

Introduction to Safety Data

DOTD Highway Safety Section



www.dotd.la.gov

Introductions

- Your Name
- Your Agency & Section
- Your experience with crash data

SAFE HIGHWAY DRIVING MEANS:



Staying at the speed limit



Leaving enough distance



Going distraction-free



Driving defensively



Adhering to move-over laws



Agenda

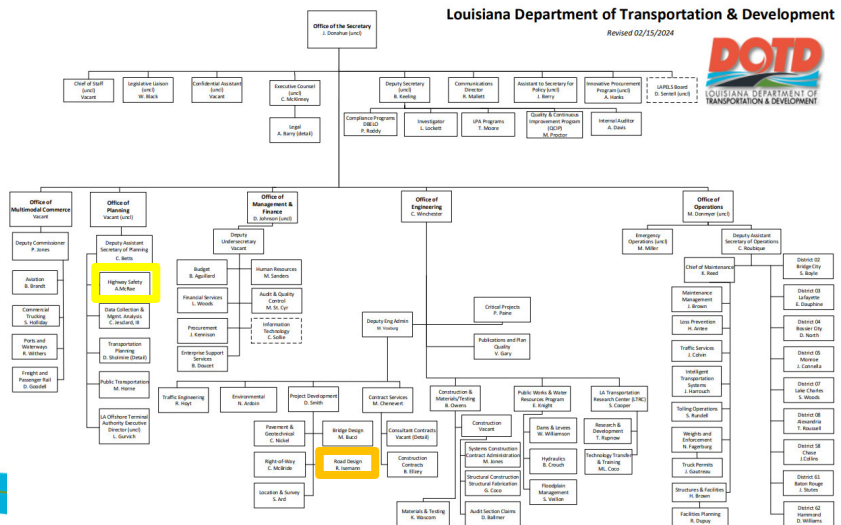
- Highway Safety Program Overview
- Understanding Safety Data
- Safety Management Process
- Interpreting the Data
 - Project Analysis
 - Other Considerations



Highway Safety Section

CRITICAL FUNCTIONS:

- Louisiana Strategic Highway Safety Plan (Req'd by NHTSA & FHWA)
- Statewide/Regional/Local Safety Data & Planning Efforts
- Highway Safety Improvement Program (FHWA \$\$\$)
- Data Driven Safety Analysis Support Statewide



Strategic Highway Safety Plan 2022

- Louisiana’s vision for **Destination Zero Deaths** (DZD) is carried out through the state’s Strategic Highway Safety Plan (SHSP)
- SHSP identifies Emphasis Areas, strategies, and tactics for reducing **fatalities and serious injuries** on all public roads in the state.
- Plan is developed with input from many experts, stakeholders, and advocacy groups.
- Federal Highway Administration (FHWA) requires all states to develop, implement, evaluate, and periodically update SHSP. **Every 5 years!**
- **Strategies must be included in the SHSP for projects to qualify for funding under the Highway Safety Improvement Program (HSIP).**

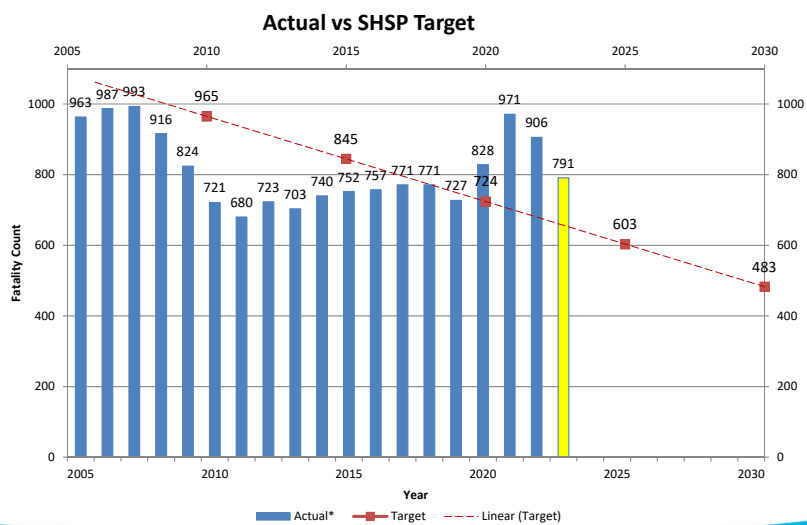


Louisiana Highway Fatalities

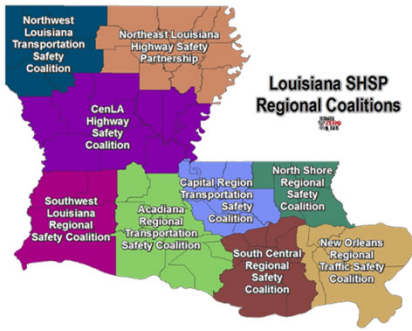
Economic Costs of Crashes:

\$10 billion/year

\$27 billion/year including loss of quality of life



SHSP Leadership



SHSP Emphasis Areas

Older driver, older pedestrians (65+), and young driver (15-24) strategies are embedded as appropriate within each of the four EAs

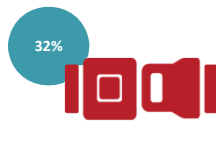


Distracted Driving
Crashes involving distracted or inattentive drivers

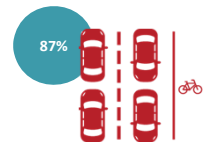


Impaired Driving
Crashes involving alcohol and/or other drugs

- 34% Alcohol
- 55% Drug



Occupant Protection
Crashes involving unrestrained drivers or occupants



Infrastructure & Operations
Crashes involving roadway departure, lane departure, intersections, pedestrians, and bicyclists

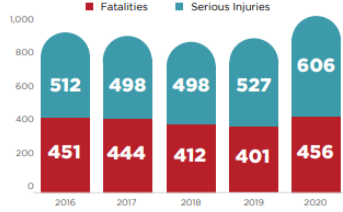
- 56% Lane/Roadway Departure
- 21% Intersection
- 18% Pedestrians
- 3% Bicyclists

*Percentages represent fatality rates

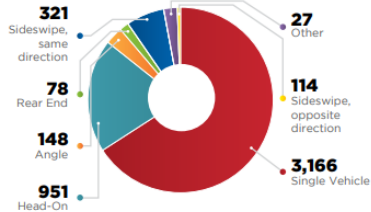


Louisiana Crash Trends

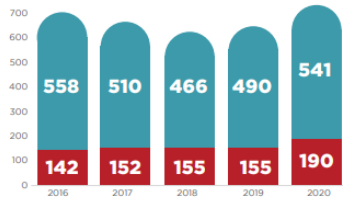
LANE/ROADWAY DEPARTURE



COLLISION MANNER GROUPINGS

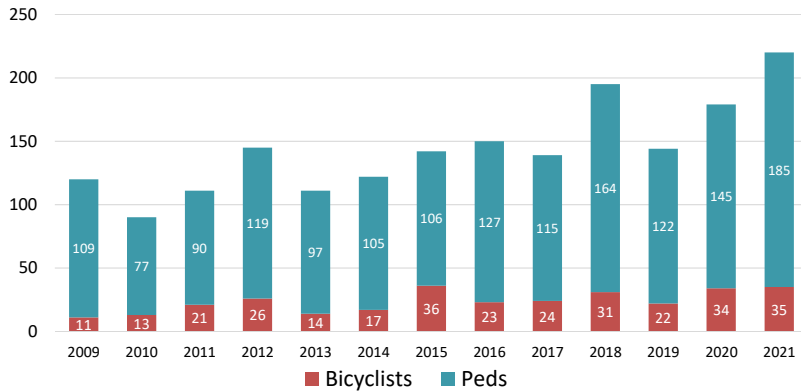


INTERSECTIONS



Louisiana Crash Trends

Louisiana Non-motorized User Fatalities

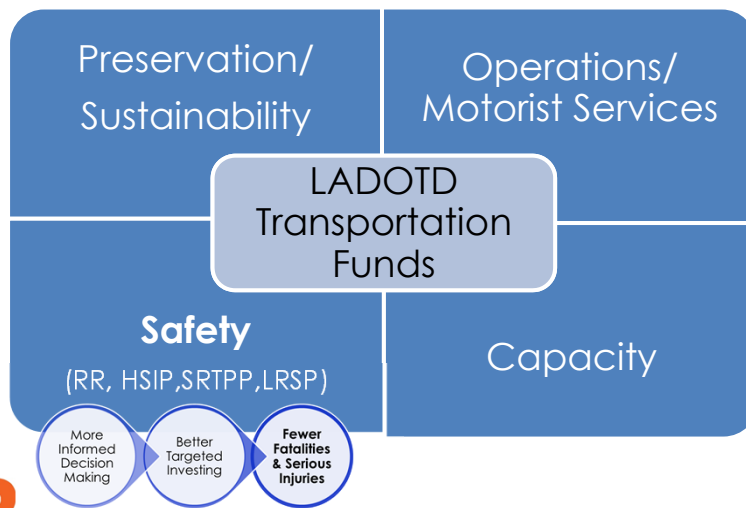


Title 23 U.S.Code 148 / CFR 924 Highway Safety Improvement Program

- Federal program (FHWA \$\$\$) to significantly reduce the occurrence of and potential for fatalities and serious injuries on all public roads
- Implemented through State-administered processes
 - » Collecting and maintaining safety data
 - » Improving safety data
 - » **Analyzing safety data**
 - » Conducting engineering studies
 - » Establishing priorities
 - » Evaluation of the HSIP and SHSP
- **DATA DRIVEN!**
- Corrects or improves a hazardous road location or feature
- Addresses a highway safety problem



HSIP & DOTD Budget Partition



Title 23 U.S.Code 407

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvements project which may be implemented using Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.



