January 29, 2021

United States Department of Transportation
Docket Management Facility, M-30
1200 New Jersey Avenue SE
West Building Ground Floor Room W12-140
Washington, DC 20590-001

Re: Docket No. NHTSA-2020-0106 Framework for Automated Driving System Safety

To Whom it May Concern:

CALSTART is pleased to submit the following comments regarding the Docket No. NHTSA-2020-0106 Framework for Automated Driving System Safety on behalf of our Next Generation, Purpose-Built, Transit Automated Vehicle (AV) cohort. As a nationally recognized leader in advancing clean transportation technologies, CALSTART commends the Unites States Department of Transportation and the National Highway Transportation Safety Administration (NHSTA) for their efforts in developing this framework and appreciates the opportunity to help shape the future of automated transportation.

CALSTART is a national 501(c)(3) organization with a global membership base consisting of 270+ firms, fleets, non-governmental organizations, and public agencies that are dedicated to moving towards a high-tech, clean transportation industry. Our mission is to support and grow the clean transportation industry and by doing so improve air quality, mitigate the contributions of transportation to future climate change, and create economic opportunity. With more than 28 years of experience, CALSTART is recognized both nationally and internationally as an effective industry catalyst organization. CALSTART focuses its work in four major initiatives: cars, buses, trucks, and fuels. We advance each of these sectors by supporting technology development, assessing, and validating new technologies and products, accelerating market growth by supporting clean vehicle incentive programs, providing policy guidance and implementation, and giving valued-added services to its member organizations. CALSTART is a national organization with multiple offices in several states including California, Colorado, Michigan, and New York.

Under Memorandum of Commitments CALSTART is working with a growing group of more than 14 transit agencies from across the US to address the critical gaps and needs for the future automated transit industry with particular focus on crashworthiness and safety. The cohort has identified key performance parameters (KPPs) necessary to satisfy both transit operations and community members who are served by public transportation and to provide better transit services, which includes the movement of goods to support their community, with vehicle solutions that holistically meets these diverse needs. Members of the cohort supporting this response on behalf of automated vehicle end users include: *Access LA, Central Ohio Transit Authority, Contra Costa Transportation Authority, Livermore Amador Valley Transit Authority, Los Angeles Department of Transportation, Maryland Department of Transportation, Michigan Department of Transportation, Regional Transportation Commission of Southern Nevada, Regional Transportation District – Denver, Santa Clara Valley Transportation Authority, Stark Area Regional Transit Authority, Toledo Area Regional Transit Authority, Utah Transit Authority and Western Reserve Transit Authority.*

Question 1. Describe your conception of a Federal safety framework for ADS that encompasses the process and engineering measures described in this notice and explain your rationale for its design.

Technology has transformed transportation all throughout the history of transportation. For technology to evolve and provide opportunities for innovation, there needs to be that 'right' balance between safety and risk when it comes to oversight. Safety (defined as the condition of being safe from undergoing or causing hurt, injury or loss) of living beings is the ultimate goal and at the core of developing any safety framework. Any judgement on safety must consider the critical need or the reason a technology was developed. Overall, risk mitigation is required to keep the potential for risk as low as possible.

New technology has the potential of addressing key challenges and needs, however, introducing new technology is a sensitive process as it can introduce new risks and unforeseen dangers. Conceptually, new technology is novel – recently developed or invented - where the safety profile is unknown. Contextually, technology that has existed will be considered new as it is introduced to a new use case or environment, or new to the end user, where the safety profile is known and well established, although training is necessary, so it is used as designed or intended.

While additional safety measures for new technological advances in ADS are obviously necessary, when it comes to transit vehicles it must be considered that transit is one of the safest ways to travel. NHTSA's Automated Safety Framework should be developed in a manner that ensures that transit remains one of the safest ways to travel with the introduction of ADS. It is recommended that transit providers form partnerships with NHTSA to provide for the safest outcome/results for the safety framework, while allowing the solutions to be implemented by transit agencies, based on a measured safety risk assessment.

Question 2. In consideration of optimum use of NHTSA's resources, on which aspects of a manufacturer's comprehensive demonstration of the safety of its ADS should the Agency place a priority and focus its monitoring and safety oversight efforts and why?

