20590–0001. You must identify the FAA Docket No. FAA–2005–22047 and Airspace Docket No. 05–ANM–10 at the beginning of your comments. You may also submit comments through the Internet at *http://dms.dot.gov.*

FOR FURTHER INFORMATION CONTACT: Ken McElroy, Airspace and Rules, Office of System Operations Airspace and AIM, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone: (202) 267–8783.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested parties are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments, as they may desire. Comments that provide the factual basis supporting the views and suggestions presented are particularly helpful in developing reasoned regulatory decisions on the proposal. Comments are specifically invited on the overall regulatory, aeronautical, economic, environmental, and energy-related aspects of the proposal.

Communications should identify both docket numbers (FAA Docket No. FAA–2005–22047 and Airspace Docket No. 05–ANM–10) and be submitted in triplicate to the Docket Management System (see **ADDRESSES** section for address and phone number). You may also submit comments through the Internet at *http://dms.dot.gov.*

Commenters wishing the FAA to acknowledge receipt of their comments on this action must submit with those comments a self-addressed, stamped postcard on which the following statement is made: ''Comments to Docket No. FAA–2005–22047 and Airspace Docket No. 05–ANM–10.'' The postcard will be date/time stamped and returned to the commenter.

All communications received on or before the specified closing date for comments will be considered before taking action on the proposed rule. The proposal contained in this action may be changed in light of comments received. All comments submitted will be available for examination in the public docket both before and after the closing date for comments. A report summarizing each substantive public contact with FAA personnel concerned with this rulemaking will be filed in the docket.

Availability of NPRM's

An electronic copy of this document may be downloaded through the Internet at *http://dms.dot.gov.* Recently published rulemaking documents can also be accessed through the FAA's Web page at *http://www.faa.gov* or the **Federal Register**'s Web page at *http://www.gpoaccess.gov/fr/index.html.*

You may review the public docket containing the proposal, any comments received, and any final disposition in person in the Dockets Office (see **ADDRESSES** section for address and phone number) between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. An informal docket may also be examined during normal business hours at the office of the Regional Air Traffic Division, Federal Aviation Administration, 1601 Lind Avenue SW., Renton, Washington, 98055–4056.

Persons interested in being placed on a mailing list for future NPRM's should contact the FAA's Office of Rulemaking, (202) 267–9677, for a copy of Advisory Circular No. 11–2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

History

On June 29, 2005, the Salt Lake City Air Route Traffic Control Center (ARTCC) requested Federal Airway V–343 be extended to accommodate arriving instrument air traffic at BTM. This action responds to this request.

Proposal

The FAA is proposing an amendment to Title 14 Code of Federal Regulations (14 CFR) part 71 to modify Federal Airway V–343 by extending the airway from the Bozeman, MT, VORTAC to the initial approach fix for the RNAV runway 15 approach to the BTM, MT.

The FAA has determined that this proposed regulation only involves an established body of technical regulations for which frequent and routine amendments are necessary to keep them operationally current. Therefore, this proposed regulation: (1) Is not a ''significant regulatory action'' under Executive Order 12866; (2) is not a ''significant rule'' under Department of Transportation (DOT) Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); and (3) does not warrant preparation of a regulatory evaluation as the anticipated impact is so minimal. Since this is a routine matter that will only affect air traffic procedures and air navigation, it is certified that this proposed rule, when promulgated, will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 71

Airspace, Incorporation by reference, Navigation (air).

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend 14 CFR part 71 as follows:

PART 71—DESIGNATION OF CLASS A, B, C, D, AND E AIRSPACE AREAS; AIR TRAFFIC SERVICE ROUTES; AND REPORTING POINTS

1. The authority citation for part 71 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40103, 40113, 40120; E.O. 10854, 24 FR 9565, 3 CFR, 1959–1963 Comp., p. 389.

§ 71.1 [Amended]

2. The incorporation by reference in 14 CFR 71.1 of the FAA Order 7400.9M, Airspace Designations and Reporting Points, dated August 30, 2004, and effective September 16, 2004, is amended as follows:

Paragraph 6010(a) Domestic VOR Federal Airways

* * * * *

V–343 (Revised)

From Dubios, ID; Bozeman, MT, INT Bozeman, MT, 302°T/284°M and Whitehall, MT, 342°T/324°M Radials.

* * * * *

Issued in Washington, DC, on August 16, 2005.

Edith V. Parish,

Acting Manager, Airspace and Rules.

[FR Doc. 05–16748 Filed 8–22–05; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Part 571

[Docket No. NHTSA–2005–22143]

RIN 2127–AG51

Federal Motor Vehicle Safety Standards; Roof Crush Resistance

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: As part of a comprehensive plan for reducing the serious risk of rollover crashes and the risk of death and serious injury in those crashes, this document proposes to upgrade the agency's safety standard on roof crush resistance in several ways. First, we are proposing to extend the application of

the standard to vehicles with a Gross Vehicle Weight Rating (GVWR) of 4,536 kilograms (10,000 pounds) or less. Second, we are proposing to increase the applied force to 2.5 times each vehicle's unloaded weight, and to eliminate an existing limit on the force applied to passenger cars. Third, we are proposing to replace the current limit on the amount of roof crush with a new requirement for maintenance of enough headroom to accommodate a mid-size adult male occupant.

Because the impacts of this rulemaking would affect and be affected by other aspects of the comprehensive effort to reduce rollover-related injuries and fatalities, we are also seeking comments on some of those other aspects.

DATES: You should submit your comments early enough to ensure that Docket Management receives them not later than November 21, 2005.

ADDRESSES: You may submit comments [identified by DOT Docket Number NHTSA–2005–22143] by any of the following methods:

- Web site: *http://dms.dot.gov.* Follow the instructions for submitting comments on the DOT electronic docket site.
- Fax: 1–202–493–2251.
- Mail: Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–001.
- Hand Delivery: Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 am and 5 pm, Monday through Friday, except Federal holidays.
- Federal eRulemaking Portal: Go to *http://www.regulations.gov.* Follow the online instructions for submitting comments.

Instructions: All submissions must include the agency name and docket number or Regulatory Identification Number (RIN) for this rulemaking. Note that all comments received will be posted without change to *http://dms.dot.gov* including any personal information provided. Please see the Privacy Act heading under Regulatory Notices.

Docket: For access to the docket to read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 am and 5 pm, Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical issues: Ms. Amanda Prescott, Office of Vehicle Safety Compliance, NVS–224, National Highway Traffic Safety Administration, 400 7th Street, SW., Washington, DC 20590. Telephone: (202) 366–5359. Fax: (202) 366–3081. e-mail: *Amanda.Prescott@nhtsa.dot.gov.*

For legal issues: Mr. George Feygin, Attorney Advisor, Office of the Chief Counsel, NCC–112, National Highway Traffic Safety Administration, 400 7th Street, SW., Washington, DC 20590. Telephone: (202) 366–5834. Fax: (202) 366–3820. E-mail: *George.Feygin@nhtsa.dot.gov.*

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Executive Summary and Overview

As part of a comprehensive plan for reducing the risk of death and serious injury from rollover crashes, this notice proposes to upgrade Federal Motor Vehicle Safety Standard (FMVSS) No. 216, *Roof Crush Resistance.* This standard, which seeks to reduce deaths and serious injuries resulting from crushing of the roof into the occupant compartment as a result of ground contact during rollover crashes, currently applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a GVWR of 2,722 kilograms (6,000 pounds) or less. The standard requires that when a large steel test plate is forced down onto the roof of a vehicle, simulating contact with the ground in rollover crashes, the vehicle roof structure must withstand a force equivalent to 1.5 times the unloaded weight of the vehicle, without the test plate moving more than 127 mm (5 inches). Under S5 of the standard, the application of force is limited to 22,240 Newtons (5,000 pounds) for passenger cars.

Recent agency data show that nearly 24,000 occupants are seriously injured and 10,000 occupants are fatally injured in approximately 273,000 non-convertible light vehicle rollover crashes that occur each year. In order to identify how many of these occupants might benefit from this proposal, the agency analyzed real-world injury data in order to determine the number of occupant injuries that could be attributed to roof intrusion. The agency examined only front outboard occupants who were belted, not fully ejected from their vehicles, whose most severe injury was associated with roof contact, and whose seating position was located below a roof component that experienced vertical intrusion as a result of a rollover crash. NHTSA estimates that there are about 807 seriously and approximately 596 fatally injured occupants that fit these criteria. The agency believes that some of these occupants would benefit from this proposal.

To better address fatalities and injuries occurring in roof-involved rollover crashes, we are proposing to extend the application of the standard to vehicles with a GVWR of up to 4,536 kilograms (10,000 pounds), and to strengthen the requirements of FMVSS No. 216 by mandating that the vehicle roof structures withstand a force equivalent to 2.5 times the unloaded vehicle weight, and eliminating the 22,240 Newtons (5,000 pounds) force limit for passenger cars. Further, we are proposing a new direct limit on headroom reduction, which would replace the current limit of test plate movement. This new limit would prohibit any roof component from contacting a seated 50th percentile male dummy under the application of a force equivalent to 2.5 times the unloaded vehicle weight. For vehicles built in two or more stages, the agency is proposing an option of certifying to the roof crush requirements of FMVSS No. 220, ''School bus rollover protection,'' instead of FMVSS No. 216. Finally, in response to several petitions, we reexamined the current testing procedures and are proposing certain modifications to the vehicle tie-down procedure and test plate positioning for raised or altered roof vehicles.

Consistent with the agency's continuing effort to reduce rollover-related injuries and fatalities, this document requests additional comments on certain other countermeasures that could further this initiative. Specifically, we ask for comments related to seat belt pretensioners that could limit vertical head excursion in a rollover event.

The agency used two alternative methods to estimate the benefits of this proposal. Under the first alternative, we estimate that this proposal would prevent 793 non-fatal injuries and 13 fatalities. Under the second alternative, we estimate that this proposal would prevent 498 non-fatal injuries and 44 fatalities. The annual equivalent lives saved are estimated at 39 and 55, respectively.

The estimated average cost in 2003 dollars, per vehicle, of meeting the proposed requirements would be $10.67 per affected vehicle. Added weight from design changes is estimated to increase lifetime fuel costs by $5.33 to $6.69 per vehicle. The cost per year for the vehicle fleet is estimated to be $88–$95 million. The cost per equivalent life saved is estimated to range from $2.1 to $3.4 million.

II. Background

A. Current Performance Requirements

FMVSS No. 216 currently applies to passenger cars, multipurpose passenger vehicles (MPVs), trucks, and buses [1] with a GVWR of 2,722 kilograms (6,000 pounds) or less. The standard requires that the ''roof over the front seat area'' [2] must withstand a force equivalent to 1.5 times the unloaded weight of the vehicle. For passenger cars, this force is limited to a maximum of 22,240 N (5,000 pounds). Specifically, the vehicle's roof must prevent the test plate from moving more than 127 mm (5 inches) in the specified test.

To test compliance, a vehicle is secured on a rigid horizontal surface, and a steel rectangular plate is angled and positioned on the roof to simulate vehicle-to-ground contact over the front seat area. This plate is used to apply the specified force to the roof structure. Currently, no test device is used to simulate an occupant in the front seat area.

In order to simulate vehicle-to-ground contact, the plate is tilted forward at a 5-degree angle, along its longitudinal axis, and rotated outward at a 25-degree angle, along its lateral axis, so that the plate's outboard side is lower than its inboard side. The edges of the test plate are positioned based on fixed points on the vehicle's roof.

For vehicles with conventional roofs, the forward edge of the plate is positioned 254 mm (10 inches) forward of the forwardmost point on the roof, including the windshield trim. This same position is required for vehicles with raised [3] or altered [4] roofs, unless the initial point of contact with the plate is rearward of the front seat area. In those instances, the plate is moved forward until its rearward edge is tangent to the rear of the front seat area.

[1] For simplicity, this notice will refer to MPVs, trucks, and buses collectively as light trucks.

[2] The roof over the front seat area means the portion of the roof, including windshield trim, forward of a transverse plane passing through a point 162 mm rearward of the seating reference point of the rearmost front outboard seating position.

[3] ''Raised roof'' means, with respect to a roof, which includes an area that protrudes above the surrounding exterior roof structure, that protruding area of the roof.

[4] ''Altered roof'' means the replacement roof on a motor vehicle whose original roof has been removed, in part or in total, and replaced by a roof that is higher than the original roof. The replacement roof on a motor vehicle whose original roof has been replaced, in whole or in part, by a roof that consists of glazing materials, such as those in T-tops and sunroofs, and is located at the level of the original roof, is not considered to be an altered roof.

B. Previous Rulemaking, Petitions, and October 2001 Request for Comments Concerning Performance Requirements

1. Extension of Roof Crush Standard to Light Trucks

In an effort to reduce deaths and injuries resulting from roof crush into the passenger compartment area in rollover crashes, the agency established FMVSS No. 216, ''Roof crush resistance.'' Specifically, the agency sought to address the strength of roof structures located over the front seat area of passenger cars. Compliance with the standard was first required on September 1, 1973.

On April 17, 1991, NHTSA published a final rule amending FMVSS No. 216 to extend its application to MPVs, trucks, and buses with a GVWR of 2,722 kilograms (6,000 pounds) or less.[5] The final rule adopted the same requirements and test procedures as those applicable to passenger cars, except for the 22,240 Newton (5,000 pound) limit on the applied force. Compliance with the final rule was required on September 1, 1994.

2. Plate Positioning Procedure

Subsequently, NHTSA published a final rule (1999 final rule) responding to several petitions for rulemaking seeking to revise the test plate positioning procedure.[6] Prior to the 1999 final rule, the test plate was positioned based on initial point of contact with the roof. After establishing the initial point of contact, the test plate was moved forward until its forwardmost edge was positioned 254 mm (10 inches) in front of the initial point of contact. For certain vehicles with aerodynamically sloped roofs, this procedure resulted in the test plate being positioned rearward of the roof over the front seat area.[7] Consequently, the plate did not apply the force in the location contemplated by the standard, *i.e.*, over the front occupants. In some instances, the test plate was positioned such that the edge of the plate was in contact with the roof, which resulted in excessive and unrealistic deformation during testing. Similar problems occurred in testing vehicles with raised or altered roofs.

The 1999 final rule addressed the difficulty in testing aerodynamically sloped roofs by specifying that the test plate be positioned 254 mm (10 inches) forward of the forwardmost point of the roof (including the windshield trim). This ensured that the leading edge of

[5] See 56 FR 15510.

[6] See 64 FR 22567 (April 27, 1999).

[7] Examples of these vehicles include model year 1999 Ford Taurus and Dodge Neon.

the plate did not contact the roof and that the test plate applied the force over the front seat area.

Certain vehicles with raised or altered roofs experienced plate positioning difficulties similar to those in vehicles with aerodynamically sloped roofs because the initial contact point on the roof occurred not over the front seat area, but on the raised rear portion of the roof. Consequently, the 1999 final rule provided for a secondary test procedure intended for vehicles with raised or altered roofs. Under this new test procedure, the test plate is moved forward until the rearward edge is tangent to the transverse vertical plane located at the rear of the roof over the front seat area.

On June 11, 1999, the Recreational Vehicle Industry Association (RVIA) and Ford Motor Company (Ford) submitted petitions for reconsideration to amend the 1999 final rule.[8] Petitioners argued that the secondary plate positioning test procedure produced rear edge plate loading onto the roof of some raised and altered roof vehicles that caused excessive deformation uncharacteristic of real-world rollover crashes. Specifically, petitioners argued that positioning the test plate such that the rear edge of the plate is at the rearmost point of the front occupant area resulted in stress concentration, which produced excessive deformation and even roof penetration. Petitioners argued that this type of loading is uncommon to real-world rollovers. Consequently, petitioners asked the agency to reconsider adopting the secondary plate positioning procedure for raised or altered roof vehicles.[9] The agency responds to these petitions for reconsideration in Section VIII(B) of this document.

3. Upgrade of Performance Requirements

On May 6, 1996, the agency received a petition for rulemaking from Hogan, Smith & Alspaugh, P.C. (Hogan).[10] Hogan argued that the current static requirements in FMVSS No. 216 bear no relationship to real-world rollover crash conditions and therefore should be replaced with a more realistic test such as the inverted vehicle drop test defined in the Society of Automotive Engineers Recommended Practice J996 (SAE J996), ''Inverted Vehicle Drop Test Procedure.'' The petitioner also requested that NHTSA require ''roll cages'' to be standard in all cars. NHTSA granted this petition on January 8, 1997, believing that the inverted drop test had merit for further agency consideration. The agency addresses the issues raised in this petition in Section VIII(A) of this document.

On October 22, 2001, NHTSA published a Request for Comments (RFC) to assist in an upgrade of FMVSS No. 216 and in addressing issues raised by the Hogan petition requesting that the agency adopt dynamic testing.[11] In the RFC, the agency posed questions related to (1) current FMVSS No. 216 test requirements and procedures; (2) the viability of introducing dynamic testing; and (3) ways to limit headroom reduction. The agency received over 50 comments from the public. The agency used the information gathered from these responses in preparing this NPRM. A summary of comments is provided in Section VI of this document.

C. Consumer Information on Rollover Resistance

In 1991, Congress instructed NHTSA to assess rollover occupant protection as a part of the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA required the agency to initiate rulemaking to address the injuries and fatalities associated with rollover crashes. In response to that mandate, NHTSA published an advance notice of proposed rulemaking (ANPRM) that summarized statistics and research in rollover crashes, sought answers to several questions about vehicle stability and rollover crashes, and outlined possible regulatory and other approaches to reduce rollover fatalities.[12] NHTSA also published a report to Congress that detailed the agency's efforts on rollover occupant protection.[13]

In 1994, the agency proposed a new consumer information regulation to require that passenger cars and light multipurpose passenger vehicles and trucks be labeled with information about their resistance to rollover.[14] However, after issuing the notice of proposed rulemaking, Congress directed NHTSA not to issue a final rule on vehicle rollover labeling until the agency had reviewed a study by the National Academy of Sciences (NAS) on how to most effectively communicate motor vehicle safety information to consumers.[15]

After the agency reviewed the NAS study, we issued a Request for Comments proposing to use Static Stability Factor to indicate rollover risk in single-vehicle crashes, as a part of NHTSA's New Car Assessment Program (NCAP). That program provides consumers with vehicle safety information, including crash test results, to aid consumers in their vehicle purchase decisions.[16] In 2001, the agency issued a final decision to use the Static Stability Factor to indicate rollover risk in single-vehicle crashes and to incorporate the new rating into NCAP.[17]

Section 12 of the Transportation Recall, Enhancement, Accountability and Documentation (TREAD) Act of November 2000 mandated that NHTSA develop a dynamic rollover resistance test for the purposes of aiding consumer information. On October 14, 2003, NHTSA modified the New Car Assessment Program to include dynamic rollover tests.[18] NHTSA's rollover resistance rating information is available at *http://www.nhtsa.dot.gov/ncap/*.

