

# *Performance Standard Development - Ejection Mitigation*

## *NAS Presentation*

**January 27, 2011**



U.S. Department  
of Transportation



# *We Start With Field Data to Identify the Problem*

- **Rollovers account for 10.7% of fatal crashes, but 24.5% of all light vehicle fatalities (2008 FARS).**
- **NHTSA took a comprehensive approach to reduce these rollover fatalities.**
  - ❑ **Prevent Rollovers from occurring – Electronic Stability Control.**
  - ❑ **Make the vehicle a safer environment – Roof Crush Resistance.**
  - ❑ **Keep the vehicle occupant from being partially or fully ejected from the vehicle – Ejection Mitigation.**
- **The focus here is ejection mitigation**

# *Ejection Problem and Countermeasures*

- **Problem: 63% of all fatal ejections (6,464 annually) are through side windows adjacent to the first 3 rows of seating.**
  
- **Thesis:**
  - ❑ **Avoiding complete ejection is associated with a 64% decrease in the risk of death.**
  - ❑ **Altering window designs or covering side windows openings will reduce ejections.**

# *Countermeasure Exploration and Test Procedure Development*

## ➤ **Countermeasures Exploration**

- ❑ **Beginning in the mid-1990s NHTSA evaluated advanced laminated glass as a countermeasure.**
- ❑ **By the early 2000s NHTSA worked with safety system suppliers to test deployable countermeasures (curtain air bags and other inflatable devices).**
  - These inflatable devices were potential very effective and less costly.

## ➤ **Performance Test Procedure Development**

- ❑ **Full vehicle rollover testing was not sufficiently repeatable, objective and robust.**
- ❑ **Thrusting a linear impactor at the opening offered the potential of targeting weak areas of coverage.**
  - Staged rollovers, laboratory simulated rollovers, sled testing and computer simulation were used to determine the appropriate impact energy (mass, velocity).

# *Final Rule Approach*

- **Impact test of side windows/curtains at multiple locations**
  - ❑ Impact locations selected to assure full opening coverage.
  - ❑ Impact velocities and timing bound ejection problem.
  - ❑ Assures robust occupant containment .



# *Benefits and Costs*

- **The final rule will save 373 lives each year and prevent 476 serious injuries.**
- **The final rule will cost \$31 per vehicle and \$507 million for the full vehicle fleet.**
- **This rule is cost effective. The cost per equivalent life saved to be \$1.4 M (3% discount rate) - \$1.7 M (7% discount rate).**
- **Manufacturers would have to begin producing vehicles that meet the standard during 2013 (2014 model year) and all new light vehicles would have to meet the standard by September 1, 2017 (2018 model year).**

# *Hip Pocket*

# *Final Rule Test Specifics*

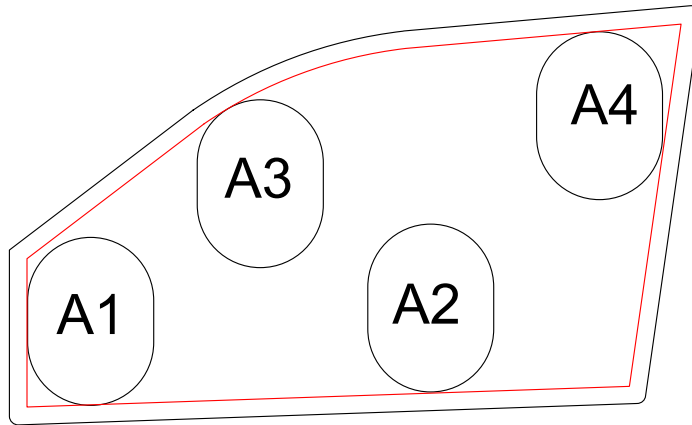
## ➤ **Test device**

- ❑ Linear impactor with headform end
- ❑ Total impactor mass = 40 lb (18 kg).

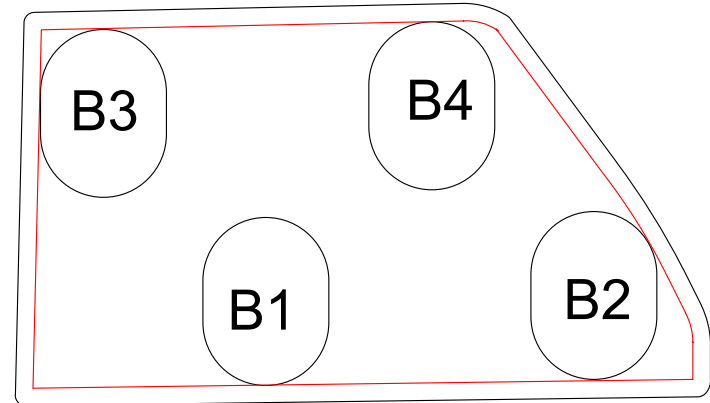
## ➤ **Critical parameters affecting requirement stringency**

- ❑ Performance criterion:  $\leq 100$  mm displacement
- ❑ Target locations: 4 per window opening
- ❑ Impact velocity/timing: 16 & 20 km/h
  - High speed @ 1.5 sec → fast roll rate, early ejections
  - Low speed @ 6 sec → severe multiple rolls, late ejections

# *Final Rule Target Location Selection and Window Condition*



Front Window



Rear Window

- **Goal of target pattern is full coverage**
  - ❑ Rollover is a random event
  - ❑ Any opening of sufficient size provides exit route
- **Window (Glazing) preparation**
  - ❑ Advanced glazing allowed up and pre-broken for the high speed test
  - ❑ Tempered ~ down/removed

# *Final Rule Phase-in Schedule*

- **Lead-time: 2 years and 7 months, with advanced credits for certified vehicles.**
  
- **Phase-in:**
  - ❑ 1<sup>st</sup> year – 25% (begins 9/1/2013)
  - ❑ 2<sup>nd</sup> year – 50% (begins 9/1/2014)
  - ❑ 3<sup>rd</sup> year – 75% (begins 9/1/2015)
  - ❑ 4<sup>th</sup> year – 100% with credits allowed (begins 9/1/2016)