Road Safety Audits*

* *Assessments, Reviews, etc.*

Agenda

- Basic Concepts of RSAs
- Common Issues and Challenges
- RSA Procedures
- Case Studies
- Keys to Success
- MPO Perspective

BASIC CONCEPTS

The Goal

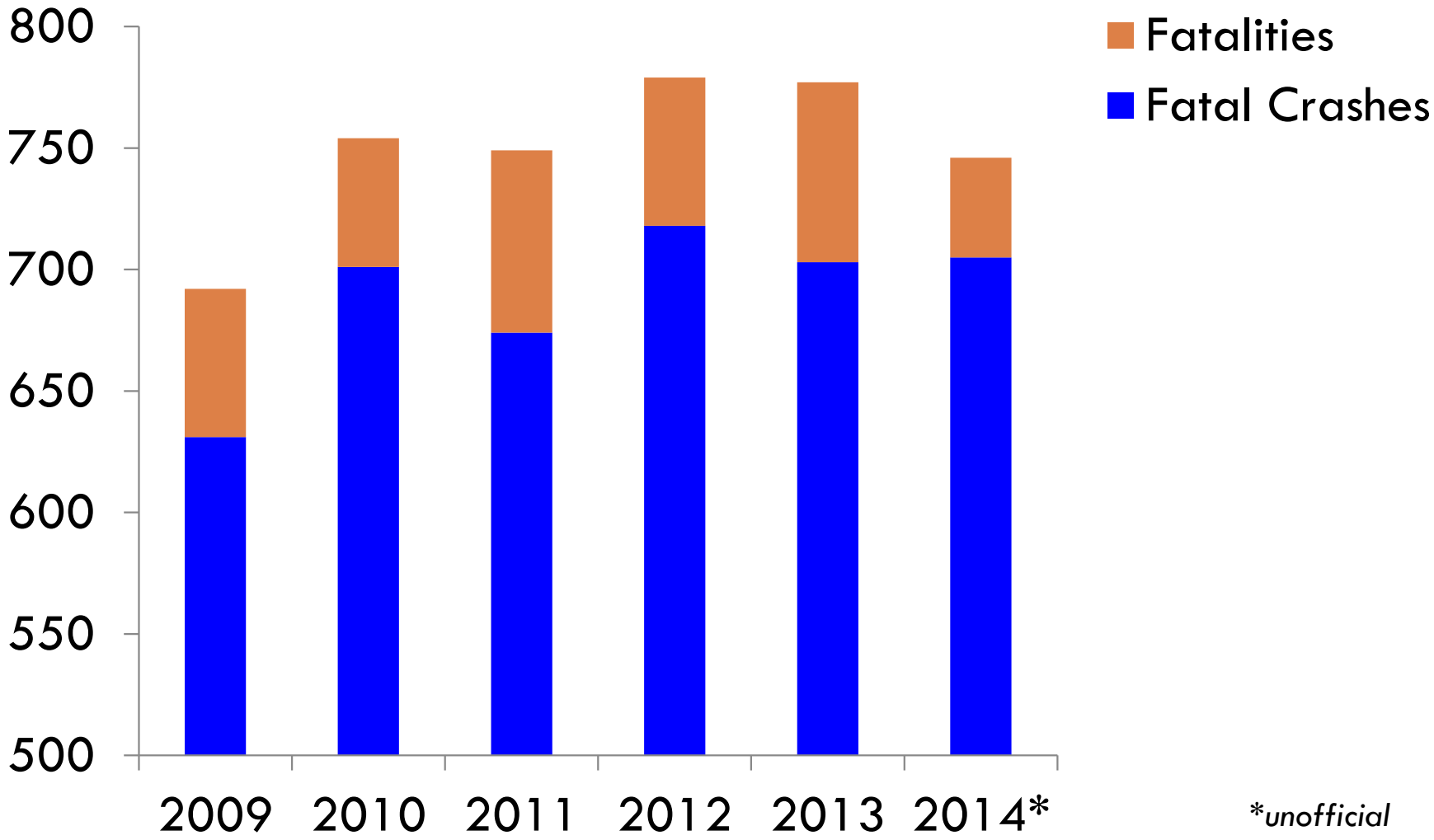
Begin with the end in mind

Reduce the number and severity of motor vehicle crashes.

Today's Objective

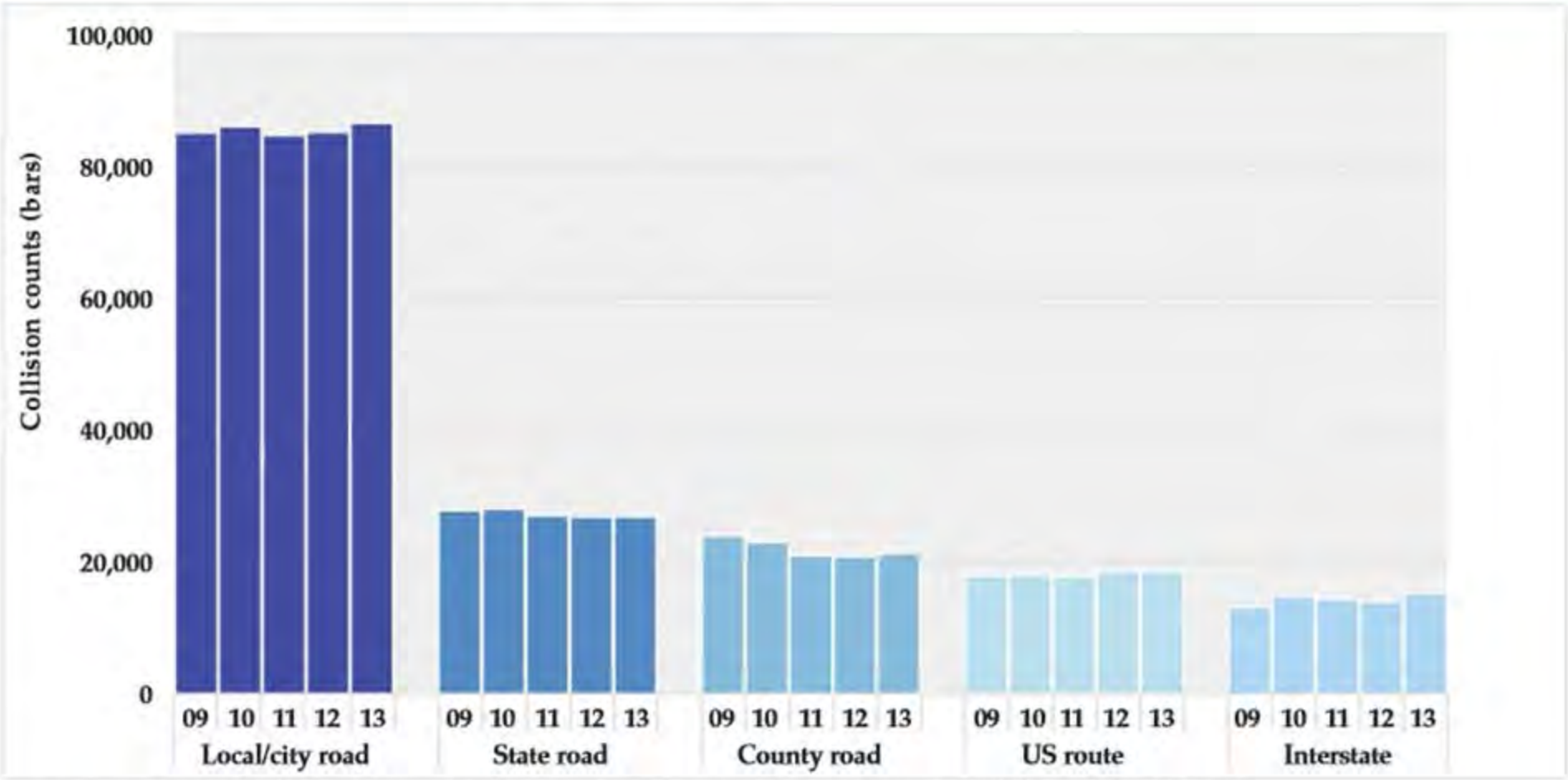
Introduce and discuss RSAs as a useful tool to reduce traffic injuries and fatalities

IN Crash Statistics



IN Crash Statistics

Figure 3.7. Indiana traffic collisions by road class, 2009-2013

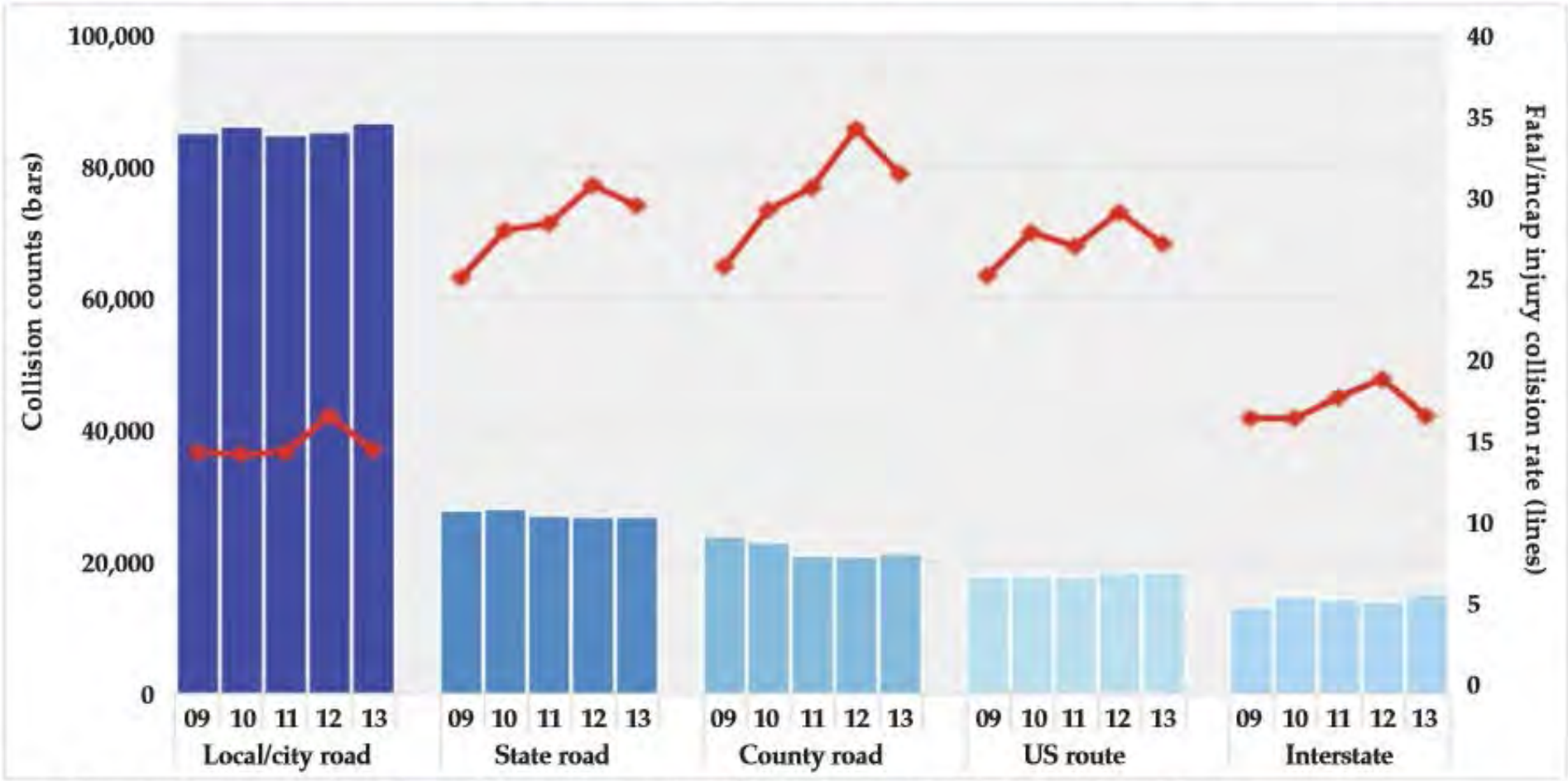


Source: Source: Indiana State Police Automated Reporting and Information Exchange System (ARIES), as of March 21, 2014

Note: Excludes unknown road class.

IN Crash Statistics

Figure 3.7. Indiana traffic collisions and fatal and incapacitating injury collision rates, by road class, 2009-2013



Source: Source: Indiana State Police Automated Reporting and Information Exchange System (ARIES), as of March 21, 2014

Note: Excludes unknown road class.

The Problem

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

The Real Problem

Of every 100 children born this year in the U.S.

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

70 will be injured in a crash during their lifetimes…

We must reduce deaths and injuries.

Basic Concepts

- What is an RSA?
- Why do we need RSAs?
- When do we conduct RSAs?

Road Safety Audits

A Road Safety Audit (RSA) is a formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team.

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An RSA also…

- Considers the safety of all road users

- Considers interactions at the borders or limits of the project
- Proactively considers mitigation measures

Traditional Road Safety Review vs. RSA

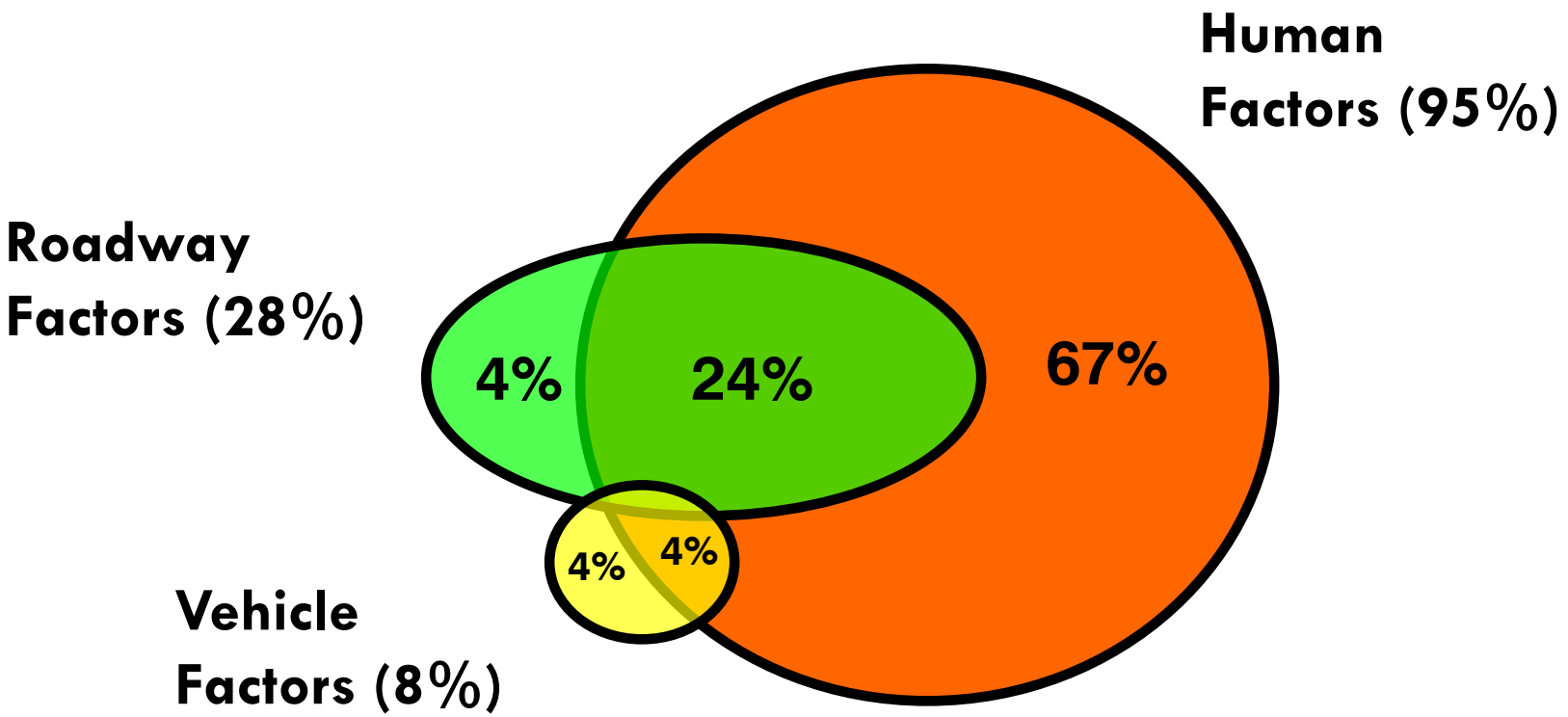
Traditional Road Safety Review

- Reactive
- In-house team
- Field review (sometimes)
- Standards compliance

RSA

- Proactive
- Independent team
- Field reviews always
- Comprehensive, with human factors

Why do we need RSAs?



