DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket No. NHTSA-2012-0057]

Advanced Braking Technologies that Rely on Forward-Looking Sensors Request for Comments

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

ACTION: Notice; Request for comments on research report.

SUMMARY: The National Highway Traffic Safety Administration (NHTSA) has, for about two years, been studying advanced braking technologies that rely on forward-looking sensors to supplement driver braking or to actuate automatic braking in response to an impending crash. NHTSA believes these technologies show promise for enhancing vehicle safety by helping drivers to avoid crashes or mitigate the severity and effects of crashes. NHTSA is soliciting comments on the results of its research thus far to help guide its continued efforts in this area.

DATES: *Comments:* The agency must receive comments on or before **[INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Comments should refer to the docket number above and be submitted by one of the following methods:

- Federal Rulemaking Portal: http://www.regulations.gov. Follow the online instructions for submitting comments. Fax: 1–202–493–2251.
- Mail: Docket Management Facility, U.S. Department of Transportation, 1200 New Jersey Avenue, S.E., West Building Ground Floor, Room W12–140, Washington, DC 20590–0001.

- Hand Delivery: West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue, S.E., Washington, DC between 9 a.m. and 5 p.m. ET, Monday through Friday, except Federal Holidays.

Instructions: For detailed instructions on submitting comments and additional information on the rulemaking process, see the Public Participation heading of the Supplementary Information section of this document. Note that all comments received will be posted without change to http://www.regulations.gov, including any personal information provided.

Privacy Act: Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78).

Docket: For access to the docket to read background documents or comments received, go to http://www.regulations.gov or the street address listed above. Follow the online instructions for accessing the dockets.

FOR FURTHER INFORMATION CONTACT: Ms. Abigail Morgan of NHTSA's Office of Crash Avoidance Standards at (202) 366-6005 or by email at abigail.morgan@dot.gov. For technical issues, contact Mr. Garrick Forkenbrock of NHTSA's Vehicle Research and Test Center (VRTC) at (937) 666-3317 or by email at garrick.forkenbrock@dot.gov. Mail to these officials may be sent in care of the National Highway Traffic Safety Administration, 1200 New Jersey Avenue, S.E., West Building, Washington, DC 20590–0001.

SUPPLEMENTARY INFORMATION:

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I. Background

There are presently three forward-looking technologies intended to address rear-end crashes involving light vehicles in the United States: Forward Collision Warning (FCW), Dynamic Brake Support (DBS), and Crash Imminent Braking (CIB). These technologies, listed in the order of increasing vehicle system assistance/intervention, may be generally defined as follows:

Forward Collision Warning (FCW): a system that uses information from forward-looking sensors, usually a camera or radar, to determine whether or not a crash is likely or unavoidable and that, in such cases, warns the driver so the driver can brake and/or steer to avoid or minimize the impact of the crash.

Dynamic Brake Support (DBS): a system that uses information from forward-looking sensors about driving situations in which a crash is likely or unavoidable to supplement

automatically the output of the brakes when the DBS system senses that the force being applied by the driver to the brake pedal is insufficient to avoid the crash.

Crash Imminent Braking (CIB): a system that uses information from forward-looking sensors to automatically apply the brakes in driving situations in which a crash is likely or unavoidable and the driver makes no attempt to avoid the crash.

In 2010, NHTSA began a thorough examination of the state of forward-looking advanced braking technologies, analyzing their performance and identifying areas of concern or uncertainty, in an effort to better understand their potential. The agency's recent research and analysis of DBS and CIB systems have been documented in the report "Forward-Looking Advanced Braking Technologies: An analysis of current system performance, effectiveness, and test protocols" (2012). This report is referred to below as the "2012 report." The report is available in the Forward Looking Advanced Braking Technologies docket NHTSA-2012-0057 at www.regulations.gov.

Our efforts to date indicate that DBS and CIB have the capability to provide substantial safety benefits (to varying degrees, depending on which vehicle make and model is considered). However, we continue to explore test procedures and effectiveness of these systems and to refine the performance criteria that should be used to assess these systems.

NHTSA will use information from the public to guide its continued efforts regarding DBS and CIB technologies.

II. Opportunity for the Public to Comment

The efforts of the agency described in the 2012 report have significantly enhanced NHTSA's knowledge of forward-looking advanced braking technologies and the state of their development. The agency wants to enhance its knowledge further and to help guide its

continued efforts. This includes work regarding effectiveness, test operation (including how to ensure repeatability using a target or surrogate vehicle), refinement of performance criteria, and exploring the need for an approach and criteria for "false positive" tests to minimize unintended negative consequences. To that end, the agency is seeking public comment in the specific areas listed below. Any other relevant comments are welcome and encouraged. However, the subjects below are the areas in which the agency thinks comments will most advance the agency's knowledge. The agency also recognizes that, for some questions below, the information provided by commenters will be manufacturer-specific and may be considered confidential. Comments containing confidential information should be submitted consistent with section III. Public Participation.

