

Road Safety Audit Fundamentals

Adam Larsen

Federal Highway Administration

360-619-2601

November 8, 2021

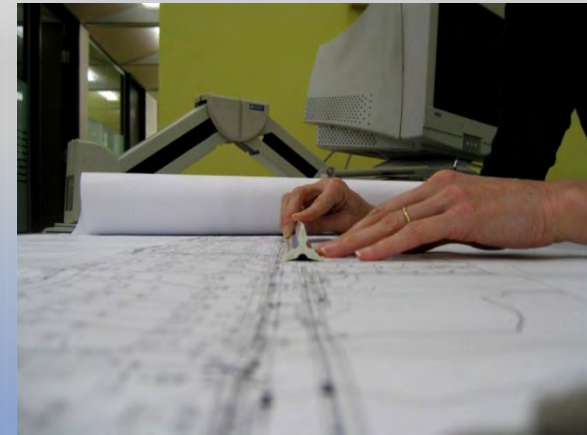


Learning Objectives

- Define Road Safety Audit
- Explain the basic RSA process, tools, and expected outcomes
- Understand how to start an RSA and implement the findings

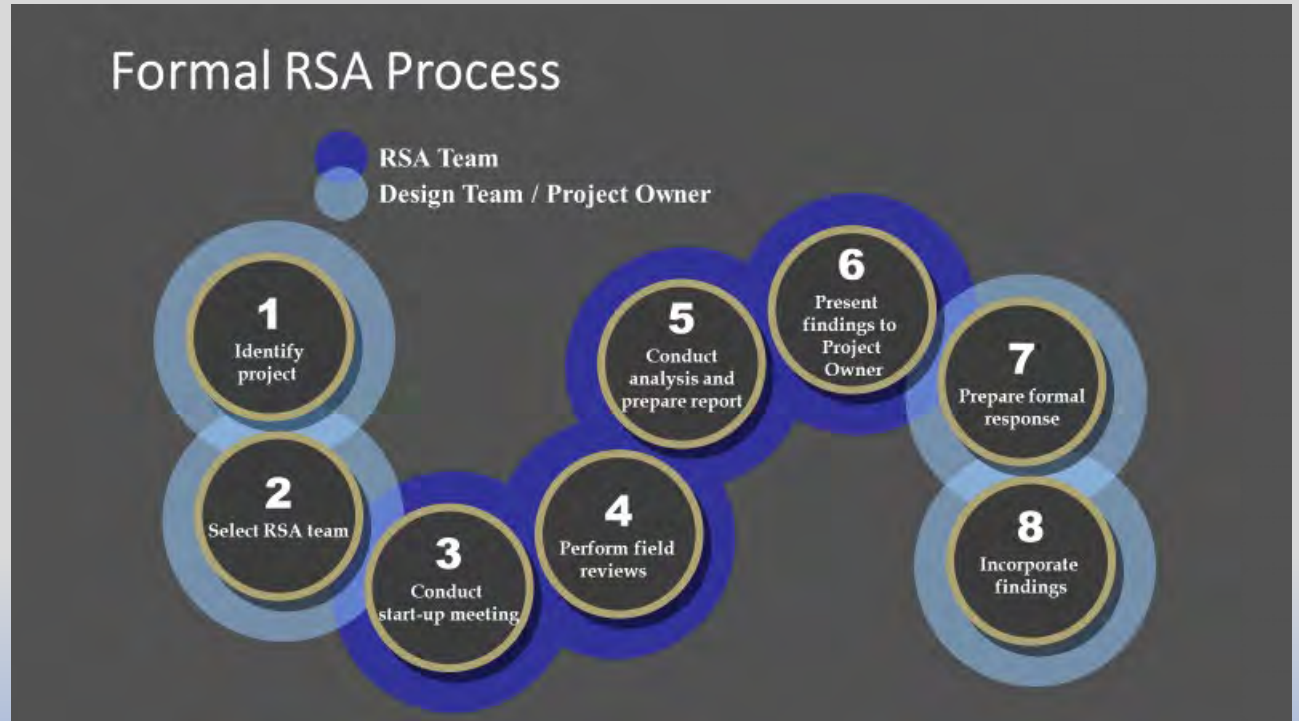
RSA Definition

A formal safety performance examination of an existing or future road or intersection by an independent, multi-disciplinary RSA team.



RSA Definition

A **formal** safety performance examination of an existing or future road or intersection by an independent, multi-disciplinary RSA team.



RSA Definition

A formal **safety**
performance
examination of an
existing or future road
or intersection by an
independent, multi-
disciplinary RSA team.

What elements of the road may present a safety issue: to what extent, to which road users, and under what circumstances?

What engineering, enforcement, and/or education solutions exist to eliminate or mitigate the identified safety issues, both in the short and long term?

RSA Definition

A formal safety
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Design stage



In-service

RSA Definition

A formal safety

performance

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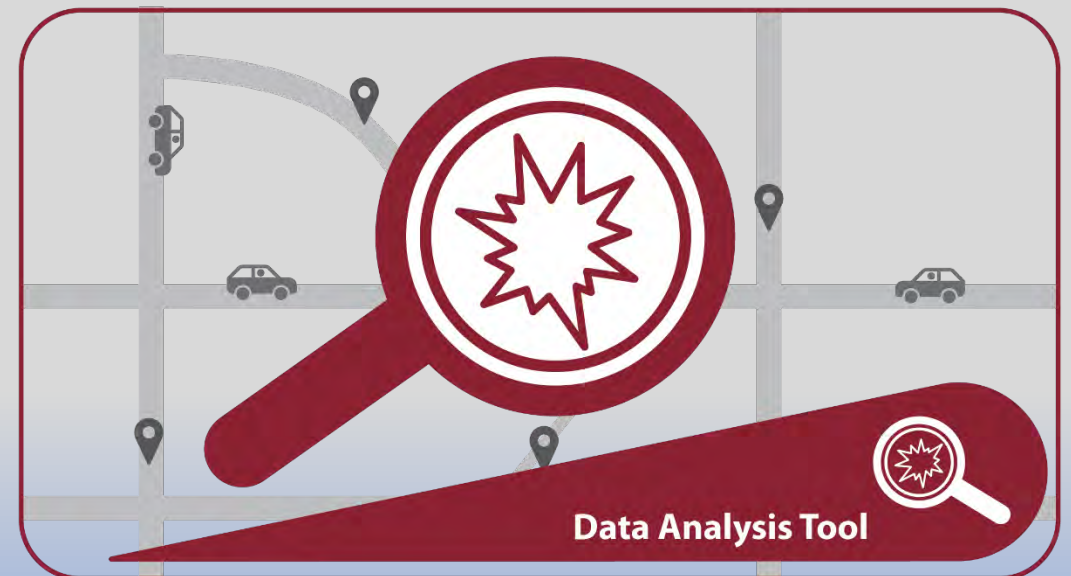
by an independent,

multi-disciplinary RSA

team.

Systemic Safety Studies and Transportation Safety Plans consider safety on the whole network.

A Road Safety Audit is focused on a road or intersection.



<https://www.tribalsafety.org/data-analysis>

RSA Definition

A formal safety performance examination of an existing or future road or intersection by an **independent,** multi-disciplinary **RSA** **team.**



Independence =
A fresh, unbiased assessment

RSA Definition

A formal safety performance examination of an existing or future road or intersection by an independent,

multi-disciplinary

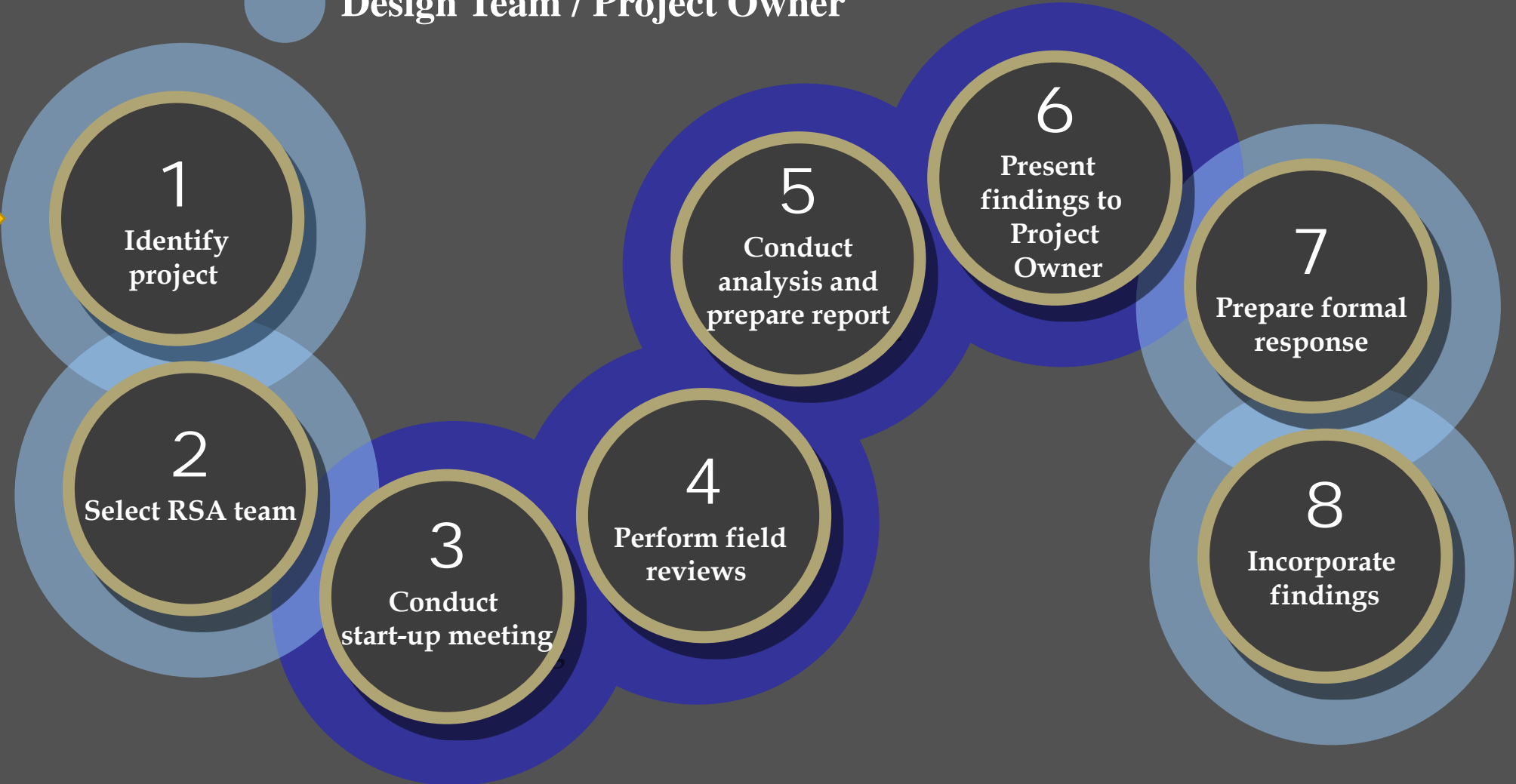
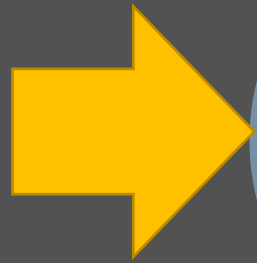
RSA team.



