



NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

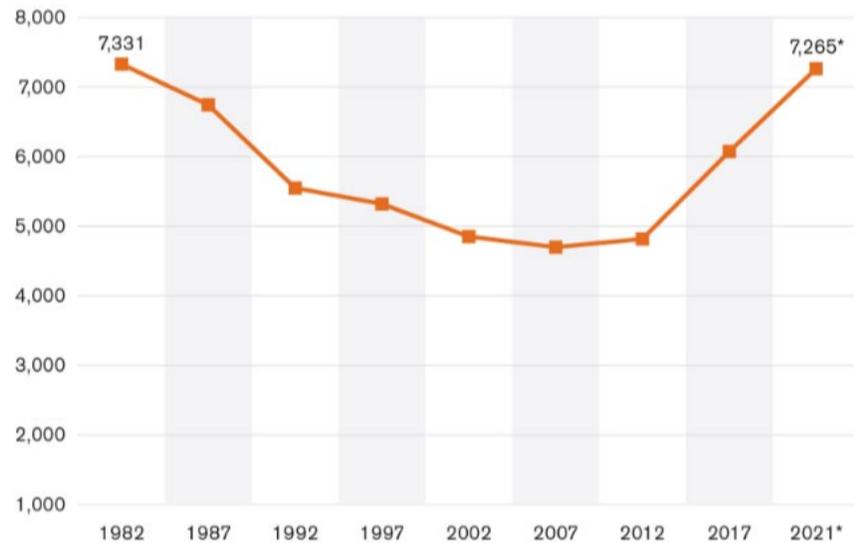
An Update on the Vulnerable Road User In-Depth Crash Investigation Study

Jack Lockerby, Mechanical Engineer

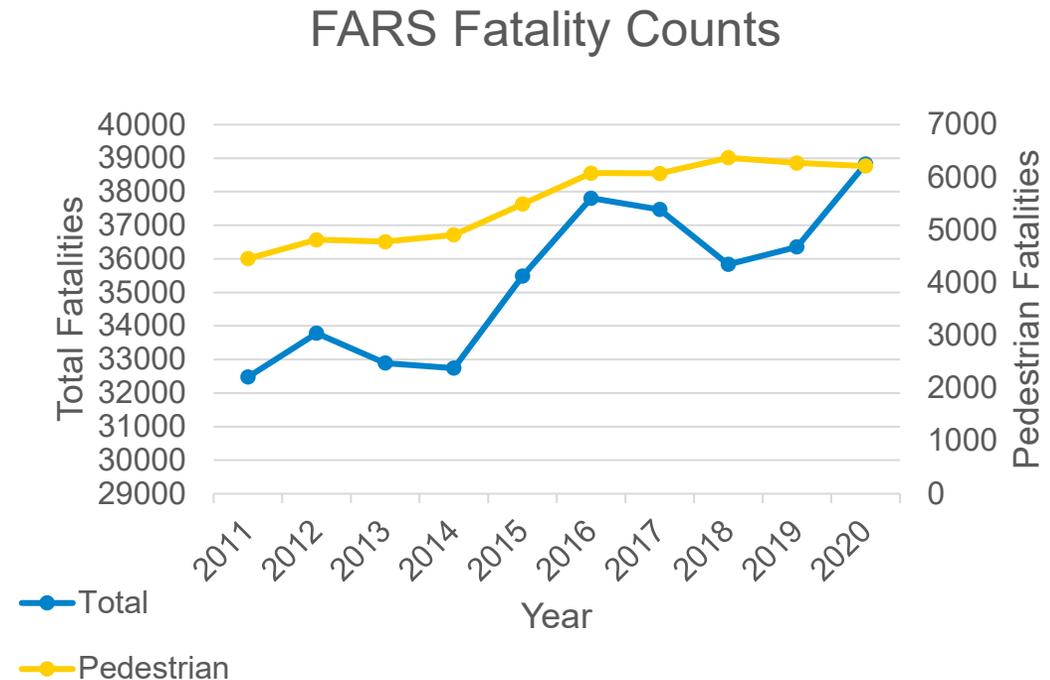
NHTSA

Motivation

- Pedestrian fatalities have been increasing
- Lack of modern in-depth pedestrian crash data
- Various research needs across NHTSA



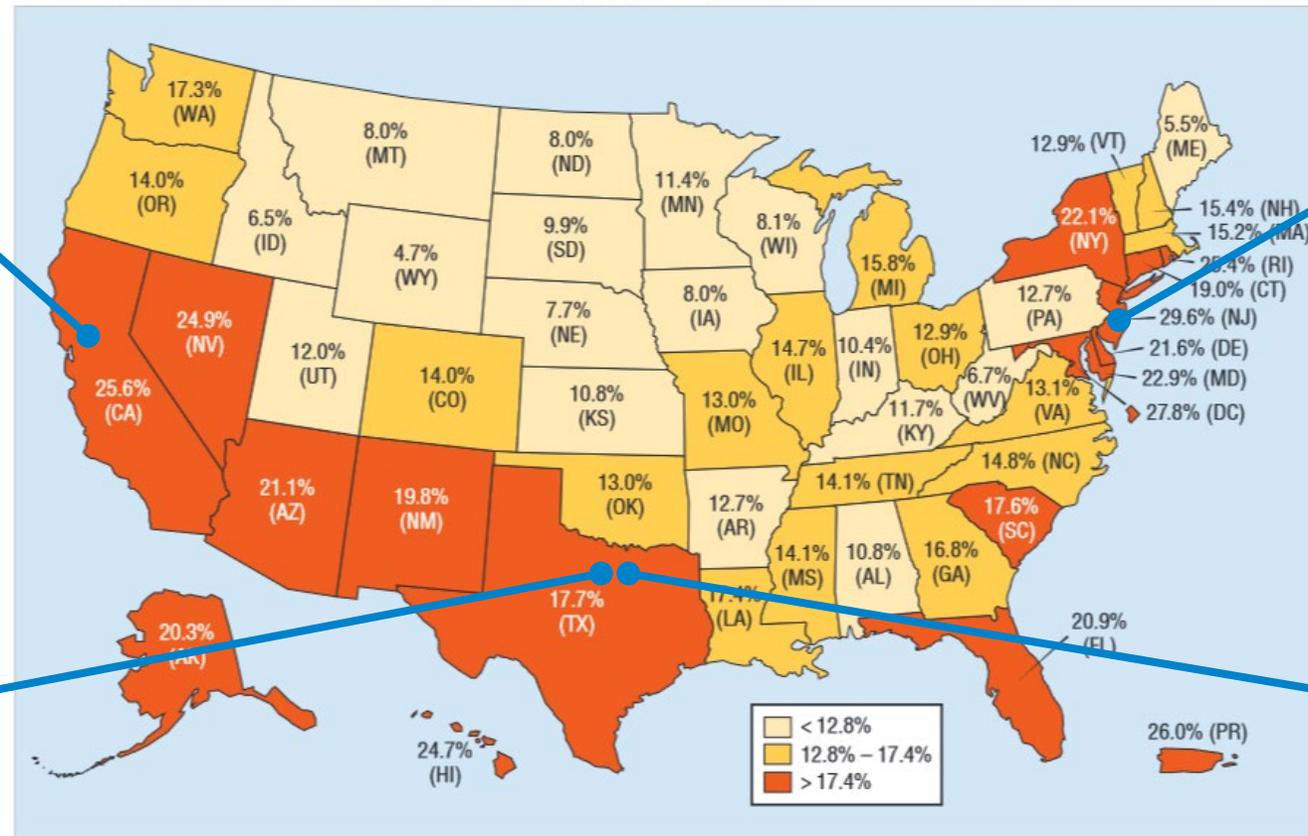
Source: Governors Highway Safety Administration



VICIS Study

Vulnerable Road User In-depth Crash Investigation Study (VICIS)

Figure 3
Percentage of Total Fatalities Who Were Pedestrians, by State, 2020



Sacramento County, CA

Atlantic County, NJ

Tarrant County, TX

Dallas County, TX

Source: FARS 2020 ARF

VICIS Study

- Inclusion criteria:
 - Only pedestrians (no bikes, scooters, or conveyances)
 - Struck by vehicle moving forward
 - Vehicle inspection or photos of contact damage required

- No Sampling – PSUs screen local police crash reports and select cases

Law Enforcement and TxDOT Use ONLY

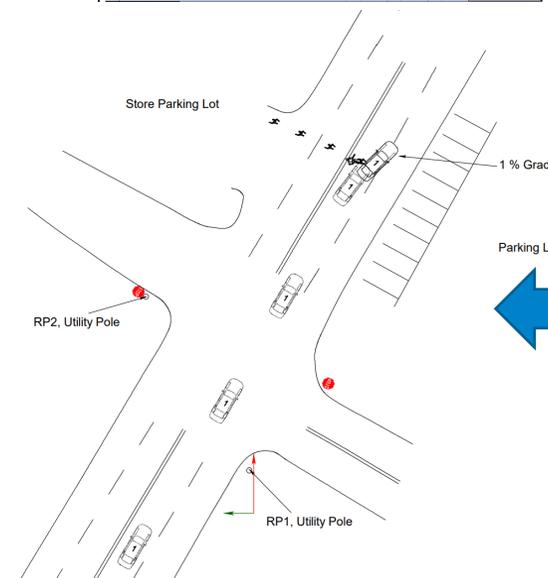
FATAL CMV SCHOOL BUS RAILROAD MVA SUPPLEMENT ATTICE SCHOOL ZONE

Texas Peace Officer's Crash Report (Form CR-3 11/2018)
 Mail to: Texas Department of Transportation, Crash Data and Analysis, P.O. Box 145343, Austin, TX 78714. Questions? Call 844.274.7457
 Refer to Attached Code Sheet for Numbered Fields
 **These fields are required on all additional sheets submitted for this crash (ex. additional vehicles, occupants, injured, etc.)

