PSI-01-16

Calculating Benefits for Oblique Pole Side Impact Rulemaking

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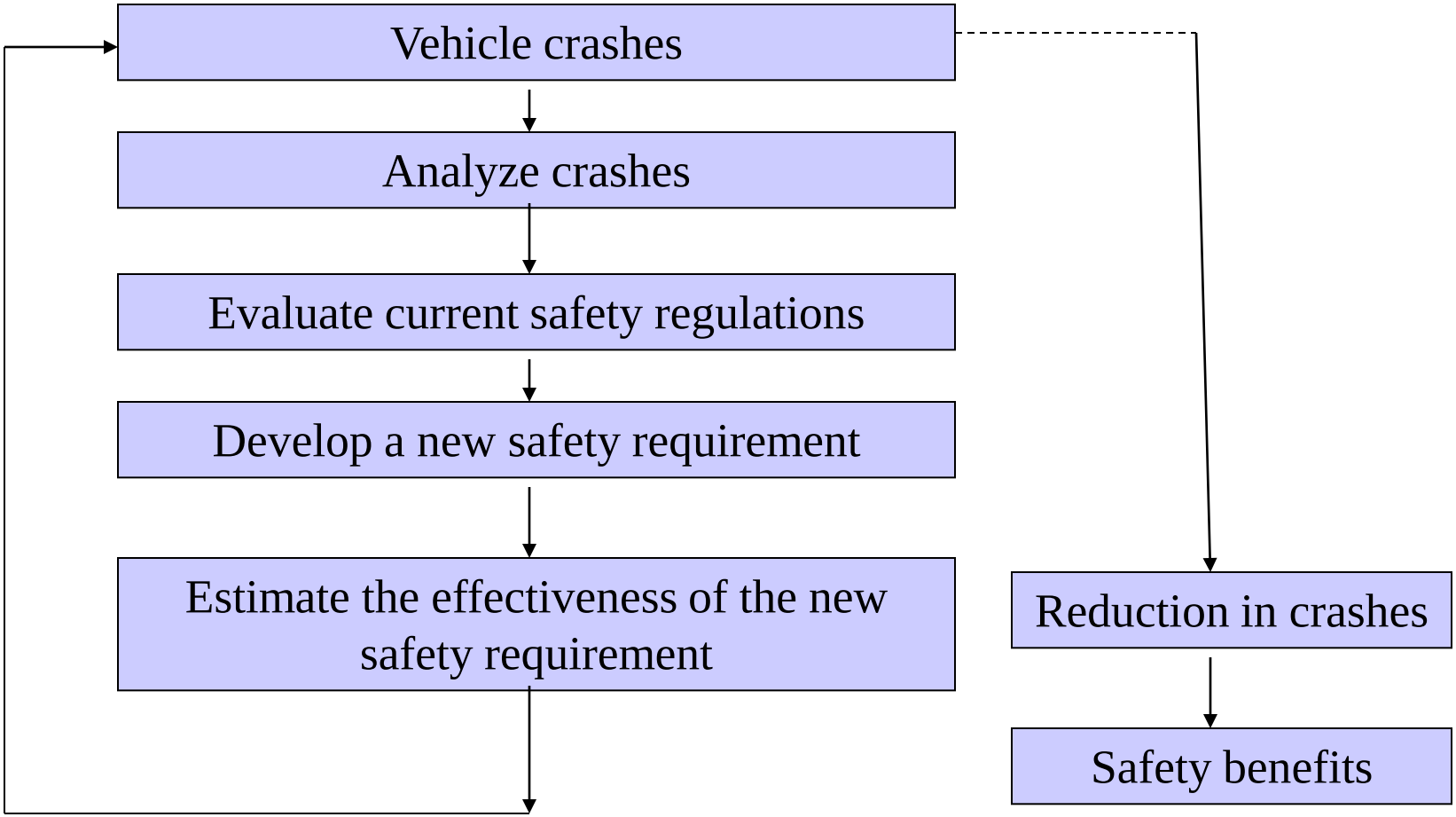
Process for Calculating Benefits