Multi-disciplinary:

- Design
- Operations
- Safety
- Human Factors
- Enforcement
- Maintenance
- Specialists

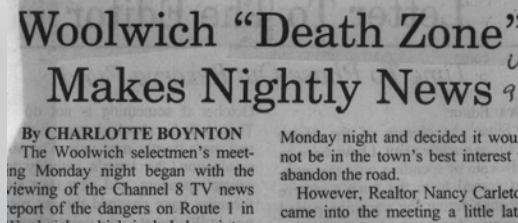
Formal RSA Process



Candidates for In-service RSAs



High-crash sites



High-profile sites



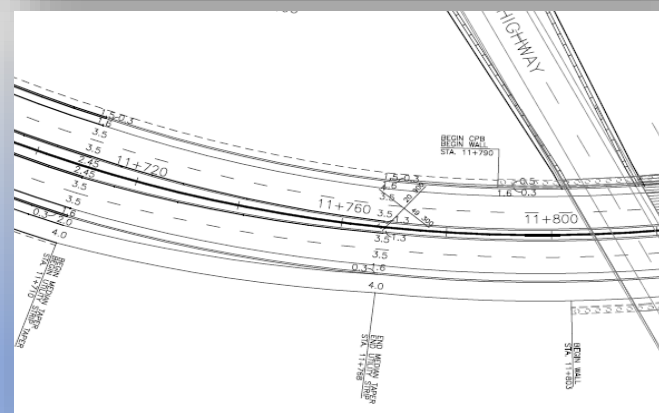
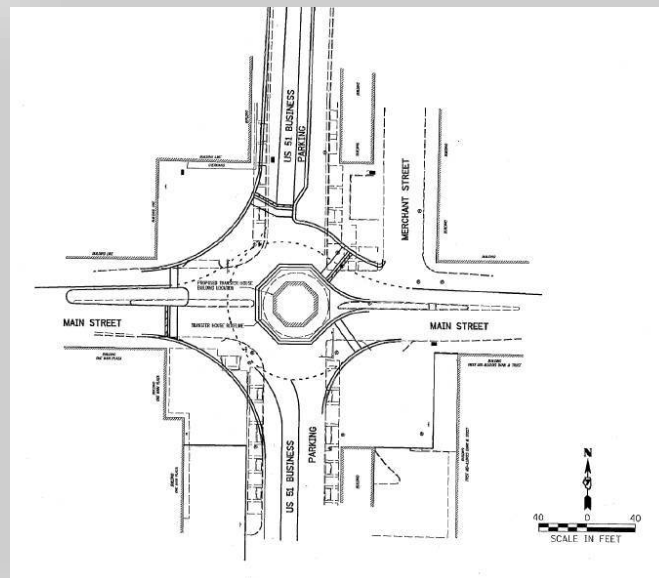
Changed traffic characteristics

Serious Crash Site



Muckleshoot Indian Tribe, WA

Candidates for Design-stage RSAs

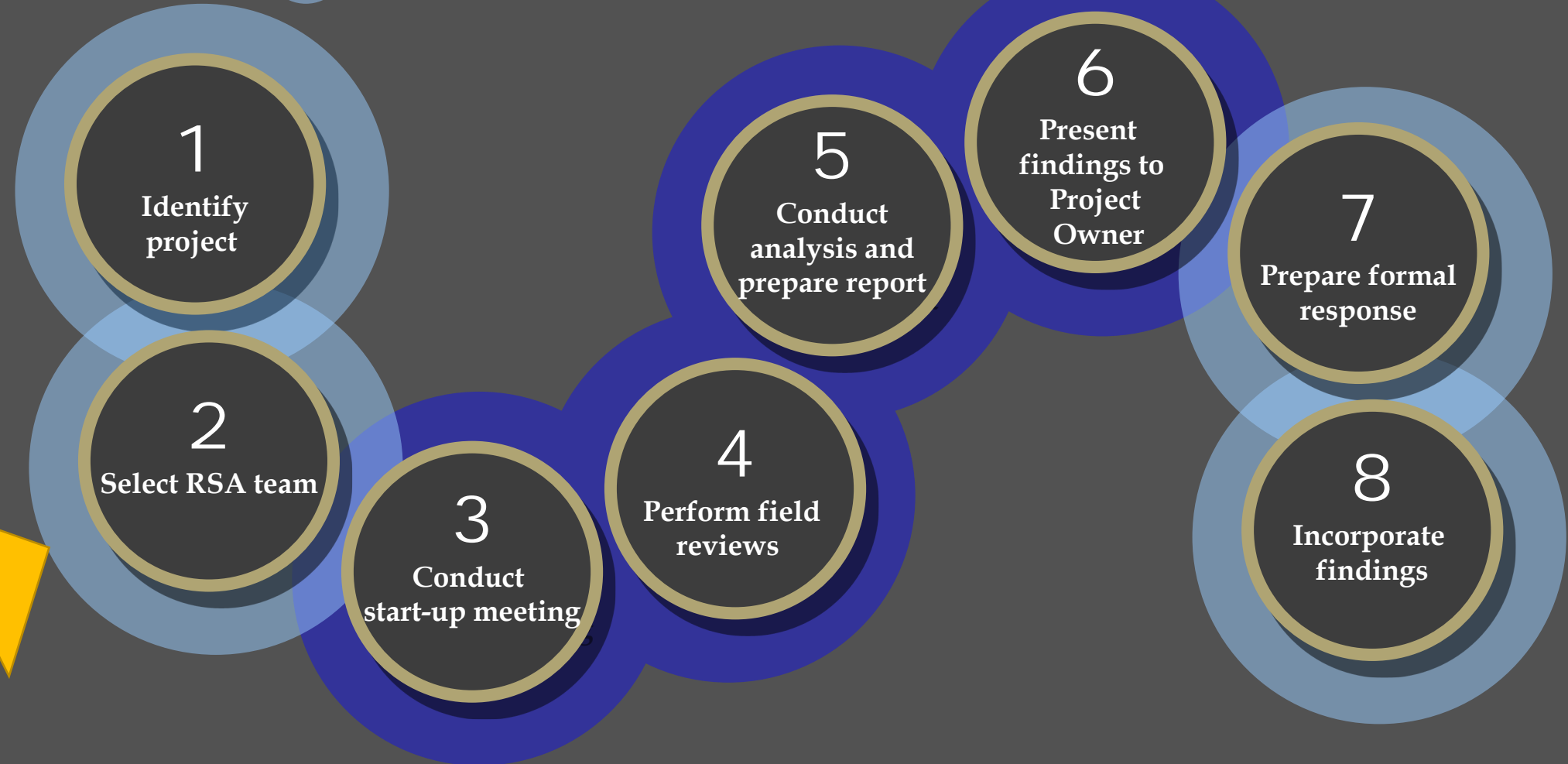


Safety-oriented

High-profile

Complex design

Formal RSA Process



Select RSA Team



- Independent
- Experienced
- Multi-disciplinary

Select the RSA Team: Core Skills

Operations



Safety



Geometrics

Select RSA Team: Supplementary Skills

- Design
- Operations
- Safety
- Human factors
- Enforcement
- Maintenance
- Specialists

