Roadway Safety Assessment

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Credit: 1 PDH

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Table of Contents

I. Introduction

A Road Safety Assessment (RSA) is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The FHWA works with State and local jurisdictions to integrate RSAs into the project development process for new roads and intersections, and also encourages RSAs on existing roads and intersections.

Some signs can be too ambiguous. As an example, below, the "CAUTION" sign is simply placed on a utility pole with no notice as to what the road user should be cautious about. Other signs can be too obvious or general in nature. The second sign below, cautions the driver that there is water on the road during rain. It is probably a safe assumption that a driver will realize there is water on the road during rain.

Some signs may warn the road user of a hazard, yet provide no guidance as to how to handle the hazard. The sign below warns the driver of a blind corner ahead and to proceed with caution. Does this sign mean reduce speed, turn on headlights, etc.?

Other caution signs are more specific, as seen in the illustrations below. These caution signs warn the road user that there may be ice on the roadway or bridge during freezing temperatures. The driver then has enough information to ascertain if the temperature is such that there may be ice on the road/bridge and to reduce speed and assess the situation.

II. Definition of Road Safety Assessment

Road safety assessments (RSAs) are meant to be qualitative assessments, not quantitative assessments. Precise measurements are not necessary.
A qualitative assessment describes the quality of something in size, appearance, value, etc. Such assessments can be submodified by words such as very and have comparative and superlative forms. A quantitative assessment relates to a measurement of something rather than its quality.

III. Benefits

The RSA process is cost-effective, although most reference qualitative rather than quantitative benefits. The benefits of RSAs are substantial, but largely immeasurable.

The benefits of RSAs are:

- May help produce designs that reduce the number and severity of crashes
- May reduce costs by identifying safety issues and correcting them before projects are built
- Promote awareness of safe design practices
- Integrate multimodal safety concerns
- Consider human factors in all facets of design

RSAs are necessary to balance competing interests in road projects, including:

- Cost
- Right-of Way
- Environment
- Politics

- Topographic and geotechnical conditions
- Socio-economic issues
- Capacity/Efficiency
- Safety

Compromise and constraints are a normal part of transportation budgeting. The competing interests must be balance with cost while ensuring the safety implications are an explicit consideration.

IV. Team Members

It is important to choose an independent, multi-disciplinary team. Also, all users must be considered including, but not limited to cars, trucks, pedestrians, bicyclists and scooters. It is important that no user "falls through the cracks."

The team should vary by project and consist loosely of any or all of the following: engineer, planner, roadway designer, drainage designer, traffic operations engineer, enforcement, local agency representative and lighting designer.

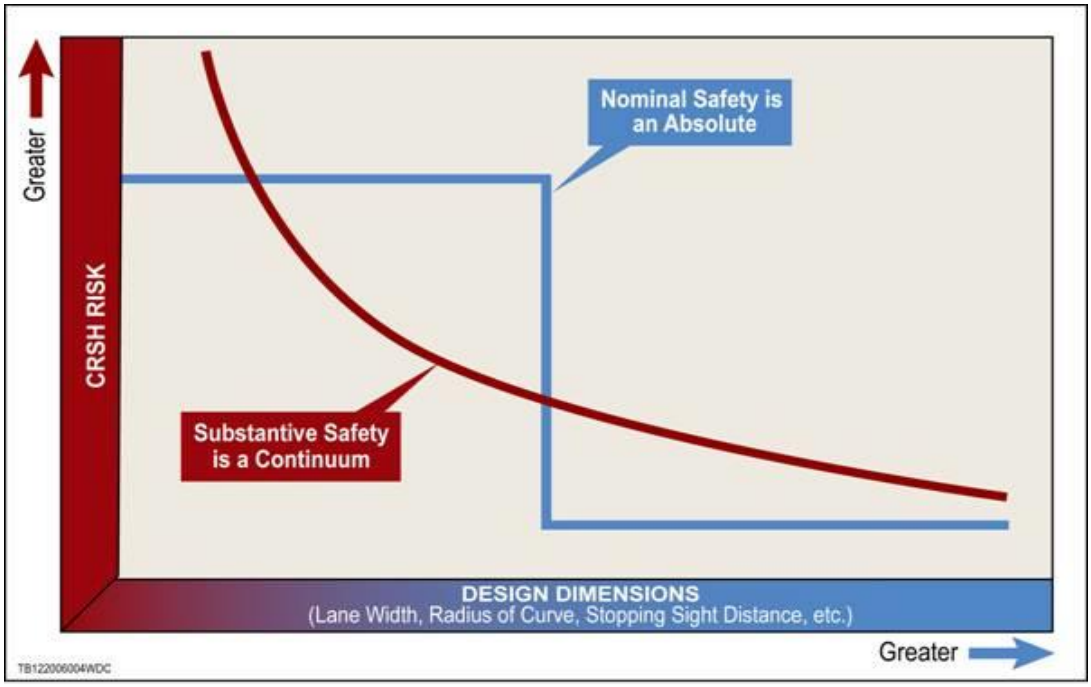
Important project information needs to be disseminated to all team members including: collision history, traffic volumes, aerial photographs, design drawings, background reports, preliminary design & engineering and design criteria.

