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Docket Management Facility
U.S. Department of Transportation
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Ms. Heidi King
Deputy Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
Washington, DC 20590

Re: Comments on National Highway Traffic Safety Administration (NHTSA) Advanced Notice of Proposed Rulemaking (ANPRM), Removing Regulatory Barriers for Vehicles with Automated Driving Systems, Docket Number NHTSA-2019-0036

Dear Ms. King,

Navya, Inc., respectfully submits the comments below in response to the NHTSA ANPRM referenced above. We welcome the opportunity to offer feedback on the suitability of approaches NHTSA may take in revising the Federal Motor Vehicle Safety Standards (FMVSS), 49 C.F.R. Part 571, to address compliance verification challenges and help NHTSA to define a path that encourages and enables development and deployment of automated driving systems.

Navya, Inc.,[1] specializes in the development and conception of 100% autonomous, driverless, electric transport solutions for the first and last mile. Navya's team of more than 250 engineers, designers, and automotive technology experts in Paris and Lyon, France, and Michigan in the United States has been providing the self-driving Autonom® Shuttle since September 2015. To date, Navya has received regulatory approval to operate public road projects in 19 countries, with approval pending in another 5 countries.[2]

Navya's Autonom® Shuttle tackles the challenge of first and last mile transportation. It has a capacity to hold 15 passengers, which includes 11 seated and 4 standing. The Shuttle has an electric engine with a 9-hour design battery life, and charge duration to 90% state of charge in 5–9 hours. The Autonom® shuttle operates at low speeds. It is software limited to 18 kilometers per hour (kmh) (11.2 mph). One reason the Autonom® Shuttle is so safe, is this low operational speed.

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[1] *See* https://navya.tech/en/.

[2] Navya has approved projects in Australia, Austria, Belgium, Canada, Finland, France, Germany, Liechtenstein, Luxembourg, Netherlands, Norway, Singapore, South Africa, South Korea, Sweden, Switzerland, UAE, **USA,** and Japan. Projects are pending regulatory approval in China, Denmark, Italy, Saudi Arabia, and the United Kingdom.

Another key to the safety of the Autonom® Shuttle is Navya's practice of carefully limiting the Operational Design Domain (ODD) in a manner specific to each operating site. Navya engineers precisely map each location at which the Autonom® Shuttle will operate and further limit the shuttle's operating speed based on the characteristics and risks associated with the route. As part of its contract with operators, Navya programs these ODD limitations into the Shuttle and, continues to evaluate alerts and warnings experienced during operations to refine the ODD over time.

1. NHTSA should evaluate other regulatory approaches to expedite safe ADS-DV deployment.

In addition to the specific questions posed in the ANPRM, Navya encourages NHTSA to consider other regulatory approaches in order to permit suitable vehicles to deploy, test, and begin commercial operations more expeditiously. For example, the Low Speed Vehicle (LSV) regulations, with slight revision or interpretive guidance, could accommodate a class of low speed commercial operations at an equivalent level of safety to current LSVs. In passing the original LSV regulations, NHTSA cited the growing trend of states permitting golf cars and similar vehicles to operate on streets, subject to speed restrictions.[3] Advantages of such authorizations were the vehicles use of electric power, which provides quieter operation and less air pollution of the community in which operated. These vehicles ranged in operating speed from 15 mph for conventional golf carts to 25 mph under State revised golf carts definitions or State regulations for newly drafted "neighborhood electric vehicles" regulations. The LSV Final Rule defined LSVs and established standards applicable to them. By regulation, NHTSA defines an LSV as

> a motor vehicle,
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> (1) That is 4-wheeled,
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> (2) Whose speed attainable in 1.6 km (1 mile) is more than 32 kilometers per hour (20 miles per hour) and not more than 40 kilometers per hour (25 miles per hour) on a paved level surface, and
>
> (3) Whose GVWR is less than 1,361 kilograms (3,000 pounds).

49 C.F.R. § 571.3.

While Navya understands that NHTSA is undertaking a comprehensive analysis of automated vehicle impacts on the FMVSS, Navya urges NHTSA, to the consider revision of the LSV definition to include operation of very low speed vehicles by taking into account the kinetic energy of an operating vehicle. Kinetic energy is the relevant analytical measure of the risk associated with an accident that may occur. Energy incorporates both GVWR and speed together instead of treating each as unrelated measures.

[3] *See* NHTSA LSV Final Rule, 63 FR 33194–217, 33194 (June 17, 1998).

