SAFETY ASSESSMENT GUIDELINES

NYSMPO

AGFTC BMTS CDTC GTC ECTC GBNRTC HOCTS ITCTC CLCTC UCTC SMTC PDCTC OCTC NYMTC

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PREFACE

This document is the result of a New York State Metropolitan Planning Organization (NYSMPO) Safety Working Group (SWG) shared cost initiative and was funded through the New York State Department of Transportation's State Planning and Research grant program. The NYSMPO association is a coalition of the thirteen Metropolitan Planning Organizations (MPO) in New York State. Each MPO is responsible for transportation planning and project programming within their region. The SA project was hosted by the Elmira-Chemung Transportation Council (ECTC).

The NYSMPO association includes several working groups which share information and advance statewide initiatives. The SWG meets monthly to share information and advance safety initiatives through collaboration with partners including the Federal Highway Administration (FHWA), the New York State Department of Transportation (NYSDOT), the Governor's Traffic Safety Committee (GTSC), the Institute for Traffic Safety Management and Research (ITSMR), the New York State Police (NYSP), the NYS Department of Health (NYSDOH) and the NYS Department of Motor Vehicles (NYSDMV). Additional information about the SWG may be found at http://www.nysmpos.org/safety_working_group.html

This document was prepared for the NYSMPO Association by Bergmann Associates in association with Synectics Transportation Consultants and Eng-Wong, Taub & Associates. Principal authors included F. Dolan, M. Croce, B. Malone, G. Junnor, and O. Tonkonjenkov.

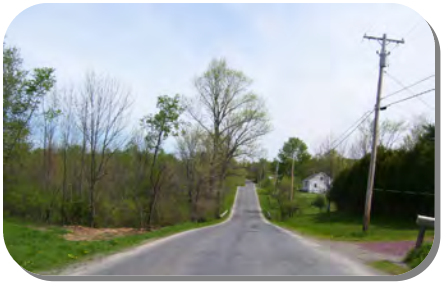
1.0 INTRODUCTION

1.1 Purpose of the Guidelines

Road Safety Audits (RSAs) are widely recognized as a proactive, low-cost tool to improve safety at each stage in the lifecycle of a transportation facility. To-date, numerous RSAs conducted throughout the United States have yielded positive results. The experience of the New York State Department of Transportation (NYSDOT) with its Safety Appurtenance Program (SAFETAP) is one of the best examples of incorporating RSAs into a pavement overlay program resulting in the identification and mitigation of safety concerns.

Safety Assessments are low cost and result in minimal project delay.

The Safe, Accountable, Flexible, Efficient, Transportation Equity Act - A Legacy for Users (SAFETEA-LU), the Federal Funding legislation for transportation projects throughout the United States from 2005 through 2009, strengthened a government program known as the Highway Safety Improvement Program (HSIP). The legislation instituted a requirement for active, explicit consideration of safety on all public roads as part of the traditional planning process and required each state to prepare a Strategic Highway Safety Plan (SHSP). Since SAFETEA-LU, increased cooperation between safety program stakeholders has improved immensely. Unfortunately, the availability of crash location, characteristic, and condition data is still limited, especially on rural roads. This continues to hinder efforts to improve safety on all the Nation's roadways for all modes of travel. With more than 75% of roads in the United States under local jurisdiction, the application of RSA procedures to local transportation projects and facilities has the potential to bring about substantive improvements in safety across the country.



The release of the Federal Highway Administration (FHWA) Road Safety Audit (RSA) Guidelines and Prompt Lists has accelerated the implementation of RSA processes, however work remains to incorporate RSA concepts into the routine activities of many transportation agencies. This is especially true where local transportation systems are involved. The NYSMPOs recognized that specific Guidelines, designed to be used both by MPOs and local agencies, are needed to support the integration of RSA processes into all types of local transportation projects and facilities statewide.

The NYSMPOs also acknowledged that RSA processes can identify safety improvements extending beyond the boundaries of pure roadway engineering countermeasures. Such improvements might include reducing road user risk through the modal shifts from passenger vehicles to mass transit, through the implementation of

intelligent transportation systems, road user safety education, and selective enforcement of traffic controls and rules of the road.

The SA guidelines are tailored for use in New York State.

As the title suggests - ***Safety Assessment (SA) Guidelines*** - these Guidelines place considerable emphasis on expanding the RSA process beyond roadways. The SA Guidelines are designed for use on the local transportation system of New York State both by MPOs and local agencies. The Guidelines are based on conventional RSA principles as outlined in the FHWA RSA Guidelines, but tailor the process to the conditions experienced by NYSMPOs and local agencies throughout New York State. They emphasize a connection between the transportation planning process, multi-modal considerations, enforcement activities, safety education, and engineering solutions.

Specific objectives of the SA Guidelines for NYSMPOs and local transportation agencies are as follows:

- Define the subject of SAs and its key elements;
- Define a standardized step-by-step SA process to enable easy use by practitioners;
- Introduce SA stages;
- Define general roles and responsibilities for the conduct of SAs;
- Explain the SA approach to selected projects and locations;
- Define the SA Team selection process and general SA team requirements;
- Provide standardized SA report formats;
- Define procedures to promote and monitor the SA process;
- Introduce SA tools; and
- Explain how to overcome challenges to the implementation of the SA process.

The SA Guidelines are intended to assist practitioners in establishing and monitoring an ongoing SA program within an MPO or local jurisdiction. They are also designed to guide those conducting individual SAs. For convenience, the Guidelines are formatted such that the most important activities are detailed in a step-by-step format with concise write-ups presented as lists of activities where appropriate. Further information on the RSA process, from which the SA process is derived, is available in the published FHWA RSA Guidelines and FHWA Pedestrian RSA Guidelines.

1.2 Definition of Safety Assessment

A Safety Assessment (SA) is defined as follows:

Definition of a Safety Assessment

A formal safety performance examination of an existing or planned transportation facility (e.g. road, intersection, sidewalk, multi-use path, or access to land use development) by an independent, qualified SA Team. The SA Team considers the safety of all users, qualitatively estimates and reports on safety issues, and suggests opportunities for safety improvement. In the assessment of existing facilities, proposed improvements may include but are not limited to short, medium, or long term engineering solutions, multi-modal considerations, enforcement activities, and safety education.

The aim of an SA is to answer the following questions:

- What elements of the transportation system may present a safety issue, to what extent, to which users, and under what circumstances?
- What opportunities exist to reduce or mitigate identified safety issues?
- Are there low cost solutions or countermeasures that would improve safety?

SAs may be used not only as a safety improvement tool, but also as a project or program generation tool. The variety of improvements which can be proposed is versatile and broad in nature.

1.3 Key Elements of Safety Assessments

Key elements of SAs

Some of the decisions that local agencies make while implementing SAs in their jurisdictions include determining what elements to include in the SA process, what elements are most important, and which may be omitted.

Past practice has shown that omitting key elements of the SA process renders the overall process much less effective and may either result in a compromised process that duplicates other processes (i.e. a conformance-to-standards check) or one that fails to add real value from a safety perspective.

Exhibit 1.1 outlines key elements of the SA process which must be present for overall effectiveness. The exhibit may be used as a quick prompt list to ensure that an SA program or individual SA is properly structured and conducted.

Exhibit 1.1: Key Elements of the SA Process

Key Element of SA	Characteristics of Key Elements
Formal Examination	• Scope and objectives of an SA are formally defined and known as "Terms of Reference". • SA is properly documented in an SA report and officially submitted to the Project Owner. • Suggestions in the SA report are reviewed with the project owner and officially documented and delivered to the SA Team and other designated recipients. • Actions necessary to implement the suggestions made are documented. • Implementation actions taken are properly documented. • SA documentation is kept in a permanent project file.
Team Review	• At least three members participate (usually not less than six members for larger projects) with experts called in as necessary for specialist input. • Larger teams are acceptable for SA training. • Incorporate a variety of experience and expertise (e.g., transportation safety, design, traffic, maintenance, construction, public safety, local officials, enforcement personnel, first-responders, human factors) specifically tailored to the project. • Include a local representative.
Independent, Non Biased SA Team	• SA of design: SA Team members should be independent of the design team directly responsible for the development of the original plans. • SA of existing facility: SA Team members are ideally independent of the team directly responsible for operating and maintaining (O&M) the facility. Especially in smaller jurisdictions, it may be necessary to draw some team members from the local O&M staff. This is acceptable as long as those individuals can approach the task with an open mind. • The purpose of independence is to avoid any direct conflict of interest, agenda, or pre-existing biases which may adversely affect the SA team's findings and suggestions. For example, one can achieve independence for an SA on an existing facility by identifying an SA Team Leader independent of the facility owner but identifying SA Team members related to the facility owner who are not directly responsible for the design, operation or maintenance of the facility. Engineering, maintenance and other representatives from the agency may participate.

Key Element of SA	Characteristics of Key Elements
Safety Focus	• SA is focused on identification of potential transportation safety issues. • SA is not a check of compliance with standards since compliance alone does not assure optimal, or even adequate, safety. • SA does not consider issues that are not safety-related.
Includes all Users	• SA considers all types of potential users (elderly drivers, pedestrians of different age groups including children and the physically-challenged, bicyclists, etc). • SA considers all appropriate vehicle types/modes of travel including but not limited to commercial, recreational, agricultural traffic, and transit access.
Proactive Nature	• The team considers more than just those safety issues demonstrated by a pattern of crash occurrence. • The absence of high quality collision data can be a reason to conduct an SA. • Locations demonstrating a higher than average crash risk may be selected for an SA, but sites may also be selected for other reasons (e.g., sections scheduled for pavement overlay, reconstruction or rehabilitation). In the latter case, potential safety issues are identified proactively.
Qualitative Assessment	• SA team uses qualitative techniques (visualization of the design features, field visits, prompt lists, “seeing” the transportation system through the eyes of different users, brainstorming, RSA software, etc.) to identify safety issues. • While crash data is reviewed (if available) it may not be a driving force behind the SA.
Versatility of Proposed Safety Improvements	• The proposed improvements may include, but not be limited to: ⇒ short, medium or long term engineering solutions. ⇒ multi-modal considerations. ⇒ enforcement activities. ⇒ safety education.

2.0 CONDUCTING SAFETY ASSESSMENTS

An MPO or a local agency may choose to establish an ongoing SA program or may conduct individual SAs as needed. **Exhibit 2.1** provides an overview of the SA process as a whole. Past experience suggests that the effectiveness of the process improves dramatically when it is well organized from the first step to the last, no important activities are overlooked, and roles and responsibilities are clearly defined.

Sections 2.1 through 2.8 provide a concise guide to each step in the SA process and can also be used as a prompt list of activities. Participants are referred to by general terms including “SA Program Liaison”, “Project Coordinator”, “Project Owner", “Design Team”, “Traffic Engineering and/or Maintenance Team”, and “SA Team”. The role of each party is defined in **Section 5.0.** Additionally**, Appendix B** contains a Glossary of Terms. The description for each role may be specified in greater detail by each jurisdiction to suit their own unique needs.

Organization of the Safety Assessment Guide

The following is an outline of the remaining Sections of these Guidelines:

- **Section 3.0** discusses the different SA stages.
- **Section 4.0** discusses the selection of projects and locations for an SA.
- **Section 5.0** provides information on typical SA roles and responsibilities.
- **Section 6.0** outlines requirements for an SA Team.
- **Section 7.0** provides more detail on the selection of an SA Team.
- **Section 8.0** discusses the format of SA reports.
- **Section 9.0** discusses monitoring and promotion of the SA process.
- **Section 10** overviews SA tools.
- **Section 11** discusses challenges to the implementation of an SA process.
- **Appendix A** provides three SA case studies, illustrating the processes, challenges, and benefits of SAs.
- **Appendix B** provides a glossary of SA terms.
- **Appendix C** overviews the FHWA RSA software tool.
- **Appendix D** provides high-level and detailed Prompt Lists to be referred to when conducting an SA.

Exhibit 2.1: Safety Assessment Process step-by-step

Steps in the SA Process

Step 1: Identify project or existing facility to be assessed
As a result of this step, the project or existing facility to undergo an SA is determined and the parameters for the SA are set.

Step 2: Select Safety Assessment Team
As a result of this step, an independent, qualified, and multidisciplinary team suitable for the specific SA stage is selected.

Step 3: Conduct a Pre-assessment Meeting to Review Project Information
The meeting brings together the project owner, the design team (or traffic engineering/maintenance representatives of the agency for the SAs of existing roads) and the assessment team.

Step 4: Conduct Review of Project Data and Field Visit
The objective of project data review is to gain insight into the project or existing facility, to prepare for the field visit, and to identify preliminary areas of safety concern. The field visit is used to gain further insight into the project or existing facility, and to further verify/identify safety concerns.

Step 5: Conduct SA Analysis and Prepare Report of Findings
As a result of this step, the safety issues are identified and prioritized and suggestions are made for improving safety. The SA results are then summarized in the formal SA report.

Step 6: Present SA Findings
In this step, the SA team orally reports the key SA findings to the project owner and design team in order to facilitate the understanding of the SA findings.

Step 7: Prepare Formal Response
The formal response becomes an essential part of the project documentation. It outlines what actions the project owner and/or design team will take in response to each safety issue listed in the SA report and why, if any, some of the SA suggestions could not be implemented.

Step 8: Incorporate SA Findings when Appropriate
This final step ensures that the corrective measures outlined in the response report are completed as described and in the time frame proposed.

2.1 Step 1: Identify Project or Location to be Assessed

- The SA Program Coordinator (refer to **Section 5.0**) appointed to manage the SA program within one or multiple jurisdictions should develop and apply an approved policy for selecting projects or existing locations to undergo an SA. Considerations in the development and application of a selection policy are outlined in **Section 4.0. Appendix B** contains definitions for many of the terms used below.

- For an individual SA, the Project Owner (refer to **Section 5.0**) should establish a specific Terms of Reference (ToR) document. ToRs for a specific SA may be developed based on a standardized template developed by the SA Program Coordinator and approved by the jurisdiction. The ToR should define:

  - Scope, goals, and objectives.
  - Schedule for completion.
  - Team requirements (refer to **Section 6.0**).
  - SA tasks (refer to **Sections 2.3-2.6**).
  - The Maintenance Supervisor, to whom all immediate maintenance problems (such as deficiencies requiring action according to local standards), should be communicated directly.
  - A formal SA report format, including forms to be completed (refer to **Section 2.5** and **Section 8.0**), should be prepared and approved by the jurisdiction. This may include statements pertaining to the ToR under which the SA was conducted, statements ensuring confidentiality of the SA report, etc.

2.2 Step 2: Select an SA Team

The Project Owner, with the assistance of the SA Program Coordinator, should select a group of qualified individuals to form the SA team. This selection may be done by committee or from a pre-established approved list if the SA team will be a Consultant or Subconsultant to another professional firm. Typical requirements for an SA team are presented in **Section 6.0**. Principles involved in selection of an SA Team are outlined in **Section 7.0**.

2.3 Step 3: Conduct a Pre-Assessment Meeting to Review Project Information

The SA team should hold a Pre-Assessment Meeting.

A pre-assessment meeting is the most effective and efficient way to acquaint an SA team with the project or existing facility and to discuss the scope, goals, and objectives of the SA.

Preparing for and conducting the pre-assessment meeting involves the following activities:

- Design team, traffic engineering, and/or maintenance team (as appropriate) prepares the background data necessary for the SA in accordance with the ToR in advance of the meeting. The type of data to be provided will vary, depending on the SA type and stage. The data may include, but not be limited to, the data outlined in **Exhibit 2.2**.

Exhibit 2.2: Data Recommended for an SA (Typical for Roadway Assessments)

Note: it is understood that not all the data below may be available.

Data	Specifics
Design Criteria	• Functional classification, land uses, control of access. • Design speeds, design vehicles (for road assessments). • List of non-standard and/or non-conforming features. • Justification for non-standard and/or non-conforming features.
Traffic Data	• Vehicular volume and composition on a facility being assessed as well as those on intersecting roads and within the surrounding roadway network. • Pedestrian/bicycle volumes and mixes (children, elderly, disabled etc.) on the facility being assessed, on intersecting facilities, and within the surrounding transportation network. • Operating speeds and points of congestion.
Environmental Characteristics	• Typical and unique weather conditions. • Topography.

Data	Specifics
Documents Showing the Existing or Proposed Facility	• For SAs of existing facilities: As-built drawings at a suitable scale (e.g. 1:40 US Customary, 1:500 Metric) and aerial photographs which would be useful to have on hand during the field review. • For planning stage SAs: Conceptual drawings at a suitable scale (e.g. 1:1000 US Customary, 1:10000 Metric) showing all planning alternatives, adjacent land uses, the surrounding transportation network, connections to adjoining transportation facilities and topography. • For preliminary design stage SAs: Contract plans at a suitable scale (e.g. 1:40 US Customary, 1:500 Metric) showing horizontal and vertical alignment, typical section, connections to adjoining transportation facilities, proposed traffic control devices, basic ramp configurations and lane configurations for interchanges. • For detailed design stage and pre-opening stage SAs: Contract plans at a suitable scale (e.g. 1:20 US Customary, 1:250 Metric) showing all signs, delineation, illumination, pavement markings, lane configuration, landscaping, roadside appurtenances, traffic signal placement, phasing and timing, and roadside barriers.
Crash Data	• For SAs of existing facilities: Crash data detailing the location, type, and severity of each crash over at least the most recent three year period of data available. Crash diagrams and/or copies of New York State Department of Motor Vehicles (NYSDMV) crash reports (Form MV-104 or equivalent) should be included. • For pre-construction stage SAs on resurfacing, rehabilitation, or reconstruction projects: crash data help identify safety concerns and guide the recommendation of countermeasures. • For pre-construction stage SAs on new construction: Crash data for the surrounding transportation network are not as important. They do however, provide insights into prevailing crash patterns and safety issues in the study area. If several alternatives are under consideration at the planning stage SA, crash data may help qualitatively estimate the safety implications of the planning alternatives.

Data	Specifics
Other Pertinent Documents	• Maintenance histories. • Previous SA reports and formal responses, if available. • Minutes of public meetings, hearings, and/or stakeholder group meetings and any agreements with municipalities or individual property owners for the accommodation of transportation needs (e.g. access permits, etc.). • Listing of all relevant design standards, guidelines, manuals, and/ or publications (e.g. New York State Highway Design Manual, Municipal Standard Details, the National Manual on Uniform Traffic Control Devices with New York State Supplement, etc.). • If applicable: Records of public complaints, law enforcement observations of speeding/unsafe behavior, etc.
Presentation	• Visual (e.g. Microsoft PowerPoint or equal) presentations on the project by its design team and of the anticipated SA (goals, objectives, scope, expectations, schedule, etc.) by the SA team leader might be useful for the meeting.

- The above data may be provided to the SA team either prior to the meeting or at the meeting. The advantage of the former is that the SA team will have an opportunity to review the documents beforehand and be prepared to ask questions at the meeting. The disadvantage however, is that an advance review might not be as effective as it would otherwise be after the project has been presented to the team. The SA team may wish to indicate to the Project Owner which option is preferred at the outset.

- The SA team may also wish to prepare a visual (e.g. Microsoft PowerPoint or equal) presentation outlining the scope, goals and objectives, schedule, and conduct of the SA to assist the design, traffic engineering, or maintenance team in better understanding the nature of the SA and how it relates to their efforts. This will assist in establishing a spirit of cooperation between all parties.

  Specifically, there should be a clear understanding amongst all parties that SAs are a tool which help identify opportunities to improve transportation safety performance. SAs are NOT intended as a substitute for periodic reviews of policies, standards, or practices to assure that desired end-results continue to be achieved (i.e. design quality, operational and maintenance objectives). They are not meant to replace existing design quality assurance checks or standards-compliance processes.

In this regard, SAs are **NOT:**

What SAs are not intended to be

- a means to evaluate, praise, or critique design, operations, or maintenance.
- a check of compliance with applicable minimum or desirable design standards, since compliance alone does not assure optimal, or even adequate, safety.
- a means of ranking or justifying one project over another.
- a means of rating one design option over another (although the expected safety performance of each planning or design alternative may be individually assessed).
- a project redesign or a policy, standards, or practices review (although an SA may suggest changes in policy, standards, or practices as a means of improving safety).
- a crash investigation or crash data analysis (although the crash history of an existing road should be reviewed as a component of an SA).
- an operational safety review of an existing facility based on a detailed, quantitative analysis of crash data and thus highly dependent on the quality of crash data. Low quality or the absence of crash data does not preclude conducting a successful SA.

Items to be discussed at the Pre-Assessment Meeting

- Items to be reviewed and discussed at the Pre-Assessment meeting may include:
  - Introductions.
  - Scope and objectives of the SA.
  - Roles and responsibilities.
  - Schedule for the completion of the SA.
  - Lines of communication between the SA team leader, the Project Owner, and the design/operations/maintenance team.
  - SA response.

- The Pre-assessment meeting should conclude with all involved parties having a clear understanding of the SA to be undertaken and the roles and responsibilities of each participant during each task.

2.4 Step 4: Conduct Review of Project Data and Field Review

Review available in the office before going to the field.

A project data review is conducted to gain insight into the project or existing facility, to prepare for a field visit and to identify preliminary areas of safety concern. The field visit is necessary to gain further insight into the project or existing facility and to further verify and/or identify safety concerns. Major considerations involving the review of project data and field visit are summarized below. Specific activities and considerations relevant to different SA stages are provided in **Section 3.0**

- Plans, drawings and other project information should be reviewed by each member of the SA team prior to and again after the field visit. The review of contract plans and/or as-built drawings is crucial to understanding the interaction between a transportation facility, its operating environment, and its users.

- For pre-construction stage assessments, the SA team should examine the design drawings in detail, imagining how the future facility may appear from the perspective of different users (including drivers of different vehicle types, older drivers), cyclists and pedestrians (including those of different age groups and abilities) as applicable. A common approach involves the systematic review of one direction at a time along segments of a facility and each individual movement at freeway interchanges or at-grade intersections. In each case the reviewer should imagine themselves driving on the road or walking along the sidewalk.

- Reviews of the project data, plans, and drawings should be performed both individually (in-depth) and in a team setting (brainstorming).

- Team members may elect to use SA tools such as those introduced in **Section 10**. Prompt lists may serve as a means of highlighting relevant aspects of the SA. It may be beneficial for each SA team member to have an individual hard copy of the prompt lists. The lists can be used to record any comments and concerns identified both during the project data review and the field visit. Prompt lists may be sourced and printed from **Appendix D** or the FHWA RSA software.

- If missing or misleading information is identified, the SA team should contact the appropriate Department of Public Works, design team, traffic engineering team, or maintenance staff to obtain clarification, ideally before the field visit is conducted. This should be done in a cooperative manner and in the spirit of gaining a better understanding of the proposed project.

There is no substitute for visiting the site.

- Field visits should be conducted as part of every SA, no matter the stage or type of project. They are crucial to identifying safety issues on existing facilities and helping participants to understand how the proposed construction will interact with the adjacent transportation network and surrounding terrain.

- The SA team should conduct a nighttime field visit.

- Daytime visits to existing facilities should be scheduled to coincide with the most critical period of operation. This for example could be a morning, evening, or off-peak period of traffic flow. Other factors may suggest different times of the day or night (e.g. peaks associated with local traffic generators such as malls, offices, schools, arenas, etc.).

- Safety of the SA team and of all facility users is paramount and should be carefully planned for at the outset. Appropriate safety equipment, apparel, and necessary traffic controls should be utilized. Potentially adverse impacts on traffic flow (to the extent that they could skew observations) and the safety of the SA team must be carefully balanced at all times.

- Approaches to a field review may vary from one SA to another. In one case each SA team member may visit the site independently noting anything they believe is of importance. An alternative would be to have the entire team review the site together, discussing various issues raised by the team as they go. A combination of these two approaches will best encourage all SA team members to participate and not to defer to an individual team member who may be perceived as most experienced. Yet another approach is for the SA team to move through the site as a group but have each team member note issues individually as they encounter them. Notes would then be discussed with the group at a subsequent meeting. Whatever approach is chosen, it should be established up front and clear to all participants before venturing out to the site.

Team members should experience the site from the perspective of all users.

- Safety issues identified during the review of project data should be verified in the field.

- Photographs and video footage should be taken of anything that may need to be reviewed or revisited while writing the SA report. High-quality digital video footage permitting still pictures to be excerpted may be especially effective, both as a review tool and to illustrate safety concerns in the SA report.

- The SA team should consider all possible movements for all facility users and drive, walk, or cycle them as appropriate during the field visit. Sample general and detailed prompt lists for the SAs of existing facilities are provided in **Appendix D**. A general list of action items for a field visit may include, but not be limited to, the items provided in **Exhibit 2.3**.

Exhibit 2.3: High-Level List of Actions for the Field Visit

SA Phase	Activities during the field visit
Existing Facilities	• Drive, cycle, and/or walk through the site in all directions and on all approaches (as appropriate and practical) to experience multiple perspectives. • Investigate pedestrian and bicyclist facilities particularly at points where potential conflicts with vehicular traffic exist. • Observe the interaction of different users with the built environment and with each other. • Consider limitations and specific requirements of drivers of different vehicle types, older drivers, pedestrians of different age groups, disabled persons, etc.
Pre-Construction Stage	• Examine how the planned improvement or new facility ties into the existing transportation network. • Examine how the planned improvement or new facility will interact with adjacent communities. • Examine adjacent facilities to identify design consistency issues for various users. • Examine compatibility of the design with prevailing climatic conditions, surrounding vegetation, and topography.
Pre-Opening Stage	• Drive, cycle, and/or walk through the site (as appropriate and practical) in all directions and on all approaches to experience multiple perspectives. • Investigate pedestrian and bicyclist facilities particularly at points where potential conflicts with vehicular traffic exist. • Imagine the interaction of different users with the built environment and with each other. • Consider limitations and specific requirements of drivers of different vehicle types, older drivers, pedestrians of different age groups, disabled persons, etc. • Examine the built environment for the presence of temporary traffic control devices, construction machinery, debris, etc.

- In situations where an SA team encounters maintenance, equipment, or appurtenance problems judged to be significant, such as deficiencies requiring action according to locally accepted maintenance standards, these should be communicated directly to the maintenance supervisor identified in the ToR or at the Pre-Assessment meeting.

2.5 Step 5: Conduct SA Analysis and Prepare SA Report

The objective of this step is to finalize the identification of safety issues, estimate the level of risk associated with each issue, prioritize the issues, suggest countermeasures, and succinctly document findings.

The SA analysis:

- Should be restricted to issues having a bearing on the safety of road users.
- May include issues relating to aesthetics, amenities, or congestion, but only if they may adversely affect safety.
- Should not include safety issues identified outside of the project limits unless the issue is directly or indirectly related to the project. An example would be the potential for traffic to shortcut through an adjoining residential area.
- May use prompt lists and the FHWA RSA software as guiding and tracking tools to facilitate analysis and drafting of the SA report

The SA report:

Prepare a concise, complete, and accurate summary report.

- In some instances needs to be written immediately after completion of the field visit (such as with a pre-opening SA). Other SA reports should typically be completed within a relatively short timeframe (e.g. two weeks).
- Should be concise.
- Should include the date of the pre-SA meeting and the dates and times that the SA was conducted.
- Should acknowledge data provided by the Project Owner and/or the design team.
- Should include SA team member names along with their affiliation and qualifications.
- Should include background information and a description of the process followed.
- Should include pictures and diagrams to further illustrate points made as required.
- Should include a map indicating the location and clearly defined project limits.

- Should include a review of signs, pavement markings, traffic signals, and other traffic control devices.

- May contain references to other reports, standards, policies, or published research pertaining to safety.

- Should be relevant and realistic. A planning stage SA should not contain a review of signs and pavement markings or propose those as a countermeasure. A pre-opening stage SA should not contain a review of interchange configuration and propose an alternative.

- For SAs of existing facilities suggested improvements should normally include short, medium, and long term engineering solutions and may also include multi-modal considerations, enforcement activities, and safety education. The ToR may require restricting suggestions to low-cost, short-term countermeasures or conversely, put an emphasis on expanding suggestions to either longer-term and/or more broadly-based countermeasures (e.g. suggestions aimed at influencing modal split or promoting improvements at a network-level).

- Should be specific, include a brief description of each safety issue, and explain how and why each poses a risk to facility users. The estimated degree of safety risk may be indicated as well.

- Should avoid negative terms such as “unsafe”, “sub-standard”, “unacceptable”, and “deficient”, focusing instead on “opportunities” for increased safety (“safer”).

Recommended formats of SA reports and approaches to estimate road user risk are presented in **Section 8.0**.

Present findings to the Owner.

2.6 Step 6: Present Safety Assessment Findings

Once the SA Report is published, the SA Team Leader (refer to **Section 5.0**) orally presents the findings to the Project Owner and Department of Public Works, design team. traffic engineering team, or maintenance team as appropriate. The presentation should clarify SA findings and suggestions, ensure that findings are within the scope of the SA, and allow for informal feedback from the Project Owner and other parties.

The presentation:

- May be facilitated visually using a software such as Microsoft PowerPoint or equal.
- Should be prefaced with a reminder that the intent of an SA is to identify opportunities to improve safety rather than critique the work of a design team, traffic engineering team, or maintenance team.
- Should start by acknowledging assistance from the Project Owner and other parties and by sharing some “positives”.
- Should briefly overview the SA scope, goals, and objectives.
- Should describe safety issues in terms of where they are located, why they represent a safety risk (circumstances, sequence of events), and what degree of safety risk is associated with them.
- May use possible solutions to further illustrate the safety concern, but these should not be cited as design recommendations or specific countermeasures.
- May show pictures or video footage to further illustrate an issue.
- May discuss approaches usually taken in reviewing and responding to an SA report. This includes accepting or not accepting the SA suggestions and documenting the results of the review in a formal SA response.

The presentation meeting should be accompanied by a written record (minutes) to help avoid the appearance of arbitrary decision making. Minutes will provide background documentation if the subsequent SA report omits certain safety issues as a result of the discussion at the meeting. Minutes should be kept in the project file.

The SA report may be submitted to the Project Owner at the meeting or may be finalized as needed and submitted shortly after the presentation (e.g. within two weeks).

2.7 Step 7: Prepare Formal Response

The concept of responding to an SA report, followed by action on accepted SA suggestions, is central to the process. It ensures that SA findings are reviewed and, if accepted for implementation, acted upon.

Specifications include the following:

- The SA report is reviewed jointly by the Project Owner and design team, engineering team, or maintenance representatives.

- The review of SA report findings and suggestions should be conducted within a set time of receiving the SA report and is completed upon preparation of a formal response. The review period may vary depending on staff availability and the overall project schedule but should be commensurate with that specified in the ToR.

Regardless of the outcome, preparing a response will help avoid liability concerns.

- Outcomes of the review and response phase may involve acceptance of the suggestions, rejection (with explanation), or modification (with explanation). For example, the Project Owner and project team may: agree with an SA suggestion and act upon it; agree but decide not to act based on project constraints; or disagree with either the safety issue or the assessment of risk and respond accordingly. Possible reasons for not acting on a suggestion may include: physical project constraints; property limitations; SA findings/suggestions which are out-of-scope; trade-offs between safety risks and mobility benefits; environmental constraints; and budget constraints. **Exhibit 2.4** lists questions which may be considered when arriving at outcomes and preparing a formal SA response.

- The outcome may acknowledge that improvements will be deferred to a future project to happen at an agreed upon time.

