Ontario Road Safety Audit Guideline

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Report for Good Roads.

Foreword

This is the first edition of a technical guidance document for road safety audits (RSA) on municipal roads in Ontario. While RSA may have been used on an ad hoc basis up to now, it has never existed as a formal process. These guidelines establish such a process.

In preparing this Guide, the authors would like to acknowledge the team at Good Roads, without whose commitment, vision and passion for road safety these guidelines would not exist. The authors would also like to acknowledge Austroads, from whose guidelines this document has drawn heavily and reflects world's best practice in the conduct and ongoing development of road safety audit as both a practice and a profession.

Good Roads wants to thank everyone at Safe System Solutions in Melbourne, Australia, but especially Kenn Beer, Kathy Doukouris, Chris Hall and Max McCardel. Their willingness to work with a small Association tucked away in the opposite corner of the world was an act of generosity that will transform the fortunes of Ontario municipalities by addressing many challenges that have vexed local governments for generations.

Good Roads must also thank Brian Anderson of Intact Public Entities, Ashley De Souza of Waste to Resource Ontario, Roberto Impero of SMA Road Safety, Ian Nokes of the Ontario Federation of Agriculture and Mark Wilson of the Going the Extra Mile for Safety Committee in Temiskaming Shores. Their patience, counsel, and feedback made a great project even better.

This initiative simply would not have been possible without the shared unparalleled professionalism and commitment of those listed above.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 What is a road safety audit?

A road safety audit is a formal examination of a future road or traffic project, or an existing road or road-related area, in which a team of appropriately qualified persons identifies deficiencies with the potential to cause crashes in the project.

The origins of road safety audit are in crash investigation, where road safety engineers would review crash data and visit crash locations to identify causal factors and design modifications to reduce the likelihood of those crashes occurring again. Some of those crashes occurred on recently built roads, which was concerning as they were thought to be inherently safe because they had been designed to modern (for the time) standards. Those engineers soon began identifying factors common to multiple crash locations, so the logical next step was to review the designs before they were built to see if the same mistakes were being made. This allowed those mistakes to be corrected before the road was built.

Therefore, in its most traditional form, a road safety audit is an examination of a proposed road design to identify road safety deficiencies so that they can be eliminated or mitigated before they are built. In this way, a road safety audit is a proactive process which attempts to prevent crashes from occurring, as opposed to a crash investigation and some other road safety engineering activities which are reactive processes and attempt to correct existing problems so that further crashes are less likely.

A road safety audit is not simply a compliance check against design standards or other technical guidance. Strict adherence to design standards does not guarantee safety since standards are not always written with safety as a primary objective.

NB: *the terms road safety audit, audit and RSA are used interchangeably throughout this Guide. Similarly, the terms road safety auditor and auditor are used interchangeably to mean the persons carrying out the audit.*

1.2 Road safety audits in Ontario

The responsibility for road safety in Ontario is shared by all three levels of government. The federal government oversees vehicle safety, Ontario is responsible for providing the legislation and regulatory framework that governs roads in the province and Ontario municipalities are the stewards of more 305,000 lane kilometers of roads and more than 30,000 bridges and culverts.

At the federal level, the Canadian Council of Motor Transportation Administrators (CCMTA) acts as the custodian of the Road Safety Strategy 2025 (RSS 2025). RSS 2025 encourages all road safety stakeholders to make Canada's roads the safest in the world. RSS 2025 is built on a "safe systems approach". To date, four provinces and one territory – British Columbia, Alberta, Manitoba, Prince Edward Island and the Northwest Territories – have adopted comprehensive road safety strategies modelled on the safe system approach outlined in the RSS 2025.

While Ontario has not yet established a comprehensive road safety strategy, some Ontario municipalities have adopted Vision Zero strategies.

The *2019 Ontario Road Safety Annual Report*[1] , published by the Ontario Ministry of Transportation, reported that 584 people were killed in collisions on Ontario roads that year. A further 47,023 people were injured. The fatality rate per 100 million vehicle kilometers travelled in Ontario has seen a trend of incremental increases in the number of fatalities since 2014.

These collisions impose multiple costs on municipalities and the province. There is the cost of repairing damaged public

[1] *Ontario Road Safety Annual Report 2019. Ministry of Transportation, p. 36. The 2019 Report was the latest version released by the Ministry. The Ministry collects data from several sources, including police services, other ministries, and the Office of the Chief Coroner of Ontario. Although Ontario's roads consistently rank among the safest in North America, on average one person is killed on Ontario's roads every 15 hours.*

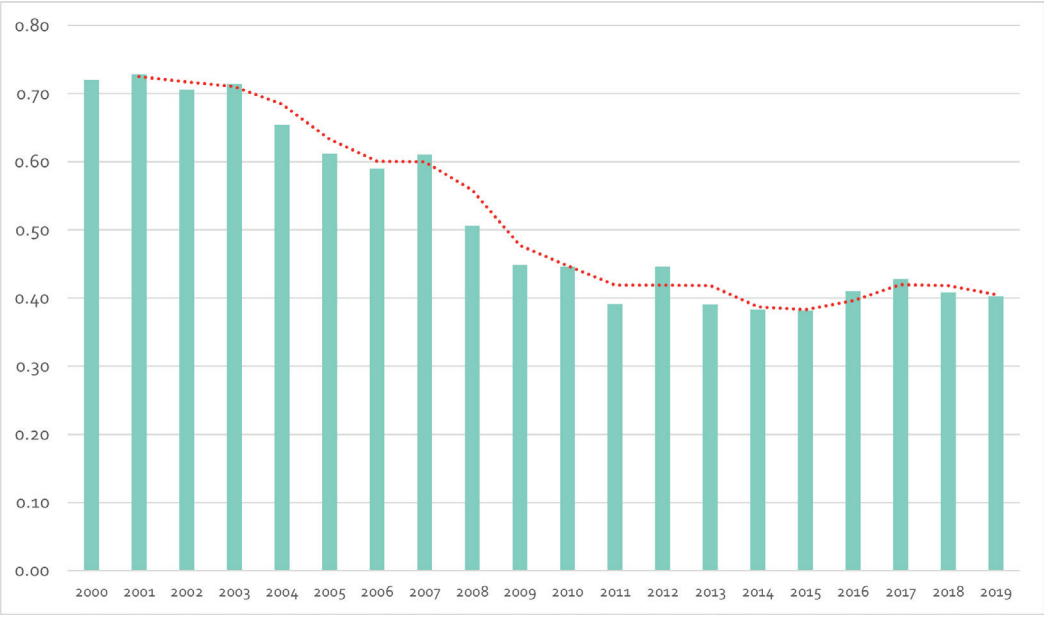

Figure 1 Fatality Rate per 100 Million Vehicle Kilometers Travelled in Ontario, 2000-2019

infrastructure. There are significant costs to the public health care system. More specifically for municipal road authorities, there are the costs associated with managing the risk that these collisions represent. Under Ontario law, municipalities must contend with the adverse outcomes associated with joint and several liability, which is a component of tort law that allows a plaintiff to recover the entire claim for damages from one of several negligent defendants. This is established in the Ontario Negligence Act. Thus, when someone is harmed through the fault or neglect of several parties, the individual can collect his/her damage award from one or all of the parties.[2] The perception that municipalities are 'deep-pocket defendants' means that every collision that happens on a municipal road could be financially perilous for the municipality.

It is imperative that every effort is made to eliminate collisions. Road Safety Audited is an established process that has proven itself to do this in every jurisdiction where is has been deployed.

Good Roads is committed to building Road Safety Audit capabilities and capacity in Ontario. To do this, Good Roads is bringing training to municipalities, establishing an accreditation process, and creating Ontario's first registry of Road Safety Auditors.

[2] Practically, joint and several liability means that if one of the parties is 50% responsible for the loss, (meaning his several liability is 50%) but is unable to pay the damages, the individual can collect the entire loss from the remaining parties, who are "jointly" liable to the plaintiff for the loss. In the case of Safranyos et al v City of Hamilton, the plaintiff was leaving a drive-in movie theatre with four children in her vehicle at approximately 1 AM. She approached a stop sign with the intention of turning right onto a highway. Although she saw oncoming headlights she entered the intersection where she was struck by a vehicle driven 15 km/h over the posted speed limit by a man who had just left a party and was determined by toxicologists to be impaired. The children in the plaintiff's vehicle suffered significant injuries. The City was determined to be 25% liable because a stop line had not been painted on the road at the intersection.

1.3 Objectives of this Guide

The objectives of this Guide are to:

- Establish RSA as a formal process in Ontario;
- Set out a process for conducting RSAs in Ontario that is based on world's best practice; and
- Set out the qualifications, experience and training requirements for those conducting RSAs.

1.4 Applicability of this Guide

This Guide applies to works on municipal roads in Ontario.

1.5 Who should use this Guide and how should it be used?

This Guide is primarily intended for those undertaking and commissioning road safety audits in Ontario.

For those conducting audits, the Guide sets out the process including the terminology and tasks involved. Although it provides guidance on good practice, it is not intended to be a 'how to' manual, as the competencies required to conduct audits successfully cannot be gained through reading alone. The Guide therefore also provides details on the qualifications, experience, and training requirements to gain the required competencies.

For those commissioning audits, the Guide describes why RSAs are important and the benefits they bring to the road design, construction, and road safety engineering industries. The Guide explains how to select an audit team, when interactions with the audit team should occur and how to respond appropriately to audit findings.

Commissioning organizations are typically road authorities, but they do not have to be only those involved in the development of projects. Road safety audits span the development, delivery, operation, and maintenance phases of a project/road, so anyone working in those fields may have the need to commission an RSA at some stage in their careers.

1.6 Why are RSAs needed?

As discussed later in this Guide, designing to standards does not guarantee that a road is safe. A separate process with the sole purpose of identifying safety hazards on a road or road project, ideally before it is built, is therefore vital and provides the best opportunity for maximizing road safety.

Regularly conducting road safety audits helps to embed road safety in the design process and normalize it as a design input, rather than a byproduct of following design guidelines. First, it catches safety deficiencies before they are built, but it also raises the awareness of road safety in the minds of designers and others in the roads industry. Road safety is the responsibility of everyone involved in the design, construction, maintenance, and operation of roads, not just road safety practitioners, so making these parties aware of their obligations is inherently a good thing.

1.7 When is an RSA conducted?

RSAs should be conducted as early as possible in the design process. The opportunity to make large changes to the project diminishes as the design progresses, so auditing a design early in the process provides the opportunity to catch deficiencies before it is too late to correct them. That is not to say that late-stage design audits and existing conditions audits are not beneficial.

Existing conditions audits are typically done in response to emerging issues or concerns raised by members of the public. They can also be done in a proactive manner by jurisdictions looking to understand and reduce the risk on their road network.

1.8 Benefits of RSAs

The most significant benefits of conducting RSAs can be summarized as follows:

- Reducing risk exposure for road users;
- The likelihood of crash occurrence can be reduced;
- The severity of crashes can be reduced;
- Road safety is given greater prominence in the minds of clients and their project managers, road funders, planners, designers, and those involved in construction and network operation and maintenance;
- Identify existing legacy deficiencies with existing roads and corridors;
- The need for costly remedial work (i.e., re-design and/or post-opening reactive measures) can be avoided, with associated reductions in trauma, disruption, and the total cost of a project to the community;
- A reduction in the likelihood of road users being exposed to undue risk; and
- A reduced likelihood that the location being audited will be deemed 'blackspot'[3] because of a crash history.

Across the world there have been several independent evaluations of the effectiveness of RSA programs – all of which show clear and tangible results. In 2012, the Federal Highways Administration (USA) published Road Safety Audits: And Evaluation of RSA Programs and Projects. The document summarized some of the results of the quantitative evaluations, which is re-produced as Table 1.