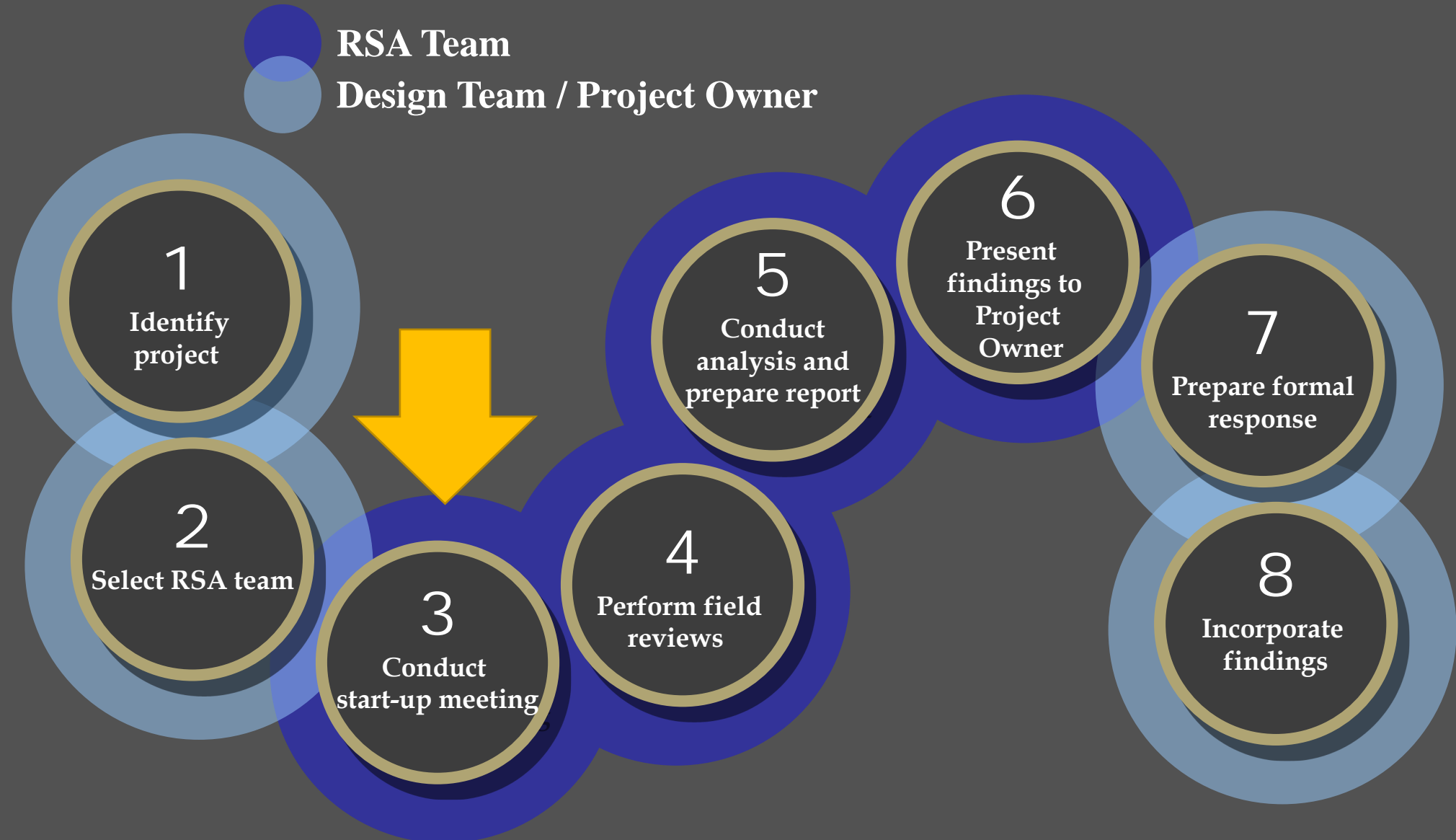




Select RSA Team: Experienced Help & Resources

- Other Tribes with RSA Experience
- State DOT Safety Office
- State Crash Data Office
- Law Enforcement and EMS agencies
- LTAP / TTAP
- FHWA

Formal RSA Process

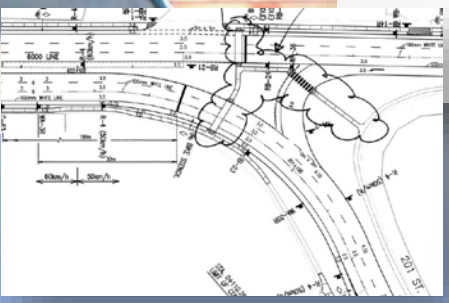
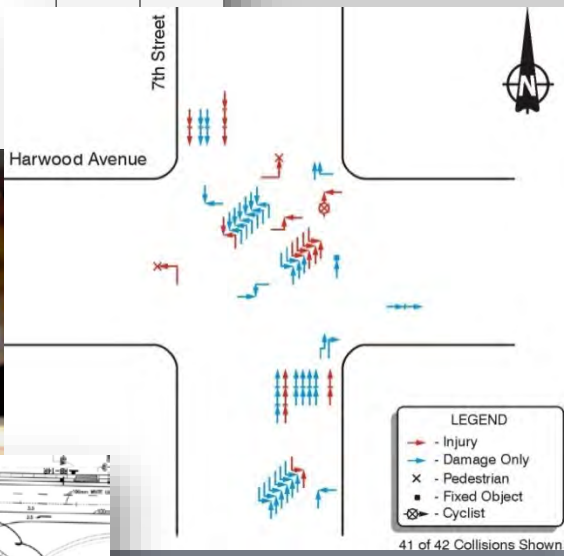
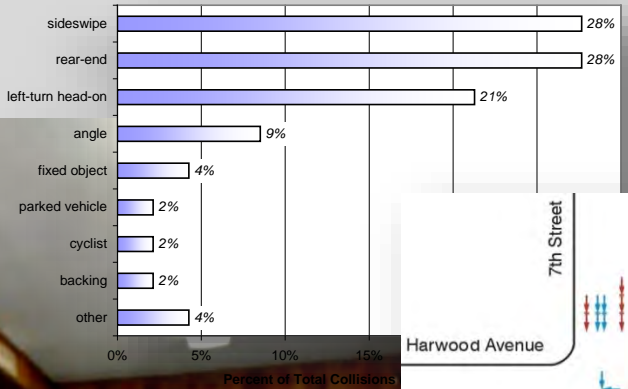
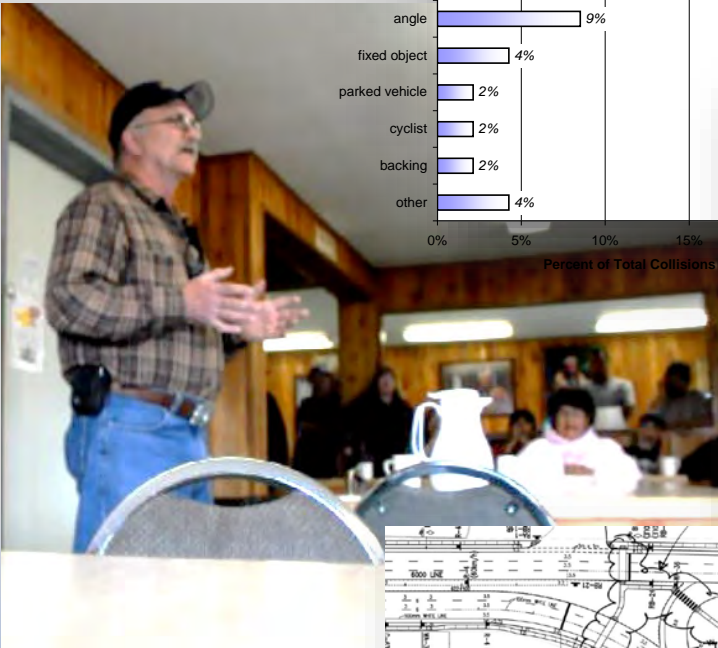


Start-up Meeting

- Identify individual roles.
- Communicate information.
- Overview of RSA process.
- Discuss project scope, opportunities, constraints.

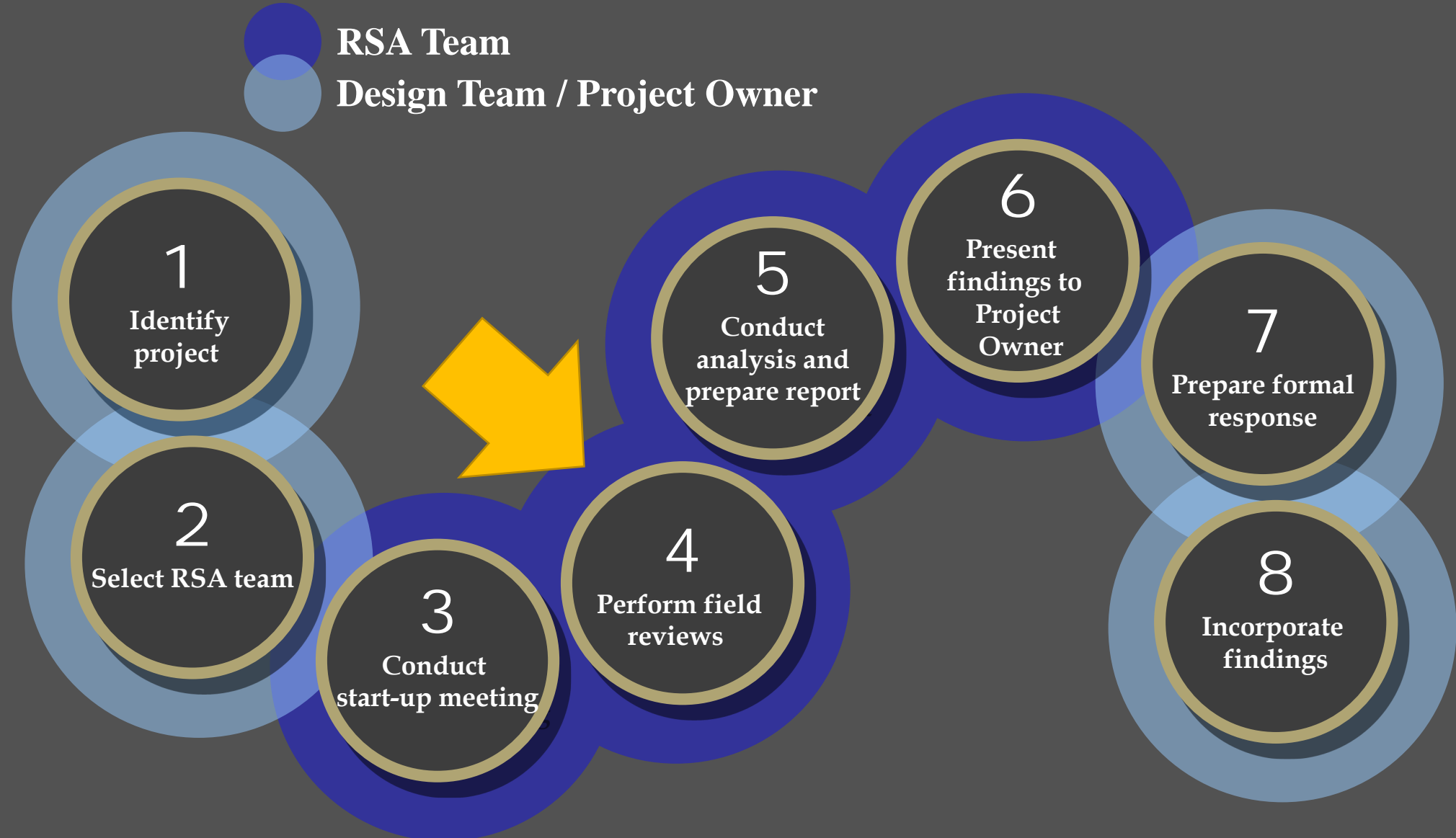


Start-up Meeting: Provide Project Information



- Crash history
- Traffic volumes
- First Responders experiences
- Aerial photos
- Design drawings
- Background reports
- Design criteria

