



TOYOTA MOTOR NORTH AMERICA, INC.
Sustainability & Regulatory Affairs
325 Seventh Street, NW #1000 Washington, DC 20004

April 8, 2022

Dr. Steve Cliff
Deputy Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: Petition for Reconsideration – Final Rule: Federal Motor Vehicle Safety Standards; Lamps, Reflective Devices, and Associated Equipment, Adaptive Driving Beam Headlamps [Docket No. NHTSA-2022-0013]

Dear Dr. Cliff:

Toyota Motor North America, Inc., on behalf of Toyota Motor Corporation (collectively, “Toyota”), submits this petition for reconsideration in response to the final rule published in the *Federal Register* on February 22, 2022 – Federal Motor Vehicle Safety Standards (FMVSS)—Lamps, Reflective Devices, and Associated Equipment, Adaptive Driving Beam Headlamps. Toyota appreciates NHTSA issuing this final rule in response to our petition for rulemaking to amend FMVSS No. 108 to allow for adaptive driving beams (ADB) to be introduced into the US market. As we mentioned in our petition, we believe that ADB systems will provide drivers and other road users with enhanced safety by improving visibility during nighttime driving while minimizing glare to other drivers.

We support the issuance of this final rule, but we seek clarity on certain test criteria to ensure objectivity and repeatability of the test procedures, and reconsideration of certain test equipment and requirements to allow for more accurate real-world representation in the testing that will help to maximize safety benefits to the public. These recommendations can be found attached in Appendix I. We look forward to continuing to work with the agency to achieve a mutually agreeable resolution that will benefit and improve safety for all road users.

Toyota also supports and endorses the petition for reconsideration on the same topic submitted by the Alliance for Automotive Innovation (“Auto Innovators”).

Should you and/or your staff have any questions, please contact Kevin Ro at the following:
kevin.ro@toyota.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Tom Stricker". The signature is fluid and cursive, with the first name "Tom" and last name "Stricker" clearly distinguishable.

Tom Stricker
Group Vice President
Sustainability & Regulatory Affairs

Attachment: Appendix I: Requests for reconsideration and clarification in the test procedures

Appendix I: Requests for reconsideration and clarification in the test procedures

We request several reconsideration and clarification points and provide proposals for ways to incorporate the requests into the regulatory text. Our recommended edits can be found in red text to indicate new recommended language, or red text with ~~strikethrough~~ to indicate removal of language from the regulatory text.

Allow for stimulus vehicles to be used as a compliance option in addition to test fixtures.

NHTSA should allow actual vehicles in place of test fixtures, as a manufacturer option, for the stimulus to be used in the compliance test. For certain systems, that take into account other characteristics of an oncoming or preceding vehicle, this would be more representative of real-world scenarios. Such systems rely on vehicle sensors (e.g., camera, radar) that use actual vehicle characteristics to better and more accurately detect the presence of another vehicle. A test fixture-based test might appropriately model vehicles in the real world for some ADB systems. However, other more advanced systems may rely on the aforementioned (other) vehicle characteristics to enhance object recognition to more accurately determine how to adjust the headlamp beam pattern. There is no need for this final rule to be designed to accommodate only one of the aforementioned types of systems.

In the final rule, NHTSA explains the results from their internal research tests comparing the performance of a Lexus NX equipped with ADB against a test fixture and an actual vehicle. Based on their results, specifically the small radius left curve (oncoming) at high speed, NHTSA concludes that this particular ADB system “likely relies on light source detection rather than using supplemental systems such as radar or LIDAR to detect a vehicle structure”. We note that the NX that NHTSA tested is an older generation system and the latest is more advanced, utilizing radar and other supplemental data for vehicle detection, and would likely not provide the same results. We suspect the same would be true for similar systems developed by other manufacturers.

While these data were used to explain the agency’s departure from the NPRM-proposed vehicle-based test, Toyota believes that a vehicle-based stimulus option in the FMVSS compliance test would be important to accommodate the latest ADB system designs, as well as future system improvements. While we appreciate the agency’s desire to harmonize and simplify the test setup, it is not necessary to rely on only one type of test setup if both can model the real-world conditions to which each system would be exposed. It would be safety-beneficial to provide different testing options to allow for and encourage manufacturers to design ADB systems with enhanced object recognition.

