

GUIDELINES FOR SAFETY IMPACTS STUDIES

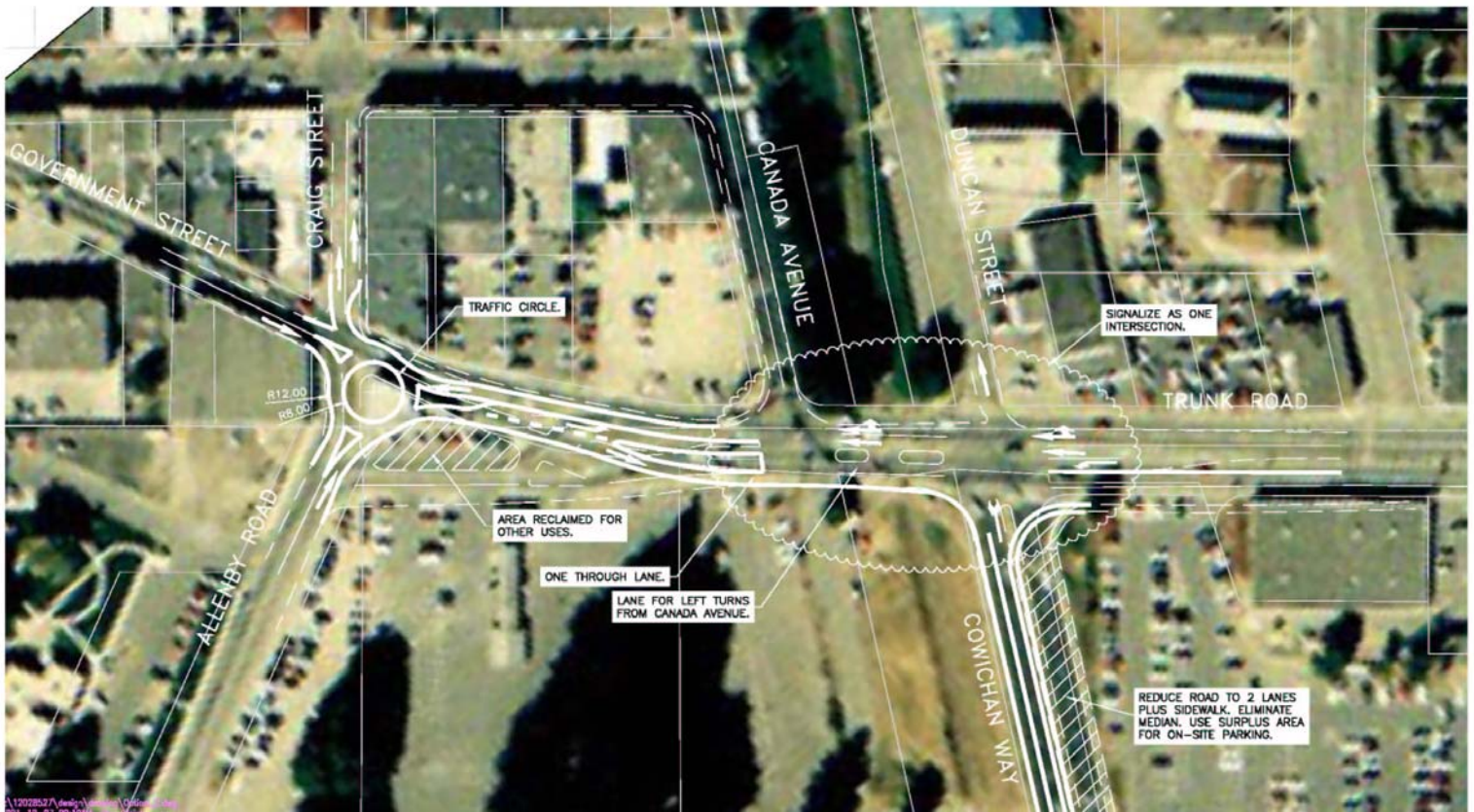
Prepared by:

Michael Skene, Limited Licensee (Eng), ASCT

Brian Malone, P.Eng, PTOE,

Edward Soldo, P.Eng

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ABSTRACT

Road authorities regularly call for the provision of traffic impact studies (TIS) in order to assist in obtaining sufficient information to make decisions. The purpose of a TIS is to assess the effects of traffic caused by a proposed development and to identify improvements that may be required in order to ensure that the roadway system will operate at an acceptable level upon completion. Traffic impact studies concentrate on the evaluation of the operational impacts. However, one issue that is not generally explicitly addressed in a TIS is safety.

