

District One Traffic Safety Academy

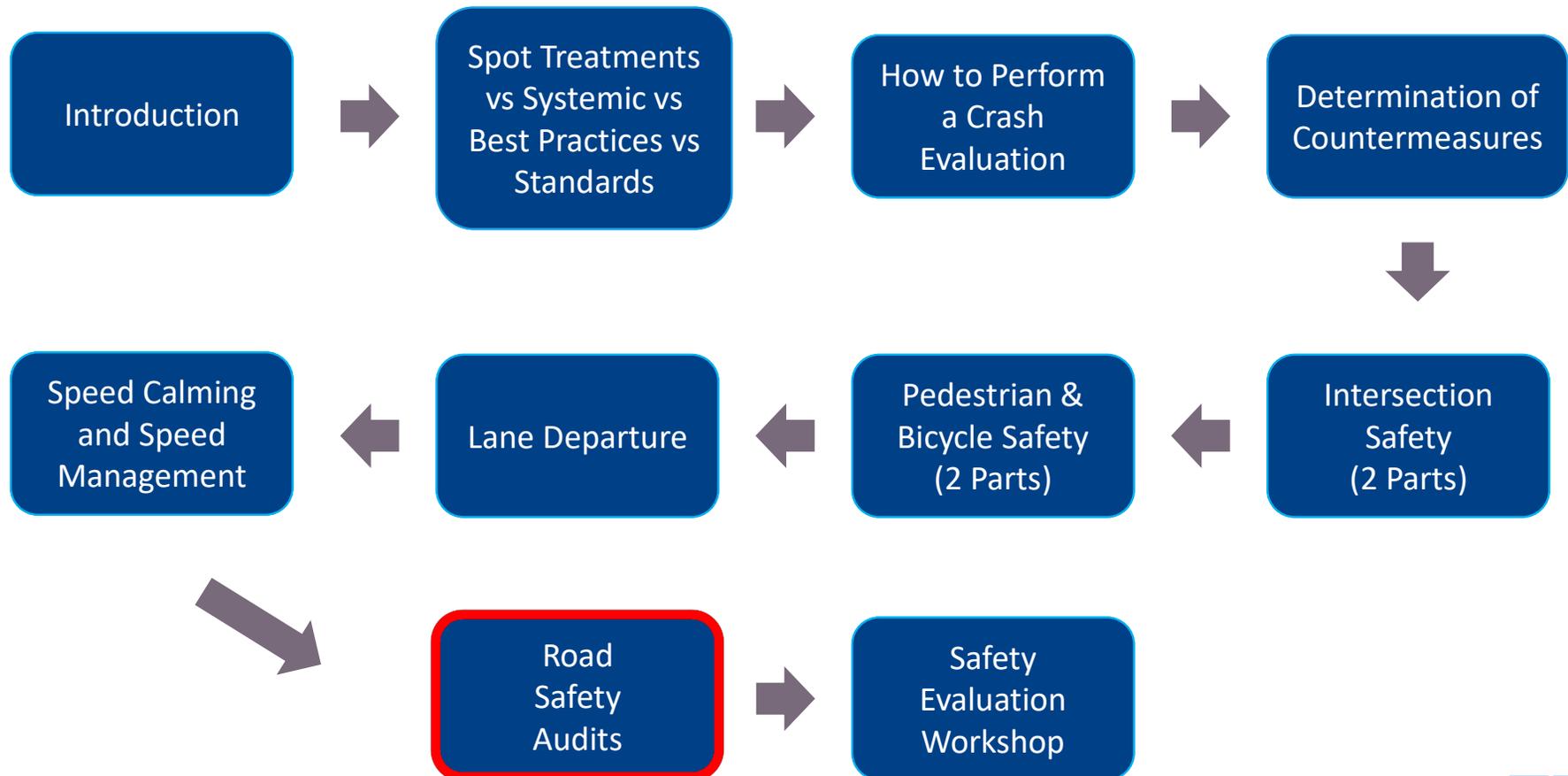
Presented by: Larry Hagen, P.E., PTOE, RSP



Session 11 – Road Safety Audits



District 1 Traffic Safety Academy

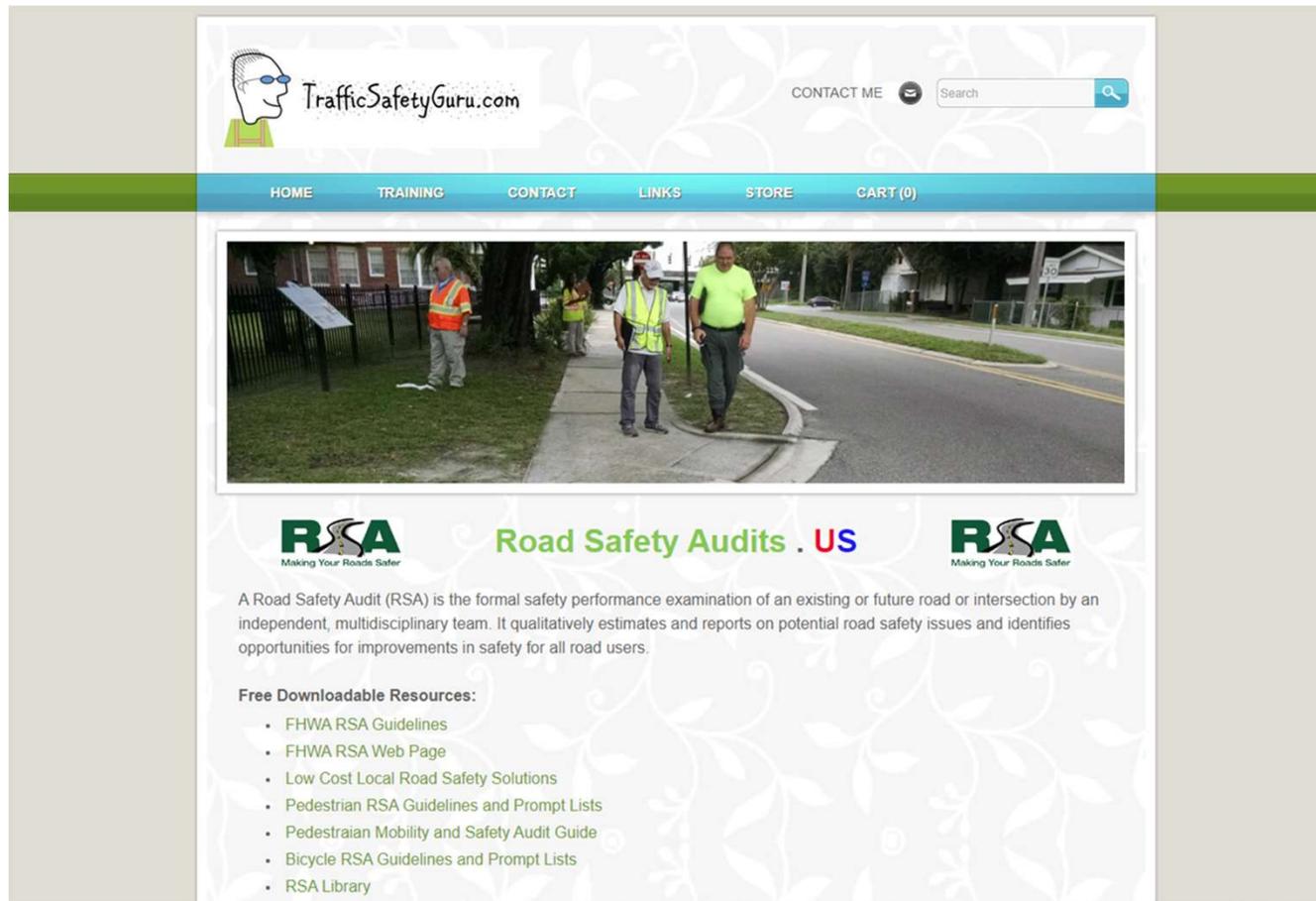


Goals & Objectives:

- Introduce Road Safety Audits (RSA) as a useful tool to help reduce traffic injuries and fatalities
- Point you to useful resources for more information



www.RoadSafetyAudits.us



The screenshot shows the homepage of the website www.RoadSafetyAudits.us. At the top left is the logo for TrafficSafetyGuru.com, featuring a stylized head with glasses. To the right of the logo is a navigation menu with links for HOME, TRAINING, CONTACT, LINKS, STORE, and CART (0). Further right is a 'CONTACT ME' button with an envelope icon and a search bar with a magnifying glass icon. Below the navigation menu is a large photograph showing several people in high-visibility vests and hard hats walking along a sidewalk next to a road, likely conducting a road safety audit. Below the photograph are two logos for 'RSA Making Your Roads Safer' and the text 'Road Safety Audits . US'. Underneath this is a paragraph defining a Road Safety Audit (RSA) as a formal safety performance examination. At the bottom, there is a section titled 'Free Downloadable Resources:' followed by a bulleted list of resources.

TrafficSafetyGuru.com

CONTACT ME

HOME TRAINING CONTACT LINKS STORE CART (0)



RSA Making Your Roads Safer **Road Safety Audits . US** **RSA** Making Your Roads Safer

A Road Safety Audit (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.

Free Downloadable Resources:

- FHWA RSA Guidelines
- FHWA RSA Web Page
- Low Cost Local Road Safety Solutions
- Pedestrian RSA Guidelines and Prompt Lists
- Pedestrian Mobility and Safety Audit Guide
- Bicycle RSA Guidelines and Prompt Lists
- RSA Library

Road Safety Audits

Basic Concepts

Basic Concepts

- What is a Road Safety Audit?
- What is a Road Safety Assessment?
- Why do we need RSAs?
- When do we conduct RSAs

What is a Road Safety Audit?

A road safety audit is a formal safety performance examination of an existing or future road or intersection by an independent audit team.

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What is a Road Safety Audit?

• <i>formal:</i>	procedures and documentation
• <i>safety performance:</i>	focus on safety
• <i>independent:</i>	no previous experience with assessed road
• <i>audit team:</i>	general experience and specialists

What does the RSA Team do?

The RSA Team considers the safety of ALL road users, qualitatively estimates and reports on road safety issues and opportunities for safety improvement.

A Road Safety Audit also...

