

INSURANCE INSTITUTE FOR HIGHWAY SAFETY

June 30, 2008

The Honorable Nicole R. Nason
Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE, West Building
Washington, DC 20590

Supplemental Notice of Proposed Rulemaking; 49 CFR Part 571, Federal Motor Vehicle Safety Standards, Roof Crush Resistance; Docket No. NHTSA-2008-0015

Dear Administrator Nason,

The National Highway Traffic Safety Administration (NHTSA) is in the process of updating Federal Motor Vehicle Safety Standard (FMVSS) 216. The Insurance Institute for Highway Safety (IIHS) previously has submitted comments to the agency (IIHS, 2008) regarding our recently completed study, which demonstrates that increased roof strength in the FMVSS 216 quasi-static test reduces the risk of fatal or incapacitating driver injury in rollover crashes (Brumbelow et al., 2008). This finding contradicts previous studies, funded by automobile manufacturers, that reported no relationship between FMVSS 216 results and injury risk in real-world rollover crashes (Moffatt and Padmanaban, 1995; Padmanaban et al., 2005). The Alliance of Automobile Manufacturers (AAM) maintains its position that stronger roofs do not reduce injury risk and has sent NHTSA a critique of the IIHS study it commissioned from M. Laurentius Marais of Wecker Associates (AAM, 2008).

On June 4, 2008, both IIHS and AAM testified at an oversight hearing on NHTSA's FMVSS 216 rulemaking held by the Senate Subcommittee on Consumer Affairs, Insurance, and Automotive Safety. In its testimony AAM, represented by Mr. Robert Strassburger, questioned IIHS's study based on Marais' critique. However, Marais' critique does not support AAM's statements concerning the IIHS study. In addition, the critique misrepresents IIHS's research and is, itself, based on problematic statistical analyses.

AAM claims not supported by the Marais analysis

During the roof strength hearing, Mr. Strassburger said, "intuitively you would think that [stronger roofs reduce injury risk] but the data do not show that." He stated that the conclusions of the IIHS study "don't hold up" and that "we don't see a causal relationship with injury risk and roof strength." However, these comments are not supported by Marais' analysis, which also indicates an overall decrease in injury risk as roof strength increases. Rather than contradicting the relationship, Marais concluded that "the IIHS Study's 28-percent result cannot be validly extrapolated to roof strength in the relevant range from SWR 2.5 to 3.0-3.5 and beyond." Thus, Marais focused on whether the data in the IIHS study indicate that injury risk decreases by exactly the same amount for each incremental change in roof strength. This was not the research question the IIHS study was designed to address. Criticizing the study on this basis can be compared to criticizing a finding that hotter temperatures increase the incidence of heat stroke by saying that the data do not show the same rate of increase between 80 and 100 degrees as from 90 to 110 degrees.

Marais began his critique of IIHS's study by attempting to duplicate the research. He was unable to obtain data from 3 of the 12 states used in the IIHS study, somewhat reducing his sample size. Even with data from the 9 remaining states, Marais has not exactly duplicated the IIHS study. Compared with IIHS counts limited to the same 9 states, Marais reported 10 percent fewer rollover crashes but more fatal and

incapacitating injuries. Figure 1b in his analysis shows injury rates 36-43 percent higher than IIHS found. Figure 1b indicates that, compared with IIHS, Marais has counted more crashes of the 2-wheel-drive vehicles in the dataset and fewer crashes of 4-wheel-drive vehicles. Table 1 summarizes these differences.

Table 1 – Comparison of crash and injury counts

	Rollover crashes	Fatal and incapacitating injuries	Crashes of 2-wheel-drive vehicles	Crashes of 4-wheel-drive vehicles
Marais data from 9 states	16,833	2,434	5,260*	11,573*
IIHS data from same 9 states	18,641	1,970	4,018	14,623

*estimated from Figure 1b in Marais' analysis

Whatever differences in data inclusion or exclusion rules produced Marais' data counts, they seem to have been applied consistently for the range of study vehicles so that the overall relationship among the vehicles' injury rates was little changed with respect to roof strength. Marais found a 27 percent reduction in the risk of fatal or incapacitating driver injury for a 1-unit increase in roof strength-to-weight ratio (SWR), compared with the IIHS study's estimate of a 28 percent risk reduction for the same increase in roof strength. This is the best estimate of the relationship between roof strength and injury risk with the data available. It answers the question IIHS research was designed to address, showing that roof strength as measured under FMVSS 216 is strongly related to the risk of injury in real-world rollovers.