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Key Points

- Perform these task honestly without fear of litigation
- Interest of the public to protect safety information
- Not the function of the judge or jury to second guess engineering decisions



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General Safety Data Protocol

- Include 23 USC 407 Disclaimer on all pages of documents that includes safety data
- Avoid printing unofficial crash reports
- Do not include copies of crash reports or Crash IDs in Traffic Studies/Reports, Stage 0, or publically available documents
- Do not share your log-in information with anyone
- Personal and sensitive information not readily available to the public should be ignored



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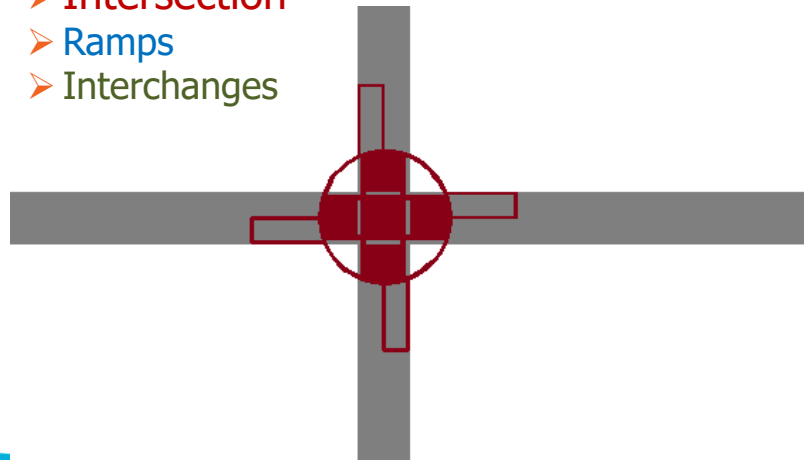
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Safety Data

- Road Data Facility Types
 - Segment Data
 - Intersection Data
- Crash Report
 - One crash per report
 - One or more motorized vehicles on public road
- Traffic Data
 - Average Annual Daily Traffic (AADT) measured in vehicle/day

Facilities Types

- Segment
- **Intersection**
- Ramps
- Interchanges



Crash Report vs. Crash Data

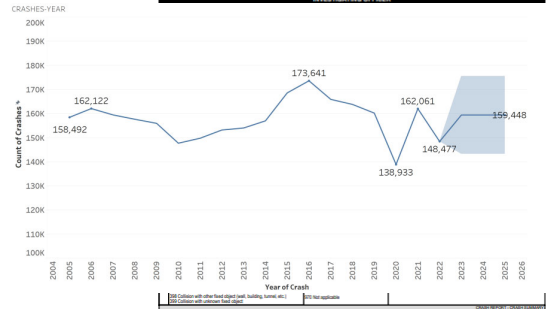
- Crash Report: form
 - Completed by Law-Enforcement Officer (LEO)
 - Owned by Law-Enforcement Agency
 - Entry Options
 - Open notes – free form
 - Certain formats (number, letters, time)
 - List Selection
- Crash Data: warehouse of elements
 - Subset of report
 - List – Codes

Crash Report

- Version
 - 2000 all paper
 - 2005 electronic & paper
 - 2022 no paper
- Format
 - Scanned paper
 - Electronic from applications
- Applications:
 - LaCrash 2005 to 2022 March
 - eCrash 2022 March to present
 - 3rd party

Safety Data & Planning

- 160,000 crashes/year from 300+ Law Enforcement Agencies
- State Sponsored Software: eCrash
- 100+ data fields / crash report
- 100% electronic, 10 day average
- Crash Report Data Collection & Quality Reviews
- Data Visualization
 - » Public SHSP Dashboards
 - » **NEW!** Law Enforcement Data Tool
- Data Analytics & Statistics
 - » Annual Louisiana Crash Data Report
 - » Safety Studies & Evaluations
 - » Crash Data Query & Analyses web-based tools




Critical Crash Data Elements




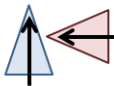

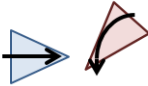
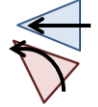

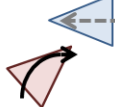
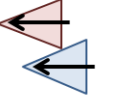
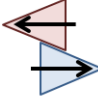

- Coordinates (Latitude & Longitude)
- Collision Manner
- (Human) Severity
- Most Harmful Event \
- Maneuver / Vehicle Factors
- Vehicle Body Type /
- NM Location / Non-Motorist
- NM Prior Action /



