

February 16, 2016

The Honorable Mark R. Rosekind, Ph.D.
Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

New Car Assessment Program; Request for Comments; Docket No. NHTSA-2015-0119

Dear Administrator Rosekind:

The Insurance Institute for Highway Safety (IIHS) is pleased to respond to the National Highway Traffic Safety Administration's (NHTSA) Request for Comments (RFC) on proposed upgrades to the New Car Assessment Program (NCAP). IIHS strongly supports efforts to provide consumers with enhanced vehicle safety information that rewards auto manufacturers who lead the industry in safety advancements and encourages others to improve.

The 1978 launch of NCAP signaled the birth of the vehicle safety marketplace. NCAP was the first government program in the world to provide consumers with objective information about how well vehicles would protect them in crashes. The landmark program has played a pivotal role in driving improved crashworthiness in vehicles, and thousands of lives have been saved as a result.

Now, NHTSA has outlined substantial changes to NCAP with the intent of publishing the new ratings in 2018 for model year 2019 vehicles. IIHS welcomes many of the proposed changes, which could maintain and enhance the effectiveness of this important program. However, the proposal contains many disparate elements, and not all of them currently have the empirical support necessary to justify their claimed contribution in reducing motor vehicle crash injury risk. In other cases, too little information has been provided about the proposed changes for an informed comment.

It is noteworthy that many of the proposed upgrades would require long lead times to implement at considerable cost, and IIHS urges NHTSA to focus on those proposals that are clearly justified and well-specified, while delaying the implementation of others until more information is available. In this comment, IIHS offers its evaluation of the proposals and hopes the agency will find these insights helpful as it seeks to make the best use of scarce resources.

In brief, IIHS believes the following proposals are ripe for action:

1. **Pedestrian impact protection and pedestrian crash avoidance.** Both areas have moderate to good empirical support, and procedures for evaluating them are well-developed and in use in Europe. IIHS urges NHTSA to adopt Euro NCAP test methods, as there is no empirical evidence that any of the proposed changes would materially improve safety.
2. **All crash avoidance features except lane departure warning.** Despite its intuitive appeal, lane departure warning has not been found to reduce insurer-reported crashes and, moreover, surveys indicate that drivers often disable the feature. Additionally, IIHS believes some of the test procedures for the other proposed crash avoidance features could be improved (e.g., visibility testing). Finally, IIHS urges NHTSA to consider how other testing agencies (Euro NCAP, IIHS) are currently

evaluating the performance of crash avoidance technologies and to diverge from these procedures only when there is empirical evidence that doing so will bring measurable benefits.

3. **A moderate overlap oblique frontal impact.** IIHS agrees that real-world data indicate occupants could benefit from improvements in vehicle design in this crash mode. IIHS suggests modifying the proposal to (a) maximize information for rear-seated passenger protection and (b) prevent automakers from manipulating seat track designs to optimize test performance in ways that provide no real-world benefit. IIHS cautions that using the moving barrier will mask meaningful differences in safety performance among similar vehicle models because vehicle mass will be a dominant factor in vehicle performance. NHTSA needs to assure that consumers who are interested in only small cars (or only large cars) will have access to information about meaningful differences in safety performance within a size class.

The following proposals have merit in principle, but there are significant questions about their readiness for NCAP:

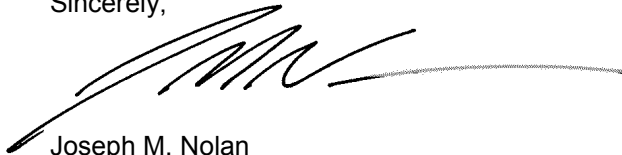
1. **Replacing the Hybrid III and ES-2e dummies with THOR and WorldSID frontal and side impact test dummies.** IIHS agrees in principle that crash tests should utilize the most biofidelic dummies available. However, NHTSA has not shown that these dummies — which are expensive, have a long lead time for availability, and have not been finalized in federal standards — would greatly improve consumer information about the crashworthiness of vehicles. In the case of THOR, IIHS is concerned that much of the justification is based on a new head injury metric, the Brain Rotational Injury Criterion (BrIC), which has been the subject of substantial debate in the scientific literature. Specifically, BrIC currently predicts injury under circumstances in which injury is known not to occur. If NHTSA moves ahead with THOR in frontal crash testing, IIHS urges that BrIC not be used until this debate is resolved.
2. **Full-width barrier test with THOR in driver seat and 5th percentile Hybrid III in rear.** IIHS agrees the inclusion of a rear-seated Hybrid III representing the 5th percentile female could provide important information about rear-seat safety. However, IIHS knows of no data relating dummy outcomes in this seating position to real-world outcomes, so it is unclear that the agency would get meaningful information. Similarly, there is no information currently that THOR in the driver seat would provide meaningfully different information than Hybrid III.
3. **VIN information on availability of crash avoidance features.** It is not clear how the agency intends to include this in NCAP. Although IIHS believes that VINs containing such information would be highly informative for research and insurance purposes, a consumer information program does not appear to be the place for this discussion. Specifically, how would the availability of the information in the VIN help consumers choose safer vehicles? IIHS believes this is an issue for rulemaking, and NHTSA should move as quickly as possible to require automakers to encode such information into the VIN.

NHTSA also asked for comments on how to present information from the revised NCAP to consumers. IIHS has no specific comments on NHTSA's proposed weighting scheme for the different safety tests, other than to urge the agency not to conflate the optional availability of crash avoidance equipment (or any other safety performance) with the effectiveness of the equipment when installed. The latter is the most important information for consumers seeking safe transportation. If the agency desires an alternative way to pressure automakers to standardize crash avoidance equipment, IIHS has found it effective to provide consumers with different ratings for the vehicles with and without the optional equipment.

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IIHS hopes these comments are useful to NHTSA in improving this important consumer information program. If the agency has questions about any of them, please let us know. In the meantime, more specific comments about the rating proposals and other areas are provided below, in the order of appearance in the RFC.

Sincerely,



Joseph M. Nolan
Chief Administrative Officer and Senior Vice President, Vehicle Research

Detailed Comments on Proposed NCAP Modifications

Frontal Crashworthiness

Full-width barrier test

NHTSA proposes to change the dummies in this test from the current Hybrid III midsize male (50th percentile male) to a Test device for Human Occupant Restraint (THOR) 50th percentile male driver and a Hybrid III 5th percentile female in the front passenger seat, plus add a second Hybrid III 5th percentile female to the right second row seat position.

IIHS supports use of the THOR dummy in both front crash modes to provide a more biofidelic assessment of occupant protection in these crash conditions if the data indicate the upgraded dummy will drive meaningful changes that improve vehicle structure and occupant restraints. We also agree that a rear seat Hybrid III 5th percentile female will help encourage improved designs for rear seat occupant safety. However, NHTSA has not supplied data to show that the proposed configuration of dummies would provide more benefits and better vehicle designs than the current configuration of dummies.

In addition, the proposed injury metrics and their injury risk curves are not complete. IIHS is especially concerned that NHTSA plans to use BrIC as part of the evaluation. There are a number of concerns about the meaningfulness of this metric, including biofidelity concerns for the THOR neck resulting in unrealistic head kinematics in controlled tests and BrIC's unsuitability to be used in the Hybrid III 5th percentile female (Dibb et al., 2006; Gabler et al., 2014; Mueller et al., 2015; Takhounts et al., 2013). Studies by IIHS and others (Gabler et al., 2014; Mueller et al., 2015) also indicate a disconnect between real-world head injury and BrIC injury risk curves. NHTSA must tie injury assessment to real-world injury occurrence in order to drive meaningful improvements. We encourage NHTSA to drop the BrIC assessment until further research can be done. This concern about BrIC extends to both the frontal and side impact test proposals.