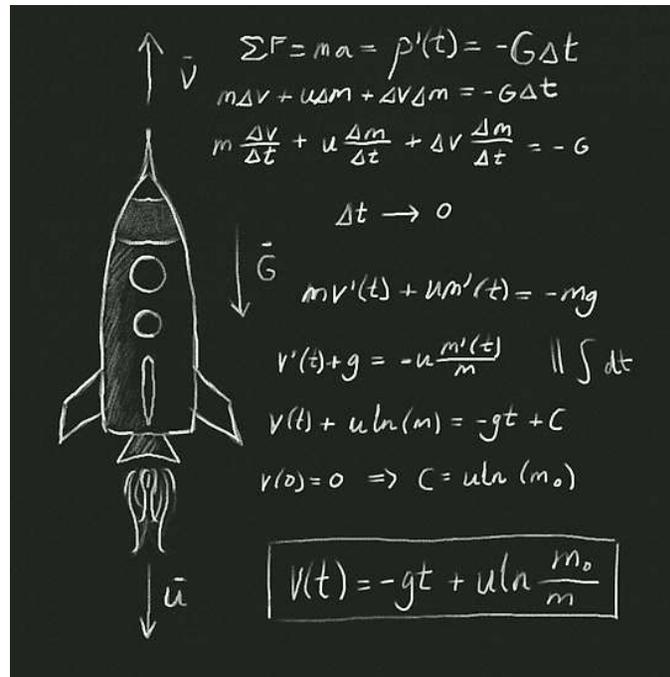
- considers the safety of all road users



- considers interactions at the borders or limits of the project
- examines the interaction of project elements
- may proactively consider mitigation measures

A Road Safety Audit is NOT....

Rocket Science At-all



$\Sigma F = ma = p'(t) = -G \Delta t$
 $m \Delta v + u \Delta m + \Delta v \Delta m = -G \Delta t$
 $m \frac{\Delta v}{\Delta t} + u \frac{\Delta m}{\Delta t} + \Delta v \frac{\Delta m}{\Delta t} = -G$
 $\Delta t \rightarrow 0$
 $m v'(t) + u m'(t) = -mg$
 $v'(t) + g = -u \frac{m'(t)}{m} \quad || \int dt$
 $v(t) + u \ln(m) = -gt + C$
 $v(0) = 0 \Rightarrow C = u \ln(m_0)$

$v(t) = -gt + u \ln \frac{m_0}{m}$

A Road Safety Audit is NOT....

... a simple standards check for adherence to design guidelines.

... an opportunity to redesign the project.

A Road Safety Audit is NOT...

An opportunity to add more signs!



A Road Safety Audit is NOT...

An opportunity to add more signs!



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A Road Safety Audit is NOT...

An opportunity to add more signs!



What are Road Safety Audits?

What are road safety audits?

RSAs 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.

What road safety audits are NOT!

RSAs are:

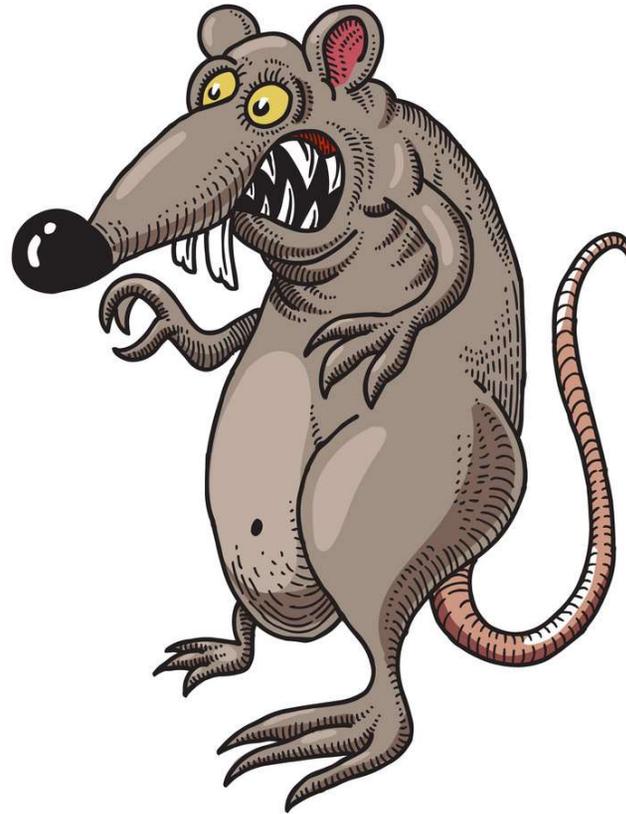
- Not a means to evaluate, praise or critique design work.
- Not a check of compliance with standards.
- Not a means of ranking or justifying one project over another.
- Not a means of rating one design option over another.
- Not a redesign of a project.
- Not a crash investigation or crash data analysis (although the crash history of an existing road is reviewed to make sure that previous crash patterns have been addressed).
- Not a safety review.

What is the aim of a Road Safety Audit?

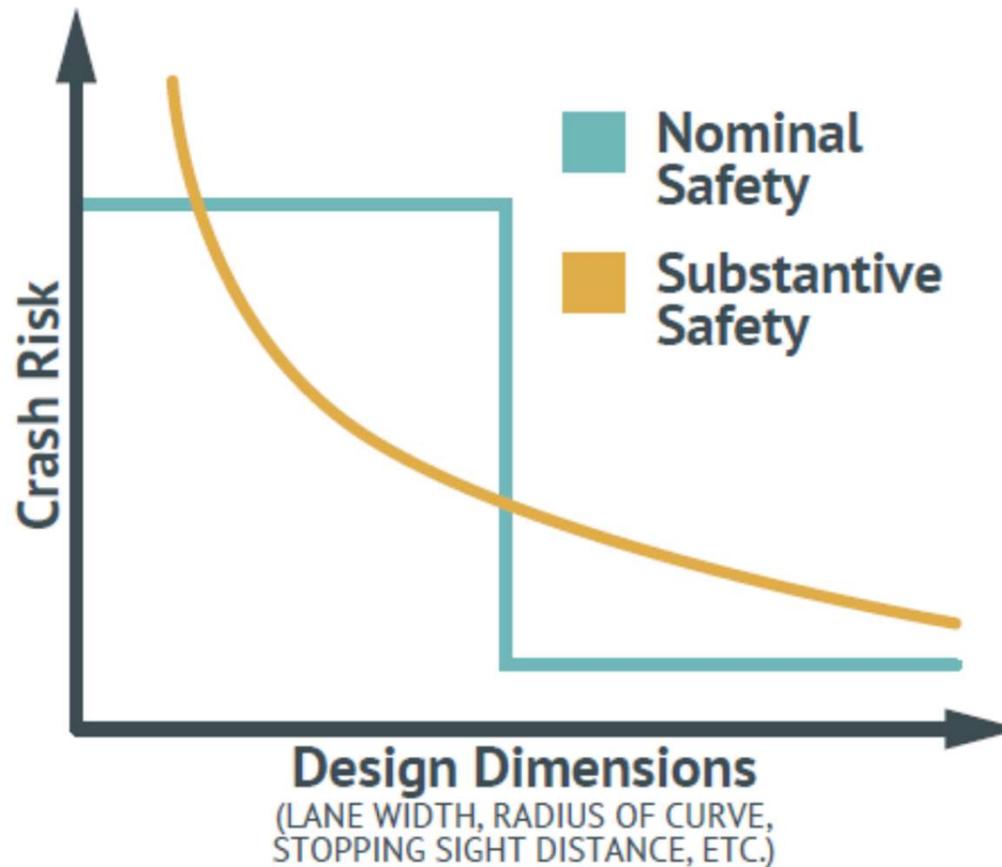
A Road Safety Audit aims to answer the following questions:

- What elements of the road may present a safety concern: to what extent, to which road users, and under what circumstances?
- What opportunities exist to eliminate or mitigate the identified safety concerns?

What are you looking for in a RSA?



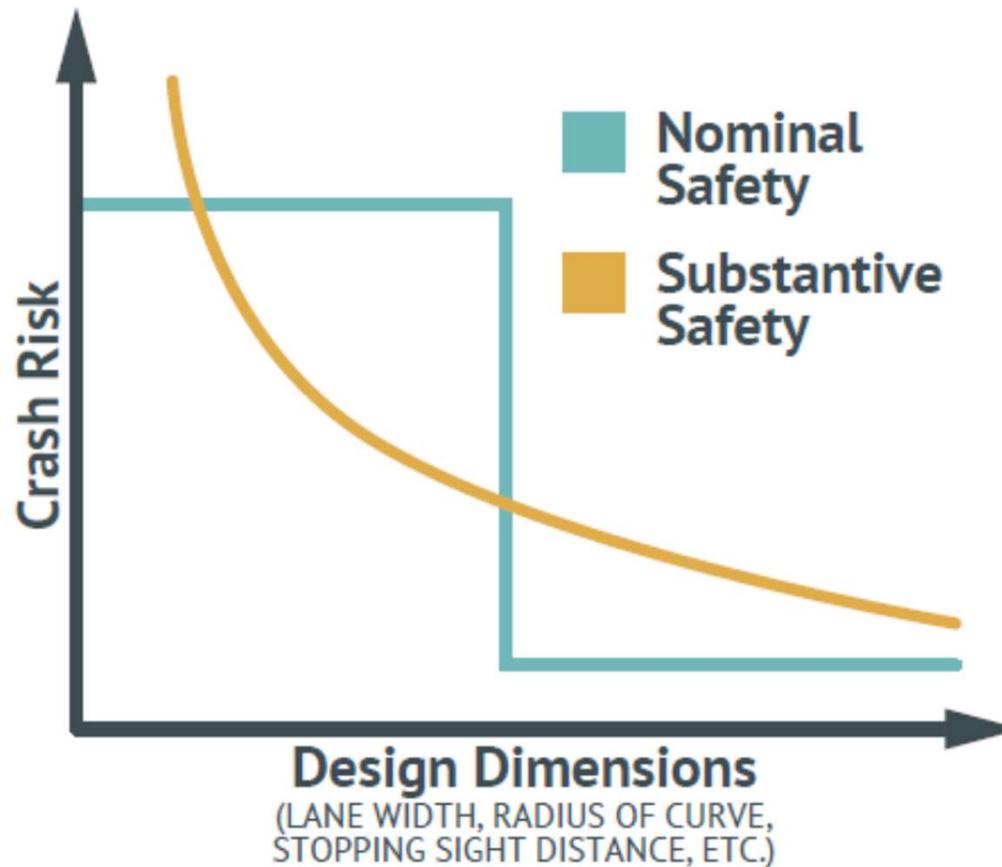
Nominal Safety vs Substantive Safety:



Consider this scenario:

If a roadway segment has a 30' clear zone requirement, is a tree that is 29' 11" from the edge of the travel way really any safer than if that tree was 30' 1" from the travel way?

