

**INSURANCE INSTITUTE
FOR HIGHWAY SAFETY**

December 13, 2004

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

**Frontal New Car Assessment Program (NCAP)
Request for Comments; Docket No. NHTSA-2004-18765**

Dear Dr. Runge:

The National Highway Traffic Safety Administration (NHTSA) has asked for comments on possible changes to the frontal New Car Assessment Program (NCAP). The Insurance Institute for Highway Safety (IIHS) is pleased the agency is taking this opportunity to consider updating NCAP.

NCAP changed the paradigm for improving vehicle safety; prior to this program the prevailing wisdom had been that federal regulation was the only way to get safety features in new vehicles. In its early years NCAP identified important differences in the performance of new vehicles in 35 mi/h frontal crash tests into rigid barriers. Major variations in the performance of restraint systems were identified, and media coverage of these results prompted automakers to improve designs quickly. Thus, NCAP signified the start of the safety marketplace that is producing rapid improvements in vehicle safety designs. In this respect NCAP probably is the most important program NHTSA ever adopted, but now an overhaul of the original frontal NCAP is long overdue.

Over the years most automakers have adopted NCAP's various tests and good ratings as de facto standards. This inevitably means that the longer a particular NCAP test remains unchanged, the smaller the performance differences will be among new vehicles. Thus any NCAP test has a limited span of usefulness because important differences in protection identified early in a program disappear as manufacturers improve their designs. Then the basic objective of providing consumers with information about meaningful differences in vehicle safety no longer is achieved.

This has been the situation for many years with respect to the frontal NCAP. Manufacturers have responded to this test by improving designs. Virtually all new vehicles are achieving good results. Except for

some relatively rare instances, the remaining performance differences among new vehicles are unlikely to translate into important differences in occupant protection in real-world crashes. So NCAP no longer serves its consumer information goal with the frontal test.

This program has matured to the point where manufacturers are modifying vehicle designs to get better ratings, not to improve real-world crash protection. For example, manufacturers are making relatively minor changes to restraint system performance, changing airbag venting or modifying belt force limiters. Yet there is no evidence that this tweaking of restraint systems for optimum performance in a single test will improve protection in the range of serious frontal crashes that occur in the real world, especially because the rigid-barrier test with its relatively short crash pulse is not particularly representative of serious real-world frontal crashes.

The fact that frontal NCAP is not identifying important safety differences among vehicles anymore means a new frontal test is needed. A future frontal NCAP test must address a different crash mode to give consumers meaningful comparisons of real-world frontal crashworthiness. IIHS offers the following comments in support of changing to alternative frontal crash tests.

Limitations of Full-Width Barrier Test Proposals

Recent amendments to Federal Motor Vehicle Safety Standard (FMVSS) 208 will raise the frontal test speed for the belted 50th percentile male dummy from 30 to 35 mi/h beginning on September 1, 2007, making this test identical to the one currently used in NCAP. As noted earlier, the differences among vehicles in recent years of NCAP already have become quite small. Most vehicles tested now receive four- or five-star frontal NCAP ratings.

To duplicate this significant progress in frontal crash protection in the coming years, NHTSA cannot simply make changes to the current flat-barrier test. That would be like adding embroidery to a tablecloth; it would change the appearance of the cloth without covering any more of the table -- and serious injury crashes span a very big "table." Full-width flat-barrier tests cover only a fraction of the table, even when only frontal crashes are considered. The agency's studies have found that about 20-25 percent of frontal crashes in the field are full width (Saunders and Kuppa, 2004; Stucki et al., 1998), and not all of these involve impacts with very rigid objects. The rest are some type of offset crash or impact with a narrow object like a tree or pole. The injury risk from offset or narrow object impacts will not be addressed by a flat-barrier crash test under any of the amendments suggested by the agency.

NHTSA has suggested it would consider altering the current NCAP star rating system, making it difficult to achieve a five-star rating by dividing the injury risk curves into smaller increments, resulting in a wider variation of star ratings. However, this would simply divide the four- and five-star performers into more groups; it would not provide consumers with additional meaningful information about crash protection. If such changes were adopted, it seems likely that automakers would strive to achieve good performance again. But increasingly this would mean manufacturers would do even more tweaking of restraint systems. The process would continue to be about passing the test, not improving real-world crash protection. For example, physics dictates that more powerful airbags providing earlier restraint to test dummies make it easier to achieve low dummy injury measures. However, real-world crash evidence suggests that such powerful airbags have, at best, a neutral effect on occupant injuries and, at worst, might contribute to additional serious injuries and fatalities across the broad spectrum of crash types (Cammisa et al., 2000). NHTSA's own comparisons of frontal NCAP test results with real-world fatality experience suggest it is difficult to identify any real-world crashworthiness differences among four- and five-star vehicles (Kahane, 1994). Test protocol changes must have some meaning outside of laboratory conditions to advance protection in real-world crashes. It would be inappropriate to waste the power of consumer information programs on a change with so little evidence that it would produce any real-world benefits and might even produce disbenefits.