Safety is an important element of the operation of a transportation system. The negative societal costs of motor vehicle collisions are staggering. Despite this, it is common to examine the impacts that will occur relating to traffic operations but not those relating to traffic safety. This does not have to be the case. Where development is proposed the undertaking of a safety impact study (SIS) is a new approach that can provide information to a road authority to allow them to assess the potential safety impacts that a development may have.

This paper describes the development of safety impact study guidelines that have been completed for the Regions of Halton and Niagara in Ontario, Canada. The paper reports on methodologies by which the safety impacts of proposed developments can be assessed and offers commentary on how safety impact studies compliment traffic impact studies. It highlights how safety impact study guidelines are used to examine safety aspects of development submissions.

Presenter: Mike Skene, Limited Licensee (Eng), ASCT, President Boulevard Transportation Group Ltd.

mskene@blvdgroup.ca

250 388 9877

2728 Spencer Rd

Victoria, BC

V9B 4C6

Canada

Coauthors: Brian Malone, PEng, Vice president, Synectics Traffic Safety Consultants

Edward Soldo, P.Eng, Region of Halton

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Prepared by Michael Skene, Limited Licensee (Eng), ASCT and Brian Malone, P.Eng, PTOE, Edward Soldo, P.Eng

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INTRODUCTION

This paper describes a draft set of guidelines that have been prepared for implementation by Halton and Niagara Regions, in Ontario, Canada. The guidelines outline procedures for undertaking an explicit evaluation of traffic safety within the development process.

In the evaluation of proposed developments, municipalities regularly call for the provision of Traffic Impact Studies (TIS) in order to assist in obtaining sufficient information to make decisions. A TIS identifies improvements that may be required to the roadway network in order to ensure that the roadway system will operate at an acceptable level of service upon completion of the proposed development. Traffic Impact Studies concentrate on the evaluation of the operational impacts of proposed developments. The elements that are evaluated are typically related to roadway capacity and the level of service that will be available. However, one issue that is not generally included in a TIS is roadway safety.

Safety is an important part of any transportation system. The performance of a roadway with respect to safety is as important as the operational performance. Agencies are also moving from addressing safety in a reactive mode, taking actions at locations where collisions have occurred, to a proactive one, evaluating roadways for their potential to operate safely and, ideally, making modifications to prevent collisions before they occur. Where new development is proposed the undertaking of a Safety Impact Study (SIS) is a new approach that can provide the required information to a road authority to allow them to assess proposed developments from a safety perspective.

Examining safety of proposed developments is, of course, not entirely new. In an ad hoc manner, road authorities have carried out safety reviews to help address traffic issues. These studies have typically been carried out when it was found that the TIS reports submitted failed to provide an evaluation of the potential safety implications of proposed developments. While individual reports were adequate in addressing specific locations, the development of guidelines that will provide standardization to the approach that should be taken for conducting safety impact studies is something that does not currently exist.

This report highlights the Safety Impact Study guidelines developed for the Regional of Halton and Niagara. With a particular emphasis on assessing the potential safety effects of proposed developments,

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safety impact studies compliment traffic impact studies. The development of guidelines for their preparation will assist municipalities to call for their preparation in conjunction with development submissions and ensure that sufficient information of acceptable quality will be provided to allow for an evaluation of the safety impacts on proposed developments.

BACKGROUND

A literature search identified a number of documents regarding traffic impact studies and guidelines. Not all of the reviewed documents discuss safety as part of a Traffic Impact Study; however, in the few documents where safety was explicitly discussed in the TIA guidelines, they indicated that safety should be included as part of the traffic impact review, but provided little explanation or details on what safety is or what is to be reviewed.

