Innovative Initiatives that Promote a Culture of Highway Safety

Module 7: Road Safety 365: A Process for Reducing Crashes (Reference: Module 5, Road Safety 365, FHWA)

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CIAPR - Mayagüez Chapter

Safe Roads for a Safer Future

Investment in roadway safety saves lives

U.S. Department of Transportation

Federal Highway Administration

Module 5: Making Safer Roads

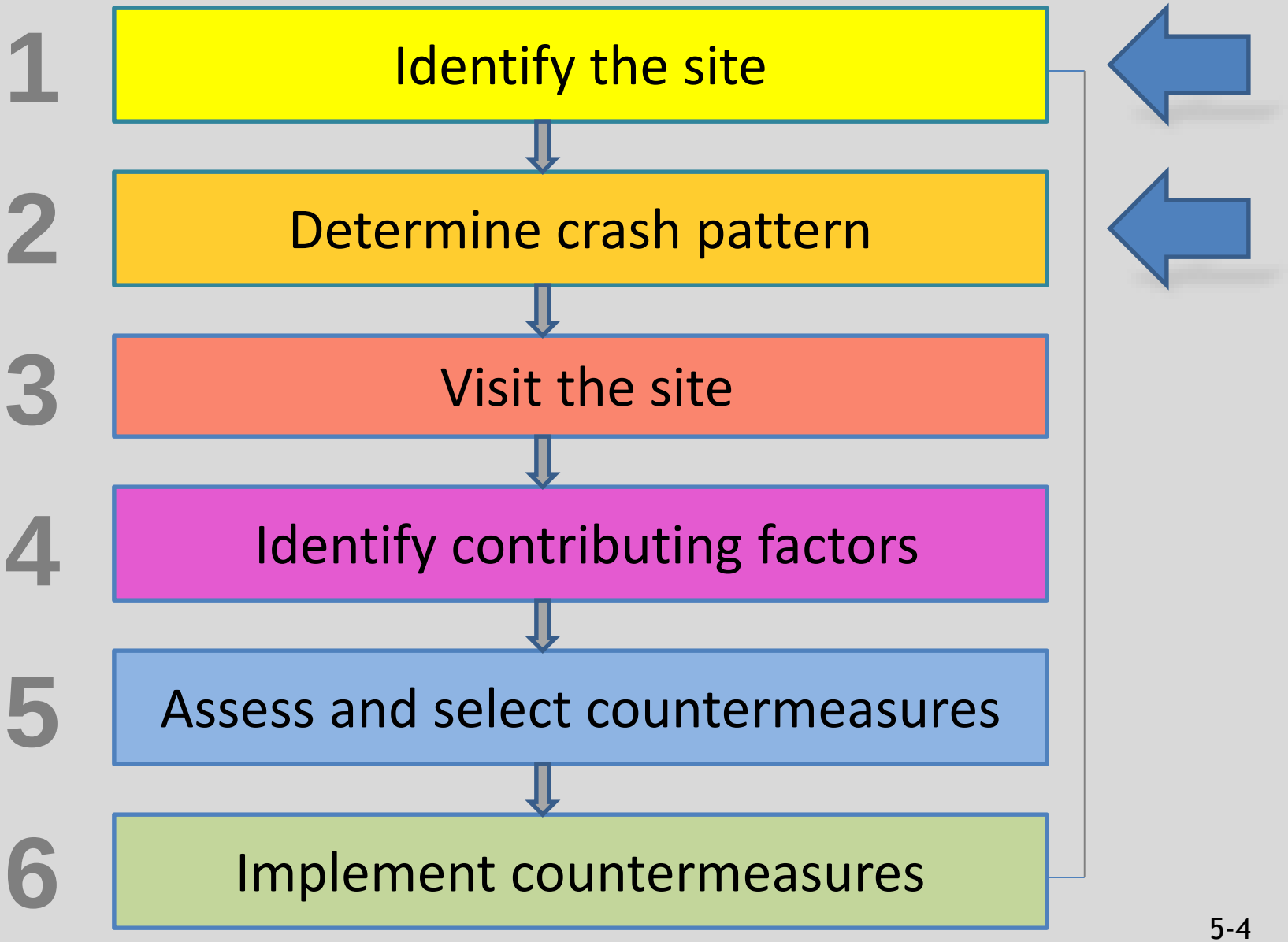
A Process for Reducing Crashes

Local & Tribal Technical Assistance Program

Learning Outcomes

- Describe the crash reduction process.
- Identify the data/information needed to assess the safety of a roadway location.
- Identify practical and low-cost countermeasures.
- Describe best practices for making roads safer.

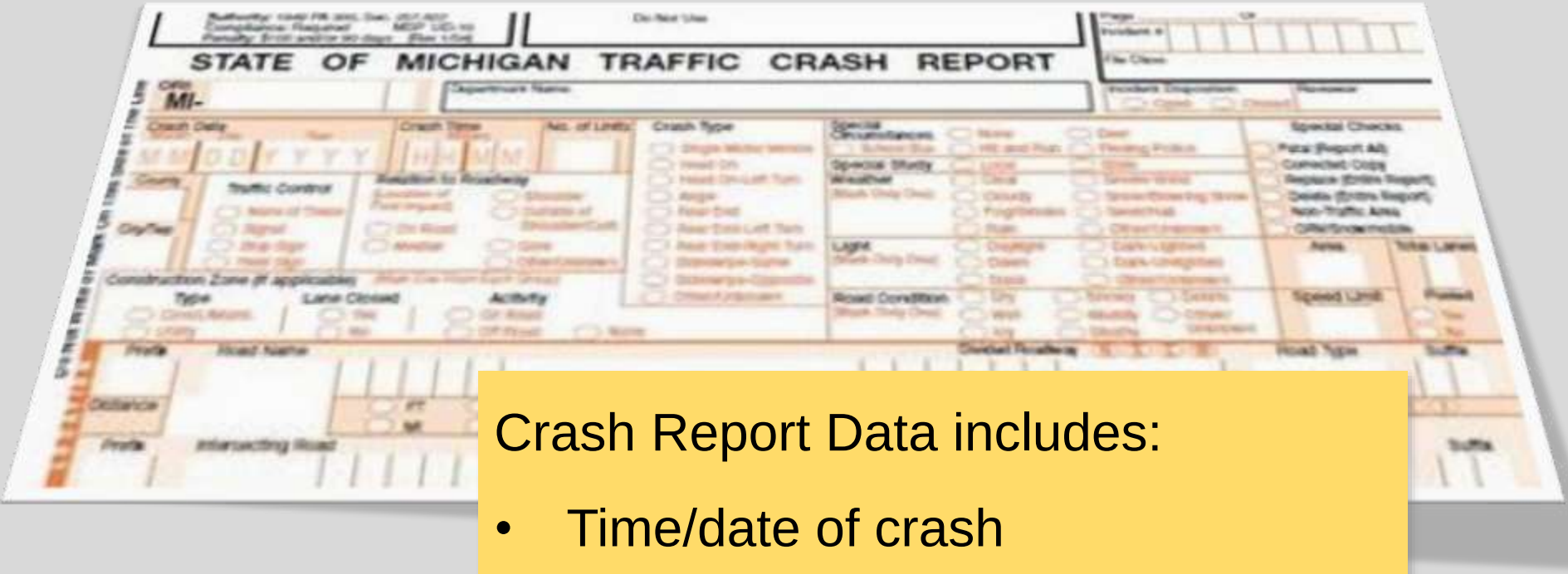
Steps in Crash Reduction Process



Crash Data Sources

- Crashes Reports: Police, DTOP
  - Place, time, drivers, vehicles, existing conditions, contributing factors
- Fatality Analysis Reporting System (FARS): NHTSA, CST
  - Fatal crashes database
- Motor Carrier Management Information System: FMCSA
  - CSP
  - Safety performance of individual suppliers

Obtain Crash Data



Crash Report Data includes:

- Time/date of crash
- Pavement or surface conditions
- Weather conditions
- Other contributing factors

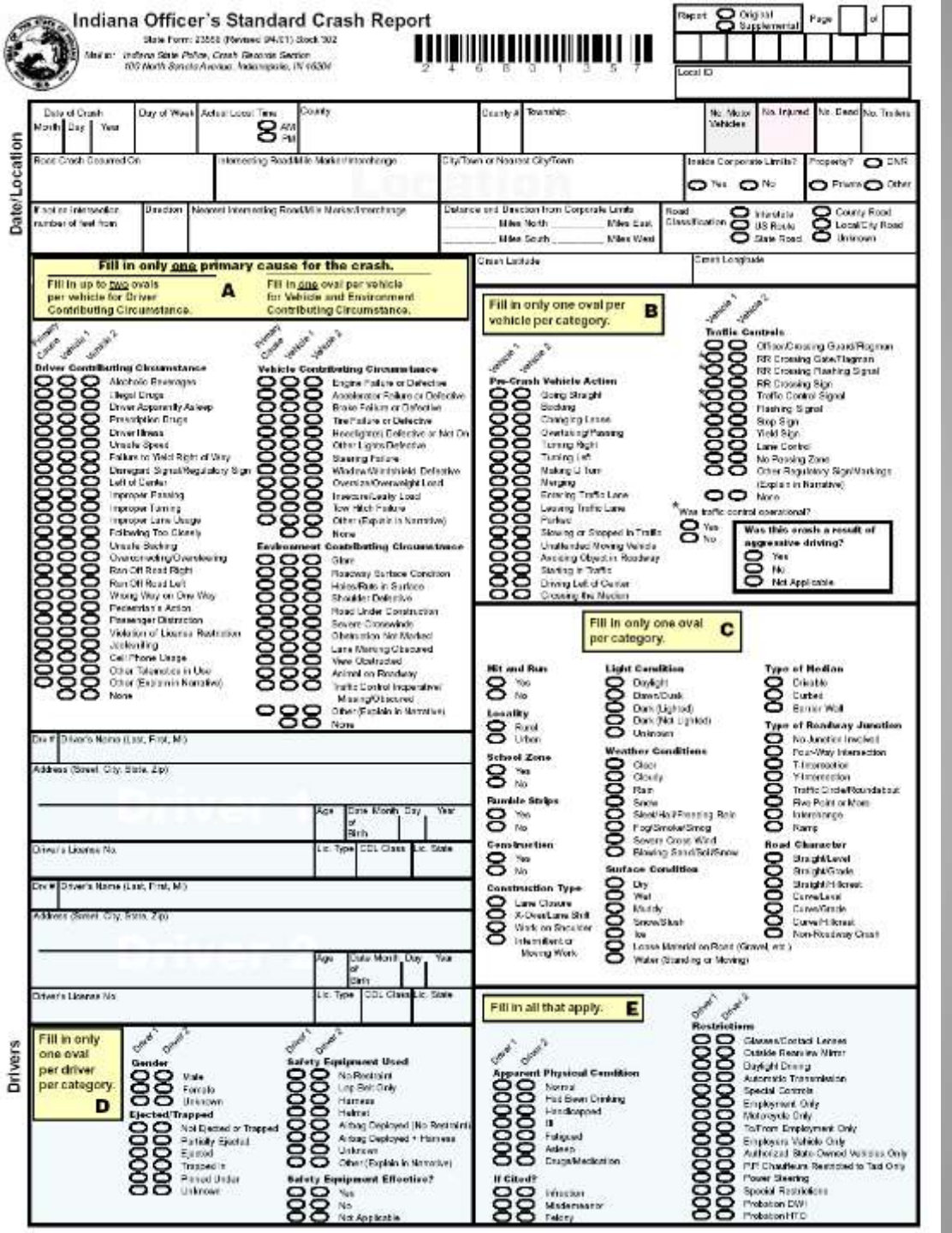
Indiana Police
Crash Report Form

[Full form]

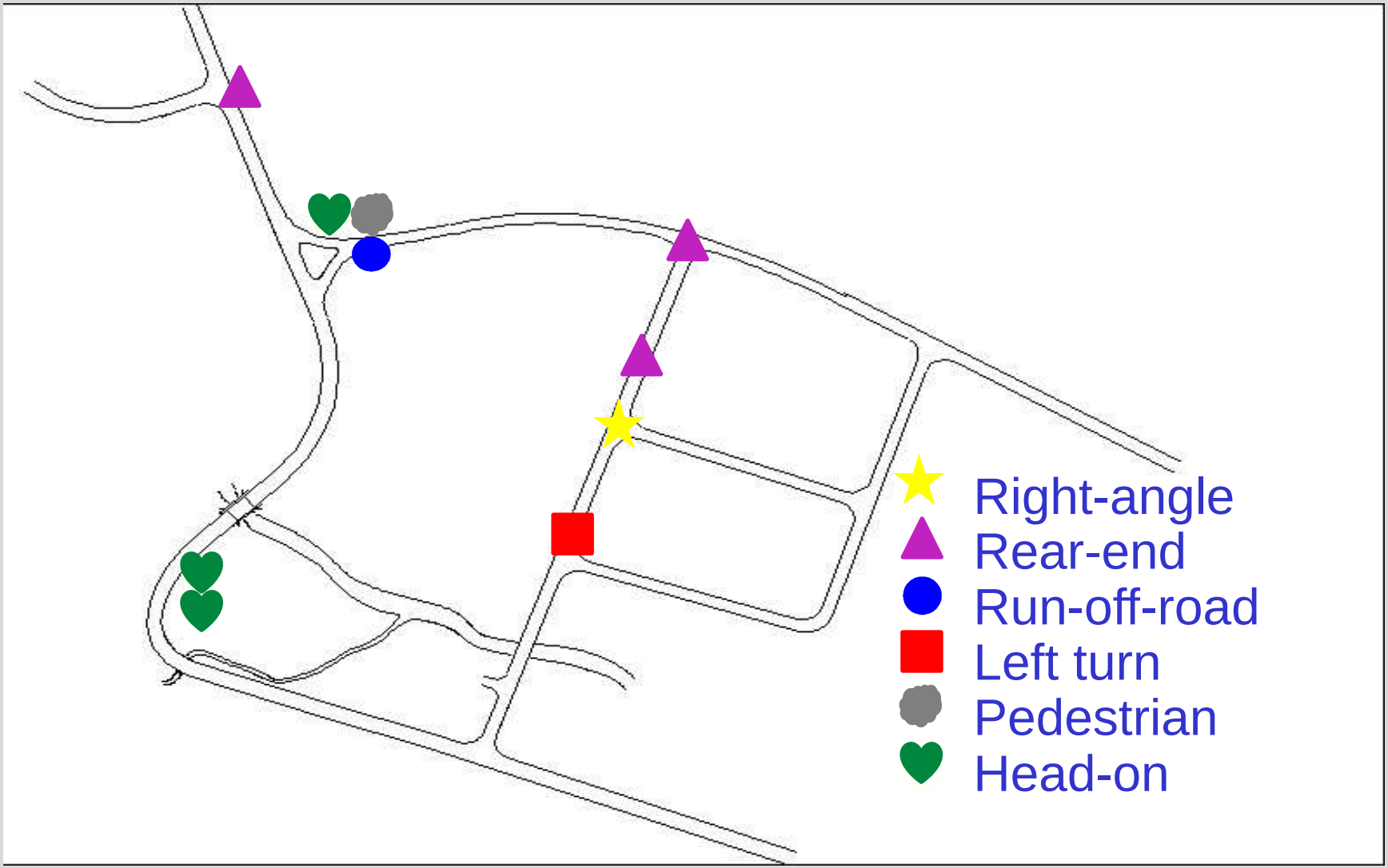
More forms at

[http://www.nhtsa.dot.gov/people/perform/trafrecords/forms/]