Another alternative suggested by NHTSA for keeping the current flat-barrier test is to include dummies of other statures in the full-width test. But this, too, would be unlikely to significantly improve real-world crash protection. Under identical test conditions, the requirements of FMVSS 208 still would be the dominant factors driving basic structural designs and restraint system parameters. Consequently, tests with dummies of other statures would lead only to more tweaking of restraint systems. It is appropriate for the agency to include such dummies in tests required under FMVSS 208 to ensure adequate minimum levels of protection for occupants of all sizes. However, no evidence indicates that including such dummies in NCAP would identify differences in protection levels that are relevant for most consumers.

A third NHTSA proposal for maintaining the flat-barrier test would be to increase the full-width barrier test speed to 40 mi/h. This idea is not well founded; it would increase the energy of an already high deceleration test by more than 30 percent, and NHTSA has not shown the relevance of doing so. Analysis of National Automotive Sampling System (NASS) data indicates that only 15 percent of seriously injured belted drivers in frontal crashes had associated delta Vs greater than

35 mi/h (Appendix A). The vast majority of serious injuries in frontal crashes occur with less severe delta Vs and in other frontal crash modes not covered by the flat-barrier test. Furthermore, among frontal crashes with delta Vs of 40 mi/h or greater, very few have delta Ts as short as the rigid-barrier crash, indicating that a 40 mi/h rigid-barrier test is atypical even of high-speed frontal crashes.

Raising the NCAP frontal barrier test speed from 35 to 40 mi/h probably sounds like a good idea to people with no technical background in crash protection, but it would drive restraint system designs in directions that, in the spectrum of real-world crashes, would not be beneficial. "Good" performance in a 40 mi/h rigid-barrier crash, which as noted above represents an extremely rare real-world event, almost certainly would result in poorer performance in the less severe crashes that occur far more often in the real world. Although "good" performance in a 40 mi/h rigid-barrier frontal test could, in theory, be achieved by significantly increasing front-end crush space, other important vehicle design constraints preclude this option. So it is likely that vehicle front ends and seat belts would become stiffer, and airbag systems would become more aggressive.

In sum, the full-width rigid-barrier test has achieved what it reasonably can as a consumer information program. It has driven automakers to study and design vehicle structures and restraint systems that can manage such a high-energy event. Having achieved this goal, the flat-barrier test now is better suited for use in safety standards to ensure maintenance of the design improvements it has produced. The frontal NCAP test should be modified to drive improvements in protection in other kinds of frontal crashes.

Significant Benefits Can Be Obtained in Other Crash Modes

Incorporating an offset test into NCAP is the best option NHTSA has proposed, although making such a test part of a federal safety standard would be even more beneficial. An offset test would complement the restraint system evaluations of the full-width FMVSS 208 test by continuing the improvements in structural designs that have occurred in recent years.

IIHS has conducted offset deformable barrier tests of many vehicles since 1995, and manufacturers have responded by making dramatic improvements to vehicle structures. Most vehicles during the past two years have performed very well. However, limited funds mean IIHS can evaluate only certain types of vehicles. And as the number of new models increases every year and new areas of research develop, our ability to continue these tests becomes more restricted. Offset

testing as part of a safety standard would ensure that important advances in design are extended to all vehicles on the market.

Although regulatory offset testing is the most desirable option, changing NCAP to an offset test would represent an improvement compared with the current frontal test. About 75 percent more vehicles per year are subjected to frontal NCAP tests than to IIHS offset tests; this includes categories of vehicles not tested by IIHS such as sports cars and large SUVs as well as two-door variants of models. An NCAP offset test would drive improvements in these vehicles and guarantee that new designs continue to emphasize good structural crashworthiness. If NHTSA chooses to go in this direction, IIHS notes the relevance of many comments we submitted in response to the agency's question about adopting a frontal offset crash test standard. Especially relevant are our comments concerning the critical importance of assessing vehicle structural performance in a direct manner (IIHS, 2004).

Although not among NHTSA's proposals, there is another important frontal crash configuration that is not being addressed by any test. Impacts into narrow objects like poles, posts, and trees make up a significant number of serious real-world crashes. Analysis of crashes in NASS shows that impacts into these types of objects accounted for about 10 percent of all frontal crashes during 1995-2003 and nearly one-quarter of crashes resulting in serious injuries. Similarly, Fatality Analysis Reporting System (FARS) data indicate that more than 20 percent of fatal frontal crashes are into fixed narrow objects (Appendix B). Offset tests more closely simulate impacts with narrow objects than do full-width tests, but the specific structural and restraint issues important in this type of crash are not necessarily being evaluated. A narrow-object NCAP test could have an important impact on real-world vehicle crashworthiness and would almost certainly give consumers a wide range of results to inform their purchasing decisions.

