0	0.0	43.0	122	3
127	MILL ST S @ MOUNTAIN BROW RD	0.0	0.0	43.0	0.0	0.0	43.0	122	2
8681	BINBROOK RD @ WESTBROOK RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1

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1267	CARLISLE RD @ FLAMBOROUGH HILLS DR	0.0	0.0	43.0	0.0	0.0	43.0	122	1
2945	COKERS LN @ FIFTY RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1
811	CONCESSION 4 W @ OFIELD RD N	0.0	0.0	43.0	0.0	0.0	43.0	122	1
547	DOUGLAS PL @ FREELTON RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1
7704	ENGLISH CHURCH RD E @ MILES RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1
7732	GOLF CLUB RD @ HENDERSHOT RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1
43315	HALL RD @ HARRISON RD	0.0	0.0	43.0	0.0	0.0	43.0	122	1
728	HIGHWAY NO. 5 W @ SOUTH DR	0.0	0.0	43.0	0.0	0.0	43.0	122	1
7819	BLACKHEATH RD @ HALL RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
7766	CHIPPEWA RD E @ TISDALE RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
1415	CONCESSION 10 W @ LENNON RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8333	CONCESSION 2 W @ ORKNEY RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
514	CONCESSION 5 W @ LEWIS LN S	0.0	0.0	43.0	0.0	0.0	43.0	122	0
1446	CONCESSION 6 W @ SETTLERS RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
7276	DICKENSON RD E @ GLOVER RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8577	FIELD RD @ JERSEYVILLE RD W	0.0	0.0	43.0	0.0	0.0	43.0	122	0
1401	GAVIN DR @ NOBLE KIRK DR	0.0	0.0	43.0	0.0	0.0	43.0	122	0
7735	GUYATT RD @ WOODBURN RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
1808	HIGHWAY NO. 8 @ JONES RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
2071	HIGHWAY NO. 8 @ KIRBY AV	0.0	0.0	43.0	0.0	0.0	43.0	122	0
2093	HILLCREST AV @ MOUNTAIN VIEW RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8540	HOWARD ST @ LIBERTY ST	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8581	INDIAN TL @ MISENER RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
2081	MOXLEY RD @ OLD BROCK RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
2065	OAK AV @ ROSEBOUGH ST	0.0	0.0	43.0	0.0	0.0	43.0	122	0
804	OLD BROCK RD @ TAYLOR CR	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8580	POWER LINE RD W @ WEIR RD	0.0	0.0	43.0	0.0	0.0	43.0	122	0
7767	TISDALE RD @ WHITE CHURCH RD E	0.0	0.0	43.0	0.0	0.0	43.0	122	0
8358	HIGHWAY NO. 52 N @ POWER LINE RD W	0.0	0.0	0.0	19.8	20.6	40.5	155	5
2693	REGIONAL 20 RD @ WOODBURN RD	0.0	0.0	0.0	19.8	20.6	40.5	155	4
8514	ALBERTON RD S @ WILSON ST W	0.0	0.0	0.0	19.8	20.6	40.5	155	3
37710	HIGHWAY NO. 5 W @ ORKNEY RD	0.0	0.0	0.0	19.8	20.6	40.5	155	2

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1457	CONCESSION 4 W @ SHEFFIELD RD	0.0	0.0	0.0	19.8	20.6	40.5	155	1
1411	MIDDLETOWN RD @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	20.6	40.5	155	1
2208	SAFARI RD @ SEATON RD	0.0	0.0	0.0	19.8	20.6	40.5	155	1
2210	SAFARI RD @ SHEFFIELD RD	0.0	0.0	0.0	19.8	20.6	40.5	155	1
2160	SAFARI RD @ VALENS RD	0.0	0.0	0.0	19.8	20.6	40.5	155	1
8585	SUNNYRIDGE RD @ WILSON ST W	0.0	0.0	0.0	19.8	20.6	40.5	155	1
498	CONCESSION 6 W @ EDGEWOOD RD	0.0	0.0	0.0	19.8	20.6	40.5	155	0
8513	DUNMARK RD @ WILSON ST W	0.0	0.0	0.0	19.8	20.6	40.5	155	0
2105	BROCK RD @ HIGHWAY NO. 8	8.3	8.2	0.0	0.0	20.6	37.2	167	4
7780	AIRPORT RD E @ MILES RD	8.3	8.2	0.0	0.0	20.6	37.2	167	3
7765	BINBROOK RD @ TRINITY CHURCH RD	8.3	8.2	0.0	0.0	20.6	37.2	167	1
56	BOULDING AV @ PARKSIDE DR	8.3	8.2	0.0	0.0	20.6	37.2	167	1
794	ROCK CHAPEL RD @ SYDENHAM RD	8.3	8.2	0.0	0.0	20.6	37.2	167	1
2967	EIGHTH RD E @ RIDGE RD	8.3	8.2	0.0	0.0	20.6	37.2	167	0
7753	AIRPORT RD E @ TRINITY CHURCH RD	8.3	8.2	0.0	19.8	0.0	36.4	173	1
3006	RIDGE RD @ TAPLEYTOWN RD	8.3	8.2	0.0	19.8	0.0	36.4	173	1
7781	AIRPORT RD E @ MILES RD	8.3	8.2	0.0	19.8	0.0	36.4	173	0
8469	BOOK RD W @ FIDDLER'S GREEN RD	8.3	8.2	0.0	19.8	0.0	36.4	173	0
480	COOPER RD @ GORE RD	8.3	8.2	0.0	19.8	0.0	36.4	173	0
8568	GOVERNOR'S RD @ HARRISBURG RD	8.3	8.2	0.0	19.8	0.0	36.4	173	0
7959	GOVERNOR'S RD @ WEIRS LN	8.3	8.2	0.0	19.8	0.0	36.4	173	0
3044	REGIONAL 20 RD @ THIRD RD E	8.3	8.2	0.0	19.8	0.0	36.4	173	0
8478	BOOK RD W @ SHAVER RD	6.3	6.2	0.0	0.0	20.6	33.1	181	2
38946	CHIPPEWA RD E @ MILES RD	6.3	6.2	0.0	0.0	20.6	33.1	181	2
8598	CARLUKE RD W @ SHAVER RD	6.3	6.2	0.0	19.8	0.0	32.3	183	1
2981	HIGHLAND RD E @ NINTH RD E	6.3	6.2	0.0	19.8	0.0	32.3	183	1
8595	BRANT COUNTY NO. 222 RD @ SAWMILL RD	6.3	6.2	0.0	19.8	0.0	32.3	183	0
7835	HALDIBROOK RD @ MILES RD	6.3	6.2	0.0	19.8	0.0	32.3	183	0
8584	INDIAN TL @ LYNDEN RD	6.3	6.2	0.0	19.8	0.0	32.3	183	0
8368	BOOK RD E @ SOUTHCOTE RD	8.3	0.0	0.0	0.0	20.6	29.0	188	1
8578	JERSEYVILLE RD W @ LYNDEN RD	6.3	0.0	0.0	19.8	0.0	26.1	189	0
1233	MILBUROUGH LI @ MOUNTSBERG RD	0.0	0.0	0.0	0.0	20.6	20.6	190	4

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2032	SYDENHAM RD @ SYDENHAM RD	0.0	0.0	0.0	0.0	20.6	20.6	190	2
8309	MINERAL SPRINGS RD @ SULPHUR SPRINGS RD	0.0	0.0	0.0	0.0	20.6	20.6	190	1
3025	RIDGE RD @ UPPER CENTENNIAL PY	0.0	0.0	0.0	0.0	20.6	20.6	190	1
38558	CONCESSION 10 W @ FOREMAN RD	0.0	0.0	0.0	0.0	20.6	20.6	190	0
8535	FIELD RD @ POWER LINE RD W	0.0	0.0	0.0	0.0	20.6	20.6	190	0
10630	PARKSIDE DR @ SPRING CREEK DR	0.0	0.0	0.0	0.0	20.6	20.6	190	0
2700	REGIONAL 20 RD @ TAPLEYTOWN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	3
37601	BINBROOK RD @ HENDERSHOT RD	0.0	0.0	0.0	19.8	0.0	19.8	197	2
8601	GLANCASTER RD @ SAWMILL RD	0.0	0.0	0.0	19.8	0.0	19.8	197	2
8683	KIRK RD @ WESTBROOK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	2
37327	SAGER RD @ PATRICK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
12260	AIRPORT RD W @ CENTRE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8502	CLAYBAR RD @ TRINITY RD S	0.0	0.0	0.0	19.8	0.0	19.8	197	1
1442	CONCESSION 4 W @ LYNDEN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
2245	CONCESSION 4 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
2229	CONCESSION 7 W @ SAGER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
2973	ELEVENTH RD E @ GREEN MOUNTAIN RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8965	ELEVENTH RD E @ SOUTH GRIMSBY ROAD EIGHTEEN	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8520	FERGUSON RD @ WILSON ST W	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8463	GARNER RD W @ HAMILTON DR	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8587	GLANCASTER RD @ WHITE CHURCH RD W	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8324	GOVERNOR'S RD @ SLOTE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
10859	HALDIBROOK RD @ MINES RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
7822	HALL RD @ TRINITY CHURCH RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8346	HIGHWAY NO. 52 N @ MINERAL SPRINGS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
8350	HIGHWAY NO. 52 N @ POWER LINE RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	1
7772	KIRK RD @ TRINITY CHURCH RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
7740	KIRK RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
2139	MIDDLETOWN RD @ SODOM RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
37308	PATRICK RD @ SAGER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	1
11159	S TOWNLINE RD @ YOUNG ST	0.0	0.0	0.0	19.8	0.0	19.8	197	1

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1426	AINSLEY RD @ LYNDEN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8472	AIRPORT RD @ BUTTER RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8512	ALBERTON RD @ WILSON ST W	0.0	0.0	0.0	19.8	0.0	19.8	197	0
3024	ALPHA ST @ MUD ST E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7742	BELL RD @ BERRY RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8684	BELL RD @ WESTBROOK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7739	BELL RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
9833	BETHEL CHURCH RD @ GOVERNOR'S RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
36867	BINBROOK RD @ HENDERSHOT RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
34135	BINBROOK RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
36773	BINBROOK RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8521	BOOK RD W @ HOLDITCH SCHOOL RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8407	BRAITHWAITE AV @ GARNER RD W	0.0	0.0	0.0	19.8	0.0	19.8	197	0
809	BROCK RD @ BROCK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
10579	CAMPBELLVILLE RD @ CHESSWOOD TL	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8592	CARLUKE RD E @ GLANCASTER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8596	CARLUKE RD W @ SAWMILL RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1249	CENTRE RD @ CONCESSION 12 E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1257	CENTRE RD @ CONCESSION 14 E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
494	CENTRE RD @ HUISMAN LN	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2698	CHAPEL HILL RD @ REGIONAL 20 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2697	CHAPEL HILL RD @ SIXTH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8593	CHIPPEWA RD W @ GLANCASTER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1456	CONCESSION 4 W @ HUNTER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1444	CONCESSION 4 W @ LYNDEN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1461	CONCESSION 4 W @ SAGER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1455	CONCESSION 4 W @ SHEFFIELD RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2242	CONCESSION 4 W @ THOMPSON RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2244	CONCESSION 4 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
754	CONCESSION 5 W @ MOFFAT RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1450	CONCESSION 5 W @ SETTLERS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
785	CONCESSION 6 W @ MIDDLETOWN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
2182	CONCESSION 6 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2183	CONCESSION 6 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2226	CONCESSION 7 W @ MCLEAN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
39110	CONCESSION 8 W @ GLENARIFF DR	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1410	CONCESSION 8 W @ MIDDLETOWN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
39604	CONCESSION 8 W @ PARK LN	0.0	0.0	0.0	19.8	0.0	19.8	197	0
35770	CONCESSION 8 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
38764	CONCESSION 8 W @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7813	CORLIS RD @ REGIONAL 56 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2985	EIGHTH RD E @ GREEN MOUNTAIN RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2986	EIGHTH RD E @ GREEN MOUNTAIN RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2968	EIGHTH RD E @ RIDGE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2975	ELEVENTH RD E @ GREEN MOUNTAIN RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2950	ELEVENTH RD E @ SMITH RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2699	FIFTH RD E @ REGIONAL 20 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
3040	FIRST RD E @ REGIONAL 20 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7773	FLETCHER RD @ KIRK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
477	FOREMAN RD @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
43160	GARNER RD W @ MUNAY LN	0.0	0.0	0.0	19.8	0.0	19.8	197	0
559	GAVIN DR @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2998	GILMAN RD @ MUD ST E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8543	GOVERNOR'S RD @ HOWARD ST	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8318	GOVERNOR'S RD @ OLD GOVERNOR'S RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8317	GOVERNOR'S RD @ OLD HIGHWAY NO. 99	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8331	GOVERNOR'S RD @ RAILWAY ST	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8570	GOVERNOR'S RD @ WEIR RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2990	GREEN MOUNTAIN RD E @ TENTH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
11039	GREEN RD @ WBROOK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7752	GUYATT RD @ TRINITY CHURCH RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
10899	HALDIBROOK RD @ ABBEY RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7824	HALDIBROOK RD @ HARRISON RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
10959	HALDIBROOK RD @ MOORES RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0

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10919	HALDIBROOK RD @ STONEMAN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7827	HALDIBROOK RD @ TRIMBLE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7833	HALDIBROOK RD @ TRINITY CHURCH RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7747	HALL RD @ SINCLAIRVILLE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8677	HALL RD @ WESTBROOK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7744	HALL RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7749	HALL RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7820	HENDERSHOT RD @ KIRK RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
3029	HIGHLAND RD E @ SEVENTH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
35124	HIGHLAND RD E @ TENTH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8564	HIGHWAY NO. 5 W @ HUNTER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8560	HIGHWAY NO. 5 W @ TROY RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8561	HIGHWAY NO. 5 W @ TROY RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
9314	HIGHWAY NO. 8 @ NEFF'S LN	0.0	0.0	0.0	19.8	0.0	19.8	197	0
37756	HIGHWY NO. 5 W @ ORKNEY RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
38439	HIGHWY NO. 8 @ MAIN ST W	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8879	HOODS RD @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8880	HOODS RD @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7814	KIRK RD @ LAIDMAN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7815	KIRK RD @ TRIMBLE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7741	KIRK RD @ WOODBURN RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1421	LENNON RD @ REGIONAL 97 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
13519	MIDDLETOWN RD @ EMMONS LN	0.0	0.0	0.0	19.8	0.0	19.8	197	0
776	MIDDLETOWN RD @ SAFARI RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2984	MUD ST E @ SEVENTH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1452	NORMAN RD @ SAGER RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1451	NORMAN RD @ SHEFFIELD RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2227	OLD HIGHWAY 8 @ SAFARI RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2203	OLD HIGHWAY 8 @ SHEFFIELD RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1458	PATRICK RD @ SHEFFIELD RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8993	REGIONAL 20 RD @ SOUTH TOWNLINE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
479	REGIONAL 97 RD @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0

