United States of America
Roof Crush  Proposed Rulemaking
FMVSS 216

December 8, 2005
Background

- United States was the first country to establish requirements limiting roof crush in 1973
  - Since then, only Canada and Saudi Arabia have adopted roof crush standards, and have the same requirements as the US standard
  - Roof crush is part of comprehensive rollover safety plan
    - Other aspects of comprehensive plan are ESC, ejection mitigation, door latches.
  - Belted occupants will benefit most from this rule
    - Unbelted occupants benefit little since they don’t remain in their seat and ejection is their biggest risk factor
Background

• Safety Problem
  - Out of the 33,000+ deaths and serious injuries in rollovers each year, this proposal will benefit a portion of about 600 fatally and 800 seriously injured belted occupants who receive head injuries due to roof intrusion
    - The injury mechanism is the interaction of the belted occupant’s head/neck with the vehicle roof
  - Upgrade based upon analysis of post-crash reduction in available headroom space
Summary of Proposal

- **Application** (Currently vehicles up to 6,000 pounds GVWR)
  - Extend application to 10,000 pounds GVWR
- **Load requirement** (Currently 1.5 times vehicle weight, with a 5,000# limit for cars)
  - Increase load requirement to 2.5 times vehicle weight
  - Eliminate 5,000# force limit on passenger cars
- **Headroom requirement** (Currently requires crush to be no more than 5 inches, without reference to available headroom)
  - 50th percentile Hybrid-III placed in the front outboard seat position
  - Under specified load, no roof component may contact the dummy
  - In lieu of current ram displacement limit @ 1.5x vehicle weight
- **Vehicles manufactured in two or more stages, other than chassis-cabs**
  - Allow certification option for roof crush requirements of FMVSS No. 220, instead of FMVSS No. 216.
    - Horizontal plate load application
    - Crush less than 5" @ load of 1.5x vehicle weight
Estimated Annual Fatalities
FARS/NASS-CDS (1997-2001)

Fatally Injured Occupants in Non-Convertible Light Vehicle Rollover Crashes
9,942

Top-Involved Fatally Injured Occupants
(1,357)
8,585

Fixed Object Collision to Top of Vehicle
(1,159)

No Fixed Object Collision to Top of Vehicle
7,426

Fully Ejected Occupants
(3,869)

Not Fully Ejected Occupants
3,557

Belted Occupants
2,026

Unbelted Occupants
(1,531)

Front Outboard and Over 12 years old
1,764

Not Front Outboard and/or Children under 12
(262)

Relevant Intrusion of Roof Component
1,030

No Relevant Intrusion of Roof Component
(734)

MAIS from Intruding Roof Component
596

MAIS Not from Intruding Roof Component
(434)
Estimated Annual Seriously Injured NASS-CDS (1997-2001)

- Seriously Injured (MAIS 3-5) Occupants in Non-Convertible Light Vehicle Rollover Crashes: 23,793
  - Top-Involved Seriously Injured Occupants: (2,788) 21,005
    - Fixed Object Collision to Top of Vehicle: (1,551)
    - No Fixed Object Collision to Top of Vehicle: 19,454
      - Fully Ejected Occupants: (6,621)
      - Not Fully Ejected Occupants: 12,833
        - Belted Occupants: 9,592
        - Unbelted Occupants: (3,241)
          - Front Outboard and Over 12 years old: 8,974
          - Front Outboard and/or Children under 12: (618)
            - Relevant Intrusion of Roof Component: 7,144
            - No Relevant Intrusion of Roof Component: (1,830)
              - Sole MAIS Injury from Intruding Roof Component: 807
              - Not Sole MAIS Injury from Intruding Roof Component: (6,337)

- Top-Involved Seriously Injured Occupants: (2,788) 21,005
Benefits and Cost Analysis

- **Cost estimate ~ $88 - $95 million**
  - Cost/new vehicle ~ $11.81 (@ 2.5x requirement)
  - Fuel costs/vehicle ~ $5.33 to $6.69 (@ 2.5x requirement)
- **Benefit estimates 13 – 44 fatalities**
  - 500 – 800 injuries
  - Cost/ELS ~ $2.1 – 3.4M
Status of Rulemaking

• **Notice of Proposed Rulemaking**
  - Published August 23, 2005
  - Comment period closed November 21, 2005
  - Regulation text, associated reports, and comments are posted at:
    - Docket Number: 22143