Safety Data Analysis

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Learning Objectives

- Understand crash data formats
- Describe the basics of a variety of crash data analysis techniques
- Identify when to use each analysis method
- Create a basic crash map.

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Introductions

- Name
- Employer/Affiliation
- Do you use crash data now?
- Expectations

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Agenda

- Crash data formats
- Safety Data Analyses
  - Contributing Factors Analysis
    - Exercise
  - Road Safety Audits
    - Exercise- Site specific crash mapping

BREAK

  - Network Screening
    - Exercise
  - Systemic Safety Approach

BREAK

  - GIS & map making

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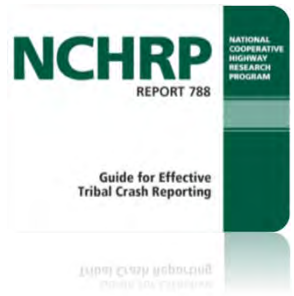
Toolkits and User Guides

www.TribalSafety.org



- Tribes encouraged to conduct Traffic Records Assessments
- NHTSA guidance for States to include Tribes in Traffic Records Assessments

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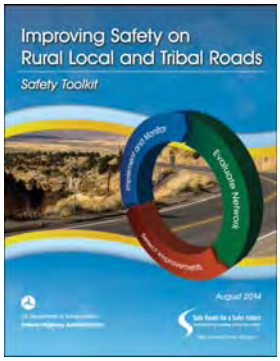
Toolkits and User Guides



Toolkits and User Guides

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

TTPSF: What is the "Data Driven" Application Ranking Criteria ?

- **Safety Data Collection, Assessment, or Analysis** For **Road Safety Audits (RSA):** In the application put the incident history data for the particular road, and/or other data that shows the road is unsafe.
  - See RSA website at https://safety.fhwa.dot.gov/rsa/resources/toolkitflh/

TTPSF: What is the "Data Driven" Application Ranking Criteria ?

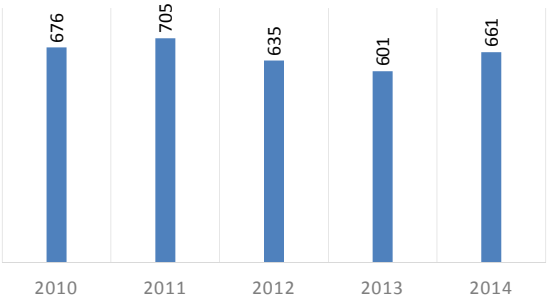
- **Infrastructure Improvement** – **Highly Qualified**: Provided incident data for the roadway the project is located on.
- **Infrastructure Improvement** – **Qualified:** Provided incident data showing a road system-wide problem that the project will improve.
- **Infrastructure Improvement** – **Not Qualified:** No incident data was provided, or only just provided data for the area-wide road system, not for the particular road the project is on.

Safety Data Sources

Safety Data & Tribal Governments

U.S. Department of Transportation
Federal Highway Administration

REPORTED MOTOR VEHICLE FATALITIES IN TRIBAL AREAS FARS 2010-2014 3,278 FATALITIES



Congress finds that…

FAST ACT

- in many States, the Native American population is disproportionately represented in (motor vehicle) fatalities and crash statistics;
- improved crash reporting… would facilitate safety planning and would enable Indian tribes to apply more successfully for State and Federal funds for safety improvements
- without more accurate reporting of crashes … it is difficult or impossible to fully understand the nature of the problem and develop appropriate countermeasures

- FAST Act §1117(b)

1. Tribes & Safety Data
2. Options to Improve Safety

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Emphasis Topics
Tribal Transportation Strategic Safety Plan
TribalSafety.org

- Safety Planning
- Data Analysis
- Roadway Departure
- Occupant Protection
- Pedestrian
- Impairment
- Availability of Public Safety Services

Tribes & Safety Data Findings

- BIA & Tribal Police should collect MMUCC data
- BIA & Tribes should share crash data with states
- States should share crash data with Tribes
- Tribes & States should consult on crash data sharing barriers
- Tribes encouraged to conduct traffic records assessments (NCHRP 788)
- NTTFI should be GIS based

TOOLS FOR IMPROVING CRASH DATA

LOCATION:
DATE: September 28, 2017
TIME: 1:00 pm - 4:30 pm

Video: "Recording Our Past, Protecting Our Future" (10min)
https://www.youtube.com/watch?v=htbjwO0ck4Y
Or Washington Traffic Safety Commission Website

What is "Safety Data"?

- **Crash**
- **Roadway**
  - **Location**
  - **Traffic**
  - **Geometry**
- Vehicles
- Drivers
- Citations

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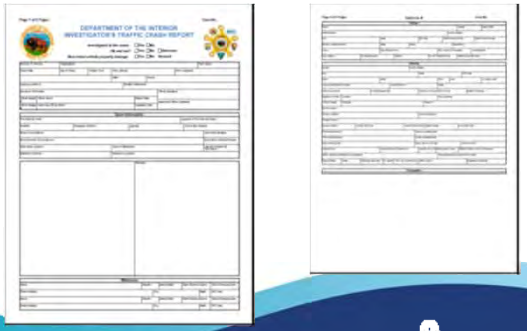
MMUCC Crash Form



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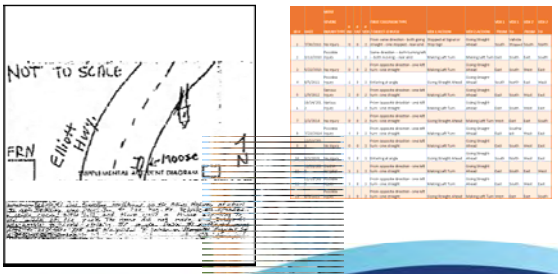
What data is available to you?