Thus, we request that NHTSA include the vehicle option as was proposed in the NPRM, except that it should specify the 3 vehicles identified in this final rule (Camry, Ford F-150, Harley Davidson) to allow for the test procedure to accommodate more advanced ADB systems in a way that would mirror the test fixture stimulus conditions. If adopted, the following sections should be updated to reflect this option.

S14.9.3.12.1.5

*The measurement distance is the linear distance measured from the headlighting system midpoint to the most forward point of the relevant photometric receptor head mounted on the **stimulus test fixture-device**.*

S14.9.3.12.3 Stimulus test ~~devices~~fixtures.

*Testing shall be conducted using the **manufacturer's choice of either the (1) stimulus test fixtures specified in S14.9.3.12.3.1 ~~this section~~ and Figures 23 through 26 or (2) vehicles and lamps specified in S14.9.3.12.3.2**. Headlamps should be aimed according to ____.*

Note: NHTSA should update all subsequent regulatory text, as appropriate, to reflect the change from “stimulus test fixture” to “stimulus test device” when referring to both or either the stimulus test fixture and the stimulus test vehicle.

S14.9.3.12.3.1 ~~Headlamps~~Option 1 (Stimulus Test Fixture).

S14.9.3.12.3.1.1. Headlamps.

S14.9.3.12.3.1.2 Taillamps.

S14.9.3.12.3.1.3 Photometers.

S14.9.3.12.3.1.4

S14.9.3.12.3.1.5

For the vehicle-based test option, we recommend using the same vehicles and lamps identified for the stimulus test fixtures to align the two test options as close as possible. The proposed language we provide below models the proposal from the NPRM, but we would recommend modifying the photometer placement to closer align with the photometer placement in the test fixture setup from this final rule. The sections below are new sections we are recommending to incorporate the stimulus test vehicle option. Please note the new section numbers which should not interrupt subsequent sections.

S14.9.3.12.3.2 Option 2 (Stimulus test vehicle).

The stimulus test vehicles shall be a 2018 Ford F-150 equipped with Halogen headlamp (part # L3Z13008C KL3Z13008D) using any replaceable light source designated for use in the system and incandescent rear combination lamp (part #JL3Z13405H/JL3Z13404H), a 2018 Toyota Camry equipped with LED headlamp (part #8111006C40/8115006C40) and rear combination lamp (part #81550-06730/81560-06730), and a 2018 Harley Davidson Sportster equipped with a 5.75-inch round headlamp kit (part #68297-05B) using an HB2 replaceable light source and LED taillamp assembly (part #67800355).

S.14.9.3.12.3.2.1 Photometers & Placement.

The photometers used should meet the requirements of S14.9.3.12.3.1.3 and placed in positions that are free from shadows and reflections from the stimulus vehicle's surface during the test.

Note: This references the photometer requirements from the test fixture section.

S14.9.3.12.3.2.1.1

The photometer is oriented such that the plane in which the aperture of the meter resides is perpendicular to the longitudinal axis of the stimulus vehicle and facing forward or rearward according to the test.

S14.9.3.12.3.2.1.2 Placement of photometers to measure glare to oncoming vehicles.

S14.9.3.12.3.2.1.2.1 Longitudinal position.

The photometer shall be positioned outside the vehicle, forward of the windshield and rearward of the headlamps. For the motorcycle, the photometers should be positioned 0.5 m behind the headlamp.

Note: We've added the motorcycle language in this section to align with the test fixture setup (Figures 25-26) as the NPRM did not specify photometer placement on a motorcycle.

S14.9.3.12.3.2.1.2.2 Lateral position.

The photometer shall be positioned 0.4 m inward from the left (driver's side) headlamp between the vehicle longitudinal centerline over to the driver's side A-pillar. For the motorcycle, the photometer shall be along the vertical line centered on the headlamp.

S14.9.3.12.3.2.1.2.3 Vertical position.

The photometer shall be positioned at the vertical center point between the bottom of the windshield and the top of the windshield. For the motorcycle, the photometer should be placed 0.7 m above the headlamp horizontal line.

S14.9.3.12.3.2.1.3 Placement of photometers to measure glare to preceding vehicles.

Photometers may be positioned at any location on the driver's side outside rearview mirror and/or the passenger's side outside rearview mirror, and/or outside the vehicle, directly outside the rear window, horizontally and vertically centered with respect to the inside rearview mirror. For the motorcycle, the photometers may be positioned at any location on both rearview mirrors.

