Using CIREN Data to Assess the Performance of the Second Generation of Air Bags

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Presentation Outline

- Description of the WLIRC Database
- Performance of 1st and 2nd Generation Driver Air Bags
- Performance of 1st and 2nd Generation Passenger Air Bags
- Illustrative Cases

Adult Trauma Criteria

	Category 1 (ANY 1 Meets TTC)	Category 2 (ANY 2 Meets TTC)
AGE		**55 years old**
AIRWAY	**Assisted / Intubated**	**Respiratory rate 30**
CONSCIOUSNESS	**Alter mental status**	**BMR 5**
	GCS ≤ 12	
CIRCULATION	**HR > 120 bpm < 90 mmHg.**	**Heart rate 120 bpm**
FRACTURE	**2 + long bone fractures**	**Long bone fracture**
CUTANEOUS	**2nd o or 3rd o burns to 15% TBSA**	**Major degloving injury**
	Amputation	**Avulsion > 5 inches**
		GSW
MECHANISM OF INJURY		**Ejection**
		Steering wheel deformity
OTHER	**High index of suspicion**	

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Crash Injury Research and Engineering Network

- Miami
- San Diego
- Seattle
- Ann Arbor
- Baltimore
- Wash. DC
- Birmingham
- Newark
- Fairfax
- Milwaukee

The WLIRC CIREN Center

- Has Been Collecting Data since 1992
- Collects a Near Census of Occupants with Air Bag Deployment in the South Florida Region who Meet the Trauma Criteria
- By 1995 Provided Data on:
  - Child Fatalities with deploying passenger air bags
  - Fatal neck injuries to small close-in drivers
- Provides Early Data on the Performance of New Safety Features

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Comparison of NASS and CIREN Data

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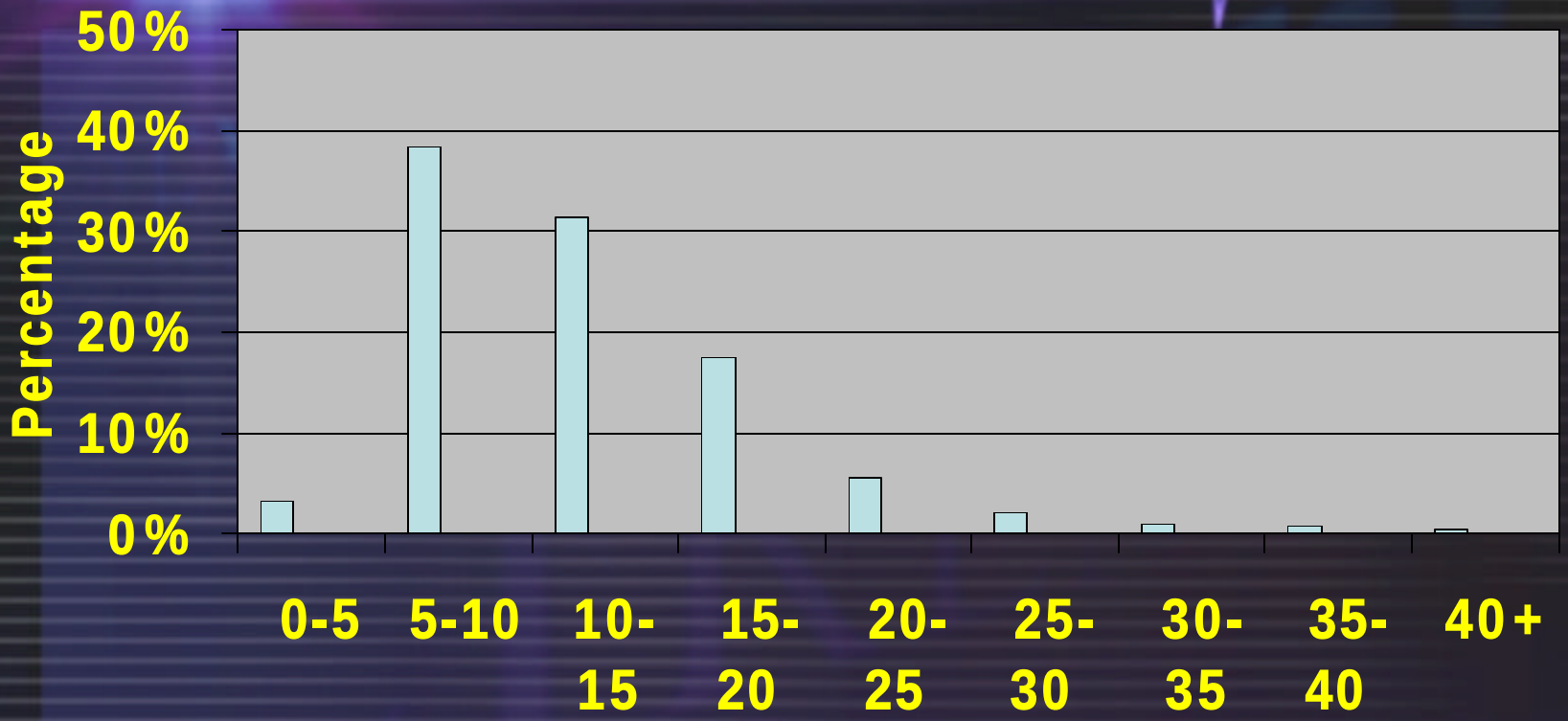
Distribution NASS Occupants, in Frontal Crashes by Delta-V



Based on Weighted NASS Data

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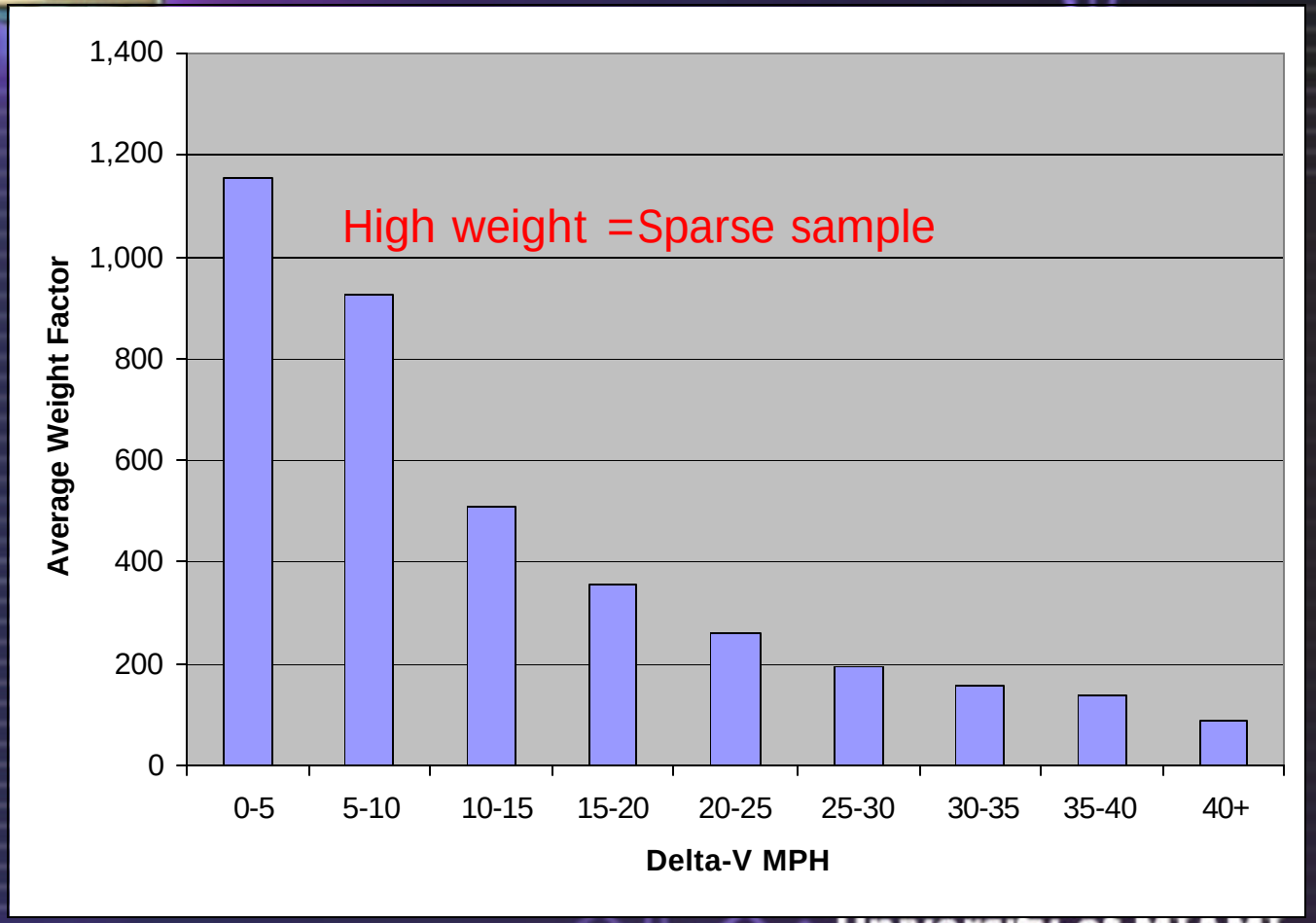
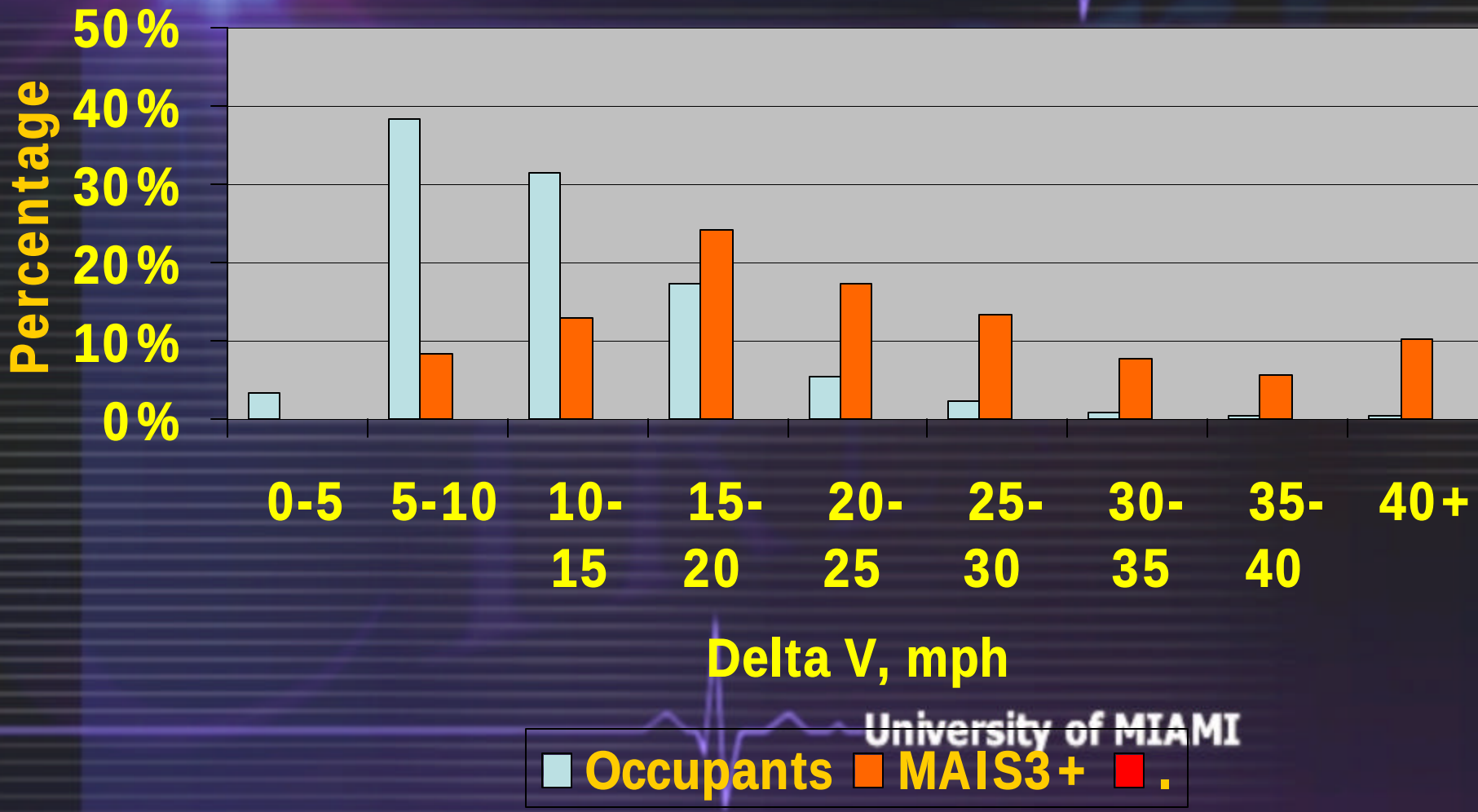
Average Weight Factors in NASS vs Delta-V