Page 1 of 1

Crash Date (MM/DD/YYYY)	Crash Time (24-HRM)	Case ID	Local Use
County Name	City Name	Latitude (percentages)	Longitude (percentages)
ROAD ON WHICH CRASH OCCURRED			
1. Road Name	2. Road Type	3. Road Part	4. Road Side
5. Road Lane	6. Road Lane	7. Road Lane	8. Road Lane
INTERSECTING ROAD, OR IF CRASH NOT AT INTERSECTION, NEAREST INTERSECTING ROAD OR REFERENCE MARKER			
9. Road Name	10. Road Type	11. Road Part	12. Road Side
13. Road Lane	14. Road Lane	15. Road Lane	16. Road Lane
VEHICLE INFORMATION			
17. Vehicle Type	18. Vehicle Make	19. Vehicle Model	20. Vehicle Year
21. Vehicle Color	22. Vehicle Weight	23. Vehicle Height	24. Vehicle Length
25. Vehicle Width	26. Vehicle Depth	27. Vehicle Area	28. Vehicle Volume
29. Vehicle Weight	30. Vehicle Height	31. Vehicle Length	32. Vehicle Width
33. Vehicle Depth	34. Vehicle Area	35. Vehicle Volume	36. Vehicle Weight
37. Vehicle Height	38. Vehicle Length	39. Vehicle Width	40. Vehicle Depth
41. Vehicle Area	42. Vehicle Volume	43. Vehicle Weight	44. Vehicle Height
45. Vehicle Length	46. Vehicle Width	47. Vehicle Depth	48. Vehicle Area
49. Vehicle Volume	50. Vehicle Weight	51. Vehicle Height	52. Vehicle Length
53. Vehicle Width	54. Vehicle Depth	55. Vehicle Area	56. Vehicle Volume
57. Vehicle Weight	58. Vehicle Height	59. Vehicle Length	60. Vehicle Width
61. Vehicle Depth	62. Vehicle Area	63. Vehicle Volume	64. Vehicle Weight
65. Vehicle Height	66. Vehicle Length	67. Vehicle Width	68. Vehicle Depth
69. Vehicle Area	70. Vehicle Volume	71. Vehicle Weight	72. Vehicle Height
73. Vehicle Length	74. Vehicle Width	75. Vehicle Depth	76. Vehicle Area
77. Vehicle Volume	78. Vehicle Weight	79. Vehicle Height	80. Vehicle Length
81. Vehicle Width	82. Vehicle Depth	83. Vehicle Area	84. Vehicle Volume
85. Vehicle Weight	86. Vehicle Height	87. Vehicle Length	88. Vehicle Width
89. Vehicle Depth	90. Vehicle Area	91. Vehicle Volume	92. Vehicle Weight
93. Vehicle Height	94. Vehicle Length	95. Vehicle Width	96. Vehicle Depth
97. Vehicle Area	98. Vehicle Volume	99. Vehicle Weight	100. Vehicle Height

Not Applicable - Alcohol and Drug Results will be reported to law enforcement for each lane.



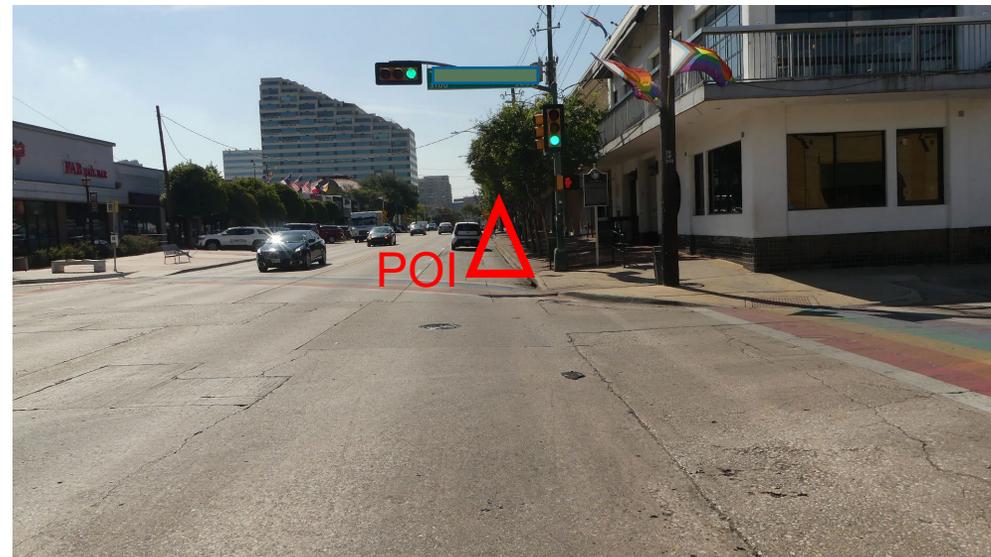
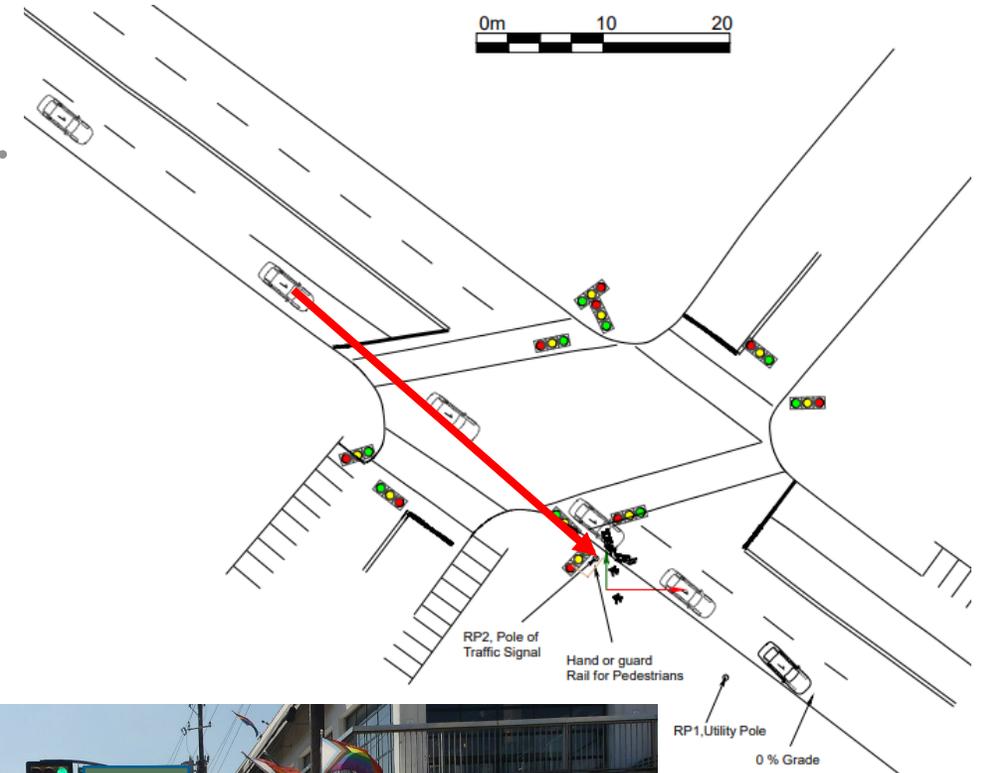
Data Collection

1. Crash Avoidance

- Pre-crash scenarios and sightlines
- Speed and trajectory of vehicle and pedestrian
- Environment, weather, and lighting

2. Crashworthiness

- Vehicle inspections/photos documenting contacts
- Pedestrian injuries from medical records



