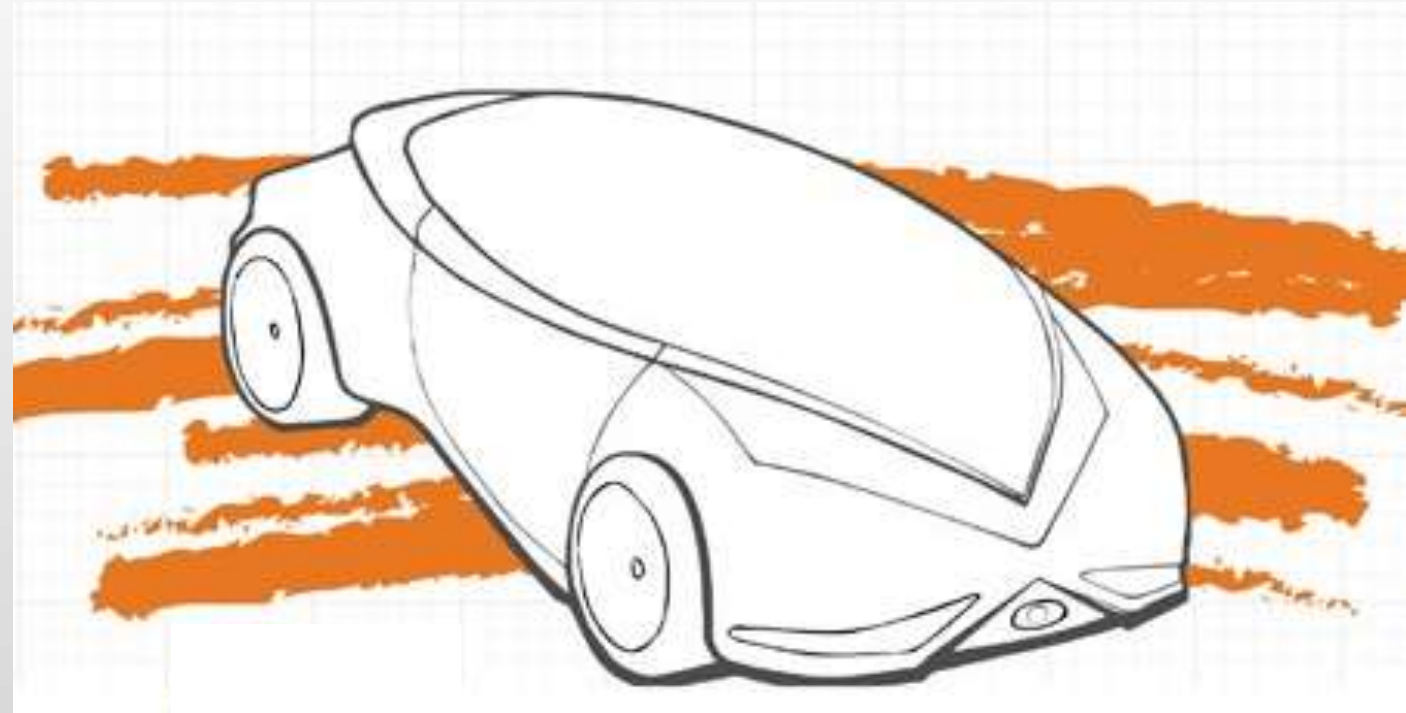




Stakeholder Meeting: FMVSS Considerations for Automated Driving Systems



100-Series Breakout Sessions

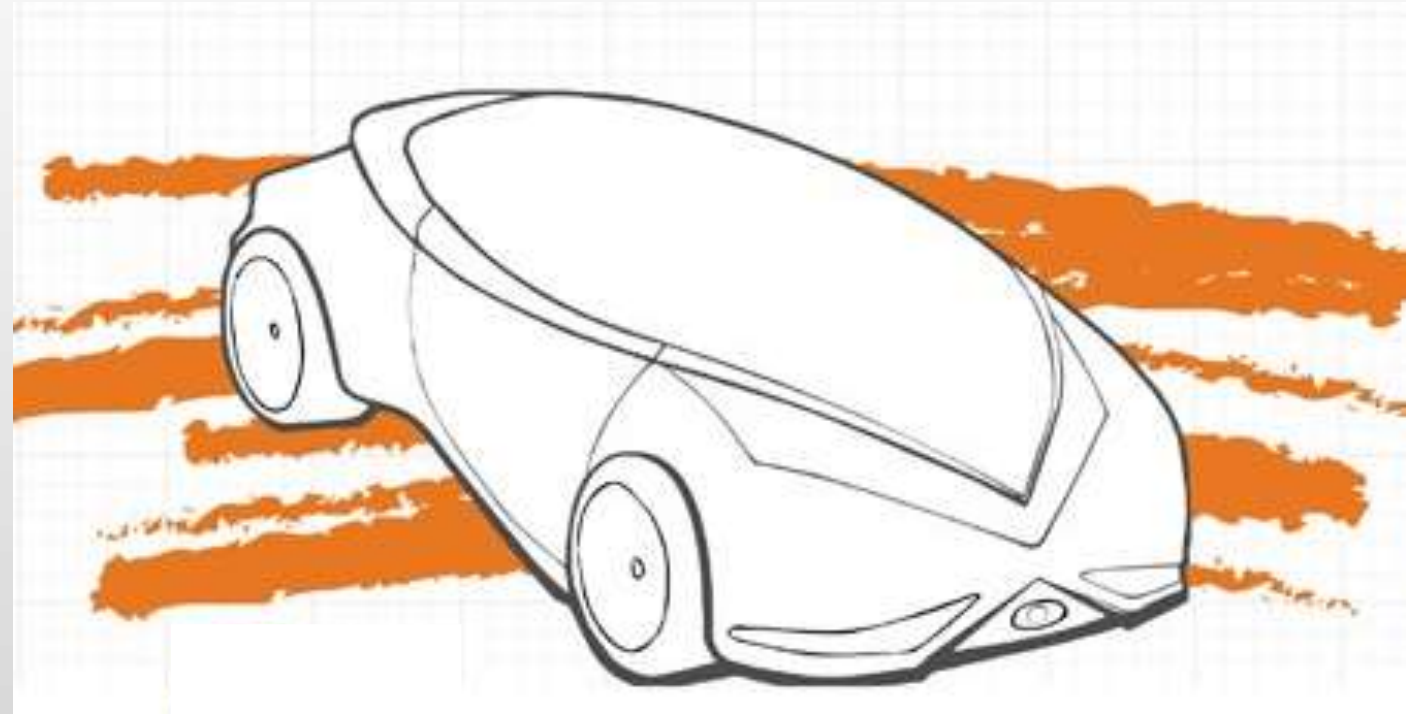


100-Series Breakout Session Focus

Panel	Themes	Phase 1.1						Phase 1.2								
		102	108	114	118	138	141	101	103	104	110	111	113	124	125	126
1	Driver (Operator)	X	X	X		X		X			X	X	X			X
	Driver/Passenger Position(s) or Driver Presence			X	X			X		X	X	X				X
	Service Brake Application	X	X	X		X					X					X
	Shift Position (gear, selects, reverse)	X	X	X			X		X							X
2	Controls and Displays		X	X		X		X						X		X
3	Front/Rear of Vehicle		X				X				X	X	X			
4	Visibility		X					X	X	X		X	X			

