Introduction to Safety Data

DOTD Highway Safety Section

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Introductions

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

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Agenda

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

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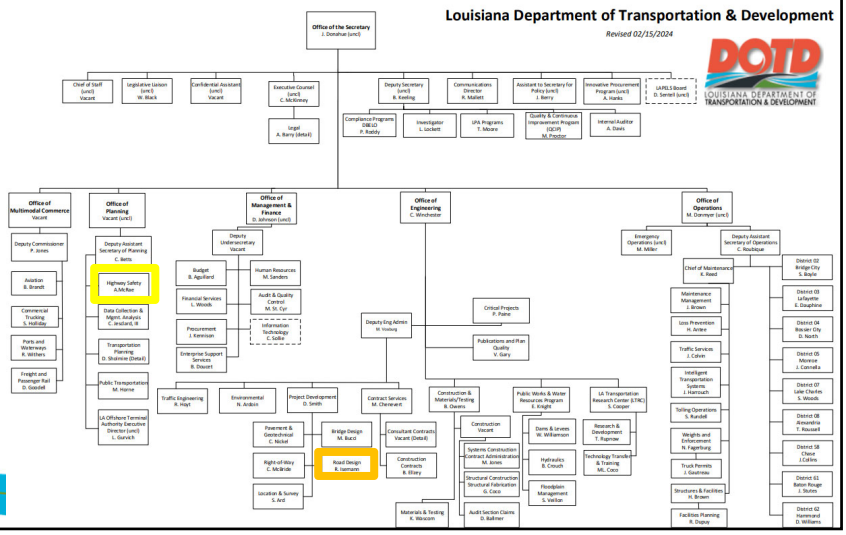
Highway Safety Section

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



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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).**

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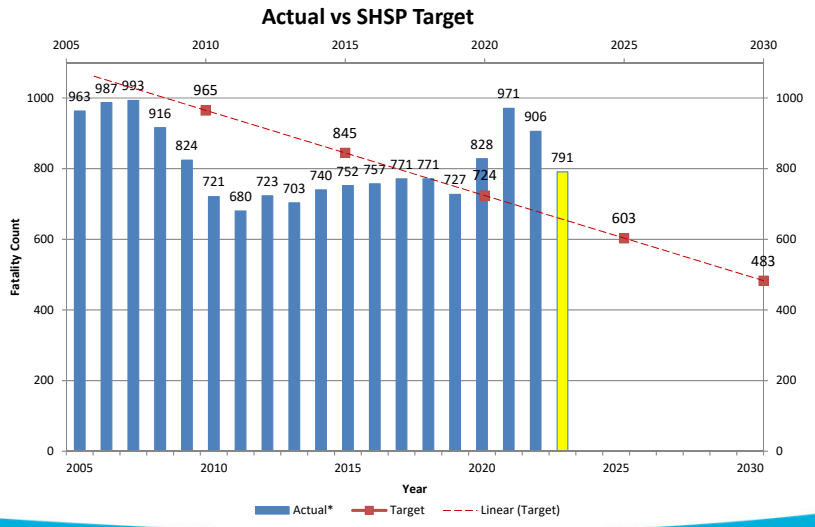
Louisiana Highway Fatalities

Economic Costs of Crashes:

$10 billion/year

$27 billion/year including loss of quality of life



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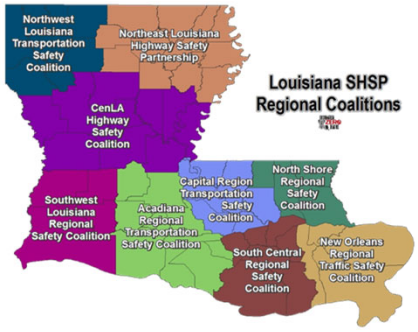
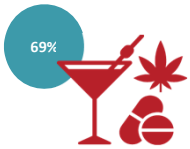
SHSP Leadership