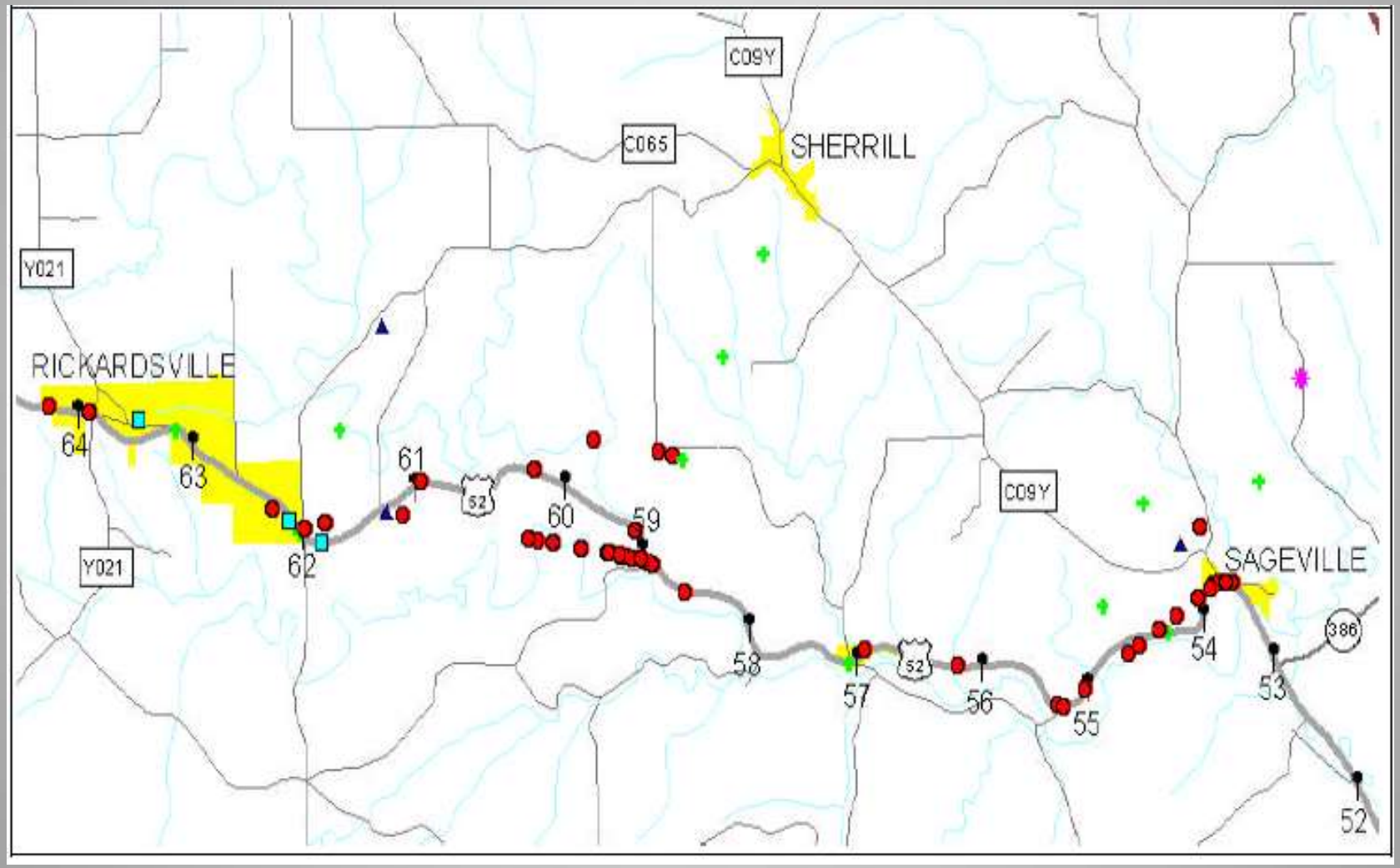
[Back]



Pin Map - Crash Locations and Crash Types

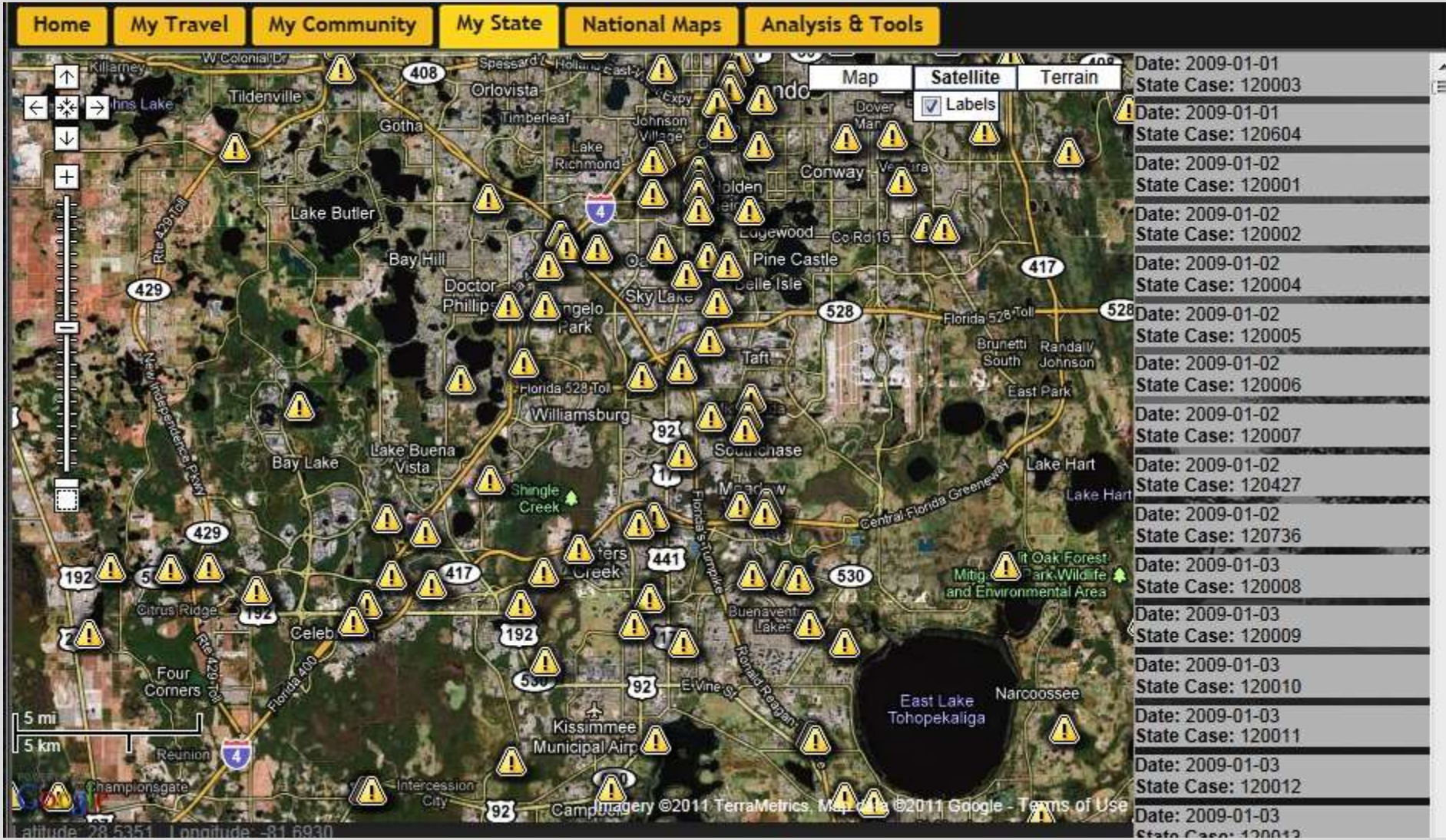


Corridor Crashes Map



Road Fatalities GIS Database
Safe Road Maps

http://www.saferoadmaps.org/home/



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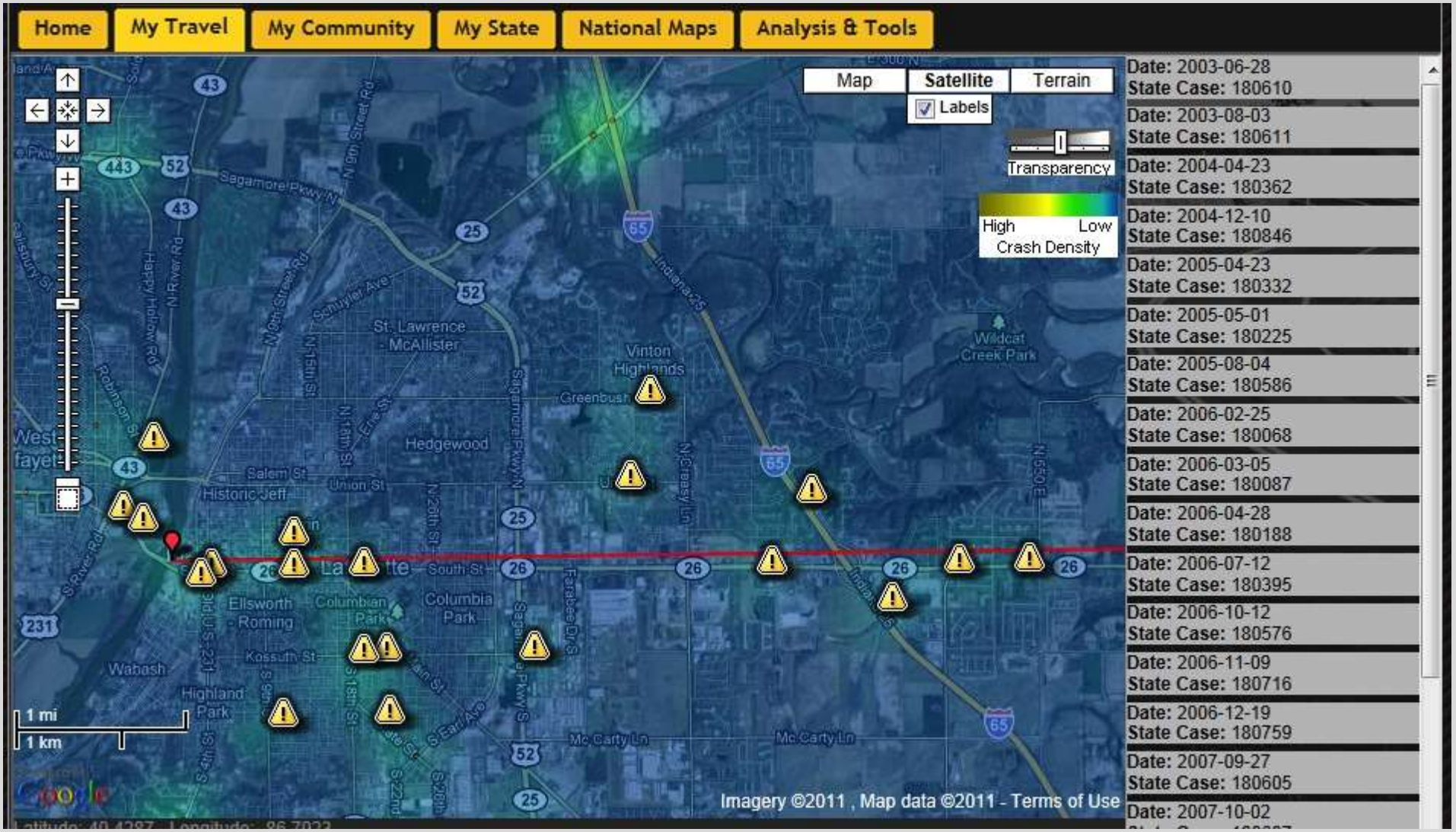


Road Fatalities GIS Database
Safe Road Maps

http://www.saferoadmaps.org/home/

Fatalities	Month	Day	Hour	Minute	Year
1	12	31	15	7	2002

SRM ID	Road Type	Speeding	Drinking	Restraint Type	Person Type	Age	Sex	Deceased
2002_180665	Rural Major Collector	No (Speeding Not Involved)	No (Alcohol Not Involved)	Unknown	Passenger of a Motor Vehicle in Transport	99	Unknown	No
2002_180665	Rural Major Collector	No (Speeding Not Involved)	Yes (Alcohol Involved)	Lap and Shoulder Belt	Driver	51	Male	No
2002_180665	Rural Major Collector	No (Speeding Not Involved)	No (Alcohol Not Involved)	Lap and Shoulder Belt	Passenger of a Motor Vehicle in Transport	8	Female	Yes
2002_180665	Rural Major Collector	No (Speeding Not Involved)	No (Alcohol Not Involved)	Lap and Shoulder Belt	Passenger of a Motor Vehicle in Transport	7	Male	No
2002_180665	Rural Major Collector	No (Speeding Not Involved)	No (Alcohol Not Involved)	None Used	Driver	32	Male	No

Crash Data: Analysis Types

1. Crash frequency
2. Crash ratios
3. Prediction of crashes
4. Statistics comparison
   a) Average
   b) Distributions
5. Crash critical rate
6. Potential Safety Improvement (PSI)
7. Before/After Studies
8. Crash Reduction Factors (CRF)

