# Opportunities for Reducing Casualties in Far-side Crashes

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# Participants in Far-side Research

- Australian Research Board
- Ford
- GM Holden
- Autoliv
- Australian Ministry of Transport
- Monash University
- GW University
- Va Tech
- Wake Forest
- Medical College of Wisc
- Miami School of Medicine
- Wayne State U
- Consultants & Students
  - US, Australia, Sweden

# Data Sources

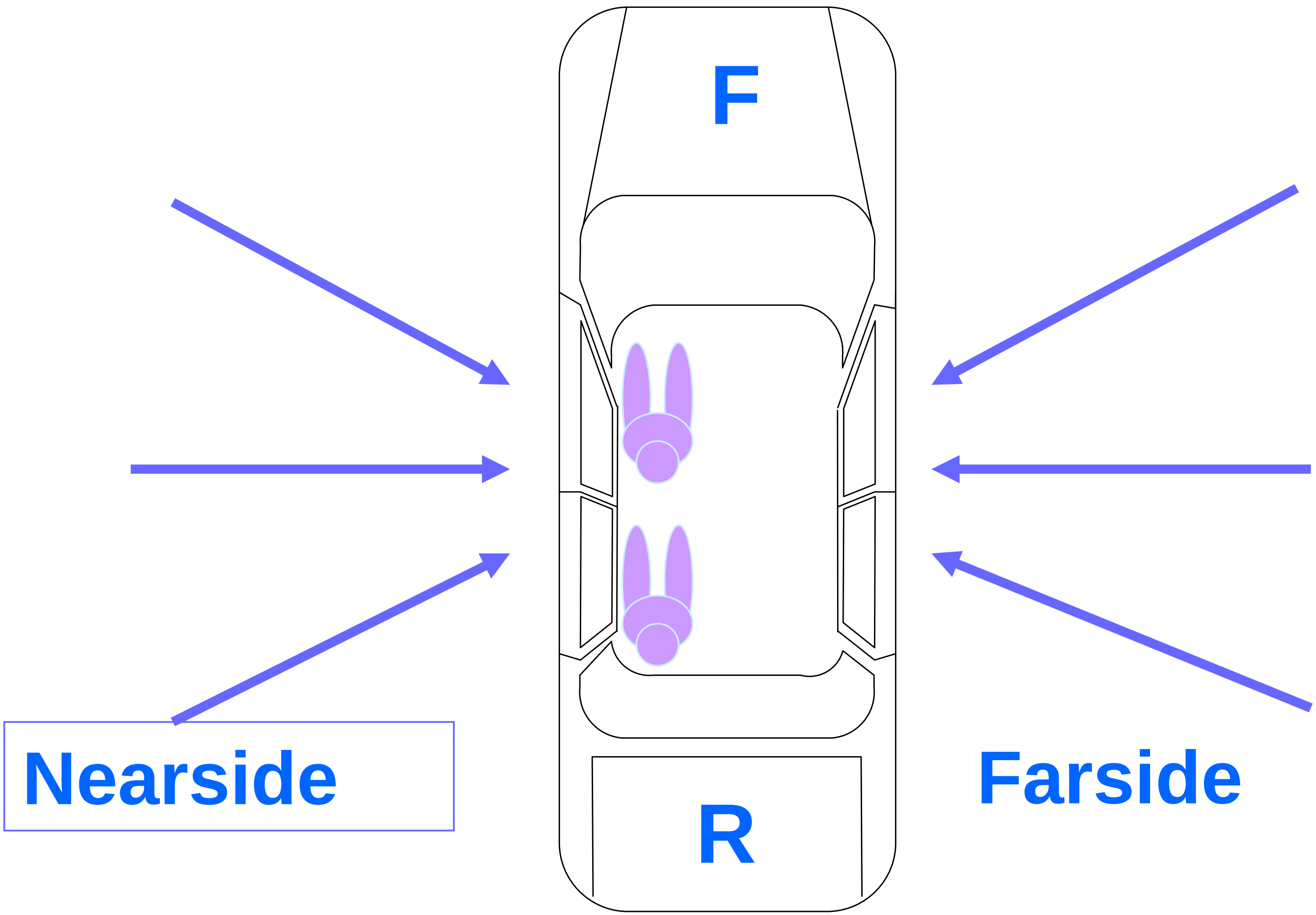
NASS/CDS 1993-2002

Front seat occupants, Age 12 and older

Restricted by:

- Far-side, Belted, Not Ejected, No Rollover

# Crash Mode Definitions



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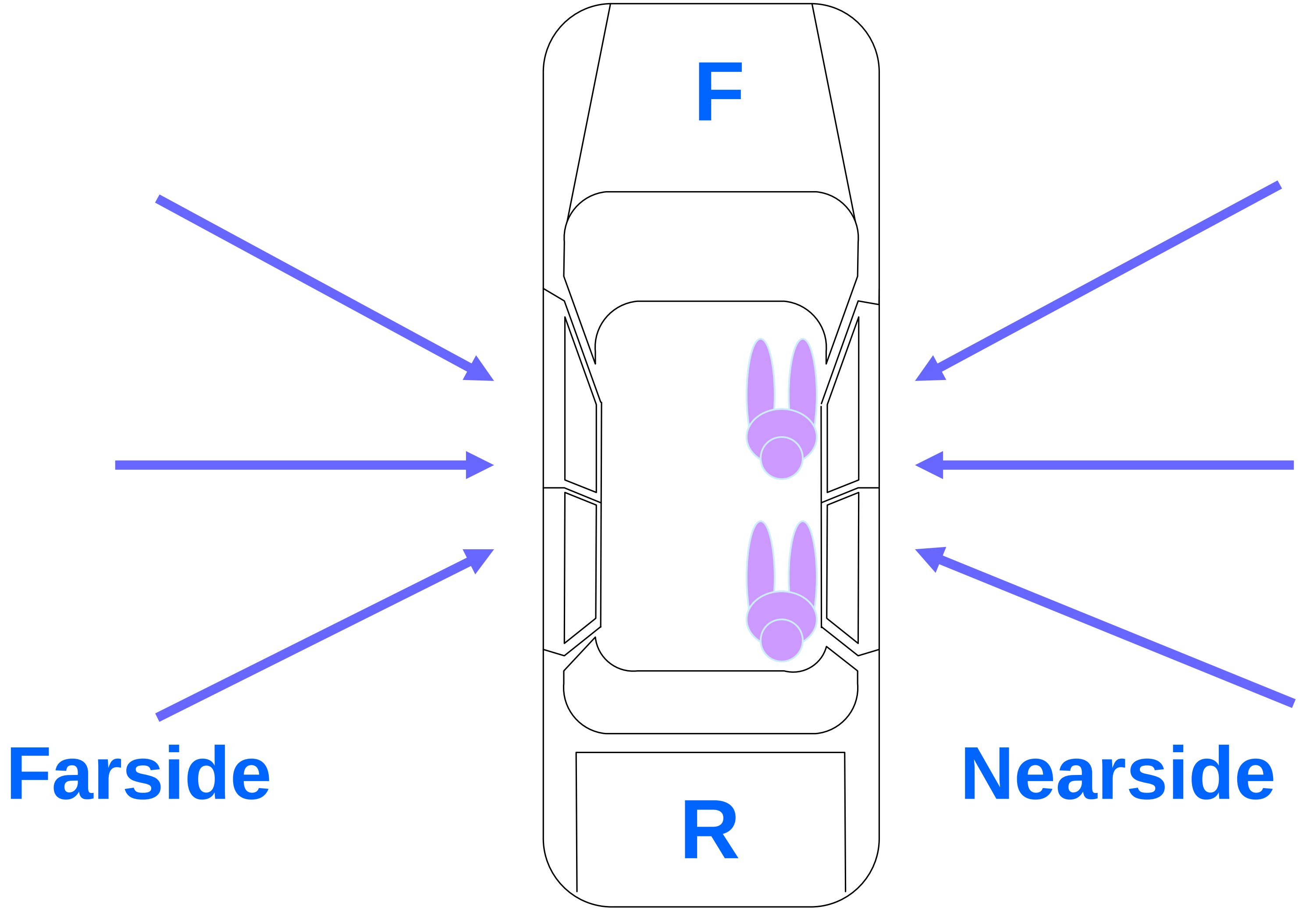


# Summary of Accident Data Far-side
# Belted Front Seat Occupants

The following data is for belted occupants in far-side crashes, based on NASS/CDS 1993-2002

“Side Impact Injury Risk for Belted Far Side Passenger Vehicle Occupants”, SAE Paper No. 2005-01-0287 (Clay Gabler, Va Tech, 1st author)

# Data Set

NASS/CDS 1993-2002

All Model Years

Passenger Cars or LTVs Only

GAD = Left or Right Side

No Rollovers

Occupant on Opposite Side of Impact

3-Point Belt Restrained Occupants

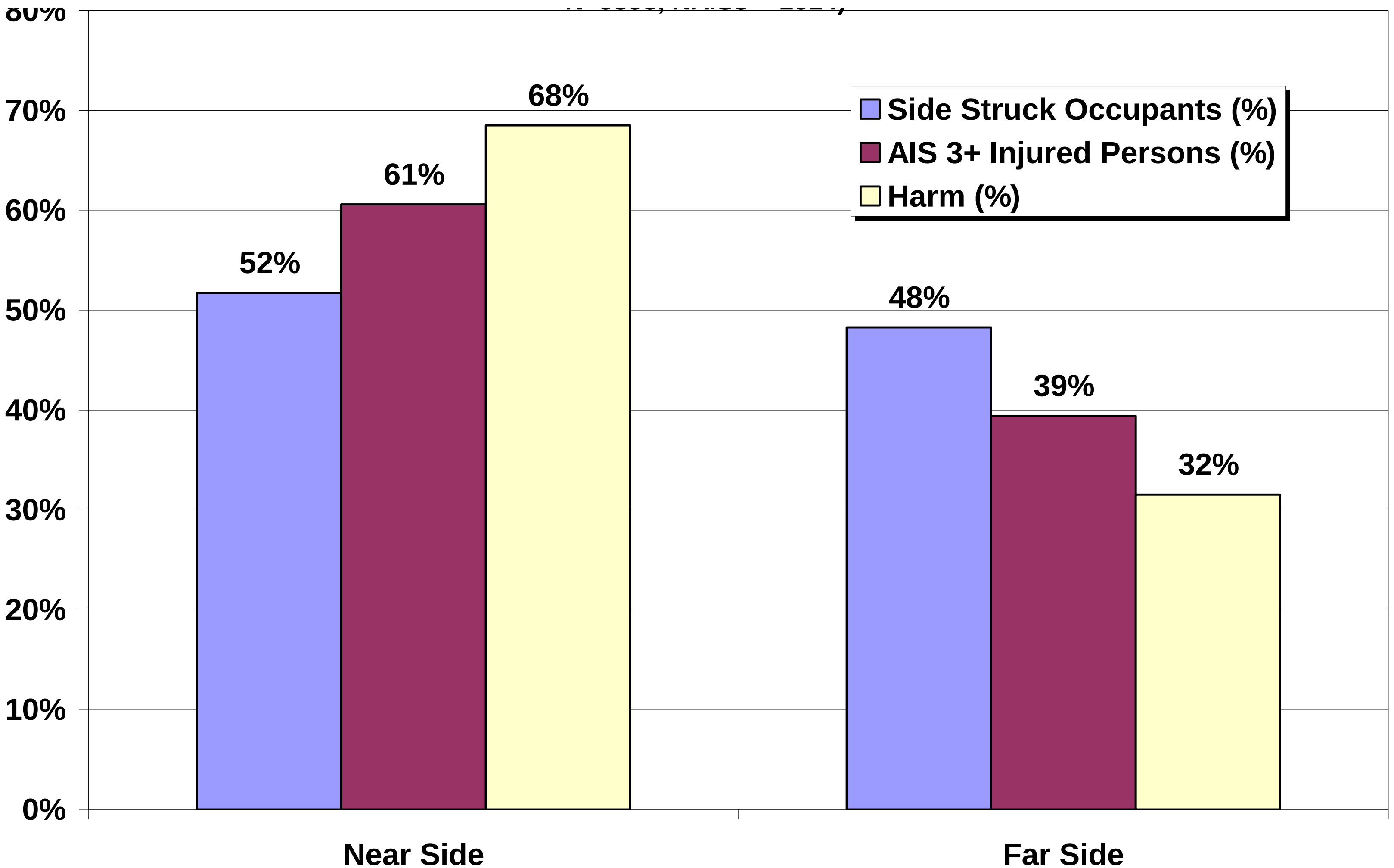
# Far Side Cases:

