INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

March 5, 2001

L. Robert Shelton, III
Executive Director
National Highway Traffic Safety Administration
400 7th Street S.W., Room 5220
Washington, D.C. 20590

Federal Motor Vehicle Safety Standard 202;
Head Restraints for Passenger Vehicles
Docket No. NHTSA 2000-8570, RIN 2127-AH09

Dear Mr. Shelton:

The Insurance Institute for Highway Safety is very supportive of the proposed rulemaking that will upgrade the head restraint requirements of Federal Motor Vehicle Safety Standard (FMVSS) 202. The proposed requirements for head restraint height and backset should lead to many fewer crash-related whiplash injuries and associated neck disorders.

The current standard is entirely inadequate. It requires only that head restraints be capable of reaching a height 27.5 inches above the seating reference point. Adjustable head restraints can be considerably lower, often 2-4 inches lower, when left in their lowest positions. Furthermore, as the agency has noted, research has shown that most vehicle occupants do not properly adjust their head restraints, either through ignorance or apathy. At these heights, head restraints are unlikely to be in position to protect the average-size male or even many shorter occupants.

The current standard also places no limit on how far the head restraint may be located behind the head. Several studies have shown that an effective head restraint should be close to the occupant's head horizontally as well as vertically. Olsson et al. (1990), as well as Svensson (1993), reported an association between horizontal distance from the head restraint and neck injury severity. Farmer et al. (1999) reported lower rates of neck injury when head restraints were designed to be both high enough and horizontally close to the occupant's head.

The proposed change in FMVSS 202 would require that all head restraints be capable of achieving a height of 31.5 inches above the seating reference point. If the head restraint were adjustable, the

new rule would establish a new minimum height requirement of 29.5 inches above the seating reference point and further require effective locking mechanisms to retain the height once adjusted. In addition, the rule would add another new requirement limiting the horizontal distance between the head and the head restraint (backset) to 2 inches. These new requirements should assure that head restraints are likely to be in position to protect most occupants. Therefore, the Institute strongly supports these changes. The Institute also notes that the proposed requirements are consistent with the new international standard for evaluating the geometry of head restraints adopted by members of Research Council for Automobile Repairs (RCAR). A copy of the RCAR evaluation procedure is available on the web at www.rcar.org/papers/rcar.pdf.

The notice of proposed rulemaking asked for comments on whether 2 inches of backset provides sufficient head clearance and comfort for most occupants. According to Institute measurements, there are already a number of vehicles with backsets less than 2 inches when measured as specified in the proposal (e.g., Ford Ranger, Jeep Cherokee, Toyota Camry, Volvo S80), and we are unaware of any comfort issues. So it seems that a backset requirement of 2 inches would be acceptable to consumers. It is imperative, however, that compliance with the standard be measured at the proposed seat back angle of 25 degrees from vertical. The measured backset can be manipulated by varying the inclination of the seat back. Specifically, seat backs with less inclination produce smaller backsets, other things being equal, but these smaller inclinations would not be representative of typical seating positions (Schneider et al., 1983).

The agency also requested information about the appropriateness of the locking height retention requirements for adjustable head restraints. The Institute agrees that the proposed test will prevent some of the worst designs -- for example, head restraints that can fall back to their lowest position just from the effects of normal road movement. However, the agency needs to consider that head restraints are frequently used as handholds by people moving in and out of rear seats. Under these circumstances, horizontal loads are placed on the head restraints at the same time as vertical loads, and these horizontal loads can unlock certain locking mechanisms. For example, some head restraints have notches on the head restraint stalks that prevent it from being lowered unless it is first pulled forward. This head restraint could easily be misadjusted by a child entering the rear seat; but the test proposed by the agency, which merely tests resistance to a vertical load, would not reveal the problem. The Institute notes that this observation led the RCAR group to define a locking mechanism as one that “prevents” inadvertent movement from its adjusted position.

Time Not Ripe for Dynamic Test

The Institute understands the agency's desire to offer a dynamic test as an alternate way of demonstrating compliance with the proposed rule. Not only does it give manufacturers flexibility in demonstrating compliance, but an effective dynamic test also could encourage the development of advanced/active head restraint designs. However, neither of these factors appears ripe for action at this time.

In comments responding to the agency's 1995 proposal to rescind the dynamic test option, only Advocates for Highway and Auto Safety and manufacturers of recreation vehicles strongly supported the need for the regulatory flexibility implied by the existence of a dynamic test option. This small number of commenters does not indicate an overwhelming need for this flexibility. In addition, a number of auto manufacturers (e.g., Volvo and Saab) have developed innovative head restraint designs without needing a dynamic test alternative.

More importantly, we are concerned that using Hybrid III dummies representing midsize and large adult males in the dynamic test proposed by the agency could inadvertently lead to active head restraints that are not effective or are even deleterious to some occupants. Dynamic tests involving these heavy dummies could result in active head restraint designs with high minimum activation force; lighter occupants would not benefit from these designs. Given that women are disproportionately at risk of whiplash injury, this would be a perverse outcome. In addition, some innovative designs could include self-powered deployable head restraints; tests with dummies representing smaller occupants would be required to ensure that these do not inflate with too much force. Finally, the Institute notes that the Hybrid III dummy's spine has not been designed to respond as a human's does to rear impacts, especially rear impacts of low severity. Failure of the dummy to interact with seat backs in ways similar to humans could easily lead to seat and head restraint designs that offer little benefit to real occupants in real crashes.