Location/Project	Result
Bullhead Parkway *Bullhead City, Arizona*	- 54% reduction in total crashes - 50% reduction in fatal/incapacitating injury crashes - 30% reduction in intersection-related crashes - B/C ratio of 20:1 (total crashes)
State Route 101 (Peavine Road) *Cumberland County, Tennessee*	- 14% reduction in total crashes - 31% reduction in injury crashes - B/C ratio of 51:1 (total crashes)
Intersection of Collier Boulevard and Golden Gate Parkway *Collier County, Florida*	- 11% reduction in total crashes (two intersections) - B/C ratio of 5:1 (total crashes)
Immokalee Road *Collier County, Florida*	- 11% reduction in total crashes
Ninth Street *Ocean City, New Jersey*	- 26% reduction in total crashes - B/C ratio of 1.2:1 (total crashes)

Table 1 – Effectiveness of RSAs on a sample of projects in the USA
Source: FHWA report: FHWA-SA-12-037

[3] The term "Blackspot" is not yet widely used in Ontario. Blackspots are also known as 'hazardous road locations', 'high-risk locations', 'accident-prone locations', 'hotspots', 'sites with promise', and 'prioritize investigation locations'. From the perspective of traffic engineering, blackspots are defined as locations where road conditions, traffic conditions, climate and/or environment make traffic accidents more prominent over a one- to three-year period. For more on Blackspots refer to Hongjun, C et al, "Identifying accident black spots based on the accident spacing distribution", Journal of Traffic and Transportation Engineering, Volume 9, Issue 6, December 2022 pp. 1017-1026.

1.9 Prevention is better than cure

At its core, RSA is a proactive process designed to eliminate the cause of crashes before a project is built to prevent crashes occurring in the first place. When applied to existing roads, it can be used to identify hazards that, while already built, have not yet resulted in crashes, and provides the opportunity to correct them before crashes do occur. This is contrasted with crash investigation, which seeks to reactively develop remedial measures to reduce the likelihood of future crashes only after having analyzed the causes of crashes that have already occurred.

An RSA can make fundamental changes to a project, if done early enough, and therefore has a much greater chance of maximizing the safety of a facility. It recognizes that safety hazards may exist even though a road design complies with all design requirements. Crash investigations are rarely able to make changes of a type and scale that will minimize crash risk – the best that can usually be hoped for is a reduction in risk, and that reduction is often modest given the types of interventions that can be implemented on the existing road network.

2.0 The road safety audit process

2.1 Which projects or road environments should be audited?

RSAs are a relatively low-cost activity when compared to the cost of designing and constructing a road project or the cost of road trauma.

While there are a number of variables that determine the cost of an RSA, generally speaking, it is understood that the cost of performing an RSA decreases as a portion of overall costs as project get larger in size. In other words, the greater the total cost of the project, the lower the percentage RSAs will account for. The decision to perform an RSAs in-house versus engaging a consultant will also contribute to cost variances. Estimates are as follows:

Project Size $	# of RSAs During Project	% of Total Estimated Cost (TEC) of Project
Small (< $0.5 M)	1	1.0%
Medium ($0.5 M - $5M)	1 or 2	0.25% - 1.0%
Large ($5 M - $50 M)	3-5	0.1% - 0.25%
Very Large ($50 m)	5 or more	0.01% - 0.1%

It is good practice to carry out an RSA on all physical changes to the road network that are expected to impact on road user behavior and/or the outcome of a crash. This is Good Roads' ultimate aim. However, acknowledging that RSA is a new process in Ontario and there are few qualified auditors, it is recommended that RSA be applied selectively based on the following methods:

- If the project meets the standards set out in section 6(1) of the Regulation for Construction Projects, O. Reg. 213/91 (the Regulation)[4]; or
- One in every x projects; or
- Projects with a focus on specific road

"The carrying out of routine maintenance provides a good opportunity to have the safety of a facility assessed."

[4] The constructor must provide a Notice of Project to the Ministry of Labour, Training and Skills Development prior to starting projects that meet the standards set out in section 6(1) of the Regulation for Construction Projects, O. Reg 213/91. A Notice of Project is required if:

- *The project has a total cost of labour and materials expected to exceed $50,000 or $250,000 if the project is confined to a factory that manufactures or assembles automobiles;*
- *The work is the erection or structural alteration of a building more than two storeys or more than 7.5 metres high;*
- *The work is the demolition of a building at least 4 metres high with a floor area of at least 30 square metres;*
- *The work is the erection, structural alteration or structural repair of a bridge, an earth-retaining structure or a water-retaining structure more than 3 metres high or of a silo, chimney or a similar structure more than 7.5 metres high;*
- *Work in compressed air is to be done at the project;*
- *A tunnel, caisson, cofferdam or well into which a person may enter is to be constructed at the project;*
- *A trench into which a person may enter is to be excavated at the project and the trench is more than 300 metres long or more than 1.2 metres deep and over 30 metres long;*
- *The work is the construction, over frozen water, slush or wetlands, of an ice road for vehicles, machinery or equipment; or*
- *A part of the permanent or temporary work is required by this Regulation to be designed by a professional engineer.*

[5] Agricultural implements have unique considerations regarding road use. For instance, maintenance and rehabilitation projects can raise the road enough to undermine vertical clearance of overhead wires above roadway or where wires in the right of way cross an entrance or exit. If a road is raised too much, large farm equipment entering a field could risk contact with wires. Steep grading or narrow grading can lead to tractor rollovers. Similarly, bridges and underpasses may not be able to accommodate equipment without risking travel into oncoming lanes of traffic.

	Speed Limit km/h						
Average Daily # of motor vehicles	91 - 100	81 - 90	71 - 80	61 - 70	51 - 60	41 - 50	< 40
> 53,000	1	1	1	1	1	1	1
23,000 - 52,999	1	1	1	2	2	2	2
15,000 - 22,999	1	1	2	2	2	3	3
12,000 - 14,999	1	1	2	2	2	3	3
10,000 - 11,999	1	1	2	2	3	3	3
8,000 - 9,999	1	1	2	3	3	3	3
6,000 - 7,999	1	2	2	3	3	4	4
5,000 - 5,999	1	2	2	3	3	4	4
4,000 - 4,999	1	2	3	3	3	4	4
3,000 - 3,999	1	2	3	3	3	4	4
2,000 - 2,999	1	2	3	3	4	5	5
1,000 - 1,999	1	3	3	3	4	5	5
500 - 999	1	3	4	4	4	5	5
200 - 499	1	3	4	4	5	5	6
50 - 199	1	3	4	5	5	6	6
0-49	1	3					

user types, e.g., pedestrians, cyclists, agricultural equipment[5]; or
- Roads that are defined as Class 1, Class 2 or Class 3 within O. Reg. 239/02: Minimum Maintenance Standards for Municipal Highways.

RSA does not need to be conducted on works that involve the like-for-like replacement of road features, such as occurs with some maintenance activities. However, the carrying out of routine maintenance provides a good opportunity to have the safety of a facility assessed, and so may form a trigger for undertaking an audit.

2.2 At what stages of a road's life cycle should an audit be conducted?

There are several distinct stages at which RSAs are commonly conducted. These are described below.

Feasibility stage: Generally, a planning stage where the alignment of a road or general location of a facility are known, but very few other details exist. The inappropriate location of infrastructure can be very costly or impossible to rectify later, so this audit stage provides the only opportunity to make fundamental changes to major infrastructure features of a project.

Concept design stage: An early stage of design where basic details have been worked out. Design documentation would typically include lane configuration and signs and line marking details. It is still possible make significant changes to the design at this stage, but less so than at the feasibility stage.

Detailed design stage: A late stage of design where virtually all the details have been

finalized. The project is typically ready for tender at this stage. Design documentation would typically include lane configurations, cross-sections, long sections, intersection details, roadside environment, traffic signal phasing, street lighting, footpaths, drainage, signs and line marking, and so on. This is the last opportunity to identify and correct safety deficiencies before the road is built. There is less scope to make changes than at the concept design stage.

Pre-opening stage: After construction when the works are substantially complete, but before the facility has been opened to the public. This is the last opportunity to identify and correct safety deficiencies before road users are exposed to them. It is likely that only minor changes can be made at this stage unless they are critical issues that warrant a delayed opening. While audits at this stage should ideally occur before the road is opened, they often need to occur a short time after opening, ideally no more than three months. Such audits are known as post-opening audits.

Existing conditions: Distinct from a post-opening audit, this is an audit of a road already in service. These audits may be carried out on a rolling basis by a road authority seeking to understand the risk on its network. These RSAs may be undertaken in response to complaints from other professionals or the public. They may also be undertaken due to a spate of near misses. As with the pre-opening stage, changes are likely to be minor only unless critical safety deficiencies are identified.

The advantages and challenges associated with auditing at each stage are summarized in Table 2.

Audit stage	Advantages	Challenges
Feasibility	- Fundamental changes can usually still be made which maximizes safety potential - Large, costly mistakes can be identified and corrected - Large changes do not usually result in extensive design work being made redundant	- Audit teams rarely get asked to audit at this stage, as it is often perceived that auditing later design stages adds greater value - There is often little in the way of design documentation which can make it difficult to envisage the final product
Concept design	- Reasonably detailed design documentation is usually available - Usually the earliest design stage to be audited - While some design re-work will be needed, there is still scope to make large changes	- If the RSA policy only requires one audit for a particular project, this stage is commonly omitted in favour of detailed design audits
Detailed design	- Last opportunity to catch safety issues before the project is built - Audits generally cover all design elements and elements not designed at earlier stages (often perceived as providing better value for money) - Some features can only be seen at this stage (e.g. interaction between horizontal and vertical alignments) - Provides a 'second chance' to catch issues that may have been missed in earlier stages	- The amount of detail/ documentation generated on large projects can be overwhelming and difficult to audit properly - Similarly, audits can generate many findings which are a challenge to address adequately - Very little scope to make large changes - Design teams often resistant to change at this stage, particularly if 3D design has been done - Usually the only opportunity to examine features that were not designed in previous stages – no second chance
Pre/post-opening	- Last opportunity to catch safety issues before road users are exposed to them - Can be easier to spot issues once the infrastructure has been built than on a drawing - Deficiencies are often small and subtle, meaning auditors need to be experienced	- Often not allowed for in construction schedules, or delays in construction force them to take place at the last minute without adequate time - Often pressure on the audit team to turn around the audit quickly, or to provide verbal on-site advice, to meet the opening schedule (less of an issue in post-opening audits) - Contractors generally very resistant to making changes, especially if it would delay opening - Changes can generally only be minor
Existing conditions	- Can be easier to identify issues once the infrastructure has been built than on a drawing - Trainee auditors tend to take to existing conditions audits faster than design stage audits - Usually used to assess existing or known issues	- Changes can generally only be minor (unless dedicated funding programs exist) - Can be difficult to select effective treatments, especially if something novel is needed - Rarely done proactively - Can be used to help justify doing or not doing something

Table 2 – Advantages and challenges at each audit stage

A note on existing conditions audits

It is likely that many of the early audits in Ontario will be on existing roads, so it is worth expanding on some of the differences between existing conditions and design stage audits.

Some jurisdictions do not call audits of existing facilities audits at all, but safety inspections, safety reviews, safety diagnostics and so on. This is to differentiate them from design stage audits which are more proactive in nature. However, for simplicity, they are referred to as existing conditions audits in this Guide.

Existing conditions audits naturally examine the existing road network. They are different from visual inspections which are often carried out from a moving vehicle as part of a maintenance or asset management regime. They generally do not involve the examination of design drawings, so a site inspection is essential. It is expected that the audit team will examine the site in as much or even greater detail as they would in a design stage audit. Existing conditions audits should be carried out on foot and be supplemented with drive-throughs/ride-throughs as appropriate. It is not possible to do a desktop existing conditions audit (see 3.3.3).

When recommending treatments to mitigate identified hazards (see also 3.3.4), auditors must be cognizant of the fact that there is generally much less leeway to make changes than there is in design stage audits. Unless the identified hazards are so critical that they warrant urgent or major changes – it is highly unlikely that an RSA will be the first time such an issue has been discovered – it is likely that the only feasible options will be minor in nature due to the issues associated with working in the existing road environment, and only modestly effective. This is why design stage audits are so important.

Existing conditions audits are commonly done in response to complaints from third parties or they may be undertaken due to a spate of near misses. Some jurisdictions may also choose to carry out existing conditions audits in a proactive manner by auditing areas or routes that meet certain criteria. In doing so, the first question that must be asked is: how to choose which roads to audit?

The recommended approach is to audit roads in order of risk. Good proxies for risk are traffic volume and speed limit (or operating speed if there is a large difference) as well as a change in use such as when a bike lane is added or ATV use is permitted. In other words, the greater the traffic volume or speed limit, the greater the risk. Ideally, risk would be quantified more accurately with an understanding of the infrastructure present as well, and there are tools available that do this, such as the globally applicable iRAP model.