Focus Key: All Phase 1.1 standards and Phase 1.2 101, 103, 104, 111, and 113 denoted in orange font

Panel 1 Driver Session



FMVSS 102, 114, and 118 Translation Discussion

Panel 1 Session Focus



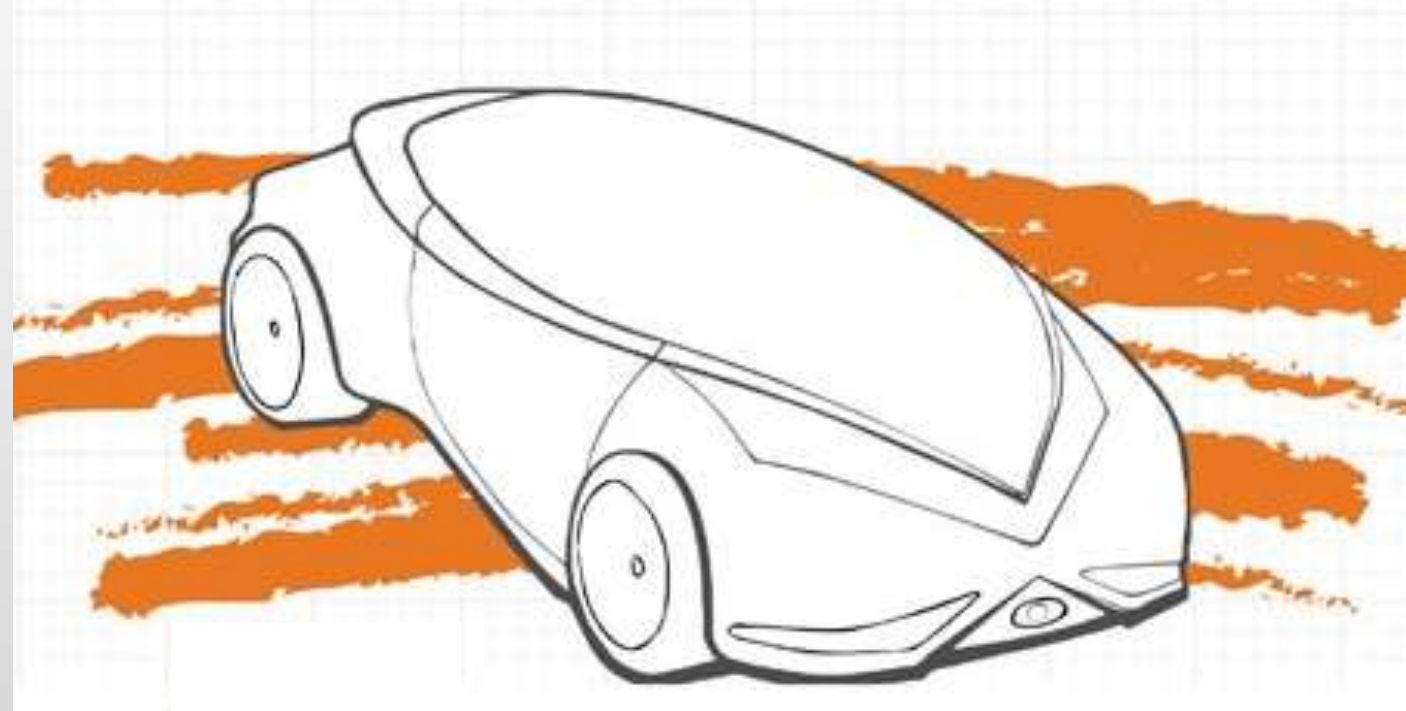
Phase 1.1 | Phase 1.2

Panel	Themes	102	108	114	118	138	141	101	103	104	110	111	113	124	125	126
1	Driver (Operator)	X	X	X		X		X			X	X	X			X
	Driver/Passenger Position(s) or Driver Presence			X	X			X		X	X	X				X
	Service Brake Application	X	X	X		X					X					X
	Shift Position (gear, selects, reverse)	X	X	X			X		X							X
2	Controls and Displays		X	X		X		X						X		X
3	Front/Rear of Vehicle		X				X				X	X	X			
4	Visibility		X					X	X	X		X	X			



Panel 1

Supporting Definitions





Candidate Driver Definition (Section 571.3)

Current Driver Definition:

Driver means the occupant of a motor vehicle seated immediately behind the steering control system.

Driver Translation Option 1:

Driver means:

- (1) the occupant of a motor vehicle seated in the driver's designated seating position (human driver), or
 - (2) the ADS (ADS driver), for ADS-equipped vehicles when the ADS is operational. When the ADS is not operational, the definition in paragraph (1) applies.
- Option 1 translation approach: **“Driver” would be used when** referring to both human driver and ADS and **“human driver”** when only (1) applies and **“ADS driver”** when only (2) applies.



Candidate Driver Definition (Section 571.3)

Current Driver Definition:

Driver means the occupant of a motor vehicle seated immediately behind the steering control system.

Driver Translation Option 2:

Driver means the occupant of a motor vehicle seated immediately behind the steering control system.

- Option 2 translation approach: “Driver” would be used when referring to human driver and “ADS” for when referring to the ADS controlling the driving task.



Candidate Driver Definition (Section 571.3)

Automated Driving System (ADS) Translation Add
(as defined in SAE J3016 Sept 2016):

ADS means 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.



Candidate Driver Definition (Section 571.3)

Comparison Chart:

Option Description	Translation Approach
1 Update definition of a driver to <u>include an ADS driver</u>	<ul style="list-style-type: none">• “<u>driver</u>” would be used when referring to both• “<u>human driver</u>” would be used when referring to only the human driver• “<u>ADS driver</u>” would be used when referring to only the ADS driver
2 Maintain current driver definition and add a <u>separate ADS definition</u>	<ul style="list-style-type: none">• “<u>driver</u>” would be differentiated between human driver and ADS driver• “<u>driver</u>” would be used when referring to the human driver• “<u>ADS</u>” would be used when referring to the ADS driver



Candidate Driver Seating Definition (Section 571.3)

Current 571.3 Designated Seating Position Definition:

Current Designated Seating Position definitions provide method for calculating the number of seating positions based on the width of the seat.

Driver's Designated Seating Position Translation Add (Option 1):

Driver's Designated Seating Position (driver's seat) means a designated seating position immediately behind the manual driving controls which a human driver can operate the vehicle, regardless of whether he or she is in active control of the vehicle.

Driver's Designated Seating Position Translation Add (Option 2):

Driver's seating position (driver's seat) means a designated seating position providing immediate access to manual-operated driving controls.



Candidate Passenger Seating Definition (Section 571.3)

Passenger's Seating Position Translation Add (Passenger's Seat)

Passenger's Seating Position (passenger's seat) means any designated seating position other than the driver's designated seating position.



Candidate Driver Seating Definition (Section 571.3) Comparison

Comparison Chart:

Option Descriptions (Translation Approaches Similar)	
1	<ul style="list-style-type: none">• immediately behind the manual driving controls• which a human driver can operate the vehicle, regardless of whether he or she is in active control of the vehicle
2	<ul style="list-style-type: none">• immediate access to manual-operated driving controls• provides immediate access to the controls



Candidate Manual Driving Control Definition (Section 571.3)

Driver's designated seating position supporting definitions:

Manual Driving Control Option 1:

Manual driving control means a system used by a human driver to manually operate the motor vehicle's lateral (steering) and/or longitudinal (acceleration and deceleration) motion in real-time.