Below is the order of priority on the 4 elements as we see it:

1. **Analysis/Planning** (how ADS analyzes the situation and plans its route or actions)
2. **Control** (how ADS executes the driving functions)
3. **Detection/Perception** (how ADS identifies elements in the world around them) – road users, infrastructure, conditions, and the 360-degree view
4. **Sensing** (how ADS receives information)

As shared in the previous question, safety (defined as the condition of being safe from undergoing or causing hurt, injury or loss) of living beings is the primary goal and at the core of developing any safety framework. From an end user transit provider perspective, ADS technology and capabilities are very varied, and specific operational design domains (ODD), which also vary greatly.

It is extremely important to ensure that transit remains one of the safest ways to travel with automated transit and therefore monitoring the safety of how ADS "analyzes" a situation and "plans" or adjusts to varying conditions based on the 360-degree world around the vehicle is priority number one. This involves everything from vehicle speeds and braking to direction and turning, to even communicating a safety concern that the vehicle cannot correct for (i.e., inoperability). Vehicle handling and ensuring all passengers safely get from point A to point B, and everywhere in between, is more critical as the vehicle is dependent on machine learning or artificial intelligence (AI) language to make decisions that have

historically been controlled by humans. Humans, who are not error free by any means, also need to follow a framework or process, and are trained and vetted for their experience and skill before being placed behind a wheel. The variant in human vs. machine ability to analyze and plan actions needs to be measured and the technology should be moving towards 'better than' human.

Quickly following is the concern for "control." Controlling how ride handling is performed and any instances of the need for backup systems or interaction with external control centers is extremely important. There needs to be the ability for a secured external access to the vehicle's controls in the event external support is needed from a control center or other source. An important factor here is security and ensuring controls are handled properly without issue or unforeseen instance (i.e., breach of system, cybersecurity).

When it comes to "sensing" and perception/detection, the details behind how these activities occur is not important if they are occurring as intended within a proper distance or timing. Sensing technologies are ever evolving as the industry works to overcome critical challenges with precipitation (i.e., snow, humidity, fog) and other sensing requirements (e.g., stationary object vs. living being - 2-way reaction). Currently, there is uncertainty with enabling communication technologies that provide guidance and information on the real-time status of the 360 world – DSRC (dedicated short-range communications) or C-V2X (cellular communications).

While a priority order has been indicated above, the priority order is not as consequential as the intended result. The vehicles must keep to safety as much as our current non-automated (SAE Level 0-3) vehicles do. The intended result is the critical item, not the journey, to deployment of a technology. It is important to note that in any development process, designing with the future in mine (futureproofing) is key as varying solutions may be presented and should be allowed to keep up with the fast pace of innovation and change. The technology should be allowed to follow process-steps or technology-development stages to achieve the ultimate purpose of safety.

Question 3. How would your conception of such a framework ensure that manufacturers assess and assure each core element of safety effectively?

Before marketing and widespread use, the technology must undergo a formal procedure for certifying that it is safe to be used. The procedure needs to ensure greater information sharing and transparency regarding technology assessment and the rigorous testing (simulation, validation/verification, and real world). It is also important to consider the way the new technology may cause harm – system failure, operator-dependent or setting-dependent. Testing needs to include a comprehensive set of driving maneuvers across a defined set of the most common operational design domains (ODDs), technical performance data in each of prioritized 4 elements (analysis/planning, control, detection/perception, sensing), and an assessment and identification of the safest and most suitable ADS technologies for these certain types of ODDs. The ADS technologies determined to be unsafe should then require additional technology development until all safety requirements are met.

Safety can be summarized as the frequency of adverse events. The means to introduce a new technology should be standardized and should follow process and key stages:

1. Product Engineering: Selecting and implementing the right technology to ensure safe and effective operation. Engineers need to participate in the planning, evaluation, selection and implementation process for new technology.

2. Technology Assessment: Performing a systematic and unbiased, robust evaluation of the technology. If the technology is so new there is no data, industry leading experts should weigh in with the following considerations:

- **Performance:** What are the safety concerns?
- **Efficacy**: Is it operating as intended in controlled test conditions?
- **Appropriateness**: Can it be integrated onto a system or vehicle and meet a need without adding additional safety risk?
- **Effectiveness:** Is it performing as intended and are there any further safety risks under real-world conditions?
- **Implementation:** How should the technology be deployed and commercialized based on design and approvals?

