Use of NASS CDS Data in Oblique Pole Side Impact Rulemaking SAE 2010

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Type of NASS Data

NASS – National Automotive Sampling System

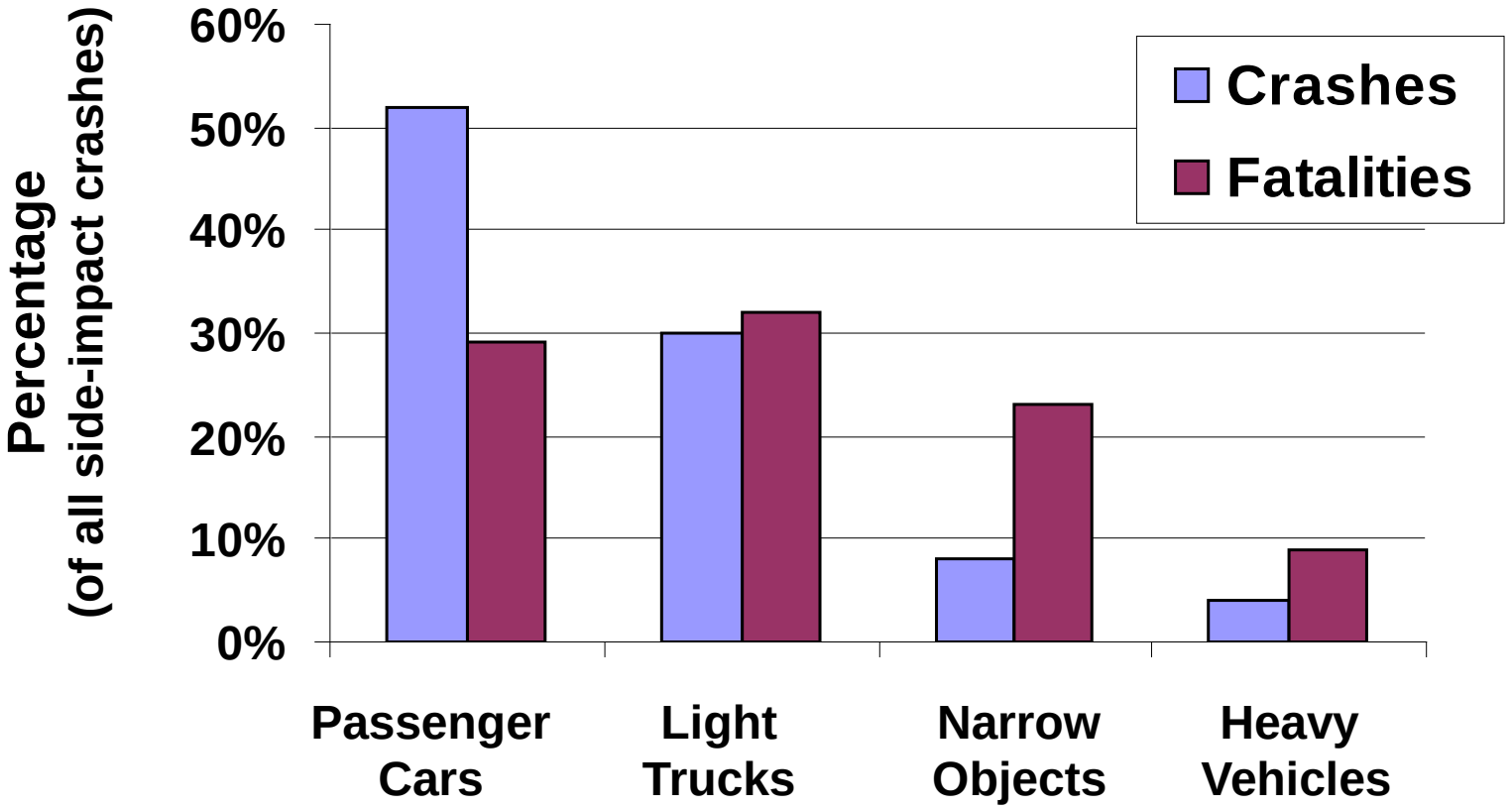
- Crashworthiness Data System (CDS):
  - Has detailed data on a representative, random sample of 4,000 – 5,000 tow-away crashes annually. Includes some with no injury, minor, serious and fatal injuries.
  - Trained crash investigators obtain data from crash site, vehicles involved, police report, and hospital records.

