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FMVSS Considerations for Vehicles With Automated Driving Systems: Volume 3

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16. Abstract The portion of the research project included in this report focuses on 28 Federal Motor Vehicle Safety Standards (FMVSS). It provides research findings, including the performance requirements and test procedures, in terms of options regarding technical translations, based on potential regulatory barriers identified for compliance verification of innovative new vehicle designs that may appear in vehicles equipped with Automated Driving Systems (ADSs) that lack manually operated driving controls. This report continues to use the foundational work from the Volume 1 report (Blanco et al., 2020) and builds on the findings from the Volume 2 report (Chaka et al., 2021). The current report describes 11 crash avoidance standards (FMVSS Nos. 105, 106, 109, 116, 117, 119, 121, 129, 135, 136, and 139), 15 crashworthiness standards for conventional seating designs (FMVSS Nos. 209, 212, 213, 217, 218, 219, 220, 221, 222, 301, 302, 303, 304, 305, and 401), 1 low-speed vehicle standard (FMVSS No. 500), and 1 crashworthiness standard for unconventional seating designs (FMVSS No. 208).		
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Executive Summary

This project uses research findings to provide options for the technical translation of select Federal Motor Vehicle Safety Standards (FMVSS), including performance requirements and test procedures. The technical translation options consider potential unnecessary/unintended regulatory barriers[1] to innovative new designs of vehicles equipped with Automated Driving Systems (ADSs).

The work presented in this report builds on that described in two previous reports, *FMVSS Considerations for Vehicles With Automated Driving Systems: Volume 1* and *Volume 2* (Blanco et al., 2020; Chaka et al., 2021), which documented the framework used to evaluate the regulatory language and test procedures with the goal of identifying possible options to remove regulatory barriers for the compliance verification of ADS-dedicated vehicles (ADS-DVs) that lack manually operated driving controls. This framework includes feedback obtained from the research team, stakeholders, and subject matter experts (SMEs).

Technical translations are modifications intended to allow NHTSA to apply regulatory language and/or perform test procedures identified as potential regulatory barriers with the same basic engineering performance but without manual control-specific restrictions or references. Figure ES-1 summarizes the research areas covered in the Volume 1 and 2 reports.

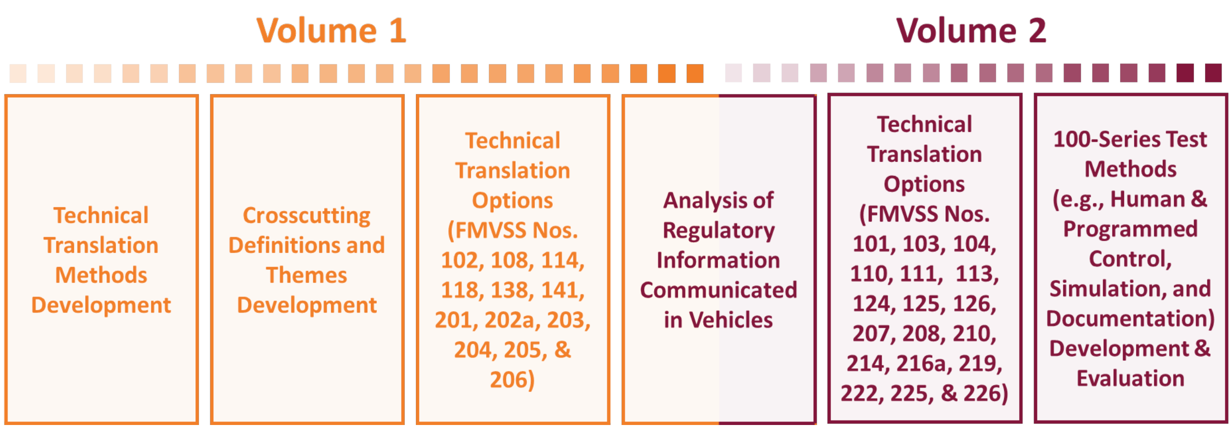

Figure ES-1. Volume 1 and 2 Research Areas

The Volume 3 research studied 28 FMVSS: 11 crash avoidance standards (with a focus on braking and heavy-truck electronic stability control [ESC] standards), 1 low-speed vehicle standard, 15 crashworthiness standards assuming conventional seating, and 1 crashworthiness standard exploring the considerations for unconventional seating. The technical translation analysis varied depending on the complexity of the potential regulatory barriers and proposed findings from NHTSA's other research. The Volume 3 research areas are shown in Figure ES-2 on the next page.

[1] The use of the term "regulatory barrier" in this report always refers to "an unintended and unnecessary regulatory barrier."

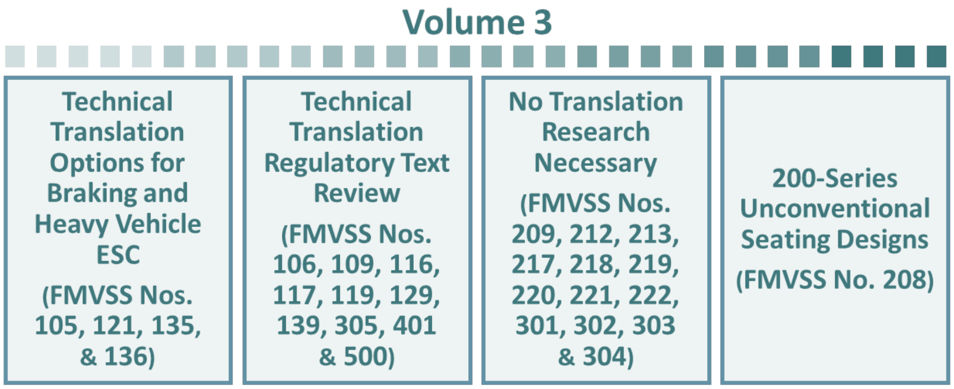

Figure ES-2. Volume 3 Research Areas

All research has certain limitations and caveats. First, the legality of the potential options discussed in this report have not yet been verified. Second, the potential options in this report do not include all translation possibilities for the FMVSS or test procedures. The options are limited to those that the authors of the report and the stakeholders involved suggested and discussed as potentially feasible at the time the research was performed. Thus, there may be other more applicable options not included in this report. Third, it is important to disclose that most stakeholders in this project were industry representatives, not public interest groups or others that NHTSA would consider "stakeholders" in NHTSA's processes. Please see Appendix E for a complete listing of the stakeholder organizations involved in the development of this report and in the technical translations of each of the FMVSS included here.

Scope

The FMVSS technical translations effort centers on a particular type of new vehicle design—the ADS-DV. Specifically, the project scope was limited to ADS-DVs designed to be operated exclusively by an SAE International (SAE) driving automation Level 4 or Level 5 ADS[2] for all trips, and which are not equipped with manually operated driving controls. The technical translations were not developed with provisions for vehicles equipped with manually operated driving controls and designed with an SAE Level 4 or Level 5 ADS. These vehicle types are expected to have the physical characteristics necessary to perform the test procedures as currently specified. Many FMVSS include both performance requirements (i.e., regulatory language) and test procedures; NHTSA's Office of Vehicle Safety Compliance (OVSC) test procedures are derived from the FMVSS regulatory language. However, the technical translation options developed focus mainly on the regulatory language. Examples of potential regulatory barriers vary. They could include features mentioned in the regulatory language that are not available in the ADS-DV (e.g., brake pedal), instances where the features are required as reference points (e.g., driver's seat), or required features may potentially serve no safety purpose for an ADS (e.g., rearview mirror). Other barriers could be specific to executing the test procedures as prescribed (e.g., measuring a steering wheel angle or brake pedal force), resulting in potential NHTSA compliance verification impediments. In Volume 1, a common set of

[2] As defined in SAE International Standard J3016_202104, *Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles*, 2021.

crosscutting themes was developed to assist in maintaining consistent technical translation approaches as well as to help identify when and why technical translations may be unique.

The knowledge and additional considerations identified during the evaluation of the 28 FMVSS covered in this report build on the information in the previous two reports (Volumes 1 and 2). In Chapter 6, this report also identifies research topics related to removing regulatory barriers that are beyond Volume 3 research.

Crash Avoidance Standards

In this report (Volume 3), the 100-series crash avoidance work focused on light- and heavy-vehicle braking, and heavy-vehicle ESC standards. These include some of the same FMVSS terms in the Volume 1 and 2 research reports, such as driver (operator), shift position, controls, telltales, indicators, and auditory alerts. These terms reflect one of the primary underlying assumptions throughout 49 C.F.R. Part 571—that a human is driving the vehicle using manually operated driving controls. As was the case in the Volume 1 and 2 reports, the research team determined that most of the current 100-series FMVSS covered in this report could be addressed with straightforward clarification of the regulatory language.

Service brake application language was identified as a crash avoidance crosscutting theme in the Volume 1 and Volume 2 research. However, the standards covered in those volumes were limited in scope to braking under normal driving conditions. The FMVSS braking standards covered in this report provide specific brake system requirements and performance metrics to "ensure safe braking performance under normal and emergency driving conditions."[3] For instance, the performance limits in FMVSS No. 135 define stopping distances but also have requirements for lateral deviation during the stopping event (S6.5.4). Consequently, the test methods will also need to provide evidence of adequate lateral control during the emergency braking maneuvers.

The pedal force requirements in the test procedure section of FMVSS No. 135, *Light vehicle brake systems,* present a unique predicament for ADS-DVs. The range of input pedal force allows people to operate the brake systems independent of their relative strength. However, this may not be relevant for ADS operation where the input to the brake system is provided by the ADS. To address this in the technical translations, the proposed options do not specify an operational range for the brake system input for ADS operation but instead put forth that the input should be sufficient to meet the brake performance requirements. This avoids implying a particular design that may be unnecessary for ADS operation. The terms used for the brake system input vary across the braking standards. FMVSS No. 135 uses "brake pedal," FMVSS No. 121, *Air brake systems,* uses "treadle," whereas FMVSS No. 105, *Hydraulic and electric brake systems*, uses a more general reference to "brake control" and "control input." This latter terminology was adapted to arrive at the terms "service brake input" and "brake system input," providing a general, yet consistent, approach across the suite of braking standards.

FMVSS No. 126, *Electronic stability control systems for light vehicles*, was covered in Volume 2 and many of the translation approaches used for this standard were also applied to FMVSS No. 136, *Electronic stability control systems for heavy vehicles*, in this report. The translation of FMVSS No. 136 was addressed with the expectation that ESC will continue to co-exist and function separately from the ADS in future ADS-DVs. The translation treats the ESC and ADS

[3] This is the stated purpose of FMVSS No. 135 in 49 CFR 571.135.

as distinct systems and does not presume a hierarchy between them. This is important to recognize, as the ESC is a secondary system intended to enhance the vehicle's stability control, a functionality which is likely to differ from the primary ADS motion control. The significant difference between the heavy vehicle standard and the light vehicle standard is the requirement for the deviation between driver-requested and ESC controlled engine torque in the heavy vehicle standard. Therefore, the translation approach includes control assistance at the engine.

As in Volume 1 and 2, language including telltales, indicators, and auditory alerts was a crosscutting theme across several of the 100-series regulations examined for this report. The options developed in the previous work to address information communicated to occupants was exercised to develop technical translations for the Volume 3 research. The 10 potential options for technical translation of provisions that specify where or to whom a telltale, indicator, or alert is directed in ADS-DVs were outlined in Volume 1. One of these options evolved further in the current research (Volume 3): the option of communicating the information to the ADS and an occupant compartment maintenance panel or screen was altered to change the latter provision to communicate to a service required log located in the occupant compartment of an ADS-DV. The refinement to this option addresses a situation wherein a person or entity responsible for the ADS-DV's service may not be present in the vehicle to receive the information in real-time. This option may help ensure relevant warning or failure information is stored and available for review by those who need it.

In addition to the light- and heavy-vehicle braking and heavy-vehicle ESC standards, the research also reviewed crash avoidance standards specifying requirements for brake hoses, brake fluids, pneumatic tires, and non-pneumatic tires. These standards are equipment standards, and the research team did not identify any regulatory barriers for ADS-DVs that lack manually operated driving controls.

Test Procedures

The research for Volume 3 continued to apply the approach developed in Volume 1 and Volume 2 when addressing test procedures—to confirm a given test method's capacity to replicate the driving and non-driving functionalities required in the respective standard and associated test procedures.

The two test methods being evaluated for FMVSS No. 135 are human control and programmed control. Human control (also referred to as "external control"[4]) provides manual controls (e.g., steering wheel, pedals) not present in an ADS-DV, which allow a human to operate the vehicle. These controls could be placed either inside or outside the vehicle. This approach would allow the execution of the test procedures as currently written. Programmed operation, as the name implies, would use programmed routines to execute the maneuvers and actions specified in the test procedures via the ADS software and hardware. Several approaches have been suggested for accomplishing this, including using preprogrammed routines on the vehicle, programmed routines supplied on a plug-in module, or routines that could be programmed using a scripting language. As discussed in Volume 2, additional research may be needed to address the interface to the preprogrammed routines.

[4] See Advanced Notice of Proposed Rulemaking, *Removing Regulatory Barriers for Vehicles With Automated Driving Systems*, 84 Fed. Reg. 24434, 24440, 24443, 24444 (May 28, 2019).

As discussed in Volume 1 and Volume 2, the test procedures of some FMVSS may require an ADS-DV to operate outside its normal programmed constraints. The angular velocity associated with the sine-with-dwell steering input specified in FMVSS No. 126 is one example of this. FMVSS No. 135 introduces new considerations for testing ADS-DVs. In addition to procedures that specify an input force, there are also test sequences that require maximum braking, maximum acceleration followed by braking at a target deceleration level, and execution of the test procedures with different brake system fault conditions. The fault conditions include five tests designed to evaluate the effectiveness of the braking system with a specific failure mode, such as hydraulic circuit failure, failed antilock, and power brake unit failure. In the current standard of FMVSS No. 135, most of these failures are introduced into the brake system prior to the start of a test run. It is possible that an ADS-DV would be programmed to not operate, or to operate at a limited capacity, with a brake system failure. If this assumption is correct, the execution of these tests may require the ADS-DV to be evaluated in a state that it would not normally operate in. Another consideration relates to the safety intent of evaluating brake system performance in a failed state. If an ADS-DV is equipped with a secondary or redundant system to ensure safe operation, the current failure modes may not reflect faults that would cause degraded brake system performance.

In addition, further approaches with respect to FMVSS No. 126 input specification options were explored. This continued research effort focused solely on programmed control and translation of handwheel angle to alternate steering system inputs. Previous work in Volume 2 demonstrated the feasibility of using the ADS equipment to execute the ESC tests with the programmed control test method. However, Volume 2 also highlighted a potential challenge of providing a definition for the steering input for vehicles that may not have a common steering system interface. Research is ongoing to further investigate steering input and measurement translation options. The results from this work will be used in assessing potential options for the Heavy Vehicle ESC test procedures for FMVSS No. 136, which will be presented in Volume 4 of this project.

Crashworthiness Standards

Of the 16 FMVSS 200-series, 300-series, and 400-series standards covered in the Volume 3 research, many were identified as having no regulatory barriers. Minor technical translations were potentially identified for FMVSS No. 217, *Bus emergency exits and window retention and release*, and FMVSS No. 305, *Electric-powered vehicles: electrolyte spillage and electrical shock protection*. Additionally, the regulatory language and translation options developed for FMVSS No. 208, *Occupant crash protection*, in the Volume 2 report were reassessed for unconventional front row seating. The evaluations of these standards also considered the Notice of Proposed Rulemaking (NPRM) published by NHTSA on March 30, 2020.[5]

The aim of the crashworthiness standards is to reduce the risk of injury or fatality in the event of a crash. The occupant protection provisions of the 200-series are associated with the potential hazards to occupants at various seating positions rather than the role of the occupants seated at those locations. Much of the language in the 200-series standards could be addressed with straightforward clarification of the regulatory language for conventional seating. For this effort,

[5] See NPRM, *Occupant Protection for Automated Driving Systems*, 85 Fed. Reg. 17624 (March 30, 2020). A final rule was published on March 30, 2022, as 87 Fed. Reg. 18560. See https://www.gao.gov/products/b-334208 for summary and download link.

an unconventional seating configuration (i.e., rear-facing front seats) was considered for FMVSS No. 208. Translation options were provided but they may require further research in several areas to determine if the current level of safety provided to occupants in a frontal crash can be maintained.

Test Procedures

For many of the crashworthiness standards where the determination was made that no technical translation may be warranted, the related OVSC test procedures were not reviewed. For the FMVSS No. 208 unconventional seating evaluation, the current anthropomorphic test devices used in the standard and associated test procedures may benefit from further research to determine the suitability for a rear-facing front row.

Stakeholders and Subject Matter Experts

As has been the case throughout this project, stakeholders and SME reviewers were involved in the technical translation process. The research team engaged several entities as collaborators on this project to obtain input and feedback, and to produce prototype technologies for testing and evaluation. These included companies, organizations, and advocacy groups invited to be involved in this project based on their experience with FMVSS and ADS-equipped vehicles. In some cases, stakeholders were sought out after a need was identified for additional expert feedback. In other instances, organizations asked to be included as stakeholders on the project.

SME reviewers were people with demonstrated expertise in and knowledge of a particular FMVSS and/or test procedure, and a comprehension of how potential barriers to unconventional vehicle designs may be addressed; these were a subset of the larger stakeholder group. SMEs were divided into working groups based on their expertise and the members assisted with the review process once technical translation options were developed.

Report Contents

This report includes the following information.

Chapter 1 – Introduction. This chapter is an overview of the research project as well as relevant background information and outlines the steps followed to analyze potential regulatory barriers for vehicles operated exclusively by an ADS (ADS-DVs). Included are descriptions of the methods used to develop technical translations options, the approach used for identifying and evaluating methods that could potentially be used by NHTSA to verify compliance, and the steps followed for stakeholder and SME review and participation.

Chapter 2 – Crash Avoidance Standards. This chapter explains the results from the analysis performed for FMVSS Nos. 105, 106, 109, 116, 117, 119, 121, 129, 135, 136, and 139. An overview of the technical translations for these FMVSS and the stakeholder and SME feedback for a select subset are presented in this chapter.

Chapter 3 – Low-Speed Vehicles. This chapter explains the results from the analysis performed for FMVSS No. 500.

Chapter 4 – Crashworthiness Standards. This chapter explains the results from the analysis performed for the following FMVSS: Nos. 209, 212, 213, 217, 218, 219, 220, 221, 222, 301, 302, 303, 304, 305, and 401. The translation overviews for these FMVSS are also included.

Chapter 5 – Crashworthiness– Unconventional Seating. This chapter focuses on unconventional seating configuration (i.e., rear-facing front seats) considerations for FMVSS No. 208.

Chapter 6 – Summary of Research Findings. This chapter reviews the key findings from the translation analyses for the FMVSS covered in Volume 3 and summarizes the ongoing research beyond this report.

Appendices – The appendices give information about definitions, technical translation worksheets, the analysis of information communicated to occupants, lists of standards incorporated by reference for the FMVSS covered in Volume 3 research, and stakeholder information.

Summary Conclusion

Many of the crosscutting themes—e.g., driver (operator), service brake application, controls, telltales, indicators, and alerts—analyzed in the Volume 1 and 2 research, and the approaches used to develop the technical translations options, continued in the Volume 3 research. Like the previous research, the inherent assumption that a human is driving the vehicle using manually operated driving controls, which comes with particular language and terms, is one of the most prevalent themes. Some assumptions include specifications for inputs based on the ranges of different human drivers, which may not be applicable for vehicles operated by an ADS. Where translation approaches evolved from the previous work, these were noted. For example, one of the potential technical translation options for telltales included a change from "an occupant compartment maintenance screen or panel" to "a service required log."

In most cases, implementation of the potential technical translation options relevant to the crash avoidance standards in this report could be addressed through clarification rather than requiring additional supporting research. However, a few of the 100-series standards in Volume 3, mainly those related to the braking and heavy vehicle ESC compliance verification test procedures, may benefit from additional research. There may also be aspects of human-centric-based inputs (e.g., pedal force), or provisions that may not be relevant for an ADS-DV, that require further exploration beyond Volume 3.

Several 200-series, 300-series, and 400-series standards were reviewed for potential regulatory barriers for ADS-DVs with conventional seating designs. Most had no regulatory barriers. The exceptions were FMVSS Nos. 217 and 305. However, the sections that may require technical translations for these standards could be addressed with straightforward translations.

The 200-series research also included an assessment of FMVSS No. 208, *Occupant crash protection*, for ADS-DVs with unconventional seating designs. During the technical translation process, themes were identified to help organize and evaluate the potential barriers (e.g., the suitability of current anthropomorphic test devices, presence, and requirement of air bags for front seats, child restraint test procedures, unbelted testing requirements, dummy positioning procedures, and injury criteria). The exercise concluded that several themes may need to be explored further to address the potential barriers unconventional seating configurations might introduce.

FMVSS No. 500, *Low-speed vehicles,* has provisions that include aspects from both the 100-series standards and the 200-series standards. The rear-visibility specification, which references portions of FMVSS No. 111, *Rear visibility* (Volume 2 standard), was the only potential barrier identified that may need further research.

The review of the 28 standards in this report continues to use the foundational work from the Volume 1 report and builds on the findings from the Volume 2 report in performing the FMVSS technical translation options for the regulatory language and associated test procedures. Technical translation approaches that maintain the current level of safety specifications and remove ADS-DV potential barriers continue to be tested and refined, and new considerations are revealed as additional standards are analyzed. Like Volume 1 and 2, the feedback from the research team, stakeholders, and SME reviewers was an important part of the research development for this report. The 100-series functionalities and methods that could potentially be used by NHTSA to conduct test procedures to verify the compliance of ADS-DVs without manually operated driving controls will continue to be developed. Additional research is ongoing to help inform the 200-series standards considerations for ADS-DVs.

Chapter 1. Introduction

This project provides research findings in terms of options regarding technical translations of select FMVSS and associated test procedures. The newly created technical translation options consider potential unnecessary/unintended regulatory barriers[6] to innovative new vehicle designs appearing in vehicles equipped with ADS that lack manually operated driving controls. These ADS-DVs are designed to be operated exclusively by an SAE driving automation Level 4 or Level 5 ADS.[7] This report builds on the two previous report volumes, *FMVSS Considerations for Vehicles With Automated Driving Systems: Volume 1* and *Volume 2* (Blanco et al., 2020; Chaka et al., 2021), which documented the framework used to evaluate the standards. Figure 1 shows the standards included in the Volume 1 and 2 research.

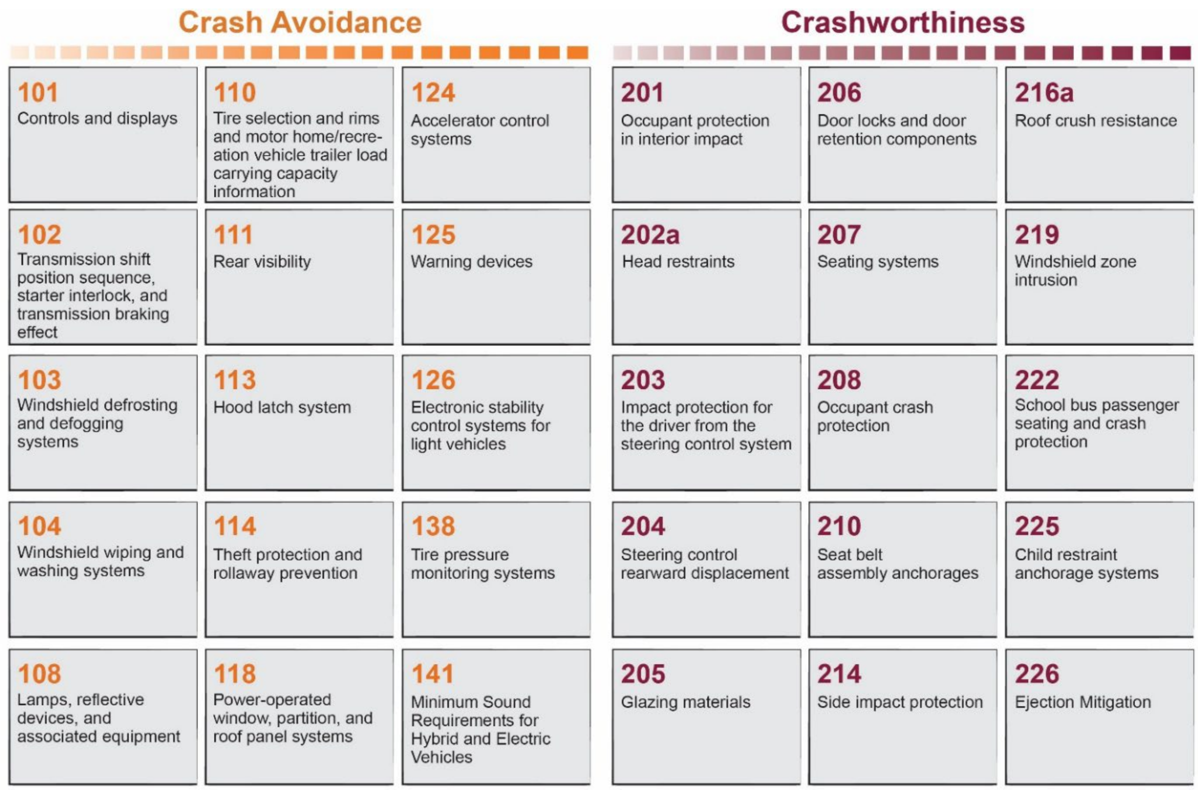

Figure 1. FMVSS Covered in Volume 1 and 2 Research

The research in Volume 3 described in this report related to 11 crash avoidance standards, 1 low-speed standard, and 16 crashworthiness standards, as shown in Figure 2.

[6] The use of the term "regulatory barrier" in this report always refers to "an unintended and unnecessary regulatory barrier."

[7] As defined in SAE Standard J3016, *Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles*, April 2021.

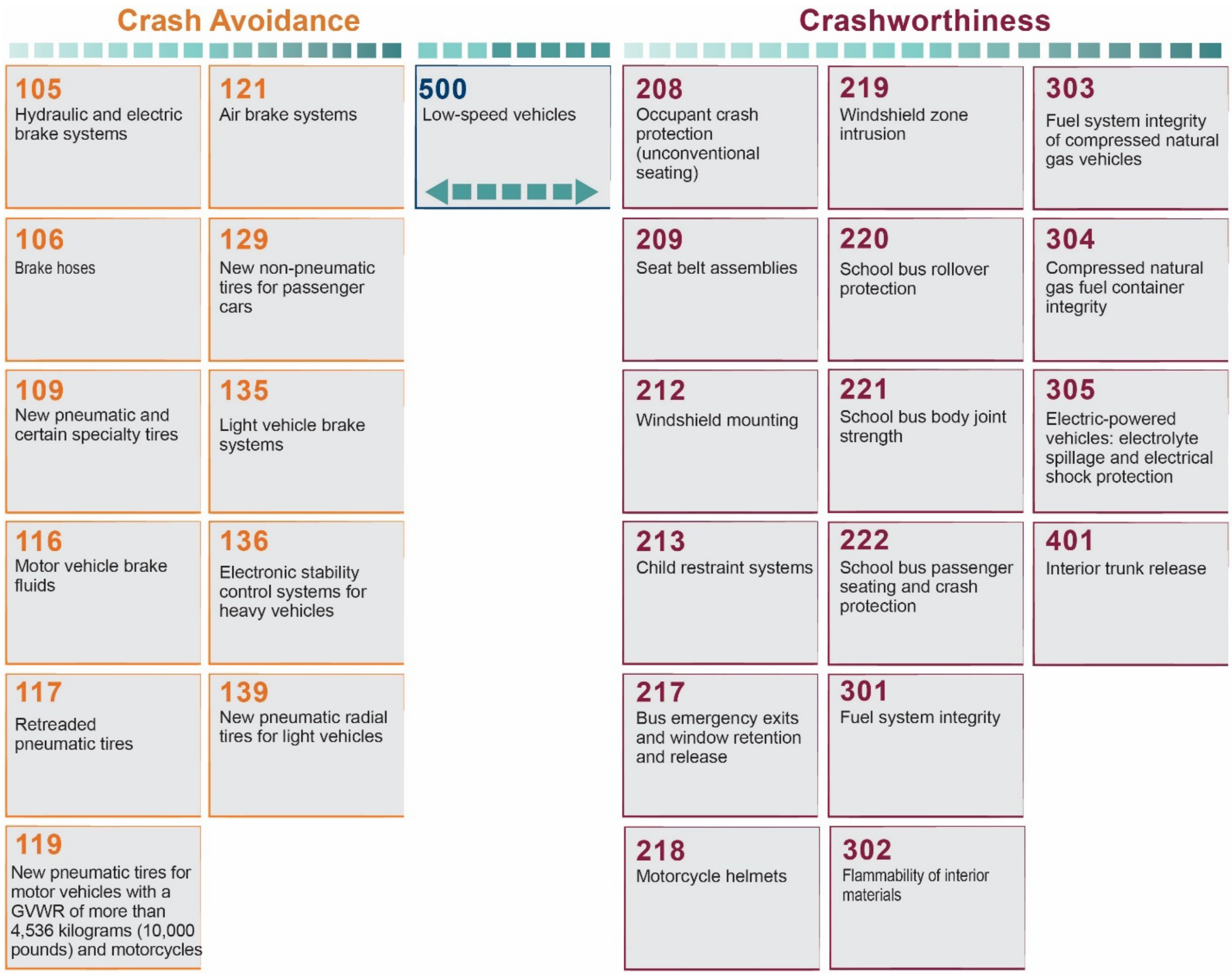

Figure 2. FMVSS Covered in Volume 3

Only existing FMVSS are covered in this effort. The methods used for analyzing the current standards for potential regulatory barriers are outlined in the Performing Technical Translation section. When a potential regulatory barrier was identified, technical translation options were developed. Consistent with the aforementioned work, a technical translation is a modification that would allow regulatory language and/or test procedures that are identified as potential barriers to result in the same basic engineering performance without manual control-specific restrictions. Technical translations for this effort present options for the regulatory language and associated test procedures when a regulatory barrier has been deemed to be present. One unique aspect for Volume 3 is the consideration of unconventional seating as a potential innovative new vehicle design appearing in ADS-equipped vehicles. An assessment of technical translation options was performed for FMVSS No. 208, focused on fixed face-to-face designated seating positions (DSPs) for the first and second rows.

Approach

The basic approaches and processes used to review, identify potential barriers, and develop technical translation options for Volume 1 and 2 standards were also applied to the Volume 3 standards. Any approaches or processes that may have evolved or differed from Volume 1 or 2 are noted throughout the document. Furthermore, definitions used in this study are listed in Appendix A. Detailed information on these definitions was included in the Volume 1 report.

As part of the Volume 1 research, an analysis was performed to group features for current concept vehicles into four types of ADS-DVs: (1) First Generation, (2) Transitional, (3) Revolutionary, and (4) Low Speed. Studying the characteristics of the features for these innovative new vehicle designs allowed the research team to identify potential barriers in the regulatory language and test procedures for ADS-DVs. For the Volume 3 research, the First Generation ADS-DV concept type was used for the evaluation of the 11 crash avoidance standards and 16 crashworthiness standards. The low-speed ADS-DV type was used to perform the evaluation of FMVSS No. 500, *Low-speed vehicles*. The Transitional ADS-DV type with fixed, face-to-face DSPs (i.e., unconventional seating configuration) provided the concept assumptions used for the initial assessment of potential barriers for FMVSS No. 208, *Occupant crash protection*.

Scope

Bidirectional Vehicles

While front and rear are referenced throughout the standards, they are not defined, which can make things unclear when discussing vehicles with bidirectional functionality. Bidirectional ADS-DVs were analyzed extensively in Volume 1 for the crash avoidance standards and potential bidirectional vehicle definition options, and application approaches were discussed. However, bidirectional vehicles were not explicitly included in the Volume 3 research. The implications of bidirectional vehicles for crashworthiness may be explored in future research.

Dual-Mode Vehicles

Since vehicles with manually operated driving controls can be designed to comply with the current FMVSS, this research does not attempt to resolve the potential regulatory issues associated with what is sometimes referred to as a “dual-mode” vehicle. While the research focused on ADS-DVs, in some cases where it would not create confusion, the translation options contain language that would apply to “dual-mode” types of vehicles to facilitate potential future considerations. For example, some of the offered translations, particularly those in the 100-series, specify that a given requirement would apply to “all vehicles that can be operated by a human driver.” The three emphasized words are not actually necessary for the translations within the scope of this research. However, with a dual-mode vehicle, the vehicle may sometimes, but not always, be operated by a human driver. A technical translation specifying “all vehicles operated by a human driver” without the “that can be” may not capture the dual mode when the ADS is operating the vehicle.

Conventional Seating Configurations

The Volume 3 report provides technical translations for the crashworthiness standards shown in Figure 2 for conventional seating configurations. Most of these standards are associated with addressing potential hazards to vehicle occupants, and the National Highway Traffic Safety

Administration has proposed that these standards do not warrant translation research at this time.[8] Of the remaining standards, only FMVSS No. 305 presented any potential barriers.

Unconventional Seating Configurations

There were various unconventional seating configurations considered to define the scope of the research. Options ranged from fixed face-to-face DSPs for the first and second row to non-fixed configurable seating for all DSPs. However, for the purposes of this initiative, the technical translations will focus on fixed face-to-face DSPs for the first and second rows (Figure 3). The rationale for selecting this configuration includes (1) maximizes use of conventional restraint systems, (2) aligns with current research initiatives, and (3) offers the least amount of complexity.

Figure 3. Interior View of the ADS-DV Unconventional Seating Concept

The technical translation analysis and discussion of FMVSS No. 208 can be found in Chapter 5 of the Volume 3 report. This analysis will provide foundational work for how the 200-series could begin to address unconventional seating configurations. Volume 3 does not include considerations for bi-directional vehicles for the crashworthiness standards.

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[8] See NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020).

Performing Technical Translations

Potential barriers for the crash avoidance braking and heavy vehicle electronic stability control (ESC) standards were analyzed at the levels of (1) regulatory language, and (2) exercise of test procedures and review of NHTSA's OVSC Laboratory Test Procedures. As a part of the second level of analysis, researchers also analyzed external standards that are incorporated by reference from several organizations external to NHTSA such as the American National Standards Institute (ANSI), ASTM International, the International Organization for Standardization (ISO), and SAE International in the same way as the rest of the text.

Some of the other Volume 3 crash avoidance, low-speed, and crashworthiness standards analyzed only required one level of review, at the regulatory language level. The remaining crashworthiness Volume 3 standards were identified in the NHTSA proposal as not requiring further research at this time.[9] Figure 4 shows the standards covered and describes the translation analysis performed as follows: (1) full analysis process (two levels) FMVSS are shown with orange borders around the cells, (2) regulatory language review (one level) FMVSS are shown with maroon borders, and (3) those FMVSS for which NHTSA has proposed that no research is necessary at this time are shown with grey borders.

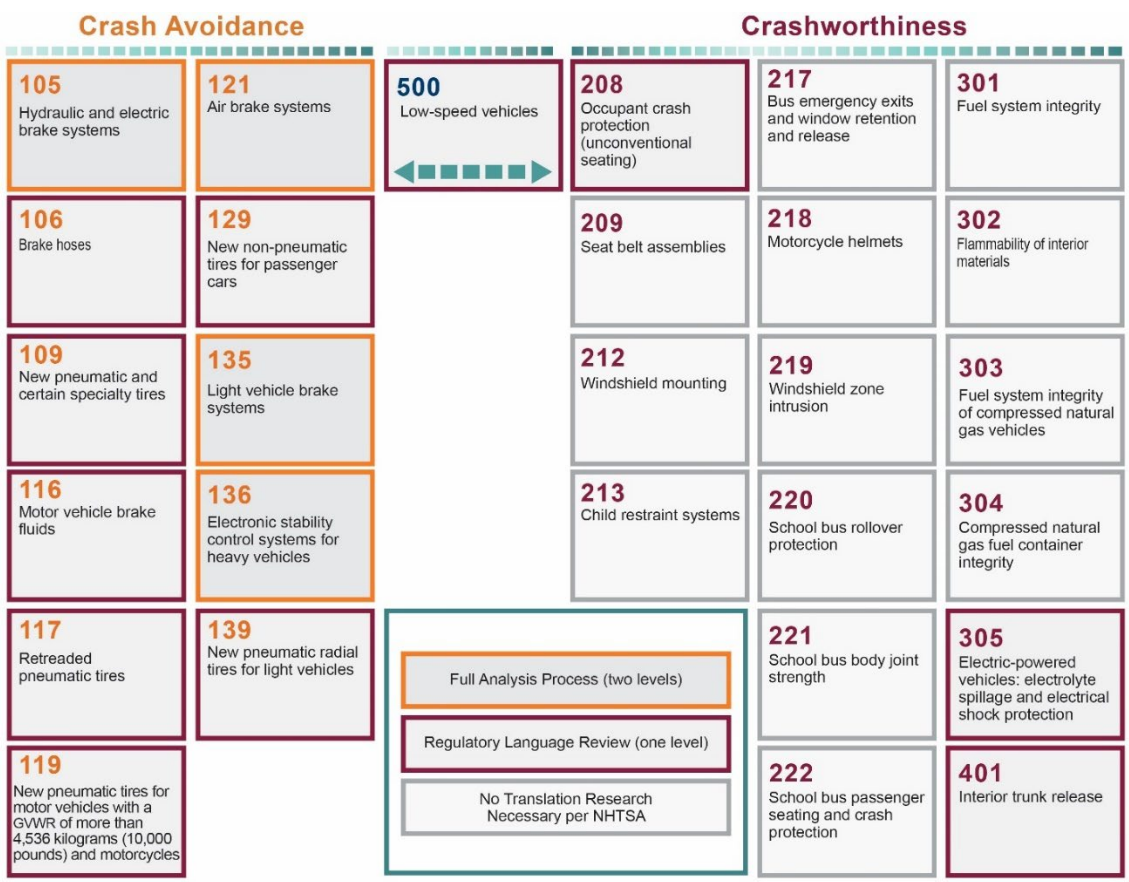

Figure 4. Volume 3 Technical Translation Process Levels

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[9] See NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020).

Technical Translation Types and Reasons for Inability to Translate

The following taxonomy was used to categorize the analysis performed for each FMVSS. This initial framework allowed for the accommodation of options as they evolved and as information developed throughout the technical translation process. The standard translation assessment code is a categorical variable ranging from 0 to 2 for conventional seating configurations. The standard translation assessment code ranges from U0 to U2 for unconventional seating configurations, which can be found exclusively in FMVSS No. 208 for unconventional seating. The code assigned to each standard's technical translation conveys what the research team believes is the appropriate category (Table 1 and Table 2). Codes were used to categorize the considered translations throughout the technical translation development process. These codes are intended to provide insight into potential future research that may be beneficial to performing a more accurate translation based on future testing. The technical translation type and assessment reason can be found in the individual standard translation worksheets for each of the FMVSS requiring full technical translation analysis in Volume 3 research. Appendix B provides a snapshot of these technical translations by only including those that were deemed as either straightforward or as potentially benefiting from limited research. The subsequent sections of this report, as well as the individual standard translation worksheets provide reasoning for what informed each FMVSS' technical translation approach and the logic behind why some were given a code of 0 – evaluated, but not performed.

Table 1. Technical Translation Taxonomy – Conventional Seating Configurations

Reason	**Technical Translation Type Description**
0 – Not performed	Translation evaluated but not performed.
1 – Translation is straightforward	The translation performed is straightforward.
2 – Limited research may be beneficial	Can translate standards or provisions of standards, maintaining current performance levels, with some limited amount of research for NHTSA to conduct compliance verification for both conventional vehicle designs and new vehicle designs associated with ADS-DVs.

Table 2. Technical Translation Taxonomy – Unconventional Seating Configurations

Reason	**Technical Translation Type Description**
U0 – Not performed for unconventional seating	Translation performed for conventional seating and no changes required for unconventional seating.
U1 – Translation is straightforward for unconventional seating	The translation performed is straightforward for unconventional seating.
U2 – Limited research may be beneficial for unconventional seating	Can translate standards or provisions of standards, maintaining current performance levels, with some limited amount of research for NHTSA to conduct compliance verification for both conventional vehicle designs and new vehicle designs associated with ADS-DVs.

Several factors were considered during the research scoping effort, including definitions, concept vehicles, and technical translation principles. The definitions can be found in Appendix A and the technical translation principles can be found in the Volume 1 report. The approaches used in Volume 1 and Volume 2 research were also used to develop the technical translation options and evaluate the test procedure implications during the Volume 3 research. The findings from this latest research are presented in the current report.

Controls, Telltales, Indicators, and Auditory Alerts

For the Volume 1, 2, and 3 reports, each FMVSS in the reports was reviewed for information communicated to vehicle occupants. Information communicated to occupants was identified by any regulatory language that included a reference to controls, telltales, indicators, auditory alerts, and symbols. For example, FMVSS No. 121, *Air brake systems,* S5.1.5 requires that there be:

> A signal, other than a pressure gauge, that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" ("run") position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view, or both audible and visible.

The use of a warning signal in today's regulatory language does not specify the recipient of the signal. Consequently, this same terminology can apply for a signal communicated to the ADS.

The analysis of information communicated to occupants in the Volume 3 standards retained the 10 potential options developed during Volume 1 research that specify where or to whom a telltale, indicator, or auditory alert is directed in ADS-DVs. They range from communicating the information to the ADS only, to communicating to the ADS and all DSPs, to not communicating the information to either the ADS or DSPs and include many options in between. One potential option that has continued to evolve since the development during Volume 1 is Potential Option 5: "To the ADS and an occupant compartment maintenance screen or panel." This option was originally presented as:

> A maintenance message, as it is possible that none of the occupants of an ADS-DV would be responsible for, or have the ability to perform, maintenance; another person or entity may be responsible for the ADS-DV's maintenance. This may be an option to help ensure maintenance information is available to those who need it in a consistent location and manner. It should be noted that the responsible person/entity may not be present in the vehicle to receive the information in real-time.

During Volume 3, this option was refined as follows – Option 5: To the ADS and a service required log located in the occupant compartment for an ADS-DV:

> A service required log could record the status of the signal for reference by personnel who would be responsible for performing, or have the ability to perform, service and still make the service information accessible to potential occupants. The option assumes the person or entity responsible for the ADS-DV's service may or may not be present in the vehicle to receive the information in real-time. This option may help ensure relevant warning or failure information is stored and available for review by those who need it. One potential consideration for this option is occupantless ADS-equipped vehicles that may not need to have the service log information located in the occupant compartment.

The braking standards, particularly FMVSS No. 135, *Light vehicle brake systems,* with its focus on performance with different system failures present, provide a unique consideration for communication to the driver, the ADS, and the occupant. Since many of the indicators specified in this standard are associated with service or repair issues, the concept of communicating these warning signals to a service required log for an ADS-DV in addition to occupants was adopted. This option does not preclude communication to occupants or to the ADS but does provide a potential means to present the information for subsequent display or retrieval by entities that may be responsible for, or interested in, the operational state of the vehicle. Conceptually, this could be like the way that current vehicles store diagnostic trouble codes. These codes can be displayed on a vehicle information center, viewed via an onboard diagnostic reader, or retrieved remotely.

Heavy vehicles have a broad range of market applications, from cargo-purposed truck tractors to truck tractors and buses. There is a range of potential occupant and occupantless configurations, including occupants in sleeper berths or coaches. These different market usages were considered when evaluating the suitability of the 10 Potential Volume 1 Options for the communication of information specified in FMVSS No. 136 (e.g., ESC Malfunction). The use of a service required log, Option 5 of the 10 Volume 1 Options, could have additional benefits for heavy vehicle applications that are subject to technical and safety inspections.

The Volume 1, Potential Option 2, "To the ADS and provide to occupants per the current standard location" is another example of the options used in the translation of information communicated for the braking and ESC standards discussed in this report. This option is intended to provide the telltales, indicators, and alerts in the same manners as specified in the current standard. For example, FMVSS No. 105, S5.3 Brake system indicator lamp, specifies that "Each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the driver, which meet the requirements of S5.3.1 through S5.3.5.," which requires the information to be provided to the driver's DSP. The application of Option 2 for this example translated "*driver*" to *"left, front outboard seating position"* for an ADS-DV only. While it is rare, the FMVSS do not require the driver's DSP to be in the left, front outboard position. Therefore, the left, front outboard seating position may not provide the telltales, indicators, and alerts in directly the same manner as the current standard. Another way to address this would be to use Option 4 from Volume 1, "To the ADS and DSPs as specified by the vehicle manufacturer," where the vehicle manufacturer could determine the location to provide the information.

Stakeholder feedback was requested on the potential options for communication of warning signals and how they were applied to pertinent sections of the technical translations for FMVSS No. 135 (S5.1.2; S5.5) and FMVSS No. 136 (S5.4; S5.4.1). FMVSS Nos. 135 and 136 were selected, as they were comprehensive in representing the translation process while not overly burdensome for stakeholders in their review. The stakeholder review process is discussed in further detail in the final section of this chapter.

In some instances, potential translations and options were revised based on stakeholder feedback. For example, the original FMVSS No. 136, S5.4.1 language, with the initial technical translation in red font, was:

> Except as provided in S5.4.3 and S5.4.6, for each vehicle that is equipped with manually operated driving controls the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.

> For each ADS-DV, the ESC malfunction condition must be communicated to the ADS only when a malfunction exists and must be continuously communicated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.

Stakeholders commented that FMVSS No. 136 specifies exceptions for continuously illuminating the telltale for the length of the ESC malfunction that should be maintained for telltales intended to be communicated to occupants in an ADS-DV. Based on this feedback, the options for S5.4.1 that may include communicating the ESC malfunction to both the ADS and the vehicle occupants (based on provisions provided in S5.4) were updated to include the exceptions provided in S5.4.3 and S5.4.6. The updates to the S5.4.1 options were as follows (shown in red text and underlined):

> For each ADS-DV, the ESC malfunction condition must be communicated to the ADS only when a malfunction exists and must be continuously communicated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. <u>Except as provided in S5.4.3 and S5.4.6, the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.</u>

Other feedback included comments that did not result in new translation options being added. For example, FMVSS S5.4 requires that an indicator lamp be in front of and in clear view of the driver and be activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's ESC system. Translation Option 2 for this section suggests similar visibility specifications for all DSPs in an ADS-DV. However, one stakeholder suggested that requiring the indicator to be visible to all DSPs in an ADS-DV may constrain the vehicle design, and that the current regulatory language does not require visibility to all DSPs.

Another stakeholder expressed concern for not providing a potential translation option requesting that the ADS perform a certain action in response to a warning or alert. This stakeholder suggested that these expected responses are often the action required to ensure the safety needs for a specific standard to be met and do not need to be explicitly written in the regulatory language to be relevant in translations. Volume 1 research included the review of owner manuals as a guide for what expected responses to telltales, indicators, and auditory alerts should be. However, given that those expected responses are not explicitly written within the current regulatory language, they are not within the scope of this project.

Appendix C provides an analysis of information communicated to occupants for the braking and heavy vehicle ESC standards. For a detailed explanation of this process, please refer to the Volume 1 and Volume 2 reports.

Analysis of Standards Incorporated by Reference

FMVSS Nos. 105, 121, 135, 136, 305, and 500 technical translations in Volume 3 incorporate standards from external organizations as found in 49 CFR § 571.5. As stated in the Volume 1 and Volume 2 reports, the goal of this analysis is to identify potential regulatory barriers to compliance verification as well as to provide options for technical translations in the sections where the standard is incorporated by reference. No analysis was completed for standards without technical translations. Each incorporated reference within the FMVSS regulatory language and the associated test procedures was evaluated and coded based on its potential to create a barrier for compliance verification using the same taxonomy in Volumes 1 and 2. No potential barriers were found in the Volume 3 analysis.

Incorporated references cited within the FMVSS ranged in publication date from 1972 to 2009. As stated in the Volume 1 and Volume 2 reports, any newer references issued by external organizations have not been updated in the FMVSS. Thus, only incorporated references presently cited within each standard were assessed. When a reference was superseded by a newer standard, this has been noted within the tables in Appendix D. Details about the analysis of standards incorporated by reference are briefly provided for each FMVSS in its respective section (Chapters 3 and 4) as well as in the full analysis tables shown in Appendix D.

Table 3. Taxonomy for Translation of Standards Incorporated by Reference

Reference Classification Scale	**Description**
0 – No barrier	The reference could be used as originally cited and intended. It does not present any regulatory barrier.
1 – Translation is straightforward	Translations were incorporated to ensure the reference does not present a regulatory barrier.
2 – Limited research may be beneficial	Research may be beneficial in order to implement a translation in the reference or the regulatory language.

Twenty-six standards by external organizations were incorporated by reference in the regulatory language, and the associated test procedures for the seven FMVSS that were evaluated as part of this report. These standards represent organizations external to NHTSA (e.g., ASTM, SAE, ISO, ANSI/ National Conference of State Legislatures [NCSL]). The total number of incorporated references within each FMVSS, as shown in Appendix D, Table 9, was calculated per referenced document, not by the number of citations to said references. For example, FMVSS No. 105 contained two citations to different sections of one incorporated-by-reference document (paragraph 3.3 and 4.3 of SAE Recommended Practice J972, 2000) but was only counted once in the tables in Appendix D.

Overall, the potential barriers presented by these standards incorporated by reference are believed by the research team to be minimal. Most references provided language that would be independent of ADS-DVs and thus the research team's analysis did not identify any potential barriers to compliance verification.

Stakeholder and SME Review Process

Research tasks for this report benefited from stakeholder and associated SME input. Stakeholders for this project were initially recruited from companies, organizations, and advocacy groups invited to be involved based on their experience with FMVSS and ADS-equipped vehicles. Additional stakeholder entities were added to the group as research tasks progressed. In some cases, organizations asked to be added and, in other cases, a need was identified for additional SME feedback, resulting in additional stakeholders being invited to participate. SME reviewers are a subset of the larger stakeholder group; SMEs are people with expertise in and knowledge of a particular FMVSS and/or test procedure and a comprehension of how potential barriers to compliance verification performed by NHTSA may be addressed. Stakeholder feedback was requested on the following: FMVSS Nos. 105, 121, 135, 136, and 208 regarding unconventional seating. Additionally, stakeholder feedback was requested on the potential options related to telltales and how those options were applied to technical translations of FMVSS No. 135 S5.1.2; S5.5 and FMVSS No. 136 S5.4; S5.4.1.

The SME reviewers for each FMVSS covered in Volume 3 research (Appendix E) were given opportunities to review the technical translation options and, if provided, their input was taken into consideration. It should be noted that no new information was requested or provided for the FMVSS technical translation options reviews.

As detailed in the Volume 1 report, worksheets were developed for each FMVSS to provide background information for developing the technical translation options. In the case of the telltales, indicators, and auditory alerts review, the material was included in a text document that outlined the specific sections and provided example translation options. The FMVSS research team completed the initial technical translations after reviewing and studying the background information. They then gathered input from core team members and further refined the technical translation options. The updated worksheets and text document were provided to SME reviewers, and their feedback was compiled and incorporated into the worksheets and text document if the input was within the project's scope. All SME reviewer feedback was anonymized and maintained within the worksheets.

The Volume 3 standards that warranted regulatory review (one level), and those for which NHTSA has proposed no translation research is necessary at this point, were not distributed to stakeholders for review because the nature of the analysis and the identification of potential barriers was straightforward.[10] These were previously shown in Figure 4, with maroon borders and grey borders, respectively.

[10] See NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020).

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Chapter 2. Crash Avoidance Standards

Overview

This chapter summarizes the technical translation performed for the crash avoidance standards covered in Volume 3 research: FMVSS Nos. 105, 106, 109, 116, 117, 119, 121, 129, 135, 136, and 139. These standards cover a range of performance requirements that help prevent motor vehicle crashes or injuries. The goal of this effort was to identify potential regulatory barriers and provide options for translating the language of each standard to accommodate ADS-DVs. In addition to the FMVSS, the associated test procedures used by NHTSA to verify compliance were reviewed for FMVSS Nos. 105, 121, 135 and 136; these are discussed further in the Test Procedures section below.

Key Considerations

Many of the crosscutting themes identified in Volume 1 and Volume 2 research are consistent with the standards considered in the Volume 3 report. Table 4 captures the crosscutting themes from Volume 1, Volume 2, and Volume 3 standards.

Table 4. Crash Avoidance Crosscutting Themes

Themes	Volume 1						Volume 2									Volume 3			
	102	108	114	118	138	141	101	103	104	110	111	113	124	125	126	105	121	135	136
Congressional Mandate			•	•	•	•				•	•						•		•
Controls, Telltales, Indicators, and Auditory Alerts	•	•	•		•		•								•	•	•	•	•
Driver (Operator)	•	•	•		•		•	•	•		•		•	•	•	•	•	•	•
Driver/Passenger Position/Presence	•	•	•	•			•	•	•	•		•			•	•	•	•	•
Equipment May Not Be Applicable		•	•					•	•		•					•	•	•	•
Front/Rear of Vehicle		•				•		•		•	•	•				•	•	•	•
Service Brake Application	•	•	•		•	•				•					•	•	•	•	•
Shift Position (Gear, Selects, Reverse)	•	•	•			•		•	•		•					•	•	•	•
Vehicle Loading Including Test Driver and Instrumentation			•		•	•				•					•	•	•	•	•
Visibility		•						•	•		•	•							

Like FMVSS No. 126, FMVSS No. 135 provides for human-centric vehicle inputs (e.g., steering wheel angle for FMVSS No. 126 and pedal force for FMVSS No. 135). Unlike the steering wheel angle and velocity limits used to ensure the ESC system will operate within reasonable human input limits, the pedal force definitions are designed to ensure most of the population will be able to realize the minimum level of braking performance defined in the standard. While these ranges are important for human operation, they may not be relevant for ADS operation since the input component (e.g., actuator) will be part of the brake system design and not be dependent on a vehicle occupant. Consequently, the primary approach for the proposed pedal force translation options was to remove the input requirements and instead make the input dependent on the performance requirements. There was also stakeholder feedback suggesting removal of the input range requirement and basing the standard on stopping distance only. This avoids implying or requiring a particular design that may be unnecessary for ADS-DVs. Note that the other braking standards covered in Volume 3 (FMVSS Nos. 105 and 121) do not use as many references to specific force requirements.

As with the force requirements, the definitions of the input interface for the braking standards also vary. FMVSS No. 135 uses “brake pedal,” FMVSS No. 121 uses “treadle,” where FMVSS No. 105 uses a more general reference to “brake control” and “control input.” To provide consistency across this family of braking standards, the translation options use more generic language such as “service brake input” and “brake system input,” which combines the terminologies from FMVSS Nos. 105 and 135.

The translation of FMVSS No. 136 was addressed with the expectation that ESC will continue to co-exist and function separately from the ADS in future ADS-DVs. The translation treats the ESC and ADS as distinct systems and does not presume a hierarchy between them. This is important to recognize, as the ESC is a secondary system intended to enhance the vehicle’s stability control, which is different and separate from the primary ADS motion control. The significant difference between the heavy vehicle standard and the light vehicle standard is the requirement for the deviation between driver-requested and ESC controlled engine torque in the heavy vehicle standard. Therefore, the translation approach included control assistance at the engine.

Some heavy vehicles are already equipped with features that are driver adjustable. These features serve to enhance heavy vehicle performance. For example, an engine brake is used to aid service (air) brakes by supplying significant motion control on roads with steep grades (e.g., mountains). Another feature is an interlocking axle. This feature is used to reduce variance in wheel speeds at very low speeds to free the heavy vehicle from a slippery surface over a short distance. During ESC testing, these features are required to be disengaged to avoid interference. Translations were applied to remove terms that were simply defining the adjustable features but could imply barriers for ADS-DVs since human drivers traditionally made adjustments on vehicles equipped with manually operated driving controls.

As discussed in the Chapter 1 Approach and Scope, bidirectional vehicles were not directly included in the Volume 3 research. However, the methods put forth in Volume 1 (i.e., generically addressed in Subpart A of 49 CFR Part 571, potentially as a new subsection (g) of § 571.7 or as a new § 571.11, or as a separate FMVSS addressing bidirectional vehicles) could address the potential barriers associated with bidirectional vehicles for the 100-series standards covered in this report.

Test Procedures

The research into the test procedures is focused on the identification and demonstration of potential test methods for execution of the compliance verification test procedures with an ADS-DV. Like the Volume 1 and 2 approach, the focus is on the functionalities that are part of the regulations or that are needed for compliance verification. Most of the functionalities were implemented and evaluated in previous work, except for some of the braking requirements. Current research into FMVSS No. 135 includes implementation and evaluation of braking functionality. The FMVSS No. 135 research evaluates human controls and programmed controls as possible test method implementations. The human control method is to provide the equipment that would allow a human to control the ADS-DV either in the vehicle or remotely, thus enabling execution of the current test procedures. Programmed operation leverages the ADS and uses a sequence of operations to execute the test procedures. In addition, the team is building on the Volume 2 research and further investigating FMVSS No. 126. Continued FMVSS No. 126 research focuses solely on programmed controls and the translation of handwheel angle to alternate steering system measurements. The Volume 2 report considered a range of vehicle-based and non-vehicle-based test methods, including a simulation test method for FMVSS No. 126.

Previous work demonstrated the feasibility of using the ADS equipment to execute the ESC tests presently performed with an external steering wheel controller. However, it also highlighted a potential challenge of providing a definition for the steering input for vehicles that may not have a common steering system interface. One of the proposed options for addressing this was to define the input at the road wheel. While road wheel angle is currently common to all vehicles, it can be influenced by the suspension design, configuration, and subsequent displacement. Research surrounding these factors aims to identify the key considerations and offer potential testing options. The results from FMVSS No. 126 will be evaluated to determine potential feasibility for use in the FMVSS No. 136, "Electronic stability control systems for heavy vehicles" test procedures.

FMVSS No. 135 presents some unique considerations required to execute the test procedures specified in the regulatory language with an ADS-DV. Five of the test conditions are designed to evaluate the effectiveness of the braking system in the presence of a specific failure condition, such as with the engine off or with an antilock brake system (ABS) failure. Operation of the vehicle with known brake system failure is not prohibited by FMVSS No. 135, which only specifies that if a failure occurs, the operator must still have a minimum level of braking performance to stop the vehicle. This may differ in the case of an ADS-DV, where the ADS-DV manufacturer may limit (e.g., limp-home mode) or prohibit operation of the vehicle when a brake system failure exists. The default failure mode may prevent the vehicle from moving or being able to execute the test procedures.

To provide additional insight into the way manufacturers may address some of these challenges, the team is engaging industry test partners to execute test protocols used for FMVSS Nos. 126 and 135 with their ADS platforms. The intent is to provide insight into how industry is currently approaching, or intends to potentially approach, the related testing, and to identify additional considerations regarding testing should they become apparent. This may be particularly useful in determining how ADS-DVs might handle failure modes, and in providing further insight into areas that may not be applicable or equivalent areas that are not covered for ADS-DVs.

Test procedure research is ongoing and additional information is provided in the section of Chapter 6 titled Beyond Volume 3 Research.