D. Development of Comprehensive Plan

In 2002, the agency formed an Integrated Project Team (IPT) to examine the rollover problem and make recommendations on how to reduce rollovers and improve safety when rollovers nevertheless occur. In June 2003, based on the work of the team, the agency published a report entitled, ''Initiatives to Address the Mitigation of Vehicle Rollover.'' [19] The report recommended improving vehicle stability, ejection mitigation, roof crush resistance, as well as road improvement and behavioral strategies aimed at consumer education.

III. Overall Rollover Problem and the Agency's Comprehensive Response

This proposal to upgrade our safety standard on roof crush resistance is one part of a comprehensive agency plan for reducing the serious risk of rollover crashes and the risk of death and serious injury when rollover crashes do occur.

A. Overall Rollover Problem

Rollovers are especially lethal crashes. While rollovers comprise just 3% of all light passenger vehicle crashes, they account for almost one-

[8] See Docket Nos. NHTSA–99–5572–3 & NHTSA–99–5572–2, respectively at: *http://dms.dot.gov/search/searchFormSimple.cfm.*

[9] On January 31, 2000, the agency published a partial response to petitions delaying application of the new secondary plate positioning testing procedure until October 25, 2000. See 65 FR 4579.

[10] See Docket No. NHTSA–2005–22143.

[11] See 66 FR 53376.

[12] See 57 FR 242 (January 3, 1992).

[13] See Docket Number NHTSA 1999–5572–35.

[14] See 59 FR 33254 (June 28, 1994).

[15] See 65 FR 34998 at 35001 (June 1, 2000).

[16] See 65 FR 34998 (June 1, 2000).

[17] See 66 FR 3388 (January 12, 2001).

[18] See 68 FR 59250.

[19] See Docket Number NHTSA 2003–14622–1.

third of all occupant fatalities in light vehicles, and more than 60 percent of occupant deaths in the SUV segment of the light vehicle population.[20]

Rollover fatalities are strongly associated with the following factors: A single vehicle crash (83 percent), a rural crash location (60 percent), a high-speed (55 mph or higher) road (72 percent), nighttime (66 percent), off-road tripping/tipping mechanism (60 percent), young (under 30 years old) driver (46 percent), male driver (73 percent), alcohol-related (40 percent), and/or speed-related (40 percent).[21]

The agency previously estimated that approximately 64 percent of about 10,000 occupants fatally injured in rollovers each year are injured when they are either partially or completely ejected during the rollover. Approximately 53 percent of the fatally injured are completely ejected, and 72 percent are unbelted.[22] Most of the fatally injured are ejected through side windows[23] or side doors.[24] Those who are not ejected, including belted occupants, are fatally injured as a result of impact with the vehicle interior.

Approximately 273,000 non-convertible light vehicles were towed after a police-reported rollover crash each year. Of these 273,000 light vehicle rollover crashes, 223,000 were single-vehicle rollover crashes. Previous agency data indicate that in ninety-five (95) percent of single-vehicle rollover crashes, the vehicles were tripped, either by on-road mechanisms such as potholes and wheel rims digging into the pavement or by off-road mechanisms such as curbs, soft soil, and guardrails.[25] Eighty-three (83) percent of single-vehicle rollover crashes occurred after the vehicle left the roadway.[26] Five (5) percent of single vehicle rollovers were untripped rollovers. They occurred as a result of tire and/or road interface friction.

NHTSA estimates that 23,793 serious injuries[27] and 9,942 fatalities occur in 272,925 non-convertible light duty vehicle[28] rollover crashes each year. In evaluating the risks of fatalities and serious injuries associated with rollover crashes, NHTSA has concluded that rollover crashes involving light duty vehicles present a higher risk of injury compared to frontal, side, and rear impacts.[29]

In arriving at our conclusions, NHTSA used (1) the Fatality Analysis Reporting System (FARS) from 1997 through 2002 to determine the annual average number of fatalities in non-convertible light duty vehicles, and (2) the National Automotive Sampling System Crashworthiness Data System (NASS–CDS) from 1997 through 2002 to determine the annual average number of seriously injured survivors of towaway crashes. These estimates were combined to produce the results in Table 1.[30]

TABLE 1.—RISK OF FATALITY AND SERIOUS INJURY TO OCCUPANTS OF NON-CONVERTIBLE LIGHT VEHICLES INVOLVED IN A TOWAWAY CRASHES BY CRASH TYPE

[NASS–CDS & FARS 1997–2002]

Crash type	Total occupants	Fatalities	Percent of occupants fatally injured	Fatal and serious injuries	Percent of occupants fatally or seriously injured
Rollover	467,120	9,942	2.1	33,735	7.2
Frontal Impact	2,786,378	12,480	0.4	58,031	2.1
Side Impact	1,218,068	7,932	0.6	29,964	2.5
Rear Impact	414,711	1,029	0.2	2,338	0.6

The estimates in Table 1 show that compared to other crash events, such as frontal, side, and rear impacts, rollover crashes present a greater risk of fatal or serious injury. However, the higher injury risks in rollover crashes may largely result from greater likelihood of full ejection from the vehicle, compared to other crash modes. Further, younger drivers, who may be more likely to become involved in rollovers, might also be less likely to use a safety restraint.[31]

Accordingly, to refine further the injury risk estimates more relevant to this proposal, we examined the rollover injury risks experienced by belted vehicle occupants, and vehicle occupants that had not been fully ejected. Although the injury risk estimates for belted occupants are lower, they remain higher for rollover crashes than for other crash modes.

[20] See Automotive News World Congress, ''Meeting the Safety Challenge'' Jeffrey W. Runge, M.D., Administrator, NHTSA, January 14, 2003, page 3, 4; (*http://www.nhtsa.dot.gov/nhtsa/announce/speeches/030114Runge/AutomotiveNewsFinal.pdf*); see also The Honorable Jeffrey W. Runge, M.D., Administrator, NHTSA, before the Committee on Commerce, Science, and Transportation. U.S. Senate, February 26, 2003; (*http://www.nhtsa.dot.gov/nhtsa/announce/testimony/SUVtestimony02–26–03.htm*); see also IPT Rollover Report at *http://www-nrd.nhtsa.dot.gov/vrtc/ca/capubs/IPTRolloverMitigationReport/* (Page 7).

[21] See *id.* at 8.

[22] See IPT Rollover Report at *http://www-nrd.nhtsa.dot.gov/vrtc/ca/capubs/IPTRolloverMitigationReport/* (Page 5).

[23] Status of NHTSA's Ejection Mitigation Research, J. Stephen Duffy, Transportation Research Center, Inc., SAE Government/Industry Meeting, May 10, 2004, slide 2, *http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/SAE/SAE2004/EjectMitigate_Duffy.pdf.*

[24] See IPT Rollover Report at *http://www-nrd.nhtsa.dot.gov/vrtc/ca/capubs/IPTRolloverMitigationReport/* (Page 12).

[25] See *id.* at 6. Tripped rollovers result from a vehicle's sideways motion, as opposed to its forward motion. When sideways motion is suddenly interrupted, for example, when a vehicle is sliding sideways and its tires on one side encounter something that stops them from sliding, the vehicle may roll over. Whether or not the vehicle rolls over in that situation depends on its speed in a sideways direction (lateral velocity). By measuring certain vehicle dimensions, it is possible to calculate each make/model's theoretical minimum lateral sliding velocity for this type of rollover to occur.

[26] See *id.*

[27] Abbreviated Injury Scale (AIS) 3 to 5.

[28] We refer to vehicles with GVWR less than or equal to 4,536 kilograms (10,000 pounds) as light duty vehicles.

[29] Injury risk is measured by the ratio of fatal and serious injuries to the number of occupants involved in towaway crashes.

[30] NASS–CDS estimates have been adjusted to account for cases with unknown or missing data.

[31] For younger drivers and rollovers, see William Deutermann, ''Characteristics of Fatal Rollover Crashes,'' DOT HS 809 438, April 2002 (*http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2002/809–438.pdf*). For younger occupants and seat belt use, see Donna Glassbrenner, ''Safety Belt Use in 2003,'' DOT HS 809 729, May 2004 (*http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2004/809729.pdf*).

TABLE 2.—RISKS OF FATALITY AND SERIOUS INJURY TO NOT FULLY EJECTED OCCUPANTS AND BELTED OCCUPANTS OF NON-CONVERTIBLE LIGHT VEHICLES INVOLVED IN A TOWAWAY CRASH BY CRASH TYPE

[NASS–CDS and FARS 1997 to 2002]

Crash type	Percent of not fully ejected occupants fatally injured (regardless of belt use)	Percent of not fully ejected occupants fatally or seriously injured (regardless of belt use)	Percent of belted occupants fatally injured (regardless of ejection status)	Percent of belted occupants fatally or seriously injured (regardless of ejection status)
Rollover	1.1	4.3	0.7	3.5
Frontal Impact	0.4	2.0	0.3	1.4
Side Impact	0.6	2.3	0.5	1.9
Rear Impact	0.2	0.5	0.1	0.3

B. Agency's Comprehensive Response

The agency has published a comprehensive plan to reduce rollover related fatalities and injuries. It is clear that the most effective way to reduce deaths and injuries in rollover crashes is to prevent the rollover crash from occurring. Countermeasures to help reduce rollover occurrence include:

- Providing consumers with information to make informed decisions when purchasing vehicles. The agency's New Car Assessment Program provides information on rollover risk predictions for light vehicles. Starting with the 2004 model year, NHTSA is making risk predictions that are based both on the vehicle's static stability factor and its performance in the agency's dynamic (fishhook) test.
- Continued research and development of advanced vehicle technologies, such as electronic control systems, road departure warnings and rollover sensors. For example, preliminary data indicates that electronic stability control systems appear effectively to reduce the occurrence of single-vehicle crashes.[32] Vehicle manufacturers continue to develop and deploy such technologies.
- Continued focus on the enforcement of laws discouraging impaired driving and compliance with speed limits and other safe driving behavior. As noted above, rollovers often involve speed (40%) and/or alcohol (40%), and tend to be associated with younger (46%), male (73%) drivers.

Countermeasures are also needed to mitigate injuries and fatalities when rollovers do occur. Such countermeasures include:

- Continued focus on ejection mitigation measures, such as side curtain airbags and rollover sensors. Such technologies are increasingly made available to the vehicle buying public. The agency will continue collaborative research efforts and, if appropriate, will establish regulations to ensure their continued deployment in the vehicle fleet.
- Enhancing other aspects of occupant protection, such as door retention (FMVSS 206), occupant restraints (FMVSS 208) and roof crush (FMVSS 216). For example, advanced safety belt systems incorporating pretensioners may help keep occupants from impacting the roof structure during a rollover.
- The continued enactment of primary safety belt laws and a continued focus on the enforcement of such laws. Safety belt use is a critical feature of reducing rollover-related fatalities and injuries. Approximately 75 percent of the people killed or injured in single-vehicle rollovers are unbelted. Twenty-nine states have yet to enact primary belt laws. Of those, twenty-one states report safety belt use below the national average of 80 percent.[33]

All of these countermeasures must work together to help create a driving environment in which rollovers can be avoided and rollover-related fatalities and injuries minimized. States legislatures, the enforcement community (including police officers, prosecutors and judges), vehicle makers and their suppliers and the driving public all play critical parts in eliminating the 10,000 rollover-related fatalities suffered each year. Government also plays a role in ensuring that safety requirements are mandated when the benefits of doing so are established. This proposal to upgrade our roof crush standard is only one such effort by the agency to address the rollover hazard.

IV. The Role of Roof Intrusion in the Rollover Problem

A. Rollover Induced Vertical Roof Intrusion

The agency has examined data on vehicle rollovers resulting in roof damage.[34] This information was derived from NASS–CDS (1997 to 2002). Vertical roof intrusion is recorded in NASS–CDS when it exceeds 2 cm (0.8 inches).

Using the NASS–CDS data from 1997 to 2002, we conclude that out of the total of 272,925 light duty vehicle rollovers in towaway crashes, 220,452 rolled more than one-quarter turn.[35] The 52,473 vehicles that experienced only a one-quarter turn were excluded from the analysis because one-quarter turn rollovers usually do not result in vertical roof intrusion since they do not experience roof-to-ground contact. We found that out of the 220,452 vehicles that rolled more than one-quarter turn, 175,253 experienced vertical intrusion of some roof component. We estimate that in 82 percent (142,954) of these cases, the most severe roof intrusion occurred over the front seat positions. Approximately 92 percent of the fatally or seriously injured belted occupants who were not fully ejected were in front seats.

In addition, NHTSA examined how vertical roof intrusion relates to a vehicle's body type and GVWR. We compared passenger cars, light trucks currently subject to the standard, and light trucks with a GVWR greater than 2,722 kilograms (6,000 pounds) but less than or equal to 4,536 kilograms (10,000 pounds). The estimates in Table 3 show that light trucks not subject to the current standard experienced patterns of roof intrusion which were slightly greater than vehicles already subject to the requirements of FMVSS No. 216. Further, the heavier vehicles above 2,722 kilograms (6,000 pounds) experienced a greater maximum vertical roof intrusion.

[32] Dang, Jennifer, ''Preliminary Results Analyzing the Effectiveness of Electronic Stability Control (ESC) Systems,'' DOT HS 809 790, September 2004. Several recent studies in Japan and Europe also indicate that ESC systems reduce single vehicle crashes. However, the samples of vehicles equipped with these systems were small. See also, C.M. Farmer ''Effect of electronic stability control,'' Traffic Injury Prevention 5:4 (317–25).

[33] See *http://www.nhtsa.dot.gov/people/injury/airbags/809713.pdf.*

[34] Roof damage is measured by the maximum degree of vertical intrusion into the vehicle by a roof component (A-pillar, B-pillar, roof, roof side rail, windshield header, and backlight header).

[35] A quarter turn occurs when the vehicle tips over from the upright position onto either of its sides.

TABLE 3.—PERCENT OF VEHICLES INVOLVED IN ROLLOVER CRASHES (MORE THAN ONE QUARTER-TURN) BY DEGREE OF VERTICAL ROOF INTRUSION

[1997–2002 NASS–CDS and 2002 Polk National Vehicle Population Profile (NVPP)]

Maximum vertical roof intrusion	Passenger cars (percent)	Light trucks subject to FMVSS No. 216 (percent)	Light trucks with GVWR > 2,722 and ≤ 4,536 Kg (percent)
No Intrusion	23,071 (23)	17,805 (19)	14,322 (17)
3 to 7 cm	22,219 (22)	19,264 (20)	1,499 (6)
8 to 14 cm	22,285 (22)	12,354 (13)	5,122 (21)
15 to 29 cm	25,260 (25)	31,184 (33)	10,487 (42)
30 to 45 cm	4,810 (5)	12,225 (13)	2,107 (8)
46 cm or more	2,334 (2)	2,695 (3)	1,253 (5)
Total	100,075 (100)	95,586 (100)	24,791 (100)
Average Amount of Intrusion	82.4 mm	111.3 mm	150.5 mm
Total Number of Vehicles	220,452		

B. Occupant Injuries in Rollover Crashes Resulting in Roof Intrusion

In addition to examining the risk of injuries associated with rollover events, and the prevalence of roof intrusions resulting from rollover, the agency examined actual occupant injuries and fatalities resulting from roof intrusions that occurred after the vehicle rolled more than one-quarter turn or end-over-end. Some occupants sustaining these injuries could potentially benefit from upgrading the roof crush resistance requirements.

Again, the agency limited this injury analysis to belted occupants who were not fully ejected from their vehicles. In order to determine the number of occupant injuries that could be attributed to roof intrusion, the injury data were further limited to only front outboard occupants.[36] Further, NHTSA excluded rollover crashes producing roof intrusion as a result of a collision with a fixed object such as a tree or a pole. Using NASS–CDS (1997—2002) data, NHTSA estimates that 4 percent of vehicles involved in rollovers collided with fixed objects in a way that caused roof damage. The agency excluded these vehicles in assessing potential benefits of this proposal because we found that roof damage observed from fixed object collisions was often catastrophic in nature and exhibited different deformation patterns than roof-to-ground impacts due to the localization of the force. The agency believes that this proposal is not likely to have appreciable benefits for these types of collisions. Finally, the occupant MAIS injury must have resulted from contact with a roof component.[37]

Our refined analysis shows that annually, there are an estimated 807 seriously and 596 fatally injured belted occupants (1,403 total) involved in rollovers resulting in roof intrusion that suffered MAIS injury from roof contact. The rollover injury distributions according to belt use, MAIS source, and roof intrusion is illustrated in Figure 1. Thus, although the number of serious and fatal injuries resulting from rollovers is very high, the number of occupants who could potentially benefit from upgraded roof crush resistance requirements is considerably more limited. However, despite the relatively small number of rollover occupants who may directly benefit from this proposal, the agency believes that roof crush resistance is an integral part of the occupant protection system, necessary to ensure benefits can be obtained from designing other rollover mitigation tools (such as padding and the restraint system) to provide better protection against injuries resulting from rollover. We note that seriously and fatally injured occupants who had a non-MAIS roof contact injury may also derive some benefit from decreased roof intrusion.