3. Validation/Verification: Active and passive means to detect problems are paramount to safety. Many failures may be too infrequent for detection or may only happen in real-world settings and only after several years (edge cases) of implementation. There should be a series of validation/verification methods to detect issues. A clearinghouse for reporting issues and findings would help at identifying risk areas or issue signals. Included under validation/verification is testing parameters: Testing cannot be limited to standard/average passenger parameters. All shapes, sizes and abilities should be tested, as safety and comfort are not standard. There are also differing use cases that could affect testing parameters, including but not limited to, parents with children/strollers, the elderly, and passengers with packages/groceries. The extremes must be tested to confirm that safety meets the spectrum of requirements.

A common set of test qualifications should be used. Additionally, in transit, with the differing suspensions across the various vehicle sizes, the safety of the vehicle when fully occupied should be considered. Those tests should include typical passenger bus safety standards (Altoona), crashworthiness of the vehicle (FMVSS) and all new testing parameters for automated driving technology. Additionally, detailing how data is to be collected and reported is also critical and a clearinghouse should feed important information back to manufacturers and users. These electronic records offer tremendous opportunity for technology assessment – using a form of traceability linking unique identifiers to ADS devices much like how the light-duty industry handles airbags would be appropriate. All airbags undergo testing that is traceable back to individual airbags (1:1).

4. Regulation: Ensuring that the technology performs safely and effectively. This should be essentially a risk mitigation process ensuring the new technology works as intended under ideal circumstances rather than unplanned. The technology, as implemented, is protecting living beings while ensuring continuous development of new technologies and innovation. The level of regulatory control should be proportional to potential risks in an ideal environment.

Question 4. How would your framework assist NHTSA in engaging with ADS development in a manner that helps address safety, but without unnecessarily hampering innovation?

In an ideal world, new technology is developed in consultation with end-users while being tested in a safe environment – starting with simulation before real-world trials that are regulated by an oversight like NHTSA. Evidence gathered during development and early test deployments are key to informing decisions. Decisions about the safety of a new

technology can be made at a variety of different levels depending on what is required in relation to the end user. Before marketing and widespread use, the technology will undergo a formal procedure for certifying that it is safe to be used. Standards and regulations regarding where, and under what conditions, AVs are currently able to safely operate need to be determined based on a technology roadmap and technology readiness levels. Three key elements to consider for the future of automated transit must be: (1) is it safe for transit, (2) how does it perform, and (3) is it crash-worthy?

Question 5. How could the Agency best assess whether each manufacturer had adequately demonstrated the extent of its ADS' ability to meet each prioritized element of safety?

All the processes in the world cannot ensure compliance. Oversight will require significant resources, as well as political will and technical expertise. Expertise that is still growing and evolving as the industry develops. Manufacturers should develop detailed Design Verification Plans and Reports (DVP&Rs) and submit record of all testing and validation both at Design Verification and Product Verification levels.

At a minimum, verification should include a required amount of testing (e.g., hours/miles/etc.) that manufacturers must meet, and the results shall be recorded for verification. To date, the USDOT has published guidelines for automation that are high-level but set early expectations. There should be further detailed requirements defined specifically for testing, and this NHTSA safety framework should address this need. While some standard situations can be tested for, real-world testing is critical, and needs be a part of the framework and inform regulation in the future. There are an infinite number of real-world circumstances that could occur, many that have yet to be defined as the industry actively works to identify the edge cases. This is extremely important for ADS sensing and reaction to an event, especially when there is not a driver/safety operator/attendant aboard. Test plans need to include as many different circumstances as possible to best ascertain the vehicle's reaction to varying stimulate (i.e., a person entering the vehicle slowly) and the greatest opportunity for testing is in the real-world environment. At all times, passengers on an automated transit vehicle, no matter the maturity level of technology, must have access to some type of panic/help button or communication method to further aid in passenger safety.

Question 6. Do you agree or disagree with the core elements (i.e., "sensing," "perception," "planning" and "control") described in this notice? Please explain why.

We agree with the core elements (i.e., "sensing," "perception," "planning" and "control") described in this notice. Please refer to the response in question 2. While each of these core elements are key to safety, it is important to reiterate that the focus should not be on the software or choice of hardware, but the intended result. Safety and success in ADS deployments are driven by the results. In other words, does the vehicle drive as safely and in control while automated (SAE Level 4 and above) as it does under manual human (SAE Level 0-3) operation? If the answer can be measured yes, then the ADS is safe.