FMVSS No. 105: Hydraulic and Electric Brake Systems

FMVSS No. 105 "specifies requirements for hydraulic and electric service brake systems, and associated parking brake systems" (S1). The stated purpose "is to insure [sic] safe braking performance under normal and emergency driving conditions" (S2). While the scope and purpose of FMVSS Nos. 105 and 135 are nearly identical, the vehicles to which they apply differ. FMVSS No. 105 applies to "multi-purpose passenger vehicles, trucks, and buses with a GVWR [gross vehicle weight rating] greater than" 3,500 kg (7,716 lb) "that are equipped with hydraulic or electric brake systems," whereas FMVSS No. 135 applies to the same classes of vehicles plus passenger vehicles with GVWRs of 3,500 kg (7,716 lb) or less.

Technical Translations

The primary themes to address in the translations are the references to driver for control of the parking and service brake, the specification of an input or control force, and the requirements for communication of the brake system state. General language that accommodates the existence of both human and ADS control was used.

Unlike FMVSS No. 135, FMVSS No. 105 does not tie the inputs needed to apply the brakes to the brake pedal. Instead, it tends to use more generic language such as "brake control" and "control force." This type of language does not necessarily imply a human is interfacing with the control, which makes these requirements more directly applicable to an ADS-DV as written. For sections that specify force requirements, potential translation options limit the force requirements to human operation or make the input requirements dependent on the target output (e.g., "the brake system input force will be sufficient to maintain the deceleration rate," S5.1.4.3, Option 2).

Communication to the driver is specified predominantly with indicator lamps in FMVSS No. 105. The proposed translation options use the more generic "warning signal" and, when applicable, note specific requirements for the human. In addition, since some of the conditions indicate a service issue, one translation option includes the concept of communicating the information to a service required log to store a record of the fault states, as discussed in Chapter 2.

Potential Considerations

For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping criteria. This approach ensures that the performance requirements are met independent of a particular design or input for the ADS-DVs' service brake system.

For the provisions addressing warning indicators, "signal" is used instead of "indicator." An option is also provided to communicate the signal to a service required log located in the occupant compartment, as discussed in Chapter 1. Note that the communication of the ABS state, particularly during a malfunction condition, falls within the larger discussion of what and to whom vehicle state information should be provided, which is also discussed in Chapter 1 of this report, and in the Volume 1 and 2 reports.

Test Procedures

For FMVSS No. 105, only a few portions of the test procedures were assessed as potential barriers. Potential translation options followed the same approach used in the regulatory language. The proposed options for the input interface use more generic language (e.g., service brake input versus pedal force, indicator lamp versus warning signal). For specific force requirements, the potential translation options apply the input force constraints to the human driver and allow an ADS to provide whatever input is needed to meet the specified performance requirements (e.g., the service brake input will be sufficient to meet the performance requirements). As stated previously, the design of a braking system for an ADS-DV may have many options regarding where and how the input is applied. Consequently, providing translation options that include specific input requirements may have the unintended effect of implying a design. While the current options presented attempt to provide design flexibility while ensuring that the current brake performance standards (e.g., stopping distance) are maintained, additional research could provide insight into potential brake system designs and subsequent input criteria for the brake system tests.

Potential Considerations

Test execution may require the ADS-DV to operate in a way that is different than it is designed to operate during normal operations (e.g., decelerate at a specific magnitude). Testing the functionality of the warning signals will be dependent on what information is required to be provided and to what entity. For example, a translation option requires a warning signal to be provided to a human occupant and the ADS. The means to verify the signal to the human remains, however, and the means to verify the signal to the ADS will need to be defined. Previous work in the project presented potential options as to how this could be done (Volume 1).

Stakeholder and SME Review Input

Stakeholder and SME reviewers generally agreed with the potential translation options provided. There were several comments reiterating the importance of providing telltales to the occupants of an ADS-DV. Regarding the input force, some reviewers felt that it may be important to define the input range for the service brake system like what is present for human drivers currently.

Though outside the scope of the project, a few comments were related to the potential need to regulate the ADS in conjunction with the brake system to ensure the safety intent. For example, one reviewer stated, “In both FMVSS No. 105 and 121 the stated purpose of the FMVSS are to ensure safe braking performance under normal and emergency conditions. However, this implies that a driver would use the brakes in those conditions to ensure the safe operation of the vehicle. Even if the brakes under either of these FMVSSs were compliant, a collision will occur if the ADS fails to react accordingly.”

Standards Incorporated by Reference

FMVSS No. 105 references the following standards: ASTM E1337-90, ASTM E1136-93, and ASTM E274-7 for road surface friction; SAE J227a (for the state of charge of propulsion batteries); SAE J299 (stopping distance test procedure) and SAE J972, paragraph 3.3 and 4.3 (defines a moving barrier). These references are independent of ADS-DVs and do not present a barrier.

FMVSS No. 121: Air Brake Systems

This standard “establishes performance and equipment requirements for braking systems on vehicles equipped with air brake systems.” (S1). The purpose of FMVSS No. 121 is “to insure [sic] safe braking performance under normal and emergency conditions.” (S2). This standard applies to trucks, buses, and trailers equipped with air brake systems, with exclusions for certain special-purpose trucks, buses, and trailers, as specified in S3.

Technical Translations

The primary potential regulatory barriers to be addressed by the translation are the references to a “driver,” the use of the term "treadle," which implies a foot-operated pedal, and the use of illuminated telltales for communicating information to the “driver.”

One of the applicability exclusions (S3(d)) pertains to relatively low-speed trucks with an unloaded vehicle weight that is no less than 95 percent of its GVWR and no capacity to carry occupants other than the driver and operating crew. The translations in Option 1 clarify that a human driver need not be present during operation of ADS-DVs. The existing language was retained in Option 2.

Translation options for the potential barriers to ADS-DVs in S4, Definitions, pertain to muscular forces applied by a human driver and the use of the word “treadle.” The reference to muscular force is addressed with a translation in Option 1 by removing the qualification that the force is provided by human muscle and retains the word “driver” by using the definition that refers to both a human driver and the ADS. Option 2 removes the reference to “driver” and replaces the term “applying force,” referring instead to components, such as “activation of the service brake input control.” The reference to the treadle is retained in Option 1. Text is added to Option 2 to clarify the language for the valve which is controlled by the treadle. Option 3 removes the term “treadle” and replaces it with a generic “input.”

The references to visual information that must be presented to human drivers, such as a pressure gauge (S5.1.4), warnings of low service brake reservoir pressure (S5.1.5), and ABS malfunctions (S5.1.6.2), present some potential regulatory barriers, since visual information is not a viable means of communication to an ADS. The translation approach for all indicators and telltales included these options: Option 1 would require communication to the ADS only; Option 2 would require communication to the ADS and to all DSPs (e.g., including sleeper berth or bus occupant DSPs); Option 3 would require communication to the ADS and to an occupant seated in the position covered by the current standard (the left, front outboard DSP); and Option 4 would require communication to the ADS and to a service required log (which could be available to occupants, technicians, or inspectors).

References to human driver controls occur throughout the standard. The reference to a brake switch that lights the stop lamps in S5.1.7 states that a vehicle must have a switch that lights the stop lamps when the service brake control is pressed. The translation option maintained that the switch requirement still be associated with manually operated driving controls while generalizing for ADS-DVs by adding the term “or activated.”

References to the weight of the test driver occur in two places in the standard (S5.3.6.2 and S5.6.2). In both cases, Option 1 translated “driver” to “human driver” and allowed for the presence or absence of a test driver. Option 2 translated “driver” to “test personnel” and again allowed for the presence or absence of test personnel. Option 3 retained the current language, with the understanding that ballast can be used to replace the test driver in an ADS-DV.

S5.6.4 requires that parking brake control on heavy trucks and buses be separate from the service brake control, and that it be operable "by a person seated in the normal driving position." Three options for translation were provided. All three options separated the requirement into vehicles equipped with manually operated driving controls and ADS-DVs, and all three options stated that the parking brake control was operable by the ADS. Option 1 translated the driver position for operation to be the "human driver's DSP." Option 2 translated the driver position to be the "driver's DSP."

S6.1.3, in the Road Test Conditions section, refers to the existence of a "transmission selector control." One translation option was provided, which removed the term "selector control" and replaced it with the term "state" when referring to the transmission being in neutral. Similarly, in S6.1.8, which refers to the "gear appropriate" for a speed of 40 mph, the term was retained in the first option, since the requirement does not refer to a manual control. However, the second option replaced the term "appropriate" with "state."

Heavy vehicles are often equipped with optional equipment that is not required but can be used to improve performance. One example referred to in FMVSS No. 121 is an interlocking axle system. The standard specifies that this option can be engaged or disengaged by drivers; however, since this optional feature may interfere with the testing of the air brakes, it must be disengaged during a compliance test. The translation addressed this feature in the first option by retaining the current language with the understanding that the human driver and ADS are equivalent under driver definition 1, in the second option by adding the terms "or ADS," and in the third option by removing the reference to the specific entity that engages or disengages the system.

Potential Considerations

The application of this standard to trucks and buses warranted a range of options to communicate information about the vehicle status to occupants through indicators and telltales. This approach was applied similarly for FMVSS No. 121 as in FMVSS No. 136, which is discussed later in this report. Four options were provided for the communication of information, such as pressure gauge indicators, warning telltales, and malfunction status telltales to occupants. The first option provided for communication to human drivers in vehicles equipped with manually operated driving controls, and communication only to the ADS in an ADS-DV. The second option provided that the information be communicated to the driver, per driver definition 2, on vehicles equipped with manually operated driving controls, as well as to the ADS and to all DSPs on ADS-DVs. The third option specified that the information be communicated to the ADS and to an occupant of the left, front outboard DSP in an ADS-DV. The fourth option was modified similarly to Option 1 by applying driver definition 1 but would also require the information to be communicated to the ADS and a service required log located in the occupant compartment that may be retrieved through an over-the-air network or at roadside inspections.

The brake shoes in air brakes move out of adjustment over time with wear. Pursuant to S5.1.8(a), this wear must be compensated for by a "system of automatic adjustment," and S5.1.8(b) requires that certain adjusters have an "indicator that is discernable when viewed with 20/40 vision from a location adjacent to or underneath the vehicle…." The status of brake adjustment is not only important to the operation of heavy ADS-DVs in the future, it is also a common challenge for fleets and drivers of vehicles equipped with manually operated driving controls today. Drivers of heavy vehicles are expected to inspect and maintain the brakes every day to assure that they are in the proper condition. The responsibility for these inspections in an ADS-DV is an important consideration.

Technology is currently available in both drum and disc brake systems that can sense and communicate brake status to the vehicle network; however, heavy vehicles are not commonly equipped with this technology. Although removing the potential barrier of requiring brake adjustment visual inspection (S5.1.8) by human drivers supports the implementation of ADS-DVs, sensing brake adjustment status and communicating it to the vehicle network could increase awareness for responsible operation personnel about the functional status of air brakes on both ADS-DVs and heavy vehicles equipped with manually operated driving controls.

Test Procedures

Two OVSC test procedures exist to support compliance testing for FMVSS No. 121: a vehicle road test procedure (S6.1) and a dynamometer test procedure (S6.2). The translation options discussed above include translations of road test conditions elements. No translation was performed for the dynamometer procedure because the assessment did not identify any potential barriers (e.g., there is no specific reference to human driver, manually operated driving controls, or input force).

The latest version of the OVSC road test procedure, issued in 2004, was translated using the same approach as was used in the translation of the regulatory language. Translations were not performed for items pertaining to manual operation of equipment and additional instrumentation added for purposes of the test. Translations were provided for the elements of the test procedure that pertain to the manually operated driving controls. It should be noted that Table II of FMVSS No. 121 has been amended since that test procedure was issued (see 78 Fed. Reg. 28, p. 9628 [February 11, 2013]).

The test procedure also required a translation for one reference to the accelerator being fully depressed in "Element D, Compressor Recharge Rate {Truck Tractors, Trucks, and Buses} (S5.1.1)." The reference occurs in the following instruction: "(3) Operate engine at vehicle manufacturer's maximum recommended rpm (fully depress accelerator) …." The first option added language to clarify that the parenthetical statement pertains to vehicles equipped with manually operated driving controls. The second option removed the parenthetical statement.

Potential Considerations

Other than the considerations described above, no significant potential considerations were identified in the OVSC test procedures. It is important to note that translating the OVSC test procedures may differ depending on the test method (e.g., human control or programmed control) used for compliance verification.

Stakeholder and SME Review Input

Three reviewers provided feedback on the translation options for FMVSS No. 121. In addition, the research team met with some of these stakeholder representatives to clarify feedback. The initial technical translations were refined based on the received input, as deemed appropriate by the research team.

A point of interest for one reviewer was the concern over whether the ABS would be a separate control from the ADS or if the performance requirements would be a function of the ADS. There may be ADS controllers in development that manage the ABS and others that may work in parallel. Whichever design is implemented by manufacturers, the vehicle must be able to satisfy the criteria provided in this standard for stopping performance and communication of malfunctions for the affected systems.

An additional concern raised by one reviewer was the lack of redundancy provided by the translations for the braking system ADS controls. One reviewer suggested that braking control redundancy may be needed in ADS-DVs to be sure that heavy vehicles can still safely brake if one part of the braking system fails. The standard does not currently require such control redundancy, and as such, requiring such redundancy would not be a "translation" of the current standard and is beyond the scope of this project.

A concern from one stakeholder regarding the translation approach to information displayed to human drivers was also repeated in reference to the ABS malfunction telltale. The concern was that the telltale lamp is intended to communicate to the driver that they should take some action to remedy the malfunction, and, therefore, the ADS may prevent vehicle operation unless the malfunction is resolved. However, FMVSS No. 121 does not currently require a human driver to take any action in response to a notification of a malfunction, so requiring the ADS to take action is beyond the scope of this project.

One final consideration came from a reviewer who suggested that an ADS-DV would require a test mode to complete the test. In contrast to the FMVSS No. 136 test procedure, the FMVSS No. 121 test procedure does not require placing the heavy vehicle in an unstable event. Because the procedure tests the vehicle in the center of a straight lane, testing of ADS-DVs is anticipated to be straightforward (i.e., not require use of a "test mode" for the tests defined in FMVSS No. 121).

Standards Incorporated by Reference

The regulation and test procedures reference several standards. The first two are incorporated into FMVSS No. 136: ASTM E1136-93, *Standard specification for a radial standard reference test tire* and in accordance with ASTM Method E1337-90, *Standard test method for determining longitudinal peak braking coefficient of paved surfaces using a standard reference test tire.* The regulation also references SAE J592, *Sidemarker lamps for use on road vehicles less than 2032 mm in overall width* and SAE J759, *Lighting identification code*. It also included in the dynamometer laboratory test procedures a reference to MIL-C-45662A for calibration system requirements. These references were not translated, as no barriers were identified for these standards incorporated by reference.

FMVSS No. 135: Light Vehicle Brake Systems

FMVSS No. 135 "specifies requirements for service brake and associated parking brake systems" (S1). The stated purpose "is to ensure safe braking performance under normal and emergency driving conditions" (S2). It applies to "passenger cars…and to multi-purpose passenger vehicles, trucks and buses with a … GVWR of 3,500 [kg] (7,716 [lb]) or less" (S3).

Technical Translations

The current regulatory language specifies that the “service brakes shall be activated by means of a foot control” and the parking brake control “may be either a hand or foot control” (S5.3.1). The primary potential challenges for the translation are the specifications and references to a "pedal" and "pedal force" to operate the service brake. As with other standards, the requirements for visual and auditory warnings provide another potential challenge for translations.

The two approaches to address both above challenges use language that is more generic and that makes a distinction between human and ADS operation. The potential for an alternate to a foot control for ADS operation is introduced in S5.3.1 and then the term "service brake input" is introduced as a generic term that can include a pedal. For the visual and auditory warnings (which are often referred to as “indicators” in the standard, but which are actually “telltales” under the definitions in FMVSS No. 101), the translations use the term “signals,” which may include visual and auditory signals when they apply to a human. In addition, since some of the conditions indicate a service issue, one translation option includes the concept of communicating the information to a service required log to store a record of the fault states.

Potential Considerations

A range of pedal force requirements are present in the current standard to ensure that a wide range of human drivers, with a wide range of strengths, can safely stop any vehicle they are driving. For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to assure that there is sufficient input into the braking system to meet the stopping distance criteria. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface, as there would be no gain in the system to accommodate a single set of lower input forces. The suggested translation options relate the input requirements to the performance requirements for a given test condition (e.g., “sufficient service brake input to achieve the applicable performance requirements”). This approach ensures that the performance requirements are met independent of an ADS-DV’s service brake system design. Another option presented to address this potential scenario may be to require the ADS to provide a service brake input consistent with that which would be used during normal operation. This has a potential challenge of not being able to confirm whether the provided input was consistent with “normal operation” for a given ADS-DV.

It is possible that not providing input constraints for the brake system could create ambiguity for test execution. However, as discussed previously for FMVSS No. 105, current input requirements are based on human performance limitations and are necessary to ensure that most of the population is able to operate any vehicle covered by the braking standards in a safe manner as defined by the performance requirements. The design of a braking system for an ADS-DV has many more options regarding where and how the input is applied or commanded. Consequently, providing translation options that include specific input requirements may have the unintended effect of implying a design. Though the current options presented attempt to provide design flexibility while ensuring that the current brake performance standards (e.g., stopping distance) are maintained, additional research could provide insight into potential input criteria for the brake system tests.

For the provisions addressing warning telltales, the term “signal” is used instead of “indicator.” An option is also provided to communicate the signal to a service required log, as covered in the Chapter 2 discussion.

Note that the communication of the ABS state, particularly during a malfunction condition, falls within the larger discussion of what and to whom vehicle state information should be provided, as discussed in more detail in Controls, Telltales, Indicators, and Auditory Alerts section presented earlier in this report as well as in the Controls, Telltales, and Indicators section of the Volume 1 report, and the Controls, Telltales, Indicators, Symbols, Labels, Markers, and Auditory Alerts section of the Volume 2 report.

Test Procedures

The test procedures are largely specified within the regulatory language itself. The proposed translations used generic language that could apply to both human and ADS operation consistent with proposed language in the regulatory language (e.g., signal versus indicator lamp; brake system input versus pedal force). The proposed translations also removed language that assigned an action to an entity (e.g., "force the driver must apply" was changed to "force that must be applied").

Potential Considerations

Unlike many of the other FMVSS, FMVSS No. 135 specifies six tests (S7.5, S7.7, S7.8, S7.9, S7.10, and S7.11) that use the same test conditions but introduce faults or failures to evaluate the impact these have on braking performance. Most of these failures are introduced into the system prior to the start of the test run. For example, prior to executing the Antilock Function Failure test (S7.8), a failure is introduced to the system by disconnecting “the functional power source, or any other electrical connector that creates a functional failure” (OVSC Laboratory Test Procedure 14.12.2.G.1). While such a failure would generate a warning telltale, a driver can choose to ignore that telltale, so the vehicle must be able to stop within the specified distance despite the failure. However, it is possible that an ADS-DV would be programmed to not operate or to operate at a limited capacity with this type (or other types) of brake system failure (discussed in the following paragraph). If that were the case, execution of these tests would require the ADS-DV to operate in a state that it would not normally operate in.

Another potential consideration regarding testing is how a failure is introduced and to what degree. The current standard seems to assume a single point failure mode (e.g., unplugging the power source to the ABS), to introduce a functional failure. However, if the manufacturer of an ADS-DV chooses to include redundancy in the braking system, the introduction of a single point failure may not have the desired effect on the braking system. This may require the introduction of a secondary failure mode to test the braking performance in a failed state. The Antilock Function Failure test discussed above states: “Disconnect the functional power source or any other electrical connector that creates a functional failure.” Conversely, with respect to a hydraulic circuit failure, S7.10.3(f) specifies: “Alter the service brake system to produce any single failure,” providing the tester with a choice among failure modes. The hydraulic circuit failure provision suggests that only one of the identified failure modes would occur at a single time. Performance criteria with more than one failure could impose a more stringent requirement upon ADS-DVs. This may not be limited to ADS-DVs; a manufacturer of a vehicle equipped with manually operated driving controls could also include a redundancy in the braking system, with the same potential effect. These considerations will be investigated further under this project and additional discussion can be found in Chapter 7’s Beyond Volume 3 Research.

Testing the functionality of the warning signals will be dependent on what information is required to be provided and to what entity. For example, for any translation option that requires a warning signal to be provided to the ADS, a test procedure may be needed to specify how to verify that the signal has been communicated to the ADS (and that the signal is no longer communicated after the condition in question has been resolved). Previous work in the project presented potential options as to how this could be done (Volume 1 report).

Stakeholder and SME Review Input

In general, stakeholders approved of the options presented. Some of the reviewers were consistent in their opinion that all warnings should be provided to all occupants of an ADS-DV (i.e., all telltales should be visible at all DSPs). Others suggested potential research was needed on the distinction of roles (i.e., users, operator, and dispatcher) in checking ADS-DV conditions. As such, some reviewers suggested warnings should only be provided to the ADS. There was some consistency in reviewers' comments related to critical operation conditions being presented to an occupant, operator, or dispatcher. There were also comments on whether ADS-DVs would have a separation between the ABS and the ADS. This may be a relevant consideration, but it is beyond the scope of this translation project.

Standards Incorporated by Reference

Two ASTM references—ASTM E1137-90 and ASTM E1136-93—are independent of ADS-DVs and do not present a barrier. Additionally, ISO 10012-1:1992 (Quality Assurance Requirements for Measuring Equipment) and ANSI/NCSL Z540.1-1994 (R2002) (Calibration Laboratories and Measuring and Test Equipment - General Requirements) were incorporated in the laboratory test procedures and were identified as not presenting a barrier. Sections 3.2.1 through 3.2.4, 3.3.1 through 3.3.2.2, 3.4.1 and 3.4.2, 4.2.1, 5.2, 5.2.1, and 5.3 of SAE Recommended Practice J227a were also determined to be independent of ADS-DVs and thus presented no barrier.

FMVSS No. 136: Electronic Stability Control Systems for Heavy Vehicles

This standard "establishes performance and equipment requirements for ESC systems on heavy vehicles" (S1). The purpose of FMVSS No. 136 is "to reduce crashes caused by rollover or by directional loss-of-control." (S2). This standard applies to truck tractors and buses with a GVWR of greater than 11,793 kg (26,000 lb), with exclusions for certain special-purpose heavy vehicles as specified in S3.1 and S3.2.

Technical Translations

Like FMVSS No. 126, which is discussed in the Volume 2 report, FMVSS No. 136 assumes the existence of a steering wheel operated by a human driver. Therefore, the technical translation approach focused on translating the references to a driver and to a human-controlled steering wheel. FMVSS No. 136 defines the attributes of the ESC, which include assisting the driver by monitoring steering inputs and by modifying engine torque, as specified in the definitions in S4. Among the standard's definitions, translation options were suggested to address the references to a "driver," both (1) by retaining the existing language through application of the broad definition of driver to apply to both a human and an ADS (Option 1), and (2) by removing the references to "driver" (Option 2).

Similarly, alternative translations were suggested to address the reference to "driver" in the exclusion in S3.1(c) of certain truck tractors. Option 1 would clarify that the provision applies only if a human driver is present, and not to ADS-DVs. The existing language was retained in Option 2 since the definition of "driver" for Option 2 means a human driver. Similar options were suggested for the reference to the "driver's seating position" in the definition of a "perimeter-seating bus."

As discussed in the Introduction, the translation approach was designed to ensure that not only will steering and torque inputs from a human driver continue to be modified by the ESC in heavy vehicles equipped with manually operated driving controls, but steering and torque inputs from the ADS will also be appropriately modified by the ESC in heavy ADS-DVs. One example is S5.3.2.1, which states, "The ESC system must reduce the driver-requested engine torque by at least 10 percent…" The reference to "driver-requested engine torque" was addressed in Option 1 by retaining the current language, since under that option, the term "driver" means either a human driver or an ADS. In Option 2, the requirement was stated separately for vehicles with human drivers and ADS-DVs. Thus, under that option, the following new provision would be added: "For each ADS-DV, the ESC system must reduce the ADS-requested engine torque by at least 10 percent."

FMVSS No. 136 also requires vehicles to detect ESC malfunctions and to communicate the existence of such malfunctions to the "driver" by means of an "indicator lamp" (S5.4). Since a telltale lamp would not be a viable means of communication to an ADS, 4 of the 10 communication options developed in Volume 1 were considered for the communication of ESC malfunctions in an ADS-DV. The first option would communicate the ESC malfunction to the ADS but would not require communication to any of the occupants in an ADS-DV. Under the second option, the existence of the malfunction would have to be communicated to the ADS and to all DSPs. The third option was like Option 2, except a different translation of the driver position was provided for vehicles with manually operated driving controls than that which was provided for communication to occupants in ADS-DVs (i.e., "left, front outboard DSP"). Under the fourth option, the information would have to be communicated to the ADS and to a service required log located in the occupant compartment.

Under S5.4.1 of the current standard, with two exceptions, the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists. (The exceptions are that the telltale must be illuminated temporarily as a check-of-lamp function [S5.4.3], and that it may be used in a flashing mode to indicate ESC operation [S5.4.6].) The exceptions are not relevant to the communication of malfunction information to an ADS (i.e., since there is no lamp, there is no need for a check-of-lamp function). Therefore, Option 1 for S5.4.1 did not refer to the telltale exceptions in connection with the communication of malfunction information to the ADS in an ADS-DV. Option 2 maintained the exceptions for the telltales at the DSPs of an ADS-DV. Option 3 was the same as Option 2. Option 4 was similar to Option 1, except it would require the continuous communication of the ESC malfunction information to both the ADS and to a service required log located in the occupant compartment.

Only one technical translation option was developed for S5.4.2–S5.4.5; this was to translate the first word in each paragraph from "The" to "Each." This simple approach allows the requirement to apply only when the vehicle is equipped with an ESC malfunction telltale. To further explain, since Option 1 does not require a telltale in an ADS-DV, those sections would not apply to ADS-DVs under that option.

The test conditions pertaining to the test driver were translated with several options. Options 1 and 2 translated "driver" by using the driver definitions and recognized the possibility that a test driver would not be present during the test. Option 3 removed the reference to the test driver and replaced it with the term "test personnel."

Heavy vehicles are often equipped with optional equipment that is not required but that can be used to improve performance. Two examples that are referred to in FMVSS No. 136 are engine braking and interlocking axle systems. The current standard recognizes that these options are adjustable by human drivers. These additional features may interfere with the ESC testing; therefore, the current standard provides that they must be disengaged during the test. The translation addressed these adjustable features in Option 1 by retaining the current language, where "driver" refers to both the ADS and to a human driver. Option 2 also retained the current language, where "driver" refers to only a human driver but specifies that the engine brake will not be engaged during the test. Option 3 removes the reference to the specific entity that engages or disengages the system.

The ESC test procedure in the current standard requires that a human driver fully depress the accelerator pedal throughout the J-Turn test maneuver and release the accelerator pedal when the vehicle is slowed by more than 4.8 km/h (3.0 mph) below the entrance speed. Option 1 for S7.7.2, S7.7.2.1, and S7.7.3.2 addressed the translation of "accelerator pedal" by replacing it with "throttle," which would be interpreted to apply to the motor speed controller on heavy vehicles powered by electric motors (see FMVSS No. 124 S4.2). Option 2 for these paragraphs translated the term "accelerator pedal" to "accelerator" that is fully actuated or no longer actuated. The references to the engine and demanded torque were translated to provide options for the ADS to command the torque through control methods that do not use an accelerator pedal.

Potential Considerations

Among special purpose buses, the definition of "perimeter-seating bus" has been translated to address the reference to the "driver's seating position." One other consideration is that this definition was translated to remove any barriers for ADS-DVs, but the purpose of defining a perimeter-seating bus in this standard is to identify a type of bus that is excluded from the application of the standard.

The communication of ESC malfunction information to occupants of truck tractors (which are purpose-built to transport cargo) and of buses (which are purpose-built to transport large numbers of occupants) creates a broad range of considerations for the translation of the requirements for ESC malfunction telltales on heavy ADS-DVs. For truck tractors, the option to communicate only to the ADS is plausible since the vehicle may not need to be equipped with any DSPs to accomplish its purpose to transport cargo. However, it may be appropriate to assure that one or more human occupants of an ADS-DV is informed of any ESC malfunction. Under Option 2 for S5.4, the information would be provided to occupants at all DSPs, but as discussed in Volume 2, other possible alternatives could be to require a telltale at one or more DSPs specified in the standard, or at one or more DSPs to be specified by the vehicle manufacturer.

On both ADS-DV truck tractors and buses, requiring vehicle status information to be provided in an information center located in the left, front of the occupant compartment (i.e., where the driver's DSP is most likely to be in a conventional vehicle) may provide the opportunity for a passenger monitor on an ADS-DV to check the ESC status throughout the trip. Finally, truck tractors are often inspected by technicians to help ensure that trailers are properly connected to the correct truck tractors and that cargo is properly secured. These technicians may be equipped with a separate device that can be connected to the truck tractor's service required log or CAN-bus to identify a potential ESC malfunction.

Test Procedures

Test procedures are included in the regulation under S7. The translation options listed above include translations of elements of the regulation test procedure. Those translation options were applied similarly in the OVSC test procedures for these categories: special-purpose vehicles exemptions, testing personnel replaced with ADS, collection of demand and feedback torque, disengagement of optional equipment, activation of the accelerator pedal, and references to telltale lamps. The translations of the OVSC test procedures were straightforward; none of the elements involved further examination of the functionalities.

The OVSC test procedures also involved translations for two references to the foot brake. Element "E. Data Acquisition System (DAS)" states that the foot brake control (treadle valve) pressure versus time should be continuously recorded. The term "foot" was translated to "service" brake. The same translation was used to address element "H. Pressure Transducers," which currently states that the foot brake control (treadle valve) air pressure be measured.

Potential Considerations

Research is ongoing to compare the translations from FMVSS No. 136 to FMVSS No. 126 to determine if the FMVSS No. 126 translation approach or considerations can be applicable to both standards. The two standards use different test methods that may be functionally similar, so there may be translation approaches or considerations from FMVSS No. 126 that may be applicable to FMVSS No. 136. One consideration that will be explored as part of this work is the input for torque demand during the Roll Stability Control Test (S7.7.3) (J-Turn maneuver). The plans for these two studies are discussed further in Chapter 7, Beyond Volume 3 Research.

Stakeholder and SME Review Input

Five reviewers provided feedback on the translation options for FMVSS No. 136. In addition, the research team met with representatives of these stakeholders to clarify feedback. The initial technical translations were refined based on the received input, as deemed appropriate by the research team.

One reviewer expressed concern over whether the ESC would be a separate control from the ADS or if the performance requirements would be a function of the ADS. This may be a relevant consideration, but one that is beyond the scope of this translation project. There may be ADS controllers in development that also manage the ESC and other designs, in which there is a separate ESC system that works in parallel. Whichever design is implemented by manufacturers, the demand and feedback of torque must be available to be measured and compared to ensure engine torque reduction. Furthermore, the vehicle must be able to satisfy the criteria provided in this standard throughout the J-Turn maneuver.

One reviewer noted an additional concern as to whether the ESC performance requirements, which were based on the capabilities of human drivers, would be adequate to ensure safety in an ADS-DV. The reviewer suggested that an ADS may induce stronger and more abrupt steering maneuvers that could negate the balanced approach that is expected through the cooperation of the ESC and human drivers today.

One stakeholder concern that surfaced in the past regarding the translation approach to telltales was also repeated in reference to ESC malfunctions. The concern was that a telltale lamp today is intended to communicate to the driver that they should take some action to remedy the malfunction, and, therefore, the ADS may be required to prevent vehicle operation unless the malfunction is resolved. However, FMVSS No. 136 does not currently require the human driver to take any action in response to a notification of a malfunction. Requiring the ADS to act is beyond the scope of this project.

One final input from a reviewer that could be considered for future research relates to the possible creation of a test mode. The reviewer suggested that an ADS-DV would not be able to execute the test procedure without a test mode that instructs the ADS to make a maneuver that creates instability; this would be followed by a controlling action by the ADS or parallel ESC later in the test that returns the ADS-DV to stable operation. Furthermore, the reviewer suggested that the test procedures should also include requirements for how the test mode should function.

Standards Incorporated by Reference

Two ASTM standards were incorporated by reference: ASTM E1136-93, "Standard Specification for A Radial Standard Reference Test Tire," and in accordance with ASTM Method E1337-90, "Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire." Neither of these standards presents a regulatory barrier.

FMVSS Nos. 106 and 116

The purpose of these standards is to reduce deaths and injuries as a result of failures in the brake system from pressure or vacuum loss due to hose or hose assembly rupture or due to improper or contaminated fluid. Requirements for motor vehicle brake hose, brake hose assemblies, brake hose end fittings, fluids for use in hydraulic brake systems of motor vehicles, containers for these fluids, and labeling are specified.

FMVSS Nos. 109, 117, 119, 129, and 139

The purpose of these standards is to ensure passenger safety by specifying requirements for pneumatic and non-pneumatic tires. These standards encompass passenger car tires, tires for vehicles with GVWR of more than 10,000 pounds, specialty tires, motorcycle tires, retreaded tires, and radial tires. Requirements for tire dimensions, load ratings, labeling, markings, and performance along with the laboratory test procedures for verifying compliance are specified.

Technical Translations

These standards are equipment standards specifying requirements for brake hoses, brake fluids, and pneumatic and non-pneumatic tires. Regulatory barriers for the compliance verification of ADS-DVs that lack manually operated driving controls were not identified and the standards could be applied to ADS-DVs as written without technical translation. Therefore, no potential considerations were captured, stakeholder and SME feedback was not requested, and the standards incorporated by reference were not reviewed.

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Chapter 3. Low-Speed Vehicles

Key Considerations

FMVSS No. 500 specifies requirements for low-speed vehicles (LSVs), which are defined as four-wheeled vehicles with a GVWR of less than 3,000 pounds that can attain a speed of 20 mph yet have a maximum speed of not more than 25 mph. FMVSS No. 500 requirements incorporate both the 100-series standards (e.g., mirrors and lighting requirements) and the 200-series standards (e.g., windshield and seat belt assembly requirements). The provision that may be a regulatory barrier to the development of ADS-DV LSVs is the requirement that the vehicle comply with the rear visibility specifications in S6.2 of FMVSS No. 111 (see S5(b)(11) of FMVSS No. 500). The Volume 2 report discusses the potential regulatory barriers and the complexities identified to develop technical translation options for FMVSS No. 111. Further research is ongoing to consider ADS sensor capabilities and to evaluate and characterize critical sensor attributes, including degradation effects for ADS applications (See Chapter 6, Beyond Volume 3 Research).

FMVSS No. 500

The purpose of this standard is to ensure that LSVs operated on the public streets, roads, and highways are equipped with at least the minimum motor vehicle equipment appropriate for motor vehicle safety.

Technical Translations

The sections requiring technical translations are outlined in Table 5. S5(6). "Requirements" and 6.3.1. "Vehicle conditions" could be addressed with straightforward translations. S5(11). "Requirements'" current language could be retained with the understanding that additional research may be warranted to address potential regulatory barriers identified in FMVSS No. 111 S6.2.

Table 5. FMVSS No. 500 Low-Speed Technical Translation Examples

FMVSS No. 500, S5(6). Requirements	
Regulatory Language	**Technical Translation Example**
An exterior mirror mounted on the driver's side of the vehicle and either an exterior mirror mounted on the passenger's side of the vehicle or an interior mirror,	For vehicles equipped with manually operated driving controls, an exterior mirror mounted on the driver's designated seating position (DSP) side of the vehicle and either an exterior mirror mounted on the opposite side of the vehicle or an interior mirror,
FMVSS No. 500, S5(11). Requirements	
Regulatory Language	**Technical Translation Example**
Low-speed vehicles shall comply with the rear visibility requirements specified in paragraphs S6.2 of FMVSS No. 111.	Retain current language, with the understanding that S6.2 may be revisited to address its applicability to ADS-DVs.
FMVSS No. 500, 6.3.1. Vehicle Conditions	
Regulatory Language	**Technical Translation Example**
The test weight for maximum speed is unloaded vehicle weight plus a mass of 78 kg (170 lb), including driver and instrumentation.	The test weight for maximum speed is unloaded vehicle weight plus a mass of 78 kg (170 lb), including driver (if present) and instrumentation.

Potential Considerations

A human driver uses equipment such as mirrors and a rearview image to obtain a clear and reasonably unobstructed view to the rear. Similarly, the ADS uses information from sensors to measure and interpret the environment around the ADS-DV. NHTSA considered the mirror requirements as a part of Nuro's petition for a temporary exemption from three provisions of FMVSS No. 500 and specific to Nuro's vehicle (i.e., low-speed, ADS-equipped vehicle equipped lacking both manual controls and occupant carrying capacity). The Executive Summary of the Nuro petition granted by NHTSA as of February 11, 2020, states:

> [T]he requirement for internal and external mirrors is meant to improve situational visibility for human drivers, who internalize information about the driving environment through direct or reflected line of sight. In a vehicle without manual controls that operates using an ADS, mirrors do not serve a safety purpose because the ADS perceives the driving environment using cameras and sensors that directly feed it information about the vehicle's surroundings.

The example translation option specifies the mirror requirements, S5(6), for vehicles with manually operated driving controls (i.e., vehicles operated by a human). ADS-DVs could be included in this section by using front left DSP instead of driver's DSP and removing the specification for "vehicles equipped with manually operated driving controls."

The translation example for S5(11) retains the current language: "low-speed vehicles shall comply with the rear visibility requirements specified in paragraph S6.2 of FMVSS No. 111." FMVSS No. 111, S6.2 specifies that a rearview image display meets the field-of-view requirements. The Volume 2 report concluded that additional research may be warranted to complete the technical translation option development for FMVSS No. 111, including the requirements specifying the field of view to the rear, the way information would be communicated to the ADS (and possibly to the occupants of an ADS-DV), and the associated test procedures.

Finally, FMVSS No. 500 includes references to the front and rear and may need to be considered further for bidirectional vehicles. The approaches developed in Volume 1 could be used to address bidirectional vehicles in the context of this standard.

Stakeholder and SME Review Input

No feedback was requested.

Standards Incorporated by Reference

The external standards are associated with pavement friction: ASTM E1136, *Standard specification for a radial standard reference test tire*, in accordance with ASTM Method E 1337-90, *Standard test method for determining longitudinal peak braking coefficient of paved surfaces using a standard reference test tire.* These are referenced in other standards (e.g., FMVSS Nos. 135 and 136) and neither presents a regulatory barrier. The standards from external organizations ISO and ANSI/NCSL do not present a regulatory barrier either. See Appendix D for complete list.

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Chapter 4. Crashworthiness Standards

Overview

This chapter summarizes the technical translation options of the crashworthiness standards covered in Volume 3 research: FMVSS Nos. 209, 212, 213, 217, 218, 219, 220, 221, 222, 301, 302, 303, 304, 305, and 401. The aim of these standards is to reduce the risk of vehicle occupant injury in the event of a crash. The goal of this effort was to provide options for translating the language of each standard to accommodate ADS-DVs while maintaining the current requirements for conventional (i.e., non-ADS-equipped) vehicles. In addition to the FMVSS, the associated OVSC test procedures used by NHTSA to verify compliance were reviewed and it was determined that no potential considerations exist at this time.

FMVSS Nos. 209, 212, 213, 217, 218, 219, 220, 221, and 222

The purpose of these standards is to reduce the number of deaths and the severity of injuries to children, vehicle occupants, school bus occupants, and motorcyclists by preventing ejection, reducing head impacts, and specifying performance requirements for seat belt assemblies, child restraint systems, windshield contact and retention, motorcycle helmets, school bus emergency exits, protection against structures within the vehicle during crashes and sudden driving maneuvers, and the structural integrity of school bus bodies.

FMVSS Nos. 301, 302, 303, and 304

The purpose of these standards is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after motor vehicle crashes and from fires that originate in the interior of the vehicle from sources such as matches or cigarettes.

Technical Translations

NHTSA has proposed no translation research is necessary. See NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020). "We have tentatively determined that no change is needed for FMVSS Nos. 202a, 209, 210, 212, 213, 217, 218, 219, 220, 221 and 222.[53]." Further, [53] states, "In addition, we have determined that no change is need for FMVSS Nos. 301, 302, 303, and 304. Any changes to FMVSS No. 305 will be discussed in future notices." Therefore, no potential considerations were captured, stakeholder and SME feedback was not requested, and the standards incorporated by reference were not reviewed for any of the FMVSS noted in the preceding quote, except for Nos. 217 (originally included in above quote) and 305, which are discussed in the following sections.

FMVSS Nos. 301 and 303 include references to frontal and rear moving barrier crashes and may need to be considered further for bidirectional vehicles. The approaches developed in Volume 1 could be used to address bidirectional vehicles in the context of these standards.

FMVSS No. 217

The purpose of this standard is to minimize the likelihood of occupants being thrown from the bus and to provide a means of readily accessible emergency egress.

Technical Translations

This standard was identified in the NPRM as one of the FMVSS where no change would be required, based on the stated scope of the NPRM. However, the NPRM did not intend to fully address information communicated to occupants in an ADS-DV, as this would be left to a future NHTSA rulemaking. FMVSS No. 217 specifies a continuous audible notification to the human driver and to those passengers sitting in the vicinity of the emergency exit when the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position. The sections that may require technical translations are outlined in Table 6. S5.3.3.1 and S5.3.3.2 and could be addressed by applying the approaches and options for information communicated to occupants that were developed in Volume 1. The intended recipient(s) of the audible notification is explicitly stated in the requirements; for example, "the driver's seating position and in the vicinity of the emergency exit door." The following technical translation options could be considered: (a) To the ADS and in the vicinity of the emergency exit, (b) In the vicinity of the emergency exit, (c) To the ADS and to the left front DSP and DSPs in the vicinity of the emergency exit, and (d) To the ADS and to all DSPs. The following technical translation example uses Option (a) and driver definition Option 2 (see Appendix A).

No potential considerations were identified. Therefore, no stakeholder or SME feedback was requested, and no standards incorporated by reference were reviewed.

Table 6. FMVSS No. 217 Bus Emergency Exits and Window Retention and Release

MVSS No. 217, S5.3.3 School Bus Emergency Exit Release	
S5.3.3.1	
Regulatory Language	**Technical Translation Example**
When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency exit door shall allow manual release of the door by a single person, from both inside and outside the passenger compartment, using a force application that conforms to S5.3.3.1 (a) through (c) of this section, except a school bus with a GVWR of 10,000 pounds or less is not required to conform to S5.3.3.1 (a). The release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of the emergency exit door.	When tested under the conditions of S6., … any failure of the vehicle's power system. For vehicles equipped with manually operated driving controls, when the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of the emergency exit door. For ADS-DVs, when the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position, a continuous warning sound shall be audible in the vicinity of the emergency exit door and communicate the release mechanism state to the ADS.

MVSS No. 217, S5.3.3 School Bus Emergency Exit Release	
S5.3.3.2	
Regulatory Language	**Technical Translation Example**
When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency exit window shall allow manual release of the exit by a single person, from inside the passenger compartment, using not more than two release mechanisms located in specified low-force or high-force regions (at the option of the manufacturer) with force applications and types of motions that conform to either S5.3.3.2 (a) or (b) of this section. In the case of windows with one release mechanism, the mechanism shall require two force applications to release the exit. In the case of windows with two release mechanisms, each mechanism shall require one application to release the exit. At least one of the force applications for each window shall differ from the direction of the initial motion to open the exit by no less than 90° and no more than 180°. Each release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When a release mechanism is open and the vehicle's ignition is in the "on" position, a continuous warning shall be audible at the drivers seating position and in the vicinity of that emergency exit.	When tested under the conditions of S6., … and notwithstanding any failure of the vehicle's power system. For vehicles equipped with manually operated driving controls, when a release mechanism is open and the vehicle's ignition is in the "on" position, a continuous warning shall be audible at the drivers seating position and in the vicinity of that emergency exit. For ADS-DVs, when a release mechanism is open and the vehicle's ignition is in the "on" position, a continuous warning shall be audible in the vicinity of that emergency exit and communicate the release mechanism state to the ADS.

FMVSS No. 305

The purpose of this standard is to reduce deaths and injuries during and after a crash that occur because of electrolyte spillage from electric energy storage devices, intrusion of electric energy storage/conversion devices into the occupant compartment, and electrical shock, and to reduce deaths and injuries during normal vehicle operation that occur because of electric shock or driver error. This standard specifies requirements for limitation of electrolyte spillage and retention of electric energy storage/conversion devices during and after a crash, and protection from harmful electric shock during and after a crash and during normal vehicle operation.

Technical Translations

This standard specifies audible or visible notifications to the human driver for loss of isolation and when the vehicle is in active driving mode. The sections that may require technical translations are outlined in the following tables. S5.4.4 "Electrical isolation monitoring," S5.4.6 "Mitigating driver error," and S8(5) "Test procedure for on-board electrical isolation monitoring system" could be addressed with straightforward translations.

The translation example uses driver definition Option 1 (Volume 1 report). However, driver definition Option 2 could also be implemented, as the current text could be retained for S5.4.6.1 and S5.4.6.2 (Table 7). The communication of information in ADS-DVs could be addressed using one of the 10 options set out in the Volume 1 report. These range from communicating the information to the ADS only, as shown in Table 7, to communicating to the ADS and one or all DSPs, to not communicating the information to either the ADS or any DSPs, and various combinations of these options.

Table 7. FMVSS No. 305 Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection Technical Translation Examples

FMVSS No. 305, S5.4.4 Electrical Isolation Monitoring	
Regulatory Text	**Technical Translation Example**
DC high voltage sources of vehicles with a fuel cell system shall be monitored by an electrical isolation monitoring system that displays a warning for loss of isolation when tested according to S8. The system must monitor its own readiness and the warning display must be visible to the driver seated in the driver's designated seating position.	DC high voltage sources of vehicles with a fuel cell system shall be monitored by an electrical isolation monitoring system that displays a warning for loss of isolation when tested according to S8. The system must monitor its own readiness and the warning display must be visible to a driver seated in the driver's designated seating position. For ADS-DVs, the warning must be communicated to the ADS.
FMVSS No. 305, S5.4.6 Mitigating Driver Error	
FMVSS No. 305, S5.4.6.1 Indicator of Possible Active Driving Mode	
Regulatory Text	**Technical Translation Example**
At least a momentary indication shall be given to the driver each time the vehicle is first placed in possible active driving mode after manual activation of the propulsion system. This requirement does not apply under conditions where an internal combustion engine provides directly or indirectly the vehicle's propulsion power when the vehicle is first placed in a possible active driving mode after manual activation of the propulsion system.	At least a momentary indication shall be given to a human driver…
FMVSS No. 305, S5.4.6.2 Indicator of Possible Active Driving Mode When Leaving the Vehicle	
Regulatory Text	**Technical Translation Example**
When leaving the vehicle, the driver shall be informed by an audible or visual signal if the vehicle is still in the possible active driving mode.	When leaving the vehicle, a human driver…
FMVSS No. 305, S8(5). Test Procedure for On-Board Electrical Isolation Monitoring System	
Regulatory Text	**Technical Translation Example**
The electrical isolation monitoring system indicator shall display a warning visible to the driver seated in the driver's designated seating position.	The electrical isolation monitoring system indicator shall display a warning visible to the driver seated in the driver's designated seating position. For ADS-DVs, the electrical isolation monitoring system shall communicate a warning to the ADS.

Potential Considerations

Under the examples above, warning information would be communicated only to the ADS, but NHTSA might conclude that there is a safety need to alert one or more of the occupants of an ADS-DV. As discussed in the technical translation section above, the options developed in the Volume 1 report could be applied to this case.

Section 5.4.6 specifies requirements to indicate to a human driver that the vehicle is in possible active driving mode to mitigate driver errors. Indications to a human driver are required after manual activation of the propulsion system (S5.4.6.1) and when the driver leaves the vehicle (S5.4.6.2). Since the occupants of an ADS-DV are not operating the vehicle, they may not need to be informed that the vehicle is in active driving mode. Furthermore, the ADS is in full control of vehicle operation and would know the operational state, so there may be no need to communicate that information to the ADS. However, if deemed appropriate, under driver definition Option 1, the current language for S5.4.6.1 could be retained, since the use of the word “driver” would cause the requirement to apply to vehicles with and without manually operated driving controls. This may not be necessary for S5.4.6.2 since the ADS can never leave the vehicle.

Stakeholder and SME Review Input

No feedback was requested.

Standards Incorporated by Reference

The incorporated references by external organizations ASTM, ISO, and ANSI/NCSL do not present a regulatory barrier. See Appendix D for complete list.

FMVSS No. 401

“This standard establishes the requirement for providing a trunk release mechanism that makes it possible for a person trapped inside the trunk compartment of a passenger car to escape from the compartment.” (S1)

Technical Translations

This standard only applies to passenger cars that have a trunk compartment. This standard does not apply to passenger cars with a back door. If the trunk is large enough so that the 3-year-old child dummy described in Subpart C of Part 572 can be placed inside the trunk compartment, and the trunk lid can be closed and latched, then the passenger vehicle must have an automatic or manual release mechanism inside the trunk compartment that unlatches the trunk lid. As written, this would be applicable to vehicles with manual steering controls as well as ADS-DVs. Therefore, no stakeholder and SME feedback was requested, and the standards incorporated by reference were not reviewed. The only potential consideration to capture for FMVSS No. 401 is bidirectional vehicles. The standard and OVSC test procedure reference the front, rear, and back door. Both front and rear trunk locations are considered, which generally supports the concept of bidirectional vehicles. However, additional clarifications may be needed, and the approaches developed in Volume 1 could be used to address bidirectional vehicles in the context of the interior trunk release standard.

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Chapter 5. Crashworthiness – Fixed Unconventional Seating

FMVSS No. 208: Occupant Crash Protection

"This standard specifies performance requirements for the protection of vehicle occupants in crashes." (S1)

"The purpose of this standard is to reduce the number of deaths of vehicle occupants, and the severity of injuries, by specifying vehicle crashworthiness requirements in terms of forces and accelerations measured on anthropomorphic dummies in test crashes, and by specifying equipment requirements for active and passive restraint systems." (S2)

This chapter summarizes the technical translation options for FMVSS No. 208, with a focus on developing translation options for applying the requirements of the standard to ADS-DVs with unconventional seating while maintaining the current requirements for conventional (i.e., non-ADS-equipped) vehicles. The current effort is focused on occupant protection for ADS-DVs with an unconventional seating configuration of fixed face-to-face DSPs for the first and second row with reclining seat backs (Figure 3). The occupant protection features considered with this seating configuration are described in Table 8. The approach used for this effort was to start with the Volume 2 FMVSS No. 208 technical translations options completed for ADS-DVs with conventional seats and refine the options based on the NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020). Because this work builds on Volume 2, the analysis only included one level of review: the regulatory language.

Table 8. Occupant Protection Features Considered in an ADS-DV With Unconventional Seating

Feature	Description
Child Restraints and Anchorage Systems	Child restraint anchorage system (LATCH system) only provided in forward-facing second row seats.
Head Restraints	May require modification to ensure occupant protection for conventional seating and rear-facing configurations.
Inflatable Restraints	Conventional air bag systems with non-traditional deployment methods. Left front outboard DSP would have the same performance requirements as to the right front outboard DSP.
Seat Belts	May require modification to ensure occupant protection for conventional seating and rear-facing seating configurations.
Seating Configuration	Seating positions are not reconfigurable.
Upper and Lower Extremity Restraints	Conventional upper and lower extremity restraints may be used in non-traditional applications for rear-facing seating configurations.

Technical Translations

The technical translations in Volume 2 for FMVSS No. 208 were reanalyzed considering an unconventional seating configuration with rear-facing front seats. Most of the translation options developed for the Volume 2 conventional seating configuration assessment of FMVSS No. 208 are still applicable for unconventional seating configurations. Throughout the assessment of FMVSS No. 208, common themes arose as translation options were being developed. Some examples of these themes include suitability of using existing Hybrid-III anthropomorphic test devices (ATDs) and applying existing FMVSS No. 208 injury criteria to rear-facing front seating positions, requirement of an inflatable restraint for front outboard occupants, and requirements allowing an automatic suppression feature for the passenger air bag when an infant or child is present. In addition, when assessing rear-facing front outboard seating positions, terms such as "forward" or "rearward" in the standard also merited additional consideration when evaluating ATDs and seat positioning.

Inflatable Restraints

S4.1.5.4 of FMVSS No. 208 states "each passenger car certified to S14 shall, at each front outboard designated seating position, meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants." (This language is derived from a statutory requirement. See 49 U.S.C. 30127.) An inflatable restraint is defined as an air bag that is activated in a crash. The technical translation options provided for conventional seating configurations included translating many references to "driver" or "passenger" to "left or right side" or to "left or right front outboard seating position" when referring to the occupant location. Similarly, some options translated "passenger" to "front outboard" to clarify that the requirements only apply to front row passengers. Some sections referring to the passenger air bag or passenger seat were translated to apply to any front outboard passenger air bag or seat. These options consider vehicles that may have two front outboard passenger seating positions (i.e., vehicles without a driver's seat). However, a rear-facing front row configuration could potentially yield translations incorporating the terms "by means of an inflatable restraint" or "air bag." It could be assumed that belted occupants of rear-facing front seats would be well protected in frontal crashes by a combination of the seat cushion, seat back, head restraints, and the seat belt. Moreover, conventional frontal air bags would be behind the seat back and therefore would provide little, if any, additional protection to rear-facing occupants. Use of conventional air bags with non-traditional deployment patterns may be an option; however, the effectiveness of an air bag in this scenario may require evaluation. Additional options were developed introducing the term "deployable restraint." This term was proposed by stakeholders as an alternative to the term "air bags," with the objective of providing a technology-neutral option for ADS-DVs. In the translations, Option 1 generally retains the current language used in the standard, as the inflatable restraint could apply to forward- or rear-facing front outboard DSPs. For other types of restraint systems that may be used in ADS-DVs, Option 2 generally uses the phrase "by means of an air bag system or deployable restraint at any front row rear-facing outboard designated seating position."

Injury Criteria

Throughout FMVSS No. 208, different injury criteria are specified for various ATDs and test procedures. For example, S15.3 specifies the injury criteria for the 49 CFR part 572, subpart O Hybrid III 5th percentile female test dummy. A translation option was developed that would apply separate criteria for forward-facing and rear-facing front seats. For example, S15.3.2 Head Injury Criterion (HIC) could be split into two sections based on seat orientation: S15.3.2.1 Forward-facing seating positions and S15.3.2.2 Rear-facing seating positions. Additional research is needed to determine what injury criteria would be appropriate (and whether a different ATD is needed) to adequately protect the occupants of rear-facing front seats. If that research demonstrates that the existing injury criteria are appropriate for rear-facing front row occupants, Option 1 could be used (maintain the current language).

Unbelted Rear-Facing Occupants

S5.1.2 of FMVSS No. 208 requires an unbelted test using a 50th percentile adult male dummy at both front outboard seating positions, with the vehicle driven between 20 and 25 mph into a fixed rigid barrier. The injury criteria that must be met in this test are set out in S6. Option 1 for this unbelted test and the other unbelted tests in the standard was to retain the current language. Option 2 was to have different injury criteria, with one paragraph applying to forward-facing front seats and another paragraph applying to rear-facing front seats.

Protection for Infants and Children

S19 of FMVSS No. 208 specifies "Requirements to provide protection for infants in rear-facing and convertible child restraints and car beds." Currently, a vehicle that complies with the advanced air bag requirements in S14 of FMVSS No. 208 can meet the requirements for the protection of infants by means of an automatic suppression feature for the passenger air bag (S19.2) or a low-risk deployment test wherein the air bag is deployed as described in S19.3, and the injury criteria specified in S19.4 must be satisfied. S19.2.1 of FMVSS No. 208 states, "The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag during each of the static tests specified in S20.2…." For rear-facing front row vehicle seats, different technical translation options have been provided to address potential regulatory barriers associated with the automatic suppression option. Three and sometimes four options were used to translate the child restraint requirements for a rear-facing front row. The general approach, using S19.2.1 as an example, was as follows:

Regulatory Language: "…automatic suppression feature for the passenger air bag which results in deactivation of the air bag…"

Option 1: "…automatic suppression feature for any front outboard passenger air bag which results in deactivation of the air bag…"

Option 2: "…automatic suppression feature for any front outboard passenger air bag in a forward-facing seat which results in deactivation of the air bag…"

Option 3: "…automatic suppression feature for any passenger air bag or deployable restraint system in a forward- or rear-facing front outboard seating position which results in deactivation of the air bag or deployable restraint system…"

When only considering a conventional seating configuration with forward-facing front seats, translation Option 1 for an ADS-DV was to change "the passenger air bag" to "any front outboard passenger air bag." This option could offer the same protection as the current requirement to a child restraint placed in the left front outboard seating position. However, additional research may be warranted when considering child restraints in a rear-facing front row vehicle seat.

Translation Option 2 for S19.2.1 was to specify that a suppression feature should be required only in "any front outboard passenger air bag in a forward-facing seat." This approach was taken from S19 through S24 as Option 2. This maintains the current requirements for conventional vehicles but does not specifically address rear-facing vehicle seats.

To provide a technology neutral option, Option 3 was added to state "any passenger air bag or deployable restraint system in a forward- or rear-facing front outboard seating position which results in deactivation of the air bag or deployable restraint system." This approach was used, typically as translation Option 3, whenever the term “air bag” was used in relation to the automatic suppression feature or low risk deployment tests and test procedures. The term “deployable restraint system” could allow for the use of an alternative protection system to air bags for rear-facing front seats.

The requirements to protect older children using 3-year-old and 6-year-old child dummies are specified in S21 and S23 of FMVSS No. 208, with the associated test procedures in S22 and S24. The technical translation options for S21 and S23 are consistent with the options for S19 and the example shown above for S19.2.1. While extending the current requirements to the rear seats is beyond the scope of this project, some options were included (typically as Option 4) to show how the current language could be translated to rear seats or a second row. Similarly, the technical translation options for S22 and S24 are consistent with the approach taken for S20.

Potential Considerations

For ADS-DVs, one option was to translate the current air bag automatic suppression feature (S19.2) for the “passenger air bag” to “any front outboard passenger air bag.” This approach was used as Option 1 in many cases where the passenger air bag or passenger seat is referenced. As stated, this option could apply to both forward- and rear-facing front seating configurations provided an air bag is present. Given the possibility of emerging technologies, another option was to use the phrase “air bag or deployable restraint system.” This could allow for more restraint options (e.g., deployable trim) in ADS-DVs that maintain the current occupant protection requirements for passengers while maintaining the language applicable to air bags for current vehicles. The concept of deployable restraints was introduced as one of the unconventional translation options in many sections which reference an “air bag” or “inflatable restraint system.” While no definition for the term currently exists, “deployable restraints” could cover conventional air bags as well as new designs that could provide injury mitigation for vehicle occupants. This terminology could remain technology-neutral for rear-facing seats in unconventional seating configurations. Considerations for this concept and related terminologies may warrant further exploration.

Another consideration was whether it would be appropriate to use the existing Part 572 ATDs for testing rear-facing seats. Technical translation options were provided assuming that the current ATDs could be used, but more research may be beneficial to confirm ATD suitability. If research indicates that the ATDs are not suitable, Part 572 may require modification.

This same consideration is applicable to the injury criteria currently specified in S6 for the 50th percentile adult male dummy and in S15.3 for the 5th percentile adult female test dummy, i.e., the appropriateness of the existing injury criteria for ATDs in rear-facing seats may warrant further research.