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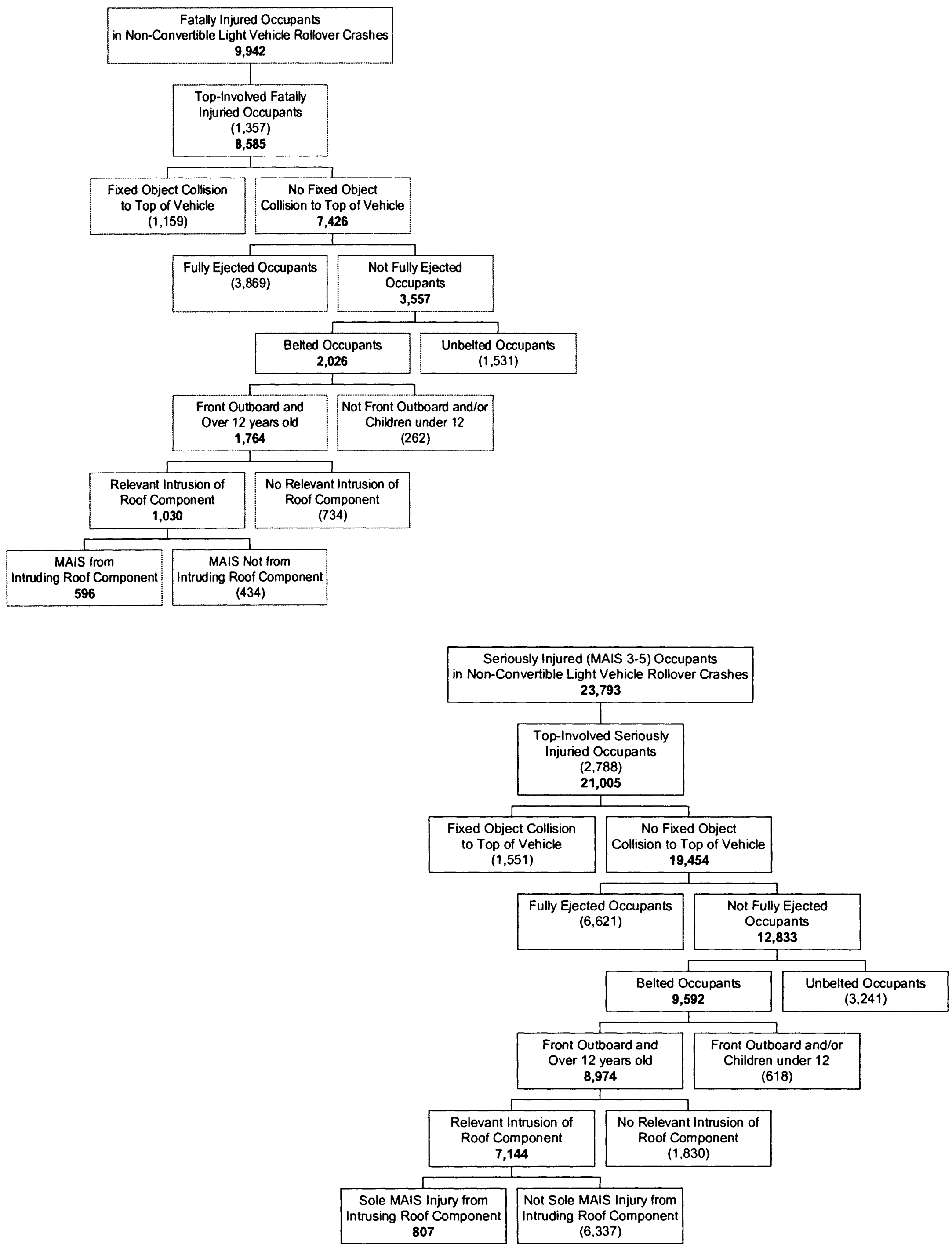
[36] We excluded rear outboard belted occupants because FMVSS No. 216 requires that the roof over the front seat area withstand the applied force. As previously stated, in 82 percent of relevant crashes, the most severe roof intrusion occurred over the front seat position. Further, we lacked the headroom data necessary to estimate potential benefits to rear seat occupants.

[37] MAIS injury is the most severe (maximum AIS) injury for the occupant.

Figure 1. Population Affected by this Proposal.



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V. Previous Rollover and Roof Crush Mitigation Research

Prior to issuing the October 2001 RFC, NHTSA conducted a research program to examine potential methods for improving the roof crush resistance performance requirements. This program included vehicle testing and analytical research.

A. Vehicle Testing

The agency vehicle testing program has consisted of: (1) Full vehicle dynamic rollover testing; (2) inverted vehicle drop testing; and (3) comparing inverted drop testing to a modified FMVSS No. 216 test.

The agency conducted over 25 full-scale dynamic rollover tests to evaluate roof integrity and failure modes in rollover crashes. These tests were expected to produce severe roof intrusion in order to help the agency investigate possible roof crush countermeasures and compare roof strengths. NHTSA designed a rollover test cart that was similar to the dolly rollover cart (as defined in FMVSS No. 208, ''Occupant crash protection''), and vertically elevated it 1.2 meters.

Pneumatic cylinders were used to initiate the vehicle's angular momentum. However, these test conditions proved so severe it was difficult to identify which vehicles had better performing roof structures and which had the worse performing roof structures.[38] Due to severity of roof crush and demonstrated lack of repeatability of results, this test procedure did not provide a reliable performance measure for roof crush resistance. Based on these tests, the agency determined that the development of an improved roof crush standard based on dynamic rollover testing was not feasible, so we proceeded to investigate alternatives.

NHTSA then evaluated the inverted drop test procedure based on the SAE J996 procedure. Previous research had suggested that the inverted drop test produced deformation patterns similar to those observed in real-world crashes.[39] NHTSA conducted a series of inverted drop tests and concluded that they were not necessarily better than quasi-static tests in representing vehicle-to-ground interaction occurring during rollover. Further, the inverted drop test procedure was significantly more difficult to conduct because it required a cumbersome procedure for suspending and inverting the vehicle. The agency concluded that the quasi-static test procedure is simpler and produces more repeatable results.

Further, the agency found that both the inverted drop and quasi-static tests produced loading and crush patterns comparable to those of the dynamic rollover test.[40] Although the roof crush loading sequence in real-world crashes differs from that of the quasi-static procedure, we determined that the roof crush patterns observed in quasi-static tests provide a good representation of the real-world roof deformations. This finding, coupled with the better consistency and repeatability of the quasi-static procedure, led the agency to conclude that the quasi-static procedure provides a suitable representation of the real-world dynamic loading conditions, and the most appropriate one on which to focus our upgrade efforts.

B. Analytical Research

In 1994, NHTSA conducted an analytical study to explore the relationship between roof intrusion and the severity of occupant injury. To determine the extent of the correlation between roof intrusion and occupant injury, the agency conducted a comparative study using NASS–CDS.[41]

The study evaluated two sets of belted occupants involved in rollover events to determine if headroom reduction was related to the risk of head injury in rollover crashes. One set of occupants had received head injuries from roof contact, the second set of occupants had not.

We observed the following: (1) Headroom reduction (pre-crash versus post-crash) of more than 70 percent substantially increased the risk of head injury from roof contact; (2) as the severity of the injury increased, the percentage of cases with no remaining headroom increased; (3) when the intrusion exceeded the original headroom, the percentage of injured occupants was 1.8 times the percentage of uninjured occupants; and (4) the average percent of headroom reduction for injured occupants was more than twice that of uninjured occupants. In sum, the agency believes that there is a relationship between the amount of roof intrusion and the risk of injury to belted occupants in rollover events.

C. Latest Agency Testing and Analysis

1. Vehicle Testing

Recently, the agency conducted roof crush tests to ascertain roof strength of more recent model year (MY) vehicles.

First, the agency conducted testing on ten vehicles equipped with string potentiometers to measure the relationship between external plate movement and available occupant headroom.[42] All ten vehicles withstood an applied force of 1.5 times the unloaded vehicle weight before the occupant headroom was exhausted. Six out of ten vehicles attained a peak force greater than 2.5 times the unloaded vehicle weight before the occupant headroom was exhausted. The detailed summary and analysis of testing and simulation research is contained in the document entitled ''Roof Crush Research: Load Plate Angle Determination and Initial Fleet Evaluation.'' [43]

Subsequently, NHTSA conducted further testing on another set of ten vehicles with a seated 50th percentile Hybrid III dummy.[44] All ten vehicles withstood an applied force of 1.5 times the unloaded vehicle weight before the occupant headroom was exhausted.[45] Seven out of ten vehicles exceeded an applied force of 2.5 times the unloaded vehicle weight before the occupant headroom was exhausted. One vehicle, a Subaru Forester, withstood an applied force of 4.0 times the unloaded vehicle weight before the occupant headroom was exhausted.

The agency also tested 10 vehicles as a part of NHTSA's compliance program.[46] These vehicles were tested in a manner similar to the 20 vehicles described above. However, these vehicles were only crushed to approximately 127 mm (5 inches) of plate displacement. The data gathered from these tests were useful in evaluating the roof crush performance of the fleet under the current requirements, which is discussed in greater detail in other sections of this notice.[47]

2. Revised Tie-Down Testing

As previously discussed, in 1999, the agency issued a final rule revising the test plate positioning procedures.[48] In response to the NPRM which preceded the 1999 final rule, Ford commented that different laboratories employ various methods to secure the vehicle for FMVSS No. 216 testing. Ford stated that the initial point of contact of the test plate varied between laboratories, which resulted in different roof crush resistance. Ford attributed the variation in initial contact point to the variation in tie-down methodologies.[49] In response to the Ford comment, the agency indicated it would address the variability in tie-down procedures separately.[50]

[38] Several identical vehicles with different levels of roof reinforcement were subjected to the test. Accordingly, we expected to observe some variability in roof performance.

[39] Michael J. Leigh and Donald T. Willke, ''Upgraded Rollover Roof Crush Protection: Rollover Test and NASS Case Analysis,'' Docket NHTSA–1996–1742–18, June 1992; and Glen C. Rains and Mike Van Voorhis, ''Quasi Static and Dynamic Roof Crush Testing,'' DOT HS 808–873, 1998.

[40] ''Rollover Roof Crush Studies,'' Contract DTNH22–92–D–07323, 1993.

[41] Kanianthra, Joseph and Rains, Glen, ''Determination of the Significance of Roof Crush on Head and Neck Injury to Passenger Vehicle Occupants in Rollover Crashes,'' SAE Paper 950655, Society of Automotive Engineers, Warrendale, PA, 1994.

[42] 1st group of vehicles: MY2002 Dodge Ram 1500, MY2002 Toyota Camry, MY2002 Ford Mustang, MY2002 Honda CRV, MY2002 Ford Explorer, MY2001 Ford Crown Victoria, MY2001 Chevy Tahoe, MY1999 Ford E–150, MY1998 Chevy S10 Pickup, and MY1997 Dodge Grand Caravan.

[43] See Docket Number NHTSA–2005–22143.

[44] 2nd group of vehicles: MY2003 Ford Focus, MY2003 Chevy Cavalier, MY2003 Subaru Forester, MY2002 Toyota Tacoma, MY2001 Ford Taurus, MY2003 Chevy Impala, MY2002 Nissan Xterra, MY2003 Ford F–150, MY2003 Ford Expedition, and MY2003 Chevy Express 15-passenger van.

[45] See Docket Number NHTSA–2005–22143.

[46] Compliance group of vehicles: MY2003 Mini Cooper, MY2003 Mazda 6, MY2003 Kia Sorento, MY2003 Chevrolet Trailblazer, MY2003 Ford Windstar, MY2004 Honda Element, MY2004 Chrysler Pacifica, MY2004 Land Rover Freelander, MY2004 Nissan Quest, and MY2004 Lincoln LS.

[47] See Docket Number NHTSA–2005–22143.

[48] See 64 FR 22567 (April 27, 1999).

[49] See Docket 94–097–N02–010.

[50] See 64 FR 22567 at 22576 (April 27, 1999).

The tie-down procedure was evaluated as part of the vehicle testing discussed in Section V(C)(1). While some of the vehicles used for testing were previously converted to sled bucks as a method to restrain vehicle motion, the agency does not consider converting vehicles into sled bucks to be a viable tie-down procedure. Two different methods of securing vehicles were explored. The first method secured the vehicle using rigidly attached vertical supports and chains. The second method used only rigidly attached vertical supports.

Based on the test results, the agency believes that both methods sufficiently restrain vehicle motion. The agency is proposing to adopt the second tie-down method using only rigidly attached vertical supports. Eliminating the use of chains prevents any pre-test stress resulting from tightening of chains. The agency believes that this method may result in a more consistent location of the initial contact point of the test plate. The details on the tie-down procedure testing, including photographs and relevant data, please see the docket.

VI. Summary of Comments in Response to the October 2001 Request for Comments

NHTSA received over fifty comments in response to the October 2001 RFC. The comments were submitted by vehicle manufacturers, trade associations, consumer advocacy groups, and individuals. Specific comments are addressed in Section VII of this document. Below is a summary of comments in response to the October 2001 RFC.

The agency received several comments in favor of retaining the current FMVSS No. 216 requirements and rejecting a dynamic testing alternative. First, the Alliance of Automobile Manufacturers (Alliance), DaimlerChrysler (DC), General Motors (GM), and Biomech, Inc. (Biomech), suggested that there are not any data to suggest that stronger roofs would reduce severity of injuries in rollover crashes. Second, Nissan North America, Inc. (Nissan) and Ford suggested that the current test procedure is the most appropriate one from the standpoint of repeatability of test conditions and results.

By contrast, NHTSA received several comments opposing the current quasi-static test procedure. Advocates for Highway Safety (Advocates) and Public Citizen stated that the current test procedure does not accurately measure vehicle roof strength and impact response in real-world rollover crashes. Therefore, the commenters suggested that the agency adopt a fully dynamic rollover test procedure.

The Alliance, GM, DC and Biomech stated that there are not any data to support extending application of FMVSS No. 216 to heavier vehicles, which, they believe, have significantly different rollover characteristics. By contrast, Consumers Union (CU), Public Citizen and several individual commenters supported extending application of the standard to vehicles with a GVWR of 4,536 kilograms (10,000 pounds) because of the widespread use of heavier sport utility vehicles for family transportation. These commenters also expressed their concerns about the rollover propensity of passenger vans.

CU, Public Citizen, and Safety Analysis and Forensic Engineering (SAFE) suggested that a modified load plate size and position would better replicate the typical location and concentration of forces in a rollover event. However, DC and Biomech stated that further changes to the current load plate size and position would not appreciably reduce injuries and might lead to unintended compliance and enforcement problems.

Center for Injury Research recommended that NHTSA include a sequential test of both sides of the vehicle roof at a roll angle of 50-degrees since the existing FMVSS No. 216 ensures reasonable strength only on the near side of the roof.

With regard to the force application requirement, Ford and Nissan stated that the current level of 1.5 times the unloaded vehicle weight is a sufficient test requirement. However, Public Citizen, Carl Nash, and Hans Hauschild recommended an increased load and application rate to replicate the dynamic forces occurring in a rollover event.

Public Citizen, CU and several individual commenters suggested that FMVSS No. 216 testing should be conducted without the windshield and/or side glazing because glazing materials often break during the first quarter turn and provide virtually no support to the roof structure in subsequent turns.

With respect to a direct headroom reduction limit, Ford, Nissan, GM, DC and Biomech stated that there is not any indication that limiting headroom reduction can offer quantifiable benefits for either belted or unbelted occupants. Specialty Equipment Marketers Association (SEMA) expressed concern that any proposed headroom regulation would create a substantial problem for aftermarket manufacturers of sunroofs, moon roofs and other roof-mounted accessories. Public Citizen, Nash and other individual commenters suggested that a minimum headroom clearance requirement should be established because real-world data indicate that roof crush is directly related to head and neck injuries.

Finally, NHTSA received several comments suggesting that the agency adopt new requirements to minimize occupant excursion in rollover crashes and require vehicles to have rollover sensors. Additionally, we received comments from DC, Biomech, and Ford suggesting that the agency develop a biofidelic rollover test dummy or at least modify the Hybrid III.

VII. Agency Proposal

Based on available information, including long-term and more recent agency research, the assessment of crash and injury statistics, and evaluation of comments in response to the October 2001 RFC, the agency has tentatively concluded that FMVSS No. 216 should be upgraded in order to mitigate serious and fatal injuries resulting from rollover crashes. Specifically, NHTSA is proposing to:

- Extend the application of the standard to MPVs, trucks, and buses with a GVWR greater than 2,722 kilograms (6,000 pounds), but not greater than 4,536 kilograms (10,000 pounds).
- Allow vehicles manufactured in two or more stages, other than chassis-cabs, to be certified to the roof crush requirements of FMVSS No. 220, instead of FMVSS No. 216.
- Clarify the definition and scope of exclusion for convertibles.
- Require that vehicles subject to the standard withstand the force of 2.5 times their unloaded vehicle weight.
- Eliminate the 22,240 Newton maximum force limit for passenger cars.
- Replace the current plate movement limit with a new direct limit on headroom reduction, which would prohibit any roof component or the test plate from contacting the 50th percentile male Hybrid III dummy seated in either front outboard designated seating position.
- Revise the vehicle tie-down procedure to minimize variability in testing.
- Revise the test device positioning to minimize variability in testing.

A. Proposed Application

1. MPVs, Trucks and Buses with a GVWR of 4,536 Kilograms (10,000 pounds) or Less

Currently, FMVSS No. 216 applies to passenger cars and to MPVs, trucks and buses with a GVWR of 2,722 kilograms (6,000 pounds) or less. However, it does not apply to school buses, convertibles, and vehicles that conform to the rollover test requirements in S5.3 of FMVSS No. 208.

As discussed in Section II(B), the agency amended FMVSS No. 216 on April 17, 1991 by extending application of the standard to include MPVs, trucks, and buses with a GVWR of 2,722 kilograms (6,000 pounds) or less. The agency sought to ensure that those vehicles offered a level of roof crush protection comparable to that offered by passenger cars.

Prior to the 1991 final rule, NHTSA proposed to extend the application of the standard up to the GVWR of 4,536 kilograms (10,000 pounds) or less. However, because of concerns regarding the feasibility of this proposal, the agency adopted a more limited extension and indicated it would investigate this issue further before conducting further rulemaking.[51]

As previously discussed in Section IV(A), recent data indicate that a significant number of serious and fatal injuries occur during rollovers of light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds). Based on these injury data and the responses to the October 2001 RFC, the agency is once again proposing to extend the application of the standard to include light trucks with a GVWR up to 4,536 kilograms (10,000 pounds).

In comments on the October 2001 RFC, the Alliance, DC, GM, and Biomech all stated that there are little or no data to support extending the application of the standard to 4,536 kilograms (10,000 pounds). In contrast, CU, Public Citizen, and several individual commenters stated that the weight limit should be raised up to 4,536 kilograms (10,000 pounds) GVWR due to widespread use of sports utility vehicles for family transportation and their concerns regarding rollover risks associated with 15-passenger vans.