Manual Driving Control Option 2:

Manual driving control means a system used by a human driver for real-time, manual operation of the motor vehicle's heading (steering) and/or speed (accelerator and brake).



Candidate Manual Driving Control Definition (Section 571.3)

Comparison Chart:

Option Descriptions (Translation Approaches Similar)

- | | |
|---|---|
| 1 | a human driver to manually operate the motor vehicle's lateral (steering) and/or longitudinal (acceleration and deceleration) motion in real-time |
| 2 | a human driver for real-time, manual operation of the motor vehicle's heading (steering) and/or speed (accelerator and brake) |



Common Themes Translation Overview

- Theme: Driver
- Challenge: Information and control referenced to driver
- Options
 1. Consider the ADS to be the driver when it is operational
 2. Distinguish human driver and ADS driver
- Theme: Driver Position/Presence
- Challenge: Information and control indicating driver presence and/or position in vehicle
- Options
 1. Driver designated position
 2. Vehicle doors opening
 3. ADS-DV occupant assumptions



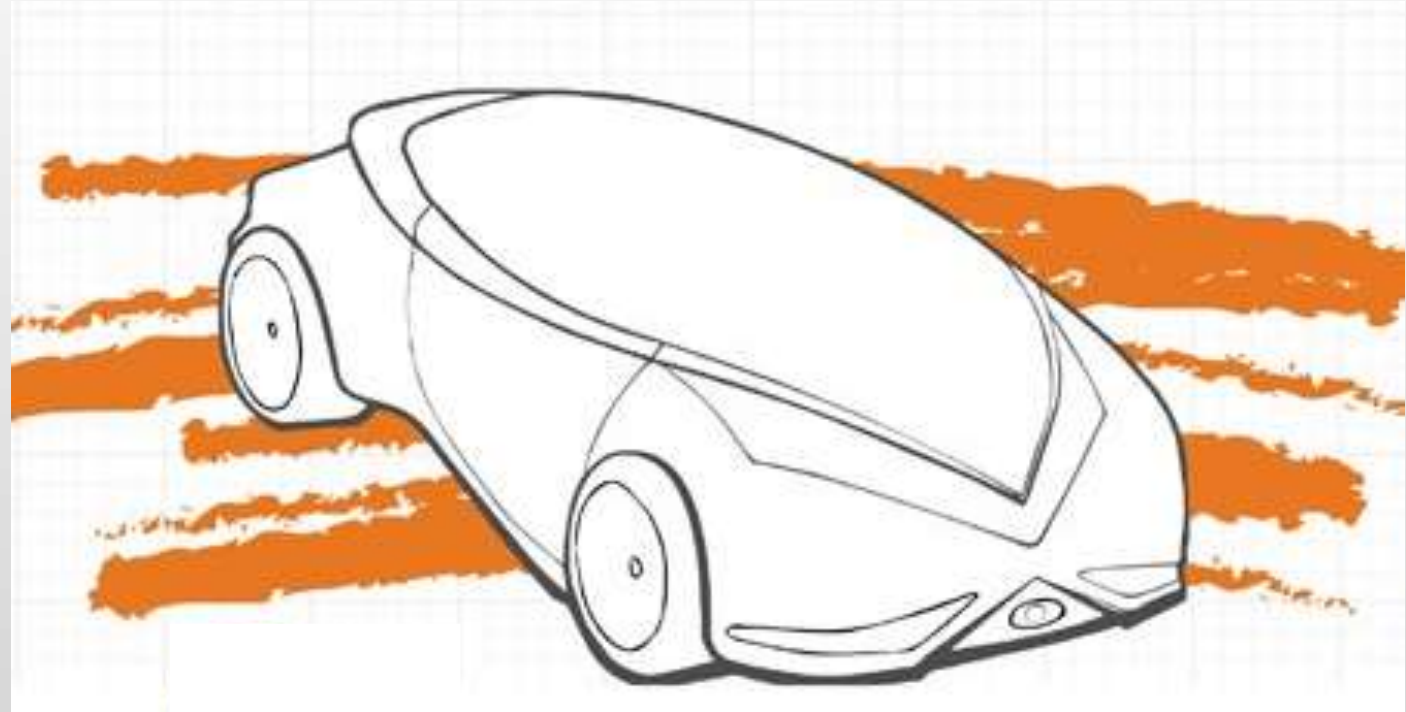
Common Themes Translation Overview

- Theme: Service Brake Application
- Challenge: Specific functionality assumed for human
- Options
 1. Apply the use of driver to the ADS
 2. Distinguish human driver and ADS driver
 3. Generic means of braking
- Theme: Shift Position (gear, selects, reverse)
- Challenge: Specific functionality assumed for human
- Options
 1. Specify a transmission state rather than a gear
 2. For display, the transmission state must be communicated to the ADS
 3. Generic function

Panel 1

Driver (Operator)

FMVSS 102 Transmission Shift Position Sequence, Starter Interlock, and Transmission Braking Effect Example





102 Translation Example

FMVSS 102 (S1): Purpose and Scope

This standard specifies the requirements for the transmission shift position sequence, a starter interlock, and for a braking effect of automatic transmissions, to reduce the likelihood of shifting errors, to prevent starter engagement by the driver when the transmission is in any drive position, and to provide supplemental braking at speeds below 40 kilometers per hour (25 miles per hour).

Crosscutting Theme: Driver (Operator)

- Driver is referenced for operating the ignition and gear selection (S3.1.3 – Starter Interlock).
- Shift position is displayed in view of driver.

102 Translation Example

S3.1.3 Starter interlock

Current Text:

Except as provided in S3.1.3.1 through S3.1.3.3, the engine starter shall be inoperative when **the transmission shift position** is in a forward or reverse drive position.

Option	Text	Consideration/Challenge
1	“... when the transmission shift position is in ...”	- Allows for a non-standard controls or no controls
2	“... transmission shift position or the ADS transmission state is in ...”	- Separates human and ADS control - Does not address vehicles that may not have a typical transmission or transmission functionality



102 Translation Example

S3.1.3 Starter interlock (cont.)

Current Text:

S3.1.3.1 After the **driver has activated** the **vehicle's** propulsion system:

...

(c) The engine may automatically restart in reverse gear only if the vehicle satisfies (1) and (2):

(1) When the engine is automatically stopped in a forward drive shift position and **the driver selects Reverse**, the engine restarts immediately whenever **the service brake is applied**.

(2) When the engine is automatically stopped in a forward drive shift position and **the driver selects Reverse**, the engine does not start automatically if the service brake is not applied.



102 Translation Example

Option 1:

After the ~~driver has activated the~~ vehicle's propulsion system ~~has been activated~~:

(a) The engine may start and stop when the transmission ~~shift position~~ is in any forward drive gear.

...

(1) When the engine is automatically stopped in a forward drive-~~shift position~~ gear and the ~~driver selects~~ transmission is placed in Reverse, the engine restarts immediately whenever the service brake is applied.

