

DOT Docket No. NHTSA 1999-5572
Docket Management
U.S. Department of Transportation
Room PL-401
400 Seventh Street, SW
Washington, DC 20590

**Comments of Public Citizen Regarding 49
CFR Part 571, Federal Motor Vehicle
Safety Standards: Roof Crush Resistance**

Introduction

Public Citizen is pleased to offer these comments to the docket on the National Highway Traffic Safety Administration (NHTSA's) request for comments regarding a sorely needed upgrade in Federal Motor Vehicle Safety Standard No. 216, "Roof Crush Resistance." Given the current, inexcusably high number of rollover crashes in which roof crush inflicts a serious or fatal injury, substantial improvement of the roof crush safety standard is long overdue.

The current roof crush standard became effective in 1973, and has only been revised since that time for extension to vehicles with a gross vehicle weight (GVW) of 6000 pounds or less and to apply to vehicles with raised roofs. It is not credible for some in the motor vehicle industry to suggest that no change to the standard is warranted given the compelling evidence that the standard is inadequate in the form of the unacceptably high death and injury toll from crashes involving rollover and roof crush. This weight limit also remains inadequate, and has allowed some manufacturers to increase the weight of their sports utility vehicles (SUVs) by marginal amounts over 6,000 pounds in order to evade the standard. The weight limit should be raised by NHTSA to 10,000 pounds GVW.

Fatality Analysis Reporting System (FARS) data reveal that 10,149 people were killed in rollover crashes in light vehicles in 1999 — fully one-third of all vehicle occupant fatalities for that year. Yet rollover crashes should be among the most survivable of all the crash types due to the low gravitational forces that are exerted in a rollover. Research shows that the primary forces on a vehicle during a rollover are entirely survivable by occupants if they are protected from ejection and roof intrusion and properly restrained with a pretensioning system and other protections. The high injury rates which nonetheless occur in rollover crashes today demonstrate that the current federal safety standards are failing to do their core job of protecting the public from thousands of unnecessary crippling injuries and deaths each year. A substantial upgrade in protection against roof crush is essential to reduce this carnage.

I. A Comprehensive Approach to Rollover Crashworthiness is Long Overdue

While an upgraded dynamic standard is a crucial first step towards improving occupant protection during rollover crashes, due to the complex nature of rollover events attention to other areas is also critical. In 1994, the agency terminated action on a vehicle safety standard to reduce rollover propensity by promising to implement better rollover crashworthiness protections and an effective consumer information program. The agency should make good on these promises by setting out ambitious goals to improve rollover crash survival rates. Given the survivability of these crashes and the availability of lifesaving and limbsaving technology and insights that could dramatically improve rollover crash survival rates, the agency should articulate a goal of bringing the fatalities

from rollover and roof crush to virtually zero, with the ultimate aim of achieving the same level of protection from injury and death for the public as is now enjoyed by professional race car drivers. The low cost of these improvements, as well as their extraordinarily high value to society in preventing high medical costs and unnecessary suffering and trauma, makes clear that nothing short of a multi-pronged campaign by the agency to thoroughly address rollover crashworthiness issues is sufficient to meet this crisis.

In keeping with this plan, the agency must articulate and implement a comprehensive set of solutions to various aspects of the risks posed by rollover crashes, including definitive action in the following seven areas:

- The potential for vehicle rollover and vehicle oversteer should be minimized by enactment of a basic standard to reduce rollover propensity, in addition to the dynamic testing consumer information program now mandated by the Transportation, Recall Enhancement, Accountability and Documentation (TREAD) Act of 2000;
- Occupants must be effectively restrained in the seat by safety belts that employ sensors which trigger pretensioning in a rollover crash, both to prevent ejection of occupants during multiple rolls of a crash and to prevent occupants from violently colliding with the roof as it impacts the ground or intrudes upon the occupant's survival space;
- Roof structures must be made strong enough to withstand the impact of a rollover crash, including during multiple rolls, which eliminate the structural strength contributed by the windshield and side windows (all of which

typically break on the first roll), as well as withstanding the exertion of lateral (sliding) crash forces on the roof without intrusion upon the survival space of the occupant;

- Roof structures must also be equipped with interior, energy absorbing materials to reduce the impact upon the occupant should any body part of the occupant contact the roof;
- The agency should require advanced window glazing for impact protection in side windows or should require installation of side curtain air bags to prevent ejection of both belted and unbelted occupants and to provide protection in a rollover crash for occupants that contact the sides of the vehicle due to the centripetal forces exerted during the roll;
- The agency should mandate improved seat structure and belt placement to contain and protect occupants by integrating the belt into the seat structure;
- The agency should strive for legislation to eliminate the prohibition on the belt use warning buzzer beyond 60 seconds.

