INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

June 18, 2008

The Honorable Mark Pryor, Chairman
Subcommittee on Consumer Affairs,
Insurance, and Automotive Safety
US Senate
255 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Pryor:

On June 4, 2008, the Senate Subcommittee on Consumer Affairs, Insurance, and Automotive Safety held an oversight hearing on passenger vehicle roof strength. I testified on behalf of the Insurance Institute for Highway Safety (IIHS) regarding a study we recently completed revealing that increased roof strength in the quasi-static test mandated under Federal Motor Vehicle Safety Standard (FMVSS) 216 reduces the risk of fatal or incapacitating driver injury in rollover crashes (Brumbelow et al., 2008). While seemingly intuitive, 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).

In testifying on June 4, the Alliance for Automobile Manufacturers (AAM), represented by Mr. Robert Strassburger, maintained its position that stronger roofs do not reduce injury risk and questioned IIHS's study based on a critique AAM commissioned from M. Laurentius Marais of Wecker Associates (AAM, 2008). 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 with 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, it is not clear that Marais correctly duplicated the IIHS study, as Figure 1b in his analysis shows injury rates 36-43 percent higher than when IIHS counts are limited to the same 9 states. Despite this discrepancy, Marais' logistic regression with these data estimated 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), which is similar to 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 show 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 2 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 SWRs at or above 2.5. These predicted injury risk increases of 2 and 3 percent, respectively, for each 1-unit SWR increase. Marais concluded 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." But 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, if Marais had estimated the risk of fatality alone (excluding incapacitating injuries) using his selected cutoff values of 2.0 and 2.5, he would have found 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.

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 AAM 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,

Stephen L. Oesch

Stephen L. Oesch
Senior Vice President, Secretary and Treasurer

References

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