TYPICAL REPORTED CRASH CAUSES

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

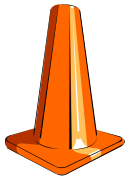
Why do we need RSAs?

- 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."

When do we conduct RSAs?

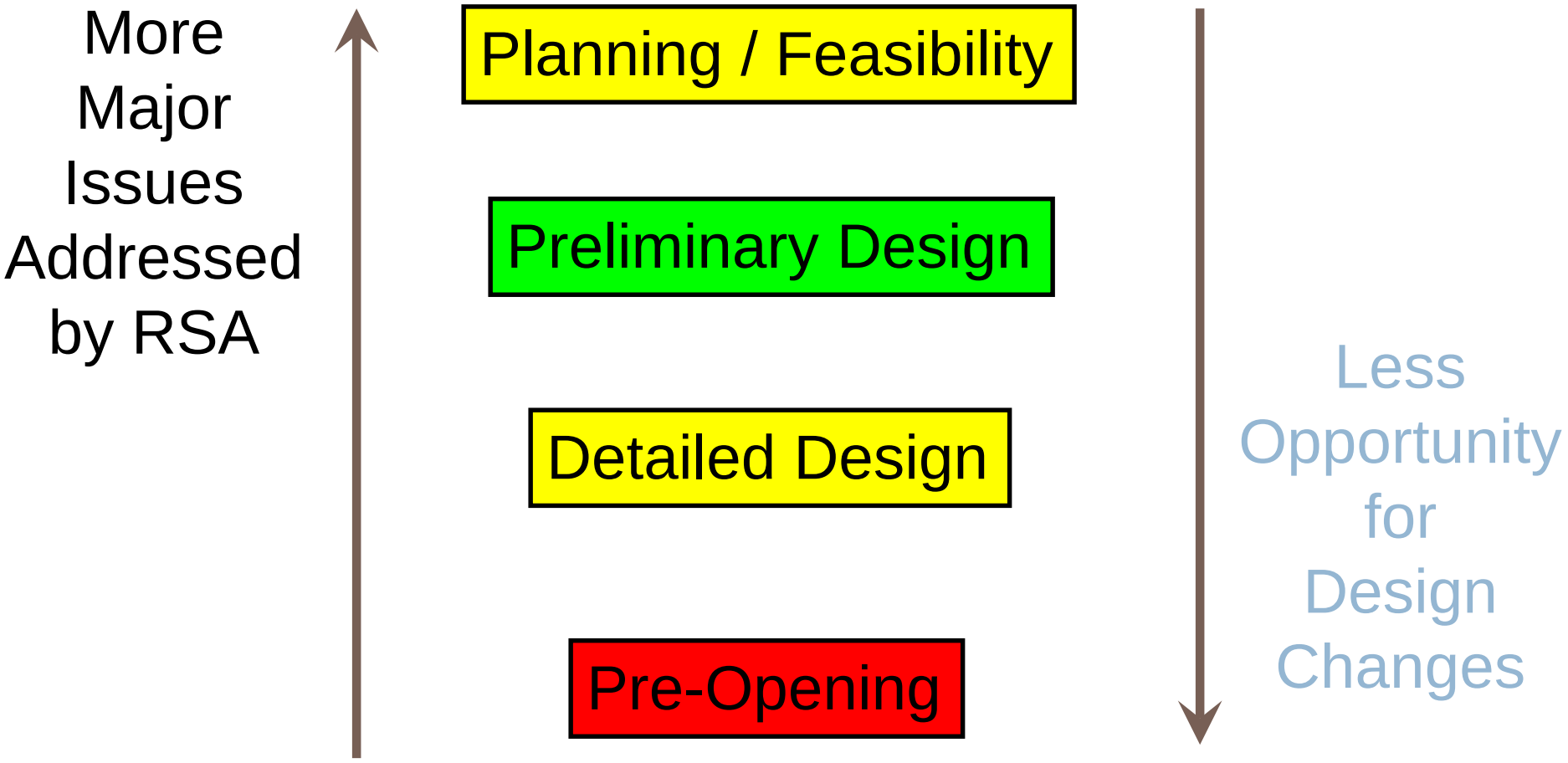
- Pre-construction
  - Planning / feasibility
  - Preliminary (draft) design
  - Detailed design

- Construction
  - Work zones
  - Pre-opening

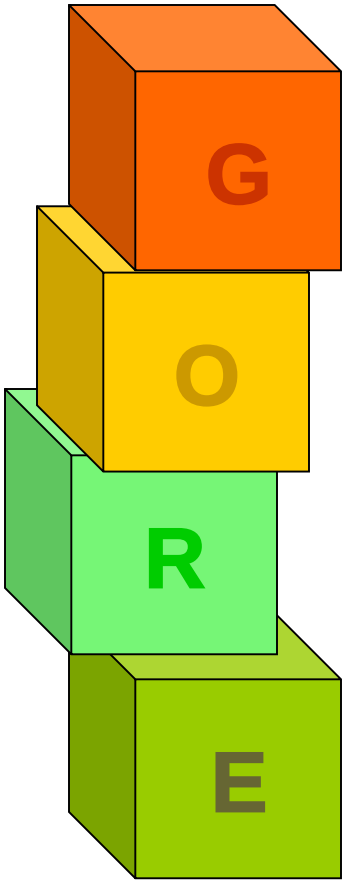


- Post-construction
  - Existing roads

RSAs & Project Staging

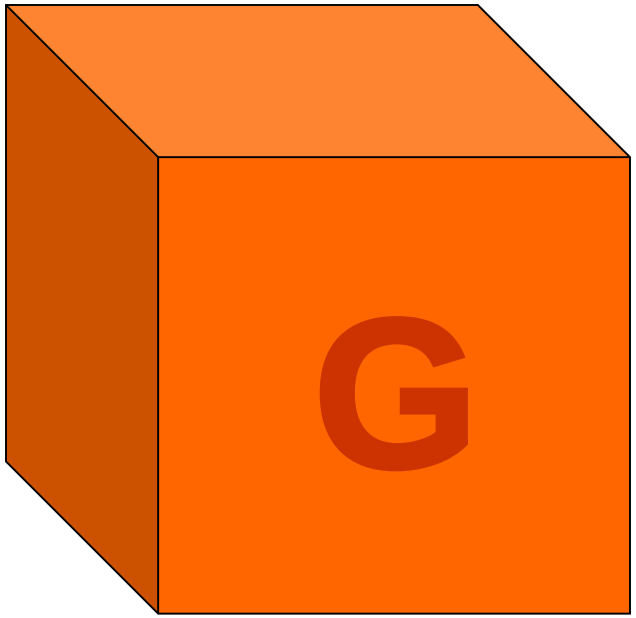


Road Safety: GORE



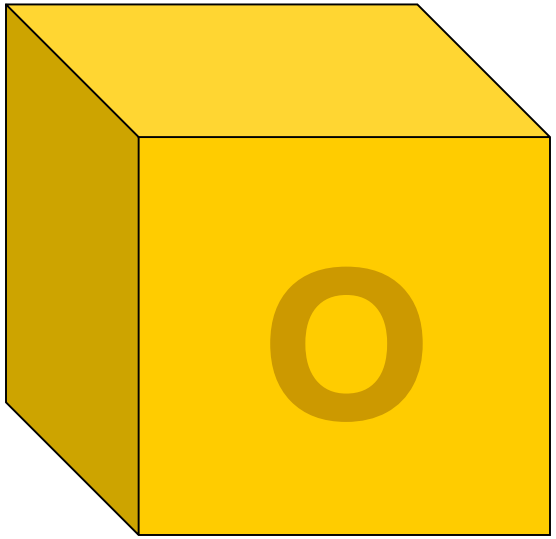
- Geometry
- Operations
- Road Users
- Environment

Road Safety: Geometry



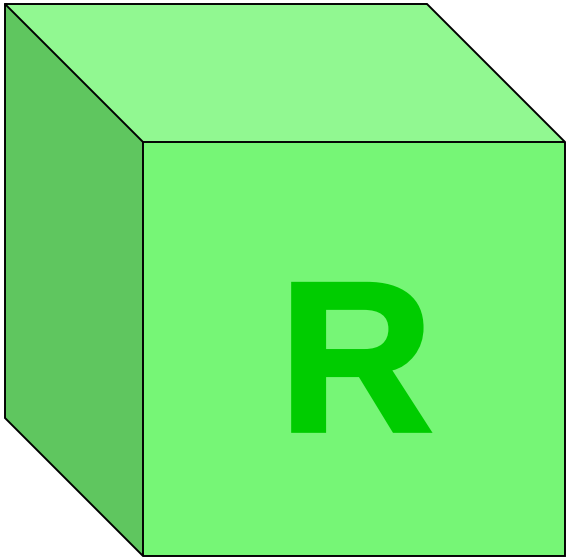
- Curve
- Gradient
- Cross Section
- Clearance
- Sight Distance
- Clear Zone

Road Safety: Operations



- Congestion
- Signing
- Signal Operation
- Speeding
- Queuing
- Turning Movements

Road Safety: Road Users / Human Factors

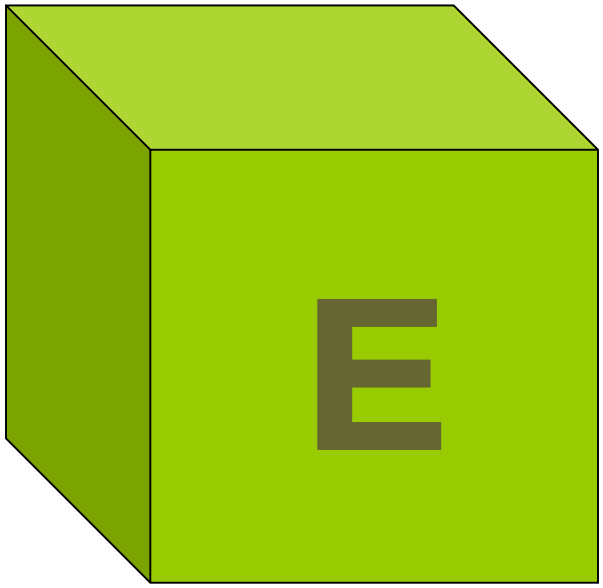


- Motorists
  - Motorcyclists
- Bicyclists
- Pedestrians
- Special Needs

Each Year in the U.S.

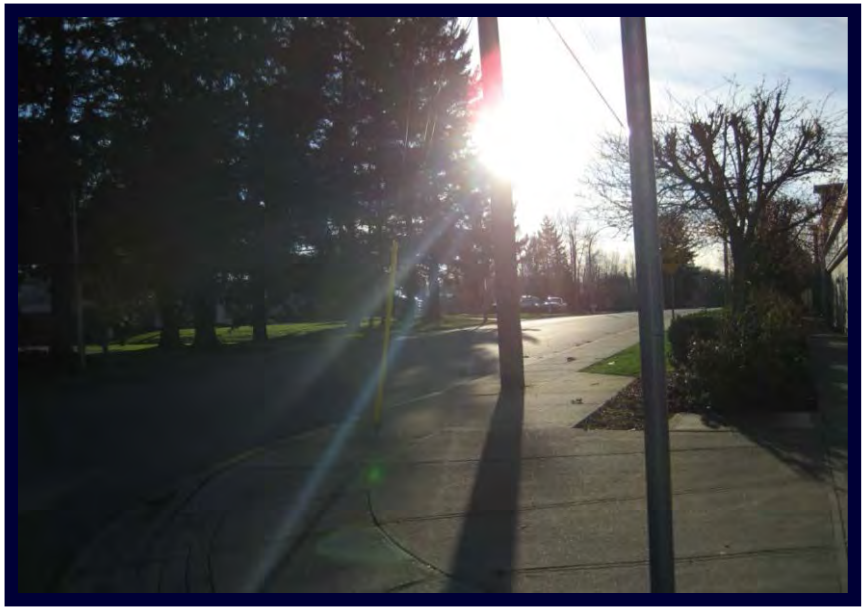
- 64,000 pedestrians injured
- 5,000 pedestrians killed

Road Safety: Environment



- Weather
- Lighting Conditions

Road Safety: Environment



Basic Concepts for MPO's

What is an RSA?

- Toolbox item

Why do MPOs need RSA's?

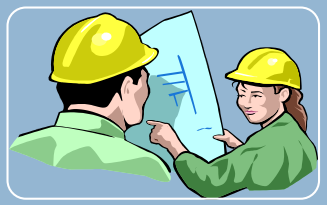
- Project justification
- Funding
- Project support
- Seek new solutions and provide recommendations
- Fiduciary responsibility

When Do We Conduct RSAs?

- Identified hazardous locations
- Project development

COMMON ISSUES & CHALLENGES

Common Issues and Challenges



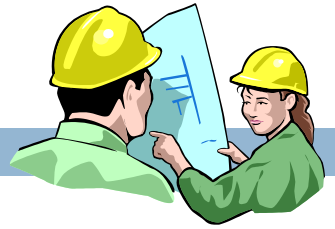
1. Responsibilities

2. Programming & Scheduling

3. Effects on Project Cost

4. Legal Liability

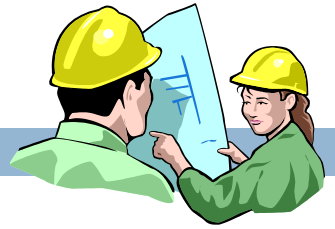
1. RSA Responsibilities



Highway Agency / Road Owner

- Commit to the RSA process
- Commit resources (time, funding, and staff)
- Select RSA team
- Provide required information
- Attend RSA meetings
- Describe issues, challenges, and constraints
- Prepare response letter

1. RSA Responsibilities



RSA Team

- Attend pre-review meeting and acquire an understanding of the roadway, challenges, and constraints
- Review available information
- Conduct field review
- Identify safety issues
- Identify feasible suggestions for mitigation
- Present preliminary findings at post-review meeting

2. Programming & Scheduling

Pre-construction RSAs: 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.

3. Effect on Project Cost

Will an RSA drive up costs?

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

Mitigate problems:

- Focus on low-cost safety improvements
- Suggestions can be pre-screened with the road agency and designer
- Suggestions must be consistent with the design stage

4. Legal Liability

What if we identify issues/problems in the RSA but the agency doesn't address them?