**NASS 1992-2002**

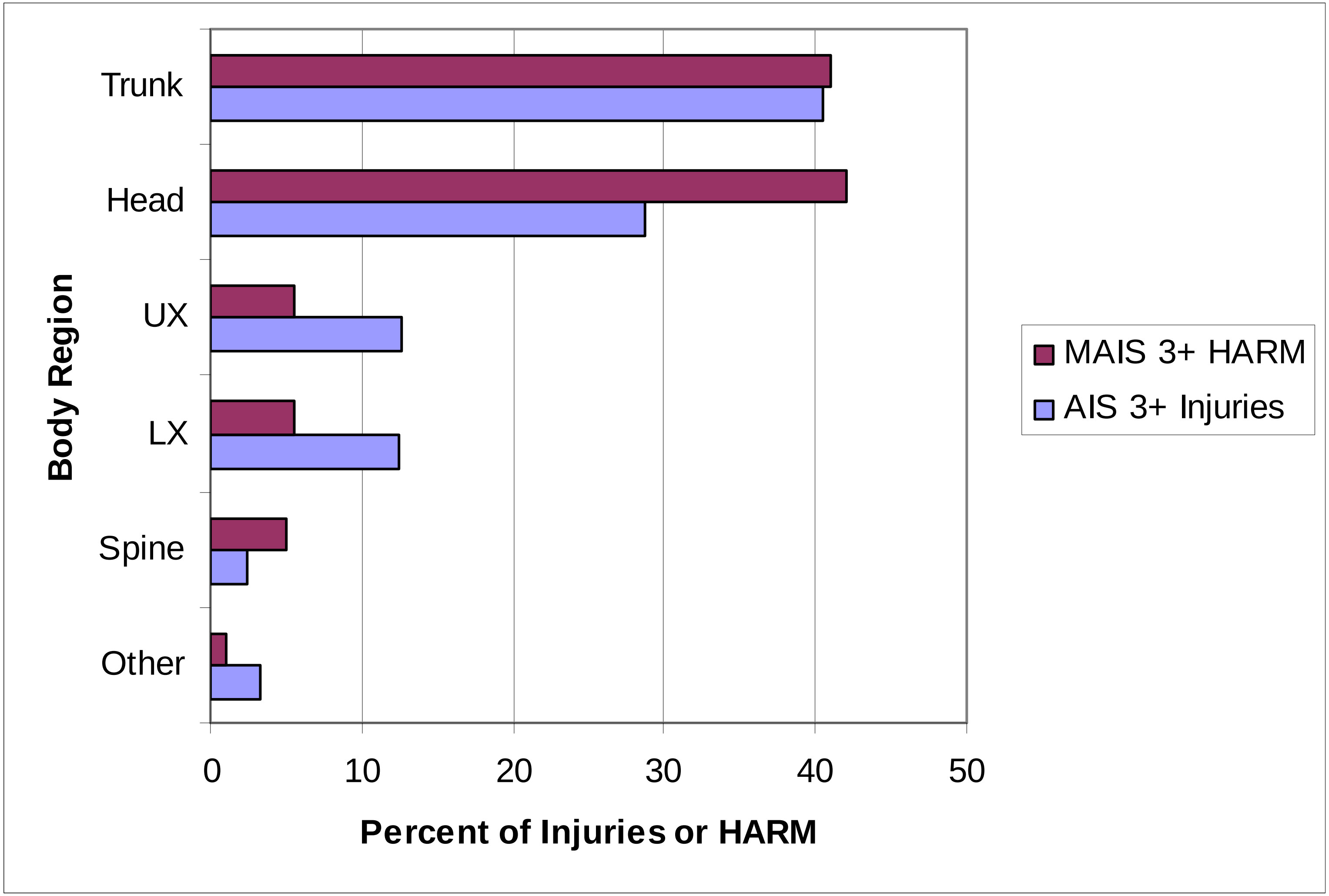
| | Weighted | Unweighted |
|---|---|---|
| Occupants | 2,386,633 | 4,518 |
| MAIS3+ Occupants | 21,982 | 281 |
| Fatalities | 5,175 | 80 |
| Harm (fatality normalized ) | 20,492 | |

# Near vs. Far Side
# 3 Pt Belted Occupants Only

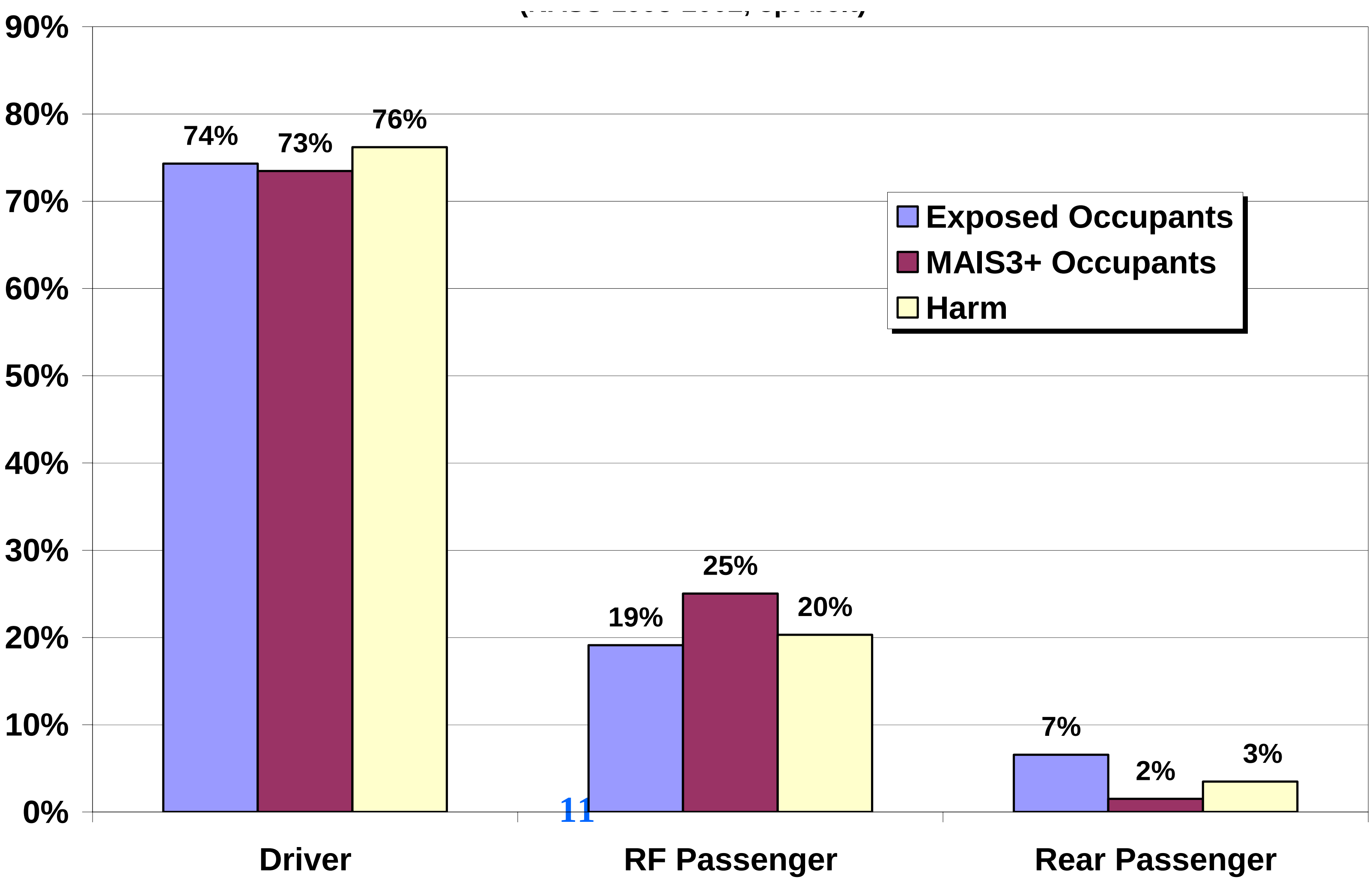
NASS/CDS 1997-2002 (MY1997+)