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VEHICLE CRASHES

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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.**

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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

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ANALYZE CRASHES

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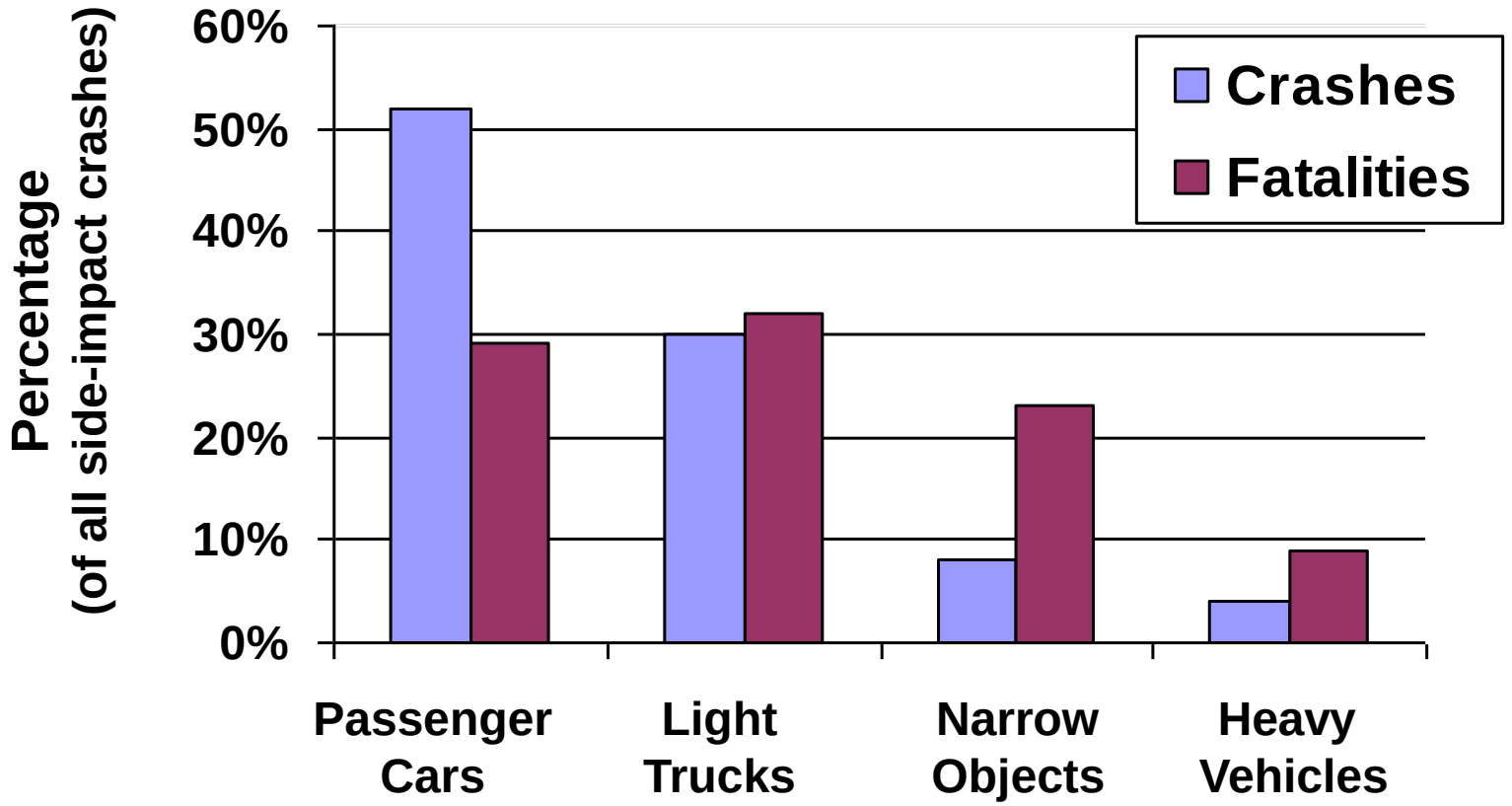
Distribution of Side-impact Crashes by Collision Partner