1. Crash Frequency

- Total crashes in analysis period
- High volume places

$$\%\ change = \frac{C_1 - C_0}{C_0} * 100\%$$

C_0 = crashes *before*
C_1 = crashes *after*

2. Crash Rates

Intersections

$$CF_{int} = \frac{c * 1{,}000{,}000}{ADT * 365}$$

Segment

$$CF_{seg} = \frac{c * 1{,}000{,}000}{ADT * 365 * L}$$

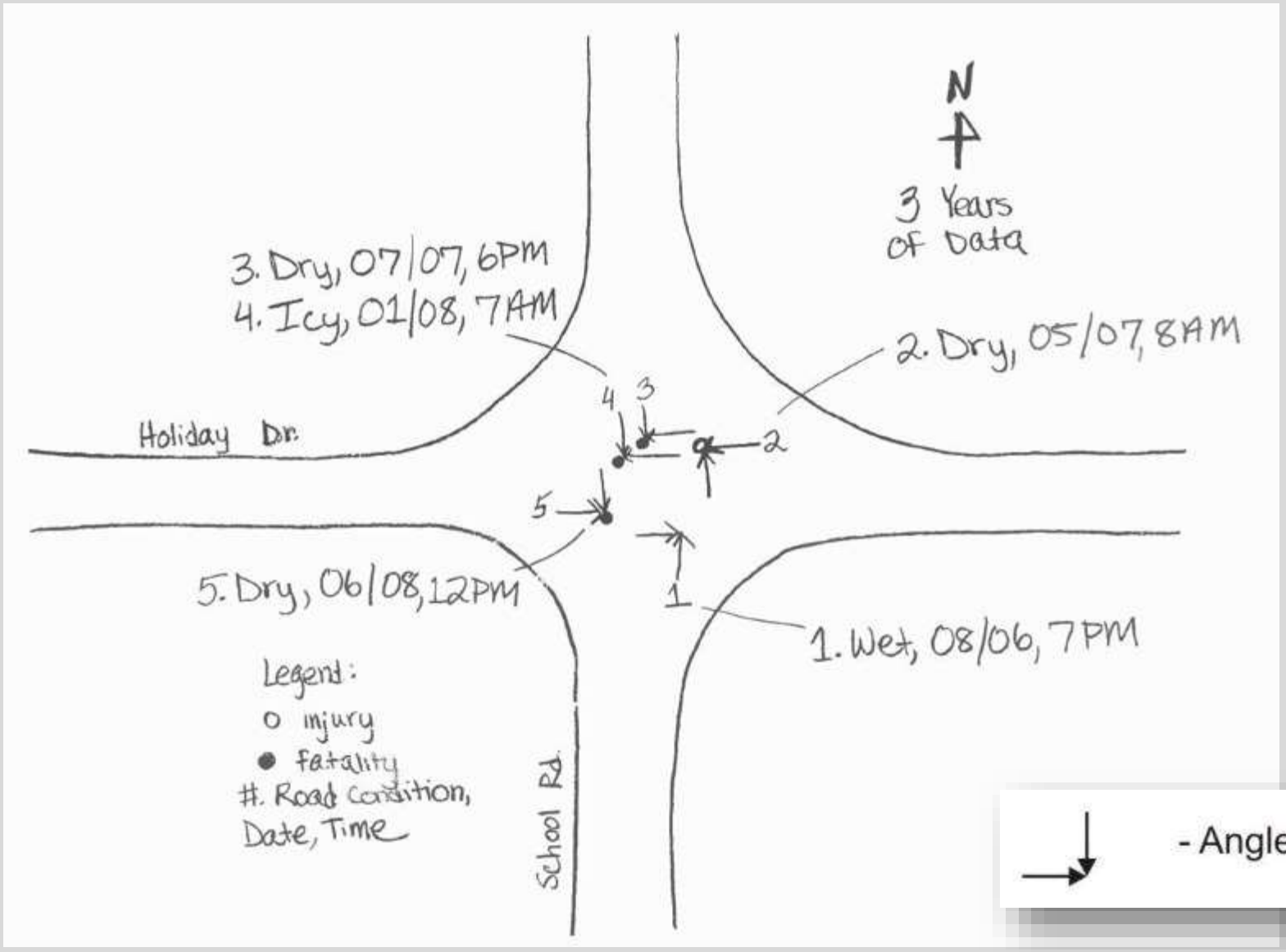
C = crash total
ADT = average daily traffic
L = segment length: *miles*

Crash Rates Exercise

1. In 2008 total of crashes registered in an intersection was 23. Average daily traffic in the intersection is 6,500 vehicles per day. *Calculate crash rate for every 1M vehicles*.

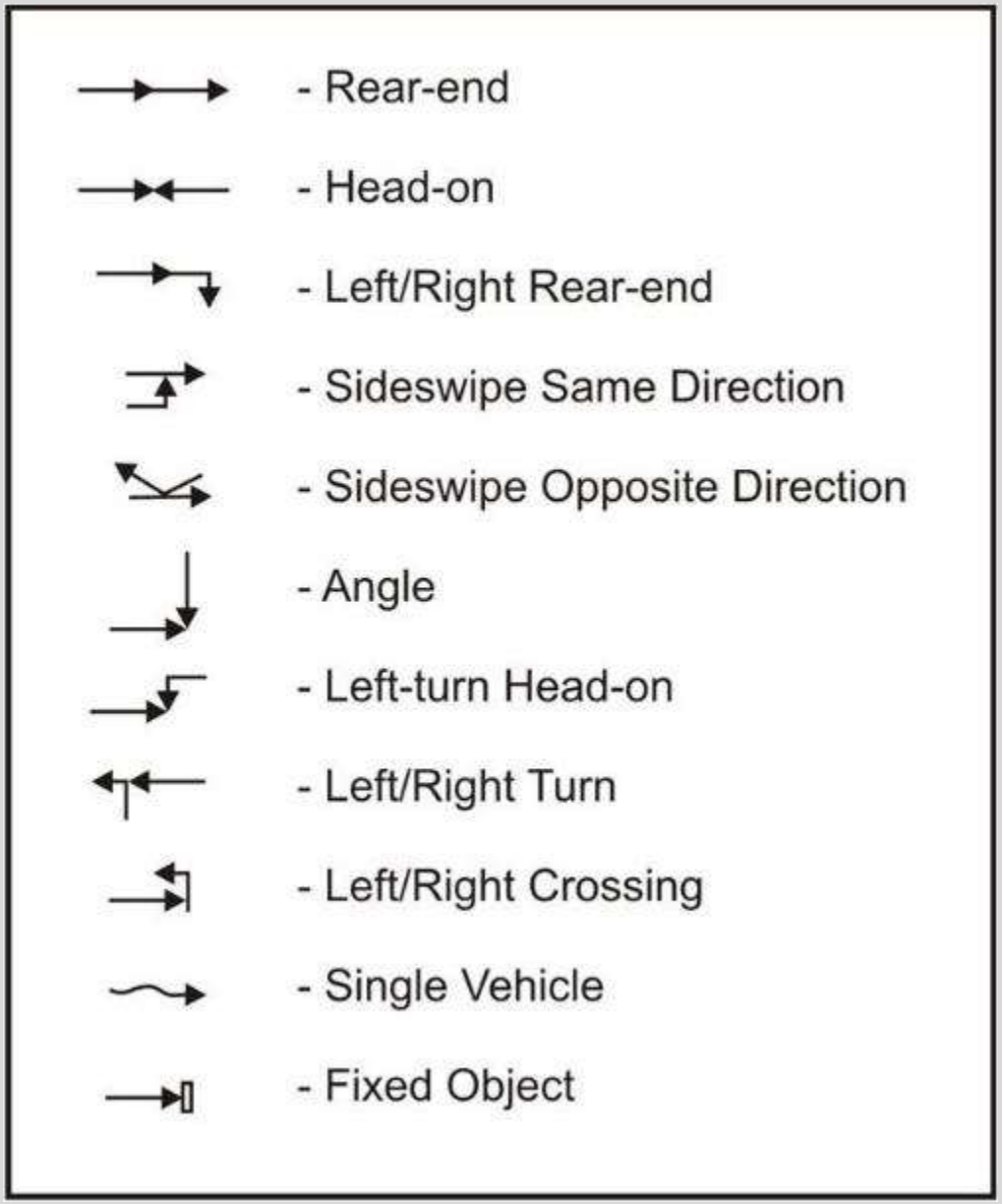
2. In a 17.5 miles segment occurred 40 crashes in 2008. The average daily traffic is 5,000 vehicles per day. *Calculate crash rate for every 100M vehicle-miles*.