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Crash Report Formats

- Uniform Criteria
  - Model Minimum Uniform Crash Criteria (MMUCC) http://mmucc.us/
  - Aids consolidation of data from multiple sources
  - Enables analysis
- Narrative Only

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MMUCC

Model Minimum Uniform Crash Criteria

mmucc.us

- Crash
- Vehicle(s)
- Person(s)

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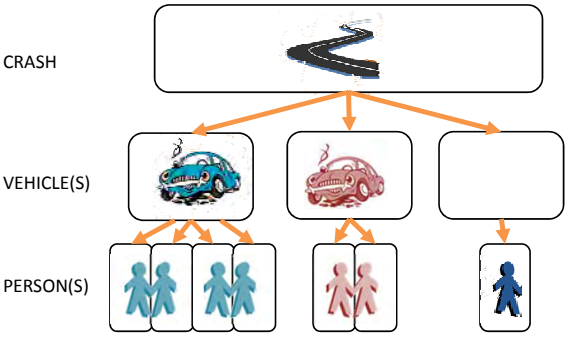
MMUCC

Model Minimum Uniform Crash Criteria

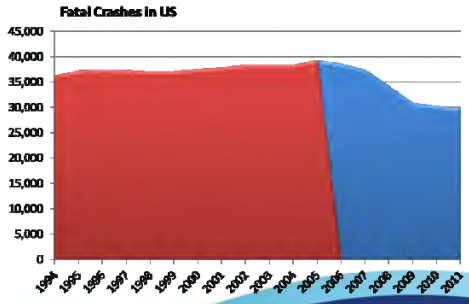


Safety Data Analysis

Contributing Factors Analysis

U.S. Department of Transportation
Federal Highway Administration

Why Safety Plans?



Safety Plans

61% of Tribes have funding to develop or have developed a safety plan.

Definitions

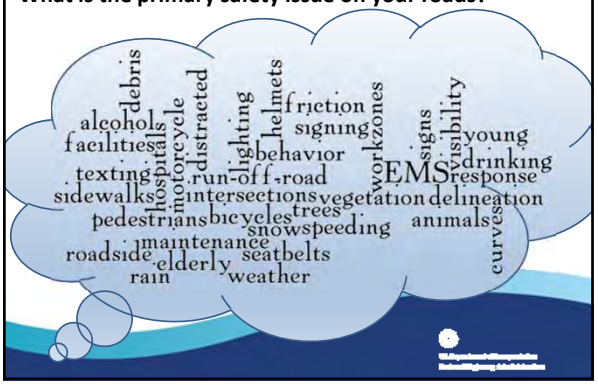
Safety Plan:

Plan developed by a multi-disciplinary team to improve safety on the entire road network by:

- Using data to identify problems
- prioritize countermeasures
- communicate with safety partners

Transportation Safety Plan:

What is the primary safety issue on your roads?



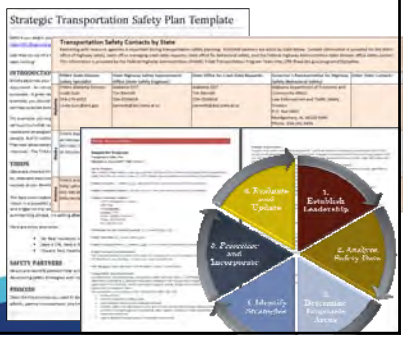
Problem Solving Approach

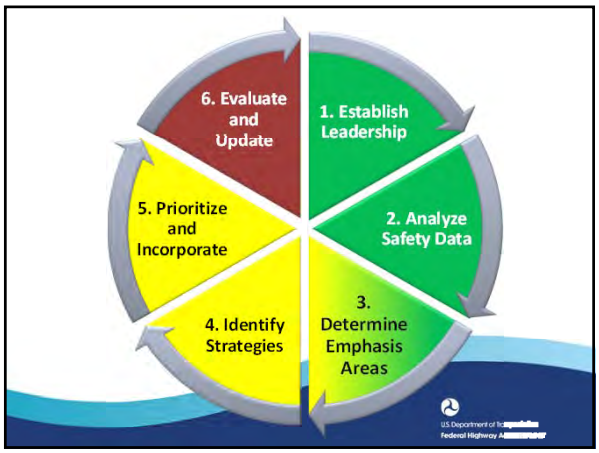
- Data should lead to decisions on programs and projects
- NOT: Decisions made then supported with data

Strategic Transportation Safety Plan

Toolkit for Tribal Governments

- Plan Template
- State Contacts
- Draft RFP
- Webinar
- Other Resources





👤 👤 👤 👤 👤	Roadway Departure
👤 👤 👤 👤 👤	Night / Low Light Crashes
👤 👤 👤 👤	Law/Policy Improvement
👤 👤 👤 👤	Speed Management
👤 👤 👤 👤	Restraint Usage
👤 👤 👤	Impaired Driving
👤	Special Users: Pedestrians and Bicycles (17% of fatal crashes compared to 9% statewide)
👤	Intersection related crashes
👤 👤 👤	Vulnerable road users (young drivers, pedestrians, and bicycles)

Further Data Analysis

EMPHASIS AREA	STRATEGIC LINKAGE
Roadway Departure	57% of fatal and serious injury crashes involved a single vehicle leaving the roadway. Roadway departure was a factor in 52 fatal crashes in five years of data.

Where? 70% of these crashes occurred on two lane rural roads.

Who? 60% of the road departure crash drivers are under age 21

What else? 30% of drivers were impaired in road departure crashes

EMPHASIS AREA	STRATEGIC LINKAGE
Roadway Departure	57% of fatal crashes involved a single vehicle leaving the roadway. Roadway departure was a factor in 52 crashes in five years of data. 45% of roadway departure crashes occurred in curves on two lane rural roads.

Strategies

Education	Enforcement	EMS	Engineering
Ensure driver training covers "over-correcting"	See emphasis areas for alcohol and seatbelt use, these behavioral factors influence roadway departure.	Acquire repelling gear and training for faster rescue for roadway departure crashes in canyon.	• Improved curve signage • Policy to include safety edge when paving • Systemic Study

Exercise 2

Contributing Factors Analysis

U.S. Department of Transportation
Federal Highway Administration

What data is available to you?

Exercise

- Tally these contributing factors.
- Do you see any topics the tribe should consider including in their safety plan?