Use of NASS CDS Data

NASS CDS data related to occupant in Side Impacts

- What we have in CDS:
  - Collision partner – vehicle or fixed objects including pole or tree
  - Injured body location
  - Belt use
  - Complete & partial ejections
  - Degree of injury
  - Injured occupant size
  - Delta-V in side impacts

Distribution of Side-impact Crashes
by Collision Partner



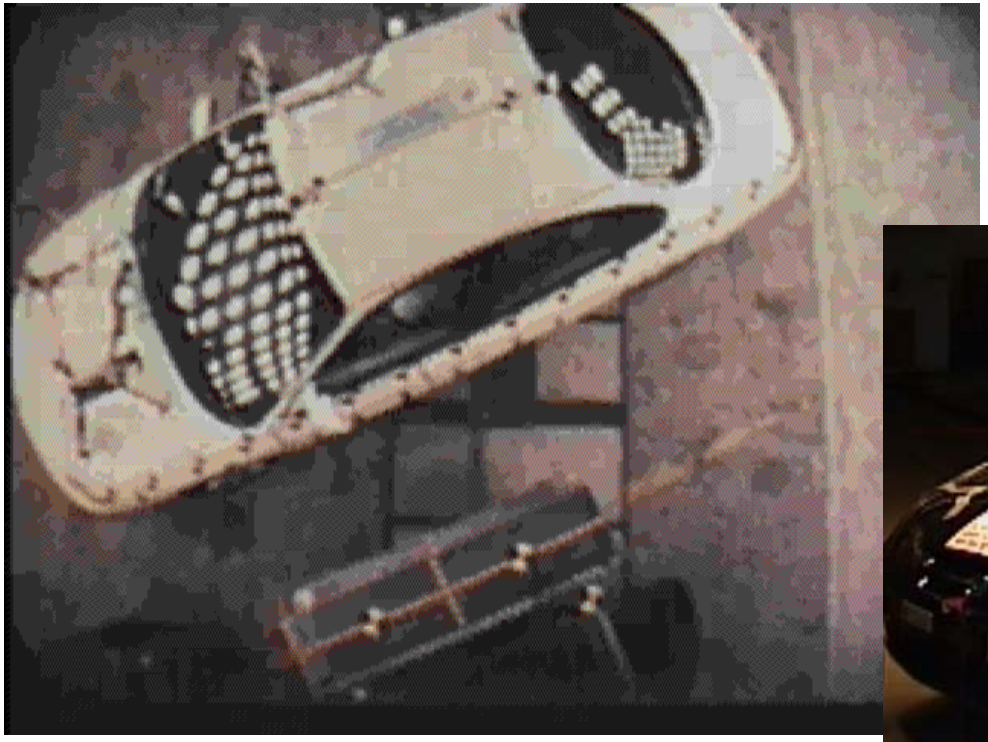
Source: 1995-2001 NASS/CDS Nearside Impacts
Struck Vehicle MY 95+(Equivalent Fatalities)

2000 – 2004 Annualized NASS CDS Data* Used by Injured Body Region

Body Region	Vehicle-to-Pole/tree		Vehicle-to-vehicle		Total, %
	Injury**	Fatal	Injury**	Fatal	
Head	266	298	903	651	**25.8%**
Chest	419	46	2,809	733	48.9%
Abdomen	0	0	128	146	3.3%
Pelvis	0	0	288	67	4.3%
Others	315	28	763	342	17.7%
Total	1,000	372	4,891	1,939	100.0%

- *delta-V of 12 -25 mph,
- **AIS 3 -5 serious injuries.