Nominal Safety vs Substantive Safety:



What types of projects may benefit from a RSA?

- An intersection or road segment that does not meet current design standards (nominal safety issues) and also has a poor record of safety performance (substantive safety issues) should be considered a high-priority candidate for RSA as the potential for safety improvement, and the likelihood of its achievement, is also high.

What types of projects may benefit from a RSA?

- An intersection or road segment that meets current design standards (no nominal safety issues) but has a poor record of safety performance (substantive safety issues) should also be considered as a priority candidate for RSA as the potential for safety improvement, and the likelihood of its achievement, is significant.

What types of projects may benefit from a RSA?

- An intersection or road segment that does not meet current design standards (nominal safety issues) but has a satisfactory record of safety performance (no substantive safety issues), should be considered as a lower priority candidate for a RSA, as the potential for safety improvement, and the likelihood of its achievement, is low to moderate.

Traditional Safety Review vs RSA

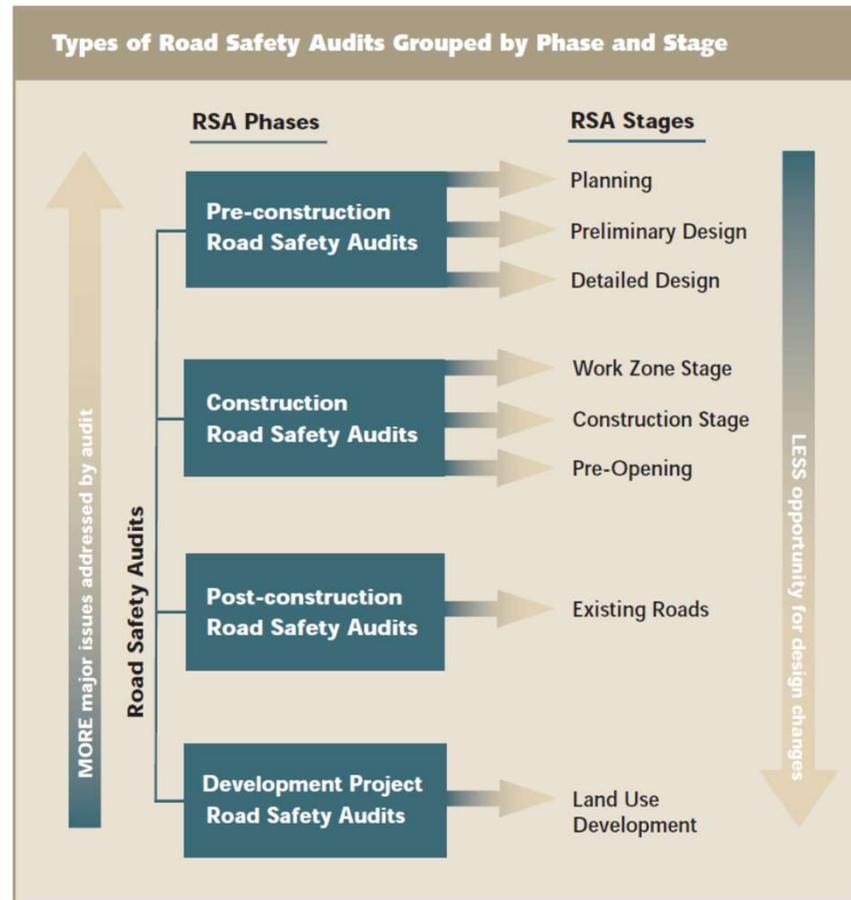
Traditional Road Safety Review

- reactive
- in-house team
- no field review
- standards compliance

Road Safety Audit

- proactive
- independent team
- field reviews
- Comprehensive
- includes human factors

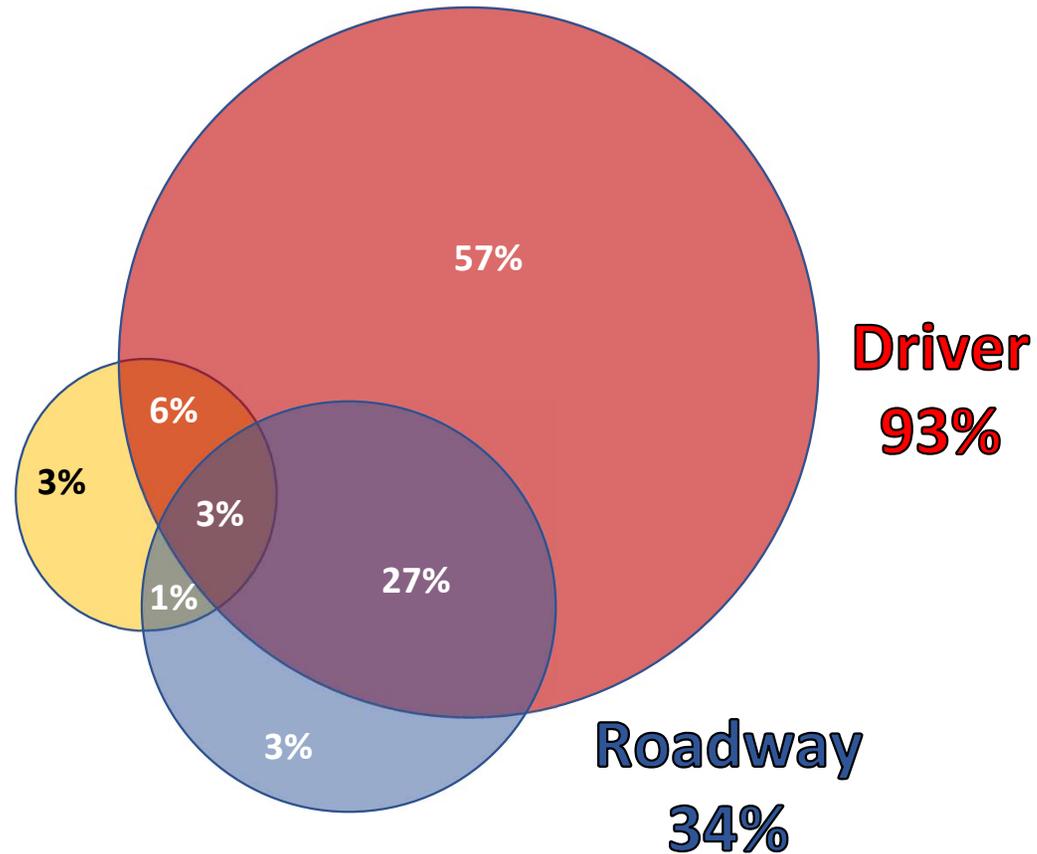
When can we do a Road Safety Audit?



Why do we need RSAs?

TYPICAL REPORTED
CRASH CAUSES:

Vehicle
13%



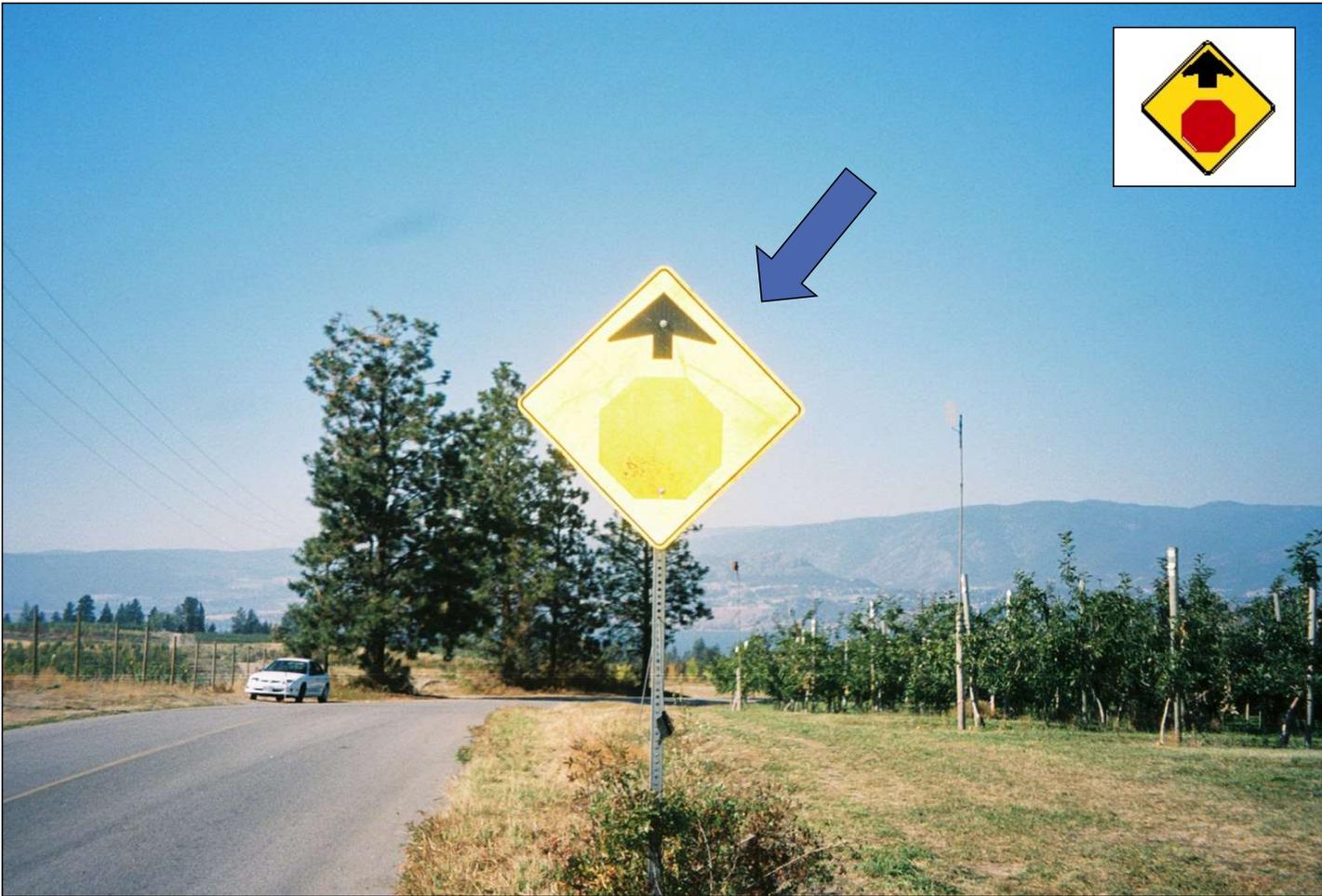
Why do we need RSAs?

