RSA PROCEDURES

The 8-step Process
RSA Procedure

1. Identify project
2. Select RSA team
3. Conduct start-up meeting
4. Perform field reviews
5. Conduct analysis and prepare report
6. Present findings to Project Owner
7. Prepare formal response
8. Incorporate findings

Responsibilities:
- RSA Team
- Project Owner
Identify project

Select RSA team

Conduct a start-up meeting

Perform field reviews under various conditions

Conduct audit analysis and prepare report of findings

Present findings to Project Owner

Prepare formal response

Incorporate findings
Identify the Project

Design stage project

Existing location
Candidates for RSAs

High-crash sites

High-profile sites

Changed traffic patterns
RSA Procedure

1. Identify project or
2. Select RSA team
3. Conduct start-up meeting
4. Perform field reviews under various conditions
5. Conduct audit analysis and prepare report of findings
6. Present RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings

Responsibilities

- RSA Team
- Design Team / Project Owner
Select RSA Team

- Independent
- Experienced
- Multi-disciplinary
Select RSA Team: Core Skills

Traffic operations

Traffic safety

Geometric design
Select RSA Team:
Supplementary Skills

- Law enforcement
- Maintenance personnel
- Emergency responders
- Local knowledge
Select RSA Team

- Exchange staff from another local agency
- Volunteers
- Consultants
- Combination of above
RSA Team Volunteers

- HELPERS maintains a list of trained RSA volunteers
- You can be on that list
1. Identify project

2. Select RSA team

3. Conduct a start-up meeting

4. Perform field reviews under various conditions

5. Conduct audit analysis and prepare report of findings

6. Present RSA findings to Project Owner

7. Prepare formal response

8. Incorporate findings

RSA Procedure

**Responsibilities**
- RSA Team
- Design Team / Project Owner
Start-up Meeting

- Identify individual roles/backgrounds
- Review project background information
- Communicate project concerns
- Review RSA process
- Discuss any constraints or limitations
- Discuss schedule
- Provide contact information
Start-up Meeting: Review Project Information

- Crash history
- Traffic volume and speed data
- Maps and/or aerial photographs
- Background reports
- History of improvements
- Design drawings/as-builts
Where to get crash data?
- ARIES
- HELPERS
- Law enforcement
- FARS (www-fars.nhtsa.dot.gov)
RSA Procedure

1. Identify project
2. Select RSA team
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4. Perform field reviews
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6. Present RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings

Responsibilities
- RSA Team
- Design Team / Project Owner
Field Reviews: Preparation

- Review available data
- Arrange transportation
- Designate photographer(s) and secretary
Field Reviews: Equipment

- Safety vests
- Camera(s)
- Measuring wheel
- Measuring tape/ruler
- Level
- Clipboard
- Notepad
- Traffic/crash data
- Prompt list
Field Reviews: Prompt List

- Provides structure to the site visit
- Reminds the team what to look for and helps ensure that nothing is overlooked
Field Reviews

Walk the site
Field Reviews

- Observe road user characteristics.
- Observe surrounding land uses.
- Observe link points to the adjacent transportation network.
Field Reviews: Common Issues

- Sight distance obstructions
- Pedestrian and cyclist conflicts
- Roadway geometry
- Pavement condition
- Signs and pavement markings
- Speeding
- Visual Clutter
Field Review

- Talk with nearby/passing residents
- Look for other issues
  - Ponding
- Evidence of other users
  - Goat paths
Field Review

- Look for indicators of crashes
  - Skid marks
  - Tire marks off edge of roadway
  - Damaged trees
  - Damaged guardrail
  - Bent signs
  - Crash debris
  - Roadside crosses or memorials
Field Reviews: Observe Variable Conditions

- Peak and off-peak traffic periods
- School arrival and dismissal
- Dry and wet weather conditions
- Day and night conditions
RSA Procedure

1. Identify project
2. Select RSA team
3. Conduct a start-up meeting
4. Perform field reviews
5. Conduct RSA analysis
6. Present RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings

Responsibilities:
- RSA Team
- Design Team / Project Owner
Conduct RSA Analysis

- Identify and prioritize safety concerns
- Develop suggestions for reducing the degree of risk
- Report on findings
## Using Relative Risk to Prioritize Safety Issues

<table>
<thead>
<tr>
<th>Crash Frequency Category</th>
<th>Risk Category</th>
<th>Severity</th>
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<tbody>
<tr>
<td></td>
<td>Frequent</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Occasional</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Infrequent</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Rare</td>
<td>A</td>
</tr>
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</table>

### Severity Levels
- **Negligible**: A
- **Low**: B
- **Med**: C
- **High**: D
Analysis: Inventory and Review Information