FMVSS No. 214 MDB
Dynamic Crash Test

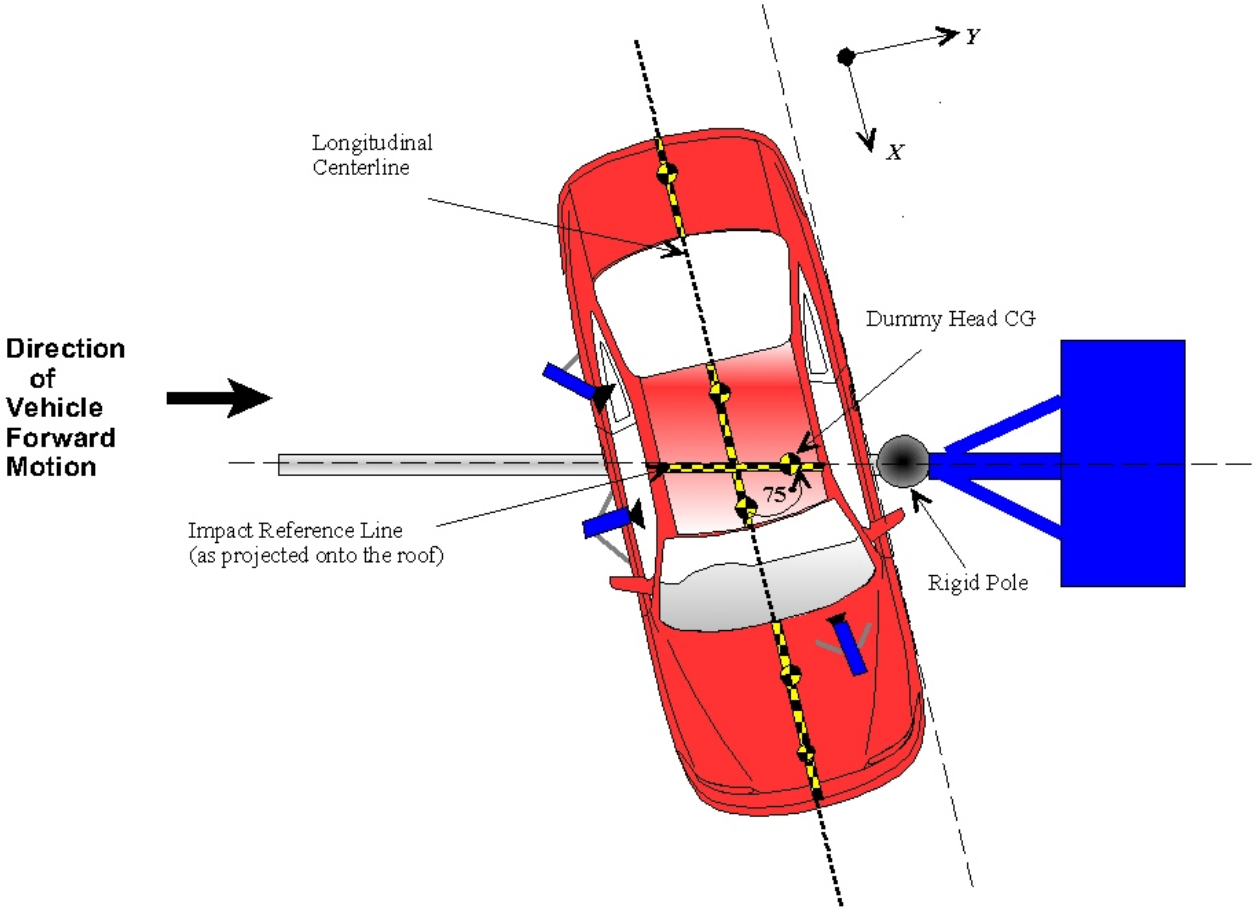


Why do we need a pole test?

- NASS CDS data show that head injuries are serious safety problem
  - However, current Moving Deformable Barrier does not adequately address this safety problem
  - With the pole test, vehicles would need to be equipped with a countermeasure to protect the head

FMVSS No. 214 Oblique Pole Dynamic Crash Test

Oblique Pole Test



Side impact test injury requirements

- Injury criteria

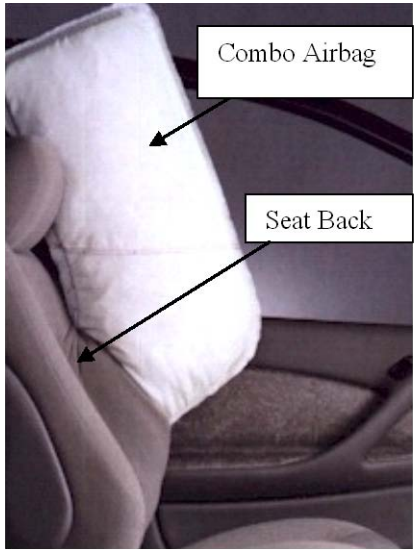
Body region	5th female test dummy (SID-IIs)	50th male test dummy (ES-2re)
Head	1,000 HIC	1,000 HIC
Chest	82 g lower spine acceleration	44 mm deflection
Abdomen	N/A	2.5 kN
Pelvis	5.5 kN	6.0 kN