- 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.

Examples...

In the following photos, what engineering improvements could improve the road environment or reduce the crash risk (frequency or severity) resulting from driver error?











Why do we need RSAs?

There are many competing interests at play in road projects:

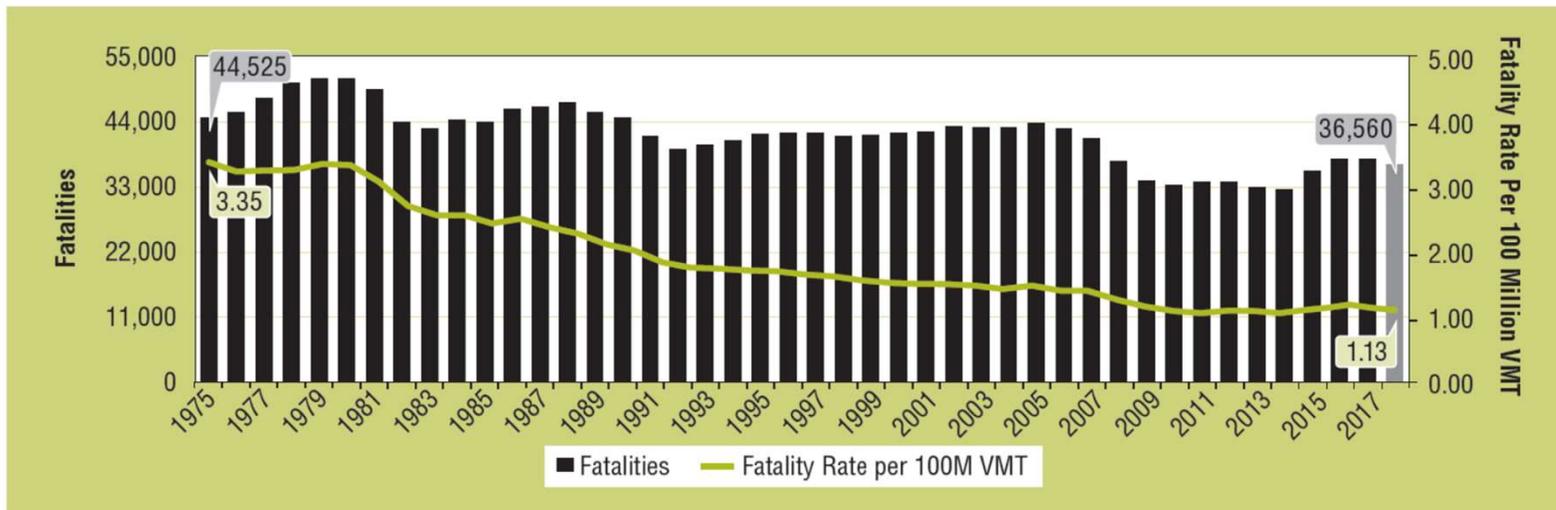
- cost
- right of way
- environment
- topographic and geotechnical conditions
- socio-economic issues
- capacity / efficiency
- politics
- safety

Why do we need RSAs?

- 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”.

Fatalities and Fatality Rate:

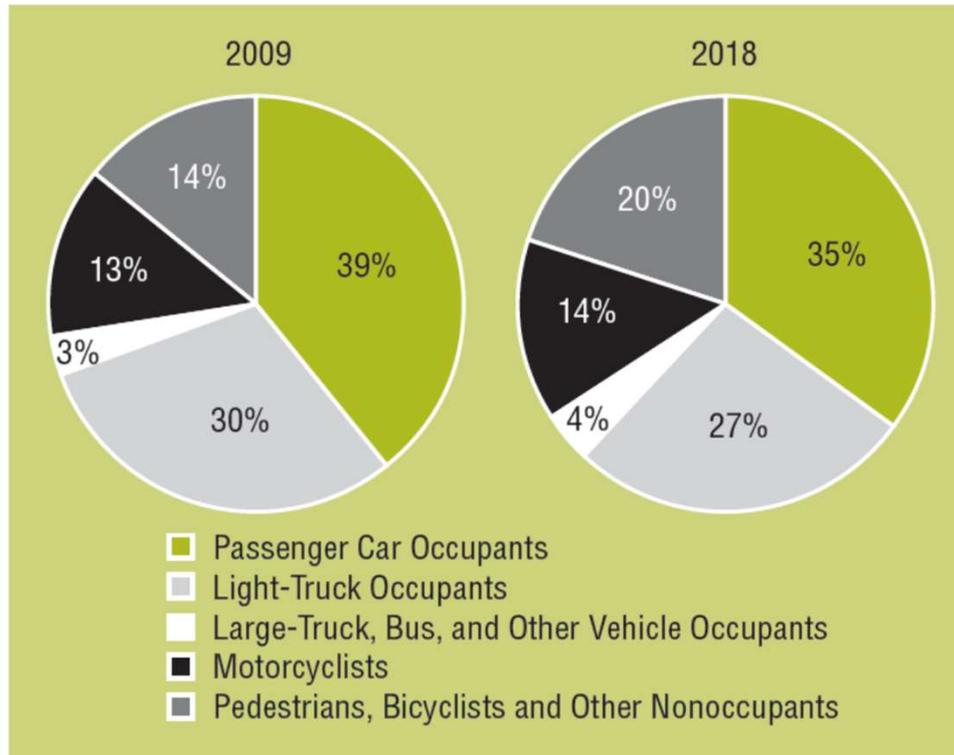
Fatalities and Fatality Rate per 100 Million VMT, by Year, 1975-2018



Sources: FARS 1975-2017 Final File, 2018 ARF; 1975-2017 VMT – Federal Highway Administration’s (FHWA) Annual Highway Statistics; 2018 VMT – FHWA’s June 2019 TVT

Fatality Composition:

Fatality Composition, 2009 and 2018



Source: FARS 2009 Final File, 2018 ARF

Note: Sum of individual slices may not add up to 100 percent due to rounding.

2018 Florida Crashes

- 403,626 reported crashes
- 3,135 fatalities
- 255,353 injuries
- 720 pedestrians killed
- 160 bicyclists killed
- 531 motorcyclists killed

The Problem:

- Increase in:
 - Drivers
 - Vehicles
 - Miles
 - Congestion
- Competition for resources
 - Budget
 - Staffing

The Real Problem:

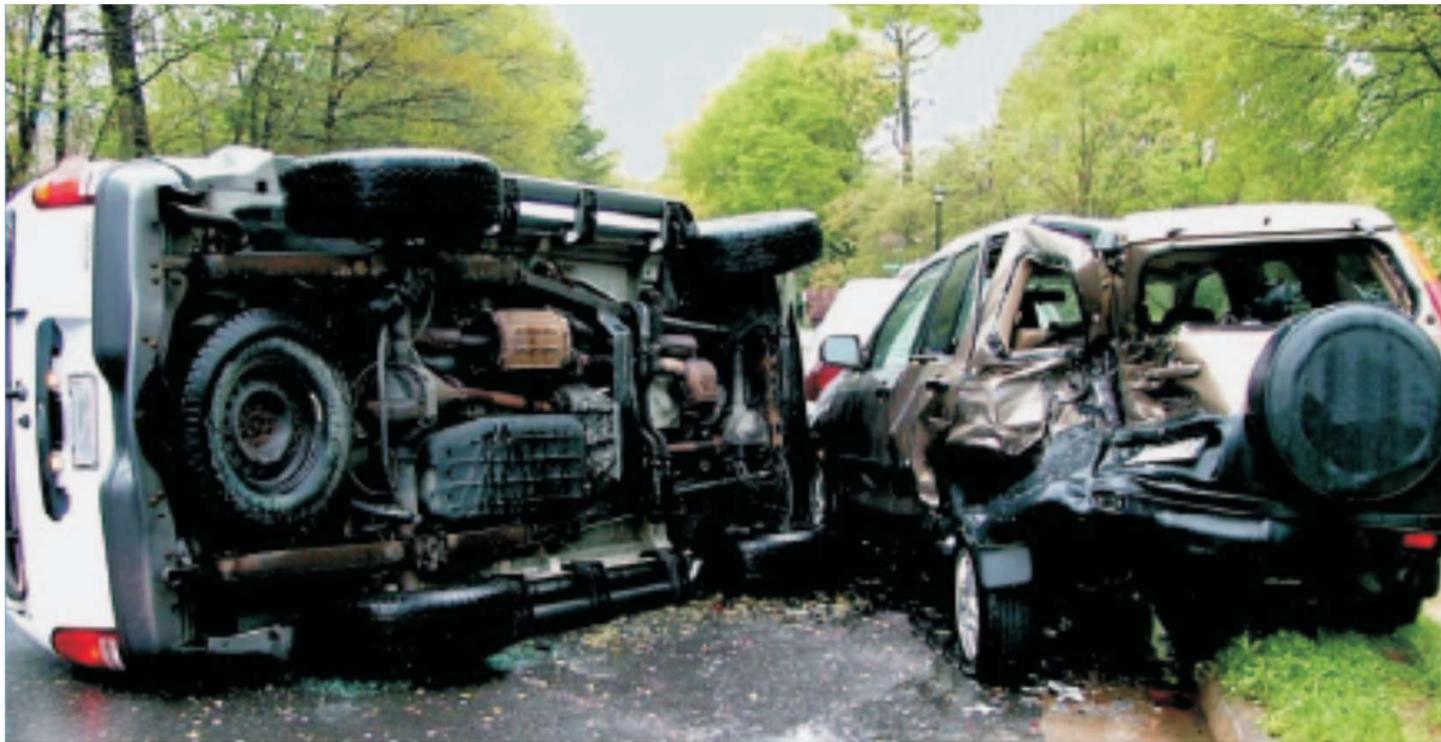
Out of every 100 children born this year...