SHSP Emphasis Areas

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

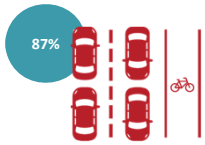
Distracted Driving
Crashes involving distracted or inattentive drivers



Impaired Driving
Crashes involving alcohol and/or other drugs

- 34% Alcohol
- 55% Drug

Occupant Protection
Crashes involving unrestrained drivers or occupants

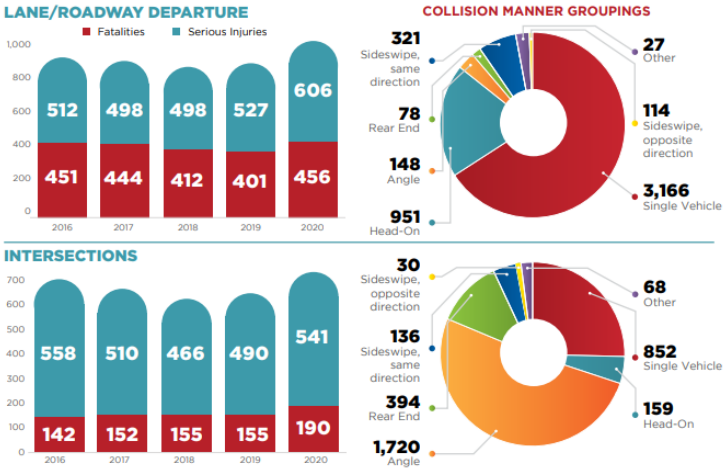


Infrastructure & Operations
Crashes involving roadway departure, lane departure, intersections, pedestrians, and bicyclists

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

**Percentages represent fatality rates*

Louisiana Crash Trends



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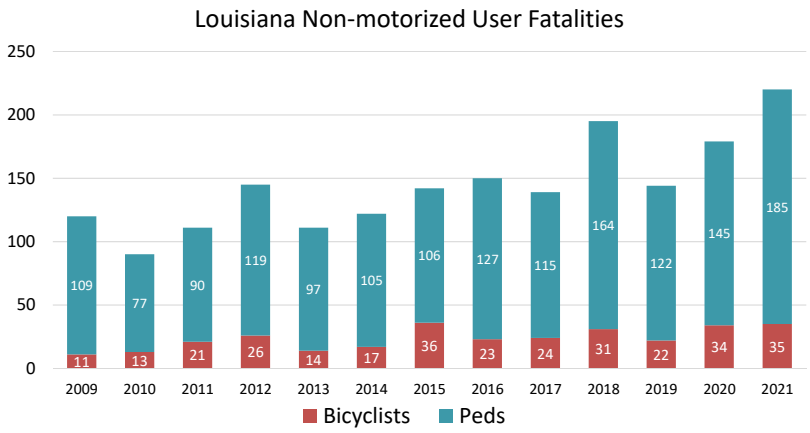
Louisiana Crash Trends



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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

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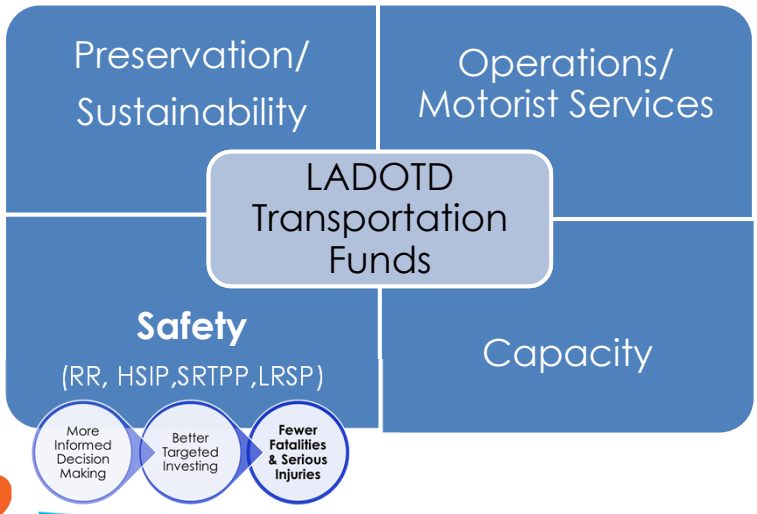
HSIP & DOTD Budget Partition