# Far-side Injuries & HARM by Body Region



# Far-Side Injuries by Occupant Seating Location



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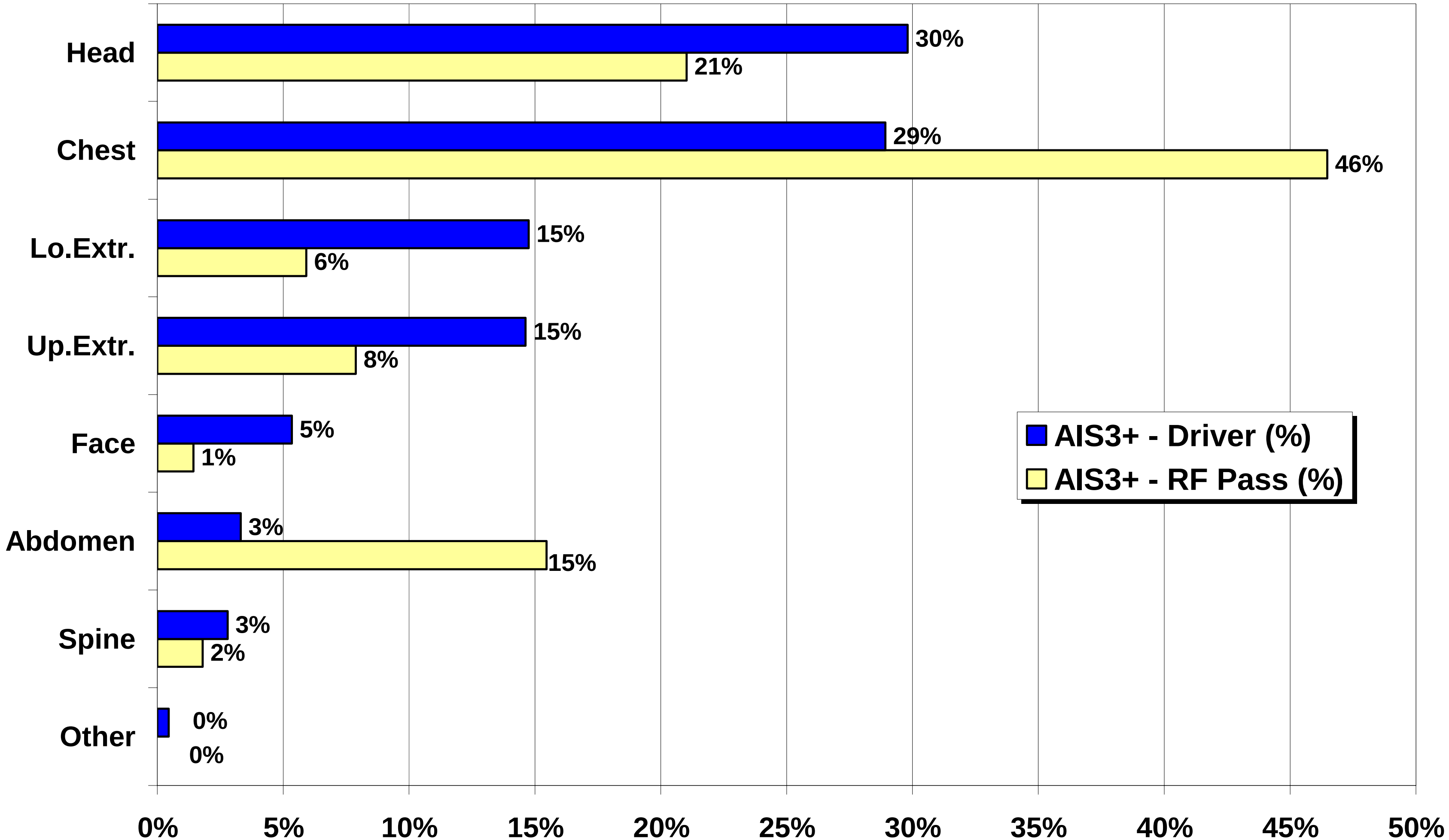
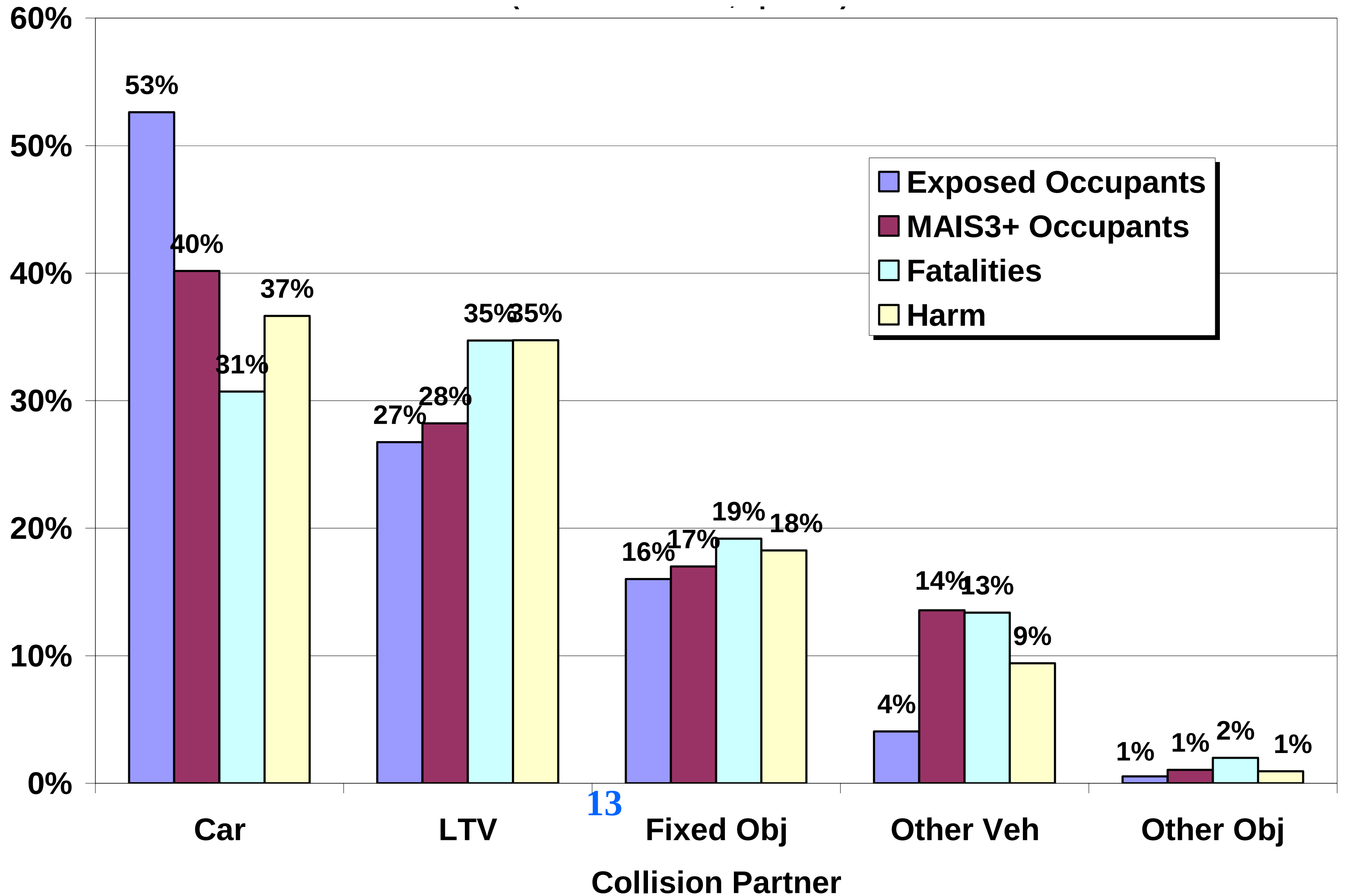