Distribution NASS Occupants, MAIS 3+ and Fatals in Frontal Crashes by Delta V



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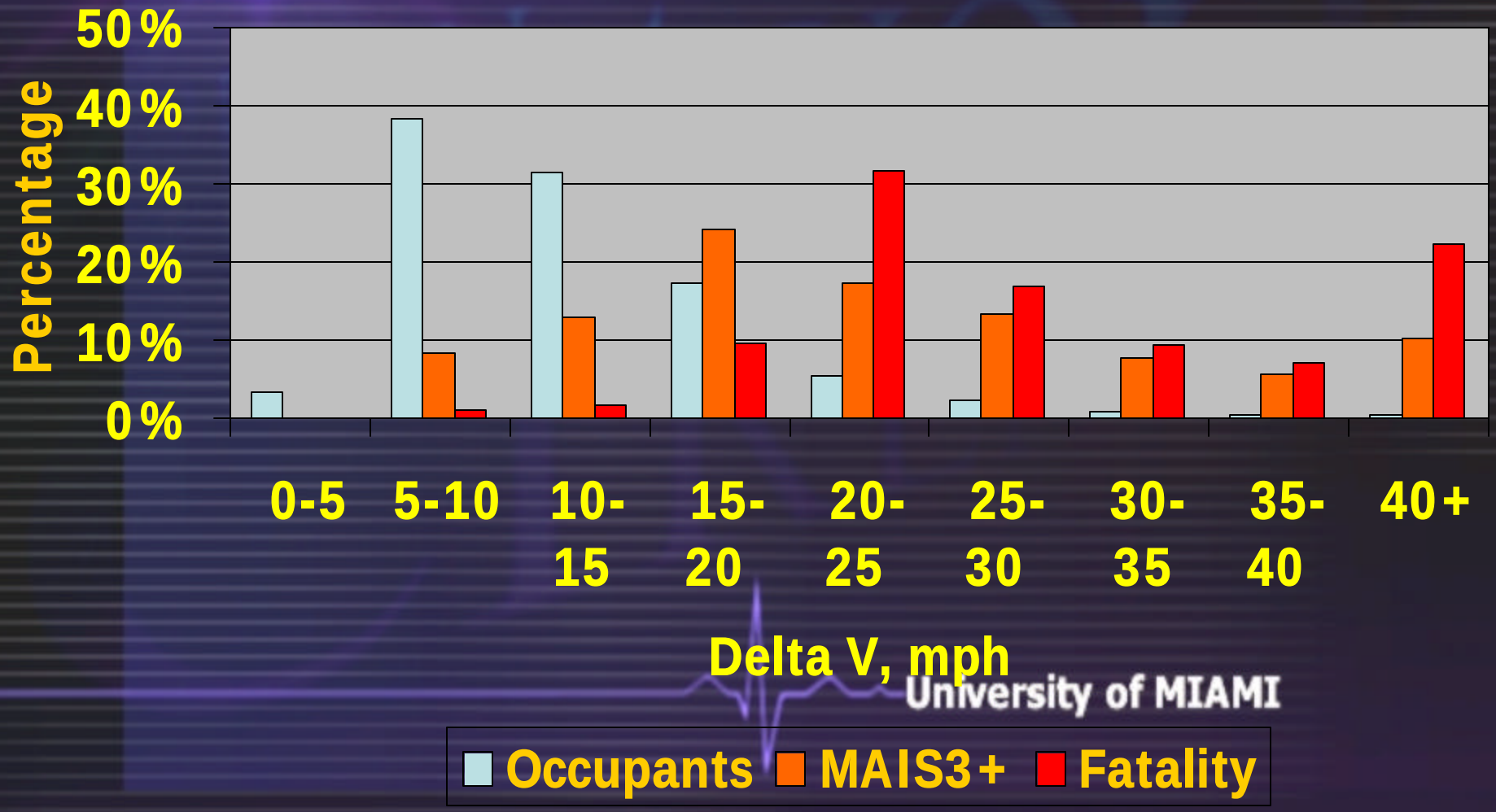
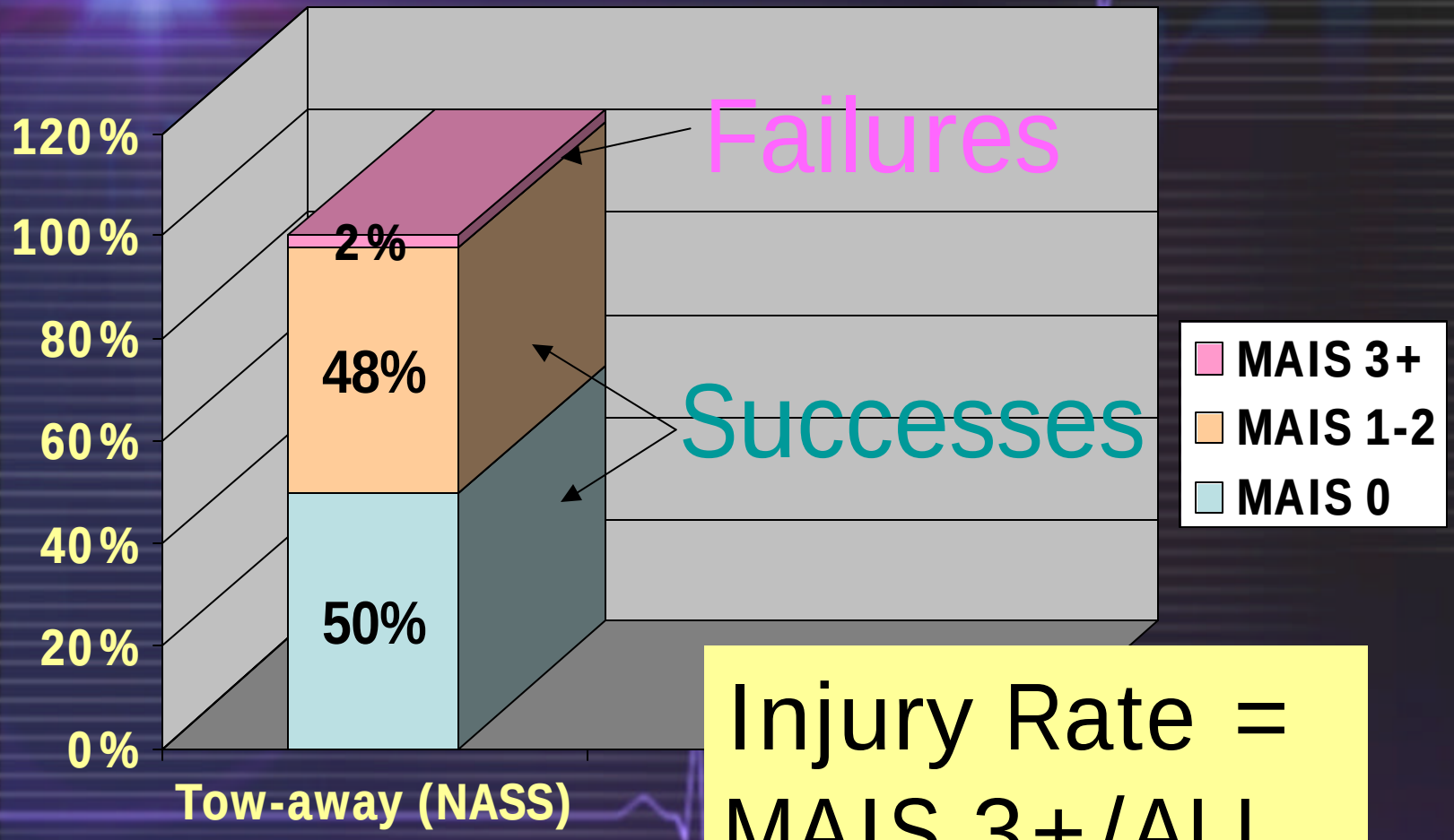
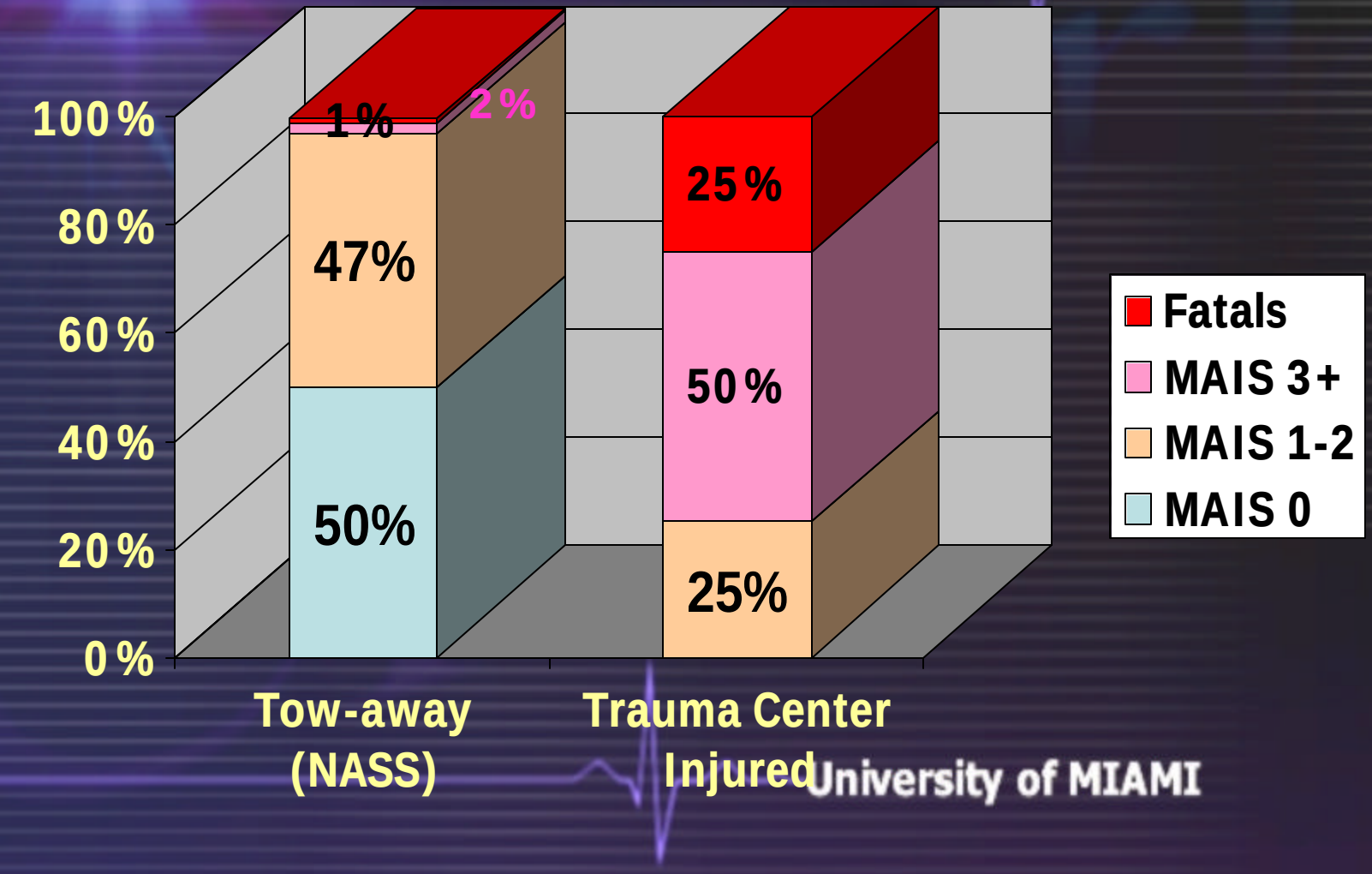