Following either of these options would require some additional research by the agency, but this should be minimal in the case of offset crash tests. IIHS has a long history of conducting offsets, and we have documented the differences in real-world crashworthiness for vehicles included in our test program (Farmer, 2004). For collisions with narrow objects, more research would be needed to estimate the expected benefits. The agency would need to document the range of performance in real-world crashes and identify an appropriate test speed and precise test configuration. However, IIHS believes the increased crash protection driven by such a test would be similar to that of the original frontal NCAP test.

Jeffrey W. Runge
December 13, 2004
Page 6

Upgrading NCAP Crash Mode is Essential

Frontal NCAP has been one of NHTSA's most successful vehicle safety programs. It has provided valuable comparative safety information to consumers and contributed to important improvements in vehicle restraint systems since the late 1970s. The current vehicle fleet has met the de facto standard established by NCAP; this means the frontal test no longer can identify important differences among new vehicles. If the program is going to continue to fulfill its purpose of providing information to consumers about differences in safety among vehicles, it must change to an alternate crash mode. The obvious alternatives are an offset deformable barrier test or a rigid pole test. Either one would represent a significant portion of serious real-world frontal crashes, complement full-width safety standards to promote design changes beneficial over a range of crash conditions, and give meaningful comparative information to the public. NHTSA should not miss this valuable opportunity to upgrade frontal NCAP in a meaningful way.

Sincerely,



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

cc: Docket Clerk, Docket No. NHTSA-2004-18765

Appendices

References

Cammisa, M.X.; Reed, R.T.; Ferguson, S.A.; and Lund, A.K. 2000. Driver fatalities in frontal crashes of airbag-equipped vehicles: a review of 1989-96 NASS cases. SAE Technical Paper Series 2000-01-1003. Warrendale, PA: Society of Automotive Engineers.

Farmer, C.M. 2004. Relationships of frontal offset crash test results to real-world driver fatality rates. *Traffic Injury Prevention*, in press.

Insurance Institute for Highway Safety. 2004. Comment to the National Highway Traffic Safety Administration concerning proposed frontal offset crash test. Docket Document No. NHTSA 2003-15715-20, July 2. Washington, DC: U.S. Department of Transportation.

Jeffrey W. Runge
December 13, 2004
Page 7

Kahane, C.J. 1994. Correlation of NCAP performance with fatality risk in actual head-on collisions. Report no. DOT-HS-808-061. Washington, DC: U.S. Department of Transportation. Available:
<http://www.nhtsa.dot.gov/cars/rules/regrev/evaluate/808061.html>

Saunders III, J.W. and Kuppa, S. 2004. NHTSA's frontal offset research program. SAE Technical Paper Series 2004-01-1169. Warrendale, PA: Society of Automotive Engineers.

Stucki, S.L.; Hollowell, W.T.; and Fessahaie, O. 1998. Determination of frontal offset test conditions based on crash data. Paper no. 98-S1-O-02. *Proceedings of the 16th International Technical Conference on the Enhanced Safety of Vehicles* (CD-ROM). Washington, DC: National Highway Traffic Safety Administration.

Appendix A
Analysis of Driver Injury Severity
in Frontal Crashes in NASS by Delta V

Crashes with known delta Vs and driver injuries classified as MAIS 3+ in 1997-2003 NASS were categorized into those with delta Vs less than 35 mi/h and those with delta-Vs equal to or greater than 35 mi/h. Only frontal crashes with a principal direction of force between 11 and 1 o'clock were included.

Belt Use	Percentage of Crashes	
	with Delta V <35 mi/h	with Delta V ≥35 mi/h
Belted	85	15
Unbelted	84	16
Unknown	83	17

Appendix B
Analysis of Proportion of Frontal Crash Modes in NASS and FARS

Frontal crashes with occupant injuries in 1995-2003 NASS were categorized by the type of object struck by the vehicle. Only crashes with a principal direction of force between 11 and 1 o'clock were included. Cases with one or more occupant fatalities were excluded, and vehicles were restricted to 1995-2004 model years. The analysis was repeated for vehicles with occupants sustaining MAIS 3+ injuries.

A similar analysis was conducted using FARS data. Frontal crashes in 1994-2003 FARS were categorized by the type of object struck by the vehicle. Only crashes with a principal impact point between 11 and 1 o'clock were included. Vehicles were restricted to those containing a fatally injured occupant and to 1995-2004 model years. Rollover crashes were excluded.

Object Struck	Percentage of Frontal Crashes		
	NASS (All Crashes)	NASS (MAIS 3+)	FARS
Another motor vehicle	73.4	63.8	62.0
Motor vehicle not in transport	1.3	0.6	n/a
Pole or post	6.0	9.4	5.0
Tree	5.1	13.5	17.5
Pole/post/tree combined	11.1	22.9	22.5
Other fixed object	12.5	10.9	11.8
Other non-fixed object	1.7	1.9	1.8
Non-collision/unknown	n/a	n/a	2.0