**One will die violently
in a highway crash
during his/her lifetime.**



**70 will be injured in a crash
during their lifetimes...**

Do we need to do something different?



Questions?



Road Safety Audits

RSA Procedures

Steps in the Road Safety Audit Process

Road Safety Audit Process: Typical RSA Steps Include:

- Step 1:** Identify project or road in-service to be audited.
- Step 2:** Select RSA team.
- Step 3:** Conduct a pre-audit meeting to review project information.
- Step 4:** Perform field observations under various conditions.
- Step 5:** Conduct audit analysis and prepare report of findings.
- Step 6:** Present audit findings to Project Owner/Design Team.
- Step 7:** Project Owner/Design Team prepares formal response.
- Step 8:** Incorporate findings into the project when appropriate.

Step 1: Identify project or road for audit

As a result of this step, the project or existing road to be audited is determined and the parameters of the RSA are set.

Step 2: Select RSA Team

As a result of this step, an independent, qualified, and multidisciplinary team of experts suitable for the specific RSA stage is selected.

Step 3: Conduct Pre-audit Meeting

The meeting brings together the project owner, the design team and the audit team to discuss the context and scope of the RSA and review all project information that is available.

Step 4: Perform Field Reviews

The objective of the field review is to gain insight into the project or road, and to further verify or identify areas of safety concern. It is important to see the road from the perspective of the users.

Step 5: Conduct Audit Analysis

The purpose of this step is to identify and prioritize the safety issues and to develop the suggested countermeasures.

These are summarized in a concise RSA report.

Step 6: Present Audit Findings to Owner

The RSA Team orally presents the key findings of the RSA to the owner and/or design team in order to facilitate a clear understanding of the RSA findings.

Step 7: Prepare Formal Response

The owner then prepares a formal response to the RSA issues. Each issue is addressed and any suggestion that will not be implemented will be explained.

Step 8: Incorporate Findings into Project

This final step ensures that the corrective measures that are outlined in the RSA report are completed as described and in the time frame documented.

Post-Construction

Good Candidate Projects for RSAs:

- high-collision sites
- high-profile (political or public interest)
- sites at which traffic characteristics have changed



Pre-Construction

Good Candidate Projects for RSAs:

- safety-oriented
- high-profile (political or public interest)
- complex design



RSA Team

- independent
- experienced
- interdisciplinary



Interdisciplinary RSA Team Skills:

Core skill set (every assessment):

- traffic operations
- geometric design
- road safety



Interdisciplinary RSA Team Skills:

Supplementary skills (some audits):

- positive guidance/human factors
- specialist skills (such as bridges or signing)
- enforcement
- maintenance



RSA Team: Composition and Size



3-member audit team

- local agency staff
- exchange staff from another local agency
- consultants
- combination of above

Step 3: Pre-Audit Meeting



Photo: Craig Allred (FHWA)

- introductions
- exchange of information
- RSA process
- schedule

Step 3: Pre-Audit Meeting (cont'd)

Exchange of Information:

- collision history
- traffic volumes
- aerial photographs
- design drawings
- background reports
- design criteria



Photo: Craig Allred (FHWA)

Step 3: Pre-Audit Meeting (cont'd)

- Assessment sites, including constraints, challenges, or known issues

Road Agency

- RSA process

Audit Team

- schedule

All

Step 4: Field Review

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



Step 4: Field Review (cont'd)

- Review crash data (if available).
- Put the assessment team in one vehicle.
- Designate a driver and secretary.



Photo: Craig Allred (FHWA)

Step 4: Field Review (cont'd)

- drawing and/or aerial photographs of site
- camera (still and video)
- measuring wheel and stopwatch (optional)
- high-visibility vests (required)



Step 4: Field Review (cont'd)

- Drive the assessment site many times (day and night.)
- Drive all approaches and make all turns.



blind curve

Step 4: Field Review (cont'd)

Look for:

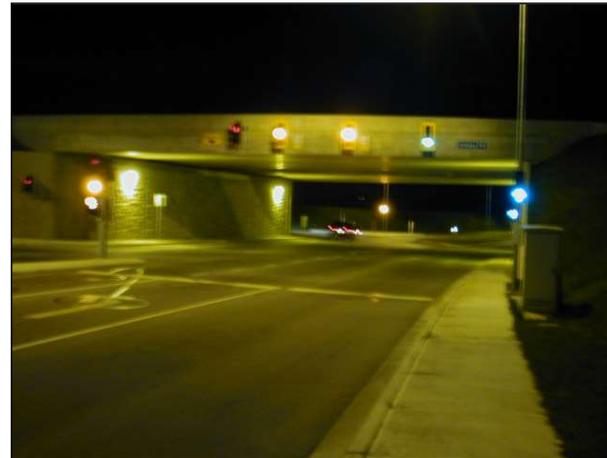
- sight distance obstructions
- roadside hazards
- driveway issues



Step 4: Field Review (cont'd)

Observe conditions during:

- peak and off-peak traffic periods
- dry and wet weather conditions
- day and night conditions



Step 4: Field Review (cont'd)



Walk the assessment site.



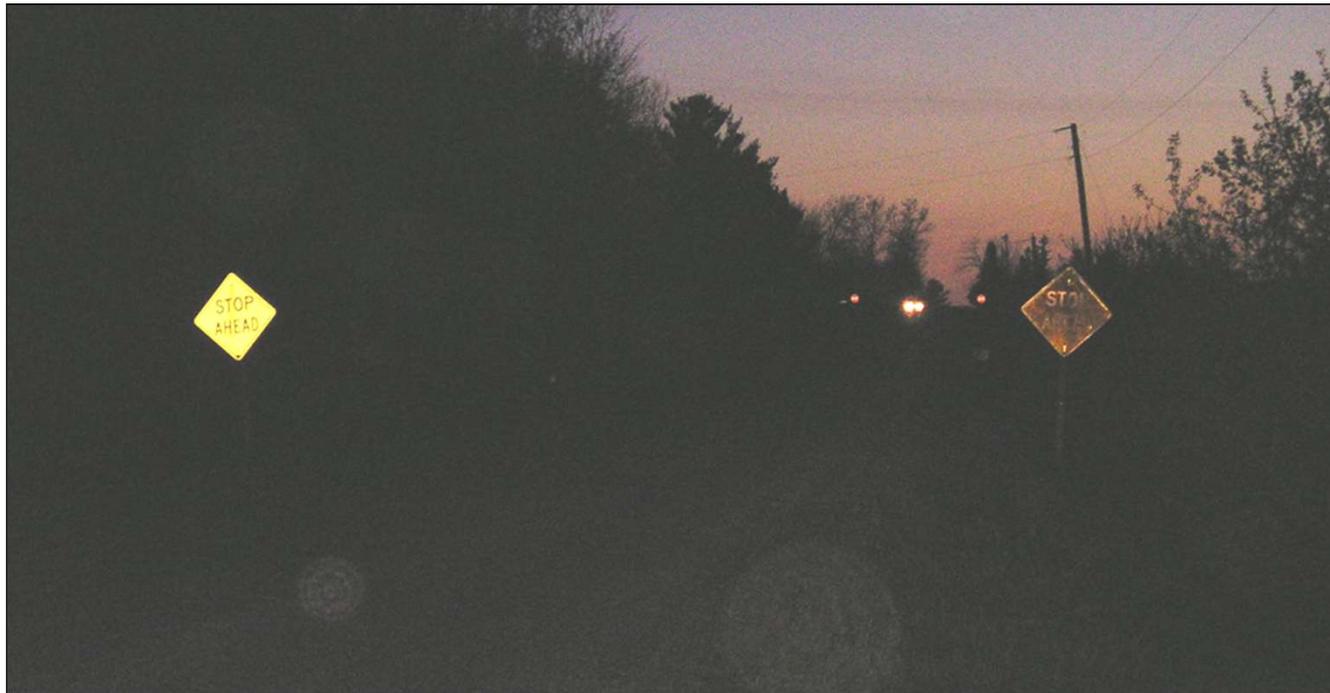
Step 4: Field Review (cont'd)

Checklists and prompt lists:

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



Example:



Example:



Example:



Example:



Step 5: RSA Analysis

- workshop setting
- review information
- systematically review information
- identify, prioritize, and mitigate safety issues



Step 6: Presentation of Findings:

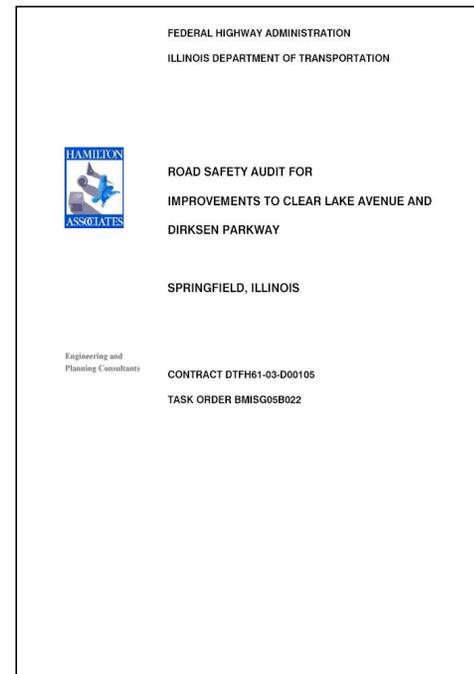
- RSA team, local road agency
- discuss preliminary findings and possible solutions
- use results to write RSA report



Photo: Craig Allred (FHWA)

Step 6: Presentation of Findings (cont'd)

- documents the results of the RSA
- identifies and prioritizes safety issues
- may include suggestions for improvements



Step 6: Presentation of Findings (cont'd)

RSA report includes:

- background
- assessment team, materials, and process
- site observations
- RSA findings

Step 6: Presentation of Findings (cont'd)

Sample Road Safety Audit
Issue 1: Closely spaced Sample Street Intersections

Safety Issues: During peak periods, left-turn queues may extend into or past adjacent closely spaced intersections on Sample Street.

Safety Issue Description:
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.