Collision Manner

- Primary pattern first two vehicles
- Simplified post-2022 chart



<p>000: Single Vehicle - A (Not a collision between two vehicle)</p>  <p>Object: moving, runaway, train, Pedestrian, Parked Vehicle, etc.</p> <p>S</p>	<p>300: Rear end - B (Front to Rear - Rear End)</p>  <p>diverge</p> <p>A</p>	<p>200: Head on^{1,3} - C (Front to Front - Head On)</p>  <p>cross</p> <p>S</p>	<p>980: Other - None of the other options - Z</p> <p>999: Unknown - Investigation was unable</p>
<p>105: Perpendicular^{1,2,3} - D (Angle - Perpendicular)</p>  <p>cross</p> <p>A</p>	<p>100, 503: Left overtake - E (... - Left Overtake)</p>  <p>cross</p> <p>A</p>	<p>101: Left across flow^{1,2} - F (Angle - Left across flow)</p>  <p>cross</p> <p>A</p>	
<p>102: Left with flow^{2,3} - G (Angle - Left into flow)</p>  <p>merge</p> <p>A</p>	<p>103: Right with flow - H (Angle - Right into flow)</p>  <p>merge</p> <p>A</p>	<p>202, 501: Right against flow^{1,3} - I (... - Right against flow)</p>  <p>scrape</p> <p>A</p>	
<p>505: Same direction swipe - J (Sideswipe - with flow)</p>  <p>scrape</p> <p>S</p>	<p>502: Opposite direct. swipe^{1,3} - K (Sideswipe - against flow)</p>  <p>scrape</p> <p>S</p>	<p>104, 504: Right overtake - new (... - Right Overtake)</p>  <p>cross</p> <p>A</p>	

(Human) Severity origin

National Safety Council

- K – Killed
- A – Incapacitating Injury
- B – Evident Injury
- C – Possible Injury
- O – No Injury



Derived Elements

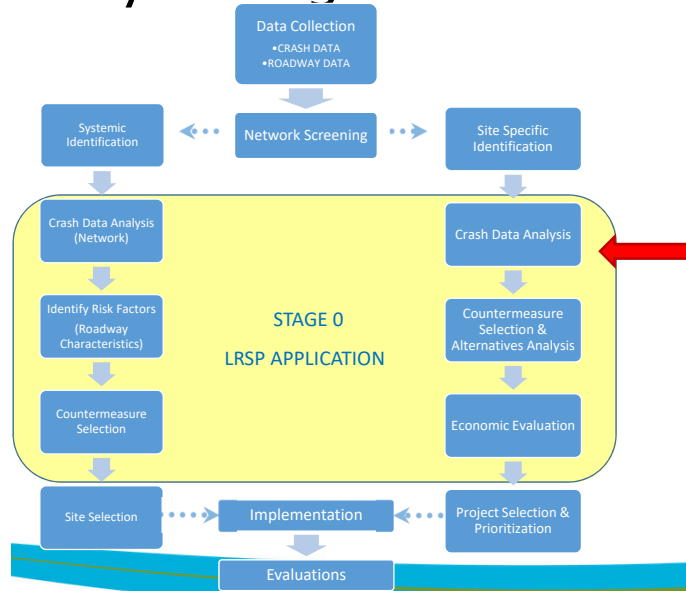
- Road Departure*
- Intersection*
- Intersection ID – geography based
- Train*
- Pedestrian*
- Bicycle*

*yes/no

Agenda

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Safety Management Process

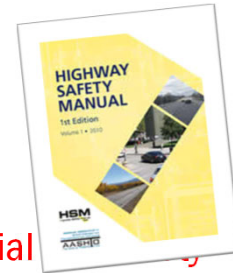


Network Screening



Network Screening Options

- **Crash Frequency (# of Crashes)** – Local Roads
- **Crash Rate** (Crashes/mi/yr/vehicles traveled)
- **Equivalent Property Damage Only (EPDO)**
- **Relative Severity Index**
- **Critical Rate**
- **Calibrated HSM Models**
- **Regression Modeling (SPF/LOSS)** – High Potential Improvement using LOS Safety
- **Excess Proportion of Specific Crash Types**
- **Systemic Approach**



Segment Model Development

	1- Oneway	2- Oneway	2- Lane	2- Divided	3- Lane	4- Lane	4- Divided	5- Lane	6- Lane	4- Freeway	6- Freeway
Rural											
Urban											

used in new CAT Scan

explore the potential to develop SPF & norms



Intersection Model Development

		Rural					Urban				
		2-Lane	2- Divided	4-Lane	4- Divided	6-Lane	2-Lane	2- Divided	4-Lane	4- Divided	6-Lane
Not Exits	Unsignalized	4-Leg	Green	Yellow	Yellow	Green	Blue	Green	Yellow	Green	Green
	3-Leg	Green	Yellow	Blue	Green	Blue	Green	Yellow	Green	Yellow	
Signalized	4-Leg	Yellow	Orange	Blue	Yellow	Blue	Green	Yellow	Green	Green	
	3-Leg	Blue	Orange	Blue	Blue	Blue	Green	Yellow	Green	Yellow	
Hwy Exits	Unsignalized	4-Leg	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
		3-Leg	Orange	Orange	Blue	Orange	Orange	Orange	Orange	Orange	Orange
	Signalized	4-Leg	Orange	Orange	Blue	Blue	Orange	Orange	Orange	Orange	Orange
		3-Leg	Blue	Orange	Blue	Blue	Orange	Orange	Orange	Orange	

used in new CAT Scan
 not used, no SPF; not needed (too few crashes or sites)
 develop SPF
 explore the potential to develop norms - already have SPF
 explore the potential to develop SPF & norms