(2) When the engine is automatically stopped in a forward ~~drive shift position~~ gear and the ~~driver selects~~ transmission is placed in Reverse, the engine does not start automatically if the service brake is not applied.



102 Translation Example

Option 1

Consideration/Challenge:

- Eliminates the dependency on a driver and physical shift position
- Does not directly address who or what applied the service brake (only implied currently)
- In an ADS-DV, does not present immediately testable case
- Passive voice introduced as part of regulatory text



102 Translation Example

S3.1.4 Identification of shift positions and of shift position sequence

Current Text:

“... if the transmission shift position sequence includes a park position, identification of shift positions, including the positions in relation to each other and the position selected, **shall be displayed in view of the driver...**”



102 Translation Example

Option 1:

“... identification of shift positions, including the positions in relation to each other and the position selected, **shall be communicated to the driver...**”

Consideration/Challenge:

- Eliminates the dependency on a display
- Opens the possibility of other communication means to human drivers (e.g., auditory). May need to provide conditional language to qualify mode of communication (**e.g., “via visual or electronic means”**).



102 Translation Example

Option 2:

“...identification of shift positions, including the positions in relation to each other and the position selected, shall be displayed in view of the **human** driver **or communicated to the ADS...**”

Consideration/Challenge:

- Separates the human and ADS but does not require both
- Does not present an easily testable case to confirm the information is being received by the ADS
- **Use of “or” allows communication to only one entity**



102 Translation Example

Option 3:

“...identification of shift positions, including the positions in relation to each other and the position selected, shall be displayed in view of the **human** driver and shall be communicated to the ADS if operational...”

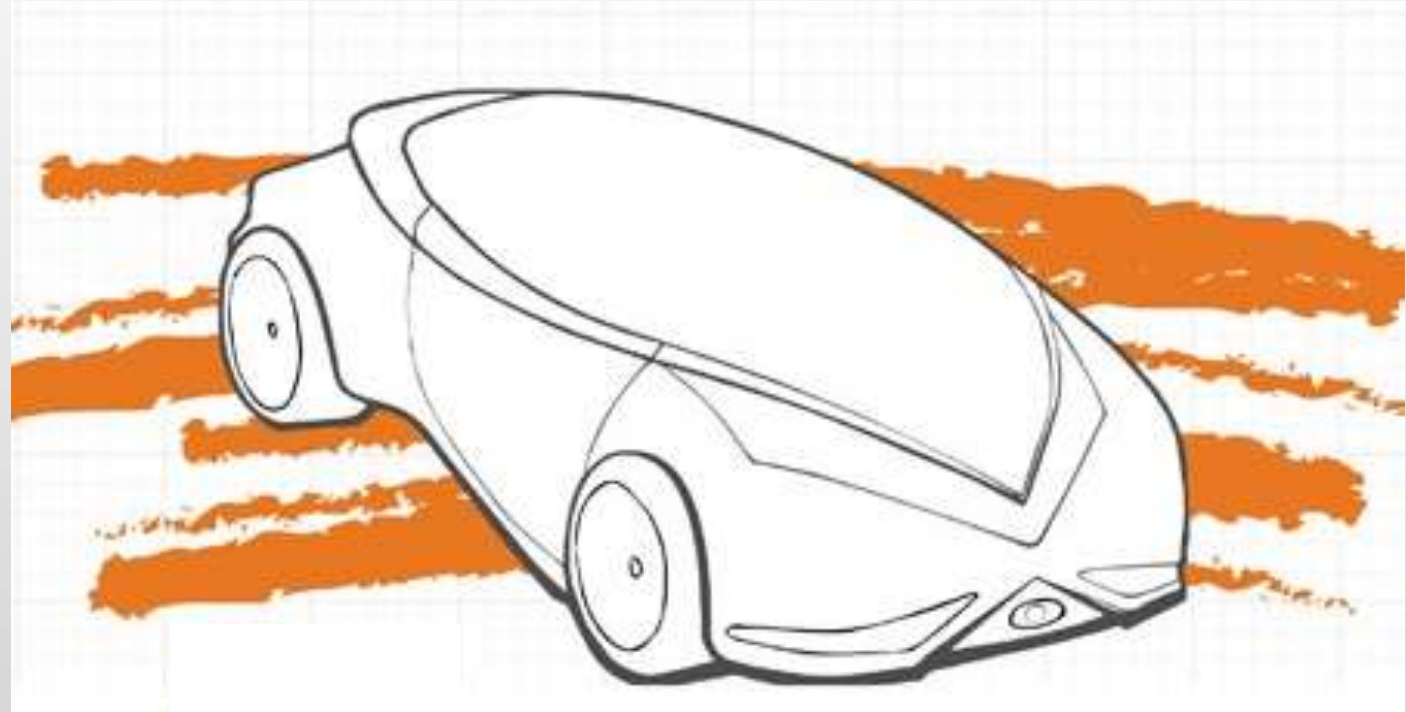
Consideration/Challenge:

- Separates the human and ADS but requires both when both functionalities exist and operational on a vehicle
- Does not present an easily testable case to confirm the information is being received by the ADS

Panel 1

Service Brake Application/Shift Position

FMVSS 114 Theft Protection and Rollaway Prevention Example





114 Translation Example

FMVSS 114: Scope (S1) and Purpose (S2)

Scope: This standard specifies vehicle performance requirements intended to reduce the incidence of crashes resulting from theft and accidental rollaway of motor vehicles.

Purpose: The purpose of this standard is to decrease the likelihood that a vehicle is stolen, or accidentally set in motion.

Crosscutting Themes: Service Brake Application and Shift Position

- Requirement that the service brake be depressed as necessary condition for the transmission to be shifted out of Park (Congressional mandate)
- Position of gear selection control is necessary condition for subsequent function or dependent on a state or condition of another control



114 Translation Example

S5.3 Brake transmission shift interlock

Current Text:

...an automatic transmission that includes a “park” position shall be equipped with a system that requires **the service brake to be depressed** before the transmission can be shifted out of “park.” **This system shall function in any starting system key position in which the transmission can be shifted out of “park.”**

Relevant interpretation:

“Depressed” is not defined in FMVSS No. 114, 49 CFR §571.3, Definitions, or the K.T. Safety Act, but Merriam-Webster defines the verb **“depress”** as **“to press (something) down”** **The “something”** that is pressed down is the service brake, which is defined in §571.3 as **“the primary mechanism designed to stop a motor vehicle.”** In the present context, we understand the term **“depressed”... to mean simply “pressed” or “applied.”**



114 Translation Example

S5.3 Brake transmission shift interlock

Option 1:

“...requires the service brake to be ~~depressed~~ applied before...”

Consideration/Challenge:

- Provides a generic means of activation of service brake rather than specific motion
- May require novel means to demonstrate that this condition has been satisfied



114 Translation Example

S5.2 Rollaway prevention

Current Text:

S5.2.1 ...**the** starting system required by S5.1 must prevent key removal when tested according to the procedures in S6, unless **the transmission or gear selection control is locked in “park” or becomes locked in “park”** as a direct result of key removal.