Frontal oblique test

NHTSA proposes to add a new frontal oblique crash test utilizing the THOR 50th percentile male as a driver. The test vehicle is stationary and struck by a moving barrier fitted with a deformable face at a 15-degree angle, with a 35 percent front overlap and a 56 mi/h impact speed.

IIHS supports the addition of the frontal oblique test with reservations. First, the proposed test condition is with a fixed mass and fixed speed moving barrier striking the test vehicle. This means, for example, that a 2,500-pound car will experience approximately a 38 mi/h change in velocity, whereas a 5,000-pound vehicle will only experience a 29 mi/h change in velocity. NHTSA needs to ensure that within a vehicle class, even among the lightest vehicles, this test will produce meaningful discrimination of performance despite the mass disadvantage inherent in small cars. Second, IIHS has serious concerns that one of the main discriminators of vehicle performance in NHTSA's research has been the head injury criterion BrIC. Third, we recommend that NHTSA add a left rear 5th percentile female passenger, as field data suggest this crash mode is more frequently injurious to these occupants than the full-width condition. Fourth, IIHS strongly recommends that NHTSA implement an intrusion-based penalty to ensure occupant compartment integrity in such tests. We base our own front crashworthiness ratings in part on measurements of intrusion, and our analyses of the relationship between real-world outcomes and IIHS crash test ratings indicate that these intrusion measures are predictive. For example, Farmer (2005) estimated that the likelihood of a driver fatality was 57 percent lower in a vehicle with a good structural rating compared with a vehicle with a poor rating for structure, despite the structural rating being only a part of the overall rating. While not statistically significant, the result is suggestive of the importance of including structural measures in the evaluation of front crashworthiness. IIHS is unable to comment further on the specific test evaluation criteria as very few details were provided in the RFC.

Frontal test dummies

NHTSA proposes to replace the current Hybrid III 50th percentile male with the THOR 50th percentile male in NCAP tests. NHTSA also proposes to adopt the Hybrid III 5th percentile female modified with the RibEye™ chest deflection measurement system, which would be a new addition.

IIHS supports the use of the most efficient anthropomorphic test devices (ATD) and relevant injury criteria required to realistically evaluate occupant protection in crash tests. Numerous deficiencies of the existing Hybrid III design have been reported in the literature, including unrealistic shoulder anatomy for belt routing and limited pelvic flexion, which might influence both belt positioning as well as excursion and submarining evaluations (Kent et al., 2003; Mueller et al., 2011; TNO Crash Safety Research Centre, 2000; Törnvall et al., 2008). Nevertheless, we have concerns about NHTSA's proposal to adopt a modified Hybrid III 5th percentile female dummy. This configuration is relatively new and, as such, very little is known about its biofidelity, durability, reliability, or repeatability. Moreover, neither NHTSA nor any other organization has evaluated how the RibEye™ measurements relate to injury risk. We suggest NHTSA delay the implementation of the RibEye™-modified dummy until a thorough evaluation of its capabilities has been conducted and published.

IIHS does not support choosing a midtrack seating position for any crash test dummies. Such procedures have proven to push automakers to design seat tracks that do not reflect realistic seating choices by human volunteers. Studies and IIHS experience using a more realistic positioning procedure based on work by the University of Michigan Transportation Research Institute (UMTRI) demonstrate that seat track design can be influenced by test protocols, not seating positions selected by drivers. Since October 2003, IIHS has used the UMTRI ATD positioning procedure in its consumer information tests. On average, a midsize male Hybrid III 50th percentile male is seated 32 mm rearward of the midtrack position. For a quarter of the vehicles measured at IIHS, the midtrack position is 48-89 mm forward of where a midsize male would place the seat to comfortably operate the vehicle controls (IIHS, 2004, 2014). Preventing manufacturers from designing seat tracks to optimize test performance is an obvious real-world improvement to NCAP. Manufacturers for many years have demonstrated a proficiency at replicating the UMTRI positioning procedure in IIHS's test experience, and it should not be ignored in this important upgrade.