NASS Distribution of MAIS Injured



Injury Rate = MAIS 3+/ALL

NASS vs Trauma Center Distribution of MAIS Injured



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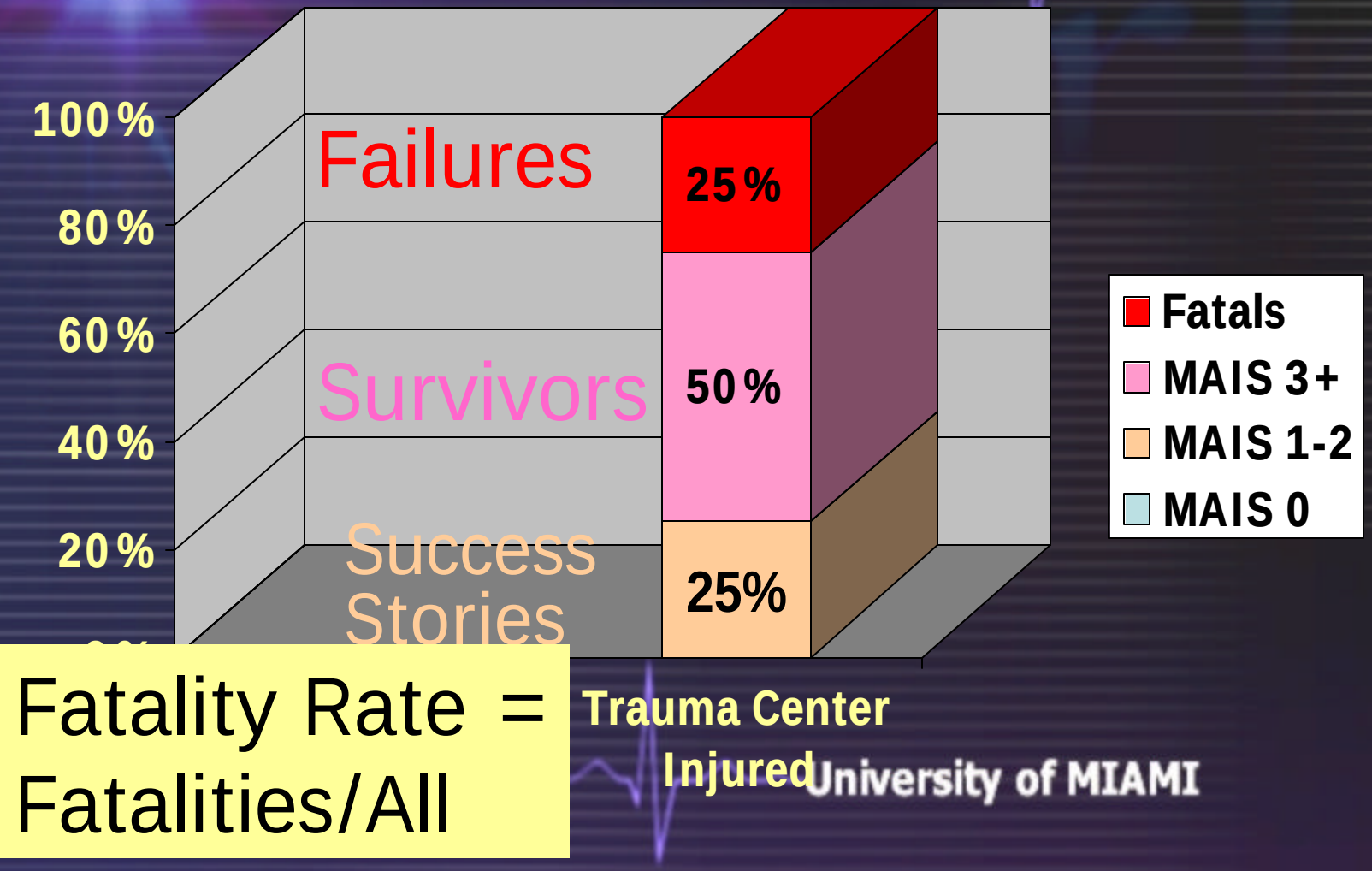
Typical Trauma Center Distribution of MAIS Injured



Fatality Rate = Fatalities/All

Disclaimer

- Statements in the following slides are made relative to WLIRC data only.
- The data is a near census of people in crashes in South Florida who meet trauma criteria; people thought to have life threatening injuries + fatals.
- Ratios are not statistically significant but are generally consistent with observations from in depth studies.
- Database is not representative of the population of all tow-away crashes in the US.

