VDOT Road Safety Assessment Guidelines

INTRODUCTION

Virginia's 2006-2010 Strategic Highway Safety Plan has set the goal of decreasing the more than 900 annual deaths and over 75,000 injuries[1] from crashes on public highways by 100 and 4,000, respectively. Road Safety Assessments (RSAs) are identified as critical strategies to address engineering improvements for several of the environmental emphasis areas, such as intersection and roadway departure crashes. Virginia Department of Transportation's (VDOT) Highway Safety Improvement Program (HSIP) provides a funding mechanism and data driven process to identify the best engineering countermeasures for the prevailing crashes at a location. The HSIP is managed through VDOT's Traffic Engineering Division (TED) in central office. Further, the Highway Safety Corridor (HSC) program is focused on reducing the frequency, density and rate of crashes and severities in selected primary and interstate corridors. The identification of safety problems within candidate and designated corridors and the development of countermeasures to address observed safety issues are critical components to the overall success of the HSC program. To facilitate the development of improvement projects, Transportation and Mobility Planning Division is leading a safety and operational analysis program called Strategic and Targeted Roadway Solutions (STARS) that will incorporate RSA procedures. Finally, HSIP funds have been allocated to improve the candidate HSC segments and top 20 jurisdictions with most injuries and deaths from crashes. So, local jurisdictions will also need to use RSA advantageously to target the safety funding.

As such, VDOT will use the RSA process to drive down the severe crash numbers by identifying existing and potential safety issues and providing recommended improvements. This document describes the RSA process applied to the HSIP and HSC/STARS programs and defines the role of the VDOT Regional and District staff and local jurisdictions in conducting to RSAs.

RSA DESCRIPTION AND BACKGROUND

A road safety assessment is defined as a formal examination of an existing or a future highway or traffic project in which a team of independent and multidisciplinary examiners reports on project's crash potential and safety performance. The overall objective of the RSA is to identify potential roadway safety problems for roadway users and to ensure that measures to eliminate or mitigate the safety deficiencies are considered.

The RSA process is synonymous to the Road Safety Audit process which were originally developed and introduced in the United Kingdom (UK). The benefits of RSA were quickly distinguished around the world and many countries have since established their own processes. Agencies in those countries adopted and developed such safety checking procedures for new or existing highways for the specific purpose of crash prevention or reduction. FHWA is presently developing methodologies and encouraging RSAs on existing highways and during new project development. The process can be applied to small and large projects and used on rural as well as

[1] Based on 2001-05 crashes on public highways in Virginia.

urban roads. The RSA process may be used for reviewing from a bike and pedestrian perspective. Several states have implemented RSA procedures on various project types including Resurfacing, Restoration and Rehabilitation (3R) projects reviews of existing conditions.

Five elements are common to the various RSA processes used around the world:

1. It is a formal examination process
2. It is proactive and independent process
3. It is carried out by a qualified team who represents a variety of experience and expertise
4. The assessment is restricted to safety issues although operations is considered
5. The assessment produces a formal report that identifies possible safety deficiencies and makes recommendations to mitigate those deficiencies.

The specific aims of RSAs are

1. To minimize the risk and severity of crashes that do occur
2. To minimize the risk of crashes occurring on adjacent segments or roads as a result of a plan to avoid creating crashes elsewhere on the network
3. To recognize the importance of safety to achieve a balance between needs where they may be in conflict
4. To reduce the long-term costs of a scheme
5. To improve the awareness of safety by all involved in the planning, design construction, and maintenance of roads

RSAs could be carried out at any stage of a project from preliminary engineering through post-construction. However, VDOT's focus will be conducting RSAs on existing roadways, initially on candidate HSCs and identified high crash locations. The reviews will consider the roadway and traffic control elements in the context of the multiple human, vehicle and roadway causes for the crashes that have occurred and the events leading up to, during and after the collision. As such, the review does not stop at checking if conditions are designed "by the book", but continues to investigate how drivers would react to conditions and information processing during different times of the day.