Code	TYPE	COUNT
4, 5	Fatal & Serious Injury	
2, 3	Possible Injury	
1	Property Damage Only (PDO)	

TYPE	COUNT
ANGLE-OTHER	
ANGLE-TURNING	
ANIMAL	
F-O	
HEAD-ON	
OTHER	
OTH-SINGLE-VEH	
PEDAL-CYCLE	
PEDESTRIAN	
REAR-END	
RIGHT-ANGLE	
ROLLOVER	
SIDESWIPE-OPP	
SIDESWIPE-SAME	

Code	Condition	Count
1	Clear	
2	Fog	
3	Clouds	
4	Raining	
5	Snowing	
6	Sleet/Hail	
7	Severe Crosswind	
8	Blowing Snow	
9	Blowing Sand/Dirt	
10	Other	
99	Unknown	

Code	Condition	Count
1	Daylight	
2	Dark - Not Lighted	
3	Dark - Lighted	
4	Dawn	
5	Dusk	
6	Dark - Unknown Lighting	
7	Other	
9	Unknown	

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EXERCISE 2b

- Using sample crash data.
- Develop pivot tables in Microsoft Excel.
- Identify 2 topics the Tribe should consider in their safety plan.

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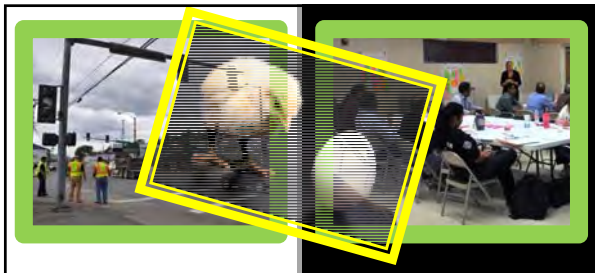
Road Safety Audits

Part 1

U.S. Department of Transportation
Federal Highway Administration

Road Safety Audit
A formal and independent safety performance review of a road project by an independent, multidisciplinary, experienced team of safety professionals, addressing the safety of all road users.



Road Safety Audit
A formal and independent safety performance review of a road project by an independent, multidisciplinary, experienced team of safety professionals, addressing the safety of all road users.

Transportation Safety Plan
A data-driven plan developed by a multi-disciplinary team to improve safety on the entire road network by prioritizing the activities implemented by a government and communicating these priorities with safety partners.

Nominal vs. Substantive Safety

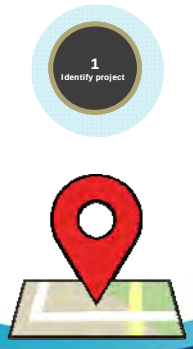
Nominal Safety

Nominal safety is meeting the standards

Substantive Safety

Substantive safety is doing what works for the site.

Identify Project



- Hot spot analysis
- Systemic Analysis
- Local knowledge/concern
- Project design process

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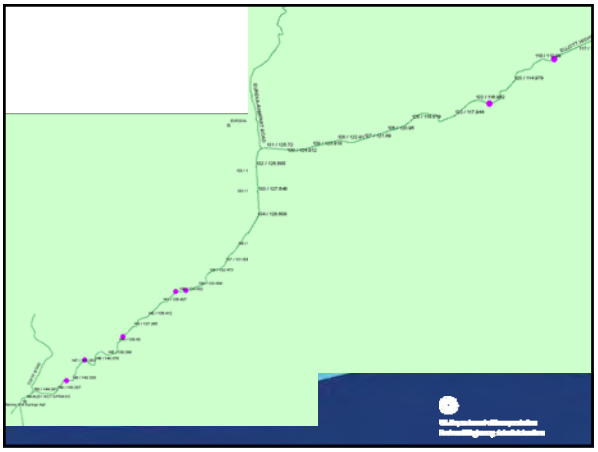
RSA Process