When safety was identified, the following safety criteria were identified to be reviewed as part of the TIS:

- Crash history
- Sight distance
- Pedestrian safety
- Cyclist safety

One set of guidelines mentioned review of transit and safe access to and from the bus stops and others indicate that the following potential safety or operational issues should be identified and reviewed as part of a safety analysis:

- Weaving
- Merging
- Corner clearance
- Sight distances
- Vehicle-pedestrian conflicts
- Traffic infiltration
- Access conflicts
- Cyclist movements
- Heavy truck movement conflicts, etc.

A review of the municipal documentation indicates that there is opportunity to incorporate a process for SIS without compromising the existing developmental process. The documentation also indicates that the SIS process will not duplicate effort as currently no such activity takes place in any part of the development process.

SAFETY IMPACT STUDY REQUIREMENTS

The function of SIS is not to put up barriers that discourage development but work towards making the development as safe as possible. SIS are intended to be applicable both on site and off site. The scope would include all modes of transportation including cycling, transit and pedestrians.

On-Site considerations include:

Pedestrian:

Often time's large developments create large parking areas but do not consider pedestrians that must travel from the storefront or office building to the parked car.

The major crash types most often associated with pedestrian crashes are:

- Pedestrians darting out mid-block in front of a vehicle.
- Running from one side of the intersection to the other.
- A vehicle turning from one street onto another.
- Pedestrian crossing a multi-lane street
- Vehicles backing up.

Transit:

Transit agencies do not typically like routing buses on site. However, consideration should be given to safe walking to and from a transit stop relative to the bus coming on site and reducing the walking risk.

Cycling:

In a similar fashion, cycling should be considered on site as well. Considerations should include the paths cyclist would use, conflict points, and location of parking facilities etc.

Vehicular operations:

When reviewing operations it is important to review all aspect of operations including circulation, queuing on site, turning movements, loading and pick up and drop off.

Off site considerations may not be as "self contained" as the on site. A study area should therefore be established and is discussed further in the guide. Again, all modes of transportation need to be considered in a Safety Impact Study.

Making the decision as to which developments are required to undertake a safety impact study and the personnel required to undertake the study is the first step of the process. This safety impact process that has been developed is aimed at small or "mid size" commercial or office developments, however they can also be used for other sizes and other land uses. Care should be taken in these other cases that all factors be considered.

The determination of the need for Safety Impact Studies should be based primarily on the potential that a development has to negatively impact safety in the community. As opposed to Traffic Impact Studies however, which may be required when a proposed development is expected to generate a minimum amount of additional traffic, the safety impacts of a development can vary considerably. Consideration needs to be given to not only vehicular traffic but also the safety of vulnerable users of the transportation system, such as pedestrians.

Not every proposed development will require the completion of a Safety Impact Study, but some criteria can be considered when evaluating the need. Developments that should be considered for safety impact studies include developments that will generate significant amounts of vehicular traffic as well as increasing the interaction between pedestrians and vehicles in proximity of the site. A defining point for the requirement of a safety impact study would be the number of driveways associated with the development. When a development has two or more designated access locations there can be an expectation to be an amount of on site circulation and parking which has the potential for broader safety impacts and requires a more detailed on-site and off-site safety analysis.

It is the proponents responsibility to retain a qualified traffic safety consultant experienced in traffic safety and traffic engineering. The consultant shall be a member of the Institute of Transportation Engineers and registered as a Professional Engineer in the Province of Ontario. The report must be dated and signed accordingly as the signing engineer is verifying that appropriate assumptions and methodologies have been utilized and that they are individuals who are taking corporate professional responsibility for their work.

The safety component does not confine itself to the development location and should be carried out in the same respect to the traffic impact study. The standard coverage area for a traffic impact study includes all affected roads, ramps and intersections through which peak hour traffic increases by 5% or more, volume/capacity ratios match or exceed 0.85 and where exclusive movement lanes reach a volume/capacity of 1.0 or greater.

In general, the SIS should be in a report format. The report should include a completed checklist, documented areas of concern, mitigating actions, and summary comments on each element of the review. With every decision should be a supporting justification. The report should reference any background material, data and the Traffic Impact Study. The report should also contain all appropriate plans indicating dimensions and standards.