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

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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%

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EVALUATE CURRENT SAFETY REGULATIONS

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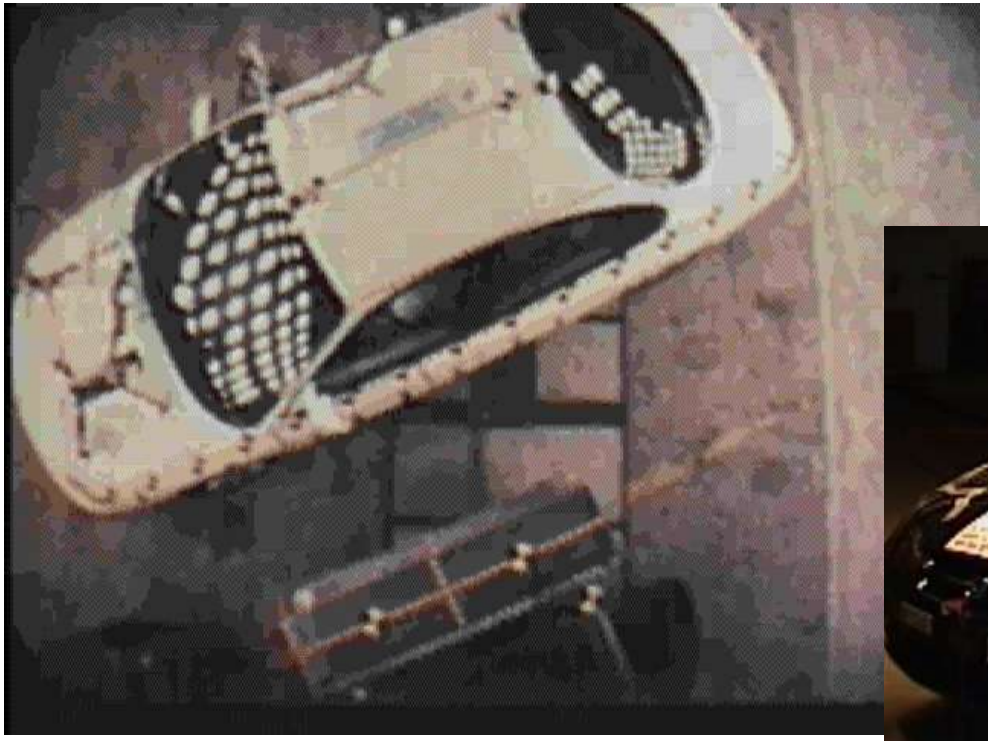
FMVSS No. 214 MDB
Dynamic Crash Test



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DEVELOP NEW SAFETY REQUIREMENT

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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, chest, and pelvis areas**