A significant percentage of light trucks are not yet subject to the requirements of FMVSS No. 216. Specifically, Polk New Vehicle Registration data show that out of a total of 8,800,000 new light trucks registered in 2003, more than 44 percent (3,900,000) had a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds), and therefore are not subject to current requirements of FMVSS No. 216. Given that the data in Table 3 show a greater average roof crush for heavier light trucks, the agency believes that this fleet data suggest the need to regulate a greater percentage of light trucks traveling on U.S. highways.

In addition, sales of new light trucks with a GVWR of 2,722 kilograms (6,000 pounds) to 4,536 kilograms (10,000 pounds) GVWR have been increasing rapidly. According to Polk New Vehicle Registry, the number of new registrations has increased from 2.3 million for model year 1997 to 3.5 million for model year 2001.[52] That number represents 21 percent of the total number of light duty vehicles sold in the United States in 2001. With the increasing sales volume of ''heavier'' light trucks, the number of passenger-carrying vehicles not subject to the requirements of FMVSS No. 216 is increasing every year.

Also, we note that analysis of recent safety data shows that a significant number of serious and fatal injuries occur during rollovers in light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds). Specifically, 412 belted, not fully ejected occupants are killed or seriously injured every year in light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) involved in rollover crashes resulting in roof intrusion. Among these 412 fatally or seriously injured occupants, we estimate that 129 could potentially benefit from upgraded roof crush resistance requirements because they suffered their most severe (MAIS) injury from roof contact.

Further, the number of light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) involved in a fatal rollover increased from 1,187 in 1997 to 1,589 in 2001.

DC and other commenters also argued that larger vehicles have a higher ratio of height-to-width, which tends to produce less intrusion in rollover crashes. However, no data were provided to support their argument. In addition, Table 3 shows that 55 percent of light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) that were involved in rollover crashes experienced at least 15 cm (5.9 inches) of vertical roof intrusion. At the same time, only 49 percent of light trucks with a GVWR of less than 2,722 kilograms (6,000 pounds) and 32 percent of passenger vehicles experienced similar intrusion levels. Because the likelihood of roof intrusion exceeding 15 cm (5.9 inches) is relatively similar among the three groups of vehicles (and actually slightly higher for heavier light trucks), these data do not suggest a lesser risk of roof contact to occupants of light trucks with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) in rollovers than to occupants of lighter vehicles.

Our research indicates that many vehicles with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) would comply with current roof crush requirements of FMVSS No. 216. The agency recently conducted roof crush testing on six vehicles with a GVWR over 2,722 kilograms (6,000 pounds).[53] All six vehicles met the requirements of the current standard.[54] We anticipate that the compliance burdens associated with the proposed roof strength requirements would be similar for vehicles with a GVWR between 2,722 kilograms (6,000 pounds) and 4,536 kilograms (10,000 pounds) as for those lighter vehicles already subject to the requirements of FMVSS No. 216.

Finally, we are cognizant that increasing roof crush resistance requirements could potentially add weight to the roof and pillars, thereby increasing the vehicle center of gravity (CG) height and rollover propensity.[55] NHTSA examined the potential effects of a more stringent roof crush requirement on vehicle rollover propensity. In Appendix A to the Preliminary Regulatory Impact Analysis (PRIA), the agency estimated the change in the CG height for two vehicles[56] with a finite element model that was used to evaluate possible design changes and costs associated with this proposal. NHTSA then analyzed six additional vehicles to provide a more representative estimate of potential impacts. Our analysis indicates that the potential CG height increases[57] were very small; *i.e.*, within the tolerance of what can be physically measured.

We also note that, in addition to structural integrity of the vehicle, other new vehicle design considerations affecting the handling and stability of the vehicle, such as vehicle track width, suspension system, and placard tire pressure, have a commensurate or even greater influence on rollover propensity.

[51] See 56 FR 15510 (April 17, 1991).

[52] *http://www.polk.com/products/new_vehicle_data.asp.*

[53] The six vehicles were: MY 1999 Ford E–150, MY 2001 Chevrolet Tahoe, MY 2002 Dodge Ram, MY 2003 Ford F–150, MY 2003 Ford Expedition, and MY 2003 Chevy Express.

[54] See Docket Number NHTSA–2005–22143.

[55] NHTSA estimates that about one third of all vehicles would require changes to meet the proposed standard.

[56] MY 1998 Dodge Neon and MY 1999 Ford E–150

[57] Less than 1 mm for the Neon, and less than 2 mm for the F–150.

An expanded discussion of the potential impacts is included in the PRIA.

Further, previous NHTSA research evaluated four Nissan vehicles modified for increased roof strength.[58] The CG height for each modified vehicle varied between 25 mm above and 25 mm below the baseline vehicle. We also note that the CG height varied by more than 6 mm even between two similar baseline vehicles. This data further supports the agency's findings that increases in the roof structural strength will not have a physically measurable influence on the CG height, and that influence on CG is commensurate with other vehicle design characteristics and production variations.

For the foregoing reasons, the agency proposes to extend the application of FMVSS No. 216 to MPVs, trucks and buses with a GVWR of 4,536 kilograms (10,000 pounds) or less.

2. Vehicles Manufactured in Two or More Stages

For vehicles manufactured in two or more stages,[59] other than vehicles incorporating chassis-cabs,[60] we are proposing giving their manufacturers the option of certifying them to either the existing roof crush requirements of FMVSS No. 220, *School Bus Rollover Protection*, or the proposed new roof crush requirements of FMVSS No. 216. FMVSS No. 220 uses a horizontal plate, instead of the angled plate of Standard No. 216.

Multi-stage vehicles are aimed at a variety of niche markets, most of which are too small to be serviced economically by single stage manufacturers. Some multi-stage vehicles are built from chassis-cabs that have intact roof designs. Others are built from less complete vehicles and are designed to service particular needs—often necessitating the addition by the final stage manufacturer of its own roof or occupant compartment. In considering requirements applicable to this segment of the motor vehicle market, the agency must consider a number of principles.

First, the mandate in the Vehicle Safety Act that the agency consider whether a proposed standard is appropriate for the particular type of motor vehicle for which it is prescribed is intended to ensure that consumers are provided an array of purchasing choices and to preclude standards that will effectively eliminate certain types of vehicles from the market. See *Chrysler Corporation* v. *Dept. of Transportation,* 472 F.2d 659,679 (6th Cir. 1972) (agency may not establish a standard that effectively eliminates convertibles and sports cars from the market). Second, the agency may not provide exemptions for single manufacturers beyond those specified by statute. See *Nader* v. *Volpe,* 320 F. Supp. 266 (D.D.C. 1970), motion to vacate affirmance denied, 475 F.2d 916 (DC Cir. 1973). Finally, the agency must provide adequate compliance provisions applicable to final stage manufacturers. Failing to provide these manufacturers with a means of establishing compliance would render a standard impracticable as to them. See *National Truck Equipment Association* v. *National Highway Traffic Safety Administration,* 919 F.2d 1148 (6th Cir. 1990) (''NTEA'').

One of the traditional ways in which the agency has handled compliance issues associated with multi-stage vehicles has been simply to exclude from the scope of the standard all vehicles, single-stage as well as multi-stage, within the upper GVWR range of light vehicles, typically from 8,500 pounds GVWR to 10,000 pounds GVWR. Many of the multi-stage vehicles manufactured for commercial use cluster in that GVWR range.[61]

The agency traditionally took this approach because the agency historically was of the view that it could not subject vehicles built in multiple-stages to any different requirements than those built in a single-stage. That was because the agency had construed 49 U.S.C. 30111(b)(3), which instructs the agency to ''consider whether a proposed standard is reasonable, practicable, and appropriate for the particular type of motor vehicle . . . for which it is prescribed,'' as precluding such an approach.

In reaching that conclusion, the agency had focused on a comment in the Senate Report:

> In determining whether any proposed standard is ''appropriate'' for the particular type of motor-vehicle * * * for which it is prescribed, the committee intends that the Secretary will consider the desirability of affording consumers continued wide range of choices in the selection of motor vehicles. Thus it is not intended that standards will be set which will eliminate or necessarily be the same for small cars or such widely accepted models as convertibles and sports cars, so long as all motor vehicles meet basic minimum standards. Such differences, of course, would be based on the type of vehicle rather than its place of origin or any special circumstances of its manufacturer.

Focusing on the last sentence of that passage, the agency had concluded that the number of stages in which a vehicle was built was a ''special circumstance[s] of its manufacturer,'' (see, *e.g.*, 60 FR 38749, 38758, July 28, 1995), rather than considering a multi-stage vehicle to be a ''type of vehicle.'' But see *NTEA* (at 1151) (Noting the agency's regulation defining ''incomplete vehicle'' as ''as assemblage consisting as a minimum, of frame and chassis structure, power train, steering system, suspension system, and braking system, to the extent that those systems are to be part of the completed vehicle that requires further manufacturing operations * * * to become a completed vehicle. 49 CFR 568.3 (1989).''

We have reconsidered our historical view in light of relevant case law and our experience with the compliance difficulties imposed on final stage manufacturers. We note that the language we had previously considered to be a limitation does not appear in the statutory text. Nothing in the statutory text implies that Congress intended that incomplete vehicles not be deemed a vehicle type subject to special consideration during the regulatory process. We believe the sentence found in the Senate Report was intended to avoid regulatory distinctions based on manufacturer-specific criteria (such as place of production or manner of importation). This is consistent with the Court's conclusion in *Nader* v. *Volpe,* supra, that the agency cannot give exemptions to particular manufacturers beyond those provided by the statute.

We also had overlooked the existence of relevant physical attributes of multi-stage vehicles. Most multi-stage vehicles have distinct physical features related to their end use. Especially in the context of the difficulties of serving niche markets, the physical limitations of incomplete vehicles can adversely affect the ability of multi-stage manufacturers

[58] ''Design Modification for a 1989 Nissan Pick-up—Final Report,'' DOT HS 807 925, NTIS, Springfield, Virginia, 1991.

[59] Vehicles manufactured in two or more stages are assembled by several independent entities with the ''final stage'' manufacturer assuming the ultimate responsibility for certifying the completed vehicle.

[60] Under 49 CFR 567.3, chassis-cab means an incomplete vehicle, with a completed occupant compartment, that requires only the addition of cargo-carrying, work-performing, or load-bearing components to perform its intended functions.

[61] As the Court noted in NTEA (at 1158): ''The Administration could meet the needs of final-stage manufacturers in many ways. It could exempt from the steering column displacement standard all commercial vehicles or all vehicles finished by final-stage manufacturers. It could exempt those vehicles for which a final-stage manufacturer cannot pass through the certification from the incomplete vehicle manufacturers. It could change the pass through regulations. It could reexamine the issue and prove that final-stage manufacturers can conduct engineering studies, and then provide in the regulation that such studies exceed the capacities of final-stage manufacturers.''

to design safety performance into their completed vehicles.

Further, as previously applied, our interpretation limits our ability to secure increases in safety. Excluding all vehicles within a given GVWR range from a safety requirement because of the possible compliance difficulties of some of those vehicles means not obtaining the safety benefits of that requirement for any of those vehicles. Likewise, applying less stringent requirement to all of those vehicles because of multi-stage considerations would also entail a loss of safety benefits.

It would be perverse to conclude that Vehicle Safety Act permits us to exclude all vehicles within a certain GVWR range primarily based on the compliance difficulties of multi-stage vehicles within that range, but not to exclude only the multi-stage vehicles within that range, thus enabling consumers to obtain the safety benefits of regulating the other vehicles within that weight range.

In the context of this rulemaking, we believe it appropriate to consider incomplete vehicles, other than those incorporating chassis-cabs, as a vehicle type subject to different regulatory requirements. We anticipate that final stage manufacturers using chassis cabs to produce multi-stage vehicles would be in position to take advantage of ''pass-through certification'' of chassis cabs, and therefore do not propose including such vehicles in the category of those for whom this optional compliance method is available.

Thus, we are proposing to allow final stage manufacturers to certify non-chassis-cab vehicles to the roof crush requirements of FMVSS No. 220, as an alternative to the requirements of FMVSS No. 216. We decided to propose this approach instead of excluding most multi-stage vehicles by proposing to exclude all vehicles with a GVWR above 8,500 pounds. The latter approach would have excluded some vehicles, *e.g.*, 15-passenger vans and vehicles built from chassis-cabs, that we tentatively conclude should be subject to the proposed upgraded requirements of FMVSS No. 216.

The requirements in FMVSS No. 220 have been effective for school buses, but we are concerned that they may not be as effective for other vehicle types. As noted above, the FMVSS No. 216 test procedure results in roof deformations that are consistent with the observed crush patterns in the real world for light vehicles. Because of this, NHTSA's preference would be to use the FMVSS No. 216 test procedure for light vehicles. However, this approach would fail to consider the practicability problems and special issues for multi-stage manufacturers.

In these circumstances, NHTSA believes that the requirements of FMVSS No. 220 appear to offer a reasonable avenue to balance the desire to respond to the needs of multi-stage manufacturers and the need to increase safety in rollover crashes. Several states already require ''para-transit'' vans and other buses, which are typically manufactured in multiple stages, to comply with the roof crush requirements of FMVSS No. 220. These states include Pennsylvania, Minnesota, Wisconsin, Tennessee, Michigan, Utah, Alabama, and California. NHTSA tentatively concludes that these state requirements show the burden on multi-stage manufacturers for evaluating roof strength in accordance with FMVSS No. 220 is not unreasonable, and applying FMVSS No. 220 to these vehicles would ensure that there are some requirements for roof crush protection where none currently exist.

3. Convertibles

Currently, convertibles are excluded from the requirements of FMVSS No. 216. FMVSS No. 216 does not define the term ''convertibles.'' However, S3 of 49 CFR 571.201 defines ''convertibles'' as vehicles whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member. In a previous rulemaking, NHTSA stated that ''open-body type vehicles''[62] are a subset of convertibles and are therefore excluded from the requirements of FMVSS No. 216.[63]

However, NHTSA has reassessed its position with respect to ''open-body type vehicles.'' Specifically, we believe that we were incorrect in stating that ''open-body type vehicles'' were a subset of convertibles because some open-body type vehicles do not fall under the definition of convertibles in S3 of FMVSS No. 201. For example, a Jeep Wrangler has a rigid structural member that connects the A-pillars to the B-pillars. The Jeep Wrangler is an ''open-body type vehicle'' because it has a removable compartment top, but it does not fall under the definition of convertibles because its A-pillars are connected with the B-pillars through the structural member.

The agency believes that ''open-body type vehicles'' such as the Jeep Wrangler are capable of offering roof crush protection over the front seat area. Accordingly, the agency proposes to limit the exclusion from the requirements of FMVSS No. 216 to only those vehicles whose A-pillars are not joined with the B-pillars, thus providing consistency with the definition of a convertible in S3 of FMVSS No. 201. To clarify the scope of the exemption for convertible vehicles, we are proposing to add the definition of convertibles contained in S3 of 49 CFR 571.201 to the definition section in FMVSS No. 216.

The agency seeks comments on the following:

1. The number of vehicle lines that fall under the definition of ''open-body type vehicles,'' but do not fall under the definition of convertibles.
2. The roof crush performance of open-body type vehicles that do not fall under the definition of convertibles.
3. The feasibility of requiring that open-body type vehicles meet FMVSS No. 216.

B. Proposed Amendments to the Roof Strength Requirements

1. Increased Force Requirement

Currently, FMVSS No. 216 requires that the lower surface of the test plate not move more than 127 mm (5 inches), when it is used to apply a force equal to 1.5 times the unloaded weight of the vehicle to the roof over the front seat area. For passenger cars, the applied force cannot exceed 22,240 Newtons (5,000 pounds). As a result, passenger cars that have an unloaded weight above 1,512 kilograms (3,333 pounds) are, in effect, tested to a less stringent requirement than other passenger cars and light trucks under the current standard.[64] Based on the agency analysis of crash data, as well as comments in response to the October 2001 RFC, NHTSA is proposing to require that the roof over the front seat area withstand the force increase equal to 2.5 times the unloaded weight of the vehicle, and to eliminate the 22,240 Newton (5,000 pound) force limit for passenger cars.

Increase Applied Force to 2.5 Times the Unloaded Vehicle Weight

NHTSA believes that FMVSS No. 216 could protect front seat occupants better if the applied force requirement reduced the extent of roof crush occurring in real world crashes. That is, the increased applied force requirement would lead to stronger roofs and reduce the roof crush severity observed in real world crashes. We observed that in many real-world rollovers, vehicles subject to the

[62] An open-body type vehicle is a vehicle having no occupant compartment top or an occupant compartment top that can be installed or removed by the user at his convenience. See Part 49 CFR 571.3.

[63] See 56 FR 15510 (April 17, 1991).

[64] 5,000 pounds ÷ 1.5 = 3,333 pounds.

requirements of FMVSS No. 216 experienced vertical roof intrusion greater than the test plate movement limit of 127 mm (5 inches). Specifically, from the 1997–2002 NASS–CDS data, we estimate that 32 percent of passenger cars and 49 percent of light trucks with a GVWR under 2,722 kilograms (6,000 pounds) exceed 150 mm (5.9 inches) of vertical roof intrusion. Further, 55 percent of light trucks with a GVWR greater than 2,722 kilograms (6,000 pounds) and less than or equal to 4,536 kilograms (10,000 pounds) exceed 150 mm (5.9 inches) of vertical roof intrusion.[65] Based on these data, we have tentatively concluded that the test force should be increased.

Accordingly, NHTSA is proposing to increase the applied force requirement to 2.5 times[66] the unloaded vehicle weight in order to better protect vehicle occupants by reducing the amount of roof intrusion in rollover crashes. The agency believes that reduction in roof intrusion would better protect vehicle occupants.

Public Citizen and several individual commenters on the October 2001 RFC suggested that NHTSA require a vehicle to withstand an applied force of 3.0 to 3.5 times the unloaded vehicle weight in order to better replicate dynamic forces occurring in rollover crashes. Carl Nash suggested that the agency propose a new requirement that the roof must sustain 1.5 times vehicle's GVWR before 127 mm (5 inches) of plate movement and sustain a force that does not drop more than 10 percent during the test. After the force of 1.5 times the GVWR has been achieved, the force should be increased to 2.5 times the vehicle's GVWR without any further roof deformation.