Exhibit 2.4: Questions to be Reviewed When Preparing a Formal Response

- Is the SA report finding within the scope of the project?
- Would the suggestion made in the SA report address the safety issue, reducing the likelihood of occurrence and/or resultant severity?
- Will the suggestion made in the SA report lead to mobility, environmental, or other non-safety related issues?
- What would be the cost associated with implementing the suggestion and how would it compare to the anticipated reduction in societal collision costs (cost-benefit analysis)?
- Are there more cost-effective alternatives to achieving the same or greater safety benefits?

- The decisions made, rationale behind each decision, and the actions necessary to implement the decisions should be properly documented in the formal SA response.

- Form A (suggested layout provided in **Exhibit 2.5**) should be filled out during the review process. This will ensure that nothing of importance is overlooked in the review and those decisions and the rationales behind them are properly documented.

- Form A should be kept in the project file and may be appended to the concise formal response.

- A letter report format, signed by the Project Owner, is an equally valid method of responding to an SA report.

- The formal response is sent to the SA team and should be kept on file together with the SA report.

Exhibit 2.5: Principal Layout of Form A - "Response on SA Findings and Suggestions"

FORM A
RESPONSE ON SAFETY ASSESSMENT FINDINGS AND SUGGESTIONS

Safety Assessment: [location/project name]

Issue identified by Safety Assessment	Agree?	If disagree, explain why	Safety Assessment suggestion(s)	To be implemented? (yes, no, partial)	If yes, or partial: deadline for implementation and who is in charge	If no or partial, explain why	If no or partial, describe an alternative action, if any
			1				
			2				
			3				
			1				
			2				
			3				

2.8 Step 8: Incorporate SA Suggestions

The objective of the final step in the SA process is to implement the list of accepted actions identified in the formal response within the documented time frame. After SA suggestions are implemented per the formal response, their implementation should be documented using Form B (suggested layout provided in **Exhibit 2.6**).

Exhibit 2.6: Principal Layout of Form B - "Implementation of SA Suggestions"

FORM B

IMPLEMENTATION OF SAFETY ASSESSMENT SUGGESTIONS

Safety Assessment: [location/project name]

Safety Assessment suggestion	Disposition per Form A	Implemented?	If no or partial, explain why	If no or partial, describe an alternative action taken, if any

3.0 SAFETY ASSESSMENT STAGES

SAs may be conducted at any stage in the lifecycle of a transportation facility. This includes when existing facilities are in-service, during pre-construction planning, design, and during construction.

At present SAs of existing facilities are conducted more frequently in the United States than any other type of assessment. This is logical, as there are generally more existing facilities than new facilities being planned, designed, or constructed. The sheer number of existing facilities also exceeds the quantity being studied for rehabilitation or expansion at any given time.

SAs conducted during the pre-construction phase have the greatest potential to cost-effectively improve safety. These SAs examine a proposed facility before any shovels hit the ground. It is easier to change a line on a drawing than it is to rebuild an existing facility.

The assessment of in-service facilities is a logical place to start an SA program.

That said, a program of SAs on existing (in-service) facilities is relatively easier to implement and does not involve the potential complication of project delays that often comes along with pre-construction and construction phase SAs. This makes the SA of existing facilities a logical starting point for their integration into the standard operating procedure of any jurisdiction. SAs of existing facilities have other advantages, either for an initial series of assessments being conduced by a jurisdiction just embarking on its program or as a component of an ongoing safety management effort. These include:

1. An opportunity to generate “early wins.” Early success stories will support the continuation of an SA program. Identifying “sites of promise”, those where safety improvements are both identifiable and achievable, is critical to generating momentum. If network-wide traffic volume and collision data are available, network safety screening techniques may be used to identify candidate locations. A jurisdiction might develop their own “top-down” ranking of sites from those with the highest frequency of crashes to the lowest. Unfortunately, the location with the highest crash rate is not always the same as that with the highest potential for safety improvement.

   Alternatively, by identifying “sites of promise” where there is both a “critical mass” of collision of data and a clear pattern of crashes to be addressed, a jurisdiction can narrow the focus of its SA program to those locations where the collision experience is susceptible to correction by proven engineering, enforcement, educational, or ergonomic (human factors) measures.

2. Existing stage SAs can be coupled with other "projects of opportunity" and may be conducted in advance of maintenance or operations activities such as traffic signal re-timing, sign replacement, or resurfacing. In this way a jurisdiction can take advantage of staff and resources already allocated to a given location to help improve safety.
3. The facility is built and operating. Unlike pre-construction assessments, the SA team need not envision how the facility will look when constructed, how it will integrate with its surroundings, or how users will interact with it under varying conditions. All these aspects can be readily observed and studied with a field visit .
4. A documented history of identified operational concerns may already exist. Operational deficiencies may generate safety concerns. The results of an SA and a traffic operations study can be combined to develop suitable mitigation measures.
5. There may be a history of identified safety issues documented by operations staff or identified as concerns by users and elected officials. Addressing these issues will be perceived as "getting something done."
6. Existing facilities may have a documented collision record. Analysis of collision data, if available, can provide important insights into existing and potential, future safety concerns.
7. There may be opportunities to conduct other studies which can yield insights into safety issues or to review the results of prior studies. These may include: traffic control device warrant analyses, speed studies, gap acceptance studies, floating car studies, conflict studies, and positive guidance reviews.
8. Assessment suggestions requiring maintenance, operations, or minor capital expenditures may be quickly implemented.
9. Assessment suggestions requiring major capital expenditures can be programmed and funded in a coherent manner in line with other projects being driven by capacity, infrastructure management, or environmental stewardship.

E
Existing

A. EXISTING FACILITIES (IN-SERVICE) PHASE SAFETY ASSESSMENTS

3.1 E Stage SAs - SAs of Existing (In-Service) Facilities

In contrast with traditional safety studies where the review of crash data is the driving force behind the identification of safety issues, SAs of existing facilities use qualitative techniques and rely mainly on site visits, as-built drawings, and other project data to determine what safety issues may exist on site. For this reason, an E stage SA is

inherently proactive, identifies where crashes might occur, and considers their potential severity. Crash data, if available, should be used to supplement any findings made as a result of the site visit and project data review. SAs of existing facilities can be conducted at sites with no significant crash history or where no crash records have been kept. They may also be conducted at locations of planned projects. For example, a roadway owner may choose to perform an SA at the site of a proposed pavement overlay.

SAs of existing facilities can vary in scope. Six different but commonly conducted types of SAs on existing facilities are as follows:

- SAs of specific locations;
- SAs of an entire arterial segment, freeway segment, or roadway network;
- SAs of a specific intersection, location, feature or design element within a transportation corridor;
- SAs of a transit facility or on-road stop;
- SAs of a transit terminal; and
- SAs of a trail facility.

Each of the above SA types may not result only in engineering countermeasures, but involve other initiatives such as reducing exposure to risk through the development and improved use of other modes of transportation, mass transit, Intelligent Transportation Systems (ITS), safety education, and enforcement.

Major considerations for existing facility assessments are provided below.

Considerations for SAs of existing facilities

- Field visits during both the day time and night time hours are a critical component of an E stage SA. This will allow the SA team members to experience the facility first hand under different conditions, observe the interaction of all users and drive, walk, or cycle it as appropriate.

- Photographs or high quality digital video footage should be taken of anything that may need to be reviewed or revisited while writing the SA report or presenting the SA findings to the Project Owner. Digital video footage is especially useful for the office reviews and analyses conducted after a field visit.

- Taking into account that an assessment of an existing facility may be conducted a considerable time after the facility was put into operation, it is important to consider whether the facility under review still has the same function and classification as it did when originally designed and constructed. For example, changes in traffic volume, vehicle mix, the increased presence of non-motorized users, or changes in adjoining land use may have rendered the original functional classification and design of the facility obsolete.

- When suggesting safety improvements the SA team should consider short term, medium term, and long term countermeasures. Development of alternative countermeasures may be appropriate. SA team members should be sensitive to the fact than a facility Owner may view an E stage SA as a work generating exercise and should be sensitive to the constraints, perhaps physical or budgetary, faced by an organization or municipality. It may be helpful to review and agree upon the scope of potential improvements with the Owner prior to conducting an SA.

P
Planning

B. PRE-CONSTRUCTION PHASE SAFETY ASSESSMENTS

3.2 P Stage SA - Planning Stage SAs

Planning stage SAs provide the opportunity to make fundamental changes before proceeding to design. In practice, a planning stage assessment may be conducted at one of three sub stages:

- PL-1 – scoping stage;
- PL-2 – a set of preferred planning alternatives is ready; and
- PL-3 –a feasible planning alternative (or a set of feasible planning alternatives) has been selected for forwarding to preliminary design.

Aspects of planning stage SAs include:

- A field visit should be conducted if at all practical.
- Locations where a proposed facility may tie to the existing transportation network or pass through existing communities are of particular interest for a field visit.

- The SA team may question fundamental decisions regarding route choice, overall design criteria, alignment, grade separation options, and more.
- The SA team should review each of the alternatives.
- Collision diagrams should be provided if available.
- Large scale plans showing planning alternatives with principal safety concerns plotted may be a useful means of illustrating issues and can be appended to the SA report

3.3 D Stage SA - Design Stage SAs

D
Design

Design stage SAs provide the opportunity to suggest physical changes to the plans. Caution on the part of the SA team is necessary to make sure that all design parameters are understood. Recommendations made by the team that alter these parameters should be thoroughly discussed with the designers and the impacts documented.

In practice, a design stage assessment may be conducted at one of two sub stages:

- D-1 – preliminary design stage with plans 30% to 40% complete; and
- D-2 – detailed design stage with plans 60% to 80% complete.

During preliminary design stage SAs:

- Non-standard features and non-conforming features should be brought to the SA team's attention and thoroughly reviewed.
- Where significant land acquisition is involved in the project, the SA should be conducted before proposed highway boundaries are finalized.
- A field visit should be conducted in all cases.
- Locations where the proposed project will tie into the existing transportation network or pass through communities are of particular interest for a field visit.
- The SA team should not question fundamental decisions regarding route choice, overall design criteria, or layout of preliminary alternatives unless a significant, definable error or omission is apparent.

A Design Stage SA should not question fundamental decisions, however it may address past errors or omissions.

- The SA team may suggest significant physical changes for a road such as horizontal and vertical alignment shifts, different intersection treatments, lane and shoulder width adjustments, provision of bicycle lanes and/or sidewalks, channelization, and access consolidation.

- When feasible alternatives remain under consideration, the SA team should review each of those alternatives.

- If phased implementation of the project is planned, each phase should be considered as well as transitions between those phases.

- The ability of the design to accommodate future widening, expansion, or extension should be considered.

Detailed design stage SAs provide the last opportunity to change the design of the preferred alternative before construction begins. Land acquisition may be finalized during this stage and will prevent the SA team from making any recommendations involving significant changes to alignment or typical section.

Major features of detailed design stage SAs include:

- Non-standard and non-conforming features should be brought to the SA team's attention and thoroughly reviewed.

- A field visit should be conducted in all cases.

- Locations where the project will tie into the existing transportation network or pass through communities are of particular interest for a field visit.

- The opportunities for the SA team to suggest significant physical changes are limited, especially if land acquisitions have already been finalized.

- If phased implementation of the project is planned, each phase should be considered, as well as transitions between those phases.

- If work zone traffic control plans have been developed, their review should be included in the scope of the SA. The SA team may also conduct an SA of work zone traffic control as a separate effort sometime before construction begins.

3.4 L Stage SAs – SAs Related to Land-Use Developments

L
Land Use

Land-use developments often have an impact on the safety performance of adjacent transportation facilities as a result of site generated traffic and points of direct or indirect access. Existing, crossing, or parallel vehicle, pedestrian and bicycle flows, as well as those generated by the land-use development are important factors affecting safety performance. Some developments may create visual clutter, affect sight lines, or even change the character of the environment from rural to suburban or urban. Developments themselves may involve a network of access roads, driveways, parking areas, transit interfaces, cycling facilities and sidewalks which could undergo the SA process. This may be especially important where one or more roads within a land-use development assume the function of or are to be dedicated as public facilities.

Not all developments must undergo SAs. International experience shows the greatest safety benefits realized from assessments conducted on:

- Strategic (master) plans.
- Land use-developments of significant size (e.g., major shopping centers, parking areas with over 50 stalls, residential subdivisions with over 20 lots, etc.).
- Land-use applications which connect directly to an arterial roadway or other significant traffic route.
- Land-use applications generating significant numbers of pedestrians and/or bicyclists interacting with the adjacent transportation network.
- Applications that extend the limits of a community along an otherwise rural or suburban roadway, or to both sides of facilities carrying large volumes of through traffic.

Developments that fit the above criteria often include gas stations, office buildings, major commercial or industrial developments and recreational developments including parks, etc.

Major aspects of land-use development stage SAs include:

- Changes in facility function, classification, environment, traffic volumes, and pedestrian/bicycle flows projected to occur as a result of the development should be considered at the outset.

- Both a day time and night time field visit are critical to a land-use development SA. These experiences will assist the SA team members in examining the projected impacts, design, and mitigation plans under a variety of applicable conditions.

- SA team members should be mindful that concerns uncovered during land-use development stage SAs may suggest mitigation beyond pure engineering countermeasures that improve the use of mass transit. Multi-modal connections, ITS, safety education, and enforcement may also be applicable.

C
Construction

B. CONSTRUCTION PHASE SAFETY ASSESSMENTS

3.5 C Stage SA - Pre-Opening SAs (Construction Practically Complete)

Pre-opening SAs are usually performed on newly-constructed or reconstructed facilities immediately prior to their opening. They represent the last opportunity for an SA team to identify potential safety concerns before road users are exposed.

For pre-opening stage SAs:

- It is desirable for C stage assessments to be scheduled such that the SA report can be presented and any issues addressed before the Contractor demobilizes. Making changes to a facility or addressing issues after the Contractor leaves the project site can be difficult.

Day and night visits are crucial to Construction Stage SAs

- Field visits during both the day time and at night time are critical. This allows SA team members the opportunity to see first hand the built transportation facility and drive, walk, or cycle it as appropriate. At that time they can imagine the interaction of all users under differing conditions. These field visits will provide an opportunity to evaluate the safety of road features or combinations of features not apparent when simply reviewing the contract plans.

- Non-standard and non-conforming features should be brought to the SA team's attention and thoroughly reviewed.

- When available, markups of the contact plans or as-built drawings should be provided to the SA team to indicate how the built environment departs from the contract plans developed during detailed design.

- During the field visit for a road, members of the SA team should verify that all temporary signage, pavement markings, construction equipment, barriers, fencing, materials and debris have been removed from the facility.

- C stage assessments must be conducted relatively quickly given the costs associated with any delay in the opening of a new transportation facility. Opportunities to review video footage in the office will be limited. Larger SA teams may be more effective.

- To expedite the process, the SA team may arrange for a meeting with the Project Owner and representatives of the design and construction teams immediately after the field visit, while on-site, to share firsthand any safety concerns identified and to suggest improvements. This will allow the Project Owner and design team to address the identified safety issues appropriately and minimize delays in the opening of the facility. The SA team may then follow up with their SA report.

- Due to time constraints, the Project Owner and design team may complete their formal SA response after countermeasures discussed on site have been implemented and the transportation facility has been opened to the public.

3.6 Other SAs at the Construction Stage

SAs may also be conducted when construction field changes are proposed. Elements of a design that would be modified should be resubmitted for SA prior to construction. The SA team should be on standby during construction and review changes as they arise when this type of SA is planned in advance. There may be a benefit to retaining the same SA team that conducted the D stage assessment as its members would already be familiar with the project. Specific procedures and the scope for such SAs may be defined on a case-by-case basis by the Project Owner.

Similar SAs may be conducted when a value engineering study is conducted. There are also opportunities to conduct SAs of work zone traffic control plans or construction staging plans, although these types of SAs are uncommon.

The procedures involved in C stage SAs are essentially the same as for all other SA stages outlined in **Section 2.0**., however these SAs may be less intensive. For example, a pre-assessment meeting may not be necessary in all cases. Specific procedures and the scope should be defined on a case-by-case basis by the Project Owner.

4.0 SELECTION OF PROJECTS AND LOCATIONS FOR SAFETY ASSESSMENTS

SA programs may encompass projects of any size being undertaken at any point in the lifecycle of a transportation facility. Policies on choosing projects for SAs throughout the United States vary. Selection of project types are reflective of local citizen interest, administrative input, and project costs, etc. Similarly, policies on selecting existing facilities for SAs vary from strictly defined quantitative criteria (e.g., certain number of high-risk intersections and segments in a jurisdiction) identified through a process of network safety screening to area-wide SAs. The latter approach often requires that all facilities in a county, town, city, village, etc. undergo SAs within several years with a certain proportion undergoing SAs annually. Some policies require conducting SAs on all facilities scheduled for pavement overlay, rehabilitation, or reconstruction projects.

A word of caution is warranted here. Jurisdictions should not **"over-reach"** with their SA program by generating more assessments and suggestions for potential safety improvements than may be reasonably responded to and implemented. It is recommended that each jurisdiction, working with the Safety Assessment Coordinator, establish a program that they can manage comfortably within the resources available.

Jurisdictions should work with their Safety Assessment Coordinators to establish a manageable program level.

It is important for a jurisdiction to "pace" their SA program in a manner which allows the broader organization to digest and respond to reports and suggestions as they are completed. Picture an SA report containing suggestions regarding an existing road, dated two years ago, and lacking either a response report or an action plan. Now imagine its existence is identified subsequent to a recent incident within the study area. Defending why the jurisdiction had commissioned the report and received information on how to improve safety in the study area yet failed to take any action within a reasonable period of time would likely prove difficult.

Selection criteria may be simple in initial focus, but modified in response to emerging needs, issues, available funding, and resources. These needs, priorities and capacities may vary over time and programs should be regularly reviewed and adjusted in response. Such policies may evolve from relatively loosely-worded statements encouraging the conduct of SAs (such as those that are common when SAs

are initially introduced to a jurisdiction) to project selection matrices that attain the status of standard.

Guidance on the development of Jurisdiction-Specific Policies.

In all cases, it is beneficial to have a policy on selecting projects and locations for SAs which reflects the specifics of the jurisdiction. Agencies should make their own decisions about which projects should undergo SAs and when they should occur based upon statewide, regional and/or local issues, priorities, and capacities.

Jurisdiction-specific policies should take into account and balance the following:

- The need to be proactive in managing safety on existing facilities as traffic volumes increase, development progresses, and traffic patterns change;
- The availability of adequate crash data, quantitative tools, and qualified personnel to identify high-risk locations in a jurisdiction (to screen for and select high-risk locations on existing facilities);
- The opportunities presented by projects being driven by other priorities, such as infrastructure preservation (resurfacing and rehabilitation projects, transit facility upgrades, utility projects) or developments and redevelopments;
- The greater opportunities, at less cost, to identify and remedy safety issues early in the planning and design process for new facilities and for facilities undergoing expansion, including the management of traffic while staging the work;
- The “last chance” opportunities presented during construction and before the public is exposed to the facility;
- The potential need to conduct SAs of specific facility elements (e.g. the implications on pedestrian safety of using channelized right turns at major urban intersections or roadside safety treatments) or planning, design, operations and/or maintenance practices (e.g. access configurations, leading/lagging left turn phases, roadway marking replacement program);
- Available funding; and
- Availability of trained SA teams and other resources.

Once a jurisdiction defines its policy on project selection, it may wish to supplement that with a matrix. The matrix would assist in identifying the *types* of projects to be assessed and provide guidance on the desirability of SAs.

Types of projects identified as SA candidates may include the following:

- Major Capital Projects (highways, bridges, interchanges, road/rail grade separation crossings, major intersections, transit facilities, pedestrian/bike trails);

- Minor Capital Projects (highways, bridges, interchanges, road/rail at-grade crossings, minor intersections, bus stops);
- Traffic control improvements, traffic circulation schemes, traffic calming schemes;
- Pedestrian and bicycle facilities (sidewalks, multi-use paths, bicycle routes or lanes);
- Major land use development projects; and
- Minor land use development projects.

Similarly, once a jurisdiction defines its policy on project selection, it may wish to supplement that with a matrix which guides the *location* of projects to be assessed and provides guidance on the desirability of SAs.

Candidate SA Locations

Locations of projects identified as SA candidates may include the following:

- High-crash intersections;
- High-crash road segments;
- Locations of expressed concern to users, elected officials, and/or partner jurisdictions;
- High-volume facilities;
- Locations selected for rehabilitation, resurfacing, or reconstruction projects; and
- Locations identified from other sources.

The degree of desirability for the various stages of SAs may be: “SA not required”, “To be decided on a case by case basis”, or “Mandatory.”

5.0 ROLES AND RESPONSIBILITIES IN THE SAFETY ASSESSMENT PROCESS

Guiding the SA process within a jurisdiction involves the following principal functions:

Roles of the SA Program Liaison, Coordinator, and Owner.

- The SA Program Liaison may assist in the development of a jurisdiction-specific SA program, tailor a standardized SA process to the specifics of a jurisdiction, and arrange for institutional support, funding, training, monitoring, and promotion of SAs. In New York State, a representative of the MPO may act as the SA Program Liaison for their given area. A representative of one or multiple jurisdictions may fill this role for areas not covered by an MPO (i.e. County Highway Department).
- The SA Coordinator is appointed to implement and manage a safety assessment program within a jurisdiction. The SA Coordinator shall be trained in the SA process and provide support to the Project Owner.
- The selection and conduct of individual SAs, at any stage in the lifecycle of a transportation facility and according to established SA guidelines, is the responsibility of the Project Owner within a local jurisdiction.

A suggested organizational chart for the SA process is presented in **Exhibit 5.1**. Major parties in the SA process and their roles and responsibilities are defined in **Exhibit 5.2**.

Note that the identified roles and responsibilities are offered as a general guideline only. Each jurisdiction may develop its own roles and responsibilities flowchart tailored to their specific organizational structure and in light of special local considerations.

Exhibit 5.1: Organizational Structure for the SA process

Exhibit 5.2: Major Parties in the SA process and their Roles and Responsibilities

Party	Roles and Responsibilities
Safety Assessment Program Liaison **(MPO or Jurisdictional Representative)**	• Approves SA Program • Approves SA Program Funding • Regularly Reviews results of the SA Program • Supports efforts of SA program Coordinators
Safety Assessment Program Coordinator **(Representative of one or Multiple Jurisdictions)**	• Undergoes SA training as needed and keeps abreast of the latest procedures, developments and tools • Develops policies on selecting projects and locations for SAs • Tailors SA Guidelines to local specifics and needs • Prepares the SA program on an annual basis • Prepares proposals for funding the SA program • Manages and monitors the SA program • Develops templates for SA Terms of Reference (ToRs) • Establishes selection criteria for SA teams. • Conducts Quality Control of SAs and formal responses • Collects and analyses SA evaluation forms (Form C) • Prepares regular reports on the SA program for the Oversight Body • Makes presentations to the Oversight Body as needed
Project Owner **(i.e. Village, Town, City or County)**	• Tailors template ToRs for SAs • Initiates SAs • Selects SA teams • Conducts Pre-SA meetings • Reviews SA reports • Prepares formal response with input from DPW / Planning / Design or Traffic Engineering / Maintenance teams as appropriate (incl. Form A) • Monitors the implementation of actions as per Form A and prepares Form B with input from DPW / Planning / Design or Traffic Engineering / Maintenance teams as appropriate • Keeps all SA documentation on file
DPW, Design Team, Traffic Engineering Team, or Maintenance Team	• Prepares data for the SA team • Participates in the Pre-SA meeting • Provides additional data to the SA team as needed • Reviews SA report • Provides input to the Project Owner for the preparation of the formal response • Implements suggestions as per the formal response (Form A) • Provides input to the Project Owner to complete Form B
SA Team	• Reviews data received and requests more data / clarifications as needed • Participates in the Pre-SA meeting • Conducts SA • Presents SA findings orally • Prepares SA report • Completes SA evaluation Form C and submits it to the SA Program Coordinator

6.0 REQUIREMENTS FOR A SAFETY ASSESSMENT TEAM

6.1 Core Skill-Sets

Core skill-sets of an SA Team may include the following:

Persons selected for an SA team may have one of more of the Core Skills

- Transportation Safety Practitioner (capability to: understand the causal factors which may lead to crashes; identify and assess effective treatments which may address the frequency of occurrence and/or severity outcomes of such crashes; and training in and/or experience with SAs).

- Department of Public Works/Traffic/Transit Operations Practitioner (knowledge and experience in the field of traffic operations; principles of traffic flow; the relationship between capacity and demand; causes of congestion; understanding of the proper placement and use of traffic control devices; and understanding of the impacts of different treatments upon multimodal traffic operations).

- Designer (knowledge and experience in transportation facility design; experience and familiarity with Federal, State, and local statutory requirements, regulations, policies, standards and practices in design; understanding of the relationship between transportation elements that contribute to the relative safety of all users; and familiarity with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) for transportation facilities that will be used by pedestrians.)

- Local Contact Person (familiar with the area under review and the transportation safety issues experienced there; a law enforcement officer would ideally fill this role for SAs of existing transportation facilities).

6.2 Supplemental Skill-sets

The core skill set should be supplemented by persons with additional skills and experience as needed (such as a practitioner with knowledge and experience in an applicable transportation mode: transit; rail; cycling; etc.) and depending on the SA stage may also include the following:

- **E Stage:** The core qualifications may be strengthened with an expert in crash investigation/reconstruction, a local maintenance representative, first-responders, etc. Local drivers (e.g. transit, taxi) could be approached to share their knowledge of the existing facility and to relay their own personal safety concerns.

- **P Stage:** It is important to have a member experienced in transportation planning with an understanding of the safety effects of planning alternatives, long-range solutions, and how planning schemes fit into the existing transportation network.

- **D-1 Stage:** It is important that the SA Team includes a design practitioner capable of visualizing the facility being reviewed in three dimensions with all its appurtenances.

- **D-2 Stage:** The SA Team should include those with skills and experience in roadside protection, traffic control device application, ITS, pedestrian, bicycle, and transit facilities, as appropriate. Depending on project features, these skills and experience may be supplemented by work zone traffic control, construction (staging), road maintenance, enforcement, first response, school transportation, highway-rail grade crossing, or other specific skills and experience.

- **C Stage:** The field review could be strengthened by human factors, positive guidance, maintenance, and law enforcement expertise.

It is not necessary to include experts in all of these fields as full-time, formal team members. They may be called upon to advise the SA Team on matters relating to their specialty on an as-needed basis.

The SA Teams should typically range in size between 3 and 6 members.

6.3 Minimum Team Size

The SA team should include a minimum of three members for simple projects and up to six members for larger projects. Larger teams are acceptable for very complex SAs or SA training.

6.4 Independence of Safety Assessment Team

The freedom, ability, and comfort of SA team members to comment frankly and openly on potentially controversial safety issues are crucial to the success of an SA. The purpose of independence is to avoid any direct conflict of interest, agenda, or pre-existing biases which may adversely affect the SA team's findings and suggestions. It is achieved by careful selection of the SA team members, as follows:

SA Team members from within their own jurisdictions should approach the SA with an open mind.

- **P, D and C Stages:** SA Team members should be independent of the design team directly responsible for the development of the original plans. Sourcing an SA Team Leader from outside of the design group (e.g., from Operations or Maintenance) and Team members from within the design group but from those without direct responsibility for the design being assessed, is one option for achieving independence. Engineering, operations, maintenance, and other representatives of the agency may round out the Team, either as participants or as advisors.

- **E Stage:** SA Team members should be independent of the team directly responsible for operating and maintaining the existing facility if possible. If team members do come from within the operating and maintaining organization they should be open minded about the facility. Sourcing an SA Team Leader from outside of the operations and maintenance group (e.g., from Engineering or Design) and SA Team members from within the group but from those without direct responsibility for the facility is one option for achieving independence. Engineering, design, and other representatives of the agency may round out the SA Team, either as participants or as advisors.

Other options for achieving independence may include sourcing SA Team Leaders and members from other agencies on a reciprocal basis, accessing Federal programs such as the FHWA Peer-to-Peer RSA assistance program, or engaging a road safety consultant with SA knowledge and experience to either lead or perform the assessment.

7.0 SELECTION OF A SAFETY ASSESSMENT TEAM

There are three basic options for selecting SA Teams. Jurisdictions may choose to utilize one or all of these, especially during initial implementation of the SA process. Based on initial results and as experience is accumulated, some options may be excluded or amended.

Team selection may be done as follows:

The method of team selection may vary greatly from jurisdiction to jurisdiction based on their size.

- from within their own agency, another public agency (usually in neighboring jurisdictions), or from within different levels of the same agency.

- as a part of the consultant selection process for planning and design projects (P, D, and C SAs). In this case, the SA Team would be hired as a sub-consultant to the design team and compensated by the prime consultant.

- independent of the consultant selection process on planning and design projects (P, D and C SAs). This could involve hiring only an SA Team Leader to lead an internal SA Team or hiring an entire team through a designated selection process.

If the option of using an outside consultant team or team leader is chosen, the SA Program Coordinator should define general parameters for selection by completing one or more of the following tasks:

- Preparing template Terms of Reference (ToRs) for SAs.

- Establishing general selection criteria for SA Teams (e.g., 20% for project approach and understanding, 25% for qualifications and experience, 30% for previous performance, 15% for responsiveness and 10% for firm's credentials).

- Compiling a list of pre-qualified SA consultants for planning/design projects and requiring planning/design teams to choose an SA subconsultant from the pre-qualified list.

8.0 FORMAT OF A SAFETY ASSESSMENT REPORT

Standardization of the SA report format facilitates preparation and review. Three basic outlines for the SA report are shown in **Exhibit 8.1**.

Part A of the SA report format contains background data. Part B of the SA report may be formatted using three different sorting options, as follows:

Three suggested formats for an SA Report

- **Format 1:** Identified safety issues are sorted first by topic/subtopic, then by location, and finally by likely severity outcomes. Likely severity outcomes may be determined using the Safety Risk concept where the severity outcomes of the issues are estimated qualitatively by the SA team members in terms of exposure, probability, and consequence. The details of Safety Risk are identified in Appendix "B" Glossary of Terms.

- **Format 2:** Identified safety issues are sorted first by location, then by severity (Safety Risk); and

- **Format 3:** Identified safety issues are sorted by severity only (Safety Risk).

Exhibit 8.2 provides a specific template for Format 3 of the SA report. The format of an SA report is further illustrated by three case studies provided in **Appendix A.** Use of the FHWA RSA software may be beneficial in ensuring standardization of SA reports. It provides an interface for entering all data and findings and is capable of converting the entered information into a draft SA report formatted to any of the templates described above.

Severity (Safety Risk) associated with each suggestion may be determined using either of three basic qualitative approaches, aggregated, fully disaggregated, and partially-disaggregated, as follows:

Aggregated approach:

Members of the SA team estimate the severity of each identified safety issue (Safety Risk) directly, using gradations "very low", "low", "medium", "high" and "very high".

Fully disaggregated approach:

Members of the SA team estimate the severity (Safety Risk) of each identified safety issue through the estimation of exposure (E), probability (P), and consequence (C) associated with each issue where Safety Risk is a function of E, P, and C. Exposure is

Exhibit 8.1: Three Basic Options for the SA report

[Title and logo (optional) of the project owner]

Header

DRAFT Safety Assessment REPORT

SA Project Title

Project Title:
Date:
SA Team and Participants:
Background:
SA Process:
SA Stage:

Part A
Project Data

Part B
SA findings

SA FINDINGS

Format 1: First Topic /Subtopics, then location and then issues for each location sorted by severity.