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 assessment
- RSAs can be part of a safety management system

4. Legal Liability

On January 14, 2003, the United States Supreme Court upheld the constitutionality of **23 USC 409**. In section 409, Congress established an evidentiary privilege for information that States and other entities compile or collect for purposes of complying with certain highway safety programs.

i.e., safety information (like an RSA study) is protected from use in the courtroom.

4. Legal Liability

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

- Identify RSA scope
- Identify RSA materials
- Identify limitations
- Consult road owner during review

4. Legal Liability

"[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."

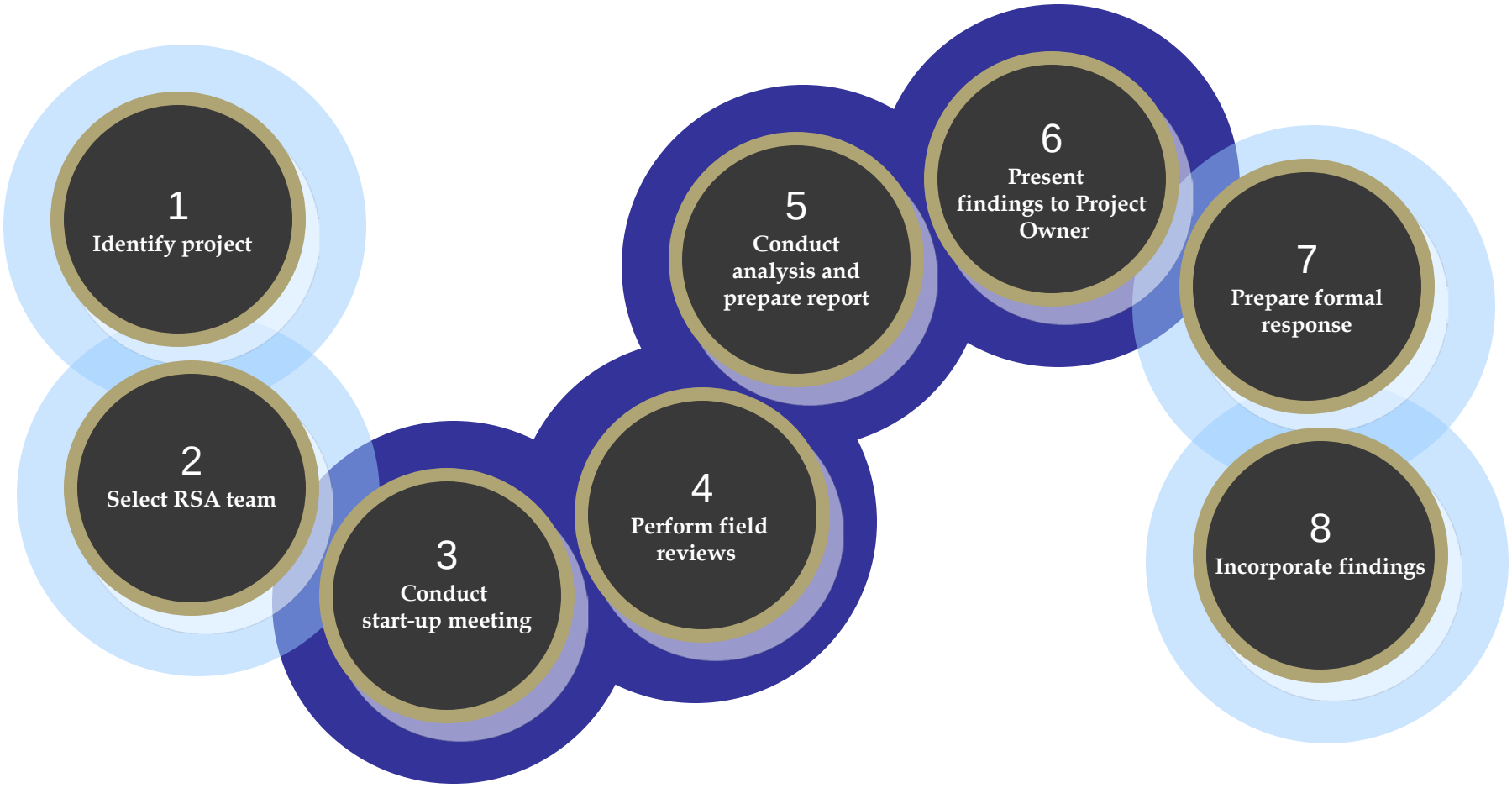
Common Issues & Challenges for MPO's

- Staff time (cost)
- Team members

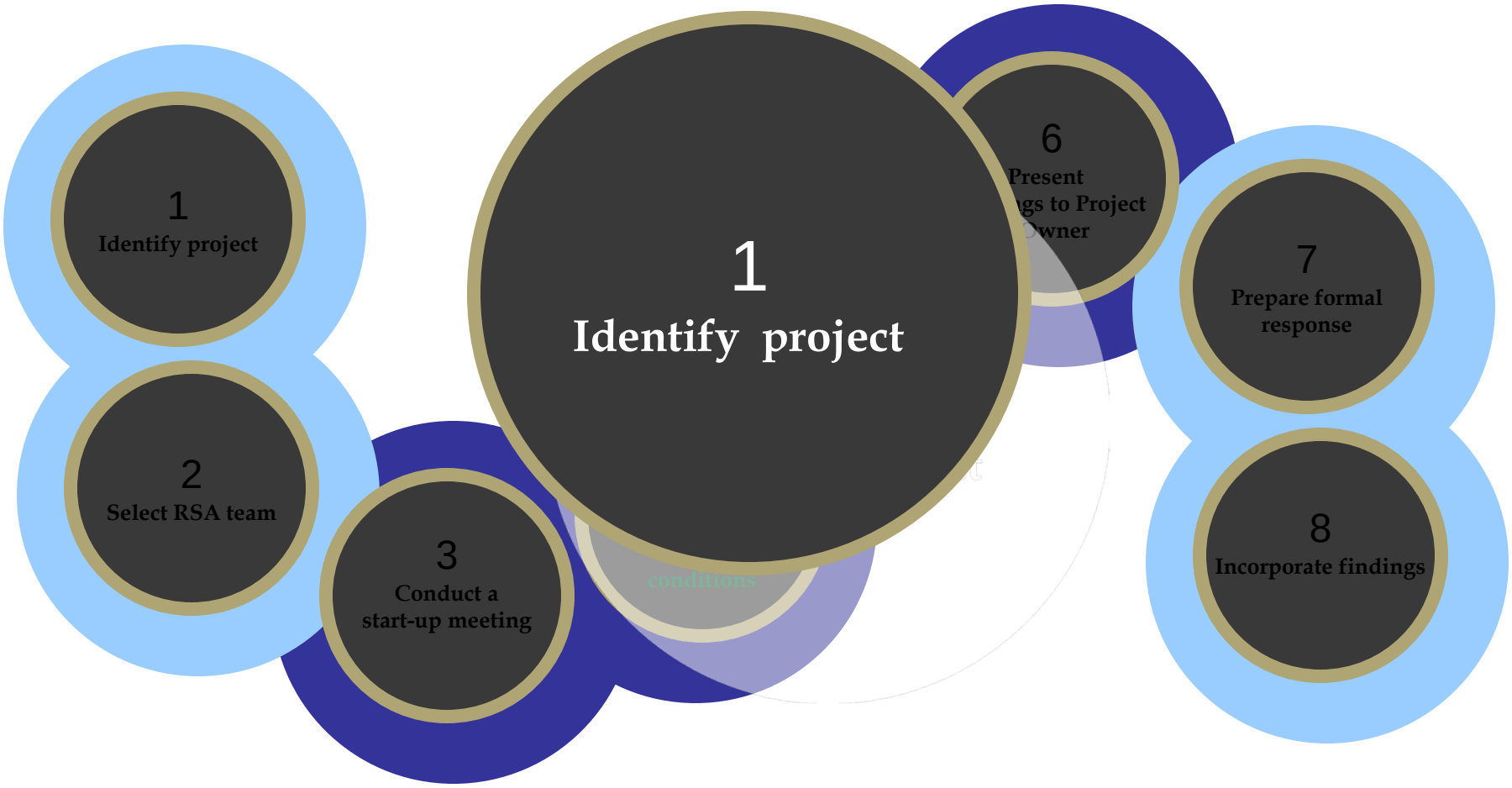
RSA PROCEDURES

The 8-step Process

RSA Procedure

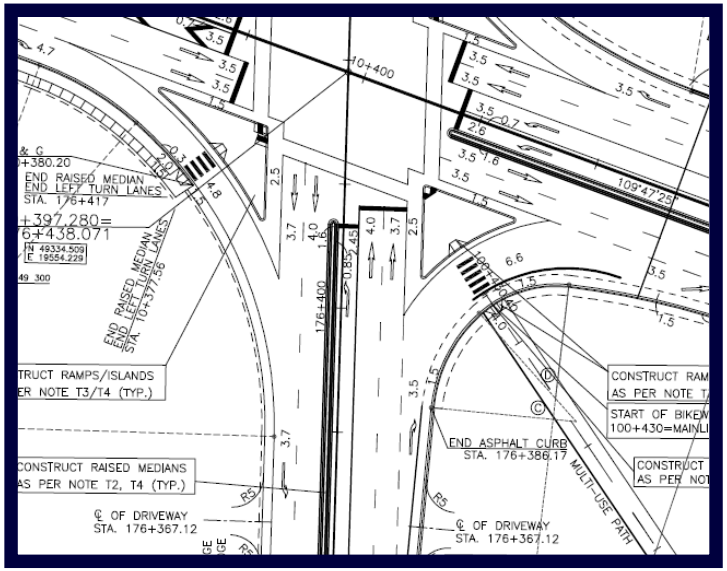


RSA Procedure



Identify the Project

Step 1



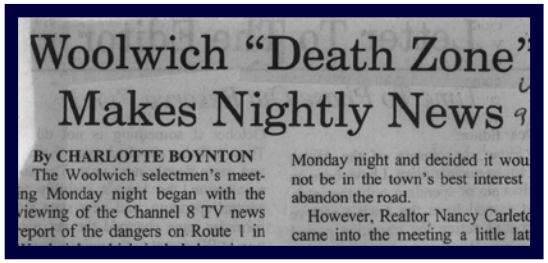
Design stage project

Existing location

Candidates for RSAs

Step 1

High-crash sites



Woolwich "Death Zone" Makes Nightly News

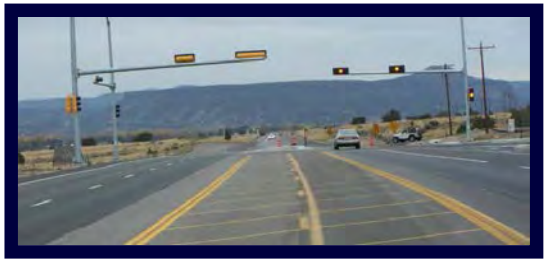
By CHARLOTTE BOYNTON

The Woolwich selectmen's meeting Monday night began with the viewing of the Channel 8 TV news report of the dangers on Route 1 in

Monday night and decided it would not be in the town's best interest abandon the road.

However, Realtor Nancy Carleto came into the meeting a little lat

High-profile sites

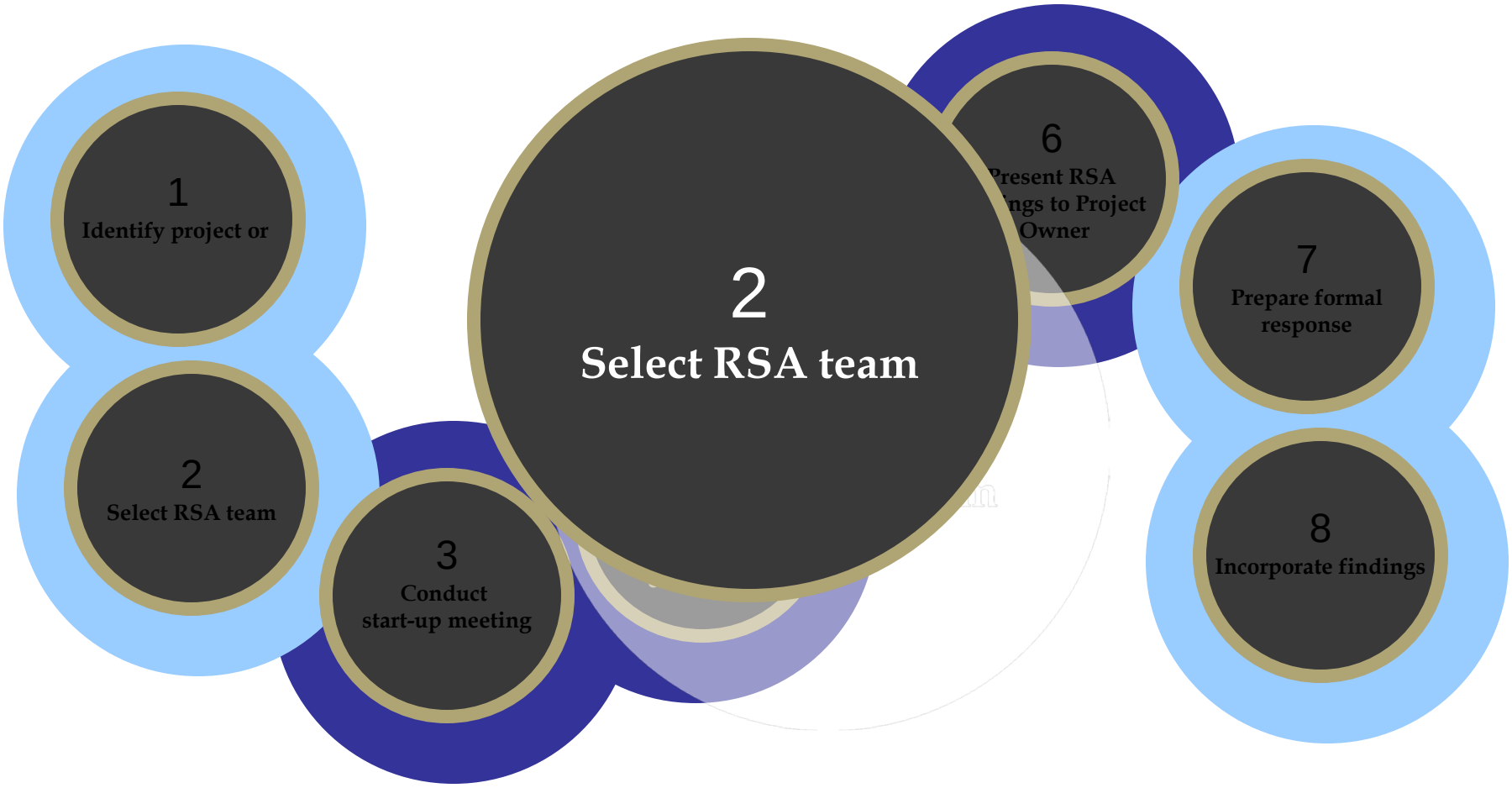


Changed traffic patterns

RSA Procedures for MPO's

1. Project Identification
   - Safety Management System
   - Transportation Improvement Program
   - Locally funded projects

RSA Procedure



Select RSA Team

Step 2

- Independent
- Experienced
- Multi-disciplinary

Select RSA Team: Core Skills

Step 2

Traffic operations

Geometric design

Traffic safety

Select RSA Team: Supplementary Skills

Step 2

- Law enforcement
- Maintenance personnel
- Emergency responders
- Local knowledge