Safety Data & Planning

- Network Screening
 - » SPFs – State Routes & Intersections
 - » SPFs – Pedestrian Crashes
 - » SPFs – Roadway Departure Crashes
 - » Local Road Crash Data Profiles
- Planning Documents
 - » Pedestrian Crash Assessment
 - » Ped/Bike Safety Action Plans
 - » Districtwide Investment Plans
 - » Roadway Departure Plan
 - » Local Road Safety Plans
- Systemic Analysis
 - » Risk-based approach
 - » Employ treatments to target risk factors

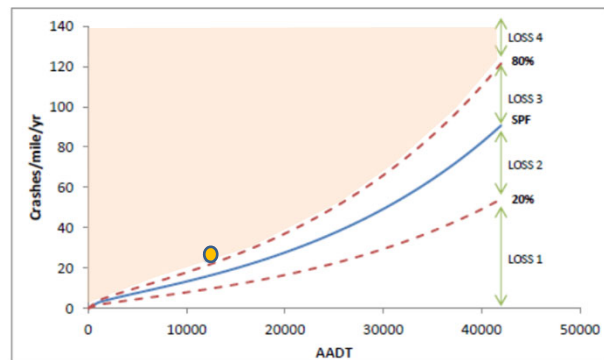


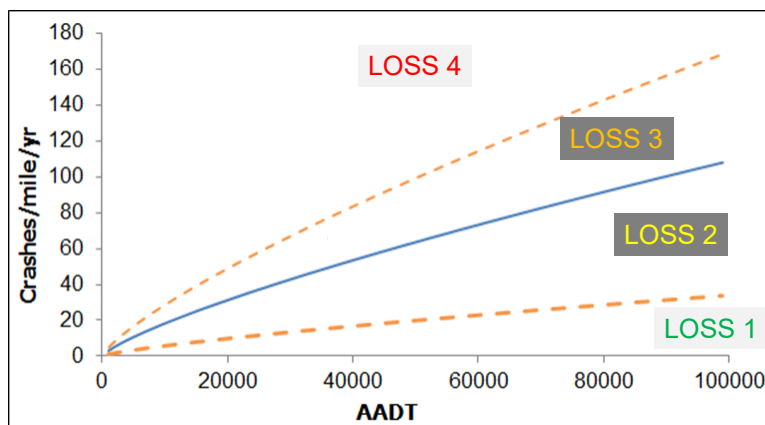
Figure 1 Urban 4-lane Undivided SPF - All Crashes



Regression Modeling

- Segment Models
 - Y-axis: crashes/year/mile
 - X-axis: AADT
- Intersection Models
 - Y-axis: crashes/year
 - X-axis: Major AADT
 - Z-axis: Minor AADT
- Models
 - All Severity: all crashes
 - Injury Crash: no Severity-0
- Bounds
 - 80th percentile
 - 20th percentile

Safety Service Level



- LOSS 4 : High potential*
 - LOSS 3 : Moderate potential*
 - LOSS 2 : Low potential*
 - LOSS 1 : Negligible potential*
- *for safety improvements

Network Screening Lists

- Lists Category
 - Segment – logical segments: Hwy Class; etc.
 - Intersection
- All PSI List – evaluates all state segments and intersections with state roads, plans to include local roads and intersections of local on local
- High PSI Lists
 - Exact criteria noted within each file – ≥ 1 Target Crash/year, where target is Severity K, A, or B
 - Evaluation Period – 5 years
 - Safety Service Level for Injury at LOSS-4

<http://apps2.dotd.la.gov/engineering/engrapps/crash1r/abnormal.aspx>



HSM's SMP

HSM = Highway Safety Manual
SMP = Safety Management Process

- Identify project and limits
- Query crash data
- Conduct quality assurance
- Calculate LOSS
- Calculate crash patterns
- Determine potential mitigation strategies
- Develop planning level cost estimates
- Calculate crash reduction benefit
- Determine benefit-cost ratio