Example:
INTERSECTIONS
Pedestrians
Intersection X
issue A (risk= 5)
issue B (risk= 3)
issue C (risk= 1)

Intersection Y
issue D (risk= 4)
issue E (risk= 2)
issue F (risk= 1)

Lighting
Intersection X
issue G (risk= 3)
issue H (risk= 2)

Intersection Z
issue I (risk= 4)
issue J(risk= 1)

FORMAT 2: First locations and then issues for each location sorted by severity.

Example:
Intersection X
issue A (risk= 5)
issue B (risk= 3)
issue G (risk= 3)
issue H (risk= 2)
issue C (risk= 1)

Intersection Y
issue D (risk= 4)
issue E (risk= 2)
issue F (risk= 1)

Intersection Z
issue I (risk= 4)
issue J (risk= 1)

Format 3: Issues sorted by severity, independent of checklist topics and location.

Example:
issue A (risk= 5)
issue D (risk= 4)
issue I (risk= 4)
issue B (risk= 3)
issue G (risk= 3)
issue E (risk= 2)
issue H (risk= 2)
issue C (risk= 1)
issue F (risk= 1)
issue J (risk= 1)

Footer

Standardization of the SA report format greatly facilitates their preparation and review.

Exhibit 8.2: Specific Template for Format 3 of the SA report

[Title and logo (optional) of the project owner]

Header

Safety Assessment REPORT

[SA Project Title]

Part A
Project Data

Date: [beginning and end date of the SA]

SA Team and Participants:
[SA team leader, members, affiliations]

Background:
[Brief description of the project, including the SA scope and objectives and any special issues raised by the project owner or design team, SA stage, reasons for project initiation, selection of project/location for SA, issues already known, previous SA report if any, data received for SA etc.]
[Project location can be shown on the aerial photograph, drawing etc. provided in the appendix to the SA Report]

SA Process:
[How the project/road entity was assessed timeline, major features of the pre-assessment meeting, dates, times and conditions of the field visit, use of FHWA RSA software if any etc]

SA Stage: [planning, preliminary design, final design, land use development, existing road etc]

Part B
SA findings

SA FINDINGS

Issue: *[brief issue title is provided here]*

Location: *[brief location description is provided here]*

Description of Safety Issue:
[Concise description of safety issue is provided here including why it is perceived to be a risk]
[Photos or schemes are provided to illustrate safety issue]

Facility Safety Risk (optional):
Exposure: [use scale 1-5: very low, low, medium, high, very high]
Probability: [use scale 1-5: very low, low, medium, high, very high]
Consequence: [use scale 1-5: very low, low, medium, high, very high]
Road Safety Risk: [use scale 1-5: very low, low, medium, high, very high]

Suggestion:
[Concise description of suggestion to mitigate/eliminate safety issue is provided here]
[May include short-term, medium term, long term road engineering countermeasures and multi-modal considerations, enforcement activities, safety education and engineering solutions if in scope].

[Page … of …] [SA Date: …]

Footer

Refer to Appendix A for Case Study examples

assessed through the number of facility users expected to be exposed to the risk of collision associated with the identified safety issue. Probability is the chance that an individual user will experience a collision associated with the identified safety issue. Consequence is the likely severity outcomes of any such collision. Each element of the function is estimated using gradations “very low”, “low”, “medium”, “high” and “very high”. The resultant Safety Risk is then estimated as a function of E, P and C using gradations “very low”, “low”, “medium”, “high” and “very high”.

Partially disaggregated approach:

Members of the SA team estimate the severity (Safety Risk) of each identified safety issue through the estimation of probability (P), and consequence (C) associated with the issue where Safety Risk is a function of P and C. As opposed to the fully disaggregated approach, Probability is defined as the chance for all road users exposed to the safety issue to be involved in a collision associated with the identified safety issue. Consequence is the severity outcomes of any such collision. As with the fully disaggregated approach, each element of the function is estimated using gradations “very low”, “low”, “medium”, “high” and “very high”. The resultant Safety Risk is then estimated as a function of P and C using gradations “very low”, “low”, “medium”, “high” and “very high”.

Exhibit 8.3: Illustration of Safety Risk Under a Partially Disaggregated Approach

Priority of safety risk		Severity of crash			
		Negligible	**Low**	**Moderate**	**High**
Probability of crashes occurring	**Frequent**	Medium	Medium-high	High	High
	Occasional	Medium-low	Medium	Medium-high	High
	Infrequent	Low	Medium-low	Medium	Medium-high
	Rare	Low	Low	Medium-low	Medium

The notation (optional) printed next to the heading “Facility Safety Risk” on page 8-3 under SA Findings in the SA Report refers to the use of a numerical scoring method of assessment. The Assessment Team may choose to assess risk on a qualitative basis. Some assessment of Facility Safety Risk should normally be provided for each issue identified.

The Assessment Team may also choose to not suggest a mitigating measure, leaving this determination to the design or operations team.

The points below summarize major features of an SA report:

- SA Team member names, their affiliation and qualifications, identification of the SA Team Leader, as well as the start and end dates of the SA should be provided in the introduction.

- Background information may include a brief description of the project, including: the scope and objectives and any special issues raised by the Project Owner, design team, operations team, or maintenance team as applicable; reasons for project initiation; selection of the project and/or location for the SA; issues already known; previous SA report(s), if any; and data received for the SA.

- The project location should be shown using an aerial photograph, map, or drawing. It may be provided in an appendix to the SA Report

- The SA process may be described including: the timeline; summary of the pre-SA meeting; findings of the in-office review; dates and conditions of the field visit; use of FHWA RSA software; etc

- A description of each safety issue, including: brief issue title; brief description of location; concise description of safety issue with a description of why it poses a risk and an estimation of severity (e.g., Safety Risk).

- SA suggestions are provided for each safety issue identified and usually include potential short-, medium- and long-term engineering countermeasures. The countermeasures may be limited to only those to be implemented in the short-term if required by the Terms of Reference (ToRs). In many cases the ToRs for SAs may require expanding suggestions to multi-modal considerations, enforcement activities, safety education, and engineering solutions if those items are within the scope of the project.

- The SA report may include statements ensuring confidentiality of the report or other standardized statements as determined by that jurisdiction.

At the close of the report, the SA Team leader may wish to suggest that another SA be conducted at a later time in the project lifecycle or upon subsequent changes to the design if significant design alterations were suggested.

9.0 MONITORING AND PROMOTION OF THE SAFETY ASSESSMENT PROCESS

Periodic reviews help to fine-tune the SA process.

It is important that the SA process is regularly reviewed. Such reviews offer a learning opportunity and greatly aid in refining future SAs. The SA Program Coordinator should not only conduct a review of each SA upon completion (e.g., through the quality control process) but should also review the SA process in a jurisdiction as a whole on a regular basis (e.g., annually). Form C (SA Team Survey, **Exhibit 9.1**) should be completed by an SA Team Leader upon the completion of each SA report and submitted directly to the SA Program Coordinator. The SA Program Coordinator should do the following:

- Review and summarize information from completed SAs and lessons learned;
- Prepare an annual report on the SA program;
- Identify SA needs; and
- Propose changes to the locally developed SA guidelines and templates.

Each of these items should be covered in the annual SA program report to be submitted to the SA oversight body for that jurisdiction. The SA Program Coordinator should also make presentations to the oversight body (SA Program Liaison) on different aspects of the SA program, as needed.

Exhibit 9.1: Follow-up SA Team Survey

FORM C
SURVEY OF A SAFETY ASSESSMENT TEAM

Project/location audited _____

Name of SA Team Leader _____

Title _____

Affiliations _____

Date _____

	Yes	No	Comment
Was the SA done at the correct stage?	⓪	⓪	
Would it have been more effective to conduct the SA at an earlier stage?	⓪	⓪	
Was the ToR for SA adequate?	⓪	⓪	
Did you receive sufficient data for SA?	⓪	⓪	
Was enough time allocated for the SA?	⓪	⓪	
Was the Pre-assessment meeting conducted in an efficient/timely manner?	⓪	⓪	
Did you have sufficient support from the project owner?	⓪	⓪	
Did you have sufficient support from the design team or traffic engineering/maintenance representatives?	⓪	⓪	
Did you use prompt lists?	⓪	⓪	
Did you use FHWA RSA software?	⓪	⓪	
Was the field visit effective?	⓪	⓪	
If not, what were the issues and how could they have been addressed?	⓪	⓪	
Was the SA team of a right size?	⓪	⓪	
If not, what other areas of expertise should have been included on the team?	⓪	⓪	
What information was most helpful in conducting this type of assessment?"	⓪	⓪	
How would you improve the SA process?	⓪	⓪	

10.0 SAFETY ASSESSMENT TOOLS

10.1 FHWA Road Safety Audit (RSA) Software

The FHWA RSA software is available free of charge by downloading it from the FHWA RSA website http://safety.fhwa.dot.gov/rsa/index.htm. After review, some jurisdictions may wish to adopt this software as their tool of choice for conducting SAs within their boundaries. The software facilitates an optimum balance between comprehensive and broad prompt lists allowing users to easily "switch" between different levels of detail for each prompt list topic. The software automatically generates prompt lists suitable for each SA stage and also serves as a guide and process tracking tool. It offers the opportunity to input explanatory text to accompany each safety issue raised along with discussion and an assessment of risk, thereby encouraging the SA Team to "think through" and justify their findings. The FHWA RSA software automatically generates draft SA reports in different formats compatible with the formats described in **Section 8.0**. **Appendix C** provides a brief overview of the FHWA RSA software, provides key screenshots to illustrate its functionality, and provides a flowchart illustrating how the FHWA RSA software may be used in the SA process.

The RSA software is supported by the FHWA and is updated with the development of new SA knowledge. For example, a past update involved the integration of FHWA Pedestrian Prompt Lists.

10.2 Prompt Lists

SA practice has resulted in the development of a variety of prompt list formats. These range from very comprehensive prompt lists that attempt to cover every consideration in exceptional detail at every SA stage (planning, preliminary design, detailed design, pre-opening, work zone traffic control, existing facilities, land use development proposals) to a short prompt list that includes only high-level topics (geometric design, traffic operations, traffic control devices, human factors, environment, and integration) that are considered common to all SA stages.

The main challenge in using comprehensive SA prompt lists is the risk that the SA becomes a mechanical rather than a thinking exercise. SAs should not become an exercise in "checking the boxes" in lieu of using the lists as an aid to the application of knowledge and experience borne by the SA team members. On the other hand, the use of high-level, broad prompt lists may result in SA teams overlooking specific issues. In this case, the advantage of prompt lists as "portable intelligence" is not realized.

Team members should not just "check the boxes" on a Prompt List.

Prompt lists fitting between the two extremes try to combine the advantages of different formats. Unfortunately, they also combine the deficiencies. Taking into account the variety of SA project types and individual preferences of assessors it is very difficult to find an optimum solution while remaining within the realm of traditional hardcopy checklists.

Given the potential for different preferences amongst SA team members, it might be useful to leave the selection of prompt lists to be used for a specific SA to the discretion of each SA team. Examples of high-level and detailed prompt lists for SAs of existing facilities as used in the FHWA RSA Software are provided in **Appendix C**. Similarly, formatted prompt lists for each SA stage may be derived from the FHWA RSA software itself. Each jurisdiction may opt to decide which prompt lists (e.g., lists within this document, FHWA RSA prompt lists, Pennsylvania DOT prompt lists, FHWA Pedestrian prompt lists, Canadian RSA Guide prompt lists, combinations of the above, etc.) should be used. If making a selection, it should be kept in mind that the purpose of a prompt list is to prompt SA team members to think about possible safety issues (not to "check off" the items). Therefore, they should not be considered a replacement for the qualifications and experience of the SA team members.

SA prompt lists help the SA team not to overlook important items, however they are not meant to be all inclusive.

What follows is a list of "things to remember" when using SA prompt lists:

- The purposes of SA prompt lists are to help the SA team identify potential safety issues and to ensure that they do not overlook important items.
- Prompt lists may be used by transportation designers to help them identify potential safety issues proactively during plan development.
- SA prompt lists, even the most detailed ones, should be viewed as a prompt only. They are not a substitute for knowledge and experience. They are an aid in the application of knowledge and experience.
- No matter how comprehensive, the SA prompt lists are not all-inclusive, nor do they intend to cover all potential issues and circumstances.
- Prompt lists may be used when reviewing project data, when conducting site visits, when conducting the SA analysis, and when writing the SA report.
- It is useful for each member of an SA team to have a printed copy of the prompt lists selected for their project in hand. The information contained in the comment fields of the prompt lists may subsequently be used to facilitate writing the SA report.
- Prompt lists should not be appended to an SA report.

11.0 CHALLENGES TO THE IMPLEMENTATION OF A SAFETY ASSESSMENT PROCESS

There are many challenges to the implementation of the SA process, but experiences across North America as well as internationally show that there are effective ways to turn these negatives into positives. These experiences also suggest that implementation of an SA program does result in cost effective safety improvements for the transportation network that are well worth the effort. Practically all jurisdictions that have embraced the SA process report positive results and proudly feature the SA process as one of their key achievements in active safety management. This section lists common challenges which may arise during the SA implementation process and summarizes ways those challenges can be overcome.

11.1 Lack of Financial Resources to Conduct SAs and Implement SA Recommendations

Consider allocating dedicated funding for an SA pilot program. This would help reduce the initial cost of conducting SAs and help foster a realistic SA program from the outset.

Obtaining funding for SAs

There are different ways to obtain funding for SAs. The State of Kentucky tailored their Highway Safety Improvement Program (HSIP) guidelines to permit HSIP funds to be spent on conducting SAs of existing facilities and on implementing SA suggestions. Some states (e.g., Illinois) have indicated that the SA became their preferred analysis tool for identifying HSIP projects. The Tennessee Department of Transportation (TDOT) has institutionalized the use of SAs and the guidance from their SAs is used to direct spending in the state's HSIP and High Risk Rural Roads (HRRR) programs. The Vermont Agency of Transportation is looking into the possibility of using HRRR funds both to conduct SAs and to fund countermeasures resulting from SAs. In Virginia, SAs are funded through the HSIP systematic funding mechanism (as the activity required to "developing the project"). This funding source is also used to fund road safety improvements resulting from SAs. Projects which resulted from their SAs are classified as: Stage 1 projects (0-12 months, signal optimization/maintenance fix); Stage II projects (12-36 months, HSIP, CMAQ and TE projects with no additional ROW required); and Stage III projects (36+ months, TIP with ROW requirements). In Wisconsin, the AAA Road Improvement Demonstration Program (RIDP) dedicated some funds to assessments of high crash locations, and has funded SAs of more than 50 intersections since 2004. There are also indications that some portion of road resurfacing and rehabilitation funds could be used to conduct SAs and fund

countermeasures resulting from SAs. ***Measuring and tracking the achievements of SAs in improving safety and demonstrating their benefits in a local context is an important component of justifying the continued funding of SAs.***

Reducing the cost of SAs

SAs are intended to be a quick and low-cost exercise.

SAs are intended to be a relatively quick and low-cost exercise (typically 3-5 days of work for a team of 3-6 individuals) mainly involving qualitative assessments of safety risk. This contrasts positively with "road safety reviews" of existing facilities, which involve a comprehensive quantitative analysis of collision data, the preparation of a full report, site visits, traffic conflict analyses, the use of specialized software tools, etc. and may take several weeks of dedicated work by a team of 2-6 individuals.

There are effective ways to keep the costs of SAs low. As demonstrated at the AASHTO/FHWA Peer Exchange Program, it is possible to develop less "threatening" and resource-consuming SA programs as many States and local agencies have done. For example, instead of having an SA team made up of outside consultants, it is possible to undertake the following:

- Select an experienced Team Leader from the roster of external consultants, and select other team members from within the organization. Of course, these members should not have any direct conflict of interests and have appropriate qualifications and experience as discussed in Section 6.0.

- Use a "pairing" (or horizontal) scheme where neighboring jurisdictions exchange their internal SA teams under a "barter" arrangement to avoid any direct conflict of interest.

- To use a "vertical" scheme where agencies at different levels exchange SA teams within a geographical area (e.g. State DOT and County SA teams).

The options above and others may be combined to arrive at the most suitable solution for any given jurisdiction. It should be noted that with the accumulation of experience in conducting SAs there will be more opportunities to use local staff and smaller teams. This trend often helps to keep the costs of assessments manageable.

Overall, the cost of SAs is dependent on: an agency's creativity in integrating SA activities within existing project tasks, practices and resources; and on the decision-making methodology used to set up SAs, evaluate and implement SA suggestions. In the words of the Pennsylvania Department of Transportation, the costs of a successful SA program are "very little for the amount of success."

Planning an SA program realistically

SAs programs may encompass projects of any size and can be undertaken at any point in the lifecycle of a transportation project. Accordingly, there are a variety of policies on the selection of projects and existing facilities for SAs. Each jurisdiction should plan their SA program realistically, based not only on emerging safety needs, but also considering available funding and resources (see **Section 5.0**). These needs, priorities, and capacities may vary over time and SA programs should be regularly reviewed and adjusted in response.

11.2 Lack of Qualified Staff to Conduct SAs

Competent staff for SAs may come from many different sources.

SAs involve qualitative assessments as opposed to comprehensive, quantitative "safety reviews". The techniques of SAs are straightforward, intuitive, and are aimed at utilizing the experience and qualifications already present within a jurisdiction. Experience shows that one full SA training session conducted on a real-world site where the trainees actively participate in the SA process brings participants to a level of understanding which allows them to become effective SA team members. Participants who have received SA training and have actively participated in several successful SAs may be considered for the role of SA Team Leader. A regular and systematic SA training program in a jurisdiction may quickly bring a sufficient number of local staff to the desired level of understanding and qualification, such that an SA program may be conducted entirely with in-house resources.

Currently, there are a number of SA training courses available. The FHWA National Highway Institute (NHI) offers an RSA training course (http://www.nhi.fhwa.dot.gov). In addition, FHWA has developed a training course on RSAs specifically for Local Agencies (http://safety.fhwa.dot.gov/rsa). Many consulting companies are offering their own SA training courses which typically combine an introduction to SA concepts and tools with the conduct of a real-world, first-in-jurisdiction SA. These courses usually involve the full participation of agency staff.

The American Association of State Highway And Transportation Officials (AASHTO) and the FHWA jointly offer a very useful RSA Peer-to-Peer Exchange Program (http://safety.fhwa.dot.gov/rsa/rsa_p2p_brochure.htm) which facilitates sharing best practices, allows those agencies with a RSA program to enhance their SA skills by conducting assessments in other jurisdictions as peers, and provides an opportunity for agencies who do not have an SA program to obtain the services of an experienced SA Team Leader at no cost. Information exchange under the program allows agencies to learn how other jurisdictions have established their SA programs, which issues were encountered, and how they were successfully dealt with.

Other approaches to SA training across the United States have included the following:

- One-on-one pairing between States that currently have SA programs and those wishing to implement one with cross-training of staff through participation in SAs under the guidance of knowledgeable team leaders;
- Training by engineering faculties from colleges and universities;
- Participation by State safety staff in university outreach programs; and
- Participation in training programs, on-line presentations (webinars), and information exchanges.

11.3 Lack of Time to Conduct SAs

The relatively short time-frame required to conduct SAs may still become an issue if SAs are not planned and accounted for well in advance. If a project schedule incorporates SAs at the outset, the time spent on SAs will not be perceived as a "delay."

It is important that owners of design projects understand the relationship between SA tasks and other project activities and that project schedules ensure that time is set aside not only to conduct the SA, but also to evaluate the suggestions, respond to the SA report, and implement the accepted SA suggestions. In design projects, the earlier an SA is performed in the project lifecycle, the easier it is to implement suggestions without disruption to the project schedule. Lead times for changes in project scope, right-of-way acquisition, design revisions, and subsequent reviews are more easily accommodated if they are identified early in the process.

11.4 Lack of Trust to the SA Process

In some jurisdictions across the United States there are still misconceptions about the SA process. Some believe that it is either a duplication of an existing process or a replacement for an existing process or tool.

Confusion of SAs with the quality control of design is the most common misinterpretation of the role and nature of an SA. It should be emphasized that one of the major principles of an SA is that compliance with design standards, while important, does not necessarily result in an optimally safe road and conversely, failure to achieve compliance with standards does not necessarily result in a facility that is unacceptable from a safety perspective. Therefore, reviewing compliance with design standards is

not a part of an SA even though departures from design standards are usually assessed for their safety implications. The aim of an SA is to identify elements which may present a safety concern within the context of the design or facility in-service and to highlight opportunities to eliminate or mitigate the safety concerns identified. As such, SAs are neither a replacement for nor a duplication of the following:

- Design quality control or standard compliance checks;
- Traffic impact or safety impact studies;
- Safety conscious planning;
- Road safety inventory programs; and
- Traffic safety modeling efforts.

SAs are not a check of compliance to standards.

Information sharing and education will help SAs from being mistaken for any of the following:

- A means to evaluate, praise, or critique design work, traffic engineering practices, or maintenance activities.
- A check of compliance with design standards.
- A means of ranking or justifying one project over another.
- A means of rating one design option over another.
- A project redesign.
- A crash investigation or crash data analysis.
- A safety review of existing facilities based largely on the quantitative analysis of crash data.

Finally, there is sufficient proof both in the United States and internationally that the SA process is highly cost effective, with major benefits being achieved in the following areas:

- Societal costs of collisions are reduced by safer facilities and fewer, less-severe crashes. For example, the NYSDOT has reported a 20-40% reduction in crashes at more than 300 high crash locations which received surface improvements and were treated with other, low-cost safety improvements as suggested by SAs. Data from the United Kingdom suggest that the assessing of highway design projects makes them almost five times more effective in reducing fatal and injury crashes when compared to design projects completed without the benefit of an SA.

- SAs at the pre-construction phase largely avoid "throwaway" reconstruction costs associated with the correction of safety deficiencies that would otherwise be identified only after a facility has been put in-service.

- Lifecycle costs are reduced since safer designs often carry lower maintenance costs (e.g. flattened slope versus guardrail) and are less likely to require subsequent modification to address safety concerns.

Lack of high quality collision data is not a detriment to performing SAs.

11.5 Lack of High Quality Collision Data

The lack of high quality collision data is actually an excellent reason to conduct an SA. The SA process relies mainly on a qualitative examination of relative safety by a multi-disciplinary team (i.e. visualization of the design features, field visits, prompt lists, "seeing" the facility through the eyes of different users, brainstorming, SA software etc.) to identify safety issues. While crash data are reviewed (if they are available) they are not a driving force behind an SA. ***Jurisdictions lacking high quality crash data should be excited about the concept of SAs*** as they can support the identification of safety issues without the need for lengthy and expensive quantitative data processing and analysis.

11.6 Defaulting to Excessive Design Standards

There is a concern that SAs may result in project designers unnecessarily defaulting to more generous design standards. Such concerns result from confusing SAs with the process of checking compliance with design standards. One of the major principles of an SA is that compliance with design standards, while important, does not necessarily result in an optimally safe design. Therefore, reviewing compliance with design standards is not part of an SA.

These concerns can be largely mitigated through SA education and training. Designers should be encouraged to attend SA training sessions, both for educational purposes and as a means of obtaining a new perspective on safety in design. They may also consult SA prompt lists during the design process to proactively identify safety issues that would be identified by an SA of their design and to avoid them in the first place.

11.7 Liability Concerns

Legal and liability information provided in this guideline is not a substitute for legal advice.

Some jurisdictions are reluctant to implement an SA program because of perceived liability concerns. Most of these concerns are caused by the fact that each SA results in a formal SA report containing identified safety issues and suggestions on how to minimize or eliminate them. Agencies must manage their transportation network within a competing set of demands and constraints including mobility, safety, cost, and environmental impact. It is not always possible to accept and implement all SA suggestions. On that basis, it is feared that the SA report could be cited as proof that the agency was aware of the risk and chose not to implement measures that would otherwise have improved safety of a design or an existing road. The sections below offer effective ways of dealing with these concerns.

General principles of defense against liability claims

SAs are conducted to identify potential opportunities for safety improvement. Determining whether the investment necessary to realize the identified potential is justifiable, whether in the context of the individual project or of the jurisdiction as a whole, is outside of the scope of an SA. The responsibility for establishing and applying justification criteria is more properly the responsibility of the Project Owner and (in the case of a proposed design) the design team or (in the case of a facility in-service) the operations and maintenance team.

Potential opportunities for safety improvement may be deemed impractical based on project constraints and competing objectives or may be proven cost-ineffective through an explicit assessment of anticipated capital and operating costs weighed against their anticipated societal benefits. Both of these justifications provide a defensible rationale for declining to implement a potential safety improvement provided due diligence is exercised and the decision making process is properly documented.

This rationale may be further strengthened if the agency has a comprehensive framework for assessing the costs and benefits of infrastructure investments. If the agency is capable of showing that limited project funds are invested on a prioritized basis and where the greatest possible societal return-on-capital is achieved, then it is in a much stronger position to defend its funding choices.

There are three critical activities that each agency must exercise when conducting SAs to be successful in defense against liability claims. These are as follows:

- Diligent review of the SA report and the preparation of a formal SA response as outlined in detail in **Section 2.6**. Not every SA suggestion need be accepted as proposed, or at all. Valid reasons for declining to implement an SA suggestion should be documented and supported by an explicit analysis when appropriate;

- Timely implementation of SA report suggestions that were accepted in the formal SA response; and

- Retention of all SA documentation on file.

A general list of actions to further reduce an agency's potential legal vulnerability may include, but may not be limited to, the following:

- Ensure that each SA has clear Terms of Reference (ToRs). Clear ToRs limit the scope, study area, and the mandate of the SA Team.

- Include in the ToRs and the SA report statements which could reduce an agency's vulnerability to legal claims (e.g., confidentiality, goal and objectives, intended use, etc.)

- Ensure that SA teams and staff responding to SAs are aware of their roles and responsibilities in an SA and that they document their analyses, decisions, and actions.

- Ensure that SAs are undertaken by competent SA teams.

- Ensure that, if applicable, safety issues raised in earlier SAs, which have not been addressed, are re-examined where and as appropriate.

Legal provisions reducing agency vulnerability

There are some provisions in existing legislation that may be used in defense against liability claims relating to the SA process.

The Highway Safety Act of 1973 was enacted to improve the safety of the nation's highways by encouraging closer Federal and State cooperation with respect to road safety improvement projects. The Act included several categorical programs to assist States in identifying highways in need of improvements and in funding those

improvements including 23 U.S.C. § 152 (Hazard Elimination Program, “Section 152”). States objected to the absence of any confidentiality with respect to their compliance measures under Section 152, fearing that any information collected could be used as an effortless tool in litigation against governments.

23 U.S.C. § 409 (“Section 409”) was enacted to address this concern. This law expressly forbids the discovery or admission into evidence of reports, data, or other information compiled or collected for activities required pursuant to several Federal highway safety programs (Sections 130, and 152 (now 148)), or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal aid highway funds, in tort litigation arising from occurrences at the locations addressed in such documents or data. In 2003, the U.S. Supreme Court upheld the Constitutionality of Section 409, indicating that it “protects all reports, surveys, schedules, lists, or data actually compiled or collected for § 152 purposes”. Some States consider information covered by Section 409 as an exemption to its public disclosure laws, but courts may not agree with this interpretation.

Some agencies put additional emphasis on the confidentiality of the SA reports. For example, PennDOT guidelines stress that it is very important that SAs remain confidential. Although Pennsylvania does not have Sovereign Immunity, PennDOT is protected by a Statute that deems safety studies non-admissible in Torts. Their document recommends the inclusion of the following statement in Pennsylvania SA reports:

"In accordance with PA Consolidated Statutes Title 75-Vehicles (Vehicle Code) Section 3754 and 23 U.S.C. Section 409, this safety study is confidential and the publication, reproduction, release, or discussion of these materials is prohibited without the specific written consent of the Pennsylvania Department of Transportation's Office of Chief Counsel. This safety study is only provided to official agencies with official duties/ responsibilities in the project development".

Similarly, the Kansas Department of Transportation (KDOT) accepted the practice where SA results are reported for internal staff use only and are not available to the public or to lawyers representing claims against the State. There have been instances where these records were requested by outside legal counsel and to date the information has remained at KDOT.

A survey of State Departments of Transportation conducted as part of NCHRP Synthesis Project #336 ”Road Safety Audits” was unable to establish any specific correlation in the application of RSAs (to new projects or to existing facilities) and whether or not the State had sovereign immunity.

NYSDOT is afforded liability protection by the doctrine of qualified immunity that has been established in various legal precedents, as follows:

Under the doctrine of qualified immunity, the State can only be found liable for injuries "arising out of the operation of a duly executed highway safety plan when there is proof that the plan either was executed without adequate study or lacked a reasonable basis." (Weiss v. Fote; Redcross v. State, 241 AD2d 787)

This legal precedent appears to indicate that conducting SAs with proper review of the SA suggestions and a formal response to the SA report could qualify as an “adequate study” and “reasonable basis”. If so, the SA report and formal SA response could be part of a qualification for immunity.

“Liability will not be imposed on a public corporation for failure to make a planning decision which, if made, would only have involved giving the public more complete protection.” (Schwartz v. NYSTA, 61 NY2d 955)

This legal precedent appears to indicate that a decision not to implement an SA suggestion, with a proper justification in a formal SA response, will not expose an agency to liability, as such a decision “would only have involved giving the public more complete protection”.

Turning SAs into a Strength

Proper performance of SAs results in a reduction in liability,, not an increase.

SA reports may be used in response to tort liability suits to demonstrate that the agency is proactively trying to improve road safety. Many litigants and their lawyers will hire an expert witness to conduct their own safety review of the location in question. The SA report may be used to refute or counter the expert witness's report and to demonstrate the public agency's explicit efforts to improve safety at the location.

There are indications that properly structured and conducted SAs may assist agencies in defending themselves against liability claims. A survey of State Departments of Transportation conducted as part of NCHRP Synthesis Project #336 “Road Safety Audits” received this response related to liability from one of responding agencies:

“Liability is one of the major driving factors in performing a good audit. It demonstrates a proactive approach to identifying and mitigating safety concerns. When findings cannot be implemented an exception report is developed to address liability and mitigating measures. Our attorneys say that once safety issues are identified and we have financial limitations on how much and how fast we can correct the issues then the audit will help us in defense of liability...”

SAFETY ASSESSMENT GUIDELINES

APPENDIX A
CASE STUDIES

APPENDIX A: CASE STUIDIES

A series of three case studies were completed during the development of these Guidelines. The Guidelines were used to complete each SA and prepare the summary reports contained within this appendix. Each example illustrates the use of the guidelines in a different part of New York State and in a different type of area.

Case Study 1: Suburban

County Road 64
Town of Big Flats
Chemung County
Conducted May 5th and 6th 2008

Case Study 2: Rural

Intersection of County Route 12 and Hatch Hill Road
Town of Granville
Washington County
Conducted May 12th and 13th 2008

Case Study 3: Urban

Intersection of 9th Avenue and West 57th Street
New York City
Conducted June 17th and 18th 2008

Road Safety ASSESSMENT (SA) Report

County Road 64 – Horseheads Big Flats Road
From Railway Overpass Easterly to County Road 35
Town of Big Flats, Chemung County, New York State

Sponsored by: New York State Metropolitan Planning Organizations

Conducted May 5th and 6th, 2008

Report dated: May 30, 2008

Eng-Wong, Taub & Associates
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Table of Contents

1.0 Background

County Road 64 (CR 64) in the Town of Big Flats, Chemung County (known locally as Horseheads Big Flats Road), between the railway overpass in the west and its connection with the Commerce Center Road in the east (**Figure 1**), is a two-lane arterial roadway with a largely rural cross-section and a posted speed limit of 45 miles per hour. The roadway is under the jurisdiction of Chemung County, with New York State DOT – NYSDOT responsible for segments located within the functional areas of interchanges with the Southern Tier Expressway.