S6.2.1 (b) **Move the gear selection control to any gear selection position** or any other position where it will remain without assistance, including a position **between any detent positions, except for the “park” position.**

(c) Attempt to remove the key in each gear selection **position.**



114 Translation Example

Option 1:

S5.2.1 *As written, applies to both human and ADS-equipped vehicles*

S 6.2.1 (b) Move the gear selection control **or set the transmission state...**

(c) Attempt to remove the key in each gear selection **position.**

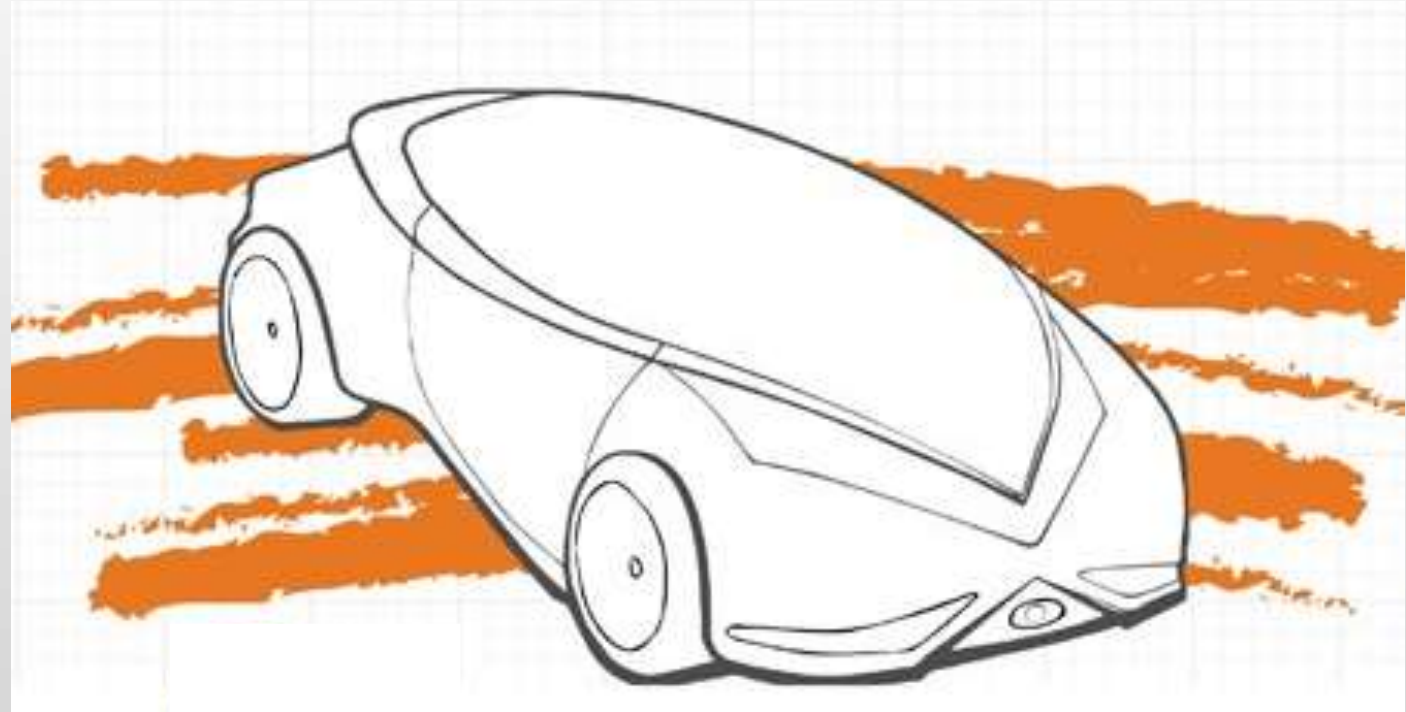
Consideration/Challenge:

- Provides a reference to the intended outcome (transmission state) in addition to a means to obtain the outcome (move the gear selection).
- Does not provide an easily testable case to confirm the state of the transmission if no lever is present

Panel 1

Driver Position/Presence

FMVSS 118 Power-operated Window, Partition, and Roof Panel Systems Example





118 Translation Example

FMVSS 118 (S1): Purpose and Scope

This standard specifies requirements for power-operated window, partition, and roof panel systems to minimize the likelihood of death or injury from their accidental operation.

Crosscutting Theme: Driver Presence

- FMVSS 118 associates driver presence or supervision with the key controls (activation of the **vehicle's engine**) and opening of the front doors.
- The standard allows for power-operated window, partition, and roof panel systems closure under certain driver supervised conditions.
- Otherwise automatic reversal is required for closure.



118 Translation Example

Current Text:

S4. Operating requirements: Except as provided in S5, power operated window, partition, or roof panel systems may be closed only in the following circumstances

- a) **When the key that controls activation of the vehicle's engine is in the "ON", "START", or "ACCESSORY" position;**
- b) By **muscular force** unassisted by vehicle supplied power;
- c) Upon continuous activation by a locking system on the exterior of the vehicle;
- d) Upon continuous activation of a remote actuation device, provided that the remote actuation device shall be incapable of closing the power window, partition or roof panel from a distance of more than 6 meters from the vehicle;

(cont'd on next slide)



118 Translation Example

Current Text:

S4. Operating requirements: Except as provided in S5, power operated window, partition, or roof panel systems may be closed only in the following circumstances

- e) During the interval between the time the locking device which controls the activation of the vehicle's engine is turned off and the opening of either of a two-door vehicle's doors or, in the case of a vehicle with more than two doors, the opening of either of its front doors;
- f) If the window, partition, or roof panel is in a static position before starting to close and in that position creates an opening so small that a 4 mm diameter semi-rigid cylindrical rod cannot be placed through the opening at any location around its edge in the manner described in S5(b); or
- g) Upon continuous activation of a remote actuation device, provided that the remote actuation device shall be incapable of closing the power window, partition or roof panel if the device and the vehicle are separated by an opaque surface and provided that the remote actuation device shall be incapable of closing the power window, partition or roof panel from a distance of more than 11 meters from the vehicle.



118 Translation Example

S4(e) During the interval between the time the locking device which controls the activation of the **vehicle's** engine is turned off and the opening of either of a two-door **vehicle's** doors or, in the case of a vehicle with more than two doors, the opening of either of its **front doors**;

Option 1:

During the interval between the time the locking device which controls the activation of the **vehicle's** engine is turned off and the opening of **any of the vehicle's doors**.

Option 2:

During the interval between the time the locking device which controls the activation of the **vehicle's** engine is turned off and the opening of either of a two-door **vehicle's** doors or, in the case of a vehicle with more than two doors, the opening of either of its **front doors for vehicles operated by a human driver and any of its doors for vehicles operated by an ADS**.



118 Translation Example

S4(e) During the interval between the time the locking device which controls the activation of the **vehicle's** engine is turned off and the opening of either of a two-door **vehicle's** doors or, in the case of a vehicle with more than two doors, the opening of either of its **front doors**;

Consideration/Challenge:

- Assumes that the use of an ADS-DV, while perhaps not a licensed driver, would be an occupant with the capability to safely operate or supervise the safe operation of the windows.
- Option 1 is not equivalent to the current standard and would impose additional restrictions for human- and ADS-operated vehicles.