Crash data can be used as a weighting or to prioritize otherwise equally risky roads but should not be used as the sole way of determining risk. This is because crash history is subject to a phenomenon known as regression to the mean whereby, due to the random nature of crashes, numbers can vary significantly over time, even down to zero, without any engineering interventions. It is therefore not a good indicator of the inherent or underlying risk profile.

Thematic audits

An RSA should identify hazards relating to all road user groups. However, it is possible to conduct an audit that focuses on one or more road user groups (e.g., motorcyclists or all vulnerable road users). These audits are commonly known as thematic audits.
It is especially important in thematic audits that the audit team has the appropriate specialist experience to conduct the audit successfully. All auditors have a duty not to operate outside their areas of expertise, but this is especially important in a thematic audit. It is also essential to consider whether the audit should be conducted in a particular way (e.g., on a bicycle in the case of a cycling audit or in large farm equipment in agricultural areas). Doing so can provide the perspective needed to see the road environment from the subject road users' point of view. Where impairments are to be considered, the inclusion of specialist advisors or advocacy groups will provide essential insight (see 3.2.2 for more detail).

2.3 Why complying with standards does not guarantee safety

The terms standard and design standard are used in this Guide to refer to all technical design documents including Canadian standards, Ontario standards/specifications, guidance documents or guidelines, codes of practice and any other documents that provide technical details on the design and construction of the road environment.

Design standards are a very important starting point with any road design. However, complying with them does not necessarily mean that the road is safe or risk-free. This is because the safety outcome achieved can be affected by:

- the complexity of the environment and design task;
- the presence of competing and sometimes overlapping and inconsistent design standards;
- the use of standards that are either insufficient or too complex for a local situation;
- the use of standards that are obsolete or no longer good practice;
- standards being developed for a range of reasons (e.g., cost or traffic capacity as well as safety) and sometimes being applied for a purpose that was not intended;
- standards often being minimum requirements. Combining a series of minima is undesirable and can leave no room for error, either on the part of the designer, the contractor, or the final road users
- standards which cover general or common situations, not all situations;
- standards being taken out of context or applied in isolation without consideration of other pertinent standards;
- standards which may not be applicable to the circumstances in the design;
- individual road elements, designed to standards, may be quite safe in isolation but may, when combined with other standard elements, impact on safety either at that location and/or an adjoining location or network; and
- application/interpretation (including any assumptions) by design practitioners who do not have the required competency (defined as knowledge, skills, experience, and attitude).

3.0 How to conduct a road safety audit

3.1 The RSA process

The basic RSA process takes place in three phases: the commissioning phase, the conducting phase, and the completion phase. The broad tasks that make up these phases are shown in Figure 2.

3.2 Commissioning phase

3.2.1 Prepare the audit brief

The objective of the audit brief is to provide the audit team with all the necessary information to allow a comprehensive safety assessment of the project.

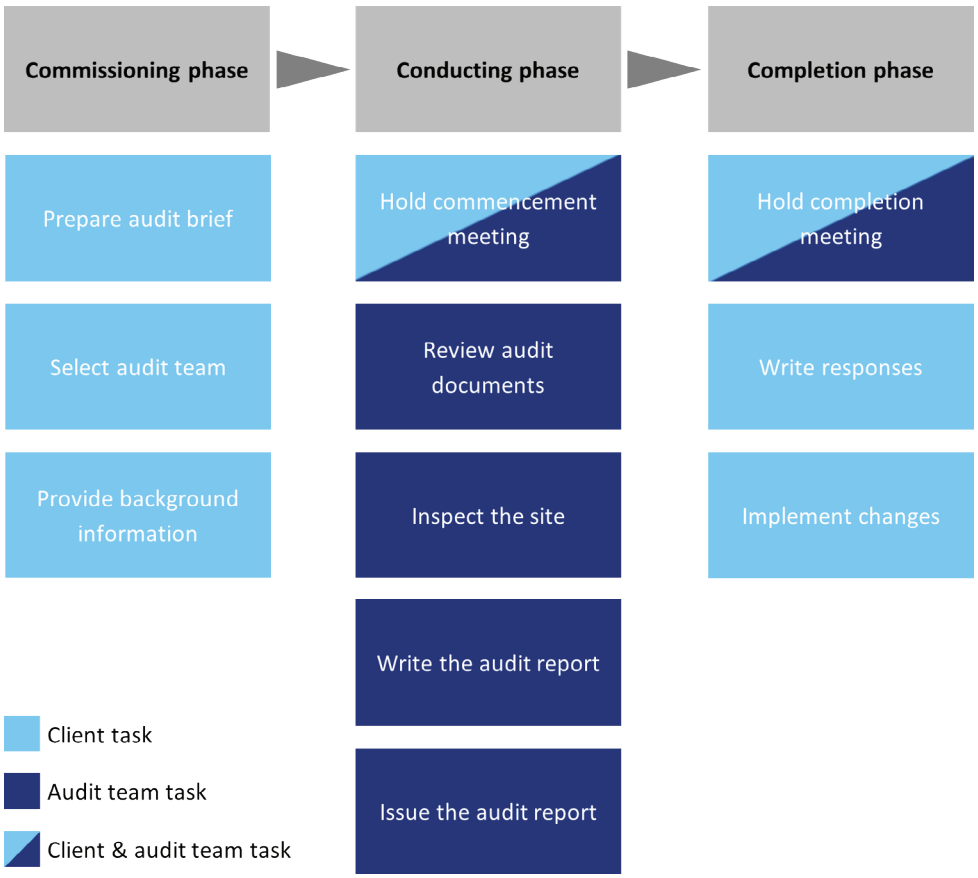

Figure 2 – The RSA process

Preparing an effective brief requires a good understanding of the objectives and process of RSA, as defined by this Guide, and any pertinent local strategy/policy documents.

At an absolute minimum, it is strongly recommended that those persons likely to be engaged in commissioning audits and preparing audit briefs should attend RSA awareness training. An incomplete or vague audit brief issued by a client team can be confusing and counterproductive, and ultimately demonstrates a lack of awareness and knowledge of the audit process.

3.2.2 Select the audit team

A team of appropriately qualified persons should be assembled to carry out the audit. This team is known as the road safety audit team, or simply the audit team. The audit team shall comprise a team leader and at least one other member (i.e., a minimum of two people). While there is no maximum size, it should generally be limited to four people for practical reasons. All members of the audit team shall be involved in reviewing the design documentation, attending the site, and writing the audit report. Members of the audit team are known as auditors or road safety auditors.

There should be three levels or categories of auditor:

1. Team leader, lead auditor, senior auditor
2. Team member, auditor
3. Observer, trainee auditor

For consistency, the terms *lead auditor, auditor,* and *trainee auditor* are used in this Guide. Note that the roles on the audit team are different from the qualification levels required to attain those positions, which are based on competency attributes (see section 4.1 for details).

Lead auditor: A person who meets the competency requirements of an RSA senior auditor. The lead auditor represents the audit team throughout the process and is the point of contact for the client. They must attend all meetings with the client and other relevant organizations. The lead auditor is ultimately responsible for the quality of the audit. They oversee the production of the audit report and sign the concluding statement at the end of the report. The lead auditor should be the most experienced auditor on the team and their experience should be relevant to the subject matter being audited. Note that while it is possible for more than one member of the team to meet the competency requirements of a lead auditor (i.e., they are senior auditors),

one person must be nominated as the lead auditor for that audit.

Auditor: A person who meets the competency requirements of an RSA auditor. S/he assists the lead auditor to prepare the audit report and attend meetings if directed by the lead auditor. S/he may or may not also meet the competency requirements of a lead auditor (i.e., a senior auditor).

Trainee auditor: A road safety auditor in training who by definition does not meet the competency requirements of an auditor. There shall be no more than two trainee auditors on the audit team. The inclusion of trainees on the audit team allows them to gain experience in RSAs.

In addition to the audit team members, specialist advisors may be included. These are usually subject matter experts (who may or may not be qualified road safety auditors themselves) such as road designers, traffic signal engineers and disability discrimination specialists. They should be used when an audit requires specialist input outside the core audit team's knowledge and experience. They should be practicing professionals able to provide independent advice to both the client and audit team as required. They may be asked to attend and observe the audit process on site or take part in meetings as required.

Key stakeholders – those with a direct and tangible interest in the project – may also be included. Such persons can represent emergency services, advocacy bodies, special interest groups and so on. Key stakeholders do not participate in the audit, nor should they influence its findings or recommendations, but can provide useful background/context.

The importance of audit team independence

The fundamental requirement of the audit team, aside from their competency, is their **independence from the design team**. It is imperative that the audit team was not involved in the design being audited. This does not mean that the audit team must be entirely separate from or cannot communicate with the design team at all. For example, it is generally acceptable that road safety auditors within a large consultancy can successfully audit a design produced by another team within the same company if management practices are implemented that allow for the two teams to be independent.

It follows that the client must not commission a particular audit team or auditors because they are the cheapest option or may be perceived to be favorable – identifying fewer issues than other auditors or proposing low-cost mitigation measures that could be questioned for their effectiveness.

Similarly, auditors must understand their responsibilities and respect the audit process. For this reason, the responsibilities of auditors should be reflected within a formal code of conduct. An example of an auditor code of conduct is provided in Appendix A.

3.2.3 Provide background information to the audit team

Separate from the actual design drawings, the client should provide the following information to the audit team well in advance of the commencement meeting. This enables gaps to be identified and resolved prior to the audit commencing.

- Any known safety issues which have been identified but are yet to be resolved
- Any deficiencies yet to be addressed
- The design parameters, standards and guidelines adopted and any known departures from those standards
- Any 'trade-offs' that have been necessary and why
- Any community input from prior discussion, correspondence, and consultations

3.3 Conducting phase

3.3.1 Commencement meeting

A commencement meeting helps ensure that the client team understands the audit process and its roles and responsibilities and acts as an opportunity for both parties to confirm the audit objectives, scope, any focus, and timeframe. The meeting also serves as a forum for the client team to provide any additional

"The fundamental requirement of the audit team, aside from their competency, is their independence from the design team."

background information to the audit team which might identify key issues, constraints and potential issues requiring consideration. This typically includes a briefing on issues that may have emerged during the previous project planning or design processes.

The client's project manager is typically responsible for organizing the commencement meeting, and ideally formulating an agenda.

3.3.2 Review the design documentation

The client must provide any relevant documents[6], such as drawings, to be audited to the audit team. It is not the audit team's responsibility to ask the client for specific drawings – they audit the documents they are given.

All members of the audit team must review the documents. It is up to the lead auditor to arrange how this occurs, but it is suggested that each member reviews the documents independently, noting down their findings as they go. At this stage, hand-written notes on the drawings are appropriate. The team members should then meet to discuss each other's findings. There will inevitably be some overlap between the members' findings, but invariably there will be some findings that not all members identify. Where there is agreement on the findings, these can confidently be added to the short list for the report. Where not all members have identified a particular hazard, these should be discussed and added to the short list if it is decided that it is a genuine hazard.

It is helpful at this stage to enter the findings in summary form into a blank audit report to refer to later while on site.

To assist in identifying hazards, prompt lists are included in Appendix D. These are useful tools for auditors, especially for those with limited experience, in the identification of risks and hazards during the various audit stages and across a range of scenarios. Notwithstanding, they are only intended to be an aid and should not be relied upon to be inclusive, nor is all the standard content applicable to all projects. Rigidly auditing to prompt lists (often described as a 'tick box approach') serves no purpose or value. Prompt lists should not be reproduced in the audit report.

3.3.3 Inspect the site

Every member of the audit team must visit the site. The inspection is to be undertaken co-operatively, with members expressing their observations and concerns in an open manner as they arise. This is because even the most experienced auditors can overlook issues or have alternative viewpoints, so all auditors in the team should be encouraged to voice any concerns they have, regardless of their experience or nominal status in the team.

A photographic and/or video record of the inspection component of an audit should be captured to supplement field notes, with a focus on this being able to adequately locate and communicate in the report the safety risks and hazards identified.

Note that it can be useful to refer to the prompt lists (Appendix D) on site as well as when reviewing the drawings.

The safety of the audit team and others attending the site is paramount. To this end, planning of site inspections is essential to ensure that workplace health and safety legislation and practical requirements are followed (e.g., risk assessment, safe work method statement prepared etc.) This is especially the case where the project or road to be audited is extensive and/or complex and lengthy and/or multiple sessions are required. Consideration must be given to where an audit vehicle can stop/park and the operating speed at the location, which could in turn give rise to the need for temporary traffic control. **Where an elevated level of risk becomes apparent during an audit, the activity must be suspended.**

It is good practice to visit the site during both daytime and nighttime conditions, as some issues are only apparent at night. However, it is sometimes not practical for some or all members to attend the site at night, so the following guidance is provided.