Create Collision Diagram

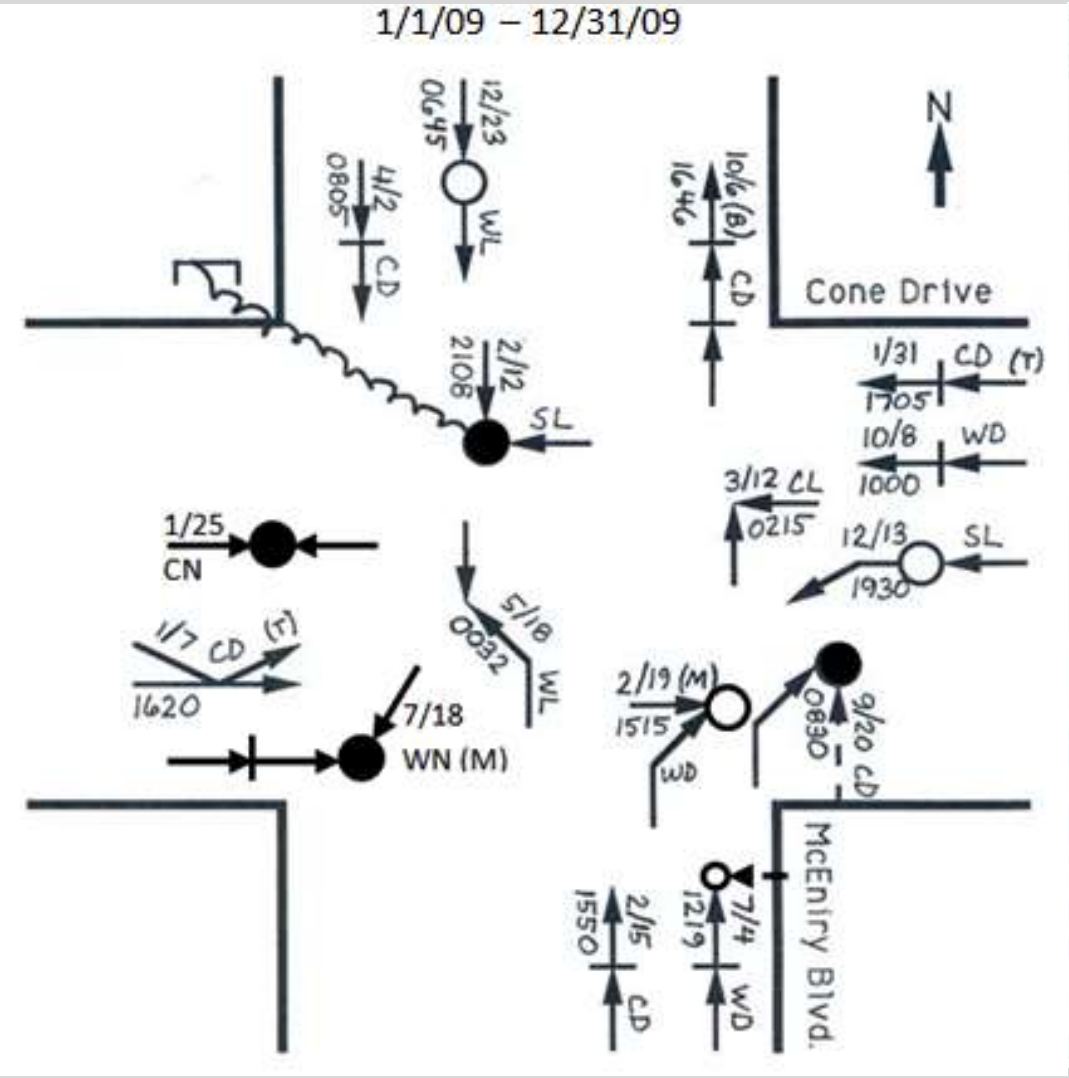


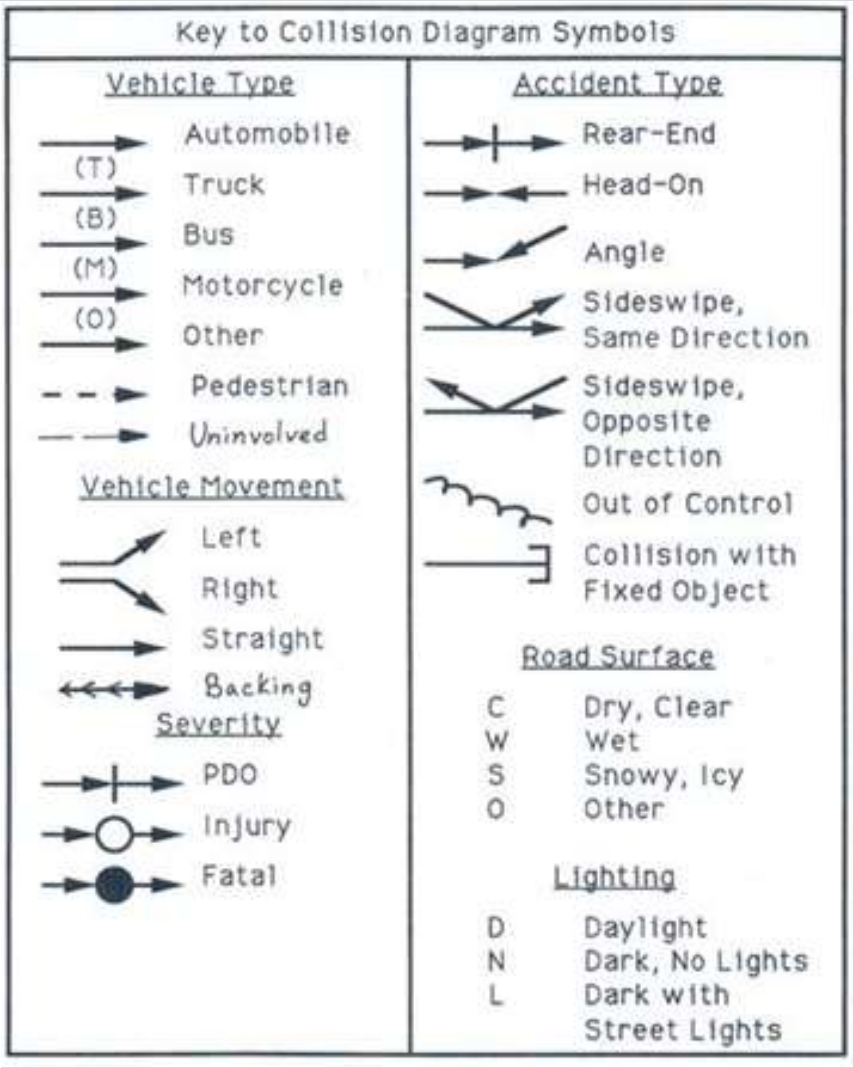
Collision Diagram

Collision Diagram Symbols



Crash Collision Diagrams





ADT Cone Drive = 8,900 vehículos / día
ADT McEniry Blv = 12,750 vehículos día

Crash Collision Diagrams

A. Indicate the total of motor vehicles involved in crashes for the intersection in 2009.

B. Indicate how many collisions occurred during the night for the intersection in 2009.

C. Calculate crash rates for every 1M vehicles for fatal crashes for the intersection in 2009.

Collision Diagram

COLLISION DIAGRAM

Key Number = 4

MUNICIPALITY: *LAKEVILLE* COUNTY: *CLEARFIELD*

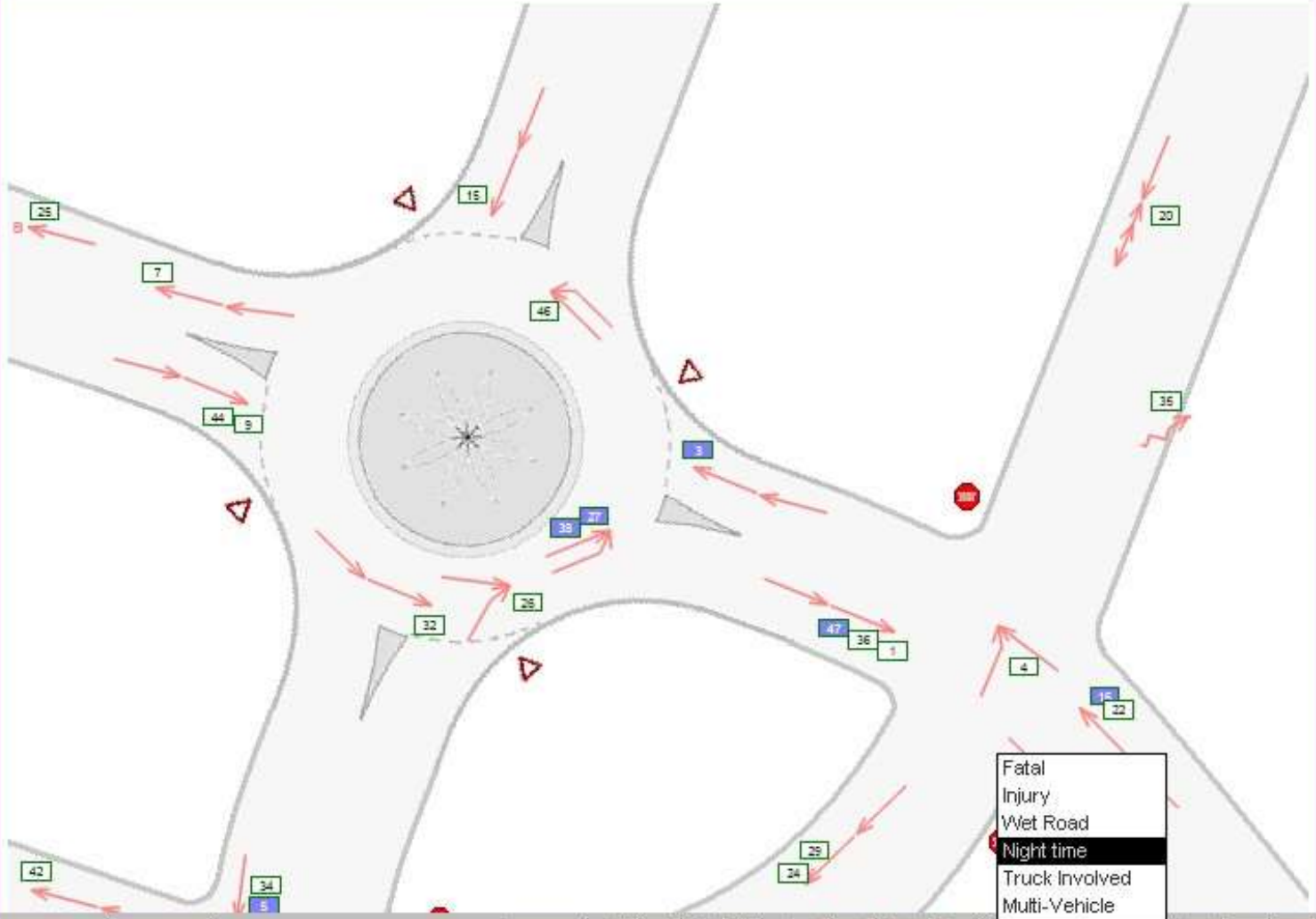
INTERSECTION: *ROUTE 100*

PERIOD: *3* YEARS *0* MONTHS FROM *1/1/1995* TO *12/31/1997*

FILE: *101Test*

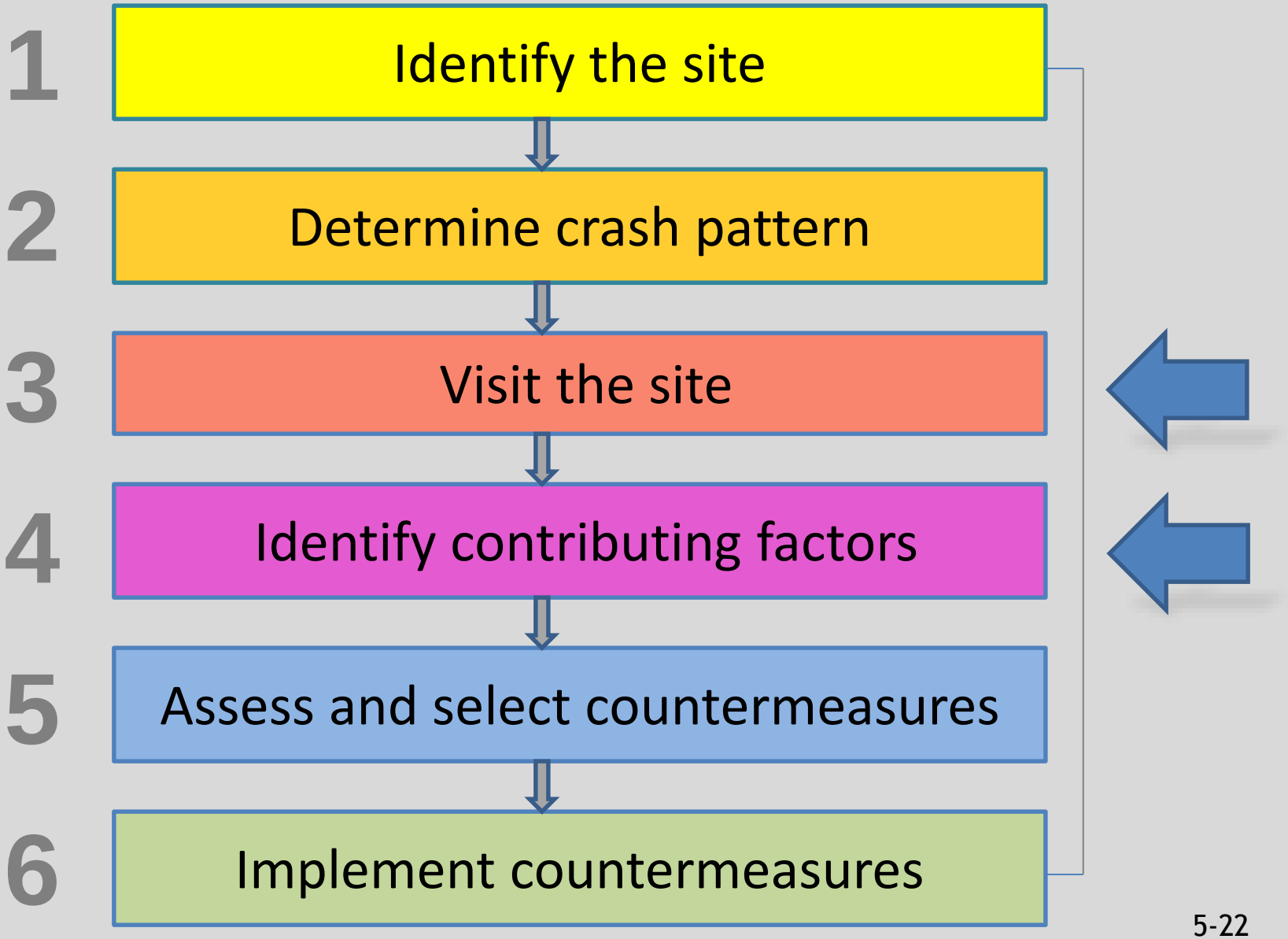
CASE # : *11-1111111*

BY: *DBS* DATE: *9/4/2005*



Done Copy Total Night time

Steps in Crash Reduction Process



Visit the site

- Observe traffic under conditions of interest
- Gather basic traffic data (volumes and speeds)

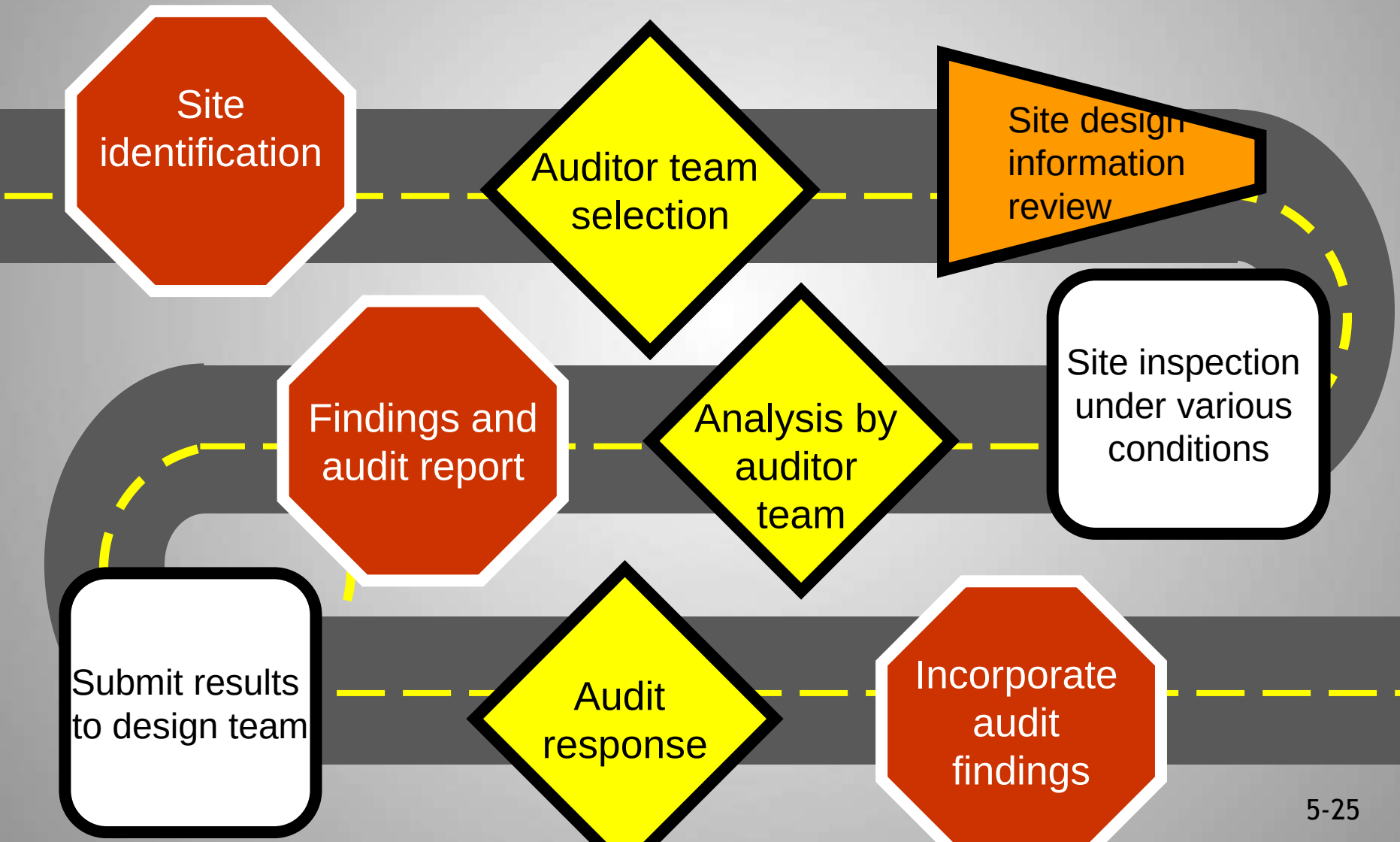
Road Safety Audit/Assessment (RSA)

RSA = formal safety performance examination of an existing or future road by an independent audit team.

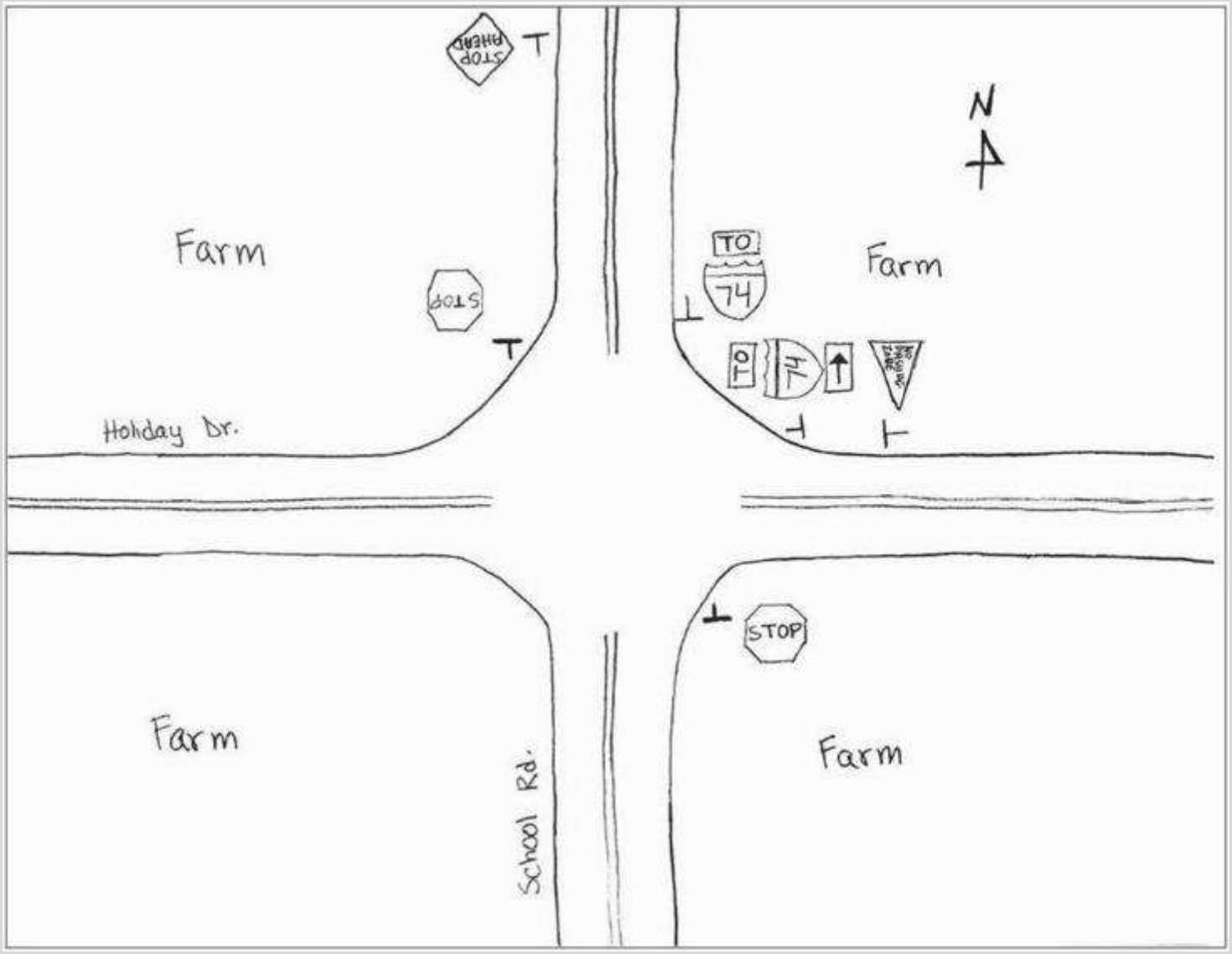
"RSAs are a proven way to review just how safe our local roads are and can be a valuable tool for local government road professionals in making their roads safer."