Formal RSA Process



Perform Field Review: Experience the Site from ALL Perspectives



DRIVE the site.



WALK the site.

Field Review: RSA Team Safety Equipment



- Safety Vests
- Good footwear
- Minimize distraction
- Watch each other

Perform Field Review: Preparation for the Field Review

- Available data
- Transportation
- Secretary, photographer
- Camera
- Safety Equipment
- Prompt list (optional)

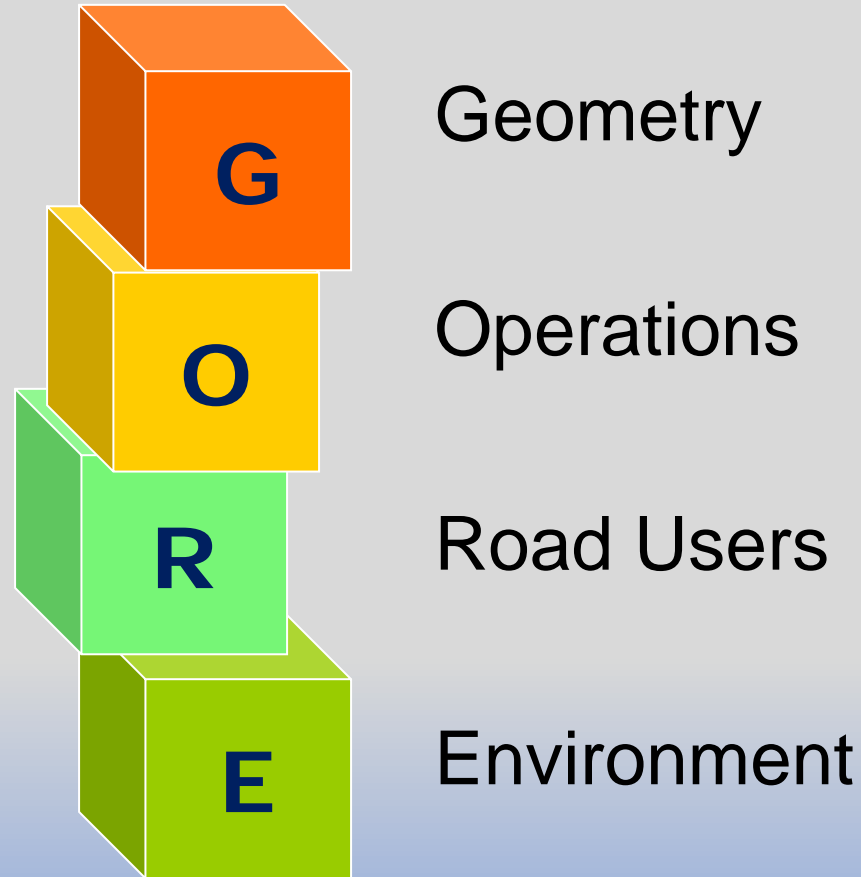


Perform Field Review: Observe Variable Conditions

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



What does a road safety audit examine?



Identify Risks

Road Safety: Geometry



- Curve
- Gradient
- Cross section
- Clearance
- Sight distance
- Clear zone

Unnecessary Risks



Muckleshoot, WA



La Jolla, CA

Road Safety: Geometry



Road Safety: Operations



- Congestion
- Circulation
- Signal operation
- Speed management
- Queuing
- Turning movements