[6] The types of documents that could inform a road safety audit vary. Depending on the type of project being examined and the stage of road safety audit being employed, audit teams, in addition to drawings could also incorporate traffic and speed data, planning studies, design reports, letters/emails of concern from other stakeholders, drone footage, crash history, etc. Nonetheless, the audits can be done with simply the design drawings.

Audit stage	Recommended	Required
Feasibility stage	✔	
Concept design stage	✔	
Detailed design stage	✔	
Pre/post-opening stage		✔
Existing conditions		✔

Table 3 – When to attend the site at night

It is possible to conduct a 'desktop' audit; that is, without visiting the site. While not recommended, a desktop audit is better than not doing an audit, but it should always be seen as being 'non-compliant' with this Guide. The reasons for not doing a site inspection should be justified and documented. Desktop audits can be appropriate when it is difficult or impossible to visit the site without prior arrangements, such as when a road passes through private land and the permission of the landowner is required, or when it would provide no benefit. For example, where a proposed road passes through open countryside and does not impact on the existing road network, there is little benefit in visiting the site. The audit team should visit locations where the proposed road intersects with the existing road network.

3.3.4 Write the audit report

Structure and content of the document

The RSA report should be a concise and succinct account of the audit, focusing on the hazards identified, their risk assessment and associated recommendations, which is then to be considered by the client team during the completion phase.

An audit report must contain as a minimum:

- Title and project introduction
  - · Title which includes the name of the road, the extent of the audited project (length of road or intersecting road name), the locality (e.g., suburb), the type/stage of the audit
  - · Brief description of the project/scheme, its objectives, and any special aspects.
- Background information
  - · The audit team and its composition – names, registration, and structure (lead auditor, auditors, trainees, other parties)
  - · Client details
  - · Reason(s) for the audit, e.g., in accordance with local strategy, conditions of contract, conditions of development approval
  - · An overall plan of the project or road length, showing the audit findings (location and reference number) and if required, recommendation referencing
  - · Factual details of, and conditions during, the audit site visit(s)
  - · Details of commencement and completion meetings (times, dates, format, attendees, agenda, etc.)
- Audit findings (including identification of crash types) and associated recommendations (i.e., mitigation measures, including with reference to primary and supporting treatment types). NB: this will be the most substantial part of the report and is commonly tabulated with space provided for the client's response.
- Formal statement/declaration – a concluding statement, signed by the lead auditor, advising they have undertaken the audit.
- Appendices
  - · Key map showing the location of the identified hazards.
  - · List of documentation provided and used during the audit, including dates/versions, e.g., drawings, maps, standards, etc.
  - · List of photographs, video, and images used.

There are many advantages to an organization developing a standard audit reporting template, not least consistency for auditors and audit clients. To assist with this approach,

a specimen audit findings proforma and audit report table of contents are included as Appendix B.

Findings

Each safety problem identified in an audit is known as a finding. Findings are generally new hazards introduced by the project, but they can also be existing hazards made worse by the project. For further guidance on how to deal with existing hazards (see 3.6.3. Non-safety issues should not be included in a road safety audit report.

While the exact wording of findings will differ according to the audit team and the individual style of those writing the report, there are factors that should be common to all findings. These are:

- **Issue or hazard:** this is the thing that could cause a crash or increase the severity of a crash. For example, poor visibility on a minor road approach to a rural intersection.
- **Outcome:** this is the type of crash that could be caused by the hazard or the effect it may have on the severity of a crash. In the above example, poor visibility to an intersection can increase the likelihood of a failure to yield to right of way that leads to collisions with other vehicles.
- **Risk factors:** factors that could increase or decrease the likelihood or severity of the crash. In the above example, overshoot incidents would be made more likely in bad weather, such as fog or ice/snow.
- **Severity:** a statement about the likely severity of the collision given all the factors involved. In the above example, the severity would depend on the angle of impact and the speed of the vehicles involved.
- **Standards:** any standards that apply to the situation. Typically, this is to point out where the road or design does not meet a particular standard. This is an optional factor, as not all hazards will relate to non-compliant infrastructure.

Putting it all together, the following is an example of a well-written audit finding:

> The design shows a slight crest on Minor Road 50 m before the intersection with Major Road which would restrict visibility to the stop line. This has the potential to cause overshoot incidents and collisions with other vehicles, particularly in poor weather when visibility and/or traction is reduced. Due to the 80 km/h speed limit on both roads and the likely impact angle of the vehicles, the collision is likely to cause death or serious injury. Visibility to the stop line is estimated to be approximately 50 m. Standard X requires an approach sight distance of 150 m.
> A photo or annotated snip of the design should be included to help illustrate the hazard.

Risk assessment

Each finding should contain a risk rating. Likelihood and severity are considered for the crash type associated with each hazard using the framework set out below.

The descriptors of likelihood and severity are:

- Likelihood[7]
  - Rare – crash occurs less than once every seven years;
  - Unlikely – crash occurs at most once every seven years;
  - Possible – crash occurs at most once every three years;
  - Likely – crash occurs at most once per year; or
  - Almost certain – crash occurs at least once per quarter.
- Severity[8]
  - Insignificant – property damage only;
  - Minor – minor first aid;
  - Moderate – major first aid and/or presents to hospital (but not admitted);
  - Serious – admitted to hospital; or
  - Fatal – death at scene or within 30 days of the crash.

Likelihood and severity are combined to produce an overall risk rating which corresponds to a priority level for risk mitigation.

[7] Likelihood is at the severity level identified. Exposure is factored into likelihood.
[8] The most likely outcome

Figure 3 makes a distinction between fatal and serious injury (FSI) outcomes and non-FSI outcomes. While RSA is concerned with all injury crashes, greater emphasis should be placed on hazards that are expected to cause FSIs. Differentiating them in this way brings them to the attention of the client. To assist in determining the likely level of injury, a severity guidance matrix is provided at Figure 4.

			SEVERITY				
			Insignificant	Minor	Moderate	Serious	Fatal
			Property damage	Minor first aid	Major first aid	Admitted to hospital	Death within 30 days
LIKELIHOOD (includes exposure)	Almost certain	≥1 per qtr	Medium	High	High	Extreme (FSI)	Extreme (FSI)
	Likely	3-12 months	Medium	Medium	High	Extreme (FSI)	Extreme (FSI)
	Possible	1-3 years	Low	Medium	High	High (FSI)	Extreme (FSI)
	Unlikely	3-7 years	Low	Low	Medium	High (FSI)	Extreme (FSI)
	Rare	7 years +	Low	Low	Low	Medium (FSI)	High (FSI)

FSI outcome threshold

Figure 3 – Risk assessment framework

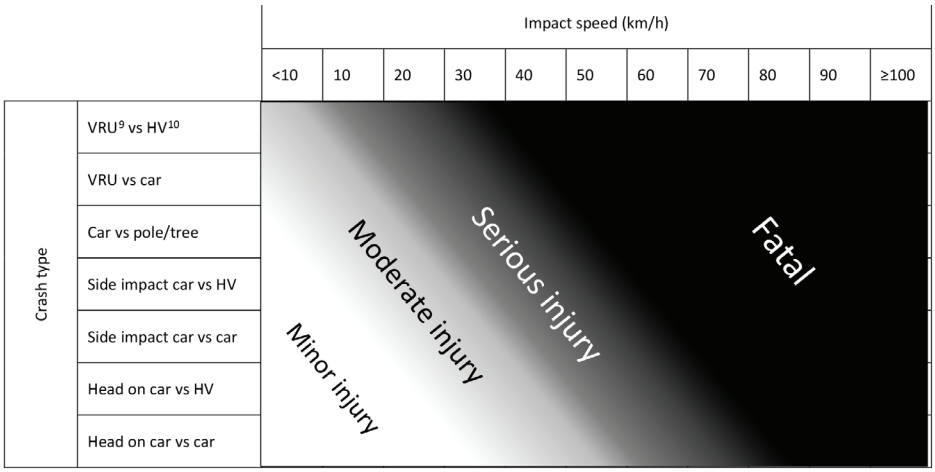

Figure 4 – Severity guidance matrix – to be used with risk matrix (Figure 3)
Note: this diagram is a general indication only. Professional engineering judgement is required in its use.

The corresponding priorities for mitigation are:

- Low – should be corrected if the treatment cost is low;
- Medium – should be corrected or the risk significantly reduced if the treatment cost is moderate but not high;
- High – should be corrected or the risk significantly reduced even if the treatment cost is high; or
- Extreme – must be corrected regardless of cost.

No guidance can be provided as to the respective monetary values of the terms low, moderate, and high cost, but it is expected that consideration against the total project cost would be an important factor when categorizing mitigation of each risk.

[9] Vulnerable road user – i.e. a pedestrian, cyclist or motorcyclist
[10] Heavy vehicle – e.g. truck or bus

Recommendations

Every audit finding should be accompanied by a recommendation to mitigate the hazard. When identifying and communicating mitigation measures, the following are considered good practice:

- Be clear and constructive about what is required to mitigate the hazard, but do not write the recommendation in such a way that it appears to be an instruction;
- If the hazard is expected to cause an FSI crash, look for treatments that will reduce the severity of injury to below the FSI threshold. Examples of such treatments are given in Appendix C;
- Be aware that there is low- and high-cost and short- and long-term mitigation measures. The ideal is to recommend low-cost measures that give a good rate of return in terms of safety. For example, installing a warning sign may be low cost, but it rarely has a material impact on risk;
- The scale and cost of mitigation should be commensurate with the risk of the hazard and scale of the project;
- Do not be so specific that the recommendation amounts to a design choice. The client/designer aways retains responsibility for the project, so contributing to the design compromises the independence of the audit;
- Provide options where they exist, but be aware that too many options can be overwhelming;
- Avoid vague terms such as 'consider…', 'monitor…', 'review…', 'investigate…', etc. These are not helpful to the client unless additional detail is provided such as why, how, when, who is responsible, etc.; and
- Avoid non-infrastructure measures such as 'consult with the police service about…'.

3.3.5 Issue the audit report

The lead auditor issues the report to the client's representative, typically by email. The audit report is typically circulated across the client team for consideration, e.g., identification of factual inaccuracies, areas where clarification is sought, or where additional information or context might be required.

3.4 Completion phase

3.4.1 Completion meeting

A completion meeting should then take place, so that client and audit teams can discuss the audit findings and recommendations made, including proposed mitigation measures. As a minimum, this will involve the lead auditor and the client project manager. Other auditors and/or the designer's team may be useful additions.

3.4.2 Respond to the audit report

The client team is responsible for considering the audit findings (including the risk assessment outcomes, recommendations, and mitigation measures) alongside other relevant scheme parameters to decide on the most appropriate response. The client or their project manager may seek input from the designers and/or specialist advisors to discuss the matters raised and the most appropriate response. Any remaining queries or clarifications regarding the report are to be raised with the lead auditor.

The audit team is not responsible for the client team response or any subsequent re-design of the project/scheme and/or design of mitigation measures and their subsequent implementation. However, it is suggested that audit teams can assist the client team in their deliberations wherever possible and reasonable to do so (e.g., answering reasonable technical questions, assisting with valid requests for references and other pertinent resources).

The client must formally document their response/actions. It is suggested that a local proforma be developed to assist with this. Each response must include the rationale and where applicable, the headline details of the proposed implementation (what, who is responsible, timeline, etc.)

In preparing their response to an audit report, the client or their project manager is advised to follow a step process:

- Consider whether to accept or reject each audit finding;
- For each accepted finding, consider whether to accept or reject the risk assessment, recommendation and mitigation options identified;
- Formally document and sign off the decision reached in designated fields of

the audit proforma;
- As a courtesy, communicate the decisions reached to the audit team;
- Implement any action/s identified (e.g., commission design changes, construction, etc.);
- Consider whether the actions are significant enough to warrant commissioning a follow-up audit (e.g., a detailed design audit of a re-design).

The client team is under no obligation to accept any finding or recommendation in the audit report. For example, after due consideration, the client team may decide to disagree with a finding, a risk assessment, or recommendation where they believe that reasonable justification exists, e.g., the audit team had reached a recommendation but were not privy to certain information. Alternatively, a recommendation may be made that, while addressing the identified issue, is considered by the client to come at an unreasonable cost relative to the risk.