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1422	REGIONAL 97 RD @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
9816	REGIONAL RD NO. 9A @ IRVINE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2211	SAFARI RD @ SEATON RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2209	SAFARI RD @ SHEFFIELD RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
2159	SAFARI RD @ VALENS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
1462	SAGER RD @ HOWELL RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
8605	SAWMILL RD @ TRINITY RD S	0.0	0.0	0.0	19.8	0.0	19.8	197	0
37482	SHAVER RD @ CARLUKE RD W	0.0	0.0	0.0	19.8	0.0	19.8	197	0
38561	TENTH RD E @ HIGHLAND RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7832	TYNESIDE RD @ WALKERS RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7778	TYNESIDE RD @ WHITE CHURCH RD E	0.0	0.0	0.0	19.8	0.0	19.8	197	0
10999	WBROOK RD @ CONCESSION 1 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
11019	WBROOK RD @ CONCESSION 2 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
11059	WBROOK RD @ CONCESSION 3 RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
11079	WBROOK RD @ GOODALE RD	0.0	0.0	0.0	19.8	0.0	19.8	197	0
7275	DICKENSON RD E @ TRINITY CHURCH RD	8.3	8.2	0.0	0.0	0.0	16.6	333	4
81	PARKSIDE DR @ ROBSON RD	8.3	8.2	0.0	0.0	0.0	16.6	333	3
1358	CONCESSION 8 W @ HIGHWAY NO. 6	8.3	8.2	0.0	0.0	0.0	16.6	333	1
2059	HIGHWAY NO. 8 @ HILLCREST AV	8.3	8.2	0.0	0.0	0.0	16.6	333	1
14119	PARKSIDE DR @ AVONSYDE BV	8.3	8.2	0.0	0.0	0.0	16.6	333	1
31	BEEFORTH RD @ CONCESSION 6 E	8.3	8.2	0.0	0.0	0.0	16.6	333	0
1307	CARLISLE RD @ WILLIAM ST	8.3	8.2	0.0	0.0	0.0	16.6	333	0
2559	RIDGE RD @ THIRD RD E	8.3	8.2	0.0	0.0	0.0	16.6	333	0
13819	SHAVER RD @ BOOK RD W	8.3	8.2	0.0	0.0	0.0	16.6	333	0
2926	FIRST RD E @ RIDGE RD	6.3	6.2	0.0	0.0	0.0	12.5	342	2
8590	FIDDLER'S GREEN RD @ GLANCASTER RD	6.3	6.2	0.0	0.0	0.0	12.5	342	0
8676	GOLF CLUB RD @ WESTBROOK RD	8.3	0.0	0.0	0.0	0.0	8.3	344	1
62	PARKSIDE DR @ EVANS RD	8.3	0.0	0.0	0.0	0.0	8.3	344	0
38147	CONCESSION 5 E @ ROBSON RD	8.3	0.0	0.0	0.0	0.0	8.3	344	0
731	ROCK CHAPEL RD @ VALLEY RD	8.3	0.0	0.0	0.0	0.0	8.3	344	0
8579	JERSEYVILLE RD W @ SUNNYRIDGE RD	6.3	0.0	0.0	0.0	0.0	6.3	348	0
8682	BINBROOK RD @ WESTBROOK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	3

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34317	LYNDEN RD @ POWER LINE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	3
7755	CEMETERY RD @ FLETCHER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	2
7751	CEMETERY RD @ REGIONAL 56 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	2
1234	CONCESSION 10 E @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	2
7274	GOLF CLUB RD @ TRINITY CHURCH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	2
2096	KING ST W @ WOODLEY LN	0.0	0.0	0.0	0.0	0.0	0.0	349	2
10201	NEWMAN RD @ YORK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	2
7769	TRINITY CHURCH RD @ WHITE CHURCH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	2
739	VALLEY RD @ YORK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	2
8321	BINKLEY RD @ MINERAL SPRINGS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8316	BINKLEY RD @ OLD HIGHWAY NO. 99	0.0	0.0	0.0	0.0	0.0	0.0	349	1
536	BRIDLE ST @ FREELTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8602	BUTTER RD W @ SAWMILL RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
7771	CHIPPEWA RD E @ TRINITY CHURCH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
94	CHURCHILL AV @ PARKSIDE DR	0.0	0.0	0.0	0.0	0.0	0.0	349	1
1240	CONCESSION 11 E @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	1
492	CONCESSION 6 E @ GARDEN LN	0.0	0.0	0.0	0.0	0.0	0.0	349	1
7720	ENGLISH CHURCH RD E @ UPPER JAMES ST	0.0	0.0	0.0	0.0	0.0	0.0	349	1
10879	HALDIBROOK RD @ MCCLUNG RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8949	HAMPTON BROOK WY @ WHITE CHURCH RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	1
2074	HIGHWAY NO. 8 @ MOUNTAIN VIEW RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
2091	HIGHWAY NO. 8 @ PARK AV	0.0	0.0	0.0	0.0	0.0	0.0	349	1
2103	HIGHWAY NO. 8 @ WEIRS LN	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8351	JERSEYVILLE RD W @ SHAVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8694	KARENDALE CR @ MARYHEATHER CR	0.0	0.0	0.0	0.0	0.0	0.0	349	1
2934	NEW MOUNTAIN RD @ RIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	1
2563	RIDGE RD @ SECOND RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	1
8462	SHAVER RD @ WESTVIEW AV	0.0	0.0	0.0	0.0	0.0	0.0	349	1
51	3RD CONCESSION RD E @ KERNS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1295	ACREDALE DR @ ASHFORD CT	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1298	ACREDALE DR @ FLAMBOROUGH HILLS DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1427	AINSLEY RD @ CONCESSION 5 W	0.0	0.0	0.0	0.0	0.0	0.0	349	0

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8549	ALBERT ST @ LYNDEN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8511	ALBERTON RD @ JERSEYVILLE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1274	ALDERSON RD @ CARLISLE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7542	ARTABAN RD @ LIONS CLUB RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7743	BARLOW RD @ SINCLAIRVILLE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8530	BARNABAS ST @ LYNDEN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38151	BEEFORTH RD @ CONCESSION 5 E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
715	BEST AV @ YORK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10819	BETHEL CHURCH RD @ POWER LINE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
508	BETTY AV @ CAREY ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8523	BEVERLY GLEN DR @ CONCESSION 2 W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8330	BEVERLY GLEN DR @ ORKNEY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7760	BINBROOK RD @ SOUTHBROOK DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1275	BLAGDEN RD @ PROGRESTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
9843	BLUE MOUNTAIN DR @ FLETCHER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1356	BLUEHERON LN @ CENTRE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8506	BONHAM DR @ JERSEYVILLE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8479	BOOK RD W @ COURTLAND DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2949	BRAND RD @ RIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1500	BRIDGMAN LN @ HIGHWAY NO. 8	0.0	0.0	0.0	0.0	0.0	0.0	349	0
26	BRITANNIA AVE @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	0
807	BROCK RD @ COLLINSON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
549	BROCK RD @ EDWARD ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
562	BROCK RD @ FREELTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2079	BROCK RD @ KIRBY AV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
548	BROCK RD @ LOUISA ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
540	BROCK RD @ PETER ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10239	BROCK RD @ SHORT ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
806	BROCK RD @ TAYLOR CR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
544	BROCK RD @ WENEIL DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10719	BRYN MAWR LN @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8475	BUTTER RD E @ GLANCASTER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0

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8474	BUTTER RD E @ SOUTHCOTE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
510	CAREY ST @ CONCESSION 5 W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1312	CARLISLE RD @ PARKSHORE PL	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1349	CARLISLE RD @ WILDBERRY WY	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1247	CENTRE RD @ CONCESSION 14 E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1289	CENTRE RD @ GEORGE ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
14539	CENTRE RD @ MEANDER CLOSE	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1319	CENTRE RD @ PROGRESTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1294	CENTRE RD @ WARREN ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1310	CENTRE RD @ WILLIAM ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1293	CENTRE RD @ WOODEND DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38685	CHIPPEWA RD E @ MILES RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38170	CONCESSION 10 W @ FOREMAN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
483	CONCESSION 10 W @ PIONEER WY	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1420	CONCESSION 10 W @ VALENS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38018	CONCESSION 11 E @ FREELTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
34681	CONCESSION 11 E @ MILL ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1291	CONCESSION 11 E @ STONEBURY PL	0.0	0.0	0.0	0.0	0.0	0.0	349	0
43200	CONCESSION 12 E @ NEEDLEPINE DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1246	CONCESSION 14 @ PRIVATE	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1255	CONCESSION 14 E @ MADDAUGH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
35995	CONCESSION 2 W @ HARRISBURG RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2138	CONCESSION 2 W @ INKSETTER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2136	CONCESSION 2 W @ MIDDLETOWN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
817	CONCESSION 4 W @ MOXLEY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
516	CONCESSION 5 W @ PALMER LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
86	CONCESSION 6 E @ JOHN MARTIN CR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
87	CONCESSION 6 E @ JOHN MARTIN CR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
27	CONCESSION 6 E @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	0
30	CONCESSION 6 E @ WYATT RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1414	CONCESSION 7 @ GORE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1316	CONCESSION 7 E @ GARDEN LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
29	CONCESSION 7 E @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	0
28	CONCESSION 7 E @ WYATT RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1280	CONCESSION 8 E @ GREEN SPRING RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1346	CONCESSION 8 E @ MERCURY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
502	CONCESSION 8 E @ NEPTUNE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1409	CONCESSION 8 W @ MIDDLETOWN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2039	CORA RD @ OLD BROCK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
481	COUNTY ROAD NO. 35 RD @ GORE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2100	CROOKS HOLLOW RD @ CRAMER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2099	CROOKS HOLLOW RD @ HIGHWAY NO. 8	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2080	CROOKS HOLLOW RD @ NICOL ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2102	CROOKS HOLLOW RD @ OLD BROCK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
520	CUMMINSVILLE DR @ MILLGROVE SR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1448	DECKERS LN @ SETTLERS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
9596	DERRY RD @ MILBUROUGH LI	0.0	0.0	0.0	0.0	0.0	0.0	349	0
3005	DEWITT RD @ RIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7702	DICKENSON RD E @ FRENCH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
11179	E TOWNLINE RD @ CONCESSION 7 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2971	EAST TOWN LI @ PURDY CR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
550	EDWARD ST @ FREELTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1309	ELDERBERRY LN @ WILLIAM ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10799	ENTRANCE RD @ SHEFFIELD RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2029	FALLSVIEW RD E @ SYDENHAM RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8517	FERGUSON RD @ VANDERLIP RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7808	FERRIS RD @ HALDIBROOK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7806	FERRIS RD @ LEEMING RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7798	FERRIS RD @ WHITE CHURCH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
13319	FIELD RD @ ADELAIDE ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8534	FIELD RD @ POWER LINE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
3000	FIFTH RD E @ POWERLINE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
3009	FIFTH RD E @ RIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2948	FIFTY RD @ RESERVOIR PARK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
9676	FILMAN RD @ WILSON ST E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
125	FLANDERS DR @ MOUNTAIN BROW RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
714	FLEMING AV @ YORK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
482	FOREMAN RD @ GORE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2086	FOREST AV @ HARVEST RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
537	FREELTON RD @ GIVEN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
546	FREELTON RD @ LOUISA ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
538	FREELTON RD @ WEST ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
9456	GATEPOST PL @ ORKNEY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2996	GILANNA ST @ THIRD RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8600	GLANCASTER RD @ NORSWORTHY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1559	GLENDRUMMOND DR @ SYDENHAM RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1251	GLENRON RD @ MOUNTSBERG RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1416	GORE RD @ LENNON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
589	GORE RD @ MADDAUGH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1419	GORE RD @ SIDEROAD 20 S	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1417	GORE RD @ SIDEROAD 25 S	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1418	GORE RD @ VALENS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8322	GOVERNOR'S RD @ OLD GOVERNOR'S RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8323	GOVERNOR'S RD @ OLD GOVERNOR'S RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7931	GOVERNOR'S RD @ RIDGEWOOD BV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8315	GRAVEL PIT RD @ MINERAL SPRINGS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2991	GREEN MOUNTAIN RD E @ TENTH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1279	GREEN SPRING RD @ PROGRESTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8679	GUYATT RD @ WESTBROOK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
9831	HALDIBROOK RD @ SINCLAIRVILLE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
3037	HARBINGER DR @ REGIONAL 20 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
712	HARMER ST @ OLD GUELPH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7774	HARRISON RD @ KIRK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2084	HARVEST CT @ HARVEST RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2058	HARVEST RD @ SHORT RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2030	HARVEST RD @ SYDENHAM RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
2031	HARVEST RD @ SYDENHAM RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2053	HARVEST RD @ TEWS LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2083	HARVEST RD @ WESITE AV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
82	HIGHWAY NO. 5 E @ KERNS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1524	HIGHWAY NO. 8 @ MAPLE GATE DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2063	HIGHWAY NO. 8 @ MARSHBORO AV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1776	HIGHWAY NO. 8 @ MCDONALDS LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2097	HIGHWAY NO. 8 @ SPRINGHILL ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2098	HIGHWAY NO. 8 @ WEBSTERS FALLS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
721	HOME ST @ OLD GUELPH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
725	HOMESTEAD AV @ OLD GUELPH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
533	HUNTSMAN GT @ WILDAN DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1278	IDARED RD @ PROGRESTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8319	INKSETTER RD @ OLD GOVERNOR'S RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8691	INNOVATION DR @ SOUTH DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1273	IRIS CT @ PROGRESTON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8344	JERSEYVILLE RD W @ PADDY GREENE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8583	JERSEYVILLE RD W @ PARSONAGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8572	JERSEYVILLE RD W @ RUSSELL RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7922	JOHNSTON AV @ WEIRS LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8503	KATSURA PL @ SHAVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2963	LACOMA DR @ MCNEILLY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8349	LAUREL CT @ SHAVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8542	LIBERTY ST @ LYNDEN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
717	LILLIAN AV @ PATTERSON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7890	LIONS CLUB RD @ OLD DUNDAS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7892	LOWER LIONS CLUB RD @ OLD DUNDAS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
6588	LOWER LIONS CLUB RD @ WILSON ST E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8547	LYNDEN RD @ MAPLE ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8528	LYNDEN RD @ MARGARET ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8536	LYNDEN RD @ MULHOLLAND LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8546	LYNDEN RD @ QUEEN ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
8541	LYNDEN RD @ UNION ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1252	MADDAUGH RD @ PUSLINCH TOWNLINE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8574	MAPLE AV @ SUNNYRIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7960	MARTIN RD @ MINERAL SPRINGS RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10200	MARYVALE AV @ NEWMAN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8625	MIDDLETOWN RD @ OLD GOVERNOR'S RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10721	MILBUROUGH LI @ NO. 3 SR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10720	MILBUROUGH LI @ STEELES AV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
551	MILL ST @ NORTH ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
512	MILLGROVE SR @ SHELTONS LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8348	MINERAL SPRINGS RD @ SLOTE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8353	MINERAL SPRINGS RD @ SLOTE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
722	MORROW ST @ OLD GUELPH RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8352	MORWICK DR @ SHAVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1232	MOUNTSBERG RD @ TIMBERRUN CT	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8604	MULLIGAN RD @ SAWMILL RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8599	NORSWORTHY RD @ SAWMILL RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
737	OLD GUELPH RD @ PATTERSON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2204	OLD HIGHWAY 8 @ SHEFFIELD RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8341	PADDY GREENE RD @ POWER LINE RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
730	PATTERSON RD @ VALLEY RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
716	PATTERSON RD @ WESLEY AV	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8573	POPLAR ST @ SUNNYRIDGE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8343	POWER LINE RD E @ POWER LINE RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8342	POWER LINE RD E @ SLOTE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
1256	PUSLINCH TOWNLINE RD @ VICTORIA RD S	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2966	RIDGE RD @ SEVENTH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2965	RIDGE RD @ SIXTH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2951	RIDGE RD @ TENTH RD E	0.0	0.0	0.0	0.0	0.0	0.0	349	0
7730	RIDGE ST @ WOODBURN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8582	RONALD RD @ JERSEYVILLE RD W	0.0	0.0	0.0	0.0	0.0	0.0	349	0
10839	SAWMILL RD @ ONONDAGA SENECA TOWNLINE	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Geo ID	Description	Systemic Safety Risk Index (SSRI)							Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Type of control	Number of legs	Speed limit major road	Proportion right of way collisions	SSRI	Rank	
8594	SAWMILL RD @ SHAVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8347	SHAVER RD @ SUMAC LN	0.0	0.0	0.0	0.0	0.0	0.0	349	0
37722	SHEFFIELD RD @ CEDAR COVE	0.0	0.0	0.0	0.0	0.0	0.0	349	0
147	SNAKE RD @ SNAKE RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
2122	SODOM RD @ WESTOVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
713	SOVEREIGN AV @ YORK RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8303	SULPHUR SPRINGS RD @ WOODVIEW CR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
8576	SUNNYRIDGE RD @ UNION ST	0.0	0.0	0.0	0.0	0.0	0.0	349	0
12105	TWENTY RD E @ GRETI DR	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38847	WATERDOWN RD @ HORNING RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
34507	WATERDOWN RD @ IRESON RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
40158	WATERDOWN RD @ OLD WATERDOWN RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
11119	WBROOK RD @ 16 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
11139	WBROOK RD @ 20 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
11099	WBROOK RD @ CONCESSION 5 RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0
38199	WOVER RD @ WOVER RD	0.0	0.0	0.0	0.0	0.0	0.0	349	0