In response to these comments, the agency notes that it previously conducted a study (Rains study)[67] that measured peak forces generated during quasi-static testing under FMVSS No. 216 and under SAE J996 inverted drop testing. In the Rains study, nine quasi-static tests were first conducted. The energy absorption was measured and used to determine the appropriate corresponding height for the inverted drop conditions. Six of the vehicles were then dropped onto a load plate. The roof displacement was measured using a string potentiometer connected between the A-pillar and roof attachment and the vehicle floor. The peak force from the drop tests was limited to only the first 74 mm (3 inches) of roof crush because some of the vehicles rolled and contacted the ground with the front of the hood. Similarly, the peak quasi-static force was limited during the first 127 mm (5 inches) of plate movement. This report showed that for the nine quasi-static tests, the peak force-to-weight ratio ranged from 1.8 to 2.5. Six of these vehicle models were dropped at a height calculated to set the potential energy of the suspended vehicle equal to the static tests. For these dynamic tests, the peak force-to-weight ratio ranged from 2.1 to 3.1. In sum, the agency concluded that 2.5 was a good representation of the observed range of peak force-to-weight ratio.

The agency believes that manufacturers will comply with this standard by strengthening reinforcements in roof pillars, by increasing the gauge of steel used in roofs or by using higher strength materials. The agency estimates that 32 percent of all current passenger car and light truck models will need changes to meet the 2.5 load factor requirement.

The agency has tentatively concluded that 2.5 constitutes a load factor appropriate to enhance roof crush performance. As described above, roof crush performance is but one of several measures necessary to reduce rollover related fatalities and injuries. Continued improvements in driver behavior, combined with advanced technologies such as electronic stability control systems and lane departure warnings will further reduce those fatalities and injuries.

Further, NHTSA's New Car Assessment Program (NCAP) provides a strong incentive for manufacturers to design vehicles that will attain favorable Static Stability Factors (representing the relatively numerous tripped rollovers) and that will perform well in the dynamic maneuver (representing the relatively few untripped rollovers), as well as meeting the minimum load factor of 2.5.

Safety Analysis and Forensic Engineering (SAFE) and Syson-Hille and Associates argued that solely attaining the peak force is not a useful indicator of roof crush resistance performance because the peak forces often drop significantly due to breaking glass and other structural failures. They recommend an energy absorption requirement in order to prevent roof collapse after initial peak forces are attained. The agency has not previously considered adding an energy absorption requirement to FMVSS No. 216 and would have to conduct significant additional analysis in order to evaluate the energy absorption requirement and determine appropriate parameters for testing. Accordingly, the agency is not proposing an energy absorption requirement in this document. Nevertheless, the agency would welcome comments on energy absorption test described by SAFE and Syson-Hille.

Eliminate 22,240 Newton Force Limit for Passenger Cars

At the inception of the standard, some passenger cars were not subjected to the full requirements of the standard, which mandated the roof over the front seat area to withstand the force of 1.5 times the unloaded vehicle weight. For passenger cars, this force was limited to 22,240 Newtons (5,000 pounds). That meant that heavier passenger cars were not tested at 1.5 times their unloaded vehicle weight. In fact, every passenger car weighing more than 1,512 kg (3,333 pounds) was subjected to less stringent requirements. The purpose of this limit was to avoid making it necessary for manufacturers to redesign large cars that could not meet the full roof strength requirements of the standard.[68] At the time, the agency believed that requiring larger passenger cars to comply with the full (1.5 times the unloaded vehicle weight) requirement would be unnecessary because heavy passenger cars had lower rollover propensity. However, as explained below, the agency tentatively concludes that occupants of passenger cars weighing more than 1,512 kg (3,333 pounds) are sustaining rollover-related injuries and therefore require the same level of roof crush protection as other vehicles subject to the standard.

While passenger car rollover propensity is lower than it is for light trucks, these vehicles can and do experience rollover crashes. Recent crash data indicate that this is just as true for passenger cars with unloaded vehicle weight of over 1,512 kg (3,333 pounds), as it is for cars with lower unloaded vehicle weights. Specifically, out of an annually estimated 6,274 seriously or fatally injured belted and not fully ejected occupants of passenger cars involved in rollovers resulting in roof intrusion, an estimated 1,460 (23 percent) were in passenger cars that had an unloaded vehicle weight of over 1,512 kg (3,333 pounds). Further, corporate average fuel economy (CAFE) data have shown that from 1991 to 2001, the average weight of passenger cars has

[65] Table 3 shows the percent of roof-involved rollover vehicles with particular degrees of vertical roof intrusion by vehicle body type.

[66] NHTSA's rationale for selecting a factor of 2.5 is discussed below in the response to public comments about the appropriate level of the factor.

[67] Glen C. Rains and Mike Van Voorhis, ''Quasi Static and Dynamic Roof Crush Testing,'' DOT HS 808–873, 1998.

[68] See 54 FR 46276.

increased more than 7 percent.[69] This trend suggests that more passenger cars are being subjected to less stringent roof crush resistance requirements each year. Based on these data, the agency believes that occupants of passenger vehicles with unloaded vehicle weight of over 1,512 kg (3,333 pounds) should be afforded the same level of roof crush protection that is being offered by lighter passenger cars and light trucks.

In addition, we note that the manufacturers already produce heavier passenger cars that exceed the current requirements of the standard. Recently, the agency tested several passenger cars with an unloaded weight of near or over 1,512 kilograms (3,333 pounds). The roof of each vehicle withstood the force of at least 1.5 times the unloaded vehicle weight. For example, MY 2002 Ford Crown Victoria with an unloaded vehicle weight of 1,788 kilograms (3,942 pounds) withstood an applied force of almost 2 times the unloaded vehicle weight (3671 kilograms (8,093 pounds)) before 127 mm (5 inches) of plate movement was attained. A MY 2004 Lincoln LS with an unloaded vehicle weight of 1,663 kilograms (3,666 pounds) withstood an applied force of slightly greater than 2.5 times (4,290 kilograms, (9,458 pounds)) the unloaded vehicle weight before 127 mm (5 inches) of plate movement was attained.

2. Headroom Requirement

The current standard requires that the lower surface of the test device not move more than 127 mm (5 inches) under the specified applied force. The purpose of the requirement is to limit the amount of roof intrusion into the occupant compartment. However, the agency now believes that the 127 mm (5 inch) limit is not the most effective way to ensure that front seat area occupants are protected from roof intrusion into the occupant compartment. Specifically, we are concerned that this requirement does not provide adequate protection to front outboard occupants of vehicles with a small amount of occupant headroom and may impose a needless burden on vehicles with a large amount of occupant headroom. For example, in a full size van with a substantial amount of pre-crush headroom, the 127 mm (5 inch) plate movement limit ensures that the collapsed portion of the roof would not contact the front seat occupants. However, in a low roofline sports vehicle, the 127 mm (5 inch) plate movement limit might allow the crushed portion of the roof to contact the head of an average size front seat occupant.

Therefore, the agency is proposing a more direct limit on headroom reduction that would prohibit any roof component from contacting a seated 50th percentile male dummy under the application of a force equivalent to 2.5 times the unloaded vehicle weight. This direct headroom reduction limit would ensure that motorists receive an adequate level of roof crush protection regardless of the type of vehicle in which they ride.

In response to the October 2001 RFC, Ford, Nissan, GM, DC, and Biomech commented that real-world data indicate that it is not possible to estimate quantifiable benefits of headroom reduction limits. However, Ford also suggested that reducing the roof/pillar deformation might benefit belted occupants if it results in the occupant not contacting the roof.

In contrast, Public Citizen and numerous individual commenters asserted that a minimum headroom clearance requirement should be established because they believe that roof crush is related to head and neck injury. Nash stated that limiting the extent and character of roof intrusions can virtually eliminate the risks of serious head and neck injury to restrained occupants in rollover crashes. Nash suggested that NHTSA define headroom reduction limits by using a 50th percentile dummy seat in the front outboard seat. Public Citizen and several other commenters suggested that the standard contain an occupant survival space/non-encroachment zone, which would not be intruded upon during the test, using a 95th percentile dummy.

The 95th percentile Hybrid III male dummy has not been incorporated into 49 CFR Part 572, *Anthropomorphic Test Devices,* and is not yet available for compliance purposes. When the dummy is available, the agency will consider whether it is appropriate to propose using this dummy for compliance testing.

To help evaluate the value of a minimum headroom requirement, NHTSA performed statistical analysis and published its findings in a report entitled, ''Determining the Statistical Significance of Post-Crash Headroom for Predicting Roof Contact Injuries to the Head, Neck, or Face during FMVSS No. 216 Relevant Rollovers.'' [70] This report examined the effect of post-crash headroom (defined as the vertical distance from the top of the occupant's head to the top of the roof liner over the occupant's head after rollover) on injuries to the head, neck, or face from contact with a roof component. We examined light duty vehicles that rolled more than one-quarter turn to the side or end-over-end and did not collide with fixed objects. The vehicle occupants were adults who were belted and seated in the front outboard seats and who were not ejected. Based on this report, the agency estimates that 14 percent of the non-ejected, belted occupants sitting in the two front outboard seats suffered a roof contact injury to the head, neck, or face, and 0.1 percent died as a result of such an injury.

The agency analyzed crash data using two sets of headroom measurement parameters from NCAP/FMVSS No. 208 frontal testing and CU testing. Using NCAP/FMVSS No. 208 headroom measurement parameters, we estimate that 9 percent of occupants with post-crash headroom above the top of their head experienced roof contact injuries to the head, neck, or face, compared to 34 percent for occupants with post-crash headroom below the top of their head. Using CU vehicle headroom measurement parameters, we estimate that 10 percent of occupants with post-crash headroom above the top of their head experienced roof contact injuries to the head, neck, or face, compared to 32 percent for occupants with post-crash headroom below their head. After conducting bivariate and multivariate analyses, we conclude that positive post-crash headroom (residual space over the occupant's head after the rollover) reduced the likelihood of suffering a roof contact injury to the head, neck, or face. This real world data shows quantifiable benefits of limiting headroom reduction.

As previously stated, the agency is proposing to prohibit any roof component or the test device from contacting a seated 50th percentile male Hybrid III dummy under the specified applied force. However, the agency is concerned that there may be some low roofline vehicles [71] in which the 50th percentile Hybrid III dummy would have relatively little available headroom when positioned properly in the seat. That is, we are concerned that, in some limited circumstances, the headroom between the head of a 50th percentile male dummy and the roof liner is so small that even minimal deformation resulting from the application of the required force would lead to test failure. Accordingly, NHTSA requests comments on whether any additional or substitute requirements would be

[69] *http://www.nhtsa.dot.gov/cars/rules/CAFE/NewPassengerCarFleet.htm.*

[70] See Docket Number NHTSA–2005–22143.

[71] Ford GT, Lamborghini Gallardo.

appropriate for low roofline vehicles in order to make the standard practicable.

The agency believes that many vehicles subject to the current requirements of FMVSS No. 216 would meet the proposed limit on headroom reduction. In the recent tests of 20 vehicles of various types and sizes in which the roofs were crushed to 254 mm (10 inches) of displacement, thirteen vehicles had remaining headroom under an applied force of 2.5 times the unloaded vehicle weight. These thirteen vehicles were randomly distributed through the various vehicle types. Based on these tests, the agency believes that vehicle manufacturers are capable of complying with the proposed headroom requirements. In response to the concerns expressed by SEMA with respect to installation of sunroofs and moon roofs, we note that one of the tested vehicles was a Nissan Quest equipped with a Sky View™ glass-paneled roof consisting of a sunroof and two separate glass panels. This vehicle withstood the force of up to 2.8 times the unloaded vehicle weight with 3 inches of displacement.

Finally, in conjunction with the proposed headroom requirement, NHTSA is proposing to create a definition for ''roof component,'' which is similar to the definition found in the NASS–CDS. Specifically, a ''roof component'' would include the A-pillar, B-pillar, front header, rear header, roof side rails, roof, and all the corresponding interior trim. Due to vast variations in roof designs, the agency proposes a ''no-contact'' requirement for all roof components, as opposed to only the actual roof structure. The agency requests comments on the proposed definition.

C. Proposed Amendments to the Test Procedures

1. Retaining the Current Test Procedure

To test compliance, the vehicle is secured on a rigid horizontal surface, and a steel rectangular plate is angled and positioned on the roof to simulate vehicle-to-ground contact over the front seat area. This plate is used to apply the specified force to the roof structure.

Plate position and angle. In response to the October 2001 RFC, the agency received several suggestions regarding the current quasi-static test procedure. Specifically, CU suggested establishing a new plate position, for which the specific application points would be (1) the top of the A-pillar; (2) the top of the rear most pillar, either the B-pillar on a pickup, C-pillar on sedans or the D-pillar on station wagons, SUVs or minivans; and (3) the horizontal and vertical axes at the center of the roof side, usually about the top of the B-pillar. CU and several individual commenters recommended that a more representative plate angle should be 45-degrees for vehicles with a taller, narrower body configuration. SAFE stated that the roll angle should be increased in an attempt to simulate the translational effect of the vehicle traveling across the ground.

In response, NHTSA reviewed NASS–CDS crash data to examine roof deformation patterns and compare real-world roof damage to compliance tests.[72] The agency also compared its findings to the previous study on roof deformation patterns.[73] The agency evaluated the damage to the A- and B-pillars, roof rails and roof plane of the vehicles. Based on the NASS–CDS crash data, we believe that the current test procedure is capable of applying loads resulting in crush patterns consistent with those that occur in the real world.

To further validate the crush patterns of the current FMVSS No. 216 compliance test, the agency evaluated previous tests that compared deformation patterns of multiple inverted drop tests to the quasi-static test procedure at different levels of crush. The tests showed a correlation in deformation patterns, and this correlation increased as the crush levels became more severe.

The agency also evaluated a previous dynamic guardrail test to compare deformation patterns of a dynamic test procedure to the current quasi-static test. A guardrail initiated a dynamic rollover on a 1989 Nissan pickup truck. The resulting rollover produced one roof-to-ground impact. The agency recorded the intrusion levels throughout the area of the vehicle roof. The deformation pattern and intrusion magnitudes of the dynamic rollover were compared to a static crush test of the same vehicle model. The resulting comparison plot showed good linear correlation between the two deformations.[74]

NHTSA also conducted a finite element modeling study to examine the effect of using alternative roll and pitch angles for the current FMVSS No. 216 test procedure.[75] A model of a 1998 Dodge Caravan was used to simulate extended FMVSS No. 216 tests for approximately 127 mm (5 inches) of plate motion using a variety of roll and pitch angles. The simulations predicted that the Caravan roof would attain similar amounts of deformation at a lower force level using 10-degree pitch and 45-degree roll (10–45) application angles compared to the current 5-degree pitch and 25-degree roll (5–25) application angles. In addition, a 1998 Chevrolet S10 pickup model was analyzed in subsequent simulations, but led to less conclusive results.

The results of the finite element modeling study were sufficiently encouraging to conduct a series of modified FMVSS No. 216 tests. Two tests were conducted on Dodge Caravan, Chevrolet S10, and 2002 Ford Explorer vehicles using both the current 5–25 degree application angles as well as using modified 10–45 degree application angles. Each test was conducted until 254 mm (10 inches) of load plate movement was achieved.

The roof damage produced by the two test configurations was generally similar. The tests using 10–45 degree application angles had some additional lateral damage. However, the damage was localized near the roof side rail and did not extend laterally to the midline of the vehicle. The force distribution applied to the front and back of the load plate changed considerably between the two test configurations. The test configuration using the 10–45 degree application angles applied almost all of the force to the forward ram located near the front of the load plate. Comparatively, the 5–25 configuration applied only two-thirds of the force to the front ram. Based on the similarity of the post-test damage patterns and general force levels, the agency concluded that there was not sufficient reason to propose a change in the load plate configuration at this time.

Testing without windshield and/or side windows in place. Public Citizen, CU, and several individual commenters stated that the quasi-static test should be conducted without the windshield and/or side glass. The comments stated that the glass usually breaks after the first quarter-turn, resulting in virtually no support to the roof on subsequent rollovers, and that the roof crush severity substantially increases after the integrity of the windshield is breached.

The agency believes that windshields provide some structural support to the roof even after the windshield breaks because the force-deflection plots in some of the recent test vehicles (*e.g.,* Ford Explorer, Ford Mustang, Toyota Camry, Honda CRV) show little or no drop in force level after the windshield

[72] See Docket Number NHTSA–1999–5572–95.

[73] Michael J. Leigh and Donald T. Willke, ''Upgraded Rollover Roof Crush Protection: Rollover Test and NASS Case Analysis,'' Docket NHTSA–1996–1742–18, June 1992.

[74] See Docket No. NHTSA–2005–22143.

[75] ''Roof Crush Research: Load Plate Angle Determination and Initial Fleet Evaluation.'' Docket No. NHTSA–2005–22143.

integrity was compromised.[76] Further, examination of real-world rollover crashes indicates that the windshield rarely separates from the vehicle, and therefore, does provide some crush resistance. Because NHTSA believes that the vehicle should be tested with all structural components that would be present in a real-world rollover crash, we decline to propose testing without the windshield or other glazing.

Near and far side testing. NHTSA received comments from Public Citizen and the Center for Injury Research regarding near and far side testing.[77] The comments stated that vehicle occupants on the far side of the rollover have a much greater risk of serious injury than occupants on the near side. Therefore, the comments suggested that NHTSA require that both sides of the same vehicle withstand the force equal to 2.5 times the unloaded vehicle weight. That is, after the force is applied to one side of the vehicle, the vehicle is then repositioned and the force is applied on the opposite side of the roof over the front seat area. Public Citizen cited a recent paper by researchers at Delphi Automotive and Saab, which compared the injury risk depending on the seating position of an occupant relative to the direction of the rollover crash.[78] From this study, Public Citizen concluded that belted, non-ejected occupants on the far side suffer 12 times the risk of serious injuries compared to belted, non-ejected occupants on the near side of the rolling vehicle.