118 Translation Example

S4: Except as provided in S5, power operated window, partition, or roof panel systems may be closed only in the following circumstances:

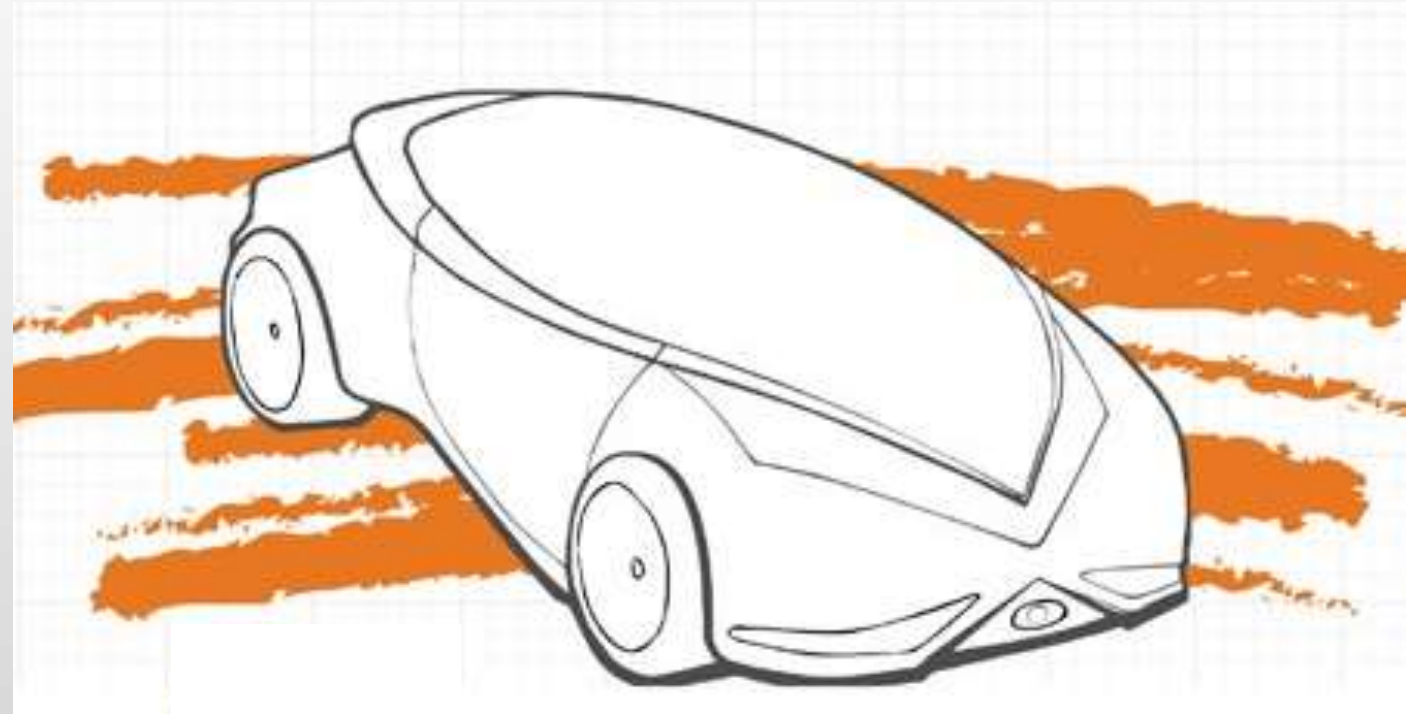
Option 3:

Vehicles operated by an ADS need to meet the automatic reversal systems S5 requirements for power operated window, partition, or roof panel systems closure. For vehicles operated by a human driver, except as provided in S5, power operated window, partition, or roof panel systems may be closed only in the following circumstances:

Consideration/Challenge:

- For an ADS-DV, a licensed driver or a capable occupant may not be present to supervise window closure. Option 3 requires closure to meet S5 automatic reversal systems.

Panel 2 Controls and Displays Session



FMVSS 101 and 138 Translation Discussion



Panel 2 Session Focus

Panel	Themes	Phase 1.1						Phase 1.2								
		102	108	114	118	138	141	101	103	104	110	111	113	124	125	126
1	Driver (Operator)	X	X	X		X		X			X	X	X			X
	Driver/Passenger Position(s) or Driver Presence			X	X			X		X	X	X				X
	Service Brake Application	X	X	X		X					X					X
	Shift Position (gear, selects, reverse)	X	X	X			X		X							X
2	Controls and Displays		X	X		X		X						X		X
3	Front/Rear of Vehicle		X				X				X	X	X			
4	Visibility		X					X	X	X		X	X			



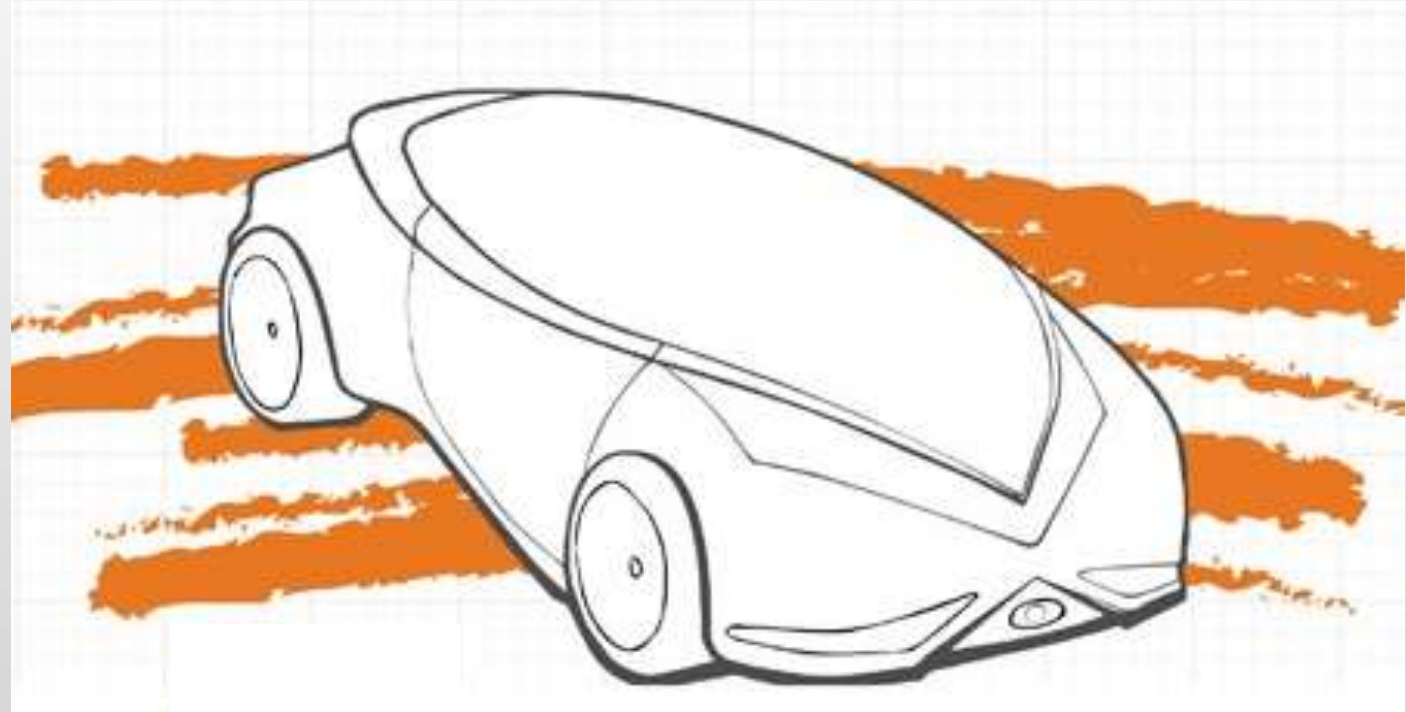
Common Themes Translation Overview

- Theme: Controls and Displays
- Challenge: Provide information to a human in a manner that can be perceived and understood. ADS needs are different from a **human driver's**.
- Options
 1. Clarify the requirements which apply to vehicles designed for operation by a human driver. Conventional identifiers are specific to the human driver.
 2. If the vehicle is not required to be fitted with a control/display, the specific identifiers do not apply, including manual driven vehicles and ADS-DVs.
 3. Mandated control, telltale, and/or indicator translations are captured within the standard that mandates them.