Figure 1 – Key Map

The subject portion of CR 64 has experienced and likely will continue to experience significant development as adjacent lands continue to be taken up by commercial retail uses.

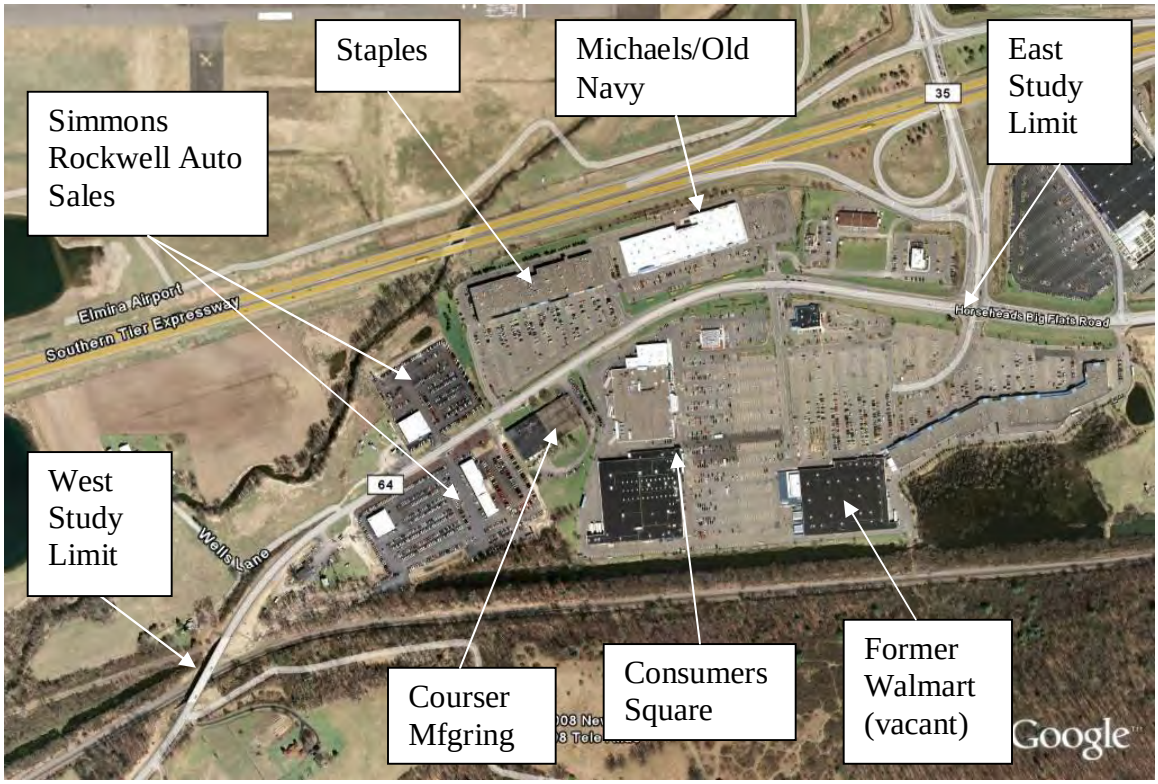
This changing land use from industrial/agricultural to retail commercial has resulted in the following:

- Substantial increases in traffic volumes, particularly during the weekday PM Peak period, and on weekends;
- An increase in the presence of vulnerable road users (pedestrians and cyclists);
- An increased crash rate; and
- A fundamental shift in the function of CR64 from a rural to a suburban arterial.

These changes in road function and traffic characteristics are expected to continue and to become more prevalent in the future, as development continues along the corridor.

The decision was taken to conduct a road safety assessment (SA) of the western portion of CR 64 (See Study Area Limits – **Figure 2**).

Figure 2 – Study Area Limits



This decision was made in response to the following:

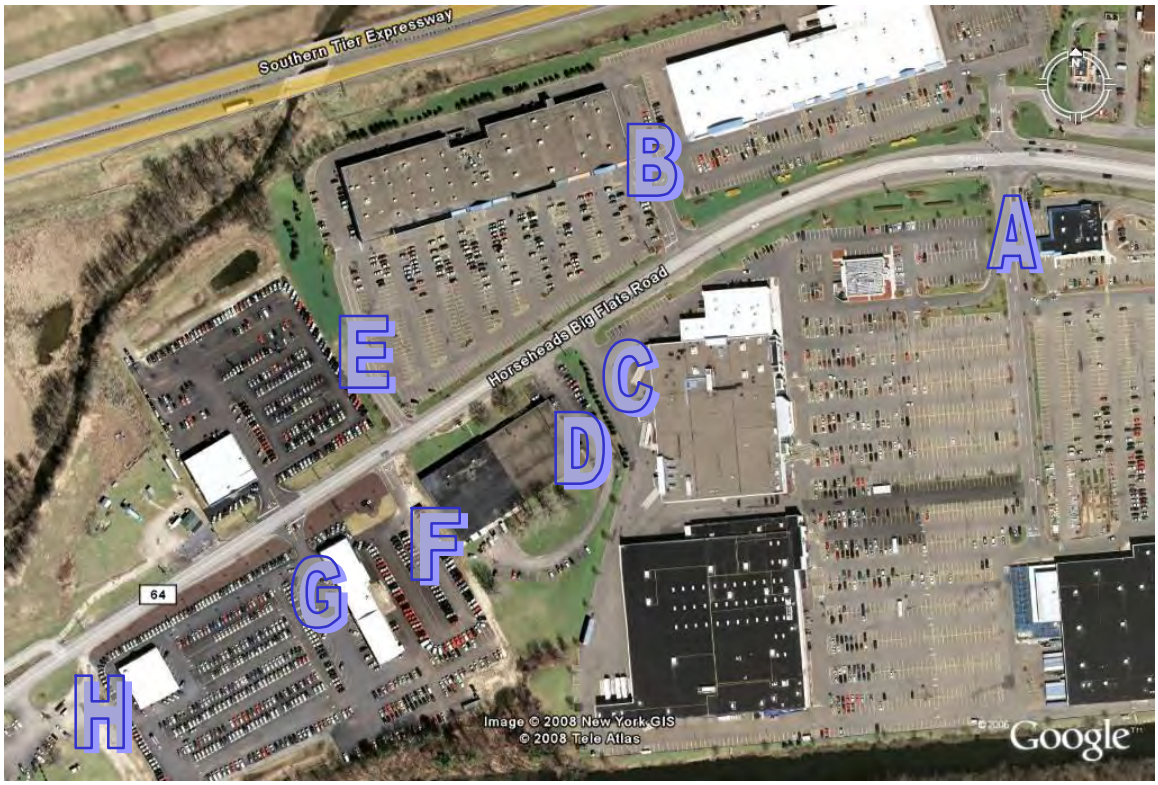
- Scope and pace of adjacent land development, and changing roadway function;
- Observations regarding changing traffic volumes, characteristics, and travel patterns;
- Introduction of new points of access and associated roadway improvements (i.e. turning lanes, traffic control signals);
- Concerns expressed by the public and elected officials regarding their perceptions of a safety problem (i.e. high crash potential);
- Review of crash records;
- Observations from the New York State Police regarding violations, conflicts, and collisions; and
- Recognition by the responsible road authorities of the potential to identify and actualize opportunities for safety improvement in the course of responding to increased traffic volumes, access, and capacity requirements through needed roadway improvements.

The signalized intersection of CR 64 and CR 35 (locally known as Chambers Road) was excluded from the study area, and forms the eastern limit of the SA. Its operation and safety performance is the responsibility of the New York State Department of Transportation (NYSDOT), based upon it being located within the functional area of the Southern Tier Expressway/CR 35 interchange.

The railway overpass to the west marks a transition in the function of CR 64 from rural arterial to the west, and suburban arterial to the east, and was thus chosen as the western limit of the SA.

Encompassed within these study area limits are numerous driveways, serving the adjacent land uses. For ease of identification, these driveways have been labeled alphabetically, from east to west, as shown in **Figure 3**.

Figure 3 – Driveway Identification



1.1 SA Team

This was the first SA conducted by Chemung County and the Town of Big Flats. Accordingly, a brief introductory training session was provided on the afternoon of the first day of the assessment.

The road safety assessment was sponsored by the New York State Metropolitan Planning Organizations (NYSMPOs) and will serve as one of three case studies to be included in guidelines for the conduct of SAs on the local road system within the State of New York.

The SA Team was composed of State (traffic and enforcement), County, MPO, and Local representatives, led by members of the consultant team. The RSA Team included the following individuals:

- **Jay Schissell**, Elmira Chemung Transportation Council jayschissell@stny.rr.com
- **Mike Perry**, Elmira Chemung Transportation Council, attended training only mperry@stny.rr.com
- **Dan Connors**, New York State DOT (Traffic) dgconnors@dot.state.ny.us
- **Vince Corona**, New York State Police vcorona@troopers.state.ny.us
- **Larry Wagner**, Town of Big Flats lwagner@bigflatsny.gov
- **Andy Avery**, City of Elmira, aavery@cityofelmira.net
- **Shawn Crater**, City of Elmira ccrater@cityofelmira.net
- **Rick Bennett**, Bergmann Associates rbennett@bergmannpc.com
- **Frank Dolan,** Bergmann Associates fdolan@bergmannpc.com
- **Greg Junnor,** Synectics Transportation Consultants Inc gjunnor@synectics-inc.net

1.2 SA Process

The SA was conducted in a manner consistent with the proposed road safety assessment guidelines being prepared for the NYSMPOs. The assessment took place on May 5th and 6th, 2008

Information reviewed in the course of the assessment included the following:

- Aerial photographs;
- Traffic characteristics data;
- Collision information;
- Traffic signal phasing/timing data;
- Adjacent land uses;
- Anticipated/proposed development and redevelopment; and
- Existing safety concerns.

Introductions and a brief assessment training session occurred in the afternoon of the first day. The assessment team reviewed the project related information on the morning of the second day of the assessment.

The assessment team then went into the field to conduct a site visit in the late morning, into the noon hour. Site visit conditions were warm and sunny.

The assessment team reconvened on the afternoon of the second day to complete the assessment analysis. Preliminary assessment findings were discussed then recorded using the FHWA RSA Software tool.

The consulting team subsequently prepared this report, which was circulated to and commented upon by the assessment team members, prior to being finalized.

1.3 SA Report

This report provides information on issues identified by the assessment team, which they deemed relevant to the stated goal of an SA; identifying opportunities to improve road safety within the study area.

Where appropriate, an assessment of road user safety risk, and suggestions for improvement, are included. These suggestions should not be viewed as design or operational recommendations. They are intended to be illustrative of potential solutions to the safety issues identified, and are presented for consideration only.

Within this report, the findings and suggestions of the assessment team are organized into three groups, as follows:

- **General Issues** – applicable to the study area as a whole;
- **Development issues** – pertaining to existing and proposed/anticipated developments within the study area; and
- **Driveway issues** –pertaining to the individual private/commercial access roadways, and their intersections with CR 64.

1.4 Study Area Characteristics, Operations and Safety Performance (Office Review)

The study area is comprised of eight driveway intersections with CR 64, referenced alphabetically as A through H, from east to west. Given the close proximity of the driveways to one-another, the relevant segments of CR 64 are addressed as approaches to each intersection.

CR 64 as a corridor is addressed under the topic “General Issues”.

Traffic is characterized by non-local travel, as the area is a regional shopping destination, and by non-standard peak periods, including Saturday noon-hour

and weekday evenings. Average Annual Daily Traffic (AADT) is approaching 20,000 – considered to be very high for a two-lane County roadway in this area.

Concerns have been identified with signs and pavement markings, including inconsistencies and lack of night-time guidance and delineation. The Simmons Rockwell car dealership attracts non-locals, who are then testing unfamiliar vehicles along CR 64. Double left turns permitted at the CR64/CR 35 intersection, and at Driveway A are not common within the area, and may be causing issues.

A transit shuttle service is provided between developments. Despite this, there is an increasing presence of vulnerable road users (pedestrians) along CR 64. Pedestrian and cycling facilities are largely absent along CR 64, save one signalized crossing of CR 64 at Driveway A, which has pedestrian crossing indications. A cycling trail is proposed from the village to the study area, but has not been implemented.

Wal-Mart has recently abandoned its former location and moved to new facilities to the east. Traffic along the corridor and additional development has migrated in response to this relocation.

There have been 100+ collisions within the corridor in the past 3 years, with 42 occurring at the CR 64/CR 35 intersection. Two significant clusters of collisions exist within the study area, at Driveway A and at Driveway B.

Driveway A serves the Michaels/Old Navy Plaza, the Applebee's and the Taco Bell to the north, and the Consumers Square/Former Wal-Mart development to the south. It is controlled by traffic control signals and lane use designation signs (**Figure 4**).

A southbound double left turn is permitted on a permissive phase (northbound and southbound traffic receive a green simultaneously).

Northbound through and left turn movements are permitted from the left lane only, with the right lane reserved exclusively for right turns.

Driveway A is located on the outside of a horizontal curve in CR 64. The superelevation on the north side of CR 64 forms a crown along the north limits of the roadway. The north approach slopes up to meet this point, and northbound and southbound vehicles may have difficulty seeing one-another as they approach the intersection.

Pedestrian pushbuttons and crosswalk markings are provided to cross the west approach only.

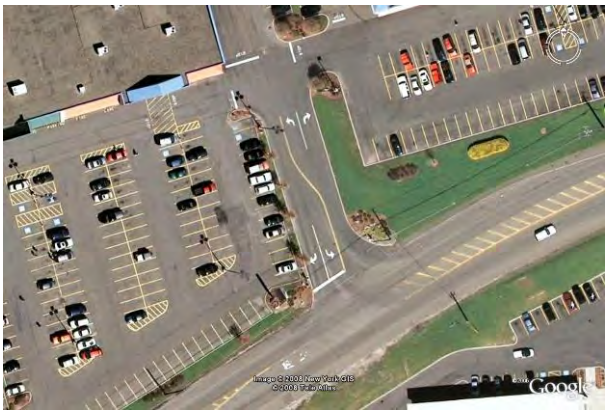
The north approach has a short throat, and limited storage capacity for outbound traffic, and inbound movements are constrained by movements to/from the Applebee's/Taco Bell access, and by operations at on-site Tee intersection immediately to the north.

Figure 4 – Driveway A

Collision experience at this location indicates a mix of collision types, with no definitive pattern.

Driveway B serves both the Michaels/Old Navy Plaza and the Staples Plaza on the north side of CR 64, and is controlled by a STOP sign (**Figure 5**). The driveway is located on the outside of a horizontal curve in CR 64, and is skewed with respect to the CR 64 alignment. Collision experience at this location (16 in total) is dominated by angle collisions (12) involving westbound vehicles striking vehicles turning left out of the driveway.

Figure 5 – Driveway B



Driveway C is identified as truck access only for servicing the Consumers Square development, and outbound left turns are prohibited by a regulatory sign and by pavement markings (**Figure 6**). Despite these restrictions, inbound and outbound movements by passenger vehicles, including outbound left turns (prohibited) were observed to occur. An inbound left turn lane is not provided.

Figure 6 – Driveway C

Driveway D serves the Courser Manufacturing site.

Figure 7 – Driveway D

Driveway E extends to the north, and provides a second access to the Staples Plaza. **Driveway F** extends to the south and provides access to the Simmons Rockwell Auto Sales (**Figure 8**). The two driveways are offset from one-another and no left or right turn lanes are provided.

Figure 8 – Driveways E and F

Driveway G to the north and south serves as the main driveway to Simmons Rockwell Auto Sales (**Figure 9**). A significant amount of pedestrian activity was noted as occurring between the north and south at this location. A westbound right turn arrow has been marked within the paved shoulder. Left turn lanes are not provided.

Figure 9 - Driveway G

Driveway H, located opposite Wells Lane, serves a small-scale commercial retail development to the south of CR 64 (**Figure 10**). It is understood that this parcel has been acquired by Simmons Rockwell to accommodate further expansion. The main driveway is poorly-defined, and lacks left or right turn lanes. Sight distance to traffic approaching from the west is limited by the horizontal curve, and the grade ascending to the overpass. It appears that an “ad-hoc” driveway further to the east (with better sightlines to the west) has developed over time.

Figure 10 – Driveway H

2.0 Assessment Findings and Suggestions

2.1 General Issues

2.1.1 Roadway classification and functional corridor considerations

Safety Concern: Existing roadway classification (rural arterial) appears to no longer reflect the current and likely future roadway function. The application of rural arterial standards (horizontal and vertical alignment, auxiliary lanes, facilities for vulnerable road users, speed limit, access design, access density, etc) and treatment of capacity and access needs driven by new developments on a case-by-case basis does not appear to be adequately addressing emerging capacity and safety needs.

Observations: CR 64 was, and likely still is, classified as a rural arterial roadway. The impacts of individual development proposals, including site-generated traffic and access requirements, appear to have been addressed in isolation from one-another, apparently without a coherent overall plan for the future of the corridor. This has led to capacity constraints, inconsistencies in roadway cross-section and traffic controls, and a conflicted road “message” which may be contributing to substantial variations in operating speeds, high driver workload, erratic maneuvers, conflicts, and collisions. An example is the

current 45 MPH speed limit which, even under off-peak conditions, was judged by the assessment team to be excessive, given the density of accesses and potential for vehicle-vehicle and vehicle/vulnerable user conflicts within the corridor.

Risk Analysis: Development pressures and traffic demand (exposure) are likely to increase congestion, conflicts, and the likelihood of collisions over time. Continued endorsement of higher operating speeds (based upon the current, posted speed limit) may contribute to future collision severity. Elevated collision risk has already been noted at existing driveways. Site-specific improvements may be possible in the short-term, but a systemic approach is required to comprehensively address the sources of risk.

Suggestions: *The following steps are suggested:*

- *Reconsider the classification of the roadway on a corridor-wide basis (from railway bridge easterly to connection with Commerce Center Road or even further to the east, if development expectations warrant), in light of existing and likely, future development pressures and traffic demands;*
- *Develop a comprehensive and consistent set of design standards, access management policies, and approaches to the provision of an environment consistent with sub-urban commercial operations and suitable to use by vulnerable road users. A more urbanized cross-section in conjunction with a lowered speed limit, for example, would include transit, pedestrian, and cyclist facilities, and communicate a road message consistent with lower operating speeds and the need for increased vigilance regarding vulnerable road users and turning traffic;*
- *Consider the suitability of a three or five-lane cross-section with a center two-way left turn lane to address access density and the need for left turn lanes. Alternatively, consider access consolidation and the provision of dedicated left and right turn lanes in conjunction with raised islands, physical channelization, and physical turn prohibition, as components of a consistent corridor cross-section;*
- *Examine options to retrofit a consistent cross-section and impose access management policies (access alignment/consolidation) within the portion of the corridor currently developed/under development, and apply these same principles to the consideration of all future developments within the corridor; and*
- *Re-evaluate the appropriateness of the current 45 MPH speed limit.*

Priority for Consideration: High.

2.1.2 Lack of facilities for vulnerable road users along CR 64

Safety Issue: Lack of pedestrian facilities along CR 64, and at waiting areas to cross at Driveway A.

Observations: Rural cross-section provides no dedicated pedestrian or cycling facilities along CR 64. Pedestrian crossing area at Driveway A has a poorly-located pedestrian pushbutton in the northwest quadrant and no waiting areas for pedestrians. Pedestrian and possibly cyclist demand in the study area is evolving, and future planning for the corridor should take this into consideration.

Risk Analysis: Pedestrians and cyclists traveling along CR 64 must use gravel/paved shoulder immediately adjacent to travel lanes and are exposed to higher-speed traffic, including traffic using shoulder for evasive maneuvers, overtaking turning traffic, or as an ad-hoc right turn lane. Designated crossing location at Driveway A lacks pedestrian pushbutton access, waiting area away from turning traffic.

Suggestion: *Consider vulnerable road user facility needs in future corridor planning. Consider upgrading Driveway A pedestrian facilities to meet ADA requirements.*

Priority for Consideration: High.

2.1.3 Side and overhead lane designation signs

Safety Concern – Inconsistent usage of lane designation signs; correlation with pavement markings.

Observations: Side and overhead lane designation signs appear to be inconsistently applied at intersections and driveways within the corridor. Combined with irregularities in lane arrangement, function, pavement marking deficiencies and road edge delineation, these inconsistencies may be resulting in driver confusion, improper lane use and erratic maneuvers, potentially leading to conflicts and collisions.

Risk Analysis: Given the prevalence of “non-typical” lane designations and functions (i.e. double left turns, through-left combined, etc.), combined with

increasing traffic volumes (exposure) the potential for higher operating speeds (severity outcomes), the risk associated with this apparent deficiency is considered to be moderate.

Suggestions – *The following steps are suggested:*

- *Consider the appropriateness of current lane designations from a capacity and consistency perspective, particularly those associated with driveway approaches and changes in main roadway cross-section;*
- *Provide lane designation on a consistent basis;*
- *Provide overhead designation where appropriate;*
- *Ensure pavement markings are consistent with lane designation signs;*
- *Ensure lane designation signs are aligned with the lane(s) to which they pertain; and*
- *Refurbish/alter markings as required.*

Priority for Consideration – High.

2.2.1 Pavement markings and road edge delineation

Safety Issue: Inconsistencies, conflicting markings.

Observations: Pavement markings indicating permitted lane usage appear to be inconsistent and/or unsupported by lane designation signs in some instances. Pavement markings in some areas require refurbishment. Obliterated markings are visible in some areas, providing an inconsistent message. Inappropriate (unauthorized?) pavement markings are present at Driveway G. Inconsistencies and conflicting information may be leading to driver confusion, inappropriate lane usage, and elevated risk of conflicts/collisions.

Risk Analysis: Inconsistent markings may be leading to inappropriate lane use and conflicts between adjacent traffic streams, increasing the likelihood of conflicts and collisions.

Suggestions: *The following steps are suggested:*

- *Re-evaluate lane configuration throughout corridor;*
- *Consider micro-resurfacing as a prelude to remarking, as required;*
- *Refurbish appropriate markings to enhance their visibility;*

- *Consider road edge delineation at lane drops.*

Priority for Consideration: High

2.2.2 Use of STOP signs and Stop Bars at driveways

Safety Issue: STOP signs appear to be inconsistently applied at driveways. When used, some STOP signs are obscured by site signs and/or do not meet MUTCD retroreflectivity standards. Stop Bars also appear to be inconsistently applied at driveway accesses.

Observations: STOP signs are provided at some driveways, but not others. Some are:

- Poorly placed;
- Obscured by site signs or landscaping; and
- Are constructed of non-retroreflective or engineering-grade materials (not high-intensity as required under MUTCD).

Stop bars are used inconsistently at driveway accesses.

Risk Analysis: While technically not required where a private roadway intersects with a public road, STOP signs and Stop Bars reinforce the need to stop and yield to traffic approaching on the public road. Their inconsistent use; lack of visibility, and improper retroreflectivity may detract from their effectiveness in this role, encouraging drivers to enter the public roadway without stopping.

Suggestions: *The following steps are suggested:*

- *Apply conforming STOP signs at all unsignalized driveway approaches;*
- *Position signs for optimal viewing;*
- *Relocate obstructions; and*
- *Apply Stop Bars consistently with STOP signs.*

Priority for Consideration: Low

2.2 West approach to CR 35 intersection

Safety Issue: East of Driveway A, the eastbound passing lane becomes an exclusive left turn lane, creating a "trap lane" situation.

Observations: On CR 64, a second eastbound through lane develops immediately west of Driveway A. The curb lane remains an eastbound through lane east of Driveway A, while the passing lane becomes designated as an exclusive left turn lane. Drivers receive limited advance notification of this change in lane designation.

Risk Analysis: "Trap lane" situations may result in last-minute lane changes and conflicts between vehicles traveling at different speeds, increasing the likelihood of a collision.

Suggestions: *Consider restriping eastbound to provide one through lane through the Driveway A intersection, then develop two exclusive left turn lanes and a single through lane beyond. This will have implications for the southbound dual left at driveway A.*

If eastbound traffic demand requires two lanes through Driveway A, consider enhanced lane designation signs and pavement legends to clearly identify the trap lane condition.

Consider requesting that NYSDOT conduct an operational safety review or safety assessment of the Southern Tier Expressway/CR 35 interchange functional area, and include the CR 64/CR 35 intersection in that review. Findings of the NYSDOT review should be considered and coordinated with future corridor planning by the County and NYSDOT.

Priority for Consideration: High (in conjunction with assessment of CR 64/CR 35 intersection and development of CR 64 corridor plan).

2.3 Driveways

2.3.1 Driveway A

Safety Issue #1: Lack of pedestrian footpaths or waiting areas at intersection

Observations: Pedestrians are permitted to cross the west approach only. No pedestrian waiting areas are provided in either the northwest or southwest quadrants (**Figure 11**).

Figure 11 – Pedestrian Waiting Area – Southwest Quadrant

Risk Analysis: Waiting pedestrians are exposed to risk of collision involving turning traffic.

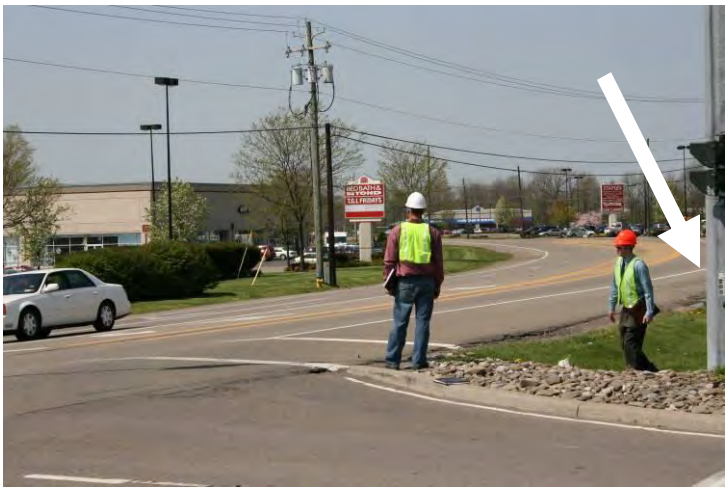
Suggestion: *Upgrade intersection to meet ADA requirements.*

Priority for Consideration: High.

Safety Issue #2: Placement of pedestrian pushbutton in northwest quadrant.

Observations: Pedestrian pushbutton in the northwest quadrant is on the main span wire support pole, at the bottom of the ditch, and is accessible only over rubble stone landscaping or by descending a grassy grade (**Figure 11**).

Figure 11 – Pushbutton Location in Northwest Quadrant



Risk Analysis: Pedestrians may choose to cross without actuating pedestrian timings, and be provided with insufficient green time to clear the intersection, increasing their risk of collision.

Suggestion: *Upgrade intersection to meet ADA requirements.*

Priority for Consideration: High

Safety Issue #3: Pedestrian crossing timings.

Observations: Pedestrians are provided with a total of 21 seconds in which to cross CR 64. Given the width of the intersection, this appears to be insufficient.

Risk Analysis: Pedestrians may be provided with insufficient green time to clear the intersection, increasing their risk of collision.

Suggestion: *Review timings and adjust as required.*

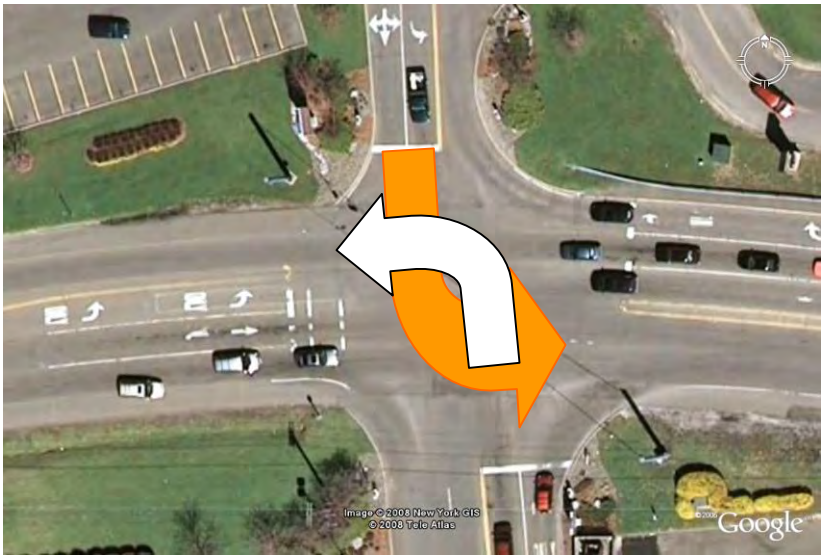
Priority for Consideration: High.

Safety Issue #4: Dual southbound left turn

Observations: The dual southbound left turn movement is permitted to operate concurrently with northbound movements. The swept path of the outer southbound left turning vehicle overlaps that of a northbound left turning vehicle,

posing the risk of an opposing sideswipe collision (**Figure 12**). The outer southbound left turning vehicle is turning into the same away lane as a northbound right turning vehicle. Under permissive operation, the left turning vehicle must yield. However, given the unusual nature of the operation, this may not be evident to all users.

Figure 12 – Swept Path of Opposing Left Turns

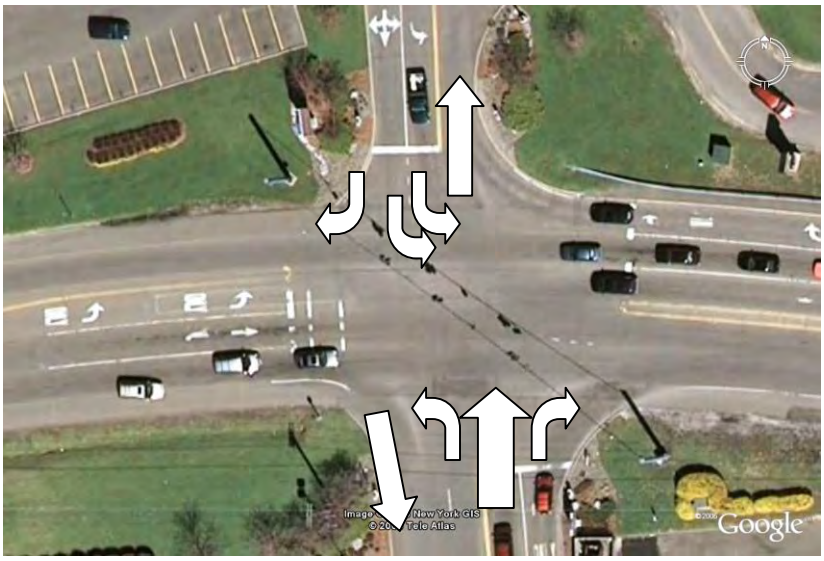


Risk Analysis: Overlapping movements increases risk of conflicts and turning movement collisions within intersection.

Suggestions: *Re-examine operational need for dual left turns. If required, consider:*

- *Split phasing northbound/southbound to separate conflicting movements in time; or*
- *Geometric revisions to southbound (two exclusive left turn lanes, one through-right turn lane, and one inbound lane) and/or southbound (one exclusive right turn lane, one through lane, one exclusive left turn lane, and one inbound lane) to offset the conflicting movements, with or without the introduction of exclusive left turn phasing.*

Figure 13 – Revised Entrance Scheme



In the interim, consider refurbishing "chicken track" markings to delineate and de-conflict the opposing left turn movements.

Priority for Consideration: High.

Safety Issue #5: Transit stopping location – northwest quadrant.

Observations: Heavy vehicles (shopper "Shuttles"? municipal transit??) appear to be stopping on right shoulder immediately west of Driveway A. There are no pedestrian waiting facilities at this location. The shoulder shows signs of pavement distress, and vehicles appear to be encroaching onto the grassed area beyond – perhaps in an effort to move completely out of the travel lane.