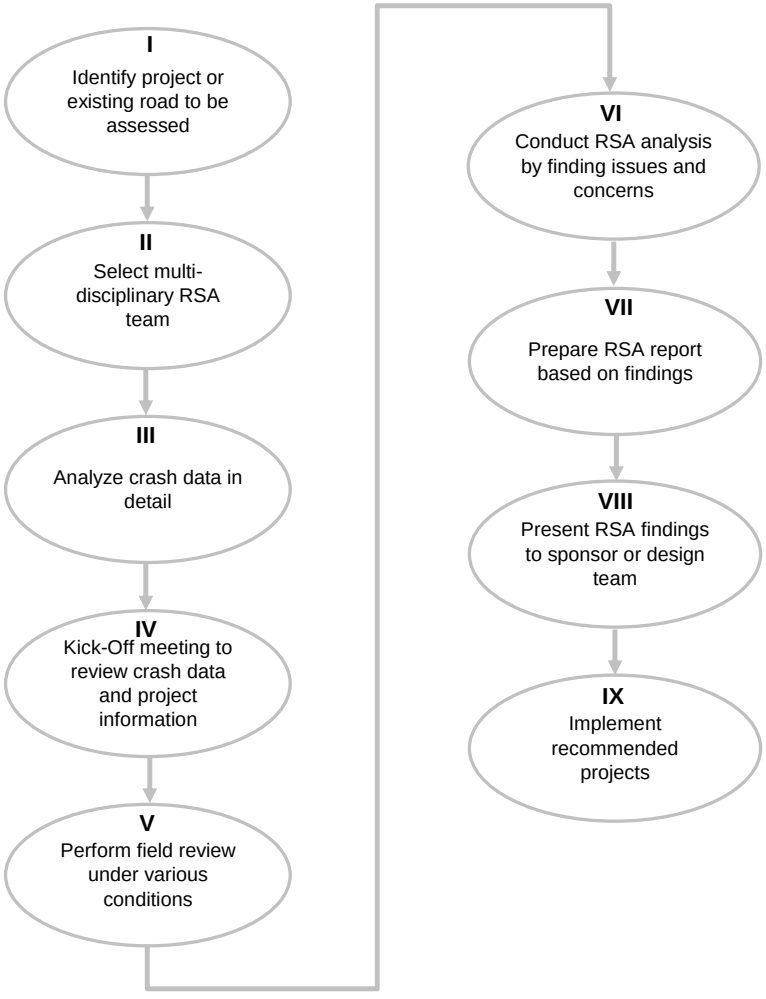
Although concerns may be raised that the use of RSAs would increase VDOT's or the locality's liability, in fact, just the opposite should be true. Implementing a plan to reduce the crash potential and improve the safety performance of a roadway using a proactive approach to safety can be used in defense of tort liability. Identifying and documenting safety issues on an existing roadway are not an admission of guilt; rather, it is the first step in a process designed to improve safety. Proper documentation, communication, and logical prioritization of an agency's plan to address safety issues would be difficult to fault.

RSA PROCESS FOR HIGH CRASH LOCATIONS

The RSA process occurs after potential corridors or intersections have been screened to determine the priority corridors/intersections by the VDOT Regional or City Traffic Engineer. The traffic engineering staff will be expected to play a major role in the assessment of safety and operations of the corridor. VDOT Central Office HSIP staff will provide support on conducting the crash data analysis and reviewing the RSA to allocate funding to the proposed safety improvement projects that are eligible.

This section provides a brief description of the process used to conduct the RSA, with an emphasis on the role of the VDOT Region or locality in performing the assessment. The RSA process consists of nine major steps. Figure 1 shows an overview of the process, and each step is discussed separately in the following sections. Region or local staff responsibilities and major deliverables are highlighted for each task. Additional information is provided in Powerpoint slide summary format in the file named *RSA Guidelines 200804.PPT* .

Figure 1. RSA Process Steps for Existing Conditions



Step 1: Select Candidate Corridor Segments or Intersections

Region/Locality responsibilities: *Short list and select priority corridors with TED-Safety*

Multiple HSC candidates have been identified within each VDOT Construction District. Regional staff should review the overall crash rate and severe crash density to prioritize which corridors overlap areas of ongoing congestion and agency or public concern. The priority list should also consider the cost and impact of safety improvements. Maps and crash data tables of the primary candidate HSC segments are available on the VDOT's TED internal team site for Safety Analysis. Maps showing the candidate HSC and high severe crash intersection within each VDOT Operations Region have been prepared for the STARS program and are also available on the VDOT TED team site.