Expected Crash Types: intersection (left-turn, rear-end, and crossing)
Expected Frequency: occasional
Expected Severity: medium
Risk Rating: D (moderate-high risk level)

Suggestions: If micro-simulation modelling 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.



safety issue

description

prioritization
(optional)

suggestions
(optional)

Using Relative Risk to Prioritize Safety Issues

RISK CATEGORY		SEVERITY			
		Negli- gible	Low	Med	High
Crash Frequency Category	Frequent	C	D	E	F
	Occasional	B	C	D	E
	Infrequent	A	B	C	D
	Rare	A	A	B	C

Step 7: Response Letter

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

Example

The RSA suggests realignment of a skewed intersection

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.”

Step 7: Formal Response Letter

- point by point response to Road Safety Audit findings
- actions to be taken
- reason for taking no action

Step 8: Implementation of Improvements

- Improvements suggested in the RSA Report are then implemented in the field
- Some may be done very quickly by maintenance forces
- Some may require design, bidding and construction contracts
- Some may take longer!



Questions?



Road Safety Audits

Examples

Example 1



Example 1



Example 2



Example 3



Example 3



Example 4



Photo: Craig Allred (FHWA)

Example 4



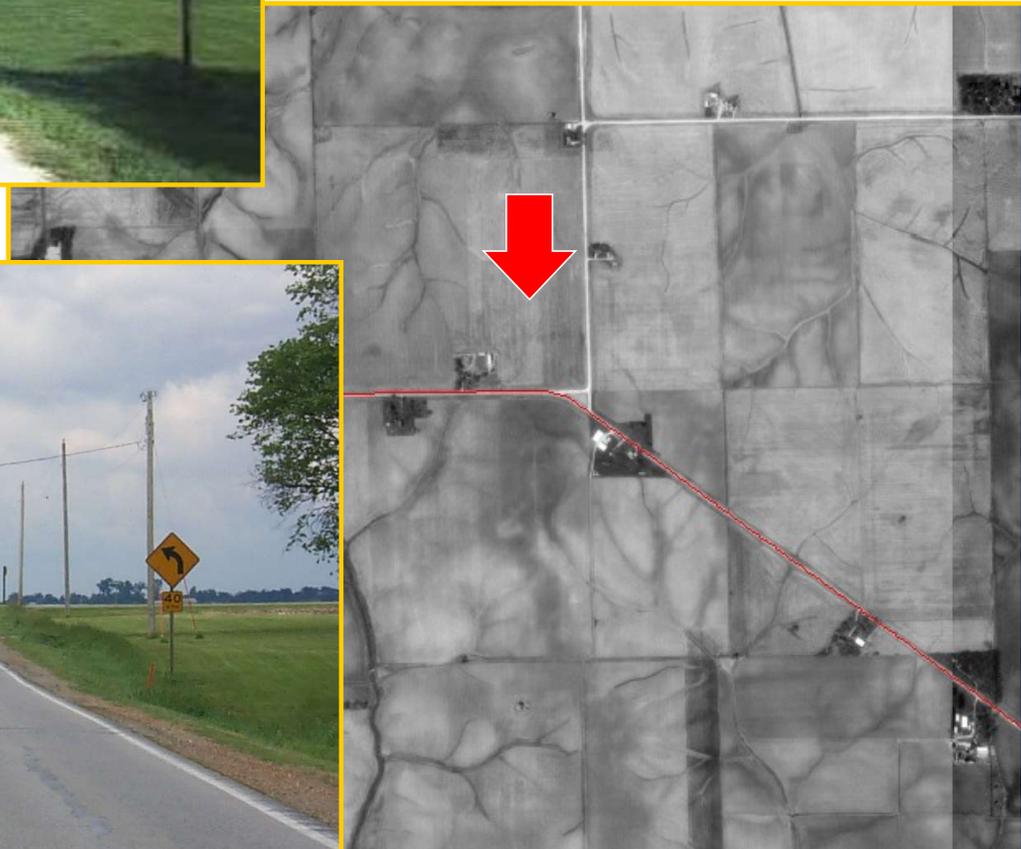
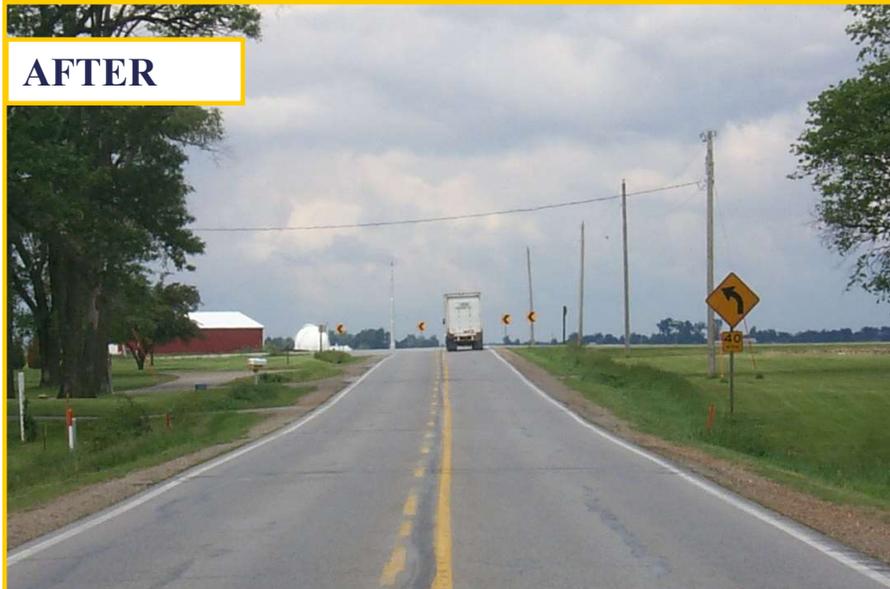
Photos: Craig Allred (FHWA)