Figure 14 – Shoulder Distress

Risk Analysis: Stopped vehicles may be encroaching into the travel lane, elevating the risk of a vehicle-vehicle collision. Lack of pedestrian waiting facilities exposes pedestrians to traffic hazards.

Suggestion: *Investigate shoulder usage by transit vehicles and, if warranted, consider inclusion of transit facilities in future corridor cross-sectional plan.*

Priority for Consideration: Low.

Safety Issue #6: Lack of inter-visibility between vehicles approaching on the north and south approaches.

Observations: Superelevation on north side of CR 64 restricts inter-visibility between vehicles approaching intersection on north and south approaches.

Figure 16 – Relative eye height of drivers approaching CR 64

Risk Analysis: Restricted inter-visibility makes judging an opposing driver's intentions under permissive green more difficult, increasing the risk of conflicts and collisions.

Suggestion: *Examine opportunities to reduce superelevation and/or "ramp" driveways to improve inter-visibility as a component of a revised cross-sectional design.*

Priority for Consideration: Low.

Safety Issue #7: Taper, deceleration and storage length, eastbound left turn lane.

Observation: The total length of the eastbound left turn lane appears insufficient for taper, deceleration, and storage for a 45 MPH posted speed limit.

Risk Analysis: Short left turn lane risks rear-end collisions as drivers enter the lane at speed, and conflicts and possible rear-end collisions within the through lane as drivers decelerate in the through lane to enter the turn lane.

Suggestion: *In the interim, re-evaluate left turn lane lengths as a component of pavement markings revisions. In the longer term, apply appropriate design standards consistent with overall corridor standards.*

Priority for Consideration. Moderate.

Safety Issue #8: Inconsistent pedestrian "WALK" and "DON'T WALK" displays

Observations: Pedestrian signals mix worded and symbolized WALK and DON'T WALK messages. Pedestrian instructions/information provided at pushbutton locations refers only to symbolized messaging.

Risk Analysis: Minor consistency issue.

Suggestion: *Revise to consistent standard when intersection is upgraded to meet ADA requirements. Consider pedestrian countdown timer displays.*

Priority for Consideration: Low

2.3.2 Driveway B

Safety Issue #1: Pattern of right-angle collisions (12 in 3 years, out of 16 total) involving outbound (southbound) left turning vehicles and westbound through vehicles.

Observations: North approach is skewed to the east, relative to the alignment of CR 64. Stop Bar placement and lane arrangement does not appear to encourage drivers to move up to optimal viewing point, or align their vehicle perpendicular to CR 64. Crash records indicate that southbound left turning drivers generally stop, then fail to yield to westbound traffic. Collisions appear associated with periods of peak traffic demand, suggesting limited gaps for entering traffic. Intersection skew, horizontal curvature of CR 64, presence of vehicles in the westbound right turn lane, and possibly speed-of-approach of westbound vehicles make gap detection and acceptance more difficult.

Risk Analysis: Skewed intersections are associated with higher crash frequency. Operating speeds may be contributing to higher severity outcomes.

Suggestions: *As an interim measure, revise Stop Bar and lane lines to encourage drivers to move up to optimal viewing point and align their vehicle perpendicular to CR 64. In the longer term, consider relocating Driveway B opposite Driveway C, and investigate possible warrant for traffic control signals.*

Priority for Consideration: High

Safety Issue #3: Non-compliant and obscured STOP sign.

Observations: Site sign and landscaping obscure STOP sign. Stop sign is not constructed of High Intensity retroreflective materials per MUTCD.

Risk Analysis: While technically not required where a private roadway intersects with a public road, STOP signs and Stop Bars reinforce the need to stop and yield to traffic approaching on the public road. Their inconsistent use; lack of visibility, and improper retroreflectivity may detract from their effectiveness in this role, encouraging drivers to enter the public roadway without stopping.

Suggestions: *The following steps are suggested:*

- *Install conforming STOP sign;*
- *Position sign for optimal viewing; and*
- *Relocate obstructions*

Priority for Consideration: High.

Safety Issue #4: Daylighting triangle sight line restrictions.

Observations: Site sign and landscaping obscure sight lines to approaching eastbound traffic from stopped position.

Risk Analysis: Outbound left turning movement associated with high workload and collisions. Improved sightlines may assist drivers in assessing gaps, focusing more attention on westbound through traffic.

Suggestions: *Relocate Stop Bar per Safety Issue #1. Relocate obstructions.*

Priority for Consideration: High.

Safety Issue #5: Taper, deceleration and storage length, eastbound left turn lane

Observation: The total length of the eastbound left turn lane appears insufficient for taper, deceleration, and storage for a 45 MPH posted speed limit.

Risk Analysis: Short left turn lane risks rear-end collisions as drivers enter the lane at speed, and conflicts and possible rear-end collisions within the through lane as drivers decelerate in the through lane to enter the turn lane.

Suggestion: *In the interim, re-evaluate left turn lane lengths as a component of pavement markings revisions. In the longer term, apply appropriate design standards consistent with overall corridor standards.*

Priority for Consideration. Moderate.

2.3.3 Driveway C

Safety Issue #1: Usage by patrons despite usage being restricted to trucks. Outbound left turn violations.

Observations: Patrons of the Consumers Square commercial facility are using this driveway for inbound and outbound movements despite:

- Inbound movement being restricted to trucks by way of (poorly orientated) regulatory sign;
- Lack of westbound left turn lane; and
- Prohibition of outbound left turns.

This activity is likely a response to internal site circulation issues, and congestion and delay at other access points.

Risk Analysis: Usage, while a violation, does not appear to be associated with an elevated risk of collision.

Suggestions: *Re-examine justification for usage restriction and left turn prohibition. If found to be justified, correct sign deficiencies as follows:*

- *Provide near-side right turn restriction sign; and*
- *Correct orientation of restricted to trucks only sign.*

If found not to be justified, amend signs and markings as follows:

- *Remove restricted to trucks only sign;*
- *Remove turn prohibition; and*
- *Mark westbound left turn lane.*

In the longer term, consider formalization as an all-users access in conjunction with re-alignment of Driveway B opposite, and possible installation of traffic control signals.

Priority for Implementation: Low.

2.3.4 Driveway D

No issues Identified

2.3.5 Driveway E

Safety Issue #1: Non-compliant and obscured STOP sign.

Observations: Site sign and landscaping obscure STOP sign. Stop sign is not constructed of High Intensity retroreflective materials per MUTCD.

Risk Analysis: While technically not required where a private roadway intersects with a public road, STOP signs and Stop Bars reinforce the need to stop and yield to traffic approaching on the public road. Their inconsistent use; lack of visibility, and improper retroreflectivity may detract from their effectiveness in this role, encouraging drivers to enter the public roadway without stopping.

Suggestions: *The following steps are suggested:*

- *Install conforming STOP sign;*
- *Position sign for optimal viewing; and*
- *Relocate obstructions*

Priority for Consideration: High.

Safety Issue #2: Daylighting triangle sight line restrictions.

Observations: Site sign and landscaping obscure sight lines to approaching eastbound traffic from stopped position.

Risk Analysis: Outbound left turning movement associated with high workload. Improved sightlines may assist drivers in assessing gaps, focusing more attention on westbound through traffic.

Suggestions: *Relocate Stop Bar per Safety Issue #1. Relocate obstructions.*

Safety Issue #3: Lack of eastbound left turn lane.

Observations: Left turning traffic stops in through lane to await gaps in westbound traffic. Through traffic uses shoulder to overtake.

Risk Analysis: Risk of rear-end collisions based on eastbound traffic operating speeds. Shoulder usage poses risk of run-off-the-road-type collisions, conflicts with outbound left turning vehicles, and conflicts with vulnerable road users on the shoulder.

Suggestions: *Consider providing left turn lane as a component of future corridor plan. Explore opportunities to realign this Driveway and Driveway F with left turn lanes for both driveways as a component of future corridor plan.*

Priority for Consideration: Moderate.

Safety Issue #4: Lack of westbound right turn lane.

Observations: Right turning traffic slows in westbound through lane. Westbound through traffic crosses centre line to overtake.

Risk Analysis: Risk of rear-end collisions based on westbound traffic operating speeds. Risk of head-on collisions during overtaking

Suggestions: *Consider providing right turn lane as a component of future corridor plan.*

Priority for Consideration: Moderate.

2.3.6 Driveway F

Safety Issue #1: Lack of eastbound left turn lane.

Observations: Left turning traffic stops in through lane to await gaps in westbound traffic. Through traffic uses shoulder to overtake.

Risk Analysis: Risk of rear-end collisions based on eastbound traffic operating speeds. Shoulder usage poses risk of run-off-the-road-type collisions, conflicts with outbound left turning vehicles, and conflicts with vulnerable road users on the shoulder.

Suggestions: *Consider providing left turn lane as a component of future corridor plan. Explore opportunities to realign this Driveway and Driveway F with left turn lanes for both driveways as a component of future corridor plan.*

Priority for Consideration: Moderate.

Safety Issue #2: Lack of eastbound right turn lane.

Observations: Right turning traffic slows in eastbound through lane. Westbound through traffic crosses centre line to overtake.

Risk Analysis: Risk of rear-end collisions based on eastbound traffic operating speeds. Risk of head-on collisions during overtaking.

Suggestions: *Consider providing right turn lane as a component of future corridor plan.*

Priority for Consideration: Moderate.

2.3.7 Driveway G

Safety Issue #1: Possible unauthorized roadway improvements.

Observations: Right turn arrows have been marked on paved shoulder. Shoulder may not be structurally sufficient to serve as a right turn lane. Pavement added to provide right turn “slips”. Is this work authorized by the County?

Risk Analysis: Minor, but there is a potential liability issue for the road authority if unauthorized roadway "improvements" go unchallenged.

Suggestions: *Clarify adjacent property owners' authority and intentions.*

Priority for Consideration: Moderate.

Safety Issue #2: Pedestrian activity.

Observations: Pedestrians observed crossing between north and south side of CR 64.

Risk Analysis: Road users, particularly those traveling eastbound, may not expect to encounter pedestrians in the roadway. Given the prevailing operating speeds, this could result in a high-severity outcome.

Suggestion: *Consider warning signs to advise eastbound (and possibly westbound road users of pedestrian activity associated with this access. Monitor activity for potential warrant for traffic control to provide assured pedestrian crossing opportunities (e.g. High-Visibility Crosswalk).*

Priority for Consideration: High.

Safety Issue #3: Lack of left turn lanes.

Observations: Simmons Rockwell has expanded incrementally, and is currently undergoing a further expansion. This is likely to increase site-generated traffic. Left turning traffic stops in through lane to await gaps in opposing traffic. Through traffic uses shoulder to overtake.

Risk Analysis: Risk of rear-end collisions based on operating speeds. Shoulder usage poses risk of run-off-the-road-type collisions, conflicts with outbound left turning vehicles, and conflicts with vulnerable road users on the shoulder.

Suggestions*: Consider providing left turn lanes as a component of future corridor plan.*

Priority for Consideration: Moderate.

2.3.8 Driveway H

Safety Issue: Proximity to horizontal and vertical curve to the west.

Observations: Eastbound traffic is descending the grade from the railway overpass at 45+ MPH. Road users entering CR 64 have difficulty seeing traffic approaching from the west. An informal driveway further to the east has apparently developed over time, possibly in response to this issue.

Risk Analysis: Restricted sightlines pose an elevated risk of higher-severity angle-type collisions, involving northbound to westbound left turning vehicles and eastbound through vehicles.

Suggestion*: Consider closing westerly driveway and formalizing a consolidated driveway further to the east, opposite Wells Lane and provide left (and possibly right) turn lanes as a component of future corridor plan.*

Priority for Consideration: Low.

2.4 Onsite Issues

During the safety assessment, a number of issues pertaining to road user safety were identified pertaining to on-site traffic movements. They are as follows:

Safety Issue #1: Most, if not all of the developments within the study area lack pedestrian facilities to provide access to stores from CR 64.

Observations: Pedestrians are forced to walk amongst traffic and between rows of parked vehicles to access store entrances.

Risk Analysis: Pedestrians are exposed to vehicular traffic along driveways, and move along random desire lines from parking areas to store entrances, increasing the likelihood of vehicle-pedestrian conflicts and collisions.

Suggestion: *In consultation with developers/property owners, examine opportunities to retrofit pedestrian facilities within adjacent developments, and provide secure pedestrian corridors between parking areas and entrances. Review and comment on pedestrian safety and on-site circulation issues as a component of future development approvals.*

Priority for Consideration: Existing Issue – Moderate, Future Issues - High.

Safety Issue #2: Michaels/Old Navy Plaza parking layout and entrance design.

Observations: The parking layout has the first two rows of parked vehicles oriented parallel to the front of the stores, along the main isle. This results in vehicles backing into the isle to exit stalls, conflicting with vehicles traveling along the isle and pedestrians crossing to and from the parking area. The columns along the front of the covered entrances to the stores obscure approaching drivers' views of pedestrians exiting the stores and stepping into the main isle.

Risk Analysis: The orientation of the first two rows of parking, the placement of the main access isle immediately in front of the stores, and the sight restriction posed by the building's architecture increase the likelihood of vehicle-vehicle and vehicle-pedestrian conflicts and collisions.

Suggestion: *In consultation with developers/property owners, consider revising the parking layout to provide perpendicular parking stalls, and to direct the majority of vehicle movements away from the isle immediately in front of the stores. Review and comment on pedestrian safety and on-site circulation issues as a component of future development approvals.*

Priority for Consideration: Existing Issues – Low, Future Issues – High.

2.5 Other Issues

During the safety assessment, other miscellaneous issues pertaining to road user safety were identified. They are as follows:

Safety Issue #1: There is a school bus stop ahead sign, for eastbound traffic, located immediately east of railway overpass.

Observation: This sign is present. However, there does not appear to be any residential uses in the vicinity.

Risk Analysis: Minimal.

Suggestion: *Review continuing requirement for sign, and remove if no longer necessary.*

Priority for Consideration: Low.

Safety Issue #2: Plant (Trucks) Entrance sign for westbound traffic upstream of Driveways C and D.

Observations: Volume of heavy trucks using these accesses likely does not warrant presence of this sign.

Risk Analysis: Minimal.

Suggestion: *Revisit warrant for sign, and remove if unwarranted.*

Priority for Consideration: Low.

Safety Issue #3: Utility pole in clear zone on north side of CR 64 between Driveway B and Driveway E.

Observation: This pole is located immediately behind the shoulder at a significantly lesser offset that other poles in the corridor.

Risk Analysis: Pole appears to represent a fixed object hazard within the roadway clear zone, with increased likelihood of collision in the event of a vehicle drifting to the outside of the curve or undertaking an evasive maneuver. There is an increased potential for a higher severity outcome if pole is struck, relative to vehicle entering ditch.

Suggestion: *Relocate pole outside of clear zone as a component of future corridor plan.*

Priority for Consideration: Low (may be considered along with other cross-sectional improvements).

Safety Issue #4: Vertical culvert headwalls.

Observations: Several ditch inlets under driveways were noted to employ vertical culvert headwalls. These headwalls may constitute a roadside hazard if struck by an errant vehicle.

Risk Analysis: Vertical headwalls may increase the severity outcomes of run-off-the-road-type collisions.

Suggestion: *Address these potential hazards in future corridor plan.*

Priority for Consideration: Low.

Safety Concern #5: Peak period/night operations review.

Observations: The assessment team was not able to conduct a PM or weekend peak period review, or a night review, due to time constraints.

Suggestion: *Observation of peak period operations may yield additional insights into collision causal factors and safety issues. A night review is suggested as part of the assessment response process. The night review should examine illumination needs; sign, delineation and pavement marking retroreflectivity; and light trespass/glare issues pertaining to the adjacent commercial developments.*

Priority for Consideration: High.

3.0 Conclusion

This assessment has been prepared to assist the responsible road authorities in the identification and actualization of opportunities to improve safety within the study area. The assessment is based on information available at the time of the field review. The suggestions it contains are for consideration only, and are in no way intended to serve as design or operational recommendations.

This report does not preclude the identification of additional issues pertaining to safety by the responsible road authorities, or the emergence of new issues over time.

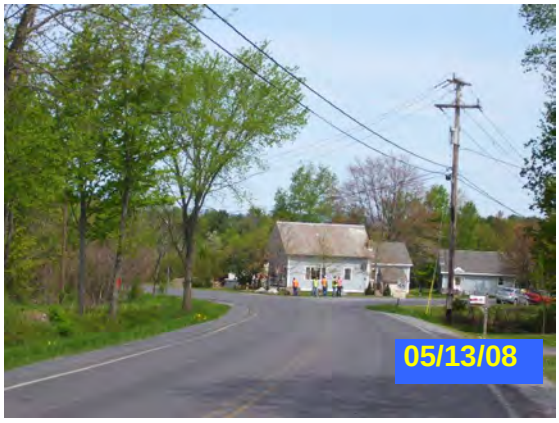
It is recommended that the responsible road authorities review this report; document their responses to the issues identified in a formal response report; and track their progress towards the implementation of safety improvements prompted by this assessment.

Road Safety ASSESSMENT (SA) Report

Washington County Route 12 at Hatch Hill Road (South Junction)
Town of Granville
Washington County
New York State

Sponsored by: New York State Metropolitan Planning Organizations

Assessment Conducted May 12th and 13th, 2008



Final Report Date: July 22, 2008

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Table of Contents

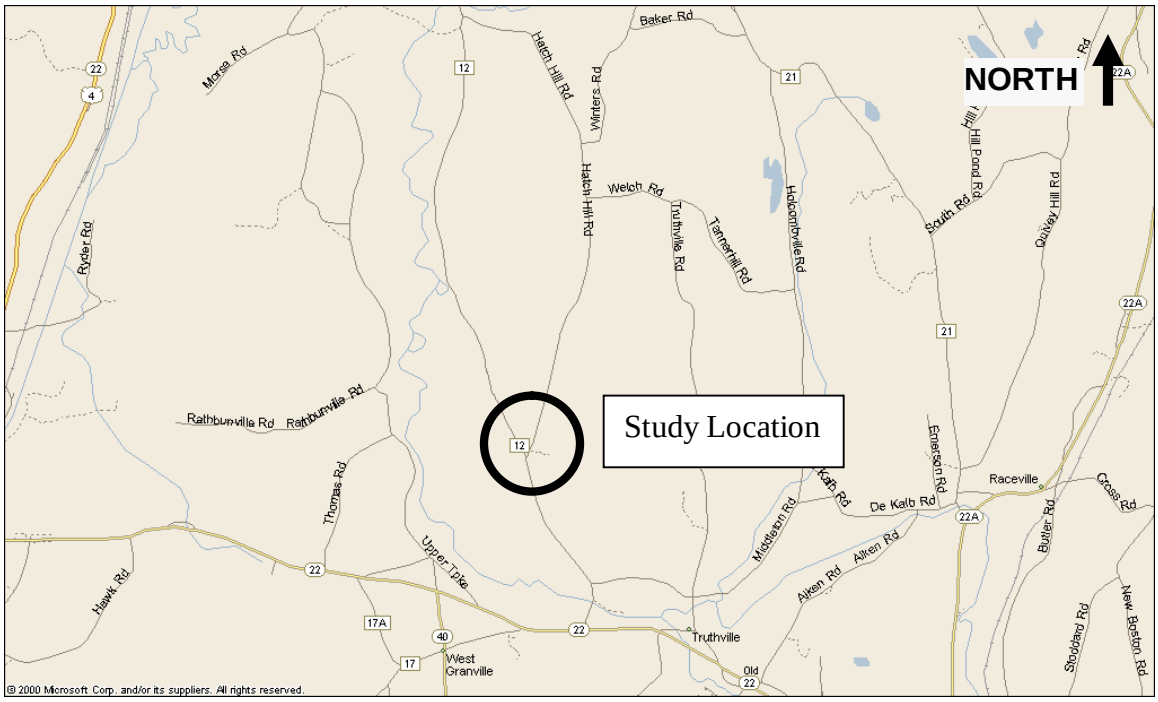
1.0 Background

Washington County Route 12 (CR 12) extends northerly from New York State (NYS) Route 22 in the south to the Town of Whitehall in the north. CR 12 is an asphalt surfaced, rural collector roadway with a two-lane rural cross-section and a statutory speed limit of 55 miles per hour. Adjacent land uses within the study area are generally rural residential and agricultural.

Approximately 1.5 miles north of NYS Route 22, CR 12 intersects with Hatch Hill Road (South Junction), an asphalt surfaced, rural local roadway with a two-lane cross-section and posted speed limit of 45 miles per hour (**Figure 1**). Adjacent land uses within the study area are generally rural residential and agricultural. Hatch Hill Road is under the jurisdiction of the Town of Granville.

Viewed from the south, the two roadways form a "Y" intersection with CR 12 bearing off to the northwest and Hatch Hill Road bearing off to the northeast. The Hatch Hill Road approach to CR 12 is controlled by a STOP sign.

Figure 1 – Study Location Map



The CR 12/Hatch Hill Road (South Junction) intersection and its approaching roadways were selected for a safety assessment (SA) based upon a network safety screening of County and municipal roadways. The results of that screening identified both the subject intersection and the adjacent roadway segment of CR 12 to the north as having a higher-than-expected collision frequency

1.1 SA Team

This was the first SA conducted by Washington County in association with the Adirondack Glens Falls Transportation Council (AGFTC). As such, a brief introductory training session was provided on the afternoon of the first day of the assessment.

This SA was sponsored by the New York State Metropolitan Planning Organizations (NYSMPOs) and will serve as one of three case studies to be included in guidelines for the conduct of SAs on locally owned and maintained transportation facilities throughout New York State.

The SA Team was comprised of Washington County Department of Public Works (DPW) and NYSMPO representatives along with two members from the consultant team leading the development of the SA guide.

The SA Team included the following individuals:

- **Aaron Frankenfeld**, AGFTC, afrankenfeld@agftc.org
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- **Scott Tracy**, Washington County DPW, stracy@co.washington.ny.us
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- **Mike Croce,** Bergmann Associates mcroce@bergmannpc.com
- **Greg Junnor,** Synectics Transportation Consultants, gjunnor@synectics-inc.net

1.2 SA Process

The SA was conducted in a manner consistent with the proposed safety assessment guidelines being prepared for the NYSMPOs. The assessment took place on May 12th and 13th, 2008.

Information reviewed during the course of the assessment included the following:

- Aerial photographs;
- Traffic volume data;
- Collision information;
- Adjacent land uses; and
- Existing safety concerns.

This information was reviewed by the assessment team on the morning of the second day of the assessment. The assessment team then went into the field to conduct a site visit. This visit began in the late morning and extended into the noon hour. Site visit conditions were warm and sunny.

The assessment team reconvened on the afternoon of the second day to complete the assessment analysis. Preliminary assessment findings were discussed then recorded using the FHWA Road Safety Audit (RSA) Software.

This report was subsequently prepared by the consultant team and circulated among the assessment team members for review and comment prior to being finalized.

1.3 SA Report

This report provides information on issues identified by the assessment team which were deemed relevant to the stated goal of an SA; “identifying opportunities to improve road safety within the study area.”

Where appropriate, an assessment of road user safety risk and suggestions for improvement are included. High, medium, and low priority designations are provided as a means for the reader to gauge the Assessment Team’s opinion on what improvements should be considered in the near term and which could be held off until others have been completed or tried.

The suggestions provided in this document should not be viewed as design or operational recommendations. They are intended to be illustrative of potential solutions to the safety issues identified and are presented for consideration only.

Within this report the findings and suggestions of the assessment team are organized into two groups:

- **Approaching Roadway Issues** – pertaining to the approaching roadways but not directly related to the intersection; and

- **Intersection and Intersection-related Issues** – pertaining to the intersection of CR 12 and Hatch Hill Road.

1.4 Study Area Characteristics, Operations, and Safety Performance (Office Review)

CR 12 within the study area carries an annual average daily traffic (AADT) of 919 vehicles south of Hatch Hill Road, and 606 vehicles north of Hatch Hill Road. Hatch Hill Road carries an AADT of 313 vehicles.

Vehicle types include passenger vehicles, farm-related truck traffic, and farm equipment. An informal review of license plates indicates a substantial number of out-of-state (Vermont) license plates, suggesting non-local users. A maple sugar house, located on Hatch Hill Road, draws tourists during the spring "sugaring-off" season. There is new development (rural acreages) being constructed on Hatch Hill Road northeast of the study area intersection.

The Hatch Hill Road approach is STOP (R1-1) controlled. There is anecdotal evidence that this approach may have been controlled by a YIELD (R1-2) sign in the past.

Collision data for the past 11 years indicates a total of 34 collisions on the CR 12 approaches. This figure includes those collisions that are within 0.3 miles north and south of the intersection and those that occurred within intersection. Hatch Hill Road experienced 11 collisions over the same time period within 0.3 miles of the intersection, for a total of 45 collisions within the study area. At least 16 crashes resulted in one or more injuries.

An informal tally of collision attributes indicates the following:

- 12 vehicle versus animal (deer, raccoon) collisions. Deer incidents were primarily located on the CR 12 north approach.

- CR 12 north of the intersection has experienced a pattern of single vehicle run-off-the-road collisions (total of 7). It is believed that they are occurring on a reverse curve where roadbed stability and localized settlement has been an ongoing maintenance concern.

- Several intersection and intersection-related collisions make reference to wet pavement and loose sand/gravel on the roadway surface.

- Collisions on Hatch Hill Road make frequent reference to slush, snow or ice on the road surface leading to single vehicle loss of control.

Washington County has ownership and maintenance jurisdiction over CR 12. The roadway was resurfaced within the last 2 years. Winter maintenance activities including routine plowing and salting to a bare pavement surface.

Maintenance on Hatch Hill Road is carried out by Town of Granville forces. Winter maintenance activities include plowing and the spreading of sand or grit. It was suggested that packed snow is occasionally allowed to remain on the roadway surface during the winter.

2.0 Assessment Findings and Suggestions

2.1 Approaching Roadway Issues

2.1.1 CR 12 North Approach

Safety Concern #1: Deer collisions

Observations: The assessment team noted substantial evidence of deer activity (fresh tracks in mud) approximately 300 to 600 yards north of the intersection, between an open field to the west and a wooded ravine to the east. This is also on the approach to the reverse curve. This observation correlates with the collision experience. Salt residue in roadside ditches from winter maintenance activities may be attracting deer to the roadway.

Risk Analysis: Crashes involving large animals and vehicles may result in evasive maneuvers and loss of control. The existing horizontal alignment makes seeing and avoiding animals on or crossing the roadway difficult. Crashes involving deer have a higher potential for severe results as an animal may be propelled through windshield and intrude into vehicle.

Suggestions: *Examine warrants for deer crossing signs. Consider reflectors, appropriate plantings, or right-of-way fencing to deter crossing activity or channel it to tangent areas with better sightlines.*

Priority for Consideration: Moderate

Safety Concern #2: Roadway settlement**.**

Observations: Settlement of the roadbed and sliding of pavement toward the east shoulder have been noted as ongoing maintenance concerns on the inside of the northbound lane approximately 200 to 300 yards north of the intersection. Field observations revealed a dip in this area. This coupled with anecdotal evidence of frost heaving and subsidence in spring, suggests the problem was not resolved when the roadway was last resurfaced.

Risk Analysis: Undulations in the roadway at this location are superimposed on a horizontal curve, thus increasing the potential for a loss of vehicular control.

Suggestions: *In the short term, consider asphalt shimming to correct settlement. In the longer term, seek more a durable solution (i.e. embankment stabilization, reconstruction with undercut and geotextile, etc).*

Priority for Consideration: Moderate.

Safety Concern #3: Steep ditch cross-section with utility poles located in the foreslope or invert.

Observations: The ditch along the west side of CR 12 (adjacent to the southbound lane) has a near-vertical back slope approximately 200 to 300 yards north of Hatch Hill Road (southern junction). Utility poles are located within the foreslope (**Figure 2**).

Risk Analysis: A steep ditch back slope raises the potential for overturning an errant vehicle, resulting in a higher collision severity outcome. The collision data set contained information on one vehicle rollover associated with this location. This combination of ditch geometry and pole location risks errant vehicles being directed into a roadside fixed object collision.

Figure 2 – Ditch Back Slope and Utility Pole

Suggestions: *Re-grade ditch and flatten back slope to 1:3 or flatter. Explore opportunities to relocate poles on the outside of a horizontal curve behind the ditch and outside of the clear zone.*

Priority for Consideration: Moderate.

Safety Concern #4: Edge drop-off opposite intersection with Hatch Hill Road.

Observations: Southbound vehicles appear to have been off-tracking to the inside of the horizontal curve to the right, resulting in the formation of an edge drop-off (**Figure 3**).

Risk Analysis: Edge drop-offs may result in a vehicle “hooking” the pavement edge resulting in a loss of control as the driver attempts to steer back onto the traveled way.

Figure 3 – Edge Drop-off

Suggestion: Consider re-grading the shoulder to eliminate drop-off.

Priority for Consideration: Low.

Safety Concern #5: Southbound sequence of reverse curve (left-then-right), T-intersection, curve (to the right), and farm vehicle signs.

Observations: The Reverse curve (W1-4) sign appears appropriate and properly-placed. The T-intersection (W2-2) sign does not accurately depict the intersection skew. The curve (W1-2) sign appears located too close to the curve it references. The farm vehicle (W11-5) sign is located at the intersection, in an area of high driver workload, and may not be necessary at this location.

Risk Analysis: Road user signs may impose additional driver workload in areas where motorists must already be on the look-out for conflicting intersection movements. The information provided may be interpreted by drivers as somewhat inaccurate or provide insufficient time to perceive and react.

Suggestions: *Combine the curve and intersection warning signs into one (W1-10) which accurately depicts the roadway and intersection geometry and locate that sign with an appropriate advance posting distance in accordance with the National MUTCD, New York State Supplement, and prevailing field conditions. Evaluate the need to retain the farm vehicle (W11-5) sign and the potential for its relocation downstream of the intersection.*

Priority for Consideration: High.

2.1.2 CR 12 South Approach

Safety Concern #1: Lack of curve sign or intersection warning sign.

Observations: Northbound road motorists approaching the Hatch Hill Road intersection on CR 12 enter a horizontal curve to the left. Although this curve is visible in the daytime, it may be less obvious at night. The wide intersection throat and superelevation on the outside of the curve may induce drivers to "run wide" potentially leading to run-off-the-road collisions on the outside of the curve or loss of control through over-correction.

Risk Analysis: Loss of control to the outside of the curve may result in a higher severity outcome due to the presence of fixed objects (boulders) and a private residence located between the two roads.

Suggestions: *Consider adding a curve warning sign which also depicts the intersection and its unusual geometry (W1-10).*

Priority for Consideration: High

Safety Concern #2: Utility pole and cable anchor on outside of horizontal curve

Observations: A utility pole exists with a guy wire extending toward the northbound lane of CR 12 on the outside of the northbound horizontal curve to the left (**Figure 4**).

Risk Analysis: Utility poles and guy wires pose a fixed object roadside hazard on the outside of a horizontal curve, potentially increasing the severity of a run-off-the-roadway type collision.

Figure 4 – Utility Pole and Guy Wire

Suggestions: *Explore options to relocate pole and guy wire outside of the clear zone.*

Priority for Consideration: Low.

Safety Concern #3: Fixed objects adjacent to the intersection.

Observations: The property owner immediately to the north of the intersection (effective gore area formed by the two roads as seen by northbound traffic) has placed boulders along the property line. This may have been an effort to reduce the risk of errant vehicles encroaching upon the property and adjacent home (**Figure 5**).