Question 7. Can you suggest any other core element(s) that NHTSA should consider in developing a safety framework for ADS? Please provide the basis of your suggestion.

Additional core elements NHTSA should consider:

- "Privacy" or "security" (how the ADS handles unintended situations like a cyber-attack)
- "Interoperability" (how well the ADS solutions work together as a system and with other systems)

- "Performance" (consideration of evaluation based on mean time between failures (MTBF) in comparison to human transit operators). Performance from technology should be minimally as safe as, but it should really be safer than, manual operation. Technology would improve driving capabilities not feasible for humans. Two examples include registering accidents in route through vehicle-to-vehicle (or vehicle to infrastructure?) communication and the use of radar to navigate through fog. These abilities should place ADS technology at a higher safety expectation than manual human operation.

Question 8. At this early point in the development of ADS, how should NHTSA determine whether regulation is needed versus theoretically desirable? Can it be done effectively at this early stage and would it yield a safety outcome outweighing the associated risk of delaying or distorting paths of technological development in ways that might result in forgone safety benefits and/or increased costs?

Similarly answered in question 4. It is important that guidance is offered from the government, but regulation may be ill-advised at this time. It is necessary for the government to provide goals, but not to dictate the specific steps or direction in which to achieve those goals. Technology is changing so rapidly that regulation may hamper the opportunity for a multitude of solutions. The industry must allow manufacturers to find their own way to solve safety issues while still accomplishing the determined goals. However, guidance is still needed to reassure and give structure to the vehicle manufacturers, transit agencies and the public.

Question 9. If NHTSA were to develop standards before an ADS-equipped vehicle or an ADS that the Agency could test is widely available, how could NHTSA validate the appropriateness of its standards? How would such a standard impact future ADS development and design? How would such standards be consistent with NHTSA's legal obligations?

The focus of such standards should be solely on safety and the current state of technology development otherwise known as technology readiness level (TRL). The key transition point for going from voluntary reporting to mandatory regulation happens around TRL 6 (please see response to question 21 for greater detail). In addition, some states have set vehicle safety regulations that must be met on all vehicle components but not until the component or product is ready for full commercialization (TRL 8). Additional NHTSA standards and regulation should only be created based on a measured risk level and the risk for loss of life. Additional regulations for existing products should not be re-regulated unless there are recall events or reports of loss of life that had not yet been mitigated prior to being fully commercialized.

Question 10. Which safety standards would be considered the most effective as improving safety and consumer confidence and should therefore be given priority over other possible standards? What about other administrative mechanisms available to NHTSA?

When it comes to automated transit vehicle and ADS safety standards, the vehicle should be tested to a confidence level that ensures the vehicle is safe enough to not have, nor require, passenger seat belts. Below is a list of safety standards that should be considered the most effective at improving safety and consumer confidence:

- **Federal Motor Vehicle Safety Standards (FMVSS)**:
  - No. 207: Seating System
  - No. 208: Occupant crash protection
  - No. 209: Seat Belt Assemblies
  - No. 210 Seat Belt Anchorages
  - No. 223: Rear Impact Guards
  - No. 224: Rear Impact Protection
  - No. 216: Roof Crush Resistance
  - No. 214: Side Impact Protection
  - No. 219: Windshield Zone Intrusion
  - No. 101: Controls and Displays
- **Other (research/review)**:
  - **Canadian CAV standards**
    - Harmonization efforts: To support common technical understanding and designs, as well as interoperability of systems across borders.
    - The Canada-US Regulatory Cooperation Council (RCC): Connected Vehicles Work-Plan; The United Nations: Working Party on Autonomous and Connected Vehicles (WP.29 GRVA)
  - **Digital infrastructure**
    - 3rd Generation Partnership Project (3GPP) (in 1998)-4G, LTE, 5G
    - IEEE 1609 Family of Standards for Wireless Access
    - ASTM F3200: Standard Terminology for Driverless Automatic Guided Vehicles
    - NEMA TS 10; SAE J2945; SAE J3161; SAE J3186; SAE J2735; SAE J2944
  - **Physical infrastructure**
    - MUTCDC: Manual of Uniform traffic Control Devices for Canada
    - NCHRP: National Cooperative Highway Research Program
    - INFRAMIX (EU): (https://ec.europa.eu/inea/en/horizon-2020/projects/h2020-transport/automated-road-transport/inframix)
  - **Usage, human-machine interfacing, and accessibility**
    - SAE J3016: Identify the role of the human operator/occupant and the automated driving system, at various levels of automation.
    - SAE J3171: Identifying Automated Driving Systems – Dedicated Vehicles Passenger Issues for Persons with Disabilities