A. Test Protocols

The draft test protocols for CIB and DBS prepared by the agency use speed reductions and crash avoidance measures for assessing system effectiveness (see Docket NHTSA–2012–0057). The agency has the following questions in this area:

1) Performance

a) Can the tests be performed within the tolerances (i.e., subject-vehicle and principle-other-vehicle test speeds, lateral movement, yaw rates, etc.) provided in the Phase 2 (October 2011) version of the agency's CIB and DBS test protocols, which are located in the docket?

b) Are there sections of the test protocols that require additional detail or more clearly-defined instructions?

c) Do the specified speed reductions in the draft performance measures accurately test system effectiveness?

d) Are the speed reduction criteria under consideration feasible for CIB and DBS systems? If not, what system changes would be necessary?

e) Given the idealized test conditions, is it feasible to achieve the speed reductions under consideration during each test trial?

f) Can fault codes occur during testing when the test vehicle makes contact with the surrogate vehicle? Will fault codes that occur during testing have an impact on system performance?

g) False positive tests are not presently included in the CIB or DBS test protocols. Work performed at the agency's VRTC has indicated it is possible to observe consistent false positive CIB activations; however, these false positive CIB activations were found to be vehicle-dependent and occurred during only one of seven test scenarios: driving over a 1-inch thick steel plate lying flat on the pavement (a plate often used as a temporary cover during road repairs). Will the omission of a false positive test (or suite of such tests) have the potential to promote systems prone to such behavior? Are CIB and DBS false activations expected to have an adverse effect on safety, or they a concern of customer acceptance of the technologies?

2) DBS Test Protocol

a) In the DBS test protocol, is the manner in which the brake controller is used (i.e., whether its control logic is based on pedal position or brake application force) a short-term concern expected to affect only a limited population of vehicles, or will this protocol have more serious implications on future-generation vehicles (e.g., vehicles with throttle-by-wire braking)?

b) For DBS testing, is the methodology used for "Foundation Brake System Characterization" a reasonable approach for objectively evaluating a vehicle's brake system without advanced braking technologies such as DBS or brake assist? Please explain if the DBS

test approach will activate brake assist technologies in some vehicles and not in others? Should this issue be further evaluated while attempting to derive the benefits of DBS?

c) Does the DBS test protocol provision for a vehicle to be evaluated with one of two force-based applications, pedal position or brake application, provide enough flexibility to evaluate the performance of systems appropriately?

d) Will the DBS system performance observed in tests performed in accordance with the DBS test protocol be sufficiently representative of the performance expected in the "real-world," given similar input conditions (including driver-based brake applications or similar magnitudes and rates)? Would such testing be sufficient to ensure robust performance, i.e., good performance in a broad range of conditions?

B. Surrogate Vehicle and Related Testing Equipment

The agency recognizes surrogate vehicles (strikeable artificial vehicles or target vehicles) are necessary to safely perform CIB and DBS tests. NHTSA believes an acceptable surrogate vehicle should be "realistic" (i.e., be interpreted the same as an actual vehicle) to systems using RADAR, camera, LIDAR, and/or infrared sensors to assess the potential threat of a rear-end collision. The surrogate vehicle should be robust and able to withstand repeated impacts from the CIB- or DBS-equipped test vehicle with little to no hysteresis over time. A test vehicle should not incur damage resulting from repeated impacts with the surrogate vehicle. Construction of the surrogate vehicle should be consistent.

1) Please provide specific recommendations for other surrogate vehicle design considerations that should be addressed (physical characteristics, radar reflectivity, material type, etc.) and suggestions for how those attributes could be objectively validated.

2) To ensure real-world robustness, should NHTSA use a "fleet" of different surrogate vehicles? Is there a need to conduct testing with a fleet of different surrogate vehicles representing various vehicle body styles that any system would encounter in the real world to ensure robustness? If there is such a need, describe what body styles should comprise the fleet.

3) Testing conducted on behalf of the agency used a simple platform on which the surrogate vehicle was mounted and towed. This apparatus worked well with good repeatability and reasonable cost, but it was unable to accurately accommodate the decelerating lead vehicle test condition. In future testing, NHTSA intends to use a rigid mechanical link between the surrogate vehicle and the towing vehicle to enable the testing of the decelerating lead vehicle condition. The agency welcomes specific recommendations for a practical, feasible, standardized towing system.

C. System Functionality and Performance

1) *Operational Speed*: Once a system has been initialized, in what speed range does it remain fully functional? What speed reduction levels are achievable with systems presently available or soon-to-be available (5-10 years)? Under what crash scenarios are those speed reductions achievable (i.e., speeds of vehicles involved and distance between vehicles)? What changes to current systems would improve system performance (sensor quality or quantity, better algorithms, etc.)?