Tony Giancola
Executive Director, NACE

General Process for Road Audits

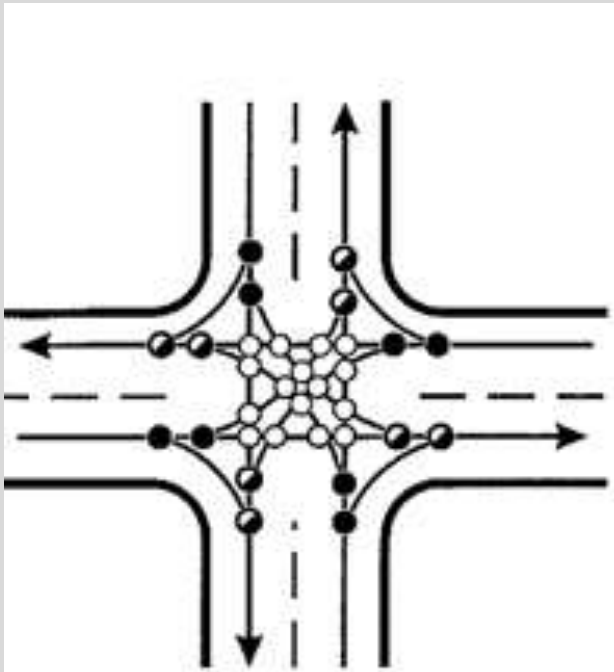


Prepare a Condition Diagram

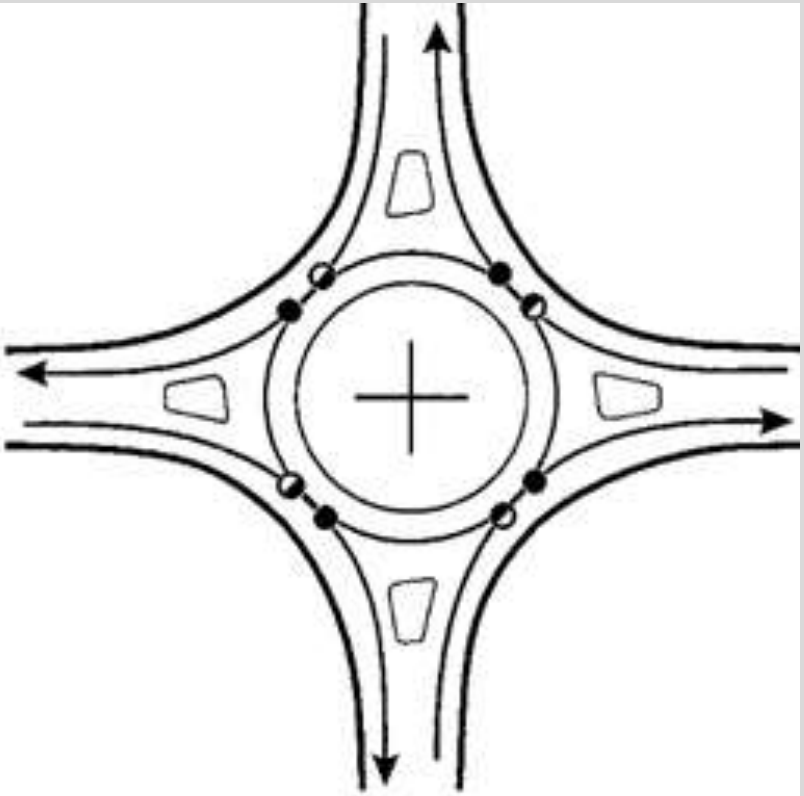


Condition Diagram

Intersection Conflicts

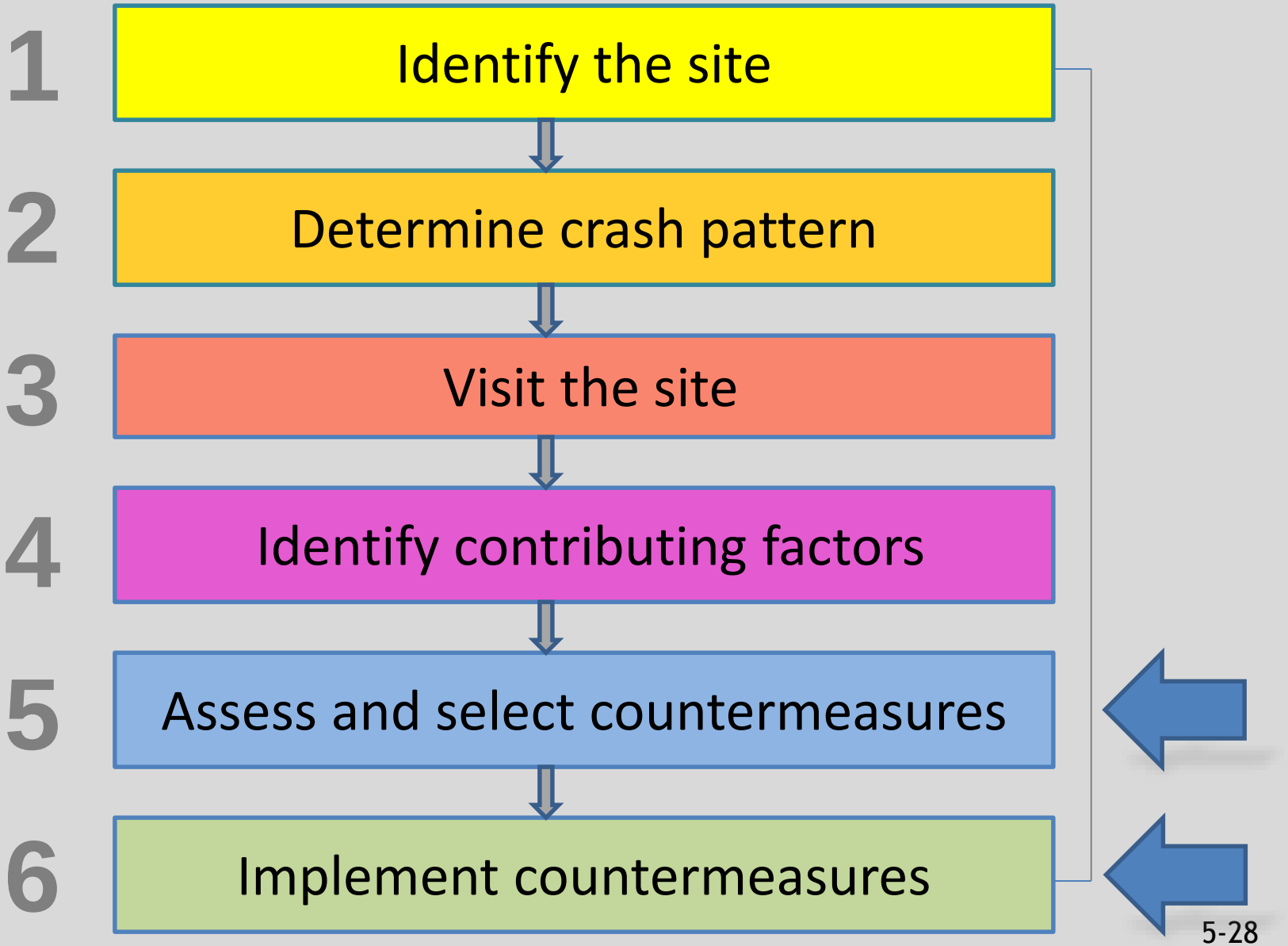


Diverging	8
Merging	8
Crossing	16
	32



Diverging	4
Merging	4
Crossing	0
	8

Steps in Crash Reduction Process



FHWA Proven Safety Countermeasures

Roundabouts

Corridor Access Management

Backplates with Retroreflective Borders

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Enhanced Delineation and Friction for Horizontal Curves

Safety Edge$_{SM}$

Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

Pedestrian Hybrid Beacon

Road Diet

http://safety.fhwa.dot.gov/provencountermeasures/

Countermeasures to Consider

- Edgelines and delineation
- Rumble strips

http://safety.fhwa.dot.gov/policy/memo071008/

Countermeasures to Consider

- Barrier/guardrail

Countermeasures to Consider

- Safety Edges

Source: FHWA

http://safety.fhwa.dot.gov/policy/memo071008/

Countermeasures to Consider

- Left-turn lanes

Countermeasures to Consider

- Sidewalks
- Walkways

Countermeasures to Consider

Pedestrian Refuges

Countermeasures to Consider

Maintenance Strategies

- Patching Potholes
- Cleaning Drainage Structures
- Blading Ditches
- Trimming Vegetation

Selection of Countermeasures

http://www.cmfclearinghouse.org/

Example of CMF for Intersection Control

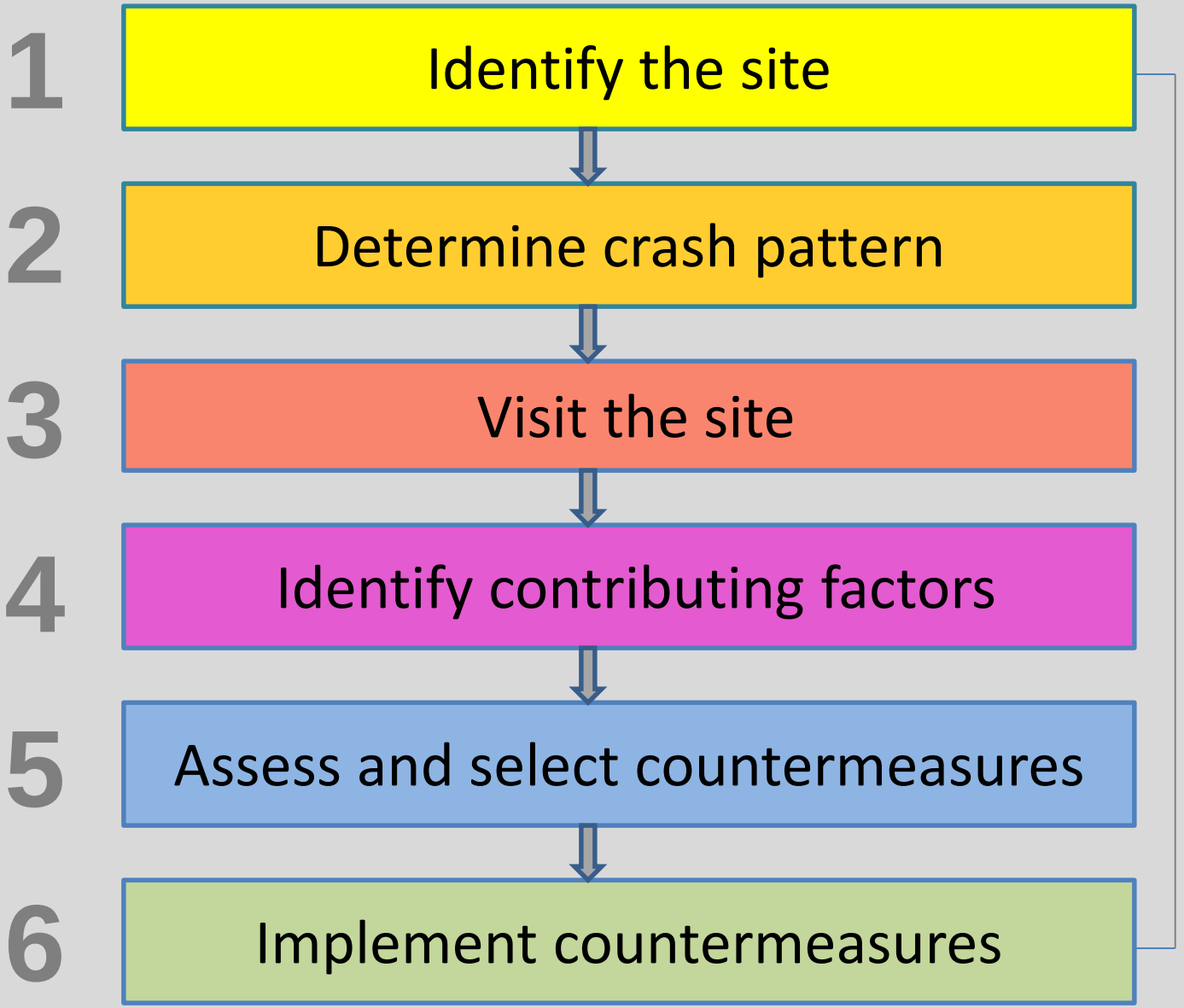
- Countermeasure: Conversion of stop-controlled intersection into single-lane roundabout

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type	Reference
0.28	72	★★★★☆	All	All	Not specified	Urban	Persaud et al., 2001
0.42	58	★★★★☆	All	All	Not specified	Rural	Persaud et al., 2001
0.12	88	★★★★☆	All	Serious injury,Minor injury	Not specified	Urban	Persaud et al., 2001
0.18	82	★★★★☆	All	Serious injury,Minor injury	Not specified	Rural	Persaud et al., 2001