Road Safety: Operations



Organized Village of Saxman, AK

Road Safety: Road Users



Mic-Mac, ME

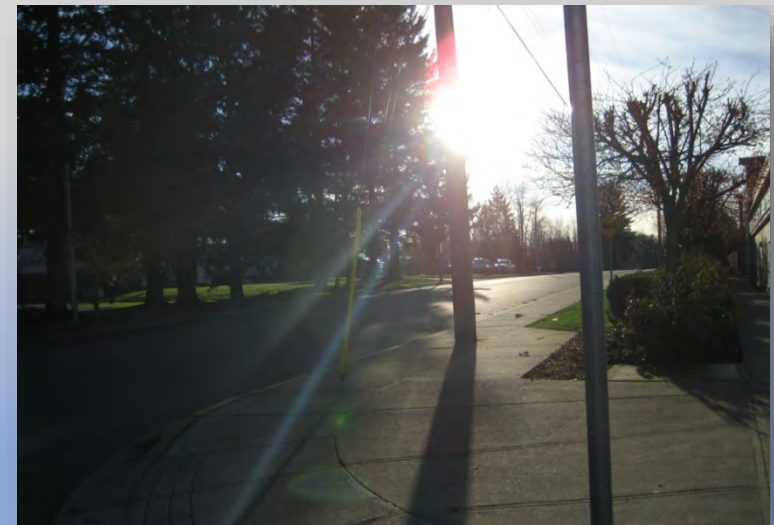


Road Safety: Environment

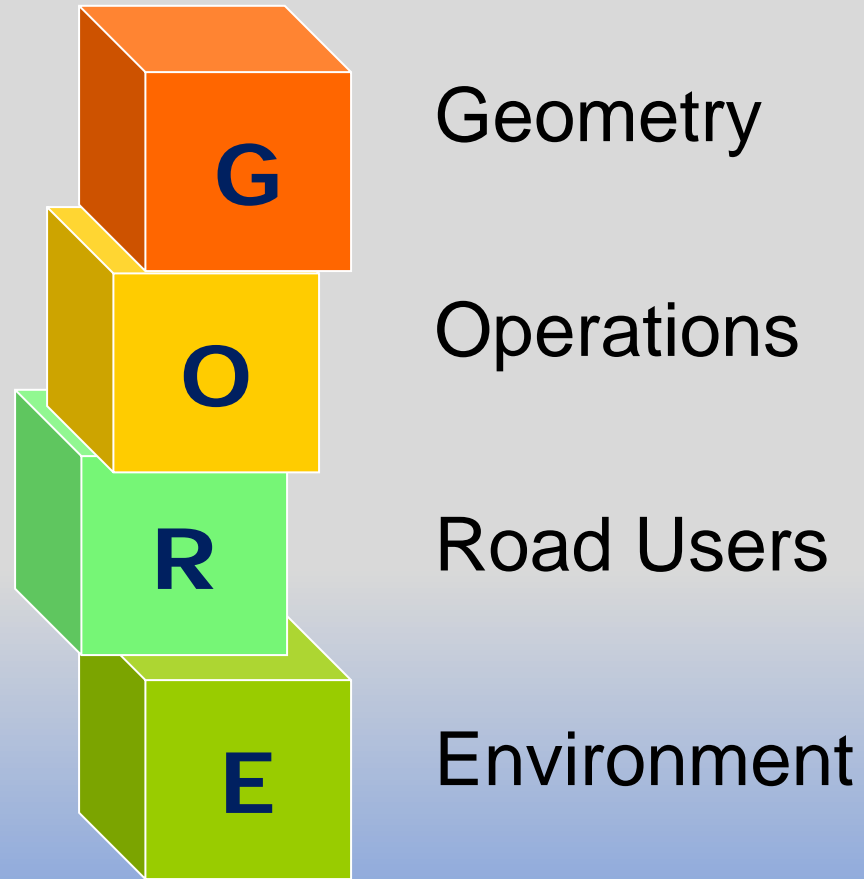


Weather

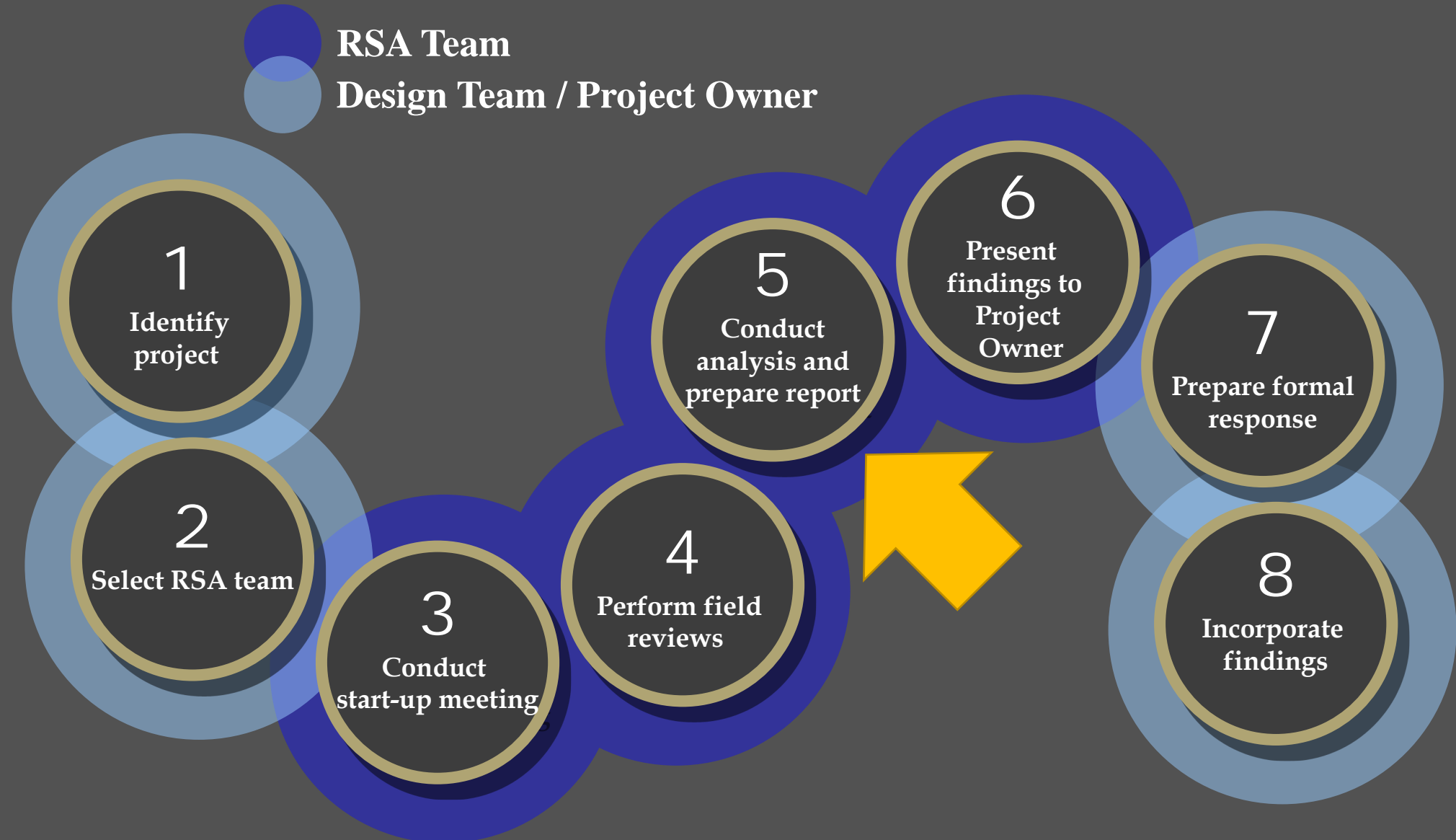
Lighting Conditions



What does a road safety audit examine?



Formal RSA Process





Step 5: Conduct RSA Analysis

- Identify and prioritize safety issues.
- Develop suggestions for enhancing safety.
- Compose presentation of early findings.

Analysis: Phase 1-2 Inventory & Review Information

- Consolidate and consider ideas/concerns from all team members



Analysis: Phase 4

Prioritize Safety Issues



- Assess risk associated with each safety issue.
- Use crash history, First Responders' experience, and RSA team's experience to assess risk.

Risk Analysis Scale

RISK CATEGORY		SEVERITY			
		Low	Medium	High	Severe
Crash Frequency	Frequent	C	D	E	F
	Occasional	B	C	D	E
	Infrequent	A	B	C	D
	Rare	A	A	B	C

Risk Levels

A	Minimal	D	Significant
B	Low	E	High
C	Moderate	F	Extreme

Prioritization Exercise: Assess the Risk

Step
5

Location: Rural area
Speed: 40mph
Crash Type: Pedestrian
Geometry: Straight Road
Vehicle Volume: Low
Ped Volume: Low



**Crash
Frequency**

Frequent	C	D	E	F
Occasional	B	C	D	E
Rare	A	B	C	D

Negligible Low Med High

Crash Severity

Prioritization Exercise: Assess the Risk

Step
5

Location: Rural area
Speed: 50mph
Crash Type: Right angle,
Roadway departure
Geometry: Intersection
Vehicle Volume: Low

Crash
Frequency

Frequent	C	D	E	F
Occasional	B	C	D	E
Rare	A	B	C	D
	Negligible	Low	Med	High

Crash Severity



Prioritization Exercise: Assess the Risk

Location: Rural area
Speed: 55mph
Crash Type: Fixed object
Geometry: Straight
Vehicle Volume: Medium



**Crash
Frequency**

Frequent	C	D	E	F
Occasional	B	C	D	E
Rare	A	B	C	D
	Negligible	Low	Med	High

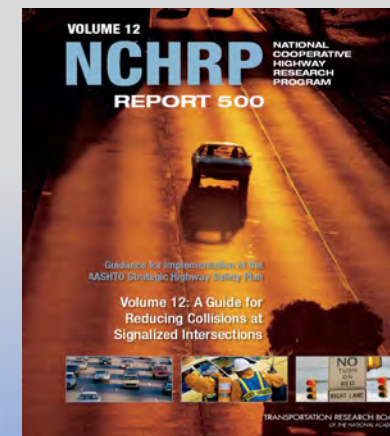
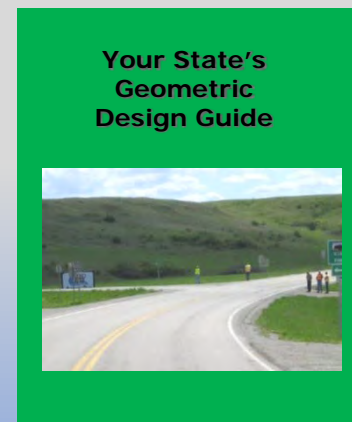
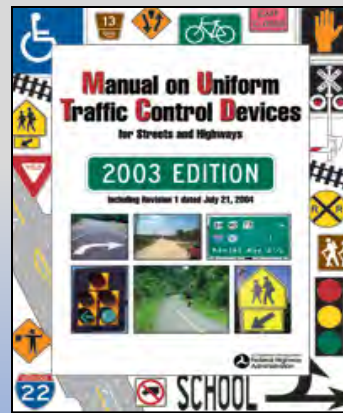
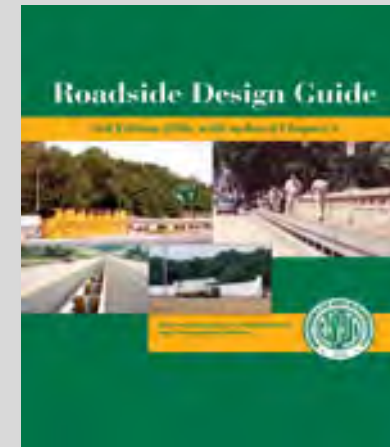
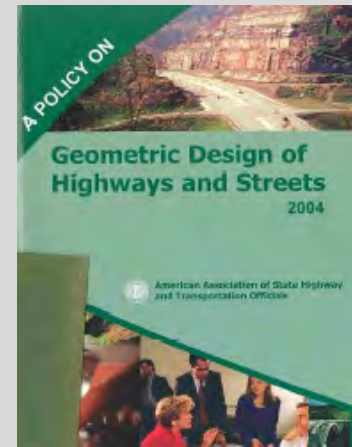
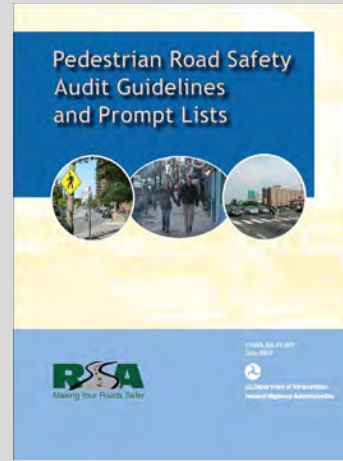
Crash Severity



Phase 5: Suggest Possible Mitigation

- Constructive and realistic
- Appropriate for stage of project
- Appropriate for all road users
- Engineering, Enforcement and Education

Resources and References



Suggest Possible Mitigation: Suggestions Appropriate to Project Stage

Short term solutions

Changing signage pavement markings, rumble strips, barriers, enforcement, etc.

Long term solutions

Flattening a curve modifying a roadway's vertical alignment, intersection re-alignment, etc.