WLIRC Data on 1st and 2nd Generation *Driver* Air Bags

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Assumptions for Old and New Air Bags

- Old Air Bags (1st Generation) are in all pre MY 1998 vehicles
- New Air Bags (2nd & 3rd Generation) in are all in MY 1998 and later vehicles
- Most of the “New” Air Bags are Sled Certified Air Bags

Driver Air Bag Performance – WLIRC Data

- Frontal Crashes with No Rollover
- WLIRC Cases + All Fatal Cases
- Trauma Center Patients + Fatals = Census of Severely Injured in South Florida
- 161 Drivers with Old Air Bags; 48% Belted
- 66 Drivers with New Air Bags; 38% Belted

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1st Generation Driver Air Bags

9 Fatalities at Delta-V >20 mph

- Characteristics of Fatalities:
- 4 Short Statured – 5'4" or less
  - Head/neck injuries
- 4 Elderly – 65 or older
  - Chest Organ Injuries
- 1 at 20 mph due to incompatibility/intrusion

Issue:

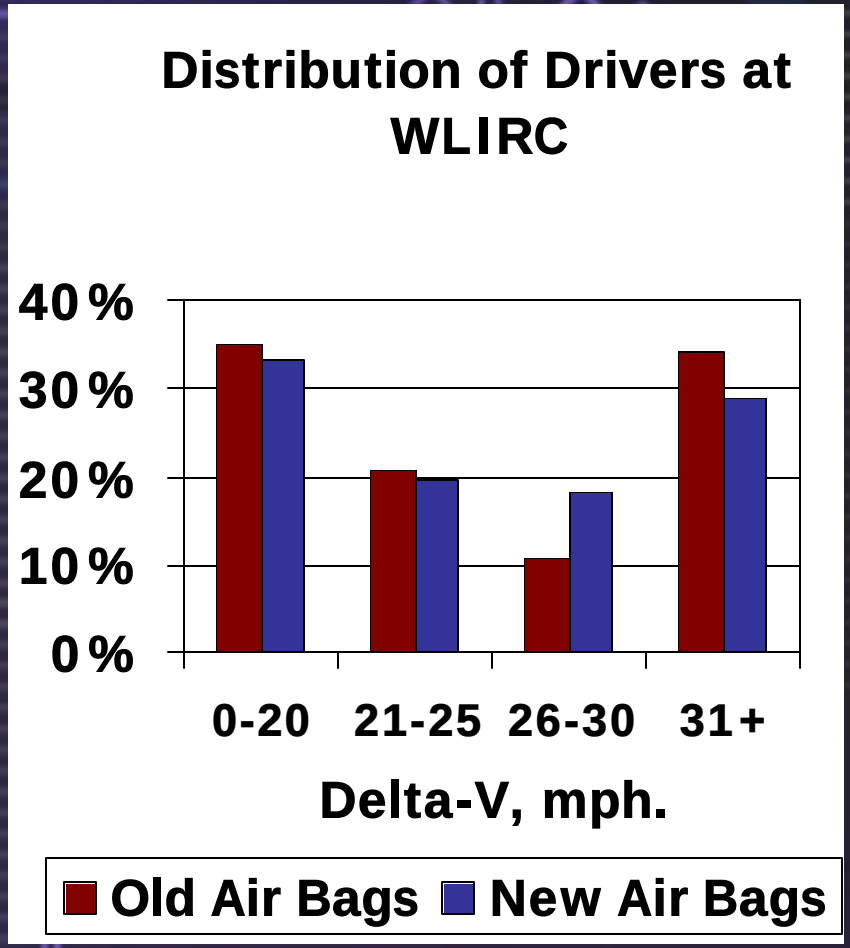
Air Bags too aggressive close-up and too stiff for elderly

Driver Air Bag Deployment in WLIRC Database by Delta-V

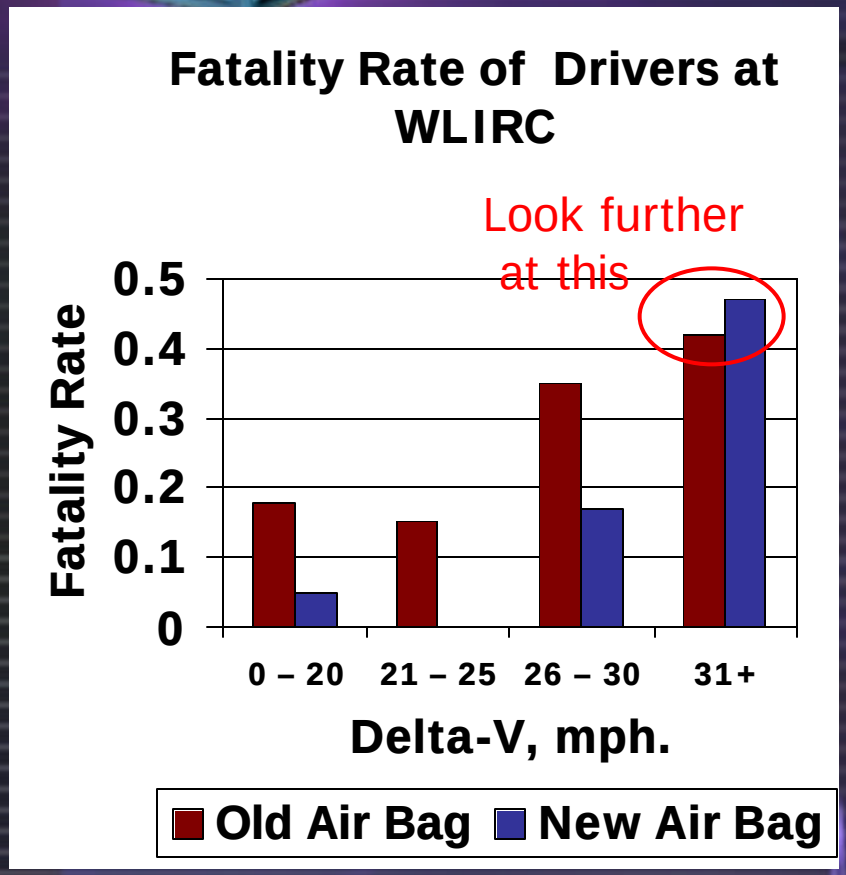
Number of Drivers at WLIRC –All Data

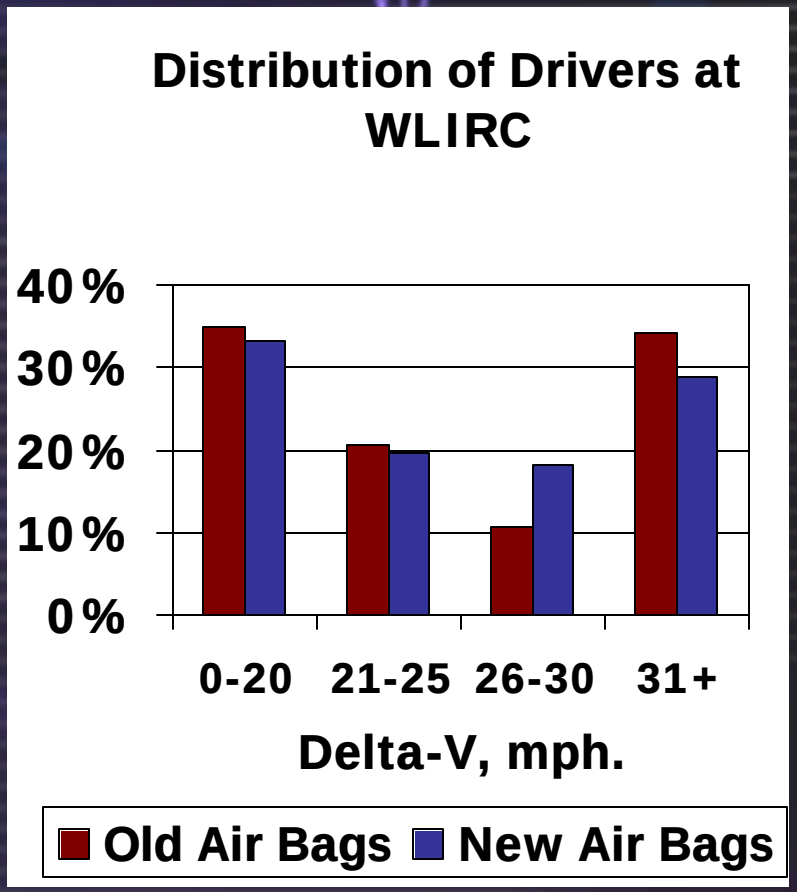
- Old Air Bags – 161
- New Air Bags – 66

Crash distribution generally similar



Driver Air Bag Deployment in WLIRC Database by Delta-V





Much Lower Rate of Fatalities in Low Severity Crashes

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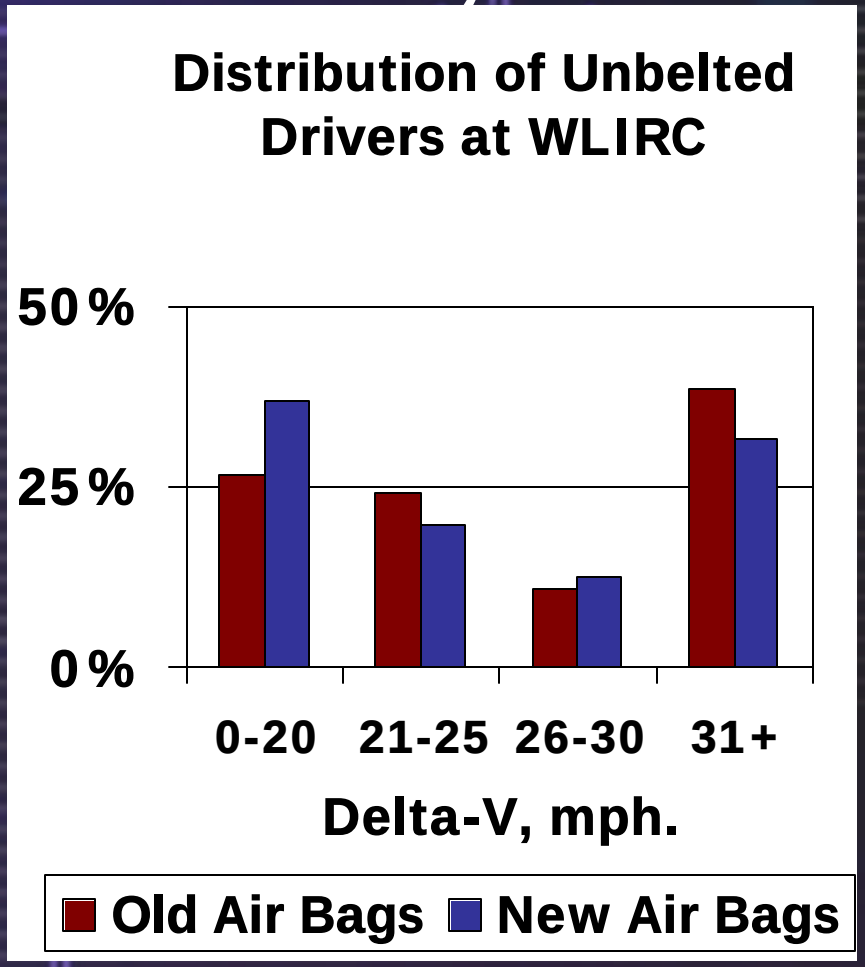
Driver Air Bag Deployment in WLIRC Database by Delta-V