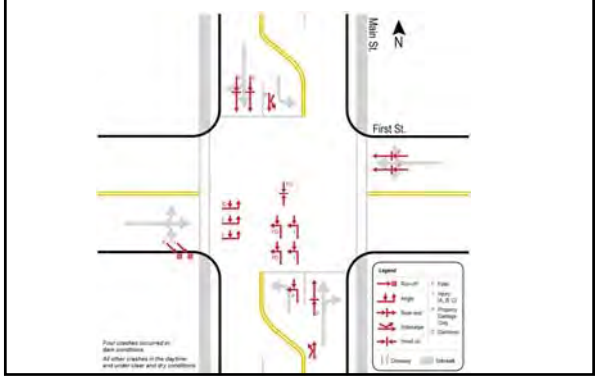
RSA Team

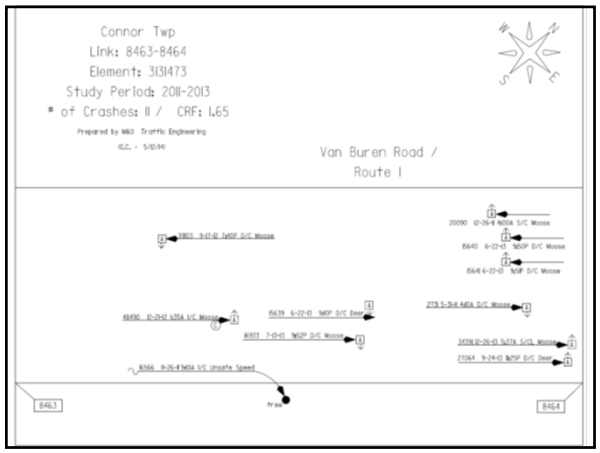


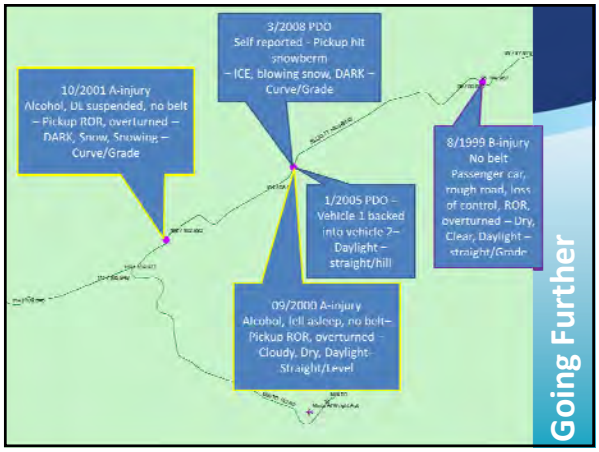
RSA Crash Data

Supplemental Crash Data

Intersection Crash Diagram







EXERCISE

Intersection Crash Diagram

Lummi Nation:
Slater Road & Haxton Way

U.S. Department of Transportation
Federal Highway Administration

Intersection of Slater Road & Haxton Way, Lummi Nation, 2010-2015 Crash Data

ID #	DATE	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	FIRST COLLISION TYPE / OBJECT STRUCK	VEH 1 ACTION	VEH 2 ACTION	VEH 1 FROM	VEH 1 TO	VEH 2 FROM	VEH 2 TO
1	7/30/2011	No Injury	0	0	2	From same direction - both going straight - one stopped - rear-end	Stopped at Signal or Stop Sign	Going Straight Ahead	South	Vehicle Stopped	South	North
2	3/13/2010	Possible Injury	1	0	2	Same direction -- both turning left -- both moving -- rear end	Making Left Turn	Making Left Turn	East	South	East	South
3	5/22/2010	No Injury	0	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	West	East
4	8/5/2011	Possible Injury	1	0	2	Entering at angle	Going Straight Ahead	Going Straight Ahead	South	North	East	West
5	1/9/2012	Serious Injury	2	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	West	East
6	10/24/2012	Serious Injury	2	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	West	East
7	2/3/2014	No Injury	0	0	2	From opposite direction - one left turn - one straight	Going Straight Ahead	Making Left Turn	West	East	East	South
8	7/23/2014	Possible Injury	3	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	Southwest	West	East
9	12/13/2014	No Injury	0	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	West	East
10	9/2/2015	No Injury	0	0	2	Entering at angle	Going Straight Ahead	Going Straight Ahead	South	North	West	East
11	11/13/2015	Died in Hospital	1	1	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	East	West
12	12/19/2015	Possible Injury	3	0	2	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	East	South	West	East
13	6/3/2013	Possible Injury	1	0	2	From opposite direction - one left turn - one straight	Going Straight Ahead	Making Left Turn	West	East	East	South

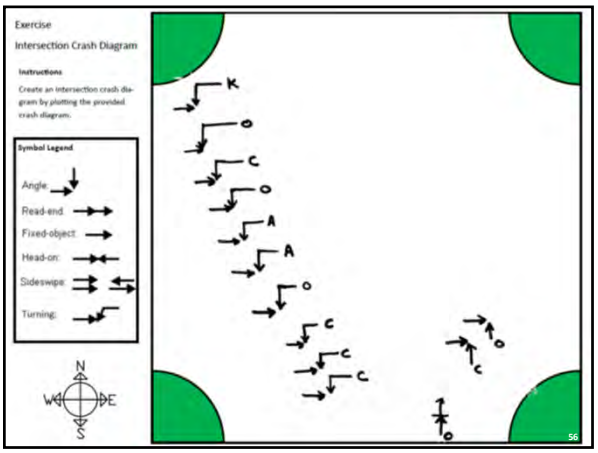
Exercise
Intersection Crash Diagram

Instructions
Create an intersection crash diagram by plotting the provided crash diagram.

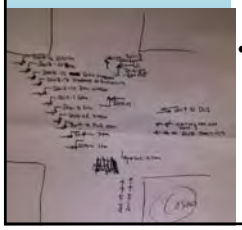
Symbol Legend

Angle
Read-and
Fixed-object:
Head-on:
Sideswipe
Turning

N
W
E
S



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:**
  - **13+ Serious Crashes**
  - **16+ PDO Crashes**
  - **3 deaths**

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Issues

- Permissive left turns, WB to SB
- Sun glare could impair visibility of EB or WB signal or oncoming vehicles
- Fog is frequent

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Issues

- EB to SB right turning vehicle may obscure other EB vehicles

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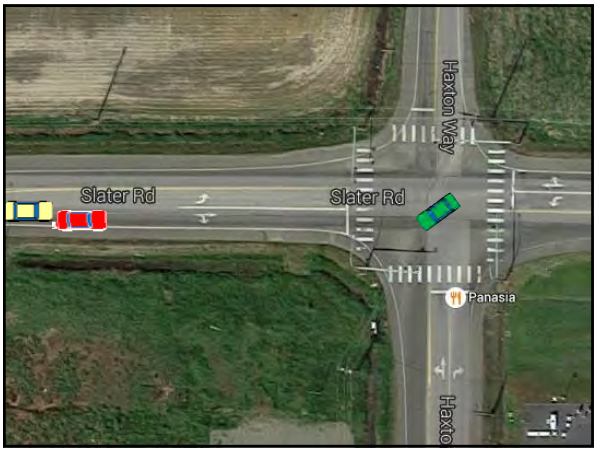

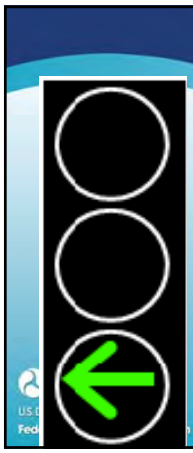

LOW Cost /SHORT Term Countermeasures

- **Add protected left turn phase for WB to SB**
- Add protected NB right turn arrow (same time as WB left turn phase)

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Low Cost / Short Term Countermeasures

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

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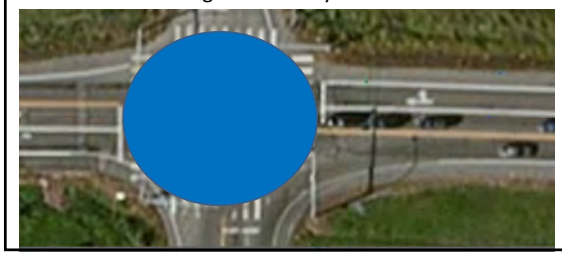
Long Term Recommendation

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



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Road Safety Audits

Part 2

U.S. Department of Transportation
Federal Highway Administration

Risk Assessment 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

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Network Screening

U.S. Department of Transportation
Federal Highway Administration

Site-Specific Network Screening Basics

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Network Screening for "Hot Spots"

- Reactive
- Focus Treatment on Identified Locations
- Uses Safety Countermeasures for Identified Crash Types
- Analysis of Crash Locations

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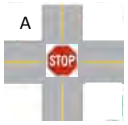
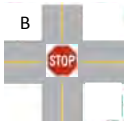
Site-Specific Network Screening

- Which intersection is "more safe"?