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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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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

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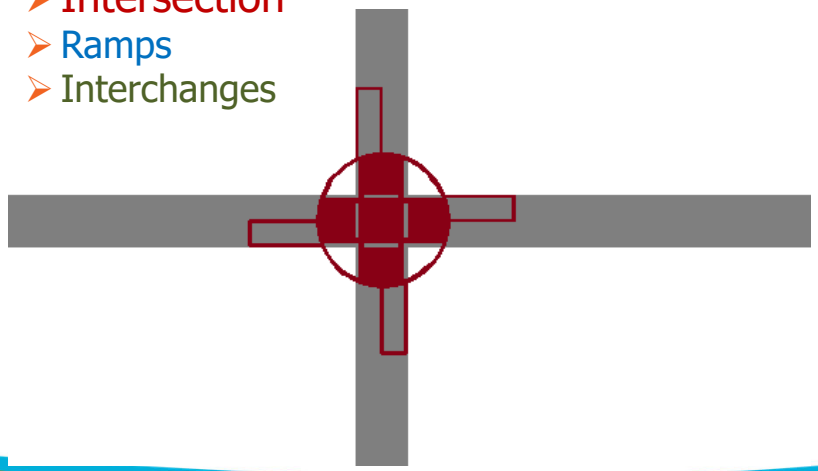
Facilities Types

- Segment
- Intersection
- Ramps
- Interchanges



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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

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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

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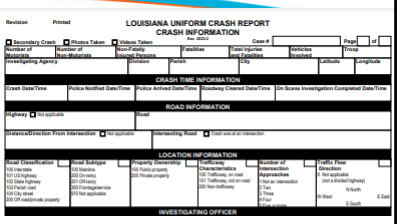
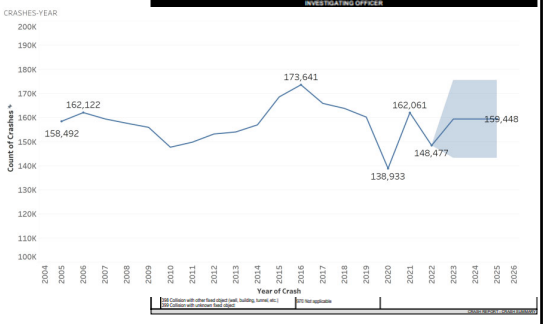
Safety Data & Planni