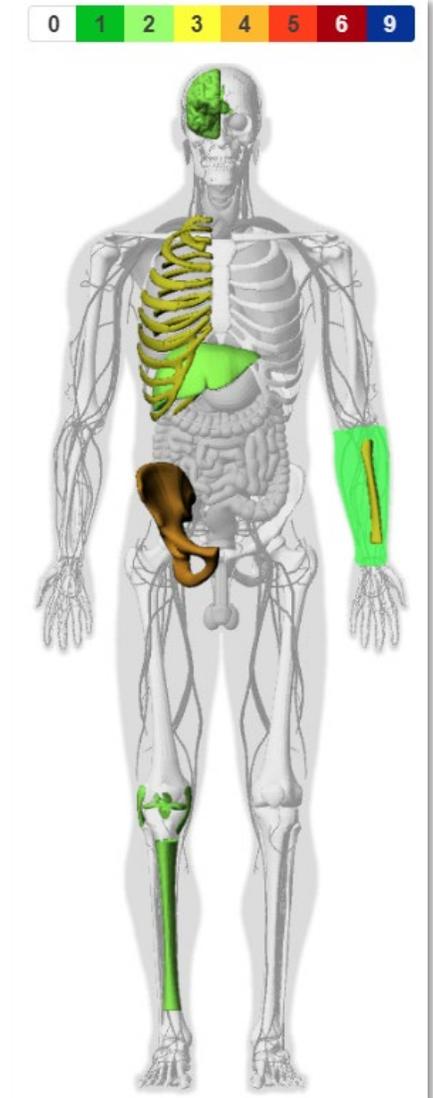
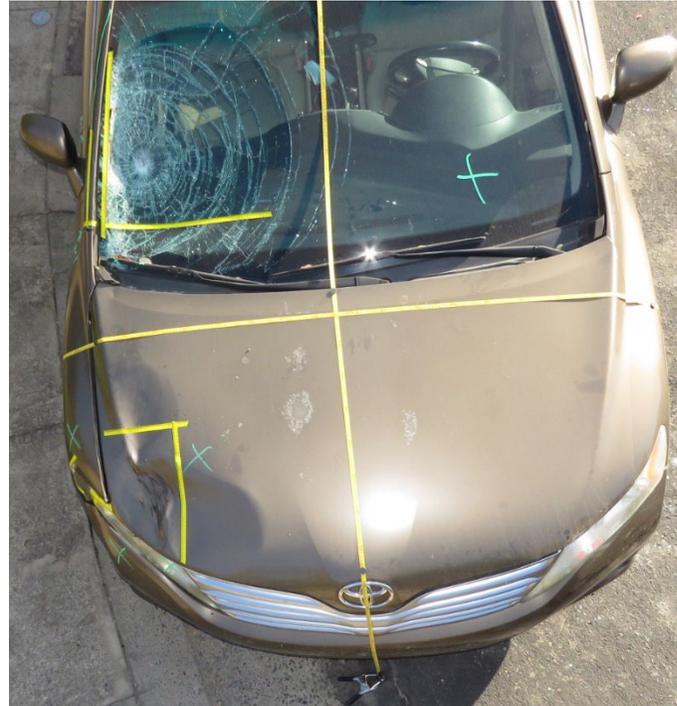
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2. Crashworthiness

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Data Collection

3. Infrastructure

- Roadway features
- Pedestrian facilities and warnings
- Streetlighting



4. Human Behavior

- Detailed interview forms for driver and pedestrian
- Distractions, impairment, trip purpose, risk-taking behavior

Driver Condition	
32. Before the crash, how were you feeling?	<input checked="" type="checkbox"/> Normal <input type="checkbox"/> Other, specify _____
33. Do you think your mental status was clear leading up to the crash?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No, specify _____
34. Were you feeling rushed?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
35. Would you say you are well rested or a little tired at the time of the crash?	<input type="checkbox"/> Very tired <input type="checkbox"/> Somewhat tired <input checked="" type="checkbox"/> Well rested
36. Did you have alcohol or another drug (over-the-counter, prescription, or other) within 12 hours of the crash?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
36a. Did you feel impaired by any substance?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Alcohol <input type="checkbox"/> Prescription Drugs, specify _____ <input type="checkbox"/> Other, specify _____
37. Before the crash, did anything distract you?	<input type="checkbox"/> Talking on cell phone <input type="checkbox"/> Another person in car <input type="checkbox"/> Moving object in car <input type="checkbox"/> Something outside the car, Specify _____ <input type="checkbox"/> Sleeping or dozing <input type="checkbox"/> Other, Specify _____ <input type="checkbox"/> Not distracted
Select all that apply. <i>NO</i>	
Trip Details and Behavior	
38. What was the main purpose of your driving trip on the day of the crash?	<input type="checkbox"/> Commuting to/from work <input type="checkbox"/> Commuting to/from school <input type="checkbox"/> Recreation <input checked="" type="checkbox"/> Personal errands (to/from the store, post office, etc.) <input type="checkbox"/> Drop off/pick up someone <input type="checkbox"/> Visiting a friend or relative <input type="checkbox"/> Other, specify _____
39. How long have you been driving in general?	<input type="checkbox"/> Less than 1 year <input type="checkbox"/> 1-5 years <input type="checkbox"/> 6-10 years <input checked="" type="checkbox"/> 10+ years
40. How many miles a year do you drive?	<input type="checkbox"/> Less than 5,000 <input type="checkbox"/> 5,000-10,000 miles <input checked="" type="checkbox"/> 10,000+ miles
41. Is this the vehicle you normally drive?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No, Explain _____
42. How long have you been driving it?	<input type="checkbox"/> Less than a month <input type="checkbox"/> 1-6 months <input checked="" type="checkbox"/> 6 months to 2 years <input type="checkbox"/> 2+ years



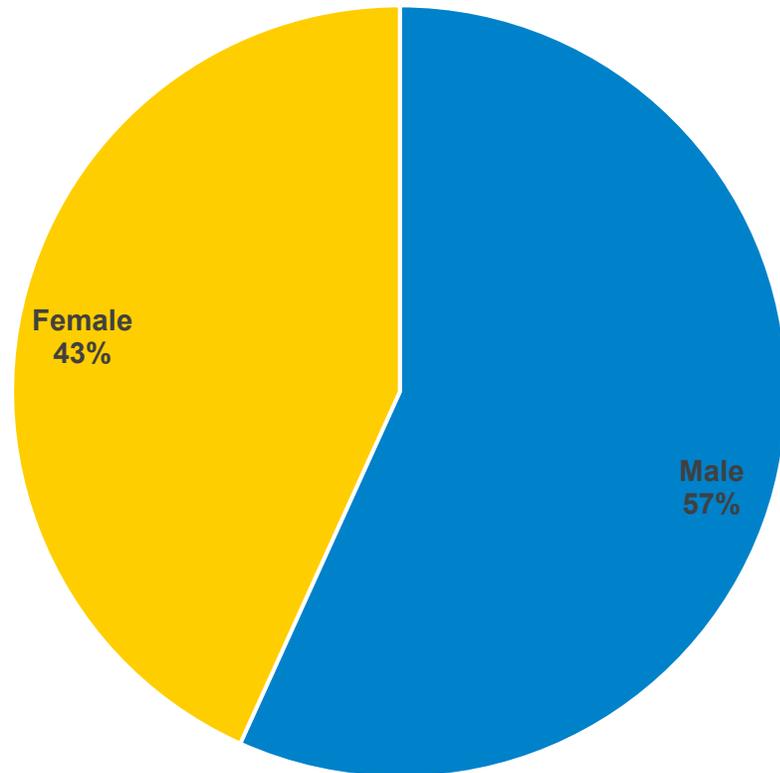
VICIS Cases

- Case enrollment for six months: July to Dec 2022
- 93 total cases collected across four sites
- PSU data entry ongoing, not all crash cases fully populated