# Far-Side Injuries by Collision Partner



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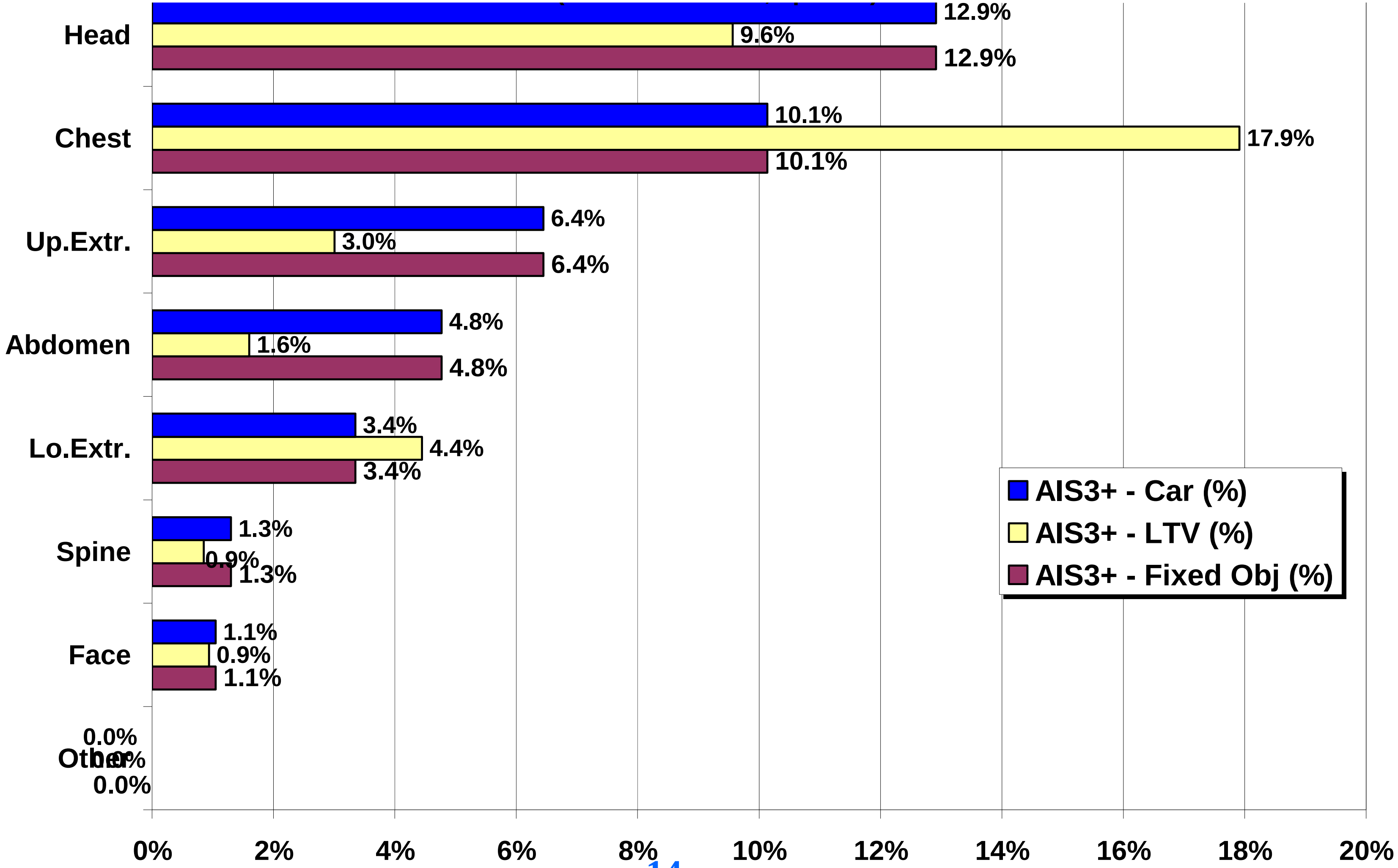
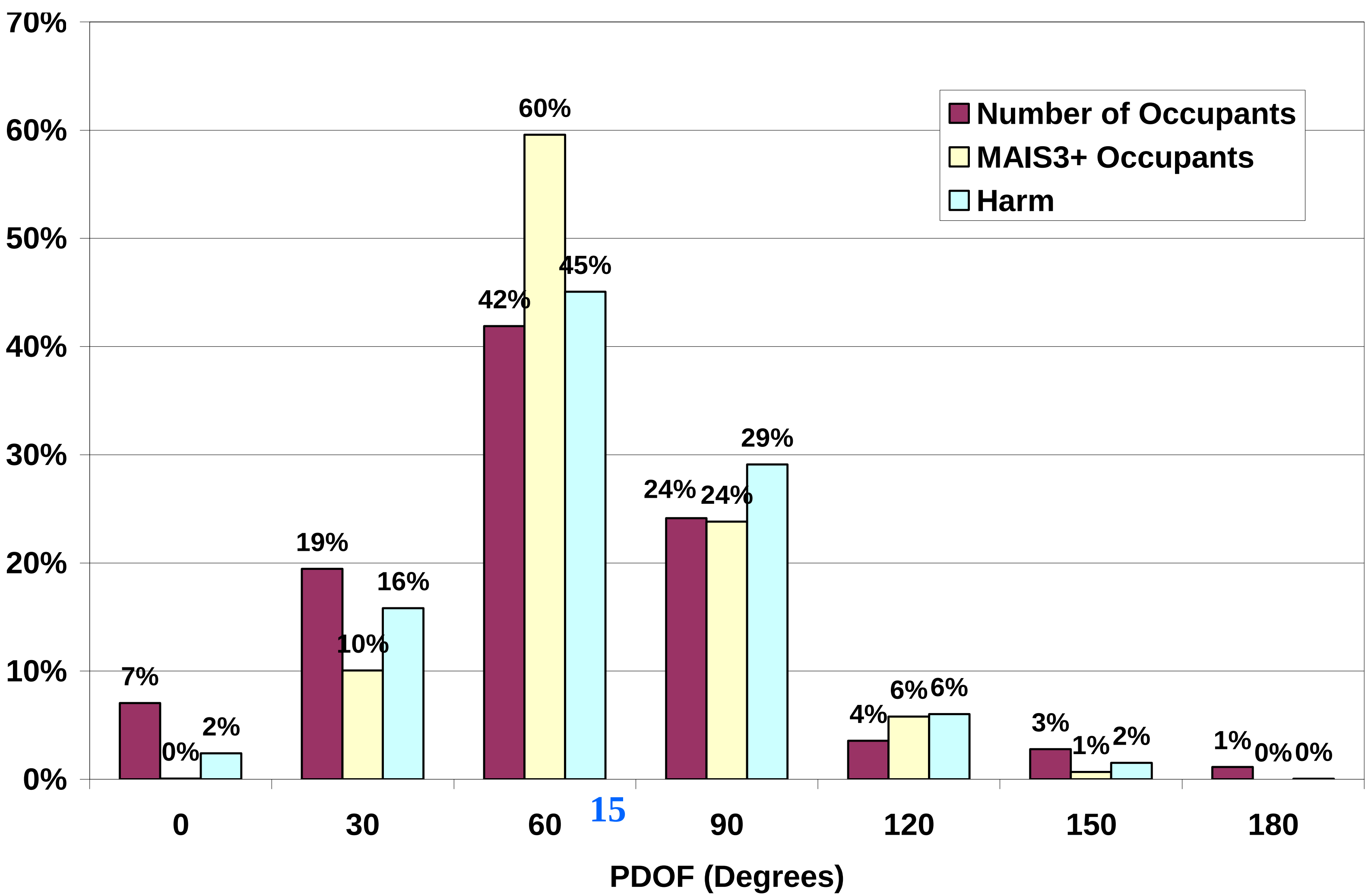
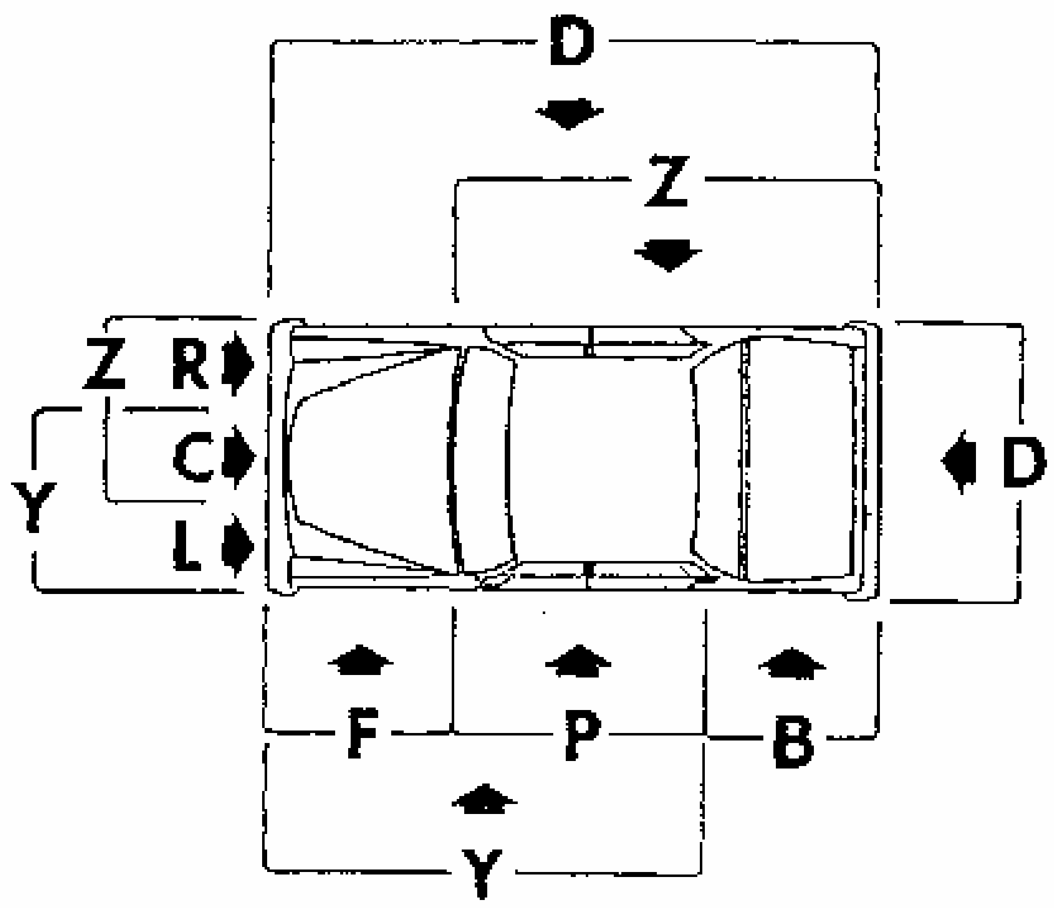


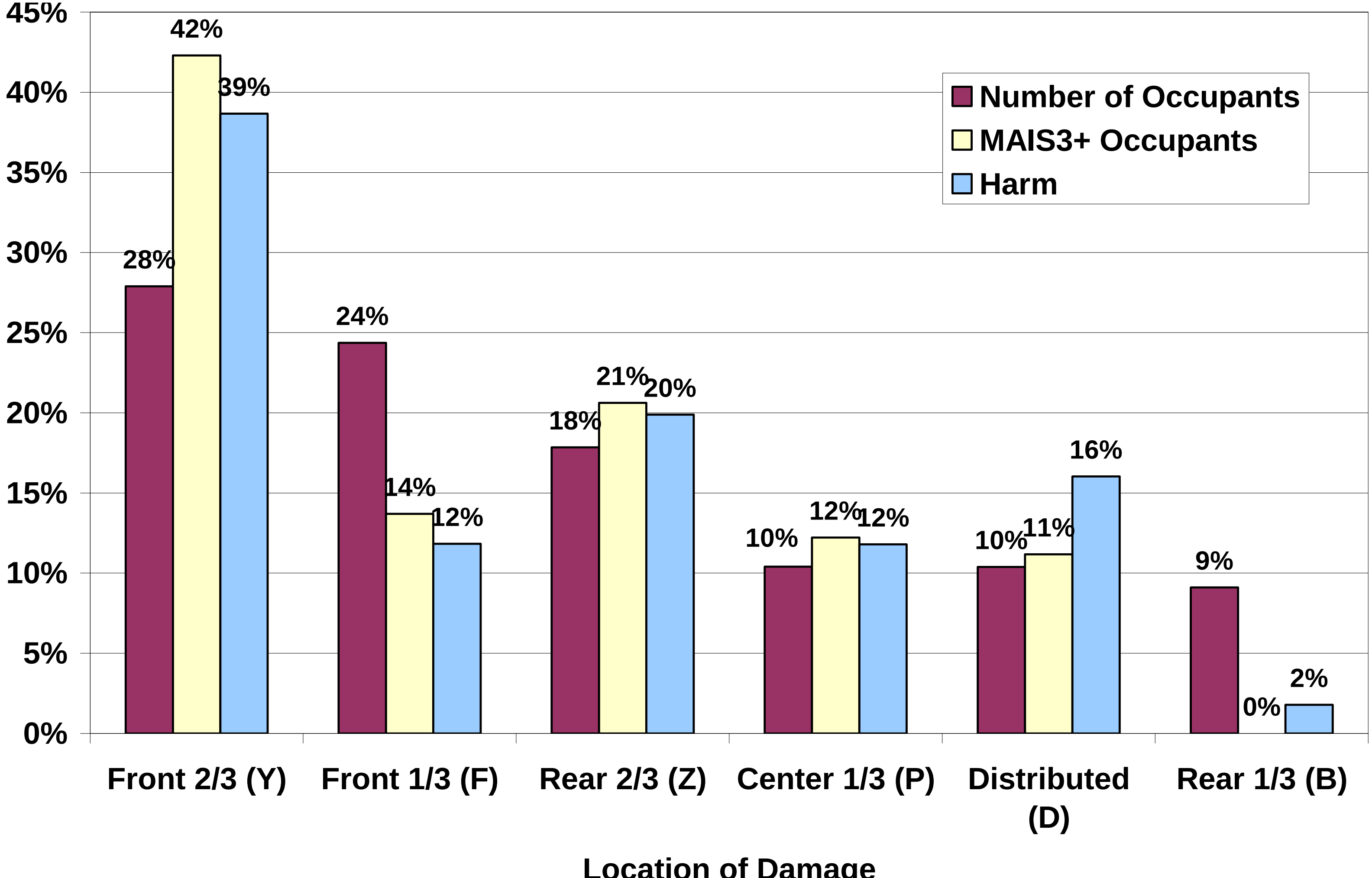
# Far-Side Injuries by Crash Direction (PDOF)