Technical translation options were provided assuming fixed rear-facing front row seats. However, some test procedures in FMVSS No. 208 specify full forward, middle, and full rearward positions for seats. For example, S16.3.3.1.8 states, “Using only the control that primarily moves the seat fore and aft, attempt to return the seat to the full forward position. If a dummy leg contacts the vehicle interior before the full forward position is attained, position the seat at the next detent where there is no contact.” In an ADS-DV with adjustable rear-facing front seats, research may be required to determine the relationship between seat position and occupant performance. In an ADS-DV with rear-facing front seats, the full rearward position could equate with the full forward position in a conventional seating configuration. As written, for rear facing seats, such positioning instructions are unclear as to whether they are referencing the vehicle or seat direction. No effort has been made in this report to translate these seat adjustments to address the situation when the seat is facing the rearward direction.

Some considerations regarding the ATDs and injury criteria that were identified as potential considerations for future research are as follows: The existence of rear-facing front row seats could result in the inability to support testing in several FMVSS regulated conditions, especially regarding FMVSS No. 208. This is primarily due to the lack of Post Mortem Human Subjects (PMHS) data and subsequently, the lack of validated ATDs and corresponding injury criteria for non-traditional Motor Vehicle Collision (MVC) loading scenarios (e.g., 40 to 48 kph frontal impact with a rear-facing front row seat). Given that there will be a mixed fleet (i.e., ADS-DVs and human-driven vehicles) on the roadways for the foreseeable future, MVCs will continue to be an important socioeconomic issue. In addition, the advent of ADS-DVs and an anticipated increase in human-driven vehicles with advanced collision avoidance technologies may result in a potential reduction in the frequency of collisions on U.S. roadways. Even with the potential reductions in the frequency of MVCs, it may still be imperative to consider occupant protection evaluation testing procedures for all seat orientations in both frontal and side impact loading scenarios, as well as other loading scenarios.

Many of the existing 200-series standards may pose challenges for future unconventional occupant compartment and associated vehicle structure designs for ADS-DVs. For example, the FMVSS No. 208 requirement for frontal air bags may confound the ability to place rear-facing seats in the front row. Further, a frontal crash involving occupants in rear-facing front row seats would mean that the occupants will experience a posteroanterior impact. This potential impact mode is one for which the biomechanics and safety community has little information. Biomechanical response and threshold data are needed for a variety of posteroanterior loading modes, including those at higher speeds. Another consideration was whether it would be appropriate to use the existing Part 572 ATDs for testing rear-facing seats. Technical translation options were provided assuming that the current ATDs could be used, but more research may be beneficial to confirm ATD suitability. In addition, rear-facing front row occupants could experience greater interaction with any forward-facing occupants positioned in the second row or rear seat. This could increase injury risk for both front- and rear-seated occupants. These factors combine to produce potential challenges in occupant protection as it relates to ADS-DVs and unconventional seating.

Currently, rear seat placement for child restraints is encouraged. As stated in S4.5.1 of FMVSS No. 208, “The back seat is the safest place for children 12 and under,” but S19, S21, and S23 specify occupant protection requirements if a child restraint is placed in a front seat. Obviously, in a rear-facing front vehicle seat configuration, rear-facing and forward-facing child restraints will be oriented differently than in a vehicle with a conventional seating configuration. In this scenario, the rear-facing child restraint would now be facing the front of the vehicle. This raises the question of whether out-of-position and suppression system testing should include a rear-facing car seat in a rear-facing passenger seat to achieve NHTSA’s safety goals. Such real-world use could lead to significant potential injuries in frontal crashes. However, the out-of-position testing in FMVSS No. 208 is also intended to capture certain misuse situations. While it is beyond the scope of this project, further research may be required to determine if the current child restraint tests are suitable for rear-facing front seats.

Stakeholder and SME Review Input

When reviewing the technical translation options for S4.1.5.4, which states that "Each passenger car certified to S14 shall, at each front outboard designated seating position, meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants," one reviewer recommended removing the word "inflatable" from the standard and proposed the following text: "…by means of a restraint system that requires no action by vehicle occupants." The suggested justification for this change is that it supports being technology neutral and performance-based as long as a vehicle can meet all the requirements.

Three reviewers also suggested that the regulation should eliminate the requirement for air bags and for unbelted testing in vehicles with rear-facing front seats. The basis for their recommendation was "… unbelted testing was established to evaluate the air bag deployment with respect to chest compression/acceleration, neck injury criteria, etc. of front row forward-facing occupants." This quote from one of the reviewers generally aligned with the other reviewers' feedback and reasoning.

Reviewer comments on using the same injury criteria for forward- and rear-facing seats was split between those who believed that the same injury criteria should be applicable to both types of seating and those who suggested that research would be needed to determine if the same criteria are appropriate. Consistent with the previous paragraph, two reviewers suggested the injury criteria would not apply to unbelted tests because those tests should not be required for rear-facing front seats.

There was much stakeholder and SME input on the applicability of child restraints in a rear-facing front seat including the stipulation that, "Vehicles without manual controls need to demonstrate means to disable installation of rear-facing child seats in rear-facing seats." Some reviewers proposed making S19 through S24 inapplicable to a rear-facing front row seat given the fact that those provisions were adopted to protect children against injuries due to aggressive air bags, and a conventional frontal air bag would not "interact directly with the occupants when they are seated rearwards." On the use of child restraints in a rear-facing front row seat, there was some discussion that it may be premature to address this situation for several reasons. For instance, one reviewer states, "FMVSS [No.] 213 does not currently address their performance in this situation; it is unknown whether the [child restraint system] manufacturers have designed the [child restraint system] considering these situations and what their recommendation for use would be." Feedback also indicated that it is unknown how users would install a child restraint system in a rear-facing seat and it may be inaccurate to assume a user would install a restraint system with the same orientation relative to the vehicle seat as is currently recommended.

One reviewer commented that they were opposed to the efforts being undertaken by this project due to the lack of necessary data to determine if the proposed translations for unconventional seating would achieve an equivalent level of protection as presently afforded by the FMVSS to occupants of conventional vehicles with forward-facing seats. They were not opposed to the effort being a thought experiment that could form the basis of future research or of the effort being considered a part of the entire investigation necessary to ensure that novel seating designs do not also introduce new injury mechanisms and risks.

Standards Incorporated by Reference

Chapter 1 of this report indicated that documents incorporated by reference were reviewed as part of the technical translation effort for unconventional seating configurations. While this review was conducted for FMVSS No. 208 in Volume 2 for conventional seating, the review was not repeated in the unconventional seating assessment.

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Chapter 6. Summary of Research Findings

This project provides technical translation options that address potential regulatory barriers to innovative new vehicle designs appearing in vehicles equipped with ADSs. This effort is focused on a particular type of ADS-equipped vehicle—the ADS-DV—which, for the purposes of this project, is defined as a vehicle designed to be operated exclusively by an SAE International driving automation Level 4 or Level 5 ADS[11] for all trips, and which is not equipped with manually operated driving controls.

Approach

The same approaches and processes detailed in Volume 1 and 2 research were used in the technical translations performed for Volume 3. When individual standards might benefit from unique options or approaches, these were clarified and noted. During the translation process for the braking and heavy vehicle ESC standards, the research team reviewed the FMVSS regulatory language (including standards incorporated by reference) and related test procedures. For these standards, the same systematic approach from the Volume 1 report was not fully applied. Many of the other standards covered in this report were identified as having no regulatory barriers, as requiring minor technical translations, or building from research completed in the Volume 2 report. For these standards, only the regulatory language was reviewed (one level) or the standard was one for which NHTSA has proposed that no translation research is presently necessary.[12]

Crash Avoidance Standards

In most cases, language in the 100-series standards could be addressed with straightforward clarification of the regulatory language. Many of the themes identified in Volume 1 and Volume 2 are consistent with the standards considered in the Volume 3 report. Many of these represent some of the inherent assumptions that a human is driving the vehicle using manually operated driving controls. FMVSS No. 135 specifies inputs (i.e., pedal force) that are human-centric (e.g., ensure that a wide range of human drivers, with a wide range of strengths, can safely stop any vehicle they are driving). While the pedal force requirements are important for the range of potential human drivers, they may not be relevant for ADS operation. For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. The translation approach was to remove the input requirements and instead make the input dependent on the performance requirements. Example approaches are provided in the appendices.

While FMVSS No. 135 uses “brake pedal,” FMVSS No. 121 uses “treadle,” and FMVSS No. 105 uses a more general reference to “brake control” and “control input.” To provide consistency across this family of braking standards, the translation options use more generic language, such as “service brake input” and “brake system input,” which combines the terminology from FMVSS Nos. 105 and 135.

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[11] As defined in SAE International Standard J3016_201806, *Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles*, 2018.

[12] See NPRM, *Occupant protection for automated driving systems*, 85 Fed. Reg. 17624, 17634, 17634 n.53 (March 30, 2020).

The translation of FMVSS No. 136 was addressed with the expectation that ESC will continue to co-exist and function separately from the ADS in future ADS-DVs. Based on the existing heavy vehicle requirements, the translation approach included control assistance at the engine.

The braking and ESC standards all specify information to be communicated to the driver. The approaches used in Volume 1 and 2 to translate these to information communicated in an ADS-DV were also used for the Volume 3 standards. The one exception is the option "To the ADS and an occupant compartment service screen or panel," which was refined in Volume 3 as, "To the ADS and service required log located in the occupant compartment." The refinement to this option addresses the situation wherein the person or entity responsible for the ADS-DV's service and/or repair may or may not be present in the vehicle to receive the information in real-time.

While the LSV standard includes aspects from both the 100-series standards (e.g., mirrors and lighting requirements) and the 200-series standards (e.g., windshield and seat belt assembly requirements), the rearview image display requirement was the only provision that may benefit from additional research. Several brake hose, brake fluid, and tire standards were also reviewed. All of these FMVSS were equipment standards, and the research team did not identify any regulatory barriers.

Though the test procedures specified in the regulatory language itself could generally be addressed with straightforward translations, there remain potential compliance verification barriers. Ongoing research to develop and validate methods that may allow NHTSA to potentially perform the tests defined in procedures used to verify ADS-DV safety compliance is a critical aspect of removing these barriers.

Crashworthiness Standards

This effort focused on an assessment of FMVSS No. 208 for ADS-DVs with fixed face-to-face seating with a rear-facing front row. The technical translations found in the NPRM published by NHTSA on March 30, 2020, Occupant Protection for Automated Driving Systems (85 FR 17624), were used to begin development of translation options for rear-facing front seats. Several themes were found when considering how to maintain the current level of occupant protection for ADS-DVs. These included the suitability of current ATDs, presence and requirement of air bags for front seats, child restraint test procedures, unbelted testing requirements, dummy positioning procedures, and injury criteria. Options that maintain the current language for both front outboard seating positions and split requirements between forward-facing and rear-facing front seats were provided. Another translation option would allow for an air bag or emerging occupant protection technology for rear-facing seats. From the assessment, there may be several potential barriers that could be further explored for unconventional seating configurations. Additional research could be performed to determine the suitability of current ATDs in a rear-facing configuration, possible new injury mechanisms, suitability of current injury criteria, applicability of unbelted tests in a rear-facing front row, and whether the child restraint tests specified in FMVSS No. 208 can be performed using a rear-facing front seat.

Beyond Volume 3 Research

Based on the Volume 1 and 2 research findings, a plan was formulated to further the development and evaluation of the 100-series test methods, the continuation of the 200-series rear seat occupant protection research, and additional research studies that stemmed from the Volume 1 and 2 technical translation analysis. An overview of the research is shown in Figure 5 and is described in the following sections.

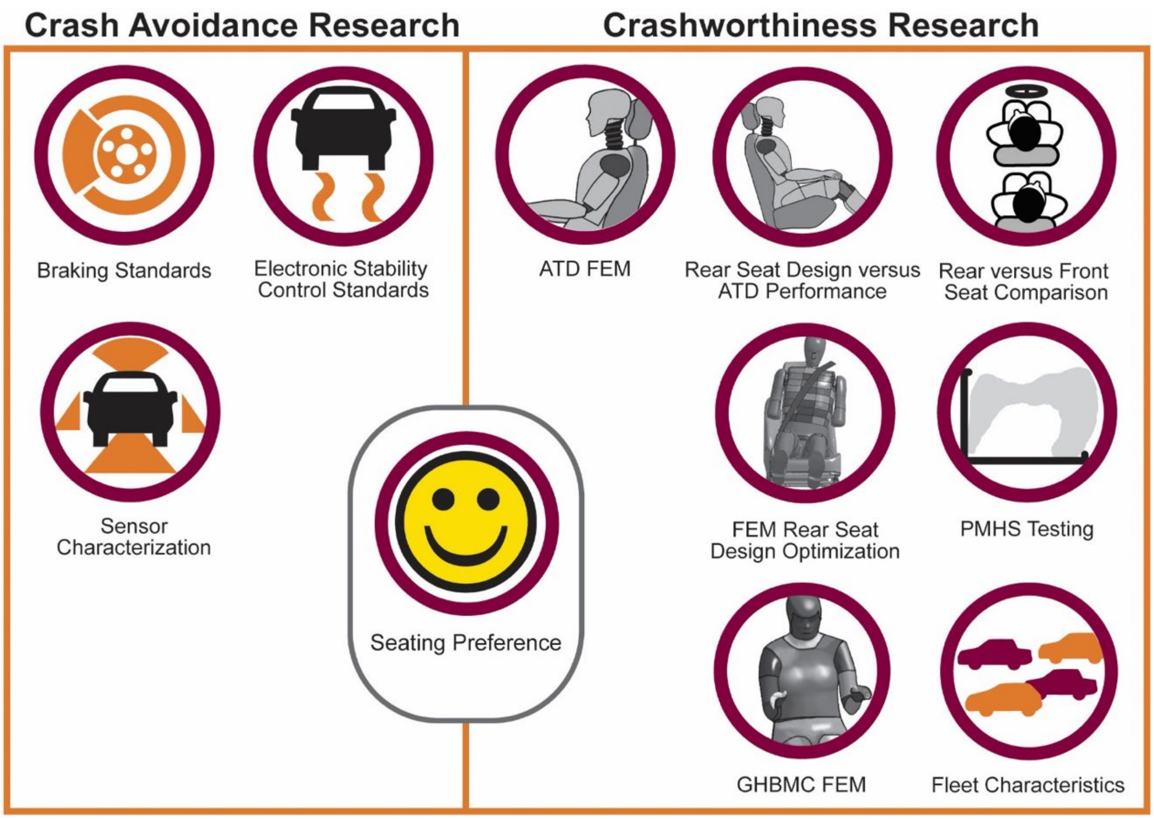

Figure 5. Beyond Volume 3 Research

Crash Avoidance Standards

Brake Standard for Light Vehicles: Vehicle testing and evaluation will be conducted for FMVSS No. 135, including the test platform used previously as part of the evaluation of the different potential test methods for an ADS-DV (Volume 2). In addition, the research team is working with industry test partners to execute the test protocols that were developed and tested with the VTTI ADS test platform on their ADS-equipped vehicle platforms. The goals of this activity are to:

- See if the ADS can execute the test procedures as currently written
- Identify what has to be done to accomplish this (if possible)
- Identify what the ADS can't do and why not
- Identify what industry partners think are equivalent procedures and, ideally, why they are considered equivalent
- Identify areas that may not be applicable to or that may be outside the way vehicle is designed to operate

It should be noted that the intent is not to develop new test procedures for ADS-DVs or to verify compliance for the test vehicles. Rather, the intent is to test the procedures with a small sample of vehicle platforms equipped with ADSs from different manufacturers/ADS developers that may have different design elements or architecture that could provide insight into what should be considered.

ESC Standard for Light Vehicles: FMVSS No. 126 specifies the execution of defined control inputs to demonstrate regulation compliance. Test procedure translations were detailed in the Volume 2 report. The following are the three alternative translation options identified in Volume 2 research to allow FMVSS No. 126 to be performed on future vehicles:

- *Option 1:* Inputs into the system via the steering wheel have been translated to refer to equivalent inputs into the steering system.
- *Option 2:* New definitions have been added for "steering wheel" and "steering wheel angle" based on a generic interface with the steering system, which allows the references to these items to remain as they currently exist in the regulatory language.
- *Option 3:* Rather than specifying the independent variable as the input at the front of the steering system, the input is defined at the road wheel angle (angle of the tires relative to the longitudinal centerline of the vehicle).

These translation options serve as the basis for translation of the test maneuver steering system input requirements. This research further evaluates the different steering input alternatives to create a potential set of test procedures and may help advance the work conducted for Volume 2. Options 1 and 2 translate the standard to refer to the steering interface in more general terms. This broadens the available specific component input translation possibilities throughout the range of differing steering systems used in industry; Option 3 maintains input specificity by defining the road wheel angle input at the front axle.

This research will examine current and possible future vehicle steering and suspension architectures to determine potential commonality within vehicle platforms of differing design. Evaluations of the FMVSS No. 126 test procedure using the most promising technical translation alternative measurement options will be performed on a controlled test track and the data analyzed relative to current standard compliance determination. Moving the measurement and control options to other parts of the steering system or road wheel could produce different results when evaluating compliance. The evaluation will aim to identify these potential differences and develop options to address them. For this research effort, control, and measurements relative to the FMVSS No. 126 test procedure will be taken at the output of the rack and pinion steering mechanism and about the steering axis at the road wheel. The implications of these new measurements on FMVSS No. 126 test procedure maneuvers will be examined.

Like the FMVSS No. 135 research, industry test partners will support the vehicle architecture research and testing of the FMVSS. No. 126 test protocols demonstrated in this study on their ADS-equipped vehicle platforms.

Braking and ESC Standards for Heavy Vehicles: The findings from FMVSS Nos. 135 and 126 (i.e., *Light vehicle brake systems* and *Electronic stability control systems for light vehicles*) will be assessed further to understand the implementation suitability for heavy vehicles. While there are some similarities between the light vehicle and heavy truck regulations, there are also differences. The size and configurations of heavy vehicles result in a different dynamic response as compared to light vehicles. However, the implementations of the control systems share similar design features. As such, lessons learned regarding how to control and direct an ADS-equipped light vehicle may be transferrable to the control of an ADS-equipped heavy vehicle. For example, the steering systems for both light and heavy vehicles primarily use mechanical systems (e.g., rack-and-pinion or pitman arm configuration) with some form of power assist to make the vehicle easier to steer. Consequently, the control scheme for either could be similar. While the steering systems are fundamentally similar, the braking systems are not. Heavy vehicles use pneumatic (compressible fluid) brake systems, whereas light vehicles use hydraulic (non-compressible fluid) braking systems. The difference in the power transfer medium of the two systems (compressible versus non-compressible fluid) results in differences in the design, operation, and response of the systems. The research team will evaluate if these fundamental differences may benefit from additional research.

Sensor Characterization: Volume 2 considered standards that include specifications associated with providing a human driver a clear view and mitigating potential visibility obstructions (e.g., FMVSS Nos. 103, 104, and 111). FMVSS No. 500, *Low-speed vehicles*, specifies mirror equipment, which may not serve the stated safety purpose because the ADS perceives the space around it using sensors, not mirrors. This standard (*Low-speed vehicles*) also requires a rearview image display that meets the field-of-view specifications in FMVSS No. 111. The ability to “see” may vary by driver type (human or ADS), and, for ADS-equipped vehicles, may vary by types of sensor technologies used and sensor fusion and redundancy. The goal of the Sensor Characterization is to identify, capture, and quantify sensor attributes that are important to the operation of ADS-equipped vehicles, including the static and dynamic situational driving information from their expected operational environment. The specific objectives are to explore sensor capabilities and evaluate and characterize critical sensor attributes, including degradation effects for ADS applications by (1) surveying test procedures and measures used by industry, (2) identifying potential gaps in characterizing performance, (3) measuring sensor capabilities, and (4) evaluating methods to characterize nominal sensor performance and sensor performance more definitively in the presence of degradation.

Crashworthiness Standards

The ongoing research supports potential translation of FMVSS No. 208 that would extend the standard to occupants seated behind the front seat. This research represents a proactive examination of potential issues that will reduce the time required to make decisions and to institute subsequent efforts. In support of this ongoing research, there are seven related areas designed to examine the expected incidence and outcomes of rear-seated occupants in an ADS-DV with conventional (forward-facing) seats, to develop dummy positioning procedures for rear-seated ATDs for FMVSS No. 208 frontal crash testing, to assess candidate injury criteria for rear-seated occupants for FMVSS No. 208 frontal crash testing, and to assess ATD performance for rear-seated occupants for FMVSS No. 208 frontal crash testing. These research areas are as follows:

- *ATD Finite Element Methods (FEMs):* Examine how well the ATD FEMs represent the actual ATDs.
- *Rear Seat Design Versus ATD Performance:* Examine the key relationships between vehicle design and vehicle safety performance for the rear/second row seat.

- *Rear Versus Front Seat Comparison:* Examine how the rear/second row seat safety performance results obtained from the ATD sled test relate to existing test results for the front seat.
- *FEM Rear Seat Design Optimization:* Use an FEM parametric investigation to examine what vehicle design characteristics, or optimization thereof, could provide improved passenger protection in the rear/second row seat.
- *PMHS Testing:* Determine whether the responses of the ATDs (kinematics, injury prediction, etc.) are accurate for the rear/second row seats.
- *Global Human Body Models Consortium (GHBMC) FEM:* Examine the GHBMC 50th male model (most valid and stable version) in the second/rear row seat under the same conditions as the PMHS tests.
- *Fleet Characteristics:* Determine how the vehicles tested on the sled relate to the existing fleet in terms of design characteristics and provide an approximation of the potential real-world scenario in terms of the range of injury incidence and severity as occupants migrate to the rear seat.

Additional Research

Seating Preference: This research will examine several questions that stem from aspects related to seating preference in future vehicle designs precipitated by the adoption of ADS-DVs. Moreover, the way in which various information is presented to the occupants of ADS-DVs could be dependent on the seating configuration. Due to the nature of ADS-DVs and the potential changes as seating configurations evolve, the two main goals for this study are as follows:

1. What are occupants' preferred seating positions and prevalence of seat belt use in an ADS-DV?
2. How is FMVSS information communicated to occupants, and do they understand it?

A range of ADS-DV concepts will be considered and a human-machine interface reference design developed. This research will create methods to evaluate participants in a closed-track course to examine participant behavior associated with closing doors, seat selection and positioning, using restraints, starting the ride, and potentially requesting an early ride termination (i.e., Passenger-initiated Emergency Stop).

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Appendix A: Definitions

ADS-Related Definitions Incorporated from SAE International's Recommended Practice J3016 (2021), Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles	
Automated Driving System (ADS)	The hardware and software that are collectively capable of performing the entire dynamic driving task (DDT) on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD); this term is used specifically to describe a Level 3, 4, or 5 driving automation system (SAE International, 2021, p. 6).
Operational Design Domain (ODD)	Operating conditions under which a given driving automation system or feature thereof is specifically designed to function, including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics (SAE International, 2021, p.17).
Dynamic Driving Task (DDT)	All of the real-time operational and tactical functions require to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints, and including, without limitation, the following subtasks: • Lateral vehicle motion control via steering (operational); • Longitudinal vehicle motion control via acceleration and deceleration (operational); • Monitoring the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical); • Object and event response execution (operational and tactical); • Maneuver planning (tactical); and • Enhancing conspicuity via lighting, signaling and gesturing, etc. (tactical) (SAE International, 2021, p.9).
Automated Driving System - Dedicated Vehicle (ADS-DV)	(1) Based on Section 3.32.3 of SAE International (2021) "An ADS-equipped vehicle designed for driverless operation under routine/normal operating conditions during all trips within its given ODD (if any)."
Translation Note	ADS-related definitions are interchangeable with the driver, seating, and driving control definitions options. SAE International's definition of ADS-DV indicates that some ADS-DVs could contain driving controls and be used to describe a Level 3 driving automation system as well as Level 4 and Level 5 systems. For the purposes of this project, the FMVSS technical translation options focused on a particular type of ADS-DV, a vehicle designed to be operated exclusively by an SAE Level 4 or Level 5 ADS for all trips, and which the vehicle is not equipped with manually operated driving controls.

<table>
<tr><th colspan="3">Driver Definitions</th></tr>
<tr><td>Currently specified in 49 CFR § 571.3</td><td colspan="2">Driver means the occupant of a motor vehicle seated immediately behind the steering control system.</td></tr>
<tr><td></td><td>Potential Option 1</td><td>Potential Option 2</td></tr>
<tr><td>Driver</td><td>Driver means:
(1) the occupant (human driver) of a motor vehicle seated immediately behind the manually operated driving controls, and
(2) the ADS (ADS driver), for ADS-equipped vehicles when the ADS is engaged. When the ADS is not engaged, the definition in paragraph (1) applies.</td><td>Driver means the occupant of a motor vehicle seated immediately behind the manually operated driving controls.</td></tr>
<tr><td rowspan="2">Translation Note</td><td colspan="2">Driver definition Options 1 or 2 are interchangeable with the ADS-related, seating, and driving control definitions.</td></tr>
<tr><td>Option 1 incorporates the ADS into the definition of “driver.” Therefore “driver” would refer to either a human driver or an ADS. “Human driver” is used when only (1) applies, and “ADS driver” is used when only (2) applies.</td><td>Under Option 2, the “driver” always refers to a human driver. The ADS would perform the driving of an ADS-DV and be incorporated into the standards independently from “driver.”</td></tr>
</table>

<table>
<tr><th colspan="3">Designated Seating Positions and Driving Controls Definitions</th></tr>
<tr><td>Currently specified in 49 CFR § 571.3</td><td colspan="2">DSP means a seat location that has a seating surface width, as described in section 571.10(c), of at least 330 mm (13 inches), and section 571.10 provides a method for calculating the number of DSPs based on the width of the seat.</td></tr>
<tr><td></td><td>Potential Set 1</td><td>Potential Set 2</td></tr>
<tr><td>Driver’s Designated Seating Position (driver’s seat or driver’s seating position)</td><td>Means a DSP immediately behind the manually operated driving controls positioned such that an occupant can operate the manual driving controls, regardless of whether the occupant is in active control of the vehicle.</td><td>Means a DSP providing immediate access to the manually operated driving controls.</td></tr>
<tr><td>Manually Operated Driving Controls</td><td>Means the system used by an occupant to manipulate the vehicle’s lateral (steering) and/or longitudinal (acceleration and deceleration) motion in real time.</td><td>Means (a) the system used by an occupant for real-time sustained manipulation of the motor vehicle’s heading (steering) and/or speed (accelerator and brake); (b) positioned such that they can be used by an occupant; (c) regardless of whether the occupant is actively manipulating the vehicle’s motion.</td></tr>
<tr><td></td><td>Potential Set (1 or 2) A</td><td>Potential Set (1 or 2) B</td></tr>
<tr><td>Passenger Designated Seating Position (Passenger Seat or Passenger Seating Position)</td><td>Means any DSP other than the driver’s DSP.</td><td>Means any DSP other than the driver’s DSP. Specifically, a seating position with stowed manually operated driving controls is a passenger DSP.</td></tr>
<tr><td>Steering Control (Wheel)</td><td colspan="2">Means the manually operated driving control used to manipulate the vehicle’s heading.</td></tr>
<tr><td rowspan="2">Translation Note</td><td colspan="2">Driver’s DSP and manually operated driving controls are grouped into sets. The definitions of “passenger DSP” and “steering control” are the same for both Set 1 and Set 2. There are two options (A and B) for the definition of passenger DSP.</td></tr>
<tr><td>Driver’s DSP definition from Set 1 should be used in conjunction with the manually operated driving controls definition from Set 1.</td><td>Driver’s DSP definition from Set 2 should be used in conjunction with the manually operated driving controls definition from Set 2.</td></tr>
</table>

Bidirectional Vehicle Definitions		
	Potential Option 1	**Potential Option 2**
Bidirectional Vehicle	Means an ADS-equipped vehicle without manually operated driving controls that can perform the DDT across an equivalent range of speed and heading control in two opposite directions.	Means a motor vehicle that operates across an equivalent range of speed and heading control in two opposite directions.
Translation Note	Instead of translating within each standard, bidirectional vehicles could be addressed generically in Subpart A of 49 CDR Part 571. In addition to the Section 571.3 definition, a new section could be added to clarify the application.	

Applicability of the FMVSS to Bidirectional Vehicles	
Bidirectional Vehicle	Each applicable standard set forth in Subpart B of this Part shall apply to bidirectional vehicles in both directions of travel
Translation Note	A new subsection (g) of section 571.7, or a new section 571.11 could be added to clarify the translations for the applicability of the FMVSS to bidirectional vehicles.

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Appendix B: FMVSS Technical Translation Worksheets

This appendix provides technical translation option summaries and their potential considerations for the FMVSS covered in Volume 3 research that went through the full analysis process. Only technical translations that were assessed as either a “1-Translation is straightforward” or “2-Limited research may be beneficial” are shown in this appendix for FMVSS Nos. 105, 121, 135, and 136 that were performed in the technical translation worksheets. For FMVSS No. 208, only technical translations that were assessed as either a “U1 – Translation is straightforward for unconventional seating” or “U2 – Limited research may be beneficial for unconventional seating” are presented. The other standards covered in Volume 3 were straightforward and technical translation examples were only developed for the few sections where potential barriers were identified. These technical translation examples can be found within each of the FMVSS’ respective chapters in this report.

As stated in Volume 2, any additional considerations for discussion with regard to the sections of the FMVSS that were assessed as a “0-Not performed” are captured within the main body of this report. If the creation of a potential additional section to the FMVSS was considered, the top header row will contain the original section number in the far left-hand column, and a unique section number followed by “Added for ADS-DV Translation” in the center column. Text colored in red font corresponds to the word or phrase that was either changed or omitted from the regulatory language into one of the technical translation options. Occasionally, there is text colored in red font within the Regulatory Language column that cites an incorporated reference. The reference analysis was not captured within the tables below; please see Appendix D for more information.

FMVSS No. 105

Technical Translation Options Summary: The focus of this FMVSS is to "insure [sic] safe braking performance under normal and emergency driving conditions." The primary potential challenges for the translation are the references to "driver" for control of the parking and service brake and the requirements for communication of the brake system state. General language that accommodates the existence of both human and ADS control was utilized. Option 1 uses driver definition 1 and Option 2 uses driver definition 2 unless the section could be generalized and the reference to the "driver" can be removed. The general approach was to remove references to the "driver" to make the language more generic, when appropriate, for Option 3. Options 4 and 5 were typically used to provide additional options for telltales (indicators) and alerts.

FMVSS No. 105, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Brake power assist unit means a device installed in a hydraulic brake system that reduces the operator effort required to actuate the system, and that if inoperative does not prevent the operator from braking the vehicle by a continued application of muscular force on the service brake control.	**Option 1**	*Brake power assist unit* means a device installed in a hydraulic brake system that reduces the human driver effort required to actuate the system, and that if inoperative does not prevent the operator from braking the vehicle by a continued application of muscular force on the service brake control.	Uses driver definition 1.
	Option 2	*Brake power assist unit* means a device installed in a hydraulic brake system that reduces the effort required to actuate the system, and that if inoperative does not prevent braking the vehicle by a continued application of force on the service brake control.	Removes reference to an operator and muscular.

FMVSS No. 105, S4. Definitions	Added for ADS-DV Translation- S4.3		
Regulatory Text	**Translation Options**		**Potential Considerations**
Regulatory Text provided as an option.	**Option 1**	*Brake system indicator lamp* means a lamp for a human driver or a signal to an ADS that clearly indicates the state of the brake system.	New definition to provide the option to keep current language regarding brake system indicator lamps.
	Option 2	*Brake system indicator lamp* means a telltale for a human driver or a signal to an ADS that clearly indicates the state of the brake system.	New definition to provide the option to keep current language regarding brake system indicator lamps which specifies "telltale" rather than "lamp" as presented in Option 1.

FMVSS No. 105, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Full brake application means a brake application in which the force on the brake pedal reaches 150 pounds within 0.3 seconds from the point of application of force to the brake control.	**Option 1**	*Full brake application* means a brake application in which the force on the brake pedal reaches 150 pounds within 0.3 seconds from the point of application of force to the brake control. For an ADS, it means a brake application in which the brake system input force reaches the maximum designed input level within 0.3 seconds from the point of application.	Creates a unique definition for an ADS that does not specify the absolute maximum input but is dependent on the vehicle brake system design to be adequate to comply with the applicable regulations.
	Option 2	*Full brake application* means a brake application in which the brake system input force on the brake pedal reaches 150 pounds, or equivalent brake system input for an ADS, within 0.3 seconds from the point of application of force to the brake control.	Provides caveat for ADS operation to apply an equivalent input to the service brake system.

FMVSS No. 105, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Lightly loaded vehicle weight means: (a) For vehicles with a GVWR of 10,000 lbs.or less, unloaded vehicle weight plus 400 lbs.(including driver and instrumentation); (b) For vehicles with a GVWR greater than 10,000 lbs., unloaded vehicle weight plus 500 lbs.(including driver and instrumentation).	**Option 1**	...including human driver (if present) and instrumentation);…	Uses driver definition 1.
	Option 2	…(including test operator and instrumentation)…	Generalizes to a test operator instead of "driver." Assumes that there will be an individual in the vehicle for initiation and execution of programmed control of ADS.

FMVSS No. 105, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Spike stop means a stop resulting from the application of 200 lbs of force on the service brake control in 0.08 s.	**Option 1**	*Spike stop* means a stop resulting from the application of 200 lbs of force for a human driver or equivalent input for ADS-DV on the service brake control in 0.08 s.	Uses driver definition 1.
	Option 2	*Spike stop* means a stop resulting from the application of 200 lbs of force for a driver or equivalent input for ADS-DV on the service brake control in 0.08 s.	Uses driver definition 2.

FMVSS No. 105, S5.1.4.1 Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
The control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds.	**Option 1**	For a vehicle equipped with manually operated driving controls, the control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds.	Uses driver definition 1. Only provides force requirements for vehicles operated by a human driver.
	Option 2	The control force used for the baseline check stops or snubs for vehicles that can be operated by a human driver shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds. For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate.	Does not specify a quantitative value for the minimum or maximum force for an ADS-DV.

FMVSS No. 105, S5.1.4.3 Partial Failure (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 20 pounds more than the average control force for the baseline check; and (2) A minimum of— (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).	**Option 1**	(a) Each vehicle equipped with manually operated driving controls with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 20 pounds more than the average control force for the baseline check; and (2) A minimum of— (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).	Uses driver definition 1. Only provides force requirements for vehicles that can be operated by a human driver.
	Option 2	(a) Each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 20 pounds more than the average control force for the baseline check; and (2) A minimum of— (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds). (C) For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate.	Does not specify a quantitative value for the minimum or maximum force for an ADS-DV.

<table>
<tr><th colspan="4">FMVSS No. 105, S5.1.4.3 Partial Failure (b)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">(b) Each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery snubs from 40 mph to 20 mph at 10 fpsps for each snub, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery snubs of 150 pounds, and for the fifth snub, of 20 pounds more than the average control force for the baseline check (but in no case more than 100 pounds); and (2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).</td><td>Option 1</td><td>(b) Each vehicle equipped with manually operated driving controls with a GVWR of more than 10,000 pounds shall be capable of making five recovery snubs from 40 mph to 20 mph at 10 fpsps for each snub, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery snubs of 150 pounds, and for the fifth snub, of 20 pounds more than the average control force for the baseline check (but in no case more than 100 pounds); and (2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).</td><td>Uses driver definition 1.

Only provides force requirements for vehicles that can be operated by a human driver.</td></tr>
<tr><td>Option 2</td><td>(b) Each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery snubs from 40 mph to 20 mph at 10 fpsps for each snub, with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery snubs of 150 pounds, and for the fifth snub, of 20 pounds more than the average control force for the baseline check (but in no case more than 100 pounds); and (2) A minimum of—

(A) The average control force for the baseline check minus 10 pounds, or

(B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).

(C) For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate.</td><td>Does not specify a quantitative value for the minimum or maximum force for an ADS-DV.</td></tr>
</table>

FMVSS No. 105, S5.1.5.1 Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
The control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 and 90 pounds.	**Option 1**	For a vehicle equipped with manually operated driving controls, the control force used for the baseline check stops or snubs shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds.	Uses driver definition 1. Only provides force requirements for vehicles that can be operated by a human driver.
	Option 2	The control force used for the baseline check stops or snubs for vehicles that can be operated by a human driver shall be not less than 10 pounds, nor more than 60 pounds, except that the control force for a vehicle with a GVWR of 10,000 pounds or more may be between 10 pounds and 90 pounds. For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate.	Does not specify a quantitative value for the minimum or maximum force for an ADS-DV

FMVSS No. 105, S5.1.5.2 (a) Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
After being driven for 2 minutes at a speed of 5 mph in any combination of forward and reverse directions through a trough having a water dept of 6 inches, each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at ten fpsps for each stop with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 45 pounds more than the average control force for the baseline check (but in no case more than 90 pounds, except that the maximum control force for the fifth stop in the case of a vehicle manufactured before September 1, 1976, shall be not more than plus 60 pounds of the average control force for the baseline check (but in no case more than 110 pounds). (2) A minimum of— (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds). (b) After being driven for 2 minutes at	**Option 1**	After being driven for 2 minutes at a speed of 5 mph in any combination of forward and reverse directions through a trough having a water dept of 6 inches, each vehicle equipped with manually operated driving controls with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph... (b) After being driven for 2 minutes at a speed of 5 mph in any combination of forward and reverse directions through a trough having a water depth of 6 inches, each vehicle equipped with manually operated driving controls with a GVWR of more than 10,000 pounds shall be capable of making five recovery stops from 30 mph...	Uses driver definition 1. Only provides force requirements for vehicles that can be operated by a human driver.
	Option 2	...each vehicle with a GVWR of 10,000 pounds or less shall be capable of making five recovery stops from 30 mph at ten fpsps for each stop with a control force application that falls within the following maximum and minimum limits: (1)... (2) A minimum of - (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds). (C) For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate. (b) After being driven for 2 minutes...each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop with a control force application that falls within the following maximum and minimum limits: (1) ... and (2) A minimum of—	Does not specify a quantitative value for the minimum or maximum force for an ADS-DV.

FMVSS No. 105, S5.1.5.2 (a) Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
a speed of 5 mph in any combination of forward and reverse directions through a trough having a water depth of 6 inches, each vehicle with a GVWR of more than 10,000 pounds shall be capable of making five recovery stops from 30 mph at 10 fpsps for each stop with a control force application that falls within the following maximum and minimum limits: (1) A maximum for the first four recovery stops of 150 pounds, and for the fifth stop, of 60 pounds more than the average control force for the baseline check (but in no case more than 110 pounds); and (2) A minimum of— (A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds).		(A) The average control force for the baseline check minus 10 pounds, or (B) The average control force for the baseline check times 0.60, whichever is lower (but in no case lower than 5 pounds). (C) For ADS-DVs, the brake system input force will be sufficient to maintain the deceleration rate.	

FMVSS No. 105, S5.2 Parking Brake System			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall be manufactured with a parking brake system of a friction type with a solely mechanical means to retain engagement, which shall under the conditions of S6, when tested according to the procedures specified in S7, meet the requirements specified in S5.2.1, S5.2.2, or S5.2.3 as appropriate, with the system engaged— (a) In the case of a vehicle with a GVWR of 4,536 kilograms (10,000 pounds) or less, with a force applied to the control not to exceed 125 pounds for a foot-operated system and 90 pounds for a hand-operated system; and (b) In the case of a vehicle with a GVWR greater than 4,536 kilograms (10,000 pounds), with a force applied to the control not to exceed 150 pounds for a foot-operated system and 125 pounds for a hand-operated system.	**Option 1**	(1) In vehicles equipped with manually operated driving controls, each vehicle shall be manufactured...a force applied to the control not to exceed 125 pounds for a foot-operated system and 90 pounds for a hand-operated system... (2) In vehicles designed to be operated by an ADS, the control of the parking brake shall be independent of the service brake control and will be activated by the ADS.	Uses driver definition 1.

FMVSS No. 105, S5.3 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
S5.3 *Brake system indicator lamp.* Each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the driver, which meet the requirements of S5.3.1 through S5.3.5. A vehicle with a GVWR of 10,000 pounds or less may have a single common indicator lamp. A vehicle with a GVWR of greater than 10,000 pounds may have an indicator lamp which is common for gross loss of pressure, drop in the level of brake fluid, or application of the parking brake, but shall have a separate indicator lamp for antilock brake system malfunction. However, the options provided in S5.3.1(a) shall not apply to a vehicle manufactured without a split service brake system; such a vehicle shall, to meet the requirements of S5.3.1(a), be equipped with a malfunction indicator that activates under the conditions specified in S5.3.1(a)(4). This warning indicator shall, instead of meeting the requirements of S5.3.2 through S5.3.5, activate (while the vehicle remains capable of meeting the requirements of	**Option 1**	S5.3. Brake system warning signal. (1) For vehicles designed for operation by a human driver, each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the driver, which meet the requirements of S5.3.1 through S5.3.5.... (2) For vehicles designed for operation by an ADS, each vehicle shall be equipped with means to communicate brake system state to the ADS, which meets the requirements put forth above for a human driver.	Uses driver definition 1. Uses similar language introduced in FMVSS 135 translation options which uses "warning signal" as it exists in the current FMVSS No. 135 in S6.3.12.b when talking about battery charge state as specified in S5.5.e. Retains current language for a vehicle operated by a human driver and adds condition for an ADS. As written, vehicles that can be operated by both a human driver and an ADS would have to meet both requirements. Does not require the information to be communicated to occupants of an ADS-DV. Does not necessarily provide direct means to verify compliance. Does not provide specific communication method requirements. Does not provide requirement that the information be communicated to a party responsible for the care of the vehicle.

FMVSS No. 105, S5.3 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
S5.1.2.2 and the ignition switch is in the “on” position) a continuous or intermittent audible signal and a flashing warning light, displaying the words “STOP-BRAKE FAILURE” in block capital letters not less than one-quarter of an inch in height.	**Option 2**	S5.3. Brake system warning signal. (1) Each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the driver or warning signal to communicate the brake system state to the ADS, which meet the requirements of S5.3.1 through S5.3.5. A vehicle with a GVWR of 10,000 pounds or less may have a single common indicator lamp. A vehicle with a GVWR of greater than 10,000 pounds may have an indicator lamp which is common for gross loss of pressure, drop in the level of brake fluid, or application of the parking brake, but shall have a separate indicator lamp or warning signal for an ADS for antilock brake system malfunction. However, the options provided in S5.3.1(a) shall not apply to a vehicle manufactured without a split service brake system; such a vehicle shall, to meet the requirements of S5.3.1(a), be equipped with a malfunction indicator that activates under the conditions specified in S5.3.1(a)(4). This warning indicator shall, instead of meeting the requirements of S5.3.2 through S5.3.5, activate (while the vehicle remains capable of meeting the requirements of S5.1.2.2 and the ignition switch is in the “on” position) a continuous or intermittent audible signal for the driver and a warning signal to the ADS and a flashing warning light, displaying the words “STOP-BRAKE FAILURE” in block capital letters not less than one-quarter of an inch in height.	Uses driver definition 2. Does not require the information to be communicated to occupants of an ADS-DV. Does not necessarily provide direct means to verify compliance. Does not provide specific communication method requirements. Does not provide requirement that the information be communicated to a party responsible for the care of the vehicle.
	Option 3	Retain current language.	Uses proposed definition for "brake system indicator lamp.”
	Option 4	S5.3. Brake system warning signal. (1) For a vehicle equipped with manually operated driving	Maintains current language for human drivers.

FMVSS No. 105, S5.3 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
		controls, each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the human driver, which meet the requirements of S5.3.1 through S5.3.5.... (b) For an ADS-DV, the information and warnings specified in S5.3.1 through S5.3.5 shall be communicated to the ADS, and the vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of all DSPs, which meet the requirements of S5.3.1 through S5.3.5.	Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and communicate the information to the ADS.
	Option 5	S5.3. Brake system warning signal. (1) For a vehicle equipped with manually operated driving controls, each vehicle shall have a brake system indicator lamp or lamps, mounted in front of and in clear view of the DSP(s), which meet the requirements of S5.3.1 through S5.3.5.... (b) For an ADS-DV, the information and warnings specified in S5.3.1 through S5.3.5 shall be communicated to the ADS, a service required log located in the occupant compartment, and the vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of all DSPs, which meet the requirements of S5.3.1 through S5.3.5.	Expand to one or more DSP. Adds a service required log storage which could be similar to storage of a diagnostic trouble code.

FMVSS No. 105, S5.3.1 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
An indicator lamp shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of the conditions (a) or (b), (c), (d), (e), (f), and (g) occur:	**Option 1**	A warning signal specified in S5.3 shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a) or (b), (c), (d), (e), (f), and (g) occur:	Follows language introduced in S5.3.

FMVSS No. 105, S5.3.1 Brake System Indicator Lamp (e)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(e) For a vehicle with electrically-actuated service brakes, failure of the source of electric power to the brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	(e) For a vehicle with electrically-actuated service brakes, failure of the source of electric power to the brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a human driver or the ADS when the vehicle is being operated by the ADS of degraded brake performance.	Uses driver definition 2. Does not necessarily provide direct means for NHTSA to verify compliance.
	Option 3	(e) For a vehicle with electrically-actuated service brakes, failure of the source of electric power to the brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning of degraded brake performance.	Removes reference to the driver.

FMVSS No. 105, S5.3.2 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Except as provided in paragraph (b) of this section, all indicator lamps shall be activated as a check of lamp function either when the ignition (start) switch is turned to the "on" (run) position when the engine is not running, or when the ignition (start) switch is in a position between "on" (run) and "start" that is designated by the manufacturer as a check position.	**Option 1**	…all warning signals shall be activated as a check of indicator function either...	Follows language introduced in S5.3.
	Option 2	…all warning signals shall be activated as a check of indicator function either when the ignition (start) switch is turned in the "on" (run) position when the engine is not running, or when the ignition (start) switch is in a position between "on" (run) and "start" that is designated by the manufacturer as a check position.	Adds language that refers to the state of the ignition rather than the action of changing the state. This is the current language used in S5.3.3.

FMVSS No. 105, S5.3.2 Brake System Indicator Lamp (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(b) The indicator lamps need not be activated when a starter interlock is in operation.	**Option 1**	(b) The warning signals need not be activated when a starter interlock is in operation.	Follows language introduced in S5.3.

FMVSS No. 105, S5.3.3 Brake System Indicator Lamp (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each indicator lamp activated due to a condition specified in S5.3.1 shall remain activated as long as the malfunction exists, whenever the ignition (start) switch is in the "on" (run) position, whether or not the engine is running.	**Option 1**	(a) Each warning signal activated due to a condition specified in S5.3.1 shall remain activated as long as the malfunction exists, whenever the ignition (start) switch is in the "on" (run) position, whether or not the engine is running.	Follows language introduced in S5.3.

FMVSS No. 105, S5.3.3 Brake System Indicator Lamp (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(b) For vehicles manufactured on and after September 1, 1999 with GVWRs greater than 10,000 lbs, each message about the existence of a malfunction, as described in S5.3.1(c), shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and the indicator lamp shall be automatically reactivated when the ignition switch is again turned to the "on" position. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the "on" (run) position. The indicator lamp shall be deactivated at the end of the check of lamp function unless there is a malfunction or a message about a malfunction that existed when the key switch was last turned to the "off" position.	**Option 1**	(b) For vehicles manufactured on and after September 1, 1999 with GVWRs greater than 10,000 lbs, each message about the existence of a malfunction, as described in S5.3.1(c), shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and the warning signal shall be automatically reactivated when the ignition switch is again changed to the "on" position. The warning signal shall also be activated as a check of lamp function whenever the ignition is changed to the "on" (run) position. The warning signal shall be deactivated at the end of the check of lamp function unless there is a malfunction or a message about a malfunction that existed when the key switch was last changed to the "off" position.	Follows language introduced in S5.3.
	Option 2	Retain current language.	Use the current language in conjunction with the language introduced as part of S5.3.

FMVSS No. 105, S5.3.4 Brake System Indicator Lamp			
Regulatory Text	**Translation Options**		**Potential Considerations**
When an indicator lamp is activated it may be steady burning or flashing.	**Option 1**	Retain current language.	For an ADS-DV that does not have a lamp, this does not apply.

FMVSS No. 105, S5.3.5 Brake System Indicator Lamp (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each indicator lamp shall display word, words or abbreviation, in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and/or this section, which shall have letters not less than ⅛ -inch high and be legible to the driver in daylight when lighted. Words in addition to those required by Standard No. 101 and/or this section and symbols may be provided for purposes of clarity.	**Option 1**	...which shall have letters not less than 1⁄8 -inch high and be legible to the human driver in daylight when lighted…	Uses driver definition 1.
	Option 2	...which shall have letters not less than 1⁄8-inch high and be legible in daylight when lighted.	Makes the legibility requirement generic; does not specify from where or to whom. Note: this section does not require new telltales, it only specifies qualifications for previously defined telltales.

<table>
<tr><th colspan="4">FMVSS No. 105, S5.3.5 Brake System Indicator Lamp (a)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><th colspan="4">FMVSS No. 105, S5.3.5 Brake System Indicator Lamp (b)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">(b) If a single common indicator is used, the lamp shall display the word “Brake.” The letters and background of a single common indicator shall be of contrasting colors, one of which is red.</td><td>Option 1</td><td>(b) If a single common indicator is used for a human driver, the lamp shall display the word “Brake.” The letters and background of a single common indicator shall be of contrasting colors, one of which is red.</td><td>Uses driver definition 1.

Does not specify an equivalent for the communication to the ADS.</td></tr>
<tr><td>Option 2</td><td>(b) If a single common indicator is used for the driver, the lamp shall display the word “Brake.” The letters and background of a single common indicator shall be of contrasting colors, one of which is red.</td><td>Uses driver definition 2.

Does not specify an equivalent for the communication to the ADS.</td></tr>
<tr><td>Option 3</td><td>Retain current language.</td><td>Not applicable to communicating state to an ADS.

Signal format is a function of the network and protocol.</td></tr>
</table>

FMVSS No. 105, S5.3.5 Brake System Indicator Lamp (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(c)(1) If separate indicators are used for one or more of the conditions described in S5.3.1(a) through S5.3.1(g) of this standard, the indicator display shall include the word "Brake" and appropriate additional labeling, except as provided in (c)(1) (A) through (D) of this paragraph.	**Option 1**	(c)(1) If separate indicators are used for one or more of the conditions described in S5.3.1(a) through S5.3.1(g) of this standard, the indicator display for a human driver shall include the word "Brake" and appropriate additional labeling, except as provided in (c)(1) (A) through (D) of this paragraph.	Uses driver definition 1. Does not specify an equivalent for the communication to the ADS.
	Option 2	(c)(1) If separate indicators are used for one or more of the conditions described in S5.3.1(a) through S5.3.1(g) of this standard, the indicator display for the driver shall include the word "Brake" and appropriate additional labeling, except as provided in (c)(1) (A) through (D) of this paragraph.	Uses driver definition 2. Does not specify an equivalent for the communication to the ADS.
	Option 3	Retain current language.	Not applicable to communicating state to an ADS. Signal format is a function of the network and protocol.

FMVSS No. 105, S5.3.5 Brake System Indicator Lamp (2)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(2) Except for a separate indicator lamp for an anti-lock system, a regenerative system, or an indicator for both anti-lock and regenerative system, the letters and background of each separate indicator lamp shall be of contrasting colors, one of which is red. The letters and background of a separate lamp for an anti-lock system, a regenerative system, or a lamp displaying both an anti-lock and a regenerative system shall be of contrasting colors, one of which is yellow.	**Option 1**	(2) Except for a separate indicator lamp for an anti-lock system, a regenerative system, or an indicator for both anti-lock and regenerative system, the letters and background of each separate indicator lamp for a human driver shall be of contrasting colors, one of which is red. The letters and background of a separate lamp for an anti-lock system, a regenerative system, or a lamp displaying both an anti-lock and a regenerative system shall be of contrasting colors, one of which is yellow.	Uses driver definition 1. Does not specify an equivalent for the communication to the ADS.
	Option 2	((2) Except for a separate indicator lamp for an anti-lock system, a regenerative system, or an indicator for both anti-lock and regenerative system, the letters and background of each separate indicator lamp for the driver shall be of contrasting colors, one of which is red. The letters and background of a separate lamp for an anti-lock system, a regenerative system, or a lamp displaying both an anti-lock and a regenerative system shall be of contrasting colors, one of which is yellow.	Uses driver definition 2. Does not specify an equivalent for the communication to the ADS.
	Option 3	Retain current language.	Not applicable to communicating state to an ADS. Signal format is a function of the network and protocol.

FMVSS No. 105, S6.1.2 Vehicle Weight			
Regulatory Text	**Translation Options**		**Potential Considerations**
For applicable tests specified in S7.5(a), S7.7, S7.8, and S7.9, vehicle weight is lightly loaded vehicle weight, with the added weight, except for the roll bar structure allowed for trucks and buses with a GVWR greater than 10,000 pounds, distributed in the front passenger seat area in passenger cars, multipurpose passenger vehicles, and trucks, and in the area adjacent to the driver's seat in buses.	**Option 1**	...and in the area adjacent to the left, front seat in buses.	Removes reference to the "driver's seat" and indicates the typical position (left, front) for buses.

FMVSS No. 105, S6.2.4 (a) Electric Vehicles and Electric Brakes			
Regulatory Text	**Translation Options**		**Potential Considerations**
For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically controlled by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral. The RBS is operational during all burnishes and all tests, except for the test of a failed RBS. (b) For an EV equipped with an RBS that is not part of the service brake system, the RBS is operational and set to produce the maximum regenerative braking effect during the burnishes, and is disabled during the test procedures. If the vehicle is equipped with a neutral gear that automatically disables the RBS, the test procedures which are designated to be conducted in gear may be conducted in neutral.	**Option 1**	For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission states, including neutral...	Uses driver definition 1. Note that using driver definition 1 implies that the RBS is not part of the service brake system for an ADS if the ADS has a means to deactivate the RBS.
	Option 2	For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the human driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral...	Uses driver definition 2. Has underlying assumption that the RBS will be controlled by the ADS and therefore part of the service brake system. This does not change transmission language since it is associated with the human driver.
	Option 3	For an EV equipped with RBS, (a) the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral. (b) the RBS is considered to be part of the service brake system for an ADS....	Adds clause that acknowledges the RBS as part of the service brake system for an ADS.

FMVSS No. 105, S6.2.5 Electric Vehicles and Electric Brakes			
Regulatory Text	**Translation Options**		**Potential Considerations**
For tests conducted "in neutral," the operator of an EV with no "neutral" position (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s)) does not apply any electromotive force to the propulsion motor(s). Any electromotive force that is applied to the propulsion motor(s) automatically remains in effect unless otherwise specified by the test procedure.	**Option 1**	For tests conducted "in neutral," the driver of an EV with no "neutral" position (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s)) does not apply any electromotive force to the propulsion motor(s). Any electromotive force that is applied to the propulsion motor(s) automatically remains in effect unless otherwise specified by the test procedure.	Uses driver definition 1.
	Option 2	For tests conducted "in neutral," the driver or ADS of an EV with no "neutral" position (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s)) does not apply any electromotive force to the propulsion motor(s). Any electromotive force that is applied to the propulsion motor(s) automatically remains in effect unless otherwise specified by the test procedure.	Uses driver definition 2.
	Option 3	Retain current language.	No reference to driver present.

FMVSS No. 105, S6.2.6 Electric Vehicles and Electric Brakes			
Regulatory Text	**Translation Options**		**Potential Considerations**
A vehicle equipped with electrically-actuated service brakes also performs the following test series. Conduct 10 stopping tests from a speed of 100 kph or the maximum vehicle speed, whichever is less. At least two of the 10 stopping distances must be less than or equal to 70 meters. The vehicle is loaded to GVWR for these tests and the transmission is in the neutral position when the service brake control is actuated and throughout the remainder of the test. The battery or batteries providing power to those electrically-actuated brakes, at the beginning of each test, shall be in a depleted state of charge for conditions (a), (b), or (c) of this paragraph as appropriate. An auxiliary means may be used to accelerate an EV to test speed. (a) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries, and with automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at not more than five percent above the EV actual automatic shut-down critical value. The critical value is determined by measuring the state-of-charge of each propulsion battery at the instant that automatic shut-down occurs and averaging the states-of-charge recorded.	**Option 1**	...two of the 10 stopping distances must be less than or equal to 70 meters. The vehicle is loaded to GVWR for these tests and the transmission is in the neutral state when the service brake control is actuated … (b)...at which the brake failure warning signal, required by S5.3.1(e) of this standard, is activated. (c)...at which the brake failure warning signal, required by S5.3.1(e) of this standard, is activated.	Provides more generic language.

FMVSS No. 105, S6.2.6 Electric Vehicles and Electric Brakes			
Regulatory Text	**Translation Options**		**Potential Considerations**
(b) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries, and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.3.1(e) of this standard, is illuminated. (c) For a vehicle which has an auxiliary battery (or batteries) that provides electrical energy to operate the electrically-actuated service brakes, the auxiliary battery(batteries) is (are) at (at an average of) not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.3.1(e) of this standard, is illuminated.			

FMVSS No. 105, S6.14 Special Drive Conditions			
Regulatory Text	**Translation Options**		**Potential Considerations**
A vehicle with a GVWR greater than 10,000 pounds equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the driver is tested with the system disengaged.	**Option 1**	Retain current language.	Uses driver definition 1 . This could be seen as more restrictive than what is currently required since current vehicles can select the state automatically as long as there is no means for the driver to engage/disengage the system.
	Option 2	A vehicle with a GVWR greater than 10,000 pounds equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the human driver is tested with the system disengaged.	Uses driver definition 2. Does not specify the drive configuration for the ADS since the current language allows for testing with the system engaged if not able to be controlled by the human driver.

FMVSS No. 105, S7. Test Procedure and Sequence			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall be capable of meeting all the applicable requirements of S5 when tested according to the procedures and sequence set forth below, without replacing any brake system part or making any adjustments to the brake system other than as permitted in the burnish and reburnish procedures and in S7.9 and S7.10. (For vehicles only having to meet the requirements of S5.1.1, S5.1.2, S5.1.3, and S5.1.7 in section S5.1, the applicable test procedures and sequence are S7.1, S7.2, S7.4, S7.5(b), S7.5(a), S7.8, S7.9, S7.10, and S7.18. However, at the option of the manufacturer, the following test procedure and sequence may be conducted: S7.1, S7.2, S7.3, S7.4, S7.5(b), S7.6, S7.7, S7.5(a), S7.8, S7.9, S7.10, and S7.18. The choice of this option must not be construed as adding to the requirements specified in S5.1.2 and S5.1.3.) Automatic adjusters must remain activated at all times. A vehicle shall be deemed to comply with the stopping distance requirements of S5.1 if at least one of the stops at each speed and load specified in each of S7.3, S7.5(b), S7.8, S7.9, S7.10, S7.15 and S7.17 (check stops) is made within a stopping distance that does not exceed the corresponding distance specified in Table II. When the transmission selector control is required to be in neutral for a deceleration, a stop or snub must be obtained by the following procedures: (a) Exceed the test speed by 4 to 8 mph; (b) Close the throttle and coast in gear to approximately 2 mph above the test speed; (c) Shift to neutral; and (d) When the test speed is reached, apply the service brakes.	**Option 1**	...(c) Move transmission to neutral state, and…	Refer to the state of the transmission rather than the action required to change the state.