Ranking: Signalized Intersections

Table C 4: Systemic Safety Review Ranking – Signalized Intersections

Geo ID	Description	Systemic Score By Risk Factor			Systemic Safety Index	Systemic Safety Rank	Frequency of Fatal and Injury Collisions
		AADT Major and Minor	Boundary	Proportion right of way collisions			
7797	UPPER JAMES ST @ WHITE CHURCH RD W	78.7	13.8	7.5	100.0	1	11
61	EVANS RD @ HIGHWAY NO. 5 E	78.7	13.8	0.0	92.5	2	3
1807	GLOVER RD @ HIGHWAY NO. 8	78.7	13.8	0.0	92.5	2	4
2679	GREEN MOUNTAIN RD E @ UPPER CENTENNIAL PY	78.7	13.8	0.0	92.5	2	9
3038	REGIONAL 56 RD @ RYMAL RD E	78.7	13.8	0.0	92.5	2	33
3042	HIGHLAND RD E @ UPPER CENTENNIAL PY	78.7	13.8	0.0	92.5	2	22
7800	AIRPORT RD E @ UPPER JAMES ST	78.7	13.8	0.0	92.5	2	27
8507	HIGHWAY NO. 52 S @ WILSON ST W	78.7	13.8	0.0	92.5	2	9
43177	MUD ST W @ UPPER CENTENNIAL PY	78.7	13.8	0.0	92.5	2	23
8332	GOVERNOR'S RD @ HIGHWAY NO. 52 N	78.7	0.0	0.0	78.7	10	5
1809	HIGHWAY NO. 8 @ MCNEILLY RD	0.0	13.8	7.5	21.3	11	6
7721	DICKENSON RD E @ UPPER JAMES ST	0.0	13.8	7.5	21.3	11	4
12259	AIRPORT RD W @ E CARGO RD	0.0	13.8	7.5	21.3	11	0
184	HOLLYBUSH DR @ PARKSIDE DR	0.0	13.8	0.0	13.8	14	1
1888	FRUITLAND RD @ HIGHWAY NO. 8	0.0	13.8	0.0	13.8	14	10
7759	REGIONAL 56 RD @ SOUTHBROOK DR	0.0	13.8	0.0	13.8	14	0
7893	MONTGOMERY DR @ WILSON ST E	0.0	13.8	0.0	13.8	14	6
8465	FIDDLER'S GREEN RD @ GARNER RD W	0.0	13.8	0.0	13.8	14	6
8989	GARNER RD W @ PANABAKER DR	0.0	13.8	0.0	13.8	14	2
95	CENTRE RD @ CONCESSION 5 E	0.0	0.0	7.5	7.5	20	4
493	CENTRE RD @ CONCESSION 6 E	0.0	0.0	7.5	7.5	20	2
3041	HENDERSHOT RD @ SECOND RD E	0.0	0.0	7.5	7.5	20	13
1743	FIFTY RD @ HIGHWAY NO. 8	0.0	0.0	0.0	0.0	23	8
2677	FIRST RD E @ MUD ST E	0.0	0.0	0.0	0.0	23	5
7265	GOLF CLUB RD @ REGIONAL 56 RD	0.0	0.0	0.0	0.0	23	4
7750	GUYATT RD @ REGIONAL 56 RD	0.0	0.0	0.0	0.0	23	0
8371	BOOK RD W @ FIDDLER'S GREEN RD	0.0	0.0	0.0	0.0	23	0

D

Appendix D
Pilot Case Studies

This section presents detailed pilot case studies for the ten selected locations in the City of Hamilton. A field visit was conducted for each site, and the report summarizes the following: a description of the study area; an assessment of collision history (2014-2023); a speed study; and field observations of signage, roadway configuration, sightlines, and other relevant factors, including the key collision-contributing elements identified on-site.

The data used for the speed study was retrieved from connected vehicle datasets recently acquired by CIMA+. This dataset includes information on vehicle position, heading, and speed. For this report, data from October 2024 was considered.

Case Study 1: Wilson St E between Montgomery & Lower Lions Club

Study Area

Figure D 1 shows the location of Wilson Street East between Montgomery Drive and Lower Lions Club Road. The segment is approximately 1.9 kilometres long and has a posted speed limit of 60 km/h. It is in a transitional zone between rural and urban areas. There are no intersections along the segment between Montgomery Drive and Lower Lions Club Road. The intersection at Wilson Street and Montgomery Drive is signalized. The segment has an AADT of 15,481.



Figure D 1: Wilson St E between Montgomery & Lower Lions Club

In most of the segment's extent, the roadway has two lanes (one lane per direction). In the westbound direction, there is a segment of approximately 300 meters where a passing lane is available in the westbound direction. A bicycle lane is present throughout the entire segment. Vertical flexible posts or barriers are used to protect cyclists in horizontal curves.

In terms of land use, there is a garden centre located west of Lower Lions Club Road that has two driveways. Additionally, the segment is located within the Tiffany Falls Conservation Area and serves as a connection for two trails: the Bruce Trail and the Tiffany Falls Side Trail. There is a pedestrian crossover (PXO) approximately at the midpoint of the segment, connecting the two trails.

Collision History

CIMA+ reviewed the collision history of the roadway segment from January 1, 2014, to December 31, 2023, to identify trends or patterns that could provide insight into potential contributing factors. During the study period, the segment experienced 82 collisions. Of these, one collision resulted in a fatality, 19 resulted in injuries, and 60 were PDO collisions. Overall key findings are as follows:

- An increasing trend in collisions was observed in recent years:
  - 2014 to 2019: average of 6.3 collisions per year
  - 2020 to 2023: average of 11.0 collisions per year
- SMV Other represented the most frequent type of collision:
  - 35 collisions (43%): 1 fatal, 7 injury, and 27 PDO
  - 10 SMV Other collisions (29%) were related to ran off road and 8 collisions (23%) to wild animals
    - The collisions involving wild animals occurred in 2016 (1), 2019 (1), 2020 (1), 2021 (2), and 2023 (3)
- Rear end collisions represented the second most frequent type:
  - 28 collisions (34%): 4 injury and 24 PDO
  - No notable patterns were identified for rear-end collisions
- 10 collisions were associated with the driver action of "lost control", 2 collisions with "exceeding speed limit", and 2 collisions with "speed too fast for condition"
  - Only 4 collisions (5%) were linked to speeding (2 of those occurred between 2019 and 2023)
- No collisions involved pedestrians, and one involved a cyclist. This occurred in 2017, when a driver made an improper U-turn
- 15 collisions (18%) happened on wet road surfaces and 7 collisions (9%) took place under snow-related conditions

Collision facts at specific intersections are as follows:

- Intersection of Wilson Street @ Montgomery Drive (signalized; Geo ID = 7,893):
  - Total collisions: 60 (6 injury and 54 PDO)
    - 37 rear end, 11 SMV Other, 6 turning movement

- Intersection of Wilson Street @ Lower Lions Club Road (unsignalized; Geo ID = 6,588):
  - Total collisions: 15 (all PDO)
    - 7 rear end, 5 SMV Other

Speed Characteristics

Table D 1 summarizes the speed characteristics in the study area per direction. The average and 85th percentile speeds were 65 km/h and 71 km/h, respectively, in both directions. While the 85th percentile speeds exceed the posted limit of 60 km/h, they remain below the threshold of 20 km/h above the posted limit.

Table D 1: Case Study 1 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Eastbound	190	65	71
Westbound	270	65	71

A review of the TAC Speed Limit Guidelines using Form A – Automated Speed Limit Guidelines Spreadsheet recommends a speed limit of 80 km/h for the study area. However, considering the presence of curves along the segment, the signalized intersection at Montgomery Drive, and the pedestrian crossover, the existing speed limit of 60 km/h is deemed appropriate for this location.

Between 2019 and 2023, only two collisions were attributed to driver actions related to speeding (i.e., "Speed too fast for conditions" or "Exceeding speed limit").

Field Investigation

Table D 2 summarizes the field investigation findings for Case Study 1. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 2: Case Study 1 – Field Investigation Findings

Signage
Regulatory Signs





- The speed limit within the study area is 60 km/h, while the approaches – area with urban characteristics – have a posted speed limit of 50 km/h.

Existing regulatory signs:

- Maximum Speed Signs (Rb-1) with speed of 60 km/h.
- No Stopping Signs (Rb-55).
- Reserved Bicycle Lane Sign (Ground-mounted) (Rb-84).
- PXO regulatory signs are discussed in a later section.
- Stop Sign (Ra-1) located on both sides of Lower Lions Club Road approach to Wilson Street. Tiger tail tabs installed below the Stop Sign to increase conspicuity.
- All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements.

Warning Signs

 	Existing warning signs: • Fallen Rock Sign (Wc-6L). • Object Marker Signs (Wa-33L/R). • Traffic Signals Ahead Sign (Wb-2). • Curve Signs. • Lane End Sign (Wa-123R). • Deer Crossing Sign (Wc-11). • Hidden Driveway Sign. • Pedestrian Ahead Sign (Wc-7). • All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. Issues are identified below: • Visibility of the Hidden Driveway sign is obstructed by tree foliage. The sign is located to the west of Lower Lions Club Road in the westbound direction. • Visibility of the Lane Ends Sign (Wa-123R) with a Distance Tab Sign of 100 meters is obscured by tree foliage in the passing lane in the westbound direction.
Westbound:	• There is a Deer Crossing sign (Wc-11) in both directions east of the PXO. • The eastbound sign is obscured by tree foliage. • According to OTM Book 6, for road segments between 1.5 km and 8 km in length—such as the study area—a Deer Crossing sign is warranted if at least one deer-related collision occurs annually over a five-year period. • From 2019 to 2023, seven deer-related collisions were reported within the study area, meeting this criterion.



Eastbound:



- We recommend relocating the existing signs – or installing new ones – at the entrances to the study area, where the roadway transitions from urban to rural conditions, in both directions.



- The Stop Ahead sign (Wb-1) on the Lower Lions Club Road approach to Wilson Street is obscured by tree foliage.
- Providing visibility to the sign is of particular importance given the vertical curve observed before the intersection.

Guide Signs

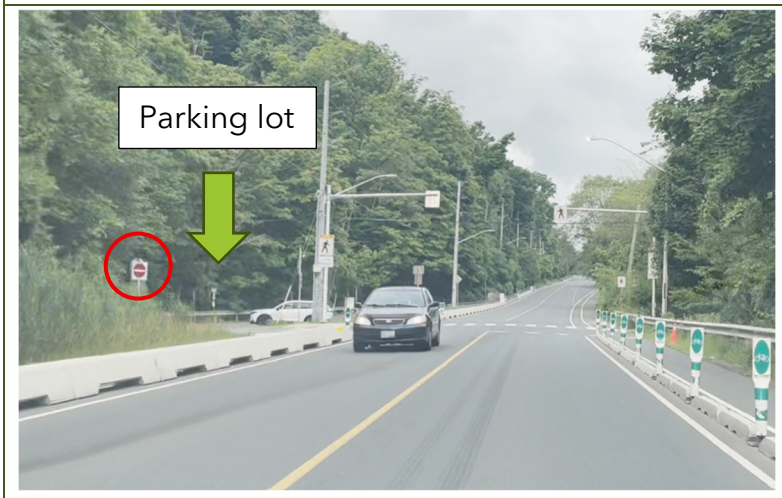


- The Street Name Blade (G216) for Lower Lions Club Road has visibility issues. The City may consider upgrading it to a Turn-Off Low-Speed Roadway Identification Sign (G207) for improved visibility and legibility.

Pedestrian Crossover



- PXO that serves the Tiffany Falls Conservation Area.
- This is a Level 2 Type B PXO.
- According to OTM Book 15, an Advanced Pedestrian Crossover Ahead sign (Wc-27R) must be placed between 50 and 130 meters in advance of the PXO
- The westbound sign is obscured by tree foliage.
- The No Passing Here to Crossing Sign (Ra-10) is also obscured by tree foliage.