In response, NHTSA conducted six tests (2 Lincoln LS, Ford Crown Victoria, Chrysler Pacifica, Nissan Quest, Land Rover Freelander), in which both sides of the vehicle roof were crushed. Using the current FMVSS No. 216 test plate angles, the first side was crushed up to approximately 100 mm (4 inches) of plate movement. The test plate motion compromised the windshield structure in each vehicle. The similar procedure was performed on the opposite side of the vehicle. However, the crush was extended up to 254 mm (10 inches) of plate movement. Detailed reports for these tests are available in the NHTSA docket.[79]

In summary, the first and second side force deflection curves track similarly for the Pacifica and Quest. For the Crown Victoria, the first and second side force curves tracked similarly except between 50–90 mm of crush. During that portion of the curve, the local peak was reduced 17 percent on the second side. However, after 90 mm, the second side force curve tracked similarly to the previously tested Crown Victoria[80] that was crushed to 254 mm (10 inches) of plate movement. For the Freelander, the second side force curve showed an increase in force over the first side, starting at approximately 40 mm of plate movement. As a result, the local peak force was increased by approximately 20 percent on the second side. In contrast, the second side force curve of the Lincoln LS showed a decrease in force starting at approximately 40 mm of plate movement. As a result, the local peak force was decreased by approximately 20 percent on the second side.

To evaluate the repeatability of the tests, the agency performed the identical test procedure on a second Lincoln LS. For the second LS test, both the first and second side force curves tracked similarly to the curves of the first LS test up to approximately 40 mm. However, the local peak for the first side was slightly lower than the first test and the local peak for the second side was slightly higher than the first test on the second side. As a result, the difference in the local peak force between the first and second side was approximately 10 percent.

In conclusion, the agency believes that some vehicles may have weakened or strengthened far side roof structures as a result of a near side impact. However, based on the few vehicles tested, NHTSA does not have enough information to make a decision on the merits of testing both sides of the roof over the front seat area. The agency plans to conduct further research before it proposes rulemaking action in this area.

On July 26, 2004, JP Research, Inc. submitted an evaluation of the Delphi Automotive and Saab research paper (Delphi research paper)[81] relied upon by Public Citizen.[82] JP Research discussed the paper with one of the principal authors and verified that the paper contained errors. Previously, Public Citizen concluded that belted, non-ejected occupants on the far side suffer 12 times the risk of serious injuries compared to belted, non-ejected occupants on the near side of the rolling vehicle. However, as a result of correcting the errors, the ratio changes from 12 to 1, to between 2.4 and 1.

In preparing this document, NHTSA analyzed NASS–CDS (1997 to 2002) data to evaluate the Delphi research paper with respect to merits of testing both sides of the roof over the front seat area. The analysis included belted front outboard adults who were not fully ejected in a manner similar to the Delphi research paper, but it further restricted the analysis to vehicles that rolled only two to four quarter turns to the side. We estimate the risk of a serious injury, defined as a maximum AIS injury of 3 or greater, to be 29 seriously injured persons per 1000 ''far side'' occupants and 30 seriously injured persons per 1000 ''near side'' occupants for a ratio of about 1 to 1. Based on this analysis, the agency believes that there is no significant increase in risk for far side belted, non-ejected occupants.

In summary, NHTSA continues to believe that the quasi-static test procedure is repeatable and capable of simulating real-world rollover deformation patterns. Based on the deformation patterns observed in NASS–CDS cases, finite element modeling, and various controlled vehicle testing, the agency believes that changing the test plate angle is not necessary. Further, the agency believes that the vehicle should be tested with all structural components that would be present in a real-world rollover crash, and therefore we decline to propose testing without the windshield or other glazing. Finally, the agency plans to further evaluate the safety need for testing both sides of the roof over the front seat area on the same vehicle, before proposing such a requirement.

2. Dynamic Testing

In response to the October 2001 RFC, we received several comments suggesting that the agency adopt some form of dynamic testing of roof crush resistance. Specifically, CU and Stilson Consulting urged the agency to adopt dynamic testing to replicate better the influence of variable crush patterns and vehicle dynamic elements that occur in real-world crashes. Further, Hans Hauschild, Hogan, Donald Slavik, and Coben and Associates suggested that NHTSA adopt the SAE J996 inverted drop test because it better replicates real-world rollover dynamics.

The Alliance argued that dynamic testing was unrepeatable. DC and Biomech stated that they have not

[76] See id.

[77] Near side is the side toward which the vehicle begins to roll and far side is the trailing side of the roll.

[78] Parenteau, Chantal, Madana Gopal, David Viano. ''Near and Far-Side Adult Front Passenger Kinematics in a Vehicle Rollover.'' SAE Technical Paper 2001–01–0176, SAE 2001 World Congress, March 2001.

[79] See Docket Number NHTSA–2005–22143.

[80] ''Roof Crush Research: Load Plate Angle Determination and Initial Fleet Evaluation.'' Docket No. NHTSA–2005–22143.

[81] Parenteau, Chantal, Madana Gopal, David Viano. ''Near and Far-Side Adult Front Passenger Kinematics in a Vehicle Rollover.'' SAE Technical Paper 2001–01–0176, SAE 2001 World Congress, March 2001.

[82] See Docket Number NHTSA–1999–5572–93.

evaluated dynamic rollover testing and do not know what injury criteria might be appropriate for assessing dynamic performance. NTEA stated that the benefits of adopting dynamic roof crush testing are unclear. Further, NTEA stated that dynamic rollover testing was neither economically nor technologically feasible.

GM, DC, and Biomech stated that inverted drop testing is not repeatable and cannot accurately represent real-world rollovers. Further, Ford stated that the drop test does not represent the multi-axis, real-world condition with respect to time duration of impact, and does not replicate centrifugal forces on the occupant because the velocity of roof rail impact with the ground in a rollover is a function of the vehicle's roll rate, translational velocity and vertical velocity. Public Citizen asserted that the SAE J996 inverted drop test does not accurately reproduce the lateral sliding forces present in a rollover crash. Carl Nash stated that the inverted drop test can be useful, but does not properly simulate the lateral friction forces that are typical in rollovers on the road.

Based on research discussed in Section V(A) NHTSA believes that the inverted drop test does not replicate real-world rollovers better than the current quasi-static method of testing. Further, the inverted drop test does not produce results as repeatable as the quasi-static method. Specifically, NHTSA believes that the drop test would not apply a consistent directional force among tested vehicles because of the vehicle roll that is introduced after the initial roof impact. Depending on the geometry of the roof and hood, vehicles may experience different load paths as they roll onto its hood or front-end structure.

Advocates for Highway Safety (Advocates) suggested that the agency consider adopting a series of tests for ensuring adequate roof strength. Specifically, Advocates suggested adopting a test similar to the FMVSS No. 208 dolly test. Donald Friedman stated that NHTSA should consider using the FMVSS No. 208 dolly test for research. By contrast, the Alliance, GM, Nissan, Ford, and DC stated that the FMVSS No. 208 dolly test is not repeatable and does not emulate the dynamics of real-world rollover crashes. Further, the test was not developed to predict roof crush performance. Hauschild suggested that the FMVSS No. 208 dolly test, while appropriate for evaluating occupant retention for belted and unbelted occupants, would not be appropriate for evaluating roof strength. Slavik and Syson-Hille asserted that the FMVSS No. 208 dolly test is useful for examining potential occupant kinematics in rollovers, but may not be feasible for pass/fail regulatory purposes due to resultant variability in roof impacts and intrusion.

The FMVSS No. 208 dolly test was originally developed only as an occupant containment test. The test was not developed to evaluate the loads on specific vehicle components. The agency believes this test lacks sufficient repeatability to serve as a structural component compliance requirement.

Biomech Inc. suggested that the agency consider using the Controlled Rollover Impact System (CRIS) device [83] because it overcomes the shortcomings of drop testing (lack of roll and translational velocity-limiting time exposure of roof-to-ground contact) by incorporating important test parameters (roll angle, vertical and horizontal velocities and pitch and yaw of the vehicle). Ford believes that the CRIS is able to create repeatable dynamic rollover impact simulations for the first roof-to-ground impact. By contrast, SAFE and several other individual comments suggested that the conclusions drawn from the CRIS tests [84] mischaracterize the real-world rollover dynamics because the tests were designed to support the hypothesis that roof crush does not cause occupant injuries.

The agency believes the CRIS device is helpful in understanding occupant kinematics during rollover crashes. However, NHTSA believes that the device does not provide the level of repeatability needed, because the CRIS test is repeatable only up to the initial contact with ground. After initial roof impact, the CRIS test allows the vehicle to continue rolling, resulting in an unrepeatable test condition.

Lastly, NHTSA received several comments regarding the Jordan Rollover System (JRS) test device. The JRS device rotates a vehicle body structure on a rotating apparatus (''spit'') while the road surface moves along the track and contacts the roof structure. Public Citizen and the Center for Injury Research believe that the JRS test can be conducted with dummies that demonstrate whether vehicle roof performance meets objective injury and ejection criteria for belted and unbelted occupants.

Although the agency is open to further investigating the JRS test, we have no data regarding the repeatability of dummy injury and roof intrusion measurements. In addition to data on repeatability, NHTSA would need further information on its performance measures, practicability, and relevance to real-world injuries.

In summary, NHTSA is not proposing a dynamic test procedure at this time. As previously stated, the agency believes that the current test procedure is repeatable and capable of simulating real-world rollover deformation patterns. Further, the agency is unaware of any dynamic test procedures that provide a sufficiently repeatable test environment.

3. Revised Tie-Down Procedures

Based on recent testing described in Section V(C), NHTSA is proposing to revise the vehicle tie-down procedure in order to improve test repeatability. Specifically, the agency is proposing to specify that the vehicle be secured with 4 vertical supports welded or fixed to both the vehicle and the test fixture. If the vehicle support locations are not metallic, a suitable epoxy or an adhesive could be used in place of welding. Under the proposal, the vertical supports would be located at the manufacturers' designated jack points. If the jack points are not sufficiently defined, the vertical supports would be located between the front and rear axles on the vehicle body or frame such that the distance between the fore and aft locations is maximized. If the jack points are located on the axles or suspension members, the vertical stands would be located between the front and rear axles on the vehicle body or frame such that the distance between the fore and aft locations is maximized. All non-rigid body mounts would be made rigid to prevent motion of the vehicle body relative to the vehicle frame.

The agency believes this method of securing the vehicle would increase test repeatability. Welding the support stands to the vehicle would reduce testing complexity and variability of results associated with the use of chains and jackstands. In addition, the agency believes that using the jacking point for vertical support attachment is appropriate because the jacking points are designed to accommodate attachments and withstand certain loads without damaging the vehicle.

In previous comments to the Docket, Ford suggested that vehicle overhangs should be supported by jackstands in

[83] The CRIS consists of a towed semi-trailer, which suspends and drops a rotating vehicle from a support frame cantilevered off the rear of the trailer.

[84] Moffatt, E.A., Cooper, E.R., Croteau, J.J., Orlowski, K.F., Marth, D.R., and Carter, J.W. ''Matched-Pair Impacts of Rollcaged and Production Roof Cars Using the Controlled Rollover Impact System (CRIS),'' Society of Automotive Engineers, 2003–01–0172, Detroit, Michigan, 2003.

order to minimize vehicle distortion.[85] However, the agency does not believe that it is necessary to support the vehicle overhangs. In fact, supporting the vehicle overhangs with jackstands could distort the shape of the vehicle prior to testing.

4. Plate Positioning Procedure

Currently, the standard contains two test plate positioning procedures. The primary procedure applies to most vehicles. It places the midpoint of the forward edge of the lower surface of the test device within 10 mm (0.4 inches) of the transverse vertical plane 254 mm (10 inches) forward of the forwardmost point on the exterior surface of the roof. The secondary procedure applies to multipurpose passenger vehicles and buses with raised or altered roofs, at the option of the manufacturer. It places the midpoint of the rearward edge of the lower surface of the test device within 10 mm (0.4 inches) of the transverse vertical plane located at the rear of the roof over the front seat area.

The agency is proposing to specify the primary test procedure for all vehicles. The agency believes that this test plate positioning procedure produces repeatable and reliable means for testing roof strength. The agency believes that the secondary plate positioning test procedure produces rear edge plate loading onto the roof of some raised and altered roof vehicles that cause excessive deformation uncharacteristic of real-world rollover crashes. Because an optimum plate position cannot be established for all roof shapes, the testing of some raised and altered roof vehicles will result in loading the roof rearward of the front seat area. However, NHTSA believes that this is preferable to edge contact because edge contact produces localized concentrated forces upon the roof typically resulting in excessive shear deformation of a small region. In some circumstances, the plate will essentially punch through the sheet metal instead of loading the structure. The agency believes that removing the secondary plate position would also make vehicle testing more objective and practicable. Accordingly, the agency proposes to eliminate the secondary positioning procedure.

VIII. Other Issues

A. Agency Response to Hogan Petition

As previously discussed, on May 6, 1996, the agency received a petition for rulemaking from Hogan.[86] The petitioner claimed that the test requirements of FMVSS No. 216 bear no relationship to real-world rollover crash conditions, and therefore, should be replaced with a more realistic test such as inverted drop test. On January 8, 1997, NHTSA granted this petition, believing that the inverted drop test had merit for further agency consideration.

After careful evaluation of the issues presented by the Hogan petition, the agency has decided against adopting the inverted drop test or other dynamic test procedures because we believe that these tests are not better than the current quasi-static test in replicating real-world rollover crash conditions.

The agency fully discussed alternatives to the current quasi-static test in Section VII(C)(1), (2). First, NHTSA conducted a series of inverted drop tests and concluded that the tests were not better than quasi-static tests in representing vehicle-to-ground interaction occurring during rollover, and were more difficult to conduct because they require suspending and inverting the vehicle.[87] Second, NHTSA conducted dynamic rollover tests and observed that dynamic testing created test conditions so severe it was difficult to discriminate between good and bad performing roof structures, and that the occupant kinematics and roof crush during dynamic rollover were unrepeatable. The agency is unaware of any dynamic test procedures that provide a sufficiently repeatable test environment. Finally, we believe quasi-static testing adequately represent real world dynamic deformation patterns occurring in rollovers.

For the reasons discussed above and in Section VI(C)(1), NHTSA is withdrawing the open rulemaking on the Hogan petition. Instead, the agency proposes to adopt the new roof strength requirements discussed elsewhere in this document.

B. Agency Response to Ford and RVIA Petition

On June 11, 1999, Ford[88] and RVIA[89] submitted petitions for reconsideration to the April 27, 1999, final rule (64 FR 22567), which established the primary and secondary test plate positioning procedures specified in S7.3 and S7.4, respectively. Petitioners argued that the secondary plate positioning test procedure produced rear edge plate loading onto the roof of some raised and altered roof vehicles that caused excessive deformation uncharacteristic of real-world rollover crashes. Specifically, petitioners argued that positioning the test plate such that the rear edge of the plate is at the rearmost point of the front occupant area resulted in stress concentration, which produced excessive deformation and roof penetration. Petitioners stressed that this type of loading is uncommon to real-world rollovers. Consequently, petitioners asked the agency to reconsider adopting the secondary plate positioning procedure for raised or altered roof vehicles. Ford also provided computer analysis that showed non-distributed loading near the edge plate contact when the secondary plate position was used.

As discussed in Section VII(C)(4), the agency is proposing to eliminate the secondary test procedure (49 CFR § 571.216, S7.4) and to require that all vehicles subject to FMVSS No. 216 use the primary test procedure in S7.3. Specifically, all vehicles would be tested such that the midpoint of the forward edge of the lower surface of the test plate is within 10 mm (0.4 inches) of the transverse vertical plane 254 mm (10 inches) forward of the forwardmost point on the exterior surface of the roof.

C. Request for Comments on Advanced Restraints

In evaluating the effectiveness of seat belt restraints in mitigating rollover-related injury, NHTSA developed a rollover test device, the ''rollover restraints tester'' (RRT).[90] RRT was used to simulate rollover conditions and evaluate the effectiveness of: (1) Typical 3-point lap and shoulder belt system; (2) D-ring[91] adjustments, (3) belt pretensioners; (4) integrated seats;[92] and (5) inflatable tubular torso restraint (ITTR) in preventing occupant excursion in a rollover event.[93]

Following testing, we arrived at the following conclusions: (1) The maximum head excursion was much higher during the test (when dummy was upside down in the restraint), compared to static pre- and post-test head excursion measurements; (2) raising the D-ring decreased the dummy head vertical and horizontal excursion

[85] See Docket Number 94–097–N02–010.

[86] See Docket No. 2005–22143.

[87] For more details on the inverted drop test evaluation please see Section VII(C)(1), and Glen C. Rains and Mike Van Voorhis, ''Quasi Static and Dynamic Roof Crush Testing,'' DOT HS 808–873, 1998.

[88] Docket No. NHTSA–99–5572–2 (*http://dmses.dot.gov/docimages/pdf37/57806_web.pdf*).

[89] Docket No. NHTSA–99–5572–3 (*http://dmses.dot.gov/docimages/pdf39/62547_web.pdf*).

[90] See *http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/Esv/esv16/98S8W34.PDF*.

[91] D-ring is the upper anchorage of the three-point seat belt assembly.

[92] An integrated seat is a seat that includes the seat belt mechanism and assembly in the seat instead of on the B-pillar.

[93] Rains, Glen C., *et al.*, ''Evaluation of Restraints Effectiveness in Simulated Rollover Conditions,'' 16th International Technical Conference on the Enhanced Safety of Vehicles, 98–S8–W–34, Windsor, Canada, 1998.

in both 3-point lap and shoulder belt system and ITTR; (3) compared to conventional seats, the integrated seat significantly reduced occupant excursion; (4) initiating belt pretensioners before testing the integrated seat (thus simulating pre-rollover activation of the pretensioners) provided additional benefit; and (5) compared to a conventional lap and shoulder seat belt system, the ITTR more effectively restrained the vertical and longitudinal excursion of the dummy.

In addition to the agency testing, several other studies indicate that pretensioned restraint systems can reduce the amount of vertical head excursion compared to the typical 3-point lap and shoulder belt system.[94] By contrast, a Nissan study showed that the maximum occupant injury values in rollovers did not decrease for occupants with activated pretensioners, compared to occupants without pretensioners.[95]

In response to the October 2001 RFC, we received several suggestions with respect to enhancing occupant protection in rollover crashes by means of using better seat belts. Slavik suggested amending FMVSS Nos. 208 and 209 to require the use of pretensioners that activate in rollovers before the vehicle rolls 90-degrees, and retractors that lock and remain locked for at least five seconds after the pretensioner is fired. Syson-Hille and Associates stated that NHTSA should continue its efforts to increase seat belt use rates, and consider amending FMVSS Nos. 208, 209, and 210 to ensure that belts provide enhanced occupant protection and remain fastened in rollover crashes.