Methods used by Marais are inappropriate

Marais' main criticism of the IIHS study is based on his application of a "rainbow test" meant to determine whether the vehicles with the lowest and highest roof strengths showed injury risk reductions of the same magnitude as vehicles with intermediate roof strengths. However, for such a test to be conclusive the low, intermediate, and high strength groups must each have enough data to be analyzed separately and produce meaningful results. This is not the case here, and Marais' manipulations of the data confirm only that this is a small dataset (11 roof designs), not that there is a level of roof strength above which there is no benefit of increased strength.

Beyond the criticisms resulting from his flawed "rainbow test," Marais performed two logistic regression analyses attempting to show the relationship of roof strength and injury risk for only those vehicles with the strongest roofs. The first was limited to vehicles with roof SWR values of at least 2.0, and the second included vehicles with roof SWR values at or above 2.5. These analyses predicted injury risk increases of 2 and 3 percent, respectively, for each 1-unit increase in SWR. Marais concluded that there is "no statistically reliable indication of a reduction in the risk of injury in the range of SWR from 2.5 to 3.5." However, these conclusions are highly sensitive to the SWR cutoff points Marais selected, as demonstrated by 3 additional logistic regression analyses of the IIHS study data. Cutoff values of 1.9, 2.0, and 2.1 produced injury risk predictions of a 32 percent decrease, 13 percent decrease, and 21 percent increase, respectively.

Furthermore, focusing on the risk of fatality alone (excluding incapacitating injuries) using Marais' selected cutoff values of 2.0 and 2.5 produces estimated risk reductions of 53 and 40 percent, respectively, for 1-unit increases in SWR. These comparisons demonstrate the potential bias from statistical analyses that use arbitrarily selected cutoffs in small datasets and confirm that these data are not sufficient to answer Marais' question of whether or not the effect of roof strength changes. The best estimates from the available data are those that consider all the vehicles in the IIHS study.

Nicole Nason
June 30, 2008
Page 3

Marais analysis misplaces burden of proof

The IIHS study clearly shows that stronger roofs reduce injury risks, in contrast to previous research funded by members of AAM. If AAM believes there is a level of roof strength that is no longer beneficial for occupant protection, or that actually increases the risk of injury in rollover crashes, the burden of proof is on it to provide data demonstrating such a trade-off. The Marais analysis fails to do this.

It is true that the available data do not allow precise estimates of the benefit of roof strength for vehicles stronger than those IIHS has tested, and IIHS has not attempted to make such estimates. However, the large benefit that has been found for the vehicles studied is sufficient evidence that increasing the minimum roof strength requirement to SWR 3.0 or 3.5 would save many more lives than the National Highway Traffic Safety Administration previously has estimated.

Sincerely,



Adrian K. Lund, Ph.D.
President

cc: Docket Clerk, Docket No. NHTSA-2008-0015

References

Alliance of Automobile Manufacturers. 2008. Comment to the National Highway Traffic Safety Administration concerning proposed upgrades to federal standard on vehicle roof crush resistance. Docket no. NHTSA-2008-0015, June 4. Washington, DC.

Brumbelow, M.L.; Teoh, E.R.; Zuby, D.S.; and McCartt, A.T. 2008. Roof strength and injury risk in rollover crashes. Arlington, VA: Insurance Institute for Highway Safety.

Insurance Institute for Highway Safety. 2008. Comment to the National Highway Traffic Safety Administration concerning proposed upgrades to federal standard on vehicle roof crush resistance. Docket no. NHTSA-2008-0015, March 27. Arlington, VA.

Moffatt, E.A. and Padmanaban, J. 1995. The relationship between vehicle roof strength and occupant injury in rollover crash data. *Proceedings of the 39th Annual Conference of the Association for the Advancement of Automotive Medicine*, 245-67. Des Plaines, IL: Association for the Advancement of Automotive Medicine.

Padmanaban, J.; Moffatt, E. A.; and Marth, D.R. 2005. Factors influencing the likelihood of fatality and serious/fatal injury in single-vehicle rollover crashes. SAE Technical Paper Series 2005-01-0944. Warrendale, PA: Society of Automotive Engineers.