A



B



Measure of Safety	Intersection A	Intersection B	Safer?
Crash history (5 years)	51	34	
Total Entering Volume (vehicles/day)	10,000	2,500	
Fatal / Serious Injury (K/A), Weight:80	0	3	
Minor/Possible Injury (B/C), Weight: 10	16	13	
Property Damage Only (PDO), Weight: 1	35	18	

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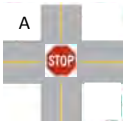
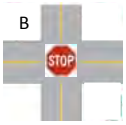
Site-Specific Network Screening

- Which intersection is "more safe"?

A



B



Measure of Safety	Intersection A	Intersection B	Safer?
Crash Frequency (crashes/year)	10.2	6.8	B
Total Entering Volume (vehicles/day)	10,000	2,500	
Crash Rate (crashes/million-vehicles)	2.8	7.5	A
Crash Rate (crashes/daily traffic)	0.00102	0.00272	

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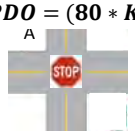
Site-Specific Network Screening

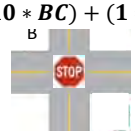
- Which intersection is "more safe"?

$$EPDO = (80 * KA) + (10 * BC) + (1 * PDO)$$

A



B

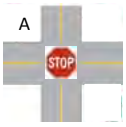


Measure of Safety	Weight	Intersection A	Intersection B	Safer?
Total crashes (5 years of data)		51	34	
Fatal / Serious Injury (K/A)	80	0	3	
Minor/Possible Injury (B/C)	10	16	13	
Property Damage Only (PDO)	1	35	18	
EPDO				

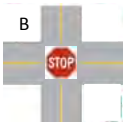
Site-Specific Network Screening

- Which intersection is "more safe"?

A



B

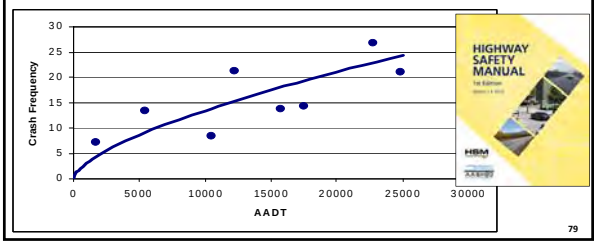


Measure of Safety	Intersection A	Intersection B	Safer?
Crash Frequency (crashes/year)	10.2	6.8	B
Crash Rate (crashes/million-vehicles)	2.8	7.5	A
EPDO	195	388	A
Severity Index	3.8	11.4	A

78

Site-Specific Network Screening: Predicted Crashes

- Safety Performance Functions
  - A mathematical model used to predict mean crash frequency based on exposure for a given facility type.



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Road Safety Audits

Making Your Roads Safer

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

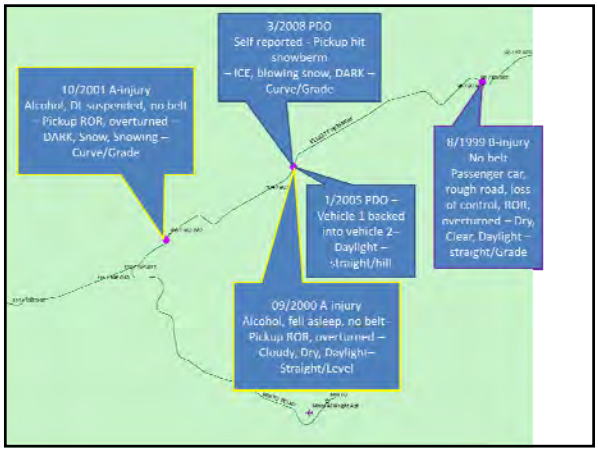
81

Road Safety Audit

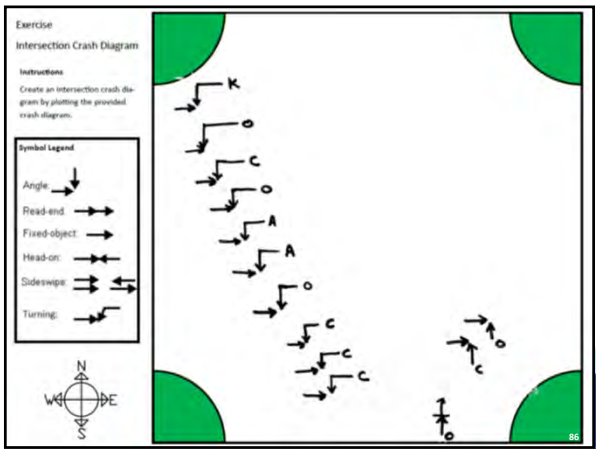
A formal and independent safety performance review of a road project by an independent, multidisciplinary, experienced team of safety professionals, addressing the safety of all road users.

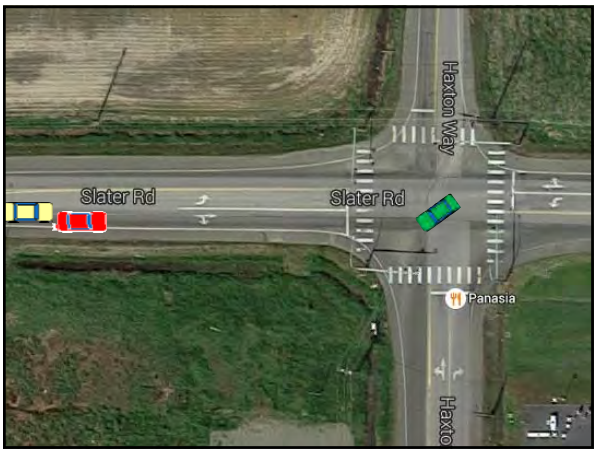
RSA Process

RSA Team
Design Team / Project Owner



Supplemental Crash Data





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)