Lummi Nation

Haxton Way & Slater Road



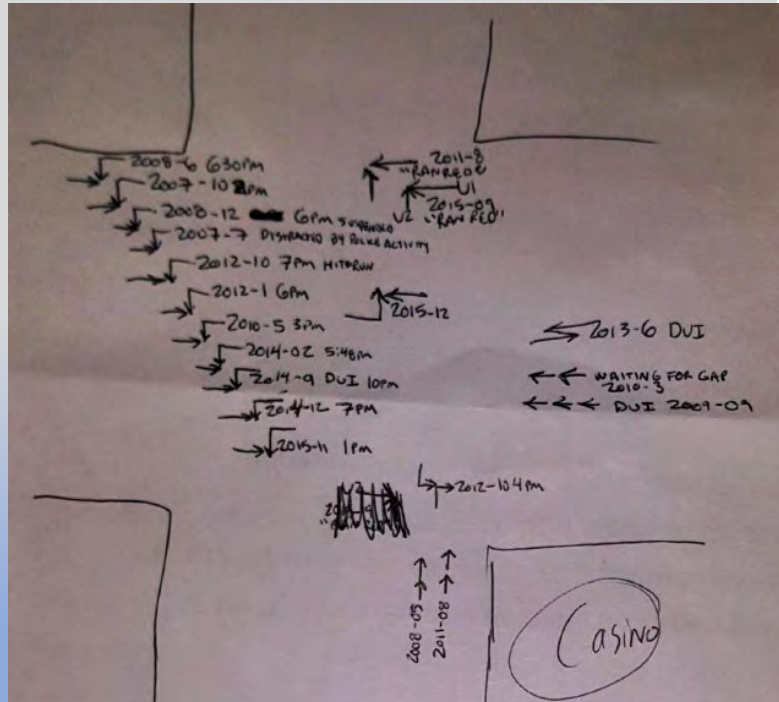
What's Working

- Ped accommodations at intersection
- Lighting
- Good pavement & pavement marking

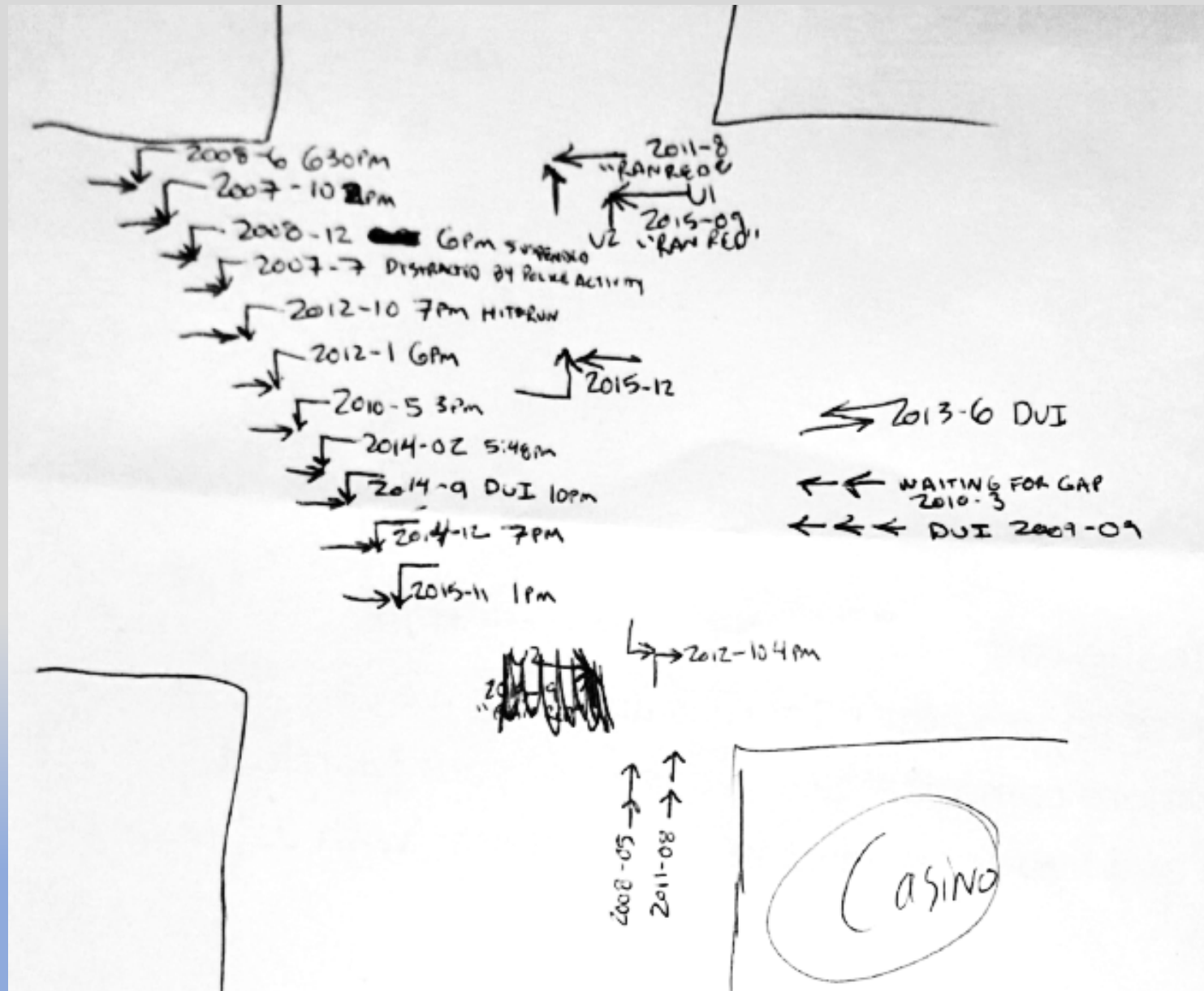
Haxton Way & Slater Road

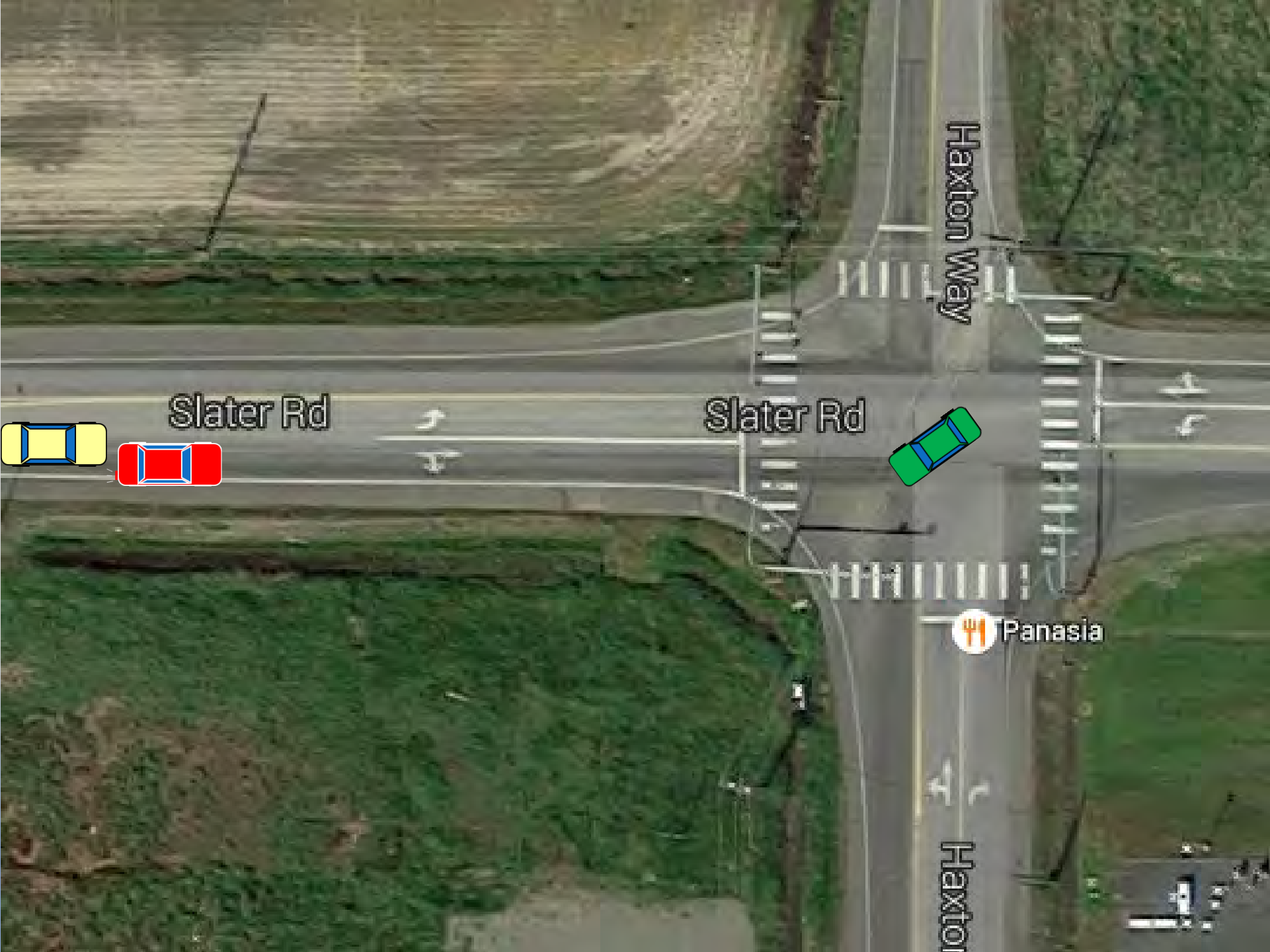
Crash Experience

- At least 12 high severity angle crashes WB to SB
- Crashes and near-collisions with NB right turns
- Ten years crash data:
 - 16+ PDO Crashes
 - 13+ Serious Crashes
 - 3 deaths



Haxton & Slater Crash Diagram





Slater Rd

Slater Rd

Haxton Way

 Panasia

Haxton

Looking WB



Issues

- Frequent crashes left turns, WB to SB
- Permissive left turn
- Gap acceptance and driver behavior
- Older drivers
- Sun glare could impair visibility of signal or oncoming vehicles; Fog is frequent