FMVSS No. 105, S7.4.1.1 Burnish				
Regulatory Text	**Translation Options**		**Potential Considerations**
Burnish the brakes by making 200 stops from 40 mph at 12 fpsps (the 150 lb control force limit does not apply here). The interval from the start of one service brake application to the start of the next shall be either the time necessary to reduce the initial brake temperature to between 230 °F. and 270 °F., or the distance of 1 mile, whichever occurs first. Accelerate to 40 mph after each stop and maintain that speed until making the next stop.	**Option 1**	Retain current language.	No force limit associated with this test.
	Option 2	...The interval from the start of one service brake activation to the start of the next …	Uses activation instead of application, the latter of which may be construed as movement of a mechanical control such as a pedal.

FMVSS No. 105, S7.4.2.1 Burnish			
Regulatory Text	**Translation Options**		**Potential Considerations**
Vehicles are burnished according to the following procedures. Make 500 snubs between 40 mph and 20 mph at a deceleration rate of 10 fpsps Except where an adjustment is specified, after each brake application accelerate to 40 mph and maintain that speed until making the next brake application at a point 1 mile from the initial point of the previous brake application. If the vehicle cannot attain a speed of 40 mph in 1 mph, continue to accelerate until the vehicle reaches 40 mph or until the vehicle has traveled 1.5 miles from the initial point of the previous brake application, whichever occurs first. The brakes shall be adjusted three times during the burnish procedure, in accordance with the manufacturer's recommendations, after 125, 250, and 375 snubs.	**Option 1**	Retain current language.	No force limit associated with this test.
	Option 2	…after each service brake activation…from the initial point of the previous brake activation...	Uses activation instead of application, the latter of which may be construed as movement of a mechanical control such as a pedal.

<table>
<tr><th colspan="4">FMVSS No. 105, S7.5 Brake Adjustment—Post Burnish</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">(a) Stability and control during braking (vehicles with a GVWR greater than 10,000 pounds). Make four stops in the lightly-loaded weight condition specified in S5.1.7. Use a full brake application for the duration of the stop, with the clutch pedal depressed or the transmission selector control in the neutral position, for the duration of each stop.

(b) Service brake system—second effectiveness test. For vehicles with a GVWR of 10,000 pounds or less, or any school bus, make six stops from 30 mph. Then, for any vehicle, make six stops from 60 mph. Then, for a vehicle with a GVWR of 10,000 pounds or less, make four stops from 80 mph if the speed attainable in 2 miles is not less than 84 mph.</td><td>Option 1</td><td>Retain current language.</td><td>Current language may be generic enough.</td></tr>
<tr><td>Option 2</td><td>... Use a full brake activation for the duration of the stop, with the clutch engaged or the transmission selector control in the neutral state, for the duration of each stop.</td><td>Uses activation instead of application, the latter of which may be construed as movement of a mechanical control such as a pedal.</td></tr>
</table>

FMVSS No. 105, S7.7 Parking Brake Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
The parking brake tests for any vehicle on different grades, in different directions, and for different loads may be conducted in any order. The force required for actuation of a hand-operated brake system shall be measured at the center of the hand grip area or at a distance of 1½ inches from the end of the actuation lever, as illustrated in Figure II.	**Option 1**	Retain current language.	Use in conjunction with translation option 1 in S5.2 Does not specify how or where the ADS is to activate the parking brake.
	Option 2	The parking brake tests for any vehicle on different grades, in different directions, and for different loads may be conducted in any order. The force required by the driver for actuation of a hand-operated brake system shall be measured at the center of the hand grip area or at a distance of 1½ inches from the end of the actuation lever, as illustrated in Figure II.	Uses driver definition 2. Does not specify how or where the ADS is to activate the parking brake.

<table>
<tr><th colspan="4">FMVSS No. 105, S7.7.1.3 Test Procedure for Requirements of S5.2.1 and S5.2.3</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td>With the vehicle held stationary by means of the service brake control, apply the parking brake by a single application of the force specified in (a), (b), or (c) of this paragraph, except that a series of applications to achieve the specified force may be made in the case of a parking brake system design that does not allow the application of the specified force in a single application:

(a) In the case of a passenger car or other vehicle with a GVWR of 10,000 lbs.or less, not more than 125 pounds for a foot-operated system, and not more than 90 pounds for a hand-operated system; and

(b) In the case of a vehicle with a GVWR greater than 4,536 kilograms (10,000 pounds) not more than 150 pounds for a foot-operated system, and not more than 125 pounds for a hand-operated system.

(c) For a vehicle using an electrically-activated parking brake, apply the parking brake by activating the parking brake control.</td><td>Option 1</td><td>Retain current language.</td><td>Sub clause (c) is applicable to an ADS.

Note: this is not a unique problem for an ADS-DV since there are examples of manual control vehicles that do not use hand or foot controls for parking brake engagement.</td></tr>
</table>

FMVSS No. 105, S7.7.1.4 Test Procedure for Requirements of S5.2.1 and S5.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Following the application of the parking brake in accordance with S7.7.1.3, release all force on the service brake control and commence the measurement of time if the vehicle remains stationary. If the vehicle does not remain stationary, reapplication of the service brake to hold the vehicle stationary, with reapplication of a force to the parking brake control at the level specified in S7.7.1.3 (a) or (b) as appropriate for the vehicle being tested (without release of the ratcheting or other holding mechanism of the parking brake) may be used twice to attain a stationary position.	**Option 1**	Retain current language.	Since sub clause (c) is not called out currently, and it is applicable for an ADS, the current language may be sufficient.

FMVSS No. 105, S7.7.1.6 Test Procedure for Requirements of S5.2.1 and S5.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Check the operation of the parking brake application indicator required by S5.3.1(d).	**Option 1**	Check the operation of the parking brake application signal required by S5.3.1(d).	Use language introduced in section S5.3
	Option 2	Check the operation of the parking brake application telltale or signal required by S5.3.1(d).	Added a term specific to the human driver or occupant.

FMVSS No. 105, S7.7.2 Test Procedure for Requirements of S5.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Check that transmission must be placed in park position to release key; (b) Test as in S7.7.1, except in addition place the transmission control to engage the parking mechanism; and (c) Test as in S7.7.1 except on a 20 percent grade, with the parking mechanism not engaged.	**Option 1**	(a) Check that transmission must be in park to release key;…	Use language that defines the state rather than the action.

FMVSS No. 105, S7.9.1 Service Brake System Test—Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
With the vehicle at lightly loaded vehicle weight or at the manufacturer's option for a vehicle with a GVWR greater than 10,000 pounds, at lightly loaded vehicle weight plus not more than an additional 1,000 pounds for a roll bar structure on the vehicle, alter the service brake system to produce any one rupture or leakage type of failure, other than a structural failure of a housing that is common to two or more subsystems. Determine the control force, pressure level, or fluid level (as appropriate for the indicator being tested) necessary to activate the brake system indicator lamp. Make four stops if the vehicle is equipped with a split service brake system, or 10 stops if the vehicle is not so equipped, each from 60 mph, by a continuous application of the service brake control. Restore the service brake system to normal at completion of this test.	**Option 1**	...Determine the control force, pressure level, or fluid level (as appropriate for the indicator being tested) necessary to activate the brake system warning signal….	Uses language introduced in section S5.3.

FMVSS No. 105, S7.9.4 Service Brake System Test—Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
(For vehicles with antilock and/or variable proportioning brake systems.) With vehicle at GVWR, disconnect functional power source, or otherwise render antilock system inoperative. Disconnect variable proportioning brake system. Make four stops, each from 60 mph. If more than one antilock or variable proportioning brake subsystem is provided, disconnect or render one subsystem inoperative and run as above. Restore system to normal at completion of this test. Repeat for each subsystem provided. Determine whether the brake system indicator lamp is activated when the electrical power source to the antilock or variable proportioning unit is disconnected.	**Option 1**	...Determine whether the brake system warning signal is activated when the electrical power source to the antilock or variable proportioning unit is disconnected.	Uses language introduced in section S5.3.

FMVSS No. 105, S7.9.5 Service Brake System Test—Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
For a vehicle in which the brake signal is transmitted electrically between the brake pedal and some or all of the foundation brakes, regardless of the means of actuation of the foundation brakes, the tests in S7.9.1 through S7.9.3 of this standard are conducted by inducing any single failure in any circuit that electrically transmits the brake signal, and all other systems intact. Determine whether the brake system indicator lamp is activated when the failure is induced.	**Option 1**	For a vehicle in which the brake signal is transmitted electrically between the service brake control and some or all of the foundation brakes...Determine whether the brake system warning signal is activated when the failure is induced.	Replace pedal with a generic service brake control. Uses language introduced in section S5.3

FMVSS No. 105, S7.9.6 Service Brake System Test—Partial Failure			
Regulatory Text	**Translation Options**		**Potential Considerations**
For an EV with RBS that is part of the service brake system, the tests specified in S7.9.1 through S7.9.3 are conducted with the RBS disconnected and all other systems intact. Determine whether the brake system indicator lamp is activated when the RBS is disconnected.	**Option 1**	...Determine whether the brake system warning signal is activated when the RBS is disconnected.	Uses language introduced in section S5.3

FMVSS No. 105, S7.11.1.1 Vehicles With GVWR of 10,000 lb or Less			
Regulatory Text	**Translation Options**		**Potential Considerations**
Make three stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated when vehicle speed falls to 5 mph. Average the maximum brake control force required for the three stops.	**Option 1**	Retain current language.	Current language may be generic enough.
	Option 2	Make three stops from 30 mph at 10 fpsps for each stop. Service brake input force readings may be terminated when vehicle speed falls to 5 mph. Average the maximum brake control input required for the three stops.	Provides more generic language.

FMVSS No. 105, S7.11.1.2 Vehicles With GVWR Greater Than 10,000 lb			
Regulatory Text	**Translation Options**		**Potential Considerations**
With transmission in neutral (or declutched), make three snubs from 40 to 20 mph at 10 fpsps for each snub. Average the maximum brake control force required for the three snubs.	**Option 1**	Retain current language.	Current language may be generic enough.
	Option 2	With transmission in a neutral (or declutched) state, make three snubs from 40 to 20 mph at 10 fpsps for each snub. Average the maximum brake control input required for the three snubs.	Considers the state of the transmission.

FMVSS No. 105, S7.11.2.1 Vehicles With GVWR of 10,000 lb or Less			
Regulatory Text	**Translation Options**		**Potential Considerations**
Make 5 stops from 60 mph at 15 fpsps followed by 5 stops at the maximum attainable deceleration between 5 and 15 fpsps for each stop. Establish an initial brake temperature before the first brake application of 130° to 150 °F. Initial brake temperatures before brake applications for subsequent stops are those occurring at the distance intervals. Attain the required deceleration within 1 second and, as a minimum, maintain it for the remainder of the stopping time. Control force readings may be terminated when vehicle speed falls to 5 mph. Leave an interval of 0.4 mi between the start of brake applications. Accelerate immediately to the initial test speed after each stop. Drive 1 mi at 30 mph after the last fade stop, and immediately follow the recovery procedure specified in S7.11.3.1.	**Option 1**	Retain current language.	Current language may be generic enough.
	Option 2	... Service brake input force readings may be terminated when vehicle speed falls to 5 mph...	Provides more generic language.

FMVSS No. 105, S7.11.2.2 Vehicles With GVWR Greater Than 10,000 lb			
Regulatory Text	**Translation Options**		**Potential Considerations**
With transmission in neutral (or declutched) make 10 snubs from 40 to 20 mph at 10 fpsps for each snub. Establish an initial brake temperature before the first brake application of 130 °F. to 150 °F. Initial brake temperatures before brake application for subsequent snubs are those occurring in the time intervals specified below. Attain the required deceleration within 1 s and maintain it for the remainder of the snubbing time. Leave an interval of 30 s between snubs (start of brake application to start of brake application). Accelerate immediately to the initial test speed after each snub. Drive for 1.5 mi at 40 mph after the last snub and immediately follow the recovery procedure specified in S7.11.3.2.	**Option 1**	With transmission in neutral (or declutched) state…	Considers the state of the transmission.

FMVSS No. 105, S7.11.3.1 Vehicles With GVWR of 10,000 lb or Less			
Regulatory Text	**Translation Options**		**Potential Considerations**
Make five stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated when vehicle speed falls to 5 mph. Allow a braking distance interval of 1 mi. Immediately after each stop accelerate at maximum rate to 30 mph and maintain that speed until making the next stop. Record the maximum control force for each stop.	**Option 1**	Retain current language.	Current language may be generic enough.
	Option 2	... Service brake input force readings may be terminated when vehicle speed falls to 5 mph.	Provides more generic language.

FMVSS No. 105, S7.11.3.2 Vehicles With GVWR of 10,000 lb or Less			
Regulatory Text	**Translation Options**		**Potential Considerations**
With transmission in neutral (or declutched) make five snubs from 40 to 20 mph at 10 fpsps for each snub. After each snub, accelerate at maximum rate to 40 mph and maintain that speed until making the next brake application at a point 1.5 mi from the point of the previous brake application. Record the maximum control force for each snub.	**Option 1**	With transmission in neutral (or declutched) state…	Considers the state of the transmission. The current control force language may be generic enough.

FMVSS No. 105, S7.16.1 Baseline Check Stop			
Regulatory Text	**Translation Options**		**Potential Considerations**
Make three stops from 30 mph at 10 fpsps for each stop. Control force readings may be terminated when vehicle speed falls to 5 mph. Average the maximum brake control force required for the three stops.	**Option 1**	Retain current language.	Current language may be generic enough.
	Option 2	... Service brake input force readings may be terminated when vehicle speed falls to 5 mph.	Provides more generic language.

FMVSS No. 105, S7.17 Spike Stops			
Regulatory Text	**Translation Options**		**Potential Considerations**
Make 10 successive spike stops from 30 mph with the transmission in neutral, with no reverse stops. Make spike stops by applying a control force of 200 lb while recording control force versus time. Maintain control force until vehicle has stopped. At completion of 10 spike stops, make six effectiveness stops from 60 mph.	**Option 1**	Make 10 successive spike stops from 30 mph with the transmission in neutral, with no reverse stops. Make spike stops by applying a control force of 200 lb for a human driver while recording control force versus time. Maintain control force until vehicle has stopped. At completion of 10 spike stops, make six effectiveness stops from 60 mph. For a vehicle designed to be operated by an ADS, make the spike stops by applying a control input that maintains the required deceleration. Maintain control force until...	This does not limit the level of input the ADS is allowed to apply to the brake system.
	Option 2	Make 10 successive spike stops from 30 mph with the transmission in neutral state, with no reverse stops. Make spike stops by applying a control force of 200 lb for the driver and not greater than xxx N (yyy lbs.) for an ADS, while recording service brake input force versus time. Maintain control force until vehicle has stopped. At completion of 10 spike stops, make six effectiveness stops from 60 mph.	Uses driver definition 2. Assumes that there may be a reason to limit the force that the ADS should apply to ensure safe and consistent braking of the vehicle during hot operation.

FMVSS No. 121

Technical Translation Options Summary: The focus of this FMVSS is to "insure [sic] safe braking performance under normal and emergency driving conditions." The primary potential challenges for the translation are the references to driver, the use of "treadle" which implies a foot operated pedal, and the use of telltales for communicating to the driver. Each technical translation option has an underlying theme that works as a set. Option 1 is based on an equivalency between the human driver and ADS, using driver definition 1. Option 2 is based on distinction between driver as only human driver and ADS, using driver definition 2. Option 3 provides an alternative that may be specified and related to driver definition 1 or driver definition 2 or generic to driver definition. For paragraphs relate to telltales, indicators, and alerts: Option 1 refers to the ADS only, Option 2 refers to the ADS and all occupant positions (e.g., sleeper berth), Option 3 refers to the ADS and occupants in the position of the current standard, Option 4 refers to the ADS and a service required log (which could be available to technicians).

<table>
<tr><th colspan="4">FMVSS No. 121, S3. Application</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">This standard applies to trucks, buses, and trailers equipped with air brake systems. However, it does not apply to:

(a) Any trailer that has a width of more than 102.36 inches with extendable equipment in the fully retracted position and is equipped with two short track axles in a line across the width of the trailer.

(b) Any vehicle equipped with an axle that has a gross axle weight rating (GAWR) of 29,000 pounds or more;

(c) Any truck or bus that has a speed attainable in 2 miles of not more than 33 mph;

(d) Any truck that has a speed attainable in 2 miles of not more than 45 mph, an unloaded vehicle weight that is not less than 95 percent of its gross vehicle weight rating (GVWR), and no capacity to carry occupants other than the driver and operating crew;

(e) Any trailer that has a GVWR of more than 120,000 pounds and whose body conforms to that described in the definition of heavy hauler trailer set forth in S4;

(f) Any trailer that has an unloaded vehicle weight which is not less than 95 percent of its GVWR; and

(g) Any load divider dolly.</td><td>Option 1</td><td>...(d)…and no capacity to carry occupants other than the human driver (if present) and operating crew;…</td><td>Uses driver definition 1.</td></tr>
<tr><td>Option 2</td><td>Retain current language.</td><td>Uses driver definition 2.

The terms "driver" and "operating crew" are used to identify the type of heavy vehicle configuration for application exception based upon the number and weight of occupants. The term "operating crew" can be used to refer to occupants that may serve various on- or off-highway roles on a specially equipped heavy vehicle including operating other equipment mounted on the heavy vehicle while stationary.</td></tr>
</table>

FMVSS No. 121, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Air brake system means a system that uses air as a medium for transmitting pressure or force from the driver control to the service brake, including an air-over-hydraulic brake subsystem, but does not include a system that uses compressed air or vacuum only to assist the driver in applying muscular force to hydraulic or mechanical components.	**Option 1**	*Air brake system* means a system that uses air as a medium for transmitting pressure or force from the driver control to the service brake, including an air-over-hydraulic brake subsystem, but does not include a system that uses compressed air or vacuum only to assist the driver in applying force to hydraulic or mechanical components.	Uses driver definition 1. Removes the qualification that the force be muscular.
	Option 2	*Air brake system* means a system that uses air as a medium for transmitting pressure or force from the service brake input control to the service brake, including an air-over-hydraulic brake subsystem, but does not include a system that uses compressed air or vacuum only to assist the activation of the service brake input control to hydraulic or mechanical components.	Removes reference to a driver.

FMVSS No. 121, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Air-over-hydraulic brake subsystem means a subsystem of the air brake system that uses compressed air to transmit a force from the driver control to a hydraulic brake system to actuate the service brakes.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	*Air-over-hydraulic brake subsystem* means a subsystem of the air brake system that uses compressed air to transmit a force from the service brake input control to a hydraulic brake system to actuate the service brakes.	Removes reference to a driver.

FMVSS No. 121, S4. Definitions.			
Regulatory Text	**Translation Options**		**Potential Considerations**
Full-treadle brake application means a brake application in which the treadle valve pressure in any of the valve's output circuits reaches 85 pounds per square inch (psi) within 0.2 seconds after the application is initiated, or in which maximum treadle travel is achieved within 0.2 seconds after the application is initiated.	**Option 1**	Retain current language.	Current language is a definition and does not explicitly refer to how the treadle valve is operated.
	Option 2	*Full-treadle brake application* means a brake application in which the treadle valve pressure in any of the valve's output circuits reaches 85 pounds per square inch (psi) within 0.2 seconds after the application is initiated, or in which maximum treadle valve travel is achieved within 0.2 seconds after the application is initiated.	Specifies the travel, refers to the valve travel rather than another input such as the treadle pedal. Retains the word treadle which is defined by Merriam-Webster (2020 online version) as "a swiveling or lever device pressed by the foot to drive a machine."
	Option 3	*Full brake application* means a brake application in which the input valve pressure in any of the valve's output circuits reaches 85 pounds per square inch (psi) within 0.2 seconds after the application is initiated, or in which maximum input valve travel is achieved within 0.2 seconds after the application is initiated.	Removes "treadle" and replaces it with a generic input.

FMVSS No. 121, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Maximum drive-through speed means the highest possible constant speed at which the vehicle can be driven through 200 feet of a 500-foot radius curve arc without leaving the 12-foot lane.	**Option 1**	*Maximum drive-through speed* means the highest possible constant speed at which the vehicle can be operated through 200 feet of a 500-foot radius curve arc without leaving the 12-foot lane.	Not driver definition specific.

FMVSS No. 121, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Maximum treadle travel means the distance that the treadle moves from its position when no force is applied to its position when the treadle reaches a full stop.	**Option 1**	Retain current language.	Current language is a definition and does not explicitly refer to how the treadle valve is operated.
	Option 2	*Maximum treadle travel* means the distance that the treadle valve displaces from its position when no force is applied to its position when the treadle reaches a full stop.	Specifies the travel, refers to the valve travel rather than another input such as the treadle pedal. Retains the word treadle which is defined by Merriam-Webster (2020 online version) as "a swiveling or lever device pressed by the foot to drive a machine.”
	Option 3	*Maximum brake input travel* means the distance that the brake input valve displaces from its position when no force is applied to its position when the brake input valve is fully engaged.	Removes "treadle" and replaces it with a generic input.

FMVSS No. 121, S4. Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Straddle trailer means a trailer that is designed to transport bulk agricultural commodities from the harvesting location as evidenced by a framework that is driven over the cargo and lifting arms that suspend the cargo for transit.	**Option 1**	*Straddle trailer* means a trailer that is designed to transport bulk agricultural commodities from the harvesting location as evidenced by a framework that is operated over the cargo and lifting arms that suspend the cargo for transit.	Not driver definition specific.

FMVSS No. 121, S5.1.4 Pressure Gauge			
Regulatory Text	**Translation Options**		**Potential Considerations**
A pressure gauge in each service brake system, readily visible to a person seated in the normal driving position, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.	**Option 1**	A pressure gauge in each service brake system, readily visible to the human driver seated in the driver's DSP, and in an ADS-DV communicated to the ADS, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.	Uses driver definition 1. Uses ADS-DV definition, which is communication to the ADS only.
	Option 2	A pressure gauge in each service brake system, readily visible to the driver's DSP, and in an ADS-DV communicated to the ADS and all DSPs, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.	Uses driver definition 2. Removes the reference to person. ADS-DV can communicate to ADS and still be visible by all DSPs.
	Option 3	A pressure gauge in each service brake system, readily visible to the human driver seated in the driver's DSP, and in an ADS-DV communicated to the ADS and the left, front outboard DSP of an ADS-DV, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.	Uses driver definition 1 to replace person. Reference to driver replaced with current human driver's DSP. Definition includes communication to the ADS only.
	Option 4	A pressure gauge in each service brake system, readily visible to the human driver seated in the driver's DSP, and in an ADS-DV communicated to the ADS and to a service required log located in the occupant compartment, that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.	Uses driver definition 1. To the ADS and data logger. This option could support a future requirement to communicate to a service required log for review on a technician provided device prior to releasing for public road operation.

FMVSS No. 121, S5.1.5 Warning Signal			
Regulatory Text	**Translation Options**		**Potential Considerations**
A signal, other than a pressure gauge, that gives a continuous warning to a person in the normal driving position when the ignition is in the “on” (“run”) position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view, or both audible and visible.	**Option 1**	A signal, other than a pressure gauge, that gives a continuous warning to the human driver in the driver's DSP and in an ADS-DV communicates a warning signal to the ADS when the ignition is in the “on” (“run”) position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the human driver's forward field of view (if present), or both audible and visible.	Uses driver definition 1. Definition includes communication to the ADS only. Applies to the human and does not require an additional signal beyond the pressure to be communicated to the ADS.
	Option 2	A signal, other than a pressure gauge, that gives a continuous warning to the driver's DSP and in an ADS-DV communicates a warning signal to the ADS and all DSPs when the ignition is in the “on” (“run”) position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view (if present), or both audible and visible.	Uses driver definition 2. Removes the reference to person. ADS-DV can communicate to ADS and visible by all DSPs.
	Option 3	A signal, other than a pressure gauge, that gives a continuous warning to the human driver in the driver’s DSP and in an ADS-DV communicates a warning signal to the ADS and the left, front outboard DSP of an ADS-DV when the ignition is in the “on” (“run”) position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the human driver's forward field of view (if present), or both audible and visible.	Uses driver definition 1 to replace person. Reference to driver replaced with current human driver's DSP. Definition includes communication to the ADS and a general seat position.
	Option 4	A signal, other than a pressure gauge, that gives a continuous warning to the human driver in the driver's DSP and in an ADS-DV communicates a warning signal to the ADS and to a service required log located in the occupant compartment when the ignition is in the “on” (“run”) position and the air pressure in the service	Uses driver definition 1 To the ADS and service required log. This option could support a future

FMVSS No. 121, S5.1.5 Warning Signal			
Regulatory Text	**Translation Options**		**Potential Considerations**
		reservoir system is below 60 psi. The signal shall be either visible within the human driver's forward field of view (if present), or both audible and visible.	requirement to communicate to a service required log for review on a technician provided device prior to releasing for public road operation.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each truck tractor manufactured on or after March 1, 1997, and each single unit vehicle manufactured on or after March 1, 1998, shall be equipped with an indicator lamp, mounted in front of and in clear view of the driver, which is activated whenever there is a malfunction that affects the generation or transmission of response or control signals in the vehicle's antilock brake system. The indicator lamp shall remain activated as long as such a malfunction exists, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running. Each message about the existence of such a malfunction shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and automatically reactivated when the ignition switch is again turned to the "on" ("run") position. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the "on" ("run") position. The indicator lamp shall be deactivated at the end of the check of lamp function unless there is a malfunction or a message about a malfunction that existed when the key switch was last turned to the "off" position.	**Option 1**	Each truck tractor manufactured on or after March 1, 1997 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 1998 that is equipped with manually operated driving controls, shall be equipped with an indicator lamp, mounted in front of and in clear view of the human driver,... was last turned to the "off" position. Each ADS-DV truck tractor shall communicate a malfunction signal to the ADS whenever there is a malfunction that affects the generation or transmission of response or control signals in the vehicle's antilock brake system. The signal shall be continuously communicated as long as such a malfunction exists, whenever the ignition (start) switch is in the "on" ("run") position whether or not the engine is running. Each signal about the existence of such a malfunction shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and automatically recommunicated when the ignition switch is again turned to the "on" ("run") position.	Uses driver definition 1. For ADS-DV, communicate only to ADS.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (a) (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
See regulatory text above.	**Option 2**	Each truck tractor manufactured on or after March 1, 1997 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 1998 that is equipped with manually operated driving controls, shall be equipped with an indicator lamp, mounted in front of and in clear view of the driver,... was last turned to the "off" position. Each ADS-DV truck tractor shall communicate a malfunction signal whenever there is a malfunction that affects the generation or transmission of response or control signals in the vehicle's antilock brake system to the ADS and shall be equipped with an indicator lamp in front of and in clear view of all DSPs that indicates the existence of the malfunction. The signal shall be continuously communicated as long as such a malfunction exists, whenever the ignition (start) switch is in the "on" ("run") position whether or not the engine is running. Each signal about the existence of such a malfunction shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and automatically recommunicated when the ignition switch is again turned to the "on" ("run") position. The indicator lamp shall remain activated as long as such a malfunction exists, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running. Each message about the existence of such a malfunction shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and automatically reactivated when the ignition switch is again turned to the "on" ("run") position. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the "on" ("run") position. The indicator lamp shall be deactivated at the end of the check of lamp function unless there is a malfunction or a message about a malfunction that existed when the key switch was last turned to the "off" position.	Uses driver definition 2. To the ADS and all DSPs. Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and communicate the information to the ADS. Considerations for occupants seated in the sleeper berth where "hours of service" are not accruing could be specified by the manufacturers.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (a) (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
See regulatory text above.	**Option 3**	Each truck tractor manufactured on or after March 1, 1997 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 1998 that is equipped with manually operated driving controls, shall be equipped with an indicator lamp, mounted in front of and in clear view of the human driver,... was last turned to the "off" position. Each ADS-DV truck tractor shall communicate a malfunction signal to the ADS and to a service required log located in the occupant compartment whenever there is a malfunction that affects the generation or transmission of response or control signals in the vehicle's antilock brake system. The signal shall be continuously communicated as long as such a malfunction exists, whenever the ignition (start) switch is in the "on" ("run") position whether or not the engine is running. Each signal about the existence of such a malfunction shall be stored in the antilock brake system after the ignition switch is turned to the "off" position and automatically recommunicated when the ignition switch is again turned to the "on" ("run") position.	Uses driver definition 1. To the ADS and service required log. This option could support a future requirement to communicate to a service required log for review on a technician provided device prior to releasing for public road operation.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
(b) Each truck tractor manufactured on or after March 1, 2001, and each single unit vehicle manufactured on or after March 1, 2001, that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the trailer ABS malfunction lamp in the cab of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. Each such truck tractor and single unit vehicle shall also be equipped with an indicator lamp, separate from the lamp required in S5.1.6.2(a), mounted in front of and in clear view of the driver, which is activated whenever the malfunction signal circuit described above receives a signal indicating an ABS malfunction on one or more towed vehicle(s). The indicator lamp shall remain activated as long as an ABS malfunction signal from one or more towed vehicle(s) is present, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the "on" ("run") position. The indicator lamp shall be deactivated at the end of the check of lamp function unless a trailer ABS malfunction signal is present.	**Option 1**	(b) Each truck tractor manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the trailer ABS malfunction lamp in the cab of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. Each such truck tractor and single unit vehicle shall also be equipped with an indicator lamp, separate from the lamp required in S5.1.6.2(a), mounted in front of and in clear view of the human driver, ... unless a trailer ABS malfunction signal is present. Each ADS-DV truck tractor that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the ADS of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. The signal shall be continuously communicated as long as an ABS malfunction signal from one or more towed vehicle(s) is present, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running.	Uses driver definition 1. Does not alter the reference to the ignition. For ADS-DV, communicate only to ADS.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (b) (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
See regulatory text above.	**Option 2**	(b) Each truck tractor manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the trailer ABS malfunction lamp in the cab of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. Each such truck tractor and single unit vehicle shall also be equipped with an indicator lamp, separate from the lamp required in S5.1.6.2(a), mounted in front of and in clear view of the driver, ...unless a trailer ABS malfunction signal is present. Each ADS-DV truck tractor that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the ADS of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. The signal shall be continuously communicated as long as an ABS malfunction signal from one or more towed vehicle(s) is present, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running. Each such truck tractor and single unit vehicle shall also be equipped with an indicator lamp, separate from the lamp required in S5.1.6.2(a), mounted in front of and in clear view of all DSPs, which is activated whenever the malfunction signal circuit described above receives a signal indicating an ABS malfunction on one or more towed vehicle(s). The indicator lamp shall remain activated as long as	Uses driver definition 2 To the ADS and all DSPs. Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and communicate the information to the ADS. Considerations for occupants seated in the sleeper berth where "hours of service" are not accruing could be specified by the manufacturers.

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (b) (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
		an ABS malfunction signal from one or more towed vehicle(s) is present, whenever the ignition (start) switch is in the “on” (“run”) position, whether or not the engine is running. The indicator lamp shall also be activated as a check of lamp function whenever the ignition is turned to the “on” (“run”) position. The indicator lamp shall be deactivated at the end of the check of lamp function unless a trailer ABS malfunction signal is present.	

FMVSS No. 121, S5.1.6.2 Antilock Malfunction Signal and Circuit (b) (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
See regulatory text above.	**Option 3**	(b) Each truck tractor manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, and each single unit vehicle manufactured on or after March 1, 2001 that is equipped with manually operated driving controls, that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the trailer ABS malfunction lamp in the cab of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. Each such truck tractor and single unit vehicle shall also be equipped with an indicator lamp, separate from the lamp required in S5.1.6.2(a), mounted in front of and in clear view of the human driver, ... unless a trailer ABS malfunction signal is present. Each ADS-DV truck tractor that is equipped to tow another air-braked vehicle, shall be equipped with an electrical circuit that is capable of transmitting a malfunction signal from the antilock brake system(s) on one or more towed vehicle(s) (e.g., trailer(s) and dolly(ies)) to the ADS and to a service required log located in the occupant compartment of the towing vehicle, and shall have the means for connection of this electrical circuit to the towed vehicle. The signal shall be continuously communicated as long as an ABS malfunction signal from one or more towed vehicle(s) is present, whenever the ignition (start) switch is in the "on" ("run") position, whether or not the engine is running.	Uses driver definition 1. To the ADS and service required log. This option could support a future requirement to communicate to a service required log for review on a technician provided device prior to releasing for public road operation.

FMVSS No. 121, S5.1.7 Service Brake Stop Lamp Switch			
Regulatory Text	**Translation Options**		**Potential Considerations**
A switch that lights the stop lamps when the service brake control is statically depressed to a point that produces a pressure of 6 psi or less in the service brake chambers.	**Option 1**	A switch that lights the stop lamps when the service brake control is statically depressed or activated to a point that produces a pressure of 6 psi or less in the service brake chambers.	Provides a more generic term for activating the service brake input.
	Option 2	Same as option 1.	

FMVSS No. 121, S5.3.1.1 Service Brakes—Road Tests			
Regulatory Text	**Translation Options**		**Potential Considerations**
Stop the vehicle from 60 mph on a surface with a peak friction coefficient of 0.9 with the vehicle loaded as follows: (a) Loaded to its GVWR so that the load on each axle, measured at the tire-ground interface, is most nearly proportional to the axles' respective GAWRs, without exceeding the GAWR of any axle. (b) In the truck tractor only configuration plus up to 500 lbs.or, at the manufacturer's option, at its unloaded weight plus up to 500 lbs.(including driver and instrumentation) and plus not more than an additional 1,000 lbs.for a roll bar structure on the vehicle, and (c) At its unloaded vehicle weight (except for truck tractors) plus up to 500 lbs.(including driver and instrumentation) or, at the manufacturer's option, at its unloaded weight plus up to 500 lbs.(including driver and instrumentation) plus not more than an additional 1,000 lbs.for a roll bar structure on the vehicle. If the speed attainable in two miles is less than 60 mph, the vehicle shall stop from a speed in Table II that is four to eight mph less than the speed attainable in two miles.	**Option 1**	...(c) At its unloaded vehicle weight (except for truck tractors) plus up to 500 lbs.(including driver - if present - and instrumentation)…(including driver - if present - and instrumentation)…	Uses driver definition 1. Acknowledges option of executing test without human present in the vehicle. May provide confusion as the ADS could be considered the test driver based on equivalency.
	Option 2	Retain current language.	Uses driver definition 2. Leave language as written with the understanding that the ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.
	Option 3	...(c) At its unloaded vehicle weight (except for truck tractors) plus up to 500 lbs.(including test personnel - if present - and instrumentation) or, at the manufacturer's option, at its unloaded weight plus up to 500 lbs.(including test personnel - if present - and instrumentation)...	Removes the reference to driver. This option recognizes that test personnel may continue to be part of the testing procedure without focusing on them in the role as driver but rather a testing occupant.

FMVSS No. 121, S5.3.6.1 Stability and Control During Braking—Trucks and Buses			
Regulatory Text	**Translation Options**		**Potential Considerations**
Using a full-treadle brake application for the duration of the stop, stop the vehicle from 30 mph or 75 percent of the maximum drive-through speed, whichever is less, on a 500-foot radius curved roadway with a wet level surface having a peak friction coefficient of 0.5 when measured on a straight or curved section of the curved roadway using an ASTM E1136-93 (Reapproved 2003) (incorporated by reference, see §571.5) standard reference tire, in accordance with ASTM E1337-90 (Reapproved 2008) (incorporated by reference, see §571.5), at a speed of 40 mph, with water delivery.	**Option 1**	Retain current language.	May be able to keep current language if definition for full-treadle brake application is used.
	Option 2	Retain current language.	May be able to keep current language if definition for full-treadle brake application is used.
	Option 3	Using a full service brake input for the duration of the stop, stop the vehicle from 30 mph or 75 percent of the maximum drive-through speed, whichever is less, on a 500-foot radius curved roadway with a wet level surface having a peak friction coefficient of 0.5 when measured on a straight or curved section of the curved roadway using an ASTM E1136-93 (Reapproved 2003) (incorporated by reference, see §571.5) standard reference tire, in accordance with ASTM E1337-90 (Reapproved 2008) (incorporated by reference, see §571.5), at a speed of 40 mph, with water delivery.	Removes the reference to the treadle (pedal).

FMVSS No. 121, S5.3.6.2 Stability and Control During Braking—Trucks and Buses			
Regulatory Text	**Translation Options**		**Potential Considerations**
Stop the vehicle, with the vehicle: (a) Loaded to its GVWR, for a truck tractor, and (b) At its unloaded weight plus up to 500 pounds (including driver and instrumentation), or at the manufacturer's option, at its unloaded weight plus up to 500 pounds (including driver and instrumentation) and plus not more than an additional 1000 pounds for a roll bar structure on the vehicle, for a truck, bus, or truck tractor.	**Option 1**	...(b) At its unloaded vehicle weight plus up to 500 lbs.(including human driver - if present - and instrumentation), or at the manufacturer's option, at its unloaded weight plus up to 500 pounds (including human driver - if present - and instrumentation)	Uses driver definition 1. Acknowledges option of executing test without human present in the vehicle. May provide confusion as the ADS could be considered the test driver based on equivalency.
	Option 2	...(b) At its unloaded vehicle weight plus up to 500 lbs.(including test personnel - if present - and instrumentation), or at the manufacturer's option, at its unloaded weight plus up to 500 pounds (including test personnel - if present - and instrumentation)	Uses driver definition 2. This option recognizes that test personnel may continue to be part of the testing procedure without focusing on them in the role as driver but rather a testing occupant.
	Option 3	Retain current language.	Uses driver definition 2. Leave language as written with the understanding that the ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.

<table>
<tr><th colspan="4">FMVSS No. 121, S5.6.2 Grade Holding</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">With all parking brakes applied, the vehicle shall remain stationary facing uphill and facing downhill on a smooth, dry portland cement concrete roadway with a 20-percent grade, both

(a) When loaded to its GVWR, and

(b) At its unloaded vehicle weight plus 1500 pounds (including driver and instrumentation and roll bar).</td><td>Option 1</td><td>...(b) At its unloaded vehicle weight plus up to 500 lbs.(including human driver - if present - and instrumentation and roll bar)</td><td>Uses driver definition 1.

Acknowledges option of executing test without human present in the vehicle.

May provide confusion as the ADS could be considered the test driver based on equivalency.</td></tr>
<tr><td>Option 2</td><td>...(b) At its unloaded vehicle weight plus up to 500 lbs.(including test personnel - if present - and instrumentation and roll bar)</td><td>Uses driver definition 2.

This option recognizes that test personnel may continue to be part of the testing procedure without focusing on them in the role as driver but rather a testing occupant.</td></tr>
<tr><td>Option 3</td><td>Retain current language.</td><td>Not specific to driver definition.

Leave language as written with the understanding that the ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.</td></tr>
</table>

FMVSS No. 121, S5.6.4 Parking Brake Control—Trucks and Buses			
Regulatory Text	**Translation Options**		**Potential Considerations**
The parking brake control shall be separate from the service brake control. It shall be operable by a person seated in the normal driving position. The control shall be identified in a manner that specifies the method of control operation. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow.	**Option 1**	The parking brake control shall be separate from the service brake control. For each vehicle equipped with manually operated driving controls, it shall be operable by a person seated in the driver's DSP. The control shall be identified in a manner that specifies the method of control operation. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow. For each ADS-DV, the parking brake control shall be operable by the ADS. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow.	Uses driver definition 1. The parking brake control remains separate from the service brake control in all vehicles.
	Option 2	The parking brake control shall be separate from the service brake control. For each vehicle equipped with manually operated driving controls, it shall be operable in the driver's DSP. The control shall be identified in a manner that specifies the method of control operation. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow. For each ADS-DV, the parking brake control shall be operable by the ADS. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow.	Uses driver definition 2. Removes reference to "person." Clarifies normal position as the driver's DSP. The parking brake control remains separate from the service brake control in all vehicles.

FMVSS No. 121, S6.1.3 Road Test Conditions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Unless otherwise specified, the transmission selector control is in neutral or the clutch is disengaged during all decelerations and during static parking brake tests.	**Option 1**	Unless otherwise specified, the transmission state is in neutral or the clutch is disengaged during all decelerations and during static parking brake tests.	Refers to the transmission state rather than the mechanism to change the state.

<table>
<tr><th colspan="4">FMVSS No. 121, S6.1.8 Road Test Conditions</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">For vehicles with parking brake systems not utilizing the service brake friction elements, burnish the friction elements of such systems prior to the parking brake test according to the manufacturer's recommendations. For vehicles with parking brake systems utilizing the service brake friction elements, burnish the brakes as follows: With the transmission in the highest gear appropriate for a speed of 40 mph, make 500 snubs between 40 mph and 20 mph at a deceleration rate of 10 fpsps , or at the vehicle's maximum deceleration rate if less than 10 fpsps Except where an adjustment is specified, after each brake application accelerate to 40 mph and maintain that speed until making the next brake application at a point 1 mile from the initial point of the previous brake application. If the vehicle cannot attain a speed of 40 mph in 1 mile, continue to accelerate until the vehicle reaches 40 mph or until the vehicle has traveled 1.5 miles from the initial point of the previous brake application, whichever occurs first. Any automatic pressure limiting valve is in use to limit pressure as designed. The brakes may be adjusted up to three times during the burnish procedure, at intervals specified by the vehicle manufacturer, and may be adjusted at the conclusion of the burnishing, in accordance with the vehicle manufacturer's recommendation.</td><td>Option 1</td><td>Retain current language.</td><td>Language calls out state of transmission.</td></tr>
<tr><td>Option 2</td><td>For vehicles with parking brake systems utilizing the service brake friction elements, burnish the brakes as follows: With the transmission in the highest gear state for a speed of 40 mph...</td><td>Provides consistent language in referring to the transmission.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 121, S6.1.11 Special Drive Conditions</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">A vehicle equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the driver is tested with the system disengaged.</td><td>Option 1</td><td>Retain current language.</td><td>Use driver definition 1. Use equivalency of human driver and ADS.

As currently written, this allows the vehicle (including the ADS) to engage/disengage the system without human input.</td></tr>
<tr><td>Option 2</td><td>A vehicle equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the driver or ADS is tested with the system disengaged.</td><td>Uses driver definition 2.</td></tr>
<tr><td>Option 3</td><td>A vehicle equipped with an interlocking axle system or a front wheel drive system that can be engaged and disengaged is tested with the system disengaged.</td><td>Not specific to driver definition.

The mention of driver in this instance describes the synchronous axle feature type available on some conventional heavy vehicles, which is designed to be disengaged.</td></tr>
</table>

FMVSS No. 135

Technical Translation Summary Paragraph: The focus of this FMVSS is to "insure safe braking performance under normal and emergency driving conditions." The primary potential challenges for the translation are the specifications and references to a "pedal" and "pedal force" to operate the service brake and the requirements for visual and auditory warning indicators. The two general approaches for both are to use fewer specific terms (e.g., "force" instead of "muscular force," "activate" instead of "illuminate") and to make a distinction between human and ADS operation. The potential for an alternative to a foot control for ADS operation is introduced in S5.3.1. The term "service brake input" is introduced and used in the translations following. For the provisions addressing warning indicators, the term "signal" is used instead of "indicator."

Option 1 is based on an equivalency between a human driver and an ADS, using driver definition 1. Option 2 is based on distinction between "driver" as only referring to a human driver and an ADS, using driver definition 2. Options 3 and 4, where present, provide alternatives that may relate to driver definition 1, driver definition 2, or a generic driver definition.

For paragraphs relating to warnings, telltales, indicators, and alerts, the following general structure applies: Option 1 retains the current requirement with the inclusion of the ADS, Option 2 refers to ADS only, Option 3 refers to ADS and one or more occupant positions, and Option 4 includes communication to a service required log.

Option 3 uses "equivalent brake system input" to translate pedal force. The equivalent input is not specified but could be considered further. The following discusses the potential options for specifying an input. As stated, the current requirements for a foot control (S5.3) and the minimum and maximum pedal force requirements in the test procedure section (e.g., S7.5.2.c) do not map directly to an ADS-DV which has no foot control. The three translation options developed specify that the manufacturer provides sufficient input to cause the vehicle to stop in accordance with the performance requirements, an input that is consistent with normal ADS-DV operation (i.e., braking application should reflect what the vehicle could do on the road), or an equivalent brake system input to the pedal force. Since there is not currently a standard brake system input for an ADS-DV to use for reference, these approaches allow for different brake system configurations and control inputs. However, the approaches do not provide a means to assess the response of the vehicle relative to a common measured input. There is the potential for defining input requirements at different points in the system. The following presents potential inputs signals that have been explored during the project.

If the pedal is replaced by an actuator, the force of the actuator is a potential replacement. However, this could limit a particular system design or architecture. For example, current braking system may use a brake power assist unit to lower the pedal force needed to apply the service brakes. An ADS-DV manufacturer may choose to eliminate this element and use a high-force actuator or increase the gain in the power assist unit to allow for a small actuator to be employed. Both extremes could fall outside of the current equivalent foot pedal limits, but the vehicle would still comply and operate safely on the road.

Moving further along the power transmission sequence, limits could be defined for hydraulic brake line pressure. Assuming the brake components currently used in vehicles continue to be used, it may be possible to define the potential limits for line pressure. However, this may also limit future designs to current components that are used to generate the necessary brake torque to stop vehicles operated by human drivers. Brake torque could potentially be used, but that adds the complexity of accounting for the mass of the vehicle when determining an equivalent input range. This would also then require the manufacturer to use brake torque as their command signal input.

The acceleration rates are implicit in the current requirement and are based on the initial speed and stopping distance requirements. Assuming constant deceleration, the equation of motion relating speed, velocity, and acceleration is

vf^2 = v0^2 + 2ad

which can be rewritten as

a = (vf^2 - v0^2)/2d

Since our final velocity is 0, this simplifies to

a = - v0^2)/2d

Plugging in 100 kph (= 27.78 m/s) as the test speed (S7.5.2.b) and the minimum stopping distance of 70 m, we get

a = - (27.78m/s)^2 / (2*70m) = -5.5m/s^2

Thus, the acceleration limit is already defined and explicitly specifying limit does not necessarily provide additional clarity.

FMVSS No. 135, S4 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Brake power assist unit A device installed in a hydraulic brake system that reduces the amount of muscular force that a driver must apply to actuate the system, and that, if inoperative, does not prevent the driver from braking the vehicle by a continued application of muscular force on the service brake control.	**Option 1**	A device installed in a hydraulic brake system that reduces the amount of force that must be applied to actuate the system, and that, if inoperative, does not prevent the driver from braking the vehicle by a continued application of force on the service brake control.	Uses driver definition 1. As this is a definition and not a requirement, it is reasonable to keep the definition as is. Added "human" for consistency with use of driver.
	Option 2	A device installed in a hydraulic brake system that reduces the amount of muscular force that a driver must apply to actuate the system, and that, if inoperative, does not prevent the driver from braking the vehicle by a continued application of muscular force on the service brake control.	Uses driver definition 2. Assumes no power brake assist unit in an ADS-DV.

FMVSS No. 135, S4 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Brake power unit A device installed in a brake system that provides the energy required to actuate the brakes, either directly or indirectly through an auxiliary device, with driver action consisting only of modulating the energy application level.	**Option 1**	Retain current language.	Uses driver definition 1. This is not a requirement of a brake system, only a definition of a component in a brake system.
	Option 2	A device installed in a brake system that provides the energy required to actuate the brakes, either directly or indirectly through an auxiliary device, with input control action consisting only of modulating the energy application level.	Removes reference to the driver.

FMVSS No. 135, S4 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Lightly loaded vehicle weight or LLVW Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds), including driver and instrumentation.	**Option 1**	Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds), including human driver (if present) and instrumentation.	Uses driver definition 1.
	Option 2	Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds), including test operator (if present) and instrumentation.	Generalizes to a test operator instead of "driver." Assumes that there may be an individual in the vehicle for initiation and execution of programmed control of an ADS.
	Option 3	Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds).	Removes the clarification of what constitutes the 180 kg of mass.

FMVSS No. 135, S4 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Stopping distance The distance traveled by a vehicle from the point of application of force to the brake control to the point at which the vehicle reaches a full stop.	**Option 1**	The distance traveled by a vehicle from the point of application of force to the brake control by a human driver or, for an ADS-DV, the point at which the ADS commands brake application, to the point at which the vehicle reaches a full stop.	Distinguishes between the human driver and the ADS-DV.
	Option 2	The distance traveled by a vehicle from the point of input to the brake control to the point at which the vehicle reaches a full stop.	Accommodates any type of input whether it be force or electrical.

FMVSS No. 135, S5.1.2 (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Acoustic or optical devices warning the driver at his or her driving position when lining replacement is necessary, or	**Option 1**	A means to communicate to the driver, including but not limited to acoustic or optical devices, a warning when lining replacement is necessary, or	Uses driver definition 1. Keeps reference to specific types of communication.
	Option 2	(1) For a vehicle equipped with manually operated driving controls, acoustic or optical devices warning the driver at his or her driving position when lining replacement is necessary, and (2) For an ADS-DV operation, the communication of a warning to the ADS when lining replacement is necessary, or	Uses driver definition 2. Communicates to the DSP at all times and only to the ADS when operated by the ADS.
	Option 3	A means to communicate to the DSP and, for an ADS-DV, to the ADS, including but not limited to acoustic or optical devices, a warning when lining replacement is necessary, or	To the ADS and the DSP; using driver definition 1. Variations to which occupant could include " to all DSPs" or "to manufacturer specified DSP."
	Option 4	(1) For a vehicle equipped with manually operated driving controls, acoustic or optical devices warning the person in the DSP at his or her driving position when lining replacement is necessary, and (2) For an ADS-DV, communicate when lining replacement is necessary to a service required log located in the occupant compartment or	Uses driver definition 2. Communicates to a DSP (if specified) at all times and to a service required log when operated by ADS. May be beneficial to define the term "service required log" (e.g., in 49 CFR 571.3). A variation of this could be to only communicate to both the ADS and a service required log.

FMVSS No. 135, S5.1.3 Regenerative Braking System (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral.	**Option 1**	For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission states, including neutral.	Uses driver definition 1. Could retain "positions" for describing the input to the transmission (which implies the physical position of the control for the transmission) rather than using "state" which describes the internal configuration of the transmission (e.g., gear) independent of the means to control that state.
	Option 2	For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided to disconnect or otherwise deactivate it, and if it is activated in all transmission states, including neutral.	Removes reference to the driver.

<table>
<tr><th colspan="4">FMVSS No. 135, S5.3.1 Controls</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">The service brakes shall be activated by means of a foot control. The control of the parking brake shall be independent of the service brake control, and may be either a hand or foot control.</td><td>Option 1</td><td>(a) For a vehicle equipped with manually operated driving controls, the service brakes shall be activated by means of a foot control. The control of the parking brake shall be independent of the service brake control, and may be either a hand or foot control.
(b) For an ADS-DV, the service brakes and parking brake shall be activated by the ADS. The application of the parking brake shall be independent of the service brake application.</td><td>Uses driver definition 1.

This does not specify a means by which the ADS should activate the service brakes or parking brake.

Relative to testing defined in Section 7, this assumes that the ADS may be designed to meet the minimum stopping distances specified independent of a given input force into the brake system.

Brake pedal forces and other requirements specified in Section 7 are not applicable to the ADS-controlled means of brake activation.</td></tr>
<tr><td>Option 2</td><td>(a) For a vehicle equipped with manually operated driving controls, the service brakes shall be activated by means of a foot control. The control of the parking brake shall be independent of the service brake control, and may be either a hand or foot control.
(b) For an ADS-DV, the parking brake shall be independent of service brake controls.</td><td>Uses driver definition 2.

Leaves current language intact and adds an allowance for vehicles being operated by an ADS.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 135, S5.3.2 Controls</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">For vehicles equipped with ABS, a control to manually disable the ABS, either fully or partially, is prohibited.</td><td>Option 1</td><td>Retain current language.</td><td>Uses driver definition 1.

As the current language does not imply a means by which to operate the control, the language can apply to both human drivers and an ADS.</td></tr>
<tr><td>Option 2</td><td>For vehicles equipped with ABS, disabling the ABS, either fully or partially, is prohibited.</td><td>Removes the specification of how the ABS might be disabled.

May be requiring a higher standard than is currently present.</td></tr>
</table>

FMVSS No. 135, S5.5 Brake System Warning Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
Brake system warning indicator. Each vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a).	**Option 1**	Brake system warning signal. (a) Each vehicle equipped with manually operated driving controls shall… (b) For an ADS-DV, the information and warnings specified in S5.5.1 through S5.5.5 shall be communicated to the ADS.	Uses driver definition 1. Does not require the information to be communicated to occupants of an ADS-DV. Does not necessarily provide direct means to verify compliance. Does not provide specific communication method requirements. Does not provide requirement that the information be communicated to a party responsible for the care of the vehicle.
	Option 2	Brake system warning signal. (a) For a vehicle equipped with manually operated driving controls, each vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a). (b) For an ADS-DV, the information and warnings specified in S5.5.1 through S5.5.5 shall be communicated to the ADS and shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the front left DSP.	Uses driver definition 2. Uses warning signal as it exists in the current regulations in S6.3.12.b when talking about battery charge state as specified in S5.5.e. Retains basic language for a vehicle operated by a human driver and adds condition for an ADS. Does not require the information to be communicated to occupants of an ADS-DV. Does not specify a means to verify compliance in an ADS-DV. Does not provide specific communication method requirements. Does not provide requirement that the information be

FMVSS No. 135, S5.5 Brake System Warning Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
			communicated to a party responsible for the care of the vehicle.
	Option 3	Brake system warning signal. (a) For a vehicle equipped with manually operated driving controls, each vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a). (b) For an ADS-DV, the information and warnings specified in S5.5.1 through S5.5.5 shall be communicated to the ADS, and the vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of all DSPs, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a).	Maintains current language for human drivers. To the ADS and all DSPs; reference to driver replaced with all DSP. Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and communicate the information to the ADS.
	Option 4	Brake system warning signal. (1) For a vehicle equipped with manually operated driving controls, each vehicle shall have one or more visual brake system	Maintains current language for human drivers. To the ADS and an occupant compartment service required log (which could be

FMVSS No. 135, S5.5 Brake System Warning Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
		warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a). (2) For an ADS-DV, the information and warnings specified in S5.5.1 through S5.5.5 shall be communicated to the ADS, and the vehicle shall be equipped with a means to communicate the warnings and information to a service required log located in the occupant compartment. In addition, a vehicle manufactured without a split service brake system shall be equipped with a means to communicate a warning to a service required log located in the occupant compartment that activates under the conditions specified in S5.5.1(a).	accessed in a number of different ways). This option could support a future requirement of a human hub technician to check status of an ADS-DV prior to releasing for public road operation, or perhaps continuously to monitor the vehicle for warnings while it is being operated.

FMVSS No. 135, S5.5.1 Activation			
Regulatory Text	**Translation Options**		**Potential Considerations**
An indicator shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a) through (g) occur:	**Option 1**	The warning signals specified in S5.5 shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a) through (g) occur:	As a subset of 5.5, the type and entity to which the warning signal is communicated is based on the configuration defined in S5.5.

FMVSS No. 135, S5.5.1 Activation (e)			
Regulatory Text	**Translation Options**		**Potential Considerations**
For a vehicle with electrically-actuated service brakes, failure of the source of electric power to those brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	For a vehicle with electrically-actuated service brakes, failure of the source of electric power to those brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning of degraded brake performance.	Removes the reference to "driver" making the communication recipient based on the definition specified in the parent section (S5.5).

FMVSS No. 135, S5.5.2 Function Check (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
All indicators shall be activated as a check function by either:	**Option 1**	All warning signals shall be activated as a check function by either:	Adopts language introduced in S5.5. May be irrelevant to an ADS-DV since the purpose of a function check is to confirm the operation of the display (e.g., a bulb) not the proper operation of the system that activates the display when a fault occurs.
	Option 2	Retain current language.	May not require check for an ADS of communication if indicators are not present, such as in an ADS-DV.
	Option 3	All telltales shall be activated as a check function by either:	Same as Option 2 but specifies "telltale." Note that this is not unique to or a barrier to an ADS-DV. Communication to ADS not required.
	Option 4	All indicators shall be activated as a check function and for vehicles that can be operated by an ADS, the warning signal shall be communicated to the ADS as a check function by either:	Uses driver definition 2.

FMVSS No. 135, S5.5.2 Function Check (1)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Automatic activation when the ignition (start) switch is turned to the "on" ("run") position when the engine is not running, or when the ignition ("start") switch is in a position between "on" ("run") and "start" that is designated by the manufacturer as a check position, or	**Option 1**	Retain current language.	Ignition on state may be independent of initiation of trip in an ADS-DV.
	Option 2	Automatic activation when the ignition (start) switch, is in the "on" ("run") position when the engine is not running, or when the ignition ("start") switch, is in a position between "on" ("run") and "start" that is designated by the manufacturer as a check position, or	Refers to the state of the ignition rather than the action of changing the state.

FMVSS No. 135, S5.5.2 Function Check (2)			
Regulatory Text	**Translation Options**		**Potential Considerations**
A single manual action by the driver, such as momentary activation of a test button or switch mounted on the instrument panel in front of and in clear view of the driver, or, in the case of an indicator for application of the parking brake, by applying the parking brake when the ignition is in the "on" ("run") position.	**Option 1**	Retain current language.	Does not provide requirement for ADS to have a separate means to test internal communication system.
	Option 2	A single manual action, such as momentary activation of a test button or switch mounted on the instrument panel, or, in the case of an indicator for application of the parking brake, by applying the parking brake when the ignition is in the "on" ("run") position.	Removes the reference to "driver."

<table>
<tr><th colspan="4">FMVSS No. 135, S5.5.3 Duration</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">Each indicator activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition (“start”) switch is in the “on” (“run”) position, whether or not the engine is running.</td><td>Option 1</td><td>Each warning signal activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition (“start”) switch, is in the “on” (“run”) position, whether or not the engine is running.</td><td>Adopts language introduced in S5.5.</td></tr>
<tr><td>Option 2</td><td>Each telltale activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition (“start”) switch is in the “on” (“run”) position, whether or not the engine is running. For an ADS, the condition shall be communicated to the ADS as long as the condition exists, whenever the ignition (“start”) switch is in the “on” (“run”) position, whether or not the engine is running.</td><td>Specifies case for ADS operation.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 135, S5.5.5 Labeling (a)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1⁄8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and this section may be provided for purposes of clarity.</td><td>Option 1</td><td>Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the human driver, under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1⁄8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and this section may be provided for purposes of clarity.</td><td>Uses driver definition 1.

Does not require information be provided to occupants of an ADS-DV.</td></tr>
<tr><td>Option 2</td><td>Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver or an occupant in the left front outboard DSP under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1⁄8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and this section may be provided for purposes of clarity.</td><td>Utilizes same requirements for words, or words to be provided to driver, and to be used to communicate to an occupant in the same location.

Note: this section does not require new telltales, it only specifies qualifications for ones previously defined.</td></tr>
<tr><td>Option 3</td><td>Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver in a vehicle with manually operated driving controls and to the occupants of all DSPs in an ADS-DV under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1⁄8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No.</td><td>Uses driver definition 2. Maintains current language for human drivers.