HSM Highway Safety Manual AASHTO

http://www.highwaysafetymanual.org/Pages/default.aspx

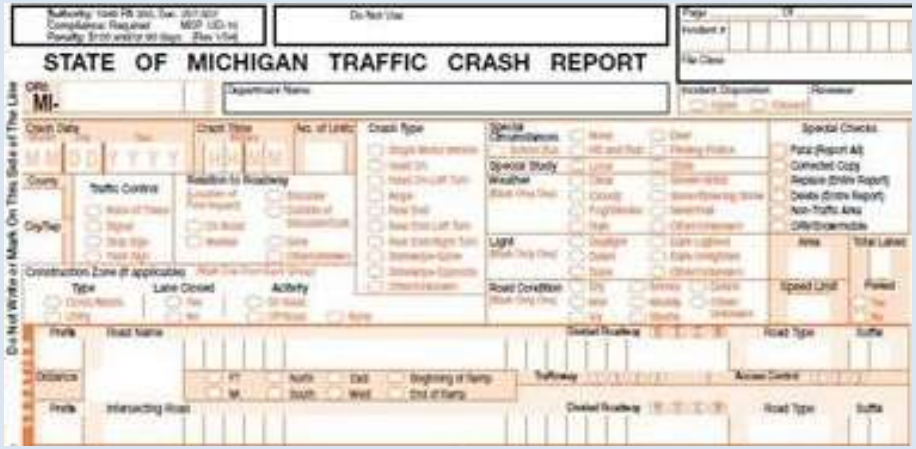
Steps in Crash Reduction Process



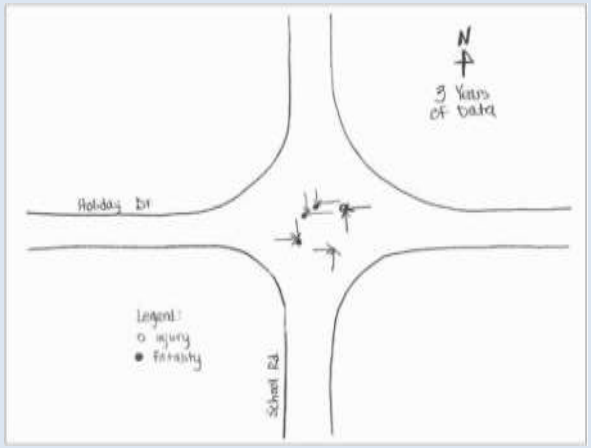
Steps in Crash Reduction Process

1 Identify the site

2 Determine crash pattern


STATE OF MICHIGAN TRAFFIC CRASH REPORT

Obtain data



Create collision diagram

Steps in Crash Reduction Process

3 Visit the site

4 Identify contributing factors

Gather data

Create condition diagram

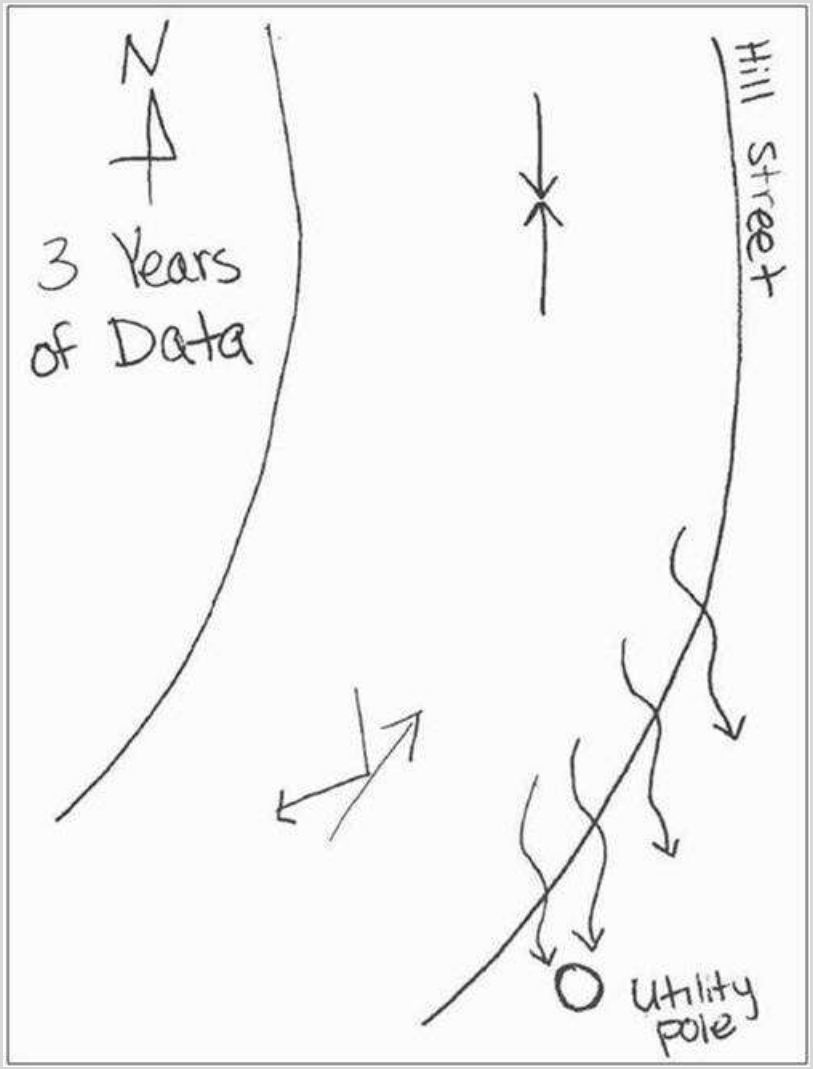
Steps in Crash Reduction Process

5 Assess and select countermeasures

6 Implement countermeasures

Consider and implement countermeasures

Example 1 - Identify Site & Obtain Crash Data



Collision Diagram

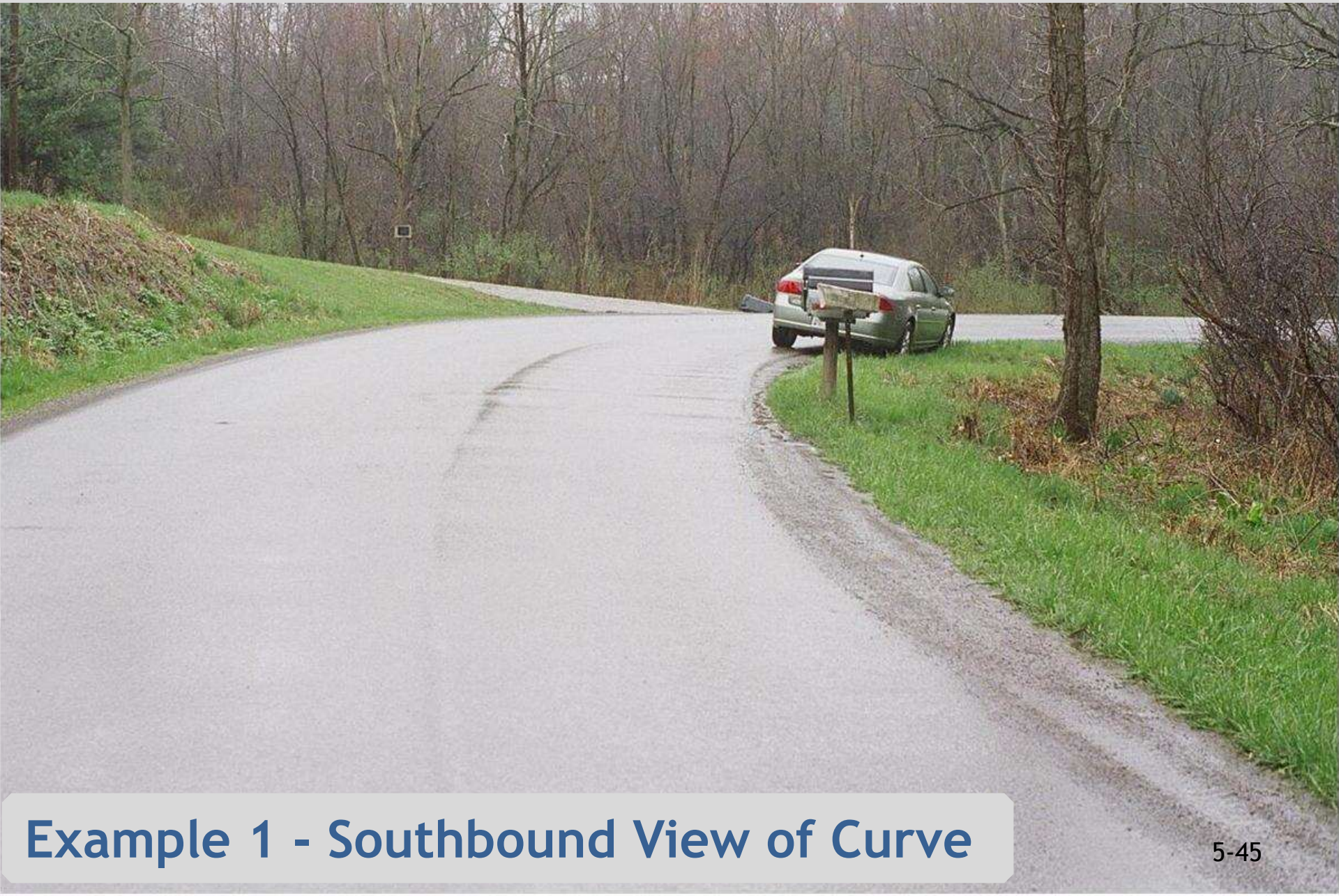
3 Years Crash Data

- 4 Run-off-road
  - 1 overturned
  - 1 went into creek
  - 2 struck utility pole
- 1 Sideswipe Opposite
- 1 Head-on

Visit the Site & Identify Contributing Factors

Example 1-Southbound View from Upstream of Curve

Visit the Site & Identify Contributing Factors



Example 1 - Southbound View of Curve

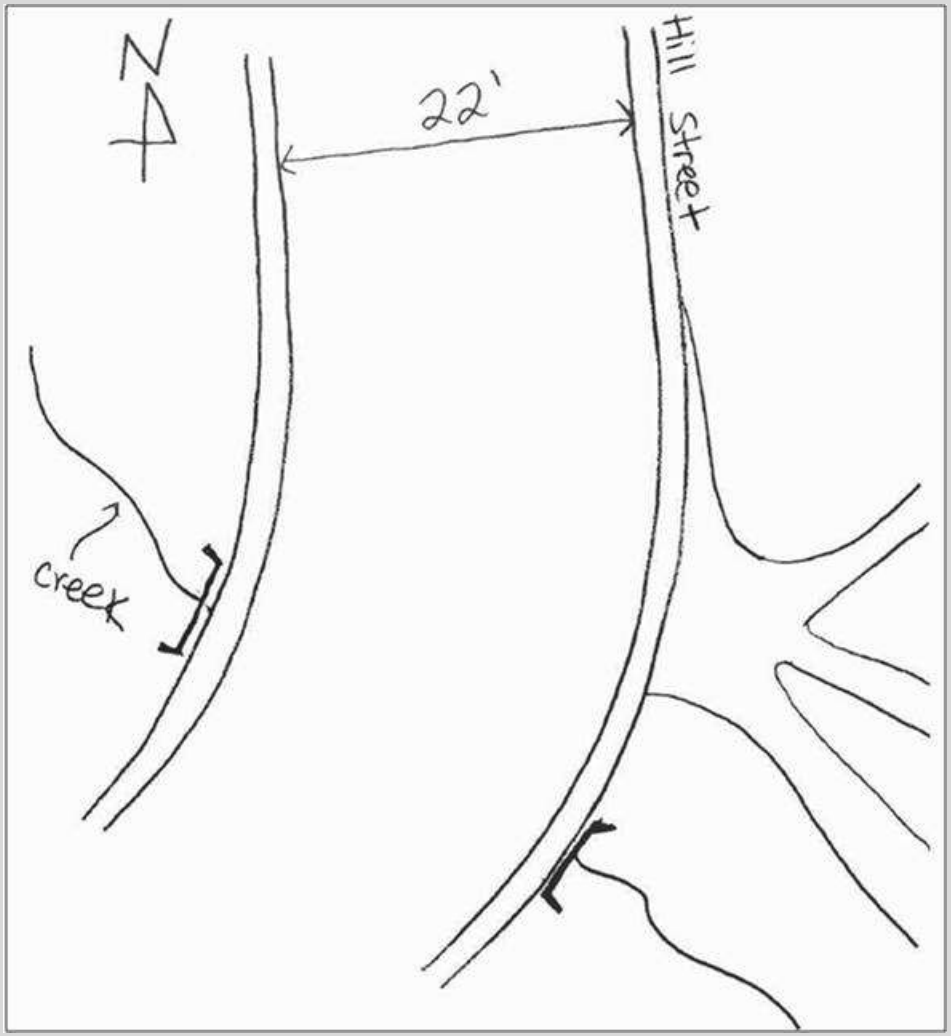
Visit the Site & Identify Contributing Factors

Example 1 - Northbound View of Curve

Visit the Site & Identify Contributing Factors

Example 1 – Evidence of Vehicle Running Off Road on Outside of Curve

Example 1 - Create Condition Diagram



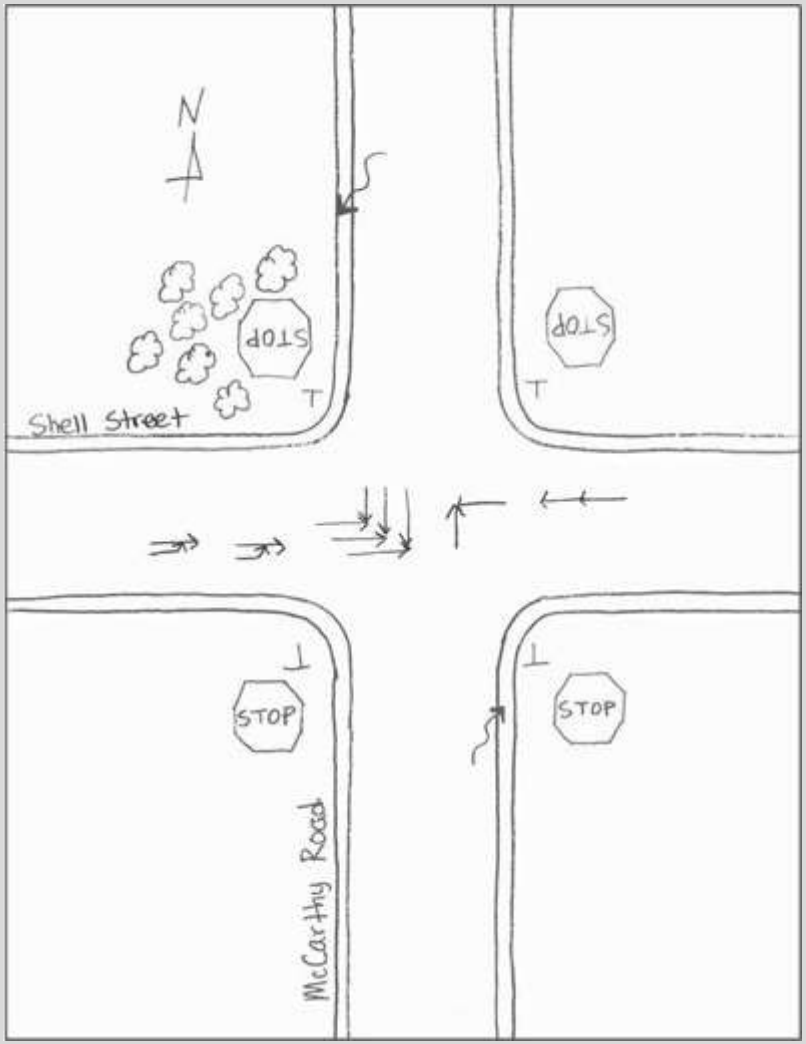
Condition Diagram

- Posted Speed Limit = 35 mph
- Turf Shoulders of Variable Width
- 6 % Superelevation
- Radius = 110'

Example 1 - Discussion

- What type of crash patterns do you see?
- What are the contributing factors
- What would be appropriate countermeasures?