Figure 5 – Boulders

Risk Analysis: These boulders constitute an unnecessary fixed object roadside hazard and may increase crash severity outcome if struck by an errant vehicle.

Suggestion: *After other intersection safety improvements have been implemented, discuss the removal of these stones with the property owner. Perhaps install low growth shrubs to snag vehicles that run off the road.*

Priority for Consideration: High.

2.1.3 Hatch Hill Road

Safety Concern #1: Lack of warning regarding presence of intersection or STOP control.

Observations: Road users approaching the intersection on Hatch Hill Road have their view of the intersection and the STOP (R1-1) sign obscured by the vertical alignment of the roadway (dip) and roadside foliage. The existing stop sign support does have a retroreflective strip The two direction large arrow sign (W1-7) and route marker assembly (M1-6) located opposite the Hatch Hill Road approach appear appropriately positioned but lack conspicuity. The two direction large arrow sign support also has a retroreflective strip.

Risk Analysis: Drivers may recognize and react to the intersection and the STOP control late, resulting in loss of control or entering the intersection without stopping (violation).

Suggestions: *Consider posting a STOP ahead (W3-1) sign on Hatch Hill Road. Consider a bigger two direction large double arrow (W1-7) sign opposite the Hatch Hill Road approach and slightly relocating the route marker assembly (M1-6). Consider adding stop line on the Hatch Hill Road approach to CR 12.*

Priority for Consideration: High.

Safety Concern #2: Speed limit sign and private advertising.

Observations: A 45 MPH speed limit (R2-1) sign is located on the east shoulder, for northbound traffic at the point where Hatch Hill Road splits from CR 12. It is unclear from the northbound driver's perspective whether this sign applies to CR 12 or Hatch Hill Road. Appended to the Speed Limit sign is a private roadside advertisement sign (Maple Sugar Shack). This secondary sign does not appear to be retroreflective.

Risk Analysis: Minimal.

Suggestions: *Confirm the regulatory speed limit on Hatch Hill Road and relocate the speed limit (R2-1) sign accordingly to eliminate the potential for misinterpretation. Consider removal or relocation of the private commercial directional sign per applicable local policy.*

Priority for Consideration: Moderate.

2.2 Intersection and Intersection-related Issues

Safety Concern #1: Intersection presentation to northbound drivers.

Observations: Northbound drivers receive no warning of either the horizontal curve to the left, the intersection, or information about which fork (left or right) is the continuation of the through roadway. The proper choice to continue their route is not immediately obvious to the unfamiliar road user (**Figure 6**).

Pavement markings (center line and edge line) are discontinuous through the intersection, faded, and occasionally obscured by gravel. The wide intersection throat makes it difficult for drivers to visually track the curve through the intersection.

Figure 6 – Northbound Driver's View of Intersection

Risk Analysis: A lack of positive guidance showing which the through roadway is may lead some drivers to run wide on the curve and risk collision with fixed objects on the adjacent property.

Suggestions: *Per earlier suggestion, consider providing a curve warning (W1-10) sign which also depicts the intersection configuration. Carry the northbound right edge line and double yellow center stripe through the intersection using a dotted line pattern per the New York State Department of Transportation Standard Sheets. Refurbish faded markings. Consider post-mounted delineation in the "gore" area formed by the north and east legs of the intersection as viewed by northbound drivers.*

Priority for Consideration: High.

Safety Concern #2: Loss of superelevation in horizontal curve through the intersection.

Observations: Superelevation to the outside of the northbound lane has been warped to blend with the elevation of Hatch Hill Road. This transition occurs midway through the horizontal curve. The resultant drainage pattern carries water, sand, and gravel across the Hatch Hill Road approach into the staging area for departing traffic. There is a ponding area for runoff adjacent to the existing stop sign.

Risk Analysis: Loss of superelevation at this location may lead northbound drivers "running wide" or losing control at this location. Fixed objects on the property located immediately adjacent to the intersection increase the likelihood of high severity outcomes. Sand and gravel carried by the over the pavement drainage pattern makes stopping at and accelerating from the stop position on Hatch Hill Road more difficult.

Suggestions: *Consider the addition of a curve and intersection warning (W1-10) sign. Continue pavement markings through intersection using a dotted line pattern, and improve delineation of the "gore" area as previously noted in the short-term. In the longer-term, consider maintaining the superelevation of CR 12 northbound through the intersection and raising the profile of Hatch Hill Road to match. Provide positive drainage on Hatch Hill Road (possibly a crown line) to address over-road drainage issues.*

Priority for Consideration: Moderate.

Safety Concern #3: Operating speeds northbound on the right turn from CR 12 on to Hatch Hill Road

Observations: Traffic turning northbound onto Hatch Hill Road does so at relatively high speed. This is facilitated by the geometry of the intersection and recently added asphalt along the shoulder. The shoulder pavement may have been installed in response to a shoulder rutting issue and to reduce the pulling of gravel off the shoulder and into the intersection. Northbound traffic was observed to signal their turn in the majority of cases, but not all. This inconsistent behavior leaves drivers turning out from Hatch Hill Road unsure of an approaching driver's intentions.

Risk Assessment: High-speed right turns are undesirable for the following reasons:

- There is a potential for loss of control under adverse road surface conditions. Under wet, slush, snow or icy conditions, vehicles may lose control;

- There is an increased potential for opposing sideswipe collisions if the right turning vehicle encroaches into the opposing lane on Hatch Hill Road;

- Given the differing winter maintenance standards applied to the two roadways, drivers may encounter a change in road surface condition (i.e. bare pavement to packed snow). Loss of control could result; and

- Vehicles "cutting the corner" pose a risk to pedestrians and other road users (driveways on Hatch Hill Road immediately beyond intersection).

Suggestions: *Consider physically tightening the radius of northbound to northeast-bound travel with a mountable or modified traversable curb and apron or the removal of asphalt to reduce operating speeds through the turn. Appropriate truck turning radii for the design vehicle should however, be maintained. This suggestion should be considered in conjunction with #4 below.*

Priority for Consideration: Moderate.

Safety Concern #4: Stopping position

Observations: Vehicles turning left from Hatch Hill Road do not align themselves perpendicular to CR 12. Instead they position themselves toward the left side of the intersection, potentially "pinching" traffic making the northbound (free flow) right turn movement.

Risk Analysis: Poor positioning means drivers must look back over their right shoulder to observe southbound traffic, potentially overlooking an approaching vehicle. This position may result in the vehicle's "B" pillar obstructing the drivers' view of southbound traffic. It also requires a neck movement which can be difficult for older drivers.

Suggestions: *Consider the following:*

- *Physically narrow the Hatch Hill Road intersection by reducing the radius in the southeast quadrant;*
- *Paint a double yellow (full barrier) center line for an appropriate distance up to the intersection on the Hatch Hill Road approach. Hook that line to the north to encourage perpendicular positioning; and*
- *Paint a white stop line at the correct stopping position.*

Priority for Consideration: High.

Safety Concern #5: Street Name Sign – Hatch Hill Road.

Observations: Hatch Hill Road is identified by a 6 inch street name sign (D3-1) with 4-inch, all capital lettering. It is located in the northeast quadrant of the intersection. This sign appears to be too small to be read and responded to at the prevailing speed limit on CR 12. Given that Hatch Hill Road spurs off from CR 12 and rejoins further to the north, a great deal of traffic using Hatch Hill Road makes this northbound right turn movement.

Risk Analysis: Lack of sign legibility poses the risk of drivers slowing on CR 12 and could potentially result in rear-end collisions. Last-minute maneuvers pose the risk of loss of control.

Suggestion: *Consider relocating the roadway identification sign to the southeast quadrant of the intersection (upstream for northbound traffic) and replacing it, increasing the letter size to 6-inch, mixed case with a white border.*

Priority for Consideration: Moderate.

3.0 Conclusion

This assessment was prepared to assist the responsible Highway Superintendents in the identification and actualization of opportunities to improve safety within the study area. The suggestions it contains are for consideration

only and are in no way intended to serve as design or operational recommendations.

The assessment team believes it has been thorough and diligent in its work based on the information available and the field review. Due to time constraints a night time assessment was not conducted. It is recommended that night time observations be made at this location.

This report does not preclude the identification of additional issues pertaining to safety by the responsible Highway Superintendents or the emergence of new issues over time.

It is recommended that the responsible Highway Superintendents review this report, document their responses to the issues identified in a formal response, and track their progress toward the implementation of any safety improvements prompted by this assessment.

Suggested actions in order of priority for consideration:

<u>CR12 North Approach</u>

#5	Sequence of Southbound Signs	High
#1	Deer Collisions	Moderate
#2	Roadway Settlement	Moderate
#3	Steep Ditch Cross Section with Utility Poles	Moderate
#4	Edge Drop-Off Opposite Intersection	Low

<u>CR 12 South Approach</u>

#1	Lack of Curve and Intersection Warning Signs	High
#3	Fixed Objects at the Intersection	High
#2	Utility Pole and Guy Wire on Curve	Low

<u>Hatch Hill Road</u>

#1	Lack Advanced Stop Warning	High
#2	Speed Limit Sign and Private Advertising	Moderate

<u>Intersection</u>

#4	Stopping Position	High
#1	Presentation of Intersection to Northbound Traffic	High
#2	Loss of Superelevation in Horizontal Curve	Moderate
#3	Operating Speeds on Northbound Right Turn	Moderate
#5	Street Name Sign	Moderate

Safety ASSESSMENT (SA) Report

9th Avenue @ West 57th Street, New York County, New York State

Sponsored by: New York State Metropolitan Planning Organizations

Conducted June 17th and 18th, 2008

Report dated: July 15, 2008

Eng-Wong, Taub & Associates
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synectics
SAFETY SPECIALISTS

Bergmann associates

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1.0 Background

An aerial view of the intersection of 9th Avenue @ West 57th Street, in Manhattan, New York City, is shown in **Figure 1**.

Figure 1 – 9th Avenue @ West 57th Street

9th Avenue is a six lane, one-way arterial roadway oriented north-south. Traffic flows from north to south. Sidewalks are provided on both sides of the roadway.

West 57th Street is a six-lane, two-way arterial roadway oriented in an east-west direction. Sidewalks are provided on both sides of the roadway.

9th Avenue south of West 57th Street, and the east and west approaches of West 57th Street, are truck routes. To the south, 9th Avenue provides access to the Lincoln Tunnel and New Jersey. Both roadways are governed by a 30 mph statutory speed limit.

The intersection is controlled by traffic control signals with pedestrian displays on all approaches. A single, pre-timed and coordinated timing plan is in effect at all times. **Figure 2** summarizes the timing plan.

Figure 2 – Timing Plan

Type: Non-actuated
Accessed: May 2008
Signal Cycle Length: 90 s
Times of Operation: All Times

Phase (movement)	**Green**	**Amber**	**All-Red**	**Split**
A - 9 Avenue	**31** (21 W +15 PC) – Crossing 57 St	**3**	**2**	**36**
B – WB 57 St + LT	**16** (21 W – Crossing 9 Ave North leg only)	**3**	**2**	**21**
B - 57 St	**21** (10 W + 16 PC) – Crossing 9 Av	**3**	**2**	**26**
B – LPI	**7** (7 W) Crossing 57 St			**7**

Note:

W = Walk
PC = pedestrian clearance (flashing dw + all-red.)
LPI = lead pedestrian interval

The traffic signal and timing plan are somewhat unique in the Manhattan context as a westbound to southbound lead protective left turn phase is provided, to facilitate turns from West 57th Street onto 9th Avenue southbound.

During the protected portion of the east-west phase, pedestrians are provided a WALK indication across the north approach to the intersection only. Pedestrians

waiting to cross the south approach receive a WALK indication only when the westbound protected left turn phase and its clearance times out, and are reminded to "Wait for Walk Signal" by signs prominently displayed on both sides of the south approach (**Figure 3**).

Figure 3 – Wait For Walk Signal signs on both sides of south approach

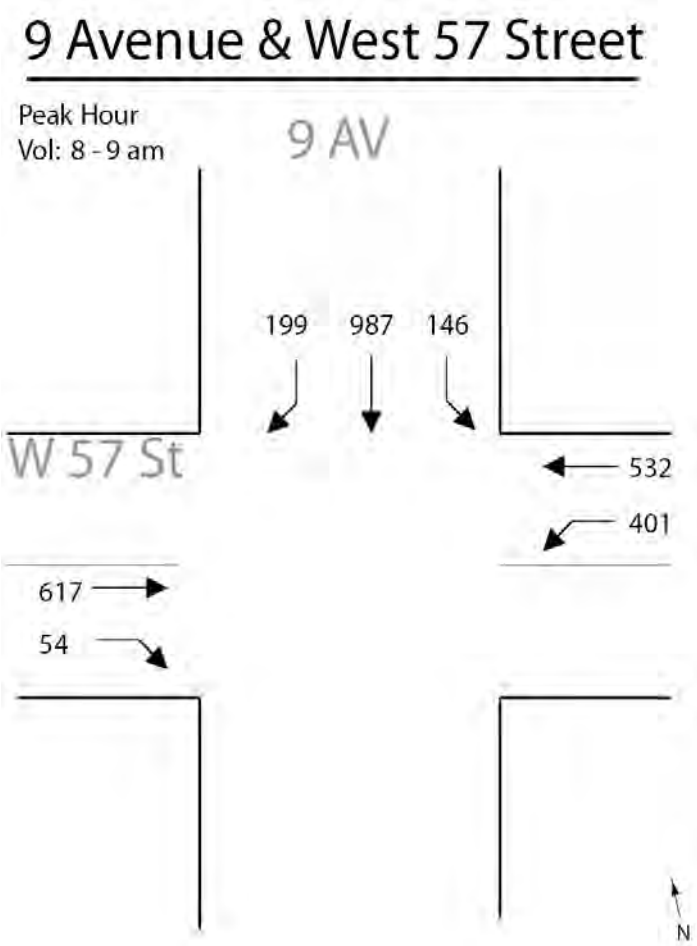
Figure 3 also illustrates the lack of observance of the WALK signal on this approach.

Another interesting feature of the signal timing plan is the provision of 7 seconds of Leading Pedestrian Indication (LPI) for pedestrians waiting to cross the east and west approaches to the intersection (West 57th Street). The LPI provides a WALK indication during a 7 second all-red period, allowing waiting pedestrians to advance into the crosswalk before southbound traffic on 9th Avenue is released. This LPI phase permits pedestrians to establish themselves in the crosswalk before vehicles wishing to turn right or left onto West 57th Street are permitted to enter the intersection.

Both 9th Avenue and West 57th Street are heavily-traveled by vehicles and vulnerable road users. Figure 4 provides peak hour vehicle movement counts. Although bicycle and pedestrian counts were not available, field observations

over the noon-hour period indicate a significant number of cyclists and a large number of pedestrians use all approaches to the intersection.

Figure 4 – Peak Hour Vehicular Volumes



Hourly ATR counts indicate that traffic volume is both heavy and sustained during the daytime, when pedestrian volumes are highest (**Figure 5**).

Figure 5 – ATR Counts

Hourly ATR & Turning Movement Splits

Location: 9th Ave. & 57th Str.

TMC Day/Date: Thursday 5/1/08
ATR Day/Date: 4/21/08 - 5/5/08

	SB - 9 AV				EB - W. 57 ST				WB - W. 57 ST		
Time	ATR	Left	Through	Right	ATR	Through	Right	WB	ATR	Left	Thro
7:00 - 8:00 am	1280	8%	73%	19%	645	90%	10%	923	843	42%	58'
7:15 - 8:15 am	1344	9%	73%	17%	654	90%	10%	923	859	42%	58'
7:30 - 8:30 am	1319	10%	75%	15%	665	90%	10%	916	905	42%	58'
7:45 - 8:45 am	1319	10%	75%	15%	668	91%	9%	922	928	42%	58'
8:00 - 9:00 am	1332	11%	74%	15%	671	92%	8%	917	933	43%	57'
12:00 - 1:00 pm	1300	10%	82%	8%	578	83%	17%	819	837	38%	62'
12:15 - 1:15 pm	1287	10%	81%	10%	561	84%	16%	799	847	37%	63'
12:30 - 1:30 pm	1267	10%	80%	10%	542	84%	16%	830	864	37%	63'
12:45 - 1:45 pm	1290	9%	81%	10%	547	83%	17%	846	869	37%	63'
1:00 - 2:00 pm	1302	8%	81%	11%	559	84%	16%	814	895	38%	62'
4:00 - 5:00 pm	1261	4%	85%	10%	562	86%	14%	985	910	33%	67'
4:15 - 5:15 pm	1244	4%	86%	10%	546	85%	15%	966	897	33%	67'
4:30 - 5:30 pm	1235	4%	85%	10%	548	86%	14%	975	900	32%	68'
4:45 - 5:45 pm	1278	4%	85%	10%	561	85%	15%	982	915	32%	68'
5:00 - 6:00 pm	1347	5%	86%	10%	557	84%	16%	967	924	30%	70'
5:15 - 6:15 pm	1418	5%	84%	11%	572	86%	15%	979	960	30%	70'
5:30 - 6:30 pm	1475	5%	85%	10%	566	85%	15%	984	977	30%	70'
5:45 - 6:45 pm	1522	5%	85%	10%	566	85%	15%	966	1003	30%	70'
6:00 - 7:00 pm	1545	5%	85%	10%	570	86%	14%	968	1018	30%	70'

1.1 SA Team

A brief introductory training session was provided on the afternoon of the first day of the assessment.

The road safety assessment was sponsored by the New York State Metropolitan Planning Organizations (NYSMPOs) and will serve as one of three case studies to be included in guidelines for the conduct of SAs on the local road system within the State of New York.

The SA field team was composed of New York City Department of Transportation (NYCDOT) representatives, led by members of the consultant team. The RSA Team included the following individuals:

- **Sean Quinn**, NYCDOT, squinn@dot.nyc.gov
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- **Greg Junnor,** Synectics Transportation Consultants Inc gjunnor@synectics-inc.net

1.2 SA Process

The SA was conducted in a manner consistent with the proposed road safety assessment guidelines being prepared for the NYSMPOs. The assessment took place on June 17 and 18, 2008

Information reviewed in the course of the assessment included the following:

- Aerial photographs;
- Traffic characteristics data;
- Collision information;
- Traffic signal phasing/timing data;
- Adjacent land uses;
- Anticipated/proposed development and redevelopment; and
- Existing safety concerns.

Introductions and a brief assessment training session occurred in the afternoon of the first day. The assessment team reviewed the project related information on the morning of the second day of the assessment.

The assessment team then went into the field to conduct a site visit in the late morning, into the noon hour. Site visit conditions were warm and sunny.

The assessment team reconvened on the afternoon of the second day to complete the assessment analysis. Preliminary assessment findings were discussed then recorded using the FHWA RSA Software tool.

The consulting team subsequently prepared this report, which was circulated to and commented upon by the assessment team members, prior to being finalized.

1.3 SA Report

This report provides information on issues identified by the assessment team, which they deemed relevant to the stated goal of an SA; identifying opportunities to improve road safety within the study area.

Where appropriate, an assessment of road user safety risk, and suggestions for improvement, are included. These suggestions should not be viewed as design or operational recommendations. They are intended to be illustrative of potential solutions to the safety issues identified, and are presented for consideration only.

1.4 Study Area Characteristics, Operations and Safety Performance (Office Review)

The intersection of 9th Avenue and West 57th Street was selected as an SA candidate based upon the frequency of pedestrian-involved collisions which occurred at the intersection between January 1, 2002 and December 31, 2006.

During that time period, 25 pedestrian-involved collisions, and 19 other collisions occurred within the intersection. **Figure 6** summarizes the collision experience at the intersection.

Figure 6 – Collision Summary

SUMMARY OF ACCIDENT STATISTICS

NODE NUMBER	INTERSECTION	SI	9.05	FI:	7.57	CF:
9630	W 57TH ST & 9TH AV	FROM	1/1/02	TO	12/31/06	1.20

TOTAL NO. OF ACCIDENTS 44 REPORTABLE ACCIDENT 44 NON-REPORTABLE ACCIDENT 0

ACCIDENT TYPE

PEDESTRIAN	25
BICYCLIST	0
OTHER	19

PED/BI LOC. / ACTIO

PED/BI AT INTER.	25
PED/BI N AT INTER.	0
PED/BI N INV/UNREP	0
X/R W/ SIG.	10
X/R A/ SIG.	11
X/R N SIG, MK X-W	0
X/R N SIG, N X-W	1
ON/OFF SCH-BUS	0
ON/OFF VEHICLE	0
PLAY IN ROADWY	0
BEHIND PARK VE	0
OTHER ACTION	3

PED/BICYC AGE

0 TO 5	0
6 TO 20	0
21 TO 29	0
30 TO 39	0
40 TO 49	0
50 TO 59	0
60 TO 65	0
65 ++	0

COLLISION TYPE

LEFT TURN (W/V)	0
LEFT TURN (A/V)	0
RIGHT TURN (W/V)	0
RIGHT TURN (A/V)	2
RIGHT ANGLE	1
OVERTAKING	2
REAR END	1
HEAD ON	0
SIDESWIPE	0
OTHER	27
NOT REPORTED	0

ACCIDENT FACTORS

D.W.I.	0
D.U.I	0
SPEEDING	0
TAIL GATING	1
WET PAVEMENT	2
IMP. TURN	3
PRESCR. MEDS.	0
T.C.D. DISREGARD	1
LIM. SIGHT. DIST.	1
IMP. LANE USE	4
PAVE. DEFECT.	0
OTHER	44

COLLISION WITH

GUARD RAIL	0
UTILITY POLE	0
SIGN POST	0
TREE	0
CRASH CUSHION	0
FIRE HYDRANT	0
MEDIAN/BARRIER	0
VEHICLES	19
OTHER	0

SURFACE CONDITION

DRY	30
WET	7
MUDDY	0
SNOW / ICE	0
SLUSH	0
OTHER	0
NOT REP	7

LIGHT CONDITION

DARK LIT	14
DARK UNLIT	0
DAYLIGHT	20
DAWN	0
DUSK	1
UNKNOWN	9

SEVERITY

TYPE K	0
TYPE A	4
TYPE B	5
TYPE C	28
P.D.O.	8
N.R.	-1

MONTH

JAN	2
FEB	2
MAR	5
APR	4
MAY	4
JUN	5
JUL	7
AUG	1
SEP	4
OCT	3
NOV	5
DEC	2

FALL:	12
WINTER:	6
SPRING	13
SUMMER:	13

TIME

00:00 - 00:59	1
01:00 - 01:59	3
02:00 - 02:59	0
03:00 - 03:59	0
04:00 - 04:59	0
05:00 - 05:59	0
06:00 - 06:59	0
07:00 - 07:59	1
08:00 - 08:59	4
09:00 - 09:59	1
10:00 - 10:59	1
11:00 - 11:59	1
12:00 - 12:59	2
13:00 - 13:59	6
14:00 - 14:59	1
15:00 - 15:59	3
16:00 - 16:59	0
17:00 - 17:59	1
18:00 - 18:59	2
19:00 - 19:59	0
20:00 - 20:59	0
21:00 - 21:59	2
22:00 - 22:59	2
23:00 - 23:59	4
UNSPECIFIED	9

7-10 (AM)	6
11-2 (MD)	9
4-7 (PM)	3

DAY OF WEEK

SUN	MON	TUES	WED	THUR	FRI	SAT
7	12	3	4	5	8	5

FATALITY AND INJURY

TOT KILLED	TOT INJURED	PED FATAL	PED INJURY	BICYC. FATAL	BICYC. INJURY	NON-PED FATAL	NON-PED INJUR
0	38	0	25	0	0	0	13

TYPE K = FATALITY; TYPE A = BLEEDING WOUND / PERSON CARRIED AWAY FROM SCENE; TYPE B = BRUISES; TYPE C = NO VISIBLE INJURIES; PDO = PROPERTY DAMAGE ONLY

NR = NON-REPORTABLE, ACCIDENTS $1000 AND UNDER; SF = SEVERITY FACTOR; FF = FREQUENCY FACTOR ; MK = MAKRED ; D.U.I = DRIVING UNDER THE INFLUENCE; D.W.I = DRIVING WHILE INTOXICATED; X/R = CROSSING/RIDING; T.C.D = TRAFFIC CONTROL

SOURCE : NYSDOT | *REPORT CREATED BY : SOLOMON ASSEFA AND DAVID C. LAUMONIER*

The summary indicates that pedestrian-involved collisions generally occurred under favorable road and weather conditions, during the daytime (particularly over the noon-hour), over all months of the year, with Mondays seemly over-represented. Fault in the occurrences were almost evenly split between the motorist and the pedestrian. Resulting injuries were generally minor, indicative of low-speed impacts.

No information was available on the age profile of the involved pedestrians, nor was information available on which approach they were crossing when struck.

2.0 Assessment Findings and Suggestions

2.1 Pedestrian Behavior

Safety Concern: Pedestrians disregard/disobey pedestrian signal indications, aggressively press their right-of-way during the WALK and clearance periods, and cross the south leg of the intersection in sympathetic movement with pedestrians crossing the north leg.

Observations:

1. Pedestrians frequently cross roadway approaches against the pedestrian signal indications, taking advantage of gaps in traffic created by the coordination of upstream and downstream traffic control signals.
2. Pedestrians are aggressive in imposing their right-of-way over turning traffic during the WALK and clearance periods.
3. Pedestrians either wait for a WALK indication while standing within the roadway, or anticipate the provision of a WALK indication as soon as the clearance interval on the conflicting roadway is displayed, by stepping into the roadway.
4. Pedestrians wishing to cross the south leg (9th Avenue) of the intersection often begin crossing when pedestrians on the north approach receive a WALK indication and begin to cross, without regard to their own pedestrian indications or the signs which warn them to “Wait for Walk Signal”.

   This appears to be a sympathetic movement – consistent with the operation of most signals in Manhattan (which are generally two-phase, and provide simultaneous WALK indications across parallel crosswalks). At this location however, this sympathetic movement without regard to the

pedestrian indications on the south leg places pedestrians in conflict with westbound-to-southbound left turning traffic, which is moving on the protected portion of the westbound protected/permissive left turn phase.

Risk Analysis:

Disobey pedestrian signals: Disobeying pedestrian signals, and crossing during gaps in traffic, appear be common at the subject intersection, as well as at many other signalized intersections in Manhattan.

Motorists appear to anticipate this behavior by pedestrians, and make some accommodations for it – slowing and honking to warn pedestrians of their approach. Despite this, significant traffic and pedestrian volumes equate to a high exposure. The aggressive attitude of many pedestrians, and the accommodation of this behavior by driver, increases the likelihood of conflicts and collisions. Potential collision severity is judged to be high, as vehicle approach speeds on the leading edge of traffic platoons tends to be higher.

Disobey pedestrian signals south leg: Vehicular volumes making the westbound-to-southbound left turning movement are significant, as is the volume of pedestrians crossing the south leg of the intersection. Field observations indicate that one or more pedestrians move sympathetically with those on the north approach on practically every cycle. Once one pedestrian moves, others tend to follow.

When conflicts occur, pedestrians are often startled, having no recognition of their error. Again, driver accommodation appears to minimize the severity of conflicts, but the potential for collisions remains. Fortunately, left turning movements generally occur at low speeds, limiting the likely severity outcomes.

An exception to this however, relates to the fact that West 57th Street and 9th Avenue south of the intersection are both truck routes. Westbound-to-southbound left turns by tractor-trailer units involve significant off-tracking by the trailer unit. Off-tracking in left and right turns is associated with truck-pedestrian and truck-cyclist collisions in urban areas. These collisions are often either severe or fatal.

Suggestions:

1. Enforcement. Selective enforcement of pedestrian rules of the road at this intersection may serve to improve compliance.

2. Education. Community outreach on the importance of compliance and the risks of disobeying pedestrian signals may serve to change attitudes and behavior over time.
3. Advanced pedestrian count-down timer displays. These displays not only count down the WALK/clearance time remaining, but may also be used to display the time remaining until the next WALK indication, where a pre-timed timing plan is in effect. An active display may provide additional conspicuity, reinforce the WALK/DON'T WALK message, and the "Wait for Walk Signal" static sign message.
4. Audible pedestrian indications.
5. Coordinate the start of the WALK displays on the north and south legs to eliminate sympathetic movement. By delaying the WALK display on the north leg until the end of the westbound-to-southbound protected left turn movement, the risk of sympathetic movement could be eliminated. However, given the current of level of compliance by pedestrians, and their propensity to cross on gaps in traffic, this approach may prove counterproductive.
6. Change westbound-to-southbound protected left turn phasing from leading to lagging. This approach would allow the WALK displays on the north and south legs to be coordinated, but would require an earlier clearance on the south leg to provide for the lagging left turn movement. Advantages would include elimination of the risks associated with sympathetic movement. Disadvantages may include timing/coordination issues, and queuing/capacity impacts on the east approach.
7. Enhance the conspicuity of the "Wait for Walk Signal" static sign message. Adding a retroreflective/fluorescent border to the sign could enhance its conspicuity for pedestrians.
8. Enhance the conspicuity of the WALK/DON'T WALK display. Use of LED displays with day/night intensity control could enhance the conspicuity of the displays.

Priority for Consideration: High

2.2 Driver Behavior

Safety Concern: Red light running.

Observations: Both the collision record and field observations raise concerns regarding motorists disobeying the red indication. During the field review, equipment at the intersection suggested that it was once a red light camera enforcement location, but is no longer active.

Risk Analysis: Exposure of pedestrians to traffic at the intersection is high.

Likelihood is dependent on the frequency of violations, however nearly ½ of the pedestrian collisions at the intersection involved a pedestrian crossing with the signal (although it is not known if the collision involved a through vehicle or a turning movement).

Red light running collisions involving pedestrians are generally of a higher relative severity, due to their vulnerability, and the speed-of-approach of the violating vehicle.

Suggestions:

1. Consider conventional red light enforcement.
2. Consider red light camera enforcement

Priority for Consideration: Moderate.

Safety Concern: Southbound double right turns

Observations: Vehicles were observed making right turns from the second, and sometimes the third lane out from the west curb, in the northwest quadrant of the intersection.

Risk Analysis: Double right turns increase the risk of vehicle-vehicle (sideswipe) and vehicle pedestrian conflicts and collisions.

Suggestions: Selective enforcement

Priority for Consideration: Moderate.

2.3 Cyclists

Safety Concern: Many cyclists observed using West 57th Street, mixing with vehicular traffic.

Observations: Cyclists observed traveling in second lane out from curb, at risk from car doors, and being “crowded” by passing vehicles.

Risk Analysis: Vehicles attempting to share a standard-width lane with a cyclist risk conflicts and or collisions. Cyclists crowded to the right are at risk from car doors and vehicles parking/un-parking.

Suggestions: Consider allocation of cross-section in context of rush hour regulations. Examine implications of 8-9 foot parking lane adjacent to curb, and wider shared-use lane as second lane out from curb. Implications of lane use by trucks and buses, and future Bus Rapid Transit (BRT) route planning for West 57th Street may also have to be considered.

Priority for Consideration: Moderate

Safety Concern: Delivery bikes chained to Muni-meters along east and west sidewalks of 9th Avenue, north of intersection

Observations: Bikes locked to Muni-meters.

Risk Analysis: Pedestrian tripping hazard, sidewalk congestion leading to pedestrians stepping into roadway.

Suggestions: Provide bike rack in front of business

Priority for Consideration: Low.

2.4 Intersection Geometry, Sightlines

Safety Concern: Sightlines for left and right turns from the south approach (9th Avenue) and for right turns on the east approach (West 57th Street westbound) are limited by parked vehicles and a truck loading zone, respectively.