Safety
Analysis



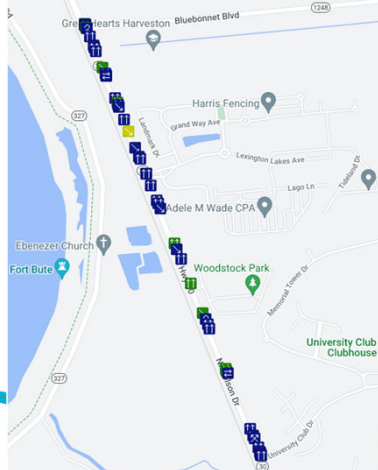
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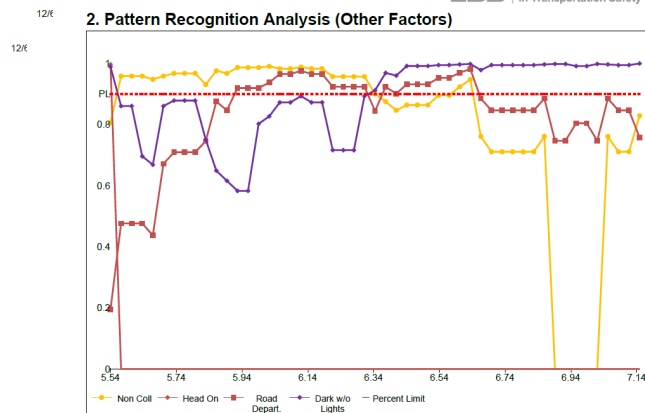
Crash Data Analysis – Output

● Intersection or Segment



12/6/2023

LSU Center for Analytics & Research in Transportation Safety



This document and the information contained herein, is prepared for the purpose of identifying, evaluating, and planning safety improvements on public roads, which may be implemented utilizing federal and highway funds. This information shall not be subject to discovery or admitted into evidence in Federal or State court pursuant to 23 U.S.C. 407.

Pattern Recognition Analysis

- Crash attribute as Binomial Trial

- $$P(X \leq x) = B(x, n; p) = \sum_{i=0}^x \frac{n!}{(n-i)! i!} p^i (1-p)^{n-i}$$

- Each trial compares: subject % v. class %

Code	Crash Types	Obs %	State %	Δs > Pct Lmt	Code	Other Factors	Obs %	State %	Δs > Pct Lmt
A	Pedestrian	0.74%	0.78%	0 0%	A	Non Coll	5.45%	9.44%	31 44%
B	Pedalcycle	0%	0.45%	0 0%	B	Rear End	53.22%	51.78%	2 3%
C	Atv	0%	0.01%	0 0%	C	Head On	0.74%	0.66%	25 35%
D	Motorcycle	0.74%	0.81%	0 0%	D	Rt Angle	5.45%	6.12%	0 0%
E	Parked	0.25%	1.12%	0 0%	E	Left Turn-e	1.73%	1.4%	0 0%
F	Not Fixed	0%	0.8%	0 0%	F	Left Turn-f	10.15%	2.59%	57 80%
G	Vertical Fixed	1.73%	1.83%	27 38%	G	Left Turn-g	1.73%	1.79%	5 7%
H	Structures	0.25%	0.71%	0 0%	H	Right Turn-h	4.7%	2.18%	51 72%
J	Train	0%	0.03%	0 0%	I	Right Turn-i	0.74%	0.18%	14 20%
K	Other Veh	0%	1%	0 0%	J	S Swipe(sd)	13.61%	19.58%	9 13%
M	Bus	0%	0.49%	0 0%	K	S Swipe(od)	0.5%	0.39%	7 10%
N	Animal	0%	0.74%	0 0%	Z	Other	1.98%	3.9%	0 0%
P	Other Fixed	1.24%	2.06%	7 10%	RD	Road Depart.	5.94%	10.22%	21 30%
Q	Transport	2.72%	5.83%	1 1%	LC	Dark w/o Lights	3.22%	5.22%	39 55%
R	3+ Vehicles	6.19%	7.9%	0 0%	Alc	Alcohol	4.21%	2.66%	47 66%
T	Miscellaneous	0.5%	1.14%	0 0%	Wet	Wet Surface	12.62%	15.18%	0 0%



Existing Safety Analysis Benefits

- Uses Highway Safety Manual methodology
- Use of Safety Performance Functions (SPF)
- Empirical Bayes to account for regression to the mean (RTM) bias

Substantive Safety



Analysis Use

- When to use
 - Stage-0 – Feasibility Studies
 - Traffic Studies
 - Transportation Management Plans
 - Design Reports
 - Design Exceptions/Waivers
- Not ideal for
 - New alignment
 - Unique locations – no model