NHTSA should incorporate the aiming instructions for the stimulus test devices into the regulation.

To help ensure the repeatability of the tests, NHTSA should specify how the headlamps on the stimulus test devices should be aimed. The correct and consistent aiming of the test devices are important to the performance of the ADB system as it can affect the recognition. NHTSA claims in the preamble that the final rule states the lamps should be aimed in the test procedures, but we were unable to find this specification in the regulation text. Toyota recommends that the stimulus test devices be aimed according to the manufacturer's instructions, which should be submitted to the docket and incorporated by reference. Aiming per the manufacturer's instructions will ensure more precise and accurate aiming which improves the repeatability of the tests. As an alternative, NHTSA could aim according to SAE J599. However, this procedure could introduce more variation and potentially stray away from real-world representation of the stimulus devices.

S14.9.3.12.3 Stimulus test devices.

*Testing shall be conducted using the manufacturer's choice of either the (1) stimulus test fixtures specified in S14.9.3.12.3.1 and Figures 23 through 26 or (2) vehicles and lamps specified in this section. **Headlamps should be aimed according to ____.***

Clarify the orientation of the photometers when measuring ambient light and calibrating.

It is important to clarify that the photometers will be in position for test data collection when it is measuring the ambient light to ensure proper and accurate calibration. If the photometers are facing a direction that has more or less ambient light than the forward position it will be tested in, the zero-calibration will yield different results. This can affect the test measurements and potentially improperly assess compliance of the system. Thus, Toyota recommends that a direction for the photometers be set for the purposes of setting the zero-calibration of the photometers for this test.

S14.9.3.12.3.1.3 Photometers.

*Photometers must be capable of a minimum measurement unit of 0.01 lux. The color response of the photometer must be corrected to that of the 1931 CIE Standard Observer (2-degree) Photopic Response Curve, as shown in the CIE 1931 Chromaticity Diagram (incorporated by reference, see § 571.5), with a cosine correction characteristic within 3%. The photometer lenses on the test fixture shall be clean and free from dirt and debris, and the photometers will be zero-calibrated, **when positioned as required for testing according to Figures 23-26** for each test to account for ambient light. The illuminance values from the photometers shall be collected at a rate of at least 100 Hz and a maximum 25- degree angle of incidence.*

S14.9.3.12.6.2

*Testing shall be conducted when the ambient illumination at the test road as recorded by the photometers is at or below 0.2 lux **in test position as described in S14.9.3.12.3.1.3 or S.14.9.3.12.3.2.1, depending on the compliance option chosen.***

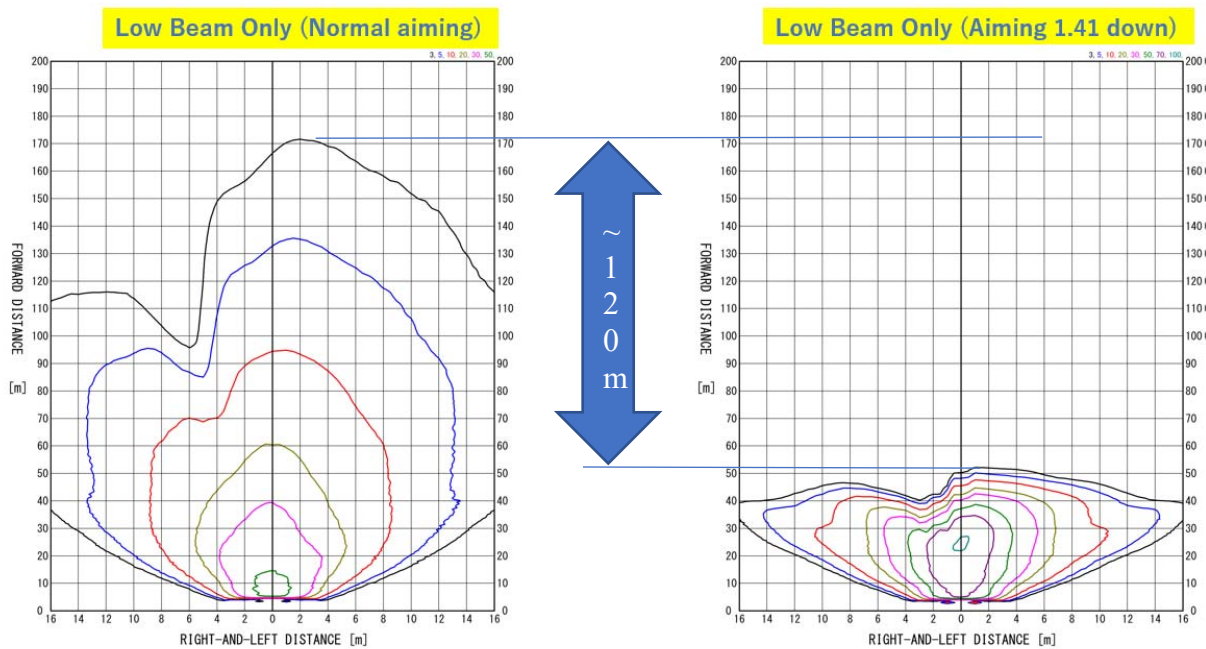
Note: The section numbers referenced are the updated section numbers per our recommended updates.