	• This PXO is relatively unexpected given the rural nature of the study area. To improve its conspicuity, we recommend installing an additional Advanced Pedestrian Crossover Ahead sign (Wc-27R) in the westbound direction and improving the visibility of the existing signs. • In eastbound direction there is a Pedestrian Ahead Sign (Wc-7) with a Trail Crossing Tab Sign before the PXO signage. This sign is partially covered by tree foliage. • Additionally, it is suggested adding a Mounted Back to Back Sign (Ra-5) on the reverse side of the sign facing the opposite direction. Rectangular Rapid Flashing Beacons (RRFBs) should also be added to the signs mounted on the pole.
	• There is a parking lot located in the south side of Wilson Street at the PXO. • Westbound vehicles are not permitted to access the lot (i.e., left turns are prohibited). • The only sign indicating this restriction is a Do Not Enter sign (Rb-19) at the parking lot entrance, which is only visible to westbound drivers when they are already near the lot. • We recommend installing a No Left Turn sign (Rb-12) on the PXO pole to improve advance notice and compliance.
Roadway Geometrics	
Shoulder Characteristics	





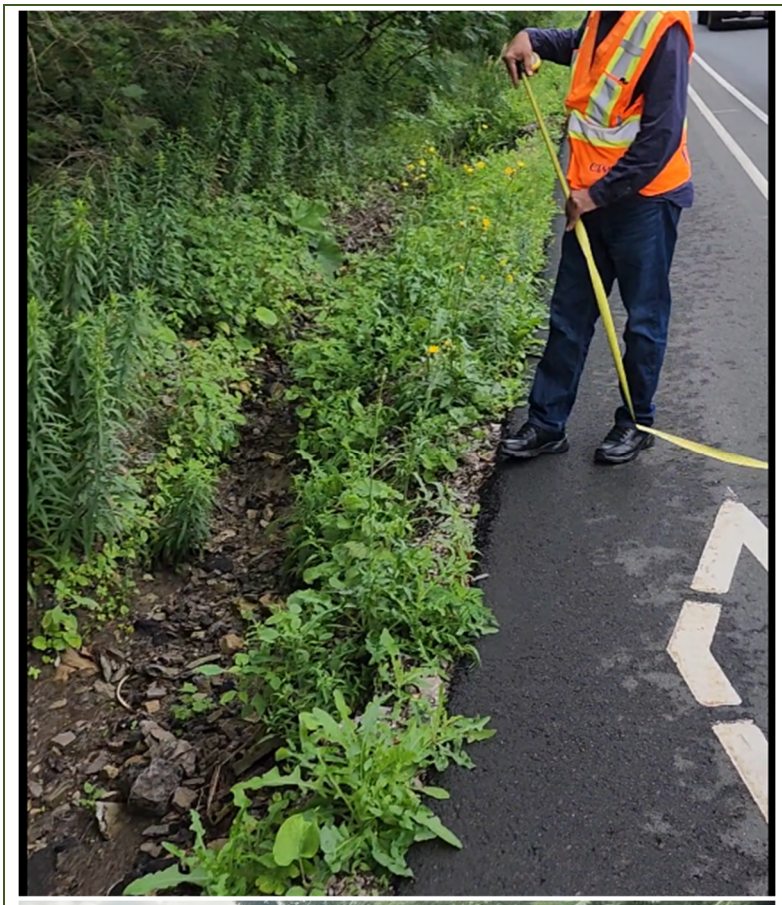
- Bicycle lanes are provided in both directions and are physically separated from the driving lanes by buffer zones.
- Concrete barriers and flex bollards are used at locations with driveways or curves to enhance cyclist protection.
- Guide rails are present along certain sections of Wilson Street, particularly at curves and in the segment where a westbound passing lane is provided.

Intersection Sight Distances



- No sightline issues were observed when exiting the PXO parking lot or at the signalized intersection with Montgomery Drive.
- However, sightline issues are present at the intersection with Lower Lions Club Road.
- The image shows the driver's view of eastbound vehicles when stopped at the stop bar. No visibility issues are observed in the opposite direction.
- To obtain a clear view of oncoming traffic when turning left onto Wilson Street, drivers must pull past the stop bar, which results in blocking the bicycle lane.
- Recommendation: trim the bushes obstructing the sightline.

Roadside Hazards





- A ditch is present in the eastbound direction along the segment between the curve following the Montgomery Drive signalized intersection and the PXO.
- The ditch is located approximately 2.5 meters from the edge of the travel lane and has a depth of about one meter with a vertical drop.
- At the point where the ditch ends, there is an exposed wall (see second image) that poses a potential hazard to drivers.
- Recommendation: consider investigating a suitable mitigation measure for the ditch and the exposed wall by conducting a risk assessment.

In summary, the following main issues were identified in the study area:

- Limited visibility of regulatory and warning signs throughout the corridor.
- Conspicuity of the PXO:
  - Five rear-end collisions occurred between 2019 and 2023 within the segment containing the PXO, which has no other driveways or features that would interrupt traffic flow and create opportunities for longitudinal conflicts or collisions.

    - Four of these collisions involved driver maneuvers of either “slowing or stopping” or “stopped”.
  - The interruption in traffic flow caused by the PXO is a potential contributing factor to these collisions.
- Sightline distances on Lower Lions Club Road:
  - Only two collisions were reported at this intersection between 2019 and 2023, with only one involving a turning movement.
- Roadside hazard between the curve after Montgomery Drive and the PXO:
  - Six SMV collisions occurred in this segment between 2019 and 2023.
    - Two of these were run-off-road collisions.
      - One involved a vehicle traveling eastbound that struck a culvert, likely the one identified during the field investigation.
      - The other involved a collision with a concrete guide rail. The direction of travel was not specified.

Case Study 2: Highway No. 52 N between North of Jerseyville Roundabout & Mineral Springs

Study Area

Figure D 2 shows the location of Highway No. 52 N between north of the Jerseyville Road Roundabout and Mineral Springs Road. The segment is approximately 2.8 kilometres long and has a posted speed limit of 70 km/h. There are two intersections along the segment between Jerseyville Road and Mineral Springs Road: Powerline Road East and Powerline Road West, both unsignalized. The segment has an AADT of 14,512.



Figure D 2: Highway No. 52 N between North of Jerseyville Roundabout & Mineral Springs

The roadway has two lanes (one lane per direction). Right-turn tapers are provided at the unsignalized intersections with Mineral Springs Road and at both Powerline Road intersections. A gravel shoulder is present along most of the segment. Guide rails are installed at multiple locations where the roadside features steep, nearly vertical slopes. Several horizontal curves are observed along the segment.

The land use is primarily residential, with multiple farms located along the corridor, resulting in various driveways throughout the segment.

Collision History

The segment experienced 69 collisions from January 1, 2014, to December 31, 2023. Of these, 17 resulted in injuries, and 52 were PDO collisions. Overall key findings are as follows:

- The collisions are relatively spread across the years, with a decreasing trend observed in more recent years:
  - 2014 to 2019: average of 7.7 collisions per year
  - 2020 to 2023: average of 5.8 collisions per year
- SMV Other represented the most frequent type of collision:
  - 31 collisions (43%): 5 injury and 26 PDO
  - Among the SMV Other collisions, 8 collisions (26%) were related to hitting wild animals, while only 3 (10%) were linked to running off the road
- Rear end collisions represented the second most frequent type:
  - 27 collisions (39%): 8 injury and 19 PDO

  - Among the rear end collisions, 15 collisions (56%) were related to "slowing or stopping". This may be related to the multiple number of driveways observed in the segment
- Four collisions (6%) were associated with drivers who had ingested alcohol
- No collisions involved pedestrians or cyclists
- No collisions were linked to driver actions related to speeding, suggesting it is not a critical contributing factor on this segment
- 11 collisions (16%) happened on wet road surfaces and 6 collisions (9%) took place under snow- and ice- related conditions

Collision facts at specific intersections are as follows:

- Intersection of Highway 52 @ Powerline Road E (unsignalized; Geo ID = 8,350):
  - Total collisions: 3 (1 injury and 2 PDO)
- Intersection of Highway 52 @ Powerline Road W (unsignalized; Geo ID = 8,358):
  - Total collisions: 19 (5 injury and 14 PDO)
    - 14 rear end, 3 angle
- Intersection of Highway 52 @ Mineral Springs Road (unsignalized; Geo ID = 8,346):
  - Total collisions: 2 (1 injury and 1 PDO)

Speed Characteristics

Table D 3 summarizes the speed characteristics in the study area per direction. The average and 85th percentile speeds were 76 km/h and 82 km/h, respectively, in both directions. While the 85th percentile speeds exceed the posted limit of 70 km/h, they remain below the threshold of 15 km/h above the posted limit.

Table D 3: Case Study 2 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Northbound	537	76	82
Southbound	942	76	82

A review of the TAC Speed Limit Guidelines using Form A – Automated Speed Limit Guidelines Spreadsheet recommends a speed limit of 70 km/h for the study area, similar to the existing limit.

Between 2019 and 2023, no collisions were attributed to driver actions related to speeding (i.e., "Speed too fast for conditions" or "Exceeding speed limit").

Field Investigation

Table D 4 summarizes the field investigation findings for Case Study 2. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area. The study area is in a community safety zone.

Table D 4: Case Study 2 – Field Investigation Findings

Signage	
Regulatory Signs	
 	Existing regulatory signs: • Maximum Speed Signs (Rb-1) with speed of 70 km/h along the corridor. Begins Tab (Rb-84t) is provided in the beginning of the study area in the southbound direction (Image 1). • There is an area of reduced speed limit (60 km/h) north of the study area. • Community Safety Zone Sign (Rc-9) and Begins Tab (Rb-84t) are installed in the northbound direction at the beginning of the study area (just north of the roundabout) and in the southbound direction just before the study area (immediately after the signalized intersection at Governors Road). The sign – without the Begins Tab – is repeated along the segment. • Do Not Pass Sign (Rb-31). • Stop Sign (Ra-1) at unsignalized intersections. Tiger tail tabs installed at Powerline Road W below the Stop Sign to increase conspicuity (Image 2). No Tiger tail tabs are available at the other two unsignalized intersections. • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All signs are visible.
Warning Signs	

	Existing warning signs: • Curve Signs. • Object Marker Signs (Wa-33R). • Trail Sign (Wc-32). • Deer Crossing Sign (Wc-11) • Checkerboard Signs (Both Directions) (Wa-108LR) at all unsignalized intersections (the three of them are 3-leg intersections). • Stop Ahead Sign (Wb-1) is provided at Powerline Road E. • Roundabout Ahead Sign (Wa-39) with advisory speed of 30 km/h (Image 1). • Yield Ahead Sign (Wb-101A). • All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All signs are visible.
	• There is a Deer Crossing sign (Wc-11) in both directions. • According to OTM Book 6, for road segments between 1.5 km and 8 km in length – such as the study area – a Deer Crossing sign is warranted if at least one deer-related collision occurs annually over a five-year period. • From 2019 to 2023, six deer-related collisions were reported within the study area, meeting this criterion. • In the southbound direction, the sign is located at the beginning of the study area. • In the northbound direction, the sign is positioned midway along the segment, between Powerline Road E and Powerline Road W (Image 1). It is recommended that an additional sign be installed at the beginning of the study area for northbound traffic.
Guide Signs	



- The Street Name Blade (G216) are provided for the unsignalized intersections in the study area. The City may consider upgrading it to a Turn-Off High-Speed Roadway Identification Sign (G209) for improved visibility and legibility.

Pavement Markings





- Yellow double solid lines are used as directional dividing lines throughout the entire study area (Image 1).
- Solid white edgelines are present in both directions along the full length of the segment.
- Right-turn tapers are provided at all three unsignalized intersections (Image 2).
- Transverse pavement markings are present prior to the curvilinear section between Powerline Road E and Powerline Road W (Image 3).



Roadway Geometrics

Shoulder Characteristics





- Various types of shoulders are present along the segment, including gravel shoulders (Image 1), paved shoulders, and sections with no shoulders.
- Guide rails are installed at select locations, particularly near unsignalized intersections and in curvilinear sections.
- Post-mounted delineators (Image 2) are installed along nearly the entire segment.
- Chevron Alignment Signs (Wa-9) are present on Powerline Road E (Image 3), where steep curves occur near the approach to Highway 52.



Intersection Sight Distances



- Sightline issues at Mineral Springs Road (Image 1). Drivers turning left onto Highway 52 have limited visibility of oncoming southbound traffic.
- Recommendation: trim the vegetation obstructing the sightline and remove the business sign.
- No sightline issues were observed at Powerline Road E and W.

Roadside Hazards

- No significant issues were identified.
- The presence of shoulders, edgelines, transverse pavement markings, post-mounted delineators, and speed feedback monitor (discussed in the next topic) collectively contribute to improved roadside safety.

Additional Features and Observations





- Speed feedback signs are present in both directions prior to the curvilinear section between Powerline Road E and Powerline Road W (Images 1 and 2).



- Approximately 500 meters north of the roundabout, at the beginning of the section, there is a driveway serving a commercial stand that was selling fruits and vegetables on the day of the field visit (Thursday, July 17, 2025).
- Multiple southbound drivers were observed turning left into the driveway (Image 1).
- In several cases, drivers had to wait for gaps in northbound traffic, leading to interruptions in southbound flow and the formation of queues of 5-8 vehicles.

Overall, the signage, roadside features, and speed management treatments in the study area are in good condition. Based on Google Street View imagery, the area was not designated as a Community Safety Zone as of October 2023. The presence of current treatments and the recent designation suggest that the City has conducted a recent review or investigation of the area.

The main issues identified during the field investigation were:

- Sightline problems at the unsignalized intersection at Mineral Springs Road:
  - Only one collision occurred at the intersection between 2019 and 2023, and it was a sideswipe collision between two vehicles travelling in the north direction, suggesting that although sightline problems occur, they are not resulting in collisions.
- Queues generated in the southbound direction by vehicles turning left into the driveway located approximately 500 meters north of the roundabout:
  - 18 collisions were reported in the segment where the driveway is located (Geo ID = 46,143) between 2019 and 2023.
    - 10 of them were rear-end collisions: 5 were in the southbound direction, 3 in the northbound direction, and 2 did not have direction identified.
    - 2 of them were approaching head-on collisions, which may be related to turning maneuvers at the driveway involving conflicts with oncoming traffic.

- The driveway in question is the main driveway within Geo ID = 46,143, potentially being the location of the reported rear-end and approaching head-on collisions.

Case Study 3: Highway No. 8 between Glover & Lewis

Study Area

Figure D 3 shows the location of Highway No. 8 between Glover Road and Lewis Road. The segment is approximately 1.8 kilometres long, with a posted speed limit of 60 km/h. There is one intersection along the segment between Glover Road and Lewis Road: McNeilly Road which is signalized. The intersection at Glover Road is signalized and the intersection at Lewis Road is unsignalized (stop controlled). The segment has an AADT of 9,005.



Figure D 3: Highway No. 8 between Glover Rd and Lewis Rd

The roadway has two lanes, one in each direction. Designated left-turn lanes are provided at the signalized intersections of Glover Road and McNeilly Road. Left turn lanes are provided at the unsignalized intersection of Lewis Road along with a right-turn taper only in the westbound direction at Lewis Road. A gravel shoulder is present along most of the segment. Several horizontal curves are observed along the segment.