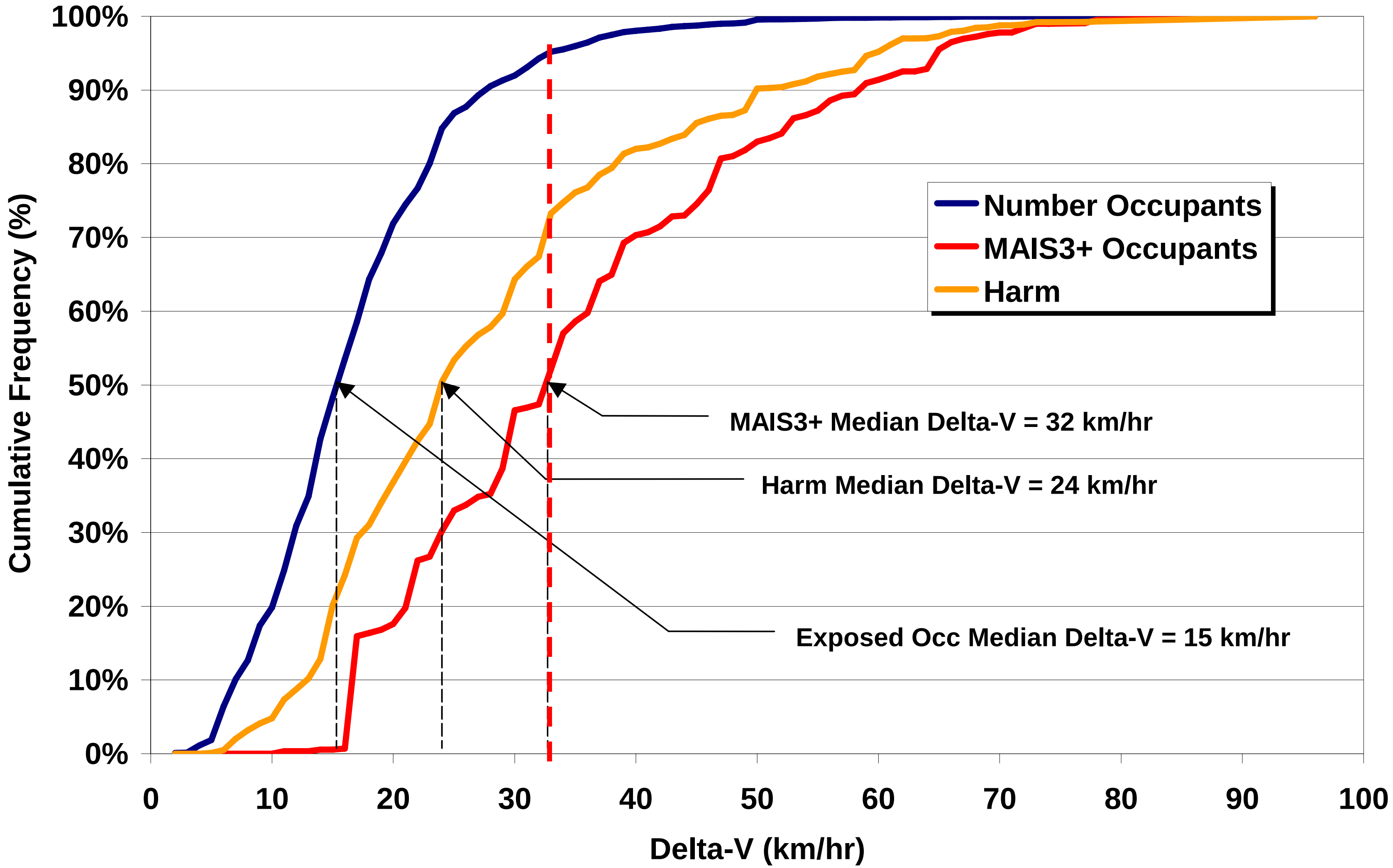
# Side Crash Damage Locations



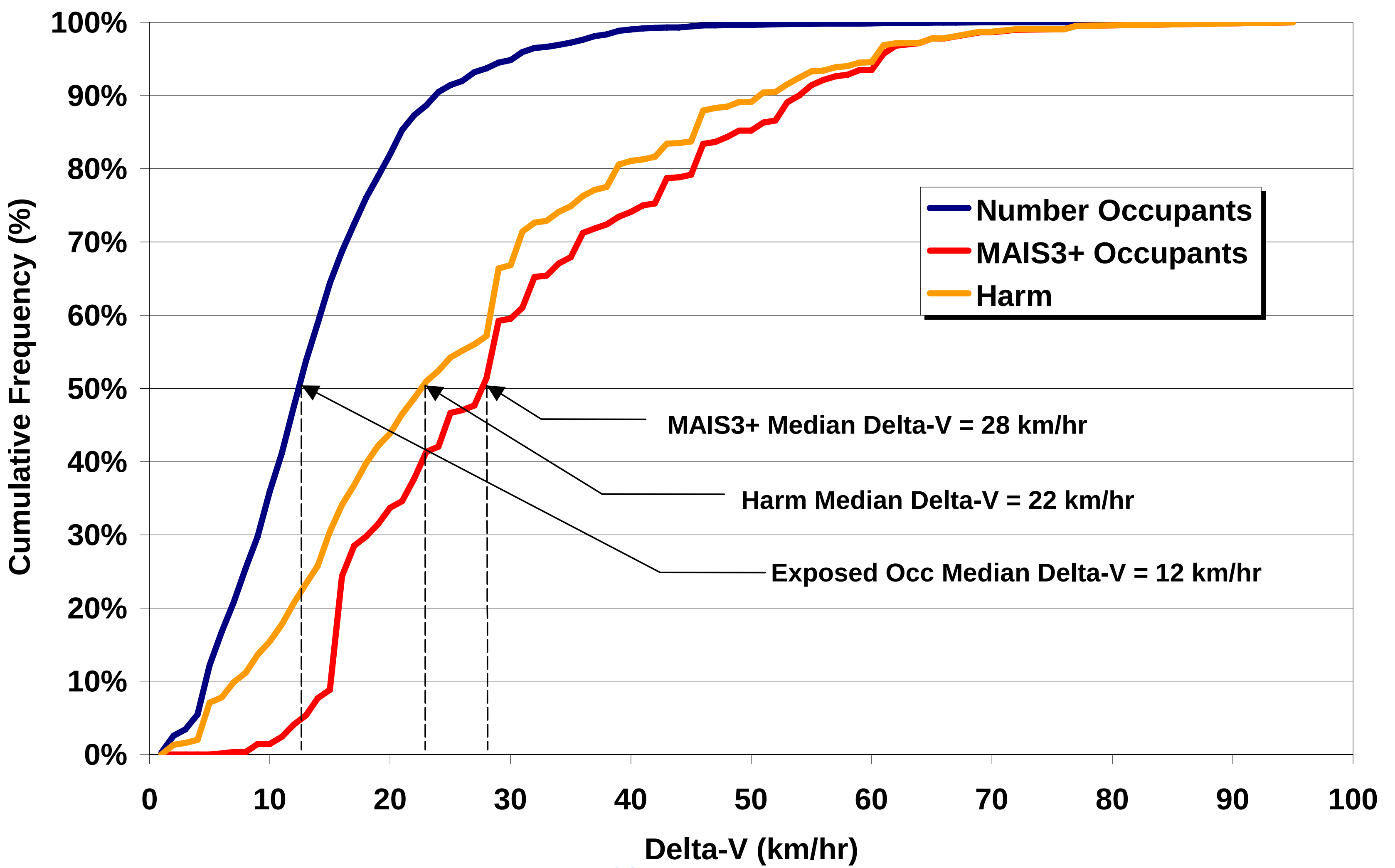
# Far-Side Injuries by Location of Impact (SHL)