Example 2 – Identify Site & Obtain Crash Data



Collision Diagram

3 Years of Crash Data

- 4 Angle
- 2 overtaking left
- 2 run-off-road
- 1 Rear-end

Visit the Site & Identify Contributing Factors

Example 2 - Northbound View

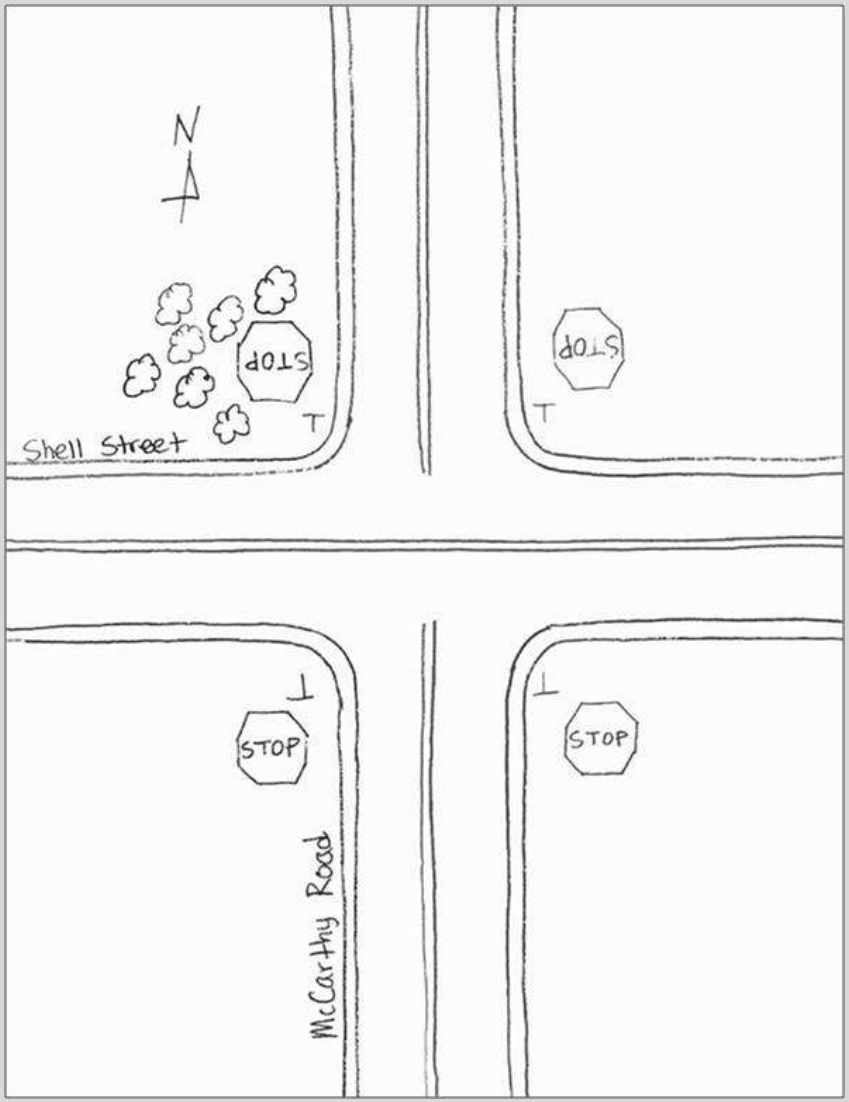
Visit the Site & Identify Contributing Factors

Example 2 - Northbound View

Visit the Site & Identify Contributing Factors

Example 2 - Eastbound Approach

Example 2 - Create Condition Diagram



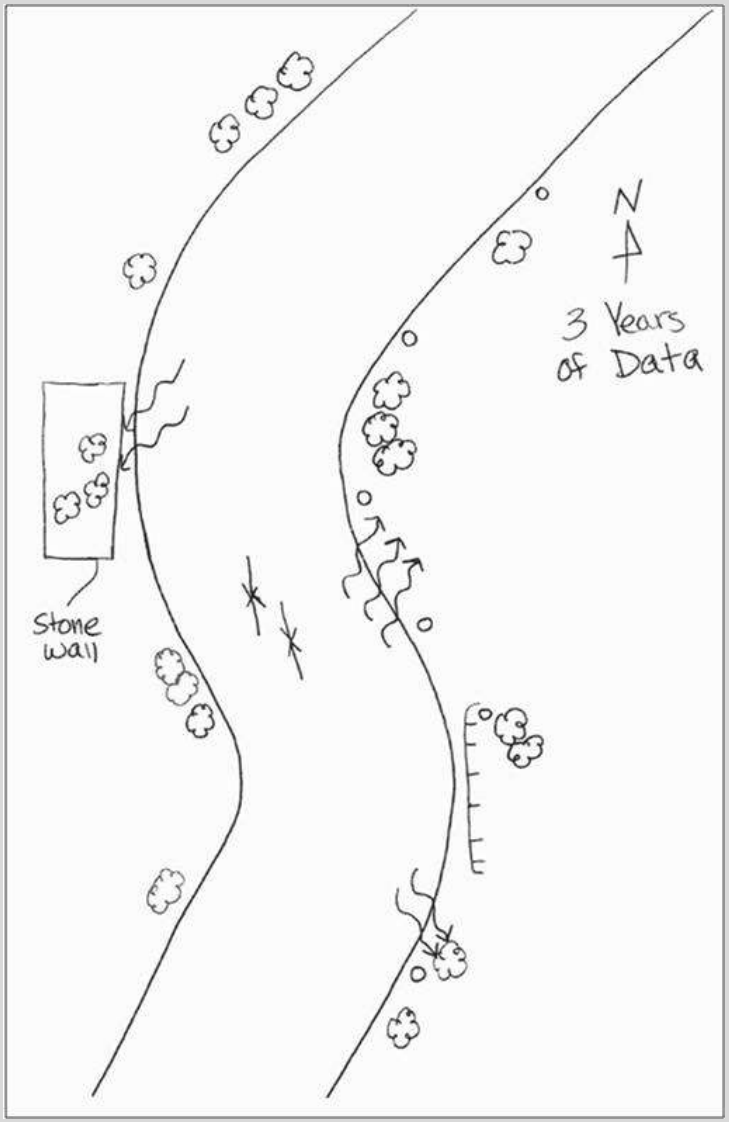
Condition Diagram

- Two-way STOP control
- Posted Speed Limit = 55 mph on both roads
- Gravel Shoulders of Variable Width

Example 2 - Discussion

- What type of crash patterns do you see?
- What are the contributing factors
- What would be appropriate countermeasures?

Example 3 – Identify Site & Obtain Crash Data



Collision Diagram

3 Years of Crash Data

- 7 Run-off-road
  - 3 overturned
  - 2 struck stone wall
  - 2 struck a tree
- 2 Head-on

Visit the Site & Identify Contributing Factors

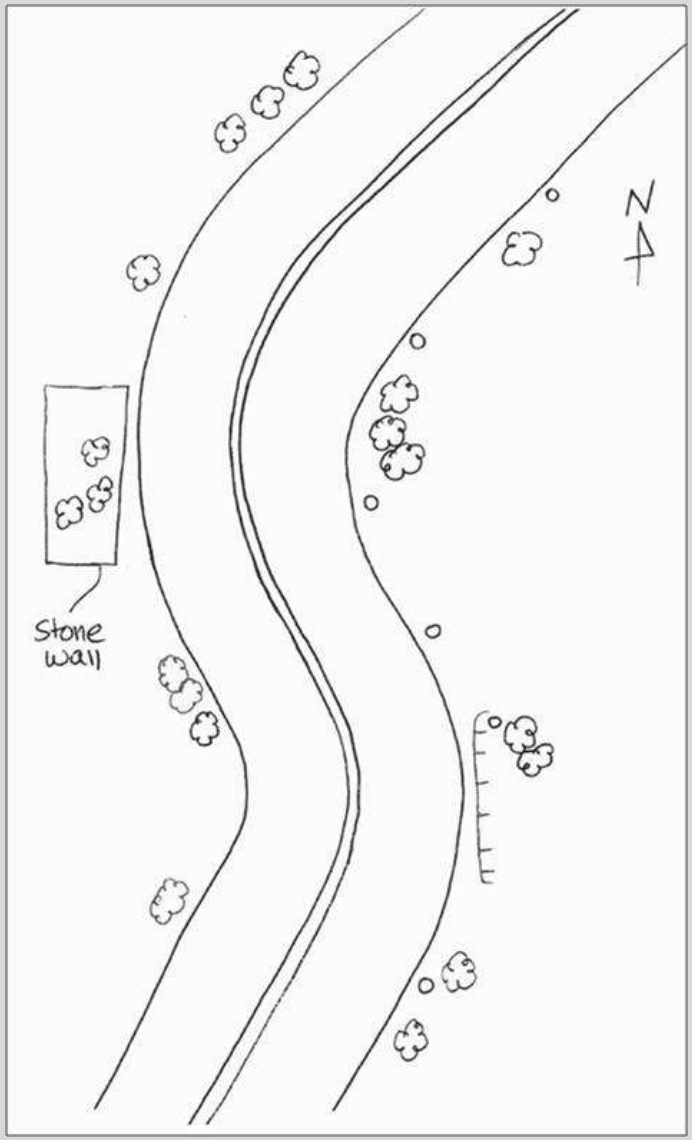
Example 3 - Two-Lane Segment

Visit the Site & Identify Contributing Factors

Example 3 - Roadside Safety Issues

Example 3 - Maintenance

Example 3 - Create Condition Diagram



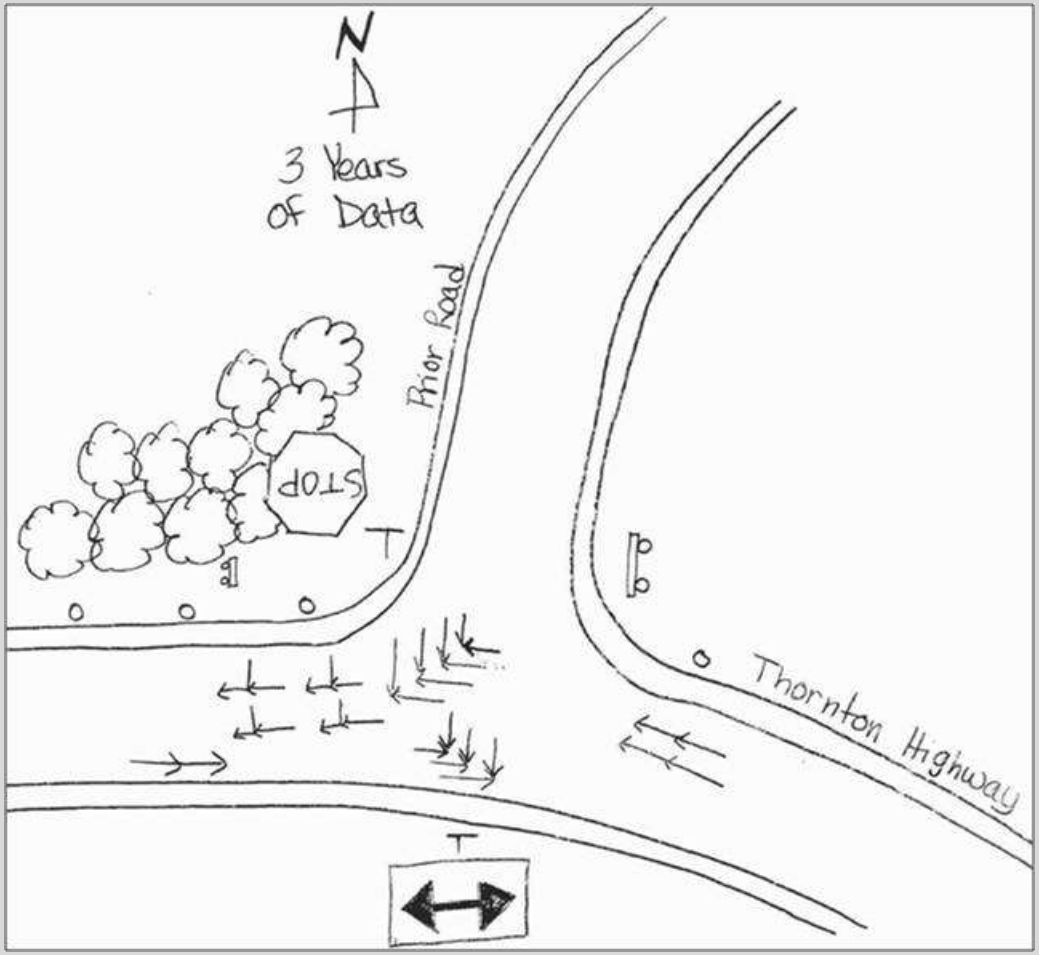
Condition Diagram

- Posted Speed Limit = 45 mph
- Gravel Shoulders of Variable Width
- Steep Sideslopes
- Many Horizontal curves

Example 3 - Discussion

- What type of crash patterns do you see?
- What are the contributing factors
- What would be appropriate countermeasures?