The surrounding land use is a mix between commercial and residential, with several homes and driveways located along the corridor.

Collision History

The segment experienced 29 collisions from January 1, 2014, to December 31, 2023. Of these, 10 resulted in injuries, and 19 were PDO collisions. Overall key findings are as follows:

- The collisions are spread throughout the study period: 5 collisions in 2014, 4 collisions in 2016, 2019, and 2021, 3 collisions in 2018 and 2022, 2 collisions in 2017 and 2020, and 1 collision in the remaining years
- Read end represented the most frequent type of collision:
  - 13 collisions (45%): 4 injury and 9 PDO
  - Among the rear end collisions, 3 collisions (23%) were related to "slowing or stopping" and 2 (15%) related to "stopped" vehicles. This may be related to the multiple number of driveways observed in the segment
- SMV other collisions represented the second most frequent type:
  - 6 collisions (21%): 2 injury and 4 PDO
  - Among the SMV Other collisions, 3 collisions (50%) were linked to running off the road.
- 2 collisions (7%) involved cyclists, and no collisions involved pedestrians
- 1 collision (3%) were linked to driver actions related to speeding, suggesting it is not a critical contributing factor on this segment
- 5 collisions (17%) occurred on wet, icy, or snowy road conditions
- No collisions involved hitting wild animals

Collision facts at specific intersections are as follows:

- Intersection of Glover Road @ Highway No. 8 (signalized; Geo ID = 1,807):
  - Total collisions: 13 (4 injury and 9 PDO)
    - 9 rear end, 2 angle, 1 sideswipe, and 1 SMV unattended vehicle
- Intersection of Highway No. 8 @ McNeilly Road (signalized; Geo ID = 1,809):
  - Total collisions: 10 (6 injury and 4 PDO)
    - 3 sideswipe, 3 angle, 2 turning movement, and 2 rear end
- Intersection of Highway No. 8 @ Lewis Road (unsignalized; Geo ID = 1,745):
  - Total collisions: 6 (all PDO)
    - 3 angle, 2 rear end, and 1 SMV other

Speed Characteristics

Table D 5 summarizes the speed characteristics in the study area by direction. Average speeds were 62 km/h eastbound and 64 km/h westbound. The 85th percentile speeds were 68 km/h and 70 km/h, respectively. While the 85th percentile speeds exceed the posted limit of 60 km/h, they remain below the threshold of 20 km/h above the posted limit.

Table D 5: Case Study 3 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Eastbound	134	62	68
Westbound	143	64	70

A review of the TAC Speed Limit Guidelines using Form A – Automated Speed Limit Guidelines Spreadsheet recommends a speed limit of 70 km/h for the study area. However, considering the presence of curves along the segment, its rural-urban boundary character, and the multiple driveways, the existing speed limit of 60 km/h is deemed appropriate for this location.

Between 2019 and 2023, no collisions were attributed to driver actions related to speeding.

Field Investigation

Table D 6 summarizes the field investigation findings for Case Study 3. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 6: Case Study 3 – Field Investigation Findings

Signage

Regulatory Signs





Existing regulatory signs:

- A school is located just east of Glover Road. School Zone Maximum Speed When Flashing Signs (Rb-6a) with regulatory speed limit of 50 km/h are present in both directions (Image 1). The standard speed limit in the study area is 60 km/h.
- In the eastbound direction, Maximum Speed signs (Rb-1) indicate 60 km/h and 50 km/h when the School Zone sign is flashing. An Ends tab is provided below the 50 km/h sign (Image 2).
- No Stopping Signs (Rb-55).
- Truck Route Sign (Rb-61).
- All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.

Warning Signs





Existing warning signs:

- School Crossing Sign (Wc-2) on both directions before the school located right east of Glover Road (Image 1).
- Truck Entrance Sign (Wc-8R).
- Curve Signs.
- The signalized intersection at McNeilly Road is located just after a steep curve in the eastbound direction. A Traffic Signal Ahead sign (Wb-102) with a mounted flashing beacon is installed before the curve (Image 2).
- Object Marker Signs (Wa-33LR).
- Pedestrians Ahead Sign (Wc-77).
- All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All warning signs are visible.

Guide Signs



- Street Name Blades (G216) are provided upstream the signalized intersection with McNeilly Road (Image 1).
- Boundary Signs.

Pavement Markings



- Yellow double solid lines are used as directional dividing lines in the entire study area.
- Solid white edgelines are present in both directions along the full length of the segment.
- Signalized intersection at Glover Road: left-turn lane on Highway 8 in both directions. No right-turn lanes.
- Signalized intersection at McNeilly Road: left-turn lane on Highway 8 in both directions. Right-turn channel in both directions.
- Unsignalized intersection at Lewis Road: left-turn lane on Highway 8 in both directions. Right-turn taper in the westbound (Image 1).

Roadway Geometrics

Shoulder Characteristics





- For most of the section, a gravel shoulder is present (Image 1). However, at certain locations – such as near intersections where the road widens to accommodate turning lanes – the shoulder is not available.
- Post-mounted delineators are installed along the curve near the McNeilly Road signalized intersection to guide westbound drivers (Image 2).

Intersection Sight Distances

	■ No sightline issues were observed at the intersections in the study area.
Roadside Hazards	
	■ Poles and trees are located relatively close to the edge of the pavement, approximately 3 to 5 meters from the edgeline (Image 1). ■ Clear zones are relatively flat across the study area.

Overall, no major issues were identified during the field investigation. The presence of the school is well signed, with regulatory speeds reduced from 60 km/h to 50 km/h when the flashing beacon is active.

One potential concern is the steep curve in the eastbound direction before the McNeilly Road signalized intersection. This situation is analyzed below:

- The City has installed a Traffic Signal Ahead sign with a flashing beacon before the curve. Based on Google Street View imagery, this warning treatment has been in place since at least 2007.
- Between 2019 and 2023, one rear-end collision occurred in 2022 in the segment between the school and McNeilly Road (Geo ID = 216) in the eastbound direction, potentially associated with the curve before the signalized intersection.
- During the same period, seven collisions occurred at the intersection itself.
  - Only two of these were related to the eastbound approach: one rear-end (2023) and one sideswipe.
- In conclusion, only two rear-end collisions occurred in the eastbound direction in the area affected by the curve over a five-year period. This relatively low frequency suggests that the existing treatment (warning sign with flashing beacon) is effective in alerting drivers to the curve and upcoming signal.

Case Study 4: Centre Rd between Concession 7 & Concession 8

Study Area

Figure D 4 shows the location of Centre Road between Concession 8 East and Concession 7 East. The segment is approximately 1.8 kilometres long, with a posted speed limit of 70 km/h. It has no intersections within its length. Both Concession 8 and Concession 7 are unsignalized intersections, where Centre Road functions as the major road. The segment has an AADT of 4,668.



Figure D 4: Centre Rd between Concession 7 & Concession 8

The roadway has two lanes, one in each direction. Paved shoulders are present near the intersection with Concession 8; however, most of the segment lacks shoulders. Guardrails are installed near Concession 8. In both directions, warning signs advising a reduced speed of 60 km/h are posted in advance of the curve.

The surrounding land use is primarily residential, with several homes and driveways located along the corridor.

Collision History

The segment experienced 17 collisions from January 1, 2014, to December 31, 2023. Of these, 5 resulted in injuries, and 12 were PDO collisions. Overall key findings are as follows:

- The collisions are spread throughout the study period: 3 collisions in 2014, 2019, and 2022, 2 collisions in 2016, and 1 collision in the remaining years
- SMV Other represented the most frequent type of collision:

  - 11 collisions (65%): 3 injury and 8 PDO
  - Among the SMV Other collisions, 6 were related to ran off road
- Rear end collisions represented the second most frequent type:
  - 4 collisions (24%): 1 injury and 3 PDO
  - Among the rear end collisions, 2 (50%) were associated with stopped vehicles, likely near one of the intersections at the extreme of the area
- No collisions involved pedestrians or cyclists
- Only 2 collisions (12%) were linked to driver actions related to speeding
- 8 collisions (47%) occurred on wet, icy, or snowy road conditions
- No collisions involved hitting wild animals

Collision facts at specific intersections are as follows:

- Intersection of Centre Road @ Concession 8 East (unsignalized; Geo ID = 1,317):
  - Total collisions: 22 (8 injury and 14 PDO)
    - 16 angle, 4 rear end
    - This intersection is further assessed as part of **Case Study 8: Centre Rd @ Concession 8 E**
- Intersection of Centre Road @ Concession 7 East (unsignalized; Geo ID = 38,105):
  - Total collisions: 10 (2 injury and 8 PDO)
    - 8 angle, 2 rear end

Speed Characteristics

Table D 7 summarizes the speed characteristics in the study area by direction. Average speeds were 72 km/h northbound and 74 km/h southbound. The 85th percentile speeds were 79 km/h and 82 km/h, respectively. While the 85th percentile speeds exceed the posted limit of 70 km/h, they remain below the threshold of 15 km/h above the posted limit.

Table D 7: Case Study 4 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Northbound	123	72	79
Southbound	149	74	82

A review of the TAC Speed Limit Guidelines using Form A – Automated Speed Limit Guidelines Spreadsheet recommends a speed limit of 80 km/h for the study area. However, considering the presence of curves along the segment and the multiple driveways, the existing speed limit of 70 km/h is deemed appropriate for this location.

Between 2019 and 2023, only one collision was attributed to driver actions related to speeding (i.e., "Speed too fast for conditions").

Field Investigation

Table D 8 summarizes the field investigation findings for Case Study 4. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 8: Case Study 4 – Field Investigation Findings

Signage	
Regulatory Signs	
 	The signage information in this table does not include features from the intersection of Centre Road and Concession 8, as this location will be assessed separately in Case Study 8. Existing regulatory signs: • Maximum Speed Signs (Rb-1) with speed of 70 km/h with Begins Tab (Image 1). North of the study area on Centre Road, the speed limit is reduced to 50 km/h. • Stop Sign (Ra-1) is installed at the intersection with Concession 7E, accompanied by tiger tail tabs and a flashing beacon (Image 2). The sign at the west side is partially obscured by tree foliage. • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. Aside from the stop sign mentioned in the previous bullet point, all regulatory signs are visible.
Warning Signs	







Existing warning signs:

- Intersection Sign (Wa-111A) on Center Road when approach Concession 7E and Concession 8E (Image 1).
- Deer Crossing sign (Wc-11).
- Curve signs (Wa-103R and Wa-103L) with advisory speed tab of 60 km/h. In the northbound, the sign is obstructed by tree foliage (Image 2).
- A curve warning sign combined with an intersection sign, accompanied by a 60 km/h advisory speed tab and a flashing beacon, is installed in both directions before the intersection with Concession 8E. Image 3 highlights the northbound sign (Image 3).
- Object Marker Signs (Wa-33R).
- Goose Ahead Sign.
- All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. Aside from the sign shown in Image 2, all warning signs are visible.



- There is a Deer Crossing sign (Wc-11) in both directions.
- According to OTM Book 6, for road segments between 1.5 km and 8 km in length – such as the study area – a Deer Crossing sign is warranted if at least one deer-related collision occurs annually over a five-year period.
- From 2019 to 2023, zero deer-related collisions were reported within the study area.

Guide Signs



- Street Name Blades (G216) are provided for the unsignalized intersections in the study area. The City may consider upgrading it to a Turn-Off High-Speed Roadway Identification Sign (G209) for improved visibility and legibility.

Pavement Markings



- Yellow double solid lines are used as directional dividing lines when approaching the unsignalized intersections of Concession 7E and 8E and before the curve before Concession 8E. In other locations, yellow single broken lines are used.
- Solid white edgelines are present in both directions along the full length of the segment.
- Left turn lanes and right turn lanes or tapers are not provided on Center Road when approaching the unsignalized intersections, which may be a risk factor for rear end collisions.

	• This is particularly a concern on the northbound approach to Concession 8E, where a downhill grade is present (Image 1). This will be explored in more details in Case Study 8.
Roadway Geometrics	
Shoulder Characteristics	
 	• Two shoulder configurations are observed along the segment: no shoulder (Image 1) and paved shoulder (Image 2). The no shoulder configuration is predominant, with paved shoulders observed primarily before the curve and near Concession 8E. • Guide rails are installed near the unsignalized intersection at Concession 8E (see Image 1 in the Pavement Markings category).
Intersection Sight Distances	
	• No sightline issues were observed at the unsignalized intersections of Center Road with Concession 7E and Concession 8E.
Roadside Hazards	

	• Poles and trees are located relatively close to the edge of the pavement, approximately 3 to 5 meters from the edgeline (Image 1). • Clear zones are relatively flat across the study area.

Overall, no major issues were identified during the field investigation.

Case Study 5: Carlisle Rd between Highway No. 6 and Wildberry

Study Area

Figure D 5 shows the location of Carlisle Road between Highway No. 6 and Wildberry Way. The segment is approximately 2.4 kilometres long, with a posted speed limit of 60 km/h and no intersections along its length. Carlisle Road intersects Highway No. 6 at a signalized T-intersection and Wildberry Way at a stop-controlled intersection, where Carlisle Road serves as the major road. A community park is located on the north side of the segment, roughly at its midpoint. At the park entrance, the northbound direction includes a left-turn lane, while the southbound direction features a right-turn taper. The segment has an AADT of 3,351.



Figure D 5: Carlisle Rd between Highway No. 6 and Wildberry Way

The roadway has two lanes – one in each direction – with no shoulders along the segment. Guide rails are present at a few locations where roadside hazards exist (e.g., areas with steep inclines or dense tree coverage).

The surrounding land use is primarily residential, with several homes and driveways located along the corridor. There is also some commercial, agricultural, and recreational land use.

Collision History

The segment experienced 28 collisions from January 1, 2014, to December 31, 2023. Of these, 5 resulted in injuries, and 23 were PDO collisions. Overall key findings are as follows:

- The collisions are spread throughout the study period: 4 collisions in 2016, 2022, and 2023, 3 collisions in 2014, 2018, 2020, and 2021, 2 collisions in 2017, and 1 collision in 2015 and 2019
- Rear end represented the most frequent type of collision:
  - 7 rear end (25%): 3 injury and 4 PDO
  - Among the rear end collisions, 3 were related to the driver action of "Following too close"
- Angle and turning movement collisions represented the second and third most frequent types of collisions, respectively:
  - 6 angle (21%): all PDO
  - 5 turning movement (18%): all PDO

  - These collisions are likely related to the presence of multiple driveways from residential places along the segment.
- No collisions involved pedestrians or cyclists
- No collisions were linked to driver actions related to speeding
- 6 collisions (21%) occurred on wet, icy, or snowy road conditions
- No collisions involved hitting wild animals

Collision facts at specific intersections are as follows:

- Intersection of Carlisle Road @ Highway No.6 (signalized; Geo ID = 1,357):
  - Total collisions: 14 (1 injury and 13 PDO)
    - 9 rear end, 3 SMV other, 1 sideswipe, and 1 turning movement
- Intersection of Carlisle Road @ Wildberry Way (unsignalized; Geo ID 1,349)
  - Total Collisions: 0

Speed Characteristics

Table D 9 summarizes the speed characteristics in the study area by direction. Average speeds were 64 km/h in both directions. The 85th percentile speeds were 71 km/h and 72 km/h in the northbound and southbound, respectively. While the 85th percentile speeds exceed the posted limit of 60 km/h, they remain below the threshold of 20 km/h above the posted limit.