G

O

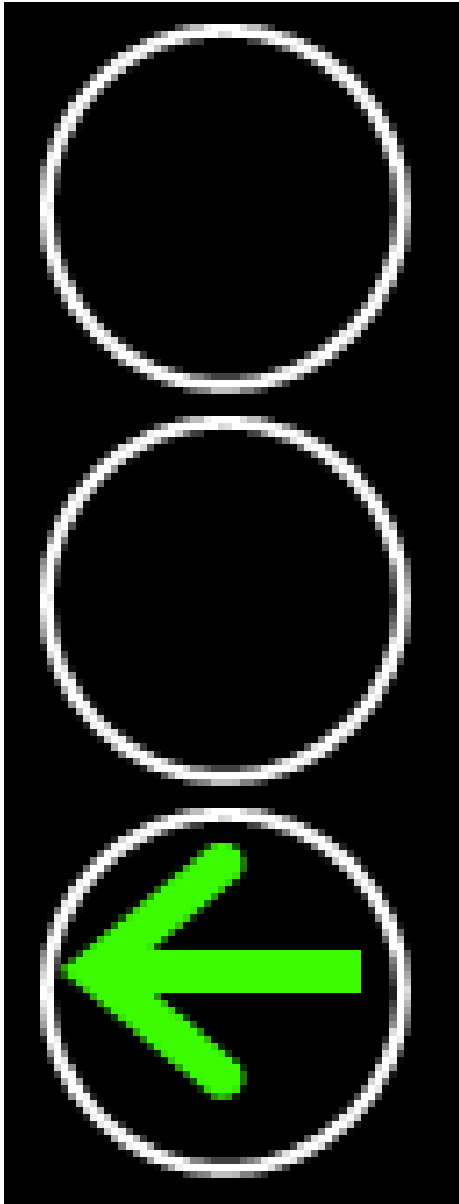
R

E

LOW Cost /SHORT Term

Countermeasures

- **Add protected left turn phase for WB to SB**
- Add protected NB right turn arrow (same time as WB left turn phase)
- Add EB acceleration lane for NB right turns or prohibit NB right turns on red





Low Cost / Short Term Countermeasures

- Extend 45mph zone EB until east of Haxton
- Over-sized, retroreflective back plates
- Upgrade to 12-inch LED signal heads

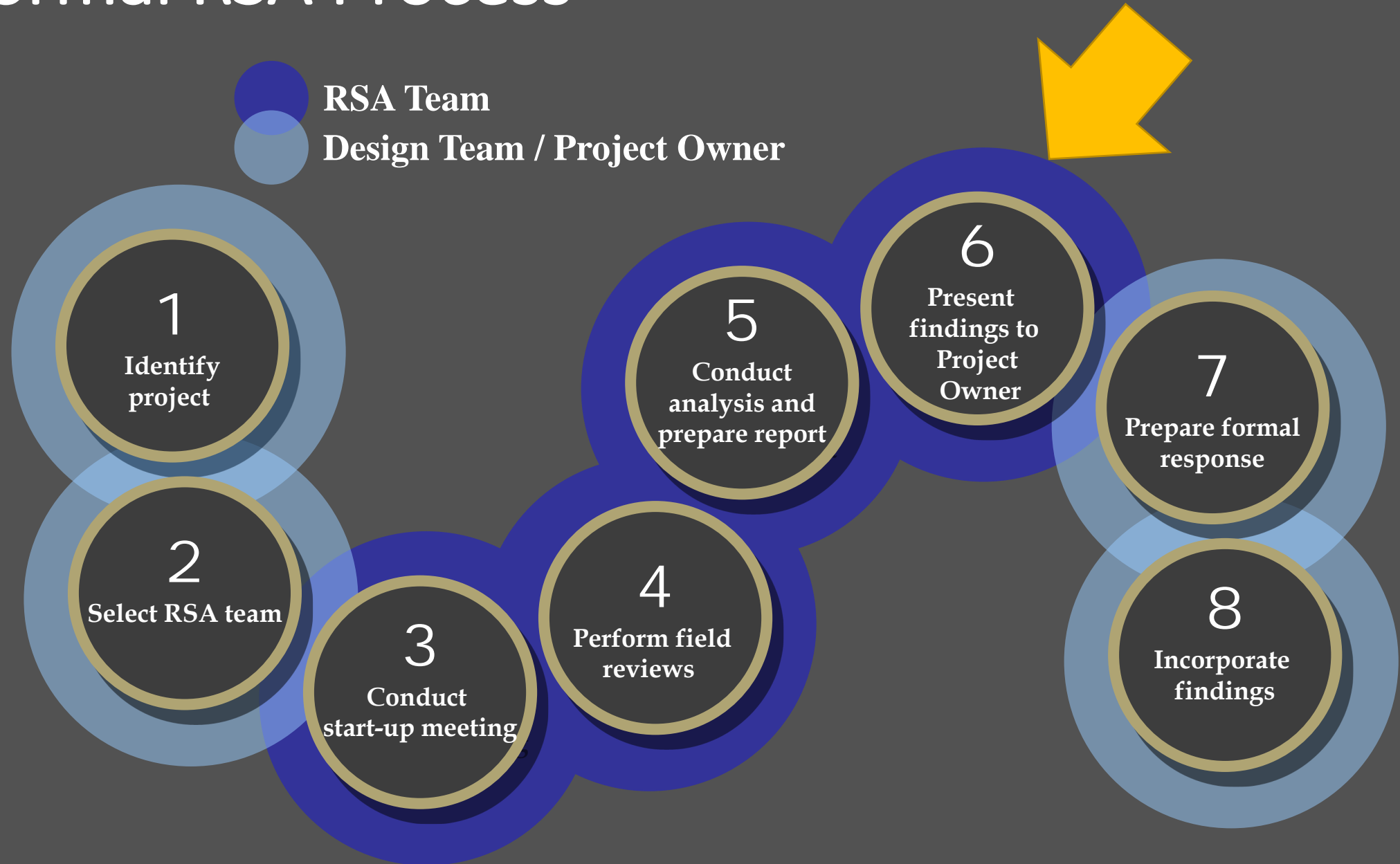
Haxton Way & Slater Road

Long Term Recommendation

- Roundabouts reduce:
 - crash severity
 - frequency
 - maintenance costs
- Potential gateway to Reservation
- Eliminates last signal in county



Formal RSA Process



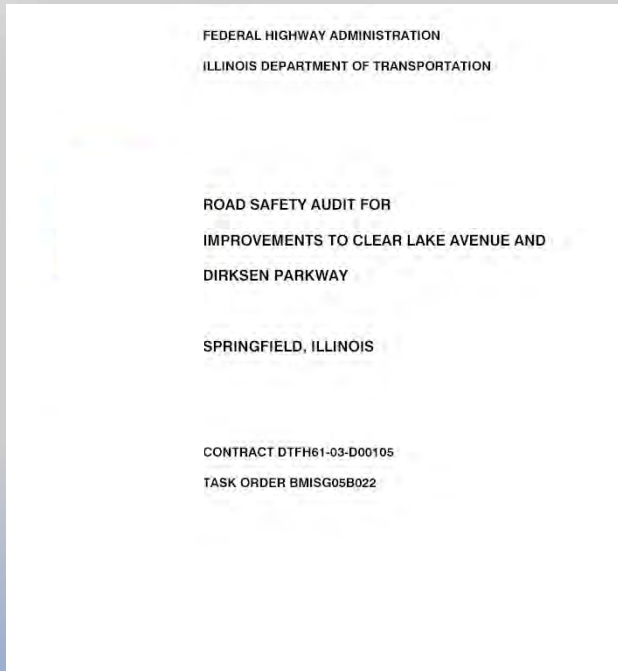
The RSA Findings Presentation

- Discuss safety successes.
- Present prioritized safety issues and suggestions.
- Constructively discuss issues and suggestions.
- Obtain comments and feedback from owner's team, but maintain independence.



The RSA Findings: Formal Report

- Summarize the project.
- Identify team.
- Identify documents used or reviewed.
- Summarize scope, opportunities, constraints.
- Document meetings and site visits.
- Document the prioritized safety issues and suggestions.
- Report samples available.




The RSA Findings Presentation: Formal Report

Sample Layout

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:	
<p>Opposing through and right-turn traffic volumes can be expected to cause peak period delays to traffic turning left at two intersections:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>	

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
- ← Suggestions

Formal RSA Process



Owner's Formal Response

Issue: Skewed intersection combined with grade creates sight distance challenges and turning-movement crash risks.

Suggestions	Owner's Responses
Short Term: Add Warning Signs and Improve Pavement Markings	Accepted
Medium Term: Cut back the slope	Accepted and will be considered for implementation next years.
Long Term: Re-align the intersection to improve the skew.	Rejected at this time because of budget limitations and conflict with long-term area road plans.

Formal Response

Response A

“We will not realign the intersection at Jefferson Road. We do not feel that it is needed.”



Formal Response

Response B

“While we agree with the need to realign the skewed intersection, the realignment cannot be achieved within the existing right-of-way. The acquisition of the required property may be considered in future budgets.”



Formal RSA Process



Incorporate Findings

- Update transportation safety plan & long-range transportation plan
- Consider what can be accomplished within existing budgets
- Coordinate with resource, planning, and grant agencies



Transportation Safety Funding

- FHWA Tribal Transportation Program Safety Fund
- BIA Indian Highway Safety Program
- Highway Safety Improvement Program
- Transportation Alternatives Funding
- State Highway Safety Office (23 USC 402)
- Indian Health Service Tribal Injury Prevention Cooperative Agreement Program (TIPCAP)

- More transportation safety funding info:
- <https://www.tribalsafety.org/funding>