Select RSA Team

Step 2

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

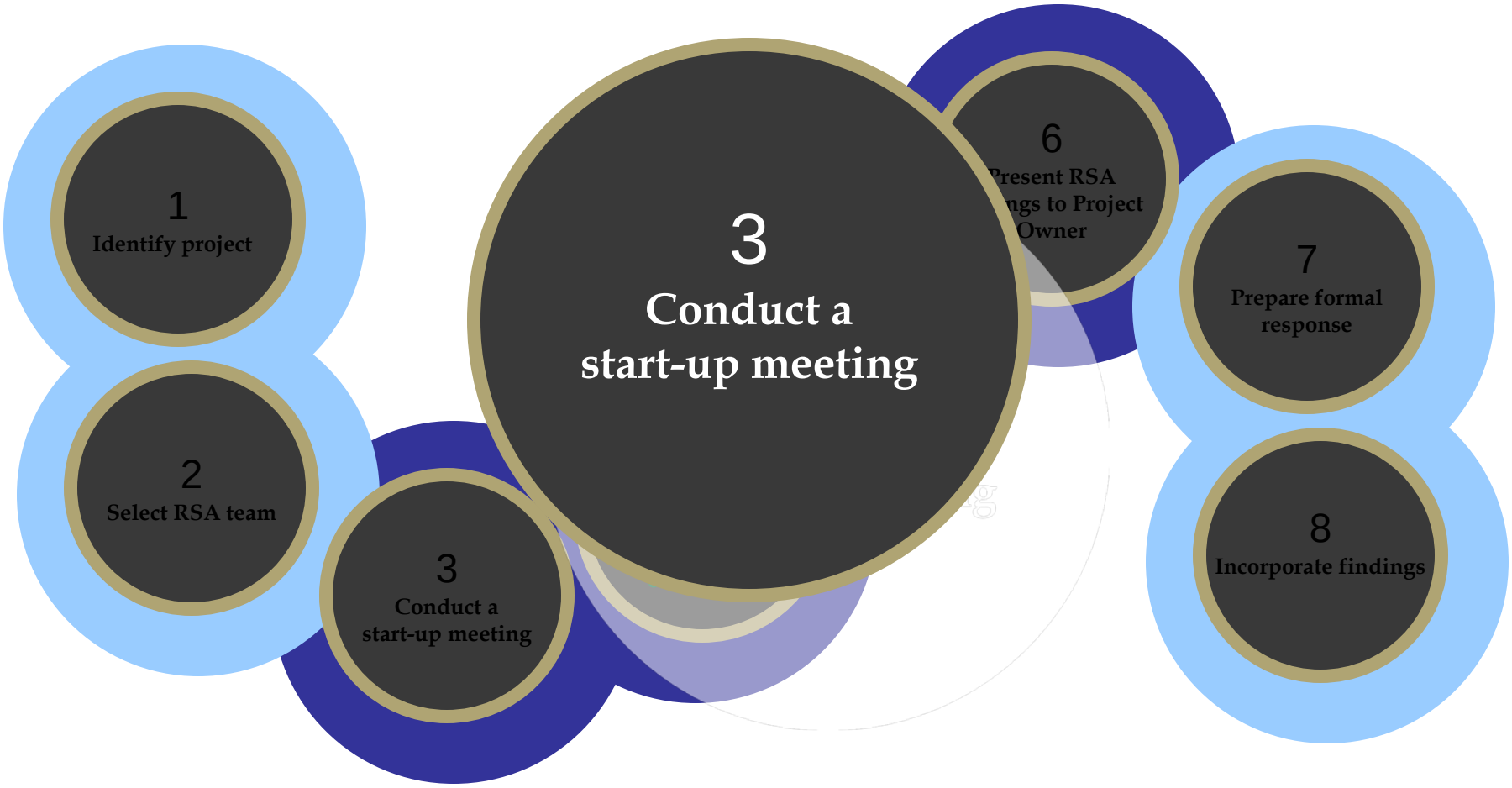
RSA Team Volunteers

- HELPERS maintains a list of trained RSA volunteers
- You can be on that list

RSA Procedures for MPO's

2. RSA Team Selection
   - Law enforcement
   - Consultants

RSA Procedure



Start-up Meeting

Step 3

- 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

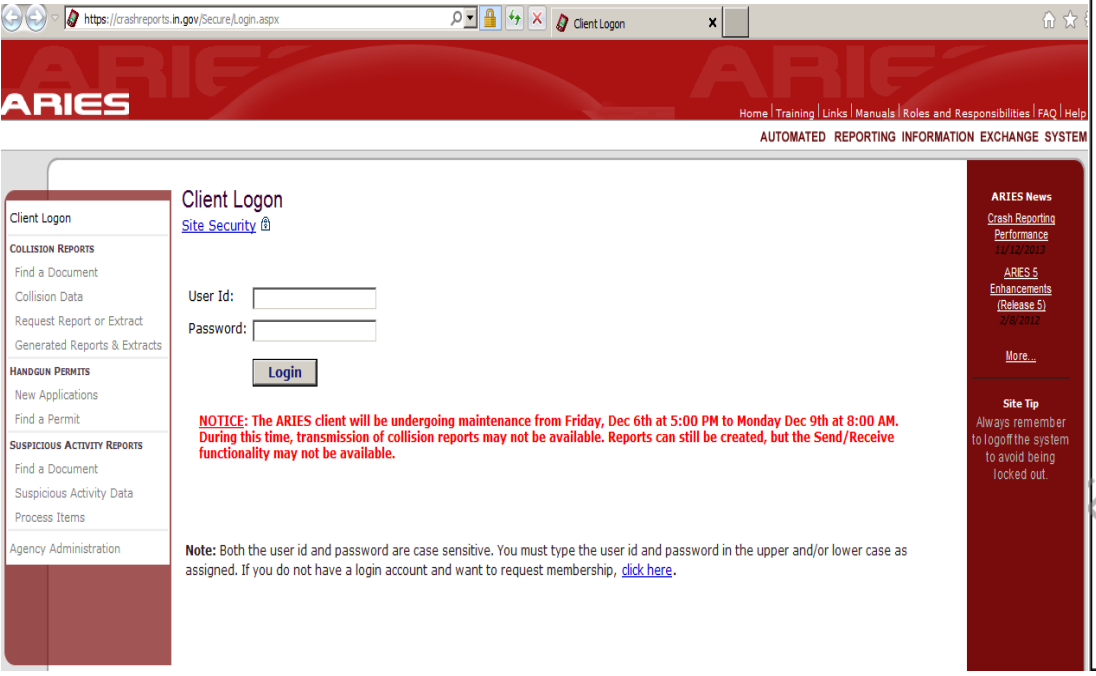
Step 3

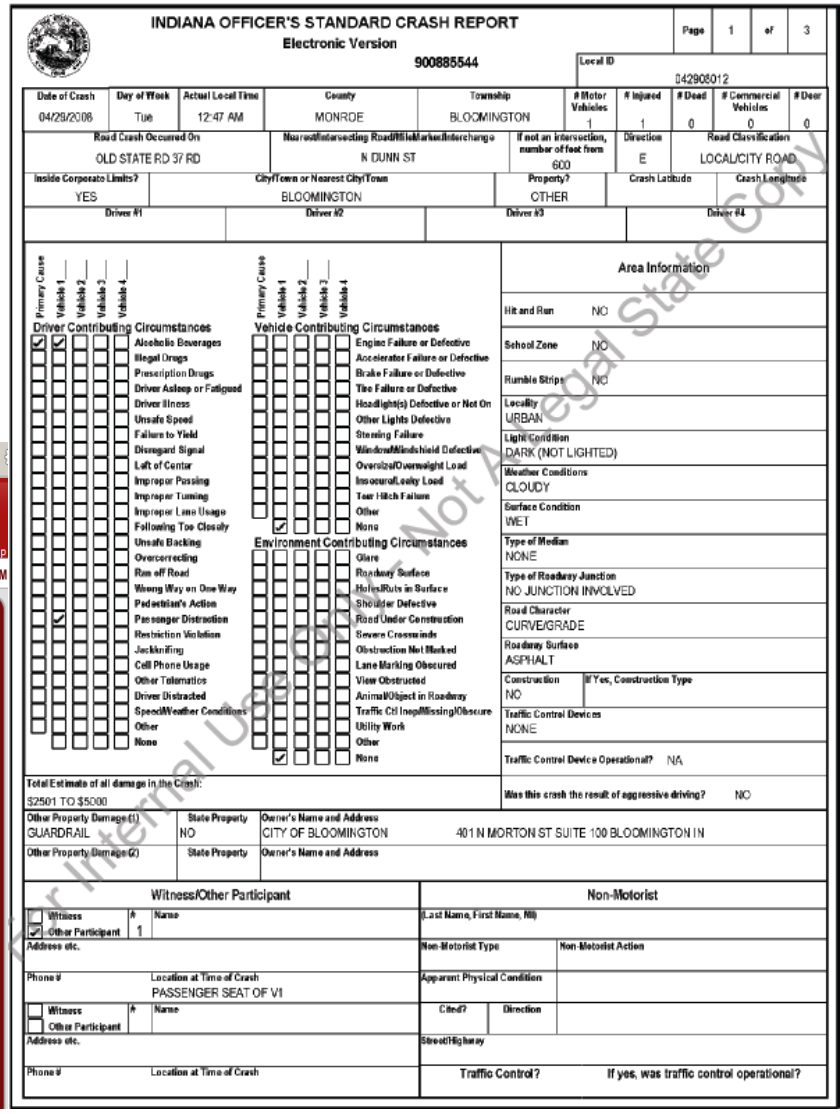
- Crash history
- Traffic volume and speed data
- Maps and/or aerial photographs
- Background reports
- History of improvements
- Design drawings/as-builts

Start-up Meeting: Provide Project Information

Step 3

- Where to get crash data?
  - ARIES
  - MPO/HELPERS
  - Law enforcement
  - FARS (www-fars.nhtsa.dot.gov)



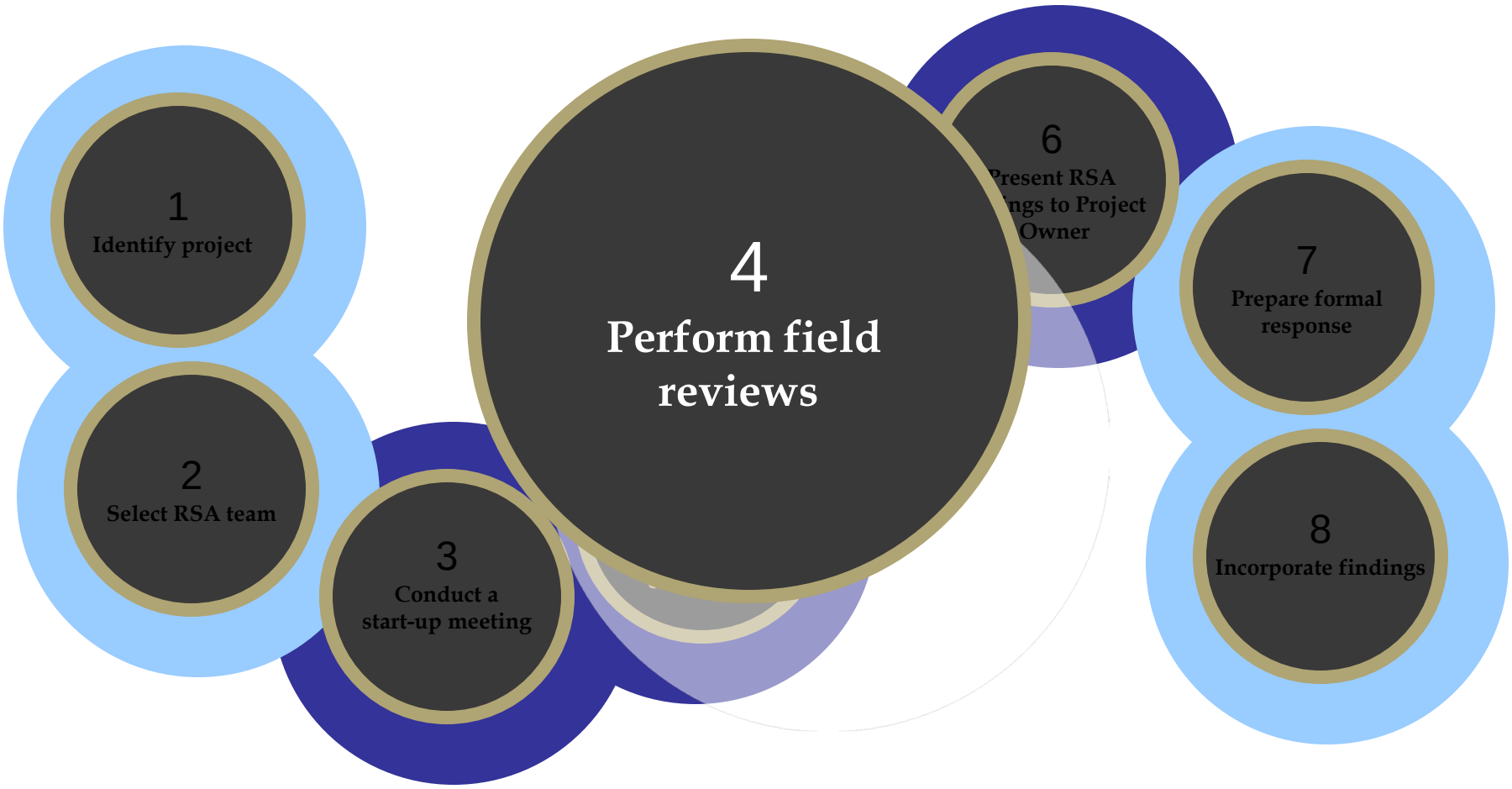


RSA Procedures for MPO's

3. Start-Up Meeting

- Encourage team members to travel the site prior to the Start-Up Meeting
- Roadway owner involvement (do NOT disclose solution)
- Discuss prior improvement efforts / changes (if applicable)
- Data – simple summary and patterns
- Signal timing (if applicable)

RSA Procedure



Field Reviews: Preparation

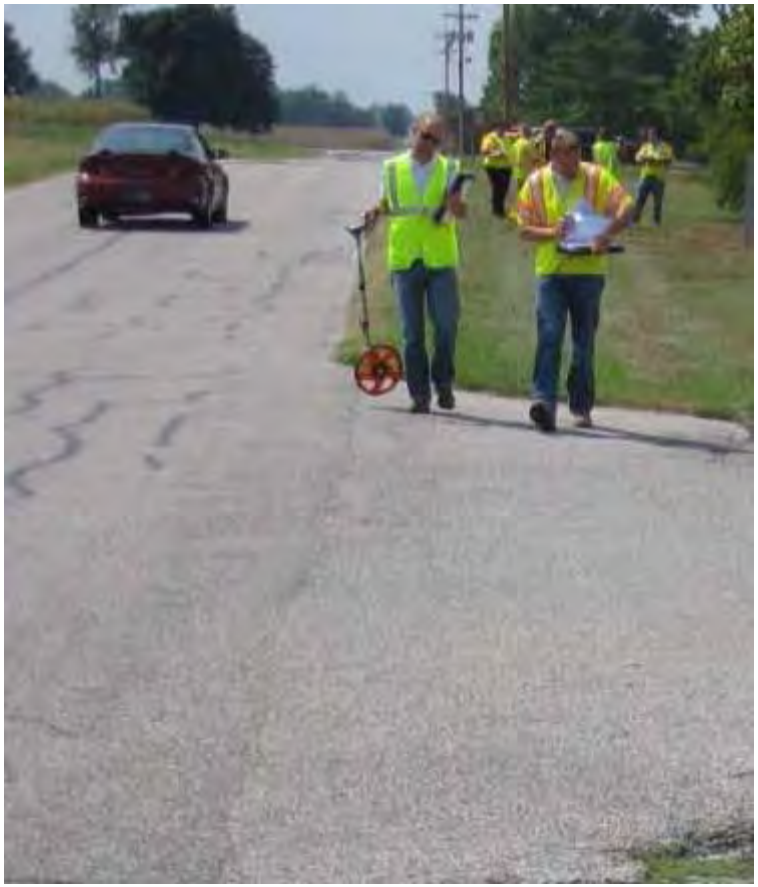
Step 4

- Review available data
- Arrange transportation
- Designate photographer(s) and secretary