V. Nominal Safety vs. Substantive Safety

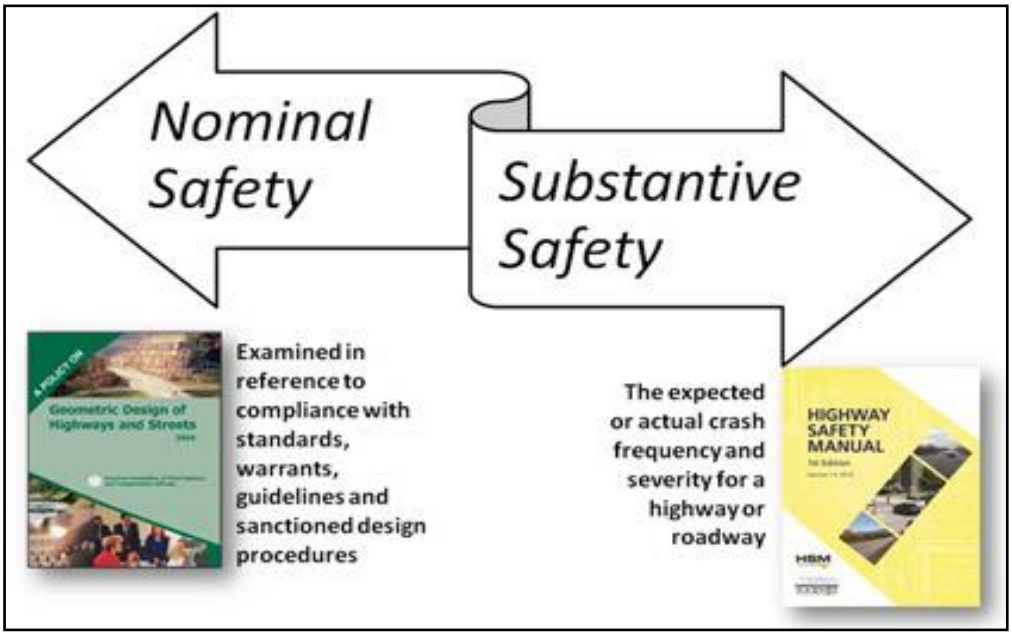
RSA is not meant for redesign. It is purely investigative in nature and goes deeper than a safety review.

Differences	
Road Safety Assessment	**Safety Review**
Performed by a team independent of the project	The safety review team is usually not completely independent of the design team
Performed by a multi-disciplinary team	Typically performed by a team with only design and/or safety expertise
Considers all potential roads users	Often concentrates on motorized traffic
Accounting for road user capabilities and limitations is an essential element of an RSA	Safety reviews do not normally consider human factors issues
Always generates a formal RSA report	Often does not generate a formal report

A high priority project is lacking in both nominal and substantive safety. Nominal safety refers to non-specific standards that do not necessarily correspond to an exact real measurement. Substantive safety refers to rules or standards that have a separate and independent existence.



As design manuals are examined, AASHTO's Policy on Geometric Design of Highways and Streets would be considered to contain nominal safety characteristics. In contrast, AASHTO's Highway Safety Manual would be considered to contain substantive safety characteristics.



A traditional road safety review is reactive in nature. It is conducted solely with an in-house team. There probably is no field review. It examines standards compliance and geared at minimizing liability.

RSA is proactive in nature. It consists of an independent team to ensure a "fresh set of eyes" looks at the issues. It may consist of multiple field reviews to examine the issues during daylight and nighttime hours, peak period and non-peak period times and in dry and wet (raining) conditions. It is a comprehensive review including human factors.

