INSURANCE INSTITUTE
FOR HIGHWAY SAFETY

August 22, 2002

The Honorable Jeffrey W. Runge, M.D.
Administrator
National Highway Traffic Safety Administration
400 Seventh Street, S.W
Washington, D.C. 20590

Federal Motor Vehicle Safety Standard 213; Child Restraint Systems, Side Impact Protection for Restrained Children
Docket No. NHTSA 02-12151

Dear Dr. Runge:

In response to the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, the National Highway Traffic Safety Administration (NHTSA) has issued an advance notice of proposed rulemaking (ANPRM) and requested comments and information about how to better protect children in side and rear crashes. Currently, Federal Motor Vehicle Safety Standard (FMVSS) 213 requires child restraints to be tested only in a frontal crash mode (30 mph sled test). The Insurance Institute for Highway Safety commends NHTSA for addressing the issue of protecting children in child restraints for other crash modes, but we agree that this issue is far from resolution. Little is known about crash characteristics associated with serious and fatal injuries to restrained children in side impacts or injury mechanisms in these crashes. Furthermore, the development of test procedures still is in flux, and suitable child dummies for side impact testing have yet to be developed. Of real concern is that potential countermeasures for child restraints have not been identified.

The ANPRM describes two possible dynamic side impact tests using the standardized bench seat specified in FMVSS 213. The first is a 90-degree lateral sled test with a delta V of 20 mph. During the test, the dummy's head must not move through a vertical plane oriented perpendicular to the direction of motion and located 20 inches outboard (near side) from the inboard (far side) LATCH anchor. The second test is a 90-degree lateral sled test with a delta V of 15 mph and includes a rigid wall located at the plane defining the head excursion limit. The first test is intended to reduce lateral movement of the head. However, as none of the rear-facing restraints NHTSA subjected to these conditions could pass the proposed excursion limit, the agency decided a second test is needed to control the forces imparted to the restrained child in the event of contact with side surfaces (e.g., inside door panel) of the vehicle interior.

The Institute agrees with NHTSA's decision to issue an ANPRM rather than a more complete proposal because available information about injuries to restrained children in side impact crashes does not suggest a clear way forward. Improving the effectiveness of child restraints will be a challenge because restraints already provide very effective protection to children in crashes. Restraint use can reduce fatality risks for infants by 71 percent and for toddlers by 54 percent (NHTSA, 2001). Unfortunately, child restraints too often are not used, and even when they are present often are not securely attached to the vehicle or the child is not harnessed securely in the restraint. These kinds of misuse are estimated to occur in 63 and 53 percent of all observations, respectively (Taft et al., 1999).

To understand the contribution of different factors leading to deaths and injuries of restrained children in side impact crashes, Institute researchers examined crashes from the National Automotive Sampling System/Crashworthiness Data System (NASS/CDS) electronic database (NHTSA, 2000). There were seven side impact crashes during 1997-2000 in which children harnessed in restraints (rearward-facing, forward-facing, or booster) were seriously injured (AIS 3 or greater injury on the Abbreviated Injury Scale) or killed.* All but one of the crashes were very severe, with substantial vehicle intrusion ranging from deformation extent zone 3 to 5 (of 9 possible categories) and where 5 represents residual deformation extending into the middle of the car (Collision Deformation Classification; Society of Automotive Engineers, 1980). Despite the severity of these crashes, only one of the restrained children was killed.

Four of the children, including the one who was killed, were sitting on the struck side of the vehicle. In each of these cases, vehicle intrusion contributed to injury severity, whether the injuries were caused by direct contact with the vehicle's interior side surface or by contact with the child restraint while the restraint was being loaded by the intruding interior. The most severe injuries in three of the four cases, including the fatality, were to the head. The most severe injury in the fourth case was an arm fracture (3 on the Abbreviated Injury Scale). Child restraints that could pass the excursion limits in NHTSA's proposed dynamic tests would not have prevented these injuries because of the extent of interior intrusion. The addition of energy-absorbing foam to the inside of child restraints and/or softening of the vehicle interior side surfaces might have provided some benefit, but it is difficult to know how much.

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*NASS cases reviewed were PSU 2000-74-07B, PSU 1998-08-12B, PSU 1998-11-123K, PSU 1999-49-126E, PSU 1998-09-54K, PSU-43-176 and PSU 2000-73-63B.

In the three cases in which children were sitting in the center of the vehicle or opposite the struck side, the children sustained serious injuries to the head and torso. The torso injuries (lacerated spleen in two crashes and bruised lung in the other) would not be addressed by NHTSA's proposal, which does not limit the force that a child restraint harness applies to the torso of the test dummies whose current designs do not include this measurement capability. Insofar as the NASS investigators attributed head injuries in all three crashes to contact with the restraints, additional energy-absorbing padding in the restraint may have prevented or reduced the severity of these injuries.

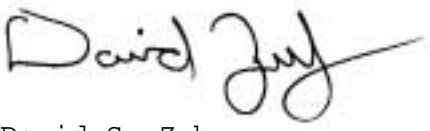
Intrusion was a significant factor in six of the seven cases reviewed by the Institute, but the proposed test procedures do not include this crash factor. Rather, the type of sled tests proposed simulate the child restraint and occupant movement due to postimpact lateral movement of the car. However, numerous crash tests demonstrate that intrusion of the side structure typically occurs well before the struck vehicle achieves significant lateral velocity. One consequence is that the intruding door may strike vehicle occupants with a higher velocity than the struck vehicle's final lateral velocity, which is the highest impact speed possible in a sled test. Thus, even adding padding to comply with the requirements of the proposed rigid wall test might not be sufficiently energy absorbing to reduce head injury risk in side crashes with intrusion.

A properly designed and installed child restraint should limit the movement of its occupant relative to the vehicle interior in a crash. Thus, efforts like LATCH to improve the attachment of restraints to vehicles are warranted. However, there is little evidence to suggest that the excursion limits proposed by NHTSA would have changed the outcome significantly for the seven cases reviewed by the Institute. The proposed 15 mph test with rigid wall seems to be an attempt to encourage child restraint designs with padded side wings, but it is not clear whether designs that meet these requirements would be effective in crashes where vehicle side structure impinges on the restraint.

There is some evidence that padding may reduce the risk of head injuries to restrained children in side impact crashes. In a recent study by Kumaresan et al. (2002), a six-month-old dummy head was struck at different velocities against the interior wings of child restraints of relatively soft and stiff materials. The addition of padding reduced head injury measures by up to 90 percent. NHTSA might want to consider additional component tests, such as the head drop test, to evaluate child restraint effectiveness.

The limited information available from real-world crashes suggests that improvements in vehicle structure to reduce intrusion will bring the most benefits in reducing the risks for restrained children, but improved child restraint designs also may be beneficial. Children need to be kept inside restraints in side impacts, and efforts should be made to keep forces low. To better design a test protocol that could achieve these aims, the agency needs to develop a better understanding of injury mechanisms in side impact crashes. The Institute encourages research toward such understanding. In the meantime, the current proposals do not address the ways children in child restraints are being injured in severe side impact crashes.

Sincerely,



David S. Zuby
Vice President, Research

cc: Docket Clerk, Docket No. NHTSA-02-12151

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