To illustrate, kinetic energy is calculated by the equation, $KE = \frac{1}{2} mv^2$. Where m is the mass of the vehicle measured in kg, and v is the velocity (or speed) of the vehicle measured in meters per second (m/s), the energy is expressed in Joules (J). Under the current LSV regulations, maximum speed is 40 kmh, which is 11.11 m/s. The maximum kinetic energy is thus:

$$KE_{LSV} = \frac{1}{2} (1361 \text{ kg}) (11.11 \text{ m/s})^2 = 84{,}012 \text{ J.}$$ [4]

At the maximum permitted speed of the Autonom® Shuttle, 18 kmh or 5 m/s, the kinetic energy associated with the vehicle is:

$$KE_{Autonom} = \frac{1}{2} (3500 \text{ kg})(5 \text{ m/s})^2 = 43{,}750 \text{ J.}$$ [5]

Thus, the Autonom® Shuttle's kinetic energy is limited to 52% of the energy permitted by a vehicle under the LSV regulation. The Autonom® Shuttle's low operating energy combined with its carefully limited, site-specific ODD provide a model under which NHTSA could reevaluate its LSV regulations to promote commercial deployment of vehicles at an equivalent (or safer) level of safety.

2. Navya responses to the NHTSA ANPRM.

The ANPRM addresses the following FMVSS 100-series regulations:

§ 571.105, Standard No. 105, Hydraulic and electric brake systems;
§ 571.108, Standard No. 108, Lamps, reflective devices, and associated equipment;
§ 571.114, Standard No. 114, Theft protection and rollaway prevention;
§ 571.121, Standard No. 121, Air brake systems;
§ 571.126, Standard No. 126, Electronic stability control systems for light vehicles;
§ 571.135, Standard No. 135, Light vehicle brake systems;
§ 571.136, Standard No. 136, Electronic stability control systems for heavy vehicles; and
§ 571.138, Standard No. 138, Tire pressure monitoring systems.

Of these, FMVSS 114, 121, 126, and 136 are not applicable or relevant to the Autonom® Shuttle. The Shuttle control is locked and only accessible by an authorized operator. Therefore theft protection and rollaway prevention for the Autonom® Shuttle, Standard No. 114, is accomplished by an alternative means. The Autonom® Shuttle does not have air brakes, thus Standard No. 121. Standard 126, Electronic stability control systems for light vehicles, is not applicable because the vehicle test conditions specify the vehicle obtain a speed of 48 +/- 8 kmh,[6] while the Autonom® Shuttle maximum speed is 18 kmh. And,

[4] *See* Attachment 1, EC-as-function-of-weight-speed.xlsx, cells A3:D3.
[5] *See* Attachment 1, EC-as-function-of-weight-speed.xlsx, cells Q23:T:23.
[6] 49 C.F.R. § 571.126, S6.3.1.

Standard No. 136, Electronic stability control systems for heavy vehicles, is not applicable because the The Autonom® Shuttle is not a bus with a GVWR greater than 11,703 kg.[7]

Thus, Navya limits its comments to the following FMVSS:

§ 571.105, Standard No. 105, Hydraulic and electric brake systems;
§ 571.108, Standard No. 108, Lamps, reflective devices, and associated equipment;
§ 571.135, Standard No. 135, Light vehicle brake systems;
§ 571.138, Standard No. 138, Tire pressure monitoring systems.

The ANPRM asked respondents to consider each of the following testing/analytical approaches as a means of confirming compliance with the above FMVSS.

(1) Normal ADS-DV operation;
(2) Test Mode with Pre-Programmed Execution (TMPE);
(3) Test Mode with External Control (TMEC);
(4) Simulation;
(5) Technical Documentation for System Design and/or Performance Approach; and
(6) Use of Surrogate Vehicle with Human Controls.

In responding to the ANPRM questions, Navya has grouped the ANPRM questions together as appropriate for its responses.

ANPRM Questions 1–3:

1. What are the possible advantages and disadvantages of each approach?

2. Discuss whether each approach fits the requirements and criteria of the Safety Act and enables effective enforcement of the FMVSSs. Explain the basis for your answers.

3. Can more than one of these approaches be specified by the agency as alternative ways for the agency to determine compliance with the same requirement in the same FMVSS? If so, please describe how this could be done consistent with the Vehicle Safety Act, using one or more specific FMVSS requirements as illustrative examples. If more than one approach could be specified for the same requirement in the same FMVSS, do commenters believe that the agency, in assessing compliance with the same requirement in the same FMVSS, choose one approach for one vehicle model, but another approach for a different model? If so, explain why.

[7] 49 C.F.R. § 571.136, S3.2.

Navya's Response to ANPRM Questions 1–3:

For each of the four considered FMVSS (105, 108, 135, and 138), the Navya Autonom® Shuttle compliance can be confirmed via (1) Normal ADS-DV operation; (2) Test Mode with Pre-Programmed Execution (TMPE); (4) Simulation; or (5) Technical Documentation for System Design and/or Performance Approach.

In each case, Navya believes that testing via either (1) Normal ADS-DV operation or (2) Test Mode with Pre-Programmed Execution (TMPE) are the best means of ensuring compliance with the FMVSS as these methods directly demonstrate compliance.

Analysis approaches via (4) Simulation and (5) Technical Documentation can, however, also provide confidence in FMVSS compliance. These approaches are likely more suitable for assessing revisions to vehicles that have previously showed compliance based on initial demonstrations.