Question 11. What rule-based and statistical methodologies are best suited for assessing the extent to which an ADS meets the core functions of ADS safety performance? Please explain the basis for your answers. Rule-based assessment involves the definition of a comprehensive set of rules that define precisely what it means to function safely, and which vehicles can be empirically tested against. Statistical approaches track the performance of vehicles over millions of miles of real-world operation and calculate their probability of safe operation as an extrapolation of their observed frequency of safety violations. If there are other types of methodologies that would be suitable, please identify and discuss them. Please explain the basis for your answers.

Currently, there is no specific, clear answer to this question of methodologies. It should be noted that minimal, rule-based assessments are preferred at this time. States, who are moving faster in this space, seem to have intentionally retained open and permissive regulatory environments.

Question 12. What types and quanta of evidence would be necessary for reliable demonstrations of the level of performance achieved for the core elements of ADS safety performance?

- **Technology Readiness Levels (TRLs)**: TRLs are a set of 9 graded definitions or description of stages of technology maturity

TRL Level	Description
1	Basic concept identified
2	Technology concept formulated
3	1st experimental proof of concept
4	Technology validated in lab/controlled setting
5	Technology validated in relevant environment
6	Technology demonstrated in relevant environment
7	System prototype demonstration in operational environment
8	System complete and qualified
9	Actual system proven and deployed

- **Maturity Levels (High-Level)**:
  - **New Technology**: Technology that radically alters the way something performed
  - **Improving/Emerging Technology**: Continuing development of new or existing technology
  - **Mature Technology**: Technology that has been fully commercialized and proven (TRL 9)
  - **Aging Technology**: Technology about to be phased out due to being replaced by newer technologies or no longer needed (TRL 9)

Currently, the question remains on how the ADS technology will compare to human/manually operated vehicles under all circumstances which appear to be infinite. This requires investigation and is especially importation when considering the implementation of ADS. In addition, there needs to be a defined comprehensive set of driving maneuvers for ADS technology to be tested for across a defined set of most operational design domains (ODDs).

Question 13. What types and amount of argumentation would be necessary for reliable and persuasive demonstrations of the level of performance achieved for the core functions of ADS safety performance?

Currently, there is no definitive answer for this question. However, it must be determined who would be liable for an accident in the case of a fully automated (SAE Level 4 and above) vehicle. Additionally, it must be continuously observed that the mean time between failures (MTBF) is improved for ADS operation vs. human/manual operation.

Question 14. What additional research would best support the creation of a safety framework? In what sequence should the additional research be conducted and why? What tools are necessary to perform such research?

International research on AV safety standards is highly recommended, with focus on both Europe and Canada. These regions are also working actively to identify gaps and needs for automated vehicle safety requirements. It is important that there is international cooperation and the ability to work together to harmonize standards which will allows greater opportunity for interoperability of technology and the promotion of consistent safety and regulation. Cooperation should also be at the national level and include other DOT departments like FTA, FRA, FAA and FHWA, as each is also working with automated

technologies. This provides a greater ability to share knowledge and support research while identifying best practices and lessons learned.

A key focus of these discussions should be on incident and real-world scenario testing (i.e., a shopping cart moving in front of the bus, pigeon in the road). There should be a goal to define testing to ensure the vehicle acts/reacts appropriately to its surroundings. Every possible scenario does not need to be tested, just a comprehensive sample. Whether the vehicle encounters a deer or a bike, the two should initiate the same reaction and action.

Question 15. Discuss the administrative mechanisms described in this notice in terms of how well they meet the selection criteria in this notice.