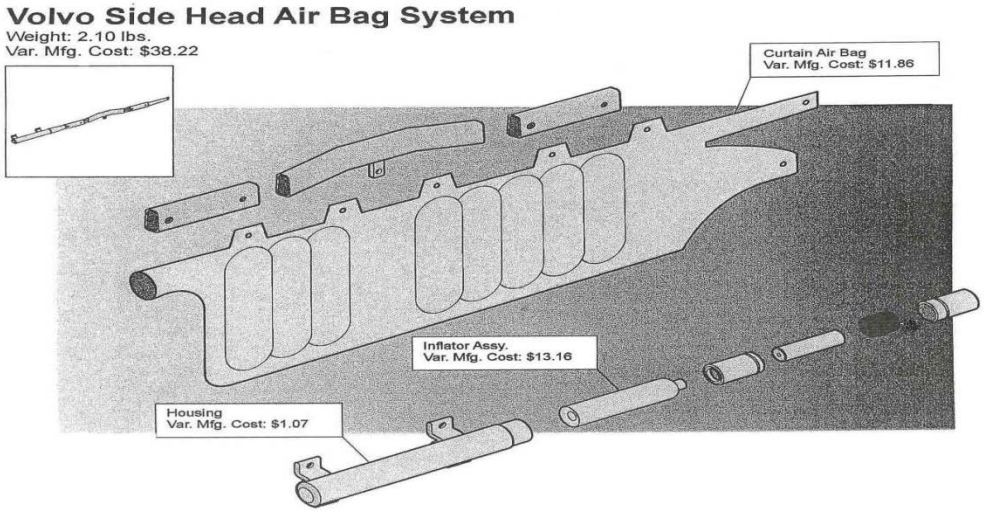
How do manufacturers meet the pole test requirements?

- Head requirement
  - Installed head air bags
- Chest
  - Strengthen vehicle's side structure or/and
  - Install thorax air bags
- Abdomen
  - Strengthen vehicle side structure or/and
  - Install thorax air bags
- Pelvis
  - Strengthen vehicle side structure

Air Bags Designed for Side Impacts

- There are three types for head protection
  - Window Curtain
  - Tubing
  - Combination – head and thorax protection





Air Bags Designed for Side Impacts (continued)

- There are two types for thorax protection
  - Thorax air bag
  - Combination air bag

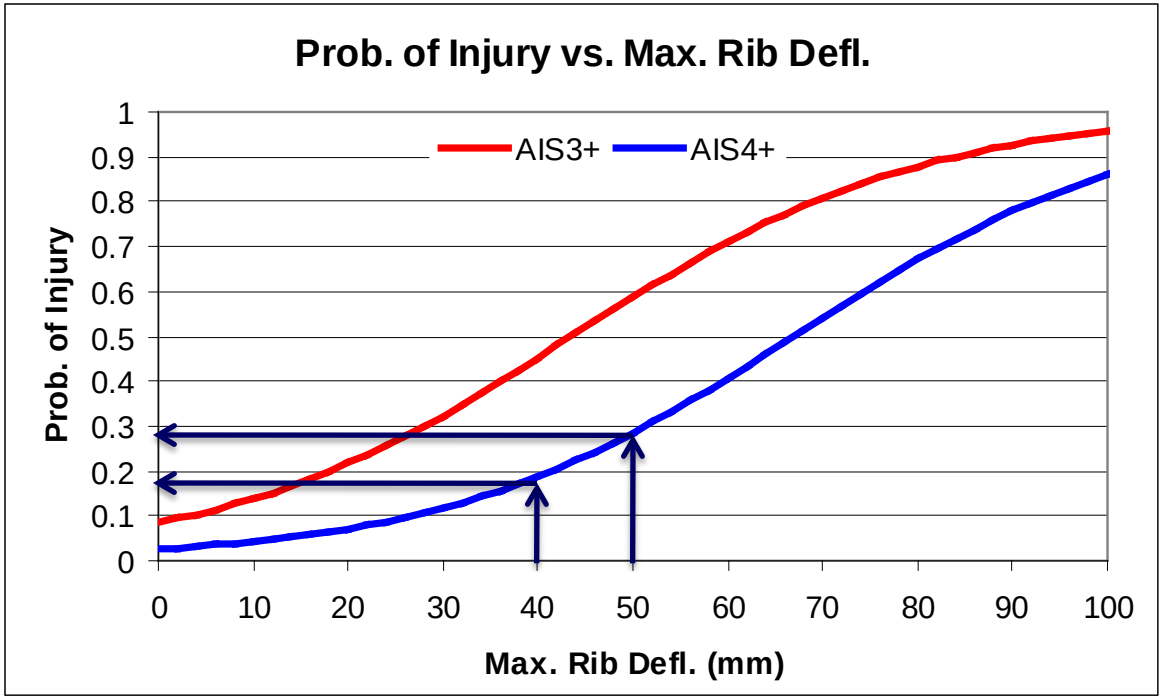
Pole test results with and without side air bag