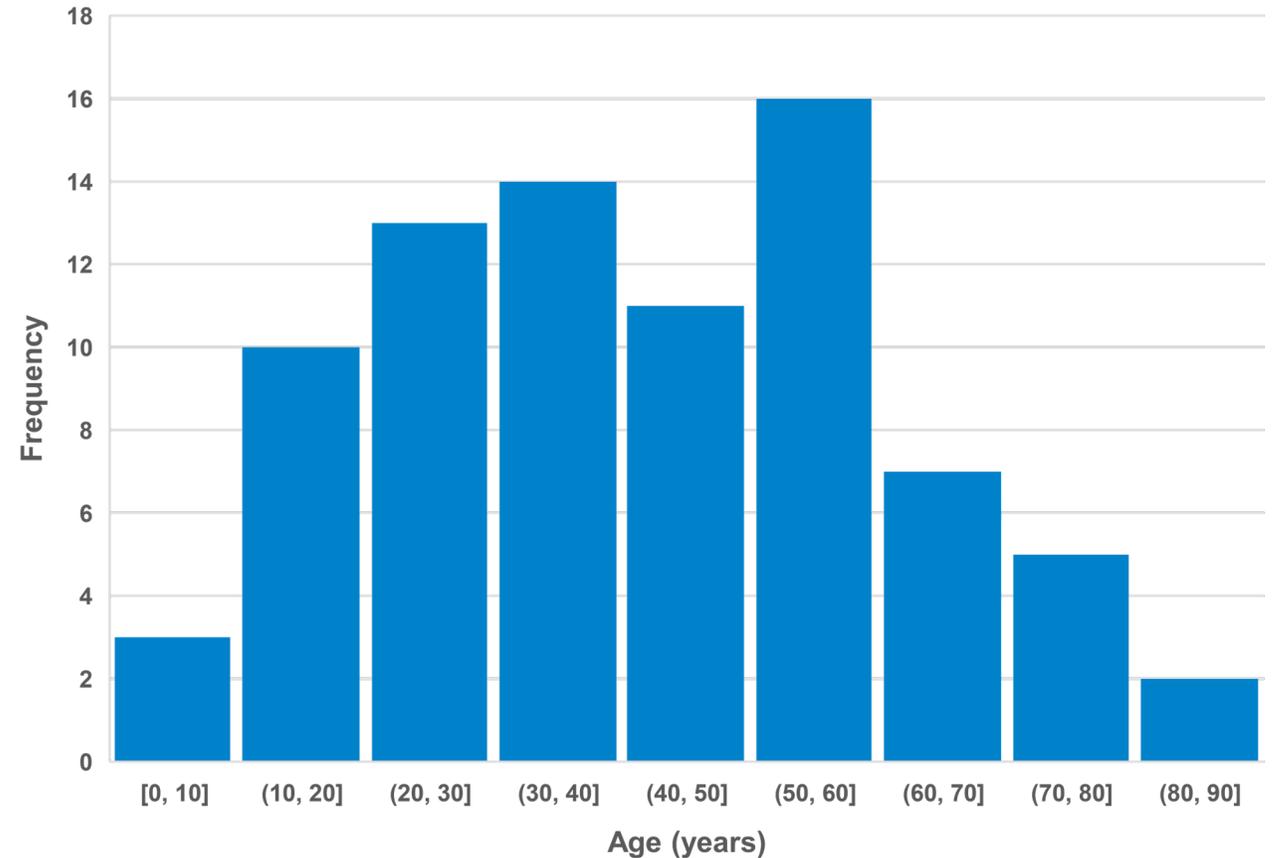


Preliminary Case Distributions

Pedestrian Sex

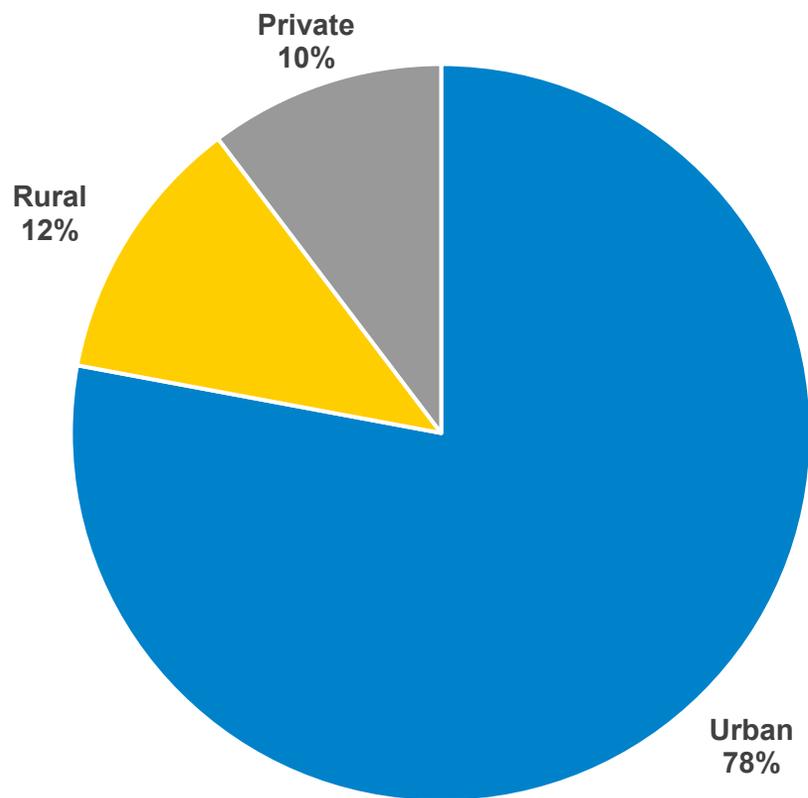


Pedestrian Age

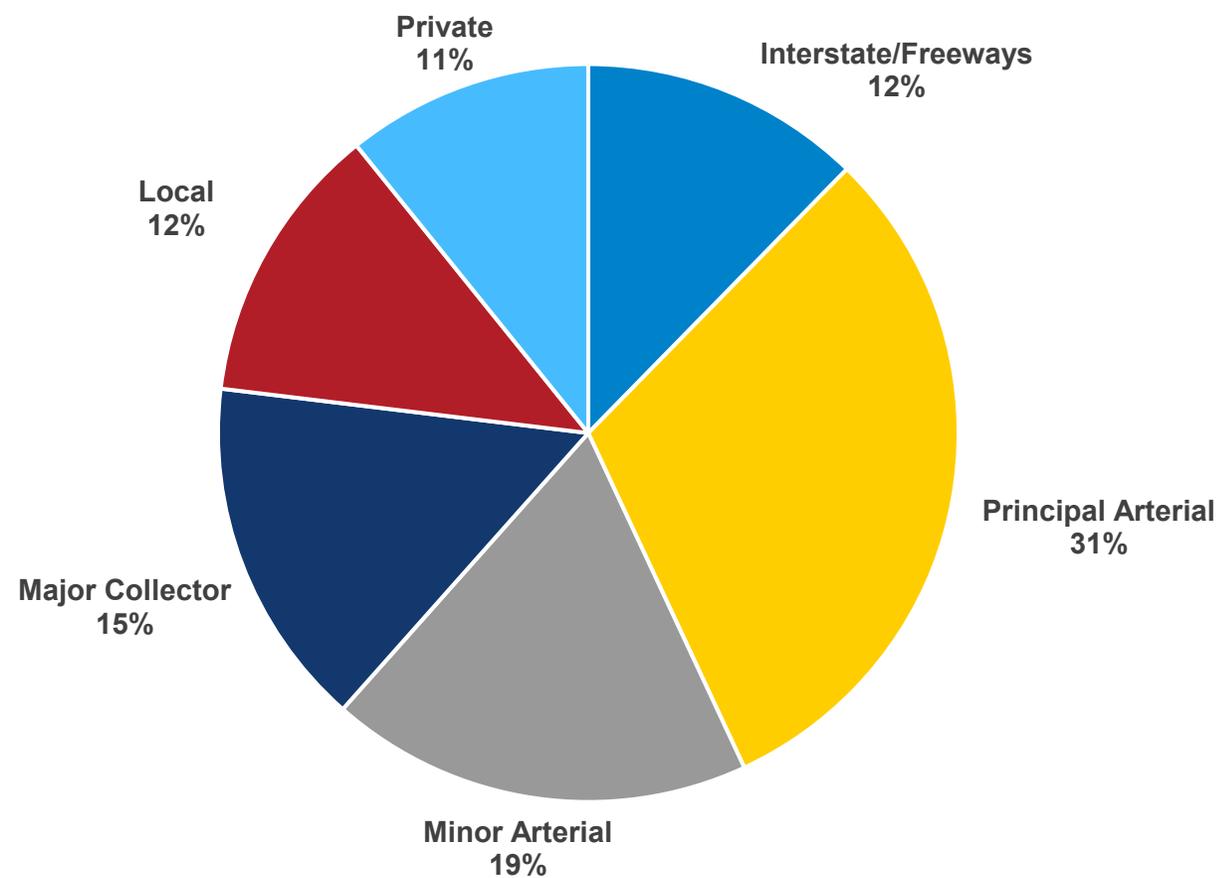


Preliminary Case Distributions

Land Use

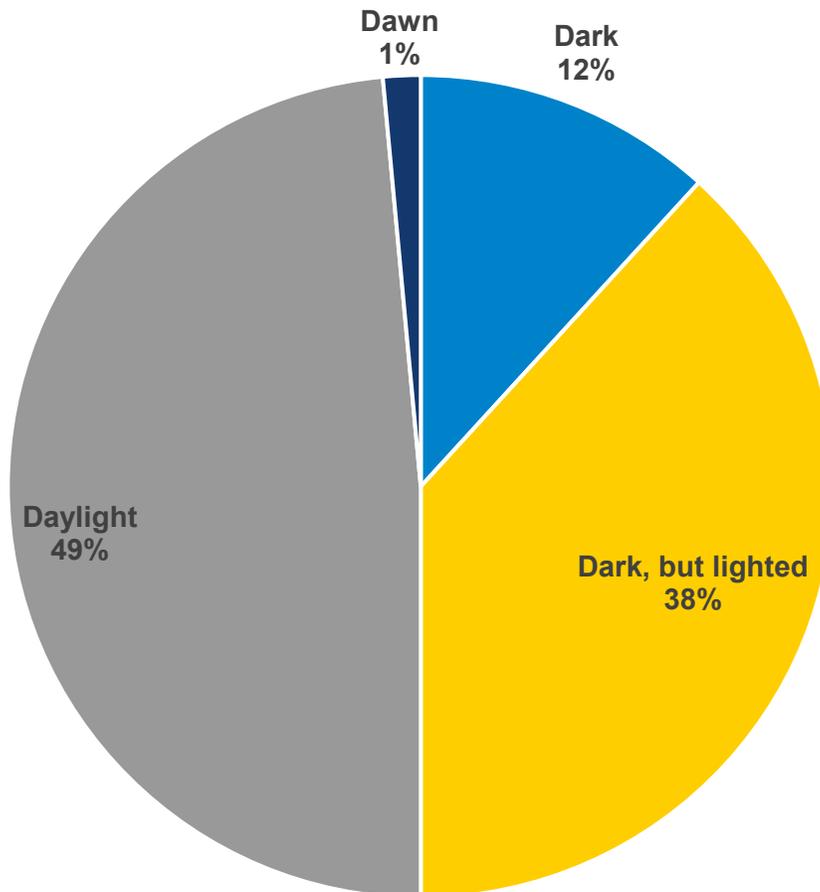


Roadway Functional System

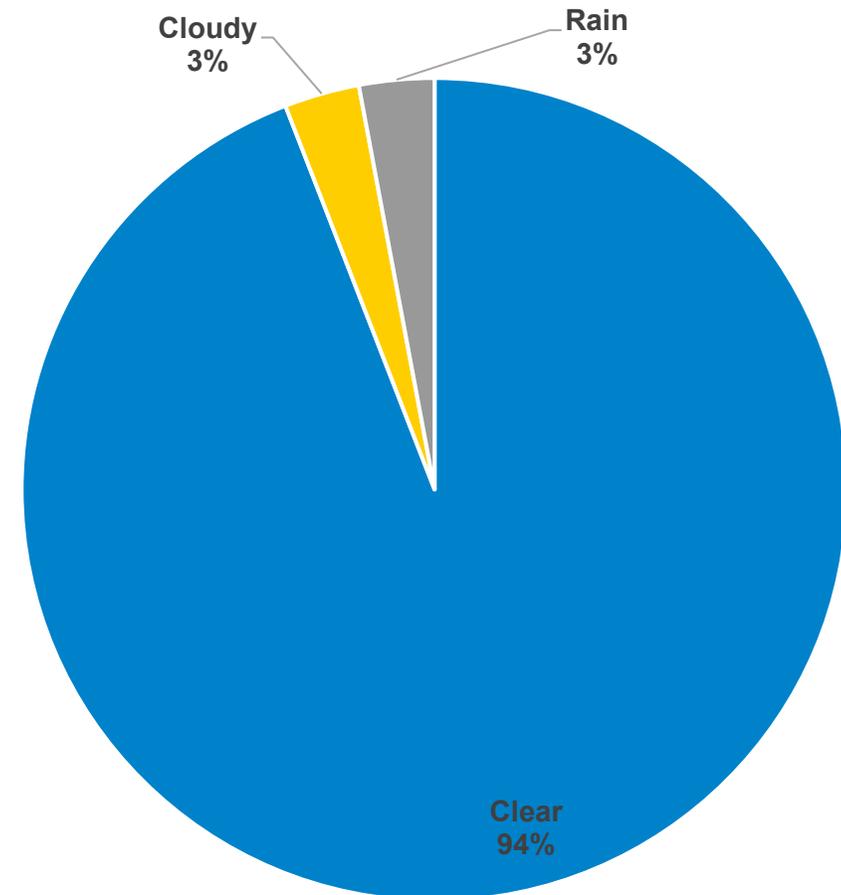


Preliminary Case Distributions

Light Condition

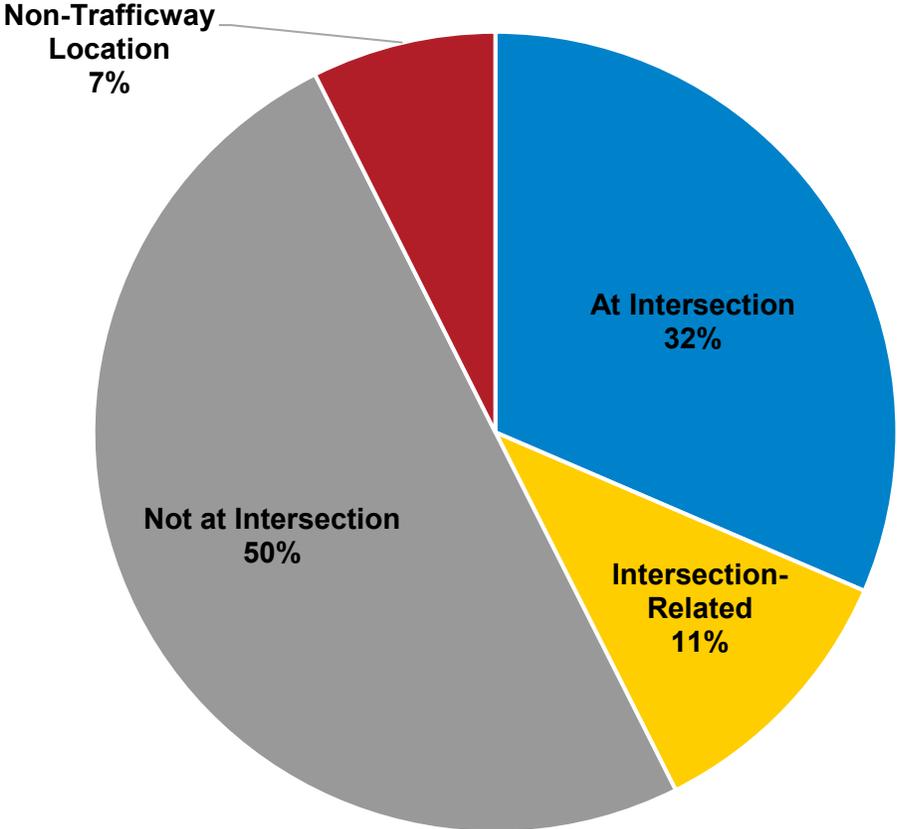


Weather

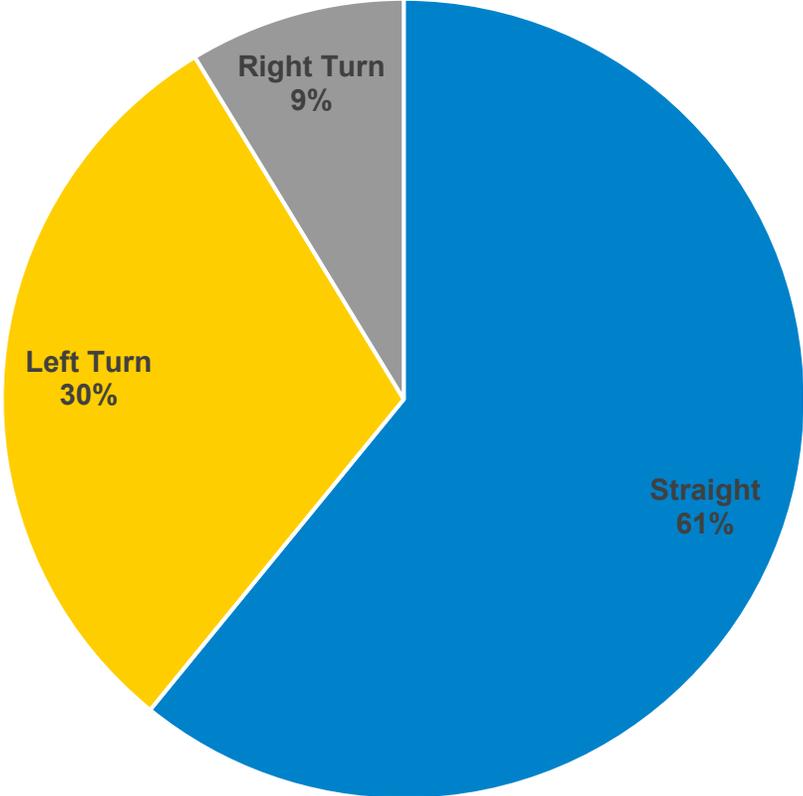


Preliminary Case Distributions

Crash Location

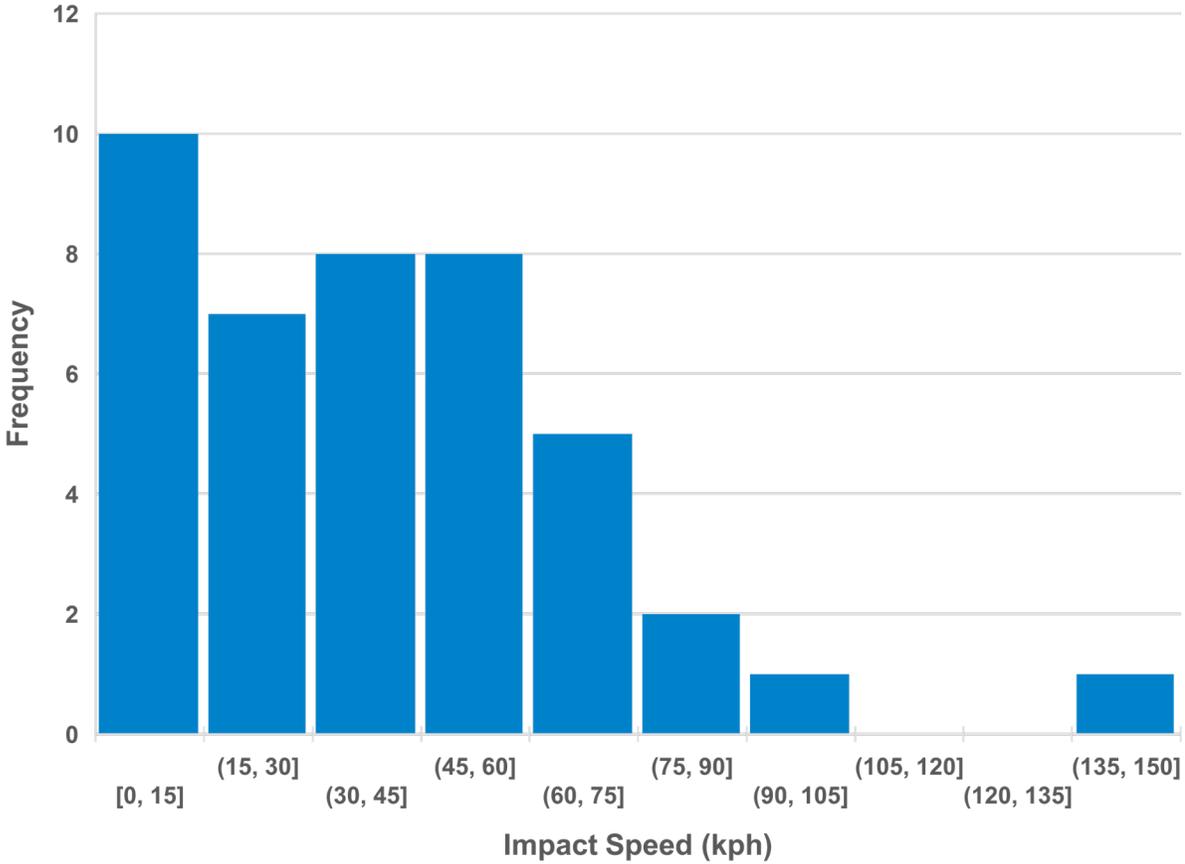


Motorist Maneuver

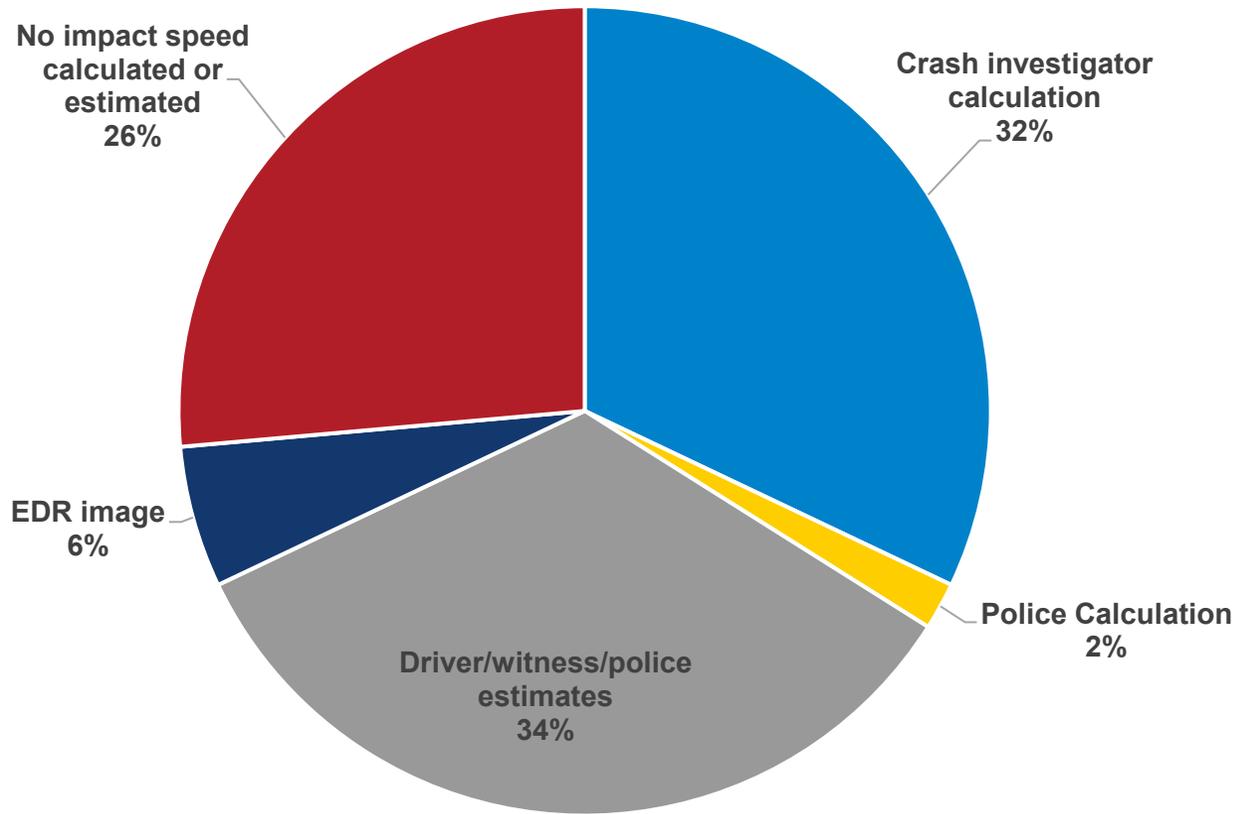


Preliminary Case Distributions