- 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



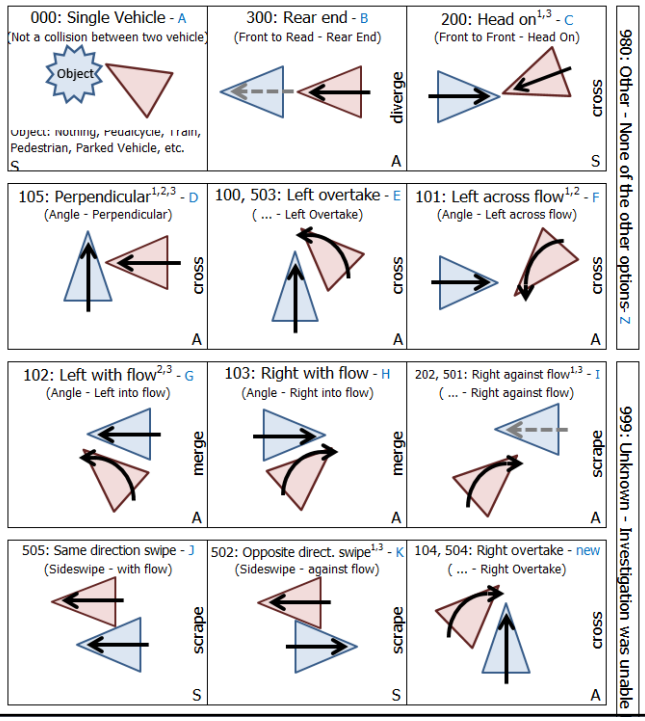


Critical Crash Data Elements

- 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



(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

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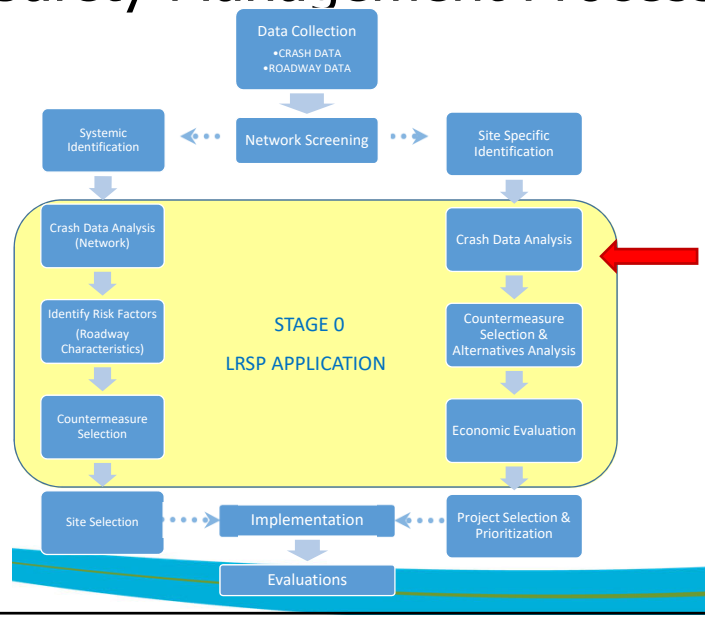
Safety Management Process



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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

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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

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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										
		3-Leg										
	Signalized	4-Leg										
		3-Leg										
Hwy Exits	Unsignalized	4-Leg										
		3-Leg										
	Signalized	4-Leg										
		3-Leg										

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

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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

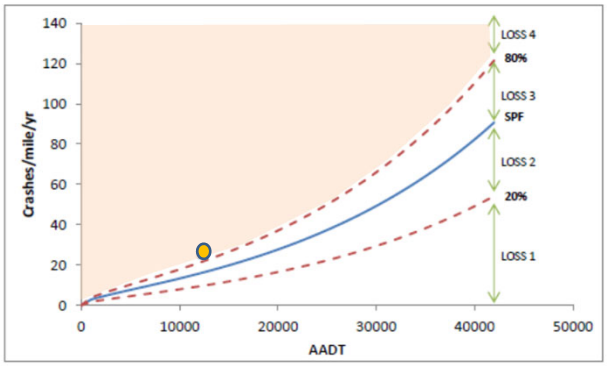

Figure 1 Urban 4-lane Undivided SPF - All Crashes

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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-O
- Bounds
  - 80th percentile
  - 20th percentile

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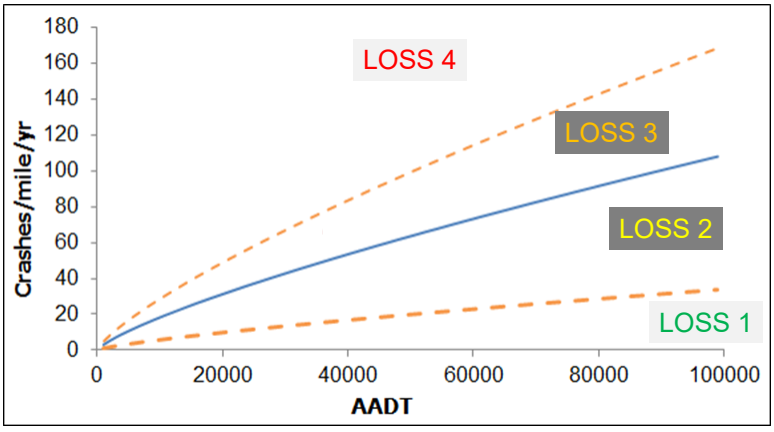
Safety Service Level



