



August 14, 2023

Raymond R. Posten
Associate Administrator for Rulemaking
National Highway Traffic Safety
Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C. 20590

**Re: Docket No. NHTSA-2023-0021,
"Federal Motor Vehicle Safety
Standards: Automatic Emergency
Braking Systems for Light Vehicles"**

Dear Associate Administrator Posten,

Applied Intuition ("Applied") welcomes the opportunity to respond to the National Highway Traffic Safety Administration's ("NHTSA") Notice of Proposed Rulemaking ("NPRM") for Federal Motor Vehicle Safety Standards: Automatic Emergency Braking Systems for Light Vehicles. As a company focused on improving vehicle safety through technology solutions, Applied supports NHTSA's decision to include requirements for automatic emergency braking ("AEB") and pedestrian automatic emergency braking ("PAEB") in light-duty vehicles. The wider deployment of these technologies will provide vital protection from collisions, not only for motorists, but also for pedestrians and other vulnerable road users ("VRU").

Applied Intuition's mission is to accelerate the world's adoption of safe and intelligent vehicle technologies. Applied provides software solutions to safely develop, test, and deploy autonomous systems, verify and validate the performance of vehicle safety systems, and test compliance with national and international standards. Applied's products are used by original equipment manufacturers ("OEMs"), part suppliers, research labs, and government agencies to model and evaluate vehicle performance. In the automotive industry, 17 of the top 20 global OEMs rely on Applied's solutions to develop, test, and deploy autonomous systems at scale.

¹ See *Case Studies*, Applied Intuition, <https://www.appliedintuition.com/case-studies> (last visited July 28, 2023); Mechanical Simulation, CarSim Customers, CarSim, <https://www.carsim.com/company/customers/carsim.php> (last visited July 28, 2023).

² *Case Studies*, Applied Intuition, <https://www.appliedintuition.com/case-studies> (last visited July 28, 2023).

As NHTSA moves forward with a final rulemaking on AEB and PAEB, the agency should consider the use of modeling and simulation software in the Federal Motor Vehicle Safety Standard (“FMVSS”) compliance testing process. Modeling and simulation technologies can complement and enhance existing real-world testing by expanding the number and types of tests and test scenarios available for use. Physics-based simulation software, like Applied’s tools, augments real-world tests by producing a virtual environment to allow continuous validation of the performance of a vehicle’s safety systems in a secure environment. This can include testing in scenarios that would otherwise be difficult, costly, or dangerous to replicate in real-world testing. By expanding the FMVSS test procedures for AEB and PAEB to include virtual simulation technologies, NHTSA can ensure these systems are tested against a wide array of scenarios and conditions that would be unavailable if testing is limited to the real world.

Simulation Technology can Expand the Available Number of Tests and Test Scenarios

In the NPRM, NHTSA lays out specific, but limited, testing scenarios. For AEB, these tests involve the system responding to a lead vehicle that has (1) stopped; (2) is traveling slower than the vehicle being tested; and (3) is decelerating. For PAEB, the scenarios include a pedestrian (1) crossing the path of a vehicle; (2) stationary in relation to the vehicle; and (3) traveling “along-path” with the vehicle. The PAEB tests include some variables, such as a running child or adult, or a stationary child obstructed from view.

We recommend that NHTSA include additional scenarios and elements through virtual testing procedures. Modeling and simulation technologies allow for a vehicle to be put through a much more expansive set of testing scenarios and elements than are possible in real-world testing due to potential expense and the limits of physical test tracks. In the case of AEB and PAEB, these added scenarios and elements could include:

- Additional pedestrians and VRUs, such as cyclists, skateboarders, pedestrians pushing strollers, shopping carts or similar items, adults and children of varying sizes, and allow for varying pedestrian/VRU behaviors.
- Occlusion and obstacles, such as parked cars, road cones, and construction equipment.
- Additional collision geometries and vehicle behaviors, including lane changes, crossings at an angle, turns, or cut ins (where a slower adjacent vehicle moves into the test vehicle’s lane) and cut outs (where a lead vehicle lane change reveals a stopped vehicle ahead).

³ Federal Motor Vehicle Safety Standards: Automatic Emergency Braking Systems for Light Vehicles, 88 Fed. Reg. 38632, 38660 (June 13, 2022). [hereinafter AEB & PAEB NPRM].