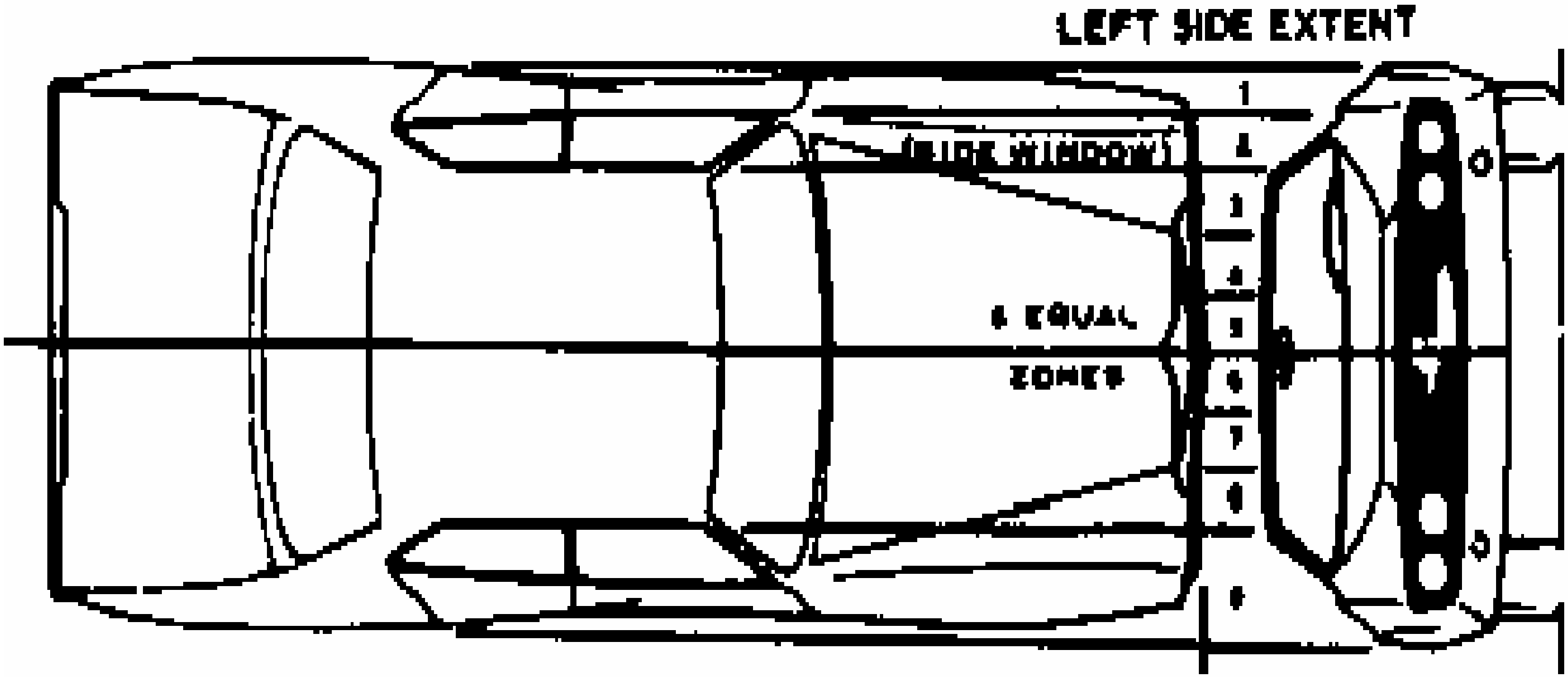
# Far-Side Injuries by Total Delta-V



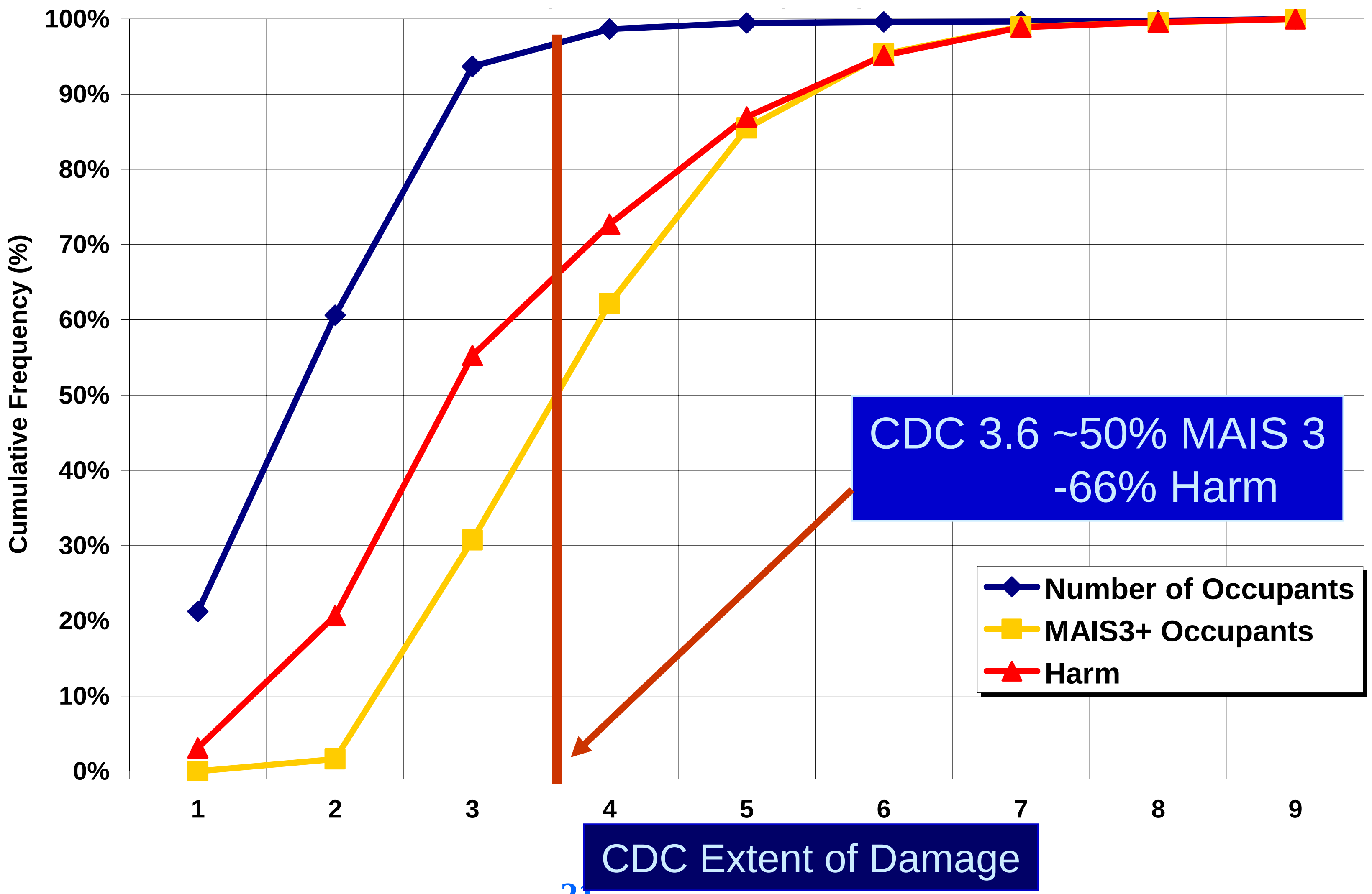
# Far-Side Injuries by Lateral Delta-V



# Measuring Damage Extent



# Far-Side Injuries by Collision Deformation



# Summary of Crash Factors

Crash Direction:

- 60% of MAIS 3+ occupants at 60 degrees
- 24% of MAIS 3+ occupants at 90 degrees

Body Region Injured:

- 40% of MAIS 3+ HARM is to the **Trunk**
- 40% of MAIS 3+ HARM is to the **Head**

CCD Extent of Damage – 3.6

Delta-V - 28 kph

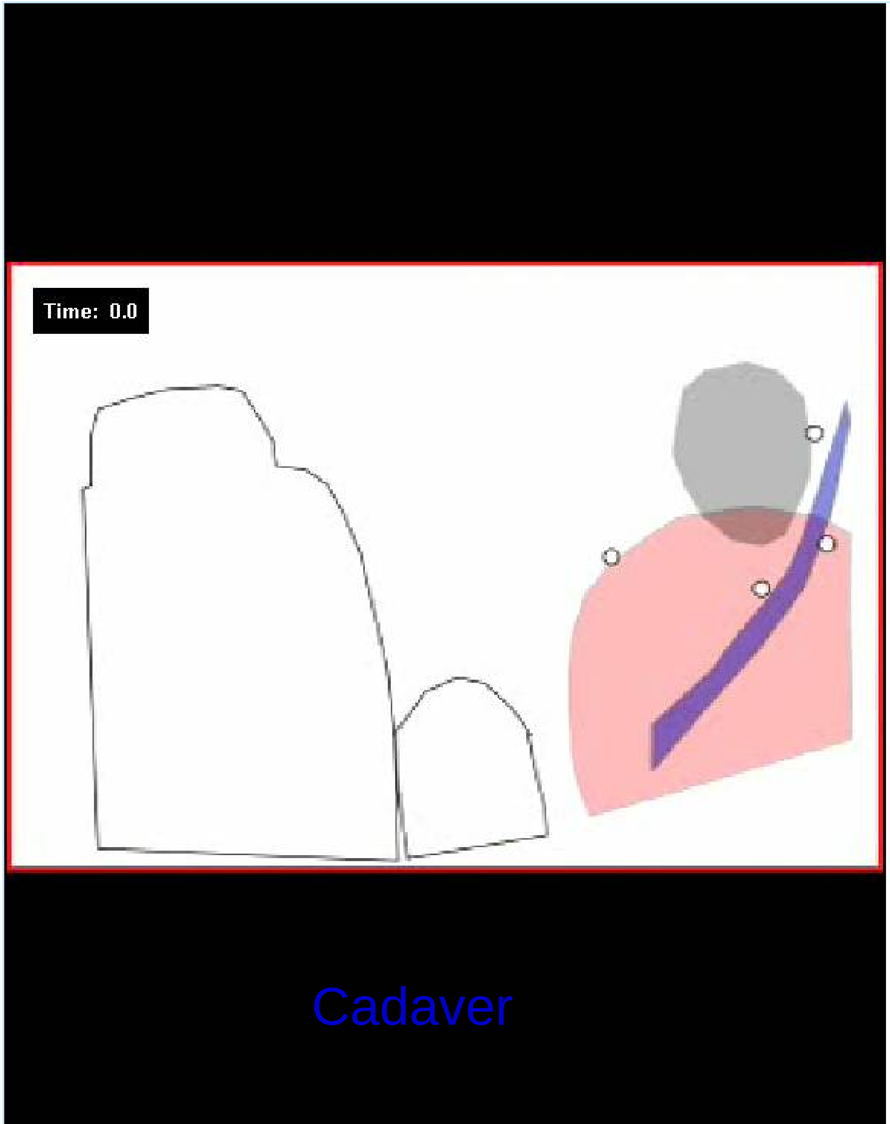
# Most Frequent Conditions for Far-side MAIS 3+ Injured Occupants

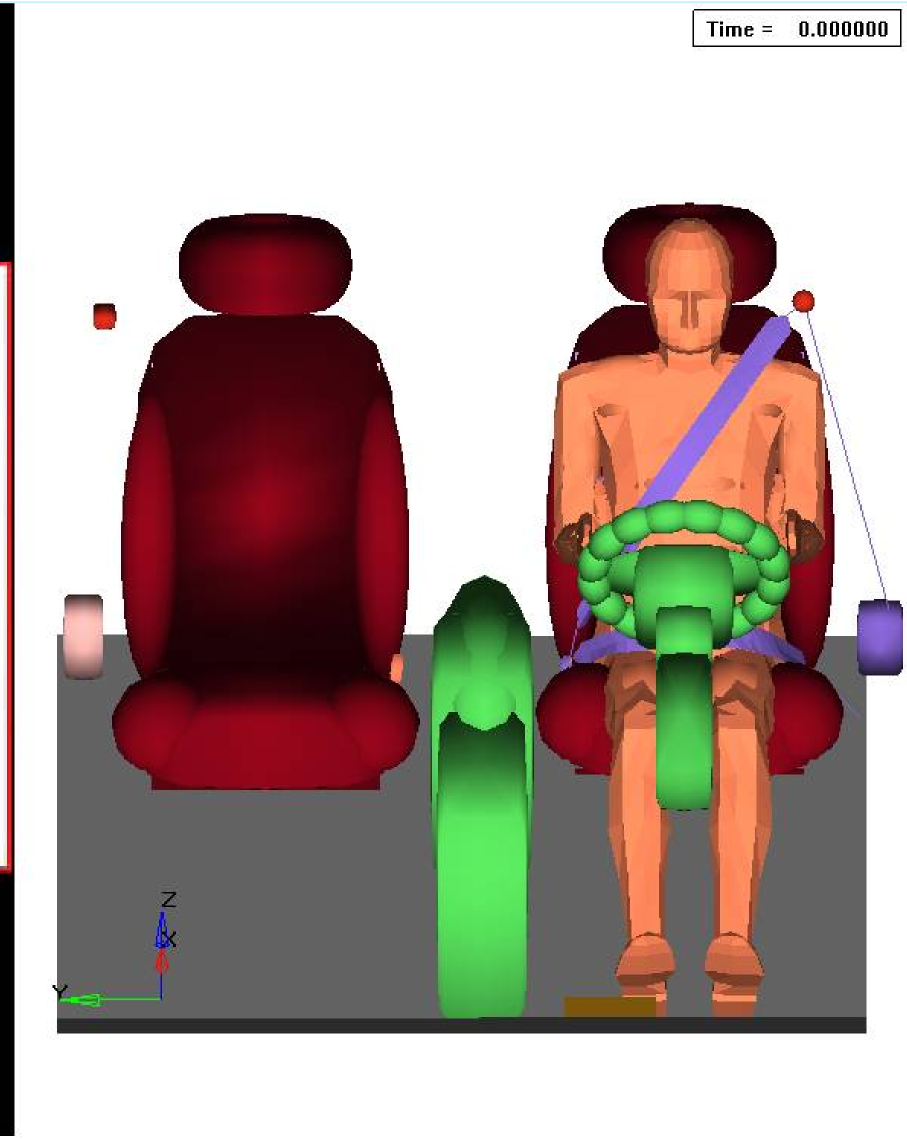
- Drivers (75%)
- Vehicle-to-vehicle Crashes (70%)
- 60º Crash (50+%); 90ºCrash (25%)
- Y Damage (40%); Z Damage (20%)
- Collision Partner:
  - Pass car -40%; LTV-28%; Fixed Obj- 10%
- Median Delta-V - 32 kph; Mean CDC - 3.6
- Median Lateral Delta-V - 28 kph