Field Reviews: Equipment

Step 4

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



Field Reviews: Prompt List

Step 4

- Provides structure to the site visit
- Reminds the team what to look for and helps ensure that nothing is overlooked
- FHWA website: http://safety.fhwa.dot.gov/rsa/
- http://www.pedbikeinfo.org/

Field Reviews

Step 4

Walk the site

Field Reviews

Step 4

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

Field Reviews: Common Issues

Step 4

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

Field Review

- Talk with nearby residents & passing motorists
- Look for other issues
  - e.g. *ponding*
- Evidence of other users
  - e.g. *goat paths*

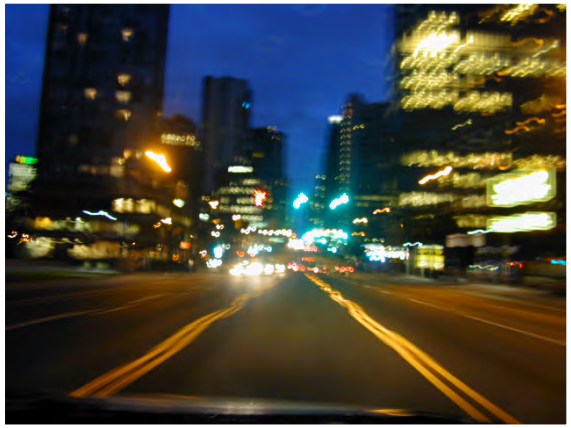
Field Review

- 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

Step 4

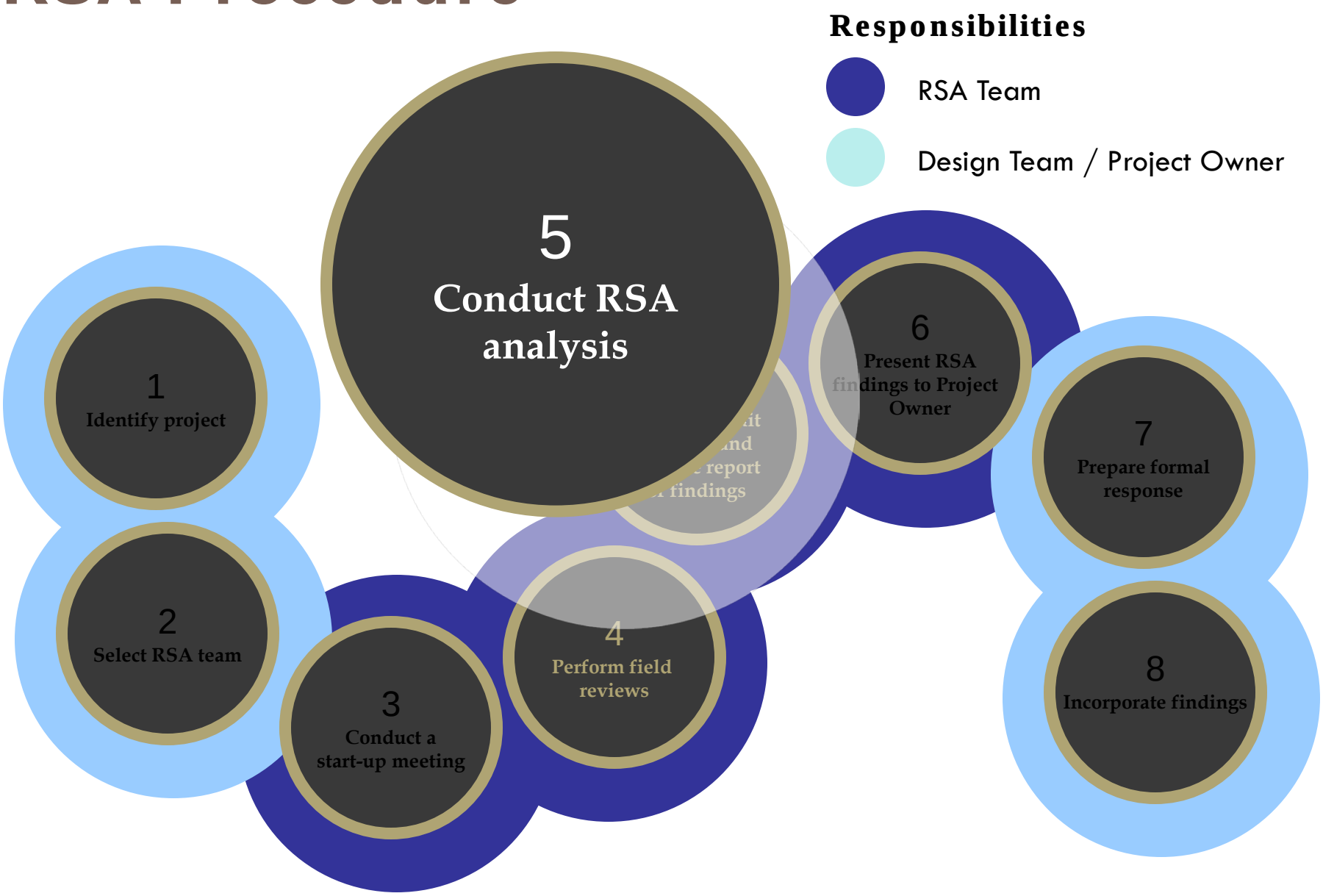
- Peak and off-peak traffic periods
- School arrival and dismissal
- Dry and wet weather conditions
- Day and night conditions



RSA Procedures for MPO's

4. Field Review
   - Single vehicle
   - Provide safety vests
   - Schedule should ensure common crash elements are present (day of week, time, weather, etc. if possible)
   - Stop watch

RSA Procedure



Conduct RSA Analysis

Step 5

- Identify and prioritize safety concerns
- Develop suggestions for reducing the degree of risk
- Report on findings

Using Relative Risk to Prioritize Safety Issues

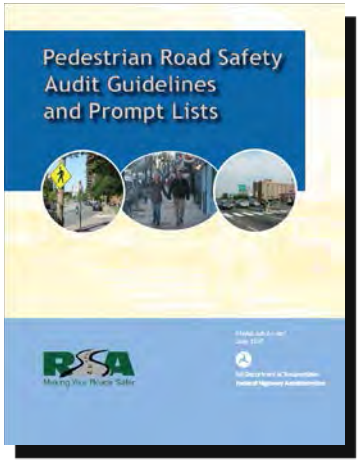
RISK CATEGORY		SEVERITY			
		Negli-gible	Low	Med	High
Crash Frequency Category	Frequent	C	D	E	F
	Occasional	B	C	D	E
	Infrequent	A	B	C	D
	Rare	A	A	B	C

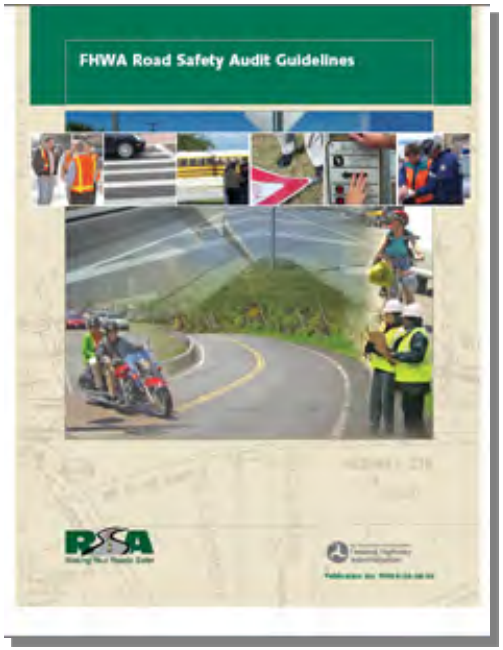
Analysis: Inventory and Review Information

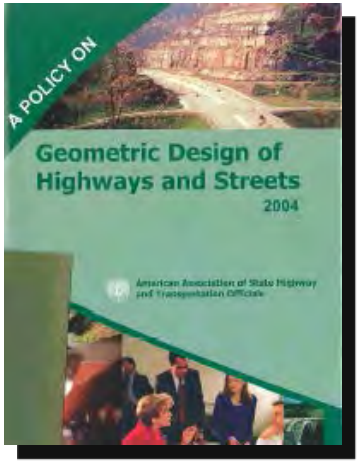
- Put aside materials that are not relevant
- Determine if any materials are missing or needed
- Organize materials the team may use

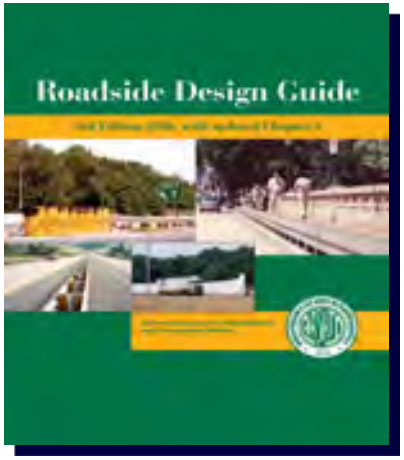
Step 5

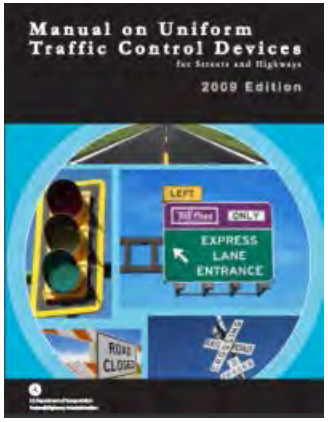
Resources & References

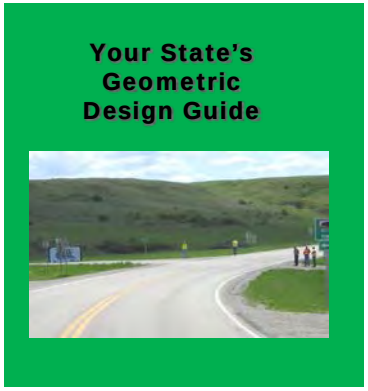


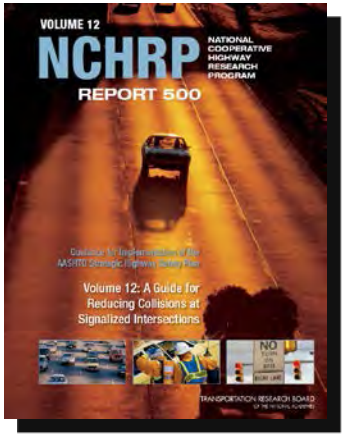












Analysis: Traffic Crashes

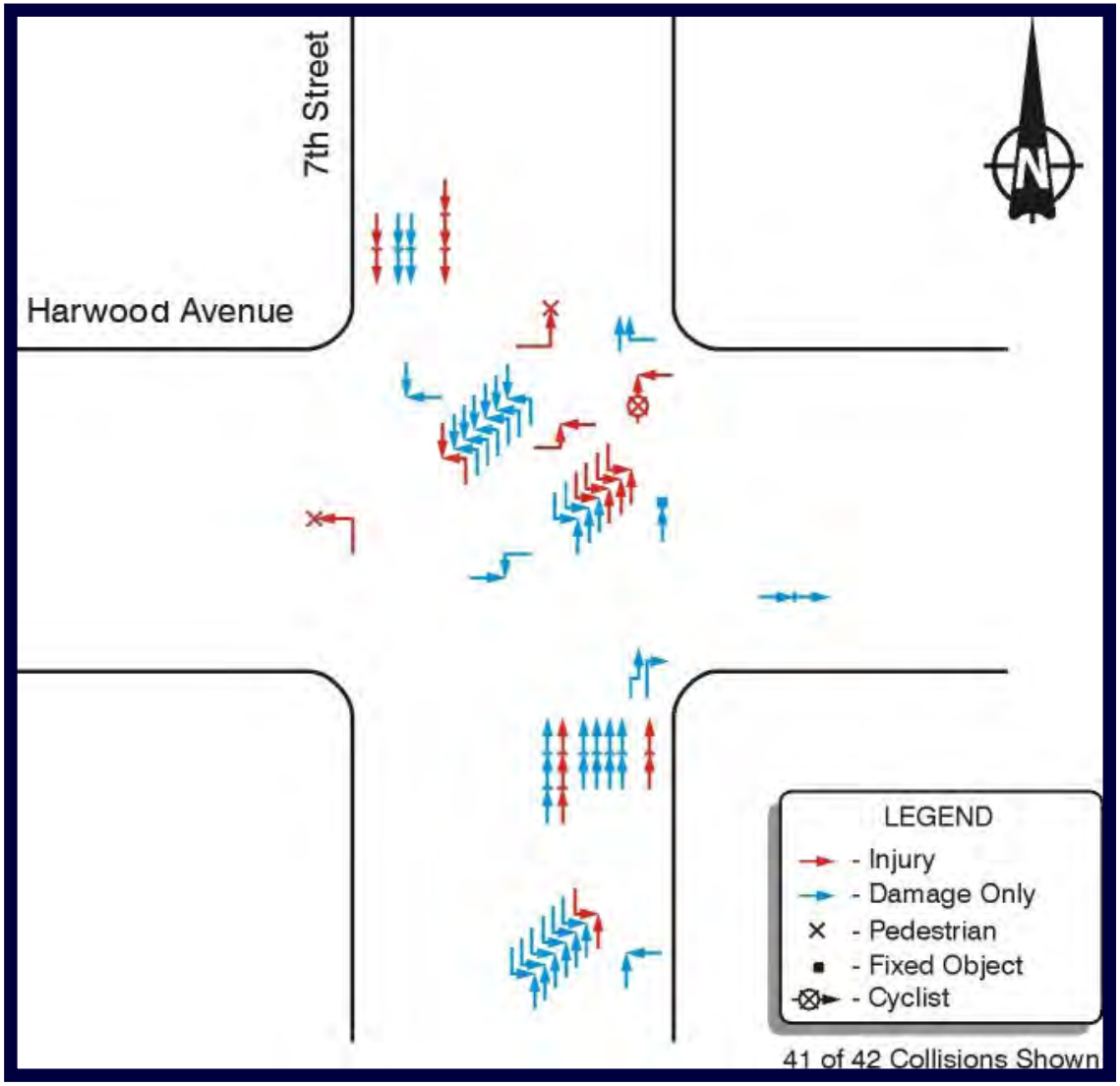
Step 5

Examine crash history of existing roads

Where do you get the data?