NHTSA should reconsider the SAE J3069 method for measuring glare.

NHTSA should allow for currently compliant and deployed low beams to be permitted in ADB systems, in order to mitigate any reduction in safety benefits that drivers have today. We support and echo the rationale and recommendations provided in the Auto Innovators petition regarding this issue. The glare requirements in this final rule are in contradiction with the laboratory photometric requirements. Meaning low beams which meet the established performance requirements of FMVSS No. 108 could exceed the glare requirements. We add that NHTSA states in their response to comments regarding hills that “the general approach of this rulemaking was to extend the current headlamp requirements to ADB systems, not to increase the stringency of existing requirements for ADB systems.” We request that NHTSA apply the same considerations in this case.

As we mentioned in our NPRM comments, the glare requirements impact higher-mounted low-beams which represents a continuously growing portion of the vehicle fleet and compliance to this requirement would significantly decrease the low-beam intensity and/or visibility for the driver because the lamp would have to be aimed lower. In NHTSA’s response to comments regarding vehicle pitch, NHTSA’s rationale that the pitch angle they selected was reasonable because no pitch or higher pitch variation allowance would result in “a more stringent test— [which] could lead manufacturers to design headlamps providing sub-optimal visibility (because manufacturers might aim the headlamps down to minimize the possible effects of pitch during a compliance test).”

In the case of a vehicle with a lamp height of 1.1 m, the vertical aiming angle of the lamp would need to be lowered 1.41 degrees to meet the photometry requirements in this final rule. This results in a reduction of ~120 meters at 3 lux of low-beam visibility down the road for the driver, as shown in Figure 1 below. As NHTSA stated, this would create “sub-optimal visibility” for the driver in that area of reduced intensity.



Visibility is worse than the current low beam (it is considerably darker).

Figure 1. Reduction in low beam intensity when aiming is lowered to meet final rule photometry requirement.

NHTSA should reconsider utilizing the SAE J3069 glare requirements which compare the glare measurement to the low beam intensity value and allow for a 25% exceedance of the low beam value.

S14.9.3.12.2. Compliance criteria.

The maximum calculated illuminance for each measurement distance interval specified in Table XXI that is applicable to the scenario being tested, as determined according to S14.9.3.12.2.1, shall not exceed the applicable maximum illuminance listed in Table XXI or a value 25% higher than the measured lower beam intensity measured according to S14.9.3.12.

NHTSA should expand the transition zone to 4-degrees.

We support and echo the comments and rationale from the Auto Innovators petition regarding changing the transition zone to 4-degrees from 1-degree. Meeting the requirements of a 1-degree transition zone would require a costly system and potentially limit the system to premium vehicles, as is the case in other markets. NHTSA also stated in their response to comments regarding hills, that adding certain tests and requirements would “likely make the systems more costly and slow deployment” as reason for not including those tests and requirements. We ask that NHTSA apply the same consideration for the transition zone requirement.

S9.4.1.6.4.5

A transition zone not to exceed ~~±0~~ 4.0 degrees in either the horizontal or vertical direction is permitted between an area of reduced intensity and an area of unreduced intensity. The Table XVIII and Table XIX photometric intensity requirements do not apply in a transition zone, except that the maximum at H-V in Table XVIII as specified in Table II for the specific headlamp unit and aiming method may not be exceeded at any point in a transition zone.