New technology has the potential to address key challenges and needs, however, introducing new technology is a sensitive process as it can introduce new risks and unforeseen dangers. Therefore, it is important that the framework include mechanisms that communicate the state of technology and a means to assess the risks. This will allow for NHTSA to make the right determination as to the level of administrative mechanisms used. It may be beneficial to determine that guidance based on technology readiness levels (1-9). As a technology moves into TRL 6, the administrative mechanism moves from voluntary to mandatory compliance, to regulation based on the information provided during the technology development process.

Question 16. Of the administrative mechanisms described in this notice, which single mechanism or combination of mechanisms would best enable the Agency to carry out its safety mission, and why? If you believe that any of the mechanisms described in this notice should not be considered, please explain why.

Regulatory Mechanisms on fully commercialized technology at TRL 9 would best help the Agency carry out their safety mission. This is when technology is entering into the commercialization phase and when the actual application of the technology in its final form and fully qualified under all operating conditions. Also, regulation needs to be flexible and able to react when there is an unexpected or unintended issue that may result in a recall with an approved technology. There must be a mechanism in place to address the regulatory standards/methods to address new needs based on new learnings and information.

Before manufacturers can permit public passengers on automated vehicles, manufacturers should be required to report safety information and testing results. This requirement would serve as a trigger for permitting and further ensure voluntary compliance to allow public use. It still needs to be determined what level of reporting provides the right level of confidence in a technology. Testing under a variety of circumstances with real-world conditions is imperative. Factors such as control and handling of the vehicle during emergency events are extremely important (i.e., how does the vehicle react to an ambulance). It cannot be assumed at this time that the vehicle will react like a human in these situations. Additionally, it needs to be ensured that testing is conducted across various operating domains, terrains, and all-weather conditions and not solely in one location.

Question 17. Which mechanisms could be implemented in the near term or are the easiest and quickest to implement, and why?

Manufacturers are interested in getting their products beyond development phases to commercial deployment. So, if they are asked to voluntarily provide reports and self-assessments as part of the development process, they should be more than willing to comply.

It is difficult to develop specific rules while the industry is in still growing, so needlessly hindering innovation should be avoided.

Question 18. Which mechanisms might not be implementable until the mid or long term but might be a logical next step to those mechanisms that could be implemented in the near term, and why?

Of all the mechanisms described, regulatory mechanisms might not be implementable until the mid or long term but might be a logical next step to those mechanisms that could be implemented in the near term. It is recommended that regulatory actions be *mandatory* when the technology is at TRL 7-9 and only be *voluntary* through TRL 6. The timing should follow the technology development process.

Question 19. What additional mechanisms should be considered, and why?

From a high level, the steps of administrative processes and standard processes that define requirements, roles, and responsibilities as technology transitions from TRL 1 to TRL 9 are key. Compliance to the FMVSS requirements defined in Question 10, provides an 'outer layer' of safety should an ADS fail (i.e., FMVSS No. 208: Occupant crash protection). Various safety functions that take place during manual operation (i.e., pulling over for an ambulance, communicating with a rider seeking help) should be considered during NHTSA rulemaking. If a human driver is expected to perform a function for safety, the ADS or ADS/human backup must be able to fulfill those requirements too.

Question 20. What are the pros and cons of incorporating the elements of the framework in new FMVSS or alternative compliance pathways?

Pros:

- NHTSA is ensuring the safety of living beings, while indirectly reducing the cost caused by accidence or negligence
- Having a standard set of guidance builds public acceptance, confidence, and trust in new technology. Standards not only reduce overall risk of deployment but communicate that manufacturers are in alignment with standards

Cons:

- Resource burden on both the developer and NHSTA
- Time it will take to fully develop any new FMVSS regulation, but critical should be based on measured risk levels

Question 21. Should NHTSA consider an alternative regulatory path, with a parallel path for compliance verification testing, that could allow for flexible demonstrations of competence with respect to the core functions of ADS safety performance? If so, what are the pros and cons of such alternative regulatory path? What are the pros and cons of an alternative pathway that would allow a vehicle to comply with either applicable FMVSS or with novel demonstrations, or a combination of both, as is appropriate for the vehicle design and its intended operation? Under what authority could such an approach be developed?

Manufacturers and end users alike need the flexibility to develop and fully test new technologies, therefore there needs to be flexibility in regulation up until the point the technology is fully deployed (TRL 9). This offers freedom to perform voluntary and compliance verification while a new technology is being developed. It also provides a defined process for fully commercialized technologies to follow, which would include any

new FMVSS requirement that is added to the regulatory process. The administrative mechanisms and the regulatory path should be based on TRL levels where the transition to regulation begins at TRL 7.

