

**INSURANCE INSTITUTE
FOR HIGHWAY SAFETY**

March 4, 2005

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

**Notice of Proposed Rulemaking
Anthropomorphic Test Devices; SID-IIIsFRG Side Impact Crash
Test Dummy (SID-IIIs with Floating Rib Guide Modifications);
5th Percentile Adult Female; Docket No. NHTSA-2004-18865**

Dear Dr. Runge:

The Insurance Institute for Highway Safety welcomes the opportunity to comment on the National Highway Traffic Safety Administration's (NHTSA) recent notice of proposed rulemaking concerning specifications and qualification requirements for a 5th percentile adult female test dummy for use in regulatory side impact crash tests. The Institute supports the use of a small adult dummy but finds the proposed floating rib guide (FRG) version of SID-IIIs an unacceptable and unnecessary compromise of the original dummy's biofidelity to address an unproven durability problem. We therefore urge NHTSA to reconsider selection of this dummy.

The Institute's primary concern about the FRG modification is that it stiffens the rib deflection response so much that rib deflection measurements no longer can be used to evaluate injury risk. NHTSA's proposal of more stringent side impact protection requirements (Docket No. NHTSA-2004-17694) does not include rib deflection performance criteria for crash tests using SID-IIIsFRG. Instead the agency is proposing limits on rib deflection in tests using the larger dummy (ES-2) because it recognizes the importance of including these limits in addition to those on torso acceleration to reduce torso injury risk. Without rib deflection limits for tests with the small dummy, the proposed side impact standard will not establish the same minimum levels of protection for vehicle occupants of various sizes. It is disappointing that part of NHTSA's reason for not including SID-IIIsFRG rib deflection limits was the need to study the issue further. By favoring the FRG modified dummy the agency is ignoring the accumulated test experience with the original dummy.

The rationale for developing the FRG version of SID-IIIs is flawed. In its early testing with the original SID-IIIs NHTSA researchers identified a sled test condition (crash simulation) that repeatedly damaged the dummy when over-compressed ribs were caught on guides that keep the ribs from moving up/down from their design position (Rhule

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and Hagedorn, 2003). This test, which was based on biofidelity testing of larger dummies and human subjects, consists of crashing the dummy into a rigid wall at 6.7 m/s. The wall is shaped so that the dummy's abdomen is loaded first, and the portion of the wall that contacts the upper torso and pelvis is offset by 100 mm. This test condition is much more severe than would occur in the tests proposed by NHTSA in its upgrade of Federal Motor Vehicle Safety Standard (FMVSS) 214. The 100 mm offset between the upper and lower portions of the rigid wall is especially unrealistic for SID-IIIs, whose ribs are limited to about 70 mm of deflection because humans the same size as the dummy would be seriously injured at lower levels of rib deflection.

The durability issue for which the agency developed the SID-IIIsFRG has not been shown to exist in actual vehicle crash tests. Not only have NHTSA's own vehicle crash tests failed to show any durability problems with the original dummy design, but Institute and industry experience confirms the dummy is durable enough for crash testing. As of October 2004 the Institute had conducted 48 side impact tests with SID-IIIs dummies positioned in the driver and rear outboard seating positions, for a total of 96 SID-IIIs test exposures. Of these only 6 caused any damage to the dummy; in 4 tests the dummy's shoulder was damaged, and in 2 tests one of the abdominal ribs did not pass post-test verification. Similar trends are found in the Occupant Safety Research Partnership (OSRP) dataset, which includes tests conducted by DaimlerChrysler, General Motors, the Institute, and Transport Canada. Of the 241 SID-IIIs test exposures (or 1,446 exposures to the dummies' individual ribs), only 21 tests (8.7 percent) caused any dummy damage; of these only 3 tests (0.3 percent of total rib exposures) exhibited any evidence of ribs catching on the vertical guides.

In proposing to use SID-IIIsFRG, NHTSA inexplicably is specifying a dummy modification addressing a problem that is exceptionally rare in crash tests, many of which are more severe than the regulatory tests NHTSA proposed in its upgrade of FMVSS 214. The effect of the FRG modification of SID-IIIs impact response is to make it less human-like. Previously published biofidelity ratings determined using the International Standards Organization (ISO) 9790 method showed the original SID-IIIs has an overall biofidelity score of 7.0 on a 10.0 scale (Scherer et al., 1998). Recent tests conducted by OSRP member laboratories have shown the SID-IIIsFRG biofidelity score drops to 5.9.

This decrease in overall biofidelity from an ISO 9790 classification of "good" to "fair" results primarily from a drop in thoracic and abdominal biofidelity, due to stiffening of the deflection response in the thoracic and abdominal ribs by the FRG system. This stiffening of the rib response was documented by researchers at Transport Canada in

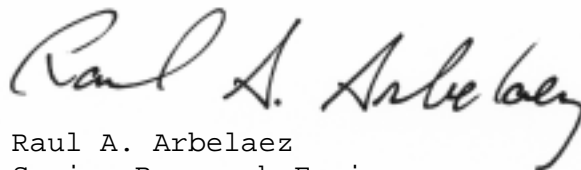
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comparative full-vehicle crash tests with the original SID-IIs and SID-IIsFRG (Tylko and Dalmotas, 2004). The authors concluded that (1) the original SID-IIs is durable despite the severe test conditions in their study (Institute MDB impacts) and (2) the FRG adversely affects dummy rib response. Thus, NHTSA's preference for SID-IIsFRG over the original dummy compromises the biofidelity of the small female dummy to address a durability problem that is rare in real crash tests.

The Institute urges NHTSA to adopt the original SID-IIs (build level C) or SID-IIs-enhanced (build level D) instead of the SID-IIsFRG. SID-IIs build level D is being evaluated by the SID-IIs Upgrade Task Group and would incorporate many of the design upgrades present in the FRG version while maintaining the dummy's high biofidelity rating. The changes to build level D that are supported by the Institute include redesigned shoulder and guide, neck mounting bracket, rib stops, and spine box. Using either C- or D-level SID-IIs would permit the agency to draw on the dummy's accumulated crash test experience to incorporate rib deflection data among the FMVSS 214 requirements.

We hope these comments help the agency in its final decision. We are open to requests for additional information or data from our side impact evaluation program.

Sincerely,



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Senior Research Engineer

cc: Docket Clerk, Docket No. NHTSA-2004-18865

References

Maltese, M.R.; Eppinger, R.H.; Rhule, H.H.; Donnelly, B.R.; Pintar, F.A.; and Yoganandan, N. 2002. Response corridors of human surrogates in lateral impacts. Paper no. SAE 2002-22-0017. *Stapp Car Crash Journal* 46:321-51.

Rhule, H. and Hagedorn, A. 2003. Development of the SID-IIs FRG. Comment to NHTSA concerning FMVSS 214, side impact protection. Docket no. NHTSA-2004-17694-14. Washington, DC: National Highway Traffic Safety Administration.

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Scherer, R.D.; Kirkish, S.L.; McCleary, J.P.; Rouhana, S.W.; Athey J.B.; Balser, J.S.; et al. 1998. SID-IIs Beta+-prototype dummy biomechanical responses. Paper no. SAE 983151. *Proceedings of the 42nd Stapp Car Crash Conference*, 89-114. Warrendale, PA: Society of Automotive Engineers.

Tylko, S. and Dalmotas, D. 2004. SID-IIs response in side impact testing. Paper no. SAE 2004-01-0350. *Rollover, Side, and Rear Impact (SP-1880)*. Warrendale, PA: Society of Automotive Engineers.