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Low Cost / Short Term Countermeasures

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

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Long Term Recommendation

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

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Example: Geospatial Analysis

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Geospatial Analysis

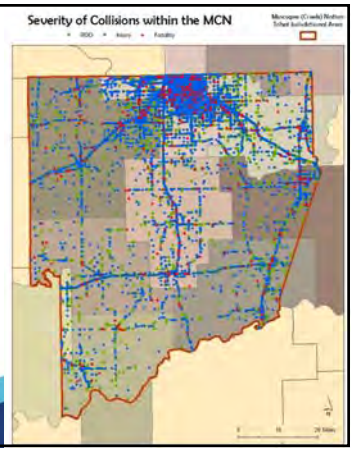
Source: Pam Jurney, Cross Timbers Consulting

Geospatial Analysis (MCN)

tyNo	CityNo	ControlNo	IntlDNo	Milepoint	HwyName	HwyClass	SpecialFeature	SpecialFeature	IntRel	NoInjured	NoKilled	CtypeofCollision	Severity	Date	Latitude	Longitude
19	0	26	0	4.61	SH-97	4	75		0	0	0	1 ROLLOVER	5	1/12/2009 0:00	36.063671	-96.1198885
19	45	26	0	4.4	SH-97	8	0		0	1	1	1 RIGHT-ANGLE	5	1/21/2009 0:00	36.060648	-96.1194425
19	0	4	90	5.2		5	0		0	1	0	1 ANGLE-OTHER	5	3/19/2009 0:00	36.017512	-96.1723706
19	0	38	0	9.8	SH-51	4	0		0	0	2	1 SIDESWIPE-OPP	5	6/2/2009 0:00	36.116167	-96.4083731
19	0	1	50	2.2		5	0		0	1	0	1 ROLLOVER	5	6/13/2009 0:00	35.7988554	-96.4765463
19	0	4	0	5.39	SH-66	4	0		0	0	0	1 ROLLOVER	5	7/6/2009 0:00	35.9007865	-96.365552
19	0	18	0	3.5	SH-33	4	0		0	0	0	1 ROLLOVER	5	8/8/2009 0:00	35.988397	-96.5600318
19	0	1	50	4.22		5	0		0	0	1	3 HEAD-ON	5	7/23/2009 0:00	35.9475053	-96.476668
19	0	1	13	2.6		5	0		0	0	1	2 ROLLOVER	5	8/20/2009 0:00	35.8278761	-96.5068327
19	0	5	53	6		5	0		0	0	0	1 F-O TREE	5	8/20/2009 0:00	36.0755253	-96.1136079
19	0	2	0	10.6	SH-66	4	0		0	0	8	1 ANGLE-OTHER	5	11/5/2009 0:00	35.8159282	-96.45147
19	0	2	0	8.1	SH-66	4	0		0	1	2	1 OTHER	5	11/2/2009 0:00	35.8082722	-96.4930364
19	0	38	0	11.7	SH-51	4	0		0	0	1	1 OTHER	5	4/8/2010 0:00	36.1309713	-96.379873
19	15	18	0	1.12	SH-33	8	0		0	0	1	1 REAR-END	5	1/25/2010 0:00	35.9884816	-96.6018168
19	35	8	0	2	US-75A	7	0		0	0	0	1 F-O EMBANKMENT	5	4/19/2011 0:00	35.8841651	-96.0607084
19	45	6	0	2.56	SH-66	8	0		0	0	1	1 F-O GUARDRL-END	5	12/2/2011 0:00	36.02258	-96.0934628
19	0	2	0	5.5	SH-66	4	0		0	0	1	1 ROLLOVER	5	8/10/2012 0:00	35.8015105	-96.5378415
19	45	26	0	2.35	SH-97	8	75		0	1	2	1 ANGLE-TURNING	5	1/5/2013 0:00	36.0318972	-96.1142152
19	45	36	0	3.09	SH-117	8	0		0	0	2	1 HEAD-ON	5	2/17/2012 0:00	35.9840496	-96.0586138
19	0	2	73	3		5	0		0	1	0	1 ANGLE-TURNING	5	3/16/2009 0:00	35.8572249	-96.3640998
19	0	5	17	5.6		5	0		0	0	1	1 ROLLOVER	5	4/14/2009 0:00	36.0464776	-96.1421688
19	0	1	30	2		5	0		0	0	0	1 ROLLOVER	5	9/7/2009 0:00	35.7842075	-96.4944149
19	0	4	70	5.29		5	0		0	0	1	1 F-O FENCE	5	9/2/2010 0:00	36.0306183	-96.1902334
19	0	2	0	0.1	SH-66	4	0		0	0	0	1 ROLLOVER	5	1/28/2010 0:00	35.7692029	-96.6179272
19	0	4	90	6		5	0		0	1	3	2 RIGHT-ANGLE	5	3/24/2010 0:00	36.0757236	-96.1727688

Geospatial Analysis (MCN)

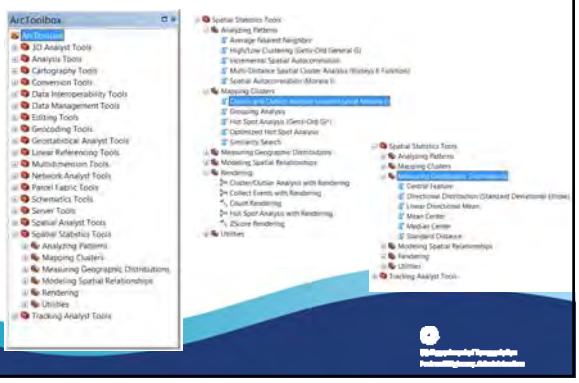
Source: Pam Jurney, Cross Timbers Consulting



Geospatial Analysis – Spatial Statistics

- The field of study concerning statistical methods that use space and spatial relationships (such as distance, area, volume, length, height, orientation, centrality and/or other spatial characteristics of data) directly in their mathematical computations.
- Spatial statistics are used for a variety of different types of analyses, including pattern analysis, shape analysis, surface modeling and surface prediction, spatial regression, statistical comparisons of spatial datasets, statistical modeling and prediction of spatial interaction, and more. The many types of spatial statistics include descriptive, inferential, exploratory, geostatistical, and econometric statistics.
- Must use GDB for activities