# Pre-test Occupant Modeling

- Validate MADYMO human model against cadaver test already conducted
- Compare MADYMO human and hybrid III models in far-side crashes
- Evaluate the geometry of the cadaver test set-up and the applied crash pulse

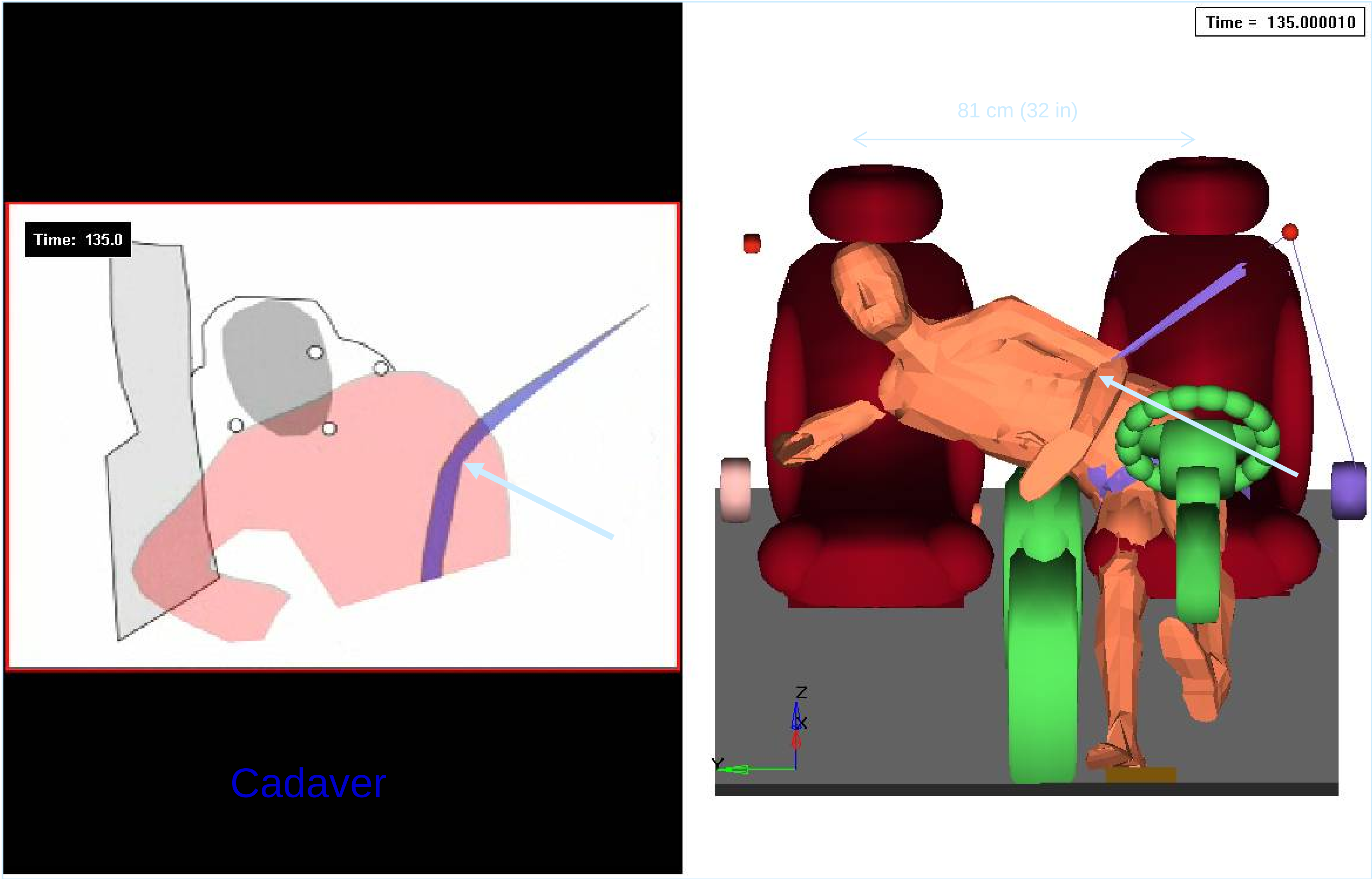
# Cadaver vs. Human MADYMO




0 ms

# Cadaver vs. Human MADYMO

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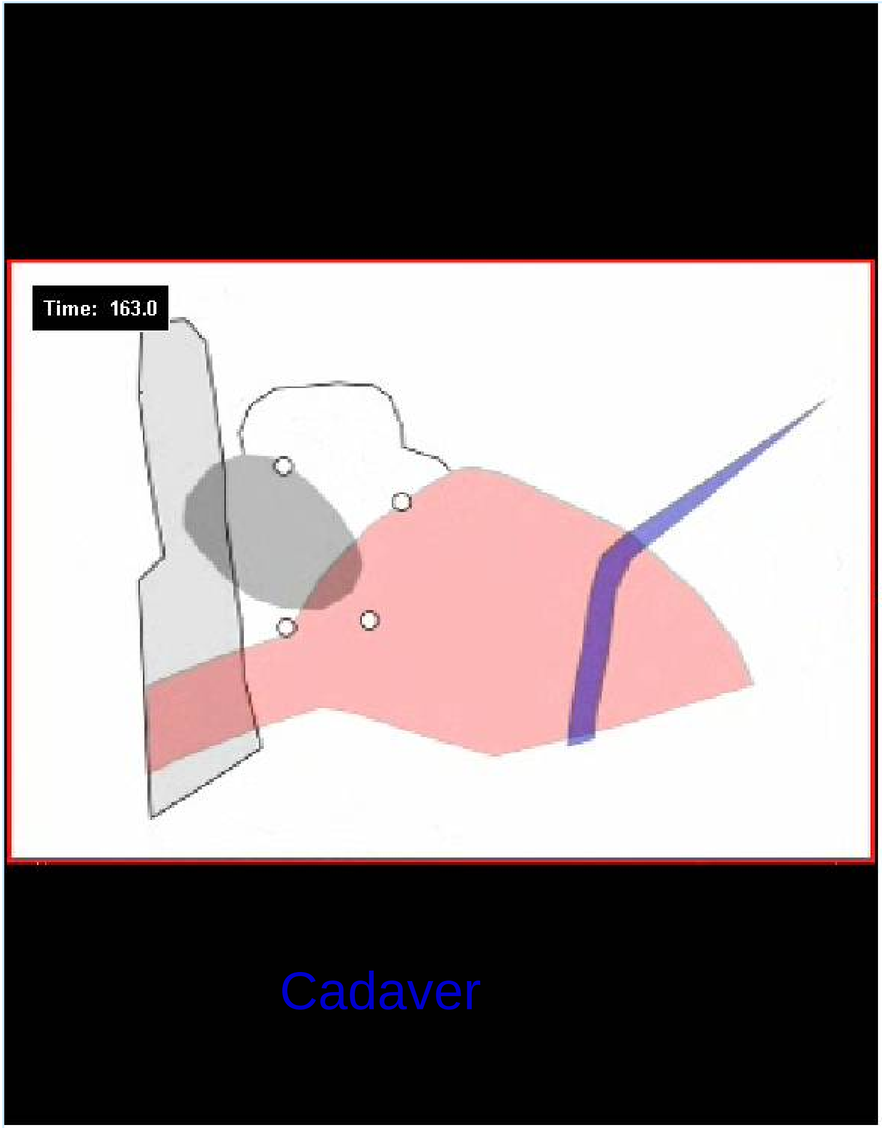
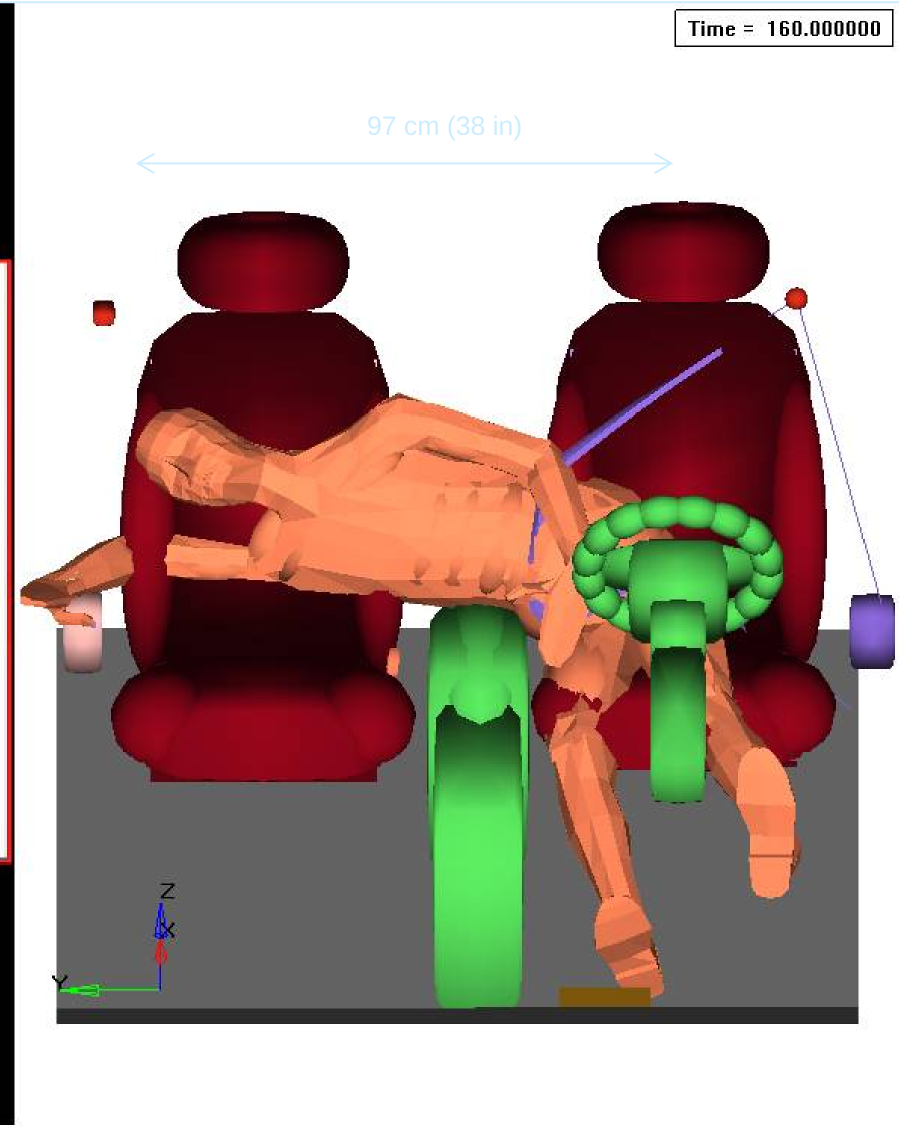
135 ms