Number of Drivers at WLIRC - Unbelted

- Old Air Bags – 83
- New Air Bags – 41

New Air Bags in lower severity crashes



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Driver Air Bag Fatality Rate in WLIRC Database by Delta-V

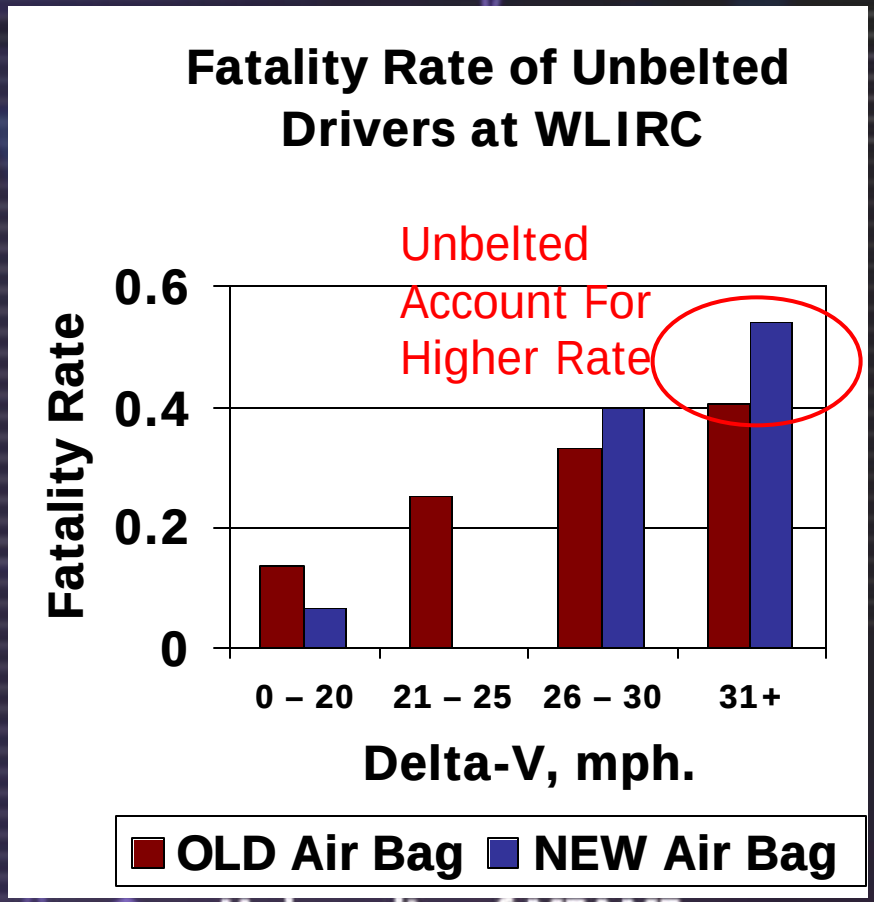
Number of Drivers at WLIRC - Unbelted

Old Air Bags – 83

New Air Bags – 41

New Air Bags Have:

- Lower % Fatalities in Low Severity Crashes
- Higher % Fatalities in High Severity Crashes



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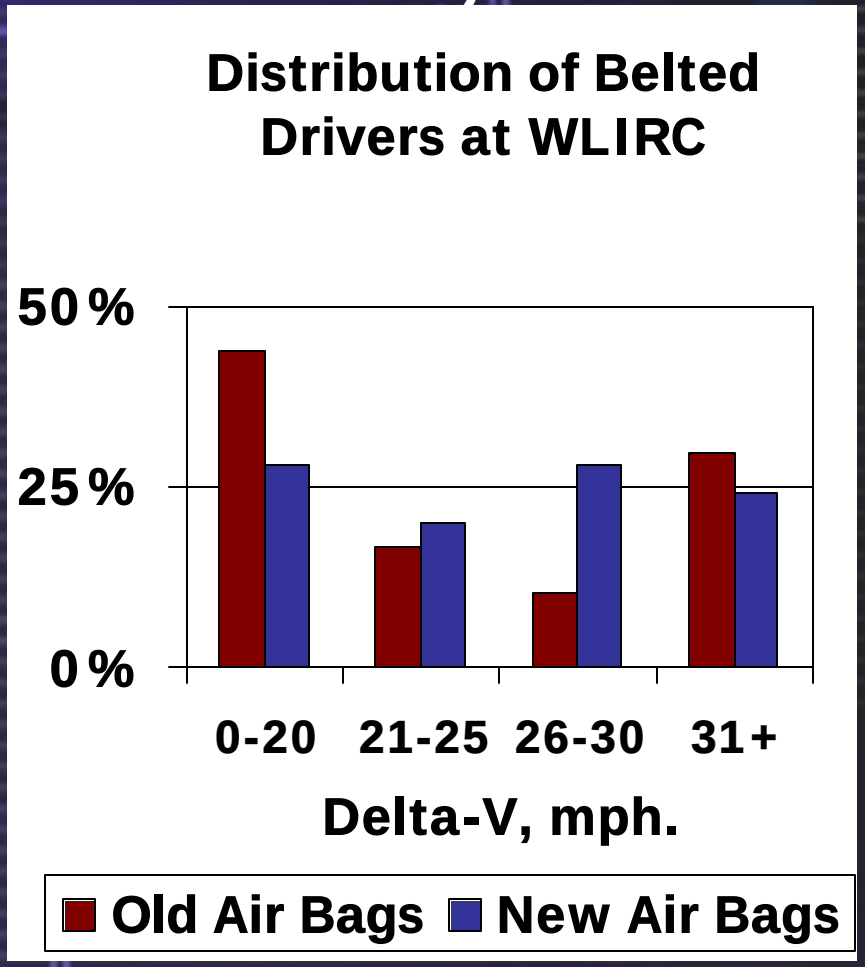
Driver Air Bag Deployment in WLIRC Database by Delta-V

Number of Drivers at WLIRC - Belted

- Old Air Bags – 78
- New Air Bags – 25

Higher % of New Air Bags in 26-30 mph crashes



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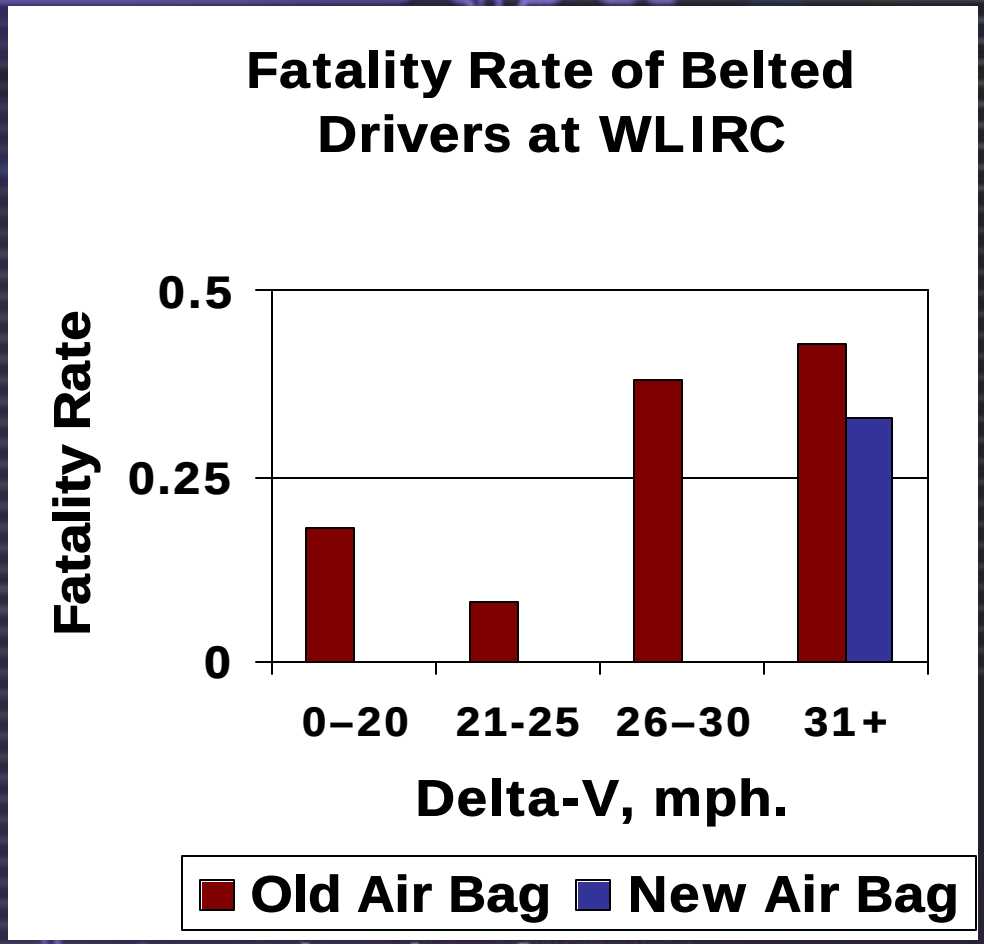
Driver Air Bag Fatality Rate in WLIRC Database by Delta-V