To the ADS and all DSPs; reference to driver replaced with all (DSP).

Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and</td></tr>
</table>

FMVSS No. 135, S5.5.5 Labeling (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
		101 and this section may be provided for purposes of clarity.	communicate the information to the ADS. Note: this section does not require new telltales, it only specifies qualifications for ones previously defined.

FMVSS No. 135, S5.5.5 Labeling (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
A vehicle manufactured without a split service brake system shall use a separate indicator to indicate the failure condition in S5.5.1(a). This indicator shall display the words “STOP—BRAKE FAILURE” in block capital letters not less than 6.4 mm (1⁄4 inch) in height.	**Option 1**	A vehicle manufactured without a split service brake system shall (1) For vehicles equipped with manually operated driving controls, use a separate warning signal to indicate the failure condition in S5.5.1(a). This indicator shall display the words “STOP—BRAKE FAILURE” in block capital letters not less than 6.4 mm (1⁄4 inch) in height. (2) For ADS-DVs, use a separate signal to communicate the failure condition in S5.5.1(a) to the ADS.	Uses driver definition 1. Would require a separate signal be communicated to the ADS. Note: this section does not require new telltales, it only specifies qualifications for ones previously defined.
	Option 2	A vehicle manufactured without a split service brake system shall use a separate warning signal to indicate the failure condition in S5.5.1(a). This indicator shall display the words “STOP—BRAKE FAILURE” in block capital letters not less than 6.4 mm (1⁄4 inch) in height.	May not require a separate signal or message to be sent to the ADS.

FMVSS No. 135, S5.5.5 Labeling (d)			
Regulatory Text	**Translation Options**		**Potential Considerations**
If separate indicators are used for one or more of the conditions described in S5.5.1(a) through S5.5.1(g), the indicators shall display the following wording:	**Option 1**	Retain current language.	Translation may not be necessary since it only applies if there are separate indicators which are not needed by an ADS-DV.
	Option 2	If separate warning signal are used for one or more of the conditions described in S5.5.1(a) through S5.5.1(g), the indicators shall display the following wording:	Aligning with S5.5.1 technical translation options (e.g., indicator was translated to warning signal). This, and the following conditions of (d), only apply if separate indicators are used. There should be no reason for an ADS to provide separate warning signal to the ADS.

FMVSS No. 135, S6.3.11.3 State of Charge of Batteries for EVs			
Regulatory Text	**Translation Options**		**Potential Considerations**
At the beginning of each performance test in the test sequence (S7.2 through S7.17 of this standard), unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95 percent. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. If a battery is replaced rather than recharged, the replacement battery shall be charged and measured for state of charge in accordance with these procedures.	**Option 1**	... If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated or, for an ADS-DV, the low state of charge brake state is communicated to the ADS, the vehicle is to be accelerated to brake test speed by auxiliary means...	Follows language from S5.5.

FMVSS No. 135, S6.3.12 State of Charge of Batteries for Electrically-Actuated Service Brakes			
Regulatory Text	**Translation Options**		**Potential Considerations**
A vehicle equipped with electrically-actuated service brakes also performs the following test series. Conduct 10 stopping tests from a speed of 100 kph or the maximum vehicle speed, whichever is less. At least two of the 10 stopping distances must be less than or equal to 70 meters. The vehicle is loaded to GVWR and the transmission is in the neutral position when the service brake control is actuated and throughout the remainder of the test. Each battery providing power to the electrically-actuated service brakes, shall be in a depleted state of charge for conditions (a), (b), or (c) of this paragraph as appropriate. An auxiliary means may be used to accelerate an EV to test speed.	**Option 1**	Retain current language.	Follows language from S5.5.
	Option 2	...transmission is in the neutral state…	References internal transmission state rather than manual control position.

<table>
<tr><th colspan="4">FMVSS No. 135, S6.3.12 State of Charge of Batteries for Electrically-Actuated Service Brakes (b)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated.</td><td>Option 1</td><td>For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is activated.</td><td>Eliminates the dependency on the illumination of a particular signal so that it can apply to a visual indicator for the human driver or an electrical signal for the ADS.

Note: this section does not specify new telltales, it addresses another vehicle configuration. The activation is for the warning signal specified in S5.5.1(e), which is dependent on S5.5 for defining the recipient.</td></tr>
<tr><td>Option 2</td><td>For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated for the driver or communicated to the ADS.</td><td>Uses driver definition 2.

Note that this section is specifying when or how a warning is presented to the driver, rather it is using it as a condition for S6.3.12.</td></tr>
</table>

FMVSS No. 135, S6.3.12 State of Charge of Batteries for Electrically-Actuated Service Brakes (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
For a vehicle which has one or more auxiliary batteries that provides electrical energy to operate the electrically-actuated service brakes, each auxiliary battery is at not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated.	**Option 1**	For a vehicle which has one or more auxiliary batteries that provides electrical energy to operate the electrically-actuated service brakes, each auxiliary battery is at not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is activated.	Uses same language as in (b) above. Note: this section does not specify new telltales, it addresses another vehicle configuration. The activation is for the warning signal specified in S5.5.1(e), which is dependent on S5.5 for defining the recipient.
	Option 2	For a vehicle which has one or more auxiliary batteries that provides electrical energy to operate the electrically-actuated service brakes, each auxiliary battery is at not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated for the driver or communicated to the ADS.	Uses same language as in (b) above. Note that this section is specifying when or how a warning is presented to the driver, rather it is using it as a condition for S6.3.12.

FMVSS No. 135, S6.3.13.1 Electric Vehicles (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
For an EV equipped with an RBS that is not part of the service brake system, the RBS is operational and set to produce the maximum regenerative braking effect during the burnish, and is disabled during the test procedures. If the vehicle is equipped with a neutral gear that automatically disables the RBS, the test procedures which are designated to be conducted in gear may be conducted in neutral.	**Option 1**	Retain current language.	Uses same language as in (b) above. Note: this section does not specify new telltales, it addresses another vehicle configuration. The activation is for the warning signal specified in S5.5.1(e), which is dependent on S5.5 for defining the recipient.
	Option 2	…with a neutral state…	Uses language introduced previously.

FMVSS No. 135, S6.3.13.2 Electric Vehicles			
Regulatory Text	**Translation Options**		**Potential Considerations**
For tests conducted "in neutral," the operator of an EV with no "neutral" position (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s)) does not apply any electromotive force to the propulsion motor(s). Any electromotive force that is applied to the propulsion motor(s) automatically remains in effect unless otherwise specified by the test procedure.	**Option 1**	Retain current language.	
	Option 2	For tests conducted "in neutral," the operator of an EV with no "neutral" (or other means such as a clutch for disconnecting the drive train from the propulsion motor(s))…	Utilizes the generic "neutral" state of the EV.

FMVSS No. 135, S6.5.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission selector control.	**Option 1**	Transmission control.	Generic language for transmission.

FMVSS No. 135, S6.5.5.2 (a)			
Regulatory Text	**Translation Options**		**Potential Considerations**
With the transmission selector in the control position recommended by the manufacturer for driving on a level surface at the applicable test speed, exceed the test speed by 6 to 12 km/h (3.7 to 7.5 mph);	**Option 1**	With the transmission in the control position recommended by the manufacturer for driving on a level surface at the applicable test speed, exceed the test speed by 6 to 12 km/h (3.7 to 7.5 mph);	Generic language for transmission.

FMVSS No. 135, S7.1.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In gear.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In gear.	Uses language introduced previously.

FMVSS No. 135, S7.1.3. Test Conditions and Procedures. The Road Test Surface Conditions Specified in S6.2 Do Not Apply to the Burnish Procedure (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: Adjust as necessary to maintain specified constant deceleration rate.	**Option 1**	Service brake input: Adjust as necessary to maintain specified constant deceleration rate.	Provides generic language for input for service brake system.

FMVSS No. 135, S7.5.1 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.5.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs).	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2. Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.5.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs).	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving. For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2. Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e., friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels. However, potential options for defining measures where discussed in the introduction summary.

FMVSS No. 135, S7.6.1 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In gear.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In gear.	Uses language introduced previously.

FMVSS No. 135, S7.6.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been updated for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2. Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.

FMVSS No. 135, S7.6.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.7.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.7.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2 Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.8.1 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.8.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV: service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2 Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.8.2 Test Conditions and Procedures (2)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Determine whether the brake system indicator is activated when any electrical functional failure of the antilock system is created.	**Option 1**	Determine whether the brake system signal is activated when any electrical functional failure of the antilock system is created.	Adopts language put forth in S5.5. May not be direct means to note when the signal is sent to the ADS.

FMVSS No. 135, S7.9.1 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.9.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2 Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.9.2 Test Conditions and Procedures (2)			
Regulatory Text	**Translation Options**		**Potential Considerations**
If the system utilizes electrical components, determine whether the brake system indicator is activated when any electrical functional failure of the variable proportioning system is created.	**Option 1**	…determine whether the brake system signal is activated when any electrical functional failure…	Adopts language put forth in S5.5. May not be direct means to note when the signal is sent to the ADS.

FMVSS No. 135, S7.10.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.10.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV, service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2 Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e., friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.10.3 Test Conditions and Procedures (f)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Alter the service brake system to produce any single failure. For a hydraulic circuit, this may be any single rupture or leakage type failure, other than a structural failure of a housing that is common to two or more subsystems. For a vehicle in which the brake signal is transmitted electrically between the brake pedal and some or all of the foundation brakes, regardless of the means of actuation of the foundation brakes, this may be any single failure in any circuit that electrically transmits the brake signal. For an EV with RBS that is part of the service brake system, this may be any single failure in the RBS.	**Option 1**	...For a vehicle in which the brake signal is transmitted electrically between the brake input (e.g., pedal) and some or all of the foundation brakes, regardless of the means of actuation of the foundation brakes, this may be any single failure in any circuit that electrically transmits the brake signal. For an EV with RBS that is part of the service brake system, this may be a single failure in the RBS.	Provides generic language for input for service brake system.

FMVSS No. 135, S7.10.3 Test Conditions and Procedures (g)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Determine the control force pressure level or fluid level (as appropriate for the indicator being tested) necessary to activate the brake warning indicator.	**Option 1**	Determine the control force pressure level or fluid level (as appropriate for the signal being tested) necessary to activate the brake warning signal.	Adopts language put forth in S5.5. May not be direct means to note when the signal is sent to the ADS.

FMVSS No. 135, S7.10.3 Test Conditions and Procedures (h)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Number of runs: After the brake warning indicator has been activated, make the following stops depending on the type of brake system:	**Option 1**	Number of runs: After the brake warning signal has been activated, make the following stops depending on the type of brake system:	Adopts language put forth in S5.5. May not be direct means to note when the signal is sent to the ADS.

FMVSS No. 135, S7.10.4 Performance Requirements			
Regulatory Text	**Translation Options**		**Potential Considerations**
For vehicles manufactured with a split service brake system, in the event of any failure in a single subsystem, as specified in S7.10.3(f) of this standard, and after activation of the brake system indicator as specified in S5.5.1, the remaining portions of the service brake system shall continue to operate and shall stop the vehicle as specified in S7.10.4(a) or S7.10.4(b). For vehicles not manufactured with a split service brake system, in the event of any failure in any component of the service brake system, as specified in S7.10.3(f), and after activation of the brake system indicator as specified in S5.5.1 of this standard, the vehicle shall, by operation of the service brake control, stop 10 times consecutively as specified in S7.10.4(a) or S7.10.4(b).	**Option 1**	For vehicles manufactured with a split service brake system, in the event of any failure in a single subsystem, as specified in S7.10.3(f) of this standard, and after activation of the brake system signal as specified in S5.5.1,... ...in the event of any failure in any component of the service brake system, as specified in S7.10.3(f), and after activation of the brake system signal as specified in S5.5.1 of this standard...	Adopts language put forth in S5.5. May not be direct means to note when the signal is sent to the ADS.

FMVSS No. 135, S7.11.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.11.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). .	**Option 1**	Service brake input: (1) For human drivers: ≥65N (14.6 lbs), ≤500N (112.4 lbs); (2) For an ADS-DV: sufficient service brake input to achieve the applicable performance requirements.	Uses driver definition 1. The performance criteria is the stopping distance for the compliance verification. Pedal force requirements are present to ensure that a wide range of human drivers, with a wide range of strengths, are able to safely stop any vehicle they are driving For an ADS-DV, there is only one "driver" and the vehicle will have to be designed in such a way to put sufficient input into the braking system to meet the stopping distance criterion. Specifying a range of inputs may also be meaningless if the actuation force is applied directly to the friction surface as there would be no gain in the system to accommodate lower input forces. Note that the sign has been update for 65N.
	Option 2	Service brake input: (1) For drivers: Pedal force: ≤65N (14.6 lbs), ≤500N (112.4 lbs). (2) For an ADS-DV: service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2 Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	Brake system input: ≤65N (14.6 lbs), ≤500N (112.4 lbs) or equivalent brake system input	Allows testing at different input levels for additional brake system embodiments. This may imply a design requirement that includes an intermediate component between the brake system input and the output of the brake system (i.e. friction material) that normalizes a variety of inputs to a minimum force at the output. Does not specify the equivalent input levels.

FMVSS No. 135, S7.12.1 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.12.2 Test Conditions and Procedures (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Parking brake control force: Hand control ≤400 N (89.9 lbs); foot control ≤500 N (112.4 lbs).	**Option 1**	Retain current language.	Since an ADS-DV will not, by definition, have a hand or foot control, this language does not apply and can remain as is.
	Option 2	Parking brake control force (for a vehicle equipped with manually operated driving controls): Hand control ≤400 N (89.9 lbs); foot control ≤500 N (112.4 lbs)	Force requirements are to ensure human can activate the parking brake. By design, the ADS would have to be able to engage the parking brake. Specifying a force would imply a particular design requirement.
	Option 3	Retain current language.	Since an ADS-DV will not, by definition, have a hand or foot control, this language does not apply and can remain as is.

FMVSS No. 135, S7.12.2 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Hand force measurement locations: The force required for actuation of a hand-operated brake system is measured at the center of the hand grip area or at a distance of 40 mm (1.57 in) from the end of the actuation lever as illustrated in Figure 3.	**Option 1**	Retain current language.	Since an ADS-DV will not, by definition, have a hand or foot control, this language does not apply and can remain as is.
	Option 2	Hand force measurement locations for vehicles equipped with manually operated driving controls): The force required for actuation of a hand-operated brake system is measured at the center of the hand grip area or at a distance of 40 mm (1.57 in) from the end of the actuation lever as illustrated in Figure 3.	Measurement of hand force is not applicable for an ADS.

FMVSS No. 135, S7.12.2 Test Conditions and Procedures (m)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Verify the operation of the parking brake application indicator.	**Option 1**	Verify the operation of the parking brake application signal.	Adopts language put forth in S5.5.

FMVSS No. 135, S7.13.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In gear.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In gear.	Uses language introduced previously.

FMVSS No. 135, S7.13.3 Test Conditions and Procedures (e)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: Adjust as necessary to maintain the specified constant deceleration rate.	**Option 1**	Service brake input: Adjust as necessary to maintain the specified constant deceleration rate.	Provides generic language for input for service brake system.

FMVSS No. 135, S7.14.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.14.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force:	**Option 1**	Service brake input:	Provides generic language for input for service brake system.

FMVSS No. 135, S7.14.3 Test Conditions and Procedures (1)			
Regulatory Text	**Translation Options**		**Potential Considerations**
The first stop is done with an average pedal force not greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop.	**Option 1**	The first stop is done with an average service brake input not greater than the average service brake input...	There does not appear to be any requirement for measuring pedal force during the cold effectiveness stop.

FMVSS No. 135, S7.14.3 Test Conditions and Procedures (2)			
Regulatory Text	**Translation Options**		**Potential Considerations**
The second stop is done with a pedal force not greater than 500 N (112.4 lbs).	**Option 1**	For a vehicle equipped with manually operated driving controls, the second stop is done with a pedal force not greater than 500 N (112.4 lbs). For an ADS-DV, the second stop is done with a sufficient service brake input to achieve the applicable performance requirements.	This does not limit the level of input the ADS is allowed to apply to the brake system.
	Option 2	The second stop service brake input: (1) For drivers: Pedal force: ≤500N (112.4 lbs). (2) For an ADS-DV: service brake inputs that are consistent with normal operation of the ADS.	Uses driver definition 2. Provides option for the ADS to operate the brake system as designed for normal operation. There is no way to confirm that "normal operation" under test conditions is the same as "normal operation" during typical driving.
	Option 3	The second stop is done with a service brake input not greater than 500 N (112.4 lbs) for the driver and not greater than xxx N (yyy lbs.) for an ADS-DV.	Uses driver definition 2. Assumes that there may be a reason to limit the force that the ADS should apply to ensure safe and consistent braking of the vehicle during hot operation.

FMVSS No. 135, S7.15.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In gear.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In gear.	Uses language introduced previously.

FMVSS No. 135, S7.15.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: Adjust as necessary to maintain specified constant deceleration rate.	**Option 1**	Service brake input: Adjust as necessary to maintain specified constant deceleration rate.	Provides generic language for input for service brake system.

FMVSS No. 135, S7.16.2 Vehicle Conditions (b)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Transmission position: In neutral.	**Option 1**	Retain current language.	
	Option 2	Transmission state: In neutral.	Uses language introduced previously.

FMVSS No. 135, S7.16.3 Test Conditions and Procedures (c)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Pedal force: The average pedal force shall not be greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop.	**Option 1**	Service brake input: The average service brake input shall not be greater than the average service brake input recorded…	There does not appear to be any requirement for measuring pedal force during the cold effectiveness stop.

FMVSS No. 135, S7.17 Final Inspection: Inspect: (d)			
Regulatory Text	**Translation Options**		**Potential Considerations**
The brake system indicators, for compliance with operation in various key positions, lens color, labeling, and location, in accordance with S5.5.	**Option 1**	The brake system signals, for compliance with operation in various key positions, lens color, labeling, and location (as applicable), in accordance with S5.5.	Adopts language put forth in S5.5.

FMVSS No. 136

Technical Translation Options Summary: The purpose of this FMVSS "is to reduce crashes caused by rollover or by directional loss-of-control." Each technical translation option has an underlying theme that works as a set. Option 1 is based on an equivalency between the human driver and ADS, using driver definition 1. Option 2 is based on the distinction that "driver" only refers to the human driver and ADS is referred to separately, using driver definition 2. Option 3 provides an alternative that may be specified and related to driver definition 1 or driver definition 2. For regulations relating to telltales, indicators, and alerts: Option 1 refers to ADS only, Option 2 refers to ADS and all occupant positions (e.g., sleeper berth), Option 3 refers to ADS and occupants in the position of the current standard, Option 4 refers to ADS and to a service required log (which could be available to technicians).

<table>
<tr><th colspan="4">FMVSS No. 136, S3.1 Application</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">Truck tractors with a gross vehicle weight rating of greater than 11,793 kilograms (26,000 pounds). However, it does not apply to:

(a) Any truck tractor equipped with an axle that has a gross axle weight rating of 13,154 kilograms (29,000 pounds) or more;

(b) Any truck tractor that has a speed attainable in 3.2 km (2 miles) of not more than 53 km/h (33 mph); and

(c) Any truck tractor that has a speed attainable in 3.2 km (2 miles) of not more than 72 km/h (45 mph), an unloaded vehicle weight that is not less than 95 percent of its gross vehicle weight rating, and no capacity to carry occupants other than the driver and operating crew.</td><td>Option 1</td><td>...(c)…and no capacity to carry occupants other than the human driver (if present) and operating crew.</td><td>Uses driver definition 1.</td></tr>
<tr><td>Option 2</td><td>Retain current language.</td><td>Uses driver definition 2.

The terms "driver" and "operating crew" are used to identify the type of heavy vehicle configuration for application exception based upon the number and weight of occupants. The term "operating crew" can be used to refer to occupants that may serve various on- or off-highway roles on a specially equipped heavy vehicle including operating other equipment mounted on the heavy vehicle while stationary.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 136, S4 Definitions (Ackerman Steer Angle)</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">(6) It has a means to estimate vehicle mass or, if applicable, combination vehicle mass;

(7) It has a means to monitor driver steering inputs;

(8) It has a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle and/or combination vehicle; and

(9) When installed on a truck tractor, it has the means to provide brake pressure to automatically apply and modulate the brake torques of a towed trailer.

ESC service brake application means the time when the ESC system applies a service brake pressure at any wheel for a continuous duration of at least 0.5 second of at least 34 kPa (5 psi) for air-braked systems and at least 172 kPa (25 psi) for hydraulic-braked systems.

Initial brake temperature means the average temperature of the service brakes on the hottest axle of the vehicle immediately before any stability control system test maneuver is executed.

Lateral acceleration means the component of the vector acceleration of a point in the vehicle perpendicular to the vehicle x-axis (longitudinal) and parallel to the road plane. Oversteer means a condition in which the vehicle's yaw rate is greater than the yaw rate that would occur at the vehicle's speed as result of the Ackerman Steer Angle.</td><td>Option 1</td><td>Retain current language.</td><td>Uses driver definition 1.</td></tr>
<tr><td>Option 2</td><td>...(7) It has a means to monitor steering system inputs;

(8) It has a means to modify engine torque, as necessary, to assist in maintaining control of the vehicle and/or combination vehicle; and…</td><td>Reference to driver has been removed.</td></tr>
</table>

FMVSS No. 136, S4 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Over-the-road bus means a bus characterized by an elevated passenger deck located over a baggage compartment, except a school bus. Peak friction coefficient or PFC means the ratio of the maximum value of braking test wheel longitudinal force to the simultaneous vertical force occurring prior to wheel lockup, as the braking torque is progressively increased. Perimeter-seating bus means a bus with 7 or fewer designated seating positions rearward of the driver's seating position that are forward-facing or can convert to forward-facing without the use of tools and is not an over-the-road bus. Side slip or side slip angle means the arctangent of the lateral velocity of the center of gravity of the vehicle divided by the longitudinal velocity of the center of gravity. Snub means the braking deceleration of a vehicle from a higher speed to a lower speed that is greater than zero. Stop-request system means a vehicle-integrated system for passenger use to signal to a vehicle operator that they are requesting a stop. Transit bus means a bus that is equipped with a stop-request system sold for public transportation provided by, or on behalf of, a State or local government and that is not an over-the-road bus.	**Option 1**	...Perimeter-seating bus means a bus with 7 or fewer designated seating positions rearward of the driver's designated seating position that are forward-facing or can convert to forward-facing without the use of tools and is not an over-the-road bus. If a driver's designated seating position is not present, a perimeter-seating bus also means a bus with 7 or fewer designated seating positions that are forward-facing or can convert to forward-facing without the use of tools and is not an over-the-road bus....	Uses driver definition 1. Uses driver's DSP Set 1 definition. Acknowledges that a driver's DSP may not be present.
	Option 2	Retain current language.	The term driver seat pertains to a definition, not a requirement.
	Option 3	Same as Option 1.	

FMVSS No. 136, S5.2.1 System Operational Capabilities			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC system must be operational over the full speed range of the vehicle except at vehicle speeds less than 20 km/h (12.4 mph), when being driven in reverse, or during system initialization.	**Option 1**	The ESC system must be operational over the full speed range of the vehicle except at vehicle speeds less than 20 km/h (12.4 mph), when being operated in reverse, or during system initialization.	Not specific to a driver definition.
	Option 2	Retain current language.	This option provides for the general application of the word "driven" to apply to the operation of the vehicle without a human driver.

FMVSS No. 136, S5.3.2.1 Engine Torque Reduction			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC system must reduce the driver-requested engine torque by at least 10 percent for a minimum continuous duration of 0.5 second during the time period from 1.5 seconds after the vehicle crosses the start gate (0 degree of radius arc angle) to when it crosses the end gate (120 degrees of radius arc angle).	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	For each vehicle equipped with manually operated driving controls, the ESC system must reduce the driver-requested engine torque by at least 10 percent… For each ADS-DV, the ESC system must reduce the ADS-requested engine torque by at least 10 percent for a minimum continuous duration of 0.5 second during the time period from 1.5 seconds after the vehicle crosses the start gate (0 degree of radius arc angle) to when it crosses the end gate (120 degrees of radius arc angle).	This option applies driver definition 2, while maintaining the intent to separate the input signal and feedback signal torques.

FMVSS No. 136, S5.4 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle must be equipped with an indicator lamp, mounted in front of and in clear view of the driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system.	**Option 1**	Each vehicle that is equipped with manually operated driving controls must be equipped with an indicator lamp, mounted in front of and in clear view of the human driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system. Each ADS-DV must communicate the existence of a malfunction to the ADS that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system.	Uses driver definition 1. For ADS-DV, communicate only to ADS.
	Option 2	Each vehicle that is equipped with manually operated driving controls must be equipped with an indicator lamp mounted in front of and in clear view of the driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system. Each ADS-DV must communicate the existence of a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system to the ADS and must be equipped with an indicator lamp in front of and in clear view of all DSPs that indicates the existence of the malfunction.	Uses driver definition 2 To the ADS and all DSPs. Another option that could be considered is having the location specified by the manufacturers. This could be done by replacing "all DSPs" with "DSPs as specified by the vehicle manufacturer" and communicate the information to the ADS. Considerations for occupants seated in the sleeper berth where "hours of service" are not accruing could be specified by the manufacturers.

FMVSS No. 136, S5.4 ESC Malfunction Detection (Continued)			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle must be equipped with an indicator lamp, mounted in front of and in clear view of the driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system.	**Option 3**	Each vehicle that is equipped with manually operated driving controls must be equipped with an indicator lamp, mounted in front of and in clear view of the driver's DSP, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system. Each ADS-DV must communicate the existence of a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system to the ADS and must be equipped with an indicator lamp in front of and in clear view of the left, front outboard DSP that indicates the existence of the malfunction.	Not specific to driver definition. Reference to driver replaced with current human driver's designated seating position (DSP). For ADS-DV, communicate to ADS and left, front outboard DSP.
	Option 4	Each vehicle that is equipped with manually operated driving controls must be equipped with an indicator lamp mounted in front of and in clear view of the human driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system. Each ADS-DV must communicate the	Uses driver definition 1. To the ADS and service required log. This option could support a future requirement to communicate to a service required log for review on a technician provided device prior to releasing for public road operation.

FMVSS No. 136, S5.4 ESC Malfunction Detection (Continued)			
Regulatory Text	Translation Options		Potential Considerations
		existence of a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system to the ADS and to a service required log located in the occupant compartment.	

FMVSS No. 136, S5.4.1 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
Except as provided in S5.4.3 and S5.4.6, the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.	**Option 1**	Except as provided in S5.4.3 and S5.4.6, for each vehicle that is equipped with manually operated driving controls the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. For each ADS-DV, the ESC malfunction condition must be communicated to the ADS only when a malfunction exists and must be continuously communicated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.	Not specific to driver definition or occupant position.
	Option 2	Except as provided in S5.4.3 and S5.4.6, for each vehicle that is equipped with manually operated driving controls the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. For each ADS-DV, the ESC malfunction condition must be communicated to the ADS only when a malfunction exists and must be continuously communicated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. Except as provided in S5.4.3 and S5.4.6, the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.	Not specific to driver definition. For ADS-DV, communicates to the ADS and the malfunction telltale illumination functionality and exceptions are maintained for each DSP communication option.
	Option 3	Same as option 2.	

FMVSS No. 136, S5.4.1 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 4	Except as provided in S5.4.3 and S5.4.6, for each vehicle that is equipped with manually operated driving controls the ESC malfunction telltale must illuminate only when a malfunction exists and must remain continuously illuminated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. For each ADS-DV, the ESC malfunction condition must be communicated to the ADS and service required log located in the occupant compartment only when a malfunction exists and must be continuously communicated for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position.	

FMVSS No. 136, S5.4.2 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC malfunction telltale must be identified by the symbol shown for "Electronic Stability Control System Malfunction" or the specified words or abbreviations listed in Table 1 of Standard No. 101 (§571.101).	**Option 1**	Each ESC malfunction telltale must be identified by the symbol shown for "Electronic Stability Control System Malfunction" or the specified words or abbreviations listed in Table 1 of Standard No. 101 (§571.101).	Applies to vehicles equipped with manually operated driving controls and ADS-DV with telltale equipped vehicles.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S5.4.3 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC malfunction telltale must be activated as a check-of-lamp function either when the ignition locking system is turned to the “On” (“Run”) position when the engine is not running, or when the ignition locking system is in a position between the “On” (“Run”) and “Start” that is designated by the manufacturer as a check-light position.	**Option 1**	Each ESC malfunction telltale must be activated as a check-of-lamp function either when the ignition locking system is turned to the “On” (“Run”) position when the engine is not running, or when the ignition locking system is in a position between the “On” (“Run”) and “Start” that is designated by the manufacturer as a check-light position.	Applies to vehicles equipped with manually operated driving controls and ADS-DV with telltale equipped vehicles.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S5.4.4 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC malfunction telltale need not be activated when a starter interlock is in operation.	**Option 1**	Each ESC malfunction telltale need not be activated when a starter interlock is in operation.	Applies to vehicles equipped with manually operated driving controls and ADS-DV with telltale equipped vehicles. Generalized reference to ESC to allow for different types of systems to communicate to both an ADS or a human driver.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S5.4.5 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The ESC malfunction telltale lamp must extinguish at the next ignition cycle after the malfunction has been corrected.	**Option 1**	Each ESC malfunction telltale lamp must extinguish at the next ignition cycle after the malfunction has been corrected.	Applies to vehicles equipped with manually operated driving controls and ADS-DV with telltale equipped vehicles. Generalized reference to ESC to allow for different types of systems to communicate to both an ADS or a human driver.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S5.4.6 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The manufacturer may use the ESC malfunction telltale in a flashing mode to indicate ESC operation.	**Option 1**	Retain current language.	Applies to vehicles equipped with manually operated driving controls and ADS-DV with telltale equipped vehicles.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S6.3.3.1 Truck Tractors			
Regulatory Text	**Translation Options**		**Potential Considerations**
A truck tractor is loaded to its GVWR by coupling it to a control trailer (see S6.3.5). The tractor is loaded with the test driver, test instrumentation, and an anti-jackknife system (see S6.3.8).	**Option 1**	Retain current language.	Uses driver definition 1. Leave language as written with the understanding that the ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.
	Option 2	A truck tractor is loaded to its GVWR by coupling it to a control trailer (see S6.3.5). The tractor is loaded with the test driver (if present), test instrumentation and an anti-jackknife system (see S6.3.8).	Uses driver definition 2. The ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.
	Option 3	A truck tractor is loaded to its GVWR by coupling it to a control trailer (see S6.3.5). The tractor is loaded with the test personnel (if present), test instrumentation, and an anti-jackknife system (see S6.3.8).	Reference to driver has been removed. This option recognizes that test personnel may continue to be part of the testing procedure without focusing on them in the role as driver but rather a testing occupant.

FMVSS No. 136, S6.3.3.2 Buses			
Regulatory Text	**Translation Options**		**Potential Considerations**
A bus is loaded with ballast (weight) to its GVWR to simulate a multi-passenger and baggage configuration. For this configuration the bus is loaded with test driver, test instrumentation, outriggers (see S6.3.6), ballast, and a simulated occupant in each of the vehicle's designated seating positions. The simulated occupant loads are attained by securing 68 kilograms (150 pounds) of ballast in each of the test vehicle's designated seating positions. If the simulated occupant loads result in the bus being loaded to less than its GVWR, additional ballast is added to the bus in the following manner until the bus is loaded to its GVWR without exceeding any axle's GAWR: First, ballast is added to the lowest baggage compartment; second, ballast is added to the floor of the passenger compartment. If the simulated occupant loads result in the GAWR of any axle being exceeded or the GVWR of the bus being exceeded, simulated occupant loads are removed until the vehicle's GVWR and all axles' GAWR are no longer exceeded.	**Option 1**	A bus is loaded with ballast (weight) to its GVWR to simulate a multi-passenger and baggage configuration. For this configuration the bus is loaded with the human test driver (if present), test instrumentation…	Uses driver definition 1. Acknowledges option of executing test without human present in the vehicle. May provide confusion as the ADS could be considered the test driver based on equivalency.
	Option 2	Retain current language.	Uses driver definition 2. Leave language as written with the understanding that the ADS-DV "test driver" does not add additional weight and therefore will be accounted for with ballast.
	Option 3	A bus is loaded with ballast (weight) to its GVWR to simulate a multi-passenger and baggage configuration. For this configuration the bus is loaded with the test personnel (if present), test instrumentation…	Reference to driver has been removed. This option recognizes that test personnel may continue to be part of the testing procedure without focusing on them in the role as driver but rather a testing occupant.

FMVSS No. 136, S6.3.4 Transmission and Brake Controls			
Regulatory Text	**Translation Options**		**Potential Considerations**
The transmission selector control is in a forward gear during all maneuvers. A vehicle equipped with an engine braking system that is engaged and disengaged by the driver is tested with the system disengaged.	**Option 1**	Retain current language.	Uses driver definition 1. Leave text as written with the understanding that both the human driver and ADS can engage or disengage the engine braking system; and as part of the test, this feature will be disengaged.
	Option 2	Same as option 1.	Uses driver definition 2. Leave text as written with the understanding that both the driver and ADS can engage or disengage the engine braking system; and as part of the test this feature will be disengaged.
	Option 3	The transmission selector control is in a forward gear during all maneuvers. A vehicle equipped with an engine braking system that can be engaged and disengaged is tested with the system disengaged.	Reference to driver has been removed. The mention of driver in this instance describes the engine (not service) brake feature type available on some conventional heavy vehicles, which is designed to be disengaged and adjusted.

FMVSS No. 136, S6.3.9 Special Drive Conditions			
Regulatory Text	**Translation Options**		**Potential Considerations**
A vehicle equipped with an interlocking axle system or a front wheel drive system that is engaged and disengaged by the driver is tested with the system disengaged.	**Option 1**	Retain current language.	Uses driver definition 1. Leave text as written with the understanding that both the human driver and ADS can engage or disengage the interlocking axle system; and as part of the test this feature will be disengaged.
	Option 2	Same as option 1.	Uses driver definition 2. Leave text as written with the understanding that both the driver and ADS can engage or disengage the interlocking axle system; and as part of the test this feature will be disengaged.
	Option 3	A vehicle equipped with an interlocking axle system or a front wheel drive system that can be engaged and disengaged is tested with the system disengaged.	Reference to driver has been removed. The mention of driver in this instance describes the interlocking axle system feature type available on some conventional heavy vehicles, which is designed to be disengaged.

FMVSS No. 136, S7.2 Telltale Lamp Check			
Regulatory Text	**Translation Options**		**Potential Considerations**
With the vehicle stationary and the ignition locking system in the “Lock” or “Off” position, activate the ignition locking system to the “On” (“Run”) position or, where applicable, the appropriate position for the lamp check. The ESC system must perform a check-of-lamp function for the ESC malfunction telltale, as specified in S5.4.3.	**Option 1**	For each vehicle equipped with manually operated driving controls, with the vehicle stationary and the ignition locking system in the “Lock” or “Off” position, activate the ignition locking system to the “On” (“Run”) position or, where applicable, the appropriate position for the lamp check. The ESC system must perform a check-of-lamp function for the ESC malfunction telltale, as specified in S5.4.3. For each ADS-DV, with the vehicle stationary and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" ("Run") position or, where applicable, the appropriate state for checking the communication of ESC malfunctions to the ADS. The ESC system must check the functioning of the communication of ESC malfunction information to the ADS, as specified in S5.4.3.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.3 Tire Conditioning			
Regulatory Text	**Translation Options**		**Potential Considerations**
Condition the tires to wear away mold sheen and achieve operating temperature immediately before beginning the J-Turn test runs. The test vehicle is driven around a circle 150 feet (46 meters) in radius at a speed that produces a lateral acceleration of approximately 0.1g for two clockwise laps followed by two counterclockwise laps.	**Option 1**	Condition the tires to wear away mold sheen and achieve operating temperature immediately before beginning the J-Turn test runs. The test vehicle is operated around a circle 150 feet (46 meters) in radius at a speed that produces a lateral acceleration of approximately 0.1g for two clockwise laps followed by two counterclockwise laps.	Not specific to a driver definition.
	Option 2	Retain current language.	This option provides for the general application of the word "driven" to apply to the operation of the vehicle without a human driver.

FMVSS No. 136, S7.6 ESC System Malfunction Check			
Regulatory Text	**Translation Options**		**Potential Considerations**
Check that the ESC system is enabled by ensuring that the ESC malfunction telltale is not illuminated.	**Option 1**	For each vehicle equipped with manually operated driving controls, check that the ESC system is enabled by ensuring that the ESC malfunction telltale is not illuminated. For each ADS-DV, check that the ESC system is enabled by ensuring that the ESC malfunction condition is not being communicated to the ADS.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.7 J-Turn Test Maneuver			
Regulatory Text	**Translation Options**		**Potential Considerations**
The truck tractor or bus is subjected to multiple series of test runs using the J-Turn test maneuver. The truck tractor or bus travels through the course by driving down the entrance lane, crossing the start gate at the designated entrance speed, turning through the curved lane section, and crossing the end gate, while the driver attempts to keep all of the wheels of the truck tractor or bus within the lane.	**Option 1**	Retain current language.	Uses driver definition 1. As the standard is written, whether the ESC is part of the ADS or a separate system, the commanded and feedback of motor torque must be available to be measured and compared to ensure engine torque reduction.
	Option 2	Each truck tractor or bus equipped with manually operated driving controls is subjected to multiple series of test runs using the J-Turn test maneuver. The truck tractor or bus travels through the course by driving down the entrance lane, crossing the start gate at the designated entrance speed, turning through the curved lane section, and crossing the end gate, while the driver attempts to keep all of the wheels of the truck tractor or bus within the lane. Each ADS-DV truck, tractor, or bus is subjected to multiple series of test runs using the J-Turn test maneuver. The truck, tractor, or bus travels through the course by driving down the entrance lane, crossing the start gate at the designated entrance speed, turning through the curved lane section, and crossing the end gate, while the ADS attempts to keep all of the wheels of the truck tractor or bus within the lane.	Uses driver definition 2. As the standard is written, whether the ESC is part of the ADS or a separate system, the commanded and feedback of motor torque must be available to be measured and compared to ensure engine torque reduction.

FMVSS No. 136, S7.7.1.1 Preliminary Reference Speed Determination			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle is subjected to two series of test runs using the J-Turn test maneuver at increasing entrance speeds. One series uses clockwise steering, and the other series uses counterclockwise steering. The entrance speed of a test run is the 0.5 second average of the raw speed data prior to any ESC system activation of the service brakes and rounded to the nearest 1.0 mph. During each test run, the driver attempts to maintain the selected entrance speed throughout the J-Turn test maneuver. For the first test run of each series, the entrance speed is 32 km/h ±1.6 km/h (20 mph ±1.0 mph) and is incremented 1.6 km/h (1.0 mph) for each subsequent test run until ESC service brake application occurs or any of the truck tractor's or bus's wheels departs the lane. The vehicle entrance speed at which ESC service brake application occurs is the Preliminary Reference Speed. The Preliminary Reference Speed is determined for each direction: Clockwise steering and counter-clockwise steering. During any test run, if any of the wheels of the truck tractor or bus depart the lane at any point within the first 120 degrees of radius arc angle, the test run is repeated at the same entrance	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	Each vehicle equipped with manually operated driving controls is subjected to two series of test runs using the J-Turn test maneuver at increasing entrance speeds. One series uses clockwise steering, and the other series uses counterclockwise steering. The entrance speed of a test run is the 0.5 second average of the raw speed data prior to any ESC system activation of the service brakes and rounded to the nearest 1.0 mph. During each test run the driver attempts to maintain the selected entrance speed throughout the J-Turn test maneuver… Each ADS-DV is subjected to two series of test runs using the J-Turn test maneuver at increasing entrance speeds. One series uses clockwise steering, and the other series uses counterclockwise steering. The entrance speed of a test run is the 0.5 second average of the raw speed data prior to any ESC system activation of the service brakes and rounded to the nearest 1.0 mph. During each test run, the ADS attempts to maintain the selected entrance speed throughout the J-Turn test maneuver. For the first test run of each series, the entrance speed is 32 km/h ±1.6 km/h (20 mph ±1.0 mph) and is incremented 1.6 km/h (1.0 mph) for each subsequent test run until ESC service brake application occurs or any of the truck tractor's or bus's wheels departs the lane. The vehicle entrance speed at which ESC service brake application occurs is the Preliminary Reference Speed. The Preliminary Reference Speed is determined for each direction: Clockwise steering and counter-clockwise steering. During any test run, if any of the wheels of the truck tractor or bus depart the lane at any point within the first 120 degrees of radius arc angle, the test run is repeated at the same entrance speed. If any of the wheels of the truck tractor or bus depart the lane again, then four consecutive	Uses driver definition 2.

FMVSS No. 136, S7.7.1.1 Preliminary Reference Speed Determination			
Regulatory Text	**Translation Options**		**Potential Considerations**
speed. If any of the wheels of the truck tractor or bus depart the lane again, then four consecutive test runs are repeated at the same entrance speed (±1.6 km/h (±1.0 mph)).		test runs are repeated at the same entrance speed (±1.6 km/h (±1.0 mph)).	

FMVSS No. 136, S7.7.1.2 Reference Speed Determination			
Regulatory Text	**Translation Options**		**Potential Considerations**
Using the Preliminary Reference Speed determined in S7.7.1.1, perform two series of test runs using the J-Turn test maneuver to determine the Reference Speed. The first series consists of four consecutive test runs performed using counter-clockwise steering. The second series consists of four consecutive test runs performed using clockwise steering. During each test run, the driver attempts to maintain a speed equal to the Preliminary Reference Speed throughout the J-Turn test maneuver. The Reference Speed is the minimum entrance speed at which ESC service brake application occurs for at least two of four consecutive test runs of each series conducted at the same entrance speed (within ±1.6 km/h (±1.0 mph)). The Reference Speed is determined for each direction: clockwise steering and counter-clockwise steering. If ESC service brake application does not occur during at least two test runs of either series, the Preliminary Reference Speed is increased by 1.6 km/h (1.0 mph), and the procedure in this section is repeated.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	Using the Preliminary Reference Speed determined in S7.7.1.1, perform two series of test runs using the J-Turn test maneuver to determine the Reference Speed. The first series consists of four consecutive test runs performed using counter-clockwise steering. The second series consists of four consecutive test runs performed using clockwise steering. During each test run on a vehicle equipped with manually operated driving controls, the driver attempts to maintain a speed equal to the Preliminary Reference Speed throughout the J-Turn test maneuver… During each test run on an ADS-DV, the ADS attempts to maintain a speed equal to the Preliminary Reference Speed throughout the J-Turn test maneuver. The Reference Speed is the minimum entrance speed at which ESC service brake application occurs for at least two of four consecutive test runs of each series conducted at the same entrance speed (within ±1.6 km/h (±1.0 mph)). The Reference Speed is determined for each direction: clockwise steering and counter-clockwise steering. If ESC service brake application does not occur during at least two test runs of either series, the Preliminary Reference Speed is increased by 1.6 km/h (1.0 mph), and the procedure in this section is repeated.	Uses driver definition 2.

<table>
<tr><th colspan="4">FMVSS No. 136, S7.7.2 Engine Torque Reduction Test</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">The vehicle is subjected to two series of test runs using the J-Turn test maneuver at an entrance speed equal to the Reference Speed determined in S7.7.1.2. One series uses clockwise steering, and the other series uses counter-clockwise steering. Each series consists of four test runs with the vehicle at an entrance speed equal to the Reference Speed and the driver fully depressing the accelerator pedal from the time when the vehicle crosses the start gate until the vehicle reaches the end gate. ESC engine torque reduction is confirmed by comparing the engine torque output and driver requested torque data collected from the vehicle communication network or CAN bus. During the initial stages of each maneuver the two torque signals with respect to time will parallel each other. Upon ESC engine torque reduction, the two signals will diverge when the ESC system causes a commanded engine torque reduction and the driver depresses the accelerator pedal attempting to accelerate the vehicle.</td><td>Option 1</td><td>...Each series consists of four test runs with the vehicle at an entrance speed equal to the Reference Speed and with the throttle fully opened from the time when the vehicle crosses the start gate until the vehicle reaches the end gate. ESC engine torque reduction is confirmed by comparing the engine torque output and the requested torque data collected…

...Upon ESC engine torque reduction, the two signals will diverge when the ESC system causes a commanded engine torque reduction and the throttle is opened attempting to accelerate the vehicle. In the case of vehicles powered by electric motors, the word "throttle" refers to the motor speed controller.</td><td>Reference to driver has been removed.

Throttle equivalent provided for vehicles powered by electric motors. Reference in FMVSS No. 124 S4.2.

As the standard is written, whether the ESC is part of the ADS or a separate system, the commanded and feedback of motor torque must be available to be measured and compared to ensure engine torque reduction.</td></tr>
<tr><td>Option 2</td><td>...Each series consists of four test runs with the vehicle at an entrance speed equal to the Reference Speed and the accelerator is fully actuated from the time when the vehicle crosses the start gate until the vehicle reaches the end gate. ESC engine torque reduction is confirmed by comparing the engine torque output and the requested torque data collected…

…...Upon ESC engine torque reduction, the two signals will diverge when the</td><td>Reference to driver has been removed.

Provides an alternate translation for accelerator pedal and throttle by using accelerator. The term "accelerator" is presumed not to pertain only to a control component in conventional vehicles.

This option might eliminate the explanation that throttle refers to electric motor speed controllers.

As the standard is written, whether the ESC is part of the ADS or a separate system, the commanded and feedback of motor torque must</td></tr>
</table>

FMVSS No. 136, S7.7.2 Engine Torque Reduction Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
		ESC system causes a commanded engine torque reduction and the accelerator is actuated attempting to accelerate the vehicle.	be available to be measured and compared to ensure engine torque reduction.

FMVSS No. 136, S7.7.2.1 Engine Torque Reduction Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
Perform two series of test runs using the J-Turn test maneuver at the Reference Speed determined in S7.7.1.2 (±1.6 km/h (±1.0 mph)). The first series consists of four consecutive test runs performed using counter-clockwise steering. The second series consists of four consecutive test runs performed using clockwise steering. During each test run, the driver fully depresses the accelerator pedal from the time when the vehicle crosses the start gate until the vehicle reaches the end gate.	**Option 1**	…During each test run, the throttle is fully opened from the time when the vehicle crosses the start gate until the vehicle reaches the end gate. In the case of vehicles powered by electric motors, the word throttle refers to the motor speed controller.	Reference to driver has been removed. Throttle equivalent provided for vehicles powered by electric motors. Reference in FMVSS No. 124 S4.2.
	Option 2	…During each test run, the accelerator is fully actuated from the time when the vehicle crosses the start gate until the vehicle reaches the end gate.	Reference to driver has been removed. Provides an alternate translation for accelerator pedal and throttle by using accelerator. The term "accelerator" is presumed not to pertain only to a control component in conventional vehicles. This option might eliminate the explanation that throttle refers to electric motor speed controllers.

FMVSS No. 136, S7.7.2.2 Engine Torque Reduction Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
During each of the engine torque reduction test runs, verify the commanded engine torque and the driver requested torque signals diverge according to the criteria specified in S5.3.2.1.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	...verify the commanded engine torque and the requested torque signals diverge…	Reference to driver has been removed.

FMVSS No. 136, S7.7.3.2 Roll Stability Control Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
During each test run, the driver will release the accelerator pedal after the ESC system has slowed vehicle by more than 4.8 km/h (3.0 mph) below the entrance speed.	**Option 1**	During each test run, the throttle is closed after the ESC system has slowed vehicle by more than 4.8 km/h (3.0 mph) below the entrance speed. In the case of vehicles powered by electric motors, the word throttle refers to the motor speed controller.	Reference to driver has been removed. Throttle equivalent provided for vehicles powered by electric motors. Reference in FMVSS No. 124 S4.2.
	Option 2	During each test run, the accelerator is no longer actuated after the ESC system has slowed vehicle by more than 4.8 km/h (3.0 mph) below the entrance speed.	Not driver definition specific. Provides an alternate translation for accelerator pedal and throttle by using accelerator. The term accelerator is presumed not to pertain only to a control in vehicle with manually operated driver control. This option might eliminate the explanation that throttle refers to electric speed controllers.

FMVSS No. 136, S7.8.1 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
Simulate one or more ESC malfunction(s) by disconnecting the power source to any ESC component, or disconnecting any electrical connection between ESC components (with the vehicle power off). When simulating an ESC malfunction, the electrical connections for the telltale lamp(s) are not disconnected.	**Option 1**	For each vehicle equipped with manually operated driving controls, simulate one or more ESC malfunction(s) by disconnecting the power source to any ESC component, or disconnecting any electrical connection between ESC components (with the vehicle power off). When simulating an ESC malfunction, the electrical connections for the telltale lamp(s) are not disconnected. For each ADS-DV, simulate one or more ESC malfunction(s) by disconnecting the power source to any ESC component, or disconnecting any electrical connection between ESC components (with the vehicle power off). When simulating an ESC malfunction, the electrical connections to the ADS are not disconnected.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.8.2 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
With the vehicle initially stationary and the ignition locking system in the “Lock” or “Off” position, activate the ignition locking system to the “Start” position and start the engine. Place the vehicle in a forward gear and accelerate to 48 ±8 km/h (30 ±5 mph). Drive the vehicle for at least two minutes including at least one left and one right turning maneuver and at least one service brake application. Verify that, within two minutes of attaining this speed, the ESC malfunction indicator illuminates in accordance with S5.4.	**Option 1**	With the vehicle initially stationary and the ignition locking system in the “Lock” or “Off” position, activate the ignition locking system to the “Start” position and start the engine. Place the vehicle in a forward gear and accelerate to 48 ±8 km/h (30 ±5 mph). Operate the vehicle for at least two minutes including at least one left and one right turning maneuver and at least one service brake application. Verify that, within two minutes of attaining this speed, the ESC malfunction indicator illuminates or the malfunction condition is communicated to the ADS in accordance with S5.4.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.8.3 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
Stop the vehicle, deactivate the ignition locking system to the "Off" or "Lock" position. After a five-minute period, activate the vehicle's ignition locking system to the "Start" position and start the engine. Verify that the ESC malfunction indicator again illuminates to signal a malfunction and remains illuminated as long as the engine is running until the fault is corrected.	**Option 1**	For each vehicle equipped with manually operated driving controls, stop the vehicle, deactivate the ignition locking system to the "Off" or "Lock" position. After a five-minute period, activate the vehicle's ignition locking system to the "Start" position and start the engine. Verify that the ESC malfunction indicator again illuminates to signal a malfunction and remains illuminated as long as the engine is running until the fault is corrected. For each ADS-DV, stop the vehicle, deactivate the ignition locking system to the "Off" or "Lock" position. After a five-minute period, activate the vehicle's ignition locking system to the "Start" position and start the engine. Verify that the ESC malfunction condition is communicated to the ADS and the condition is continuously communicated to the ADS as long as the engine is running until the fault is corrected.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.8.4 ESC Malfunction Detection			
Regulatory Text	**Translation Options**		**Potential Considerations**
Deactivate the ignition locking system to the “Off” or “Lock” position. Restore the ESC system to normal operation, activate the ignition system to the “Start” position and start the engine. Verify that the telltale has extinguished.	**Option 1**	For each vehicle equipped with manually operated driving controls, deactivate the ignition locking system to the “Off” or “Lock” position. Restore the ESC system to normal operation, activate the ignition system to the “Start” position and start the engine. Verify that the telltale has extinguished. For each ADS-DV, deactivate the ignition locking system to the "Off" or "Lock" position. Restore the ESC system to normal operation, activate the ignition system to the “Start” position and start the engine. Verify that an ESC malfunction condition is not communicated to the ADS.	Not specific to driver definition or occupant position.
	Option 2	Same as option 1.	
	Option 3	Same as option 1.	
	Option 4	Same as option 1.	

FMVSS No. 136, S7.9.3 Post Data Processing			
Regulatory Text	**Translation Options**		**Potential Considerations**
The activation point of the ESC engine torque reduction is the point where the measured driver demanded torque and the engine torque first begin to deviate from one another (engine torque decreases while the driver requested torque increases) during the Engine Torque Reduction Test. The torque values are obtained directly from the vehicle communication network or CAN bus. Torque values used to determine the activation point of the ESC engine torque reduction are interpolated.	**Option 1**	Retain current language.	Uses driver definition 1.
	Option 2	The activation point of the ESC engine torque reduction is the point where the measured torque demand and the engine torque first begin to deviate from one another (engine torque decreases while the requested torque increases)...	Reference to driver has been removed.

FMVSS No. 208

Technical Translation Options Summary: The purpose of this FMVSS is "to reduce the number of deaths of vehicle occupants, and the severity of injuries, by specifying vehicle crashworthiness requirements in terms of forces and accelerations measured on anthropomorphic dummies in test crashes, and by specifying equipment requirements for active and passive restraint systems." These technical translation options are for conventional (forward-facing front row) and unconventional (rear-facing front row) seating. The focus for translation is to ensure that the current crashworthiness requirements are maintained for ADS-DVs while simultaneously not being compromised for conventional vehicles. ADS-DVs may not have traditional driver/front passenger DSPs, so the placement and requirements for dummies in test crashes of ADS-DVs are clarified in addition to the required active and passive restraint systems. For this review, the scope was limited to fixed rear-facing seats with reclining seat backs in the front row.

<table>
<tr><th colspan="4">FMVSS No. 208, S4.1.5.4 Passenger Cars Certified to S14</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">Each passenger car certified to S14 shall, at each front outboard designated seating position, meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants.</td><td>Option 1</td><td>Retain current language.</td><td>Maintains use of an inflatable restraint requiring no action by vehicle occupants for forward- or rear-facing front row outboard designated seating position.</td></tr>
<tr><td>Option 2</td><td>Each passenger car certified to S14 shall meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system, at each front forward-facing outboard designated seating position, or by means of an air bag system or deployable restraint at any front row rear-facing outboard designated seating position, that requires no action by vehicle occupants.</td><td>Maintains inflatable restraint requiring no action by vehicle occupants for forward-facing front row. Applies to rear-facing front row utilizing an alternative system that requires no action by vehicle occupants.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 3</td><td>Each passenger car certified to S14 shall, at each front forward-facing outboard designated seating position, meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants. Each front row rear-facing outboard designated seating position must meet the requirements of S5.1.2(b) by means of an air bag system or deployable restraint system.</td><td>Maintains inflatable restraint requiring no action by vehicle occupants for forward-facing front row. Applies to rear-facing front row to meet the requirements of S5.1.2(b) utilizing an alternative system.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 208, S4.2.6.3 Trucks, Buses, and Multipurpose Passenger Vehicles Certified to S14</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">Each truck, bus, or multipurpose passenger vehicle with a GVWR of 3,855 kg (8,500 lb.) or less and an unloaded vehicle weight of 2,495 kg (5,500 lb.) or less certified to S14 shall, at each front outboard designated seating position, meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants.</td><td>Option 1</td><td>Retain current language.</td><td>Maintains use of an inflatable restraint requiring no action by vehicle occupants for forward- or rear-facing front row outboard designated seating position.</td></tr>
<tr><td>Option 2</td><td>Each truck, bus, or multipurpose passenger vehicle with a GVWR of 3,855 kg (8,500 lb.) or less and an unloaded vehicle weight of 2,495 kg (5,500 lb.) or less certified to S14 shall meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system, at each front forward-facing outboard designated seating position, or by means of an air bag system or deployable restraint, at each front row rear-facing outboard designated seating position, that requires no action by vehicle occupants.</td><td>Maintains inflatable restraint requiring no action by vehicle occupants for forward-facing front row. Applies to rear-facing front row utilizing an alternative system that requires no action by vehicle occupants.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 3</td><td>Each truck, bus, or multipurpose passenger vehicle with a GVWR of 3,855 kg (8,500 lb.) or less and an unloaded vehicle weight of 2,495 kg (5,500 lb.) or less certified to S14 shall, at each front forward-facing outboard designated seating position meet the applicable frontal crash protection requirements of S5.1.2(b) by means of an inflatable restraint system that requires no action by vehicle occupants. Each front row rear-facing outboard designated seating position may meet the requirements of S5.1.2(b) by means of an air bag system or deployable restraint system.</td><td>Maintains inflatable restraint requiring no action by vehicle occupants for forward-facing front row. Applies to rear-facing front row to meet the requirements of S5.1.2(b)utilizing an alternative system.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

FMVSS No. 208, S4.5.1(b) Sun Visor Air Bag Warning Label			
Regulatory Text	**Translation Options**		**Potential Considerations**
(1) Except as provided in S4.5.1(b)(2), each vehicle shall have a label permanently affixed to either side of the sun visor, at the manufacturer's option, at each front outboard seating position that is equipped with an inflatable restraint. The label shall conform in content to the label shown in either Figure 6a or 6b of this standard, as appropriate, and shall comply with the requirements of S4.5.1(b)(1)(i) through S4.5.1(b)(1)(iv). (i) The heading area shall be yellow with the word "WARNING" and the alert symbol in black. (ii) The message area shall be white with black text. The message area shall be no less than 30 cm2 (4.7 in2). (iii) The pictogram shall be black with a red circle and slash on a white background. The pictogram shall be no less than 30 mm (1.2 in) in diameter. (iv) If the vehicle does not have a back seat, the label shown in Figure 6a or 6b may be modified by omitting the statements: "The BACK SEAT is the SAFEST place for children." (2) Vehicles certified to meet the requirements specified in S19, S21, or S23 before September 1, 2003 shall have a label permanently affixed to either side of the sun visor, at the manufacturer's option, at each front outboard seating position that is equipped with an inflatable restraint. The label shall conform in content to the label shown either in Figure 8 or Figure 11 of this standard, at the manufacturer's option, and shall comply with the requirements of S4.5.1(b)(2)(i) through S4.5.1(b)(2)(iv). (i) The heading area shall be yellow with the word "WARNING" and the alert symbol in black. (ii) The message area shall be white with black text. The message area shall be no less than 30 cm2 (4.7 in2). (iii) The pictogram shall be black on a white background. The pictogram shall be no less than 30 mm (1.2 in) in length. (iv) If the vehicle does not have a back seat, the label shown in the figure may be modified by omitting the statement: "The BACK SEAT is the SAFEST place for CHILDREN." (v) If the vehicle does not have a back seat or the back seat is too small to accommodate a rear-facing child restraint consistent with S4.5.4.1, the label shown in the figure may be modified by omitting the statement: "Never put a rear-facing child seat in the front." (3) Vehicles certified to meet the requirements specified in S19, S21, or S23 on or after September 1, 2003 shall have a label permanently affixed to either side of the sun visor, at the manufacturer's option, at each front outboard seating position that is equipped with an inflatable restraint. The label shall conform in content to the label shown in Figure 11 of this standard and shall comply with the requirements of S4.5.1(b)(3)(i) through S4.5.1(b)(3)(iv). (i) The heading area shall be yellow with the word "WARNING" and the alert symbol in black. (ii) The message area shall be white with black text. The message area shall be no less than 30 cm2 (4.7 in2). (iii) The pictogram shall be black on a white background. The pictogram shall be no less than 30 mm (1.2 in) in length. (iv) If the vehicle does not have a back seat, the label	**Option 1**	Retain current language.	Front forward-facing seats with sun visor would require visor label. Vehicles with front row rear-facing seats may not be equipped with inflatable restraints or sun visors. Sun visors could also be installed in non-traditional locations (e.g., above side glass). Research may be required to determine appropriate location for rear-facing seats.