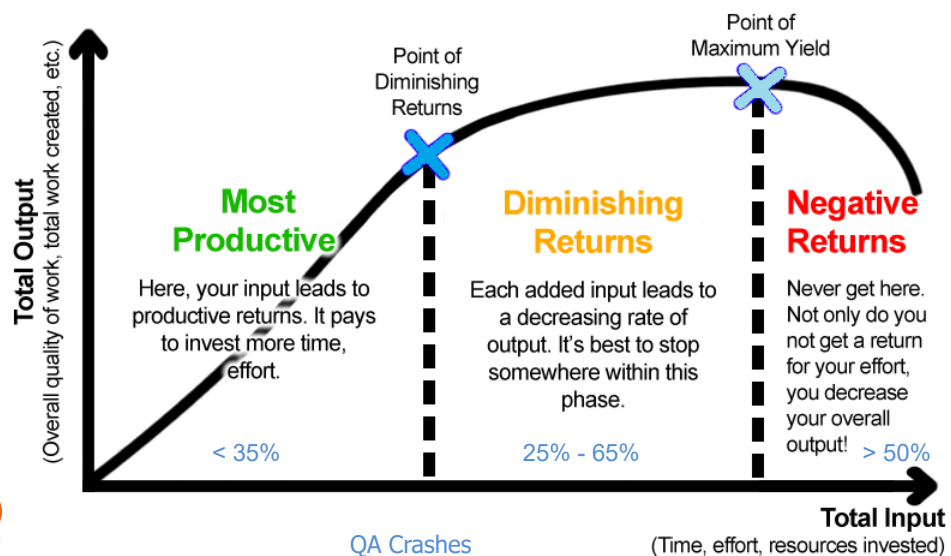
Why perform Quality Assurance?

- Most data elements from LEOs ~70% - 80% accurate
 - Collision Manner – 76%
 - Location at 0.05 mile threshold – 75%
- Without Quality Assurance
 - Answers ≈ **Maybe True**
- With Quality Assurance
 - Answers ≈ **Likely True**

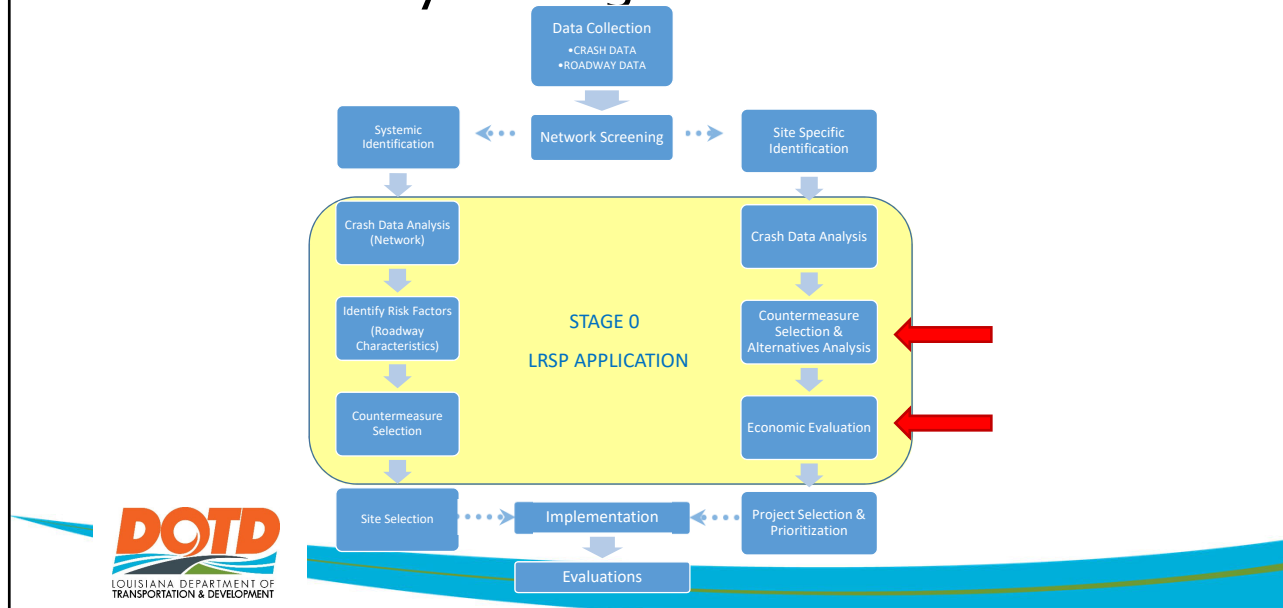
Why partial Quality Assurance?

- High priority to review
 - Severity "K" and "A"
 - Over-represented crash patterns where Severity is not "O"
 - Collision Manner is "Other"
 - Intersection where Intersection crash data is "No"
- Developing mitigation strategies – theory of diminishing returns

Why partial Quality Assurance?