In practice, it is preferred that the client team's response is predominantly positive as conveyed in one of the following:
- Accept a recommendation completely and adopt the audit team's recommendation which will typically include an infrastructure-based mitigation measure;
- Accept a finding completely but adopt an alternative measure that is equally effective; and/or
- Accept a finding and/or recommendation in part or in principle but, due to other constraints, implementing changes which go only part of the way to resolving the safety problem, and hence lead to the client team consciously agreeing to recognize and accept the residual risk.

However, more negative responses include:
- Accept a finding in part or in principle but, due to other constraints, deferring the recommended action(s), or staging them over an extended period, with an understanding and acceptance of the associated risks;
- Accept a finding in part or in principle but deciding to take no action and formally document the rationale; and/or
- Reject a finding and therefore deciding to take no action(s) and not formally document the rationale.

It is not the audit team's responsibility to approve the client's response to the audit findings and recommendations, nor to ensure that they are implemented. Notwithstanding, it is considered both courtesy and good practice for the client team to communicate its actions and progress to the lead auditor for continual improvement purposes.

It is often the case that several potential solutions (mitigation measures) can be identified to an issue within an audit report. It is then the responsibility of the client's team to make a final decision on the best course of action. Typically, this will require consideration of factors such as the viability and cost/benefit of a treatment, and the feasibility of actioning the treatment to fit in with the timeframe and scope of the project.

3.5 Auditing at the municipal level

Several challenges exist when undertaking RSAs at the municipal level. These challenges tend to be exacerbated where the network is in a remote and/or rural area.

The uncertainties and challenges tend to relate to:
- Whether the road authority is the client for the audit of a design for a new or existing facility, or where the client is a private body (developer) and the project has a road component and the infrastructure is ultimately likely to transfer to public ownership;
- The rate of development and growth of infrastructure and the road network in some areas (e.g. bedroom community/commuting belts of large cities and new subdivisions within these);
- The cost of road safety auditing when considered against the benefits accrued and competing demands, and mitigation measures recommended within audit reports;
- The extent of the municipal network and whether the project to be audited is hard to access and/or a considerable distance from the administrative center or technical office;

- The availability of competent auditors – either in-house or commercially on a fee-for-service, including for in-house resources the costs of training and maintaining existing accreditation; and
- General lack of understanding of road safety issues and the importance of consideration at the earliest possible stage, e.g. feasibility and concept design.

While there may be a strong desire within municipal road authorities to promote road safety, the constraints faced make it largely inevitable that such organizations will have to adopt audit practices which are not totally consistent with the good practice positions identified within this Guide. While such practices are likely to be introduced with the best of intent (i.e. they are considered, pragmatic solutions which respect the objectives of auditing to ensure as far as practicable that positive road safety outcomes are secured), in strict terms, they are exemptions and must be formally managed as such (justified, signed off etc.).

Examples of such responses include:
- The carrying out of desktop road safety checks to a design by an internal or external, experienced road safety professional – known in some jurisdictions as a 'peer review' of the design; and
- The commissioning of an on-site assessment by a single competent auditor (as opposed to an audit team) rather than no assessment activity being undertaken at all.

However, such responses should only be short to medium-term, with the involved parties being actively encouraged to continually improve towards good practice. The objective must be that the need for, and number of, exemptions should be reduced, and ultimately removed. An example of this could be road authorities in rural/remote areas allowing exemptions from auditing on practical grounds but on the proviso that a long-term action plan is put in place to ensure compliance within an agreed timescale.

3.6 Common grey areas

While RSAs globally follow a well-established process, there will inevitably be situations that fall outside documented procedure. This section lists some of the more common situations and provides suggestions as to how to resolve them.

3.6.1 Identifying a hazard just outside the project limits

As design drawings typically do not show detail beyond the limit of works, hazards that fall outside project limits may be identified during the site inspection. All projects will eventually interface with the existing road network, so the scope of an audit should always include a transitional zone at the edges or ends of the project. The exact length or size of this transitional zone will vary from project to project and should ideally be agreed with the client before the audit commences (e.g., at the commencement meeting) but in any case, it should encompass the area or length that will reasonably be impacted by the project.

But what if a hazard is identified beyond the transitional zone? Good practice is that the way of addressing these events should be recorded in the audit brief. However, where direction is not provided or not adequate, the audit team's understanding of road safety and their professional duty of care should prevail to ensure a reasonable outcome. Auditors must always follow their professional duty of care and record and notify the client and any other relevant stakeholders of obvious safety issues regardless of the audit brief. It is common for such findings to be communicated outside of the audit report, e.g., via e-mail with accompanying photos or video evidence.

3.6.2 Hazards for a road user group that is not the focus of a thematic audit

As outlined in section 2.2, a thematic audit is one that focuses on the road safety of specific road user groups. It is common in such audits to identify hazards that relate to road user groups that are not the focus of the audit (e.g. pedestrian issues in a motorcyclist audit).

As with identifying hazards beyond the limit of works (3.6.1), the audit team's duty of care should prevail and the client's attention should be brought to any significant risks.

However, care must be taken to ensure that a thematic audit does not become a standard audit just because an auditor has a duty of care to raise all safety issues regardless of the focus of the audit.

Where a piece of infrastructure designed to improve road safety for the road user group that is the focus of the thematic audit would negatively impact the safety of other road user groups, it is suggested that these be included in the audit report as normal. In other situations (say an existing conditions thematic audit for motorcyclists) it is suggested that where the issue is significant (e.g. it would be rated extreme or high risk) it should be raised outside the audit report via email.

3.6.3 Existing hazards and non-safety issues

It is very common to identify existing safety issues and non-safety issues while on site. In the case of existing safety issues, the audit team once again has a professional duty of care to bring these to the client's attention, regardless of the audit brief. Where the project would make an existing issue worse, it should be included in the audit report as normal. However, where the project would not make an existing issue worse, it is suggested that these be raised outside the audit report via email.

Non-safety issues should not be included in an audit report.

3.6.4 Issues brought to the audit team's attention

It is common for an audit team to be engaged to investigate a known safety problem or issue raised by a third party, for example a member of the public. Standard practice when writing audit findings is not to discuss issues that are not safety hazards. If after due consideration the audit team does not consider an issue to be a safety concern, the audit report should be silent on it. However, in cases where the audit team has been asked to investigate a specific issue, it is appropriate to provide a statement in the report (usually prior to the findings) to the effect that the audit team has investigated the reported issue but found no safety problems. For legal reasons, it is probably best not to state that the infrastructure/issue is safe, but that safety deficiencies have not been identified.

3.6.5 Summary

How the audit team deals with the above common issues should be documented in the audit brief, or at least agreed during the commencement meeting. This reinforces the importance of these phases of an audit and should not be seen as optional or administrative only.

4.0 Who can undertake a road safety audit?

4.1 Competencies of the audit team

4.1.1 The SEKA model

Under the SEKA model, competency can be defined as follows:

The SEKA model illustrates that competency is the sum of the following attributes:

- **Ability –** the sum of skills, experience, and knowledge, defined as the 'possession of the means or skill to do something' or alternatively, 'talent, skill or proficiency in a particular area'.
- **Skill –** defined as 'the capabilities or proficiencies developed through training or hands-on experience' or 'proficiency (direct application of knowledge) to perform a particular task or learned act' (i.e., a person acquires skills by practically applying knowledge).
- **Experience –** defined as 'practical contact with and observation of facts or events'.
- **Knowledge –** defined as 'facts, information and skills acquired through experience or education, the theoretical or practical understanding of a subject' or 'a body of information (factual or procedural knowledge) required for performance of a task or function'. This includes the understanding of concepts (i.e., it is theoretical and not practical). Reading technical guidelines and texts alone, with the primary purpose of only gaining knowledge, does not provide competency.
- **Attitude –** defined as 'a settled [consistent] way of thinking or feeling about something', which is held as highly significant in influencing performance and one of the most important factors in learning and building on the potential provided by knowledge and skills.

Thus, competent auditors must possess a range of attributes. The framework below is intended to provide a starting point to the development of RSA capability in Ontario. It will naturally need to evolve as the RSA process matures, more audits are carried out and more auditors are trained.

4.1.2 Qualification and progression

An RSA is inherently linked to the road transport engineering industry. While qualifications in a relevant engineering discipline such as civil engineering are not essential, they are extremely beneficial since the concepts drawn on by road safety auditors are generally those practiced by professional engineers. Thus, most road safety auditors are also professional engineers as they work in the transport engineering field.

The relevant fields of work are generally sub-disciplines of civil engineering. While many auditors have a degree and working background in civil engineering,

it is recognized that skills, experience, and knowledge can be gained in a variety of ways. For example, it is likely that many Certified Engineering Technicians would meet the work experience requirements and many of the competency requirements. Relevant fields of work include:

- Road design;
- Traffic engineering;
- Network operations and maintenance, including road construction, traffic management and traffic control;
- Road safety engineering; and
- Value engineering.

Table 4 shows a pathway for auditors from trainee to lead auditor.

	Trainee auditor	Auditor	Senior auditor
Role	- Gain exposure and experience by observing and fulfilling a minor role on audits	- Part of audit team - Mentor trainee auditors	- Part of audit team - Lead audits (as appointed) - Mentor junior auditors
Pre-qualification	- Two years' experience working in a relevant field[11] - Successful completion of an accredited RSA training course - Willingness and commitment to learn	- Trainee auditor	- Auditor
To maintain level	- Continued interest in road safety engineering and RSA	- Participate in at least one audit per year - Meet ongoing CPD requirements	- Lead at least one audit per year - Meet ongoing CPD requirements - Promote RSA as a practice
To progress to next level	- Receive mentoring - Meet CPD requirements - Observe or fulfill a minor role on at least two audits within two years[9]	- Receive mentoring - Be part of audit team on at least five design stage audits[9] - Five years' experience working in a relevant field - Meet ongoing CPD requirements	

Table 4 – Road safety auditor qualification and progression pathway

[11] After the inception of the RSA process, there will be a period during which there will not have been enough time for auditors to complete the required number of audits to attain the position of auditor or senior auditor, but when there will nevertheless be a need for people in these positions. It is suggested that this requirement be temporarily waived for a period of at least two years, or until enough auditors are available to both mentor trainees and not cause a sudden reduction in qualified resources.

4.2 Training

One of the relevant fields of work for road safety auditors is road safety engineering (see 4.1.2). The competencies of a road safety engineer are:

- sound knowledge in traffic engineering and road design practice;
- an appreciation of road user behavior and the contribution it makes to road crashes; and
- competency in crash investigation (i.e., crash data analysis and identification of crash causation and severity factors) and countermeasure development (i.e., identification of targeted cost-effective remedial treatments/mitigation measures).

It is expected that knowledge of traffic engineering and road design practice will come from a person's working experience. However, the other competencies are generally not learned on the job and must be taught in the first instance and built upon through practical experience.

As the purpose of an RSA is to identify hazards with the potential to cause crashes, an understanding of crash investigation and countermeasure development should be considered foundational knowledge.

All road safety auditors must have successfully completed an accredited RSA training course. It is expected that such a course would cover:

- What a road safety audit is (and is not), their benefits and why they should be done;
- The audit process including the different types of audits and the roles and responsibilities of those involved;
- Crash investigation and countermeasure development;
- Examples of common road safety issues;
- How to write audit findings and recommendations;
- Special considerations for certain road user groups;
- Legal issues, auditor registration and accreditation; and
- Theoretical and practical exercises culminating in the completion of an actual road safety audit.
-

4.3 Accreditation

Accreditation is the process of formally recognizing someone's competency in the field of RSA. It results in the person (auditor) being listed on a register of accredited road safety auditors in a jurisdiction.

Good Roads has established Ontario's registry of accredited Road Safety Auditors. The minimum competency requirements for auditors in Ontario are shown in Table 3.