BEFORE

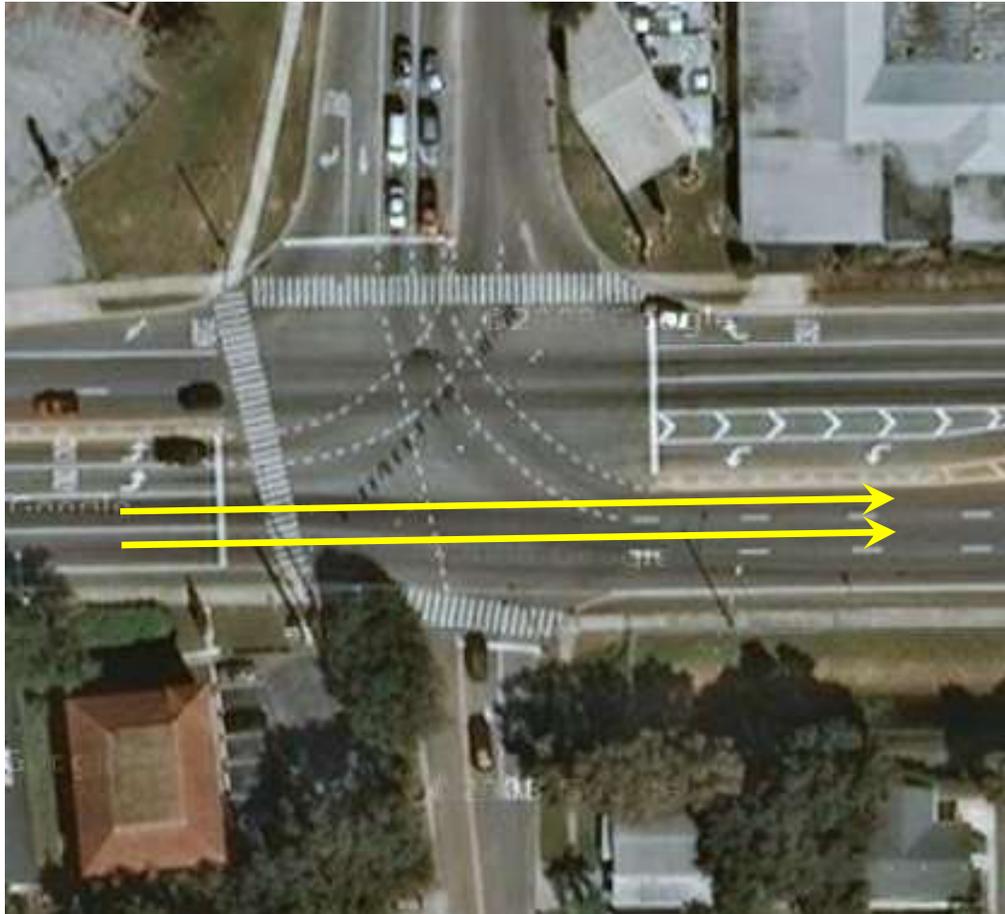


High Crash Curve: Low Cost Mitigation

AFTER



Countermeasure: Lane Delineation



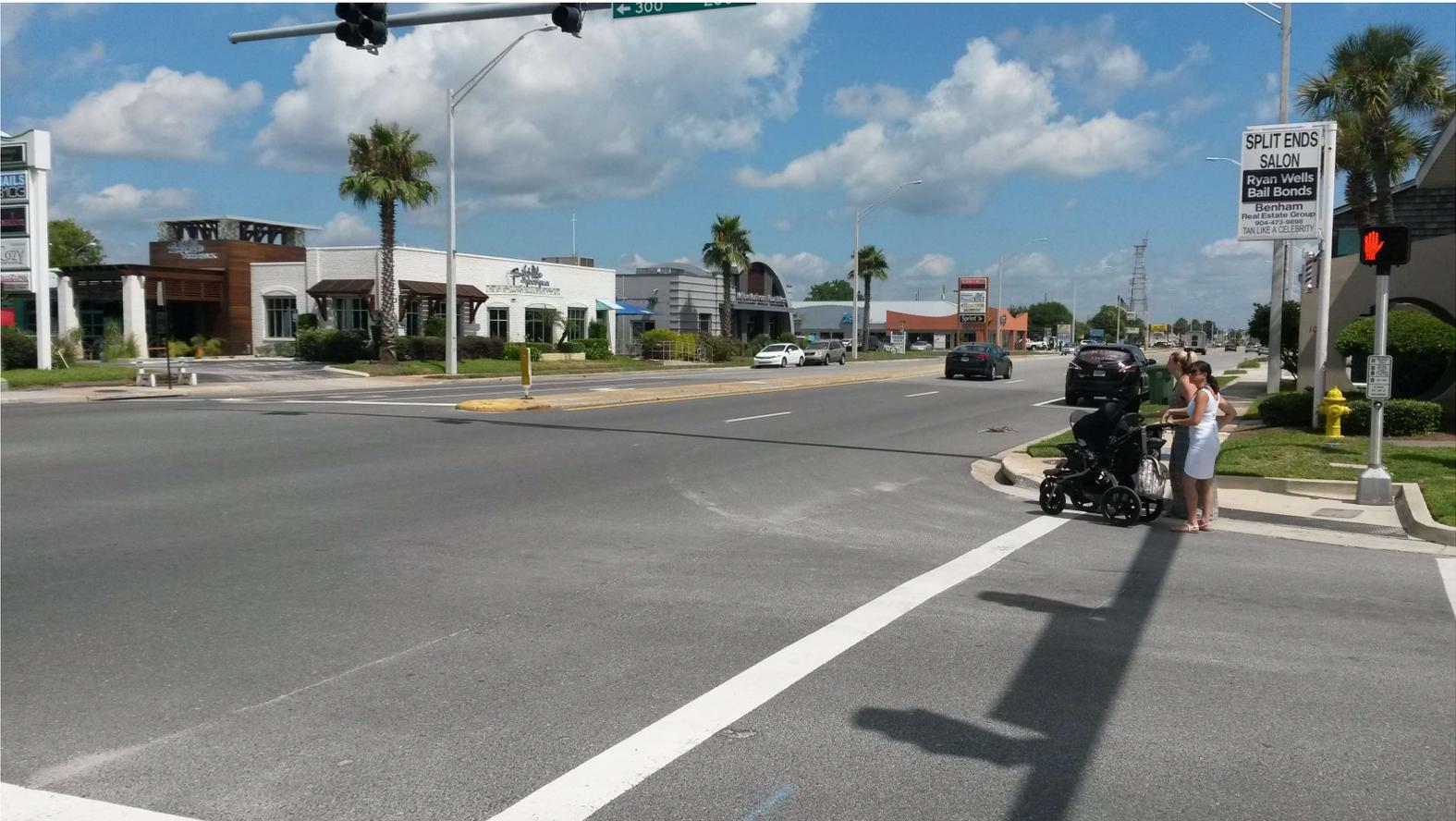
Countermeasure: Lane Delineation



Countermeasure: Lane Delineation



Challenge: Peds will not use crosswalks



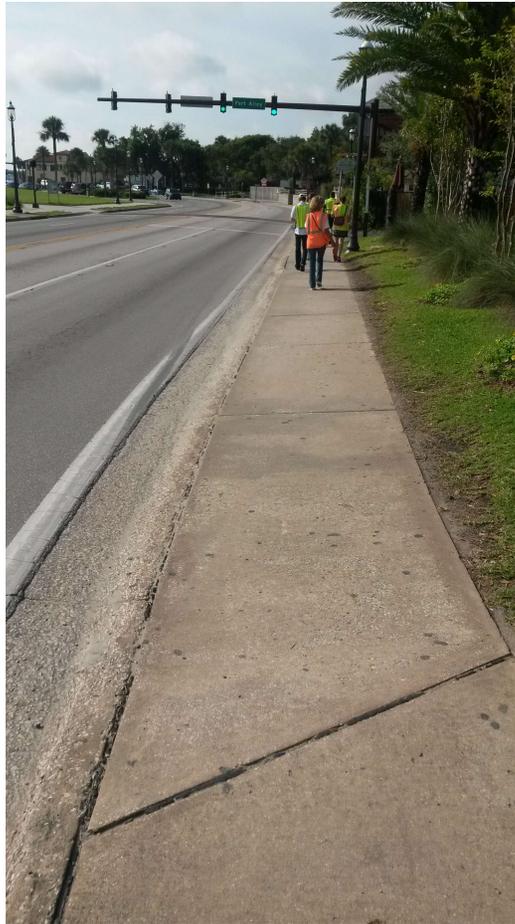
Challenge: Peds will not use crosswalks



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Challenge: Long drop curb areas