Table D 9: Case Study 5 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Northbound	194	64	71
Southbound	254	64	72

A review of the TAC Speed Limit Guidelines, using Form A – Automated Speed Limit Guidelines Spreadsheet, recommends a speed limit of 70 km/h for the study area. However, due to the presence of multiple driveways and the high frequency of residential land use along the segment – which gives it an urban character – the existing speed limit of 60 km/h is considered appropriate for this location.

Between 2019 and 2023, no collisions were attributed to driver actions related to speeding.

Field Investigations

Table D 10 summarizes the field investigation findings for Case Study 5. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 10: Case Study 5 – Field Investigation Findings

Signage	
Regulatory Signs	
 	Existing regulatory signs: - Maximum Speed Signs (Rb-1) with speed of 60 km/h along the corridor (Image 1). - At the end of the study area, near Wildberry Road, the speed limit is reduced to 50 km/h. In the northbound direction, a speed feedback monitor is mounted alongside the speed limit sign (Image 2). - No Stopping Signs (Rb-55). - Stop Sign (Ra-1) at Wildberry Road. - All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All signs are visible. Identified issues: - At the Courtcliffe Community Park access to Carlisle Road (Image 3), right- and left-turn lanes are marked on the pavement, even though it is not a formal road. However, Stop Signs (Ra-1) are not provided. - Recommendation: install a Stop Sign (Ra-1) and a Checkerboard Sign (Wa-8LR).

	
Warning Signs	
	Existing warning signs: • Deaf Child Sign. • Pedestrian Ahead Sign (Wc-7) (Image 1). • Object Marker Signs (Wa-33R). • Intersection Sign (Wa-13A) before Wildberry Road in both directions. • Traffic Signals Ahead Sign (Wb-102) before the signal at Highway 6 in the southbound. • No collisions involving wild animals were reported; therefore, Deer Crossing Signs (Wc-11) are not warranted and are not present in the study area. • All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All signs are visible.



Guide Signs



- Route Marker Shields before the signal at Highway 6 in the southbound.

Pavement Markings



- Yellow double solid lines are used as directional dividing lines when approaching the traffic signal at Highway 6 and between the Courtcliffe Community Park and Wildberry Road.
- Yellow single broken lines are used between after the signal approach and the Courtcliffe Community Park.
- Solid white edgelines are present in both directions along the full length of the segment.
- A left-turn lane and a right-turn taper are provided on Carlisle Road at the Courtcliffe Community Park entrance.
- No turning lanes or tapers are provided on Carlisle Road at Wildberry Road.

Roadway Geometrics

Shoulder Characteristics





- There are no shoulders in either direction along this segment (Image 1).
- Guide rails are installed in portions of the segment between Courtcliffe Community Park and Wildberry Road in both directions (Image 2). These locations feature dense vegetation and likely have clear zones with steep slopes.

Intersection Sight Distances





- Limited visibility of southbound vehicles when stopped at the stop bar on Wildberry Road due to tree foliage (Image 1). Clear sightlines are available if the driver moves forward past the stop bar toward the intersection (Image 2).
- We recommend trimming the tree foliage to improve sightlines at this location.
- No sightline issues were identified at the Courtcliffe Community Park.

Roadside Hazards



- Poles and trees are located relatively close to the edge of the pavement, approximately 3 to 5 meters from the edgeline (Image 1).
- Except for the areas where guide rails are present due to steep slopes in the clear zone, the clear zones for the remaining locations are relatively flat (Image 2).



In summary, the following main issues were identified in the study area:

- Sightline issues at Wildberry Road:
  - No collisions were report at the intersection between 2019 and 2023. This remains the case if the period is extended to 2014.
  - Although sightlines issues occur at the intersection, they are not resulting in collisions.
- Shoulder and roadside characteristics:
  - The segments have no shoulder in the study area.
  - Although relatively flat and recoverable clear zones exist, objects (e.g., trees and poles) and located approximately 3-5 meters from the edgeline.
  - No SMV collisions (including run-off-road collisions) were reported in the study area between 2019 and 2023.
  - Due to the flat and relatively recoverable clear zones, as well as the absence of SMV collisions in the study area, the lack of shoulders and the presence of trees and poles 3–5 meters from the edgeline were not considered a main issue.

Case Study 6: Ridge Rd between Seventh & Sixth

Study Area

Figure D 6 shows the location of Ridge Road between Seventh Road East and Sixth Road East. The segment is approximately 0.84 kilometres long and has a posted speed limit of 60 km/h. There are no intersections along the segment itself. At the west end, Ridge Road intersects Sixth Road East at a stop-controlled intersection, with Ridge Road as the major road. At the east end, Seventh Road East functions as a driveway and is not controlled by any traffic sign. The AADT on Ridge Road is 2,472.



Figure D 6: Ridge Rd between Seventh Rd E and Sixth Rd E

The roadway has two lanes, one in each direction. Gravel shoulders are present along most of the segment.

The surrounding land use is primarily residential with several homes and driveways located along the corridor. There is also agricultural (farm) land along the corridor.

Collision History

The segment experienced 11 collisions from January 1, 2014, to December 31, 2023. Of these, 4 resulted in injuries, and 7 were PDO collisions. Overall key findings are as follows:

- The collisions are spread throughout the study period: 3 collisions in 2022, 2 collisions in 2018 and 2020, 1 collision in the remaining years, and no collisions report in 2014.
- SMV Other represented the most frequent type of collision:
  - 6 collisions (55%): 2 injury and 4 PDO
  - Among the SMV Other collisions, 3 collisions (50%) were related to running off the road, and 1 related to hitting a domestic animal. 3 collisions (50%) were related to the driver action losing control, 2 of which led to the related running off the road events mentioned.
- Rear end collisions represented the second most frequent type:
  - 2 collisions (18%): All injuries
  - Among the rear end collisions, 1 collision (50%) was related to “exceeding speed limit”. 1 collision (50%) was related to “slowing or stopping” and 1 collision (50%) was related to “following too close”.
- No collisions involved pedestrians or cyclists

- 1 collision (9%) was linked to driver actions related to speeding
- 1 collision (9%) happened on wet road surfaces

Collision facts at specific intersections are as follows:

- Intersection of Ridge Road @ Sixth Road E (unsignalized; Geo ID = 2,965):
  - Total collisions: 2 (all PDO)
    - 1 SMV other and 1 rear end
- Intersection of Ridge Road @ Seventh Road E (unsignalized; Geo ID = 2,966):
  - Total collisions: 0

Speed Characteristics

Table D 11 summarizes the speed characteristics in the study area by direction. Average speeds were 66 km/h eastbound and 68 km/h westbound. The 85th percentile speeds were 73 km/h and 77 km/h, respectively. While the 85th percentile speeds exceed the posted limit of 60 km/h, they remain below the threshold of 20 km/h above the posted limit.

Table D 11: Case Study 6 – Summary of Speed

Direction	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Eastbound	62	66	73
Westbound	37	68	77

A review of the TAC Speed Limit Guidelines using Form A – Automated Speed Limit Guidelines Spreadsheet recommends a speed limit of 60 km/h for the study area, similar to the existing limit.

Between 2019 and 2023, only one collision was attributed to driver actions related to speeding (i.e., "Exceeding speed limit").

Field Investigation

Ridge Road was one of the locations suggested by the City of Hamilton for potential investigation. The segment assessed in the previous sub-sections – between Sixth Road E and Seventh Road E – is relatively short, extending approximately 840 meters. During the field investigation, we extended the study area to include the segment from Third Road E to Eighth Road E, resulting in a total length of approximately 4 km.

Table D 12 summarizes the field investigation findings for Case Study 6. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 12: Case Study 6 – Field Investigation Findings

Signage	
Regulatory Signs	
	Existing regulatory signs: • Maximum Speed Signs (Rb-1) with speed of 60 km/h along the corridor. • Stop Sign (Ra-1) at unsignalized intersections. At Tapleytown Road approach to Ridge Road, there is a flashing beacon on a pole (not exactly on top of the intersection) to increase the sign's conspicuity. The speed limit at Tapleytown Road is 80 km/h. • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.
Warning Signs	
	Existing warning signs: • Curve Signs. • Object Marker Signs (Wa-33R) at poles that are close to the edgeline (Image 1). • Checkerboard Sign (Both Directions) (Wa-108LR) at 3-leg unsignalized intersections (Tapleytown Road, Fifth Road E, Sixth Road E, Eighth Road E). • Deer Crossing Sign (Wc-11) between Tapleytown Road and Fifth Road E in the eastbound direction and between Sixth Road E and Fifth Road E in the westbound direction. • Intersection Sign (Controlled) (Wa-13A). • Hidden Driveway Sign. • All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All warning signs are visible.
	• There is a Deer Crossing sign (Wc-11) in both directions.

	■ According to OTM Book 6, for road segments between 1.5 km and 8 km in length – such as the study area – a Deer Crossing sign is warranted if at least one deer-related collision occurs annually over a five-year period. ■ From 2019 to 2023, only two collisions involving wild animals occurred in the segment between Tapleytown Road and Sixth Road E (Geo IDs = 236 and 237).
Guide Signs	
	■ Street Name Blades (G216) are provided upstream some of the intersections (Tapleytown Road, Sixth Road E, Eighth Road E) (Image 1). ■ Boundary Signs.
Pavement Markings	
	■ Yellow double solid lines, yellow single broken lines, and yellow double solid and broken lines are used as directional dividing lines in the entire study area. ■ Solid white edgelines are present in both directions along the full length of the segment. ■ A left-turn lane is provided in the westbound direction on Ridge Road when approaching Eighth Road E (Image 1). Turning lanes are not present at the other intersections along the corridor.
Roadway Geometrics	
Shoulder Characteristics	









- At some locations, narrow gravel shoulders (<1 meter) are present (Image 1), while at others, no shoulder is available (Image 2).
- A guide rail is installed in the westbound direction (Image 3), beginning roughly midway between Fifth Road East and Tapleytown Road and extending beyond the study area, past Third Road East. The guide rail protects vehicles from a steep hill, shown in Image 4 (viewed from below on Dewitt Road).

Intersection Sight Distances



- Visibility from the stop bar at Tapleytown Road is somewhat restricted, particularly for observing westbound oncoming traffic. However, the presence of the flashing beacon reinforcing the regulatory stop sign helps mitigate this issue. Collisions will be checked at the section summary after the table.
- Visibility at Eighth Road E is limited for observing westbound oncoming traffic, primarily due to the guide rail (Image 1) obstructing the line of sight. Installing a flashing beacon – similar to the one at Tapleytown Road – is recommended to enhance driver awareness.
- No sightline issues were observed at the other intersections in the study area.

Roadside Hazards





- Poles are close to the end of the pavement (< 3 meters) as shown in Image 1 in the Warning Sign section.
- Headwalls are present at multiple driveways along the segment between Fifth Road E and Sixth Road E. They are frequent throughout this stretch and pose a potential risk to drivers (Image 1).
- Potential solutions include flattening the ditch, installing fixed object markers, or modifying/removing driveway headwalls to improve roadside safety. Detailed roadside risk assessment is suggested for this issue.
- At Eighth Road E, there is a sharp curve when approaching Ridge Road (Image 2 – taken from the perspective of a driver turning onto Eighth Road E from Ridge Road). A checkerboard sign, an advisory speed of 30 km/h, and post-mounted delineators are installed to enhance safety at the curve.

	• Also at Eighth Road E, when approaching Ridge Road, there are two curves – one shown in Image 2 and another in Image 3. In the northbound direction, heading toward the intersection, there is no curve warning sign or advisory speed posted before the first curve (Image 3). Collisions along these curvilinear segments will be reviewed in the section summary following the table.

In summary, the following main issues were identified in the study area:

- Visibility at Tapleytown Road:
  - Two collisions were reported at this intersection between 2019 and 2023. Both were SMV collisions.
  - No turning movement collisions were reported, suggesting that the identified visibility issues are not resulting in collisions.
- Visibility at Eighth Road E:
  - Only one collision was reported at this intersection between 2019 and 2023. It was a SMV collision.
  - The collision occurred when a driver struck the guide rail while turning right onto Ridge Road.
  - No turning movement collisions were reported, suggesting that the identified visibility issues are not resulting in collisions.
- Curves at Eighth Road E in the approach to Ridge Road:
  - Two collisions were reported between 2019 and 2023 in the segment of Geo ID = 41, which is a 430-meter stretch of Eighth Road E between Ridge Road and a nearby driveway. This segment includes both curves approaching Ridge Road.
  - One collision was a sideswipe, and the other was a sideswipe in the opposite direction.
  - Both collisions involved trucks.
- Headwalls at driveways along Ridge Road between Fifth Road E and Sixth Road E:
  - Four collisions occurred in this 880-meter segment (Geo ID = 236) between 2019 and 2023, including two SMV collisions.
  - One of the SMV collisions involved a deer strike; the other was a run-off-road collision that resulted in the vehicle striking a ditch, which is likely related to the identified risk factor.

  - Despite the presence of exposed headwalls in this area, only one collision over the five-year period appears to be associated with them.
- Fixed objects close to the edge of the pavement across the entire study area:
  - Over the 4 km extended study area, 18 collisions were reported between 2019 and 2023:
    - 10 were SMV collisions (1 injury and 9 PDO):
      - 5 run-off-road collisions (2 hit poles, 2 hit ditches, and 1 hit a tree).
      - 2 collisions involved hitting animals.
      - 3 collisions were undetailed in the records
  - An average of one run-off-road collision per year along a 4-km stretch is not an alarming rate. While fixed objects close to the pavement edge do represent a potential risk factor, the collision history does not suggest a high frequency of incidents attributable to them.

Case Study 7: Mud St E @ Second Rd E

Study Area

Figure D 7 shows the location of the unsignalized intersection of Mud Street East and Second Road East. It is an all-way stop-controlled intersection. Both roads have two lanes, one in each direction. The posted speed limit is 70 km/h on Mud Street East and 60 km/h on Second Road East. The AADTs are 3,100 on Mud Street and 1,817 Second Road East. There are no turning lanes at the intersection.

In terms of land use, there are a few residential properties near the intersection that are spread out and a religious building located at the southeast corner. There are two developments near the intersections, one residential property located at the northwest corner and a religious building located at the southeast corner, with driveways situated approximately 40 meters and 50 meters from the stop line, respectively.