FMVSS No. 208, S4.5.1(b) Sun Visor Air Bag Warning Label			
Regulatory Text	**Translation Options**		**Potential Considerations**
shown in the figure may be modified by omitting the statement: "The BACK SEAT is the SAFEST place for CHILDREN." (v) If the vehicle does not have a back seat or the back seat is too small to accommodate a rear-facing child restraint consistent with S4.5.4.1, the label shown in the figure may be modified by omitting the statement: "Never put a rear-facing child seat in the front." (4) Design-specific information. (i) A manufacturer may request in writing that the Administrator authorize additional design-specific information to be placed on the air bag sun visor label for vehicles certified to meet the requirements specified in S19, S21, or S23. The label shall conform in content to the label shown in Figure 11 of this standard and shall comply with the requirements of S4.5.1(b)(3)(i) through S4.5.1(b)(3)(iv), except that the label may contain additional, design-specific information, if authorized by the Administrator. (ii) The request must meet the following criteria: (A) The request must provide a mock-up of the label with the specific language or pictogram the manufacturer requests permission to add to the label. (B) The additional information conveyed by the requested label must be specific to the design or technology of the air bag system in the vehicle and not applicable to all or most air bag systems. (C) The additional information conveyed by the requested label must address a situation in which foreseeable occupant behavior can affect air bag performance. (iii) The Administrator shall authorize or reject a request by a manufacturer submitted under S4.5.1(b)(4)(i) on the basis of whether the additional information could result in information overload or would otherwise make the label confusing or misleading. No determination will be made as to whether, in light of the above criteria, the particular information best prevents information overload or whether the information best addresses a particular air bag risk. Moreover, the Administrator will not verify or vouch for the accuracy of the information. (5) Limitations on additional labels. (i) Except for the information on an air bag maintenance label placed on the sun visor pursuant to S4.5.1(a) of this standard, or on a utility vehicle warning label placed on the sun visor that conforms in content, form, and sequence to the label shown in Figure 1 of 49 CFR 575.105, no other information shall appear on the same side of the sun visor to which the sun visor air bag warning label is affixed. (ii) Except for the information in an air bag alert label placed on the sun visor pursuant to S4.5.1(c) of this standard, or on a utility vehicle warning label placed on the sun visor that conforms in content, form, and sequence to the label shown in Figure 1 of 49 CFR 575.105, no other information about air bags or the need to wear seat belts shall appear anywhere on the sun visor.			

FMVSS No. 208, S4.5.1(f) Information to Appear in Owner's Manual			
Regulatory Text	**Translation Options**		**Potential Considerations**
(1) The owner's manual for any vehicle equipped with an inflatable restraint system shall include an accurate description of the vehicle's air bag system in an easily understandable format. The owner's manual shall include a statement to the effect that the vehicle is equipped with an air bag and lap/shoulder belt at both front outboard seating positions, and that the air bag is a supplemental restraint at those seating positions. The information shall emphasize that all occupants, including the driver, should always wear their seat belts whether or not an air bag is also provided at their seating position to minimize the risk of severe injury or death in the event of a crash. The owner's manual shall also provide any necessary precautions regarding the proper positioning of occupants, including children, at seating positions equipped with air bags to ensure maximum safety protection for those occupants. The owner's manual shall also explain that no objects should be placed over or near the air bag on the instrument panel, because any such objects could cause harm if the vehicle is in a crash severe enough to cause the air bag to inflate. (2) For any vehicle certified to meet the	**NPRM**	(1) The owner's manual for any vehicle equipped with an inflatable restraint system shall include an accurate description of the vehicle's air bag system in an easily understandable format. The owner's manual shall include a statement to the effect that the vehicle is equipped with an air bag and lap/shoulder belt at both front outboard seating positions, and that the air bag is a supplemental restraint at those seating positions. The information shall emphasize that all occupants should always wear their seat belts, …	
	Option 1	Retain proposed language.	Applicable to forward- and rear-facing outboard seating positions if equipped with air bags in both seating configurations. Does not consider the possibility that rear-facing outboard seating positions may not utilize an air bag.
	Option 2	(1) The owner's manual for any vehicle equipped with an inflatable restraint system at the front outboard seating positions shall include an accurate description of the vehicle's air bag system in an easily understandable format. The owner's manual shall include a statement to the effect that the vehicle is equipped with an air bag and lap/shoulder belt at both front outboard seating positions, and that the air bag is a supplemental restraint at those seating positions. The information shall emphasize that all occupants should always wear their seat belts whether or not an air bag is also provided at their seating position to minimize the risk of severe injury or death in the event of a crash. The owner's manual shall ...	Retains proposed language and includes additional revision to clarify statement applies to any front outboard seating positions (forward- or rear-facing) equipped with an air bag.

FMVSS No. 208, S4.5.1(f) Information to Appear in Owner's Manual			
Regulatory Text	**Translation Options**		**Potential Considerations**
requirements specified in S14.5, S15, S17, S19, S21, S23, and S25, the manufacturer shall also include in the vehicle owner's manual a discussion of the advanced passenger air bag system installed in the vehicle. The discussion shall explain the proper functioning of the advanced air bag system and shall provide a summary of the actions that may affect the proper functioning of the system. The discussion shall include, at a minimum, accurate information on the following topics: (i) A presentation and explanation of the main components of the advanced passenger air bag system. (ii) An explanation of how the components function together as part of the advanced passenger air bag system. (iii) The basic requirements for proper operation, including an explanation of the actions that may affect the proper functioning of the system. (iv) For vehicles certified to meet the requirements of S19.2, S21.2 or S23.2, a complete description of the passenger air bag suppression system installed in the vehicle, including a discussion of any suppression zone. (v) An explanation of the interaction of the advanced passenger air bag system			

FMVSS No. 208, S4.5.1(f) Information to Appear in Owner's Manual			
Regulatory Text	**Translation Options**		**Potential Considerations**
with other vehicle components, such as seat belts, seats or other components. (vi)Brighton2019!1 A summary of the expected outcomes when child restraint systems, children and small teenagers or adults are both properly and improperly positioned in the passenger seat, including cautionary advice against improper placement of child restraint systems. (vii) For vehicles certified to meet the requirements of S19.2, S21.2 or S23.2, a discussion of the telltale light, specifying its location in the vehicle and explaining when the light is illuminated. (viii) Information on how to contact the vehicle manufacturer concerning modifications for persons with disabilities that may affect the advanced air bag system.			

FMVSS No. 208, S4.5.2 Readiness Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
An occupant protection system that deploys in the event of a crash shall have a monitoring system with a readiness indicator. The indicator shall monitor its own readiness and shall be clearly visible from the driver's designated seating position. If the vehicle is equipped with a single readiness indicator for both a driver and passenger air bag, and if the vehicle is equipped with an on-off switch permitted by S4.5.4 of this standard, the readiness indicator shall monitor the readiness of the driver air bag when the passenger air bag has been deactivated by means of the on-off switch, and shall not illuminate solely because the passenger air bag has been deactivated by the	**NPRM**	From the NPRM: "The agency notes that other barriers, such as those involving indicator and warnings included in FMVSS No. 208 may be addressed in a future notice that includes a holistic discussion of the appropriate applicability of telltale requirements in ADS-equipped vehicles."	
	Option 1	…have a monitoring system with a readiness indicator. The indicator shall monitor its own readiness and shall be clearly visible from the driver's designated seating position, or from any front outboard designated seating position. If the vehicle is equipped with a single readiness indicator for both a driver and passenger air bag, and if the vehicle is equipped with an on-off switch permitted by S4.5.4 of this standard, the readiness indicator shall monitor the readiness of the driver air bag when the passenger air bag has been deactivated by means of the on-off switch, and shall not illuminate solely because the air bag has been deactivated by the manual on-off switch. A list of the elements of the system being monitored by the indicator shall be included with the information furnished in accordance with S4.5.1 but need not be included on the label. For vehicles without manually operated driving controls, the readiness indicator for any passenger air bag shall monitor its own readiness and shall provide an input to the ADS indicating the underlying condition.	If there is a driver's DSP and it is occupied, i.e., if there is a human driver, the original purpose of the text is preserved. If not, to ensure that any person protected by the air bag receives the warning, all front outboard occupants would receive the warning. The readiness is also communicated to the ADS. Since the provision for vehicles with an "on-off switch permitted by S4.5.4." expired in 2012, so no vehicle covered by these translations could have such a switch so no translation was performed. Requires ADS to be defined. Does not assume that the active air bag will be the air bag in the driver's DSP.

FMVSS No. 208, S4.5.2 Readiness Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
manual on-off switch. A list of the elements of the system being monitored by the indicator shall be included with the information furnished in accordance with S4.5.1 but need not be included on the label.	**Option 2**	…have a monitoring system with a readiness indicator. The indicator shall monitor its own readiness and shall be clearly visible from the driver's designated seating position, or from any front outboard designated seating position. If the vehicle is equipped with a single readiness indicator for both front outboard air bags, and if the vehicle is equipped with an on-off switch permitted by S4.5.4 of this standard, the readiness indicator shall monitor the readiness of the air bag when the passenger air bag has been deactivated by means of the on-off switch, and shall not illuminate solely because the passenger air bag has been deactivated by the manual on-off switch. A list of the elements of the system being monitored by the indicator shall be included with the information furnished in accordance with S4.5.1 but need not be included on the label. For vehicles without manually operated driving controls, the readiness indicator for any front outboard passenger air bag shall monitor its own readiness and shall provide an input to the ADS indicating the underlying condition.	If there is a driver's DSP and it is occupied, i.e., if there is a human driver, the original purpose of the text is preserved. If not, to ensure that any person protected by the air bag receives the warning, all front outboard occupants would need to receive the warning. The readiness is also communicated to the ADS. Since the provision for vehicles with an "on-off switch permitted by S4.5.4." expired in 2012, so no vehicle covered by these translations could have such a switch so no translation was performed. Requires ADS to be defined. Does not assume that the active air bag will be the air bag in the driver's DSP.
	Option 3	An occupant protection system that deploys in the event of a crash shall have a monitoring system with a readiness indicator. The indicator shall monitor its own readiness and shall be clearly visible from the driver's designated seating position, and be visible to the left front outboard seating position in an ADS-DV. If the vehicle is equipped with a single readiness indicator for both the left front outboard and right front outboard air bag, and if the vehicle is equipped with an on-off switch permitted by S4.5.4 of this standard, the readiness indicator shall monitor the readiness of the air bag that has not been deactivated when the air bag has been deactivated by means of the on-off switch, and shall not illuminate solely because air bag has been deactivated by the manual on-off switch. A list of the elements of the system	This option maintains the current language for conventional vehicles and ensures the indicator is visible per the current standard location for ADS-DVs. Since the provision for vehicles with an "on-off switch permitted by S4.5.4." expired in 2012, so no vehicle covered by these translations could have such a switch so no translation was performed. Requires ADS to be defined.

FMVSS No. 208, S4.5.2 Readiness Indicator			
Regulatory Text	**Translation Options**		**Potential Considerations**
		being monitored by the indicator shall be included with the information furnished in accordance with S4.5.1 but need not be included on the label. For vehicles without manually operated driving controls, the readiness indicator for the left front outboard seating position air bag shall monitor its own readiness and shall provide an input to the ADS indicating the underlying condition.	
	Option 4	An occupant protection system that deploys in the event of a crash shall have a monitoring system with a readiness indicator. The indicator shall monitor its own readiness and shall be clearly visible from the driver's designated seating position in a vehicle with manually operated driving controls. If the vehicle is equipped with a single readiness indicator for both front outboard air bags, and if the vehicle is equipped with an on-off switch permitted by S4.5.4 of this standard, the readiness indicator shall monitor the readiness of the active air bag when the other air bag has been deactivated by means of the on-off switch, and shall not illuminate solely because that other air bag has been deactivated by the manual on-off switch. A list of the elements of the system being monitored by the indicator shall be included with the information furnished in accordance with S4.5.1 but need not be included on the label. For vehicles without manually operated driving controls, the readiness indicator for the left front outboard seating position air bag shall monitor its own readiness and shall provide an input to the ADS indicating the underlying condition.	The telltale is visible to the driver's DSP in conventional vehicles and the information is communicated to the ADS in ADS-DVs. Since the provision for vehicles with an "on-off switch permitted by S4.5.4." expired in 2012, so no vehicle covered by these translations could have such a switch so no translation was performed. Requires ADS to be defined.

FMVSS No. 208, S5.1.1 Belted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Vehicles not certified to S14. Impact a vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle, and at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, under the applicable conditions of S8 and S10. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(a), S6.3, S6.4(a), and S6.5 of this standard. (b) Vehicles certified to S14—(1) Vehicles certified to S14.1 or S14.2. Impact a vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle under the applicable conditions of S8 and S10. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 of this standard. (2) Vehicles certified to S14.3 or S14.4. Impact a vehicle traveling longitudinally forward at any speed, up to and including 56 km/h (35 mph), into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle under the applicable conditions of S8 and S10. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 of this standard.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- and rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	Retain current language.	Any injury criteria that may be established for rear-facing front seats could be added to S6 to define forward-facing and rear-facing injury criteria. For example: S6.2 Head Injury Criteria S6.2.1 Forward-facing occupant (a)(1) For any two points in time, t1 and t2…(i.e., use existing standard). S6.2.2 Rear-facing occupant (needs to be developed)

FMVSS No. 208, S5.1.2 Unbelted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Vehicles not certified to the requirements of S13 or S14. At the manufacturer's option, either one of the following unbelted tests shall be met: (1) Impact a vehicle traveling longitudinally forward at any speed up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle, and at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, under the applicable conditions of S8 and S10, excluding S10.7, S10.8, and S10.9. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(a), S6.3, S6.4(a), and S6.5 of this standard. (2) Impact a vehicle traveling longitudinally forward at any speed between 32 km/h (20 mph) and 40 km/h (25 mph), inclusive, into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle, and at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, under the applicable conditions of S8 and S10, excluding S10.7, S10.8, and S10.9. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 of this standard. (b) Vehicles certified to the requirements of S14. Impact a vehicle traveling longitudinally forward at any speed between 32 km/h (20 mph) and 40 km/h (25 mph), inclusive, into a fixed rigid barrier that is perpendicular to the line of travel of the vehicle, and at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, under the applicable conditions of S8 and S10, excluding S10.7, S10.8, and S10.9. The test dummy specified in S8.1.8 placed in each front outboard designated seating position shall meet the injury criteria of S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 of this standard.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- and rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	Retain current language.	If research indicated different injury criteria would be required for rear-facing occupants, revision would be required to S6 to define forward-facing and rear-facing injury criteria. For example: S6.2 Head Injury Criteria S6.2.1 Forward-facing occupant (a)(1) For any two points in time, t1 and t2…(i.e., use existing standard). S6.2.2 Rear-facing occupant (needs to be developed)

FMVSS No. 208, S6 Injury Criteria for the Part 572, Subpart E, Hybrid III Test Dummy			
Regulatory Text	**Translation Options**		**Potential Considerations**
Injury criteria for the part 572, subpart E, Hybrid III test dummy	**Option 1**	Retain current language.	Existing subpart E dummy and related injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if dummy and injury criteria are appropriate for rear-facing occupants.
	Option 2	S6 Injury criteria for the 50th percentile adult male dummy	This proposal assumes a different dummy may be required for rear-facing testing. Title changed to be more generic. Would require renumbering of existing S6.1 through 6.7. For example: S6.1 Injury criteria for the forward-facing part 572, subpart E, Hybrid III test dummy S6.2 Injury criteria for the rear-facing part 572, subpart TBD, Hybrid III test dummy S6.3 Unless otherwise indicated, instrumentation for data acquisition, data channel frequency class, and moment calculations.. (current 6.7 language)

FMVSS No. 208, S6 Injury Criteria for the Part 572, Subpart E, Hybrid III Test Dummy			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	Injury criteria for the part 572, subpart E, Hybrid III test dummy (forward-facing) and part 572, subpart TBD, Hybrid III test dummy (rear-facing)	May require additional research to determine appropriate dummy to be used in rear-facing testing. S6.1 through S6.6 could be revised to identify forward-facing and rear-facing injury criteria. For example: S6.2 Head Injury Criteria S6.2.1 Forward-facing occupant (a)(1) For any two points in time, t1 and t2…(i.e., use existing standard). S6.2.2 Rear-facing occupant (Limited research may be required to identify rear-facing criteria)

FMVSS No. 208, S6.2 Head Injury Criteria			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a)(1) For any two points in time, t1 and t2, during the event which are separated by not more than a 36 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC36) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (2) The maximum calculated HIC36 value shall not exceed 1,000. (b)(1) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (2) The maximum calculated HIC15 value shall not exceed 700.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S6.2.1 Forward-facing occupant (a)(1) For any two points in time, t1 and t2, during the event which are separated by not more than a 36 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC36) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (2) The maximum calculated HIC36 value shall not exceed 1,000. (b)(1) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (2) The maximum calculated HIC15 value shall not exceed 700. S6.2.2 rear-facing occupant - TBD	This option assumes that different injury criteria may be required for rear-facing front outboard occupants.

FMVSS No. 208, S6.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing 78051.218, revision R incorporated by reference in part 572, subpart E of this chapter shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S6.3.1 Forward-facing occupant The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing 78051.218, revision R incorporated by reference in part 572, subpart E of this chapter shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds. S6.3.2 rear-facing occupant - TBD	This option assumes that different injury criteria may be required for rear-facing front outboard occupants.

FMVSS No. 208, S6.4 Chest Deflection			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Compressive deflection of the sternum relative to the spine shall not exceed 76 mm (3.0 in). (b) Compressive deflection of the sternum relative to the spine shall not exceed 63 mm (2.5 in).	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S6.4.1 Forward-facing occupant (a) Compressive deflection of the sternum relative to the spine shall not exceed 76 mm (3.0 in). (b) Compressive deflection of the sternum relative to the spine shall not exceed 63 mm (2.5 in). S6.4.2 rear-facing occupant - TBD	This option assumes that different injury criteria may be required for rear-facing front outboard occupants.

FMVSS No. 208, S6.5 Chest Deflection			
Regulatory Text	**Translation Options**		**Potential Considerations**
The force transmitted axially through each upper leg shall not exceed 2250 pounds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S6.5.1 Forward-facing occupant The force transmitted axially through each upper leg shall not exceed 2250 pounds S6.5.2 rear-facing occupant - TBD	This option assumes that different injury criteria may be required for rear-facing front outboard occupants.

FMVSS No. 208, S6.6 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S6.6(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 6806 N (1530 lbf) when Fz is in tension (ii) Fzc = 6160 N (1385 lbf) when Fz is in compression (iii) Myc = 310 Nm (229 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 135 Nm (100 lbf-ft) when an extension moment	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S6.6.1 Forward-facing occupant When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S6.6(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 6806 N (1530 lbf) when Fz is in tension (ii) Fzc = 6160 N (1385 lbf) when Fz is in compression (iii) Myc = 310 Nm (229 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 135 Nm (100 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and	This option assumes that different injury criteria may be required for rear-facing front outboard occupants.

FMVSS No. 208, S6.6 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz/Fzc) + (Mocy/Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 4170 N (937 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 4000 N (899 lbf) at any time.		the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz/Fzc) + (Mocy/Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 4170 N (937 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 4000 N (899 lbf) at any time. S6.6.2 Rear-facing occupant - TBD	

FMVSS No. 208, S7.1.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
A Type 1 lap belt or the lap belt portion of any Type 2 seat belt assembly installed at any forward-facing outboard designated seating position of a vehicle with a gross vehicle weight rating of 10,000 pounds or less to comply with a requirement of this standard, except walk-in van-type vehicles and school buses, and except in rear seating positions in law enforcement vehicles, shall meet the requirements of S7.1 by means of an emergency locking retractor that conforms to Standard No. 209 (49 CFR 571.209).	**Option 1**	A Type 1 lap belt or the lap belt portion of any Type 2 seat belt assembly installed at any outboard designated seating position of a vehicle with a gross vehicle weight rating of 10,000 pounds or less to comply with a requirement of this standard, except walk-in van-type vehicles and school buses, and except in rear seating positions in law enforcement vehicles, shall meet the requirements of S7.1 by means of an emergency locking retractor that conforms to Standard No. 209 (49 CFR 571.209).	Removing "forward-facing" restriction allows application to all rows and forward- and rear-facing seating positions.
	Option 2	A Type 1 lap belt or the lap belt portion of any Type 2 seat belt assembly installed at any forward-facing or rear-facing front row outboard designated seating position of a vehicle with a gross vehicle weight rating of 10,000 pounds or less to comply with a requirement of this standard, except walk-in van-type vehicles and school buses, and except in rear seating positions in law enforcement vehicles, shall meet the requirements of S7.1 by means of an emergency locking retractor that conforms to Standard No. 209 (49 CFR 571.209).	Extends application to rear-facing seats using row definition.

FMVSS No. 208, S8.1.8.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The anthropomorphic test dummies used for evaluation of occupant protection systems manufactured pursuant to applicable portions of S4.1.2, S4.1.3, and S4.1.4 of this standard shall conform to the requirements of subpart E of part 572 of this chapter.	**Option 1**	Retain current language.	Subpart E dummy would be used in front outboard forward-facing and rear-facing frontal crash testing. May require additional research to determine if dummy is suitable for rear-facing crash testing.
	Option 2	The anthropomorphic test dummies used for evaluation of occupant protection systems manufactured pursuant to applicable portions of S4.1.2, S4.1.3, and S4.1.4 of this standard shall conform to the requirements of subpart E of part 572 of this chapter (forward-facing) or Subpart TBD of part 572 (rear-facing).	The Part 572 reference would require modification if different dummies are required for the front-facing and rear-facing seating positions.
	Option 3	The anthropomorphic test dummies used for evaluation of occupant protection systems manufactured pursuant to applicable portions of S4.1.2, S4.1.3, and S4.1.4 of this standard shall conform to the requirements of subpart E of part 572 of this chapter for forward-facing and Subpart TBD of part 572 for rear-facing.	Same consideration as option 2 except references simplified to eliminate repetition.

FMVSS No. 208, S8.2.7			
Regulatory Text	**Translation Options**		**Potential Considerations**
The barrier and the test vehicle are positioned so that at impact—(a) The vehicle is at rest in its normal attitude; (b) The barrier is traveling in a direction perpendicular to the longitudinal axis of the vehicle at 20 m.p.h.; and (c) A vertical plane through the geometric center of the barrier impact surface and perpendicular to that surface passes through the driver's seating reference point in the tested vehicle.	**NPRM**	(c) A vertical plane through the geometric center of the barrier impact surface and perpendicular to that surface passes through the driver's seating position seating reference point in the tested vehicle.	
	Option 1	(c) A vertical plane through the geometric center of the barrier impact surface and perpendicular to that surface passes through the front outboard designated seating position in the tested vehicle.	Uses NPRM defined direct translation. Would be applicable to both sides of vehicle.

FMVSS No. 208, S10.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
The palms of the passenger test dummy shall be in contact with the outside of the thigh. The little finger shall be in contact with the seat cushion.	**NPRM**	The palms of any passenger test dummy shall…	
	Option 1	Retain proposed language.	
	Option 2	The palms of any front outboard passenger test dummy shall…	Clarifies proposed NPRM wording by adding "front outboard" to better define seating position.

FMVSS No. 208, S10.6.2.1 Vehicles With a Flat Floor Pan/Toeboard			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place the right and left feet on the vehicle's toeboard with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the feet cannot be placed flat on the toeboard, set them perpendicular to the lower leg centerlines and place them as far forward as possible with the heels resting on the floor pan.	**Option 1**	Retain current language.	Toeboard and the intersection of the toeboard and floor pan may not exist in vehicles with unconventional seating. For vehicles with front row rear-facing outboard seating positions, would require foot to be set perpendicular to lower leg and moved as far forward as possible with heels resting on floor pan. Would still be subject to the upper leg positioning requirements of S10.5
	Option 2	Place the right and left feet on the vehicle's toeboard with the heels resting on the floor pan as close as possible to the intersection point with the toeboard. If the feet cannot be placed flat on the toeboard, set them perpendicular to the lower leg centerlines and place them as far from the dummy H-point as possible with the heels resting on the floor pan.	Toeboard and the intersection of the toeboard and floor pan may not exist in vehicles with unconventional seating. Would apply to forward- and rear-facing seating positions. Another potential option would be to use "from the front of the seat" in lieu of "from the dummy H-point."

FMVSS No. 208, S10.7 Test Dummy Positioning for Latchplate Access			
Regulatory Text	**Translation Options**		**Potential Considerations**
The reach envelopes specified in S7.4.4 of this standard are obtained by positioning a test dummy in the driver's or passenger's seating position and adjusting that seating position to its forwardmost adjustment position. Attach the lines for the inboard and outboard arms to the test dummy as described in Figure 3 of this standard. Extend each line backward and outboard to generate the compliance arcs of the outboard reach envelope of the test dummy's arms.	**NPRM**	The reach envelopes specified in S7.4.4 of this standard are obtained by positioning a test dummy in the driver's or front outboard passenger's seating position and adjusting that seating position to its forwardmost adjustment position. Attach the lines for the inboard and outboard arms to the test dummy as described in Figure 3 of this standard. Extend each line backward and outboard to generate the compliance arcs of the outboard reach envelope of the test dummy's arms.	
	Option 1	Retain proposed language.	Retains existing requirement for front forward-facing or rear-facing outboard seating positions. If front row rear-facing outboard seating positions are fixed, reach envelopes can be located following existing protocol. If front row rear-facing seating positions are adjustable, may not position dummy in appropriate position to determine compliance arcs.
	Option 2	The reach envelopes specified in S7.4.4 of this standard are obtained by positioning a test dummy in the driver's or front outboard passenger's seating position and adjusting that seating position to be as far away from the stowed latchplate as possible. Attach the lines for the inboard and outboard arms to the test dummy as described in Figure 3 of this standard. Extend each line backward and outboard to generate the compliance arcs of the outboard reach envelope of the test dummy's arms.	Clarifies and retains existing requirement for front forward-facing outboard seating positions. If rear-facing outboard seating position is adjustable, would position seat in appropriate position to determine reach envelopes.

FMVSS No. 208, S14.5.1 Rigid Barrier Belted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each vehicle that is certified as complying with S14.1 or S14.2 shall, at each front outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.1(b)(1). (b) Each vehicle that is certified as complying with S14.3 or S14.4 shall, at each front outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.1(b)(2).	**Option 1**	Retain current language.	Front-facing or rear-facing differentiation not identified. Existing injury criteria would apply to forward-facing and rear-facing occupants.
	Option 2	Retain current language.	Front-facing or rear-facing differentiation not identified. Would utilize in combination with S6 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing occupants.
	Option 3	(a) Each vehicle that is certified as complying with S14.1 or S14.2 shall, at each front forward-facing or rear-facing outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.1(b)(1). (b) Each vehicle that is certified as complying with S14.3 or S14.4 shall, at each front forward-facing or rear-facing outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.1(b)(2).	Provides additional clarification for forward- or rear-facing outboard seating positions. Would utilize in combination with S6 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing occupants.

FMVSS No. 208, S14.5.2 Rigid Barrier Unbelted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S14 shall, at each front outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.2(b).	**Option 1**	Retain current language.	Front-facing or rear-facing differentiation not identified. Existing injury criteria would apply to forward-facing and rear-facing occupants.
	Option 2	Retain current language.	Front-facing or rear-facing differentiation not identified. Would utilize in combination with S6 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing occupants.
	Option 3	Each vehicle that is certified as complying with S14 shall, at each front forward-facing or rear-facing outboard designated seating position, meet the injury criteria specified in S6.1, S6.2(b), S6.3, S6.4(b), S6.5, and S6.6 when tested under S5.1.2(b).	Provides additional clarification for forward- or rear-facing outboard seating positions. Would utilize in combination with S6 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing occupants.

FMVSS No. 208, S15.1 Belted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Each vehicle that is certified as complying with S14.1 or S14.2 shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 when tested under S16.1(a)(1). (b) Each vehicle that is certified as complying with S14.6 or S14.7 shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 when tested under S16.1(a)(2).	**Option 1**	Retain current language.	Front-facing or rear-facing differentiation not a factor here. Existing injury criteria would apply to forward-facing and rear-facing dummies.
	Option 2	Retain current language.	Front-facing and rear-facing seating positions not differentiated. Would utilize in combination with S15.3 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing seating positions.
	Option 3	(a) Each vehicle that is certified as complying with S14.1 or S14.2 shall, at each front forward-facing and rear-facing outboard designated seating position, meet the injury criteria specified in S15.3 when tested under S16.1(a)(1). (b) Each vehicle that is certified as complying with S14.6 or S14.7 shall, at each front forward-facing and rear-facing outboard designated seating position, meet the injury criteria specified in S15.3 when tested under S16.1(a)(2).	Provides additional clarification for forward- and rear-facing outboard seating positions. Would utilize in combination with S15.3 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing seating positions.

FMVSS No. 208, S15.2 Unbelted Test			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S14 shall, at each front outboard designated seating position, meet the injury criteria specified in S15.3 of this standard when the vehicle is crash tested in accordance with the procedures specified in S16.1(b) of this standard with the anthropomorphic test devices unbelted.	**Option 1**	Retain current language.	Front-facing or rear-facing differentiation not a factor here. Existing injury criteria would apply to forward-facing and rear-facing dummies.
	Option 2	Retain current language.	Front-facing and rear-facing seating positions not differentiated. Would utilize in combination with S15.3 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing seating positions.
	Option 3	Each vehicle that is certified as complying with S14 shall, at each front forward-facing and rear-facing outboard designated seating position, meet the injury criteria specified in S15.3 of this standard when the vehicle is crash tested in accordance with the procedures specified in S16.1(b) of this standard with the anthropomorphic test devices unbelted.	Provides additional clarification for forward- and rear-facing outboard seating positions. Would utilize in combination with S15.3 Option 2 which proposed breaking out injury criteria to forward-facing and rear-facing seating positions.

FMVSS No. 208, S15.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
S15.3 Injury criteria for the 49 CFR part 572, subpart O Hybrid III 5th percentile female test dummy	**Option 1**	Retain current language.	Existing subpart O dummy and related injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if dummy and injury criteria are appropriate for rear-facing occupants.
	Option 2	S15.3 Injury criteria for the forward-facing 49 CFR part 572, subpart E, Hybrid III test dummy when tested in forward-facing seating positions and for the part 572, subpart TBD, Hybrid III test dummy when tested in rear-facing seating positions.	Possible translation if research indicates different dummy is required.

FMVSS No. 208, S15.3.2 Head Injury Criteria			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 700.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation]. (b) The maximum calculated HIC15 value shall not exceed 700 for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions.	May require additional research to determine appropriate rear-facing HIC15 value.
	Option 3	S15.3.2 Head injury criteria S15.3.2.1 Forward-facing seating positions (a) For any two points in time, t1 and t2…(use existing standard). S15.3.2.2 Rear-facing seating positions (a) For any two points in time, t1 and t2, ... (b) The maximum calculated HIC15 value shall not exceed TBD.	Sub-sections and titles added to define forward- and rear-facing criteria. May require additional research to determine appropriate rear-facing HIC15 value.

FMVSS No. 208, S15.3.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 g's for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions, except for intervals whose cumulative duration is not more than 3 milliseconds.	May require additional research to determine appropriate rear-facing thoracic value.
	Option 3	S15.3.3.1 forward-facing seating positions The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds. S15.3.3.2 rear-facing seating positions The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed TBD g's for rear-facing occupant, except for intervals whose cumulative duration is not more than 3 milliseconds.	Sub-sections and titles added to define forward- and rear-facing criteria. May want to consider adding section title for consistency (e.g., Chest g's). May require additional research to determine appropriate rear-facing thoracic value.

FMVSS No. 208, S15.3.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Compression deflection of the sternum relative to the spine, as determined by instrumentation, shown shall not exceed 52 mm (2.0 in).	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	Compression deflection of the sternum relative to the spine, as determined by instrumentation, shown shall not exceed 52 mm (2.0 in) for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions.	May require additional research to determine appropriate rear-facing sternum compression value.
	Option 3	S15.3.4 Chest deflection S15.3.4.1 forward-facing seating positions Compression deflection of the sternum relative to the spine, as determined by instrumentation, shown shall not exceed 52 mm (2.0 in) S15.3.4.2 rear-facing seating positions Compression deflection of the sternum relative to the spine, as determined by instrumentation, shown shall not exceed TBD mm (TBD in)	Section title added for clarification (similar to S6.4). Sub-sections and titles added to define forward- and rear-facing criteria. May require additional research to determine appropriate rear-facing sternum compression value.

FMVSS No. 208, S15.3.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
The force transmitted axially through each femur shall not exceed 6805 N (1530 lb.).	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	The force transmitted axially through each femur shall not exceed 6805 N (1530 lb.) for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions.	May require additional research to determine appropriate rear-facing femur loads.
	Option 3	S15.3.5 Femur Loads S15.3.5.1 forward-facing seating positions The force transmitted axially through each femur shall not exceed 6805 N (1530 lb.) S15.3.5.2 rear-facing seating positions The force transmitted axially through each femur shall not exceed TBD N (TBD lb.)	Section title and Sub-sections with titles added. May require additional research to determine appropriate rear-facing femur loads.

FMVSS No. 208, S15.3.6 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S15.3.6(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 4287 N (964 lbf) when Fz is in tension (ii) Fzc = 3880 N (872 lbf) when Fz is in compression (iii) Myc = 155 Nm (114 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 67 Nm (49 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S15.3.6(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 4287 N (964 lbf) when Fz is in tension (ii) Fzc = 3880 N (872 lbf) when Fz is in compression (iii) Myc = 155 Nm (114 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 67 Nm (49 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed	May require additional research to determine appropriate rear-facing neck injury value.

FMVSS No. 208, S15.3.6 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz/Fzc) + (Mocy/Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 2620 N (589 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 2520 N (566 lbf) at any time.		and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz/Fzc) + (Mocy/Myc) (5) None of the four Nij values shall exceed 1.0 for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 2620 N (589 lbf) for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 2520 N (566 lbf) for a dummy in forward-facing seating positions and shall not exceed TBD for a dummy in rear-facing seating positions at any time.	
	Option 3	S15.3.6.1. Forward-facing seating positions When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion	Sub-sections and titles added to define forward- and rear-facing neck injury criteria. May require additional research to determine appropriate rear-facing neck injury value.

FMVSS No. 208, S15.3.6 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
		(Ncf). (3) When calculating Nij using equation S15.3.6(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 4287 N (964 lbf) when Fz is in tension (ii) Fzc = 3880 N (872 lbf) when Fz is in compression (iii) Myc = 155 Nm (114 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 67 Nm (49 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz/Fzc) + (Mocy/Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 2620 N (589 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 2520 N (566 lbf) at any time. S15.3.6.2. Rear-facing Occupant When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear....... (5) None of the four Nij values shall exceed TBD at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed TBD N (TBD lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed TBD N (TBD lbf) at any time.	

FMVSS No. 208, S16.1 General Provisions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Crash testing to determine compliance with the requirements of S15 of this standard is conducted as specified in the following paragraphs (a) and (b). (a) Belted test—(1) Vehicles certified to S14.1 or S14.2. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (2) Vehicles certified to S14.6 or S14.7. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 56km/h (35 mph), into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (b) Unbelted test. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard, except S16.3.5. Impact	**Option 1**	Retain current language.	Subpart O dummy would be used in front outboard forward-facing and rear-facing frontal crash testing. May require additional research to determine if dummy is suitable for rear-facing crash testing.
	Option 2	Crash testing to determine compliance with the requirements of S15 of this standard is conducted as specified in the following paragraphs (a) and (b). (a) Belted test—(1) Vehicles certified to S14.1 or S14.2. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy (forward-facing) and a 49 CFR Part 572 Subpart TBD 5th percentile adult female test dummy (rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (2) Vehicles certified to S14.6 or S14.7. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy (forward-facing) and a 49 CFR Part 572 Subpart TBD 5th percentile adult female test dummy (rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 56km/h (35 mph), into a fixed rigid	Part 572 references in S16.1(a)(2) and S16.1(b) would require modification if different dummies are required for front outboard forward- and rear-facing crash testing. S16.1(a)(1) not revised since it is not applicable to current or future vehicles.

FMVSS No. 208, S16.1 General Provisions			
Regulatory Text	**Translation Options**		**Potential Considerations**
the vehicle traveling longitudinally forward at any speed, from 32 km/h (20 mph) to 40 km/h (25 mph), inclusive, into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard.		barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (b) Unbelted test. Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy (forward-facing) and a 49 CFR Part 572 Subpart TBD 5th percentile adult female test dummy (rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard, except S16.3.5. Impact the vehicle traveling longitudinally forward at any speed, from 32 km/h (20 mph) to 40 km/h (25 mph), inclusive, into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard.	
	Option 3	Crash testing to determine compliance with the requirements of S15 of this standard is conducted as specified in the following paragraphs (a) and (b). (a) Belted test—(1) Vehicles certified to S14.1 or S14.2. Place the appropriate 49 CFR Part 572 5th percentile adult female test dummy (Subpart O for forward-facing and Subpart TBD for rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 48 km/h (30 mph), into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (2) Vehicles certified to S14.6 or S14.7. Place the appropriate 49 CFR Part 572 5th percentile adult	Same consideration as option 2 except references simplified to eliminate repetition.

FMVSS No. 208, S16.1 General Provisions			
Regulatory Text	**Translation Options**		**Potential Considerations**
		female test dummy (Subpart O for forward-facing and Subpart TBD for rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 56km/h (35 mph), into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard. (b) Unbelted test. Place the appropriate 49 CFR Part 572 5th percentile adult female test dummy (Subpart O for forward-facing and Subpart TBD for rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard, except S16.3.5. Impact the vehicle traveling longitudinally forward at any speed, from 32 km/h (20 mph) to 40 km/h (25 mph), inclusive, into a fixed rigid barrier that is perpendicular within a tolerance of ±5 degrees to the line of travel of the vehicle under the applicable conditions of S16.2 of this standard.	

FMVSS No. 208, S16.2.10.2 Other Seat Adjustments			
Regulatory Text	**Translation Options**		**Potential Considerations**
Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. Position any adjustable head restraint in the lowest and most forward position.	**Option 1**	Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. Position any adjustable head restraint in the lowest position and a in a fore-aft position closest to the dummy head.	In lieu of specifying a direction, revision specifies head restraint proximity to the front of the seat. This allows application to forward- and rear-facing occupants.

FMVSS No. 208, S16.3.3.1.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle. .	**Option 1**	Hold the dummy's thighs down and push rearward for forward-facing seating positions or forward for rear-facing seating positions on the upper torso to maximize the dummy's pelvic angle.	Clarifies direction, based on seating configuration, to push torso to maximize pelvic angle.
	Option 2	Hold the dummy's thighs down and push rearward (forward-facing seating positions) or forward (rear-facing seating positions) on the upper torso to maximize the dummy's pelvic angle.	Clarifies direction (in fewer words), based on seating configuration, to push torso to maximize pelvic angle.
	Option 3	Hold the dummy's thighs down and push the upper torso into the seat back to maximize the dummy's pelvic angle.	Simplifies requirement and is applicable to forward- and rear-facing occupants. Still references direction "into the seat back to maximize pelvic angle."

FMVSS No. 208, S16.3.3.1.6			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place the legs at 120 degrees to the thighs. Set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Push rearward on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion.	**Option 1**	Place the legs at 120 degrees to the thighs. Set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Push rearward for forward-facing seating positions or forward for rear-facing seating positions on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the seat cushion.	Clarifies direction, based on seating configuration, to push torso to minimize gap between the pelvis and the seat back. Removed the reference to "front" when describing potential contact between the back of the dummy's calves and the seat cushion to avoid confusion.
	Option 2	Place the legs at 120 degrees to the thighs. Set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Push rearward (forward-facing seating positions) or forward (rear-facing seating positions) on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the seat cushion.	Clarifies direction (in fewer words), based on seating configuration, to push torso to minimize gap between the pelvis and the seat back. Removed the reference to "front" when describing potential contact between the back of the dummy's calves and the seat cushion to avoid confusion.
	Option 3	Place the legs at 120 degrees to the thighs. Set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Push longitudinally on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion.	Reference to rearward replaced with longitudinally. Still references direction "force pelvis into the seat." Applicable to forward- and rear-facing occupants.

FMVSS No. 208, S16.3.3.1.8			
Regulatory Text	**Translation Options**		**Potential Considerations**
If needed, extend the legs slightly so that the feet are not in contact with the floor pan. Let the thighs rest on the seat cushion to the extent permitted by the foot movement. With the feet perpendicular to the legs, place the heels on the floor pan. If a heel will not contact the floor pan, place it as close to the floor pan as possible. Using only the control that primarily moves the seat fore and aft, attempt to return the seat to the full forward position. If a dummy leg contacts the vehicle interior before the full forward position is attained, position the seat at the next detent where there is no contact. If the seats are power seats, position the seat to avoid contact while assuring that there is a maximum of 5 mm (0.2 in) distance between the vehicle interior and the point on the dummy that would first contact the vehicle interior.	**Option 1**	Retain current language.	Only applicable if unconventional seating position is adjustable. If adjustable, research may be required to determine relationship between seat position (i.e., full forward, mid track, or full rearward) and occupant performance.

FMVSS No. 208, S16.3.3.1.9			
Regulatory Text	**Translation Options**		**Potential Considerations**
For vehicles without adjustable seat backs, adjust the lower neck bracket to level the head as much as possible. For vehicles with adjustable seat backs, while holding the thighs in place, rotate the seat back forward until the transverse instrumentation platform of the head is level to within ±0.5 degrees, making sure that the pelvis does not interfere with the seat bight.	**Option 1**	For vehicles without adjustable seat backs, adjust the lower neck bracket to level the head as much as possible. For vehicles with adjustable seat backs, while holding the thighs in place, rotate the seat back towards the dummy until the transverse instrumentation platform of the head is level to within ±0.5 degrees, making sure that the pelvis does not interfere with the seat bight. Inspect the abdomen to insure that it is properly installed.	Reference to forward replaced with "towards the dummy." References direction in relation to the dummy and the seat. Applicable to forward- and rear-facing occupants.

FMVSS No. 208, S16.3.3.1.9			
Regulatory Text	**Translation Options**		**Potential Considerations**
Inspect the abdomen to insure that it is properly installed.			

FMVSS No. 208, S16.3.3.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
If the feet cannot be placed flat on the toe board, set them perpendicular to the leg centerlines and place them as far forward as possible with the heels resting on the floor pan. If either foot does not contact the floor pan, place the foot parallel to the floor pan and place the lower leg as perpendicular to the thigh as possible.	**Option 1**	Retain current language.	For vehicles with front row rear-facing outboard seating positions, would require foot to be set perpendicular to lower leg and moved as far forward as possible with heels resting on floor pan.
	Option 2	If the feet cannot be placed flat on the toe board, set them perpendicular to the leg centerlines and place them as far away from the dummy H-point as possible with the heels resting on the floor pan. If either foot does not contact the floor pan, place the foot parallel to the floor pan and place the lower leg as perpendicular to the thigh as possible.	Provides direction for feet placement with respect to the seat. Consistent with option proposed for 50th. Another potential option would be to use "from the front of the seat" in lieu of "from the dummy H-point"

FMVSS No. 208, S16.3.4.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
If the head restraint has a fore and aft adjustment, place the restraint in the forwardmost position or until contact with the head is made, whichever occurs first.	**Option 1**	If the head restraint has a fore and aft adjustment, place the restraint in the position closest to or until contact with the head is made, whichever occurs first.	Simplifies wording and provides direction to move restraint. Applicable to forward- and rear-facing head restraints.

FMVSS No. 208, S18.1 General Provisions			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 40 km/h (25 mph), into a fixed offset deformable barrier under the conditions and procedures specified in S18.2 of this standard, impacting only the left side of the vehicle.	**Option 1**	Retain current language.	Subpart O dummy would be used in front outboard forward-facing and rear-facing frontal crash testing. May require additional research to determine if dummy is suitable for rear-facing crash testing.
	Option 2	Place a 49 CFR Part 572 Subpart O 5th percentile adult female test dummy (forward-facing) or a 49 CFR Part 572 Subpart TBD 5th percentile adult female test dummy (rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 40 km/h (25 mph), into a fixed offset deformable barrier under the conditions and procedures specified in S18.2 of this standard, impacting only the left side of the vehicle.	Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 3	Place the appropriate 49 CFR Part 572 Subpart O 5th percentile adult female test dummy (Subpart O for forward-facing and Subpart TBD for rear-facing) at each front outboard seating position of a vehicle, in accordance with the procedures specified in S16.3 of this standard. Impact the vehicle traveling longitudinally forward at any speed, up to and including 40 km/h (25 mph), into a fixed offset deformable barrier under the conditions and procedures specified in S18.2 of this standard, impacting only the left side of the vehicle.	Same consideration as option 2 except references simplified to eliminate repetition.

FMVSS No. 208, S19.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle certified as complying with S14 shall, at the option of the manufacturer, meet the requirements specified in S19.2 or S19.3, under the test procedures specified in S20.	**Option 1**	Retain current language.	Emerging technologies in a rear-facing front row could be included in S19.2 or S19.3.

FMVSS No. 208, S19.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag during each of the static tests specified in S20.2 (using the 49 CFR part 572 Subpart R 12-month-old CRABI child dummy in any of the child restraints identified in sections B and C of appendix A or A-1 of this standard, as appropriate and the 49 CFR part 572 subpart K Newborn Infant dummy in any of the car beds identified in section A of appendix A or A-1, as appropriate), and activation of the air bag system during each of the static tests specified in S20.3 (using the 49 CFR part 572 Subpart O 5th percentile adult female dummy).	**NPRM**	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger air bag which results in deactivation of the air bag during each of the static tests specified in S20.2 (using the 49 CFR part 572 Subpart R 12-month-old CRABI child dummy in any of the child restraints identified in sections B and C of appendix A or A-1 of this standard, as appropriate and the 49 CFR part 572 subpart K Newborn Infant dummy in any of the car beds identified in section A of appendix A or A-1, as appropriate), and activation of the air bag system during each of the static tests specified in S20.3 (using the 49 CFR part 572 Subpart O 5th percentile adult female dummy).	
	Option 1	Retain proposed language.	If the vehicle is not equipped with manually operated driving controls, the requirements for the occupant detection system passenger air bag out of position tests were translated to both left and right outboard seating positions ("any front outboard "). Would be applicable to forward- and rear-facing seating configurations. Would not apply if no air bag is present. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger air bag at a forward-facing seat which results in deactivation of the air bag during each of the static tests specified in S20.2 (using the 49 CFR part 572 Subpart R 12-month-old	The requirements for the occupant detection system passenger air bag out of position tests are maintained for forward-facing front left and right outboard seating positions only.

FMVSS No. 208, S19.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
		CRABI child dummy in any of the child restraints identified in sections B and C of appendix A or A-1 of this standard, as appropriate and the 49 CFR part 572 subpart K Newborn Infant dummy in any of the car beds identified in section A of appendix A or A-1, as appropriate), and activation of the air bag system during each of the static tests specified in S20.3 (using the 49 CFR part 572 Subpart O 5th percentile adult female dummy).	
	Option 3	The vehicle shall be equipped with an automatic suppression feature for any passenger air bag or deployable restraint system in a forward- or rear-facing front outboard seating position which results in deactivation of the air bag or deployable restraint system during each of the static tests specified in S20.2 (using the 49 CFR part 572 Subpart R 12-month-old CRABI child dummy in any of the child restraints identified in sections B and C of appendix A or A-1 of this standard, as appropriate and the 49 CFR part 572 subpart K Newborn Infant dummy in any of the car beds identified in section A of appendix A or A-1, as appropriate), and activation of the air bag system during each of the static tests specified in S20.3 (using the 49 CFR part 572 Subpart O 5th percentile adult female dummy).	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing left and right outboard seating positions. Would allow an alternative occupant protection system for rear-facing front seats that would have a similar automatic suppression feature to air bags. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with an automatic suppression feature for any outboard passenger frontal air bag which results in deactivation of the air bag during each of the static tests	This option would apply the suppression feature to any frontal air bag as these types of air bags may extend to rear seats in ADS-DVs. The

FMVSS No. 208, S19.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
		specified in S20.2 (using the 49 CFR part 572 Subpart R 12-month-old CRABI child dummy in any of the child restraints identified in sections B and C of appendix A or A-1 of this standard, as appropriate and the 49 CFR part 572 subpart K Newborn Infant dummy in any of the car beds identified in section A of appendix A or A-1, as appropriate), and activation of the air bag system during each of the static tests specified in S20.3 (using the 49 CFR part 572 Subpart O 5th percentile adult female dummy).	feature still applies to any front outboard passenger DSP in a forward- or rear-facing first row. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.

FMVSS No. 208, S19.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with at least one telltale which emits light whenever the passenger air bag system is deactivated and does not emit light whenever the passenger air bag system is activated, except that the telltale(s) need not illuminate when the passenger seat is unoccupied. Each telltale: (a) Shall emit yellow light; (b) Shall have the identifying words "PASSENGER AIR BAG OFF" or "PASS AIR BAG OFF" on the telltale or within 25 mm (1.0 in) of the telltale; and (c) Shall not be combined with the readiness indicator required by S4.5.2 of this standard. (d) Shall be located within the interior of the vehicle and forward of and above the design H-point of both the driver's and the right front passenger's seat in their forwardmost seating positions and shall not be located on or adjacent to a surface that can be used for	**NPRM**	The vehicle shall be equipped with telltales for each front outboard passenger seat which emits light whenever the associated front outboard passenger air bag system is deactivated and does not emit light whenever the associated front outboard passenger air bag system is activated, except that the telltale(s) need not illuminate when the associated front outboard passenger seat is unoccupied. Each telltale: ... ... (d) Shall be located within the interior of the vehicle and forward of and above the design H-point of both the driver's and front outboard passenger's seat in their forwardmost seating positions and shall not be located on or adjacent to a surface that can be used for temporary or permanent storage of objects that could obscure the telltale from either the driver's or any front outboard passenger's view, or located where the telltale would be obscured from the driver's view or the adjacent front outboard passenger's view if a rear-facing child restraint listed in appendix A or A-1, as appropriate, is installed in any front outboard passenger's seat. (e) Shall be visible and recognizable to all front outboard occupants during night and day when the occupants have adapted to the ambient light roadway conditions. ... ... (g) Means shall be provided for making telltales visible and recognizable to the driver and any front outboard passenger under all driving conditions. The means for providing the required visibility may be adjustable manually or automatically, except that the telltales may not be adjustable under any driving conditions to a level that they become invisible or not recognizable to the driver and any front outboard passenger. (h) The telltale must not emit light except when any passenger	

FMVSS No. 208, S19.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
temporary or permanent storage of objects that could obscure the telltale from either the driver's or right front passenger's view, or located where the telltale would be obscured from the driver's view if a rear-facing child restraint listed in appendix A or A-1, as appropriate, is installed in the right front passenger's seat. (e) Shall be visible and recognizable to a driver and right front passenger during night and day when the occupants have adapted to the ambient light roadway conditions. (f) Telltales need not be visible or recognizable when not activated. (g) Means shall be provided for making telltales visible and recognizable to the driver and right front passenger under all driving conditions. The means for providing the required visibility may be adjustable manually or automatically, except that the telltales may not be adjustable under any driving		air bag is turned off or during a bulb check upon vehicle starting.	
	Option 1	Retain proposed language.	This option applies to each front outboard seat and could apply to rear-facing front seats if a frontal air bag system is present. Option 3 adds language to allow for other deployable restraints that may be used for a rear-facing front seat in an ADS-DV.
	Option 2	The vehicle shall be equipped with telltales for each front forward-facing outboard passenger seat which emits light whenever the associated front outboard passenger air bag system is deactivated and does not emit light whenever the associated front outboard passenger air bag system is activated, except that the telltale(s) need not illuminate when the associated front outboard passenger seat is unoccupied. Each telltale: ... ... (d) Shall be located within the interior of the vehicle and forward of and above the design H-point of both the driver's and the front outboard passenger's seat in their forwardmost seating positions and shall not be located on or adjacent to a surface that can be used for temporary or permanent storage of objects that could obscure the telltale from either the driver's or any front outboard passenger's view, or located where the telltale would be obscured from the driver's view or the adjacent front outboard passenger's view if a rear-facing child restraint listed in appendix A or A-1, as appropriate, is installed in any front outboard passenger's seat.	The requirements for each telltale are maintained for forward-facing front left and right outboard seating positions only. Could pose a barrier for rear-facing front seats as a telltale is not required as stated under this option.

FMVSS No. 208, S19.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
conditions to a level that they become invisible or not recognizable to the driver and right front passenger. (h) The telltale must not emit light except when the passenger air bag is turned off or during a bulb check upon vehicle starting.		(e) Shall be visible and recognizable to all front outboard occupants during night and day when the occupants have adapted to the ambient light roadway conditions. ... ... (g) Means shall be provided for making telltales visible and recognizable to the driver and any front outboard passenger under all driving conditions. The means for providing the required visibility may be adjustable manually or automatically, except that the telltales may not be adjustable under any driving conditions to a level that they become invisible or not recognizable to the driver and any front outboard passenger. (h) The telltale must not emit light except when any passenger air bag is turned off or during a bulb check upon vehicle starting.	
	Option 3	The vehicle shall be equipped with telltales for each front outboard passenger seat which emits light whenever the associated front outboard air bag system or deployable restraint system is deactivated and does not emit light whenever the associated front outboard air bag system or deployable restraint system is activated, except that the telltale(s) need not illuminate when the associated front outboard passenger seat is unoccupied. Each telltale: ... ... (d) Shall be located within the interior of the vehicle and forward of and above the design H-point of both the driver's and the front outboard passenger's seat in their forwardmost seating positions and shall not be located on or adjacent to a surface that can be used for temporary or permanent storage of objects that could obscure the telltale from either the driver's or any front outboard passenger's view, or located where the telltale would be obscured from the driver's view or the	The requirements for each telltale are maintained for forward- and rear-facing front left and right outboard seating positions. The telltale requirements are maintained for any deployable restraint that may be present (includes air bags). Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S19.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
		adjacent front outboard passenger's view if a rear-facing child restraint listed in appendix A or A-1, as appropriate, is installed in any front outboard passenger's seat. (e) Shall be visible and recognizable to all front outboard occupants during night and day when the occupants have adapted to the ambient light roadway conditions. ... ... (g) Means shall be provided for making telltales visible and recognizable to the driver and any front outboard passenger under all driving conditions. The means for providing the required visibility may be adjustable manually or automatically, except that the telltales may not be adjustable under any driving conditions to a level that they become invisible or not recognizable to the driver and any front outboard passenger. (h) The telltale must not emit light except when any passenger air bag or any deployable restraint system is turned off or during a bulb check upon vehicle starting.	
	Option 4	The vehicle shall be equipped with telltales for each outboard passenger seat which emits light whenever the associated outboard passenger air bag system is deactivated and does not emit light whenever the associated outboard passenger air bag system is activated, except that the telltale(s) need not illuminate when the associated outboard passenger seat is unoccupied. Each telltale: ... ... (d) Shall be located within the interior of the vehicle and forward of and above the design H-point of both the driver's and any outboard passenger's seat in their forwardmost seating positions and shall not be located on or adjacent to a surface that can be used for temporary or permanent storage of objects	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position. A telltale would be required for any outboard passenger seating position with an air bag. Another option would be to state "deployable restraint system" such as in Option 3 so that the telltales would apply to any seat and not only those seats with an associated air bag.

FMVSS No. 208, S19.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
		that could obscure the telltale from either the driver's or any outboard passenger's view, or located where the telltale would be obscured from the driver's view or the adjacent outboard passenger's view if a rear-facing child restraint listed in appendix A or A-1, as appropriate, is installed in any outboard passenger's seat. (e) Shall be visible and recognizable to all outboard occupants during night and day when the occupants have adapted to the ambient light roadway conditions. ... ... (g) Means shall be provided for making telltales visible and recognizable to the driver and any outboard passenger under all driving conditions. The means for providing the required visibility may be adjustable manually or automatically, except that the telltales may not be adjustable under any driving conditions to a level that they become invisible or not recognizable to the driver and any outboard passenger. (h) The telltale must not emit light except when any passenger air bag is turned off or during a bulb check upon vehicle starting.	

FMVSS No. 208, S19.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with a mechanism that indicates whether the air bag system is suppressed, regardless of whether the passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S19.2.2.	**NPRM**	The vehicle shall be equipped with a mechanism that indicates whether the air bag system is suppressed, regardless of whether any front outboard passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S19.2.2.	
	Option 1	The vehicle shall be equipped with a mechanism that indicates whether the air bag system at any front outboard passenger seat is suppressed, regardless of whether the corresponding seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S19.2.2.	This option could assume an ADS-DV with rear-facing front seats has an air bag system for each front seating position. However, language could be added that this applies to forward- and rear-facing seats. In a scenario with multiple passenger seating positions, one should be able to tell that a specific air bag that is associated with a specific seat is suppressed if empty and the telltale is unlit.
	Option 2	The vehicle shall be equipped with a mechanism that indicates whether the air bag system at any forward-facing front outboard passenger seat is suppressed, regardless of whether any front forward-facing outboard passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S19.2.2.	Maintains the requirements for any front forward-facing seats only.
	Option 3	The vehicle shall be equipped with a mechanism that indicates whether the air bag system or deployable restraint system is suppressed, regardless of whether any front outboard passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S19.2.2.	Deployable restraint system should cover novel technologies while still applying to air bags. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with a mechanism that indicates whether the air bag system or deployable restraint system is suppressed, regardless of whether any outboard passenger seat is occupied. The mechanism need not be located in the occupant	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position. This option may be introducing new requirements for rear/second- and third-row seats.

FMVSS No. 208, S19.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
		compartment unless it is the telltale described in S19.2.2.	Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S19.3 Option 2—Low Risk Deployment			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall meet the injury criteria specified in S19.4 of this standard when the passenger air bag is deployed in accordance with the procedures specified in S20.4.	**NPRM**	Each vehicle shall meet the injury criteria specified in S19.4 of this standard when any front outboard passenger air bag is deployed in accordance with the procedures specified in S20.4.	
	Option 1	Retain proposed language.	This option would apply the injury criteria requirements in S19.4 to any front outboard passenger air bag, if installed.
	Option 2	Each vehicle shall meet the injury criteria specified in S19.4 of this standard when any front outboard passenger air bag in a forward-facing seat is deployed in accordance with the procedures specified in S20.4.	Any injury criteria that may be established for rear-facing front seats could be added as S19.6 and state "each vehicle shall meet the injury criteria specified in S19.6 of this standard when any front outboard air bag system at a rear-facing seat is deployed". Could require additional procedure similar to S20.4.
	Option 3	Each vehicle shall meet the injury criteria specified in S19.4 of this standard when any deployable restraint system corresponding to a front seating position is deployed in accordance with the procedures specified in S20.4.	Deployable restraint system should cover novel technologies while still applying to air bags. Would require a "deployable restraint" definition to be added to S571.3.