As illustrated below, a nighttime review of a roadway segment may reveal substandard lighting resulting in "dark" spots on sections of roadway.

Peak period reviews may reveal little to no information due to the heavy congestion on the roadway. Non-peak period review may reveal more useful information as to how the roadway is actually functioning.

Evaluation conducted during dry conditions may miss important issues such as poor drainage resulting in safety hazards. The picture below shows severe roadway ponding during a rain event creating safety hazards such as loss of lane lines and hydroplaning.

VI. When to do RSA?

An RSA can be conducted at any stage in project development from planning and preliminary engineering, design and construction. The earlier in the project (planning phase), the more proactive the study can be by addressing more issues and bigger changes.

The later in the project (in design), it compares the roadway issues before construction to the ultimate design. It can also be conducted after a project is built, but will accomplish less change.

RSAs can also be used in any sized project from minor intersection and roadway retrofits to mega-projects.

VII. RSA Process

The steps of responsibilities of the RSA team and project owner are detailed in the following illustration.

The final presentation of findings should be short and concise consisting of the following:

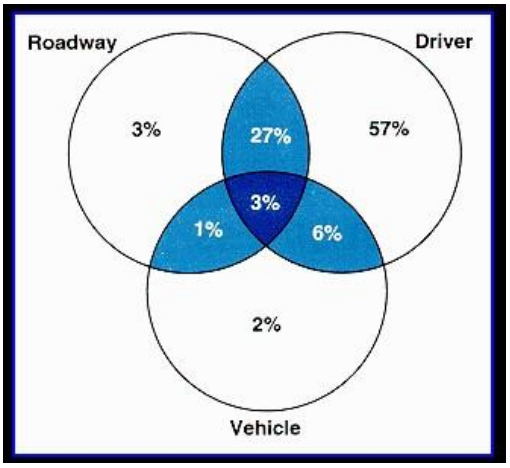
- Identify safety issue
- Description
- Prioritization
- Suggestions

VIII. Typical Reported Crashes

If roadway crashes are attributed to a single source, the breakdown of the results are:

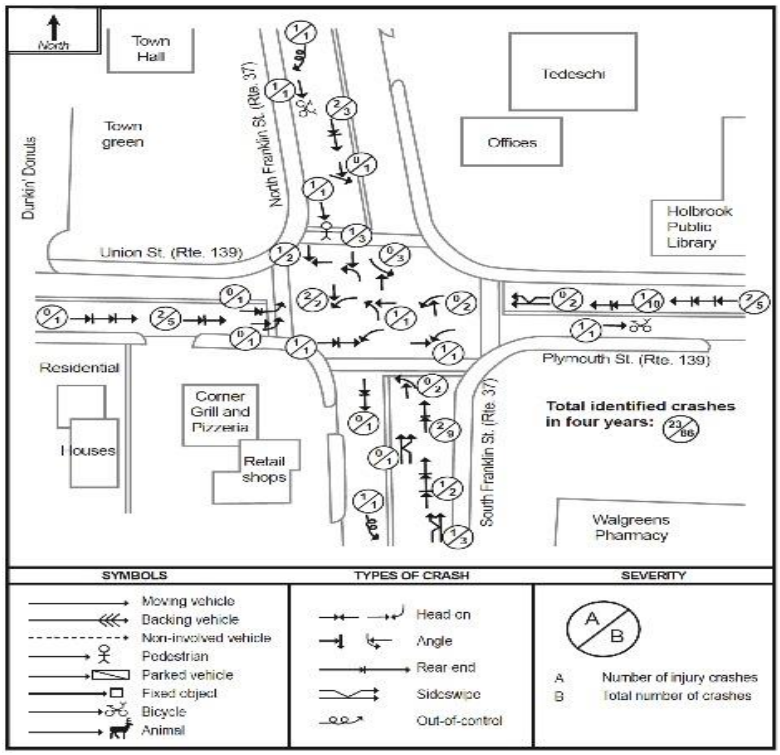
93% Driver Error
34% Roadway
12% Vehicle

However, as illustrated below, roadway crashes should consider a combination of sources. In doing so, up to 37% of crashes can be attributed to all sources: driver, roadway and vehicle.



IX. Collision Diagram

The collision report generally does not show road condition issues. Generally, collision diagrams are typically limited to traffic control, type of crash and severity. Detailed specifics such as pavement condition or drainage issues may be overlooked.