- Test results

Body region	5th female test dummy		50th male test dummy	
Side air bag	W/o	With	W/o	With
Head	11,534 HIC	508 HIC	14,292 HIC	504 HIC
Chest	114 g	63 g	41 mm	38 mm
Abdomen	N/A	N/A	3.7 kN	1.3 kN
Pelvis	7.8 kN	6.9 kN	2.5 kN	2.3 kN

Effectiveness of Side Air Bag

- Based on risk of injury
- For example, probability of AIS 3+ and AIS 4+ injury as function of maximum rib deflection of the 50th male test dummy

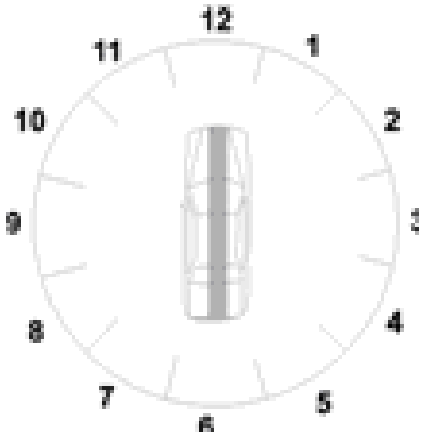


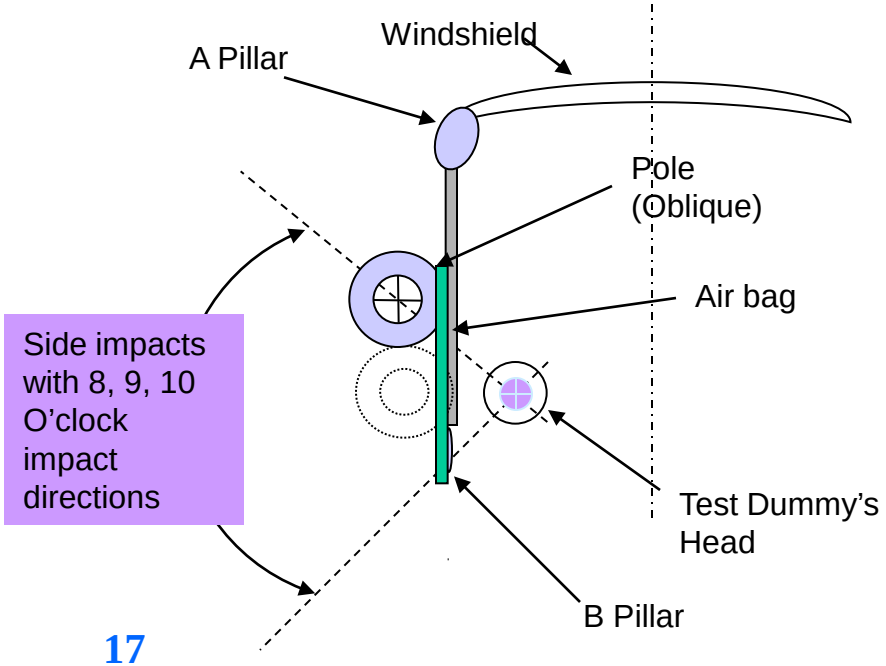
Characteristics of side air bag system meeting oblique pole test requirements

- Not necessarily effective in rollovers
  - No rollover sensors
- Relatively narrow range of operation
  - Lower range of 12 mph and Upper range of 25 mph
    - Based on side crash test results performed at different impact speeds
- Assumed side air bags are not wide enough to
  - Prevent complete ejections, and
  - Protect children from partial or complete ejections

Characteristics of side air bag system meeting oblique pole test requirements (continued)

- Effective for side impacts with 2, 3, 4 O'clock and 8, 9, 10 O'clock impact directions
  - Based on the test configuration





Estimated benefits with side air bags

- Based on characteristics of side air bags, some side crashes were excluded from NASS data, such as:
  - Rollovers followed by side impacts
  - Delta-V's lower than 12 mph and higher than 25 mph
  - Complete ejections
  - Children
  - Occupants in rear seat
- Side air bag effectiveness:
  - Based on pole test results and injury curves
- Estimated benefits:
  - Apply the effectiveness to the target population
  - Estimated 311 lives and 361 serious injuries would be prevented when all light vehicles meet the test requirements

Summary of How We used NASS CDS for Side Impact Rule Making