Additional maps showing the high crash intersections in the VDOT maintained jurisdictions with the most deaths and injuries are also available in the TED team site. Locations (segments or intersections) with severe crash history must be identified to target the resources for detailed analysis and field review. Review should begin with the top five percent severe crash intersections or segments with the highest severe crash density on the VDOT system. Documentation of the systematic approach to address the top intersections and locations shall be submitted to HSIP staff. Local jurisdictions who maintain their own roadways must find the high crash corridors or intersection locations. Requirements for reporting local crash information to use HSIP funding for improvements are documented in the *Proactive HSIP Funding Guidelines*. Methods for detailed cash analysis are provided in Step 3 below.

Step 2: Select Members of the Assessment Team for a Specific HSC

Region/District/Locality responsibilities: *Select multi-disciplinary assessment team*

The Region/District/Locality project owner must work to make sure the key RSA features, such as the formality of the RSA, the use of a qualified, independent multi-disciplinary RSA team, and the inclusion of all road users are part of all RSAs. The Traffic Engineer (or designee) will be expected to chair the assessment team as the sponsor.

In managing the RSA process, the region/district/locality project owner also must set up ground rules regarding how information requests will be handled, how meetings and other activities of RSA team mesh with the overall timetable for the development of projects, and how identified problems and suggested solutions are presented.

For each RSA, an assessment team should be created to perform the data collection, analysis and documentation and those that will conduct the field review and propose countermeasures. Members and responsibilities to lead/manage the RSA data analysis, field inventory collection and review, and the final RSA documentation must be identified. Support staff will be needed to collect, summarize and analyze the data collected. Consultants may be chosen to perform part of all of the RSA steps with public agency members involved.

HSIP staff has a listing of VDOT staff that has been trained in RSA procedures and will work with the region/district/locality to identify potential members of the team. Typically, the field review team should not be very large and will be composed of experienced traffic engineering, location and design, and possibly maintenance staff that are preferably independent to the operation and maintenance of the subject locations. Members of the Virginia state police, local law enforcement agencies, and other local government staff (such as, public works, schools or emergency services) may also be included at the discretion of the sponsoring Traffic Engineer. The assessment team will be charged with examining the past crash history of the highway segment or intersection(s) and with proposing countermeasures to address observed problems.

Step 3: Conduct crash analysis and collect background information for RSA team

Region/Locality responsibilities: *Collect traffic, crash and existing conditions information*

Regional/Local sponsor and team leader will assign team staff to collect back ground information to provide the RSA team prior to an initial kick-off meeting and field review, including the following:

- Site maps, aerial photos, construction as-built plans
- Traffic volumes including turning movement volume and signal timing plans by time of day
- Details crash analysis of the high crash locations

Crash Analysis Procedures for Roadway Safety Assessments documents the crash analysis that identifies high crash locations within a corridor and the detailed crash information that should be generated for the RSA field review. For corridor segments, the crash and traffic data should be segregated into intersection and section related information. Crash analysis procedures have been developed by TED-HSIP staff to assess crashes within a corridor for the previous five years. Additional details may be determined from review of the police reports (FR300) available in the VDOT //CRASH web tool, from HTRIS, or the local crash database. Localities presently must rely on their own crash reporting systems for analysis of location specific trends. The purpose of these crash summaries is to identify locations, causal factors, crash types, and other conditions that appear to be over-represented in the crash data. Issues and areas requiring special attention during the field review should be identified. Traffic volume data may also provide understanding of the operational and conflict issues to review. Roadway plans and/or maps of the corridor will be used for the safety assessment to identify potential safety problems, and may also provide some indication of potential countermeasures to address the problems.

Prior or during the field review the following supporting information is suggested to be collected:

1. Video and travel time driving data of the corridor, including all cross roadway approaches to the targeted intersections, at various time of day especially in congested corridors.

2. Ball-banking data should also be collected during the drive if deemed necessary; review of estimated or measured horizontal and vertical curvatures from as-built plans may be necessary.
3. Stationary video of all intersection approaches for a minimum of 15-20 minutes to observe and records varying traffic conditions and signal phase timings. Near and wide angle positions may been to be connected for more congested urban/sub-urban intersections
4. Spot speed samples along corridor

Step 4: Hold kick-off meeting

Region/Locality responsibilities: *Hold kick-off meeting, perform thorough assessment of crash, traffic and existing conditions data collected, set date and times for site inspection*