- Put aside materials that are not relevant
- Determine if any materials are missing or needed
- Organize materials the team may use
Resources & References
Analysis: Traffic Crashes

Examine crash history of existing roads

Where do you get the data?
Analysis: Collision Diagrams
Analysis: Collision Diagrams
Analysis: Review Data

- Operations
  - Congestion, delay, queueing
  - Signal operations
  - Vehicle speeds
  - Driveways
Analysis: Review Data

- Geometry
  - Curve radius
  - Sight distance
  - Clear Zone
Analysis: Review Data

- All users
  - School buses
  - Farm vehicles
  - Buggies
  - Trucks
  - Cyclists
  - Pedestrians
  - Transit
  - Children
  - Special needs
  - Animals
  - Golf carts
Address All Users

Unintended Consequences
Analysis: Review Data

Identify and summarize main issues. Examples:

- Sight distance
- Roadway geometry
- Warning sign locations
- Intersection recognition
- Vehicle operating speeds
- No School Zone warning signs or speed limit
- Sign height and placement at the driveways
- Lack of shoulders
- Roadside hazards - drainage ditch and culvert head wall
- Multiple driveway conflicts
- Sight distance at the first driveway
- Inexperienced teenage drivers
- The school’s internal traffic flow
Project Suggestions

- **Short Term Solutions**
  - Maintenance (e.g. clear vegetation, repair guardrail)
  - Signs
  - Pavement Markings
  - Remove/shield roadside hazards
  - Enforcement
  - Driver education

- **Long Term Solutions**
  - Redesign curve
  - Modify alignment
  - Roundabout
RSA Procedure

1. Identify project
2. Select RSA team
3. Conduct a start-up meeting
4. Perform field reviews under various conditions
5. Conduct audit analysis and prepare report of findings
6. Present preliminary RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings
RSA Findings Presentation

- Discuss safety concerns
- Clarify findings and suggestions
- Assist project owner in making an informed decision
Be positive

Discuss safety successes
RSA Findings Presentation

- Factor in feedback
- Review and revise findings as appropriate
- Initiate formal report
  - Designate tasks
# RSA Findings: Formal Report

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<td>Figure 4</td>
<td>Looking west through curve</td>
<td>5</td>
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<td>Figure 5</td>
<td>Damaged Guardrail</td>
<td>5</td>
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<tr>
<td>Figure 6</td>
<td>At Dunn Street looking east on Old SR 37</td>
<td>6</td>
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</tbody>
</table>
RSA Findings: Formal Report

Safety concerns

CORRIDOR-WIDE ISSUES:
1. Visibility of signal heads is limited by the use of 8-inch signal lenses, diagonal span wires, and the absence of low-level signal heads.
2. Faded pavement markings provide limited guidance to drivers.

Vacant corner lots and faded pavement markings render the intersection inconspicuous. Drivers fail to anticipate the intersection and enter during the red phase, causing angle collisions.

The presence of left-turn vehicles in the shared lane reduces visibility of opposing through vehicles, resulting in left-turn head-on and secondary rear-end and sideswipe collisions.

Vehicles are unable to clear the intersection in time due to the lack of an all-red interval, resulting in angle collisions.

Suggestions

Restripe all pavement markings, including crosswalks.

Provide eastbound and westbound left-turn lanes and phases.

Correct westbound secondary signal head alignment.

Restrict parking near intersection to accommodate left turn lanes.

Provide signal ahead sign (W3-3) at eastbound and westbound approaches.

Remove turn restriction signs.

Provide lane markings at North-South Road.

CORRIDOR-WIDE COUNTERMEASURES:
1. Install 12-inch lenses on primary signal heads.
2. Mount primary signal heads with reflective yellow backboards in a box span configuration.
3. Provide far-left low-level signal heads on all approaches.
Be brief!
RSA Procedure

1. Identify project
2. Select RSA team
3. Conduct a start-up meeting
4. Perform field reviews under various conditions
5. Conduct audit analysis and prepare report of findings
6. Present RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings

Responsibilities
- RSA Team
- Design Team / Project Owner
**Suggestion 1:** Use of W2-1 (Cross Road) as advance intersection warning signs on both US 60 approaches.

**Action taken:** Traffic Division will revise the plans to add the signs.
Response Letter

Reason for taking no action

Suggestion 2: If ROW is available, add acceleration lane on US 60 in the westbound direction for RT turning from Bowring Rd.