In recognition of these shortcomings, the Institute has joined with Thatcham, in the United Kingdom, and Allianz and GDV, in Germany, to form an International Insurance Whiplash Prevention Group to develop new dynamic test procedures that resolve these issues (Attachment). Likewise, the Institute recommends that the agency defer adoption of an alternative dynamic test until these shortcomings have been addressed. Instead, the agency should initiate research on current knowledge of whiplash injuries and effective countermeasures. Such research should involve testing with the crash dummies specially designed (e.g., BioRID or RID2α) to measure the parameters that biomechanics research finds predictive of whiplash injury risk. The dynamic test currently proposed does not reflect current knowledge or

incorporate an appropriate test device. Rather, the proposed test merely attempts to mimic the effect on one aspect of head motion (i.e., rotation relative to the torso) that the agency expects will be achieved with the proposed geometric requirements. Furthermore, the agency's demonstration that the proposed dynamic test achieves this limited aim is based on a small number of tests.

The Institute notes that this recommendation is consistent with previous comments to the agency. For example, in comments on NHTSA's Technical Report in 1996, Volvo expressed concern that there was insufficient biomechanical knowledge to specify an effective alternative test. As part of its rationale for offering the proposed dynamic test option, the agency dismissed Volvo's concern, noting that Volvo's active whiplash-preventing seat design (WHIPS) must be based on the kind of knowledge needed to specify such a test. However, the proposed dynamic test does not take into account the principle that controlling torso acceleration is critical to reducing whiplash injury risk, which is the basis for the WHIPS design. Thus, Volvo's innovative seat design depended in no way on a dynamic test procedure similar to that proposed by the agency.

Previous Institute comments are also consistent. Although we have expressed support for a dynamic test alternative in concept (1995 comments on proposal to rescind the dynamic test option), the main focus of those comments was to encourage upgrading the geometric requirements. Our support for a dynamic test then specifically noted the need for a better dummy and injury criteria that address injury mechanisms besides neck bending. Consequently, the Institute's support for the concept of a dynamic head restraint test does not extend to the test proposed by the agency.

In summary, we strongly support the new geometric requirements but recommend that the dynamic test option be deferred pending further study. Overall, the proposal will greatly strengthen a standard that was weak when it was first issued more than 30 years ago.

Sincerely,

Adrian K. Lund, Ph.D.
Chief Operating Officer

cc: Docket Clerk, Docket No. NHTSA 2000-8570, RIN 2127-AH09

Attachment

References

Farmer, C.M.; Wells, J.K.; and Werner, J.V. 1999. Relationship of head restraint positioning to driver neck injury in rear-end crashes. Accident Analysis and Prevention 31:719-28.

Olsson, I.; Bunketorp, O.; Carlsson, G.; Gustafsson, C.; Planath, I.; Norin, H.; and Ysander, L. 1990. An in-depth study of neck injuries in rear end collisions. *Proceedings of the 1990 International IRCOBI Conference on the Biomechanics of Impacts*, 269-80. Bron, France: International Research Council on the Biokinetics of Impacts.

Schneider, L.; Robbins, D.; Pflug, M.; and Snyder, R. 1983. Development of anthropometrically based design specifications for an advanced adult anthropometric dummy family (UMTRI-83-53-1). Ann Arbor, MI: University of Michigan Transportation Research Institute.

Svensson, M.Y. 1993. Neck-injuries in rear-end car collisions – sites and biomechanical causes of the injuries, test methods and preventative measures. Göteborg, Sweden: Chalmers University of Technology.

ATTACHMENT

International Insurance Whiplash Prevention Group
Meeting December 1, 2000
Munich, Germany

Participants

Klaus Langwieder, GDV
Wolfram Hell, GDV
Dieter Anselm, AZT
Christian Deutscher, AZT
Hartmuth Wolff, AZT
Brian O'Neill, IIHS
Adrian Lund, IIHS
Michael Smith, Thatcham
Ken Roberts, Thatcham
Matthew Avery, Thatcham

The above members from insurer-supported research centres have formed a working group to coordinate their activities in whiplash injury prevention research. This first meeting was held at GDV in Munich, and the following points were decided:

1. The group agreed that head restraints with good geometry are a necessary first step for whiplash injury prevention, but dynamic evaluation procedures also are needed. The objective of the International Insurance Whiplash Prevention Group is to develop dynamic test procedures to evaluate and compare seat/head restraint designs.

2. It is expected that these procedures will lead to a global standard for assessing whiplash prevention. The standard should reflect the risk of neck injuries in real world vehicle-to-vehicle crashes.

3. The starting point for these procedures will be tests at delta Vs of 16 km/h. However, to ensure that vehicle manufacturers do not design seats and head restraints to perform well at a single test speed the group envisages tests at lower and higher velocities to be included in the standard.

4. These procedures will be based on sled tests of seats/head restraints with standard pulses. Some full vehicle tests also may be included.

5. The group agreed that Hybrid III's rigid spine lacks sufficient biofidelity to assess future designs. BioRID and RID2 Alpha test dummies are the only two under consideration for use.

6. The group recognized that women are more at risk of whiplash injury and that testing procedures should reflect this. Options to be considered include modifying the mass of the current 50th percentile male test dummies in the short term or, in the longer term, developing a new dummy to reflect the stature of the average female.

7. The group agreed to coordinate research activities with the aim of finalising test procedures by the end of 2001.

8. The next meeting of the group will be held at Thatcham on April 6, 2001. The agenda will include discussions of suitable crash pulses and test methodology.