Road Safety Audits

Making Your Roads Safer

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Definition

A road safety audit is a formal and independent safety performance review of a road transportation project by an experienced team of safety specialists, addressing the safety of all road users.

Road Safety Audits are

- Focused on road safety
- A formal examination
- Proactive in nature
- Conducted by a multidisciplinary team (more than one auditor)
- Conducted by an audit team that is independent of the design team
- Conducted by an audit team that is adequately qualified, both individually and as a team
- Broad enough to consider the safety of all road users and road facilities
- Qualitative in nature

Road Safety Audits are not

- A means to evaluate, praise or critique design work
- A check of compliance with standards
- A means of ranking or justifying one project over another
- A means of rating one design option over another
- A redesign of a project
- A crash investigation or crash data analysis (although the crash history is reviewed)
- A safety review

Why do we need RSAs?

Typical Reported Crash Causes

- Road Environment Factors (28%)
- Human Factors (95%)
- Vehicle Factors (8%)

4% 24% 67%
Why do we need RSAs?

There are many competing interests at play in road projects:
- cost
- right of way
- environment
- topographic and geotechnical conditions
- socio-economic issues
- capacity / efficiency
- politics
- safety

Relatively few road-related safety issues are identified in collision reports.
Road designs need to anticipate and accommodate common driver errors.
Easier to design and build safer roads than to modify some entrenched driver behaviors.

Compromises and constraints are a normal part of transportation budgeting.
RSAs demonstrate the safety implications of roadway elements.
RSAs ensure that safety is an explicit consideration, and that safety does not “fall through the cracks.”

Reduce the number and severity of crashes
Promote awareness of safe practices
Process to identify and address problems
Considers human factors and multimodal issues
Low cost

Benefits

“Road Safety Audits are a proven way to review just how safe our local roads are and can be a valuable tool for local government road professionals in making their roads safer.”
Tony Giancola
Executive Director
NACE

“We have implemented RSAs on proposed resurfacing projects. We now see our staff consistently looking for and implementing numerous low cost safety improvements on Iowa’s roads.”

Thomas Welch, P.E.
State Safety Engineer
Iowa DOT
What are the Costs and Benefits?

• The following are typical values...
  - Audit Costs: $5k to $30k per audit stage
  - Design Costs: vary (change drawings or mid-construction)
  - Construction Costs: vary (to build accepted audit suggestions)
  - Benefits: Crashes prevented or made less severe
  - Benefit / Cost ratio: 10:1 or better

Audits & Project Staging

When do we conduct RSAs?

• Pre-construction:
  – Planning / feasibility
  – Preliminary (draft) design
  – Detailed design

• Construction:
  – Work zones
  – Pre-opening

• Post-construction/operational:
  – Existing roads

A road safety audit also...

• Considers the safety of all road users

• Considers interactions at the borders or limits of the project

• Examines the interaction of project elements

• May proactively consider mitigation measures

Good Candidate Projects for Post-Construction RSAs

• High-collision sites
• High-profile (political or public interest)
• Sites at which traffic characteristics have changed
Good Candidate Projects for Pre-Construction RSAs

- Safety-oriented
- High-profile (political or public interest)
- Complex design

RSA Team

- Independent
- Experienced
- Interdisciplinary

Team Composition & Size

- Local agency staff
- Exchange staff from another local agency
- Consultants
- Combination of above

Interdisciplinary Skills

Core skill set (every audit):
- Traffic operations
- Geometric design
- Road safety

Supplementary skills (some audits):
- Positive guidance/human factors
- Specialist skills (such as bridges or signing)
- Enforcement
- Maintenance

Start-up Meeting

- Introductions
- Exchange of information
- RSA process
- Schedule

Photo: Craig Allred (FHWA)
Exchange of Information

- Collision history
- Traffic volumes
- Aerial photographs
- Design drawings
- Background reports
- Design criteria

Common Issues and Challenges

- Responsibilities
- Programming and scheduling
- Effects on project costs
- Legal liability
- Management of expectations
- Resources and references

Management of Expectations

- All parties need to be:
  - Diplomatic
  - Cooperative
  - Constructive

Field Review

- Put the audit team in one vehicle.
- Designate a driver and note taker.
- Drive the audit site several times (day/night and differing conditions).
- Drive all approaches and make all turns.

Tools for Field Review

- Drawing and/or aerial photographs of site
- Camera (still and video)
- Measuring wheel and stopwatch (optional)
- High-visibility vests (recommended)

Look for...

- Sight distance obstructions
- Roadside hazards
- Driveway issues
and Observe

- Observe road user characteristics.
- Observe surrounding land uses.
- Observe link points to the adjacent transportation network.

View Under Differing Conditions

Observe conditions during:
- Peak and off-peak traffic periods
- Dry and wet weather conditions
- Day and night conditions

Get Up Close

Walk the audit site.

Checklists & Prompt Lists

- May provide structure to the site visit
- Remind the team what to look for, and help ensure that nothing is missed

RSA Analysis

- Workshop setting
- Review information
- Systematically review information
- Identify, prioritize, and mitigate safety issues

RSA Analysis: Getting Organized

- Appoint a coordinator and note take.
- Organize audit information.
- Assemble references.
RSA Safety Analysis

Safety analysis considers three elements concurrently:

- Geometry
- Operations
- User characteristics and interactions

Identify Geometric Safety Issues

Use of design standards and guidelines:

- A sound starting point
- Cumulative effect of minimum/maximum values
- Supplement with human factors analysis and project-specific concerns (such as maintenance concerns)

Identify Operational Safety Issues

- Congestion and delay
- Signal operation
- Operating speeds
- Queuing
- Turning movements
- Driveways