Panel 2

Controls and Displays

FMVSS 101 Controls and Displays Example





101 Translation Example

FMVSS 101: Scope (S1) and Purpose (S2)

Scope: This standard specifies performance requirements for location, identification, color, and illumination of motor vehicle controls, telltales, and indicators.

Purpose: The purpose of this standard is to ensure the accessibility, visibility, and recognition of motor vehicle controls, telltales, and indicators, and to facilitate the proper selection of controls under daylight and nighttime conditions, in order to reduce the safety hazards caused by the diversion **of the driver's attention** from the driving task, and by mistakes in selecting controls.

Crosscutting Theme: Controls and Displays

- The reference to attention under S2 relates to the topics covered in the standard. For example, eliciting urgency by the color, flashing rate, etc. The focus of the application of this standard is human attention.
- The current FMVSS does not provide how similar information would be presented to an ADS.



101 Translation Example

Current Text:

S5. Requirements: Each passenger car, multipurpose passenger vehicle, truck and bus **that is** fitted with a control, a telltale or an indicator listed in Table 1 or Table 2 must meet the requirements of this standard for the location, identification, color, and illumination of that control, telltale or indicator. However, the requirements for telltales and indicators do not apply to vehicles with GVWRs of 4,536 kg or greater if these specified vehicles are manufactured before September 1, 2013.



101 Translation Example

Option 1:

*“Each passenger car, multipurpose passenger vehicle, truck and bus **that can be operated by a human driver and** is fitted with...”*

Option 2:

*“Each passenger car, multipurpose passenger vehicle, truck and bus **designed to be driven by a driver and** is fitted with...”*



101 Translation Example

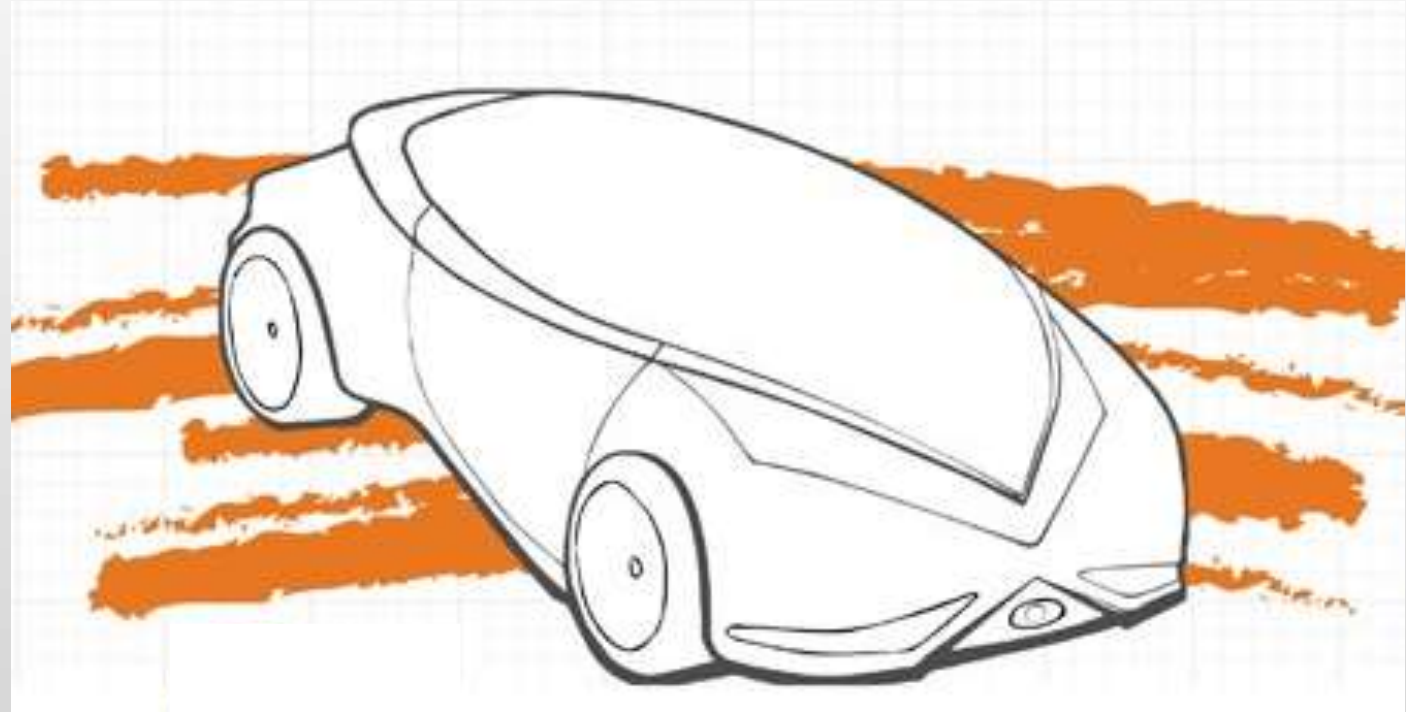
Considerations/Challenges:

- Focused on human driver detection and recognition.
- ADS-DVs do not require visible telltales with a particular illumination, color, location, and identification.
- The type of information needed for an ADS is not specified (e.g., priority).
- Mandated control, telltale, and/or indicator translation options for ADS-DVs are translated within the standard which mandates the control, telltale, or indicator.

Panel 2

Controls and Displays

FMVSS 138 Tire Pressure Monitoring Systems Example





138 Translation Example

FMVSS 138 (S1): Scope

This standard specifies performance requirements for tire pressure monitoring systems (TPMSs) to warn drivers of significant under-inflation of tires and the resulting safety problems.

Crosscutting Theme: Controls and Displays

- Congressional mandate (TREAD ACT): Directed NHTSA to require a warning system in new motor vehicles to indicate to the operator when a tire is significantly underinflated.
- The current standard contains minimum requirements for warning the driver. It does not include requirements for action.



138 Translation Example

Current Text:

S3 Definitions:

Tire pressure monitoring system means a system that detects when one or more of a **vehicle's** tires is significantly under-inflated and **illuminates a low tire pressure warning telltale**.