Example 4 - Identify Site & Obtain Data



Collision Diagram

3 Years of Crash Data

- **7 Angle**
- **4 Right-turn Crossing**
- **3 Rear-end**

Visit the Site & Identify Contributing Factors

Example 4 - Southbound Approach

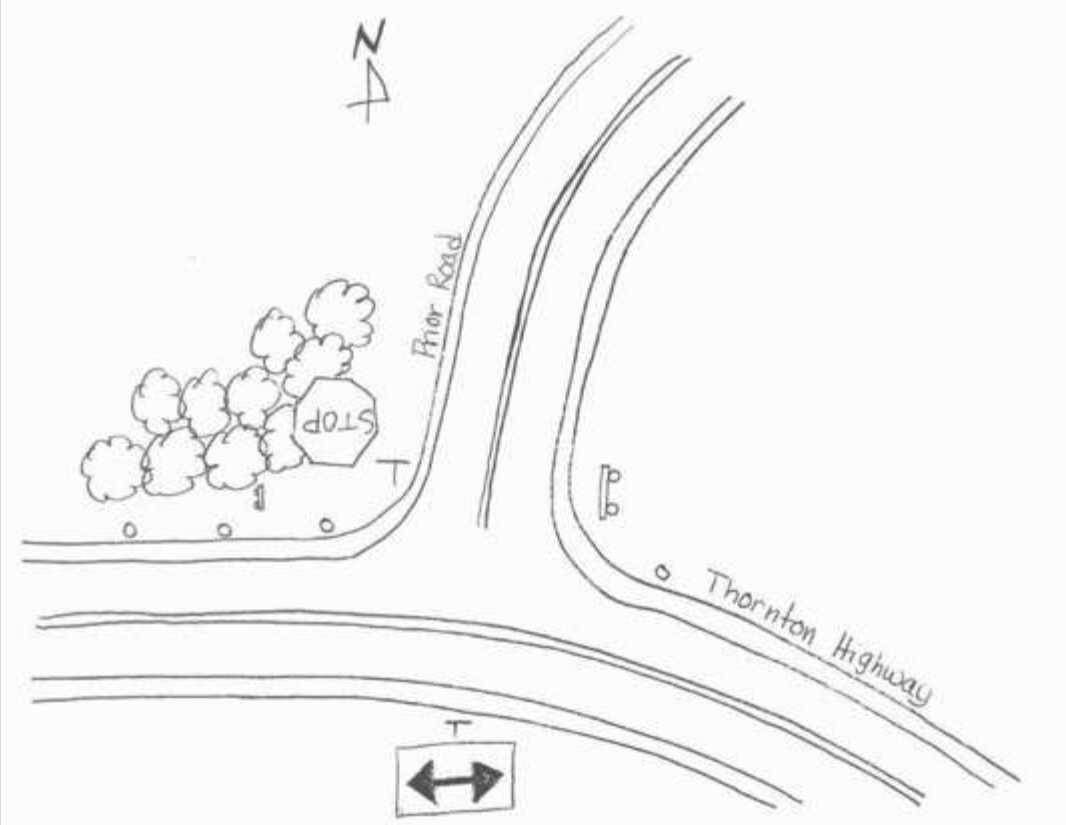
Visit the Site & Identify Contributing Factors

Example 4 - Looking Westbound

Visit the Site & Identify Contributing Factors

Example 4 - Looking Eastbound

Example 4 - Create a Condition Diagram



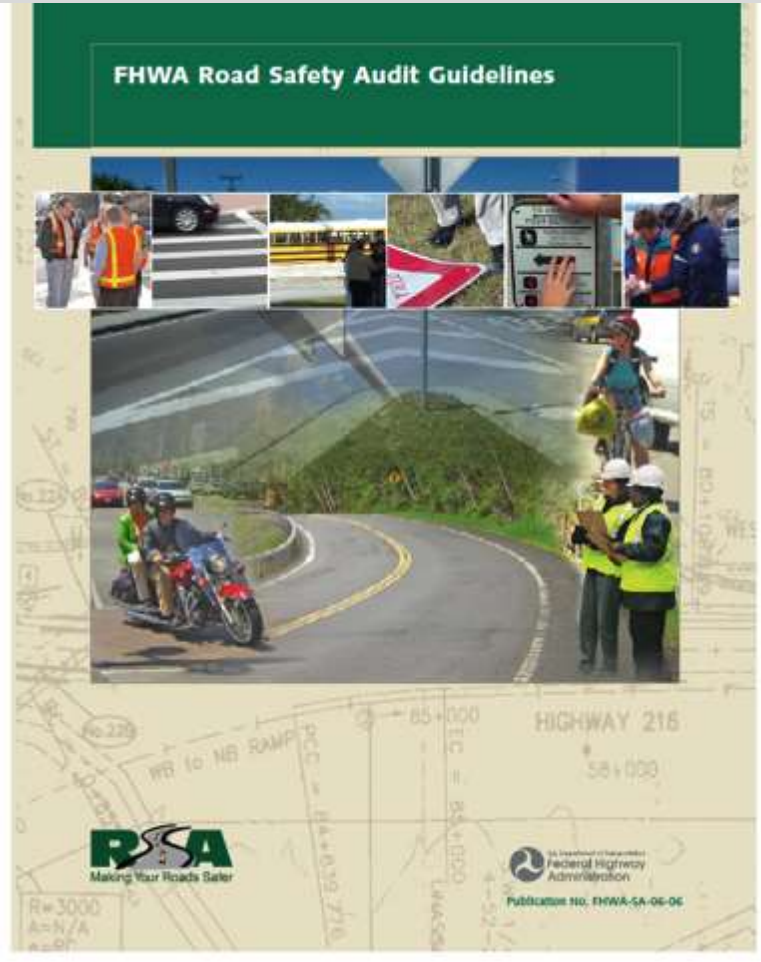
Condition Diagram

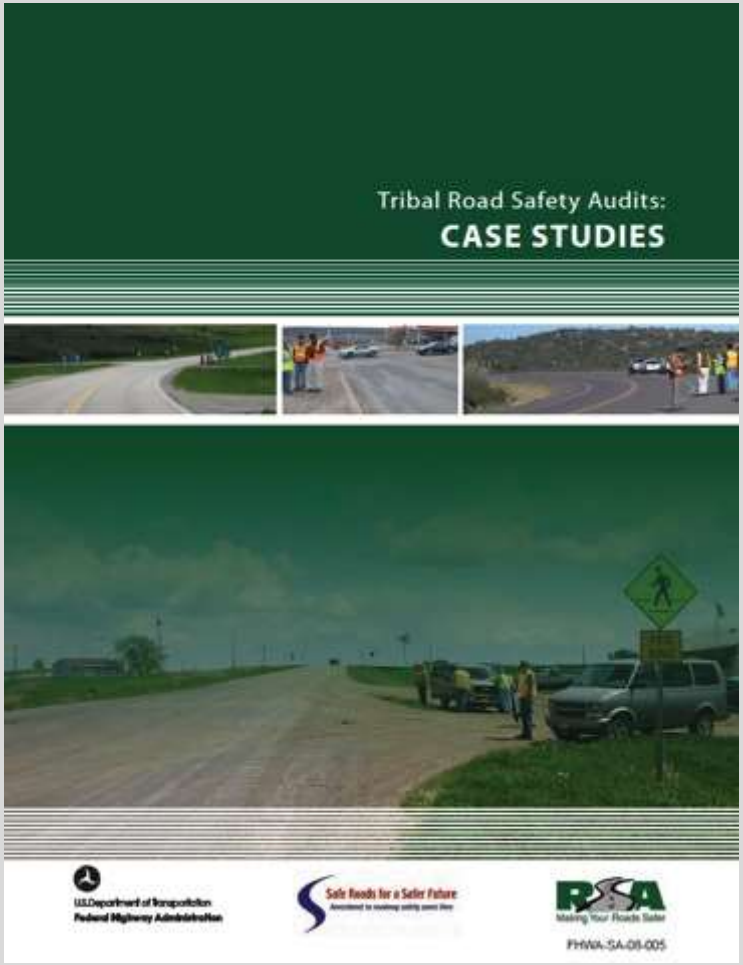
- T-intersection
- Posted Speed Limit = 55 mph on both roads
- 4’ Paved shoulders on Thornton Hwy
- Gravel Shoulders of Variable Width on Prior Rd.

Example 4 - Discussion

- What type of crash patterns do you see?
- What are the contributing factors
- What would be appropriate countermeasures?

Resources

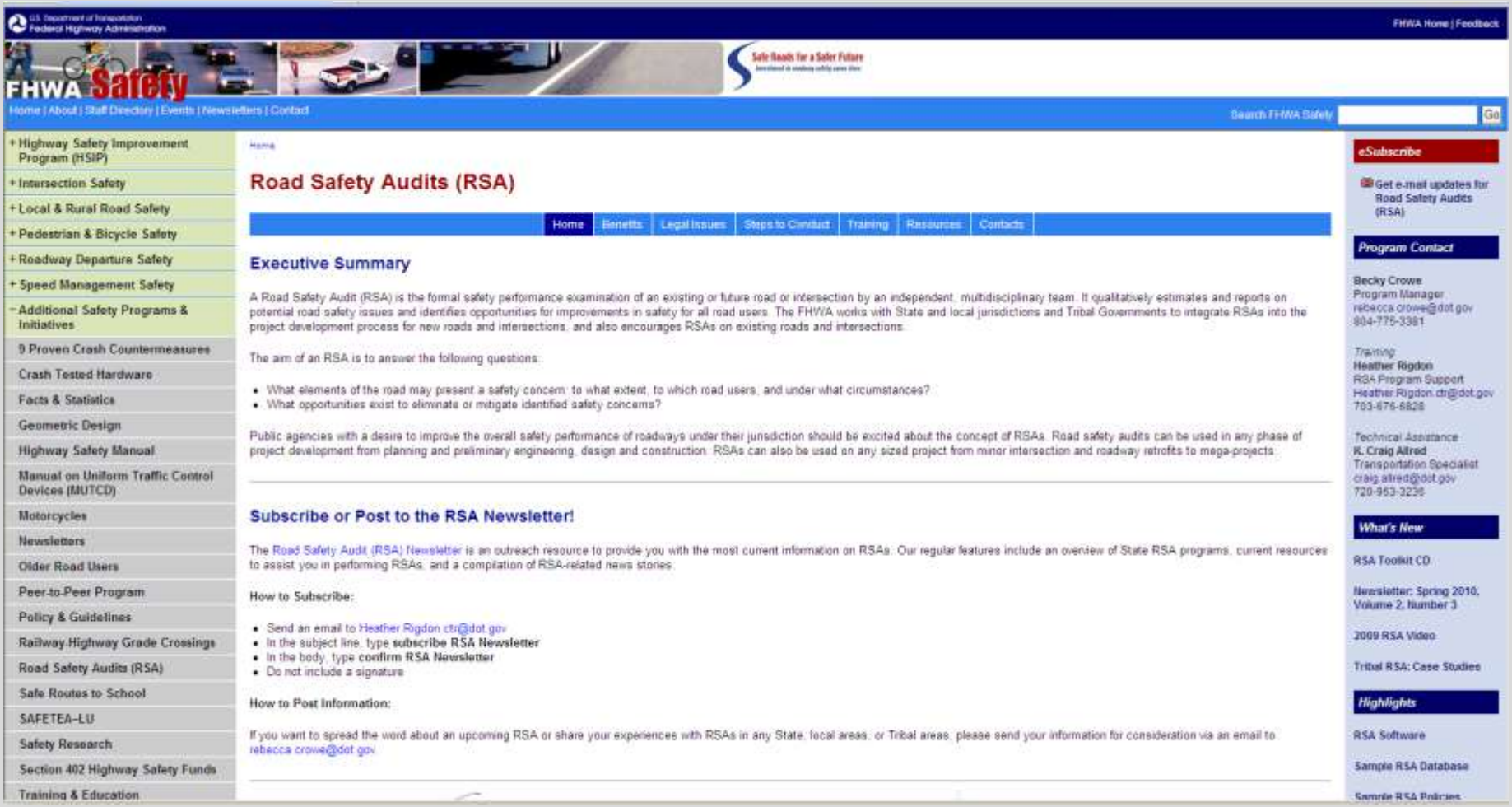




http://safety.fhwa.dot.gov/rsa/guidelines/documents/FHWA_SA_06_06.pdf

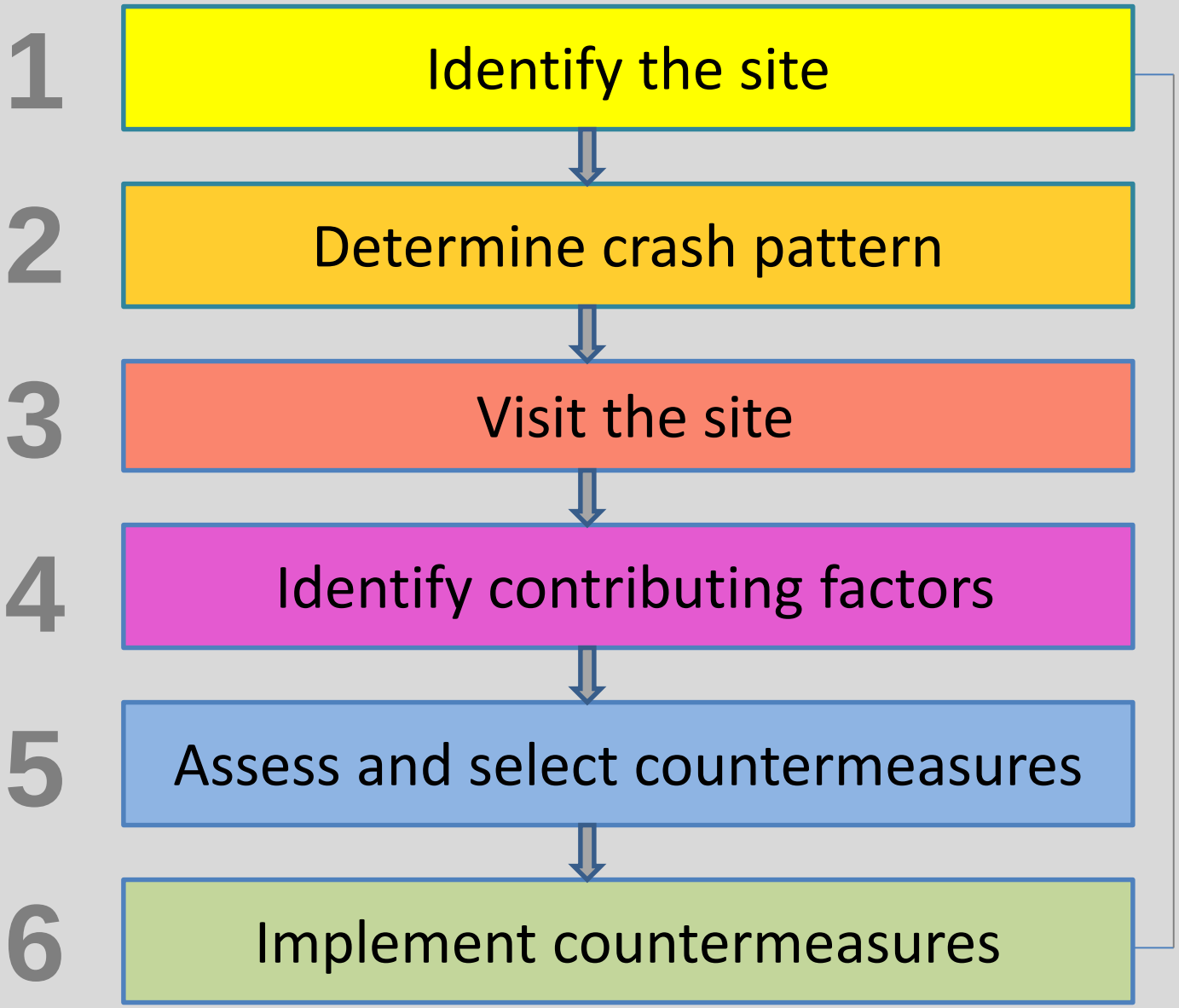
http://safety.fhwa.dot.gov/rsa/tribal_rsa_studies/tribal_rsa_studies.pdf

Resources



safety.fhwa.dot.gov/rsa/

Review - Crash Reduction Process



REVIEW

Two tools used in identifying contributing factors in crashes are:

1. Condition Diagram
2. Collision Diagram

REVIEW

Information that can be obtained from a site visit includes:

- Observing traffic under conditions of interest
- Gathering basic traffic data (volumes and speeds)

REVIEW

List 3-4 low-cost countermeasures that FHWA promotes:

1. Rumble strips
2. Safety Edge
3. Barrier/Guardrail
4. Left Turn Lanes
5. Right Turn Lanes
6. Bypass Lanes
7. Walkways
8. Pedestrian Refugees
9. Road Safety Audits

Summary of Learning Outcomes

- Describe the crash reduction process.
- Identify the data/information needed to assess the safety of a roadway location.
- Identify practical and low-cost countermeasures.
- Describe best practices for making roads safer.

Questions?