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

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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

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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

Safety Analysis

- Determine potential mitigation strategies
- Develop planning level cost estimates
- Calculate crash reduction benefit
- Determine benefit-cost ratio

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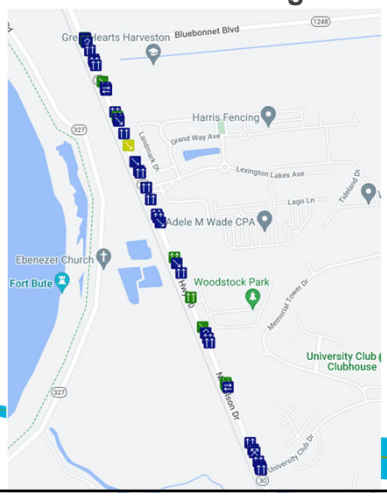
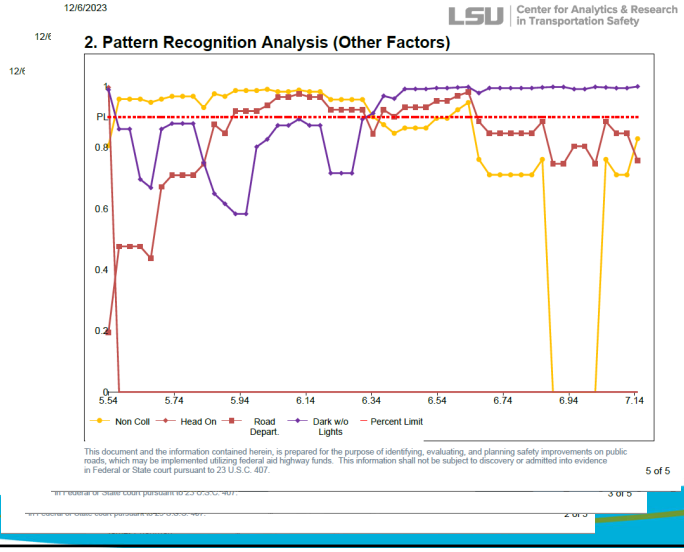
Crash Data Analysis – Output

- Intersection or Segment





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%

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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

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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 – <u>theory of diminishing returns</u>

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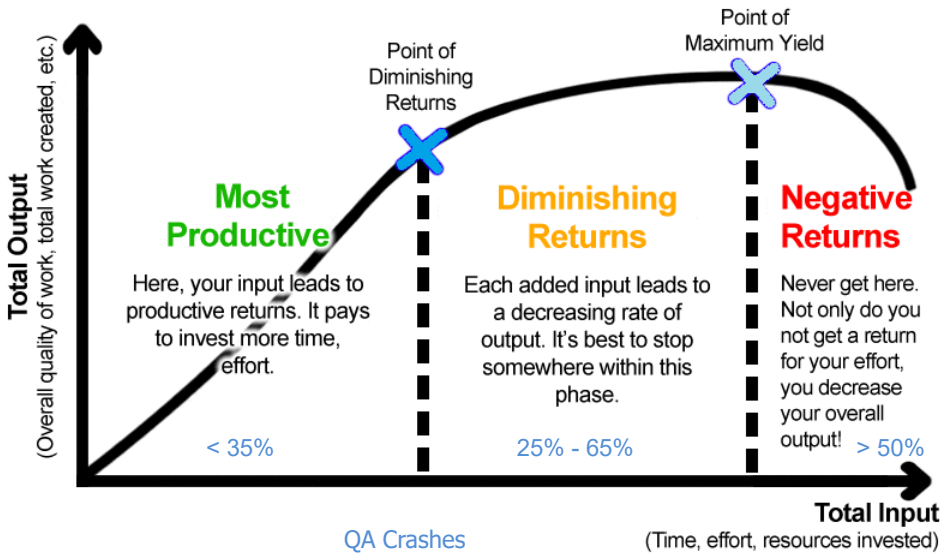
Why partial Quality Assurance?