II. The Agency Has Chronically Failed to Meet its Obligations on Rollover Crashworthiness

In 1994, the agency, relying in part on obsolete data from the late 1980s regarding the number of sports utility vehicles (SUVs) in the vehicle population, terminated its work on a rollover propensity standard by promising that a series of improvements in rollover crashworthiness and consumer information were forthcoming. *See* 59 F.R. 33254, 33255 (June 8, 1994). These included mandating anti-lock brake systems, advanced window glazing to prevent ejections and incentives to increase the use of seat

belts. The agency also promised stronger roofs; therefore, this request for comments is both overdue and a minimal response to obligations outstanding since at least 1994. The agency has made additional promises in subsequent public statements about requiring improvements in door latches and hinges and upper side impact protection.

None of the promised regulations on rollover crashworthiness have been issued. This record, which demonstrates a dereliction of the agency's duty to protect the public, is particularly shocking when we consider that the number of rollover-prone SUVs being driven by the general public has skyrocketed since that time, and that light truck vehicles (LTVs) now comprise more than one-half of all new vehicle sales. With these vehicles' much heavier bodies and higher greenhouses, roof strength in SUV or LTV rollover crashes is a critical safety issue.

The issue of rollover-ready occupant restraints is another critical focus for the agency, and should be the next step in an overall strategy to virtually eliminate fatalities and injuries from rollover crashes. Safety belt use inducements and eliminating the limit warning buzzers must be part of this coordinated effort; so must mandatory safety belt pretensioners and locks for safety belt retractors that are triggered in a rollover crash and keep occupants in the seat structure. Restraint suppliers are ready and willing to supply effective rollover sensors to trigger pretensioners and to keep belts snug during a rollover crash. A safety upgrade of the belt standard should be the next item on the agency's agenda.

III. The Current Standard is Functionally Inadequate to Measure Roof Intrusion and to Provide Meaningful Protection from Injury and Death

The current quasi-static standard fails to adequately measure the forces actually exerted in real-world rollover crashes. The dynamic conditions of real crashes produce far greater intrusion than is implied by the results of testing under current Federal Motor Vehicle Safety Standard (FMVSS) 216. Research described by Don Slavik in comments to this docket has shown that roofs that comply with FMVSS 216 experience intrusion under dynamic conditions that is 20 percent greater than the level of intrusion that occurs during the test. This shows a serious mismatch between the intent of the standard and events in the real world. Both an updated quasi-static standard *and* a new dynamic test are necessary components of a roof crush alleviation strategy and are needed to provide an adequate picture of a vehicle's rollover crashworthiness.

A. Quasi-Static Prong of Two-Part Rollover Crashworthiness Test

Regarding the quasi-static portion of a new test, the strength-to-weight ratio must be raised to three times the weight of the vehicle to allow the test to measure the performance of the vehicle under more real-world conditions. In addition, vehicles must be tested without the windshield in place so as to counteract the tendency of the strength of windshield bonding to falsely improve test results. Vehicles that undergo more than one roll lose their windshield, endangering occupants by facilitating roof collapse. In addition, the placement and angle of the platen are inappropriate and must be corrected.

Based on extensive research by Don Friedman, a roof on a vehicle without a windshield should be able to withstand a quasi-static force of at least three times the vehicle weight applied at a roll angle of 45 to 55 degrees (altered dependent on vehicle type), a pitch angle of 7 degrees (for passenger cars) or 14 degrees (for LTVs) and a yaw angle of 7 degrees in order to demonstrate that it is capable of adequate performance in a real world rollover crash.

In summary, the following changes to the standard are *de minimis* to adequately protect consumers, if a quasi-static test is maintained by the agency as the primary basis for a safety standard: 1) improved weight requirements to account for the dynamic and lateral forces exerted in a crash by increasing the weight/strength ratio to 3 times the vehicle's weight, applying a 10,000 pounds GVW minimum; 2) changes in the size and placement of the face angle of the test platen vis-à-vis the vehicle's A-pillar to better replicate the typical location and concentration of crash forces; 3) testing vehicles with the windshields removed to avoid skewed results from differences resulting from the bonding strength applied by manufacturers to side windows and windshield glass; 4) a definition of occupant survival space which cannot be intruded upon during the test, using appropriate placement of a 95th percentile anthropomorphic dummy.

B. Dynamic Prong of Two-Part Rollover Crashworthiness Test

A quasi-static test will provide only limited information regarding the adequacy of restraints and the forces which impact occupants during a rollover. For this reason, the agency must also develop and implement a dynamic roof crush standard, which will

allow the agency to adopt a more holistic approach to the overall vehicle dynamics implicated in a rollover crash. While some may argue that a dynamic crash information program is sufficient, this is a short-sighted approach to the issues because many, if not most, consumers will not find their way to the information being disseminated by the agency. Furthermore, only a limited number of vehicle models are tested each year under the New Car Assessment Program (NCAP), and consumers have no access to this information at the crucial juncture — the point of sale for the vehicle. For these reasons, a two-part test, rather than a weak and narrow consumer information program, should be made a critical part of the agency's comprehensive strategy on rollover crashworthiness.