An assessment field review team kick-off meeting should be held at an office nearby the site after the distribution of the crash analysis results. The purpose of this meeting is to bring together representatives of the affected stakeholders (and potentially other agencies) on the review team. The crash data prepared by traffic engineering staff should be reviewed in detail to determine if there are any locations or conditions that should be subjected to a through examination. Some RSA team leaders may wish to have the team members individually review the information provided; reviewing the information as a group before the first field review is another option. This meeting will also provide an opportunity for team members to discuss potential information not included in the crash analysis and background, as well as discuss potential issues that should be considered during the site field review. Initial plans for countermeasures may also be discussed. Plans for timing of the RSA field review of the site and resulting documentation of the review should also be made. Based on the crash and traffic data, the RSA sites should be field reviewed more than one time of day. One approach is to review the information as a team during the morning before an afternoon field review. A second field review could be planned for the next morning with a team meeting to discuss and document the findings and recommendations the second afternoon.

Step 5: Site field review

Region/District/Locality responsibilities: *Perform site inspection*

The field review inspections should take an overall view of safety on the corridor. While it is important to ensure that compliance with relevant standards exists (reviewing nominal safety), the inspections should also look for additional treatments that could be used to improve safety. Using the crash, traffic and existing conditions data should point to improving the substantive safety[2]. That is, beyond meeting standards, what treatments could improve the interaction of drivers (and non-motorized users) with the roadway and traffic control design elements?

[2] The introduction to ITE's 1999 "The Traffic Safety Toolbox: a primer on traffic safety" is suggested reading on this subject and proceeding chapters are an excellent resource for Step 5: Developing Countermeasures

To help with the engineering field review process, a series of checklists have been developed for the RSA. These checklists have been incorporated into Microsoft Exel worksheets in a spreadsheet called Field Review Assessment Tool (FRAT). Separate sheet templates are available for intersections and section sites. For a corridor segment review, multiple locations should be identified and labeled with separate sheets for each site. The items and elements identified in the FRAT should be used to assist in the diagnosis of safety concerns and development of potential countermeasures. If the site inspections reveal additional safety concerns not addressed in these checklists, they should also be noted and sketched. Those locations and/or crash causes that may need enforcement and educational countermeasures should be noted.

During the field review all possible engineering improvements should be noted with the expected implementation cost and schedule as short-term/low cost, medium-term and cost and longer term and larger capital construction improvements determined during the documentation steps. Ultimately the team should work with the VDOT District and Central Office HSIP staff to identify the different opportunities to fund the preferred safety improvement categories.

Step 6: Develop countermeasures

Region/District/Locality responsibilities: *Develop countermeasure plan working to address observed safety concerns*

After the field review(s), the assessment team will develop potential safety countermeasures based on the crash data summaries and field conditions noted in the FRAT documentation. The proposed countermeasures should be grouped into:

Short-term	1. Roadway maintenance and operations related treatments that can be implemented within a few months
Intermediate	2. HSIP allocation eligible projects with minimal ROW and utilities impacts that can be implemented in one or two years, such as: a. Guardrail b. Traffic Signs c. Traffic Signals & ITS d. Pavement Marking e. Roadway Lighting f. Roadside Safety including pedestrian facilities g. Shoulder Improvement including turn lane modifications h. Rumble Strips
Long-term	3. Construction projects with more environmental and right-of-way impacts that require three of more years for project development. These may be submitted as annual HSIP application or funded with other capital improvement funds.

A 3-E (enforcement, engineering, and education) plan should also be considered to work with stakeholders to address the specific deficiencies identified on the corridor or site. While the RSA sponsor may take the lead role in delegating the responsibility for the improvements, traffic engineering staff should include relevant local government and state agency stakeholders and partners to produce the countermeasure plan. For example, proposed 3E countermeasures should also be reviewed by Public Affairs, law enforcement (local and/or VSP) or EMS to be prioritized for implementation and potential funding.

Step 6: Develop RSA report and hold completion meeting

Regional/District/Locality responsibilities: *Generate RSA report memo, hold completion meeting with assessment team*

The RSA team staff will produce a formal report on the review and resulting proposals of the RSA. An RSA report will include the following components at a minimum:

1. Overview of corridor characteristics with a location map
2. Aerial photos and/or sketches showing critical design and traffic control device features and measurements, traffic volumes (turning movement counts if applicable) and signal timing information
3. Table summaries and collision diagrams of crashes throughout the corridor and intersections and/or critical segments
4. Identification of site specific conditions in FRAT worksheets
5. Proposed safety improvements
6. Recommended plan for implementation of the improvements, including potential funding sources

The FRAT worksheets may be used as the memo framework or a separate memo written. For a memo format, a sample annotated outline template is provided at RSA report. Proposed safety improvements should be prioritized in case funding limitations prohibit the implementation of all measures. The report should be completed and distributed to the assessment team within two weeks of the completion of the site inspections.