Observations: Vehicles parked or stopped for the purposes of loading and unloading compromise sightlines on these approaches for turning traffic.

Risk Analysis: Compromised sightlines increase the risk of conflicts and collisions between turning traffic and pedestrians.

Suggestions:

1. 9th Avenue – set stop bar back 10 feet from crosswalk. Eliminate last parking stall adjacent to east and west curbs.

2. West 57th Street – Set stop bar back 10 feet from crosswalk Reduce length of loading zone to open up daylighting in the northeast quadrant of the intersection. Terminate loading zone 25 feet east of new stop bar location.

Priority for Consideration: Moderate.

Safety Concern: ADA curb cut not provided on north for crossing West 57th Street on the NW corner.

Observations: Granite curb stones do not include ADA curb cut.

Risk Analysis: Poses difficulty for disabled pedestrians

Suggestions: Install curb cut.

Priority for Consideration: Low.

Safety Concern: Raised utility access (manhole) covers in crosswalks on north and south legs.

Observations: Not flush with pavement

Risk Analysis: Tripping hazard

Suggestions: Make flush

Priority for Consideration: Low

Safety Concern: Lane alignment through intersection (West 57th Street east-west across 9th Avenue).

Observations: Intersection is very wide, and some vehicles wander/encroach into paths of adjacent vehicles.

Risk Analysis: Potential for opposing sideswipe collisions, evasive movements.

Suggestions: Install pavement markings to extend center line across intersection.

Priority for Consideration: Low.

2.5 Traffic Control Signals - Displays

Safety Concern: Signal head displays not aligned over through lanes, and may lack conspicuity.

Observations: Primary (right-hand) heads tend to be aligned over parking lanes. Secondary (left-hand) heads tend to be aligned over receiving lanes. Displays are incandescent, and some are 8-inch diameter. Westbound left-turn display is to the left-of-center, and not optimally placed within a left-turning driver's cone of vision

Risk Analysis: Less-conspicuous head placement risks motorists failing to see/respond to displays, increasing the risk of violations leading to conflicts and/or collisions.

Suggestions:

1. Install longer mast-arms to improve head placement.
2. Install LED displays.
3. Install larger (all 12-inch) displays.

Priority for Consideration: Moderate.

2.6 Traffic Control Signals – Timing and Phasing

Safety Concern: Pedestrian crossing timings

Observations: Timings are only sufficient for 4 feet per second walking speed.

Risk Analysis: Crosswalk users observed included school-aged children, seniors and disabled. Timings applicable to 3 feet per second recommended for these groups under new MUTCD requirements.

Suggestions: Examine opportunities to increase pedestrian WALK and clearance timings.

Priority for Consideration: Moderate.

2.7 Parking, Stopping, Standing Controls

Safety Concern: Marking of curb lanes on West 57th Street

Observations: Curb lanes on West 57th Street are marked as through lanes, yet information indicates that rush hour regulations do not yet apply to this roadway. Revisions to the rush hour regulations are reportedly pending.

Risk Analysis: Potential exists for motorist in curb lane to encounter parked vehicles, leading to abrupt lane changes, conflicts, and collisions.

Suggestions: Amend regulations and enforce.

Priority for Consideration: Low.

Safety Concern: Parking stall permits parking between corner and bus stop, west receiving side of West 57th Street.

Observations: Vehicle legally parked between crosswalk and bus stop.

Risk Analysis: Compromise of intersection sightlines.

Suggestions: Eliminate parking, extend bus stopping zone to intersection.

Priority for Consideration: Low.

Safety Concern: Trucks double parking to load/unload, east and west curb, 9th Avenue.

Observations: Double-parking by trucks.

Risk Analysis: Weaving, conflicts, collisions involving vehicles on this approach.

Suggestions: Consider need for loading zone.

Priority for Consideration: Low

2.8 Other Traffic Control Devices

Safety Concern: High visibility crosswalks on all four legs in poor condition.

Observations: Markings worn, damaged by road cuts/resurfacing.

Risk Analysis: Reduced crosswalk emphasis for motorists.

Suggestions: Remark.

Priority for Consideration: Moderate.

Safety Concern: "Wait for Walk Signal" signs mounted too low

Observations: Mounting height less than 7 feet.

Risk Analysis: Could be impacted by head of pedestrian.

Suggestions: Raise signs, place adjacent to pedestrian signal displays (see suggestion regarding increased sign conspicuity).

Priority for Consideration: Low.

2.9 Other Issues/Features

Safety Concern: Scaffold/hoarding around building on southwest corner.

Observations: Sidewalks on the southwest corner are covered by scaffolding/hoarding.

Risk Analysis: These elements may reduce the visibility of pedestrians crossing the south and west approaches from this corner, particularly under night-time conditions.

Suggestions: Check illumination and visibility under dark conditions.

Priority for Consideration: Low.

Safety Concern: Lack of night review.

Observations: SA Team was not able to conduct a night review, due to scheduling issues.

Risk Analysis: A night-time review may reveal additional safety issues.

Suggestions: NYCDOT staff should conduct a night-time review and record observations as a supplement to this report.

Priority for Consideration: Moderate.

Safety Concern: Trash barrels on corners interfere with access to ADA drop curbs.

Observations: Barrels block access for mobility devices used by disabled pedestrians.

Risk Analysis: Low.

Suggestions: Relocate.

Priority for Consideration: Low.

Safety Concern: Bus stop west receiving side of West 57th Street does not have a concrete bus pad.

Observations: Asphalt showing signs of shoving/rutting.

Risk Analysis: Pedestrian trip hazard/water ponding hazard.

Suggestions: Install concrete pad.

Priority for Consideration: Low

Safety Concern: Pavement deterioration in crosswalk, west approach of West 57th Street

Observations: Broken pavement, truck rutting/shoving of pavement.

Risk Analysis: Pedestrian tripping hazard.

Suggestions: Repair.

Priority for Consideration: Low.

Safety Concern: Water ponding in northwest quadrant of intersection.

Observations: Standing water

Risk Analysis: Winter pedestrian slip/fall hazard.

Suggestions: Arterial maintenance – mill and patch.

Priority for Consideration: Low.

3.0 Conclusion

This assessment has been prepared to assist the responsible NYC. Transportation Agencies in the identification and actualization of opportunities to improve safety within the study area. The assessment is based on information available at the time of the field review. The suggestions it contains are for consideration only, and are in no way intended to serve as design or operational recommendations.

This report does not preclude the identification of additional issues pertaining to safety by the responsible road authorities, or the emergence of new issues over time.

It is recommended that the responsible agencies review this report; document their responses to the issues identified in a formal response report; and track their progress towards the implementation of safety improvements prompted by this assessment.

SAFETY ASSESSMENT GUIDELINES

APPENDIX B
GLOSSARY OF TERMS

APPENDIX B: GLOSSARY OF TERMS

Blackspot
An existing location, experiencing collisions at a frequency that is higher than would otherwise be expected. Methods used to identify blackspots differ by jurisdiction and vary from qualitative evaluations (which can be based on collision diagrams) to statistically rigorous network safety screening techniques. The term "High Collision Risk Location" is perceived by many as a more descriptive term.

Baseline Road Safety Conditions
These include updated crash frequencies, average crash rates, severity listings, and records of common collision types on different classes of facilities within a jurisdiction. As of late, frequencies are considered a better metric of safety as compared to collision rates. Baseline road safety conditions are used in Safety Management Systems (SMS) to define safety targets. They can be also used to select locations for Safety Assessments (SAs).

Collision (Crash)*
A failed interaction between one or more road users, vehicles, and the transportation environment; leading to death, injury, or property damage. Members of the engineering profession have begun to use this term in lieu of "Accident" as the latter term implies an event over which there is no control. The term “crash” is another acceptable alternative.

Collision (Crash)* Reconstruction
Study which attempts to explain in detail the events leading up to an individual collision and consequently the actions and behaviors that may have caused or contributed to that event. It is not a part of the SA process.

Collision (Crash)* Modification Factor
The collision modification factor (CMF) for any given road safety countermeasure is the ratio of the expected collision frequency with the countermeasure installed to the expected collision frequency without the countermeasure in place, calculated over the same period of time. The calculation is typically made over increments of one year.

Collision (Crash)* Prediction Model
A mathematical model that relates an entities’ expected collision frequency (for example an intersection or road segment), to its traffic and geometric characteristics. Collision prediction models have numerous safety engineering applications including the identification of high collision risk locations and evaluating the effectiveness of road safety improvement countermeasures.

* Though often used synonymously, crash is currently the preferred term within the fields of safety and traffic engineering.

Collision (Crash)* Reduction Factor

The collision reduction factor (CRF) for any given collision countermeasure is the percentage of reduction in collision frequency associated with that countermeasure.

Exposure

Number of vehicles or other facility users exposed to a particular hazard over a fixed period of time. It is used in the SA process for the qualitative evaluation of Safety Risk. Average annual daily traffic (AADT) as well as pedestrian and bicycle volumes can be used for qualitative estimation of exposure for the purposes of estimating Safety Risk.

FHWA RSA Software

A tool developed to support the practical implementation of the Federal Highway Administration's Road Safety Audit Guidelines. A beta version was released to the public in 2006 followed by full release in 2008. The software guides the process and includes a tracking tool enabling the use of RSA prompt lists at a desired level of detail.

It requires the user to accompany each safety issue raised with a discussion and assessment, thereby forcing them to carefully consider and justify their findings. It assists in drafting RSA reports, enables one to record safety issues both by prompt list topic and location, helps verify issues and locations entered, and is an effective means of RSA training.

High Collision (Crash)* Risk Location

An existing location, experiencing collisions at a frequency that is higher than would otherwise be expected. Methods used to identify high collision risk locations differ by jurisdiction and vary from qualitative evaluations (which can be based on collision diagrams) to statistically rigorous network screening techniques. The term "High Collision Risk Location" is perceived by many as a more descriptive term than "blackspot."

In-Service Safety Review

In-depth engineering study of an existing transportation facility; undertaken for the purposes of identifying cost-effective collision countermeasures and improving operations and safety for all users. In-service safety reviews may be conducted on any transportation element including for example: roadway segments, intersections, or interchanges, sidewalks, bicycle paths, etc. However, in order to optimize the usefulness of available resources, these reviews are most effective when conducted at locations where a high collision risk has been identified. An in-service safety review typically involves a structured review of collision history, geometric characteristics, and traffic operations. It may also include traffic conflict observations and a human factors assessment. Safety assessments are typically more dependent on the experience and judgment of the assessment team while in-service reviews rely more on quantitative analysis of empirical data. This term and process is commonly used in Canada.

* Though often used synonymously, crash is currently the preferred term within the fields of safety and traffic engineering.

Independence of the SA Team

This is a fundamental element of the safety assessment process. In the case of a design stage safety assessment, team members should ideally be separate from (that is not affiliated with) the design team charged with plan development. In the case of safety assessments for an existing entity, the assessment team may be qualified as independent if its members do not have any conflict of interest which might affect the findings and recommendations. In the case of smaller jurisdictions throughout New York State, it may necessary for Owners to utilize their own Department of Public Works or other staff, supplemented with outside expertise as necessary, to accomplish SAs. This practice is acceptable as long as those individuals charged with conducting the assessment can approach the entity with an open mind.

Network Screening

A process by which the safety performance of a transportation network is evaluated at the macro level; to identify and rank sites which are strong candidates for safety improvement. Such sites may then be subjected to safety assessments.

Project Owner

An organizational unit or individual in a public agency which is responsible for: transportation planning, design, and/or construction projects. A Project Owner would typically incorporate a desire to follow the safety assessment process in a request for proposals (for planning and design projects). They may be responsible for coordinating with the design team, functioning as safety assessment program coordinator, coordinating with the assessment team, participating in the pre-assessment meeting, review safety assessment reports, approve and release response reports, and track the implementation of recommendations made in those response reports.

Proactive Road Safety Approach

Safety improvement actions are often identified based upon anticipated (expected) safety performance. Identification can be based on quantitative techniques (collision prediction models etc.) or qualitative techniques such as safety assessments. Safety assessments completed at the planning, design, construction, and pre-opening stages of transportation projects are considered part of a proactive approach. Safety assessments conducted on existing transportation facilities may be proactive (when locations are not selected based on collision history or no collision data are available) or a combination of both proactive and reactive approaches if locations are selected based on collision history and collision data are analyzed by the safety assessment team. In safety assessments of existing facilities the analysis of collision data should not be the sole driving force for the identification of road safety issues. Safety assessment team members should rely on human factors techniques, expert judgment, field observations, and prompt lists to identify and evaluate road safety issues.

Reactive Approach to Safety

Under this approach, safety improvement actions are identified using demonstrated crash histories and patterns of crash occurrence. Overall the most effective safety management systems balance proactive and reactive approaches. In-service safety reviews and remedial safety work are typical examples of a reactive approach. Safety assessments conducted on existing transportation facilities may be based on a combination of both proactive and reactive approaches if locations are selected based on collision history and collision data are analyzed as part of the safety assessment process.

Safety Assessment (SA) Response Report

This is a mandatory element for each safety assessment. This document summarizes the review of a safety assessment report including its findings and suggestions. It must cover decisions on how to address identified safety concerns, the rationale behind those decisions, and actions planned to implement decisions. Decisions documented in the response report may vary. For example, a reviewer may agree with the safety assessment suggestions and specify action, disagree while providing an alternative, agree with but choose not to act upon the findings, or disagree with any identified safety issues.

Safety Assessment (SA) Policy

A set policy established by a jurisdiction stating the commitment of its top management to the SA process and outlining what projects should undergo safety assessments. The term “policy” may also refer to jurisdiction-specific safety assessment guidelines. The policy may rely on a project selection matrix and/or narratives outlining what projects or locations should undergo safety assessments.

Safety Assessment (SA) Stages

Safety assessments can be conducted at any stage in the project development process (for example planning, design, and/or construction) or to address an existing transportation facility. Safety assessments are named accordingly including planning stage safety assessments, preliminary design safety assessments, detailed design safety assessments, work zone safety assessments, pre-opening safety assessments, and safety assessments of existing facilities. Land use development projects can also undergo safety assessments.

Safety Assessment (SA)

This is a term used by some jurisdictions within the United States in lieu of the term “Safety Audit” or “Road Safety Audit”. Its use avoids the negative connotation commonly associated with the word “audit” and does not restrict the facility type to roadways alone.

The practice involves the formal safety performance examination of an existing or future transportation facility by an independent team. The safety assessment team must consider the safety of all road users, qualitatively estimate and reports on road safety issues, and investigate opportunities for safety improvement. Other established guidelines define safety assessments as a process which considers only pre-construction and construction stage projects while safety assessments of existing facilities are defined as safety assessment reviews or in-service safety reviews.

Safety Assessment (SA) Prompt Lists

A list of questions or items, intended to be considered by the members of the safety assessment team. They have also been traditionally known as “checklists”. Promptlists may be comprehensive in nature, covering as many considerations as possible, or broad with general instructions for what to consider. Promptlists should be considered a tool for the assessment team and not a replacement for the knowledge and experience of those individuals.

Safety Assessment (SA) Program Coordinator

This individual is appointed to implement and manage a safety assessment program within a jurisdiction. They usually prepare or offer advice on terms of reference for safety assessments, participate on a technical committee to select safety assessment teams, ensure that adequate data for safety assessments are prepared by the design team, participate in the pre-assessment meetings, conduct quality reviews of safety assessment reports, and review safety assessment response reports. They typically also archive, review, and summarizes information from past safety assessments including “lessons learned”, prepare an annual report on their safety assessment program, identify safety assessment needs including funding, and propose changes to the safety assessment guidelines or policies.

Safety Assessment (SA) Report

A mandatory element of each safety assessment, this report typically identifies safety issues, their importance, and suggests improvements.

Safety Assessment (SA) Reviews

See In-Service Safety Review.

Safety Assessment Subconsultant to the Planning/Design Team

Subconsultant hired by the planning/design team to examine and participate in all transportation safety-related aspects of planning and design projects. The safety assessment sub-consultant differs from the safety assessment team in that it interacts with the planning/design team throughout the planning/design process and becomes a part of the design team.

Safety Review

A process established by most state departments of transportation through their high hazard identification and correction programs. Safety reviews often involve a small (1-2 persons) team with design expertise. Those persons may also be directly involved in the design process. A safety review does not typically involve field visits, concentrates on the evaluation of designs based on compliance with standards, and does not normally consider human factor issues. A safety review is always reactive as hazardous locations are identified through the analysis of crash statistics.

Safety Risk

This term indicates the relative safety of a location. Safety risk for a single transportation facility user is determined by the probability of a collision and its severity. Safety Risk for a transportation entity is determined by taking into account the exposure of all road users. In application to safety assessments, safety risk is determined qualitatively in terms of the estimated exposure, probability, and consequence as follows:

Safety risk = exposure * probability of the event * consequence of the event. Each element of the equation is typically estimated by safety assessment team members as very low, low, medium, high or very high.

Safety of the Entity

Safety is measured by the expected frequency of fatal, injury and property damage only collisions on the entity over a certain period of time, typically one year. In the safety assessment process, it is understood as the qualitative estimate of the above by the safety assessment team members. Safety risk can be used to facilitate and support the qualitative estimation of safety for a given entity.

Safe Field Visit Practices

Procedures for carrying out specific tasks, which when followed, will ensure that safety assessment team members reduce their exposure to hazards during a field visit.

Safety Management System (SMS)

Coordinated multidisciplinary partnership process which strives to achieve safety goals by ensuring that opportunities to improve safety are identified, considered, implemented, and evaluated in all phases of planning, design, maintenance and operations. Safety assessments are considered to be an important element of a SMS

Terms of Reference (TOR): A document that generally describes the purpose, scope, objectives, stakeholder involvement, deliverables, available budget, and proposed schedule of an activity, requirement, or service. SA Terms of Reference may be used by a transportation agency to solicit external SA consulting services.

Traffic Conflict

A near miss that occurs when two transportation facility users approach each other in time and space and one of them takes evasive action to avoid a collision.

SAFETY ASSESSMENT GUIDELINES

APPENDIX C
FHWA RSA SOFTWARE

APPENDIX C: FHWA RSA SOFTWARE

C1. Concept

The FHWA RSA Software is more than the automation of SA prompt lists – it is intended to be a guiding and process tracking tool enabling the use of SA prompt lists at a variety of detail levels, while providing a way to accompany each safety issue raised with a discussion and an assessment. Using the software helps assessors to think about and justify their findings. The software assists in drafting SA reports, enables users to record safety issues both by prompt list topic and by location, helps verify issues and locations entered, and may be used in SA training.

C2. Project initiation

The initial step in working with the FHWA RSA software is to either create a new project to work on or to open a previously-created project to continue working on it. Defining SA stage in the Project Characteristics screen will enable the software to select appropriate prompt lists for the SA. FHWA RSA software also provides on option for selecting SA Team members from the list of available assessors, or adding new assessors to the list of those available.

C3. Generating Prompt lists

Once the project has been initiated and initial project data are entered, the software may be used to generate and print out prompt lists which may be distributed among the SA team members. The prompt lists generated are customized based on the SA stage specified within the Project Characteristics. The software offers a default file name, date/time capture, and default location for the generated prompt lists on the computer. For the convenience of the users, the generated prompt lists are automatically opened in MS Word and minimized immediately after the generation.

C4. Conducting Safety Assessment

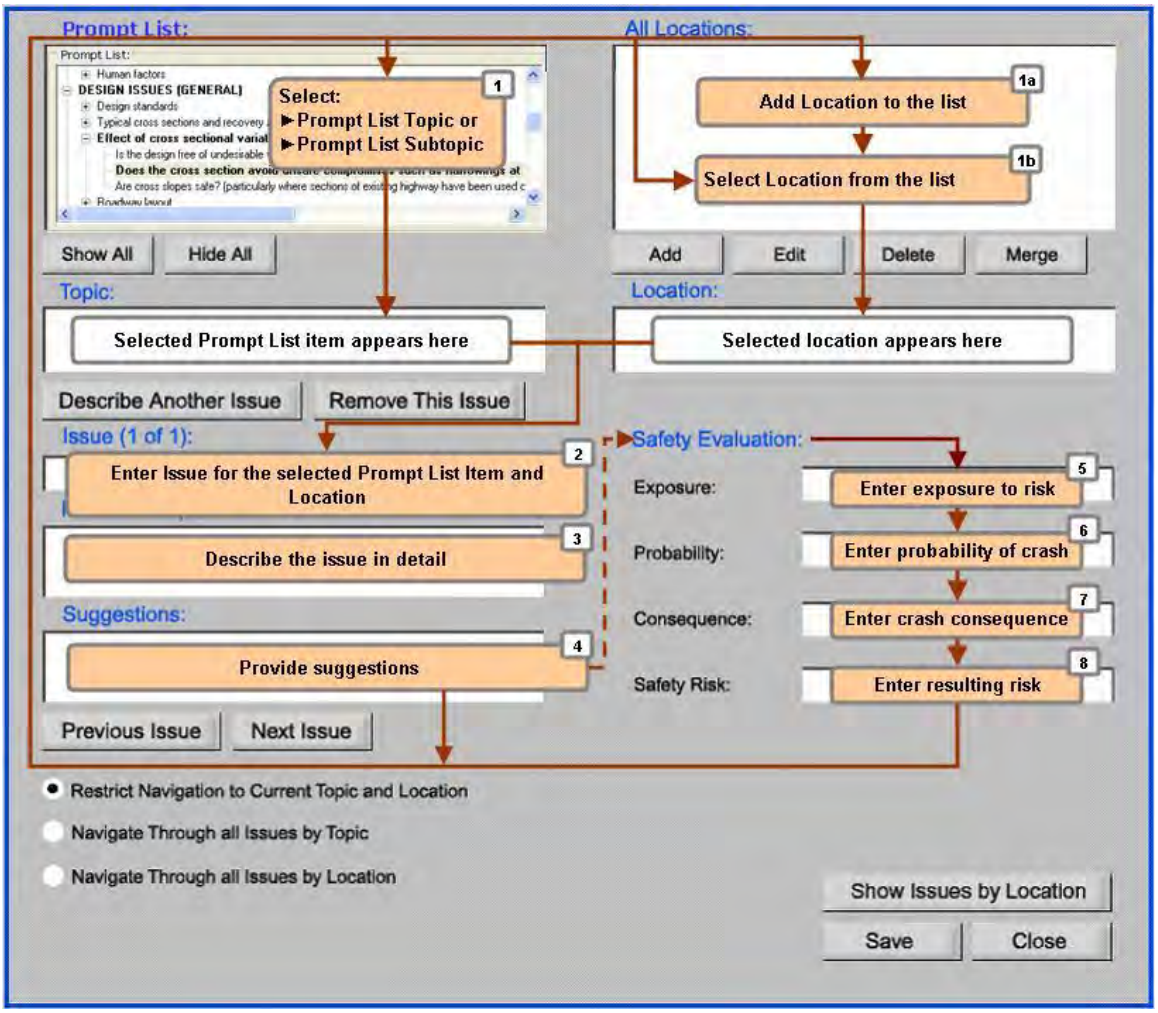
A typical series of steps for conducting SAs are identified in **Exhibit D-1**, numbered from 1 through 8. Users can alter the order or sequence of steps, such as to add a new location or to enhance the level of detail for an issue, as needed.

There are two main alternatives for conducting SA analysis. Mode 1 is by topic/subtopic of the Prompt list, Mode 2 is by Location. The selection of the SA analysis mode depends on the project and preferences of the SA team members.

- *Mode 1:* The process begins with the selection of the prompt list topic/subtopic which may be "drilled down" to a set of specific prompt list questions (Step 1). The selected prompt list item appears in the topic box below the prompt list window. The SA team members then consider possible safety issues related to the prompt list topic/subtopic considering the SA project in its entirety. Once a safety issue is identified, the location of the issue is added to the list of the locations (Step 1a). Location details are at the discretion of the SA team. The selected location (Step 1b) appears in the location box. SA team members then proceed to the description and evaluation of the identified safety issue(s) for the selected topic/subtopic and location (steps 2-8).

- *Mode 2:* As an alternative approach, the SA team may begin by identifying locations to be assessed (Step 1a). Selected locations (Step 1b) are then assessed by the SA team members as they go through the prompt list, select topics/subtopics and identify possible safety issues related to the selected location. Once the safety issue is identified, SA team members proceed to the documenting and analysis of the identified safety issue for the selected location and topic/subtopic (steps 2-8).

Exhibit C-1: Typical series of steps for conducting SAs



The SA software provides several windows for recording identified safety issues, as follows: “Issue”, “Issue description” and “Suggestions”.

- The “Issue” window (Step 2) serves for a concise definition of title of the safety issues identified, e.g., “Driveway Exit – Visibility Obstruction”.
- The “Issue description” window serves for a detailed description of the safety issue identified, e.g., “Existing foliage and an unused concrete span-wire pole are blocking visibility for traffic exiting the service station lot.”
- Finally, the “Suggestion” window serves for recording suggestions on how to improve safety of the identified issue, e.g., “Consider trimming the hedge back to improve visibility.”
- The descriptions provided in each of these windows are at the discretion of the SA team. There is no limit to the amount of data which may be recorded. All data entered will be included in the draft SA Report generated by the software.

C5. Analyzing severity of safety issues

The FHWA RSA software provides an optional method for analyzing the importance or severity of an identified road safety issue. A qualitative estimation of the Road Safety Risk, which is measured in terms of its three components (exposure, probability, and consequences) may be assigned to each issue. Each component may be assigned a rating from very low to very high. Using a simple score of 1-5 the RSA Software will assign a numerical value to the safety evaluation, if it is used. While this aspect of the software is optional, it may assist assessors in making determinations of which identified issues are most critical in terms of improving safety.

An example of a completed SA screen is shown in **Exhibit D-2**.

C6. Generating SA reports

Once the SA analysis is completed, the FHWA RSA software may generate draft SA reports. Part A of the draft RSA report contains data input to the RSA software at the SA project setup stage and has the same formatting, independent of selected sorting options implemented in Part B of the RSA report. Part B of the RSA report implements three sorting options, as follows:

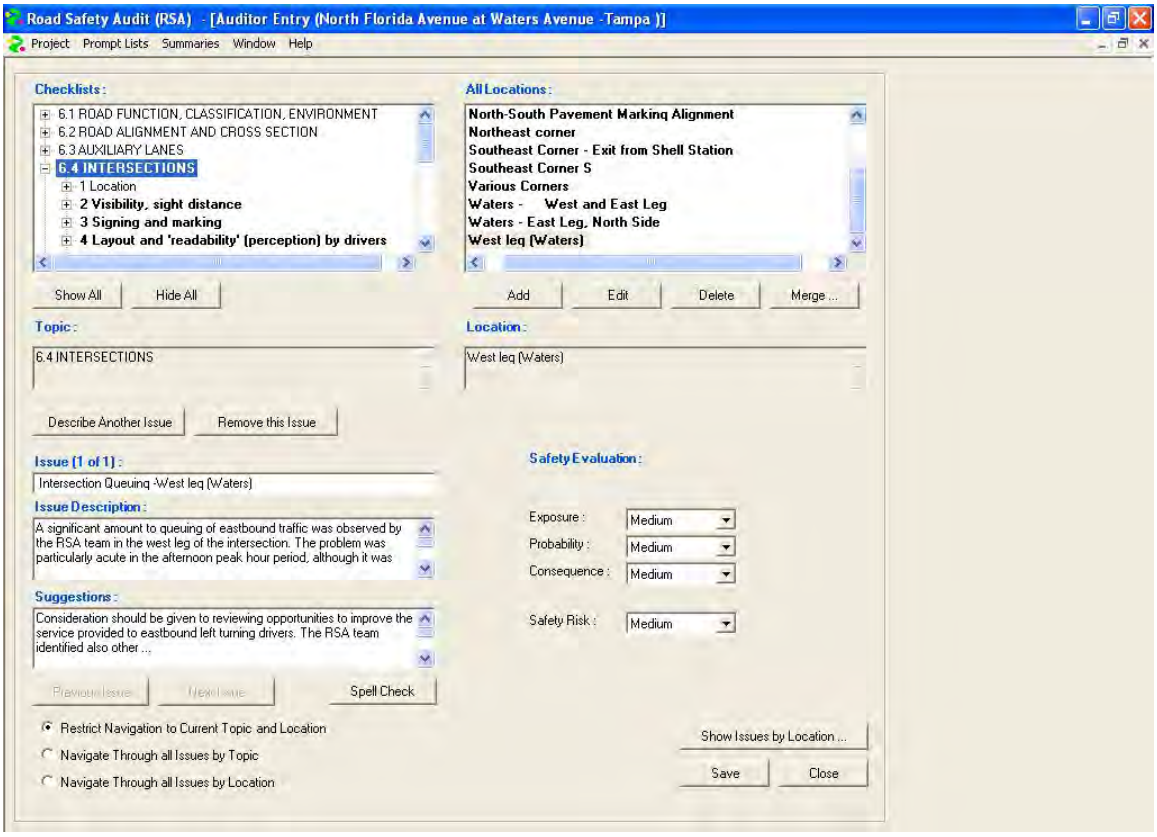
- Format 1: Identified safety issues are sorted first by prompt list topic/subtopic, then by location, and finally by severity (Road Safety Risk);

- Format 2: Identified safety issues are sorted first by location. and then by severity (Road Safety Risk); and

- Format 3: Identified safety issues are sorted by severity (Road Safety Risk) only.

Examples illustrating Parts A and B of the draft RSA reports are provided in **Exhibits C-3 and C-4.**

Exhibit C-2 Example of a completed SA screen



The possible incorporation of the FHWA RSA software into each individual SA is illustrated by the flowchart provided in **Exhibit C-5**.

- The FHWA RSA software may start to be used before or immediately after the pre-SA meeting. At this point all project data have been obtained, and subjected to a preliminary review. FHWA RSA software may be used to enter required project data, and to generate and print out prompt lists at the required level of detail for each SA team member. In the process of entering data it may be recognized that some data are missing or unclear. If this is the case, the design team or traffic engineering/ maintenance staff (if ER stage SA is being conducted) may be contacted to obtain additional data or clarifications.

- The FHWA RSA software may subsequently be used after the field visit is conducted. At this point the FHWA RSA software may be used as a tool that guides the SA analysis in a team setting, and provides the opportunity to record identified safety issues and severities (Safety Risks) associated with each issue.

- Once the SA analysis is completed, the FHWA RSA software generates draft SA report in the desired format. This draft may be further used by the SA Team leader to develop a final version of the SA report, complete with maps, photographs, schemes, etc.