<table>
<tr><th colspan="4">FMVSS No. 208, S19.3 Option 2—Low Risk Deployment</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td></td><td>Option 4</td><td>Each vehicle shall meet the injury criteria specified in S19.4 of this standard when any outboard passenger air bag or deployable restraint system is deployed in accordance with the procedures specified in S20.4.</td><td>This would apply to any outboard seating position in a vehicle with forward- or rear-facing front seats.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

FMVSS No. 208, S19.4.2 Head Injury Criteria			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 390.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants. SME Feedback: Vehicles without manual controls need to demonstrate means to disable installation of rear-facing child seats in rear-facing seats.
	Option 2	(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 390 for forward-facing seats and shall not exceed TBD for rear-facing seats.	Research may be beneficial to determine the maximum HIC15 value for rear-facing front rows. Option 1 should apply if the current criteria is applicable to forward- and rear-facing front seats.

FMVSS No. 208, S19.4.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 50 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants. SME Feedback: Vehicles without manual controls need to demonstrate means to disable installation of rear-facing child seats in rear-facing seats.
	Option 2	The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 50 g's for forward-facing seats and TBD g's for rear-facing seats, except for intervals whose cumulative duration is not more than 3 milliseconds.	Research may be beneficial to determine the maximum HIC15 value for rear-facing front rows. Option 1 should apply if the current criteria is applicable to forward- and rear-facing front seats.

FMVSS No. 208, S19.4.4 Neck injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S19.4.4(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 1460 N (328 lbf) when Fz is in tension (ii) Fzc =	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants. SME Feedback: Vehicles without manual controls need to demonstrate means to disable installation of rear-facing child seats in rear-facing seats.
	Option 2	When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) For forward-facing seats, when calculating Nij using equation S19.4.4(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 1460 N (328 lbf) when Fz is in tension (ii) Fzc = 1460 N (328 lbf) when Fz is in compression (iii) Myc = 43 Nm (32 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 17 Nm (13 lbf-ft)	Research may be beneficial to determine the neck injury criteria for rear-facing front rows. Option 1 should apply if the current criteria is applicable to forward- and rear-facing front seats.

FMVSS No. 208, S19.4.4 Neck injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
1460 N (328 lbf) when Fz is in compression (iii) Myc = 43 Nm (32 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 17 Nm (13 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij ' (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 780 N (175 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 960 N (216 lbf) at any time.		when an extension moment exists at the occipital condyle. For rear-facing seats, when calculating Nij using equation S19.4.4(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = TBD N (TBD lbf) when Fz is in tension (ii) Fzc = TBD N (TBD lbf) when Fz is in compression (iii) Myc = TBD Nm (TBD lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = TBD Nm (13 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij ' (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 780 N (175 lbf) at any time for forward-facing seats and shall not exceed TBD N (TBD lbf) at any time for rear-facing seats. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 960 N (216 lbf) at any time for forward-facing seats and shall not exceed TBD N (TBD lbf) at any time for rear-facing seats.	

FMVSS No. 208, S20.1.2

Regulatory Text	Translation Options		Potential Considerations
Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position, if adjustable fore and aft, at full rearward, middle, and full forward positions. If the child restraint or dummy contacts the vehicle interior, move the seat rearward to the next detent that provides clearance, or if the seat is a power seat, using only the control that primarily moves the seat fore and aft, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance between the dummy or child restraint and the vehicle interior.	**NPRM**	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position, if adjustable…	
	Option 1	Retain proposed language.	Would only apply to rear-facing outboard seats only if they are adjustable.
	Option 2	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted at any forward-facing front outboard passenger seating position, if adjustable…	This option would only require the child restraint or dummy tests for vehicles with forward-facing front seats. May pose a barrier since rear-facing front seats are excluded.
	Option 3	Except as otherwise specified, if the car bed, rear-facing child restraint, or convertible child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with any outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.	This option would apply if any outboard DSP is to comply with the child restraint tests.

FMVSS No. 208, S20.1.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position, if adjustable fore and aft, at full rearward, middle, and full forward positions. If the child restraint or dummy contacts the vehicle interior, move the seat rearward to the next detent that provides clearance, or if the seat is a power seat, using only the control that primarily moves the seat fore and aft, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance between the dummy or child restraint and the vehicle interior.	**NPRM**	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position, if adjustable…	
	Option 1	Retain proposed language.	Would only apply to rear-facing outboard seats only if they are adjustable.
	Option 2	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted at any forward-facing front outboard passenger seating position, if adjustable…	This option would only require the child restraint or dummy tests for vehicles with forward-facing front seats. May pose a barrier since rear-facing front seats are excluded.
	Option 3	Except as otherwise specified, if the car bed, rear-facing child restraint, or convertible child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with any outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.	This option would apply if any outboard DSP is to comply with the child restraint tests.

<table>
<tr><th colspan="4">FMVSS No. 208, S20.1.6</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">Except as otherwise specified, if the car bed, rear-facing child restraint, or convertible child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with a front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.</td><td>Option 1</td><td>Retain proposed language.</td><td>Would maintain the current tests for forward- or rear-facing front seats. However, these test procedures for child restraints in a rear-facing front seat may require research by car seat manufacturers. FMVSS No. 213 and FMVSS No. 225 will also need to be evaluated for potential barriers for rear-facing front seats.</td></tr>
<tr><td>Option 2</td><td>Except as otherwise specified, if the car bed, rear-facing child restraint, or convertible child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with a forward-facing front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.</td><td>Would specifically apply to only forward-facing front seats.

FMVSS No. 213 and FMVSS No. 225 are referenced.</td></tr>
</table>

FMVSS No. 208, S20.1.6			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	Except as otherwise specified, if the car bed, rear-facing child restraint, or convertible child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with any outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.	This option would apply if any outboard DSP is to comply with the child restraint tests.

FMVSS No. 208, S20.1.9.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Using only the control that primarily moves the seat in the fore and aft direction, determine the full rearward, middle, and full forward positions of the SCRP. Using any part of any seat or seat cushion adjustments, other than that which primarily moves the seat or seat cushion fore-aft, determine the SCRP mid-point height for each of the three fore-aft test positions, while maintaining, as closely as possible, the seat cushion reference line middle angle determined in S16.2.10.3.1.	**Option 1**	Retain current language.	Would only apply to rear-facing front seats if the seats are adjustable in the fore and aft direction. Could also apply to a second row of forward-facing seats if included in testing.

<table>
<tr><th colspan="4">FMVSS No. 208, S20.2 Static Tests of Automatic Suppression Feature Which Shall Result in Deactivation of the Passenger Air Bag</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="4">S20.2 Static tests of automatic suppression feature which shall result in deactivation of the passenger air bag
Each vehicle that is certified as complying with S19.2 shall meet the following test requirements.</td><td>NPRM</td><td>S20.2 Static tests of automatic suppression feature which shall result in deactivation of any front outboard passenger air bag</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>Requirement remains the same for forward-facing front seats and applies to rear-facing front seats provided there is an air bag.</td></tr>
<tr><td>Option 2</td><td>S20.2 Static tests of automatic suppression feature which shall result in deactivation of any front outboard passenger air bag or front outboard deployable restraint system</td><td>Alternative occupant protection systems may require an additional test section if translation is not possible.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 3</td><td>S20.2 Static tests of automatic suppression feature which shall result in deactivation of any outboard passenger frontal air bag</td><td>This option coincides with the option in 19.2.1 that extends the automatic suppression feature to any seat with a frontal air bag.</td></tr>
</table>

FMVSS No. 208, S20.2.1.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in the front outboard passenger vehicle seat in the following orientations: (a) With the section B and section C child restraints facing rearward as appropriate; and (b) With the section C child restraints facing forward.	**NPRM**	The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in any front outboard passenger vehicle seat in the following orientations:…	
	Option 1	The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in any front outboard passenger seat in the following orientations:…	Applies to forward- and rear-facing front row seats. Research may be required to determine if current child restraints can or should be installed in rear-facing front seats. As written with the term "vehicle seat," the requirement may inadvertently not apply to light trucks and SUVs.
	Option 2	The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in any forward-facing front outboard passenger seat in the following orientations: (a) With the section B and section C child restraints facing rearward as appropriate; and (b) With the section C child restraints facing forward.	Alternative occupant protection systems may require an additional test section if translation is not possible.

FMVSS No. 208, S20.2.1.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in any front outboard passenger seat in the following orientations: (a) With the section B and section C convertible child restraints facing rearward; (b) With the section C child restraints facing forward; and (c) With the section C child restraints facing rearward for rear-facing front seats.	This option maintains the current language for conventional vehicles with forward-facing seats. Research may be beneficial to determine if current rear-facing child restraints should be tested facing forward in a rear-facing front row. There is a note included in section C that excludes convertible child restraints not intended for rear-facing use to be tested in the rear-facing configuration: "(Note: Any child restraint listed in this subpart that does not have manufacturer instructions for using it in a rear-facing position is excluded from use in testing in a belted rear-facing configuration under S20.2.1.1(a) and S20.4.2):" Under option (a), the section B child restraints (rear-facing) may not be applicable to a rear-facing seat since the manufacturer instructions may be specific to a rear-facing restraint in a forward-facing seat.
	Option 4	The vehicle shall comply in tests using any child restraint specified in section B and section C of appendix A or A-1 of this standard, as appropriate, installed in any outboard passenger seat with a frontal air bag in the following orientations: (a) With the section B and section C convertible child restraints facing rearward; (b) With the section C child restraints facing forward; and (c) With the section C child restraints facing rearward for rear-facing front seats.	This option maintains the current language for conventional vehicles with forward-facing seats. Research may be beneficial to determine if current rear-facing child restraints should be tested facing forward in a rear-facing front row. Would extend the placement of child restraints to any outboard passenger seat with a

FMVSS No. 208, S20.2.1.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
			frontal air bag. Under option (a), the section B child restraints (rear-facing) may not be applicable to a rear-facing seat since the manufacturer instructions may be specific to a rear-facing restraint in a forward-facing seat.

FMVSS No. 208, S20.2.1.5 Installation With Vehicle Safety Belts			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant. (b) Without attaching the child restraint anchorage system components specified in S5.9 of §571.213 to a vehicle child restraint anchorage system specified in §571.225, align the child restraint system facing rearward or forward, depending on the orientation being tested, such that Plane A is aligned with Plane B. (c) While maintaining the child restraint positions achieved in S20.2.1.5(b), secure the child restraint by following, to the extent possible, the child restraint manufacturer's directions regarding proper installation of the restraint for the orientation being tested. Cinch the vehicle belts to any tension from zero up to 134 N to secure the child restraint. Measure belt tension in a flat, straight section of the lap belt between the child restraint belt path and the contact point with the belt anchor or vehicle seat, on the side away from the buckle (to avoid interference from the shoulder portion of the belt). (d) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (e) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.	**Option 1**	Retain current language.	This option would only apply to rear-facing front seats if an air bag is present. The requirements are maintained for forward-facing front seats with air bags installed.
	Option 2	(a) Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant. (b) Without attaching the child restraint anchorage system components specified in S5.9 of §571.213 to a vehicle child restraint anchorage system specified in §571.225, align the child restraint system facing rearward or forward, depending on the orientation being tested, such that Plane A is aligned with Plane B. (c) While maintaining the child restraint positions achieved in S20.2.1.5(b), secure the child restraint by following, to the extent possible, the child restraint manufacturer's directions regarding proper installation of the restraint for the orientation being tested. Cinch the vehicle belts to any tension from zero up to 134 N to secure the child restraint. Measure belt tension in a flat, straight section of the lap belt between the child restraint belt path and the contact point with the belt anchor or vehicle seat, on the side away from the buckle (to avoid interference from the shoulder portion of the belt). (d) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's	An alternative system to air bags for rear-facing front seats is included in the test. ADS-DVs could require a translation for placing the ignition in the "on" position. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S20.2.1.5 Installation With Vehicle Safety Belts			
Regulatory Text	**Translation Options**		**Potential Considerations**
		instructions provided with the child restraint for seating infants. (e) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	

FMVSS No. 208, S20.2.1.6.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
If the attachment mechanism provided by the manufacturer incorporates a strap(s), use the following procedure: (a) Place the child restraint on the vehicle seat facing rearward or forward, depending on the orientation being tested, with Plane A of the child restraint aligned within ±10 mm with a longitudinal vertical plane passing through a point midway between the centers of the two lower anchor bars. (b) Position any adjustments on the child restraint, to the extent possible according to the child restraint manufacturer's instructions. (c) Connect the lower anchor straps of the restraint to the lower anchor bars of the seat and remove the slack, but do not apply any load using these straps. (d) Move the child restraint rearward until it contacts the seat back. (e) Use the loading device equipped with the loading foot shown in Figure A1 and position it as shown in Figure A2 of appendix A and appendix A-1 of this section. The 15±3 degree angle of the loading device illustrated in Figure A2 is determined with an initial preload of 75±25N. (f) Over a period of 90±30 seconds, increase the load to 875N±25 N. (g) After achieving the 875 N load in step (f) of this section, hold the bar length at present position and allow the load to settle for 60 seconds. (h) Following the one-minute settling period specified in step (g) of this section, increase the load to 875±25 N such that the 875±25 N load is achieved within 10 seconds of the settling period. (i) Hold the bar length at present position and allow the load to settle for 120 seconds after achieving the load in step (f) of this section. (j) Following the settling period specified in step (i) of this section, increase the load to 875±25 N such that the 875±25 N load is achieved within 10 seconds of the settling period. (k) Observe the settling of the load and tighten the lower anchor straps when the load is 850±5N or 180 seconds has elapsed since achieving the 875±25 N load in step (f) of this section, whichever comes first. Tighten the lower anchor straps at the same time such that the load is reduced 15±10 N and the change occurs within 2 seconds.	**Option 1**	Retain current language.	This option would only apply to rear-facing front seats if an air bag is present. The requirements are maintained for forward-facing front seats with air bags installed.
	Option 2	If the mechanism provided by the manufacturer does not incorporate a strap(s), use the following procedure: ... (j) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	An alternative system to air bags for rear-facing front seats is included in the test. ADS-DVs could require a translation for placing the ignition in the "on" position. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S20.2.1.6.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
(l) Remove the loading device and position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (m) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.			

FMVSS No. 208, S20.2.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Unbelted rear-facing and convertible child restraints	**Option 1**	Retain current language.	If ADS-DVs with rear-facing front seats are to comply with this section, any alternative system to air bags must be included in the language.

FMVSS No. 208, S20.2.2.4 Facing Rear			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Align the child restraint system facing rearward such that Plane A is aligned with Plane B and the child restraint is in contact with the seat back. (b) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (c) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.	**Option 1**	Retain current language.	This option would only apply to rear-facing front seats if an air bag is present. The requirements are maintained for forward-facing front seats with air bags installed.
	Option 2	(a) Align the child restraint system facing rearward such that Plane A is aligned with Plane B and the child restraint is in contact with the seat back. (b) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (c) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	An alternative system to air bags for rear-facing front seats is included in the test. ADS-DVs could require a translation for placing the ignition in the "on" position. Would require a "deployable restraint" definition to be added to S571.3.

<table>
<tr><th colspan="4">FMVSS No. 208, S20.2.2.5 Facing Forward</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">(a) Align the child restraint system facing forward such that Plane A is aligned with Plane B and the child restraint is in contact with the seat back. (b) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (c) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.</td><td>Option 1</td><td>Retain current language.</td><td>This option would only apply to rear-facing front seats if an air bag is present. The requirements are maintained for forward-facing front seats with air bags installed.</td></tr>
<tr><td>Option 2</td><td>(a) Align the child restraint system facing forward such that Plane A is aligned with Plane B and the child restraint is in contact with the seat back. (b) Position the 49 CFR part 572 subpart R 12-month-old CRABI dummy in the child restraint by following, to the extent possible, the manufacturer's instructions provided with the child restraint for seating infants. (c) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.</td><td>An alternative system to air bags for rear-facing front seats is included in the test. ADS-DVs could require a translation for placing the ignition in the "on" position.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

FMVSS No. 208, S20.2.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Install the car bed following, to the extent possible, the car bed manufacturer's directions regarding proper installation of the car bed. If the seat belt cannot be secured around the car bed, move the seat rearward to the next detent that allows the belt to be secured around the car bed, or if the seat is a power seat, using only the control that primarily moves the seat fore and aft, move the seat rearward the minimum distance necessary for the seat belt to be secured around the car bed. (b) Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant. Cinch the vehicle belts to secure the car bed. (c) Position the 49 CFR part 572 subpart K Newborn Infant dummy in the car bed by following, to the extent possible, the car bed manufacturer's instructions provided with the car bed for positioning infants. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.	**Option 1**	Retain current language.	This option would only apply to rear-facing front seats if an air bag is present. The requirements are maintained for forward-facing front seats with air bags installed.
	Option 2	(a) Install the car bed following, to the extent possible, the car bed manufacturer's directions regarding proper installation of the car bed. If the seat belt cannot be secured around the car bed, move the seat rearward to the next detent that allows the belt to be secured around the car bed, or if the seat is a power seat, using only the control that primarily moves the seat fore and aft, move the seat rearward the minimum distance necessary for the seat belt to be secured around the car bed. (b) Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant. Cinch the vehicle belts to secure the car bed. (c) Position the 49 CFR part 572 subpart K Newborn Infant dummy in the car bed by following, to the extent possible, the car bed manufacturer's instructions provided with the car bed for positioning infants. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	An alternative system to air bags for rear-facing front seats is included in the test. ADS-DVs could require a translation for placing the ignition in the "on" position. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S20.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Static tests of automatic suppression feature which shall result in activation of the passenger air bag system	**NPRM**	Static tests of automatic suppression feature which shall result in activation of any front outboard passenger air bag system.	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if an air bag is present.
	Option 2	Static tests of automatic suppression feature which shall result in activation of any front outboard passenger air bag system or deployable restraint system.	This option should allow for air bags as well as other novel technologies to meet the requirements. Would require a "deployable restraint" definition to be added to S571.3.
	Option 3	Static tests of automatic suppression feature which shall result in activation of any forward-facing front outboard passenger air bag system.	This would exclude ADS-DVs with rear-facing front seats.
	Option 4	Static tests of automatic suppression feature which shall result in activation of any outboard passenger frontal air bag system.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.

FMVSS No. 208, S20.3.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position, if adjustable fore and aft, at the mid-height, in the full rearward and middle positions determined in S20.1.9.4, and the forward position determined in S16.3.3.1.8.	**NPRM**	Each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position, if adjustable fore and aft, at the mid-height, in the full rearward and middle positions determined in S20.1.9.4, and the forward position determined in S16.3.3.1.8.	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if the seats are adjustable in the fore and aft directions.
	Option 2	Each vehicle certified to this option shall comply in tests conducted with any forward-facing front outboard passenger seating position, if adjustable fore and aft, at the mid-height, in the full rearward and middle positions determined in S20.1.9.4, and the forward position determined in S16.3.3.1.8.	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier in that rear-facing front seats would not have to meet the requirement.
	Option 3	Each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position, if adjustable fore and aft, at the mid-height, in the full rearward and middle positions determined in S20.1.9.4, and the forward position determined in S16.3.3.1.8.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.

FMVSS No. 208, S20.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at the front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S20.3.1, subject to the fore-aft seat positions in S20.3.1. Do not fasten the seat belt.	**NPRM**	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S20.3.1, subject to the fore-aft seat positions in S20.3.1. Do not fasten the seat belt.	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any forward-facing front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S20.3.1, subject to the fore-aft seat positions in S20.3.1. Do not fasten the seat belt.	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier in that rear-facing front seats would not have to meet the requirement.
	Option 3	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any outboard passenger seating position of the vehicle with a frontal air bag present, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S20.3.1, subject to the fore-aft seat positions in S20.3.1. Do not fasten the seat belt.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present. Would apply to rear-facing front seats provided they are adjustable. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.

FMVSS No. 208, S20.3.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Wait 10 seconds, then check whether the air bag system is activated.	**NPRM**		
	Option 1	Retain current language.	This option would not cover ADS-DVs with an alternative occupant protection system. The control methods in the ADS-DV could dictate whether 10 seconds is the appropriate amount of time.
	Option 2	Wait 10 seconds, then check whether the air bag system or deployable restraint system is activated.	Allows for an alternative system for rear-facing front seats but still would include air bags as an option for meeting the requirement. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S20.4.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Position the front outboard passenger vehicle seat at the mid-height in the full forward position determined in S20.1.9.4, and adjust the seat back (if adjustable independent of the seat) to the nominal design position for a 50th percentile adult male as specified in S8.1.3. Position adjustable lumbar supports so that the lumbar support is in its lowest, retracted or deflated adjustment position. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. If adjustable, set the head restraint at the full down and most forward position. If the child restraint or dummy contacts the vehicle interior, do the following: using only the control that primarily moves the seat in the fore and aft direction, move the seat rearward to the next detent that provides clearance; or if the seat is a power seat, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance.	**NPRM**	Position any front outboard passenger vehicle seat at the mid-height in the full forward position determined in S20.1.9.4, and adjust the seat back (if adjustable independent of the seat) to the nominal design position for a 50th percentile adult male as specified in S8.1.3...	
	Option 1	Retain proposed language.	This option would cover forward- and rear-facing front seats. The current procedure could still apply to rear-facing front seats if adjustable.
	Option 2	Position any forward-facing front outboard passenger seat at the mid-height in the full forward position determined in S20.1.9.4, and adjust the seat back (if adjustable independent of the seat) to the nominal design position for a 50th percentile adult male as specified in S8.1.3...	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier in that rear-facing front seats would not have to meet the requirement. Deleted the word "vehicle" from the regulation text.

<table>
<tr><th colspan="4">FMVSS No. 208, S20.4.9</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="4">Deploy the front outboard passenger frontal air bag system. If the air bag system contains a multistage inflator, the vehicle shall be able to comply at any stage or combination of stages or time delay between successive stages that could occur in the presence of an infant in a rear-facing child restraint and a 49 CFR part 572, subpart R 12-month-old CRABI dummy positioned according to S20.4, and also with the seat at the mid-height, in the middle and full rearward positions determined in S20.1.9.4, in a rigid barrier crash test at speeds up to 64 km/h (40 mph).</td><td>NPRM</td><td>Deploy any front outboard passenger frontal air bag system.</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>This would apply to forward- and rear-facing front seats but only if an air bag system is present.</td></tr>
<tr><td>Option 2</td><td>Deploy any front outboard passenger frontal air bag system for forward-facing front seats and any air bag or deployable restraint system for rear-facing front seats. If the air bag or deployable restraint system contains a multistage inflator, the vehicle shall be able to comply at any stage or combination of stages or time delay between successive stages that could occur in the presence of an infant in a rear-facing child restraint and a 49 CFR part 572, subpart R 12-month-old CRABI dummy positioned according to S20.4, and also with the seat at the mid-height, in the middle and full rearward positions determined in S20.1.9.4, in a rigid barrier crash test at speeds up to 64 km/h (40 mph).</td><td>Allows for alternative technology for rear-facing front seats in ADS-DVs.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 3</td><td>Deploy any outboard passenger frontal air bag system. If the air bag system contains a multistage inflator, the vehicle shall be able to comply at any stage or combination of stages or time delay between successive stages that could occur in the presence of an infant in a rear-facing child restraint and a 49 CFR part 572, subpart R 12-month-old CRABI dummy positioned according to S20.4, and also with the seat at the mid-height, in the middle and full rearward positions determined in S20.1.9.4, in a rigid barrier crash test at speeds up to 64 km/h (40 mph).</td><td>This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.</td></tr>
</table>

FMVSS No. 208, S21.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S14 shall, at the option of the manufacturer, meet the requirements specified in S21.2, S21.3, S21.4 or S21.5, under the test procedures specified in S22 or S28, as applicable.	**Option 1**	Retain current language.	If ADS-DVs with rear-facing front rows are to comply with S14, this section would apply. .

FMVSS No. 208, S21.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with an automatic suppression feature for the passenger air bag which results in deactivation of the air bag during each of the static tests specified in S22.2 (using the 49 CFR part 572 subpart P 3-year-old child dummy and, as applicable, any child restraint specified in section C and section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system during each of the static tests specified in S22.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	**NPRM**	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger air bag which results in deactivation of the air bag during each of the static tests specified in S22.2…	If ADS-DVs with rear-facing front rows are to comply with S14, this section would apply. .
	Option 1	Retain proposed language.	If the vehicle is not equipped with manually operated driving controls, the requirements for the occupant detection system passenger air bag out of position tests were translated to both left and right outboard seating positions ("any front outboard "). Would be applicable to forward- and rear-facing seating configurations. Would not apply if no air bag is present. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger air bag in a forward-facing seat which results in deactivation of the air bag during each of the static tests specified in S22.2 (using the 49 CFR part 572 subpart P 3-year-old child dummy and, as applicable, any child restraint specified in section C and section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system during each of the static tests specified in S22.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	The requirements for the occupant detection system passenger air bag out of position tests are maintained for forward-facing front left and right outboard seating positions only.

FMVSS No. 208, S21.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	The vehicle shall be equipped with an automatic suppression feature for any air bag or deployable restraint system in a forward- or rear-facing front outboard seating position which results in deactivation of the air bag or deployable restraint system during each of the static tests specified in S22.2 (using the 49 CFR part 572 subpart P 3-year-old child dummy and, as applicable, any child restraint specified in section C and section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system or deployable restraint system during each of the static tests specified in S22.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing left and right outboard seating positions. Would allow an alternative occupant protection system for rear-facing front seats that would have a similar automatic suppression feature to air bags. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with an automatic suppression feature for any outboard passenger frontal air bag which results in deactivation of the air bag during each of the static tests specified in S22.2 (using the 49 CFR part 572 subpart P 3-year-old child dummy and, as applicable, any child restraint specified in section C and section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system during each of the static tests specified in S22.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	This option would extend the automatic suppression feature to any outboard seating position provided a frontal air bag is present. This would apply to an ADS-DV that may have a type of frontal air bag installed at any outboard seat, whether the front row is forward-facing or rear-facing.

FMVSS No. 208, S21.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether the passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	**NPRM**	The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether any front outboard passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	
	Option 1	The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of if the corresponding seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	This option would assume an ADS-DV with rear-facing front seats has an air bag system for each seating position. This option associates the air bag with a seat or seats so if multiple passenger seating positions are required to have an automatic suppression feature for an air bag, the language should still apply.
	Option 2	The vehicle shall be equipped with a mechanism that indicates whether the air bag system is suppressed, regardless of whether any front forward-facing outboard passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	Maintains the requirements for any front forward-facing seats only.
	Option 3	The vehicle shall be equipped with a mechanism that indicates whether the air bag system or deployable restraint system is suppressed, regardless of whether the corresponding passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	Adds an option for rear-facing front seats to have alternative systems to air bags to meet requirements. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with a mechanism that indicates whether the air bag system is suppressed, regardless of whether any outboard passenger seat with a frontal air bag present is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S21.2.2.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.

FMVSS No. 208, S21.3 Option 2—Dynamic Automatic Suppression System That Suppresses the Air Bag When an Occupant Is Out of Position			
Regulatory Text	**Translation Options**		**Potential Considerations**
(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for the passenger air bag system which meets the requirements specified in S27.	**NPRM**	The vehicle shall be equipped with a dynamic automatic suppression system for any front outboard passenger air bag system which meets the requirements specified in S27.	
	Option 1	Retain proposed language.	This option would assume an ADS-DV with rear-facing front seats has an air bag system for each seating position.
	Option 2	(This option is available under the conditions set forth in S27.1.) In vehicles with front forward-facing seats, the vehicle shall be equipped with a dynamic automatic suppression system for the passenger air bag system which meets the requirements specified in S27.	Maintains the requirements for any front forward-facing seats only.
	Option 3	S21.3 Option 2—Dynamic automatic suppression system that suppresses the air bag or deployable restraint system when an occupant is out of position (This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for any front outboard forward-facing passenger seating position with an air bag system or deployable restraint system which meets the requirements specified in S27.	Adds an option for rear-facing front seats to have alternative systems to air bags to meet requirements. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for any outboard passenger frontal air bag system which meets the requirements specified in S27.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.

FMVSS No. 208, S21.4 Option 3—Low Risk Deployment			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall meet the injury criteria specified in S21.5 of this standard when the passenger air bag is deployed in accordance with both of the low risk deployment test procedures specified in S22.4.	**NPRM**	Each vehicle shall meet the injury criteria specified in S21.5 of this standard when any front outboard passenger air bag is deployed in accordance with both of the low risk deployment test procedures specified in S22.4.	
	Option 1	Retain proposed language.	This option would assume an ADS-DV with rear-facing front seats has an air bag system for each seating position.
	Option 2	Each vehicle shall meet the injury criteria specified in S21.5 of this standard when any front outboard passenger air bag in a forward-facing seat is deployed in accordance with the procedures specified in S22.4.	Any injury criteria that may be established for rear-facing front seats could be added as S19.6 and state 'each vehicle shall meet the injury criteria specified in S19.6 of this standard when any front row rear-facing outboard passenger system is deployed'. Could require additional procedure similar to S20.4.
	Option 3	Each vehicle shall meet the injury criteria specified in S21.5 of this standard when any front outboard passenger seating position with an air bag or deployable restraint system is deployed in accordance with the procedures specified in S22.4.	Adds an option for rear-facing front seats to have alternative systems to air bags to meet requirements. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	Each vehicle shall meet the injury criteria specified in S21.5 of this standard when any outboard passenger frontal air bag is deployed in accordance with the procedures specified in S22.4.	This option coincides with the option where the automatic suppression feature is applied to any outboard seating position provided a frontal air bag is present.

FMVSS No. 208, S21.5 Injury Criteria for the 49 CFR Part 572, Subpart P 3-Year-Old Child Test Dummy			
Regulatory Text	**Translation Options**		**Potential Considerations**
Injury criteria for the 49 CFR part 572, subpart P 3-year-old child test dummy	**Option 1**	Retain current language.	If rear-facing front seats require different injury criteria, the subsequent sections may require translations.

FMVSS No. 208, S21.5.2 Head Injury Criteria			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 570.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	S21.5.2.1 Head injury criteria - forward-facing front row (a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 570 for forward-facing front seats and shall not exceed TBD for rear-facing front seats.	This option adds language if different injury criteria is to be established for rear-facing front seats.

FMVSS No. 208, S21.5.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 55 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 55 g's for forward-facing front seats and shall not exceed TBD g's for rear-facing front seats, except for intervals whose cumulative duration is not more than 3 milliseconds.	This option adds language if different injury criteria is to be established for rear-facing front seats.

FMVSS No. 208, S21.5.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Compression deflection of the sternum relative to the spine, as determined by instrumentation, shall not exceed 34 millimeters (1.3 in).	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	Compression deflection of the sternum relative to the spine, as determined by instrumentation, shall not exceed 34 millimeters (1.3 in) for forward-facing front seats and shall not exceed TBD millimeters (TBD in) for rear-facing front seats.	This option adds language if different injury criteria is to be established for rear-facing front seats.

FMVSS No. 208, S21.5.5 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S21.5.5(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 2120 N (477 lbf) when Fz is in tension (ii) Fzc = 2120 N (477 lbf) when Fz is in compression (iii) Myc = 68 Nm (50 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 27 Nm (20 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz),	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S21.5.5(a)(4), the critical values, Fzc and Myc, for forward-facing front seats are: (i) Fzc = 2120 N (477 lbf) when Fz is in tension (ii) Fzc = 2120 N (477 lbf) when Fz is in compression (iii) Myc = 68 Nm (50 lbf-ft) when a flexion moment exists	This option adds language if different injury criteria is to be established for rear-facing front seats.

FMVSS No. 208, S21.5.5 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
measured at the upper neck load cell, shall not exceed 1130 N (254 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 1380 N (310 lbf) at any time.		at the occipital condyle (iv) Myc = 27 Nm (20 lbf-ft) when an extension moment exists at the occipital condyle. The critical values, Fzc and Myc, for rear-facing front seats are: (i) Fzc = TBD N (TBD lbf) when Fz is in tension (ii) Fzc = TBD N (TBD lbf) when Fz is in compression (iii) Myc = TBD Nm (TBD lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = TBD Nm (TBD lbf-ft) when an extension moment exists at the occipital condyle. (5) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 1130 N (254 lbf) for forward-facing front seats and shall not exceed TBD N (TBD lbf) for rear-facing front seats at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 1380 N (310 lbf) for forward-facing front seats and shall not exceed TBD N (TBD lbf) for rear-facing front seats at any time.	

FMVSS No. 208, S22.1.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position at the mid-height, in the full rearward, middle, and the full forward positions determined in S22.1.7.4. If the dummy contacts the vehicle interior, using only the control that primarily moves the seat fore and aft, move the seat rearward to the next detent that provides clearance. If the seat is a power seat, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance.	**NPRM**	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position at the mid-height, in the full rearward, middle, and the full forward positions determined in S22.1.7.4…	
	Option 1	Retain proposed language.	This option would apply to forward- or rear-facing front seats provided the front seats are adjustable.
	Option 2	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any forward-facing front outboard passenger seating position at the mid-height, in the full rearward, middle, and the full forward positions determined in S22.1.7.4. If the dummy contacts the vehicle interior, using only the control that primarily moves the seat fore and aft, move the seat rearward to the next detent that provides clearance. If the seat is a power seat, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance.	This option would require the child restraint or dummy tests for only vehicles with forward-facing front seats.
	Option 3	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position at the mid-height, in the full rearward, middle, and the full forward positions determined in S22.1.7.4. If the dummy contacts the vehicle interior, using only the control that primarily moves the seat fore and aft, move the seat rearward to the next detent that provides clearance. If the seat is a power seat, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) clearance.	This option coincides with the option in S21.2.1 that extends the automatic suppression feature to any outboard seat with a frontal air bag. Would apply to any forward- or rear-facing seat. The instructions would only apply if the seat is adjustable.

FMVSS No. 208, S22.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Except as otherwise specified, if the child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with a front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply with the belted test conditions with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached.	**NPRM**	Except as otherwise specified, if the child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with any front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached...	
	Option 1	Retain current language.	Would maintain the current tests for forward- or rear-facing front seats.
	Option 2	Except as otherwise specified, if the car bed, rear-facing child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with a forward-facing front outboard passenger seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.	Would specifically apply to only forward-facing front seats. Research may be beneficial to determine whether both tests are necessary for rear-facing front seats. FMVSS No. 213 and FMVSS No. 225 are referenced.
	Option 3	Except as otherwise specified, if the car bed, rear-facing child restraint has an anchorage system as specified in S5.9 of FMVSS No. 213 and is tested in a vehicle with any outboard passenger seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply in the belted tests with the restraint anchorage system attached to the vehicle seat anchorage system and the vehicle seat belt unattached. It	This option aligns with similar options that extend the testing to any passenger DSP with a frontal air bag.

FMVSS No. 208, S22.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
		shall also comply in the belted test requirements with the restraint anchorage system unattached to the vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply in the unbelted tests with the restraint anchorage system unattached to the vehicle seat anchorage system.	

FMVSS No. 208, S22.1.7.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Using only the control that primarily moves the seat in the fore and aft direction, determine the full rearward, middle, and full forward positions of the SCRP. Using any part of any seat or seat cushion adjustments other than that which primarily moves the seat or seat cushion fore-aft, determine the SCRP mid-point height for each of the three fore-aft test positions, while maintaining, as closely as possible, the seat cushion reference line angle determined in S16.2.10.3.1.	**Option 1**	Retain current language.	Requirement remains the same for forward-facing front seats and applies to rear-facing front seats provided the seats are adjustable.

FMVSS No. 208, S22.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Static tests of automatic suppression feature which shall result in deactivation of the passenger air bag. Each vehicle that is certified as complying with S21.2 shall meet the following test requirements:	**NPRM**	S22.2 Static tests of automatic suppression feature which shall result in deactivation of any front outboard passenger air bag…	Requirement remains the same for forward-facing front seats and applies to rear-facing front seats provided the seats are adjustable.
	Option 1	Retain proposed language.	Requirement remains the same for forward-facing front seats and applies to rear-facing front seats provided there is an air bag.
	Option 2	Static tests of automatic suppression feature which shall result in deactivation of any front outboard passenger air bag or deployable restraint system. Each vehicle that is certified as complying with S21.2 shall meet the following test requirements:	Alternative occupant protection systems may require an additional test section if translation is not possible. Would require a "deployable restraint" definition to be added to S571.3.
	Option 3	Static tests of automatic suppression feature which shall result in deactivation of any front forward-facing outboard passenger air bag. Each vehicle that is certified as complying with S21.2 shall meet the following test requirements:	Would only apply to forward-facing seating in an ADS-DV with air bags.
	Option 4	Static tests of automatic suppression feature which shall result in deactivation of any outboard passenger frontal air bag. Each vehicle that is certified as complying with S21.2 shall meet the following test requirements:	This option aligns with similar options that extend the testing to any passenger DSP with a frontal air bag.

FMVSS No. 208, S22.2.1.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Install the restraint in the front outboard passenger vehicle seat in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat for use by children with the same height and weight as the 3-year-old child dummy.	**NPRM**	Install the restraint in any front outboard passenger vehicle seat in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat for use by children with the same height and weight as the 3-year-old child dummy.	Requirement remains the same for forward-facing front seats and applies to rear-facing front seats provided the seats are adjustable.
	Option 1	Retain proposed language.	The requirements are maintained to place the restraint in any front seat for forward- or rear-facing seats.
	Option 2	Install the restraint in any front forward-facing outboard passenger vehicle seat in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat for use by children with the same height and weight as the 3-year-old child dummy.	Excludes vehicles with rear-facing front rows.
	Option 3	Install the restraint in any outboard passenger vehicle seat with a frontal air bag in accordance, to the extent possible, with the child restraint manufacturer's instructions provided with the seat for use by children with the same height and weight as the 3-year-old child dummy.	This option aligns with similar options that extend the testing to any passenger DSP with a frontal air bag.

FMVSS No. 208, S22.2.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
For bucket seats, "Plane B" refers to a vertical longitudinal plane through the longitudinal centerline of the seat cushion of the front outboard passenger vehicle seat. For bench seats, "Plane B" refers to a vertical plane through the front outboard passenger vehicle seat parallel to the vehicle longitudinal centerline the same distance from the longitudinal centerline of the vehicle as the center of the steering wheel.	**NPRM**	For bucket seats, "Plane B" refers to a vertical longitudinal plane through the longitudinal centerline of any front outboard passenger vehicle seat cushion. For bench seats in vehicles equipped with manually operated driving controls, "Plane B" refers to a vertical plane through any front outboard passenger vehicle seat parallel to the vehicle longitudinal centerline the same distance from the longitudinal centerline of the vehicle as the center of the steering control. For bench seats in vehicles not equipped with manually operated driving controls, "Plane B" refers to the vertical plane parallel to the vehicle longitudinal centerline, through any front outboard passenger seat's SgRP.	
	Option 1	Retain proposed language.	"Plane B" would remain the same in forward- or rear-facing seats.

FMVSS No. 208, S22.2.1.7.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.	**Option 1**	Retain current language.	ADS-DVs may require an alternative to the "on" position as a typical ignition may not be present.
	Option 2	Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	Allows for an alternative system for rear-facing front seats. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.1.8.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. Wait 10 seconds, then check whether the air bag is deactivated.	**Option 1**	Retain current language.	ADS-DVs may require an alternative to the "on" position as a typical ignition may not be present.
	Option 2	Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system and close all vehicle doors. Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	Allows for an alternative system for rear-facing front seats. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2 Unbelted Tests With Dummies			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place the 49 CFR part 572 subpart P 3-year-old child dummy on the front outboard passenger vehicle seat in any of the following positions (without using a child restraint or booster seat or the vehicle's seat belts):	**NPRM**	Place the 49 CFR part 572 subpart P 3-year-old child dummy on any front outboard passenger vehicle seat in any of the following positions (without using a child restraint or booster seat or the vehicle's seat belts):	
	Option 1	Retain proposed language.	This option would maintain the unbelted test for forward- and rear-facing front seats. Research to determine
	Option 2	Place the 49 CFR part 572 subpart P 3-year-old child dummy on any forward-facing front outboard passenger vehicle seat in any of the following positions (without using a child restraint or booster seat or the vehicle's seat belts):	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier.
	Option 3	Place the 49 CFR part 572 subpart P 3-year-old child dummy on any outboard passenger vehicle seat in any of the following positions (without using a child restraint or booster seat or the vehicle's seat belts):	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

<table>
<tr><th colspan="4">FMVSS No. 208, S22.2.2.1 Sitting on Seat With Back Against Seat Back</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">(a) Place the dummy on the front outboard passenger seat.

(b) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the torso of the dummy against the seat back. Position the dummy's thighs against the seat cushion.

(c) Allow the legs of the dummy to extend off the surface of the seat.

(d) Rotate the dummy's upper arms down until they contact the seat back.

(e) Rotate the dummy's lower arms until the dummy's hands contact the seat cushion.

(f) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and then close all vehicle doors.

(g) Wait 10 seconds, then check whether the air bag is deactivated.</td><td>NPRM</td><td>(a) Place the dummy on any front outboard passenger seat.

(b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle’s longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the torso of the dummy against the seat back. Position the dummy's thighs against the seat cushion...</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>This option would maintain the unbelted test for forward- and rear-facing front seats.</td></tr>
</table>

FMVSS No. 208, S22.2.2.1 Sitting on Seat With Back Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 2	(a) Place the dummy on any forward-facing front outboard passenger seat. (b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the torso of the dummy against the seat back. Position the dummy's thighs against the seat cushion...	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier.
	Option 3	(a) Place the dummy on any front outboard passenger seat. (b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and	Allows for an alternative system for rear-facing front seats. Would require a "deployable restraint"

FMVSS No. 208, S22.2.2.1 Sitting on Seat With Back Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
		the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the torso of the dummy against the seat back. Position the dummy's thighs against the seat cushion... (c) Allow the legs of the dummy to extend off the surface of the seat. (d) Rotate the dummy's upper arms down until they contact the seat back. (e) Rotate the dummy's lower arms until the dummy's hands contact the seat cushion. (f) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (g) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	definition to be added to S571.3.

FMVSS No. 208, S22.2.2.1 Sitting on Seat With Back Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 4	(a) Place the dummy on any outboard passenger seat. (b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle’s longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the torso of the dummy against the seat back. Position the dummy's thighs against the seat cushion...	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

<table>
<tr><th colspan="4">FMVSS No. 208, S22.2.2.3 Sitting on Seat With Back Not Against Seat Back</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">(a) Place the dummy on the front outboard passenger seat.

(b) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy with the spine vertical so that the horizontal distance from the dummy's back to the seat back is no less than 25 mm (1.0 in) and no more than 150 mm (6.0 in), as measured along the dummy's midsagittal plane at the mid-sternum level. To keep the dummy in position, a material with a maximum breaking strength of 311 N (70 lb.) may be used to hold the dummy.

(c) Position the dummy's thighs against the seat cushion.

(d) Allow the legs of the dummy to extend off the surface of the seat.

(e) Position the upper arms parallel to the spine and rotate the dummy's lower arms until the dummy's hands contact the seat cushion.

(f) Start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system, and then close all vehicle doors.

(g) Wait 10 seconds, then check whether the air bag is deactivated.</td><td>NPRM</td><td>(a) Place the dummy on any front outboard passenger seat…

(b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle’s longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy with the spine vertical...</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>This option would apply to forward- and rear-facing front seats.</td></tr>
<tr><td>Option 2</td><td>(a) Place the dummy on any forward-facing front outboard passenger seat.

(b) In the case of vehicles equipped with</td><td>This would exclude ADS-DVs with rear-facing front seats.</td></tr>
</table>

FMVSS No. 208, S22.2.2.3 Sitting on Seat With Back Not Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
		bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy with the spine vertical...	
	Option 3	(a) Place the dummy on any front outboard passenger seat. (b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.3 Sitting on Seat With Back Not Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
		manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any front outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy with the spine vertical... (c) Position the dummy's thighs against the seat cushion. (d) Allow the legs of the dummy to extend off the surface of the seat. (e) Position the upper arms parallel to the spine and rotate the dummy's lower arms until the dummy's hands contact the seat cushion. (f) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (g) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	

FMVSS No. 208, S22.2.2.3 Sitting on Seat With Back Not Against Seat Back			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 4	(a) Place the dummy on any outboard passenger seat. (b) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of any outboard dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy with the spine vertical...	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.2.2.4 Sitting on Seat Edge, Spine Vertical, Hands by the Dummy's Sides			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in the seated position forward in the seat such that the legs are vertical and the back of the legs rest against the front of the seat with the spine vertical. If the dummy's feet contact the floor pan, rotate the legs forward until the dummy is resting on the seat with the feet positioned flat on the floor pan and the dummy spine vertical. To keep the dummy in position, a material with a maximum breaking strength of 311 N (70 lb.) may be used to hold the dummy. (c) Place the upper arms parallel to the spine. (d) Lower the dummy's lower arms such that they contact the seat cushion. (e) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (f) Wait 10 seconds, then check whether the air bag is deactivated.	**NPRM**	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in).	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats. This positioning procedure could be applied to tests involving the instrument panel or dashboard which may not be present in an ADS-DV.

FMVSS No. 208, S22.2.2.4 Sitting on Seat Edge, Spine Vertical, Hands by the Dummy's Sides			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 2	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls and forward-facing front seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in).	This would exclude ADS-DVs with rear-facing front seats.
	Option 3	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.4 Sitting on Seat Edge, Spine Vertical, Hands by the Dummy's Sides			
Regulatory Text	**Translation Options**		**Potential Considerations**
		±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in the seated position forward in the seat such that the legs are vertical and the back of the legs rest against the front of the seat with the spine vertical. If the dummy's feet contact the floor pan, rotate the legs forward until the dummy is resting on the seat with the feet positioned flat on the floor pan and the dummy spine vertical. To keep the dummy in position, a material with a maximum breaking strength of 311 N (70 lb.) may be used to hold the dummy. (c) Place the upper arms parallel to the spine. (d) Lower the dummy's lower arms such that they contact the seat cushion. (e) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (f) Wait 10 seconds, then check whether the	

FMVSS No. 208, S22.2.2.4 Sitting on Seat Edge, Spine Vertical, Hands by the Dummy's Sides			
Regulatory Text	**Translation Options**		**Potential Considerations**
		air bag or deployable restraint system is deactivated.	
	Option 4	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in).	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.2.2.5 Standing on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel rim. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on the front outboard passenger seat cushion facing the front of the vehicle while placing the heels of the dummy's feet in contact with the seat back. (b) Rest the dummy against the seat back, with the arms parallel to the spine. (c) If the head contacts the vehicle roof, recline the seat so that the head is no longer in contact with the vehicle roof, but allow no more than 5 mm (0.2 in) distance between the head and the roof. If the seat does not sufficiently recline to allow clearance, omit the test. (d) If necessary use a material with a maximum breaking strength of 311 N (70 lb.) or spacer blocks to keep the dummy in position. (e) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (f) Wait 10 seconds, then check whether the air bag is deactivated.	**NPRM**	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control rim. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on any front outboard passenger seat cushion facing the front of the vehicle while placing the heels of the dummy's feet in contact with the seat back...	
	Option 1	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering	This option would apply to forward- and rear-facing front seats.

FMVSS No. 208, S22.2.2.5 Standing on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		control rim. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on any front outboard passenger seat cushion facing in the same direction as the seat while placing the heels of the dummy's feet in contact with the seat back...	
	Option 2	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls and forward-facing front seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control rim. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case	This would exclude ADS-DVs with rear-facing front seats.

FMVSS No. 208, S22.2.2.5 Standing on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on any front outboard passenger seat cushion facing the front of the vehicle while placing the heels of the dummy's feet in contact with the seat back...	
	Option 3	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control rim. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on any front outboard passenger seat cushion facing in the same direction as the seat	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.5 Standing on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		while placing the heels of the dummy's feet in contact with the seat back... (b) Rest the dummy against the seat back, with the arms parallel to the spine. (c) If the head contacts the vehicle roof, recline the seat so that the head is no longer in contact with the vehicle roof, but allow no more than 5 mm (0.2 in) distance between the head and the roof. If the seat does not sufficiently recline to allow clearance, omit the test. (d) If necessary use a material with a maximum breaking strength of 311 N (70 lb.) or spacer blocks to keep the dummy in position. (e) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (f) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	
	Option 4	(a) In the case of vehicles equipped with bench seats and with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply

FMVSS No. 208, S22.2.2.5 Standing on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control rim. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). Position the dummy in a standing position on any outboard passenger seat cushion facing the front of the vehicle (facing the rear of vehicle for rear-facing front seats) while placing the heels of the dummy's feet in contact with the seat back...	to any outboard passenger seat.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in the front outboard passenger vehicle seat with the dummy facing the front of the vehicle with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine. (c) If necessary use a material with a maximum breaking strength of 311 N (70 lb.) or spacer blocks to keep the dummy in position. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (e) Wait 10 seconds, then check whether the air bag is deactivated.	**NPRM**	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any front outboard passenger vehicle seat with the dummy facing the front of the vehicle with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 1	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any front outboard passenger vehicle seat with the dummy facing in the direction of the seat with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	This option would apply to forward- and rear-facing front seats.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 2	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any forward-facing front outboard passenger vehicle seat with the dummy facing the front of the vehicle with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	This would exclude ADS-DVs with rear-facing front seats.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any front outboard passenger vehicle seat with the dummy facing in the same direction as the seat with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine... (c) If necessary use a material with a maximum breaking strength of 311 N (70	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		lb.) or spacer blocks to keep the dummy in position. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (e) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	
	Option 4	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		position in any outboard passenger vehicle seat with the dummy facing the front of the vehicle (if a rear-facing seat, facing the rear of the vehicle) with its toes at the intersection of the seat back and seat cushion. Position the dummy so that the spine is vertical. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	

FMVSS No. 208, S22.2.2.7 Kneeling on Seat, Facing Rearward			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) In the case of vehicles equipped with bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering wheel. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in the front outboard passenger vehicle seat with the dummy facing the rear of the vehicle. Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine. (c) Start the vehicle engine or place the ignition in the "on"	**NPRM**	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat	

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
position, whichever will turn on the suppression system, and then close all vehicle doors. (d) Wait 10 seconds, then check whether the air bag is deactivated.		cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any front outboard passenger vehicle seat with the dummy facing the rear of the vehicle. Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	
	Option 1	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle’s longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling	This option would apply to forward- and rear-facing front seats. However, if facing rearward, the dummy's back would be contacting the back of the seat in a rear-facing front row.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		position in any front outboard passenger vehicle seat with the dummy facing the rear of the vehicle (if a rear-facing seat, facing the front of the vehicle). Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	
	Option 2	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any forward-facing front	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		outboard passenger vehicle seat with the dummy facing the rear of the vehicle. Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	
	Option 3	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any front outboard passenger vehicle seat with the dummy facing the rear of the vehicle (if a rear-facing seat,	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		facing the front of the vehicle). Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine... (c) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (d) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	
	Option 4	(a) In the case of vehicles equipped with bench seats and manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the vehicle's longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat that it occupies. In the case of vehicles equipped with bucket seats, position the midsagittal plane of the	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). (b) Position the dummy in a kneeling position in any outboard passenger vehicle seat with the dummy facing the rear of the vehicle (if a rear-facing seat, facing the front of the vehicle). Position the dummy such that the dummy's head and torso are in contact with the seat back. Push down on the legs so that they contact the seat as much as possible and then release. Place the arms parallel to the spine...	

FMVSS No. 208, S22.2.2.8 Lying on Seat			
Regulatory Text	**Translation Options**		**Potential Considerations**
This test is performed only in vehicles with 3 designated front seating positions. (a) Lay the dummy on the front outboard passenger vehicle seat such that the following criteria are met: (1) The midsagittal plane of the dummy is horizontal, (2) The dummy's spine is perpendicular to the vehicle's longitudinal axis, (3) The dummy's arms are parallel to its spine, (4) A plane passing through the two shoulder joints of the dummy is vertical, (5) The anterior of the dummy is facing the vehicle front, (6) The head of the dummy is positioned towards the passenger door, and (7) The horizontal distance from the topmost point of the dummy's head to the vehicle door is 50 to 100 mm (2-4 in). (8) The dummy is as far back in the seat as possible.	**NPRM**	(a) Lay the dummy on any front outboard passenger vehicle seat such that the following criteria are met: (1) The midsagittal plane of the dummy is horizontal, (2) The dummy's spine is perpendicular to the vehicle's longitudinal axis, (3) The dummy's arms are parallel to its spine, (4) A plane passing through the two shoulder joints of the dummy is vertical, (5) The anterior of the dummy is facing the vehicle front, (6) The head of the dummy is positioned towards the nearest passenger door, and (7) The horizontal distance from the topmost point of the dummy's head to the vehicle door is 50 to	

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
(b) Rotate the thighs as much as possible toward the chest of the dummy and rotate the legs as much as possible against the thighs. (c) Move the dummy's upper left arm parallel to the vehicle's transverse plane and the lower left arm 90 degrees to the upper arm. Rotate the lower left+C587:C589 arm about the elbow joint and toward the dummy's head until movement is obstructed. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (e) Wait 10 seconds, then check whether the air bag is deactivated.		100 mm (2-4 in). (8) The dummy is as far back in the seat as possible...	
	Option 1	(a) Lay the dummy on any front outboard passenger vehicle seat such that the following criteria are met: (1) The midsagittal plane of the dummy is horizontal, (2) The dummy's spine is perpendicular to the vehicle's longitudinal axis, (3) The dummy's arms are parallel to its spine, (4) A plane passing through the two shoulder joints of the dummy is vertical, (5) The dummy is facing in the direction of the seat, (6) The head of the dummy is positioned towards the nearest passenger door, and (7) The horizontal distance from the topmost point of the dummy's head to the vehicle door is 50 to 100 mm (2-4 in). (8) The dummy is as far back in the seat as possible...	This option would apply to forward- and rear-facing front seats. Research may be beneficial to determine whether this test may be applicable to the second row of seats in an ADS-DV with a rear-facing first row.
	Option 2	This test is performed only in vehicles with 3 designated forward-facing front seating positions. (a) Lay the dummy on any front outboard passenger vehicle seat such that the following criteria are met: (1) The midsagittal plane of the dummy is horizontal, (2) The dummy's spine is perpendicular to the vehicle's longitudinal	This would exclude ADS-DVs with rear-facing front seats which may pose a barrier.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		axis, (3) The dummy's arms are parallel to its spine, (4) A plane passing through the two shoulder joints of the dummy is vertical, (5) The anterior of the dummy is facing the vehicle front, (6) The head of the dummy is positioned towards the nearest passenger door, and (7) The horizontal distance from the topmost point of the dummy's head to the vehicle door is 50 to 100 mm (2-4 in). (8) The dummy is as far back in the seat as possible...	
	Option 3	(a) Lay the dummy on any front outboard passenger vehicle seat such that the following criteria are met: (1) The midsagittal plane of the dummy is horizontal, (2) The dummy's spine is perpendicular to the vehicle's longitudinal axis, (3) The dummy's arms are parallel to its spine, (4) A plane passing through the two shoulder joints of the dummy is vertical, (5) The dummy is facing in the same direction as the seat, (6) The head of the dummy is positioned towards the nearest passenger door, and (7) The horizontal distance from the topmost point of the dummy's head to the vehicle door is 50 to 100 mm (2-4 in). (8) The dummy is as far back in the seat as possible... (b) Rotate the thighs as much as possible toward the chest of the dummy and rotate the legs as much as possible against the thighs. (c) Move the dummy's upper left	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.2.2.6 Kneeling on Seat, Facing Forward			
Regulatory Text	**Translation Options**		**Potential Considerations**
		arm parallel to the vehicle's transverse plane and the lower left arm 90 degrees to the upper arm. Rotate the lower left arm about the elbow joint and toward the dummy's head until movement is obstructed. (d) Start the vehicle engine or place the ignition in the "on" position, whichever will turn on the suppression system, and then close all vehicle doors. (e) Wait 10 seconds, then check whether the air bag or deployable restraint system is deactivated.	

FMVSS No. 208, S22.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Static tests of automatic suppression feature which shall result in activation of the passenger air bag system	**NPRM**	Static tests of automatic suppression feature which shall result in activation of any front outboard passenger air bag system	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats assuming an air bag system is present.
	Option 2	Static tests of automatic suppression feature which shall result in activation of any front outboard passenger air bag system or deployable restraint system	This option would apply to forward- and rear-facing front seats. Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.
	Option 3	Static tests of automatic suppression feature which shall result in activation of any outboard passenger frontal air bag system	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.3.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position at the mid-height, in the full rearward, and middle positions determined in S22.1.7.4, and the forward position determined in S16.3.3.1.8.	**NPRM**	Each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position at the mid-height, in the full rearward, and middle positions determined in S22.1.7.4, and the forward position determined in S16.3.3.1.8.	
	Option 1	Retain proposed language.	Would apply to rear-facing front seats provided they are adjustable.
	Option 2	Each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position at the mid-height, in the full rearward, and middle positions determined in S22.1.7.4, and the forward position determined in S16.3.3.1.8.	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S22.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at the front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S22.3.1. Do not fasten the seat belt.	**NPRM**	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S22.3.1. Do not fasten the seat belt.	
	Option 1	Retain proposed language.	Would apply to rear-facing front seats provided they are adjustable. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any outboard passenger seating position of the vehicle in accordance with procedures specified in S16.3.3 of this standard, except as specified in S22.3.1. Do not fasten the seat belt.	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.

FMVSS No. 208, S22.3.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Wait 10 seconds, then check whether the air bag system is activated.	**Option 1**	Retain current language.	As written, this could apply to any forward- or rear-facing seat assuming an air bag system is present.
	Option 2	Wait 10 seconds, then check whether the air bag system or deployable restraint system is activated.	Allows for alternative occupant protections systems in ADS-DVs with rear-facing front rows. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.4.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S21.4 shall meet the following test requirements with the 49 CFR part 572, subpart P 3-year-old child dummy in both of the following positions: Position 1 (S22.4.2) and Position 2 (S22.4.3).	**Option 1**	Retain current language.	Rear-facing front seats may require different positions than S22.4.2 and S22.4.3 given the absence of the instrument panel. Could add "each vehicle with forward-facing front seats that is certified.…" The position described in S22.2.2.4 (Sitting on seat edge, spine vertical, hands by the dummy's sides) may be a good alternative position and research path.

FMVSS No. 208, S22.4.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Position 1 (chest on instrument panel)	**Option 1**	Retain current language.	This test S22.4.2 and the subsequent sections may not apply to rear-facing front seats given the absence of an instrument panel.