The Spatial Statistics Toolbox



Spatial Statistics in Action

- Spatial Autocorrelation
  - Definition: "Everything is related to everything else, but nearby things are more related than distant things." - Waldo Tobler
  - Definition: Systematic pattern in the spatial distribution of a variable
  - Evaluate the spatial association of a variable within a specified distance of a single point
- Applications:
  - Hot Spots
  - Clusters & Outliers
    - Collision severity (must be a number datatype)
    - Mapping Clusters
      - HH – HL – LH – LL – Not Significant

Source: Pam Jurney, Cross Timbers Consulting

Geospatial Analysis (MCN)

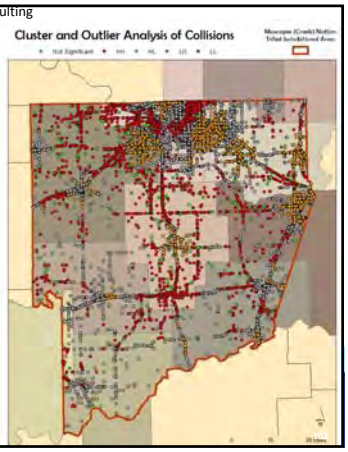
Each Crash Ranked (z-scores):

HH = High frequency & severity

HL = Apparent outlier, high severity mixed with several low severity

LH = Low frequency amid high severity

LL = Cluster of PDO crashes



Source: Pam Jurney, Cross Timbers Consulting

MCN Safety Plan: Locations for further study

Critical Locations (z-scores)

- 1: US Hwy 75 & Will Sampson Road
- 2: County Road E960 at County Road N362
- **3: SH 48 between and at intersections of SH 33 and SH 51**
- 4: SH 33 approaching I-44 from the west
- 5: US 75 (Business) in Henryetta
- 6: US 75 between Henryetta and Okmulgee
- 7: US 64 / SH 72 / US 62, south of Haskell
- 8: US 69 between Eufaula and Checotah
- 9: US 75 and US Alt 75, west of Winchester and Liberty

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Source: Pam Jurney, Cross Timbers Consulting

Geospatial Analysis

Each Crash Ranked:

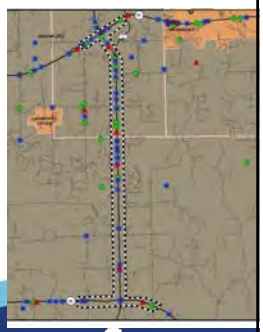
HH = High frequency in high severity

HL = Apparent outlier, high severity mixed with several low severity

LH = Low frequency amid high severity

LL = Cluster of PDO crashes

Concentrated groups of HH identified for further study.



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CRASH DATA ANALYSIS
Systemic Safety Analysis

U.S. Department of Transportation
Federal Highway Administration

Site Specific Network Screening

Hot Spot Location

- Reactive
- Focus Treatment only on Identified Locations
- Analysis required for each identified site

Systematic Approach

- Preventative - Improvement not focused on high crash locations
- Prioritize treatment by risk
- Uses proven, low cost countermeasures
- Can be more difficult to acquire funding

Systemic Method

Systemic Safety Improvements

Improvements that are widely implemented based on roadway features that are deemed high-risk because of correlation with severe crashes.

Examples?

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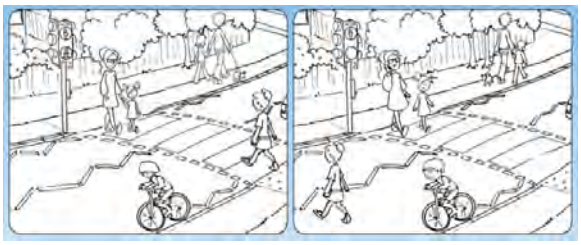
Spot the Differences



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Spot the Similarities

Site visit serious/fatal crash locations and look for similarities.
These are "risk factors".

112

Identify Focus Crash Type

	Roadway Departure
	Night / Low Light Crashes
	Law/Policy Improvement
	Speed Management
	Restraint Usage
	Impaired Driving
	Special Users: Pedestrians and Bicycles (17% of fatal crashes compared to 9% statewide)
	Intersection related crashes Vulnerable road users (young drivers, pedestrians, and bicycles)

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EMPHASIS AREA	STRATEGIC LINKAGE
Roadway Departure	57% of fatal crashes involved a single vehicle leaving the roadway. Roadway departure was a factor in 52 crashes in five years of data. 45% of roadway departure crashes occurred in curves on two lane rural roads.

Strategies			
Education	Enforcement	EMS	Engineering
Ensure driver training covers "over-correcting"	See emphasis areas for alcohol and seatbelt use, these behavioral factors influence roadway departure.	Acquire repelling gear and training for faster rescue for roadway departure crashes in canyon.	• Improved curve signage • Policy to include safety edge when paving • Systemic Study

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Identify Risk Factors

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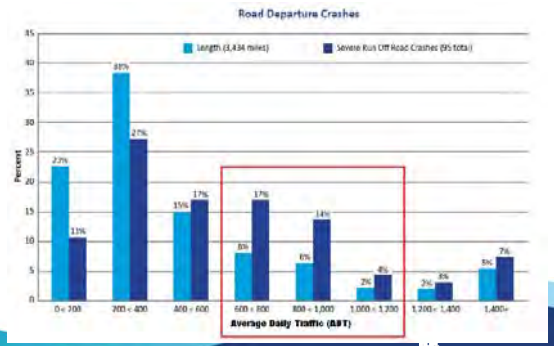
Segment Traffic Volume as Potential Risk Factor



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Risk Factors – Curve Radius

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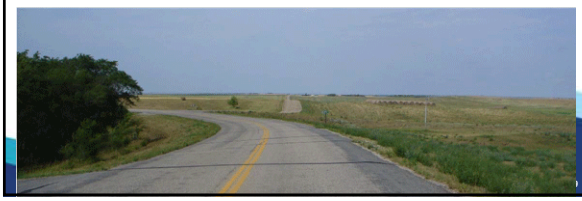
Risk Factors – Visual Trap



Risk Factors – Intersection in Curve

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Systemic Safety Planning Process

safety.fhwa.dot.gov/systemic/

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Identify Candidate Locations

- Locate all sites with at least one risk factor

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Screen Candidate Locations

Symptoms

Severe roadway departure crashes on curves.