Safety Management Process



Interpreting Crash Patterns

- ITE Transportation Engineering Handbook
- SHSP I&O Countermeasure Resource Guide

Mitigation Strategies

- Engineering Judgement
 - Decipher correctable crash pattern
 - Design mitigation strategy

- CMF Clearinghouse
 <<http://www.CMFclearinghouse.org>>



Proven Countermeasures

SPEED MANAGEMENT

- Speed Safety Cameras
- Variable Speed Limits
- Appropriate Speed Limits for all Road Users

ROADWAY DEPARTURE

- Wider Edge Lines
- Enhanced Delimitation for Horizontal Curves
- Longitudinal Rumble Strips and Stripes
- Safety Edge™
- Roadside Design Improvements at Curves
- Median Barriers

CROSSCUTTING

- Pavement Friction Management
- Lighting
- Local Road Safety Plans
- Road Safety Audits

INTERSECTIONS

- Backplates with Reflective Borders
- Corridor Access Management
- Left- and Right-Turn Lanes at Two-Way Stop-Controlled Intersections
- Reduced Left-Turn Conflict Intersections
- Roundabouts
- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
- Yellow Change Intervals

PEDESTRIAN/BICYCLIST

- Crosswalk Visibility Enhancements
- Bicycle Lanes
- Rectangular Rapid Flashing Beacons
- Leading Pedestrian Interval
- Medians and Pedestrian Refuge Islands in Urban and Suburban Areas
- Pedestrian Hybrid Beacons
- Road Diets (Roadway Reconfiguration)
- Walkways

<<https://safety.fhwa.dot.gov/ProvenCountermeasures>>



Economic Appraisal

- Safety Benefit
 - Benefits of reduced crashes
 - CMF x (Expected Crashes)
 - When using multiple CMF, one should not reduce the same crash more than once
 - Cost of modifications
 - Estimated construction
 - Not right-of-way acquisition

Other Considerations

- ADA Transition Plan
- Complete Streets Policy
- Bicycle Planning Tool
 - Network Analysis
 - Recommended Facility Type
- Local Plans
- Stakeholder Input
- Future development plans

DOTD Maps

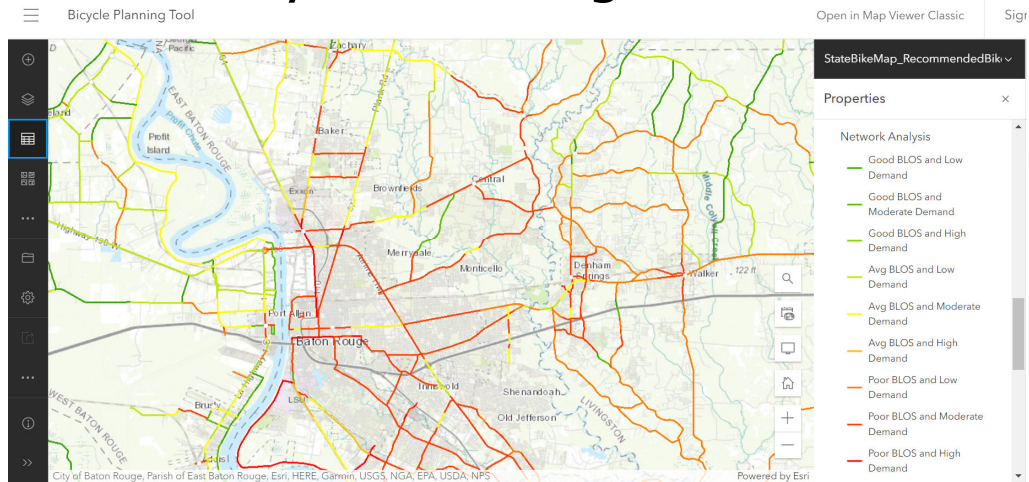


ADA Transition Plan

- State routes with existing sidewalks only
- ADA Program Funds available
- Required to fix deficiencies if within project limits (even PRRR)



Bicycle Planning Tool



<https://ladotd.maps.arcgis.com/home/index.html>

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Crash Data Summary

<<https://CARTS.lsu.edu/home>>

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DOTD Highway Safety

<http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Pages/Highway_Safety_Analysis_Toolbox.aspx>

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Highway Safety Analysis Toolbox

State Policies and Procedures on the Use of the Highway Safety Manual (HSM)

Scale and Scope of Safety Assessment Methods in the Project Development Process

AASHTO's Highway Safety Manual

The HSM introduces a science-based technical approach that takes the guesswork out of safety analysis. The HSM provides tools to conduct quantitative safety analyses, allowing for safety to be quantitatively evaluated alongside other transportation performance measures such as traffic operations, environmental impacts, and construction costs. The HSM provides the following tools:

- ▶ Methods for developing an effective roadway safety management program and evaluating their effects.
- ▶ A predictive method to estimate crash frequency and severity.
- ▶ Guidance on the development and application of crash modification factors to estimate crash reductions.

HIGHWAY SAFETY MANUAL
1st Edition
Volume 1 • 2010

HSM
AASHTO

Type Name Modified File Size



Highway Safety Staff

- Adriane McRae – Administrator
- Jessica Deville – Data Improvement
 - Bryan Costello – Crash Data Manager
 - Jim Chapman – Highway Safety Engineer
 - Michael Connors – FARS Manager
- Laura Riggs – HSIP Program Manager
 - David Worsham – Highway Safety Engineer
 - Carrie Wiebelt – LRSP / SRTPPP Manager
- Autumn Goodfellow-Thompson – SHSP Manager
- Jennifer Mizzell – Program Specialist



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Questions



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