The successful completion of any one of the following courses satisfies the Ontario RSA training requirement:

CANADA

- Good Roads X Safe System Solutions Road Safety Audit Course

AUSTRALIA

- Australian Road Research Board (ARRB) Road Safety Engineering Workshop (with Audit Course)
- Centre for Accident Research and Road Safety Queensland (CARRS-Q) Road Safety Audit
- Institute of Public Works Engineering Australasia (IPWEA) Road Safety Audit course
- Road Safety International Road Safety Audit and/or Road Safety Engineering Workshop
- Safe System Solutions Pty Ltd Road Safety Audit Course
- University of Adelaide Road Safety Audit Course

SWEDEN

- Lund University, Sweden, Road Safety Audit and Inspection Course

UNITED KINGDOM

- TMS Road Safety Engineering

INTERNATIONAL

- International Road Federation (IRF) Road Safety Audit
- iRAP Star Rating for Road Safety Audit course (with Road Safety Audit course components)

In addition to the above training, accredited auditors must also complete 25 hours per year of Continued Professional Development

(CPD) in road safety, traffic engineering, and/or highway/road/street design.

Accredited auditors must adhere to a code of conduct.

A person may be removed from the register of accredited auditors if they fail to meet the above requirements.

4.4 Continuing professional development

Road safety engineering, and engineering in general, is a continually evolving field. Practicing road safety auditors are expected to keep their competency up to date through a process known as continuing professional development (CPD). Generally, this means:

- Undertaking audits regularly
- Staying abreast of developments in the industry
- Updating and honing skills
- Contributing to the development of the profession where possible

To maintain status as an auditor, a person must take part in at least one audit per year. To maintain status as a senior auditor, a person must lead at least one audit per year.

Staying abreast of developments in the industry is generally achieved by reading industry journals, attending conferences, joining and attending events organized by professional bodies and generally staying active in the industry.

The updating and honing of skills can be achieved by attending seminars, webinars, and formal training courses on topics relevant to road safety.

Contributing to the development of RSA as a profession can be achieved by writing journal articles, presenting papers at conferences and passing on skills by delivering training to others.

Ultimately, it is expected that auditors will complete a minimum of 25 hours of CPD each year to maintain accreditation. However, initially, it is suggested that the requirement for auditors to take part in one audit per year and for senior auditors to lead one audit per year is sufficient to maintain accreditation.

Appendix A – Example Road Safety Auditor Code of Conduct

Sample Code of Conduct (CoC) for Road Safety Auditors

1. Purpose

This Code of Conduct (CoC) outlines the professional and ethical standards, responsibilities, and commitments that auditors are required to meet and maintain while carrying out their professional work. It is an essential item, as the ongoing contribution and standing of RSA and auditors depend on the technical and ethical excellence demonstrated by all auditors.

It is vital that every auditor, regardless of seniority/level:

- Personally respects and adheres to the principles expressed in this CoC; and
- Encourages and supports adherence by other auditors, both generally, as a profession, and directly as colleagues in an audit team.

Compliance with the provisions of this CoC is a requirement of registration as an accredited road safety auditor in Ontario. Auditors who do not follow the provisions of this CoC, or engage in gross misconduct, may have their accreditation revoked by the [accreditation body] upon determination by its [governance team] in accordance with [relevant procedure].

It is important to remember that the conduct and findings of audits can have legal ramifications, which can ultimately result in proceedings against [client organization].

2. General principles

Auditors shall always be committed to the general principles of:

2.1 - Acting in the interest of all road users, including the vulnerable and mobility/vision impaired;

2.2 - Operating only within their competency and field of expertise;

2.3 - Upholding the dignity of their professional role; and

2.4 - Maintaining independence by not engaging (ideally) or advising promptly (as a minimum) of any activities or issues that could constitute a conflict of interest.

3. Core responsibilities

Auditors shall:

3.1 - Place the safety of all road users and the community before all other interests;

3.2 - Carry out their work in a careful and diligent manner in accordance with recognized industry and local guidelines, standards and practices and shall express opinions, make statements or give evidence with fairness and honesty and on the basis of their competency;

3.3 - When fulfilling the role of lead auditor, that auditor must ensure that the audit team includes accredited auditors with the relevant competency to undertake the audit in hand and are independent of a design (for new projects) or management (of an existing road) being audited;

3.4 - Actively avoid conducting audits where they are the only accredited auditor or situations where the issue to be audited is outside their field of expertise;

3.5 - Ensure that the audit identifies immediate road safety hazards and reports them to the pertinent responsible road authority as a matter of urgency. Other road safety issues that are likely to impact on the specific project or road being audited are also to be identified and reported, even if these are located beyond the boundary of the section of road being audited, or are beyond the scope set by the client within the audit brief (note that such issues may be reported outside the audit report);

3.6 - Ensure that audits include a site inspection wherever practicable, and that where relevant, the site is inspected during specific traffic conditions such as peak periods and school start and finish times if these are relevant to the project at hand. Road environmental issues such as wet, dry, day, night, sunrise, sunset and/or winter conditions must be considered even if not experienced firsthand;

3.7 - Inform the client/client team of the audit findings and recommendations and where appropriate, the potential consequences if corrective actions are not taken;

3.8 - Understand and acknowledge that in the event of legal proceedings requiring attendance at court or tribunal by the pertinent auditors, that they have an overriding duty to assist on technical matters relevant to their competency and that they shall not act as advocates for the body engaging them;

3.9 - Actively update and enhance their competency in road safety auditing and road and traffic engineering and related disciplines (including relevant guidelines, etc.); and

3.10 - Fully cooperate with the investigation of any complaints against an auditor or audit team, as set out in the [client body/auditor accreditation body] complaints procedure.

4. Acceptance of the CoC

As an accredited road safety auditor, I will:

4.1 - Uphold and promote the general principles and core responsibilities of this CoC; and

4.2 - Recognize and treat the violation of any provision of this CoC as inconsistent with the professional and ethical standards expected of a road safety auditor.

Name _____

Signature _____

Auditor ref no. _____

Date _____

Appendix B – RSA Report Table of Contents and Sample Audit Finding Table

Sample table of contents

Table of Contents

Appendices

List of Tables

List of Figures

Audit finding	Risk assessment			Recommendations	Client's response	
	Likelihood	Severity	Level of risk		Accept? Yes/No	Comments
1. There is a see-through effect when approaching the intersection of Dummer Asphode Road and County Road 40 from the North East (on Dummer Asphodel Road). This may cause a driver to misjudge the intersection priority and overshoot the STOP control. This could result in a collision with a vehicle on Country Road 40. This issue is exacerbated by the crest on Dummer Asphodel Road which obscures the intersection. 	Rare	Serious	Medium (FSI)	Consider measures to reduce the see-through effect, or to increase warning of the intersection on Dummer Asphodel Road. This could include: - Offsetting the intersection creating an staggered T-intersection - Installation of a splitter island on Dummer Asphode Road - Advanced warning signs on Dummer Asphode Road		
2.						
3.						
4.						
5.						

Appendix C – List of Common Road Safety Treatments and Their Effects

Table 5 – Run-off-road (to left or right) treatments

Treatment	Influence L = likelihood S = severity
Flexible roadside and median barriers (or equally/better performing future equivalent)	S
Very high-quality compacted roadside surface, very gentle to flat side slopes and exceptionally wide run-off areas	S
Very low speed environment/speed limit	L, S
Wide run-off areas, with well-maintained shallow drainage and gentle side slopes	S
Wide sealed shoulders with audio-tactile edge line	L
Lower speed limit	L, S
Non-flexible safety barrier	S
Consistent design along the route (i.e. no out-of-context curves)	L
Consistent delineation for route	L
Skid resistance improvement	L
Improved superelevation	L
Audio-tactile center line	L
Audio-tactile edge line	L
Vehicle activated signs	L
Speed enforcement	L, S
Rest area provision	L
Lane marking compatible with in-vehicle lane-keeping technology	L

Table 6 – Head-on treatments

Treatment	Influence L = likelihood S = severity
One-way traffic	L
Flexible median barrier	S
Very wide median	S
Very low speed environment/speed limit	L, S
Wide median	L
Painted median/wide centre lines	L
Non-flexible barrier provision	S
Lower speed environment/speed limit	L, S
Ban overtaking	L
Skid resistance improvement	L
Audio-tactile centreline	L
Audio-tactile edge line	L
Roadside barriers	S
Consistent design along the route (i.e. no out-of-context curves)	L
Consistent delineation for route	L
Overtaking lanes	L
Improved superelevation.	L
Speed enforcement	L, S
Rest area provision	L
Lane marking compatible with vehicle-lane-keeping technology	L

Table 7 – Intersection treatments

Treatment	Influence L = likelihood S = severity
Grade separation	L, S
Close intersection	L (via exposure)
Low speed environment/speed limit	L, S
Roundabout	L, S
Raised platform	L, S
Right-in/right-out, with protected acceleration and deceleration lanes where required	L, S
Ban selected movements	L (via exposure)
Reduce speed environment/speed limit	L, S
Redirect traffic to higher quality intersection	L (via exposure)
Turning lanes	L
Vehicle activated signs	L
Improved intersection conspicuousness	L
Advanced direction signage and warning	L
Improved site distance	L
Traffic signals with fully controlled right turns	L
Skid resistance improvement	L
Improved street lighting	L
Automated speed enforcement cameras combined with red light cameras	L, S

Other vehicle crash type treatments

Treatment	Influence L = likelihood S = severity
Low speed environment	L, S
Reduce speed environment/speed limit	L, S
Variable message signs/managed freeway systems	L
Skid resistance improvement	L
Turning lanes	L
Overtaking lanes	L
Improved sight distance/conspicuousness	L
Improved delineation	L
Speed enforcement	L, S

Pedestrian treatments

Treatment	Influence L = likelihood S = severity
Separation (footpath)	L (via exposure)
Separation (crossing point)	L
Very low speed environment, especially at intersections or crossing points	L, S
Reduce speed environment/speed limit	L, S
Pedestrian refuge	L
Reduce traffic volume	L (via exposure)
Pedestrian signals	L
Skid resistance improvement	L
Improved sight distance to pedestrians	L
Improved lighting	L
Rest-on-red signals	L (via exposure)
Speed enforcement	L (via exposure)

Cyclist treatments

Treatment	Influence L = likelihood S = severity
Separation (separate cyclist path)	L (via exposure)
Very low speed environment, especially at intersections	L, S
Shared pedestrian/cyclist path	L (via exposure)
Cyclist lane	L
Reduce traffic volumes	L (via exposure)
Separate cyclist signals at intersections	L
Cyclist box at intersections	L
Skid resistance improvement	L
Speed enforcement	L, S
Enforcement of other regulations	L

Motorcyclist treatments

Treatment	Influence L = likelihood S = severity
Separate motorcycle lane (e.g., on freeways)	L (via exposure)
Shared motorcycle/bus/taxi lane (e.g., on freeways)	L
Consistent design along the route (i.e., no out-of-context curves)	L
Consistent delineation for route	L
Skid resistance improvement	L
Motorcycle-friendly barrier systems	S
Speed enforcement	L, S
Enforcement of other regulations	L

Appendix D – RSA Prompt/ Check Lists

Table 8 – Prompt list covering general safety principles

Prompt to be addressed	Audit team comments
What is/are the reason/s for the project?	
Is there a specific risk of a crash type/s with the most severe likely outcomes? (e.g., run-off-road and head-on)	
If so, what are the causal factors of this crash type and how are they going to be addressed?	
Does the project reduce exposure, likelihood, and/or severity of the crash types identified above?	
Does the project address specific issues such as poor speed limit compliance, road access, congestion, future traffic growth, freight movement, amenity concerns from the community, maintenance/asset renewal, etc?	
Have operating speeds and impact angles been managed to minimize crash energy?	
Have the needs of all vulnerable road user groups been adequately considered?	
Does the project fit strategically within the overarching objectives or strategy pertinent to the network/link?	
Has consultation been undertaken with key internal and external stakeholders, e.g. regarding potential impacts of the project?	
Were energy management principles considered and addressed during the planning/conceptual design phase?	
Were road safety data, crash reports, etc. considered during the planning and design stages?	
Does the project encourage road users to be alert and compliant, as well as aiming to reduce the severity of crashes through protective infrastructure treatments, speed reductions and vehicle/safety features?	
Has specific 'road safety expertise' been engaged during the planning and/or design of the project and the procurement requirements of contractors (if applicable)?	

Have there been any changes to the scope of the project or original design which do not align with energy management principles?
Have there been any design exceptions identified and applied and if so, have safety measures been implemented in ongoing operational and maintenance plans etc?
Is the project consistent with the safety vision for the corridor in which it is located?
Have decisions regarding the design standards and guidelines to be applied been taken with consideration of the complete corridor in which the project is located, as part of sustainable network safety planning?
How does the design/project consider key aspects at macro/context level as well as at the specific micro (project specific) level? For example: - is the context appropriate – is the site appropriate within the wider/ bigger picture – corridor and network? - will the project be self-explaining within the corridor? - is there strategic alignment of the project with network and corridor plans and visions? - is the project maximizing the safety value contribution to the network or is it obligating more effort in lieu of other locations? - is the design sustainable over say 10 years and will it achieve a self-explaining result over that period? - are the project parameters (e.g., operating speed) aligned to the corridor and the level of risk at the location? - is the level of risk of the project higher or lower than other locations – and is the design appropriate when this is considered?