Vehicle Impact Speed

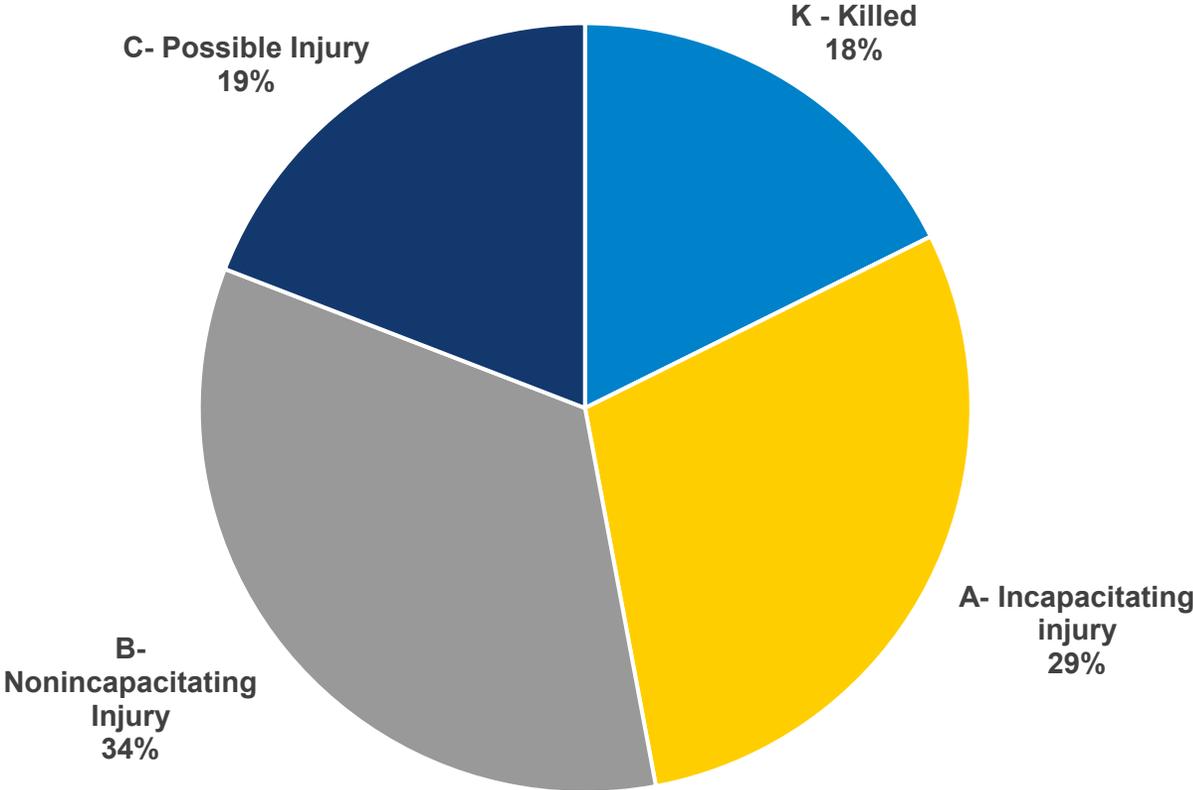


Data Source for Impact Speed



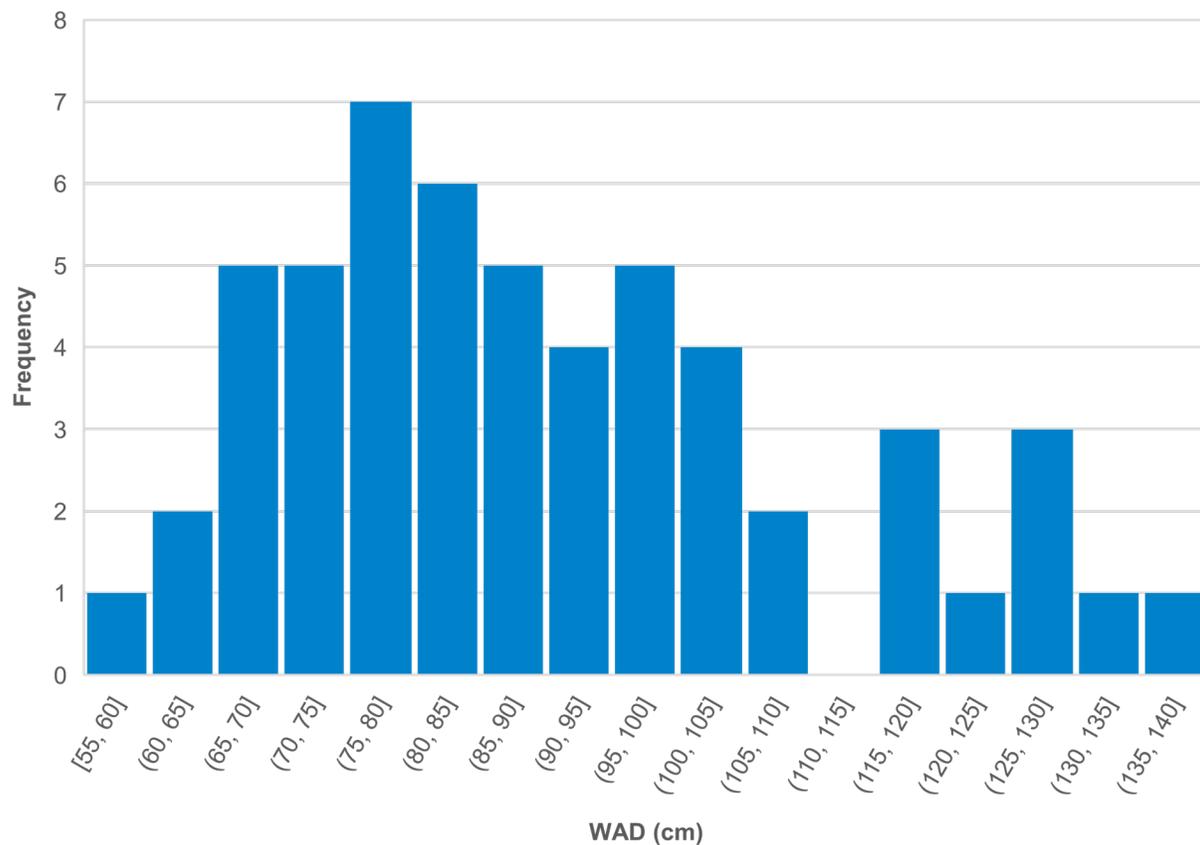
Preliminary Case Distributions

PCR Injury (KABCO)



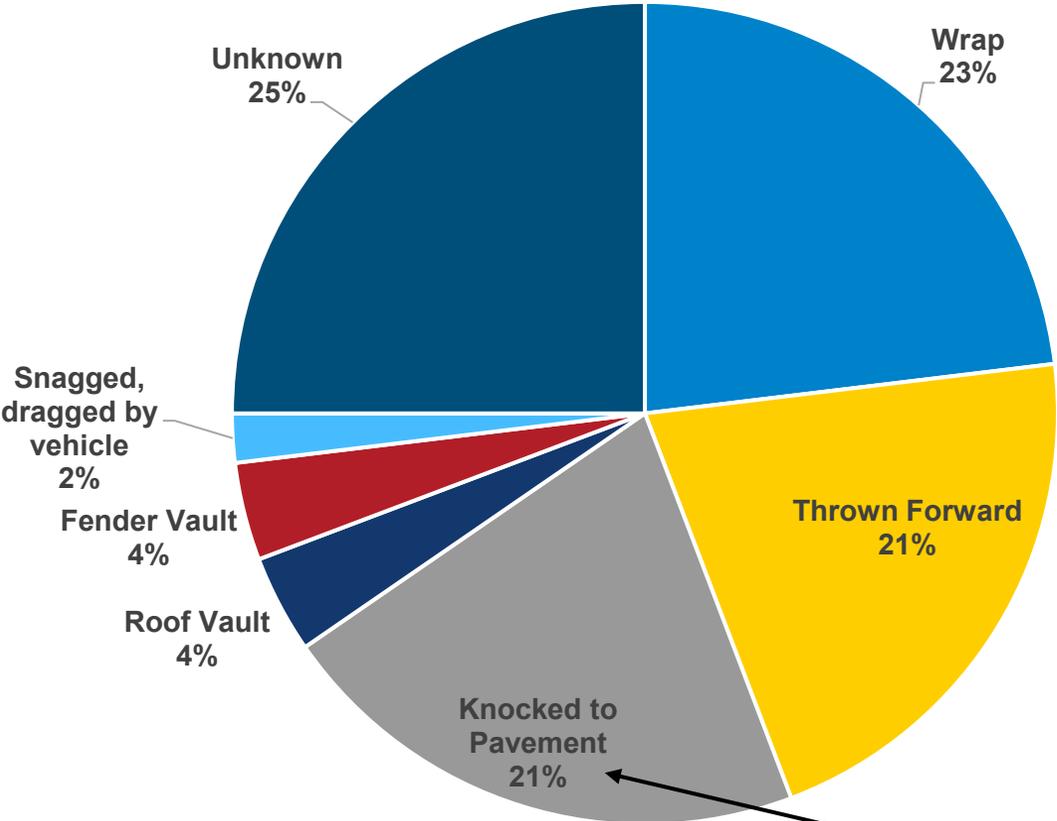
Preliminary Case Distributions

Front-to-Top Plane Transition Height



Preliminary Case Distributions

Pedestrian-to-Vehicle Interaction



Wrap Trajectory



Forward Projection



Fender Vault



Roof Vault



Pedestrian falls to the ground immediately in front of the vehicle

Injury and Engineering Center (IEC)

- CIREN Engineering Centers
 - Wake Forest University
 - Medical College of Wisconsin
- Review medical records and code injuries