Side Crashworthiness

Side impact dummies

NHTSA proposes to replace the ES-2re male currently used in NCAP with a WorldSID 50th percentile male. NHTSA also proposes to use additional injury metrics with the current SID-IIs 5th percentile female dummy.

As cited above, IIHS supports the use of the best ATD, and this applies to side impact dummies, as well. NHTSA has not provided any comparative data to show that the WorldSID 50th percentile male will drive improvements not already occurring with ES-2re. Another difficulty in assessing this proposal is that it does not include specific dummy injury criteria. IIHS supports the inclusion of abdomen and chest deflection injury criteria for SID-IIs. We have evaluated thoracic injury risk in our side crashworthiness tests using such measurements. An IIHS analysis of the relationship between ratings in our side crashworthiness tests found that the chest injury risk component rating in our evaluation is a statistically significant predictor of driver fatality risk in side crashes (Teoh and Lund, 2011).

Pedestrian Impact Testing

NHTSA proposes to adopt the European New Car Assessment Program (Euro NCAP) procedure for evaluating the passive pedestrian protection afforded by pedestrian-friendly front-end designs. The agency also proposes to use an upgraded leg-impactor design in the tests.

IIHS strongly supports the addition of the Euro NCAP passive pedestrian protection suite of tests. IIHS and others have shown reductions in injuries and fatalities among the better performing vehicles in these tests, especially the head impact scores (Liers and Hannawald, 2011; Mueller et al., 2013; Pastor, 2013; Strandroth et al., 2011). We also support the lower legform upgrade to Flex-PLI, which numerous studies have shown to be more biofidelic in vehicle-to-pedestrian impacts. IIHS is concerned about the thigh/torso impact test because it has not been shown to have real-world effectiveness, either in laboratory or field data analyses. IIHS supports evaluating light trucks and pickups because these vehicle types are most likely to cause pedestrian injuries. We request that NHTSA provide further details on which vehicle sizes/classes will be included and how the testing protocol may be modified for different front-end geometries.

Crash Avoidance Technologies

NHTSA proposes evaluating three systems: front crash warning and automatic braking, visibility and conspicuity, and driver awareness systems.

Emergency braking (warning and automatic systems)

Forward collision warning (FCW): NHTSA proposes to use the FCW procedure currently used for the Recommended Advanced Technology Features on www.safercar.gov. The test requires vehicles to warn in three scenarios: a lead vehicle stopped, a lead vehicle decelerating, and a slower moving lead vehicle. The procedure requires warnings at 2.1, 2.4, and 2.0 seconds, respectively. NHTSA also asks for comments on whether to only award FCW credit if the vehicle is equipped with a haptic warning.

IIHS supports the inclusion of this criteria. Such systems, as fitted to vehicles like the Honda Accord, have been shown to significantly reduce insurance claim and police-reported crash rates, including those involving injury (Cicchino, 2016a, HLDI, 2012a, 2012b, 2015b). IIHS does not support limiting credit to only systems with a haptic warning. The reductions in insurance claim frequencies and police-reported

crash rates described above are for vehicles with a range of forward collision warnings that do not necessarily include a haptic component. Additionally, there is not enough evidence to suggest that haptic warnings of any type (e.g., seat pan vibration, brake pulse, seat belt tug) produce a quicker braking response than an auditory warning (e.g., Forkenbrock et al., 2011; Mohebbi et al., 2009; Scott and Gray, 2008).

Crash imminent braking (CIB): NHTSA is proposing to use the CIB procedure published in 2015. The procedure includes four lead vehicle tests (lead vehicle stopped, lead vehicle decelerating, and two slower moving lead vehicle) and two false activation tests driving over a steel trench plate. In order to pass the criteria in the lead vehicle scenarios, the test vehicle needs to reduce the speed or avoid the collision in five out of seven trials. The test vehicles must not activate in five out of seven trials when driving over the steel trench plate.