Table 9 – Prompt list covering local alignment issues

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Visibility				
- Are all aspects associated with the location of the route and/or its alignment safe? - If the route follows existing roads what are the effects of this? - If the route is in 'green fields' (undeveloped corridor), is the alignment safe? Could it be safer? - Does the scheme fit in with the physical constraints of the landscape? - Does the scheme take account of major network considerations? - Have all harmful safety effects of this scheme upon the surrounding road network been identified? Have they been adequately dealt with? - Is sight distance generally satisfactory: - At intersections? (If not, what implications?) - At entry and exit ramps? - At property entrances? - At emergency vehicle access points? - Are there any curves which are compliant but are obviously out of character with those curves adjacent/close to it?	- Are horizontal and vertical alignments consistent with required visibility? - Will sight lines be obstructed by permanent or temporary features e.g., bridge abutments and parked vehicles?	Are sight lines obstructed by: - Safety fences - Boundary fences - Street furniture - Parking facilities - Signs - Landscaping - Structures - Environmental barriers - Crests - Features such as buildings, plants, or materials outside the highway boundary? - Is the forward visibility of at-grade crossings sufficient to ensure they are conspicuous?	- Are the sight lines clear of obstruction?	- Is the sight distance adequate for the speed of traffic using the route? - Is adequate sight distance provided for intersections and crossings? (e.g., pedestrian, cyclist, livestock, railway) - Is adequate sight distance provided at all private driveways and property entrances? - Are there any visual clues which give a false impression of the vertical or horizontal geometry, including the presence of intersections? - Is the horizontal and vertical alignment suitable for the (85th percentile) traffic speed? If not: - Are warning signs installed? - Are advisory speed signs installed? - Are the posted advisory speeds for curves appropriate? - Is the speed limit compatible with the function, road geometry, land use and sight distance? - Are safe overtaking opportunities provided? - Is the road free of elements that may cause confusion? For example: - Is alignment of the roadway clearly defined? - Has disused pavement (if any) been removed or treated? - Have old pavement markings been removed properly? - Do tree lines follow the road alignment? - Does the line of streetlights or the poles follow the road alignment? - Is the road free of misleading curves or combinations of curves? - Are medians and islands of adequate width for the likely users? - Are traffic lane and road widths adequate for the traffic volume and mix?

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Visibility				
				- Are bridge widths adequate? - Are shoulders wide enough to allow drivers to regain control of errant vehicles? - Are shoulders wide enough for broken-down or emergency vehicles to stop safely? - Are shoulders sealed? Are shoulders trafficable for all vehicles and road users? (i.e., are shoulders in good condition) - Is the transition from road to shoulder safe? (No drop-offs) - Is appropriate superelevation provided on curves? - Is any adverse crossfall safely managed (for cars, trucks, etc.)? - Do crossfalls (road and shoulder) provide adequate drainage? - Are batter slopes traversable by cars and trucks that run off the road?
New/existing road interface				
- Are all sections/transitions where the proposed road scheme connects with the existing network free of potential problems? - Have any railway level crossings been identified and are they treated adequately? - Have other distractions (for example, low-flying aircraft, advertising, etc.) been adequately dealt with? - Has the potential of the location to attract roadside stalls been considered? - Have all unusual or hazardous conditions associated with special events been considered?	- Will the proposed project be consistent with the standard of provision on adjacent lengths of road and if not, is this made obvious to the road user? - Does interface with other roads occur near any potential hazard, i.e., crest, bend after steep gradient?	- Where a new road joins an existing road, or where an on-line improvement is to be constructed, will the transition give rise to potential hazards? - Where the road environment changes (e.g., urban to rural, restricted to unrestricted) is the transition made obvious by appropriate signing and road markings?	- Is there a need for additional signs and/or road markings?	- Where another road joins, does this give rise to potential hazards? - Where the road environment changes (e.g., urban to rural, restricted to unrestricted) is the transition made obvious by appropriate signing and road markings? - Have safe run-off areas been provided where high speed merges are present or there are other conflict points?

Table 10 – Prompt list covering general aspects

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Departures from Standards				
- What are the road safety implications of any approved departures from standards or relaxations?	- What are the road safety implications of any approved departures from standards or relaxations?	- Consider road safety aspects of any departures granted since the preliminary design stage	- Are there any adverse road safety implications of any departures from standard granted since the detailed design stage?	
Public utilities				
- Will utility infrastructure/ equipment introduce safety issues?	- Could utility infrastructure/ equipment be struck by an errant vehicle? - Could utility infrastructure/ equipment obscure sight lines?	- Can maintenance vehicles stop clear of traffic lanes? If so, could they obscure signs or sight lines? - Is utility infrastructure/equipment located in safe positions away from locations that may have a high potential of errant vehicle strikes? - Does infrastructure/equipment interfere with visibility? - Has sufficient clearance to overhead cables been provided? - Have any special accesses/ parking areas been provided and are they safe? - □Are there any utility inspection chambers in live traffic lanes and/ or wheel tracks including those of motorcyclists or cyclists? Do they give concern for motorcyclist/ cyclist stability?	- Can maintenance vehicles stop clear of traffic lanes? If so, could they obscure signs or sight lines? - Is utility infrastructure/equipment located in safe positions away from locations that may have a high potential of errant vehicle strikes? - Does infrastructure/equipment interfere with visibility? - Have any special accesses/ parking areas provided safe? - Are there any utility inspection chambers in live traffic lanes and/ or wheel tracks? - Has any loose material around utility covers or gratings located in the verge been compacted down and made level with the surrounding ground?	
Access				
	- Can all accesses be used safely? - Can multiple accesses be linked into one service road? - Are there any conflicts between turning and parked vehicles?	- Is the visibility to/from accesses adequate? - Are the accesses of adequate length to ensure all vehicles clear the main road? - Do all accesses appear safe for their intended use?	- Is the visibility to/from accesses adequate? - Are the accesses of adequate length to ensure all vehicles clear the main road?	- Is the visibility to/from accesses adequate? - Are the accesses of adequate length to ensure all vehicles clear the main road?

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Surfacing/surface friction/skid resistance				
		- Are there locations where high friction surfacing (such as on approaches to junctions and crossings) would be beneficial? - Do surface changes occur at locations where they could adversely affect motorcycle stability? - Is the colour of any high friction surfacing appropriate?	- Do any joints in the surfacing appear to have excessive bleeding or low friction? - Do surface changes occur at locations where they could adversely affect motorcycle stability?	- Is the condition of the pavement edges satisfactory? - Is the transition from pavement to shoulder free of dangerous edge drop offs? - Is the pavement free of defects (for example, excessive roughness or rutting, potholes, loose material, etc.) that could result in safety problems (for example, loss of steering control)? - Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades, and approaches to intersections? - Has skid resistance testing been carried out where necessary? - Is the pavement free of areas where ponding or sheet flow of water could contribute to safety problems? - Is the pavement free of loose stones and other material e.g. fallen leaves, nuts/seeds, branches?
Emergency vehicles				
	- Has provision been made for safe access and egress by emergency vehicles?	- Has provision been provided for safe access and egress by emergency vehicles?		- Is provision for emergency vehicles unhindered and effective?
Agriculture				
- Are there any adjoining agricultural areas? Have the safety implications of this been adequately considered?	- Is there a need for safety barriers to protect road users from signs, gantries, parapets, abutments, steep embankments, or water hazards? - Are there land barriers or traffic slowing devices that will impede the safe control of large farm equipment?	- Have the needs of agricultural vehicles and plant been taken into consideration (e.g. room to stop between road and gate, facilities for turning on dual roads)? - Are such facilities safe to use and are they adequately signed? - Are shoulders wide enough to accommodate farm vehicles if/ when they need to travel on shoulder? - Are shoulders clear of signage etc. to accommodate farm equipment? - Are the slopes of the shoulder excessively steep so as to risk equipment tip over on shoulder? - Do lead-up to roundabouts give traffic time to decelerate? - Are road shoulder grades low enough to accommodate hydro vertical clearance specs?		- Is adjoining agriculture having an adverse effect on road safety? If any mitigation measures have been affected, are they effective? - Are bridge and underpasses wide enough to accommodate farm equipment without risking entry to oncoming traffic lanes?

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Fences and safety barriers				
	- Is there a need for safety barriers to protect road users from signs, gantries, parapets, abutments, steep embankments, or water hazards?	- Is there a need for safety barriers to protect road users from signs, gantries, parapets, abutments, steep embankments, or water hazards? - Do the safety barriers provided give adequate protection? - Are the safety barriers provided long enough? - Are specific barrier systems required for motorcyclists? - If there are roads on both sides of the fence is an interlocking-design necessary to prevent impalement on impact?	- Is the safety barrier system adequate? - In the case of boundary fencing, are the rails placed on the non-traffic side of the posts? - Have specific barrier systems been provided for motorcyclists?	- Is the safety barrier system provided appropriate and well maintained? - In the case of boundary fencing, are the rails placed on the non-traffic side of the posts? - Have specific barrier systems been provided for motorcyclists?
Adjoining/adjacent development				
- Will adjoining/adjacent development cause interference/ confusion?	- Does adjoining/adjacent development cause interference/ confusion? (e.g., lighting or traffic signals on adjacent roads may affect a road user's perception of the road ahead) - Is screening required to avoid headlamp glare between opposing roads, or any distraction to road users?	- Has screening been provided to avoid headlight glare between opposing roads, or any distraction to road users? - Are there any safety issues relating to the provision of environmental barriers or screens?	- Have environmental barriers been provided and do they create a potential hazard?	- Are adjoining/adjacent development causing interference/confusion such that road safety is adversely affected?
Basic design principles				
- Is the proposed concept appropriate for the predicted level of use for all road users?	- Are the overall design principles appropriate for the predicted level of use for all road users?			
Bridge parapets				
		- Are parapet heights appropriate for the adjacent road user groups?	- Is the projection of any attachment to the parapet likely to be struck by road users?	- Are bridge parapets well maintained and adequately protected?
Specific/vulnerable road users				
- Does the concept provide specific consideration of vulnerable groups? (i.e. the young, older users, mobility and visually impaired, motorcyclists.)	- Is specific provision required for vulnerable groups? (i.e., the young, older users, mobility and visually impaired, motorcyclists.)	- Are gradients appropriate for mobility scooters? - Are timings at controlled crossings sufficient for all users? - Do surface changes or excessive use of road markings occur at locations where they could adversely affect motorcycle stability? - Are specific barrier systems required for motorcyclists? - Are features such as traffic calming, utility covers or gratings located in the likely wheel tracks for motorcyclists or cyclists? Do they give concern for motorcyclist/cyclist stability?	- Are the following adequate for specific and vulnerable groups? - Visibility - Signs - Surfacing - Other guardrails - Drop curbing/flush surfaces - Tactile paving - Gradients - Lighting levels - Restraint systems - Positioning of utility covers/ gratings	- Are the measures provided for specific/vulnerable road users effective and well maintained? - Does adjoining landscaping and/ or vegetation lead to items being on the surface that can impinge upon the safety of a vulnerable road user (e.g. make the surface particularly slippery for a young or ageing pedestrian or cyclist)

Table 11 – Prompt list covering intersections

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Layout				
Are all aspects of intersections (for example, spacing, type, layout, etc.) appropriate with respect to: - The broad concept of the project - The function of this road and intersecting roads - The traffic mix on this road and intersecting roads - Types which are consistent within the scheme - And consistent with adjacent sections? - Is the frequency of intersections appropriate (neither too high nor too low): - For safe access? - To avoid impacts on the surrounding network? - For emergency vehicle access? - Has the vertical and/or horizontal alignment been considered regarding the style or spacing of intersections? - Have all physical, visibility or traffic management constraints which would influence the choice or spacing of intersections been considered? - Are all the proposed intersections necessary or essential? - Can any unnecessary intersections be removed? - Can access safety be improved by changes on the surrounding road network?	- Is provision for right turning vehicles required? - Are acceleration/deceleration lanes required? - Are splitter islands required on minor arms to assist pedestrians or formalise road users' movements to/from the intersection? - Are there any unusual features that affect road safety? - Are widths and swept paths adequate for all road users? - Will large vehicles overrun pedestrian or cycle facilities? - Are there any conflicts between turning and parked vehicles? - Are any intersections sited on a crest? - Is the intersection type appropriate for the traffic flows and likely vehicle speeds?	- Are the intersections and accesses adequate for all vehicular movements? - Are there any unusual features, which may have an adverse effect on road safety? - Have guardrails/safety fences been provided where appropriate? - Do any roadside features (e.g. guard rails, safety fences, traffic bollards signs and traffic signals) intrude into drivers' line of sight? - Are splitter islands and bollards required on minor arms to assist pedestrians or formalise road users' movements to/from the intersection? - Are parking or stopping zones for buses, taxis and public utilities vehicles situated within the intersection area? Are they located outside visibility splays? - Are any utility covers or gratings located in the likely wheel tracks of motorcyclists or cyclists?	- Have guard rails/safety fences been provided where appropriate? - Do any roadside features (e.g. guard rails, safety fences, traffic bollards signs and traffic signals) intrude into drivers' line of sight? - Have bollards been provided to assist pedestrians or formalise road user movements?	- Are all intersections and accesses operating effectively/safely for all vehicular movements?
Visibility				
- Will the angle of the intersecting roads and the sight lines be adequate for the safety of all road users?	- Are sight lines adequate on and through junction approaches and from the minor arm? - Are visibility splays adequate and clear of obstructions such as street furniture and landscaping? - Will the use of deceleration or acceleration lanes obscure junction visibility?	- Are the sight lines adequate at and through the junctions and from minor roads? - Are visibility splays clear of obstruction?	- Are all visibility splays clear of obstructions?	- Are all visibility splays clear of obstructions?