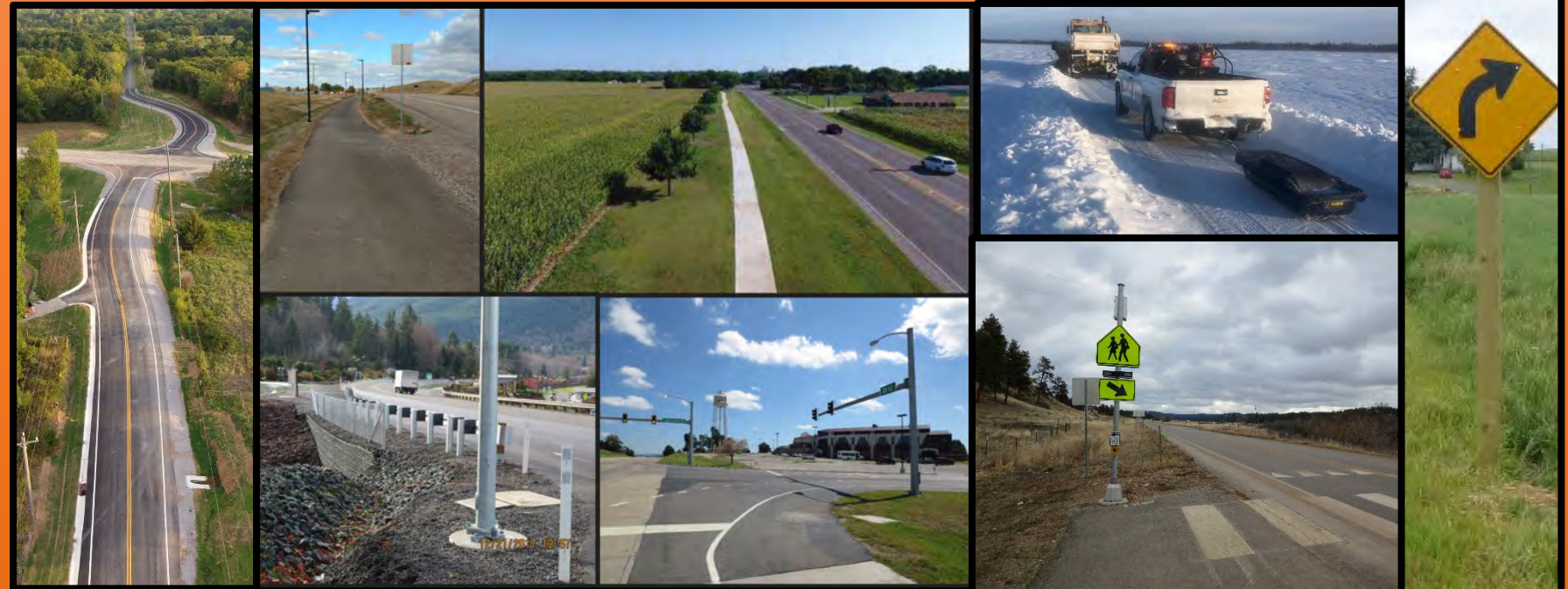
TTP Safety Fund Overview

<https://www.tribalsafety.org/funding>

- Can be used as match for other federal funding
- Competitive funding on application basis
- New category to focus on roadway departure crashes
- Changes likely under IIJA

13% Safety Plans	4% Data + RSA + Study	9% Education+ EMS + Enforce- ment
 FLANDREAU SANTEE SIOUX TRIBE 2015 TRIBAL TRANSPORTATION SAFETY PLAN		
 PUEBLO DE COCHITI TRIBAL SAFETY PLAN		Not eligible under the FAST Act

74%
Infrastructure



Getting an RSA started

- Identify the need for an RSA in your safety plan
- Contact resource agencies – ask about Road Safety Audit programs
 - <https://www.tribalsafety.org/state-contacts>
- Collect crash reports
- Apply for funding to hire RSA organization and report writing

RSA Team: Finding Experienced Help

HOME COMMUNITY RESOURCES NEWS/EVENTS Transportation Safety for Tribes

FATALITY DATA

Partnering with resource agencies is important during transportation safety planning. Potential partners are listed by state below. Contact information is provided for the state office of highway safety, state office managing crash data requests, state office for behavioral safety, and the Federal Highway Administration state division office safety contact.

Click the orange symbol that corresponds to the state of interest to reveal contact information.

See also: [Federal agency contacts with a role in Tribal transportation safety \(click here\)](#)

See also: [BIA Tribal Leaders Directory](#)


← Arizona

State Name
Arizona

FHWA State Division Safety Specialist
FHWA Arizona Division
Jeff King
Safety Specialist
602-382-8991
Jeffrey.King@dot.gov

State Highway Safety Improvement Office
(State Safety Engineer)
Kerry Wilcoxon, P.E., PTOE
State Traffic Safety Engineer
TSM&O Division
1615 W. Jackson St.
Phoenix, AZ 85007
602-712-2060 office
480-390-9737 cell
KWilcoxon@azdot.gov

State Office for Crash Data Requests



State Safety Contacts

<https://www.tribalsafety.org/state-contacts>

Adam Larsen

Office of Tribal Transportation

Federal Highway Administration

Adam.Larsen@dot.gov

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Road Safety Audits (RSA) Videos

[Tribal RSA Training - National Center For Rural Road Safety](https://ruralsafetycenter.org)
(ruralsafetycenter.org)

<https://ruralsafetycenter.org/resources/tribal-rsa-training/>

Introduction to Road Safety Audits.



Road Safety Audits (RSA) on Tribal Lands
ROAD SAFETY AUDITS STOP Watch later Share

Building safer roads and communities for our Tribal Lands.

A tool to address road safety challenges, injuries and fatalities.

Watch on YouTube

Part 2: Road Safety Audits: What they are and how to get started.



Part 2: Road Safety Audits: What they are and how to get started... Watch later Share

Watch on YouTube

dit (RSA) Making roads safer

Part 3: Road Safety Audits: A Brief Overview of the Eight Step Process



Part 3: Road Safety Audits: A Brief Overview of th... Watch later Share

Road Safety Audits:
A Brief Overview of the
Eight Step Process

Watch on YouTube

Virtual Tours Camera Kit



Questions? Want to use the camera kit?
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VR Camera Kit Instructional Video:
https://youtu.be/Oj8E3L_7kXY

Navajo Nation Roads Virtual Tours:
<https://youtube.com/playlist?list=PLVStkITp8obP8hdMhQDI6lXsifTdnA5Y8>

Organized Village of Kasaan Virtual Tour:
<https://www.youtube.com/embed/aT7N0JsPOI8>

Road Safety Audits videos:
<https://ruralsafetycenter.org/resources/tribal-rsa-training/>



Organized Village
of Kasaan
Virtual Tour



Navajo Nation
Virtual Tour



Virtual Tours Virtual RSA

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Virtual Tours Camera Kit

- FHWA ships the camera to the Tribe.
- Tribe records a project.
- Tribe ships the camera back.
- FHWA puts the 360 video/photos online so the team can visit the project in virtual tours.



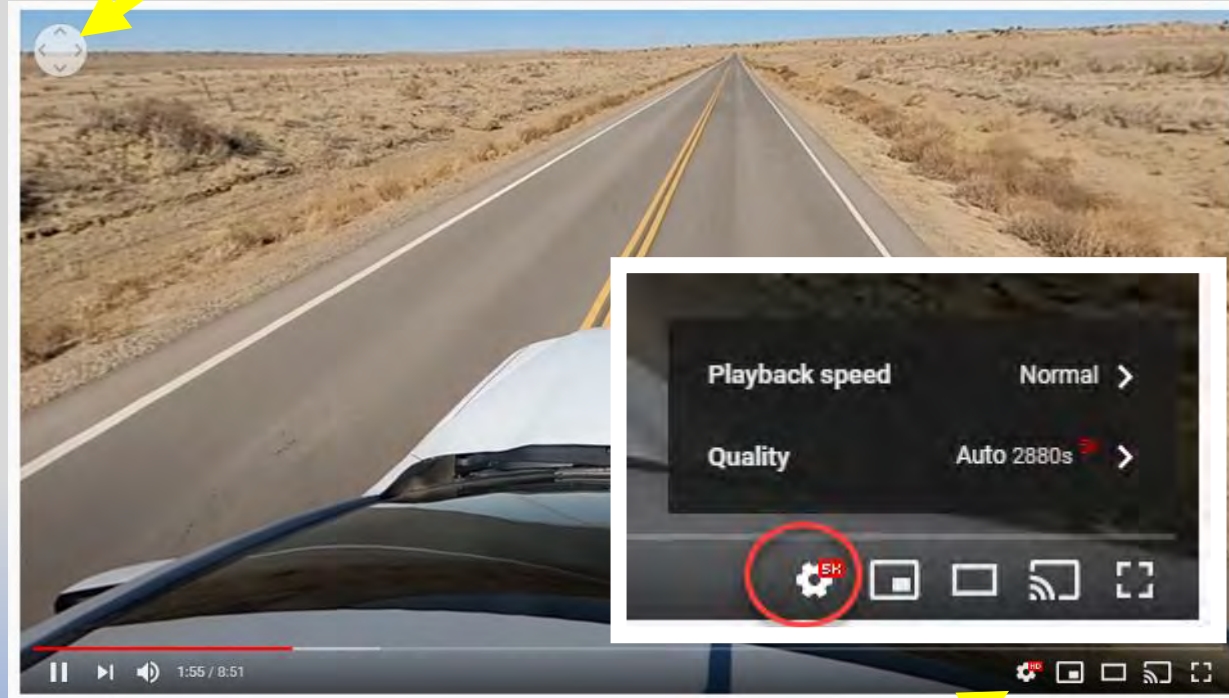
VR Camera Kit Uses

- Timely technical assistance
- Before/after project video
- Video log
- Virtual Road Safety Audits
- Project Close-outs
- Grant application virtual tour
- usRAP Safety Risk Assessment
- More...



Virtual Tour Controls

Change your view on a computer
(or just move your phone/tablet)



Adjust video quality and playback speed

Tohono O'odham Nation, Route 15 Video 5

<https://www.tribalsafety.org/rsa-workshop>

Video Link:

<https://www.youtube.com/watch?v=jaV5GtFwHe0>

OR

Scan QR Code with phone or
tablet's camera

Map & Crash Data:

<https://www.google.com/maps/d/embed?mid=1eoesM4Lhe9M-3yLh5bhEZMImxXuxuYqY>





Virtual Tours Camera Kit

Virtual RSA Exercise

<https://www.tribalsafety.org/rsa-workshop>

Road Safety Audits Training Videos:

<https://ruralsafetycenter.org/resources/tribal-rsa-training/>

Questions?

Want to use the camera kit?

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