Exhibit C-3: Example of Part A of the SA report

DRAFT Road Safety Audit REPORT

North Florida Avenue at Waters Avenue -Tampa

Project Title: North Florida Avenue at Waters Avenue -Tampa

Date: Nov 13, 2006 - Sep 15, 2007

RSA Team and Participants:
Brian Malone, Synectics Transportation Consultants (Audit Lead)
Peter Hsu, Florida DOT, District 7
Scott Friedman, URS Consultants
William Shaw, William Shaw -Tampa Police Department

Project Characteristics:
Audit Type: Existing Roads
Units of Measure: Metric
Adjacent Land Use: Urban
Design Speed (Metric): 60 km/h
Opposite Flow Separation: Other
Service Function (Urban): Arterial
Terrain: Flat
Climatic Conditions - Temperature: Mild Winter (no freezing, icing)
Climatic Conditions - Snow: Snowless Winter

Background:
This RSA was the first RSA conducted by the Florida Department of Transportation, District 7, as part of an expansion of safety programs. In conjunction with this RSA a brief introductory training program was carried out at the start of the RSA. This training session and the RSA of North Florida Avenue (N. Florida) and Waters Avenue (Waters) were also attended by the multidisciplinary RSA team and by invited observers and participants. This RSA was conducted at the existing signalized intersection of N. Florida at Waters in Tampa. The location had been

Exhibit C-4: Example of Part B of the SA report

DRAFT Road Safety Audit REPORT

RSA FINDINGS

Location: N. Florida -North Leg, Right Turn Lane

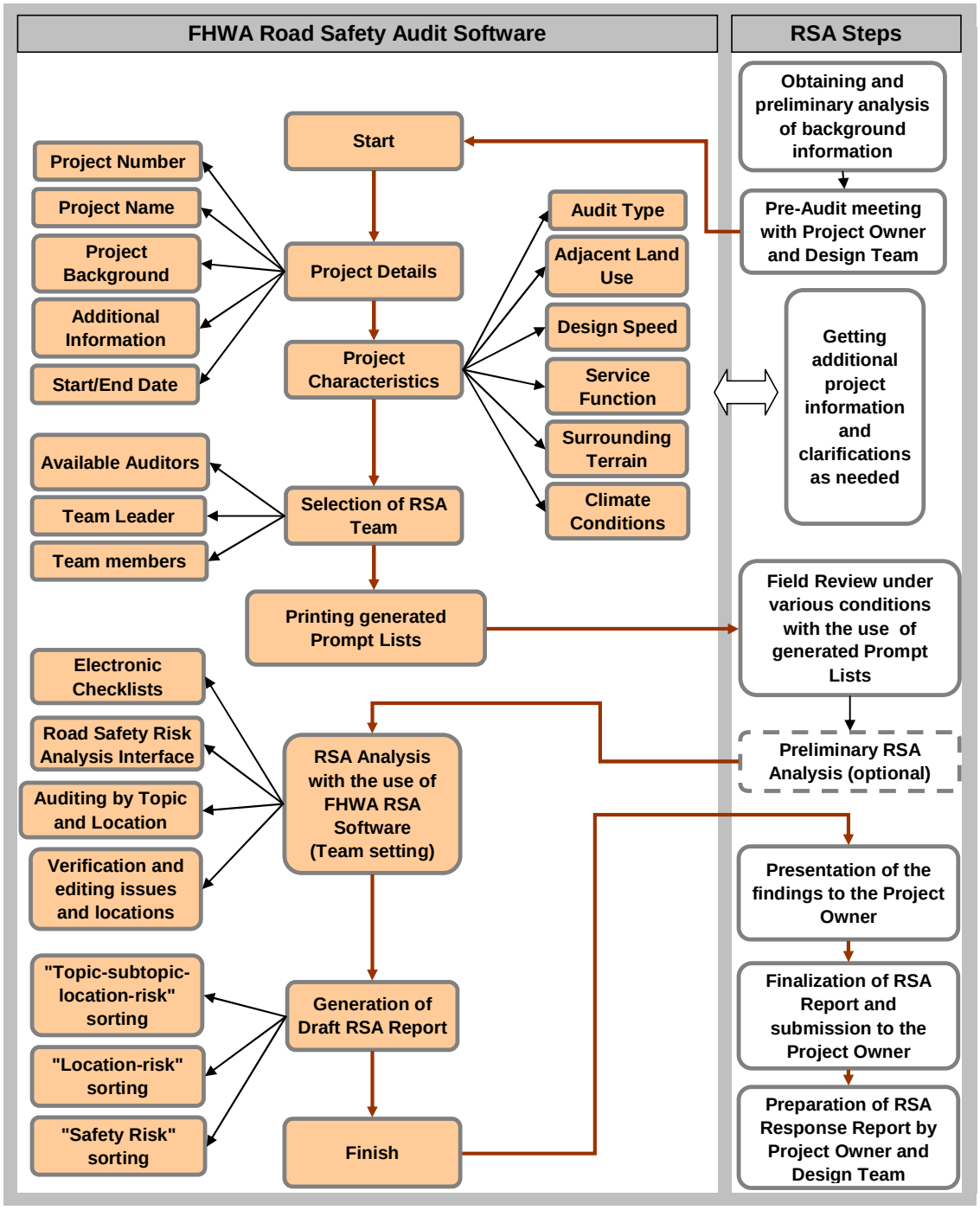
Issue: Southbound Right Turn Lane Signing

Description of Safety Issue:
The southbound right-most lane becomes a mandatory turn lane. North of the intersection the road is six lanes wide and one lane is dropped as the road reduces to four lanes, Fig. 14. The right lane is a "trap" for motorists. It was observed that some motorists make last minute decisions to leave the turn lane and there was some evidence of vehicles colliding with the traffic separator at the intersection, possibly as a result of not being aware that the lane ends, Fig. 15. There is currently no overhead signing to indicate the mandatory right-turn from the lane.

Safety Risk: |
Exposure: High
Probability: High
Consequence: High
Resulting Road Safety Risk: High

Suggestion:
Consideration should be given to placing overhead signing which would identify the lane as a mandatory right-turn lane, and would provide this information further in advance for southbound motorists.

Exhibit C-5 Incorporation of the FHWA RSA Software into the SA.



SAFETY ASSESSMENT GUIDELINES

APPENDIX D
PROMPT LISTS

SAFETY ASSESSMENT OF EXISTING FACILITIES

D1: HIGH-LEVEL PROMPT LIST

Topic	Comment
6.1 ROAD FUNCTION, CLASSIFICATION, ENVIRONMENT	
6.2 ROAD ALIGNMENT AND CROSS SECTION	
1 Visibility, sight distance	
2 Design speed	
3 Speed limit/speed zoning	
4 Passing	
5 'Readability' (perception) of the alignment by drivers	
6 Human factors	
7 Widths	
8 Shoulders	
9 Cross slopes	
10 Side slopes	
11 Drains	
12 Combinations of features	

6.3 AUXILIARY LANES

1 Tapers

2 Shoulders

3 Signs and markings

4 Turning traffic

6.4 INTERSECTIONS AND ROUNDABOUTS

1 Location

2 Visibility, sight distance

3 Signing and marking

4 Layout and 'readability' (perception) by drivers

5 Pedestrians, bicyclists

6 Lighting

6.5 INTERCHANGES

1 Visibility, sight distance

2 Lanes, shoulders

3 Signing, marking, delineation

4 Pedestrians, bicyclists

5 Lighting

6.6 SIGNS AND LIGHTING

1 Lighting

2 General signs issues

3 Sign legibility

4 Sign supports

6.7 MARKING AND DELINEATION

1 General issues

2 Centerlines, edge lines, lane lines

3 Guideposts and reflectors

4 Curve warning and delineation

6.8 BARRIERS AND CLEAR ZONES

1 Clear zones

2 Barriers

3 End treatments / Crash cushions

4 Pedestrian Railing

5 Visibility of barriers and fences

6.9 TRAFFIC SIGNALS

1 Operations

2 Visibility

3 Placement of signal heads

6.10 PEDESTRIANS AND BICYCLISTS

1 General issues

2 Pedestrians

3 Bicyclists

4 Public transport

6.11 OLDER DRIVERS

1 Turning operations (receiving lane widths, radii)

2 Channelization, opposing left turn lanes

3 Sight triangles

4 Signing, marking and delineation

5 Traffic signals

6.12 BRIDGES AND CULVERTS

1 Design features

2 Barriers

3 Pedestrian and recreational facilities, delineation

6.13 PAVEMENT

1 Pavement defects

2 Skid resistance

3 Ponding/Icing/Snow Accumulation

4 Loose stones/material

5 Manholes

6.14 PARKING

6.15 PROVISIONS FOR HEAVY VEHICLES

1 Design issues

2 Pavement/shoulder quality

6.16 FLOODWAYS AND CAUSEWAYS

1 Ponding, flooding

2 Safety of devices

6.17 OTHER SAFETY ISSUES

1 Landscaping

2 Temporary works

3 Headlight glare

4 Roadside activities

5 Signs of possible problems (pavement, roadside)

6 Rest areas

7 Environment

8 Median curbing

SAFETY ASSESSMENT OF EXISTING FACILITIES

D2: DETAILED PROMPT LIST

6.1 ROAD FUNCTION, CLASSIFICATION, ENVIRONMENT	Yes / No	Comment
Is the road function and classification the same as it was when the road was designed and constructed?		
Is the road environment the same as it was when the road was designed and constructed (no new developments, no new pedestrian/bicyclists activities, special events, scenic vistas etc)		

6.2 ROAD ALIGNMENT AND CROSS SECTION	Yes / No	Comment
1 Visibility, sight distance		
Is sight distance adequate for the speed of traffic using the route?		
Is adequate sight distance provided for intersections and crossings? (e.g., pedestrian, bicyclist, cattle, rail crossings)		
Is adequate sight distance provided at all private driveways and property entrances?		
2 Design speed		
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 appropriate?

3 Speed limit/speed zoning

Is the speed limit compatible with the road function, road geometry, land use and sight distance?

4 Passing

Are safe passing opportunities provided?

5 'Readability' (perception) of the alignment by drivers

Is the form and function of the road and its traffic management easily recognized under likely operating conditions? (e.g., under heavy traffic; minimal traffic or poor visibility conditions.)

Is the road free of elements that may cause confusion? E.g., 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 street lights or the poles follow the road alignment?

Is the road free of misleading curves or combinations of curves?

6 Human factors

Does the road comply with the driver expectancy?

Is driver workload not too high at any section?

Are principles of positive guidance observed?

7 Widths

Are medians and islands of adequate width for the likely users?

Are traffic lanes, shoulders, and clear zone widths adequate for the speed, traffic volume and mix?

Are bridge widths adequate?

8 Shoulders

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 paved?

Are there shoulder or edge rumble strips?

Is there adequate space for bicyclists if rumble strips used?

Are shoulders suitable 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 the cross slope difference between the pavement and shoulder particularly in curves, safe?

9 Cross slopes

Is appropriate superelevation provided on curves?

Are cross slope transitions safe (for cars, trucks, etc.)?

Do cross slopes (roadway and shoulder) provide adequate drainage? Also consider possible effect of rutting in the wheel tracks.

10 Side slopes

Are side slopes traversable by cars and trucks that run off the road?

Is the side slope treatment adequate to prevent or limit debris falling on to the road?

11 Drains

Are roadside drains and culvert end walls traversable?

12 Combinations of features

Is the road free of unsafe combinations of design features? (e.g., short radius horizontal curve at end of long tangent; curve within long steep downgrade; bridge or intersection on curve, etc.)

6.3 AUXILIARY LANES	**Yes / No**	**Comment**
1 Tapers		
Are starting and finishing tapers located and aligned correctly?		
Is there sufficient sight distance to the end of the auxiliary lane?		
2 Shoulders		
Are appropriate shoulder widths provided at merges?		
Have shoulder widths been maintained beside the auxiliary lane?		
3 Signs and markings		
Have all signs been installed in accordance with the appropriate guidelines?		
Are all signs conspicuous and clear?		
Do all markings conform to these guidelines?		
Is there advance warning of approaching auxiliary lanes?		
4 Turning traffic		
Have left turns from the through lane been avoided?		
Is there advance warning of turn lanes?		

6.4 INTERSECTIONS (INCLUDING ROUNDABOUTS)	**Yes / No**	**Comment**
1 Location		
Are all intersections located safely with respect to the horizontal and vertical alignment?		
Where intersections occur at the end of high-speed environments (e.g., at approaches to towns); are there traffic control devices to alert drivers?		
2 Visibility, sight distance		
Is the presence of each intersection obvious to all road users? Consider different driver eye heights: cars; trucks; bicycles; motorcycles; vehicles with restricted visibility.		
Is the sight distance appropriate for all movements and all users? Consider sight triangles appropriate for the intersection control used. Also consider different driver eye heights: cars; trucks; bicycles; motorcycles; vehicles with restricted visibility.		
Will sight lines remain adequate and not be obstructed by permanent or temporary features such as parked vehicles or queued traffic? Also consider seasonal changes such as foliage, grass, snow storage etc.		
Is there stopping sight distance to the rear of any queue or slow-moving turning vehicles?		
Is the pavement friction adequate for safe stopping?		

3 Signing and marking

Are pavement markings and intersection control signs satisfactory?

Are vehicle paths through intersections delineated satisfactorily?

Are all lanes properly marked (including any arrows)?

Where the right turn on red is permitted: is safety maintained? (e.g., consider need for additional signage warning of presence of pedestrians/bicyclists etc.)

Are street name signs conspicuous and readable, particularly for older drivers?

Are Yield signs, Stop signs and Stop lines visible in time?

4 Layout and 'readability' (perception) by drivers

Is the form and function of the intersection clear to drivers on all approaches? (Check by driving.)

Are all conflict points between vehicles safely managed?

Is the intersection layout obvious to all road users?

Is the alignment of curbs obvious and appropriate?

Is the alignment of traffic islands obvious and appropriate?

Is the alignment of medians obvious and appropriate?

Can all likely vehicle types be accommodated?

Are merge tapers long enough?

Is the intersection free of capacity problems that may produce safety problems?

Are there sufficient visual cues to prevent overshooting into the conflicting traffic?

5 Pedestrians, bicyclists

Are the sight lines adequate for the safety of all pedestrian groups?

Is the movement of vulnerable road users safely accommodated at all intersections?

6 Lighting

Is the lighting correctly in place and adequate?

6.5 INTERCHANGES	**Yes / No**	**Comment**
1 Visibility, sight distance		
Is visibility adequate at approaches: to the interchange, on and off ramps, terminal intersections etc.?		
Has the minimum sight triangle been provided at: entry and exit ramps? gore areas? other conflict points? Consider different driver eye heights: cars; trucks; bicycles; motorcycles; vehicles with restricted visibility		
Will sight lines remain adequate and not be obstructed by permanent or temporary features such as parked vehicles or queued traffic? Also consider seasonal changes such as foliage, grass, snow storage etc.		
2 Lanes, shoulders		
Are acceleration and deceleration lane lengths adequate?		
Are weaving section lengths adequate?		
Is the layout of the interchange clear to drivers on all approaches? (Check by driving.)		
Is lane continuity maintained?		
Are appropriate shoulder widths provided at merges?		
Have shoulder widths been maintained beside the auxiliary lane?		
3 Signing, marking, delineation		

Are advisory speed signs adequate (check by driving)?

Are all signs, markings, delineation correctly in place?

Are Yield signs, Stop signs and Stop lines visible in time?

4 Pedestrians, bicyclists

Are pedestrian crossings on ramp terminals conspicuous?

Are safety provisions for pedestrian and bicycle movements adequate?

If bikeways are provided, are they safe?

5 Lighting

Is the lighting correctly in place and adequate?

6.6 SIGNS AND LIGHTING	**Yes / No**	**Comment**
1 Lighting		
Is lighting required and, if so, has it been adequately provided?		
Is the road free of features that interrupt illumination (e.g., trees or overpasses)?		
Is the roadside free of lighting poles that are a fixed roadside hazard?		
Is lighting adequate to compensate for rapid changes in light conditions (e.g., at tunnel entrances)?		
Are breakaway 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 lighting scheme free of any lighting black spots?		
2 General signs issues		
Are all necessary regulatory, warning and direction signs in place?		
Are they conspicuous and clear?		
Are the correct signs used for each situation and is each sign necessary?		

Is the number, placement and spacing of signs such that driver information overload is avoided?

Are all signs effective for all likely conditions (e.g., 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?

Is the signing and marking adequate for the older driver?

3 Sign legibility

In daylight and darkness; are signs satisfactory regarding visibility? clarity of message? readability/legibility at the required distance?

Is sign retroreflectivity or illumination satisfactory?

Are signs able to be seen without being hidden by their background or adjacent distractions?

Is driver confusion due to too many signs avoided?

4 Sign supports

Are sign supports out of the clear zone?

If not, are they: breakaway? on slip bases? shielded by barriers? shielded by crash cushions?

6.7 MARKING AND DELINEATION	Yes / No	Comment
1 General issues		
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? (e.g., unnecessary turn arrows; unnecessary barrier lines; etc.)		
2 Centerlines, edge lines, lane lines		
Are centerlines, edge lines, lane lines provided?		
If not: do drivers have adequate guidance?		
Are Raised Retroreflective Pavement Markers (RRPMs) provided where necessary?		
If RRPMs are installed: are they correctly placed; correct colors; in good condition?		
Are centerline, shoulder, and/or edge rumble strips provided where required?		
Is the marking in good condition?		
Is there sufficient contrast between marking and pavement color?		
3 Guideposts and reflectors		
Are guideposts appropriately installed?		
Are delineators clearly visible?		

Are the correct colors used for the delineators?

Are the delineators on barriers and bridge railings consistent with those on guideposts?

4 Curve warning and delineation

Are curve warning signs, markings, and advisory speed signs installed where needed?

Are advisory speeds adequate and 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? (e.g., consider appropriateness of oversize signs)

Are chevron alignment markers installed where required?

Is the positioning of chevron alignment markers satisfactory to provide guidance around the curve?

Are chevron alignment markers the correct size?

Are chevron alignment markers confined to curves (not used to delineate islands etc)?

6.8 BARRIERS AND CLEAR ZONES	**Yes / No**	**Comment**
1 Clear zones		
Is the clear zone width adequate for existing traffic pattern?		
Is the clear zone width traversable (i.e. drivable)?		
Is the clear zone width free of rigid fixtures? (if not: can all of these rigid fixtures be removed or shielded?)		
Are all utility poles, trees, etc. at a safe distance from the traffic paths?		
Is the appropriate treatment or protection provided for any objects within the clear zone?		
2 Barriers		
Are barriers installed where necessary?		
Are barriers installed at all necessary locations in accordance with the relevant guidelines?		
Are the barrier systems suitable for the purpose?		
Are the barriers installed correctly?		
Is the length of crash barrier at each installation adequate?		
Is the guard rail attached correctly to bridge railings?		

Is there sufficient width between the guard rail and the pavement edge line to contain a broken down vehicle?

Are barrier systems free of any damage/deteriorating that may cause their improper performance? Consider rotated blocks, downed poles, cracked barriers, damaged rails, extensive cable sags etc.)

3 End treatments / Crash cushions

Are end treatments constructed correctly?

Is there a safe run-off area behind gating end treatments?

Are end treatments/crash cushions free of any damage/deteriorating that may cause their improper performance?

Are end treatments for median barriers non-gating?

4 Pedestrian Railing

Are pedestrian fences of breakaway design?

Are vehicles safe from being 'speared' by horizontal fence railings located within the clear zone?

Are drivers able to see pedestrians approaching crossings (and vice versa) through the railing?

5 Visibility of barriers and fences

Is there adequate delineation and visibility of barriers and pedestrian railing at night?

6.9 TRAFFIC SIGNALS	**Yes / No**	**Comment**
1 Operations		
Are traffic signals operating correctly?		
Is the signal phasing and timing safe?		
Is adequate time provided for traffic movements, pedestrian and bicyclist movements? Consider the duration of green, yellow, all-red, walk/clearance indications for all movements. Check whether the crossing time is sufficient for all pedestrian groups, i.e., with rate of travel less than 3.5 feet per second.		
Are turn phases coordinated with walk/don't walk signals?		
Is protected left turn signal phase (if provided) leading, not lagging?		
Are the number, location and type of signal displays appropriate for the traffic mix and traffic environment?		
Are there provisions for visually impaired pedestrians (e.g., audio-tactile push buttons; tactile markings)?		
Is the controller located in a safe position? (i.e., where it is unlikely to be hit and maintenance access is safe.)		
Is the condition (especially skid resistance) of the road surface on the approaches satisfactory?		
Are signalized intersections coordinated?		

2 Visibility

Are traffic signals clearly visible to approaching motorists?

Are the signal heads free from obstructions? (e.g., trees; light poles; signs; bus stops; etc.)

Is there adequate stopping sight distance to the ends of possible vehicle queues?

Are there any visibility problems that could be caused by the rising or setting sun?

Are signal displays shielded so that they can be seen only by the motorists for whom they are intended?

If optically programmed signals are used: is their operation safe? (e.g., for left turn signals: visibility for the left turning traffic, possible deteriorating of aiming/masking in the operation, physical separation of left turning and through traffic in the vicinity of intersection, etc)

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?

3 Placement of signal heads

Are signal heads located as required by guidelines? (e.g., primary left turn signal head is within projections of separated left-turn lane etc.)	
Are signal posts located where they are not an undue hazard?	

6.10 PEDESTRIANS AND BICYCLISTS	**Yes / No**	**Comment**
1 General issues		
Are there appropriate travel paths and crossing points for pedestrians and bicyclists?		
Is a safety railing installed where necessary to guide pedestrians and bicyclists to crossings or overpasses?		
Is a safety barrier installed where necessary to separate vehicle, pedestrian and bicyclist flows?		
Are pedestrian and bicycle facilities suitable for night use?		
Is traffic calming used where appropriate to improve safety? Is the application safe? (e.g., unsafe narrowing, unforgiving fixed objects are avoided)		

(Users may wish to refer to the FHWA Pedestrian Road Safety Audit Prompt Lists for additional prompts)

2 Pedestrians

Is there adequate separation distance between vehicular traffic and pedestrians on footways?	
Are pedestrian footpaths or sidewalks provided where appropriate?	
Is there an adequate number of pedestrian crossings along the route?	
At crossing points is railing oriented so pedestrians face oncoming traffic?	
Is there adequate provision for the elderly; the disabled; children; wheelchairs and baby carriages (e.g., holding rails; curb and median crossings; ramps; sidewalk width, grades, cross slope, surface; detectable warnings)?	
Are adequate hand rails provided where necessary (e.g., on bridges; ramps)?	
Is signing about pedestrians near schools adequate and effective?	
Is signing about pedestrians near any hospital adequate and effective?	
Is the distance from the stop line to a cross walk sufficient for truck drivers to see pedestrians?	
Are the information needs of blind and low-vision pedestrians met? (e.g., where pedestrian signals are provided, is crossing and timing information available to blind/low vision pedestrians?)	

(Users may wish to refer to the FHWA Pedestrian Road Safety Audit Prompt Lists for additional prompts)

3 Bicyclists

Is the pavement width adequate for the number of bicyclists using the route?

Are bike lanes or separate bikeways to accommodate bicycle traffic provided where appropriate?

Is the bicycle route continuous (i.e., free of squeeze points or gaps)?

Where bikeways terminate at intersections or adjacent to the roadway, has the transition treatment been handled safely?

Are drainage inlets 'bicycle safe'?

Are rumble strips (type and placement) safe for bicyclists?

Are bicycle/pedestrian conflicts avoided?

Is there enough space for bicyclists to safely pass the parking cars (consider provision of buffer zones; angle vs. parallel parking etc.)

Are driveway aprons avoided on the bike routes?

Are manholes flush with roadway surface?

Is 10 feet of vertical clearance from signs and structures provided on the bike routes?

Is there adequate signing to provide safety of bicyclists? (e.g., "Share the Road"; "Wrong Way"; "No Parking"; bike lane designation signs etc.)

Where bicyclists are required to dismount (e.g., in front of shared pedestrian crossings), is there adequate warning (signage, marking, pavement surface, etc)?	

4 Public transport

Are bus stops safely located with adequate visibility and clearance to the traffic lane?	
Are bus stops positioned accounting for pedestrian flows generators?	
Are bus stops in rural areas signposted in advance?	
Are shelters and seats located safely to ensure that sight lines are not impeded?	
Is clearance to the road adequate?	
Is the height and shape of the curb at bus stops suitable for pedestrians and bus drivers?	

6.11 OLDER DRIVERS	**Yes / No**	**Comment**
1 Turning operations (receiving lane widths, radii)		
Is receiving lane (throat) width for turning operations wide enough to ensure safety for older drivers? It is desired to provide 12 ft minimum accompanied, wherever practical, by 4ft shoulder.		
Are curb radii adequate for older drivers? (30 ft is desired)		
2 Channelization, opposing left turn lanes		
Is raised channelization (sloping curbed medians) provided for left-lane treatments at intersections?		
At intersections with high volume of pedestrians: If right-turn channelization is present, is an acceleration lane adequate for passenger car characteristics provided?		
At intersections with high volume of pedestrians: If right-turn channelization is present, is an adjacent pedestrian refuge island provided?		
Are the opposing left turn lanes designed to provide unrestricted sight distances? Also, at intersections where there are larger percentages of left turning trucks, is sight distance unrestricted when opposing left-turn vehicles are trucks?		
If the channelized offset left turn lanes are used, are they properly signed and delineated to prevent wrong way entrance to the lane (e.g., left turn traffic from an intersecting road)?		

3 Sight triangles

Are the intersection sight distances (sight triangles) adequate for reaction time of older drivers (minimum 2.5 s)

4 Signing, marking and delineation

Are island curb sides and curb surfaces treated with reflectorized paint? Is a luminance contrast level adequate for older drivers (3.0 or higher under low beam headlight of a passenger car)

Is edge treatment/delineation of curbs, medians and obstacles adequate for older drivers? (i.e., minimum in-service contrast of painted roadway edge level of 2.0 for intersections with overhead lighting and 3.0 without it)

Where RTOR is permitted and a pedestrian crosswalk is delineated, is there a sign requiring turning traffic to yield to pedestrians? If the intersection is skewed (less than 75 degrees or greater than 105 degrees), is RTOR prohibited?

Is the letter size, type and placement of street-name signs adequate for older drivers? (e.g., minimum letter height 6 inches, use of overhead-mounted signs with minimum letter size 8 inches at major intersections, using directional arrows if street names are different in different directions etc)

Is one-way/wrong way signage (number and placement) on approaches to divided highways adequate to ensure clear perception for older drivers? Is the Divided Highway Crossing sign used?

Is Cross Traffic Does Not Stop warning sign panel mounted below the Stop sign used for two-way stop control intersections where appropriate? E.g., where sight triangle is restricted, wherever a conversion from four-lane control is implemented etc.

Are lane-use control signs placed overhead at intersections, as a supplement to pavement markings and shoulder- and/or median mounted signage?

5 Traffic signals

Is protected-only left turn signal operation implemented where capacity allows? Is it controlled by a separate signal? If it is protected/permitted operation, is protected phase leading, not lagging?

Are signal displays adequate for the reduced ocular transmittance of the older driver's eye? Are backplates used?

Is all-red clearance interval implemented and is its duration adequate for older drivers?

6.12 BRIDGES AND CULVERTS	**Yes / No**	**Comment**
1 Design features		
Are bridges and culverts the full formation width?		
Are bridge and culvert roadway widths consistent with approach conditions?		
Is the approach alignment compatible with the 85th percentile travel speed?		
Have warning signs been erected if either of the above two conditions (i.e. width and speed) are not met?		
2 Barriers		
Are there suitable barriers on bridges and their approaches to protect errant vehicles?		
Is the connection between barrier and bridge railing safe?		
Is the bridge free of curbing that would reduce the effectiveness of barriers or rails?		
3 Pedestrian and recreational facilities, delineation		
Are pedestrian facilities on the bridge appropriate and safe?		
Is fishing from the bridge prohibited?		
Is fishing from the bridge is not prohibited, has provision been made for 'safe' fishing?		
Does delineation continue over the bridge?		

6.13 PAVEMENT	**Yes / No**	**Comment**
1 Pavement defects		
Is the pavement free of defects (e.g., excessive roughness or rutting; potholes; loose material; etc.) that could result in safety problems (e.g., loss of steering control)?		
Is the condition of the pavement edges satisfactory?		
Is the transition from pavement to shoulder free of dangerous edge drop offs?		
2 Skid resistance		
Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades and approaches to intersections?		
Is the crack sealing not too extensive to cause the unsafe differential in skid resistance?		
Has skid resistance testing been conducted where necessary?		
Has the location of manholes on curves been avoided? (difference in skid resistance - issue for motorcyclists)		
3 Ponding/Icing/Snow Accumulation		
Is the pavement free of areas where ponding, sheet flow of water, icing and snow accumulations may cause safety problems?		

Is the road surface free of significant rutting in the wheel paths that can accumulate water or snow?	

4 Loose stones/material

Is the pavement free of loose stones and other material?	

4 Manholes

Are manholes flush with roadway surface?	

6.14 PARKING	**Yes / No**	**Comment**
Are the provisions for, or restrictions on parking satisfactory in relation to traffic safety?		
Is the frequency of parking turnover compatible with the safety of the route?		
Is there sufficient parking for delivery vehicles so that safety problems due to double parking do not occur?		
Are parking maneuvering along the route possible without causing safety problems? (e.g., angle parking without a buffer zone)		
Is the sight distance at intersections and along the route unaffected by parked vehicles?		

6.15 PROVISIONS FOR HEAVY VEHICLES	**Yes / No**	**Comment**
1 Design issues		
Are passing opportunities available for heavy vehicles where volumes are high?		
Does the route accommodate the size of vehicle likely to use it?		
Is there adequate maneuvering room for large vehicles along the route, at intersections, roundabouts; etc.?		
Is access to rest areas and truck parking areas adequate for the size of vehicle expected? Consider acceleration; deceleration; shoulder widths; etc.		

2 Pavement/shoulder quality

Are shoulders sealed at bends to provide additional pavement for long vehicles?	
Is the pavement width adequate for heavy vehicles?	
In general: is the pavement quality sufficient for the safe travel of heavy and oversized vehicles?	
On truck routes: are reflective devices appropriate for truck drivers' eye heights?	

6.16 FLOODWAYS AND CAUSEWAYS	**Yes / No**	**Comment**

1 Ponding, flooding

Are all sections of the route free from ponding or flow across the road during wet weather?	
If there is ponding or flow across the road during wet weather: is there appropriate signposting?	
Are floodways and causeways correctly signposted?	

2 Safety of devices

Are all culverts or drainage structures located outside the clear roadside recovery area?	
If not, are they shielded from the possibility of vehicle collision?	

6.17 OTHER SAFETY ISSUES	**Yes / No**	**Comment**
1 Landscaping		
Is landscaping in accordance with guidelines (e.g., clearances, sight distance)?		
Will existing clearances and sight distances be maintained following future plant growth?		
Does the landscaping at roundabouts avoid visibility problems?		
2 Temporary works		
Are all locations free of construction or maintenance equipment that is no longer required?		
Are all locations free of signs, markings or temporary traffic control devices that are no longer required?		
3 Headlight glare		
Have any problems that could be caused by headlight glare been addressed (e.g., a two-way service road close to main traffic lanes; the use of glare fencing or screening)?		
4 Roadside activities		
Are the road boundaries free of any activities that are likely to distract drivers?		
Are all advertising signs installed so that they do not constitute a hazard?		

5 Signs of possible problems (pavement, roadside)

Is the road pavement free of brake/skid tire marks that could indicate a possible problem, hazard or conflict at the site?

Is the roadside hardware, trees, and poles free of damage from errant vehicles that could indicate a possible problem, hazard or conflict at the site?

6 Rest areas

Is the location of rest areas and truck parking areas along the route appropriate?

7 Environment

Is the route free from large numbers of animals (e.g., cattle; sheep; moose; bears etc.)? If not: is it protected by animal-proof fencing? are the underpasses for animals provided?

Is there any negative safety effects of wind, sun angles at sunrise and sunset?

Will the road perform safely when there is a rain, mist, ice, fog, snowfall, blowing snow?

Is there adequate provisions for snow accumulations (e.g., obstruction of sight lines, barrier performance etc).

Will snow storage not disrupt pedestrian access or visibility?

Are visual distractions (e.g., scenic vistas) adequately addressed (e.g., by providing areas to stop safely)?

Is the route free of unsafe overhanging branches?	

8 Median curbing

If back-to-back median curbing is used is it: adequately delineated? obvious where it starts? obvious at intersections? unlikely to be a hazard to pedestrians?	