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
T, X, Y intersections				
		- Have painted island right turn lanes and refuges been provided where required? - Do intersections have adequate stacking space for turning movements? - Can staggered crossroads accommodate all vehicle types and movements?	- Are priorities clearly defined? Is signing adequate?	
Roundabouts				
		- Are the deflection angles of approach roads adequate for the likely approach speed? - Are splitter islands necessary? - Is visibility on approach adequate to ensure drivers can perceive the correct path through the roundabout? - Where chevron signs are required, have they been correctly sited? - Are dedicated approach lanes required? If provided, will the road markings and signs be clear to all users? - Are any utility covers or gratings located in the likely wheel tracks of motorcyclists or cyclists? - Does lead up to roundabout have sufficient distance to safely reduce traffic speeds? - Do roundabouts have soft shoulders to allow wide and long farm equipment to safely negotiate circle if they need to go over the inner circle curb?	- Can the roundabout be seen from appropriate distances and is the signing adequate? - Where chevron signs are required, have they been correctly sited?	- Are any roundabouts provided operating effectively and safely?

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
		Traffic signals		
		- Will speed discrimination equipment be required? - Is the advance signing adequate? - Are signals clearly visible in relation to the likely approach speeds? - Is 'see through' likely to be a problem? If so, would lantern filters assist? - Is the visibility of signals likely to be affected by sunrise/sunset? - Would high intensity signals and/or backing boards improve visibility? - Would high-level signal units be of value? - Are the STOP/Give Way markings in the correct location? - Are any pedestrian crossings excessively long? - Are the proposed tactile paving layouts correct? - Are the markings for right turning vehicles adequate? - Is there a need for box junction markings? - Is the phasing appropriate? - Will pedestrian/cyclist phases be needed? - Does the number of exit lanes equal the number of approach lanes? - If not is the taper length adequate? Is the required intersection intervisibility provided?	- Can the traffic signals be seen from appropriate distances? - Can drivers see traffic signal heads for opposing traffic? - For the operation of signals: Are the signal phases working correctly, are unnecessary delays being created? - Do pedestrian and cycle phases give adequate crossing time? - Can pedestrians or cyclists mistakenly view the green signal for other pedestrian or cycle phases?	- Are traffic signals operating correctly? - Are the number, location and type of signal displays appropriate for the traffic mix and traffic environment? - Are there provisions for visually impaired pedestrians as defined by the Accessibility for Ontarians with Disabilities Act? (e.g., audio-tactile push buttons, tactile markings) - Are there provisions for elderly or disabled pedestrians as defined by the Accessibility for Ontarians with Disabilities Act? (e.g., extended green or clearance phase) - Is the controller located in a safe position? (i.e., where it is unlikely to be hit, but maintenance access is safe) - Is the condition (especially skid resistance) of the road surface on the approaches satisfactory? - Are traffic signals clearly visible to approaching motorists? - Is there adequate stopping sight distance to the ends of possible vehicle queues? - Have any visibility problems that could be caused by the rising or setting sun been addressed? - Are signal displays shielded so that they can be seen only by the motorists for whom they are intended? - Where signal displays are not visible from an adequate distance, are signal warning signs and/or flashing lights installed? - Where signals are mounted high for visibility over crests, is there adequate stopping sight distance to the ends of traffic queues? - Is the primary signal free from obstructions on the nearside footway to approaching drivers? (trees, light poles, signs, bus stops, etc.)

Table 12 – Prompt list covering walking and cycling

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Adjacent land				
- Will the project adversely affect adjacent land?	- Will the scheme have an adverse effect on safe use of adjacent land?	- Are accesses to and from adjacent land/properties safe to use? - Has adjacent land been suitably fenced?	- Has suitable fencing been provided?	- Is fencing provided complete and well maintained? - Is the risk of incursion onto the road from the adjacent land minimal?
Cyclist				
	- Have cycle routes been provided where required? - Do shared facilities take account of the needs of all user groups? - Can verge strips dividing footways/cycleways and roads be provided? - Is specific provision required for special and vulnerable groups? (i.e. the young, older users, mobility impaired?) - Have all cycling needs been considered, especially at intersections? - Are these routes clear of obstructions such as signposts, lamp columns etc.?	- Have the needs of cyclists been considered especially at intersections and roundabouts? - Are cycle lanes or segregated cycle tracks required? - Does the signing make clear the intended use of such facilities? - Are cycle crossings adequately signed? - Has lighting been provided on cycle routes? - Are any proposed drop curbs flush with the adjacent highway? - Are any parapet heights sufficient? - Is tactile paving proposed? - Is it specified correctly and in the best location?	- Do the following provide sufficient levels of road safety for cyclists on, or crossing the road? - Visibility - Signs - Guardrails - Drop curbing or flush surfaces - Surfacing - Tactile paving	- Is a safety fence installed where necessary to guide cyclists to crossings or overpasses? - Are there appropriate travel paths and crossing points for cyclists? - Is a safety barrier installed where necessary to separate vehicle and cyclist flows? - Are cycling facilities suitable for night use? - Is the pavement width adequate for the number of cyclists using the route? - Is the bicycle route continuous? (i.e., free of squeeze points or gaps) - Are drainage pit grates bicycle safe?

Table 13 – Prompt list covering traffic signs, line marking and road lighting

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Signs				
	- Is there likely to be sufficient highway land to provide the traffic signs required? - Are sign gantries needed? - Have traffic signs been located away from locations where there is a high strike risk?	- Do destinations shown align with signing policy and standards? - Are signs easy to understand? - Are the signs located behind safety fencing and out of the way of pedestrians and cyclists? - Is there a need for overhead signs? - Where overhead signs are necessary is there sufficient headroom to enable designated walking and cycling usage? - Has sign clutter been considered? - Is intersection signing adequate, consistent with adjacent signing and easily understood? - Have the appropriate warning signs been provided? - Does the municipality have MTO warning signage to highlight slow moving vehicles? - Are signs appropriately located and of the appropriate size for approach speeds? - Are sign posts and sign structures passively safe or protected by safety barriers where appropriate? - Are traffic signs illuminated where required and the correct reflectivity provided? - Are traffic signs located in positions that minimize potential strike risk? - Is the mounting height of sign faces appropriate? - Are traffic signs oriented correctly to ensure correct visibility and reflectivity?	- Are the visibility, locations, and legibility of all signs (during daylight and darkness) adequate? - Are signposts protected from vehicle impact or passively safe? - Will signposts impede the safe and convenient passage of pedestrians and cyclists? - Have additional warning signs been provided where necessary?	- Have all signs been installed in accordance with the appropriate guidelines? - Are all signs conspicuous and clear? - Are all necessary regulatory, warning and direction signs in place? - Are the correct signs used for each situation, and is each sign necessary? - Are all signs effective for all likely conditions? (for example, day, night, rain, fog, rising or setting sun, oncoming headlights, poor lighting) - If restrictions apply for any class of vehicle, are drivers adequately advised? - If restrictions apply for any class of vehicle, are drivers advised of alternative routes? - In daylight and darkness, are signs satisfactory regarding visibility and: - Clarity of message? - Readability/legibility at the required distance? - Are signs able to be seen without being hidden by their background or adjacent distractions? - Is driver confusion due to too many signs avoided? - Is sign retroreflectivity or illumination satisfactory? - Are sign supports out of the clear zone? If not, are they: - breakaway signposts? - protected by barriers (for example, guard fence, crash cushions)? - Are curve warning signs and advisory speed signs installed where required? - Are advisory speed signs consistent along the route? - Are the signs correctly located in relation to the curve? (i.e. not too far in advance) - Are the signs large enough? - Are chevron alignment signs (CAS) installed where required as prescribed by OTM Book 11? - Is the positioning of CASs satisfactory to provide guidance around the curve? - Are the CASs the correct size? - Are CASs confined to curves? (not used to delineate islands, etc)

Feasibility stage	Concept design	Detailed design	Pre-opening	Existing roads or post-opening
Lighting				
	- Is the project to be street lit? - Has lighting been considered at new intersections and where adjoining existing roads? - Are lighting columns located in the best positions? (e.g., behind safety fences)	- Has lighting been considered at new intersections and where adjoining existing roads? - Is there a need for lighting, including lighting of signs and bollards? - Are lighting columns passively safe? - Are lighting columns located in the best positions, e.g., behind safety fences and not obstructing walking and cycling routes?	- Does the street lighting provide adequate illumination of roadside features, road markings and non-vehicular users to drivers? - Is the level of illumination adequate for the road safety of pedestrians and cyclists? - Is lighting obscured by vegetation or other street furniture?	- Has lighting been adequately provided where required? - Is the road free of features that interrupt illumination? (for example, trees or overbridges) - Is the road free of lighting poles that are a fixed roadside hazard? - Are breakaway signposts or slip-base poles provided? - Ambient lighting: if it creates special lighting needs, have these been satisfied? - Is the lighting scheme free of confusing or misleading effects on signals or signs? - Is the scheme free of any lighting black patches?
Posts/columns				
	- Will poles/columns be appropriately located and protected?	- Are poles and columns passively safe? - Are poles and columns protected by safety fencing where appropriate?		- Do all poles and columns have structural integrity and are well maintained?
Lines, other markings and delineators				
	- Are any road markings proposed at this stage appropriate?	- Do the road markings clearly define routes/priorities? - Are the dimensions of the road markings appropriate for the speed limit/design speed of the road? - Have old road markings and road studs (cat eyes) been adequately removed? - Are pavement markings appropriate to the location? - Are centre and edge lines; hatching; road studs (cat eyes); text/ destinations etc approved and/or conform to local standards?	- Are all road markings/studs (cat eyes) clear and appropriate for their location? - Have all superseded road markings and studs been removed adequately? - Do the road markings clearly define routes and priorities? - Have all superseded road markings and studs been removed adequately?	- Does all line marking conform with these standards and/or guidelines? - Is there advance warning of approaching auxiliary lanes? Is the line marking and delineation: - appropriate for the function of the road? - consistent along the route? - likely to be effective under all expected conditions? (day, night, wet, dry, fog, rising and setting sun position, oncoming headlights, etc.) - Is the pavement free of excessive markings? (for example, unnecessary turn arrows, unnecessary barrier lines, etc.) - Are centrelines, edge lines, lane lines provided? If not, do drivers have adequate guidance? - Have raised retroreflective pavement markers (RRPMs) been installed where required? - If RRPMs are installed, are they correctly placed, correct colours, in good condition? - Are profiled (audible) edge lines provided where required? - Is the line marking in good condition? - Is there sufficient contrast between line marking and pavement colour? - Are guideposts appropriately installed?

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