# Cadaver vs. Human MADYMO



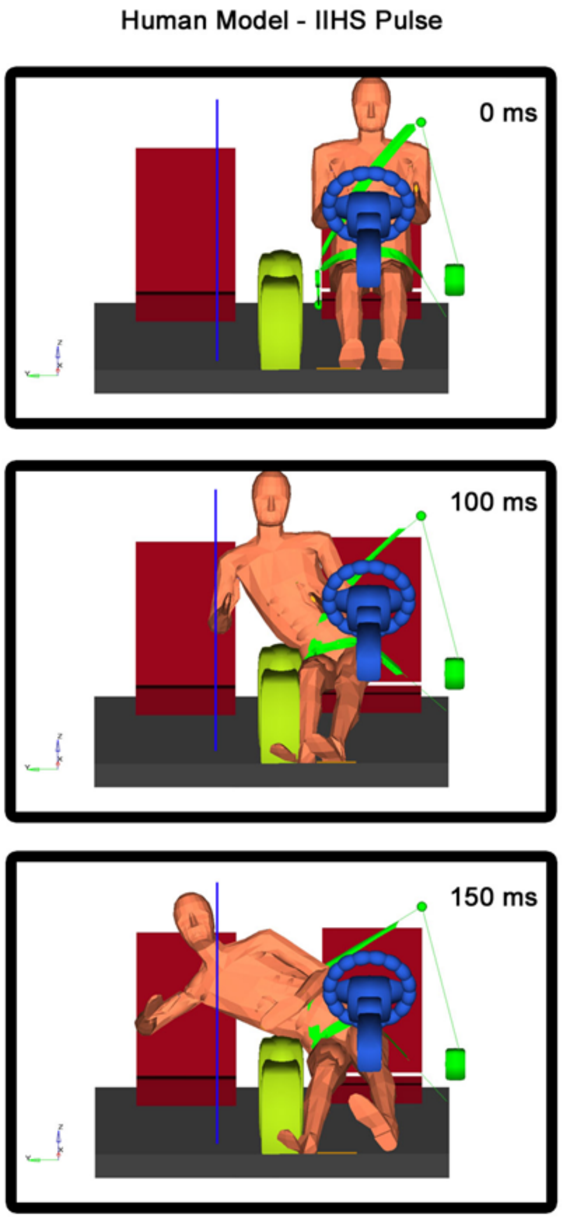

160 ms

# Observations

MADYMO human model does reasonable job of predicting cadaver motion.

Cadaver retains the shoulder belt better than the model

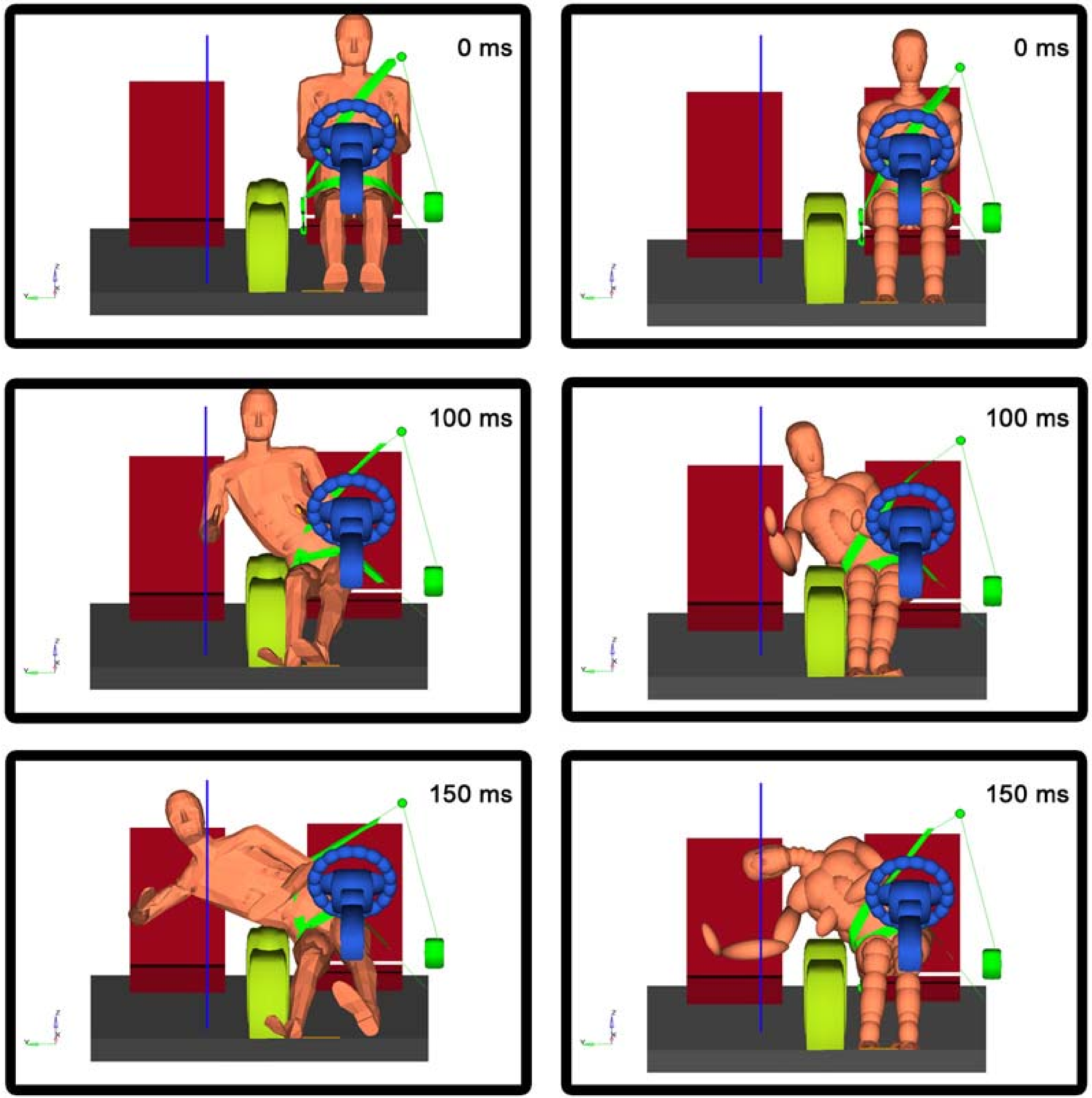
# MADYMO Human Model with 3.6 CDC Intrusion Displayed



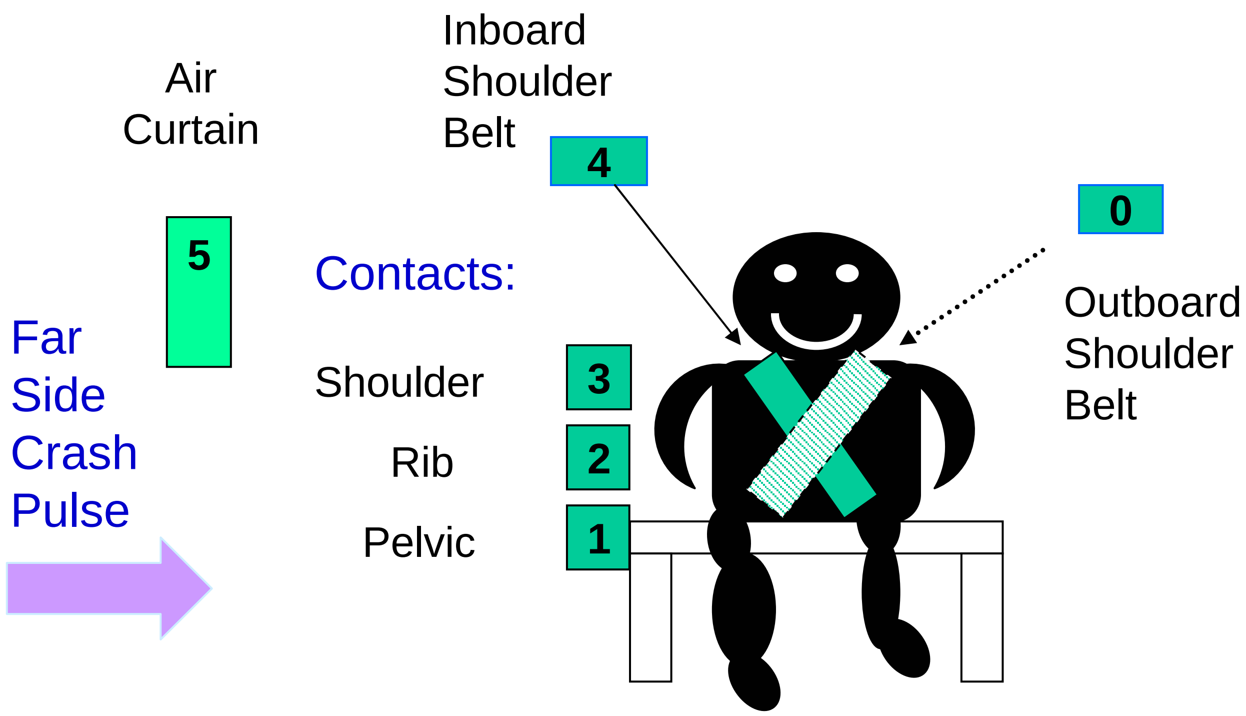
**Hybrid III Dummy vs Human Model**

**Sid 2S, Eurosid S impact dummies were no better**

Human Facet MADYMO Model vs Hybrid III MADYMO Model - IIHS Pulse



# Dummy Measurement Challenges: Possible Far-side Countermeasures



# New Injury Measures Needed

Corotid artery injury

Neck skeletal injury in side impact

T-12 injury

Lumbar spinal injury

The usual side impact injury measures

# Conclusions

- Crash configuratrion for 50% far-side MAIS 3+F belted occupants in planar crashes
  - Delta-V -28 kph
  - Extent of Damage – 3.6 CDC
  - Crash direction 60º (60%)
- IIHS barrier at higher delta-V is best available test device
- MADYMO human facet model is good evaluation device
- Improved dummy needed

# Conclusions

- Target MAIS 3+F population for far-side belted planar crashes - 2,244
- Target MAIS 3+F population for all far-side crashes - 17,194
- Target MAIS 3+F population for all near-side planar crashes - 14,625

# Conclusion

Far-side occupant protection offers large opportunities for injury and fatality reduction

# Acknowledgement

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Questions?



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