IIHS has for several years awarded its highest accolades to vehicles incorporating autonomous emergency braking and supports its inclusion in the RFC. IIHS is concerned, however, that the proposed evaluation would not give credit to low-speed-only systems, such as Volvo's City Safety, because it does not operate at some of the proposed test speeds. City Safety has shown significant crash reduction benefits in real crashes worldwide (Cicchino, 2016b; Fildes et al., 2015; HLDI, 2015a; Issakson-Hellman and Lindman, 2015; NHTSA, 2015; Rizzi et al., 2014).

Dynamic brake support (DBS): Dynamic brake support applies additional braking in situations where the front crash sensors determine that the braking applied by the driver is insufficient. NHTSA's proposal for DBS uses the same scenarios as the CIB tests. The testing is conducted with a brake robot applying insufficient braking to avoid the impact. The DBS systems should supply the additional brake support to avoid the crash in all the scenarios. In the steel trench plate scenario, the braking must be less than 150 percent of the input braking from the robot.

The only supporting evidence of the benefits of DBS is based on an assumption of scenarios in which it could activate, but there is no evidence that by itself or with FCW there is a meaningful real-world benefit.

Visibility systems

Low beam headlight performance: NHTSA is proposing a static evaluation with five light meters aligned to the centerline of the vehicle at different locations in front of the vehicle (75, 85, 95, 105, and 115 meters). Another light meter is placed 4 meters to the left and 60 meters in front of the vehicle to evaluate glare. The evaluation is based on an equation that includes light levels that are at least 3 lux at each of the light meters. It also takes into account any glare that is more than 0.634 lux. The lights are aimed based on the manufacturers' recommended procedure.

IIHS supports the inclusion of a lighting assessment in NCAP but has significant concerns with the proposal. First, re-aiming the lamps to the procedure recommended by the manufacturer prior to the evaluation has the potential to result in irrelevant ratings. Aim is unregulated in FMVSS 108, and a nominally level aim can differ greatly from the aim as delivered to customers. It is likely that some manufacturers would specify a certain aim value for the NCAP test while the targeted factory aim for the same vehicle was completely different. IIHS has measured the "as-delivered" aim for 62 vehicles (2015-16 model years). One measure of aim variation is provided by comparing the aim for the right and left headlamps on the same vehicle. The average difference between lamps measured by IIHS is 0.12 degree, with a standard deviation of 0.15 degree and a maximum of 0.70 degree for one vehicle.

These values are substantial when considering NHTSA's proposed glare measurement point is around 0.3 degree above the horizontal for a vehicle with a typical mounting height. Second, the limited number

of locations at which NHTSA has proposed to measure visibility could encourage headlamp beam patterns that direct more light to those locations while reducing the illumination everywhere else. For example, a pair of low beams could provide adequate visibility 4 meters to the right of the vehicle's path on a straight road, where the evaluation is made, but have poor visibility on curved roads, on the left side of a straight road, or even in the center of its own lane on a straightaway. Similarly, taking one measurement of glare 60 meters away from the test vehicle could allow beam patterns with limited glare at this point in space to obtain high ratings, while oncoming drivers exposed to the full duration of the vehicle approach still perceive excessive glare.

Semi-automatic headlight beam switching: NHTSA is proposing two scenarios to assess semi-automatic headlamp switching. The first scenario involves the test vehicle approaching another vehicle or test stand with a headlighting system illuminating the lower beam headlamps. The second scenario involves the test vehicle approaching another vehicle or test stand with a lighting system illuminating the taillamps. Both scenarios are conducted in a straight direction with the test vehicle travelling faster than 25 mi/h. The test vehicle must demonstrate that the headlamps switch from upper to lower beams in response to the preceding vehicle and then return to upper beams after passing the vehicle or test stand.