⁴ AEB & PAEB NPRM at 38668.

⁵ *Id.*

⁶ AEB & PAEB NPRM at 38696.

Another critical benefit of simulation technology is the ability to vastly increase the number of tests that can run, creating a much greater pool of data from which to evaluate a vehicle. Simulation software is not limited by variables like test track availability, weather conditions, or available daylight. Simulation further benefits from significantly reduced costs when compared to real-world tests. Using simulation, a vehicle can undergo thousands of test runs, far more than could be achieved with real-world testing alone. This in turn provides a much denser sampling of vehicle behaviors across scenarios and a more detailed and comprehensive look at a vehicle's capabilities, which can be further informed by complementary real-world tests.

Simulation Technology can Help Evaluate False Activations

Simulation technology can also be used to support NHTSA's proposed false activation tests under consideration in the NPRM. As written, the NPRM proposes only two tests for false activation: (1) a steel trench plate in the vehicle's path; and (2) vehicle pass-through, where two vehicles are positioned in adjacent lanes to the vehicle on the right and the left. As with the AEB and PAEB tests discussed above, simulation can supplement and expand the number of scenarios used to test for false activation by testing how AEB and PAEB systems respond to birds, debris, and other environmental or road conditions. As with the other proposed tests, this expansion of testing via simulation can allow for a much more rigorous and robust evaluation of a system's capabilities.

As an alternative to false positive tests, the NPRM proposes a documentation requirement, where manufacturers would have to "maintain documentation demonstrating that robust process standards are followed specific to the consideration and suppression of false application of AEB in the real world." Such a standard would make proving AEB and PAEB performance more difficult than the use of traditional testing (with or without simulation) and would be a noticeable departure from traditional processes used to test motor vehicle standards. Applied believes the use of real-world and simulation testing would provide better verification of AEB and PAEB performance.

NHTSA also proposes, as a second alternative to false positive testing, targeted data recording and storage requirements for "significant AEB activations." If implemented, the data collected could be evaluated using simulation, and verification and validation software to help identify potential false positives, and likewise could provide new information and scenarios for future simulation testing scenarios. If NHTSA were to require such data collections, ensuring the ability for data to be analyzed by OEMs and regulators alike would be important,

³ Federal Motor Vehicle Safety Standards: Automatic Emergency Braking Systems for Light Vehicles, 88 Fed. Reg. 38632, 38660 (June 13, 2022). [hereinafter AEB & PAEB NPRM].

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⁶ AEB & PAEB NPRM at 38696.

and software developers like Applied would be positioned to assist in that analysis.

Simulation Technology is Regularly Used to Evaluate AEB Performance

As NHTSA considers the inclusion of simulation technologies into the AEB and PAEB standards testing process as proposed above, it is important to note that simulation software products, like those developed by Applied, are already in use today by OEMs, automotive parts suppliers, automation technology developers, and others to evaluate vehicle performance and safety. Applied's software is currently used to verify and validate the performance of advanced driver assistance systems ("ADAS") under existing Euro NCAP, and could similarly be applied for testing the AEB and PAEB standards found in the NPRM. Applied's software can provide the diverse set of testing scenarios and elements discussed above, to provide rigorous virtual testing, while also being used to extract relevant metrics from real-world test track data to complement those simulations. Thus, Applied's software offers OEMs and others the ability to combine simulation and physical testing to better evaluate vehicle performance and ensure all safety standards are met. Given the maturity and sophistication of modeling and simulation software, including Applied's own products, NHTSA should incorporate it in the FMVSS testing process for AEB and PAEB systems before finalizing the rules proposed in this NPRM.

Applied Intuition appreciates the opportunity to provide comments on NHTSA's AEB and PAEB NPRM. We look forward to continued engagement with NHTSA to provide subject matter expertise on the benefits and opportunities around the use of modeling and simulation to evaluate and validate AEB and PAEB systems.

Sincerely,
Sunmin Kim
Director of Public Policy, Applied Intuition

⁷ AEB & PAEB NPRM at 38697.

⁸ *Id.*

⁹ *Euro NCAP*, Applied Intuition, <https://www.appliedintuition.com/use-cases/euro-ncap#workflow> (last visited July 19, 2023).