Number of Drivers at WLIRC & CIREN - Belted

- Old Air Bags – 78
- New Air Bags – 25

New Air Bags Have Lower % of Fatalities in all Crashes



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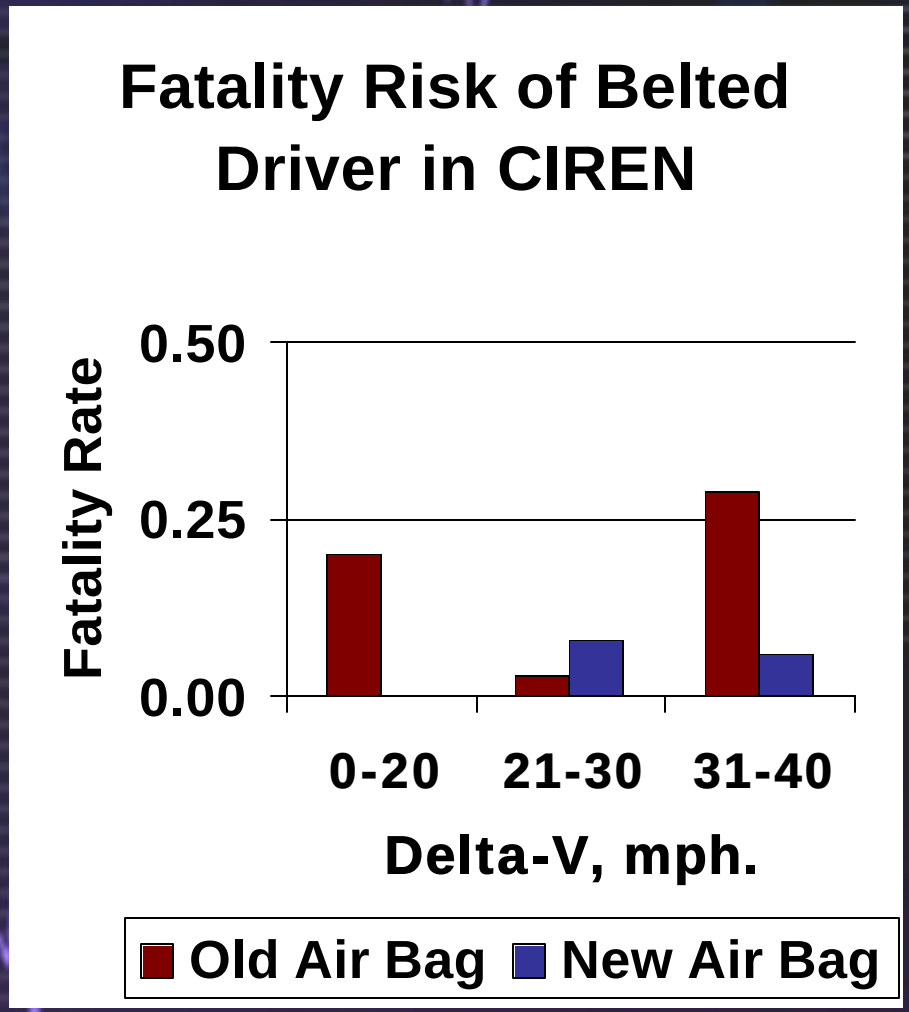
Belted Driver Air Bag Risks in CIREN Database by Delta-V

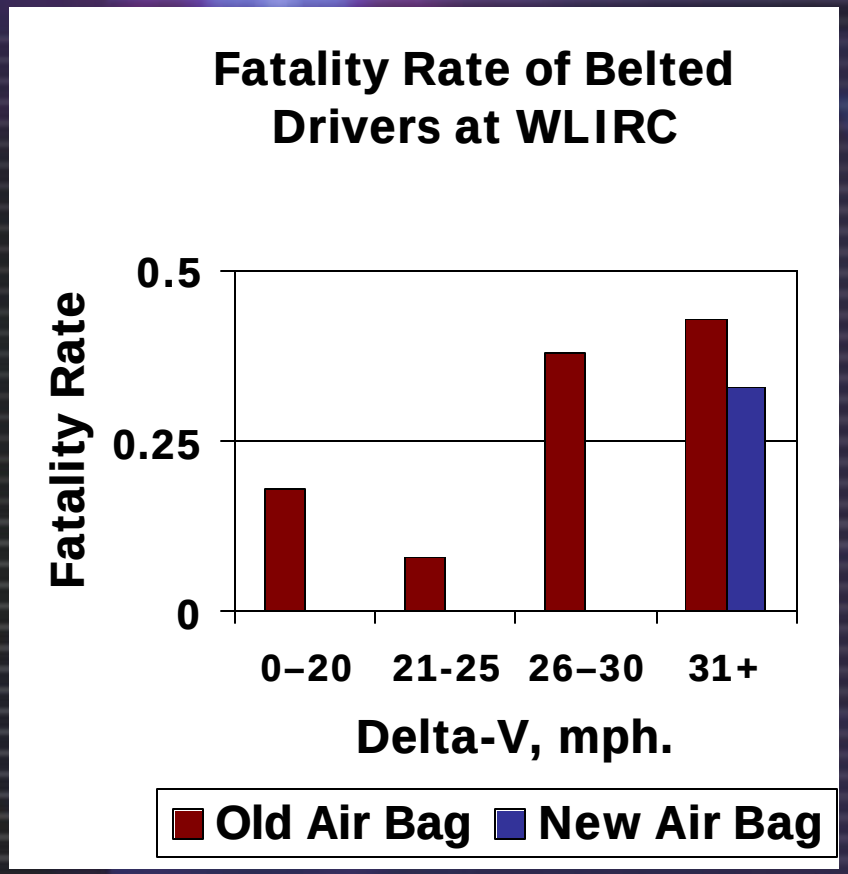
Number of Drivers at CIREN – Belted

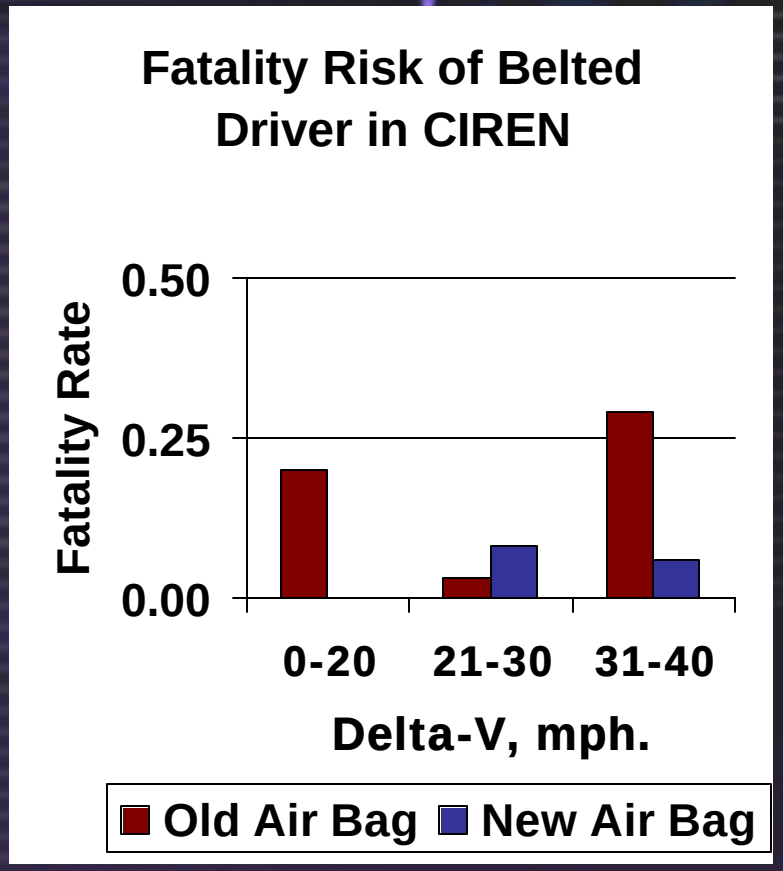
- Old Air Bags – 141
- New Air Bags – 78

New Air Bags Performing Well for Belted Drivers



Belted Driver Air Bag Risks in WLIRC & CIREN





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New Driver Air Bags - Observations

- No Elderly Fatalities below 30 mph Delta-V
- No Short Statured fatalities below 30 mph Delta-V
- New Driver Air Bags appear to be working well for belted drivers at all crash severities and for unbelted drivers in crashes less than 25 Mph
- Watch the unbelted fatality rate at 25+ mph

Selected Cases from WLIRC Data

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Frontal Narrow Tree Impact

Unrestrained Driver – New Air Bag -Survivor of 44 mph Crash

Case 03-011

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Case Subject

- 18 Year old male – Driver
- 66” , 125 lbs
- Unrestrained
- Front & passenger air bags deployed
- Single occupant

High suspicion of injury

9 days in hospital

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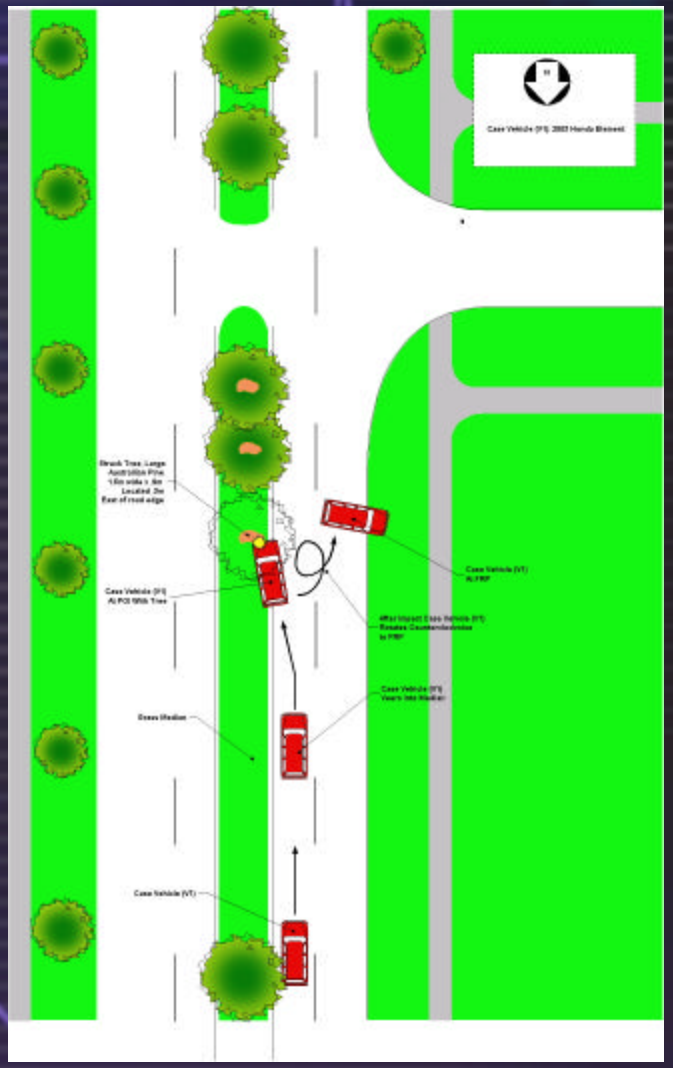
Scene