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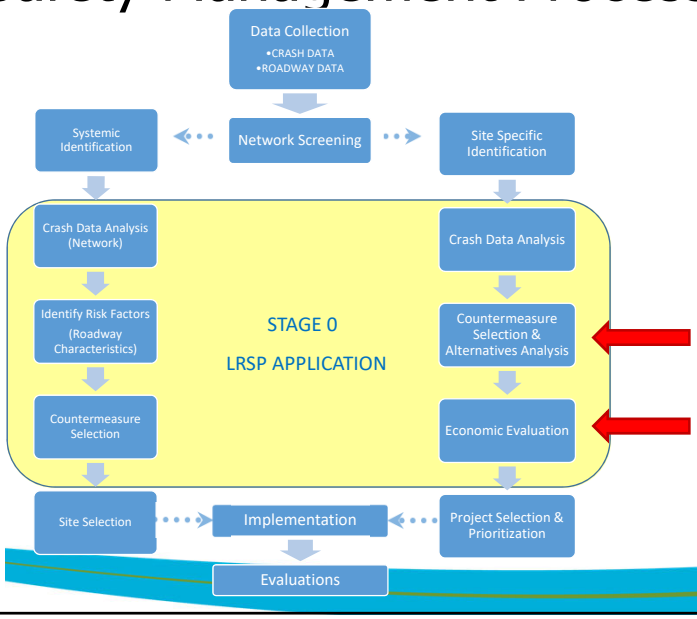
Safety Management Process



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Interpreting Crash Patterns

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

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Mitigation Strategies

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

- CMF Clearinghouse

<http://www.CMFclearinghouse.org>

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Proven Countermeasures

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

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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

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Other Considerations

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

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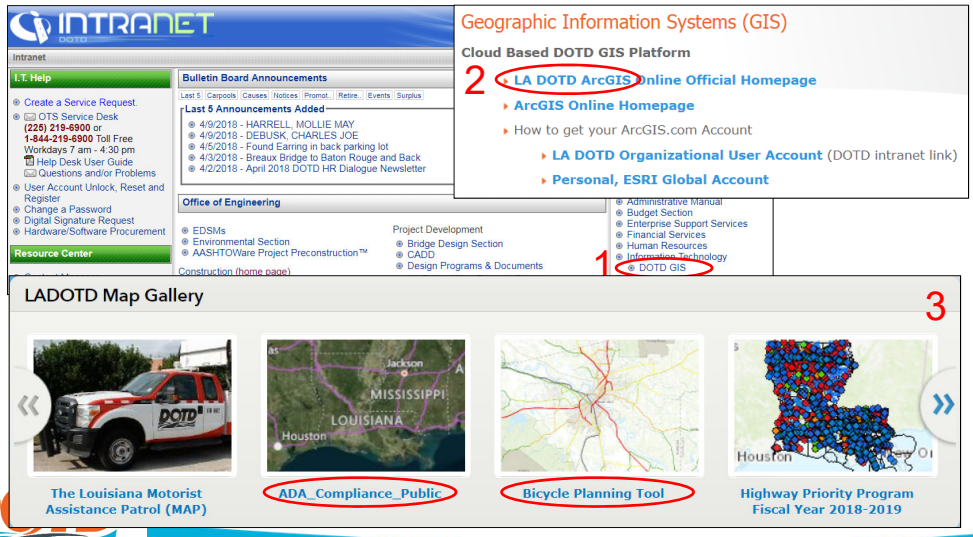
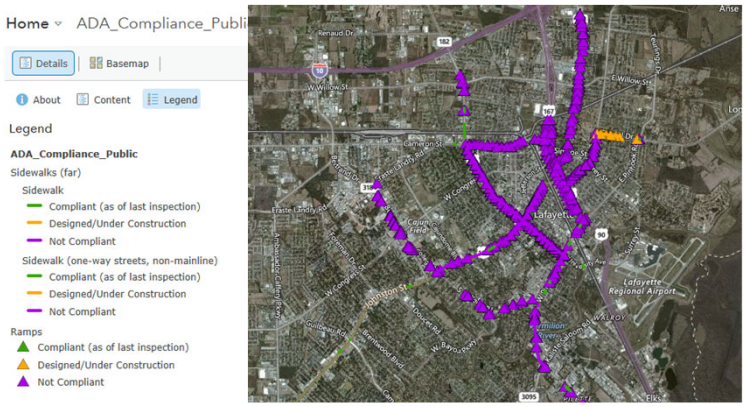
DOTD Maps