Identify User Characteristics & Interactions Safety Issues

- Pedestrians (especially older and younger; school children)
- People with disabilities
- Cyclists
- School buses
- Farm vehicles
- Trucks
- Transit
Prioritize Safety Issues

May be based on crash frequency and severity:

- Crash history (audits of existing roads)
- Expected crashes (design stage audits)
  - Qualitative estimate of risk
  - Quantitative estimate of risk

Expected Crashes
(Design Stage Audits)

- No collision history
- Estimate future crash risk:
  - Qualitative estimation
  - Quantitative estimation

Qualitative Estimate of Risk

Deficiencies = Risk

Risk is composed of two elements:
1. The likelihood that a collision occurs
2. The severity of the collision

Risk: Crash Likelihood

Likelihood reflects:
- Exposure
- Probability

Ratings with Example Crash Frequencies

- **Frequent** - 5 collisions or more per year
- **Occasional** - 1 to 5 collisions per year
- **Infrequent** - Less than 1 collision a year, but more than 1 collision every 5 years
- **Rare** - Less than 1 collision in 5 years

Risk: Crash Severity

Severity reflects:
- Collision types
- Expected speeds

Crash Severity Ratings

<table>
<thead>
<tr>
<th>High</th>
<th>Fatality likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Severe injury likely</td>
</tr>
<tr>
<td>Low</td>
<td>Injury likely</td>
</tr>
<tr>
<td>Negligible</td>
<td>Property damage only</td>
</tr>
</tbody>
</table>

Using Relative Risk to Prioritize Safety Issues

<table>
<thead>
<tr>
<th>RISK CATEGORY</th>
<th>SEVERITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Accident Frequency Category</strong></td>
<td><strong>Frequent</strong></td>
</tr>
<tr>
<td></td>
<td>C</td>
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<td></td>
<td>B</td>
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Mitigate Safety Issues

For each safety issue, the audit team may provide suggestions or possible solutions to reduce collision frequency and/or severity.

Suggestions should be:
- Appropriate for stage of audit
- Appropriate for all road users

Presentation of Findings:
Preliminary Findings Meeting

- RSA team, local road agency
- Discuss preliminary findings and possible solutions
- Use results to write RSA report

Presentation of Findings:
RSA Report

- Documents the results of the RSA
- Identifies and prioritizes safety issues
- May include suggestions for improvements
- Includes:
  - Background
  - Audit team, materials, and process
  - Site observations
  - RSA findings

### Sample Road Safety Audit

<table>
<thead>
<tr>
<th>Safety issue</th>
<th>Description</th>
<th>Prioritization</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue 1: Closely-spaced Sample Street Intersections</td>
<td>During peak periods, left-turn queues may extend into or past adjacent closely-spaced intersections on Sample Street. Opposing through and right-turn traffic volumes can be expected to cause peak-period delays to traffic turning left at two intersections: Sample Street and the northbound entrance to I-XX, which has limited (70-foot) left-turn storage lane; Sample Street and Example Street, which has no left-turn lane. If left-turn movements experience a long delay, queued left-turn traffic may obstruct through traffic on Sample Street. Queued or obstructed traffic may queue back and affect operations at upstream intersections, increasing the risk of all types of intersection collisions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Crash Types</th>
<th>Expected Frequency</th>
<th>Expected Severity</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection (left-turn, rear-end, and crossing)</td>
<td>occasional</td>
<td>medium</td>
<td>D (moderate-high risk level)</td>
</tr>
</tbody>
</table>

Suggestions:
- If micro-simulation modeling or post-construction observations show congestion related to left-turn queues, the following measures may be considered:
  - Signalize the ramp intersection, and coordinate the ramp signal with those at Sample Street and Example Street to clear traffic when queues approach the adjacent upstream intersection.
Response Letter

- Prepared by the local road agency (with possible input from designer)
- For each audit issue, identifies what action will (or will not) be taken with a brief explanation
- Part of the project record

Example
The RSA suggests realignment at the skewed intersection of Jefferson Road.

Inadequate response: "We will not realign the intersection at Jefferson Road. We do not feel that it is needed."

Adequate response: "While we agree with the need to realign the skewed intersection, the realignment cannot be achieved within the existing right-of-way. Realignment will require the purchase of property at a cost of about $500,000, representing about 15 percent of the total annual transportation budget. The acquisition of the required property may be considered in future budgets."

Response Letter & Implementation of Improvements

- Point by point response to audit findings
- Actions to be taken
- Reason for taking no action

Pre-Construction Audits: Will an RSA delay the project?

- RSAs require a relatively short time.
- Pre-construction RSAs can occur concurrently with the agency’s review of the design drawings.

Pre- and Post-Construction Audits: Will an RSA drive up costs?

The audit team provides suggestions only. The road agency or designer remains responsible for design decisions.

Audit suggestions:
- Can focus on low-cost safety improvements,
- Can be pre-screened with the road agency and designer,
- Must be consistent with the design stage.

Do RSAs expose agencies to more legal liability?

- Agencies should seek legal advice.
- Agencies can be taken to court with or without a road safety audit.
- RSAs can be part of a safety management system.
Do RSAs expose agencies to more legal liability?

Auditors must carefully complete the RSA to a reasonable standard of care and professionalism.

- identify RSA scope
- identify RSA materials
- identify limitations
- consult during audit

“[RSAs] demonstrate a proactive approach to identifying and mitigating safety concerns.”

“Our attorneys say that once safety issues are identified, and if 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.”

Questions?

Contact Tori Brinkly, Highway Safety Engineer for any traffic/safety questions
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RSA Newsletter, Spring 2010

http://one.dot.gov/fhwa/Safety\%DSS/Lists/Technical\%20Forum/Attachments/141/03%2031%2010_newsletter-spring2010.pdf