IIHS supports giving credit to such systems. IIHS studies and others show that drivers do not utilize high beams manually as often as situations would allow it (Mefford et al., 2006; Sullivan et al., 2003). In the dynamic tests that NHTSA proposes to evaluate the beam switchover, IIHS recommends specifying a minimum distance between vehicles where the switchover must occur to prevent glare.

Amber rear turn signal lamps: NHTSA research shows amber rear turn signals could reduce rear impact crashes by 5.3 percent. The agency plans to use the Tristimulus method to determine if the color of the rear turn-signal lamp falls within the range of allowable amber colors.

IIHS supports this proposal.

Driver awareness and other technologies

Lane departure warning (LDW): NHTSA intends to use the current NCAP LDW procedure but redefine the performance criteria. The procedure is based on tests conducted at 45 mi/h both to the left and right with three different roadway markers. The pass/fail criteria must be met for three out of five. The current procedure allows for the warning to occur between 2.5 feet inside the lane marker to 1 foot outside the lane marker. NHTSA is aware that drivers choose to disable the LDW system if they experience too many alerts. The new LDW performance criteria will not allow the warning when the lateral position of the vehicle is greater than 1 foot from the line edge. It still will allow for the warning to occur up to 1 foot outside of the lane marker. NHTSA is again asking whether to only give credit for haptic warnings.

IIHS does not support continuing to give credit for LDW systems even with the proposed performance test changes. These systems have not been shown to have significant crash reductions (HLDI, 2011, 2012a, 2012b, 2015b, 2015c, 2015d). IIHS suggests that NHTSA allow these systems to be unconstrained by performance tests. This would grant freedom to automakers to adjust the systems so drivers will accept them, an issue if not addressed will result in the technology not being used. If real-world benefits of LDW are established, IIHS would be pleased to support the technology's inclusion in NCAP at that time.

Rollover resistance: Because all new vehicles are equipped with electronic stability control (ESC), NHTSA intends to change the star bands for the rollover resistance rating with a new rollover risk function for static stability factor (SSF).

IIHS supports NHTSA's effort to more accurately report a rollover rating that captures the effect of ESC, which has been shown to reduce the risk of fatal single-vehicle rollovers by 75 percent for SUVs and by 72 percent for cars (Farmer, 2010). However, NHTSA has stated that it plans to continue performing the dynamic fishhook test maneuver but has not detailed how these test results would be included in the rollover resistance rating. It is unclear how this would be possible because the agency has not observed a vehicle tip-up since 2007 and does not have separate tip/no-tip rollover probabilities.

Blind spot detection (BSD): NHTSA plans to conduct three tests on each vehicle equipped with BSD. The scenarios include straight lane tests with a converging vehicle; straight lane tests with a vehicle traveling 5, 10, and 15 mi/h faster; a principle other-vehicle pass-by to simulate a vehicle changing lanes and passing; and a principle other-vehicle and secondary other-vehicle pass-by to simulate two vehicles passing simultaneously.

IIHS supports inclusion of BSD in NCAP. Preliminary studies of the insurance claim experience of vehicles fitted with BSD are showing a range of results (HLDI, 2012a, 2012b, 2013, 2015b, 2015c). IIHS believes BSD systems should be able to detect motorcycles.

Other

NHTSA proposes to work collaboratively with automakers to modify the vehicle identification number (VIN) positions 4-8 to indicate the availability of collision avoidance technologies associated with the VIN and asks for comments if specific fitment should be indicated for those systems that are optional.

In principle, IIHS strongly supports including crash avoidance technologies in the VIN. However, the RFC proposal to collaboratively utilize existing VIN positions to potentially indicate only the availability of such systems has no practical value if the specific fitment of all crash avoidance technologies on the vehicle is not required. IIHS studies of the effectiveness of crash avoidance technologies have been constrained by voluntary data sharing agreements with automakers. It is not clear why this is included in a consumer information program proposal, but this clearly should be addressed in the VIN standard and mandated for all automakers.