Challenge: Sealer On Asphalt Surface



Challenge: Farm Vehicles



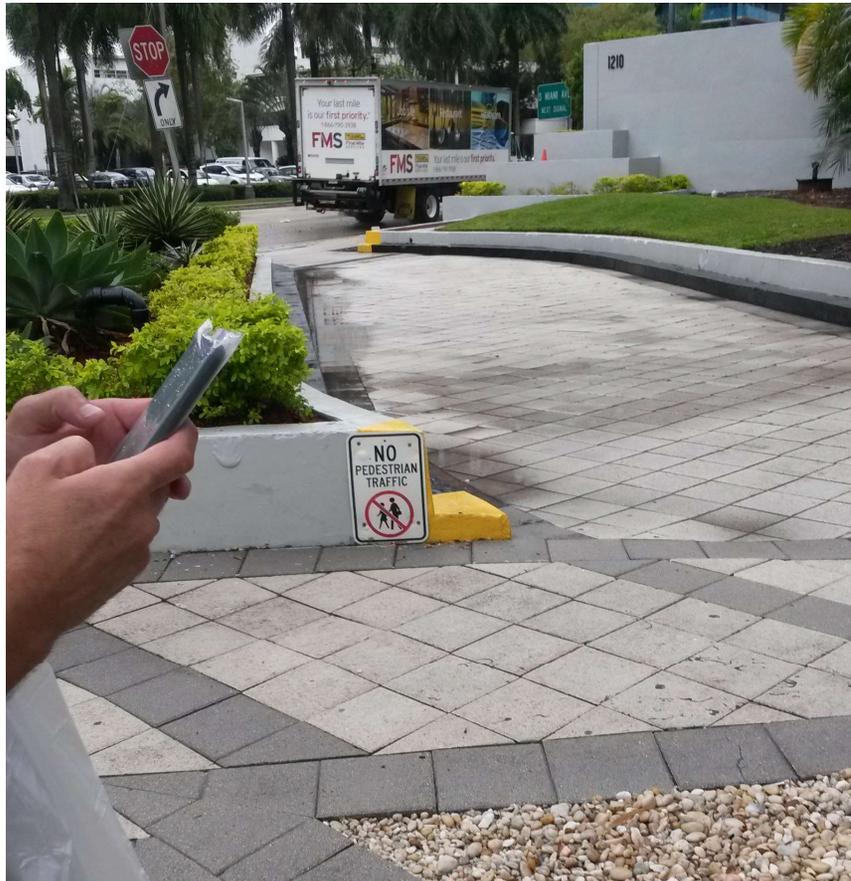
Challenge: Farm Vehicles



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



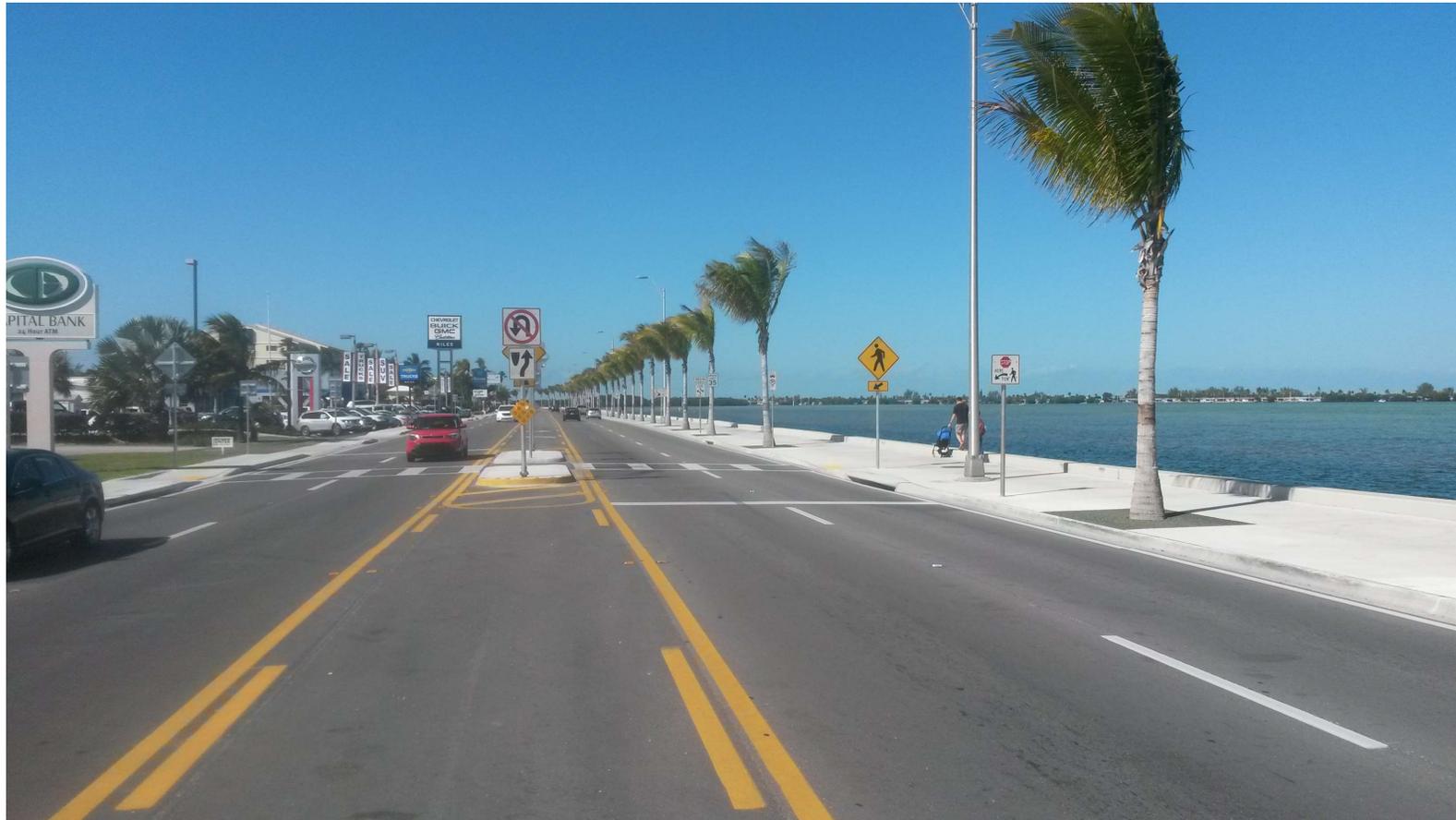
Challenge: City Design Issues



Challenge: City Design Issues



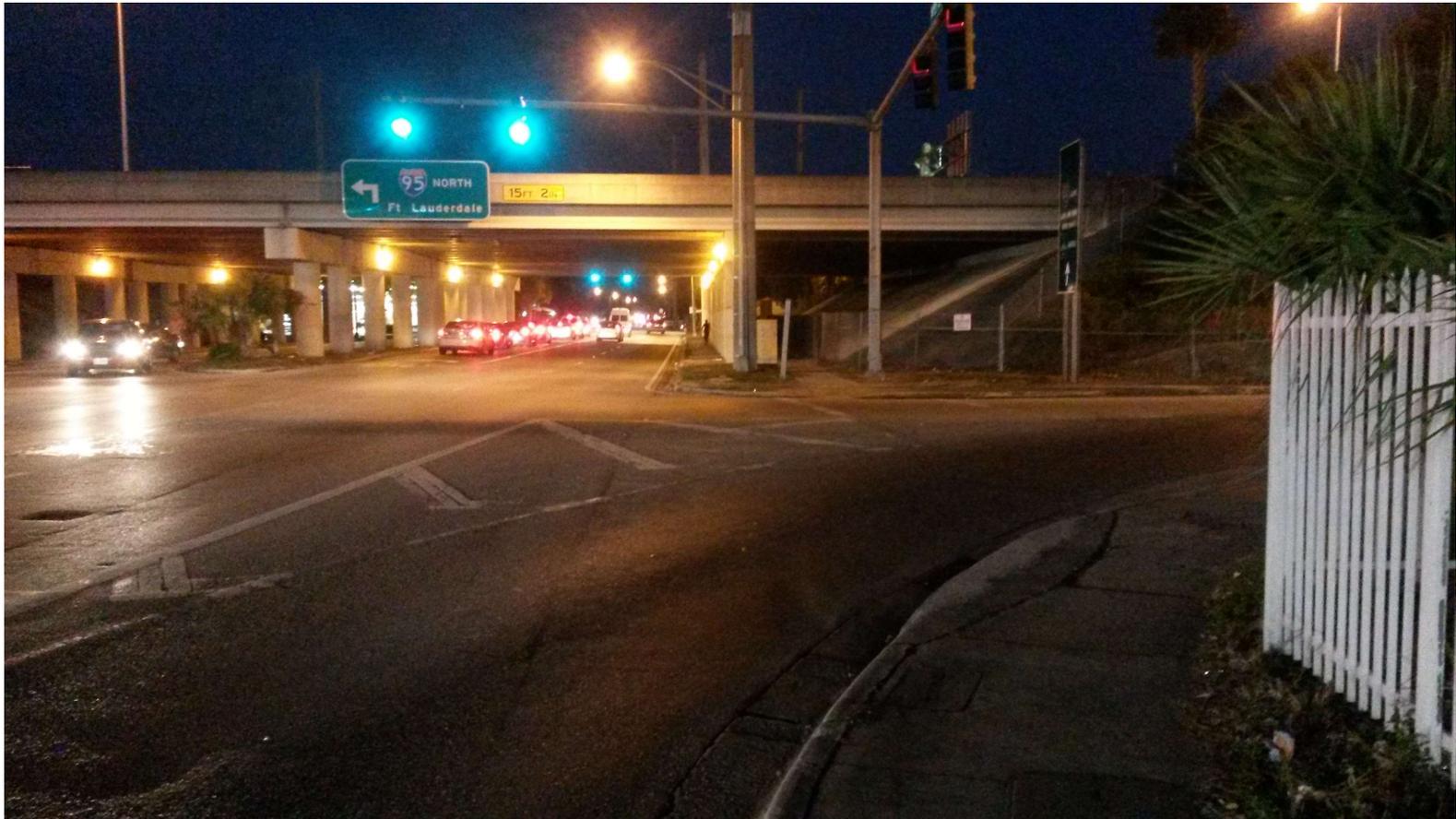
Challenge: City Design Issues



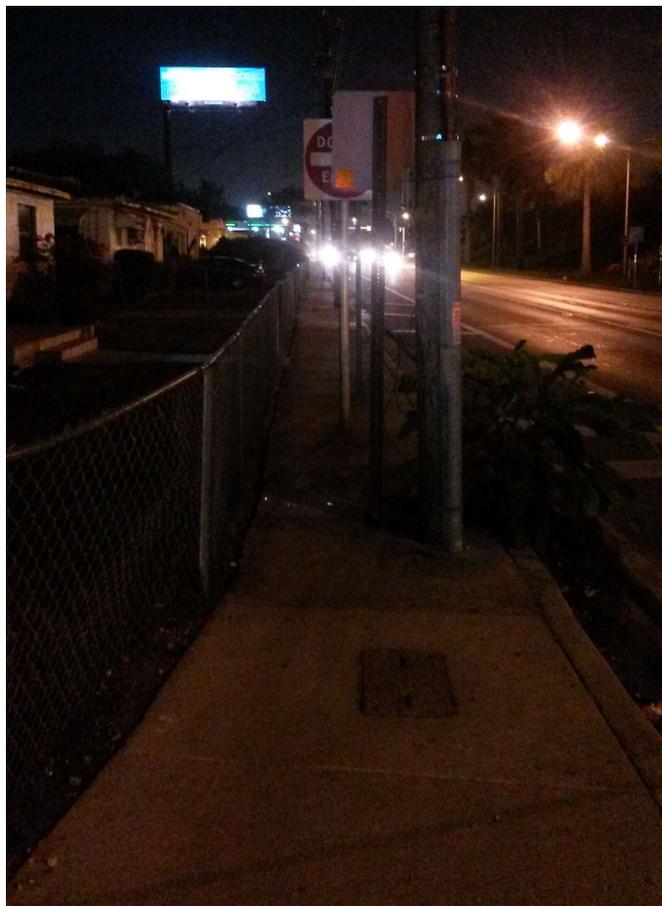
Challenge: City Design Issues



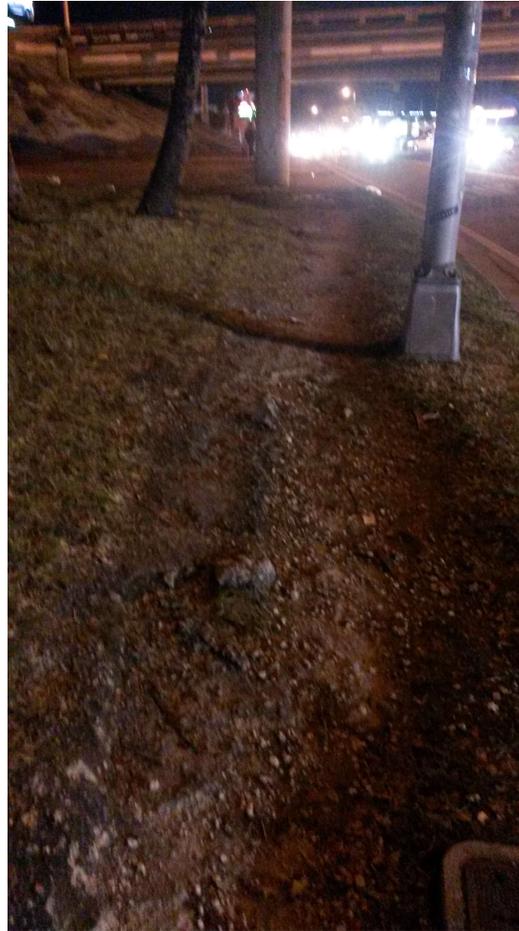
Challenge: City Design Issues



Challenge: City Design Issues



Challenge: City Design Issues



Challenge: Urban Maintenance Issues



Challenge: Urban Maintenance Issues



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



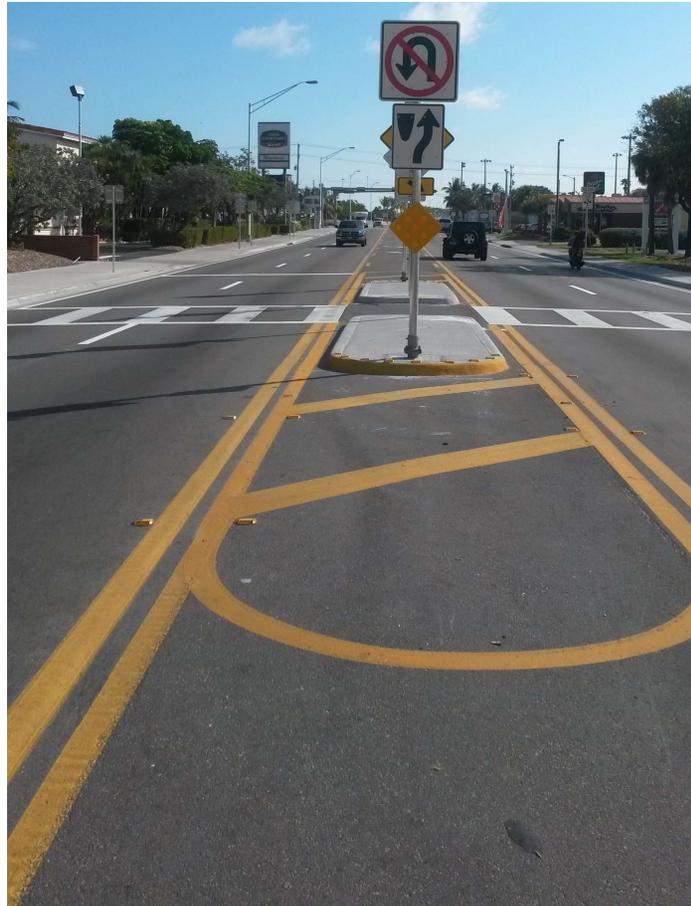
Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Get the pedestrian across



Challenge: Ped/Bike Safety



Challenge: Ped/Bike Safety



Challenge: Ped/Bike Safety



Challenge: ???





Questions?