TRL Level	Administrative Mechanism/ Regulatory Path
1	**New Tech**: Voluntary information sharing
2	**New Tech**: Voluntary information sharing
3	**New Tech**: Voluntary information sharing
4	**New Tech**: Voluntary information sharing
5	**New Tech**: Voluntary compliance verification and data sharing
6	**New Tech and Commercialized Tech**: Voluntary verification and data sharing (transition point)
7	**New Tech**: Mandatory compliance verification and data sharing **Commercialized Tech**: FMVSS required on existing platform or technology that the new technology is being integrated onto.
8	**All Tech:** Mandatory compliance verification and data sharing
9	**All Tech**: FMVSS regulated, as determined

Pros:

- Allows for freedom to develop new technologies
- As the technology evolves, so does the reporting requirement, which feeds into the development of regulation as needed based on risk to living beings

Cons:

- None

Question 22. Discuss how each element of the framework would interact with NHTSA's rulemaking, enforcement, and other authority under the Vehicle Safety Act.

The Vehicle Safety Act tasks NHTSA with reducing traffic accidents, deaths, and injuries resulting from traffic accidents through issuing motor vehicle safety standards for motor vehicles and motor vehicle equipment and carrying out needed safety research and development. The focus of NHTSA rulemaking, enforcement, and other authority should solely focus on the intended result of technology and not how a technology achieves a result. The decision to regulate should be based off the potential safety risk and the need to protect living beings. Holistically, safety performance is most important.

1. **Analysis/Planning**: Should focus on the measured result of how well ADS analyzes the situation and plans its route or actions in a manner that protects against the loss of life and minimizes the cost of unintended actions or events within a minimum set of standards (e.g., reaction time, distance, stopping/accelerating, turning force on occupants) which includes seated, standing (if allowed and an option), and those in mobility devices. Once a technology is fully developed and the measure of safety risk indicates a need for FMVSS, regulation should be made.

2. **Control:** Should focus on the measured result of how well ADS executes the driving functions and ensures the safety of the passengers, deliveries, and the world around the vehicle (e.g., uphill reverse lockout, downhill speed limiting, turning radius, stopping, and accelerating) while co-existing with the world outside the vehicle (i.e., other road users, pedestrians, nature, debris, weather). Once a technology is fully developed and the measure of safety risk indicates a need for FMVSS, regulation should be made.

3. **Detection/Perception**: Should focus on how well, not the means to achieve a result, ADS identifies elements in the world around the vehicle. This translates into how well the technology analyzes/plans and controls the situation. Once a technology is fully developed and the measure of safety risk indicates a need for FMVSS, regulation should be made.

4. **Sensing:** Should focus not on how but on how well ADS receives information which translates into how well the technology analyzes/plans and controls the situation. Once a technology is fully developed and the measure of safety risk indicates a need for FMVSS, regulation should be made.

Question 23. Discuss how each element of the framework would interact with Department of Transportation Rules concerning rulemaking, enforcement, and guidance.

Currently, there is no definitive answer for this question.

Question 25. If you believe that any of the administrative mechanisms described in this Notice falls outside the Agency's existing rulemaking or enforcement authority under the Vehicle Safety Act or Department of Transportation regulations, please explain the reasons for that belief.

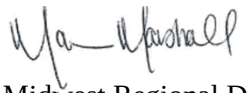
Not applicable, per the definition shared everything should be in NHTSA's purview.

Question 24. If your comment supports the Agency taking actions that you believe may fall outside its existing rulemaking or enforcement authority, please explain your reasons for that belief and describe what additional authority might be needed.

There is concern that "sensing" and "perception", when it relates to communication, may fall under FCC regulations and not under NHTSA. The FCC and US DOT need to be coordinated for vehicle safety and to detail how ADS based communication is specified and handled. Overall, all Federal agencies need to be more unified. Coordination across all agencies will help to ensure vehicle safety across all aspects.

CALSTART and its Next Generation, Purpose-Built, Transit Automated Vehicle cohort members appreciate the opportunity to share the above comments with NHTSA on behalf of the ADS end user perspective. The future of automated vehicles is upon us and we are proud to be a leading industry as stakeholders.

Sincerely,



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