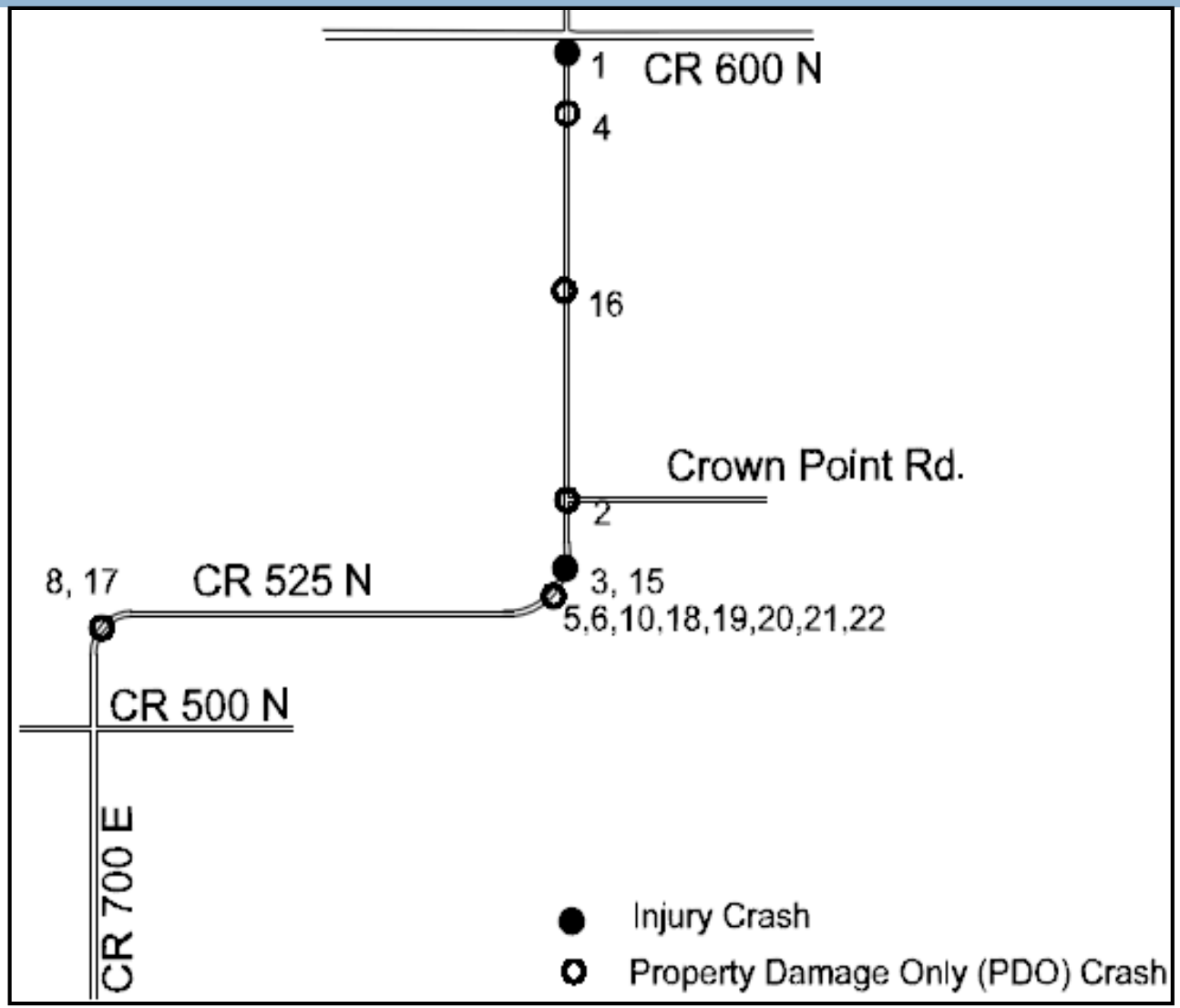
Analysis: Collision Diagrams

Step 5



Analysis: Collision Diagrams

Step 5



Analysis: Review Data

Step 5

- Operations
  - Congestion, delay, queueing
  - Signal operations
  - Vehicle speeds
  - Driveways

Analysis: Review Data

Step 5

- Geometry
  - Curve radius
  - Sight distance
  - Clear Zone

Analysis: Review Data

Step 5

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

Address All Users

Step 5

Unintended Consequences

Analysis: Review Data

Step 5

Identify and summarize main issues. Examples:

- Sight distance
  - lack of SD around curve
  - lack of SD at intersection
- Roadway geometry
  - complex horizontal curves
  - vertical curve
  - improper superelevation
- Roadway surface
  - pavement cracking
  - polishing of pavement
- Signs
  - no curve warning sign or advisory speed
  - incorrect sign location
  - incorrect sign size
  - signs lack retroreflectivity

Project Suggestions

Step 5

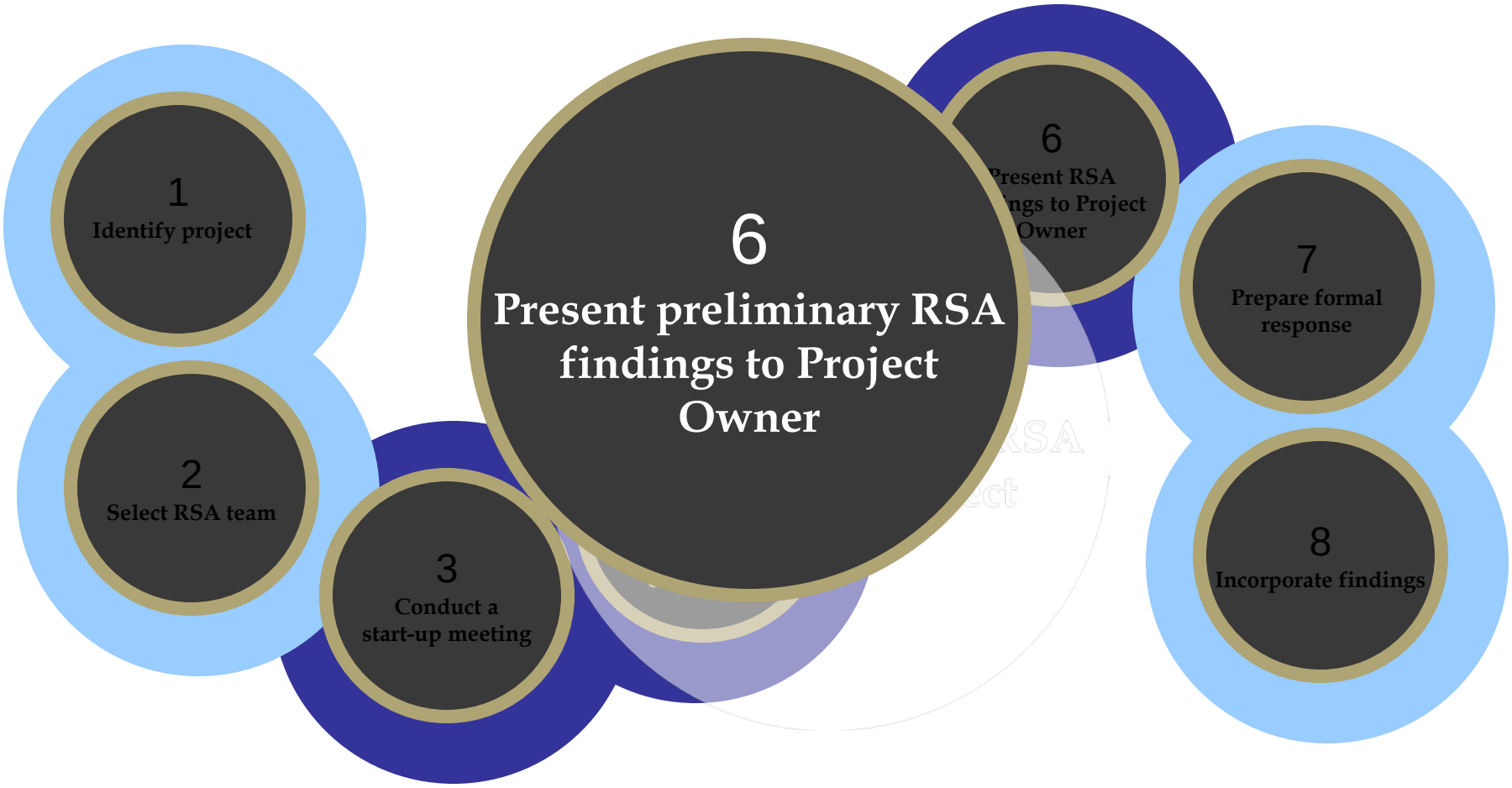
- **Short Term Solutions**
  - Maintenance (e.g. clear vegetation, repair guardrail)
  - Signs
  - Pavement Markings
  - Remove/shield roadside hazards
  - Enforcement
  - Driver education
- **Long Term Solutions**
  - Redesign curve
  - Modify alignment
  - Roundabout

RSA Procedures for MPO's

5. Conduct Analysis

- Include the "Good"
- Low Cost (Short Term) & High Cost (Long Term)
  - Ensure short term recommendations are included within long term improvements, if applicable

RSA Procedure



RSA Findings Presentation

Step 6

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

RSA Findings Presentation

Step 6

- Be positive
- Discuss safety successes

RSA Findings Presentation

Step 6

- Factor in feedback
- Review and revise findings as appropriate
- Initiate formal report
  - Designate tasks