Crash occurred: 06:30 am
Trauma arrival: 06:54 am
Via-rescue vehicle



-High suspicion of injury

Case Vehicle

- 2003 Honda Element
- Max crush: 43”
- PDOF: 12 O’clock
- DeltaV: 44mph

Injuries

- AIS 3 - Liver laceration
- AIS 2- Spleen laceration
- AIS 3- Right lung contusion & laceration
- AIS 2- Right rib FX
- AIS 2- Right malleolus & fibular FX

Observation

- Young Male, unbelted in 44 mph narrow object crash
- No head injuries
- Survivable AIS 3 chest injuries
- Air bag + steering column absorbed crash energy

40 MPH Fatality

Unrestrained Driver
Barrier Type Crash

FATALITY

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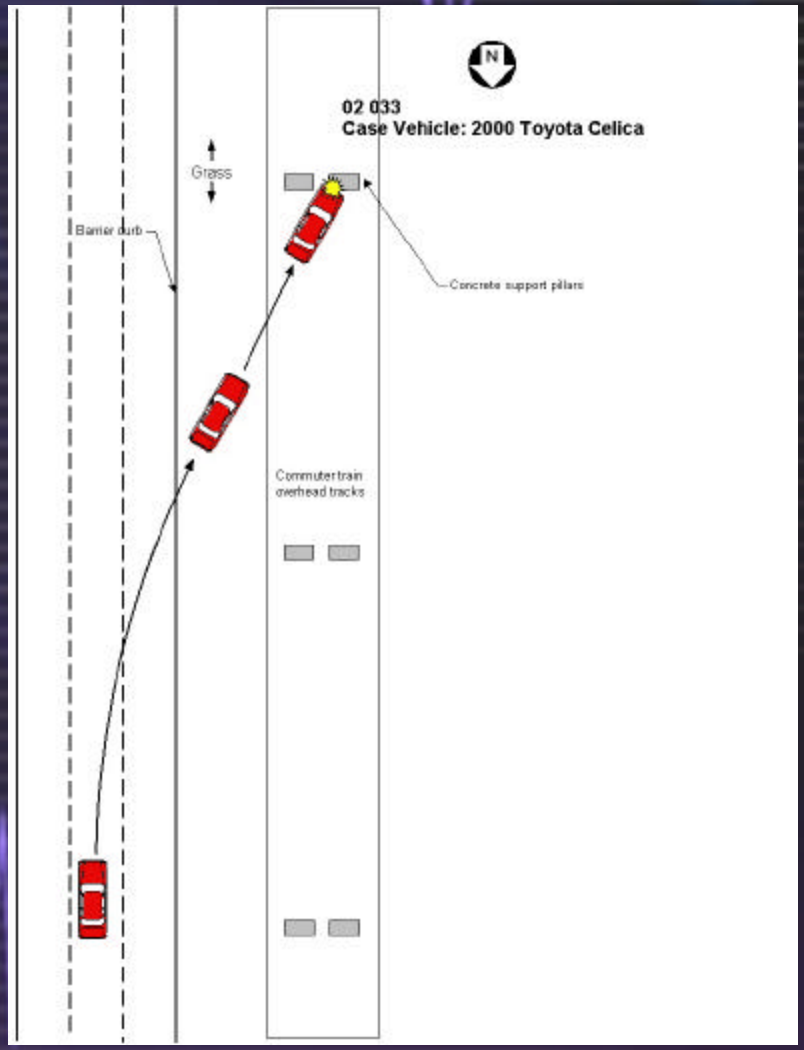
40 MPH Fatality

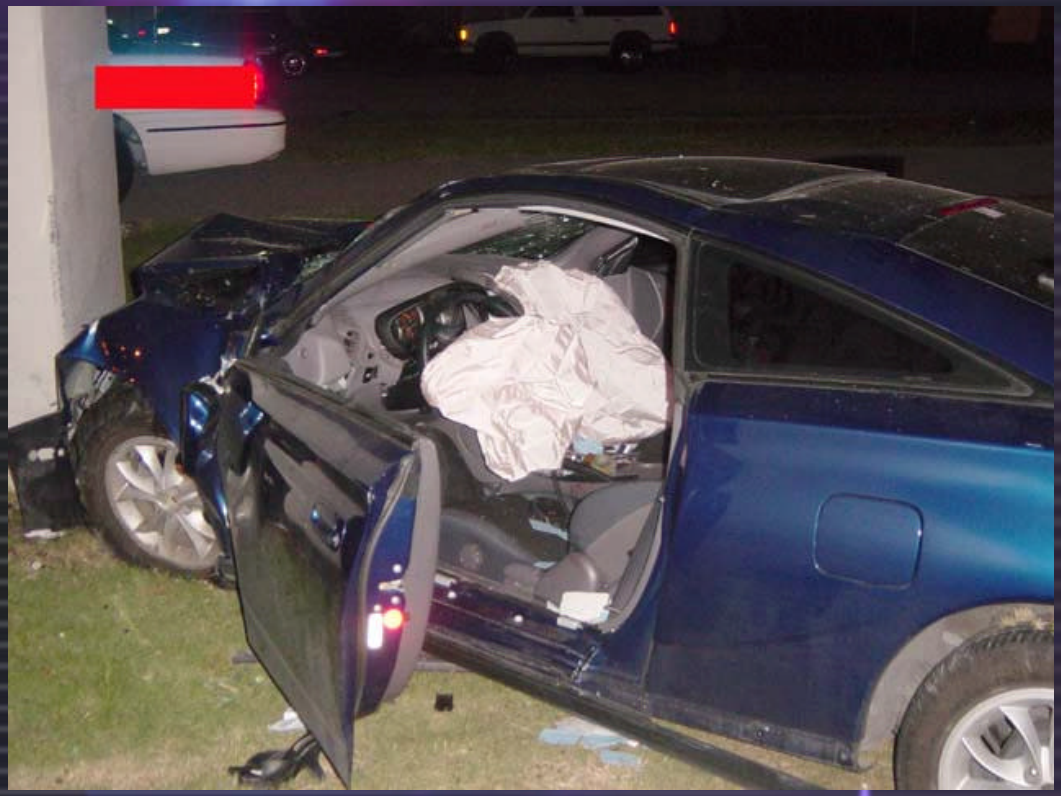
2000 Toyota Celica
Vehicle-to-Barrier
PDOF: 12 o'clock
Delta V: 39 mph
Max Crush: 31 in.

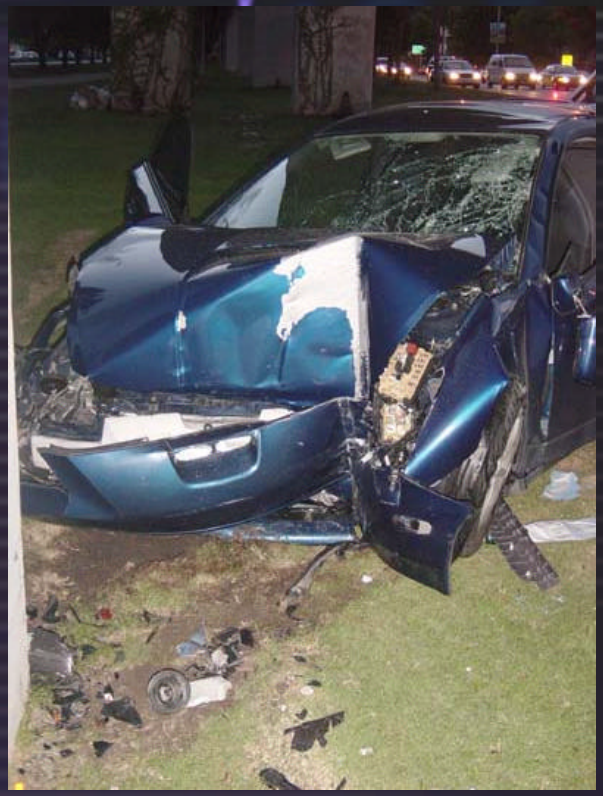


On Scene Picture

Uneven Ground

Car to Barrier Crash





30” max vehicle crush

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Vehicle Interior

A-pillar head strike

11” Left Toepan Intrusion

3.1” Steering Wheel Deformation

Vehicle Interior

Driver:
Unrestrained 20 year old Female
5’4”, 135 lbs

Fatal
Head Injury
A-Pillar Contact

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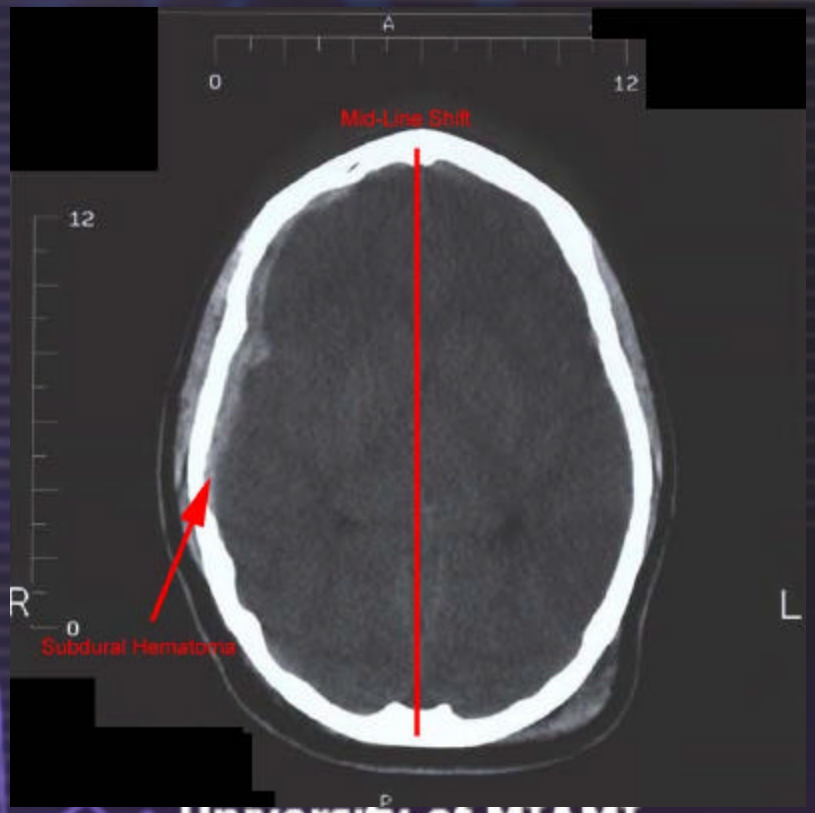
Fatal Brain Injuries – A-pillar Contact