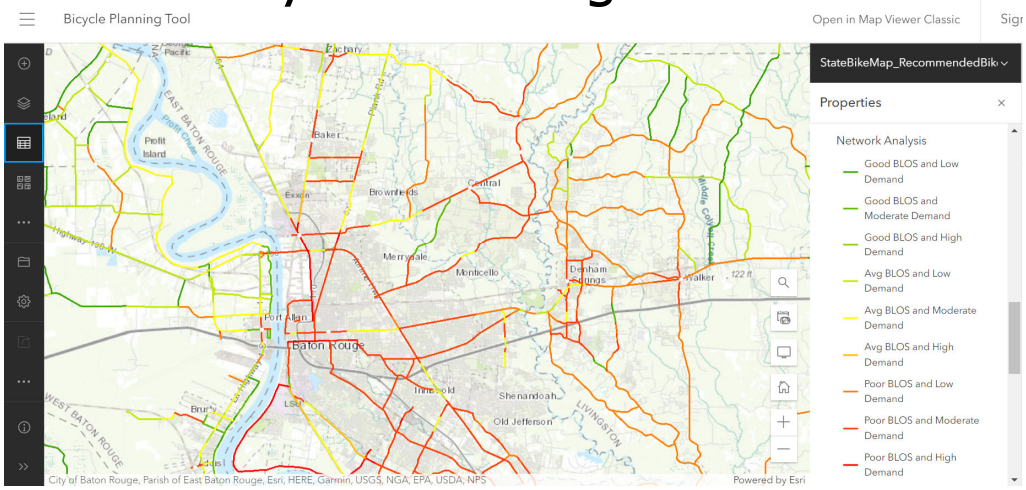


ADA Transition Plan



- 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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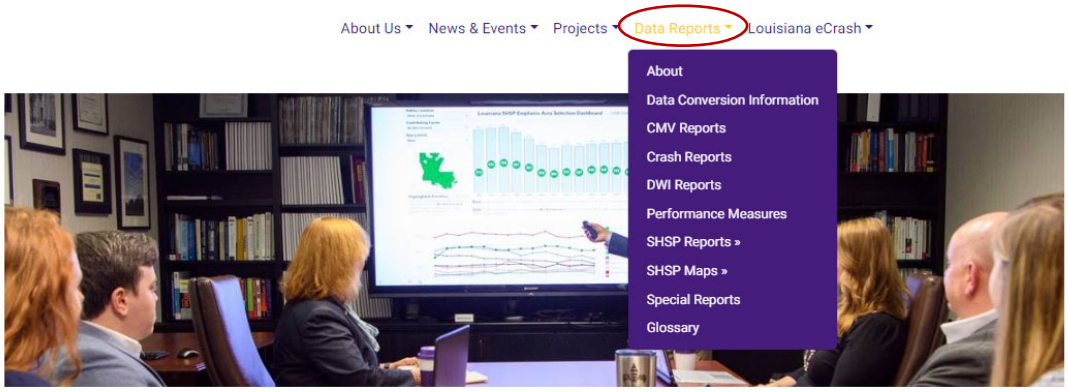
Crash Data Summary

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

Center for Analytics & Research in Transportation Safety



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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 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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