Trauma ICU Pr
LOS: 2

Mechanism of Injuries:

- IVH small vt
- ?diffuse axo
- ?SAH
- Avulsion fx
- Left sided
- small right
- Acute disp
- 4-12 L rib
- 10-11 R r
- R clavicle
- G1 right
- left kidne
- Acute n

Consults:
NSGY
Ortho

Subject
24 Hour
Yester
neuro
report

Objective
Vital

General: NAD.
POC and dc.

Neurological:

HEENT: PERR

Cardiovascular:

Respiratory: auscultation th supplemental

Abd. / GI: At

GU: Voiding

Extremities: without diffi

Skin / Wou

ISV: 1500

Incentive

Pertinent
No ima

Asses
Active
Frac
Clos
Curr

Orth
Ima
of p
cor

Vital
Temp
Puls
Res
BP
MA

Ins/Outs:

Intake/Output Summary (Last 24 hours) at ***
Last data filed at ***

	Gross per 24 hour
Intake	2832.73 ml
Output	1460 ml
Net	1372.73 ml

Physical Exam:

General: Well nourished, well hydrated, young man
HEENT: Normocephalic, **hard collar in place**, multiple abrasions to face
Neck: Trachea midline

Respiratory: **L chest tube to suction**, Lungs CTAB

Cardiovascular: Regular rhythm, normal rate, no murmurs appreciated, 2+ radial pulses bilaterally.

Gastrointestinal: Abdomen soft, non-tender, non-distended

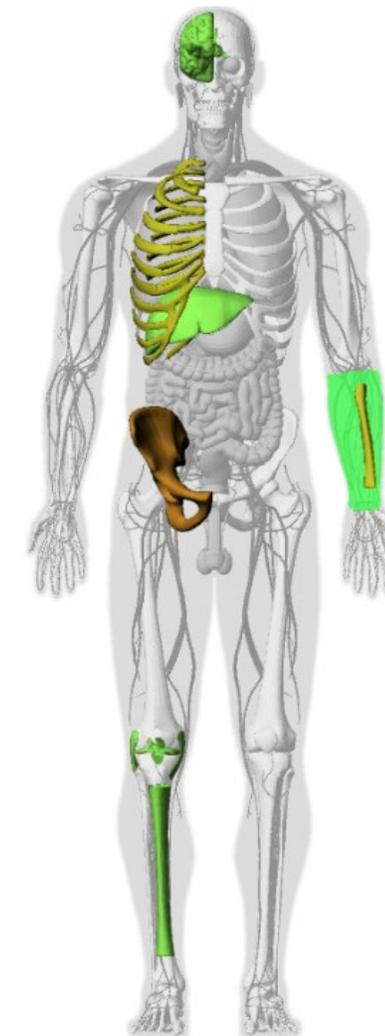
Musculoskeletal: Moving all 4 extremities, no gross deformity
Skin: Multiple hemostatic superficial abrasions to left arm, **Abrasion to R knee**

Neurologic: Obeys commands, moves all four extremities.