Road design needs to anticipate and accommodate common driver errors. It is easier to build safer roads than modify driver behavior (cell phone usage, tuning radio, eating/drinking).

X. Examples of Safety Hazards

A. Utility Poles

Utility poles are common safety hazards. Obviously, the picture below is an extreme condition in which the utility pole is located in the middle of a roadway with a simple object marker denoting the hazard. This is a severe safety hazard and should be addressed immediately.

A more common occurrence is a utility pole located within the clear zone of the roadway. This often occurs due to narrow right-of-way constraints. Right-of-way can be very expensive depending on the location of the roadway and movement of certain obstruction may not be feasible.

B. Pavement Edge Erosion

Pavement edge erosion often occurs due to poor drainage design. Roadways without shoulders are particularly vulnerable to pavement edge erosion. As the edge of the roadway disintegrates, it

can lead to dangerous run off the road crashes. In addition, pavement edge erosion can lead into alligator cracking that moves into the travel way.

C. Detours

Road closures with no advance detour warning are another common occurrence in areas of dense reconstruction.

D. Roadway Ponding

Roadway ponding is a serious safety hazard because the poor drainage causes standing water which obscures pavement markings, inhibits vision of vehicles behind the lead car and can result in hydroplaning.

E. Steep Drop-Offs

Roadway edges drop-offs greater than 2:1 are a serious concern. Roadways without shoulders are particularly vulnerable to run-off the road crashes because there is no recovery zone available to the driver. Roadside slopes should not be steeper than 4:1.

As illustrated in the photo below, steep drop-offs should be mitigated with guardrail.

F. Roadway Drop-Offs

Many rural roadways have roadway drop-offs. They are particularly concerning on roadways without shoulders. This is because there is no shoulder available to assist the driver with a recovery area.

A 3 to 4-inch drop-off can easily lead to a driver "catching" a wheel off the drop-off and overcorrecting (hooking) in error resulting in crossing into head-on traffic.

A safety edge is an inexpensive addition to a paving operation that can include a sloped drop-off which will not result in wheel catching and overcorrection errors. A 90 degree drop-off will tend to catch a tire where the safety edge slope allows the vehicle to recover to the travel way.

G. Narrow Bridges

The narrow bridge caution sign is used to alert the road user that a wider roadway with or without shoulders is approaching a narrower bridge crossing. These are very common caution signs since it is expensive to build bridge structures. Most often, bridge structures are not build to accommodate the adjacent width of the roadway approaches due to cost.

The following illustration shows a roadway with shoulders approching a narrower bridge with reduced shoulder widths. In this example, the designer added guardrail to protect the approaching driver and bridge stucture.

The following illustration shows a roadway with minimal shoulder approaching a narrower bridge structure with no shoulders. Object markers and guardrail were added to the approaches to call attention to the narrow structure from the road user.

H. Retro-Reflectivity

Old signs in need of maintenance or replacement can result in poor retro-reflectivity. As illustrated below, only the “ALL WAY” panel is visible at night with headlights. The street name and stop signs have lost their retro-reflectivity.

XI. Prioritization

All of the disciplines represented by the road safety assessment want to have their specific "needs" met. However, during the final compiling of data, it is critical for the team to define which improvements are a "necessity" and which are a "want." The team needs to prioritize the desired improvements into a list of "needs" and "wants". Since roadway improvements can be very costly, the project owner must be involved to determine the cost-benefit ratio. This list can be further investigated by the project owner. The lists should be included in the final road safety assessment document.

XII. Summary

A Road Safety Assessment (RSA) is an evaluation of a highway improvement scheme during planning, design, at the end of construction or post-construction to identify road safety issues and

suggest measures to eliminate or mitigate any concerns. It is generally a relatively concise report with illustrations showing the issues and possible resolutions.

When properly conducted, an assessment can help to identify and correct regulatory deficiencies, which, in turn, can improve workplace safety and help reduce liability. It is a formal examination of the safety performance of a given roadway facility by and independent, multidisciplinary team.

The importance of the road safety assessments cannot be underestimated as they can be very significant in minimizing loss of lives due to crashes, reducing the costs arising from crash occurrences and preventing the traumatic experiences by the family members and friends to those whose lives have been claimed by road crashes.

I leave you with a couple of comics representing what can happen when detours are not properly signed in advance, and caution all road safety assessment team members to not let any human factors "fall through the cracks."