This is not feasible for the following reasons: Any changes to the top of cut/toe of slope would affect the utility relocation which is currently under way. Also, the drive at Sta. 551+20 may conflict with the accelerating vehicles.
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.”
RSA Procedure

1. Identify project
2. Select RSA team
3. Conduct a start-up meeting
4. Perform field reviews under various conditions
5. Conduct audit analysis and prepare report of findings
6. Present RSA findings to Project Owner
7. Prepare formal response
8. Incorporate findings into the project

Responsibilities
- RSA Team
- Design Team / Project Owner
Implementation may depend on policy, manpower and/or funding.
Implementation of Improvements

Pre-construction RSAs

Changes to design drawings

Post-construction RSAs

Incorporate improvements in operating budgets or maintenance programs
CASE STUDIES
Case Study

City of Bloomington
Case Study: Background

- ADT: 4800 vehicles/day
- Posted speed: 30 mph
- 85\textsuperscript{th} percentile speed: 38-42 mph
- Curve advisory speed: 20 mph
- Chevrons present
- 5\% grade
- Nearby bicycle route
86% of the curve crashes are the fault of the WESTBOUND driver.

<table>
<thead>
<tr>
<th>Total Crashes</th>
<th>% of total</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tbody>
<tr>
<td>Total Crashes</td>
<td>46</td>
<td>8</td>
<td>12</td>
<td>11</td>
<td>9</td>
<td>6</td>
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<tr>
<td>Fatal Crashes</td>
<td>2</td>
<td>4%</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Injury Crashes</td>
<td>21</td>
<td>46%</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>3</td>
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<tr>
<td>Roadway Departure Crashes</td>
<td>42</td>
<td>91%</td>
<td>7</td>
<td>11</td>
<td>9</td>
<td>9</td>
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<tr>
<td>Rear-End Crashes</td>
<td>2</td>
<td>4%</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Bicycle Crashes</td>
<td>2</td>
<td>4%</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<td>Wet Roadway Crashes</td>
<td>38</td>
<td>83%</td>
<td>8</td>
<td>8</td>
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<td>Dark Roadway Crashes</td>
<td>19</td>
<td>41%</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Horizontal Curve Crashes</td>
<td>44</td>
<td>96%</td>
<td>8</td>
<td>12</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>


**Crashes by Time of Day**

**Crashes by Time of Year**

[Charts showing crash data by time of day and time of year]
WESTBOUND
Case Study: Major Findings

- Narrow lanes
- No shoulders
- Superelevation OK
- Damaged guardrail at insufficient height
- Worn pavement markings
- Pavement: cracked, polished look, smooth aggregates
Case Study: Major issues

- Challenging roadway geometry
- Westbound driver expectation
- Narrow roadway width
- Lack of shoulder
- Guardrail issues
- Pavement condition
- Vehicle speed
# Case Study: Suggestions for Improvements

<table>
<thead>
<tr>
<th>Short Term</th>
<th>Long Term</th>
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<tbody>
<tr>
<td>Signing</td>
<td>□ Rebuild curves</td>
</tr>
<tr>
<td>Guardrail</td>
<td>□ Add shoulders</td>
</tr>
<tr>
<td>High Friction Surface Treatment</td>
<td>□ Raise intersection</td>
</tr>
<tr>
<td>Street sweeping</td>
<td>□ Accommodate bicyclists</td>
</tr>
<tr>
<td>Pavement markings</td>
<td></td>
</tr>
<tr>
<td>Speed Enforcement</td>
<td></td>
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</table>
KEYS TO SUCCESS &
LESSONS LEARNED
Keys to Success

The RSA Team must acquire a clear understanding of the project background and constraints.
Keys to Success

The RSA Team and Local Road Owner must work cooperatively.
Keys to Success

A “Local Champion” can greatly help facilitate the establishment of RSAs
Keys to Success

The RSA field review should be scheduled to coincide with important site conditions.
Lessons Learned

- Be flexible with project limits
- Bring more than one camera
- Double-check the time zone
- Bees like safety vests!
WRAP UP
Road Safety Audits (RSAs)

- Formal safety performance examination
- Existing or Future Road Segment or Intersection
- Independent, multidisciplinary team
RSA Procedure

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2. Select RSA team
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Responsibilities:
- RSA Team
- Design Team / Project Owner
RSA Resources

- Free RSA Peer-to-Peer Program
  - Phone: (866) P2P-FHWA
  - Email: SafetyP2P@fhwa.dot.gov

- FHWA RSA Website
  - http://safety.fhwa.dot.gov/rsa
RSA Resources

- www.roadwaysafetyaudits.org
- NCHRP Syntheses
  - 321: Roadway Safety Tools for Local Agencies
  - 336: Roadway Safety Audits
- RSA Guidelines
QUESTIONS?

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