Figure D 7: Mud St E @ Second Rd E

Collision History

Assessing Google Street View imagery, it is observed that a change in the intersection configuration occurred between June 2019 (image shows a two-way stop with Mud Street serving as the major road) and March 2021 (all-way stop configuration). Therefore, the collision history for the intersection will consider the period from January 1, 2021, to December 31, 2023, to account exclusively for the new configuration.

The intersection experienced 7 collisions in the period between 2021 and 2023, all of which were PDO collisions. Overall key findings are as follows:

- One collision occurred in 2021, and three collisions occurred in each of the years 2022 and 2023
- Angle represented the most frequent type of collision, with 5 reported cases (71%).:
  - Additionally, one turning movement collision occurred
  - The angle and turning movement collisions were distributed across the intersection approaches, with no clear pattern observed
  - Two of the angle collisions were associated with the driver action "Failed to yield right-of-way"

- No collisions involved pedestrians or cyclists
- No collisions were linked to driver actions related to speeding
- No collisions involved hitting wild animals

Speed Characteristics

Table D 13 presents the average and 85th percentile speeds at the intersection approaches. Speed data were collected over a 300-meter segment defined as follows: a) the segment begins 200 meters upstream from the intersection centroid, and b) ends 500 meters from the centroid. This setup captures vehicle speeds as drivers approach the intersection.

On Mud Street, which carries higher vehicular volumes, the average speeds are close to the posted speed limit of 70 km/h, and the 85th percentile speeds are slightly above the limit.

On Second Road Street, the 85th percentile speeds in both directions exceed the threshold of 75 km/h, representing the posted speed limit of 60 km/h plus 20 km/h. However, the sample sizes for this road are small (10 and 17 observations), so these results should be interpreted with caution. Between 2019 and 2023, no collisions at this intersection were attributed to driver actions related to speeding.

Table D 13: Case Study 7 – Summary of Speed

Direction	Speed limit (km/h)	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Mud Street Eastbound	70	58	70	76
Mud Street Westbound	70	49	68	73
Second Road Street Northbound	60	17	69	80
Second Road Street Southbound	60	10	70	90

Field Investigation

Table D 14 summarizes the field investigation findings for Case Study 7. The investigation focuses on the approaches to the intersection. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 14: Case Study 7 – Field Investigation Findings

Signage
Regulatory Signs



Existing regulatory signs:

- Stop signs (Ra-1) are present at all approaches, with signs installed on both sides of the road and accompanied by tiger tails at each of the four approaches (see Image 1).
- Truck Route Sign (Rb-61).
- Maximum Speed Signs (Rb-1) with speed of 70 km/h on Mud Street and with speed of 60 km/h on Second Road Street.
- All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.

Warning Signs



Existing warning signs:

- Stop Ahead Sign (Wb-101) installed at all approaches.
- All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All warning signs are visible.

Roadway Geometrics

Intersection Sight Distances



- Vegetation in the northeast corner is partially obstructing sightlines. Trimming it would improve visibility (image 1).
- No sightlines issues were observed at the other corners.

Pavement Conditions





- The road surface is deteriorated at the intersection and its approaches (see Images 1 and 2).

In summary, aside from the sightline issues caused by vegetation in the northeast corner – which is a relatively minor concern given that all vehicles are required to stop at the intersection – and the deteriorated pavement surface, no major issues were identified during the field investigation. Stop Ahead Signs are present at all approaches, and the Stop Signs are clearly visible, being installed on both sides of the road at each approach and equipped with tiger tails.

However, the speed analysis revealed that the northbound and southbound approaches exceeded the threshold for identifying speeding issues, with 85th percentile speeds of 80 km/h and 90 km/h, respectively (speed limit = 60 km/h). Note that these statistics are based on limited observations (17 and 10, respectively):

- Between 2021 and 2023, seven collisions occurred at the intersection.
  - One collision was reported in each direction, while three collisions had no direction identified.
  - The collision on the north approach involved a driver action of "Failed to yield right-of-way."
  - This collision may be related to the speeding issues observed on the north approach.

Case Study 8: Centre Rd @ Concession 8 E

Study Area

Figure D 8 shows the location of the unsignalized intersection of Centre Road and Concession 8 East. It is a two-way stop-controlled intersection, with Centre Road functioning as the major road. Both roads have two lanes, one in each direction. The posted speed limit is 70 km/h on Centre Road and 60 km/h on Concession 8 East. The AADTs are 4,479 for the major road and 1,351 for the minor road. All corners of the intersection are protected by guardrails, except the southeast corner. There are no exclusively turning lanes or right-turn tapes at the intersection.

The only nearby development is a single-family residence located in the northwest corner. Its driveway is situated approximately 40 meters from the stop line.

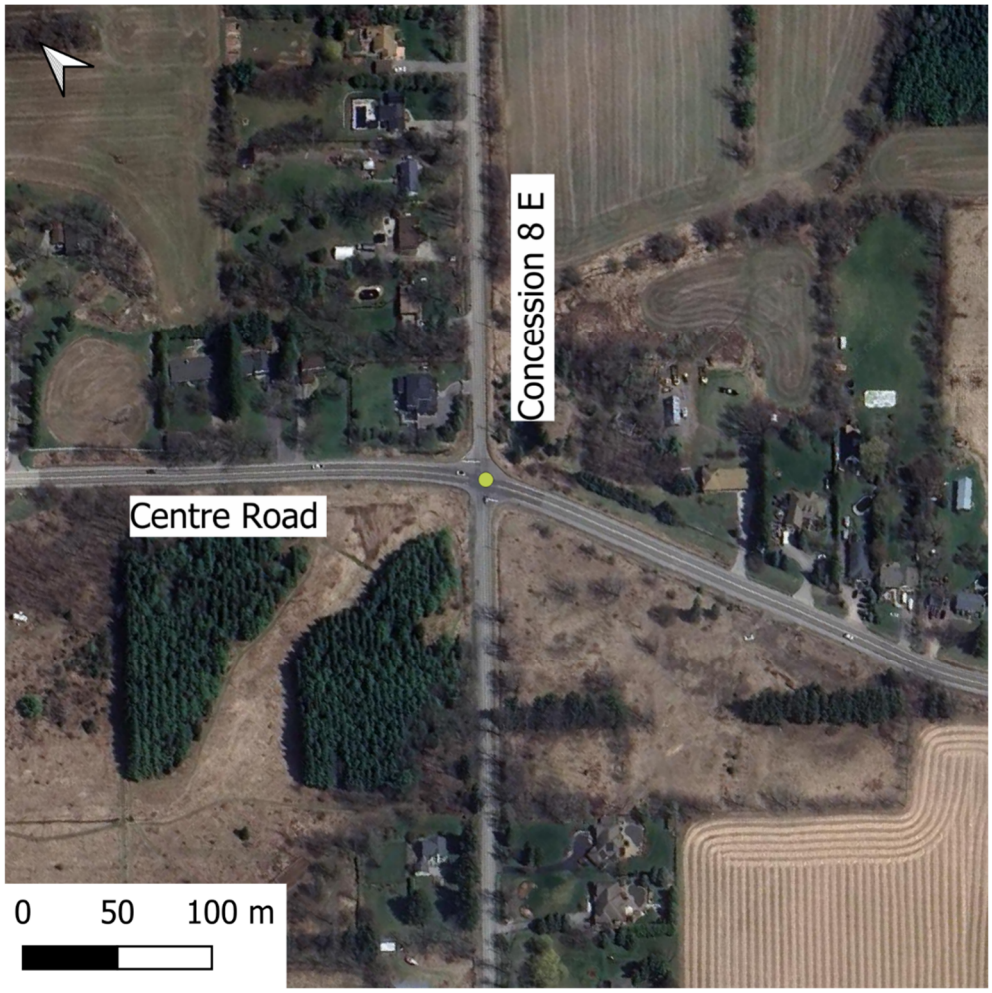


Figure D 8: Centre Rd @ Concession 8 E

Collision History

The intersection experienced 22 collisions January 1, 2014, to December 31, 2023. Of these, 8 resulted in injuries, and 14 were PDO collisions. Overall key findings are as follows:

- The collisions are relatively spread throughout the study period, with yearly frequencies ranging from 0 (2020) to 4 (2016 and 2023)
  - In 2022 and 2023, there were 3 and 4 collisions, respectively
- Angle represented the most frequent type of collision:
  - 16 collisions (73%): 8 injury and 8 PDO
    - All injury collisions at the intersection were angle collisions
    - Of the angle collisions, 11 collisions involved vehicles travelling in the eastbound direction and 5 in the westbound direction
      - The field investigation will place particular focus on the eastbound direction

  - Out of the 16 collisions, 5 were related to "failed to yield right-of-way" and 3 to "disobeyed traffic control"
- The other types of collisions that occurred at the intersection are rear end (4 collisions) and "other" (2 collisions)
- No collisions involved pedestrians or cyclists
- No collisions were linked to driver actions related to speeding
- No collisions involved hitting wild animals
- 3 collisions (14%) occurred on wet, icy, or snowy road conditions

Speed Characteristics

Table D 15 presents the average and 85th percentile speeds at the intersection. For the stop-controlled approaches (Concession 8 East), speed data were collected over a 300-meter segment defined as follows: a) beginning 200 meters upstream from the intersection centroid, and b) ending 500 meters from the centroid. This setup captures vehicle speeds as drivers approach the intersection. For the uncontrolled approach (Center Road), vehicle speeds were assessed within a 200-meter buffer radius from upstream and downstream of center of the intersection.

On Center Road, the uncontrolled road, the speed limit is 70 km/h. The average speed (75 km/h) is slightly above the posted limit, and the 85th percentile speed reaches 84 km/h. These values suggest that vehicles on Center Road tend to cross the intersection at relatively high speeds, but below the threshold of 15 km/h above the posted limit

On the stop-controlled approaches (Concession 8), vehicles approaching from the eastbound direction travel at higher speeds, with an average of 70 km/h and an 85th percentile of 79 km/h – despite the posted speed limit of 60 km/h on Concession 8 East. According to the collision history, most of the reported collisions at the intersection involved vehicles traveling in the eastbound direction.

Table D 15: Case Study 8 – Summary of Speed

Direction	Speed limit (km/h)	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Center Road 200 meters upstream and downstream the intersection	70	78	75	84
Concession 8 Eastbound (200-500m section)	60	17	70	79
Concession 8 Westbound (200-500m section)	60	23	65	71

Field Investigation

Table D 16 summarizes the field investigation findings for Case Study 8. The investigation focuses on the approaches to the intersection. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 16: Case Study 8 – Field Investigation Findings

Signage	
Regulatory Signs	
	Existing regulatory signs: • Stop signs (Ra-1) installed on both sides of the road and accompanied by tiger tails and flashing beacons at the two stop-controlled approaches (see Image 1). • Truck Route Sign (Rb-61). • Maximum Speed Signs (Rb-1) with speed of 70 km/h on Center Road and with speed of 60 km/h on Concession 8 East Road. • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.
Warning Signs	
	Existing warning signs: • Stop Ahead Sign (Wb-101) installed at both stop-controlled approaches. • Object Marker Signs (Wa-33R) at guide rails in the westbound approach. • All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All warning signs are visible.
Roadway Geometrics	
Intersection Sight Distances	

	■ Although the intersection is located along a curvilinear section of Center Road (Image 1), no sightline issues were observed at either approach on Concession 8 East.

In summary, the following main issues were identified in the study area:

- Speeds in the eastbound direction did not exceed the threshold for identifying speeding issues but are close to it (85th percentile = 79 km/h; speed limit = 60 km/h).
  - Between 2019 and 2023, 10 collisions occurred at the intersection. The travel directions of the vehicles at fault are presented below:
    - East direction = 4 collisions.
    - West direction = 2 collisions.
    - North direction = 1 collision.
    - Direction not identified = 3 collisions.
  - Of the four collisions in the east direction, one involved a “Disobeyed traffic control” driver action. The remaining three did not have driver actions identified.
  - These collisions may be related to the speeding issues observed on the east approach.
  - As a reminder, sightlines at the intersection are clear; Stop Ahead signs are present, and Stop signs are clearly visible, installed on both sides of the road at each approach and equipped with tiger tails and flashing beacons, which already serve as countermeasures to the high speeds observed.

Case Study 9: Upper James St @ White Church Rd W

Study Area

Figure D 9 shows the location of the signalized intersection at Upper James Street and White Church Road West. Upper James Street is a four-lane road with two lanes in each direction and a raised median island separating the traffic near the intersection. White Church Road West is a two-lane road with one lane in each direction. The posted speed limits are 80 km/h on Upper James Street and 60 km/h on White Church Road West. The AADTs are 17,049 for Upper James Street and 4,749 for White Church Road West. Both approaches on Upper James Street include dedicated left- and right-turn lanes, while no turning lanes are present on White Church Road West. Standard pedestrian crosswalks are provided on all sides of the intersection.

In terms of land use, there are some residential properties located near the intersection, with the closest driveway being situated approximately 30 meters from the White Church Road West stop line.



Figure D 9: Upper James St @ White Church Rd W

Collision History

The intersection experienced 30 collisions January 1, 2014, to December 31, 2023. Of these, 11 resulted in injuries, and 19 were PDO collisions. Overall key findings are as follows:

- The collisions are relatively spread across the years, with a decreasing trend observed in more recent years:
  - 2014 to 2019: average of 3.5 collisions per year
  - 2021 to 2023: average of 2.3 collisions per year
- Rear end represented the most frequent type of collision:
  - 10 collisions (33%): 2 injury and 8 PDO
  - Rear-end collisions were relatively evenly distributed across approaches, with 2 or 3 occurring at each approach
- The other most frequent types of collisions at the intersection were angle and turning movement collisions
  - Angle: 7 collisions (23%): 4 injury and 3 PDO
  - Turning Movement: 7 collisions (23%) 4 injury and 3 PDO
  - Combined, these collisions were also evenly distributed across all approaches
- 1 collision involved a pedestrian, and no collisions involved cyclists
- No collisions were linked to driver actions related to speeding
- No collisions involved hitting wild animals

Speed Characteristics

Table D 17 presents the average and 85th percentile speeds at the intersection. For all approaches, speed data were collected over a 300-meter segment defined as follows: a) beginning 200 meters upstream from the intersection centroid, and b) ending 500 meters from the centroid. This setup captures vehicle speeds as drivers approach the intersection. Considering a) the presence of other signalized intersections near the studied intersection, b) the existence of queues generated by the traffic signals, and c) the objective of identifying speeding issues at the intersection, only observations with speeds of 50 km/h or greater were considered.

As expected, due to the higher speed limit and the two-lane-per-direction configuration, speeds on Upper James Street are higher than on White Church Road. Southbound speeds are higher than northbound speeds, likely due to the presence of a traffic signal approximately 400 meters south of the study intersection. All 85th percentile speeds fall within the speed limit threshold and are not identified as having speeding issues.