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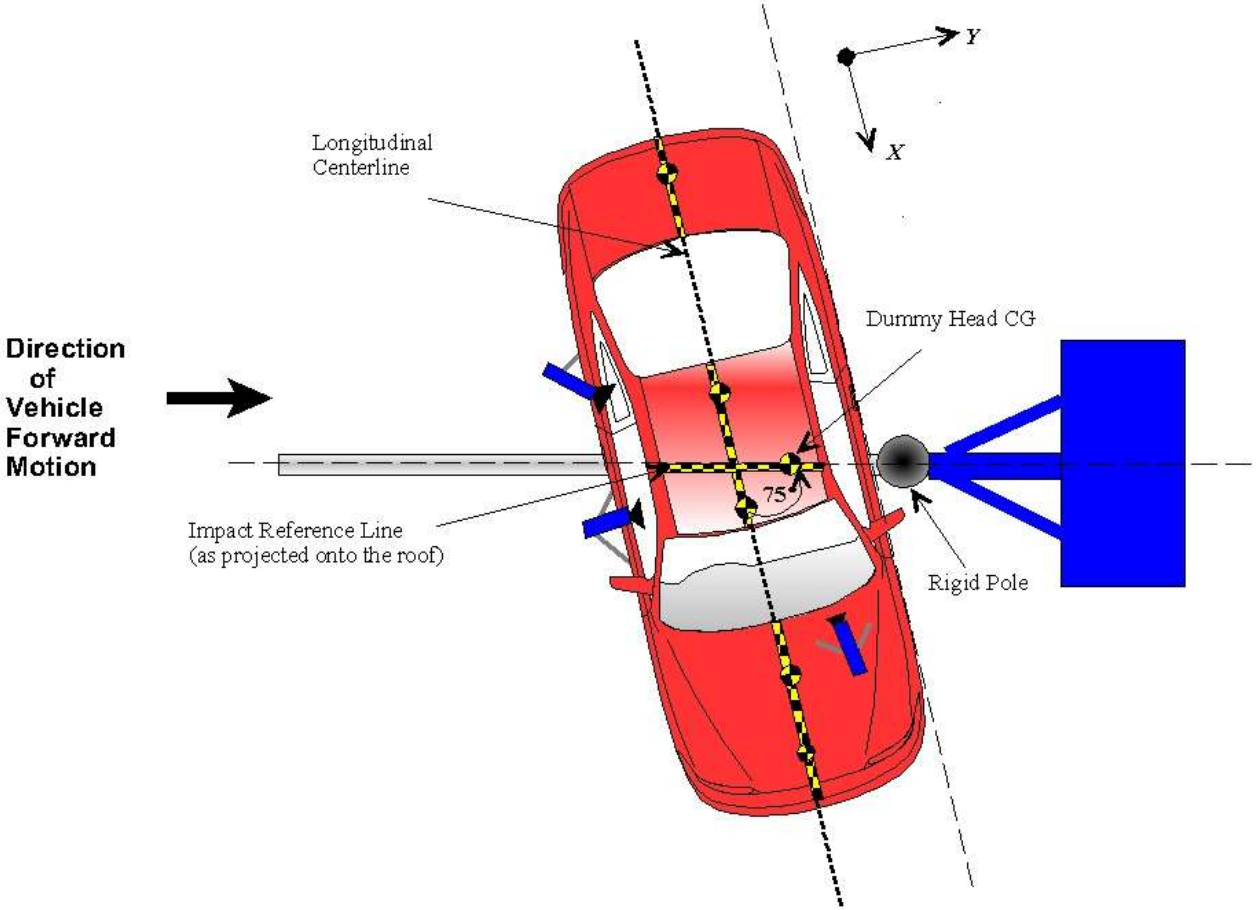
Oblique Pole Test



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Use of Dummies to Represent Occupants

- Drivers (females and elderly) 163 cm or less compromise ~25% of seriously or fatally injured drivers in narrow object side impacts*
- The 5th Female (150 cm) and 50th Male (175 cm) represent the range of occupants protected.
- Drivers less than 163 cm are best represented by the 5th Female dummy

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*Based on 2002-2004 NASS CDS data (value is 35% for 1997-2001 data)

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

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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