RSA Findings: Formal Report

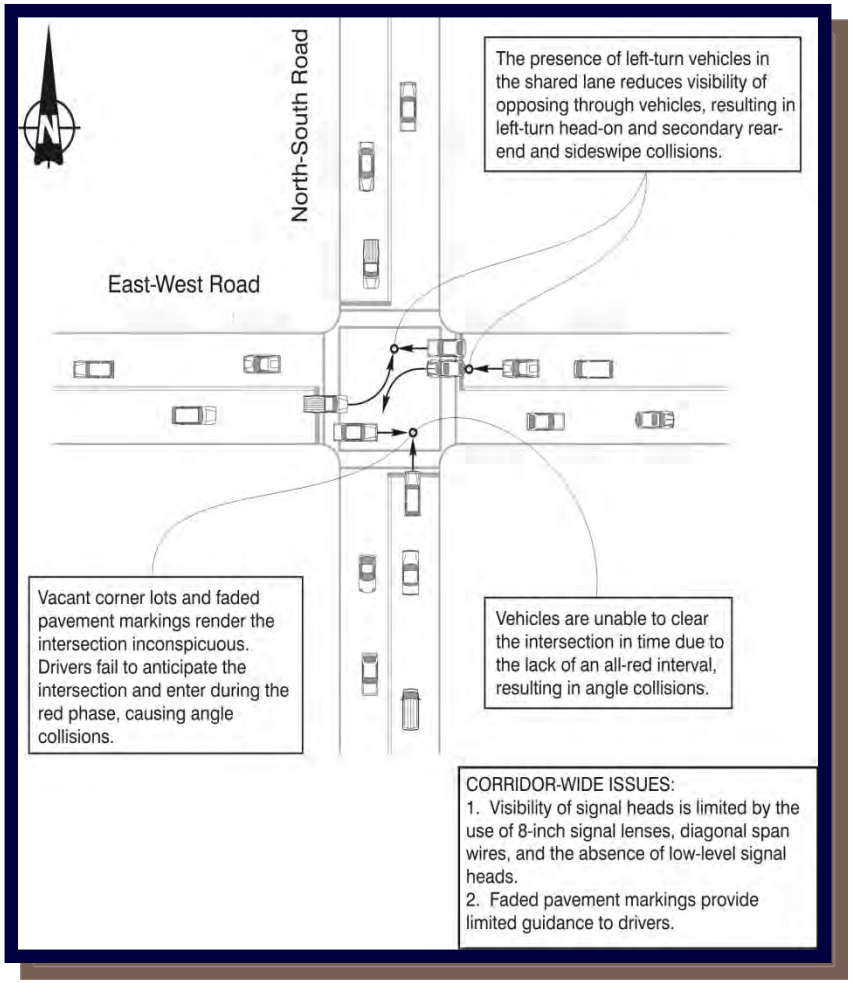
Step 6

Table of Contents

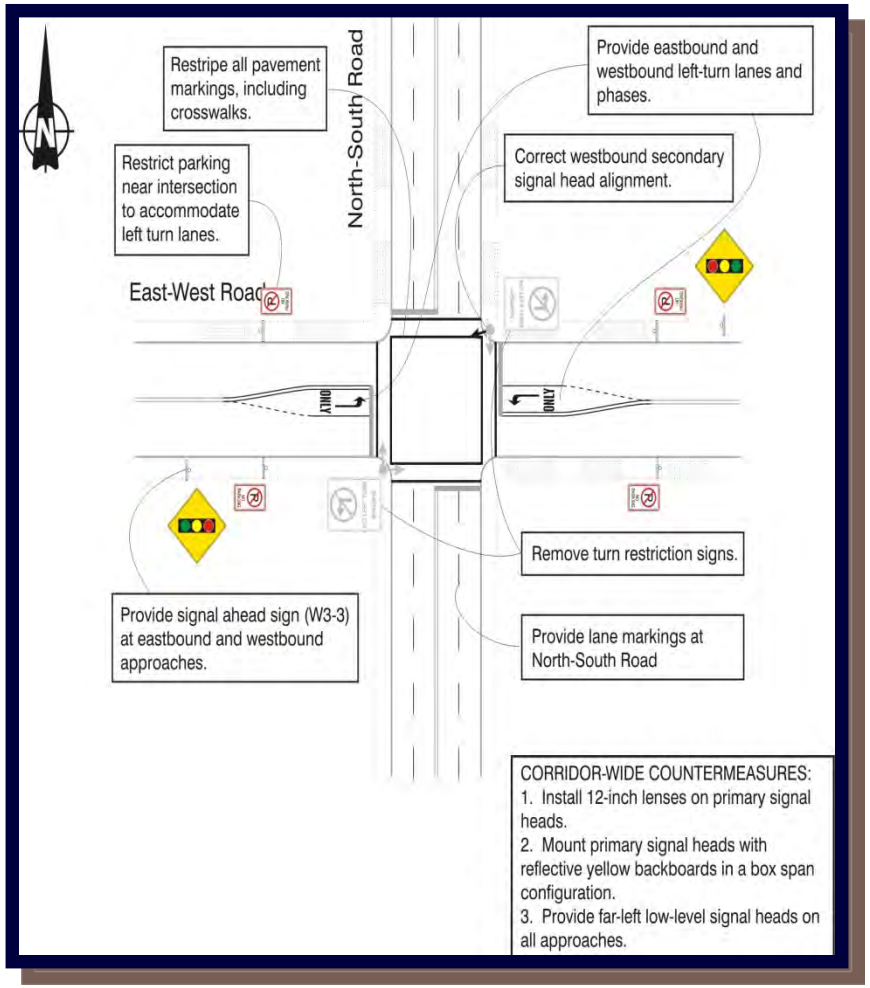
Table of Figures

Step 6

RSA Findings: Formal Report



Safety concerns



Suggestions

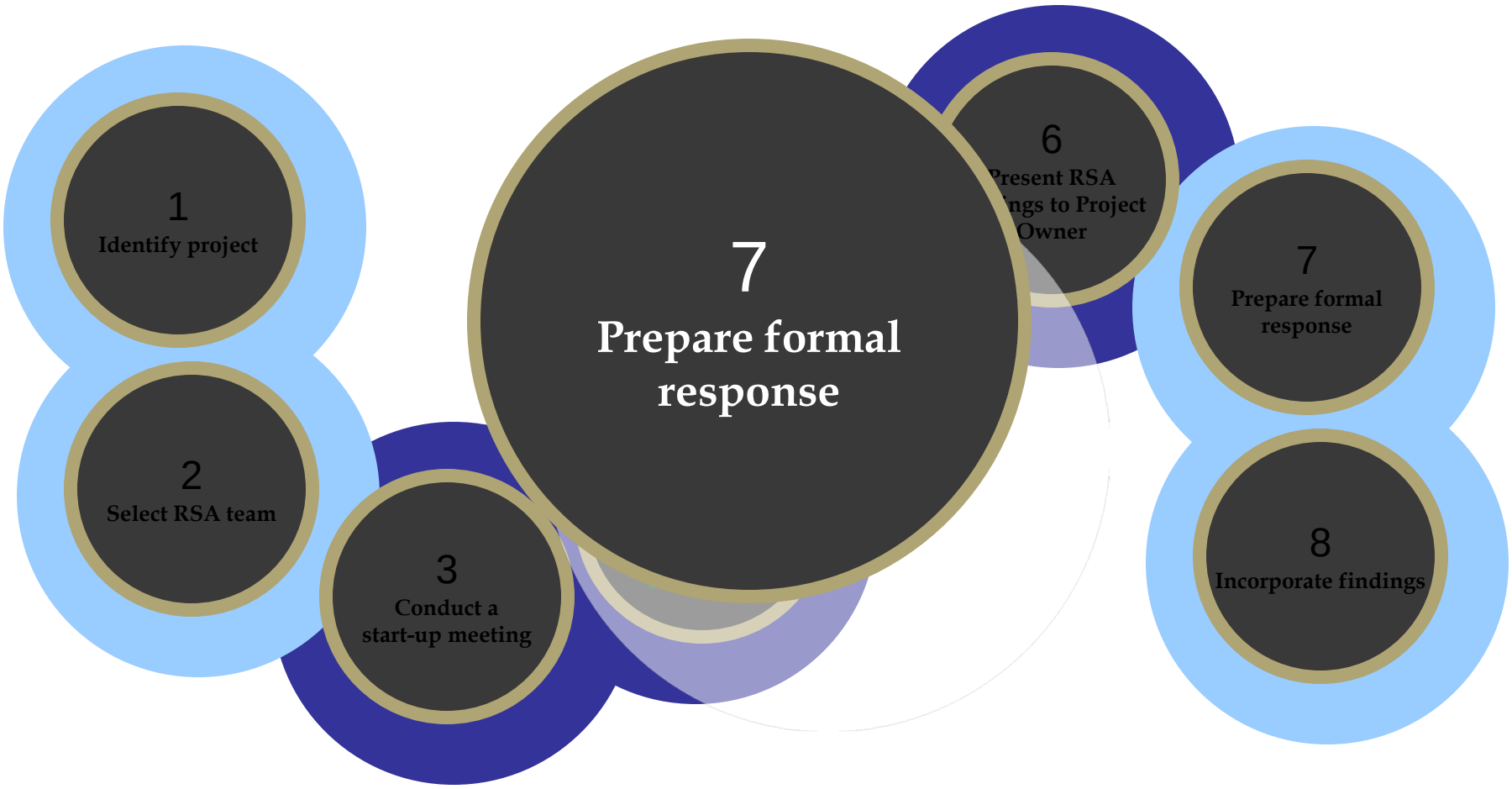
RSA Report

Be brief!

RSA Procedures for MPO's

6. Present Findings to Project Owner
   - Invite elected officials
   - Offer future support
   - Discuss owner's proposed solution

RSA Procedure



Response Letter

Step 7

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

Step 7

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

Reason for taking no action

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.

Response Letter

Step 7

Inadequate Response

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

Response Letter

Step 7

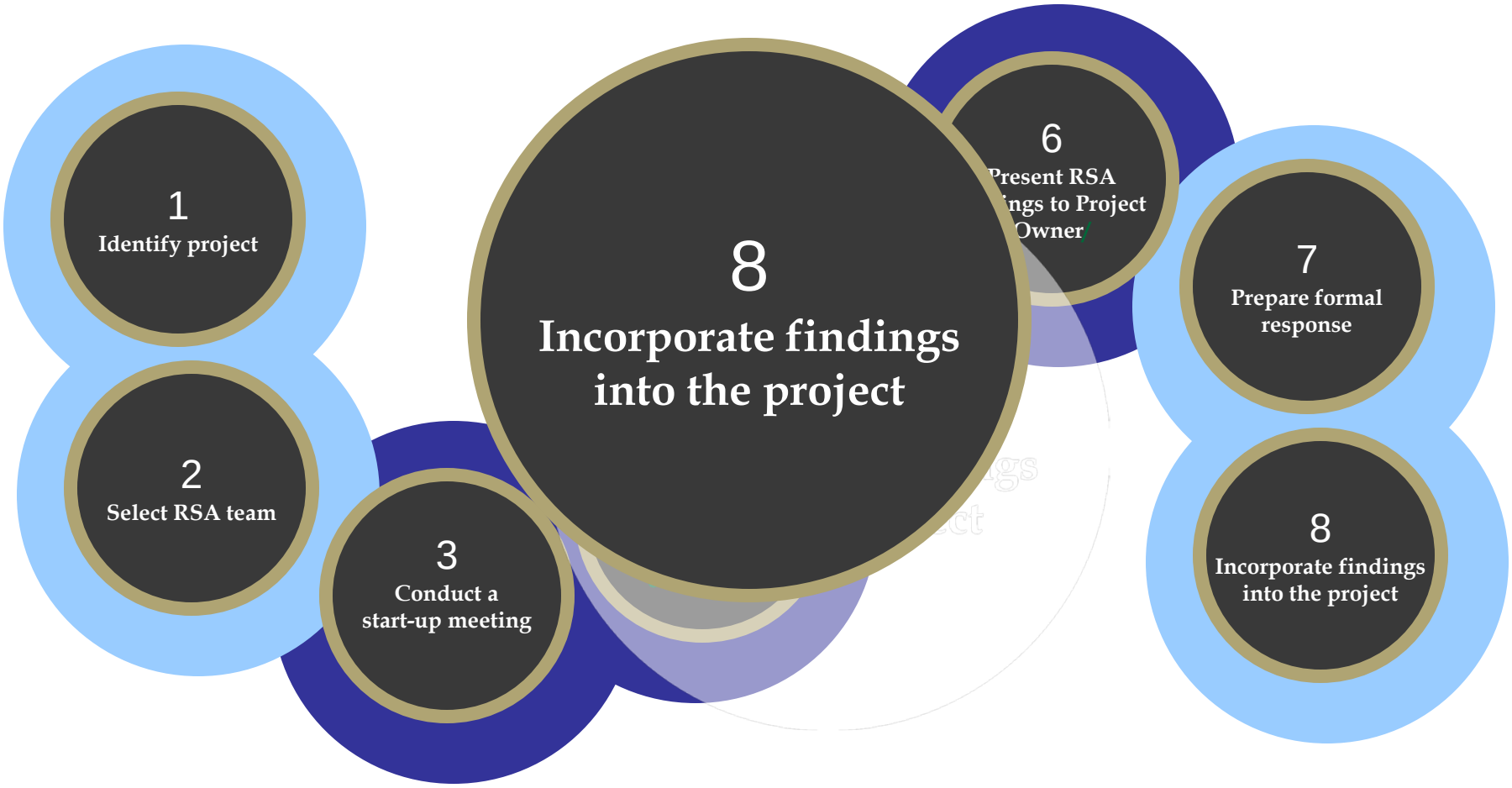
Adequate Response

"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 Procedures for MPO's

7. Formal Response
   - Roadway owner to MPO
   - Letterhead
   - Highest ranking official

RSA Procedure



Implementation of Improvements

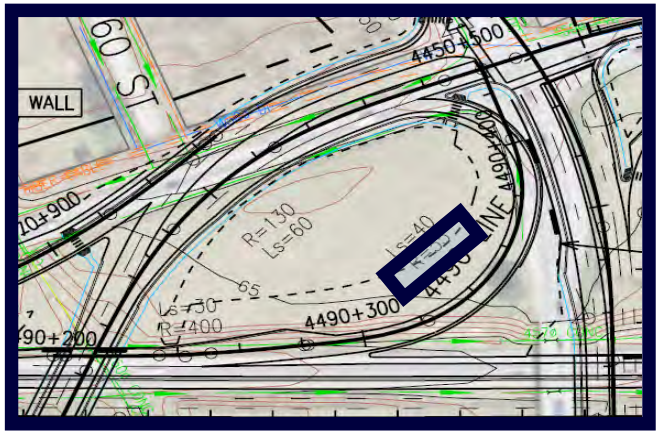
Step 8

Implementation may depend on policy, manpower and/or funding.

Implementation of Improvements

Step 8

Pre-construction RSAs



Changes to design drawings

Post-construction RSAs

Incorporate improvements in operating budgets or maintenance programs

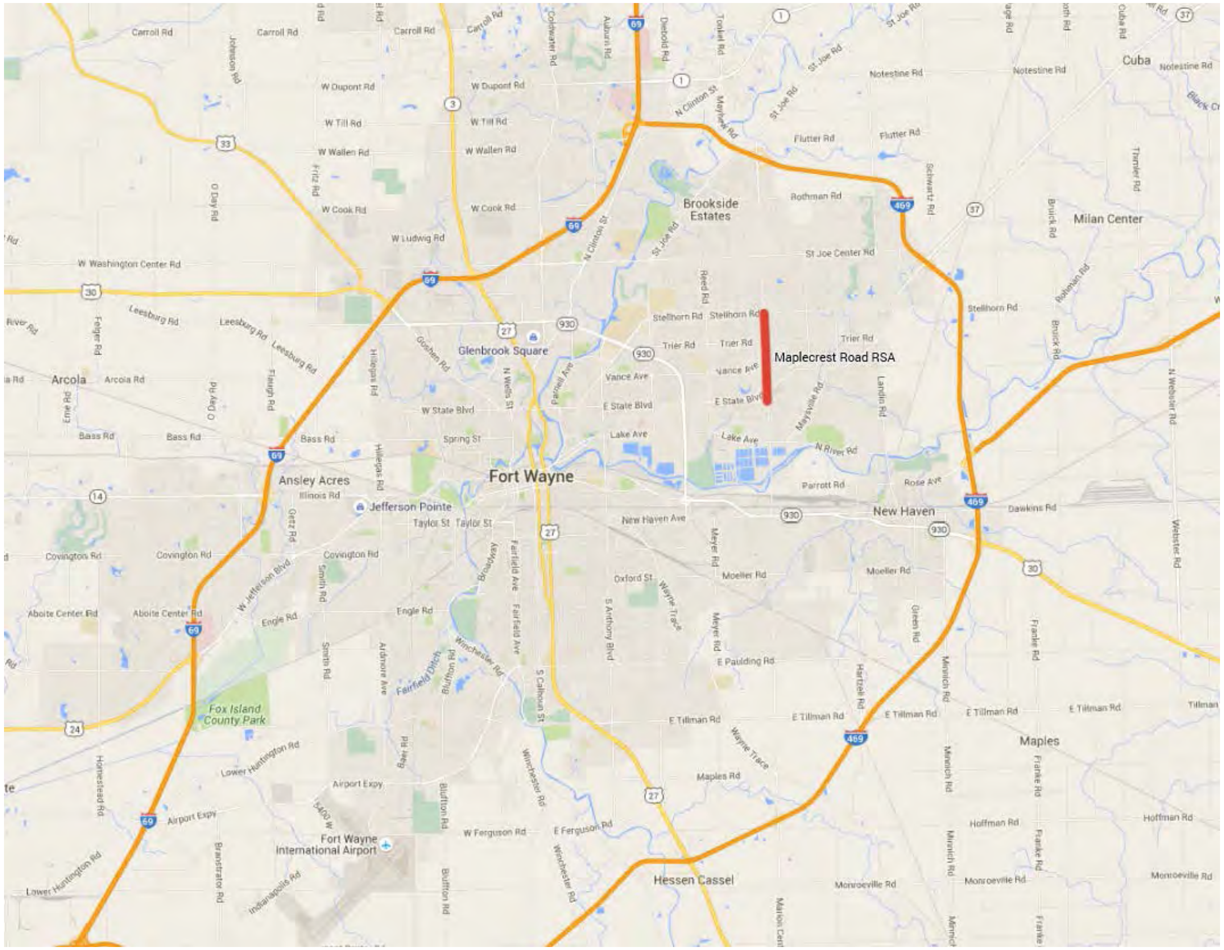
RSA Procedures for MPO's

8. Incorporate Findings into the Project
   - HSIP application
   - RFP
   - Field Check
   - Law Enforcement
     - Review Data
   - Maintenance Department

CASE STUDIES

Case Study 1

Maplecrest Road: from Stellhorn Road to State Boulevard



Case Study 1

Maplecrest Rd: Stellhorn Rd to State Blvd


Crash Density
High
Low
N
W
E
S
NIRCC
SAINT JOE RD
WHEELOCK RD
ROTHMAN RD
EVARD RD
SAINT JOE CENTER RD
MAPLECREST RD
LAHMEYER RD
SAINT JOE RD
STELLHORN RD
TRIER RD
LAHMEYER RD
MAYSVILLE RD
REED RD
HOBSON RD
STATE BLVD
MAYSVILLE RD
NORTH RIVER RD

Case Study 1

RSA Team

- 1- Law Enforcement
- 1- County highway
- 1- Technical Committee Member (Land-Use Planner)
- 2 - INDOT

NIRCC – MPO

- Collected and Prepared Data
- Assembled RSA Team
- Scheduled and Coordinated RSA
- Attended RSA
  - Assist in process
  - Documentation
  - Answer Questions Regarding data
- Summarized RSA

Case Study 1

Maplecrest Rd: s/o Stellhorn Road to n/o State Boulevard

2007 to 2009 Crash Summary

Summary	No.	%
Total Crashes	105	
PDO	74	0.70
I/F	31	0.30

Crash Index	
Index of Crash Cost (Icc)	2.65
Index of Crash Frequency (Icf)	1.64

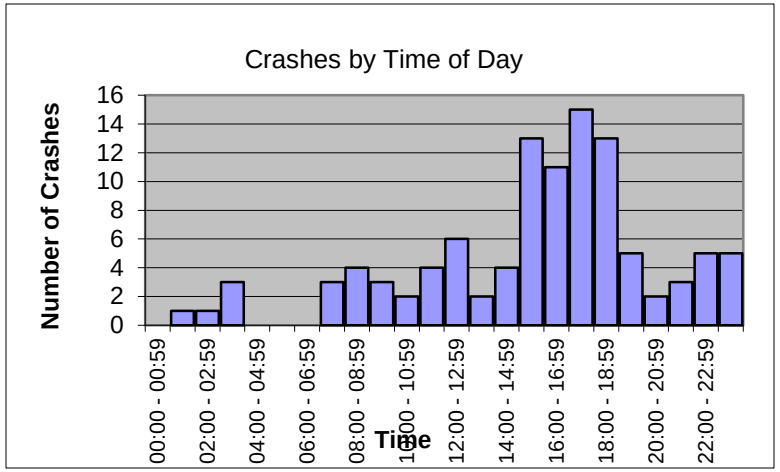
Month	No.	%
January	6	0.05
February	8	0.07
March	10	0.09
April	9	0.08
May	18	0.16
June	7	0.06
July	9	0.08
August	8	0.07
September	2	0.02
October	9	0.08
November	6	0.05
December	13	0.12