Pedestrian Crash Avoidance Systems

NHTSA plans to evaluate two pedestrian emergency braking technologies: pedestrian automatic emergency braking (PAEB) systems for front crashes and rear automatic emergency braking (RAEB) for backover crashes.

IIHS supports encouraging the fitment of front and rear pedestrian detection and autonomous braking with a few recommendations and concerns indicated below.

Pedestrian automatic emergency braking

NHTSA is proposing to focus on four pedestrian scenarios: S1 - vehicle moving straight/pedestrian crossing road, S2 - vehicle turning right/pedestrian crossing road, S3 - vehicle turning left/pedestrian crossing road, and S4 - vehicle moving straight/pedestrian moving with/against traffic. The document references a potential test procedure including the above crash configurations, two vehicle speeds (16 and 40 km/h), three mannequin speeds (stationary, walking, and running), and two mannequin sizes (child and adult). The potential to test false activations is also mentioned, but no test method is proposed or specified. All of the above parameters have yet to be finalized, and there is no draft procedure available.

IIHS supports the crash modes proposed in the RFC to evaluate PAEB, as they represent the most common injuries in pedestrian impact scenarios. An IIHS analysis of pedestrian injuries and fatalities in motor vehicle crashes present in GES and FARS during 2005-09 indicated that the largest number of pedestrian involvements and deaths in single-vehicle crashes occurred with a pedestrian crossing the roadway when the vehicle was traveling straight (Jermakian and Zuby, 2011). The same analysis also showed that while a large majority of pedestrian involvements occur in daylight conditions, less than 30 percent of fatal pedestrian crashes occur during daylight hours. IIHS recommends that NHTSA consider adding tests under non-daylight conditions if the agency expects pedestrian crash avoidance systems to address pedestrian fatalities. Finally, NHTSA would be missing an opportunity to harmonize with Euro NCAP if it did not choose the same pedestrian dummies and related test equipment (European New Car Assessment Programme, 2015a, 2015b).

Rear automatic braking

NHTSA is proposing a test procedure in which the vehicle coasts straight rearward toward a stationary 4active systems '4a' child pedestrian mannequin located along the longitudinal centerline of the vehicle. The same test is repeated with the pedestrian mannequin offset 2 feet laterally in each direction.

IIHS has several comments and suggestions concerning the proposed confirmation test procedure. First, the procedure could be improved by using a shorter child-size target simulating a younger child consistent with the at-risk backover crash population (children younger 5; NHTSA, 2014), objects used to assess rear visibility (31.5 inches; Office of the Federal Register, 2014), and objects used in research on rearview cameras (30.2 to 36 inches; e.g., Kidd et al., 2015; Mazzae, 2010, 2013). An adult-size object lying prone also should be considered to simulate a fallen 70-year-old adult, consistent with the older population overrepresented in backover crashes (NHTSA, 2014).

IIHS recommends adding dynamic object tests to further round out the test matrix. An in-depth analysis of 2007 SCI backover cases conducted by the federal government indicated the backover crash victim was moving in 32 of the 42 cases (76 percent) where movement could be determined (NHTSA, 2014). Additionally, the moving condition is more challenging for sensor-based systems that would support rear automatic braking (Mazzae and Garrott, 2006). Finally, findings from a recent IIHS study suggest the mannequin location in the proposed confirmation test procedure is directly visible or visible using mirrors for drivers of most vehicles including larger ones (Kidd and Brethwaite, 2014). The average minimum distance that the head of a 60-72-month-old child (42.7 inches tall) could be observed behind the vehicle rear bumper by a 50th percentile male driver was 13.2 feet among 21 2010-13 model year vehicles; this is 34 percent shorter than the 20-foot distance proposed using an object that is almost 4 inches shorter than the child mannequin in NHTSA's proposed test. Backover crashes often involve a pedestrian located in the blind zone area where he or she cannot be seen directly or with mirrors. Rear automatic braking systems are intended to prevent backovers, so the mannequin in the confirmation test should be placed in the blind zone.