- Brain Injuries –
- 3- AIS 5
- 4- AIS 4
- 1- AIS 3
- 1-AIS 2
- No other AIS 2+ Injuries
- No Skull Fracture



Observation

- Unrestrained driver 5’4” in 39 mph collision
- May have been out of position due to rough ground
- No severe chest/abdominal injuries
- Catastrophic brain injuries from a-pillar contact
- Crash direction/driver position may have induced a-pillar head impact – head missed air bag

Conclusions- New Driver Air Bags

- New Driver Air Bags Perform Better than Expected
  - Very Low Fatality Rate for Belted (.08 new vs. .26 old)
  - Slightly Lower Fatality Rate for Unbelted
- No Short Person Fatalities Below Delta-V 30 Mph
- No Elderly Fatalities Below Delta-V 30 Mph
- Several Success Stories Above Delta-V 40 Mph
- Head Injuries Observed in Angular Impact (High Severe Crash & Unbelted Occupant)
- Need to Monitor Unbelted at 30+ mph – May Tend to Miss the Air Bag

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WLIRC Data on Old and New *Passenger* Air Bags

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Fatalities in 1st Generation Passenger Air Bags

Characteristics of 4 Low Delta-V Fatalities:

- 2 Infants in rear facing child seats
  - Head/neck injuries
- 2 Children under 3 years old – no belts
  - Head/neck injuries
- 1 Unexpected Fatality at moderate severity– Occupant reaching forward at time of crash (Out of Position)
  - Head/neck injuries

Issue: 1st Generation Passenger Air Bags too aggressive close-up

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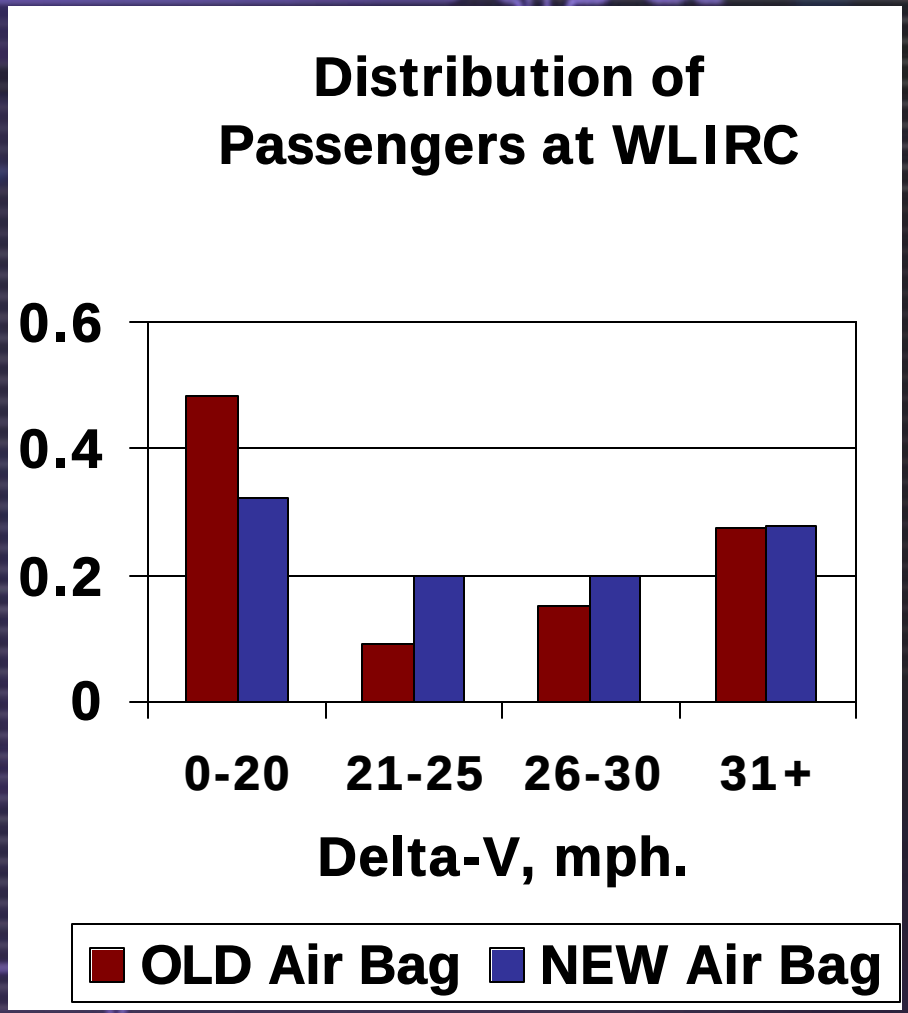
Passenger Air Bag Deployment in WLIRC Database by Delta-V

Number of Passengers at WLIRC

- Old Air Bags – 33
- New Air Bags – 25

New Air Bags Had Fewer Passengers in Lowest Severity Crashes

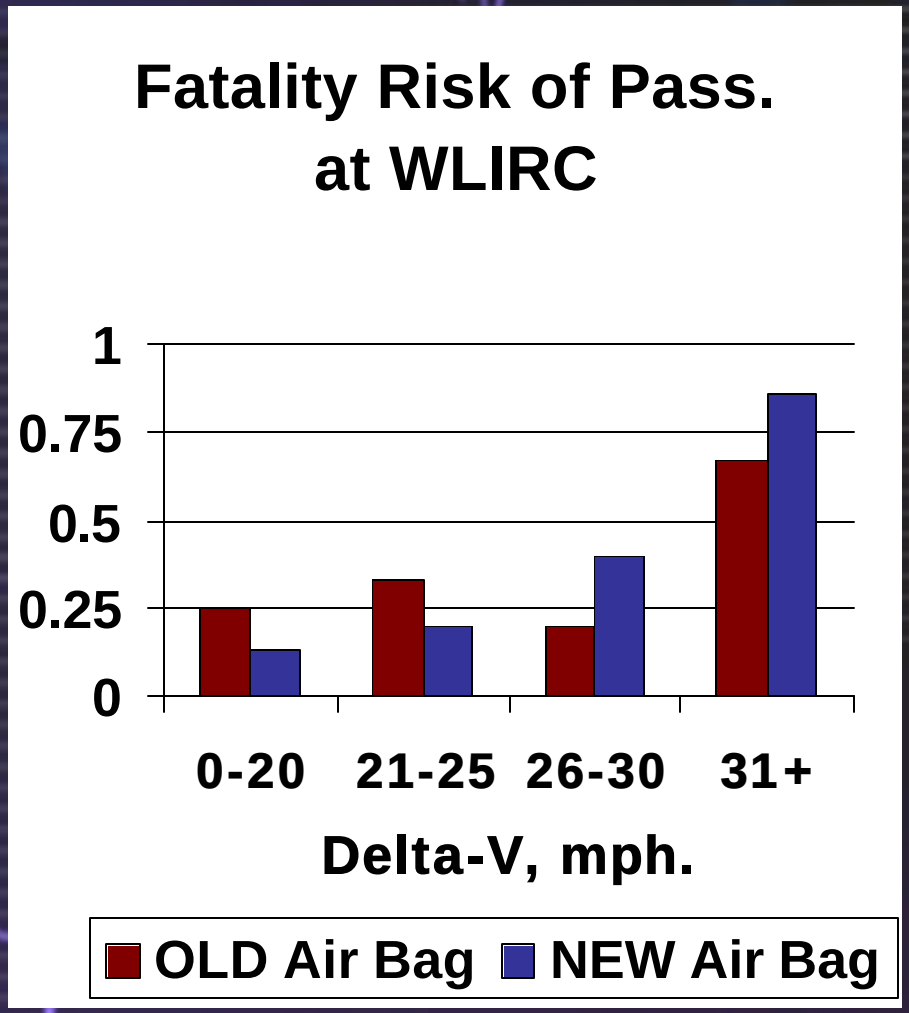


Passenger Air Bag Risks in WLIRC Database by Delta-V

Number of Passengers at WLIRC

- Old Air Bags – 33
- New Air Bags – 25

New Air Bags Have Lower Fatality Rate in Low Severity Crashes; Higher in High Severity Crashes



Conclusions- New Passenger Air Bags

- New Passenger Air Bags Perform As Expected In WLIRC Data
- No Child Fatalities, No Close-in Fatalities
- No Elderly Fatalities below 30 mph
- Not Much Difference in Old and New Fatality Rates
- Need to Verify Increased Fatality Rate Above Delta-V 25 mph

Conclusions –New Air Bags

- In WLIRC data, New Air Bags performed as expected – Less injury in lower severity crashes
- Except for higher fatality rates above 25 mph for unbelted drivers and passengers, findings are consistent with other research by Blue Ribbon Panel
- Limited data – Needs validation from other sources

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The End

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