Possible Risk Factors:

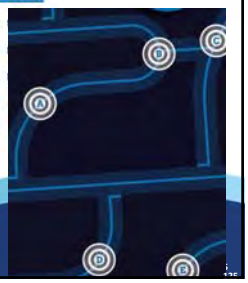
- Avg. Daily Traffic > 1,000 vehicles
- Curve Radius < 1,000 feet
- Intersection within Curve
- Visual Trap within Curve
- Severe Crash within Curve

Diagnosis

11% of all curves have 3 or more risk factors

Lab Results:

Curve A
Curve B
Curve C
Curve D
Curve E



Systemic Safety Planning Process

safety.fhwa.dot.gov/systemic/

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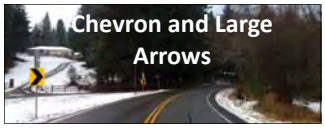
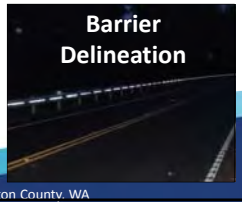
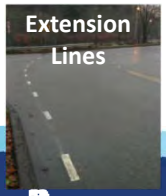
Select Countermeasures







Source: Scott Davis, Thurston County, WA

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Systemic Safety Planning Process

safety.fhwa.dot.gov/systemic/

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Prioritize Implementation

Lab Results:

Curve A
Curve B
Curve C
Curve D
Curve E

Prioritization

Curve B
Curve E
Curve C
Curve D
Curve A

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Example Prioritization

Curve Count	ID	Corridor	Segment	Crashes Total	Severe	K	A	B	C	PDO	Severe RoR K	A	Radius (ft)	Length Curve (ft)	ADT	Intersection on Curve	Chevrons	Visual Trap	Rank	Proximity	Chevron Candidate
1	001A	1.01	CSAH 1	1	-	-	-	-	-	1	-	-	92	125	50	-	-	-			
2	001B	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	557	422	50	-	-	-	*		
3	001C	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	823	493	50	-	-	-	*		
4	001D	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	379	359	50	-	-	-			
5	001E	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	669	456	50	-	-	-	*		
6	001F	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	270	431	50	-	-	-			
7	001G	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	314	324	50	-	-	-			
8	001H	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	545	239	50	-	-	-	*		
9	001I	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	459	225	50	-	-	-			
10	001J	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	368	274	50	-	-	-			
11	001K	1.01	CSAH 1	1	-	-	-	-	-	1	-	-	318	390	50	-	-	-			
12	001L	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	267	399	50	-	Yes	-			Installed
13	001M	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	1,475	345	50	-	-	-	*		
14	001N	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	763	578	130	Yes	-	-	* *		
15	001O	1.01	CSAH 1	-	-	-	-	-	-	-	-	-	859	353	210	Yes	-	-	* *		
16	002A	2.02	CSAH 2	1	-	-	-	1	-	-	-	-	583	752	930	-	-	-	* *	Yes	Yes
17	002B	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	584	635	930	Yes	-	-	* * *	-	Yes
18	002C	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	799	665	930	Yes	-	-	* * *	-	Yes
19	002D	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	963	626	930	-	-	-	* *	Yes	Yes
20	002E	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	1,234	584	930	-	-	-	* *	Yes	Yes
21	002F	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	1,188	719	930	-	-	-	* *	Yes	Yes
22	002G	2.02	CSAH 2	1	1	-	1	-	-	-	-	1	938	556	930	-	-	-	* * *	-	Yes
23	002H	2.02	CSAH 2	-	-	-	-	-	-	-	-	-	1,199	402	930	-	-	-	* *	Yes	Yes
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...
502	249ZH	249.01	CR 249	-	-	-	-	-	-	-	-	-	432	301	275	Yes				Yes	Yes
503	249ZI	249.01	CR 249	-	-	-	-	-	-	-	-	-	814	344	275	-	-	-		Yes	Yes
504	249ZJ	249.01	CR 249	-	-	-	-	-	-	-	-	-	800	685	275	-	-	-	*	Yes	Yes

Complete census of 504 curves

32 High Priority Curves (6%)

Systemic Approach to Safety: Using Risk to Drive Action

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

REVIEW

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U.S. Department of Transportation
Federal Highway Administration

What is the minimum analysis that should be done for a safety plan?

- Data Assessment
- Contributing Factors Analysis

How can funding be obtained for safety plan development?

- Check TribalSafety.org and FHWA's TTP website for the latest funding opportunities

Name methods that can be used to find locations for further investigation

- Network Screening Analysis / Hot Spot Analysis
- Safety Performance Functions
- Simple crash frequency
- Crash rates
- Equivalent Property Damage

What could be done when "hot spots" are found?

- Site-specific study
- Road Safety Audits

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What could be done when "hot spots" are NOT found?

- Systemic safety approach
- Use risk factors at severe crash locations to drive improvements on like facilities

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Questions?

- TTP Safety Fund
- Safety Data Sources
- Safety Data Analyses
  - Contributing Factors Analysis & Safety Plans
  - Network Screening (or hot spot analysis)
  - Site Specific Crash Mapping (Road Safety Audit)
  - Systemic Safety Approach

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Additional Resources

- **NCHRP 500 Safety Data and Analysis for Developing Emphasis Area Plans (Vol. 21)**
- **Improving Safety on Rural Local and Tribal Roads**
  - Safety Toolkit
  - Site Safety Analysis – User Guide #1
  - Network Safety Analysis – User Guide #2
- Safety Plans Toolkit for Tribes
  https://flh.fhwa.dot.gov/programs/ttp/safety/stsp-toolkit.htm
- TribalSafety.org

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Activity: Map Making

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