Incentive Spirometry Volume: **750**

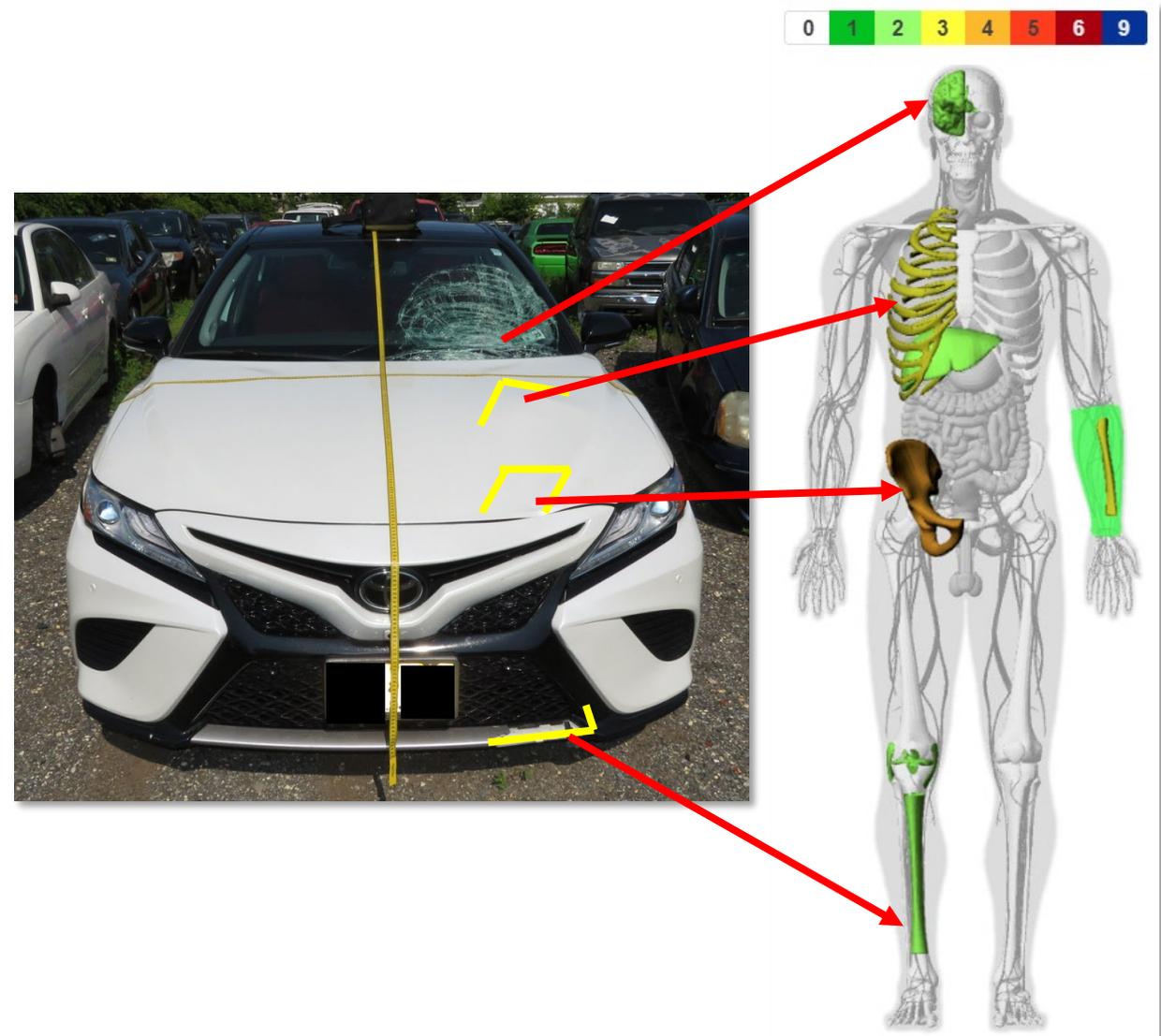
Pertinent Labs in the Last 24 Hours:
See results tab. CBC with WBC downtrending now 12.9. Hg downtrending now 11.5 from 14.6 on arrival. LFTs are downtrending AST 153, ALT 241. Tbili increased to 2.2. Cr. Improved to 0.81 from 1.35. Electrolytes WNL.

Pertinent Diagnostic Studies in the Last 24 Hours:
See imaging tab. Several CXRs, most not read. Most recently read CXR yesterday with 1. Interval decrease in size of the left pneumothorax, now trace. Left chest tube in similar position to prior.
2. Patchy opacities in the left lung base favored atelectasis/contusion.
3. Please see CT CAP *** for demonstration of osseous trauma.
4. Other support apparatus in expected radiographic position.



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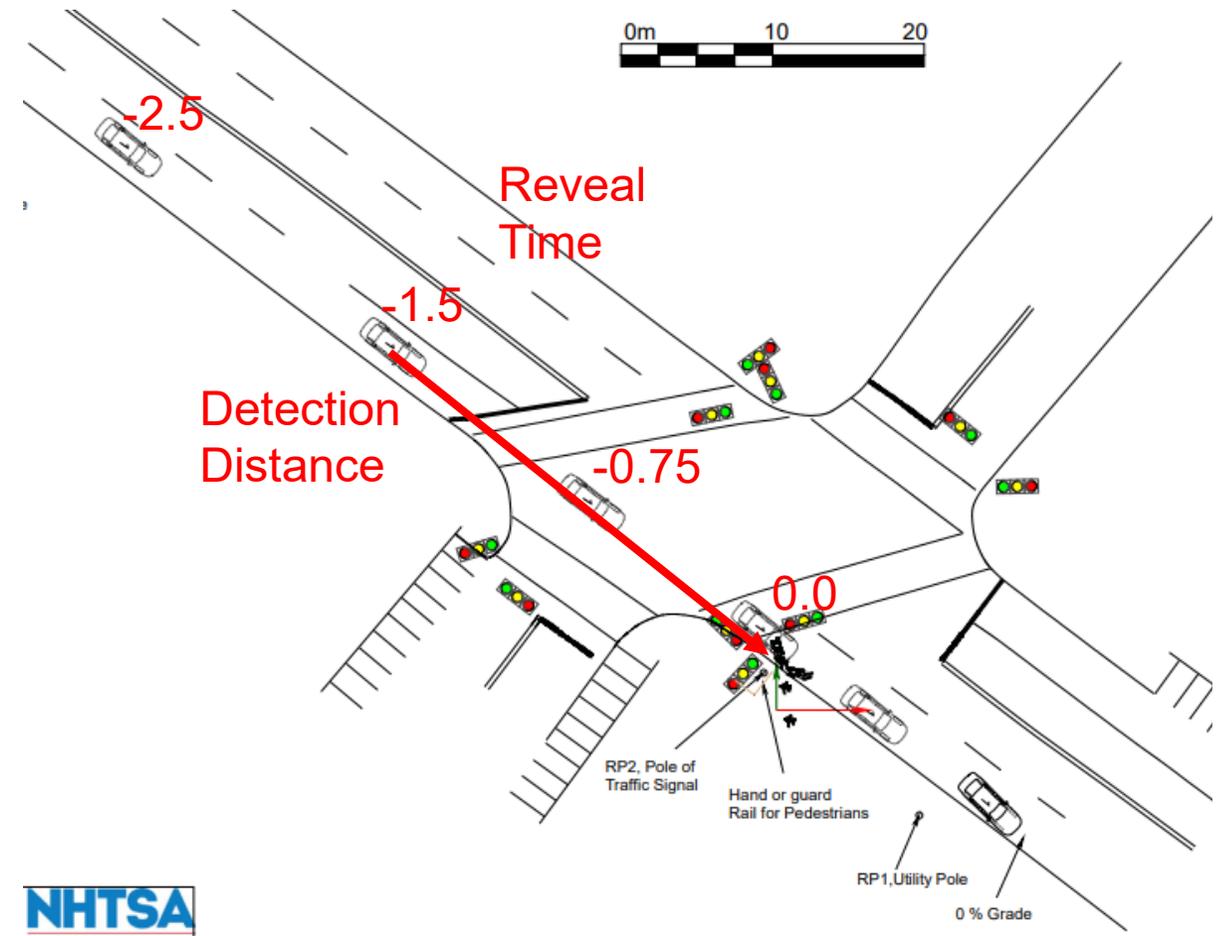
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- Review medical records and code injuries
- Perform injury causation analysis
- Determine kinematic trajectories
- Review crash avoidance calculations



Next Steps

- Case enrollment – complete
- Crash data population by PSU's – ongoing
- Injury and engineering analysis by IEC's – started
- Quality control and case publishing by NHTSA – future

Questions?

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