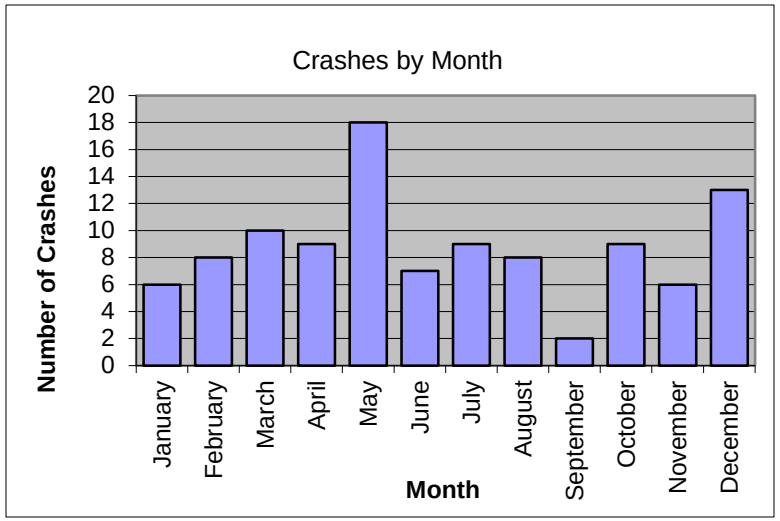
Weather Conditions	No.	%
Clear	59	0.54
Cloudy	26	0.24
Fog/Smoke/Smog	1	0.01
Rain	15	0.14
Sleet/Hail/Freezing Rain	1	0.01
Snow	3	0.02

Pavement Type	No.	%
Dry	77	0.70
Ice	3	0.03
Snow/Slush	3	0.03
Wet	22	0.20

Time of Day	No.	%
00:00 - 00:59	0	0.00
01:00 - 01:59	1	0.01
02:00 - 02:59	1	0.01
03:00 - 03:59	3	0.03
04:00 - 04:59	0	0.00
05:00 - 05:59	0	0.00
06:00 - 06:59	0	0.00
07:00 - 07:59	3	0.03
08:00 - 08:59	4	0.04
09:00 - 09:59	3	0.03
10:00 - 10:59	2	0.02
11:00 - 11:59	4	0.04
12:00 - 12:59	6	0.05
13:00 - 13:59	2	0.02
14:00 - 14:59	4	0.04
15:00 - 15:59	13	0.12
16:00 - 16:59	11	0.10
17:00 - 17:59	15	0.14
18:00 - 18:59	13	0.12
19:00 - 19:59	5	0.05
20:00 - 20:59	2	0.02
21:00 - 21:59	3	0.03
22:00 - 22:59	5	0.05
23:00 - 23:59	5	0.05

Primary Factor	No.	%
Alcoholic Beverages	2	0.02
Brake Failure or Defective	2	0.02
Disregarding Signal/Reg Sign	2	0.02
Driver Distracted	8	0.07
Failure to Yield	20	0.18
Following too Closely	34	0.31
Headlight Defective or Not On	1	0.01
Improper Lane Usage	1	0.01
Improper Passing	2	0.02
Improper Turning	2	0.02
Left of Center	1	0.01
Other Explain in Narrative (Driver)	15	0.14
Other Explain in Narrative (Environmental)	2	0.02
Pedestrian Action	1	0.01
Ran off Road Right	5	0.05
Roadway Surface Condition	1	0.01
Speed too Fast for Weather Condition	1	0.01
Tire Failure or Defective	1	0.01
Unsafe Backing	1	0.01
Unsafe Speed	1	0.01
View Obstructed	1	0.01
Unknown	1	0.01

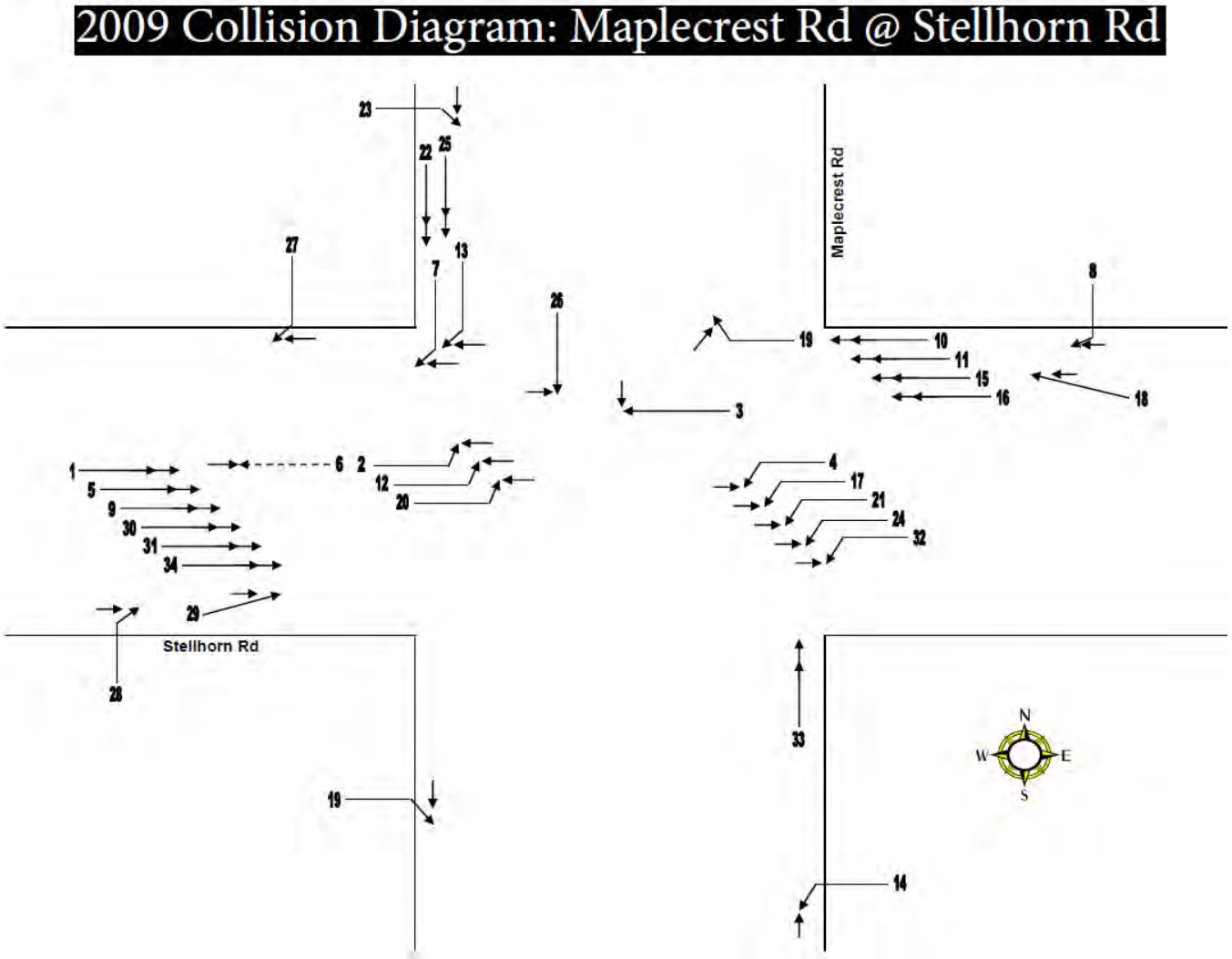




Case Study 1

Traffic Volume Data					
Location	**Date of Collection**	**AADT**	**24 Hour D-Factor**	**AM Peak Volume**	**PM Peak Volume**
Stellhorn Rd to Birchdale Dr	9/16/2009	18429	0.5127 (SB)	1346 (SB)	1696 (SB)
Birchdale Dr to Trier Rd	9/16/2009	17458	0.5122 (SB)	1237 (SB)	1606 (NB)
Trier Rd to Vance Ave	5/12/2010	15777	0.5327 (NB)	1063 (SB)	1360 (NB)
Vance Ave to Alvarez Dr	7/10/2008	16561	0.5068 (NB)	963 (SB)	1503 (NB)

Case Study 1


2009 Collision Diagram: Maplecrest Rd @ Stellhorn Rd
Maplecrest Rd
Stellhorn Rd
N
W
E
S

Case Study 1

Acceptable Features

- Speed limit
- Lane Widths
- Drainage
- Overhead illumination (at intersection)
- Horizontal and vertical alignment
- Signalized intersections

Primary Deficiencies

- Capacity during peak hours
- Lack of pedestrian
- Corridor illumination between intersections
- Specific signing issues
- Inadequate space for transit
- Signage obstructing sight distance

Case Study 1

Short Term Recommendations

- New pavement markings
- Signage improvements
- Access Control
- Increase length of left turn lane
- Relocate bus stop

Long Term Recommendations

- Added Travel Lanes needed in both directions
- Continuous two way left turning lanes needed in designated areas
- Bicycle and pedestrian facilities needed
- Intersections improvements needed at Georgetown N Blvd & Stellhorn Rd

Case Study 1

Outcome of RSA

- Roadway owner agreed to;
  - Add travel lanes
  - Install sidewalk and trail system
  - Install overhead illumination
  - Make intersection improvements
  - Create safe bus stop location(s)
  - Upgrade all signage

KEYS TO SUCCESS & LESSONS LEARNED

Keys to Success

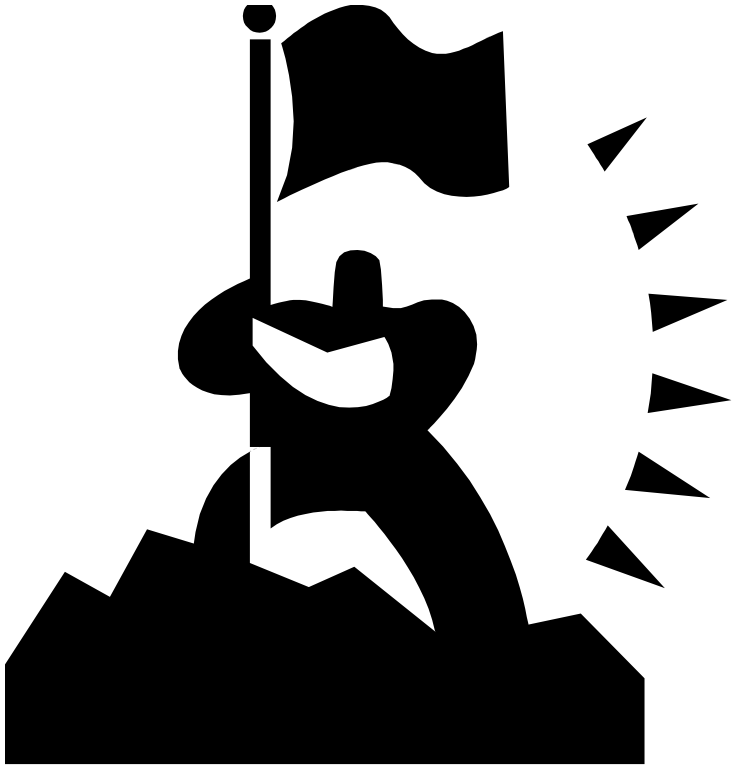
The RSA Team must acquire a clear understanding of the project background and constraints.

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

RSA reports have been brief

Lessons Learned

- Don't have tunnel vision
- Be flexible with project limits (if feasible)
- Bring more than one camera
- Double-check the time zone

Keys to Success – MPO Perspective

- Select “good” location for RSA
- Engage with local law enforcement
- Provide all available resources
- Involve elected official throughout the process
- Follow up
  - Promote project
  - Be engaged throughout the project development

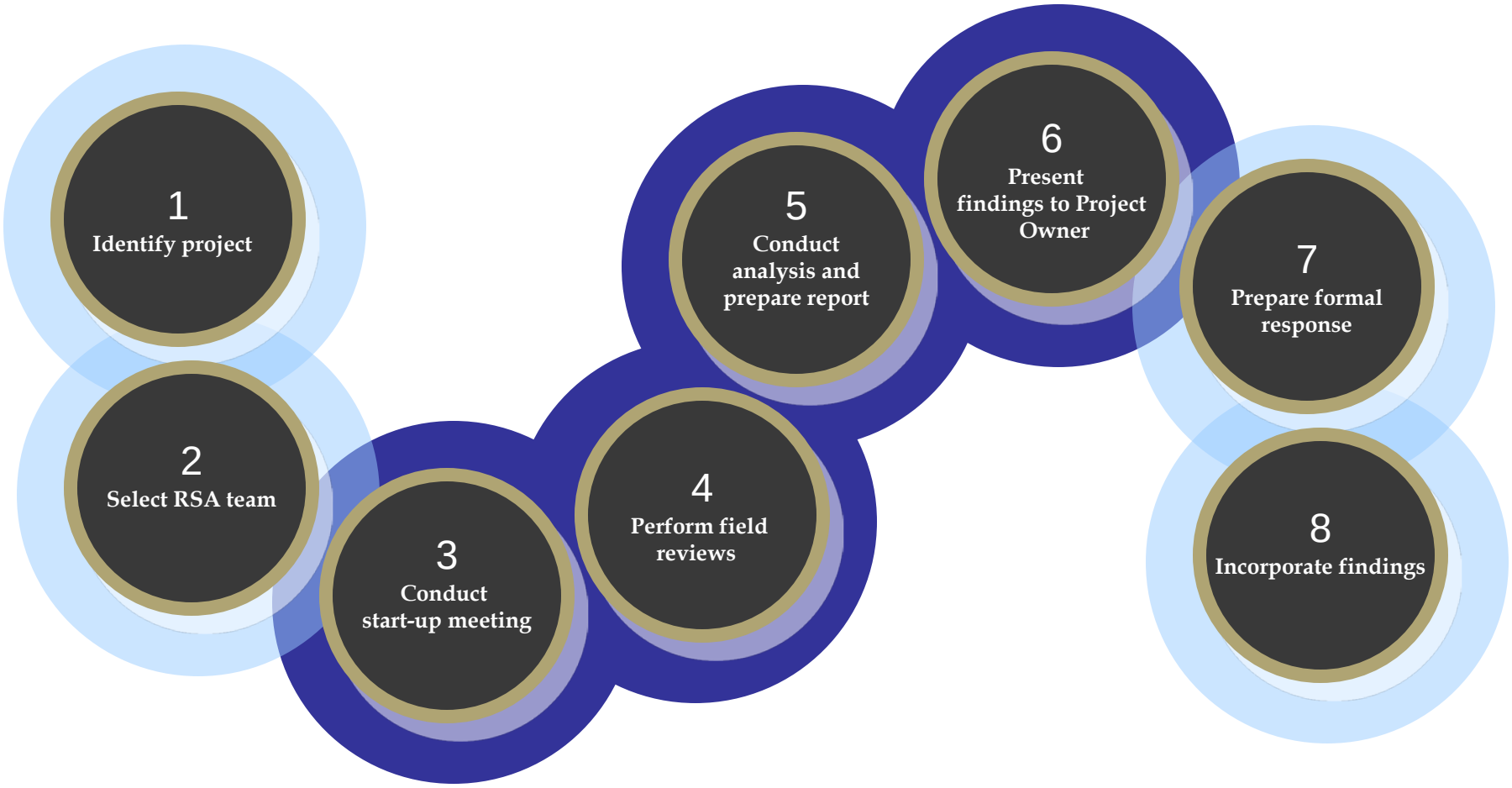
WRAP UP


MELISSA

Road Safety Audits (RSAs)

- Formal safety performance examination
- Existing or future road segment or intersection
- Independent, multidisciplinary team

RSA Procedure



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

- NCHRP Syntheses
  - 321: Roadway Safety Tools for Local Agencies
  - 336: Roadway Safety Audits
- RSA Guidelines

QUESTIONS?

Jerry Foust
jerry.foust@co.allen.in.us
NIRCC

Laura Slusher
lslusher@purdue.edu
Indiana LTAP