SAFETY ANALYSIS METHODS

In general, the safety impacts of a development can be estimated in two different ways. The first one is a **quantitative** approach using statistical estimates based on collision data where available. Such an assessment may be carried out if collision and volume data exists within the study area. The proposed process also allows for the prediction of collision performance for the development using crash modification factors. Comparison of the pre-existing collision history to the prediction collision performance upon completion of the development can then be undertaken. Based on this, a change in collision experience because of the development can be predicted.

A **qualitative** approach may also be taken. This approach identifies issues and problems, which may adversely affect the safety of road users, and estimates the road travel risk level associated with them. The identification of the issues and problems are based on the driver, vehicle, road/infrastructure, environment and temporal characteristics of the study area. A scoring system using a series of checklists has been developed to assess the safety of the development in a more qualitative approach.

A flowchart has been developed which steps through the process of the safety impact study. The flow chart identifies the appropriate steps and decisions required in the process. After deciding that a SIS is required and a study area is determined, data is reviewed and a decision is made whether the qualitative or quantitative method should be undertaken. If the qualitative approach is taken the consultant would apply the safety risk index (SRI), assess the exposure, probability and consequences of potential crashes by using the checklist provided. The consultant would then compare and summarize his results, develop his conclusions and make appropriate recommendations.

If the decision was that the data was sufficient for a quantitative approach, the consultant would develop crash prediction models, apply trip generation factors and determine the safety impact. The consultant would then summarize his results, develop his conclusions and make appropriate recommendations.

Quantitative Methodology

The objective of a quantifiable safety assessment is to identify locations that may be in need of safety improvement. Quantitative assessments allow for an understanding of the existing safety performance of the proposed development site. The safety performance can be evaluated in comparison to other locations. The goal is not to use the existing performance as a reason to prohibit the proposed development, but to understand existing conditions such that opportunities for improvements in safety can be incorporated into the development, if possible. Knowing what issues exist allows designer to make explicit considerations of safety. By looking directly at the safety impacts of the proposed development, and conducting that evaluation with an understanding of existing conditions, the goal is to include considerations that will improve safety rather than degrade it.

The quantitative safety assessment of a location in conjunction with a safety impact study has the potential to be predictive in the determination of safety impacts. Knowledge of the potential modifications that specific treatments can have on safety, can allow the development of ‘what-if’ scenarios based on alternatives that are proposed in conjunction with the development. This approach can be a valuable tool, aiding in the selection of the most appropriate design treatments.

Quantitative assessments are not without limitations. They require information regarding existing safety performance in order to complete the evaluation. In some locations, information is not always available, is not sufficiently detailed or is not up to date. As such, quantitative assessment is not always possible.

Qualitative Methodology

The qualitative methodology involves the identification of issues or problems that may adversely affect the safety of road user and the estimation of the road safety risk level associated with them. The ‘road safety risk’ concept is used to determine if the development will negatively impact safety and to what degree. Road safety risk is dependent upon the probability of a collision occurring under the geometric, environmental and traffic characteristics, the exposure of the different road users, and the likely consequences of a collision. Thus, the safety risk is a function of these three parameters and can be expressed using the following formula:

$$\text{Road Safety Risk} = f(\text{Exposure, Probability, Consequence})$$

Where:

Exposure –Exposure is measured in terms of traffic volume including passenger vehicles, transit, trucks, pedestrians, bicyclists, etc. Exposure is also expressed in distance travelled or in time spent on the roadway. The key principle here is, the more a person is involved in road traffic, the more likely it is that the person would be involved in an crash;

Probability – The probability of a collision measures the degree of uncertainty that a particular event would occur. Probability is dependant upon design parameters, traffic operations, time periods, environmental conditions and traffic characteristics; and

Consequence – The consequences refers to the severity of an injury sustained by a person involved in a collision. The severity is measured in terms of property damage collisions, injuries or fatalities.