ANPRM Questions 4–5:

> 4. If only one of these approaches can be used to enforce a particular FMVSS requirement, what factors should be considered in selecting that approach? What policy or other considerations should guide the agency in choosing one alternative approach versus another for determining the compliance of a particular vehicle or item of equipment?
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> 5. With respect to any single approach or combination of approaches, could it be ensured that the compliance of all makes and models across the industry is measured by the same yard stick, i.e., that all vehicles are held to the same standard of performance, in meeting the same FMVSS requirement?

Navya's Response to ANPRM Questions 4–5:

NHTSA should not overly constrain vehicle manufacturers to specific approaches, where more than one approach is viable. Different manufacturers are likely to have different existing test capabilities. Taking a more flexible approach to testing requirements, so long as adequate demonstration to performance standards is achieved, will permit more rapid development by manufacturers. This will promote deployment of systems

ANPRM Question 7:

> 7. Should NHTSA consider an approach to establish new definitions that apply only to ADS-DVs without traditional manual controls?

Navya's Response to ANPRM Question 7:

While NHTSA may eventually develop definitions applicable only to ADS-DVs without traditional manual controls, such definitions are likely to take considerable time and regulatory development in order to accommodate the variety of vehicle types under consideration by industry. In order to encourage technological development and speed deployment of existing and developing vehicles, NHTSA should continue to take a flexible approach to evaluating FMVSS terms in the context of ADS-DVs so long as adequate safety can be demonstrated. For example, in FMVSS 105 S5.3, instead of a brake system indicator lamp "mounted in front of and in clear view of the driver," the indicator could be shown on an internal screen visible to a safety operator or remotely viewable by a remote safety monitor, or provided as an input to the automated vehicle systems. Such an interpretive approach will permit the public to more quickly receive the safety benefits of ADS-DVs associated with reductions in human error.

ANPRM Questions 8–9:

> 8. For compliance testing methods involving adjusting current test procedures to allow alternative methods of controlling the test vehicle during the test (normal ADS-DV function, TMPE, TMEC), or to allow the use of a surrogate vehicle:
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> a. How could NHTSA ensure that the test vehicle's performance using the compliance method is an accurate proxy for the ADS-DV's performance during normal operation?
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> b. If NHTSA were to incorporate the test method into its test procedures, would NHTSA need to adjust the performance requirements for each standard (in addition to the test procedures) to adequately maintain the focus on safety for an ADS-DV?
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> 9. For compliance testing methods that replace physical tests with non-physical requirements (simulation, documentation):
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> a. If the test method is used to determine compliance with a real-world test, how can NHTSA validate the accuracy of a simulation or documentation?
>
> b. If NHTSA must run real-world tests to validate a simulation or documentation, what is the advantage of non-physical requirements over these other compliance methods?

Navya's Response to ANPRM Questions 8–9:

As noted above, for the FMVSS addressed here, Navya believes testing via normal ADS-DV function or TMPE are likely better means of ensuring compliance. Testing during normal ADS-DV function will provide confidence the test regime adequately reflects performance during normal operational. Manufacturers using a TMPE approach could be required to document how the programmed routine reflects normal operation or any relevant limitations on the ODD inherent in the testing.

Analysis of simulation or technical documentation, while feasible, are likely more appropriate for relatively minor changes to existing vehicles that have previously demonstrated compliance.

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ANPRM Question 10:

10. Would non-physical requirements simply replicate the existing physical tests in a virtual world? If not, what would be the nature of the non-physical requirements (that is, what performance metrics would these requirements use, and how would NHTSA measure them)? Are there ways that NHTSA could amend the FMVSSs to remove barriers to ADS-DVs that would not require using the compliance test methods described in below?

a. Are there any barriers in the FMVSS or NHTSA's test procedures that could be addressed by altering or removing references to manual controls in the test procedures without substantively changing the FMVSS performance requirement?

b. Are there any changes that NHTSA could make to the FMVSS test procedures that could incorporate basic ADS capabilities to demonstrate performance, such as using an ADS-DV's capability to recognize and obey a stop sign to test service brake performance?

Navya's Response to ANPRM Questions 10:

Use of the term "driver," as NHTSA has previously recognized, if interpreted too narrowly, would impose unwarranted design limitations on automated vehicle design and testing. Per 49 C.F.R. § 571.3, "[d]river means the occupant of a motor vehicle seated immediately behind the steering control system." NHTSA should continue to affirm interpretive guidance that "driver" as applied to ADS-DV and compliance testing thereof, will include automated systems, procedures, or alternative operational models that perform or replace the functions of a traditional human driver.

Specific to FMVSS 108, the requirement for cancellation of turn signals via manual control could be revised to include control by safety operators not located in traditional seating configurations, control via automated systems, or both.

Specific to FMVSS 135, S.5.5.2 Functional Checks, should be permitted to include indication on internal screens visible to a safety operator or other personnel performing pre operational checks, visible to personnel remotely monitoring the checks, or other automated systems.

Specific to FMVSS 138, S4.2 TPMS detection requirements, resetting of the TPMS should be permitted by a safety operator, a remote monitor, or an automated system.

Respectfully submitted,

NAVYA, INC.

Jerome Rigaud
CEO

Attachment: EC-as-function-of-weight-speed.xlsx,