The Hybrid III dummy must be improved to allow for more realistic posture and force measurements on the head and neck of the dummy. But once the dummy has been made more realistic and a dynamic standard is adopted, one test will provide information on all of the following indicators of rollover crashworthiness: 1) the level of integrity achieved by window glazing and retention in windshields or side windows; 2) the adequacy of seat structure, door lock and latch strength; 3) the maintenance of survival space within the vehicle; 4) the adequacy of safety belts and pretensioners triggered in a rollover crash; and 5) the severity of forces exerted on the neck and spine of dummy occupants. An overall metric of rollover crashworthiness should be developed as a result of this testing and used as a standard representing the agency's goal of 95 to 100 percent rollover crash survivability. The combination of the improved quasi-static testing and the agency's dynamic test would finally produce the necessary changes in roof crush and rollover crashworthiness.

Any dynamic test chosen by the agency should, at a minimum, be capable of producing the results above and should also as closely as possible mimic real-world rollover forces. An inverted drop test along the lines of the SAE J996 fails the second criteria as it does not accurately reproduce the lateral sliding forces present in a rollover crash. We strongly agree with the comments of Advocates for Highway and Auto Safety that the test should be designed as a worst case scenario, and should test vehicle performance under those conditions. The drop angle should be selected so that the vehicle's center of gravity is over the most severe likely contact point of the roof with the ground, which is most often the top of the A-pillar front roof rail and side roof rail intersection point with approximately a 5-degree pitch angle. Also, the vehicle should be dropped onto a raised platform to ensure that roof contact is the vehicle's initial contact with the ground. We are intrigued by several of the other tests suggested in the comments to the docket and by recent research, and believe it will be possible for the agency to produce a dynamic test that meets these criteria and is useful as a worst-case exploration of the rollover crashworthiness of a vehicle.

IV. The Agency's Request Inappropriately Uses Obsolete and Industry-Biased Research Conclusions Regarding the Causes of Injury and Fatality Rates for Belted and Unbelted Occupants, Unacceptably Skewing the Cost-Benefit Analysis

In its request for comments, the agency relies heavily on discredited and industry-biased data concerning the level of harm roof intrusion inflicts upon ejected occupants, without so much as an acknowledgement of the substantial body of research which contradicts industry claims. While the industry continues in comments filed to this

docket to loudly claim that roof strength and occupant injury are unrelated, many studies, and most notably, D. Friedman and K. Friedman, "Roof Crush Versus Occupant Injury from 1988 to 1992 NASS," Society of Automotive Engineers Paper No. 980210, February 1998, have proven this link conclusively with detailed analysis of crash records and other evidence. Further proof of their position is provided by safety engineer and attorney Don Slavik, who observes in comments filed to this docket that accident investigations reveal a pattern of injury among occupant seating positions that directly correlates with the location of roof intrusion in the vehicle. Occupants outside the area of the intrusion experience no injury, thus belying the claim by the industry that no correlation exists.

Moreover, the agency essentially writes off injuries to unbelted occupants, despite ample evidence from field investigations that injuries to unbelted occupants may be the result of contact with the roof prior to ejection. In addition, numerous factors related to roof strength may affect the injury levels experienced by unbelted occupants in rollover crashes. For example, distortion of the roof may have made ejection portals larger, by causing windows to break and thus opening ejection portals, or the roof may have collapsed laterally, opening an ejection portal and risking injury to the occupant, or an occupant may have been injured by contact with the roof prior to ejection. Don Friedman and Carl Nash, based on their years of crash investigations, have estimated that as many as one-half of seriously injured ejected occupants could have received injury first as a consequence of roof crush. The agency should do a thorough investigation of NASS rollover cases involving ejection before it can dismiss the impact of roof strength for unbelted occupants, including its effects on the likelihood of ejection.

Public Citizen is particularly concerned about the agency's apparent conclusions in this regard given their potential implications for the agency's regulatory cost-benefit analysis. With or without such distortions, however, the cost-benefit calculus should be concluded clearly in favor of an upgraded combined quasi-static and dynamic standard. Given the light weight of current roofs and thus the relatively low cost of enhancements, cost estimates for both roof strength and restraint adjustments developed by Don Friedman and Carl Nash are well below \$100 per vehicle in mass production. Their estimate shows that even by high-balling the costs and conservatively assuming that changes in restraints and roof strength reduce fatalities by only half, the net benefits would have a direct economic value of at least \$10 billion, and under "willingness to pay" criteria would be approximately four times that amount. Given the high proportion of fatalities and serious injuries attributable to rollover crashes, these figures are compelling.

Conclusion

Public Citizen commends the agency for issuing this request for comments. NHTSA must finally act upon the obligations created by its assertions in 1994 that a rollover propensity standard was unwarranted due to soon-to-be-issued crashworthiness requirements. While NHTSA has failed to act, thousands of people have been unnecessarily injured or killed. We cannot fail to emphasize that given the inherent survivability of rollover crashes as demonstrated by professional race car drivers, the agency's goal should be to virtually eliminate rollover fatalities and greatly reduce injuries. The technology, including seat belt pretensioners and sensors, side curtain air bags, and improved safety testing protocols, is available that could render this goal a

reality. While this may be an ambitious goal, it is one truly worthy of the nation's highway safety agency.

Submitted by:

Joan Claybrook
President, Public Citizen