An IIHS drive-in claims study also showed that 49 percent of backing claims involved the vehicle turning left or right (McCartt and Hellinga, 2003). For this reason, IIHS also recommends evaluating the performance of rear automatic braking when the vehicle is turning. IIHS has conducted rear automatic braking tests on three production vehicles (Cadillac CTS, Infiniti Q50, and Jeep Cherokee) based on a draft procedure developed by the Research Council for Automobile Repairs. In two cases, the rear automatic braking is much less effective when the vehicle is turning (IIHS, 2015).

IIHS in principle supports encouraging this technology. Rear automatic braking systems should be more effective for preventing backover crashes than technologies that enhance rear visibility (e.g., rearview cameras, sensor-based systems, auxiliary mirrors). However, research is lacking on the safety benefits of

rear automatic braking systems relative to current technologies to support the inclusion of the feature in NCAP at this time.

New Rating System

NHTSA proposes to have an overall rating combining the results for crashworthiness, crash avoidance, and pedestrian protection. NHTSA did not specify how the ratings would be combined.

The rating for crashworthiness is to be based on a combination of results from the full-frontal rigid barrier test, frontal oblique test, side MDB test, and side pole test. NHTSA proposes that one way to combine the results is to use the current NCAP method. This would mean computing the risk of injury (relative to a baseline) for each test, then averaging these with weights equal to the distribution of these crash types among belted occupants injured in crashes. The agency requests suggestions for other weighting schemes.

The rating for crash avoidance is to be based on the sum of points from FCW evaluation (0-12 points), CIB evaluation (0-12 points), DBS evaluation (0-11 points), low beam headlight evaluation (0-15 points), semi-automatic headlight beam switching (0-9 points), amber rear turn signals (0-6 points), LDW evaluation (0-7 points), blind spot detection evaluation (0-8 points), and rollover resistance evaluation (0-20 points). NHTSA proposes that optional crash avoidance systems only receive half credit.

The relationship between points and NCAP crash avoidance star ratings is as follows:

CA point total	CA rating
1-19	1 star
20-39	2 stars
40-59	3 stars
60-79	4 stars
80-100	5 stars

The rating for pedestrian protection is to be based on the sum of points from headform tests (0-24 points), upper legform tests (0-6 points), lower legform tests (0-6 points), PAEB evaluation, and rear automatic braking evaluation. If following the Euro NCAP procedure, then PAEB would be credited up to 6 points only if the sum of the headform and legform points is at least 22.

NHTSA requests comments on how best to combine and present ratings. IIHS recommends strongly that individual performance ratings be made available to the public. If NCAP combines all crashworthiness or crash avoidance systems into a single rating, IIHS is concerned that vehicles could achieve high star ratings with a subpar individual test performance.

IIHS also is concerned that NHTSA's proposal to apply half credit for optional crash avoidance systems could mislead consumers. For example, a manufacturer with high-performing but optional crash avoidance technologies can at best earn half total credit. Meanwhile, a vehicle with underperforming standard crash avoidance features could potentially earn a higher total score than the vehicle with better performing technologies. IIHS recommends NHTSA evaluate vehicles both with and without the crash avoidance technologies. We utilized this strategy in our consumer information side impact test programs when side airbags were optional equipment. Providing dual ratings is a powerful communications tool for the public to understand the importance of the optional equipment.

Communications Efforts in Support of NCAP Enhancements

NHTSA proposes to communicate aggressively to the public via multiple technologies and strategies including revamping online content, dealer information, and social media outreach. IIHS applauds such strategies to increase consumer awareness.

In summary, IIHS is pleased that NHTSA is utilizing NCAP to encourage automakers to make meaningful safety improvements in their products. As noted above, some of the proposals need significant work prior to finalizing, and others are not fully supported by scientific data.

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