On August 7, 2003, NHTSA met with representatives of the Automotive Occupant Restraints Council (AORC) to discuss seat belt technologies that have the potential for improving occupant protection in rollover crashes.[96] AORC made a presentation entitled, ‘‘Seat Belt Technologies Improving Occupant Protection in Rollover.’’ In the presentation, AORC discussed several seat belt technologies including pretensioning systems, electric retractors, inflatable seat belts, and four-point harnesses.

Since advanced restraints have the potential for contributing to the comprehensive effort to reduce rollover-related injuries and fatalities, the agency would like comments on the following issues:

1. Could requiring advanced restraints systems on vehicles significantly reduce head excursion and decrease occupant injury values in rollovers?

2. Which kinds of advanced restraints systems are the most effective at minimizing vertical occupant excursion during rollovers?

3. What is the current state of technology with respect to pretensioning systems that are capable of activating in a rollover event as well as other crash modes? What are the associated costs?

4. What procedures would be appropriate for testing performance of advanced seat belt systems? At what values should the pretension sensor activate?

5. What would be an appropriate limit for the force exerted by a pretensioning system on an occupant and how would it be measured?

IX. Benefits

The agency examined the relationship between injuries in rollover crashes and the amount of post-crash headroom and found a statistically significant relationship between injury rates and instances in which the roof intruded below the occupant’s normal seating height. The injury patterns were less serious in cases in which roof intrusion did not encroach on the pre-crash headroom of the occupant; i.e., when the deformed roof structure did not intrude below the top of the seated occupant’s head.

Using two alternative analytical approaches, the agency prepared two estimates of safety benefits resulting from the proposed roof crush resistance upgrade. The second approach was developed to cure shortcomings in the first approach.

Under the first approach, the agency analyzed specific cases of actual injuries and fatalities involving belted occupants that were not fully ejected during rollovers. Using FARS and NASS–CDS databases, we analyzed only those cases in which the roof intrusion occurred over the injured occupant’s seat, and the MAIS was in fact caused by roof contact with the occupant. We sought to estimate how an injured or killed occupant in each specific case might have benefited from a stronger roof structure. The agency believes that this estimate is conservative since limiting roof crush might also benefit those occupants who have roof crush related injuries that are not MAIS. That is some occupants are injured as a result of roof crush, but their most severe injury resulted from something other than roof crush.

Based on the first approach, the agency estimates that the proposed requirements would prevent 13 fatalities and 793 non-fatal injuries. We estimate 39 annual equivalent lives saved.

We note, however, that because we narrowed the case sample to reflect specific crash characteristics, the agency has a very limited sample of relevant cases at its disposal. Further, some of the relevant cases within that sample lacked some data elements, resulting in data gaps. At the same time, certain individual cases were assigned very large sample weight by the NASS–CDS database. This distorted the overall profile of relevant injuries (case weight spikes). As a result, the agency believes that the characteristics of this limited sample may not accurately represent the full benefits resulting from the proposed roof crush resistance upgrade.

Under the second approach, the agency again examined the same injury cases discussed in the first approach. However, in evaluating actual crashes, the agency noted that post-crash negative headroom[97] measurements available from FARS and NASS–CDS databases were related to occupant’s actual height. For example, the amount of post-crash headroom in a vehicle occupied by a taller person would be different from post-crash headroom of the same vehicle occupied by a shorter person.

To better estimate how this proposal would benefit occupants of varying heights, the agency assumed that the probability of occupant height in each actual relevant rollover case would be equal to the national distribution of occupant heights. That is, an occupant of any size might have been involved in a crash that fits the agency’s case criteria. We calculated the odds of the occupant in each case being of a height to benefit from the proposed requirements. This calculation differed for each rollover case based on amount of actual roof intrusion and vehicle design. As a result, the agency was able to use a more refined case sample to estimate the benefits of the proposed requirements. We were able to estimate how any occupant would benefit from stronger roofs in each actual crash case.

[94] Pywell, James *et al.*, ‘‘Characterization of Belt Restraint Systems in Quasi-Static Vehicle Rollover Tests,’’ SAE Paper 973334, Society of Automotive Engineers, Warrendale, PA, 1997; and Moffatt, Edward *et al.*, ‘‘Head Excursion of Seat Belted Cadaver, Volunteers and Hybrid III ATD in a Dynamic/Static Rollover Fixture,’’ SAE Paper 973347, Society of Automotive Engineers, Warrendale, PA, 1997.

[95] Hare, Barry *et al.*, ‘‘Analysis of Rollover Restraint Performance with and without Seat Belt Pretensioner at Vehicle Trip,’’ SAE Paper 2002–01–0941, Society of Automotive Engineers, Warrendale, PA, 2002.

[96] See Docket Number NHTSA 2003–14622–10.

[97] Negative headroom means post-crash headroom that is below the occupant’s seated height.

This approach minimized case weight spikes inherent to the first approach used to estimate potential benefits of this proposal.

Under the second approach, the agency estimates that the proposed requirements would prevent 44 fatalities and 498 non-fatal injuries. We estimate 55 equivalent lives saved annually.

We note however, that the second approach assumes a random relationship between the height of drivers and the headroom in vehicles that they purchase. The agency believes that the relationship between vehicle headroom and occupant size is insignificant in most cases. It is likely that taller drivers adjust the seat positions to prevent uncomfortable proximity to the roof.

The agency requests comments on both approaches for estimating benefits of this proposal. A more detailed discussion of the estimated benefits associated with this proposal are in the PRIA.

X. Costs

The agency estimates that upgrading the roof crush resistance standard would result in annual fleet costs of $88 to $95 million. The total fleet cost is based on structural changes and impacts on fuel economy. The average cost of strengthening the roof structure of vehicles that do not meet the proposed requirements is estimated to be $10.67 per vehicle, with an annual fleet cost of $58.6 million. We estimate that approximately 32 percent of the current vehicle fleet would need improvements to meet the proposed upgraded requirements. The average fuel economy impact cost is estimated to be $5.33 to $6.69 per vehicle, with an annual fleet cost of $29.4 to $36.9 million.

We estimated the structural costs using finite element vehicle modeling in which various components of two vehicles that do not meet the proposed requirements were upgraded until the two vehicles met the proposed requirements, and roof crush tests of twenty recent model year vehicles. The two vehicles were a 1998 Plymouth Neon passenger car, and a 1999 Ford E–150 van. The initial baseline crush tests of the Neon and Ford E–150 showed that each vehicle could withstand a roof crush force of about 1.9 times its unloaded weight. Neither vehicle would comply with the proposed requirements because the roof over the front seat area cannot withstand a force of 2.5 times the unloaded vehicle weight.

Through an iterative process, improvements were reflected within the finite element model until the Neon and E–150 could withstand a roof crush force of about 20 percent greater than 2.5 times their vehicle weight.[98]

We estimate the price increase for the purchaser (consumer cost) to improve the Neon roof strength to 2.5 times the unloaded vehicle weight with a 20 percent compliance margin to be $3.02, and the consumer cost to improve the E–150 roof strength to 2.5 times the unloaded vehicle weight with a 20 percent compliance margin to be $29.66.[99] Further, we estimated the average cost of strengthening the roof structure of vehicles that do not meet the proposed requirements to be $10.67.[100]

In addition to finite element vehicle modeling, the agency tested a representative sample of 20 recent model year vehicles to estimate what percentage of the overall fleet already complies with the proposed requirements. Based on the current sales data, these 20 vehicles represent a current vehicle fleet population of approximately 5.9 million vehicles. Seven of the 20 vehicles tested by the agency failed the proposed roof crush resistance requirements. The seven failing vehicles represent a vehicle fleet population of approximately 1.9 million. The cost of upgrading these 1.9 million vehicles would be $20.3 million.

We estimate that 17 million new vehicles would be subject to the proposed requirements. Accordingly, before accounting for weight gain implications, we estimate the total fleet cost to be $58.6 million (17 million ÷ 5.9 million × $20.3 million).

Additionally, the changes made to increase roof strength may require heavier materials and or reinforcements that could increase the weight of the vehicle. This weight increase may adversely affect the vehicle's fuel economy and thus increase the amount of fuel it consumes over its lifetime. We estimate that the average weight gain necessary to upgrade the roof crush resistance of the vehicle fleet of 17 million vehicles is 0.6 lbs per vehicle. We estimate that this added weight would result in additional fuel expenditures in the amount of $29.4 to $36.9 million per year, resulting in the total annual fleet costs of $88 to $95 million ($58.6 + $29.4) or ($58.6 + $36.9).[101]

XI. Lead Time

NHTSA proposes that the manufacturers be required to comply with the new requirements for FMVSS No. 216 on and after the first September 1 that occurs more than three years (36 months) after the issuance of the final rule. Based on recent agency testing, the agency estimates that 68 percent of the current fleet already complies with the proposed roof strength requirements. Accordingly, the proposed roof strength requirements would not necessitate fleet-wide roof structure changes. NHTSA believes that vehicle manufacturers have engineering and manufacturing resources that would enable vehicles to meet the new requirements three years after the publication of the final rule. We request comments on the lead time necessary to comply with the proposal requirements.

XII. Request for Comments

How Do I Prepare and Submit Comments?

Your comments must be written and in English. To ensure that your comments are correctly filed in the Docket, please include the docket number of this document in your comments. Your comments must not be more than 15 pages long.[102] We established this limit to encourage you to write your primary comments in a concise fashion. However, you may attach necessary additional documents to your comments. There is no limit on the length of the attachments. Please submit two copies of your comments, including the attachments, to Docket Management at the address given above under **ADDRESSES.** Comments may also be submitted to the docket electronically by logging onto the Docket Management System Web site at *http://dms.dot.gov*. Click on ''Help & Information'' or ''Help/Info'' to obtain instructions for filing the document electronically. If you are submitting comments electronically as a PDF (Adobe) file, we ask that the documents submitted be scanned using Optical Character Recognition (OCR) process, thus allowing the agency to search and

[98] The agency assumes that manufacturers would design their vehicles so that they can meet a standard with a 20% compliance margin in order to address production and performance variability concerns. Vehicle manufacturers normally include compliance margins in their vehicle designs to assure that each vehicle could pass the applicable test requirements. In this case, a safety margin of 20 percent would require that vehicles withstand applied force of 3 times the unloaded vehicle weight (1.2 × 2.5).

[99] These improvements include changes in the material strength (steel gage, for example) of various vehicle components.

[100] The consumer cost average estimate was weighted for relative roof strength of different vehicles and corresponding sales volumes.

[101] For details on the fuel economy impacts, please see the PRIA.

[102] See 49 CFR 553.21.

copy certain portions of your submissions.[103]

Please note that pursuant to the Data Quality Act, in order for substantive data to be relied upon and used by the agency, it must meet the information quality standards set forth in the OMB and DOT Data Quality Act guidelines. Accordingly, we encourage you to consult the guidelines in preparing your comments. OMB's guidelines may be accessed at *http://www.whitehouse.gov/omb/fedreg/reproducible.html*. DOT's guidelines may be accessed at *http://dmses.dot.gov/submit/DataQualityGuidelines.pdf*.

How Can I Be Sure That My Comments Were Received?

If you wish Docket Management to notify you upon its receipt of your comments, enclose a self-addressed, stamped postcard in the envelope containing your comments. Upon receiving your comments, Docket Management will return the postcard by mail.

How Do I Submit Confidential Business Information?

If you wish to submit any information under a claim of confidentiality, you should submit three copies of your complete submission, including the information you claim to be confidential business information, to the Chief Counsel, NHTSA, at the address given above under **FOR FURTHER INFORMATION CONTACT**. In addition, you should submit two copies, from which you have deleted the claimed confidential business information, to Docket Management at the address given above under **ADDRESSES.** When you send a comment containing information claimed to be confidential business information, you should include a cover letter setting forth the information specified in our confidential business information regulation.[104]

Will the Agency Consider Late Comments?

We will consider all comments that Docket Management receives before the close of business on the comment closing date indicated above under **DATES**. To the extent possible, we will also consider comments that Docket Management receives after that date. If Docket Management receives a comment too late for us to consider in developing a final rule (assuming that one is issued), we will consider that comment as an informal suggestion for future rulemaking action.

How Can I Read the Comments Submitted By Other People?

You may read the materials placed in the docket for this document (*e.g.*, the comments submitted in response to this document by other interested persons) by going to the street address given above under **ADDRESSES.** The hours of the Docket Management System (DMS) are indicated above in the same location.

You may also read the materials on the Internet. To do so, take the following steps:

(1) Go to the Web page of the Department of Transportation DMS (*http://dms.dot.gov/search/searchFormSimple.cfm*).

(2) On that page type in the five-digit docket number cited in the heading of this document. After typing the docket number, click on ''search.''

(3) On the next page (''Docket Search Results''), which contains docket summary information for the materials in the docket you selected, scroll down and click on the desired materials. You may download the materials.

XIII. Rulemaking Analyses and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

NHTSA has considered the impact of this rulemaking action under Executive Order 12866 and the Department of Transportation's regulatory policies and procedures. The Office of Management and Budget reviewed this rulemaking document under E.O. 12866, ''Regulatory Planning and Review.'' This rulemaking action has been determined to be significant under Executive Order 12866 and the DOT Policies and Procedures because of Congressional and public interest. This rulemaking action is not economically significant because the estimated yearly costs do not exceed $100 million. The total estimated recurring fleet cost for all changes proposed by this document is $88 to $95 million. NHTSA is placing in the public docket a PRIA describing the costs and benefits of this rulemaking action.[105] The costs and benefits are also summarized in Sections IX and X above. We estimate that, if adopted, this proposal would result in 13–44 fewer fatalities and 498–793 fewer non-fatal injuries each year.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 (5 U.S.C. 601 *et seq.*) requires agencies to evaluate the potential effects of their proposed rules on small businesses, small organizations and small governmental jurisdictions. I have considered the possible effects of this rulemaking action under the Regulatory Flexibility Act and certify that it would not have a significant economic impact on a substantial number of small entities.

Under 13 CFR 121.201, the Small Business Administration (SBA) defines small business (for the purposes of receiving SBA assistance) as a business with less than 750 employees. Most of the manufacturers of recreation vehicles, conversion vans, and specialized work trucks are small businesses that manufacture vehicles in two or more stages. Some of these manufacturers produce vehicles that would be subject to the proposed requirements, as their GVWR is less than or equal to 10,000 pounds. While the number of these small businesses potentially affected by this proposal is substantial, the economic impact upon these entities will not be significant for the following reasons:

1. As indicated in Section VII(A)(2), we are proposing to allow vehicles manufactured in two or more stages (other than chassis-cabs), to certify to the roof crush requirements of FMVSS No. 220, instead of FMVSS No. 216. This aspect of our proposal will afford significant economic relief to small businesses because some of them are already required by the States to certify to the requirements of FMVSS No. 220. Thus, the proposal would not require additional expenditure by these small businesses.

2. Small businesses using chassis cabs would be in position to take advantage of ''pass-through certification,'' and therefore, are not expected to incur any additional expenditures.

3. We believe that some of the vehicles manufactured by these small businesses already comply with the proposed requirements.[106]

In addition to small businesses that manufacture vehicles in two or more stages, there are four manufacturers of passenger cars that are small businesses.[107] All of these manufacturers could be affected by the proposed requirements. However, the economic impact upon these entities will not be significant for the following reasons.

1. While the average cost for roof crush resistance upgrades was estimated at approximately $12 per vehicle, the cost of upgrading the roof structures of

[103] Optical character recognition (OCR) is the process of converting an image of text, such as a scanned paper document or electronic fax file, into computer-editable text.

[104] *See* 49 CFR Part 512.

[105] *See* Docket No. NHTSA–2005–22143.

[106] As discussed in Section X above, 68% of the current fleet meets the proposed requirements.

[107] Avanti, Panoz, Saleen, Shelby.

passenger cars is lower because we believe that this cost is a function of weight of the vehicle. For example, the cost of upgrading the roof structure of Dodge Neon, a passenger vehicle, was estimated at $3.

2. The agency believes that a cost increase of $3 to $12 would not have a significant economic impact upon small businesses that manufacture passenger cars because these costs can be passed onto the consumer. This increase would represent, at most, less than one-half of one tenth of a percent of the least expensive vehicle manufactured by the four entities.[108]

3. We believe that some of the vehicles manufactured by these small businesses already comply with the proposed requirements.[109]

4. Some of the vehicles manufactured by these small businesses are convertibles not subject to this proposal.

C. National Environmental Policy Act

NHTSA has analyzed this proposal for the purposes of the National Environmental Policy Act. The agency has determined that implementation of this action would not have any significant impact on the quality of the human environment. Upgrading the roof crush resistance standard may impact the weight of the vehicles subject to that standard and consequently result in the reduced fuel economy for these vehicles. However, the agency believes that the resulting impact on environment will be insignificant. A full discussion of fuel economy implications is in the PRIA.

D. Executive Order 13132 (Federalism)

The agency has analyzed this rulemaking in accordance with the principles and criteria contained in Executive Order 13132 and has determined that it does not have sufficient federal implications to warrant consultation with State and local officials or the preparation of a federalism summary impact statement. The proposal would not have any substantial impact on the States, or on the current Federal-State relationship, or on the current distribution of power and responsibilities among the various local officials.

E. Unfunded Mandates Act

The Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually ($120.7 million as adjusted annually for inflation with base year of 1995). The assessment may be combined with other assessments, as it is here.

This proposal is not likely to result in expenditures by State, local or tribal governments or automobile manufacturers and/or their suppliers of more than $120.7 million annually. The agency estimates that upgrading the roof crush resistance standard would result in annual fleet costs of $88 to $95 million. No expenditures by State, local or tribal governments are expected. A full assessment of the rule's costs and benefits is provided in the PRIA.

F. Civil Justice Reform

This NPRM would not have any retroactive effect. 49 U.S.C. 30161 sets forth a procedure for judicial review of final rules establishing, amending, or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

State action on safety issues within the purview of a Federal agency may be limited or even foreclosed by express language in a congressional enactment, by implication from the depth and breadth of a congressional scheme that occupies the legislative field, or by implication because of a conflict with a congressional enactment. In this regard, we note that section 30103(b) of 49 U.S.C. provides, ''When a motor vehicle safety standard is in effect under this chapter, a State or a political subdivision of a State may prescribe or continue in effect a standard applicable to the same aspect of performance of a motor vehicle or motor vehicle equipment only if the standard is identical to the standard prescribed under this chapter.'' Thus, all differing state statutes and regulations would be preempted.