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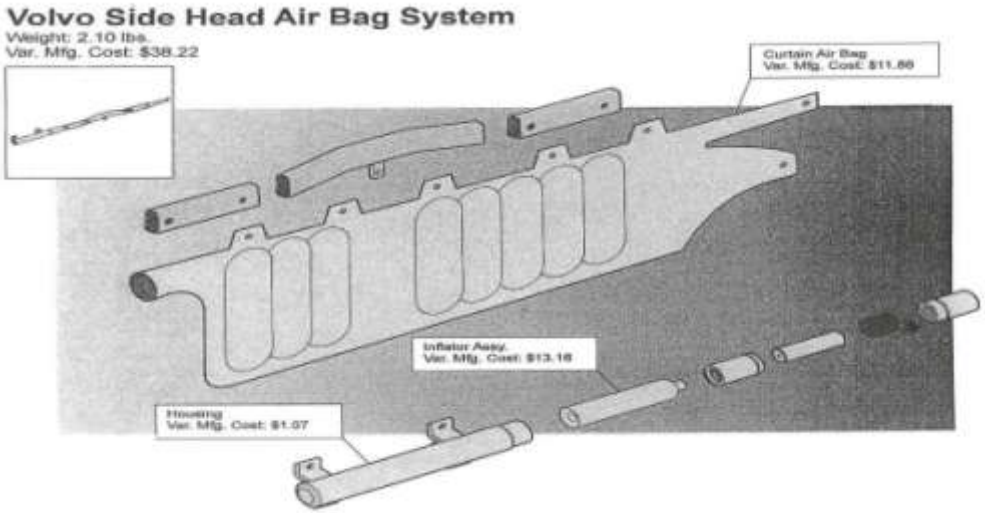
Air Bags Designed for Side Impacts

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



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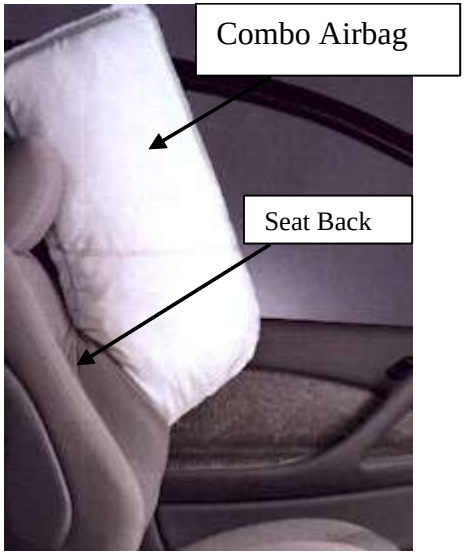
Air Bags Designed for Side Impacts (continued)

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



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ESTIMATE THE EFFECTIVENESS OF THE NEW SAFETY REQUIREMENT

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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

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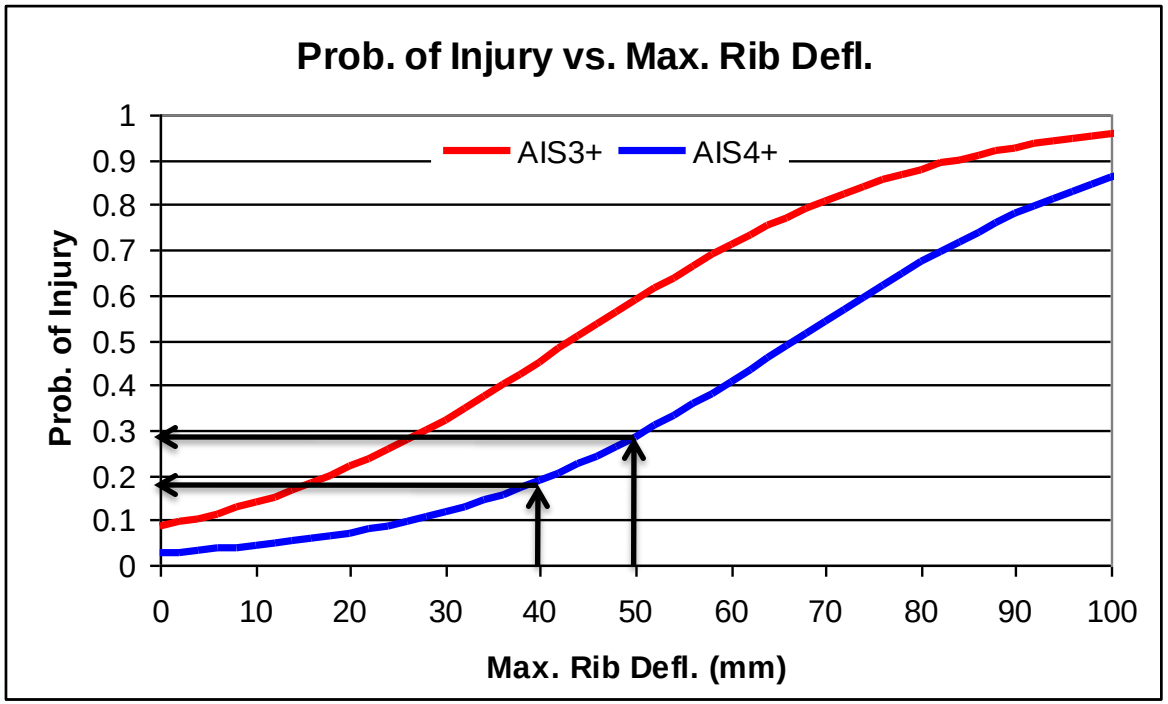
Effectiveness of Side Air Bag