2) *Suppression algorithms*: The agency requests comments on the rationale used to determine when a CIB and/or DBS system will be activated and when its activation will be suppressed including, but not limited to answers to the following questions:

a) What inputs to the steering wheel and/or throttle pedal are capable of suppressing system activation?

b) If an object is on the roadway in the driver's forward path, what characteristics of the object or situation will cause the system activation to be suppressed?

c) How and why could the presence of one or more unbelted vehicle occupants suppress or limit system operation?

d) If the system activation is suppressed because of an unbelted occupant, on which unbelted occupants does the system suppression rely (e.g., driver, front seat passenger, rear seat passenger)?

e) If suppression is based on vehicle speed, what are the relative and absolute upper and lower velocity thresholds? What is the rationale for these limits?

f) Are certain environmental conditions capable of suppressing system activation (e.g., a wet/rainy roadway surface)? If so, please describe these conditions and explain how these conditions are measured and determined by the vehicle?

g) What other factors can be capable of suppressing, or contributing to the suppression, of system activation?

3) *System Robustness*: What environmental and/or driving conditions totally or partially negate the ability of CIB and/or DBS systems presently on the market to perform as designed (e.g., driving in the dark or in adverse weather)? What information should be communicated to the driver when conditions have negated the system's capabilities and how? Are there improvements under development to respond to these challenges? What are they and what is the timing of their availability? What is the expected useful life of the system components installed in vehicles presently on the market?

D. Target Population and its Relationship to Benefit Estimates

1) With the relatively short time to collision (TTC) defining when a CIB and/or DBS operation is possible (i.e., system availability), what is the effectiveness of these systems, if activated, at preventing a fatal crash when the relative front-to-rear end impact speed (difference in speed between the two vehicles involved in crash) is 80 km/h or higher?

2) In fatal crashes in which the lead vehicle was a large truck or trailer, under what circumstances would the CIB and/or DBS technology have decreased the impact speed enough to prevent the fatality given the current state of the technology?

3) At what impact speed is it reasonable to assume that the outcomes of high speed fatal crashes in which the fatalities occurred in the lead (struck) vehicle would be the same if CIB and/or DBS systems were activated, due to the fact that the impact was severe and the crashworthiness of the vehicle was exceeded?

E. Activities of Other Countries, Multiple Government Entities, or Non-Government Organizations (NGOs)

In addition to the studies listed in the *Review of Literature and Current Activities* section of the 2012 report, are there additional noteworthy activities that are planned or ongoing by individual countries, entities consisting of multiple governments, or non-government organizations (NGOs) that may provide additional information on the capabilities, limitations, and readiness of these systems?

III. Public Participation

How do I prepare and submit comments?

Your comments must be written and in English. To ensure that your comments are correctly filed in the Docket, please include the docket number of this document in your comments.

Comments may be submitted to the docket electronically by logging onto the Docket Management System Web site at http://www.regulations.gov. Follow the online instructions for submitting comments.

You may also submit two copies of your comments, including the attachments, to Docket Management at the address given above under ADDRESSES.

Please note that pursuant to the Data Quality Act, in order for substantive data to be relied upon and used by the agency, it must meet the information quality standards set forth in the Office of Management and Budget (OMB) and DOT Data Quality Act guidelines. Accordingly, we encourage you to consult the guidelines in preparing your comments. OMB's guidelines may be accessed at http://www.whitehouse.gov/omb/fedreg/reproducible.html. DOT's guidelines may be accessed at http://dms.dot.gov.

How can I be sure that my comments were received?

If you wish Docket Management to notify you upon its receipt of your comments, enclose a self-addressed, stamped postcard in the envelope containing your comments. Upon receiving your comments, Docket Management will return the postcard by mail.

How do I submit confidential business information?

If you wish to submit any information under a claim of confidentiality, you should submit three copies of your complete submission, including the information you claim to be confidential business information, to the Chief Counsel, NHTSA, at the address given above under FOR FURTHER INFORMATION CONTACT. In addition, you should submit two copies, from

which you have deleted the claimed confidential business information, to Docket Management at the address given above under ADDRESSES. When you send a comment containing information claimed to be confidential business information, you should include a cover letter setting forth the information specified in our confidential business information regulation. (See 49 CFR part 512.)

How can I read the comments submitted by other people?

You may read the comments received by Docket Management at the address given above under ADDRESSES. The hours of the Docket are indicated above in the same location. You may also see the comments on the Internet. To read the comments on the Internet, go to http://www.regulations.gov. Follow the online instructions for accessing the dockets.

Please note that even after the comment closing date, we will continue to file relevant information in the Docket as it becomes available. Further, some people may submit late comments. Accordingly, we recommend that you periodically check the Docket for new material.

Authority: 49 U.S.C. 30101.

Issued: June 26, 2012

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Billing Code: 4910-59 P

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[FR Doc. 2012-16250 Filed 07/02/2012 at 8:45 am; Publication Date: 07/03/2012]