Further, it is our tentative judgment that safety would best be promoted by the careful balance we have struck in this proposal among a variety of considerations and objectives regarding rollover safety. As discussed above, this proposal is a part of a comprehensive plan for reducing the serious risk of rollover crashes and the risk of death and serious injury in those crashes. The objective of this proposal is to increase the requirement for roof crush resistance only to the extent that it can be done without negatively affecting vehicle dynamics and rollover propensity. The agency has tentatively concluded that our proposal would not adversely affect vehicle dynamics and cause vehicles to become more prone to rollovers. In contrast, the agency believes that either a broad State performance requirement for greater levels of roof crush resistance or a narrower requirement mandating that increased roof strength be achieved by a particular specified means, would frustrate the agency's objectives by upsetting the balance between efforts to increase roof strength and reduce rollover propensity.

Increasing current roof crush resistance requirements too much could potentially result in added weight to the roof and pillars, thereby increasing the vehicle center of gravity (CG) height and rollover propensity. In order to avoid this, we sought to strike a careful balance between improving roof crush resistance and potentially negative effects of too large an increase upon the vehicle's rollover propensity.

We recognize that there is a variety of potential ways to increase roof crush resistance beyond the proposed level. However, we believe that any effort to impose either more stringent requirements or specific methods of compliance would frustrate our balanced approach to preventing rollovers from occurring as well as the deaths and injuries that result when rollovers nevertheless occur.

First, we believe that requiring a more stringent level of roof crush resistance for all vehicles could increase rollover propensity of many vehicles and thereby create offsetting adverse safety consequences. While the agency is aware of at least several current vehicle models that provide greater roof crush resistance than would be required under our proposal, requiring greater levels of roof crush resistance for all vehicles could, depending on the methods of construction and materials used, and on other factors, render other vehicles more prone to rollovers, thus frustrating the agency's objectives in this rulemaking.

Second, we believe that requiring vehicle manufacturers to improve roof crush resistance by a specific method would also frustrate agency goals. The optimum methods for addressing the risks of rollover crashes vary considerably for different vehicles, and requiring specific methods for improving roof crush resistance could interfere with the efforts to develop optimal solutions. Moreover, some methods of improving roof crush resistance are costlier than others. The resources diverted to increasing roof strength using one of the costlier

[108] Approximately $25,000.

[109] As discussed in Section X above, 68% of the current fleet meets the proposed requirements. We believe this may be especially true for high performance vehicles typically manufactured by small businesses.

methods could delay or even prevent vehicle manufacturers from equipping their vehicles with advanced vehicle technologies for reducing rollovers, such as Electronic Stability Control.

Based on the foregoing, if the proposal were adopted as a final rule, it would preempt all conflicting State common law requirements, including rules of tort law.

G. National Technology Transfer and Advancement Act

Under the National Technology Transfer and Advancement Act of 1995 (NTTAA) (Pub. L. 104–113), ''all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments.'' As discussed in Section V, we evaluated the Society of Automotive Engineers (SAE) inverted drop testing procedure, but decided against proposing it. We were unable to identify any other relevant technical standards. The agency requests comments on other relevant technical standards.

H. Paperwork Reduction Act

Under the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3501, *et seq.*), Federal agencies must obtain approval from the Office of Management and Budget (OMB) for each collection of information they conduct, sponsor, or require through regulations. NHTSA has reviewed this proposal and determined that it does not contain collection of information requirements.

I. Plain Language

Executive Order 12866 requires each agency to write all rules in plain language. Application of the principles of plain language includes consideration of the following questions:

- Have we organized the material to suit the public's needs?
- Are the requirements in the rule clearly stated?
- Does the rule contain technical language or jargon that isn't clear?
- Would a different format (grouping and order of sections, use of headings, paragraphing) make the rule easier to understand?
- Would more (but shorter) sections be better?
- Could we improve clarity by adding tables, lists, or diagrams?
- What else could we do to make the rule easier to understand?

If you have any responses to these questions, please include them in your comments on this proposal.

J. Privacy Act

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov*.

XVI. Vehicle Safety Act

Under 49 U.S.C. Chapter 301, *Motor Vehicle Safety* (49 U.S.C. 30101 *et seq.*), the Secretary of Transportation is responsible for prescribing motor vehicle safety standards that are practicable, meet the need for motor vehicle safety, and are stated in objective terms.[110] ''Motor vehicle safety standard'' means a minimum performance standard for motor vehicles or motor vehicle equipment. When prescribing such standards, the Secretary must consider all relevant, available motor vehicle safety information.[111] The Secretary must also consider whether a proposed standard is reasonable, practicable, and appropriate for the types of motor vehicles or motor vehicle equipment for which it is prescribed and the extent to which the standard will further the statutory purpose of reducing traffic accidents and associated deaths.[112] The responsibility for promulgation of Federal motor vehicle safety standards is delegated to NHTSA.

In proposing to improve roof crush resistance, the agency carefully considered these statutory requirements.

First, we believe that this proposal will meet the need for motor vehicle safety because the proposed applied force requirement would lead to stronger roofs and reduce the roof crush severity observed in real world crashes, thus better protecting front seat occupants.

Second, we believe that the roof crush resistance standard subject of this proposal is performance oriented because it requires only that the vehicle roof be able to withstand a certain amount of applied force. The standard does not specify the means by which the vehicle must meet the standard.

Third, this proposal was preceded by a Request for Comments, which facilitated the efforts of the agency to obtain and consider relevant motor vehicle safety information. We anticipate receiving an even more comprehensive array of relevant information in response to this proposal. Further, in preparing this document, the agency carefully evaluated previous agency research and vehicle testing that was relevant to this proposal. We also conducted additional testing in support of this document. Finally, the agency conducted a detailed statistical analysis in order to estimate risks of death or injury associated with roof crush, and to determine the relevant target population and potential costs and benefits of our proposal. In sum, this document reflects our consideration of all relevant, available motor vehicle safety information.

Fourth, to ensure that requiring greater roof crush resistance is practicable, the agency tested a number of vehicles and found that many already comply with the proposed requirements, while others could comply with relatively inexpensive modifications to their roof structure. In response to the request for comments, the agency received no indication that the proposed roof crush resistance requirements were impracticable. However, based on the latest information from the manufacturers and our own testing, we are proposing to amend the test procedure for vehicles with raised or altered roofs to provide additional assurance of practicability.[113] To improve practicability still further, the agency also proposes to revise the tie-down procedure. Because we are especially concerned with practicability of this proposal as it applies to vehicles manufactured in two or more stages, we are proposing to allow the certification of these vehicles to the roof crush requirements of FMVSS No. 220. In sum, we believe that this proposal to improve roof crush resistance is practicable.

Fifth, the proposed regulatory text following this preamble is stated in objective terms in order to specify precisely what performance is required and how performance will be tested to ensure compliance with the standard. Specifically, a large steel test plate would be forced down onto the roof of a vehicle. If the displaced roof structure does not contact the head or neck of the dummy seated inside the vehicle, the vehicle passes the test. The agency believes that this test procedure is sufficiently objective and would not result in any uncertainty as to whether a given vehicle satisfies the proposed roof crush resistance requirements.

[110] 49 U.S.C. 30111(a).

[111] 49 U.S.C. 30111(b).

[112] Id.

[113] The agency previously adopted a ''secondary'' test procedure for vehicles with raised or altered roofs which proved to be an impracticable solution.

Finally, we believe that this proposal is reasonable and appropriate for motor vehicles subject to the proposed requirements. As discussed elsewhere in this notice, the agency is concerned with the amount of fatalities and serious injuries resulting from rollovers. Our statistical data indicate that vehicles subject to the proposed requirements are involved in rollovers that cause death and serious injury. Accordingly, we believe that this proposal is appropriate for vehicles that are or would become subject to FMVSS No. 216 because it furthers the agency's objective of preventing deaths and serious injuries associated with roof crush occurring in some of the rollovers.

XV. Proposed Regulatory Text

List of Subjects in 49 CFR Part 571

Motor vehicle safety, Reporting and recordkeeping requirements, Tires.

In consideration of the foregoing, NHTSA proposes to amend 49 CFR Part 571 as follows:

PART 571—[AMENDED]

1. The authority citation of Part 571 would continue to read as follows:

Authority: 49 U.S.C. 322, 2011, 30115, 30166 and 30177; delegation of authority at 49 CFR 1.50.

2. Section 571.216 would be amended by:

a. Revising S3 to read as set forth below;

b. Adding to S4, in alphabetical order, new definitions of ''Convertible'' and ''Roof component;''

c. Revising S5 to read as set forth below;

d. Removing S5.1;

e. Revising S7.1 through S7.6 to read as set forth below; and

f. Removing S8 through S8.4.

The revisions and additions read as follows:

§ 571.216 Standard No. 216; Roof crush resistance.

* * * * *

S3. Application. This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a GVWR of 4,536 kilograms (10,000 pounds) or less. However, it does not apply to—

(a) School buses;

(b) Vehicles that conform to the rollover test requirements (S5.3) of Standard No. 208 (§ 571.208) by means that require no action by vehicle occupants;

(c) Convertibles, except for optional compliance with the standard as an alternative to the rollover test requirement (S5.3) of Standard No. 208; or

(d) Vehicles manufactured in two or more stages, other than chassis cabs, that conform to the roof crush requirements (S4) of Standard No. 220 (§ 571.220).

S4. Definitions.

* * * * *

Convertible means a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member.

* * * * *

Roof component means the A-pillar, B-pillar, roof side rail, front header, rear header, roof, and all interior trim in contact with these components.

* * * * *

S5. Requirements. When the test device described in S6 is used to apply a force to either side of the forward edge of a vehicle's roof in accordance with S7, no roof component or portion of the test device may contact the head or the neck of the seated Hybrid III 50th percentile male dummy specified in 49 CFR Part 572, Subpart E. The maximum applied force in Newtons is at least 2.5 times the unloaded vehicle weight of the vehicle, measured in kilograms and multiplied by 9.8. A particular vehicle need not meet the requirements on the second side of the vehicle, after being tested at one location.

* * * * *

S7.1 Secure the vehicle in accordance with S7.1(a) through (d).

(a) Support the vehicle off its suspension at a longitudinal vehicle attitude of 0 degrees ± 0.5 degrees. Measure the longitudinal vehicle attitude along both the driver and passenger sill. Determine the lateral vehicle attitude by measuring the vertical distance between a level surface and a standard reference point on the bottom of the driver and passenger side sills. The difference between the vertical distance measured on the driver side and the passenger side sills shall not exceed ± 1 cm.

(b) Secure the vehicle with four stands. The locations for supporting the vehicle are defined in S7.1(c) or (d). Welding is permissible. The vehicle overhangs are not supported. Chains and wire rope are not used to secure the vehicle. Fix all non-rigid body mounts to prevent motion of the body relative to the frame. Close all windows, close and lock all doors, and secure any moveable or removable roof structure in place over the occupant compartment. Remove roof racks or other non-structural components.

(c) For vehicles with manufacturer's designated jacking locations, locate the stands at or near the specified location.

(d) For vehicles with undefined jacking locations, generalized jacking areas, or jacking areas that are not part of the vehicle body or frame, such as axles or suspension members, locate two stands in the region forward of the rearmost axle and two stands rearward of the forwardmost axle. All four stands shall be located between the axles on either the vehicle body or vehicle frame.

S7.2(a) Adjust the seats and steering controls in accordance with S8.1.2 and S.8.1.4 of 49 CFR 571.208.

(b) Place adjustable seat backs in the manufacturer's nominal design riding position in the manner specified by the manufacturer. Place any adjustable anchorages at the manufacturer's nominal design position for a 50th percentile adult male occupant. Place each adjustable head restraint in its lowest adjustment position. Adjustable lumbar supports are positioned so that the lumbar support is in its lowest adjustment position.

S7.3 Position the Hybrid III 50th percentile male dummy specified in 49 CFR Part 572, Subpart E in accordance with S10.1 through S10.6.2.2 of 49 CFR 571.208, in the front outboard designated seating position on the side of the vehicle being tested.

S7.4 Orient the test device as shown in Figure 1 of this section, so that—

(a) Its longitudinal axis is at a forward angle (in side view) of 5 degrees below the horizontal, and is parallel to the vertical plane through the vehicle's longitudinal centerline;

(b) Its transverse axis is at an outboard angle, in the front view projection, of 25 degrees below the horizontal.

S7.5 Maintaining the orientation specified in S7.4—

(a) Lower the test device until it initially makes contact with the roof of the vehicle.

(b) Position the test device so that—

(1) The longitudinal centerline on its lower surface is within 10 mm of the initial point of contact, or on the center of the initial contact area, with the roof; and

(2) The midpoint of the forward edge of the lower surface of the test device is within 10 mm of the transverse vertical plane 254 mm forward of the forwardmost point on the exterior surface of the roof, including windshield trim, that lies in the longitudinal vertical plane passing through the vehicle's longitudinal centerline.

S7.6 Apply force so that the test device moves in a downward direction perpendicular to the lower surface of the test device at a rate of not more than 13 millimeters per second until reaching the force level specified in S5. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S7.4(a) and S7.4(b). Complete the test within 120 seconds.

* * * * *

Issued: July 15, 2005.

Stephen R. Kratzke,

Associate Administrator for Rulemaking.

[FR Doc. 05–16661 Filed 8–19–05; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Parts 571 and 572

[Docket No. NHTSA–2005–21698]

RIN 2127–AH73 and 2127–AI39

Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Anthropomorphic Test Devices; Instrumented Lower Legs for 50th Percentile Male and 5th Percentile Female Hybrid III Dummies

AGENCY: National Highway Traffic Safety Administration (NHTSA), DOT.

ACTION: Withdrawal of rulemakings.

SUMMARY: On February 3, 2004, NHTSA published a notice in the **Federal Register** requesting comments on whether to propose adding a high speed frontal offset crash test to Federal Motor Vehicle Safety Standard (FMVSS) No. 208, ''Occupant crash protection.'' The notice informed the public about recent testing the agency conducted to assess the benefits and/or disbenefits of such an approach. Based on our analysis of those comments, and other information gathered by the agency, we have decided to withdraw the rulemaking proceeding to amend FMVSS No. 208 to include a high speed frontal offset crash test requirement. Additional research and data analyses are needed to make an informed decision on rulemaking in this area. Additionally, we have decided to withdraw the related rulemaking proceeding to amend part 572 to include lower leg instrumentation until further testing necessary for federalization is completed.

FOR FURTHER INFORMATION CONTACT: For non-legal issues: Lori Summers, Office of Crashworthiness Standards, NVS–112, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590. Telephone (202) 366–1740. Fax: (202) 366–7002.

For legal issues: Dorothy Nakama, Office of the Chief Counsel, NCC–112, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590. Telephone: (202) 366–2992. Fax: (202) 366–3820.

SUPPLEMENTARY INFORMATION:

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I. Background

Improving occupant protection in frontal crashes is a major goal of the National Highway Traffic Safety Administration (NHTSA). Frontal crashes are the most frequent cause of motor vehicle fatalities. In 1972, NHTSA promulgated FMVSS No. 208 to improve the frontal crash protection provided to motor vehicle occupants. The dynamic performance requirements of the standard include frontal rigid barrier crash tests, at angles between perpendicular and ±30 degrees with belted and unbelted dummies.[1] Occupant protection is evaluated based on data acquired from anthropomorphic test dummies positioned in the driver and right front passenger seats. Data collection instrumentation is mounted in the head, neck, chest, and femurs of the test dummies.

NHTSA initiated research in the early 1990s to develop performance tests not currently included in FMVSS No. 208, such as high severity frontal offset crashes that involve only partial engagement of a vehicle's front structure. Such performance tests result in large amounts of occupant compartment intrusion and increased potential for intrusion-related injury. The agency also instrumented the dummies in these tests with advanced lower leg instrumentation, not currently required in FMVSS No. 208, to assess the potential for lower extremity injury, specifically, to the knee, tibia, and ankle.

During the same time period, considerable international research focused on the development of a fixed offset deformable barrier crash test procedure. In December 1996, the European Union (EU) adopted the EU Directive 96/79 EC for frontal crash protection. This directive required vehicle compliance with a 56 km/h, 40 percent offset, fixed deformable barrier crash test. In 1998, Australia introduced a similar regulation for new passenger car model approvals. In addition to these regulations, several consumer information programs also began to utilize the EU Directive 96/79 EC crash test procedure, but raised the impact speed to 64 km/h. These programs included the European New Car Assessment Program (EuroNCAP), Australia NCAP (ANCAP), Japan NCAP and the Insurance Institute for Highway Safety (IIHS) Crashworthiness Evaluation program in the U.S.

Given the world-wide focus on the fixed offset deformable barrier crash test procedure, the conferees on the appropriations legislation for the Department of Transportation for FY 1997 directed NHTSA to work ''toward establishing a Federal motor vehicle safety standard for frontal offset crash testing'' in fiscal year 1997.[2] NHTSA was further directed to consider the harmonization potential with other countries and to work with interested parties, including the automotive industry, under standard rulemaking procedures. In 1997, NHTSA submitted a Report to Congress [3] on the status of the agency's efforts toward establishing a high speed frontal offset crash test requirement. The agency made a preliminary assessment that the adoption of the EU 96/79 EC frontal offset test procedure, in addition to the current requirements of FMVSS No. 208, could result in substantial benefits, since lower leg injuries were typically associated with long-term recovery and significant economic cost. However, the Report to Congress also made note of NHTSA's concerns relative to the potential for exacerbating small and large car incompatibility, as a result of adopting a frontal offset crash test procedure.

During 1998–2002, NHTSA completed over 25 frontal offset crash tests in an attempt to answer a number of research questions. Specifically, what are the merits of a fixed offset deformable barrier crash test procedure and what is the most appropriate dummy size, lower leg instrumentation and impact speed? Dummy injury measures from the fixed offset deformable barrier crash tests demonstrated the potential for injury reductions over and above the full frontal rigid barrier test configuration.[4]

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[1] In March of 1997, NHTSA temporarily amended FMVSS No. 208 so that passenger cars and light trucks had the option of using a sled test for meeting the unrestrained dummy requirements. This option will be phased out in accordance with the advanced air bag rulemaking schedule.

[2] Conference Report 104–785, September 16, 1996. This report accompanied H.R. 3675.

[3] Report to Congress, ''Status Report on Establishing a Federal Motor Vehicle Safety Standard for Frontal Offset Crash Testing,'' April 1997.

[4] Docket No. NHTSA–1998–3332.