- 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



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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 19 km/h and Upper range of 40 km/h
    - 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

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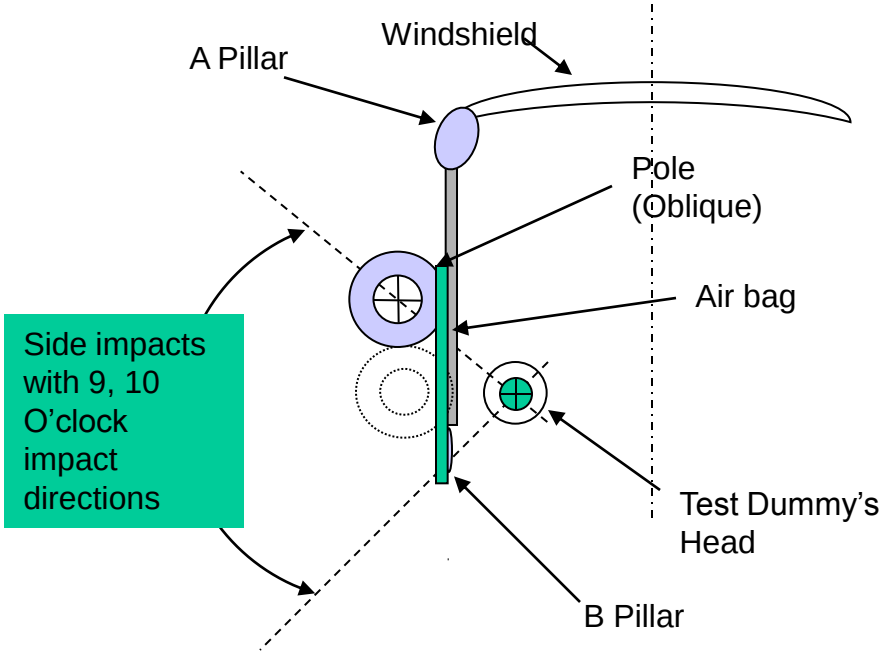
Characteristics of side air bag system meeting oblique pole test requirements (continued)

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



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SAFETY BENEFITS

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Impact of ESC on Benefits

- **Develop adjustment factors based on**
  - Portion of target population impacted by ESC
  - ESC Effectiveness rates
  - Percent of future on-road fleet equipped with ESC
- **ESC effectiveness in single vehicle run-off-road crashes**
  - 35% for passenger cars
  - 67% for SUVs
- **Adjustment factors calculated for passenger cars and SUVs, then weighted based on percentage in fleet.**
  - ESC estimated to prevent 41% of fatal crashes
  - ESC estimated to prevent 35% of serious injuries

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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

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Thank You

References

FMVSS 214 – Final Regulatory Impact Analysis

August 2007

For More Information, Please Contact

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