Assessment Tool

A series of checklists were developed to enable the development to qualitatively evaluate for safety. After

answering specific questions in each category, the issues are scored as low, moderate or high in terms of exposure, probability and consequences. The values are then included on a summary page providing an easy ranking scale to establish the safety of the proposed development.

An important consideration when developing this tool was to ensure the developer is not discouraged from proceeding with the development based on the safety impact guidelines. For this reason the developer is not required to compare the development with a ‘do nothing’ scenario as a new development would rarely be seen in a favourable light when compared with the existing situation. It was however important to ensure developers have considered all the safety aspects of the development to ensure the result is the safest possible without jeopardising the viability of the proposal.

GUIDELINES, DOCUMENTATION AND REPORTING

As this initiative has never been done in the past it is important that both the road authority and the practitioner working on the SIS follow a process closely. A process has been recommended in the guidelines. It is recommended that each of the stages of the process be signed off by both parties prior to advancing in the process.

In addition to issues highlighted, there may be variances to this guideline and the road authority should use their discretion if there are unsafe circumstances prevalent in the area or some other circumstance that would require an explicit review of traffic safety. If there is a TIS being conducted the same study area should be used, however often times the TIS study area may be too cumbersome for a SIS and therefore the decision to consider an alternative boundary should rest with the road authority. A discussion should take place with both parties to review the available data and the data deemed to be required. This would include crash data as well as volume data.

Depending on the available data, a qualitative or a quantitative method of safety assessment will be determined in discussions with the road authority and the consultant. It should be noted that the quantitative approach could be supplemented by the qualitative checklist.

It is desirable to have a field meeting with both the road authority and the consultant however this is not always possible. It is however important that the consultant undertake a field visit at the very least. The consultants should review existing conditions, make themselves familiar with the checklist and document any unusual or unsafe traffic characteristics.

As discussed the qualitative assessment utilizes a checklist process. The checklist should not be construed as a complete list and other items may be identified. There are two series of reviews contained in the checklist, a review of on site elements and a review of off site elements. Typically on site element review would be completed through a review of the development plans. The off site review should be completed through

site investigations and the appropriate traffic engineering practices. The checklists are set up to assist in reviewing all modes of transportation and the integration with the other modes. Corridors and intersections should be evaluated.

Conclusions will be documented as the traffic safety elements are rated and tallied. A checklist summary page is provided for this reason. A document summarizing the process, ratings, justification and recommended actions should Section 3 and be forwarded to the Region for acceptance. It may be however that recommended actions may not arise as once they have been identified in draft form actions to propose changes may already have been made to the plans.

Checklists have been developed to guide the undertaking of the qualitative assessment and to enhance the quantitative assessment. It is important to monitor the results of the SIS and modification of the checklists by the road authority is expected as improvements are identified. The following are checklists that have been developed.

- OFF SITE PEDESTRIAN CHECKLIST
- ON SITE PEDESTRIAN CHECKLIST
- OFF SITE CYCLIST CHECKLIST
- ON SITE CYCLIST CHECKLIST
- CRASH HISTORY CHECKLIST
- OFF SITE PARKING CHECKLIST
- ON SITE PARKING CHECKLIST
- SITE LAYOUT AND ACCESS INTERSECTION CHECKLIST
- ROAD GEOMETRY CHECKLIST
- CHECKLIST SUMMARY SHEET

UPDATE

Since the adoption of the SIS there have not been any developments that have formally gone through the process. It is speculated that the process is burdensome for a developer and therefore might not be fully embraced by all involved in a development proposal. However since its adoption the author has applied the checklist on a number of development projects for municipal clients in a “peer review” manner. This has been seen as successfully ensuring that the developments are built with the safest considerations. One of these projects is the subject of the presentation at the Transportation Association of Canada’s Fall Conference in Quebec City.

CONCLUSIONS

These guidelines have been developed for two Regional authorities in Ontario. They are replicable for any local, regional or provincial government in Canada. This progressive and proactive approach to development should be seen as a benefit to communities and developers alike and should not be construed as a burdensome addition to an already bureaucratic development approval process.

The benefits of this proactive approach are yet to be measured but other proactive approaches to safety have resulted in significant safety savings and it is expected that these guidelines will also show the same benefits.