The RSA report will be presented to the entire assessment team at a completion meeting. This meeting will be hosted by the sponsor and should occur shortly after the final report is distributed. The assessment team, as well as representatives of other affected agencies, will review the recommendations of the plan. If the recommendations are supported, responsibilities for implementation and monitoring will also be assigned to the affected agencies, divisions and sections at this meeting. If the additional concerns are presented at the meeting, some steps of the RSA process may need to be reconsidered until all affected groups agree to an action plan.

A plan to provide the data needed to evaluate the effectiveness of the countermeasures should also be a product of this meeting. Projects funded by HSIP are required to have post

construction evaluation of the safety benefits. Presently the cities must provide the three year post period crash data.

Step 7: Implement countermeasures and monitor performance

District responsibilities: *Implement recommended countermeasures, monitor HSC performance*

The proposed countermeasures identified as priorities will be proposed for potential funding by each agency. Prioritized and funded countermeasures would then be implemented and monitored. Funding projects with federal HSIP allocations must follow approved procedures documented in guidelines at: **www.virginiadot.org/business/ted_app_pro.asp**

Requests for funding should be submitted to HSIP staff in VDOT Traffic Engineering Division. The District or locality would be responsible for the implementation of the engineering-related countermeasures. Other agencies, such as law enforcement and DMV, may also have a role in implementing countermeasures.

The safety performance of the HSIP projects will also be monitored to determine whether the RSA countermeasures have improved safety. Typically the HSIP evaluation collects three years of crash data after the project completion. Crash data on locally maintained roads crash data will be collected and forwarded to VDOT HSIP staff to be included in an annual evaluation report for the program.

RSA Field Review Assessment Tool Checklists

To facilitate the thorough safety review of a site or segment of highway, a detailed review checklist has been developed by HSIP staff. The checklist has been documented in an MS-Excel spreadsheet (XLS) called the Field Review Assessment Tool (FRAT). The FRAT XLS incorporates three sheets to document the RSA:

1. The *General* sheet provides overall RSA study area information so that the complete coverage of both intersections and highway sections reviewed are described. So, if a corridor segment is to be assessed, each homogeneous sub-section and intersection to review should be identified and labeled with a chosen nomenclature. Further, the general focus and outcome/recommendations of the RSA should be provided.
2. The *Intersection* sheet provides several pages to cover the following elements of an intersection – Separate sheets should be used for multiple intersections reviewed.
3. The *Segment* sheet provides several pages to cover the following elements of the roadway sub-sections within the study area segment. Again, segment sub-sections should be chosen to define homogeneous built environment, roadway and traffic composition elements.

The final RSA findings and assessment report should be completed based on the results of the checklists and the assessment team's analysis and judgment.

RSA General Field Review

Study Name : Jurisdiction :

Study Route/Location : Area Land Use : **RSA Study # (Office Use Only) :**

Types of Area Use : Study Category :

Project Purpose :

Improvement Plan :
- ☐ Traffic Sign Improvement
- ☐ Traffic Signal Improvement
- ☐ Channelization Improvement
- ☐ Pavement Improvement
- ☐ Roadside Improvement
- ☐ Realignment Improvement
- ☐ Illumination & Lighting
- ☐ Regulation Improvement
- ☐ Drainage
- ☐ Traffic Sign Improvement
- ☐ School Area Safety
- ☐ Road User Facility
- ☐ Others - specify

Implementation Approach : ☐ Spot Improvement* ☐ System-Wide Improvement** Length : Mile Direction :

Mile Point : FR TO Number of Intersections : Number of Horizontal Curves :

RSA Inspectors:

	Name	Division/District	Position	Telephone	E-mail
1					
2					
3					
4					
5					

RSA Inspection Stage : Date of RSA Inspection (MM/DD/YYYY) : Begin Date End Date

Available Data/Information :
- ☐ Aerial Photo
- ☐ Crash Data (by type, severity, and location)
- ☐ Traffic Volume and ADT
- ☐ Pedestrian Flow
- ☐ Signal Timing/Queue Length (if applicable)
- ☐ Topographic Map/Plan Sheet
- ☐ Existing Policies / Standards
- ☐ Previous RSA Report
- ☐ Others - specify