Table D 17: Case Study 9 – Summary of Speed

Direction	Speed limit (km/h)	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Upper James Street Northbound (200-500m section)	80	68	74	85
Upper James Street Southbound (200-500m section)	80	52	82	93
White Church Road Eastbound (200-500m section)	60	103	65	72
White Church Road Westbound (200-500m section)	60	59	67	73

Field Investigation

Table D 18 summarizes the field investigation findings for Case Study 9. The investigation focuses on the approaches to the intersection. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 18: Case Study 9 – Field Investigation Findings

Signage	
Regulatory Signs	
	Existing regulatory signs: • Maximum Speed Signs (Rb-1) with speed of 60 km/h on White Church Road and with speed of 80 km/h on Upper James Street. • No Stopping Signs (Rb-55) on Upper James Street. • Keep Right Sign (Rb-25R) along with Warning Object Marker Signs (Wa-33L) are installed in the medians on Upper James Street (Image 1). • Truck Route Sign (Rb-61). • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.
Warning Signs	





Existing warning signs:

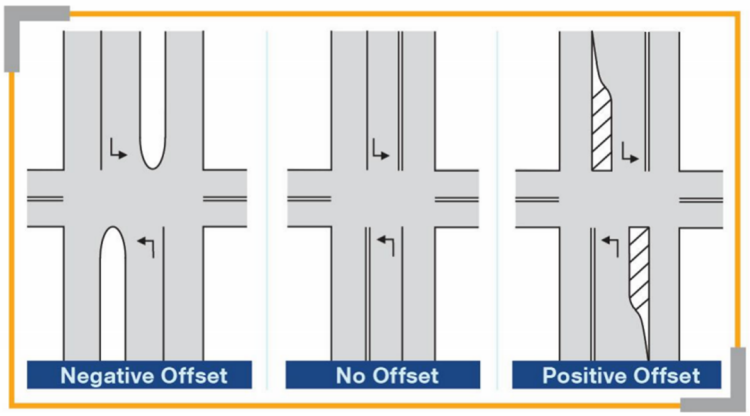
- Traffic Signal Ahead signs (Wb-2) are installed on all approaches. However, given the 80 km/h speed limit on Upper James Street, oversize Traffic Signal Ahead signs (Wb-102) should have been used instead of the standard size.
- Image 1 shows an oversize sign adequately installed on the northbound approach of Upper James Street, before the signal located upstream of the study intersection. Image 2 shows the standard-size sign used for the study intersection.
- Object Marker Signs (Wa-33L) are installed in the medians on Upper James Street (See Image 1 from Regulatory Signs).

Roadway Geometrics

Visibility: Left-Turn Offset



- Image 1 shows the northbound driver's view when making a left turn onto White Church Road. The left-turn lane has a negative to zero offset in comparison to the left-turn lane in the opposite direction (see Image 2 for reference), which may reduce the visibility of oncoming vehicles when opposing drivers are also attempting left turns.
- The left-turn movement from the southbound has a similar configuration to the one shown in Image 1.
- Upper James Street operates with permissive-only left-turn phasing.
- White Church Road has one travel lane in each direction; as a result, left-turning vehicles will always block the view of oncoming traffic.



Source: Nevada Strategic Highway Safety Plan

Traffic Signals



- The traffic signal heads follow the Highway Type described in OTM Book 12: 300 mm diameter lenses for red indication, and 200 mm lenses for yellow and green indications (Image 1).
- Some difficulty was experienced in seeing the signal lenses when travelling westbound.

Additional Observations



- Deteriorated pavement conditions were observed on the White Church Road approaches (Image 1).



- While crosswalks and pedestrian signal heads are provided at the intersection, there are no sidewalks or other pedestrian facilities along either Upper James Street or White Church Road (Image 1).

In summary, the following main issue was identified in the signalized intersection:

- Limited visibility for left turns on Upper James Street due to a negative to no offset configuration, which may reduce the visibility of oncoming vehicles when opposing drivers are also attempting left turns:
  - Signal operates with permissive-only left-turn phasing
  - Between 2019 and 2023, two turning movement collisions were reported at the intersection, all in 2023:
    - Vehicle direction was not identified in either collision

Case Study 10: Regional 56 Rd @ Rymal Rd E

Study Area

Figure D 10 shows the location of the signalized intersection at Regional Road 56 and Rymal Road East. Both roads have four lanes – two in each direction – with a raised median separating opposing traffic near the intersection. The posted speed limit is 60 km/h on both roads, and the AADT is approximately 14,500 for each. Right-turn and left-turn lanes are present at all approaches. Note that the westbound right-turn channel shown in **Figure D 10** no longer exists. The intersection also features zebra-marked pedestrian crosswalks on all sides. Additionally, there is a curve on the northbound approach upstream of the intersection that is not illustrated in **Figure D 10**.

There are two signalized intersections located near the study intersection: one approximately 300 meters to the north and another about 400 meters to the west.

There primary land use surrounding the intersection is commercial, with large plazas and commercial stores. The intersection is in a boundary area between urban and rural environments.

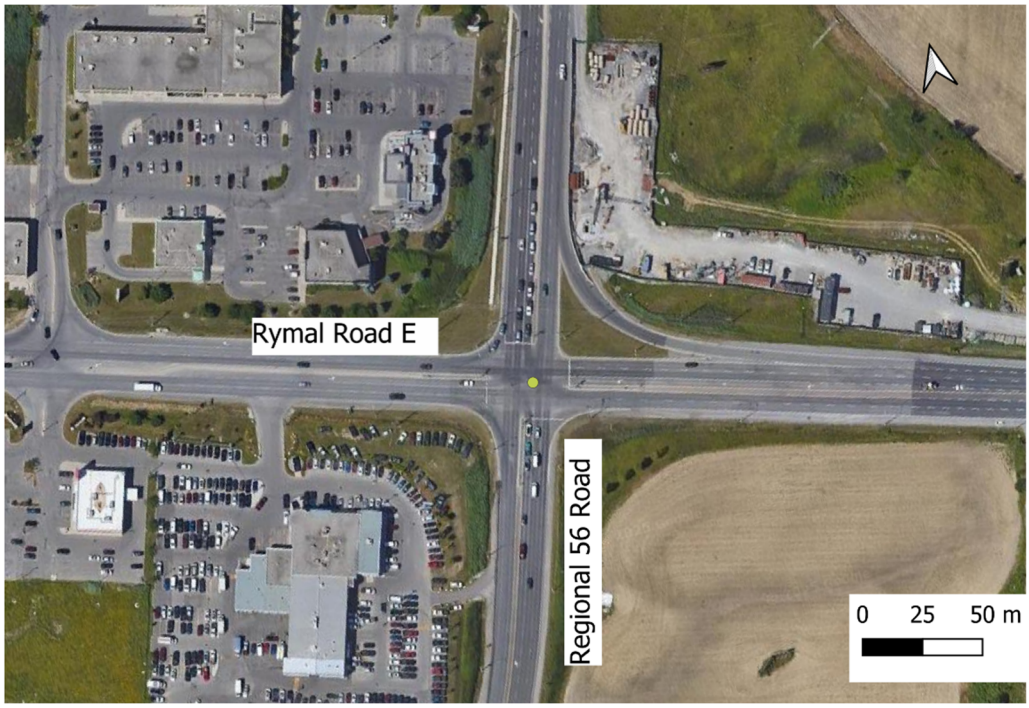


Figure D 10: Centre Rd @ Concession 8 E

Collision History

The intersection experienced 160 collisions January 1, 2014, to December 31, 2023. Of these, 33 resulted in injuries, and 127 were PDO collisions. Overall key findings are as follows:

- The collisions are relatively spread across the years, with a decreasing trend observed in more recent years:
  - 2014 to 2019: average of 17.3 collisions per year
  - 2021 to 2023: average of 13.0 collisions per year
- Rear end represented the most frequent type of collision:
  - 85 collisions (53%): 8 injury and 77 PDO
    - By approach: 26 occurred in the southbound direction, 21 in the northbound, 18 in the eastbound, and 14 in the westbound. The direction was not identified for 6 collisions
    - A similar distribution was observed when considering only recent years (2019–2023), with higher frequencies in the southbound and northbound directions

- The second most frequent type of collision that occurred at the intersection was tuning movement:
  - 38 collisions (24%): 17 injury and 21 PDO
    - Of the turning movement collisions, 31 involved vehicles turning left, 2 involved vehicles turning right, and 5 had no direction or turning movement identified
    - By approach: the southbound direction accounted for the highest number of turning movement collisions, with 16 over the 10-year period. The northbound approach recorded 8, the eastbound 5, and the westbound 4.
- Due to the concentration of collisions, especially in the southbound direction, the field investigation will place special attention to the southbound and northbound approaches.
- 1 collision involved pedestrians, and no collisions involved cyclists
- 2 collisions were linked to driver actions related to speeding
- No collisions involved hitting wild animals
- 4 (2.5%) collisions were related to impaired drivers
- Only 16 collisions (10%) occurred on wet, icy, slush or snowy road conditions

Speed Characteristics

Table D 19 presents the average and 85th percentile speeds at the intersection. For all approaches, speed data were collected over a 300-meter segment defined as follows: a) beginning 200 meters upstream from the intersection centroid, and b) ending 500 meters from the centroid. This setup captures vehicle speeds as drivers approach the intersection. Considering a) the presence of other signalized intersections near the studied intersection, b) the existence of queues generated by the traffic signals, and c) the objective of identifying speeding issues at the intersection, only observations with speeds of 50 km/h or greater were considered.

The southbound and eastbound directions exhibited lower speeds compared to the northbound and westbound directions. This is likely related to the presence of upstream traffic signals on the southbound and eastbound approaches.

The northbound approach is on a curvilinear segment, and although the 85th percentile speed of 76 km/h does not exceed the threshold of 80 km/h (posted speed limit of 60 km/h plus 20 km/h), it will still be considered for further assessment.

Although the southbound approach accounted for the highest percentage of collisions, the speeds recorded in that direction are not critical (average = 63 km/h; 85th percentile = 71 km/h).

Table D 19: Case Study 10 – Summary of Speed

Direction	Speed limit (km/h)	Number of observations	Average speed (km/h)	85th percentile speed (km/h)
Regional 56 Road Northbound (200-500m section)	60	96	69	76
Regional 56 Road Southbound (200-500m section)	60	118	63	71
Rymal Road Eastbound (200-500m section)	60	57	60	65
Rymal Road Westbound (200-500m section)	60	178	67	74

Field Investigation

Table D 20 summarizes the field investigation findings for Case Study 10. The investigation focuses on the approaches to the intersection. Following the table, the main issues are outlined and discussed in relation to the frequency of collisions observed in the study area.

Table D 20: Case Study 10 – Field Investigation Findings

Signage	
Regulatory Signs	
	Existing regulatory signs: • Keep Right Sign (Rb-25R) along with Warning Object Marker Signs (Wa-33L) are installed in the medians at all approaches (Image 1). • Truck Route Sign (Rb-61). • Maximum Speed Signs (Rb-1) with speed of 60 km/h. • No Stopping Signs (Rb-55). • Right-Turn Only Sign (Rb-42) installed in the right-turn lanes. • All signs are installed consistently throughout the study corridor meeting the OTM Book 5 requirements. All regulatory signs are visible.
Warning Signs	



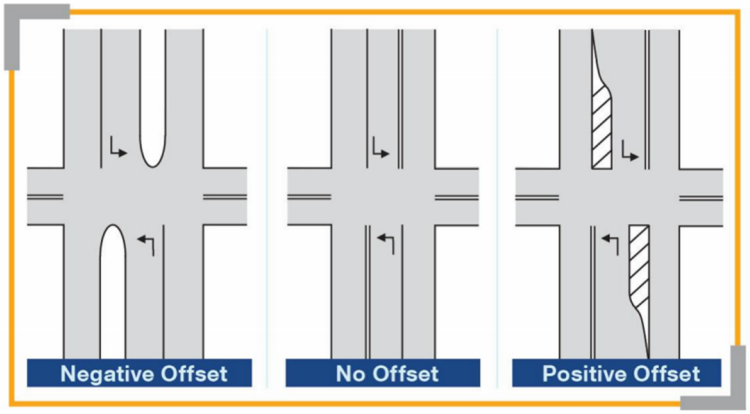
Existing warning signs:

- Traffic Signal Ahead Signs (Wb-2) installed in the westbound and southbound approaches. The northbound approach is in a curvilinear section (Image 1), and no Traffic Signal Ahead Sign is provided.
- Object Marker Signs (Wa-33L) are installed in the medians at all approaches (See Image 1 from Regulatory Signs).
- Object Marked Signs (Wa-33R) are installed in the sidewalk curb at some locations.
- All signs are installed consistently throughout the study corridor meeting the OTM Book 6 requirements. All warning signs are visible.

Roadway Geometrics

Visibility: Left-Turn Offset





- Image 1 shows the northbound driver's view when making a left turn onto Rymal Road. The left-turn lane has a negative to zero offset in comparison to the left-turn lane in the opposite direction (see Image 2 for reference), which may reduce the visibility of oncoming vehicles when opposing drivers are also attempting left turns.
- The other left-turn movements have a similar configuration to the one shown in Image 1.
- All approaches operate with permissive/protected left-turn phasing, which serves as a countermeasure for the limited visibility.

Source: Nevada Strategic Highway Safety Plan	
Traffic Signals	
	■ The traffic signals follow the Type 10 standard for signal heads described in OTM Book 12: 300 mm diameter lenses for red and left-turn indications, and 200 mm lenses for yellow and green indications (Image 1). ■ Some difficulty was experienced in seeing the signal lenses when travelling westbound.

In summary, the following issues were identified in the signalized intersection:

- In the northbound direction, the traffic signal is located just after a curve, and "Traffic Signal Ahead" sign is not provided.
  - This could increase the risk of collisions, particularly rear-end collisions, when queues form at the intersection. Drivers may not anticipate stopped traffic due to the limited visibility, increasing the likelihood of rear-end collisions.
  - Between 2019 and 2023, 31 rear end collisions were recorded at the intersection:
    - Northbound and southbound: 8 collisions each.
    - Westbound: 6 collisions.
    - Eastbound: 5 collisions.
    - Direction not identified: 4 collisions.
- Limited visibility for left turns due to a negative to no offset configuration, which may reduce the visibility of oncoming vehicles when opposing drivers are also attempting left turns:
  - Between 2019 and 2023, 18 turning movement collisions were reported at the intersection:
    - Of these, vehicle direction was identified in 13 cases: all involving a vehicle turning left and colliding with a vehicle either going through or turning right.
      - Out of those 13, 9 occurred along the north/southbound approaches, while only 4 were along the east/westbound.
- Limited visibility of the yellow and green traffic signal lenses (200mm) in the westbound approach:
  - We experienced some difficulty seeing the lenses when approaching the intersection, which may increase the risk of rear end and angle collisions.

- Between 2019 and 2023, 39 rear end and angle collisions were reported at the intersection:
  - Of these, 6 collisions (15%) occurred in the westbound direction – all of which were rear end collisions; no angle collisions were recorded.