FMVSS No. 208, S22.4.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Deploy the front outboard passenger frontal air bag system. If the frontal air bag system contains a multistage inflator, the vehicle shall be able to comply with the injury criteria at any stage or combination of stages or time delay between successive stages that could occur in a rigid barrier crash test at or below 26 km/h (16 mph), under the test procedure specified in S22.5.	**NPRM**	Deploy any front outboard passenger frontal air bag system…	
	Option 1	Retain current language.	This test S22.4.3 and the subsequent sections may not apply to rear-facing front seats given the absence of an instrument panel.
	Option 2	Deploy the front outboard passenger frontal air bag system or deployable restraint system. If the frontal air bag system or deployable restraint system contains a multistage inflator, the vehicle shall be able to comply with the injury criteria at any stage or combination of stages or time delay between successive stages that could occur in a rigid barrier crash test at or below 26 km/h (16 mph), under the test procedure specified in S22.5.	Adds an option for alternative technology in rear-facing front seats. However, this test may not apply to a rear-facing first row given the absence of an instrument panel. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
Test procedure for determining stages of air bag systems subject to low risk deployment (low speed crashes) test requirement.	**Option 1**	Retain current language.	This option would apply to forward- and rear-facing front seats assuming an air bag system is present.
	Option 2	Test procedure for determining stages of air bag systems or deployable restraint system subject to low risk deployment (low speed crashes) test requirement.	Adds an option for alternative technology in rear-facing front seats. However, this test may not apply to a rear-facing first row given the absence of an instrument panel. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S22.5.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The test described in S22.5.2 shall be conducted with an unbelted 50th percentile adult male test dummy in the driver seating position according to S8 as it applies to that seating position and an unbelted 5th percentile adult female test dummy either in the front outboard passenger vehicle seating position according to S16 as it applies to that seating position or at any fore-aft seat position on the passenger side.	**NPRM**	The test described in S22.5.2 shall be conducted with an unbelted 50th percentile adult male test dummy in the driver's seating position according to S8 as it applies to that seating position and an unbelted 5th percentile adult female test dummy either in any front outboard passenger vehicle seating position according to S16 as it applies to that seating position or at any fore-aft seat position on any passenger side.	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats assuming an air bag system is present. Research may be beneficial to determine whether the current test is applicable to a rear-facing front row. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	The test described in S22.5.2 shall be conducted with an unbelted 50th percentile adult male test dummy in the driver's seating position according to S8 as it applies to that seating position and an unbelted 5th percentile adult female test dummy either in any forward-facing front outboard passenger vehicle seating position according to S16 as it applies to that seating position or at any fore-aft seat position on any passenger side.	Would exclude rear-facing front rows which may pose a barrier.

FMVSS No. 208, S22.5.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Determine which inflation stage or combination of stages are fired and determine the time delay between successive stages. That stage or combination of stages, with time delay between successive stages, shall be used in deploying the air bag when conducting the low risk deployment tests described in S22.4, S24.4, and S26.	**Option 1**	Retain current language.	This option would apply to forward- and rear-facing front seats assuming an air bag system is present. A rear-facing front seat with alternative occupant protection systems may require different language or tests.

FMVSS No. 208, S22.5.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
If the air bag does not deploy in the impact described in S22.5.2, the low risk deployment tests described in S22.4, S24.4, and S26 shall be conducted with all stages using the maximum time delay between stages.	**Option 1**	Retain current language.	This option would apply to forward- and rear-facing front seats assuming an air bag system is present.

FMVSS No. 208, S23			
Regulatory Text	**Translation Options**		**Potential Considerations**
Requirements using 6-year-old child dummies	**Option 1**	Retain current language.	The 6-year-old child dummy may require research in unconventional seating configurations.

FMVSS No. 208, S23.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S14 shall, at the option of the manufacturer, meet the requirements specified in S23.2, S23.3, or S23.4, under the test procedures specified in S24 or S28, as applicable.	**Option 1**	Retain current language.	If ADS-DVs with rear-facing front rows are to comply with S14, this section would apply.

FMVSS No. 208, S23.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with an automatic suppression feature for the passenger frontal air bag system which results in deactivation of the air bag during each of the static tests specified in S24.2 (using the 49 CFR part 572 subpart N 6-year-old child dummy in any of the child restraints specified in section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system during each of the static tests specified in S24.3 (using the 49 CFR part 572 subpart O	**NPRM**	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger frontal air bag system which results in deactivation of the air bag during each of the static tests specified in S24.2…	
	Option 1	Retain proposed language.	If the vehicle is not equipped with manually operated driving controls, the requirements for the occupant detection system passenger air bag out of position tests were translated to both left and right outboard seating positions ("any front outboard "). Would be applicable to forward- and rear-facing seating configurations. Would not apply if no air bag is present. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	The vehicle shall be equipped with an automatic suppression feature for any front outboard passenger frontal air bag system in a forward-facing seat which results in deactivation of the air bag during each of the static tests specified in S24.2…	The requirements for the occupant detection system passenger air bag out of position tests are maintained for forward-facing front left and right outboard seating positions only.

FMVSS No. 208, S23.2.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
5th percentile adult female dummy).	**Option 3**	The vehicle shall be equipped with an automatic suppression feature for any air bag or deployable restraint system in a forward- or rear-facing front outboard seating position which results in deactivation of the air bag or deployable restraint system during each of the static tests specified in S24.2 (using the 49 CFR part 572 subpart N 6-year-old child dummy in any of the child restraints specified in section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system or deployable restraint system during each of the static tests specified in S24.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing left and right outboard seating positions. Would allow an alternative occupant protection system for rear-facing front seats that would have a similar automatic suppression feature to air bags. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with an automatic suppression feature for any passenger frontal air bag system which results in deactivation of the air bag during each of the static tests specified in S24.2 (using the 49 CFR part 572 subpart N 6-year-old child dummy in any of the child restraints specified in section D of appendix A or A-1 of this standard, as appropriate), and activation of the air bag system during each of the static tests specified in S24.3 (using the 49 CFR part 572 subpart O 5th percentile adult female dummy).	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing and rear-facing front left and right outboard seating positions which use an air bag or alternative occupant protection systems. This option could be applied to a second row of seats with some type of frontal air bag system as well. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.

FMVSS No. 208, S23.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether the passenger seat is occupied. The mechanism need not be located in the occupant compartment unless it is the telltale described in S23.2.2.	**NPRM**	The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether any front outboard passenger seat is occupied…	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if an air bag is present.
	Option 2	The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether any front forward-facing outboard passenger seat is occupied…	Would only apply to forward-facing front seats. rear-facing front rows may have different requirements.
	Option 3	The vehicle shall be equipped with a mechanism that indicates whether the air bag or deployable restraint system is suppressed, regardless of whether any front outboard passenger seat is occupied…	Adds an option for alternative protection systems in rear-facing front seats. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	The vehicle shall be equipped with a mechanism that indicates whether the air bag is suppressed, regardless of whether any outboard passenger seat with a frontal air bag is occupied…	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing and rear-facing front left and right outboard seating positions which use an air bag or alternative occupant protection systems. This option could be applied to a second row of seats with some type of frontal air bag system as well.

<table>
<tr><th colspan="4">FMVSS No. 208, S23.3 Option 2—Dynamic Automatic Suppression System That Suppresses the Air Bag When an Occupant Is Out of Position</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="5">(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for the passenger frontal air bag system which meets the requirements specified in S27.</td><td>NPRM</td><td>(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for any front outboard passenger frontal air bag system which meets the requirements specified in S27.</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>This option would apply to forward- and rear-facing front seats if an air bag is present.</td></tr>
<tr><td>Option 2</td><td>(This option is available under the conditions set forth in S27.1.) In vehicles with front forward-facing seats, the vehicle shall be equipped with a dynamic automatic suppression system for the passenger air bag system which meets the requirements specified in S27.</td><td>Would only apply to forward-facing front seats. rear-facing front rows may have different requirements.</td></tr>
<tr><td>Option 3</td><td>(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for any front outboard deployable restraint system which meets the requirements specified in S27.</td><td>Adds an option for alternative protection systems in rear-facing front seats.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 4</td><td>(This option is available under the conditions set forth in S27.1.) The vehicle shall be equipped with a dynamic automatic suppression system for any outboard passenger frontal air bag system which meets the requirements specified in S27.</td><td>The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing and rear-facing front left and right outboard seating positions which use an air bag or alternative occupant protection systems. This option could be applied to a second row of seats with some type of frontal air bag system as well.</td></tr>
</table>

FMVSS No. 208, S23.4 Option 3—Low Risk Deployment			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall meet the injury criteria specified in S23.5 of this standard when the passenger air bag is statically deployed in accordance with both of the low risk deployment test procedures specified in S24.4.	**NPRM**	Each vehicle shall meet the injury criteria specified in S23.5 of this standard when any front outboard passenger air bag is statically deployed in accordance with both of the low risk deployment test procedures specified in S24.4.	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if an air bag is present.
	Option 2	Each vehicle with front forward-facing seats shall meet the injury criteria specified in S23.5 of this standard when the passenger air bag is deployed in accordance with both of the low risk deployment test procedures specified in S24.4.	Would only apply to forward-facing front seats. rear-facing front rows may have different requirements.
	Option 3	Each vehicle shall meet the injury criteria specified in S23.5 of this standard when any front outboard deployable restraint system is deployed in accordance with both of the low risk deployment test procedures specified in S24.4.	Adds an option for alternative protection systems in rear-facing front seats. Would require a "deployable restraint" definition to be added to S571.3.
	Option 4	Each vehicle shall meet the injury criteria specified in S23.5 of this standard when any outboard passenger frontal air bag is deployed in accordance with both of the low risk deployment test procedures specified in S24.4.	The requirements for the occupant detection system passenger out of position tests are maintained for forward-facing and rear-facing front left and right outboard seating positions which use an air bag or alternative occupant protection systems. This option could be applied to a second row of seats with some type of frontal air bag system as well.

FMVSS No. 208, S23.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
Injury criteria for the 49 CFR part 572 subpart N 6-year-old child dummy	**Option 1**	Retain current language.	Research may be beneficial to determine whether the injury criteria would apply to rear-facing front seats.

FMVSS No. 208, S23.5.2 Head Injury Criteria			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 700.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	(a) For any two points in time, t1 and t2, during the event which are separated by not more than a 15 millisecond time interval and where t1 is less than t2, the head injury criterion (HIC15) shall be determined using the resultant head acceleration at the center of gravity of the dummy head, ar, expressed as a multiple of g (the acceleration of gravity) and shall be calculated using the expression: [HIC equation] (b) The maximum calculated HIC15 value shall not exceed 700 for forward-facing seats and shall not exceed TBD for rear-facing seats.	Research may be conducted to determine whether rear-facing front seats require different injury criteria.

FMVSS No. 208, S23.5.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	The resultant acceleration calculated from the output of the thoracic instrumentation shall not exceed 60 g's for forward-facing seats and shall not exceed TBD g's for rear-facing seats, except for intervals whose cumulative duration is not more than 3 milliseconds.	Research may be conducted to determine whether rear-facing front seats require different injury criteria.

FMVSS No. 208, S23.5.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Compression deflection of the sternum relative to the spine, as determined by instrumentation, shall not exceed 40 mm (1.6 in).	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	Compression deflection of the sternum relative to the spine, as determined by instrumentation, shall not exceed 40 mm (1.6 in) for forward-facing seats and shall not exceed TBD mm (TBD in) for rear-facing seats.	Research may be conducted to determine whether rear-facing front seats require different injury criteria.

FMVSS No. 208, S23.5.5 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S23.5.5(a)(4), the critical values, Fzc and Myc, are: (i) Fzc = 2800 N (629 lbf) when Fz is in	**Option 1**	Retain current language.	Existing injury criteria would apply to forward- or rear-facing front outboard occupants. May require additional research to determine if injury criteria is appropriate for rear-facing occupants.
	Option 2	When measuring neck injury, each of the following injury criteria shall be met. (a) Nij. (1) The shear force (Fx), axial force (Fz), and bending moment (My) shall be measured by the dummy upper neck load cell for the duration of the crash event as specified in S4.11. Shear force, axial force, and bending moment shall be filtered for Nij purposes at SAE Recommended Practice J211/1 MAR95 (incorporated by reference, see §571.5) Channel Frequency Class 600. (2) During the event, the axial force (Fz) can be either in tension or compression while the occipital condyle bending moment (Mocy) can be in either flexion or extension. This results in four possible loading conditions for Nij: Tension-extension (Nte), tension-flexion (Ntf), compression-extension (Nce), or compression-flexion (Ncf). (3) When calculating Nij using equation S23.5.5(a)(4), the critical values, Fzc and Myc, for forward-facing front seats are: (i) Fzc = 2800 N (629 lbf) when Fz is in tension (ii) Fzc = 2800 N (629 lbf) when Fz is in compression (iii) Myc = 93 Nm (69 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 37 Nm (27 lbf-ft) when an extension moment exists at the occipital condyle. (4) When calculating Nij using equation S23.5.5(a)(4), the critical values, Fzc and Myc, for rear-facing front seats are: (i) Fzc = TBD N (TBD lbf) when Fz is in tension (ii) Fzc = TBD N (TBD lbf) when Fz is in compression (iii) Myc = TBD Nm (TBD lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = TBD Nm (TBD lbf-ft) when an	Research may be conducted to determine whether rear-facing front seats require different injury criteria.

FMVSS No. 208, S23.5.5 Neck Injury			
Regulatory Text	**Translation Options**		**Potential Considerations**
tension (ii) Fzc = 2800 N (629 lbf) when Fz is in compression (iii) Myc = 93 Nm (69 lbf-ft) when a flexion moment exists at the occipital condyle (iv) Myc = 37 Nm (27 lbf-ft) when an extension moment exists at the occipital condyle. (4) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 1490 N (335 lbf) at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 1820 N (409 lbf) at any time.		extension moment exists at the occipital condyle. (5) At each point in time, only one of the four loading conditions occurs and the Nij value corresponding to that loading condition is computed and the three remaining loading modes shall be considered a value of zero. The expression for calculating each Nij loading condition is given by: Nij = (Fz / Fzc) + (Mocy / Myc) (5) None of the four Nij values shall exceed 1.0 at any time during the event. (b) Peak tension. Tension force (Fz), measured at the upper neck load cell, shall not exceed 1490 N (335 lbf) for forward-facing front seats and shall not exceed TBD N (TBD lbf) for rear-facing front seats at any time. (c) Peak compression. Compression force (Fz), measured at the upper neck load cell, shall not exceed 1820 N (409 lbf) for forward-facing front seats and shall not exceed TBD N (TBD lbf) for rear-facing front seats at any time.	

FMVSS No. 208, S24.1.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position at the mid-height, in the full rearward seat track position, the middle seat track position, and the full forward seat track position as determined in this section. Using only the control that primarily moves the seat in the fore and aft direction, determine the full rearward, middle, and full forward positions of the SCRP. Using any seat or seat cushion adjustments other than that which primarily moves the seat fore-aft, determine the SCRP mid-point height for each of the three fore-aft test positions, while maintaining as closely as possible, the seat cushion angle determined in S16.2.10.3.1. Set the seat back angle, if adjustable independent of the seat, at the manufacturer's nominal design seat back angle for a 50th percentile adult male as specified in S8.1.3. If the dummy contacts the vehicle interior, move the seat rearward to the next detent that provides clearance. If the seat is a power seat, move the seat rearward while assuring that there is a maximum of 5 mm (0.2 in) distance between the vehicle interior and the point on the dummy that would first contact the vehicle interior.	**NPRM**	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position at the mid-height, in the full rearward seat track position, the middle seat track position, and the full forward seat track position as determined in this section...	
	Option 1	Retain proposed language.	This would apply to forward- and rear-facing front seats if they are adjustable.
	Option 2	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any forward-facing front outboard passenger seating position at the mid-height, in the full rearward seat track position, the middle seat track position, and the full forward seat track position as determined in this section...	This option would only apply to forward-facing front rows. This may pose a barrier for rear-facing front seats.
	Option 3	Unless otherwise specified, each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position at the mid-height, in the full rearward seat track position, the middle seat track position, and the full forward seat track position as determined in this section...	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S24.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Except as otherwise specified, if the booster seat has an anchorage system as specified in S5.9 of FMVSS No. 213 and is used under this standard in testing a vehicle with a front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the FMVSS No. 225 vehicle seat anchorage system and the vehicle seat belt unattached. It shall also comply with the belted test conditions with the restraint anchorage system unattached to the FMVSS No. 225 vehicle seat anchorage system and the vehicle seat belt attached. The vehicle shall comply with the unbelted test conditions with the restraint anchorage system unattached to the FMVSS No. 225 vehicle seat anchorage system.	**NPRM**	Except as otherwise specified, if the booster seat has an anchorage system as specified in S5.9 of FMVSS No. 213 and is used under this standard in testing a vehicle with any front outboard passenger vehicle seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the FMVSS No. 225 vehicle seat anchorage system and the vehicle seat belt unattached...	
	Option 1	Retain proposed language.	This would apply to forward- and rear-facing front seats if they are adjustable. Research into whether the unbelted tests still apply to rear-facing front rows could be beneficial.
	Option 2	Except as otherwise specified, if the booster seat has an anchorage system as specified in S5.9 of FMVSS No. 213 and is used under this standard in testing a vehicle with any forward-facing front outboard passenger seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the FMVSS No. 225 vehicle seat anchorage system and the vehicle seat belt unattached...	This option would only apply to forward-facing front rows. This may pose a barrier for rear-facing front seats.
	Option 3	Except as otherwise specified, if the booster seat has an anchorage system as specified in S5.9 of FMVSS No. 213 and is used under this standard in testing a vehicle with any front outboard passenger seat that has an anchorage system as specified in FMVSS No. 225, the vehicle shall comply with the belted test conditions with the restraint anchorage system attached to the FMVSS No. 225 vehicle seat anchorage system and the vehicle seat belt unattached...	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat.

FMVSS No. 208, S24.2 Static Tests of Automatic Suppression Feature Which Shall Result in Deactivation of the Passenger Air Bag			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S23.2 of FMVSS No. 208 shall meet the following test requirements with the child restraint in the front outboard passenger vehicle seat under the following conditions: (a) Using the vehicle safety belts as specified in S22.2.1.5 with section D child restraints designed to be secured to the vehicle seat even when empty; (b) If the child restraint is certified to S5.9 of §571.213, and the vehicle seat has an anchorage system as specified in §571.225, using only the mechanism provided by the child restraint manufacturer for attachment to the lower anchorage as specified in S22.2.1.6; and (c) Without securing the child restraint with either the vehicle safety belts or any mechanism provided with a child restraint certified to S5.9 of §571.213.	**NPRM**	Each vehicle that is certified as complying with S23.2 of FMVSS No. 208 shall meet the following test requirements with the child restraint in any front outboard passenger vehicle seat under the following conditions:…	
	Option 1	Retain proposed language.	This would apply to forward- and rear-facing front seats if they are adjustable. Research into whether the test is applicable to rear-facing front rows could be beneficial since the child restraint would be facing rearward in that instance.
	Option 2	Each vehicle that is certified as complying with S23.2 of FMVSS No. 208 shall meet the following test requirements with the child restraint in any forward-facing front outboard passenger seat under the following conditions:…	This option would only apply to forward-facing front rows. This may pose a barrier for rear-facing front seats.
	Option 3	Each vehicle that is certified as complying with S23.2 of FMVSS No. 208 shall meet the following test requirements with the child restraint in any outboard passenger seat with a frontal air bag present under the following conditions:…	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Research may be beneficial to determine whether the booster seat tests are applicable to any passenger seat.

FMVSS No. 208, S24.2.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
(a) Place the dummy in the seated position in the front outboard passenger vehicle seat. For bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). For bench seats, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the longitudinal centerline of the vehicle, within ±10 mm (±0.4 in), as the center of the steering wheel. (b) Place the dummy's back against the seat back and rest the dummy's thighs on the seat cushion. (c) Allow the legs and feet of the dummy to extend off the surface of the seat. If this positioning of the dummy's legs is prevented by contact with the instrument panel, using only the control that primarily moves the seat fore and aft, move the seat rearward to the next detent that provides clearance. If the	**NPRM**	(a) Place the dummy in the seated position in any front outboard passenger vehicle seat. For bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). For bench seats in vehicles with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of rotation of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat it occupies, .	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if an air bag is present.
	Option 2	(a) Place the dummy in the seated position in any forward-facing front outboard passenger seat. For bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). For bench seats in vehicles with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of rotation of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat it occupies, .	This option would only apply to forward-facing front rows. This may pose a barrier for rear-facing front seats.
	Option 3	(a) Place the dummy in the seated position in any front outboard passenger seat. For bucket seats, position the midsagittal plane of the dummy vertically such that it coincides	Adds an option for alternative protection systems in rear-facing front seats.

<table>
<tr><th colspan="4">FMVSS No. 208, S24.2.3</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">seat is a power seat, move the seat rearward, while assuring that there is a maximum of 5 mm (0.2 in) distance between the vehicle interior and the part of the dummy that was in contact with the vehicle interior.
(d) Rotate the dummy's upper arms toward the seat back until they make contact.
(e) Rotate the dummy's lower arms down until they contact the seat.
(f) Close the vehicle's passenger-side door and then start the vehicle engine or place the ignition in the “on” position, whichever will turn on the suppression system.
(g) Push against the dummy's left shoulder to lean the dummy against the door; close all remaining doors.
(h) Wait ten seconds, then check whether the air bag is deactivated.</td><td></td><td>with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). For bench seats in vehicles with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of rotation of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any front outboard dummy vertically and parallel to the longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat it occupies.
...
(h) Wait ten seconds, then check whether the air bag or deployable restraint system is deactivated.</td><td>Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 4</td><td>(a) Place the dummy in the seated position in any outboard passenger seat with a frontal air bag. For bucket seats, position the midsagittal plane of the dummy vertically such that it coincides with the longitudinal centerline of the seat cushion, within ±10 mm (±0.4 in). For bench seats in vehicles with manually operated driving controls, position the midsagittal plane of the dummy vertically and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline, within ±10 mm (±0.4 in), as the center of rotation of the steering control. For bench seats in vehicles without manually operated driving controls, position the midsagittal plane of any outboard dummy vertically and parallel to the longitudinal centerline, within ±10 mm (±0.4 in) of the seating reference point of the seat it occupies.</td><td>If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Research may be beneficial to determine whether the booster seat tests are applicable to any passenger seat.</td></tr>
</table>

FMVSS No. 208, S24.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Static tests of automatic suppression feature which shall result in activation of the passenger air bag system	**NPRM**	Static tests of automatic suppression feature which shall result in activation of any front outboard passenger air bag system	
	Option 1	Retain proposed language.	This option would apply to forward- and rear-facing front seats if an air bag is present.
	Option 2	Static tests of automatic suppression feature which shall result in activation of any front outboard air bag or deployable restraint system	Adds an option for alternative protection systems in rear-facing front seats. Would require a "deployable restraint" definition to be added to S571.3.
	Option 3	Static tests of automatic suppression feature which shall result in activation of any passenger frontal air bag system	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Research may be beneficial to determine whether the booster seat tests are applicable to any passenger seat.

FMVSS No. 208, S24.3.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.	**NPRM**	Each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.	
	Option 1	Retain proposed language.	This would apply to forward- and rear-facing front seats if they are adjustable.
	Option 2	Each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position with an air bag or deployable restraint system at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Research may be beneficial to determine whether the booster seat tests are applicable to any passenger seat. This option would only apply to seats that are adjustable in the fore and aft directions. Would require a "deployable restraint" definition to be added to S571.3.

<table>
<tr><th colspan="4">FMVSS No. 208, S24.3.1</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">Each vehicle certified to this option shall comply in tests conducted with the front outboard passenger seating position at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.</td><td>NPRM</td><td>Each vehicle certified to this option shall comply in tests conducted with any front outboard passenger seating position at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.</td><td></td></tr>
<tr><td>Option 1</td><td>Retain proposed language.</td><td>This would apply to forward- and rear-facing front seats if they are adjustable.</td></tr>
<tr><td>Option 2</td><td>Each vehicle certified to this option shall comply in tests conducted with any outboard passenger seating position with an air bag or deployable restraint system at the mid-height, in the full rearward and middle positions determined in S24.1.2, and the forward position determined in S16.3.3.1.8.</td><td>If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. Research may be beneficial to determine whether the booster seat tests are applicable to any passenger seat. This option would only apply to seats that are adjustable in the fore and aft directions.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

FMVSS No. 208, S24.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at the front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S24.3.1. Do not fasten the seat belt.	**NPRM**	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any front outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S24.3.1. Do not fasten the seat belt.	
	Option 1	Retain proposed language.	This would apply to forward- and rear-facing front seats if they are adjustable. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.
	Option 2	Place a 49 CFR part 572 subpart O 5th percentile adult female test dummy at any outboard passenger seating position of the vehicle, in accordance with procedures specified in S16.3.3 of this standard, except as specified in S24.3.1. Do not fasten the seat belt.	If the automatic suppression feature was added for any seat with a frontal air bag, the unbelted test could apply to any outboard passenger seat. This would apply to forward- and rear-facing front seats if they are adjustable. Part 572 reference would require modification if different dummies are required for front outboard forward- and rear-facing crash testing.

FMVSS No. 208, S24.3.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Wait 10 seconds, then check whether the air bag system is activated.	**Option 1**	Retain current language.	As written, this option could apply to any forward- or rear-facing seat with an air bag system.

FMVSS No. 208, S24.4.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle that is certified as complying with S23.4 shall meet the following test requirements with the 49 CFR part 572, subpart N 6-year-old child dummy in both of the following positions: Position 1 (S24.4.2) or Position 2 (S24.4.3).	**Option 1**	Retain current language.	Position 1 (24.4.2) and Position 2 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test(s) for rear-facing seats may be beneficial. For vehicles without manually operated driving controls, LRD for all seating positions could be based on deployable restraint deployment trajectory relative to occupant in the absence of an instrument panel/dash. The position described in S22.2.2.4 (Sitting on seat edge, spine vertical, hands by the dummy's sides) may be a good alternative and research path.

FMVSS No. 208, S24.4.1.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Mark a point on the instrument panel that is longitudinally and transversely, as measured along the surface of the instrument panel, within ±6 mm (±0.2 in) of the point that is defined by the intersection of the instrument panel and a line between the volumetric center of the smallest volume that can encompass the folded undeployed air bag and the volumetric center of the static fully inflated air bag.	**Option 1**	Retain current language.	Position 1 (24.4.2) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.1.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Locate the vertical plane parallel to the vehicle longitudinal centerline through the point located in S24.4.1.2. This is referred to as "Plane D."	**Option 1**	Retain current language.	Position 1 (24.4.2) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.1.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Locate the horizontal plane through the point located in S24.4.1.2. This is referred to as "Plane C."	**Option 1**	Retain current language.	Position 1 (24.4.2) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial. For vehicles without manually operated driving controls, LRD for all seating positions could be based on deployable restraint deployment trajectory relative to occupant in the absence of an instrument panel/dash.

FMVSS No. 208, S24.4.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Position 1 (chest on instrument panel)	**Option 1**	Retain current language.	Position 1 (24.4.2) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial. For vehicles without manually operated driving controls, LRD for all seating positions could be based on deployable restraint deployment trajectory relative to occupant in the absence of an instrument panel/dash.

FMVSS No. 208, S24.4.2.3

Regulatory Text	Translation Options		Potential Considerations
Place the dummy in the front outboard passenger seat such that: (a) The midsagittal plane is coincident with Plane D within ±10 mm (±0.4 in). (b) The upper arms are parallel to the torso and the hands are next to where the thighs would be. (c) Without changing the seat position and with the dummy's thorax instrument cavity rear face 6 degrees forward of the vertical, move the dummy forward until the dummy head/torso contacts the instrument panel. If the dummy loses contact with the seat cushion because of the forward movement, maintain the height of the dummy while moving the dummy forward. If the head contacts the windshield before head/torso contact with the instrument panel, maintain the thorax instrument cavity angle and move the dummy forward such that the head is following the angle of the windshield until there is head/torso contact with the instrument panel. Once contact is made, raise or lower the dummy vertically until Point 1 lies in Plane C within ±10 mm (±0.4 in). If the dummy's head contacts the windshield and keeps Point 1 from reaching Plane C, lower the dummy until there is no more than 5 mm (0.2 in) clearance between the head and the windshield. (The dummy shall remain in contact with the instrument panel while being raised or lowered which may change the dummy's fore-aft position.)	**NPRM**	Place the dummy in any front outboard passenger seat such that:…	
	Option 1	Retain current language.	Position 1 (24.4.2) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial. For vehicles without manually operated driving controls, LRD for all seating positions could be based on deployable restraint deployment trajectory relative to occupant in the absence of an instrument panel/dash.
	Option 2	Place the dummy in any forward-facing front outboard passenger seat such that:…	This test position (chest on instrument panel) may only apply to forward-facing seats so rear-facing seats are not included in the regulation language. This option may exclude rear-facing front seats which could pose a barrier moving forward.

FMVSS No. 208, S24.4.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Position 2 (head on instrument panel)	**Option 1**	Retain current language.	For vehicles without manually operated driving controls, LRD for all seating positions could be based on deployable restraint deployment trajectory relative to occupant in the absence of an instrument panel/dash.

FMVSS No. 208, S24.4.3.1			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place the front outboard passenger seat at the mid-height full rearward seating position determined in S24.1.2. Place the seat back, if adjustable independent of the seat, at the manufacturer's nominal design seat back angle for a 50th percentile adult male as specified in S8.1.3. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. Position an adjustable head restraint in the lowest and most forward position.	**NPRM**	Place any front outboard passenger seat at the mid-height full rearward seating position determined in S24.1.2…	
	Option 1	Retain proposed language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.
	Option 2	Place any forward-facing front outboard passenger seat at the mid-height full rearward seating position determined in S24.1.2…	This test position (chest on instrument panel) may only apply to forward-facing seats so rear-facing seats are not included in the regulation language. This option may exclude rear-facing front seats which could pose a barrier moving forward.

FMVSS No. 208, S24.4.3.2			
Regulatory Text	**Translation Options**		**Potential Considerations**
Place the dummy in the front outboard passenger seat such that: (a) The midsagittal plane is coincident with Plane D within ±10 mm (±0.4 in). (b) The legs are perpendicular to the floor pan, the back of the legs are in contact with the seat cushion, and the dummy's thorax instrument cavity rear face is 6 degrees forward of vertical. If it is not possible to position the dummy with the legs in the prescribed position, rotate the legs forward until the dummy is resting on the seat with the feet positioned flat on the floor pan and the back of the legs are in contact with the front of the seat cushion. Set the transverse distance between the longitudinal centerlines at the front of the dummy's knees at 112 to 117 mm (4.4 to 4.6 in), with the thighs and the legs of the dummy in vertical planes. (c) The upper arms are parallel to the torso and the hands are in contact with the thighs.	**NPRM**	Place the dummy in any front outboard passenger seat such that:…	
	Option 1	Retain proposed language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.
	Option 2	Place the dummy in any forward-facing front outboard passenger seat such that:…	This test position (chest on instrument panel) may only apply to forward-facing seats so rear-facing seats are not included in the regulation text. This option may exclude rear-facing front seats which could pose a barrier moving forward.

FMVSS No. 208, S24.4.3.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
Using only the control that primarily moves the seat in the fore and aft direction, move the seat forward, while maintaining the thorax instrument cavity rear face orientation until any part of the dummy contacts the vehicle's instrument panel.	**Option 1**	Retain current language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.3.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
If dummy contact has not been made with the vehicle's instrument panel at the full forward seating position of the seat, slide the dummy forward on the seat until contact is made. Maintain the thorax instrument cavity rear face orientation. If the dummy loses contact with the seat, from that point forward maintain the height of the dummy. Except as provided in S24.4.3.5, maintain the angle of the thigh with respect to the horizontal.	**Option 1**	Retain current language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.3.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
If head/torso contact with the instrument panel has not been made, maintain the angle of the thighs with respect to the horizontal while applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints, perpendicular to the thorax instrument cavity rear face, until the head or torso comes into contact with the vehicle's instrument panel or until a maximum force of 222 N (50 lb.) is achieved. If the head/torso is still not in contact with the instrument panel, hold the femurs and release the 222 N (50 lb.) force. While maintaining the relative angle between the torso and the femurs, roll the dummy forward on the seat cushion, without sliding, until head/torso contact with the instrument panel is achieved. If seat contact is lost prior to or during femur rotation out of the horizontal plane, constrain the dummy to rotate about the dummy H-point. If the dummy cannot be rolled forward on the seat due to contact of the dummy feet with the floor pan, extend the lower legs forward, at the knees, until floor pan contact is avoided.	**Option 1**	Retain current language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.3.5			
Regulatory Text	**Translation Options**		**Potential Considerations**
If head/torso contact with the instrument panel has not been made, maintain the angle of the thighs with respect to the horizontal while applying a force towards the front of the vehicle on the spine of the dummy between the shoulder joints, perpendicular to the thorax instrument cavity rear face, until the head or torso comes into contact with the vehicle's instrument panel or until a maximum force of 222 N (50 lb.) is achieved. If the head/torso is still not in contact with the instrument panel, hold the femurs and release the 222 N (50 lb.) force. While maintaining the relative angle between the torso and the femurs, roll the dummy forward on the seat cushion, without sliding, until head/torso contact with the instrument panel is achieved. If seat contact is lost prior to or during femur rotation out of the horizontal plane, constrain the dummy to rotate about the dummy H-point. If the dummy cannot be rolled forward on the seat due to contact of the dummy feet with the floor pan, extend the lower legs forward, at the knees, until floor pan contact is avoided.	**Option 1**	Retain current language.	Position 1 (24.4.3) may not apply to rear-facing front rows since there is not an instrument panel. Research into a possible additional test for rear-facing seats may be beneficial.

FMVSS No. 208, S24.4.4			
Regulatory Text	**Translation Options**		**Potential Considerations**
Deploy the front outboard passenger frontal air bag system. If the frontal air bag system contains a multistage inflator, the vehicle shall be able to comply with the injury criteria at any stage or combination of stages or time delay between successive stages that could occur in a rigid barrier crash test at or below 26 km/h (16 mph), under the test procedure specified in S22.5.	**NPRM**	Deploy any front outboard passenger frontal air bag system…	
	Option 1	Retain proposed language.	Any language related to emerging technology is not included in this option, however, the test may not apply to rear-facing seating given the absence of the instrument panel for testing.
	Option 2	Deploy any front outboard passenger frontal air bag system in a forward-facing designated seating position…	This test position (head on instrument panel) may only apply to forward-facing seats so rear-facing seats are not included in the regulation text.

<table>
<tr><th colspan="4">FMVSS No. 208, S27</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="2">Option for dynamic automatic suppression system that suppresses the air bag when an occupant is out-of-position</td><td>Option 1</td><td>Retain current language.</td><td>This option could apply to any forward- or rear-facing seat with an air bag that is subject to testing. An "out-of-position occupant" may require research to determine if the concept should apply to rear-facing seats. An occupant could be out of position in a rear-racing front seat such that they could be adversely affected by the deployment of an air bag (if one were present). However, the specific seating position(s) that could be problematic may be different for front-facing and rear-facing seats.</td></tr>
<tr><td>Option 2</td><td>Option for dynamic automatic suppression system that suppresses the air bag or deployable restraint system when an occupant is out-of-position</td><td>This option would allow rear-facing front seats to have an alternative system to air bags that could meet the requirements.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
</table>

<table>
<tr><th colspan="4">FMVSS No. 208, S27. 1 Availability of Option</th></tr>
<tr><th>Regulatory Text</th><th colspan="2">Translation Options</th><th>Potential Considerations</th></tr>
<tr><td rowspan="3">This option is available for either air bag, singly or in conjunction, subject to the requirements of S27, if: (a) A petition for rulemaking to establish dynamic automatic suppression system test procedures is submitted pursuant to subpart B of part 552 and a test procedure applicable to the vehicle is added to S28 pursuant to the procedures specified by that subpart, or (b) A test procedure applicable to the vehicle is otherwise added to S28.</td><td>Option 1</td><td>Retain current language.</td><td>This option could apply to any forward- or rear-facing seat with an air bag that is subject to testing.</td></tr>
<tr><td>Option 2</td><td>This option is available for either air bag or deployable restraint system, singly or in conjunction, subject to the requirements of S27, if: (a) A petition for rulemaking to establish dynamic automatic suppression system test procedures is submitted pursuant to subpart B of part 552 and a test procedure applicable to the vehicle is added to S28 pursuant to the procedures specified by that subpart, or (b) A test procedure applicable to the vehicle is otherwise added to S28.</td><td>This option would allow rear-facing front seats to have an alternative system to air bags that could meet the requirements.

Would require a "deployable restraint" definition to be added to S571.3.</td></tr>
<tr><td>Option 3</td><td>This option is available for any frontal air bag, singly or in conjunction, subject to the requirements of S27, if: (a) A petition for rulemaking to establish dynamic automatic suppression system test procedures is submitted pursuant to subpart B of part 552 and a test procedure applicable to the vehicle is added to S28 pursuant to the procedures specified by that subpart, or (b) A test procedure applicable to the vehicle is otherwise added to S28.</td><td>This would extend the option to any seat with a frontal air bag, which may include a forward-facing second row in an ADS-DV.</td></tr>
</table>

FMVSS No. 208, S27. 2 Definitions			
Regulatory Text	**Translation Options**		**Potential Considerations**
For purposes of S27 and S28, the following definitions apply:	**Option 1**	Retain current language.	An alternative occupant protection system that may be installed for rear-facing front seats could require a similar set of definitions or translation of the current definitions for testing purposes.

FMVSS No. 208, S27. 3 Requirements			
Regulatory Text	**Translation Options**		**Potential Considerations**
Each vehicle shall, at each applicable front outboard designated seating position, when tested under the conditions of S28 of this standard, comply with the requirements specified in S27.4 through S27.6.	**Option 1**	Retain current language.	This option could apply to either forward- or rear-facing front seats as currently stated.
	Option 2	Each vehicle shall, at each applicable outboard designated seating position with a passenger frontal air bag system, when tested under the conditions of S28 of this standard, comply with the requirements specified in S27.4 through S27.6.	This option could apply to any passenger seat that has a frontal air bag system installed, including a rear-facing front row.

FMVSS No. 208, S27.5.2 Passenger (49 CFR Part 572 Subpart P 3-Year-Old Child Dummy and 49 CFR Part 572 Subpart N 6-Year-Old Child Dummy)			
Regulatory Text	**Translation Options**		**Potential Considerations**
S27.5.2 Passenger (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummy) Each vehicle shall meet the injury criteria specified in S21.5 and S23.5, as appropriate, when the passenger air bag is deployed in accordance with the procedures specified in S28.2.	**NPRM**	S27.5.2: Front outboard passenger (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummy) Each vehicle shall meet the injury criteria specified in S21.5 and S23.5, as appropriate, when any front outboard passenger air bag is deployed in accordance with the procedures specified in S28.2.	
	Option 1	Retain proposed language.	This option would apply to rear-facing seats provided an air bag is present. rear-facing front seats could require different injury criteria from those that are specified in S21.5 and S23.5.
	Option 2	S27.5.2: Front outboard passenger (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummy) Each vehicle shall meet the injury criteria specified in S21.5 and S23.5, as appropriate, when any passenger air bag in a forward-facing front outboard seat is deployed in accordance with the procedures specified in S28.2.	This option excludes rear-facing front seats.
	Option 3	S27.5.2: Front outboard passenger (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummy) Each vehicle shall meet the injury criteria specified in S21.5 and S23.5, as appropriate, when any front outboard deployable restraint system is deployed in accordance with the procedures specified in S28.2.	This option allows for an alternative to air bags for rear-facing front seats. Any additional or different injury criteria could be listed under S21.5 and S23.5. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S27.5.2 Passenger (49 CFR Part 572 Subpart P 3-Year-Old Child Dummy and 49 CFR Part 572 Subpart N 6-Year-Old Child Dummy)			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 4	S27.5.2: Outboard passenger (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummy) Each vehicle shall meet the injury criteria specified in S21.5 and S23.5, as appropriate, when any outboard passenger air bag is deployed in accordance with the procedures specified in S28.2.	This would extend the option to any seat with a frontal air bag, which may include a forward-facing second row in an ADS-DV.

FMVSS No. 208, S27.6.2 Passenger			
Regulatory Text	**Translation Options**		**Potential Considerations**
S27.6.2 Passenger The DASS shall suppress the passenger air bag before head, neck, or torso of the specified test device enters the ASZ when the vehicle is tested under the procedures specified in S28.4.	**NPRM**	S27.6.2: Front outboard Passenger The DASS shall suppress any front outboard passenger air bag before head, neck, or torso of the specified test device enters the ASZ when the vehicle is tested under the procedures specified in S28.4.	
	Option 1	Retain proposed language.	This option would apply to rear-facing seats provided an air bag is present. rear-facing front seats could require different injury criteria that can be listed in S21.5 and S23.5. The ASZ described in S27.2 may have to be redefined for a rear-facing front seat.
	Option 2	S27.6.2: Front outboard Passenger The DASS shall suppress any passenger air bag in a forward-facing front outboard seat before head, neck, or torso of the specified test device enters the ASZ when the vehicle is tested under the procedures specified in S28.4.	This option excludes rear-facing front seats.
	Option 3	S27.6.2: Front outboard Passenger The DASS shall suppress any front outboard deployable restraint system before head, neck, or torso of the specified test device enters the ASZ when the vehicle is tested under the procedures specified in S28.4.	This option allows for an alternative to air bags for rear-facing front seats. Rear-facing front seats could require different injury criteria that can be listed in S21.5 and S23.5. The ASZ described in S27.2 may have to be redefined for a rear-facing front seat. Would require a "deployable restraint" definition to be added to S571.3.

FMVSS No. 208, S27.6.2 Passenger			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 4	S27.6.2: Outboard Passenger The DASS shall suppress any outboard passenger air bag before head, neck, or torso of the specified test device enters the ASZ when the vehicle is tested under the procedures specified in S28.4.	This would extend the option to any seat with a frontal air bag, which may include a forward-facing second row in an ADS-DV.

FMVSS No. 208, S28.2 Passenger Suppression Zone Verification Test (49 CFR Part 572 Subpart P 3-Year-Old Child Dummy and 49 CFR Part 572 Subpart N 6-Year-Old Child Dummies)			
Regulatory Text	**Translation Options**		**Potential Considerations**
S28.2 Passenger suppression zone verification test (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummies) [Reserved]	**NPRM**	S28.2: Front outboard passenger suppression zone verification test (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummies)	
	Option 1	Retain proposed language.	This option would apply to rear-facing seats provided an air bag is present. rear-facing front seats could require different injury criteria that can be listed in S21.5 and S23.5.
	Option 2	S28.2: Front forward-facing outboard passenger suppression zone verification test (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummies)	This option excludes rear-facing front seats so that may present a barrier.

FMVSS No. 208, S28.2 Passenger Suppression Zone Verification Test (49 CFR Part 572 Subpart P 3-Year-Old Child Dummy and 49 CFR Part 572 Subpart N 6-Year-Old Child Dummies)			
Regulatory Text	**Translation Options**		**Potential Considerations**
	Option 3	S28.2: Outboard passenger suppression zone verification test (49 CFR part 572 subpart P 3-year-old child dummy and 49 CFR part 572 subpart N 6-year-old child dummies)	This would extend the option to any seat with a frontal air bag, which may include a forward-facing second row in an ADS-DV.

FMVSS No. 208, S29.3			
Regulatory Text	**Translation Options**		**Potential Considerations**
A manufacturer exercising this option shall upon request: (a) Provide NHTSA with a method to deactivate the air bag during compliance testing under S20.2, S20.3, S22.2, S22.3, S24.2, and S24.3, and identify any parts or equipment necessary for deactivation; such assurance may be made by removing the air bag; and (b) Provide NHTSA with a method to assure that the same test results would be obtained if the air bag were not deactivated.	**Option 1**	Retain current language.	A similar request could be added for any type of alternative occupant protection system to air bags that may be present in a rear-facing front row.

Appendix C: Analysis of Information Communicated in an ADS-DV

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
105	Brake System Indicator Lamp	Status/ Warning				X	X		X	Stop vehicle operation and seek brake system maintenance	X	S5.3	"This warning indicator shall, instead of meeting the requirements of S5.3.2 through S5.3.5, activate (while the vehicle remains capable of meeting the requirements of S5.1.2.2 and the ignition switch is in the "on" position) a continuous or intermittent audible signal and a flashing warning light, displaying the words "STOP-BRAKE FAILURE" in block capital letters not less than one-quarter of an inch in height."	X	?	X	The indicator is currently only required to be visible at the driver's DSP. However, occupants may require an indicator that communicates the underlying condition to the ADS. If there is a brake failure, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness.	<u>Ford, 2018: pg. 92;</u> Driving your vehicle with the warning lamp on is dangerous. A significant decrease in braking performance may occur. It may take you longer to stop your vehicle. Have your vehicle checked as soon as possible. If it illuminates when you are driving, check that the parking brake is not engaged. If the parking brake is not engaged, this indicates low brake fluid level or a brake system malfunction. Have the system checked immediately by your authorized dealer. ----- <u>Honda, 2018: pg. 24;</u> The brake system has a problem. Press the brake pedal lightly to check pedal pressure. If normal, check the brake fluid level when you stop. If abnormal, take immediate action. If necessary, downshift the transmission to slow the vehicle using engine braking. Have your vehicle repaired immediately. ----- <u>Toyota, 2018: pg. 497;</u> Brake system warning light indicates that the brake fluid level is low or the brake system is malfunctioning. Immediately stop the vehicle in a safe place and contact your Toyota dealer. Continuing to drive the vehicle may be dangerous.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
121	Air Brake System Low Pressure	Warning			X		X		X	Stop vehicle operation and seek brake system maintenance due to low brake system pressure	if equipped	S5.1.5	"A signal, other than a pressure gauge, that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" ("run") position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view, or both audible and visible."	X	?	X	The warning is currently only required to be visible at the driver's DSP. However, occupants may require a warning that communicates the underlying condition to the ADS. If there is low air pressure, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness.	**PACCAR, 2018: pg. 212;** Use these steps if the air gauges in the dash or any warning lights turn on that indicate that an air leak exists in the system. Checking for air leaks should also be done after any service or repair has been done to the air system. Do not operate the vehicle if leakage in the air system is detected. Failure to check the brakes or follow these procedures could cause a system failure, increasing the risk of an accident and may result in death, personal injury, equipment, or property damage. ----- **Daimler, 2018: pg. 90;** The warning light and audible alert activate if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the air pressure gauges to determine which system has low air pressure. Although the vehicle's speed can be reduced using the foot brake control pedal, either the front or rear service brakes will not be operating at full capacity, causing a longer stopping distance. Bring the vehicle to a safe stop and have the air system repaired before continuing.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
121	Air Brake Antilock Malfunction Signal and Circuit	Malfunction				X	X		X	Check the air brake system	if equipped	S5.1.6.2	"A signal, other than a pressure gauge, that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" ("run") position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view, or both audible and visible."	X	?	X	The indicator is currently only required to be visible at the driver's DSP. However, occupants may require an indicator that communicates the underlying condition to the ADS. If there is low air pressure, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness.	**PACCAR, 2018: pg. 212;** Use these steps if the air gauges in the dash or any warning lights turn on that indicate that an air leak exists in the system. Checking for air leaks should also be done after any service or repair has been done to the air system. Do not operate the vehicle if leakage in the air system is detected. Failure to check the brakes or follow these procedures could cause a system failure, increasing the risk of an accident and may result in death, personal injury, equipment, or property damage. ----- **Daimler, 2018: pg. 90;** The warning light and audible alert activate if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the air pressure gauges to determine which system has low air pressure. Although the vehicle's speed can be reduced using the foot brake control pedal, either the front or rear service brakes will not be operating at full capacity, causing a longer stopping distance. Bring the vehicle to a safe stop and have the air system repaired before continuing.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
121	Air Brake Antilock Trailer Malfunction	Malfunction			X		X		X			S5.2.3.3	"... shall be present whenever there is a malfunction that affects the generation or transmission of response or control signals in the trailer's antilock brake system"	?		X	Although this section includes communicated information, this was not translated as there is no mention of the driver and the required location is outside of the truck tractor cabin.	<u>PACCAR, 2018: pg. 79;</u> Illuminates during the Instrumentation System Self-Test and the tractor/truck is connected with an ABS equipped trailer. Illuminates during normal operating conditions to indicate a problem with the Trailer ABS System. This should be checked by an authorized dealer as soon as possible. ----- <u>Daimler, 2018: pg. 4;</u> Momentary illumination indicates the trailer ABS is engaged. Solid illumination indicates a problem with the trailer ABS. Repair the ABS immediately to ensure full braking capability.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method: Telltale	Delivery Method: Auditory Alert	Delivery Method: Warning	Delivery Method: Indicator	Intended For: Human Driver	Intended For: Passengers	Intended For: Maintenance Entity	Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations: ADS	Relevance Considerations: Occupant(s)	Relevance Considerations: Maintenance	Relevance Considerations: Observations	Expected Response Owner Manual References
135	Brake Liner Replacement	Warning		X	X		X		X	Check the brake liner condition	X	S5.1.2(a)	"A means of visually checking the degree of brake lining wear, from the outside or underside of the vehicle, utilizing only the tools or equipment normally supplied with the vehicle."	X	X	X	The warning is currently only required to be visible at the driver's DSP. However, occupants may require a warning that communicates the underlying condition to the ADS. If their brake liner condition is poor, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness. If an acoustic method of communication is provided, the ADS may need a means to detect.	

Notation	Meaning
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?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
135	Light Vehicle Brake System	Status/ Warning		X	X	X	X			Stop vehicle operation and check owner manual for steps to take to address this warning	X			X	?	X	The warning is currently only required to be visible at the driver's DSP. However, occupants may require a warning that communicates the underlying condition to the ADS. If there is a problem with the brake system, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness.	Ford, 2018: pg. 92; Driving your vehicle with the warning lamp on is dangerous. A significant decrease in braking performance may occur. It may take you longer to stop your vehicle. Have your vehicle checked as soon as possible. If it illuminates when you are driving, check that the parking brake is not engaged. If the parking brake is not engaged, this indicates low brake fluid level or a brake system malfunction. Have the system checked immediately by your authorized dealer. ----- Honda, 2018: pg. 24; The brake system has a problem. Press the brake pedal lightly to check pedal pressure. If normal, check the brake fluid level when you stop. If abnormal, take immediate action. If necessary, downshift the transmission to slow the vehicle using engine braking. Have your vehicle repaired immediately. ----- Toyota, 2018: pg. 497; Brake system warning light indicates that the brake fluid level is low or the brake system is malfunctioning. Immediately stop the vehicle in a safe place and contact your Toyota dealer. Continuing to drive the vehicle may be dangerous.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

FMVSS	Component	Information Communicated	Delivery Method				Intended For			Expected Response (after receiving the information)	Required	Expected Response Regulatory Citation	Citation Example	Relevance Considerations				Expected Response Owner's Manual References
			Telltale	Auditory Alert	Warning	Indicator	Human Driver	Passengers	Maintenance Entity					ADS	Occupant(s)	Maintenance	Observations	
136	ESC Malfunction Detection	Malfunction	X				X			Check owner manual for steps to take to address this telltale malfunction	X	S5.4	Each vehicle must be equipped with an indicator lamp, mounted in front of and in clear view of the driver, which is activated whenever there is a malfunction that affects the generation or transmission of control or response signals in the vehicle's electronic stability control system.	X	?	X	The telltale is currently only required to be visible at the driver's DSP. However, occupants may require a telltale that communicates the underlying condition to the ADS. If there is an ESC malfunction, that information could be communicated to the ADS, a maintenance entity, or both. May be important for operational readiness.	<u>**PACCAR, 2018: pg. 78;**</u> The Stability Control Icon (ESC or Electronic Stability Control) illuminates during the power-on self-test when the ignition is turned ON. It turns off after a few seconds if no system problems are detected. If a problem is detected, the ESC Warning lamp will turn on and stay on.

Notation	Meaning
X	Denotes category applicable to regulatory information being communicated in an ADS-DV
?	Technical translation includes options with and without a noted entity or system

Appendix D: Lists of Standards Incorporated by Reference for the Volume 3 FMVSS

Table 9. FMVSS Reference Summary

FMVSS No.	Number of Incorporated References	No Regulatory Barrier	Potential Research Needed
105	6	6	0
121	6	6	0
135	5	5	0
136	2	2	0
305	3	3	0
500	4	4	0
Total	**26**	**26**	**0**

Table 10. FMVSS No. 105 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
Paragraphs 7.1 and 7.2 of ASTM E274-70 (revised July, 1974) *Standard Test Method for Skid Resistance Of Paved Surfaces Using A Full-Scale Tire*	RT, LTP	S4; Definitions- Skid Number	2	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E274 / E274M - 15(2020)	None
ASTM E1136-93 (Reapproved 2003) *Standard Specification for P195/75R14 Radial Standard Reference Test Tire*	RT, LTP	S6.9.2(a), S6.9.2(b); G. Road Surface	3	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1136-19	None
ASTM E1337-90 (Reapproved 2008) *Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire*	RT, LTP	S6.9.2(a), S6.9.2(b); G. Road Surface	3	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1337-19	None
Sections 3.2.1 through 3.2.4, 3.3.1 through 3.3.2.2, 3.4.1 and 3.4.2, 4.2.1, 5.2, 5.2.1, and 5.3 of SAE Recommended Practice J227a_1976 *Electric Vehicle Test Procedure*	RT, LTP	S6.2.1, O. Electric Vehicles and Electric Bakes	2	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE J227A_199305 (canceled)	None

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
SAE J299_200901 *Stopping Distance Test Procedure*	LTP	15. INSTRUCTIONS FOR COMPLETING DATA SHEETS	1	0 – No Barrier	Current	None
Paragraph 3.3 of SAE Recommended Practice J972_2000 *Moving Rigid Barrier Collision Tests*	LTP	G. General Parking Brake Procedure:14.7.2; 11. Test Equipment and References O.	2	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE Recommended Practice J972_201503	None
Paragraph 4.3 of SAE Recommended Practice J972_2000 *Moving Rigid Barrier Collision Tests*	RT	S7.19	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE Recommended Practice J972_201503	None

Table 11. FMVSS No. 121 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
SAE Recommended Practice J592_199206 *Sidemarker Lamps for Use on Road Vehicles Less than 2032 mm in Overall Width*	RT	S5.2.3.3	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE Recommended Practice J592_201609	None
SAE Recommended Practice J592e_197207 *Sidemarker Lamps for Use on Road Vehicles Less than 2032 mm in Overall Width*	RT	S5.2.3.3	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE Recommended Practice J592_201609	None
SAE Recommended Practice J759_199501 *Lighting Identification Code*	RT	S5.2.3.3	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE Recommended Practice J759_201712	None
ASTM E1136-93 (Reapproved 2003)	RT; LTP (V)	S5.3.6.1, S6.1.7; A. Service and Emergency	4	0 – No Barrier	Newer standard issued, but not incorporated by	None

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
Standard Specification for P195/75R14 Radial Standard Reference Test Tire		Stopping Distance Tests; B. Stability and Control Tests			reference in FMVSS: ASTM E1136-19	
ASTM E1337-90 (Reapproved 2008) *Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire*	RT; LTP (V)	S5.3.6.1, S6.1.7; A. Service and Emergency Stopping Distance Tests. PEAK FRICTION COEFFICIENT (PFC); B. Stability and Control Tests	5	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1337-19	None
MIL-C-45662A *Calibration System Requirements*	LTP (D)	8. CALIBRATION OF TEST INSTRUMENTS	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ANS/ISO/IEC 17025:2005 for part 1 and ANSI/NCSL Z540.3-2006 for part 2	None

Table 12. FMVSS No. 135 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
Sections 3.2.1 through 3.2.4, 3.3.1 through 3.3.2.2, 3.4.1 and 3.4.2, 4.2.1, 5.2, 5.2.1, and 5.3 of SAE Recommended Practice J227a_1976 *Electric Vehicle Test Procedure*	RT	S6.3.11.1	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: SAE J227A_199305 (canceled)	None
ASTM E1136-93 (Reapproved 2003) *Standard Specification for P195/75R14 Radial Standard Reference Test Tire*	RT	S6.2.1	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1136-19	None
ASTM E1337-90 (Reapproved 2008) *Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire*	RT	S6.2.1	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1337-19	None
ISO 10012-1:1992 *Quality Assurance Requirements for Measuring Equipment*	LTP	8. CALIBRATION OF TEST INSTRUMENTS E.	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ISO 10012:2003	None

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
ANSI/NCSL Z540.1-1994 (R2002), *Calibration Laboratories and Measuring and Test Equipment - General Requirements*	LTP	8. CALIBRATION OF TEST INSTRUMENTS E.	1	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ANS/ISO/IEC 17025:2005 for part 1 and ANSI/NCSL Z540.3-2006 for part 2	None

Table 13. FMVSS No. 136 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
ASTM E1136-93 (Reapproved 2003) *Standard Specification for P195/75R14 Radial Standard Reference Test Tire*	RT; LTP	S6.2.2; J. Test Track and Surface (S6.2)	2	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1136-19	None
ASTM E1337-90 (Reapproved 2008) *Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire*	RT; LTP	S6.2.2; J. Test Track and Surface (S6.2)	2	0 – No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1337-19	None

Table 14. FMVSS No. 305 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
ASTM E29-06b *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*	LTP	2. General Requirements	1	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E29-13(2019)	None
ISO 10012-1: 1992 *Quality Assurance Requirements for Measuring Equipment*	LTP	8. Calibration of Test Instruments (H)	1	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ISO 10012:2003	None
ANSI/NCSL Z540- 1 *Calibration Laboratories and Measuring and Test Equipment General Requirements*	LTP	8. Calibration of Test Instruments (H)	1	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ANS/ISO/IEC 17025:2005 for part 1 and ANSI/NCSL Z540.3-2006 for part 2	None

Table 15. FMVSS No. 500 Reference List

Referenced Document	Regulatory Text or Lab TP	Section	Total No. of Citations	Translation Assessment	External Standard Status	Regulatory Barrier Identified
ASTM E1136 *Standard Specification for A Radial Standard Reference Test Tire*	RT	S6.2.1	1	No Barrier	Current	None
ASTM Method E 1337-90 (2008) *Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire*	RT; LTP	S6.2.1; 13. General Test Conditions Test Areas (D.)	2	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ASTM E1337-19	None
ISO 10012-1: 1992 *Quality Assurance Requirements for Measuring Equipment*	LTP	8. Calibration of Test Instruments (E)	1	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ISO 10012:2003	None
ANSI/NCSL Z540- 1 *Calibration Laboratories and Measuring and Test Equipment General Requirements*	LTP	8. Calibration of Test Instruments (E)	1	No Barrier	Newer standard issued, but not incorporated by reference in FMVSS: ANS/ISO/IEC 17025:2005 for part 1 and ANSI/NCSL Z540.3-2006 for part 2	None

Appendix E: Stakeholders and SME Involvement

As a part of Volume 3, SMEs representing stakeholder organizations were engaged to obtain feedback on the Volume 3 FMVSS Technical Translation Options. The SMEs involved in this effort are listed below.

FMVSS No. 105
Advocates for Highway and Auto Safety
Alliance for Automotive Innovation
Apple, Inc.
Insurance Institute for Highway Safety
Truck and Engine Manufacturers Association

FMVSS No. 121
Advocates for Highway and Auto Safety
Alliance for Automotive Innovation
Truck and Engine Manufacturers Association

FMVSS No. 135
Advocates for Highway and Auto Safety
Alliance for Automotive Innovation
American Honda Motor Company
Apple, Inc.
Center for Auto Safety
Continental AG
Insurance Institute for Highway Safety
Waymo

FMVSS No. 136
Advocates for Highway and Auto Safety
Apple, Inc.
Bosch
Truck and Engine Manufacturers Association
Waymo

FMVSS No. 208 Unconventional Seating
Advocates for Highway and Auto Safety
Alliance for Automotive Innovation
Apple, Inc.
Automotive Safety Council
Insurance Institute for Highway Safety
MGA Research Corporation
Volvo Car Corporation
Waymo
Zoox

Controls, Telltales, Indicators, and Auditory Alerts
Advocates for Highway and Auto Safety
American Honda Motor Company
Truck and Engine Manufacturers Association

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Administration

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