138 Translation Example

S3 Definitions:

Option 1:

Tire pressure monitoring system means a system that detects when one or more of a **vehicle's** tires is significantly under-inflated and **communicates the low tire pressure condition to the driver.**

Option 2:

Tire pressure monitoring system means a system that detects when one or more of a **vehicle's** tires is significantly under-inflated and **illuminates a low tire pressure warning telltale to the driver and communicates a low tire pressure condition to an ADS if operational.**



138 Translation Example

Current Text:

S4.2 TPMS Detection Requirements:

The tire pressure monitoring system must:

- (a) **illuminate** a low tire pressure warning **telltale** not more than 20 minutes after the inflation pressure in one or more of the **vehicle's** tires, up to a total of four tires, is equal to or less than either the pressure 25 percent below the vehicle **manufacturer's** recommended cold inflation pressure, or the pressure specified in the 3rd column of Table 1 of this standard for the corresponding type of tire, whichever is higher;
- (b) Continue to **illuminate** the low tire pressure warning **telltale** as long as the pressure in any of the **vehicle's** tires is equal to or less than the pressure specified in S4.2(a), and the **ignition locking system is in the "On" ("Run") position, whether or not the engine is running,** or until manually reset in accordance with the vehicle manufacturer's instructions.



138 Translation Example

Option 1:

S4.2 TPMS Detection Requirements:

The tire pressure monitoring system must:

- (a) **Indicate** a low tire pressure **condition** not more than 20 minutes after the inflation pressure in one or more of the **vehicle's** tires, up to a total of four tires, is equal to or less than either the pressure 25 percent below the vehicle **manufacturer's** recommended cold inflation pressure, or the pressure specified in the 3rd column of Table 1 of this standard for the corresponding type of tire, whichever is higher;
- (b) Continue to **indicate** the low tire pressure **condition** as long as the pressure in any of the **vehicle's** tires is equal to or less than the pressure specified in S4.2(a), and the ignition **locking system is in the "On" ("Run") position, whether or not the engine is running, or until manually reset in accordance with the vehicle manufacturer's instructions.**



138 Translation Example

Option 2:

S4.2 TPMS Detection Requirements:

The tire pressure monitoring system must:

- (a) For vehicles operated by a driver, illuminate a low tire pressure **telltale condition** and for vehicles operated by an ADS, communicate the low tire pressure **condition**, not more than 20 minutes after the inflation pressure in one or more of the **vehicle's** tires, up to a total of four tires, is equal to or less than either the pressure 25 percent below the vehicle **manufacturer's** recommended cold inflation pressure, or the pressure specified in the 3rd column of Table 1 of this standard for the corresponding type of tire, whichever is higher;
- (b) Continue to indicate the low tire pressure warning **condition** as long as the pressure in any of the **vehicle's** tires is equal to or less than the pressure specified in S4.2(a), and the **ignition locking system is in the "On" ("Run") position, whether or not the engine is running,** or until manually reset in accordance with the vehicle **manufacturer's** instructions.



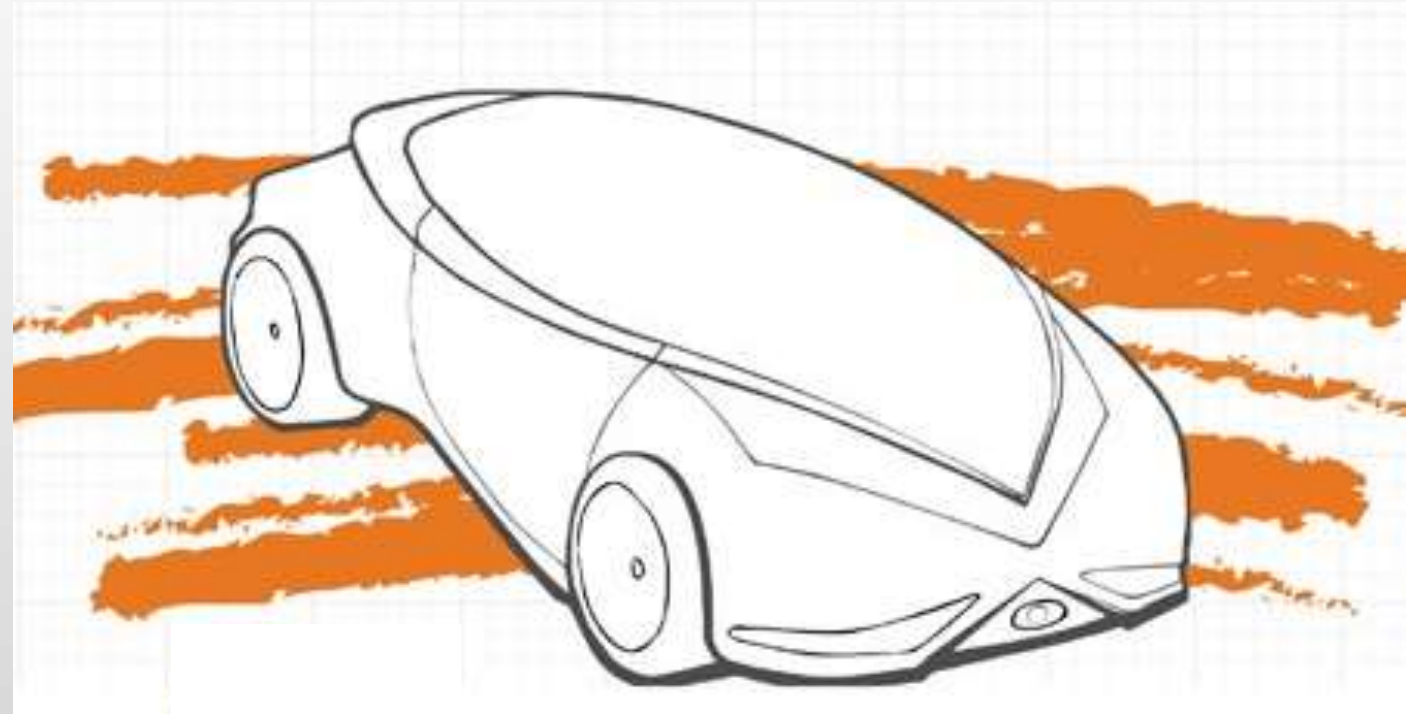
138 Translation Example

Consideration/Challenge:

- The current standard contains minimum requirements for warning the driver.
- It does not include requirements for action, but it requires written instructions to be **included in the owner's manual to state that "it is the driver's responsibility to maintain correct tire pressure."**
- **This could be translated to "it is imperative that the vehicle is maintained at the correct tire pressure"**
- More research beyond the translations of FMVSS 138 may be needed:
 - What if any malfunction or vehicle condition information is relevant for the ADS-DV occupants and the owners and/or person(s) responsible for ADS-DV maintenance?
 - How will the information be communicated to the responsible individual(s)?

Panel 3

Front/Rear of the Vehicle Session



FMVSS 108 and 141 Translation Discussion



Panel 3 Session Focus

Panel	Themes	Phase 1.1						Phase 1.2								
		102	108	114	118	138	141	101	103	104	110	111	113	124	125	126
1	Driver (Operator)	X	X	X		X		X			X	X	X			X
	Driver/Passenger Position(s) or Driver Presence			X	X			X		X	X	X				X
	Service Brake Application	X	X	X		X					X					X
	Shift Position (gear, selects, reverse)	X	X	X			X		X							X
2	Controls and Displays		X	X		X		X						X		X
3	Front/Rear of Vehicle		X				X				X	X	X			
4	Visibility		X					X	X	X		X	X			



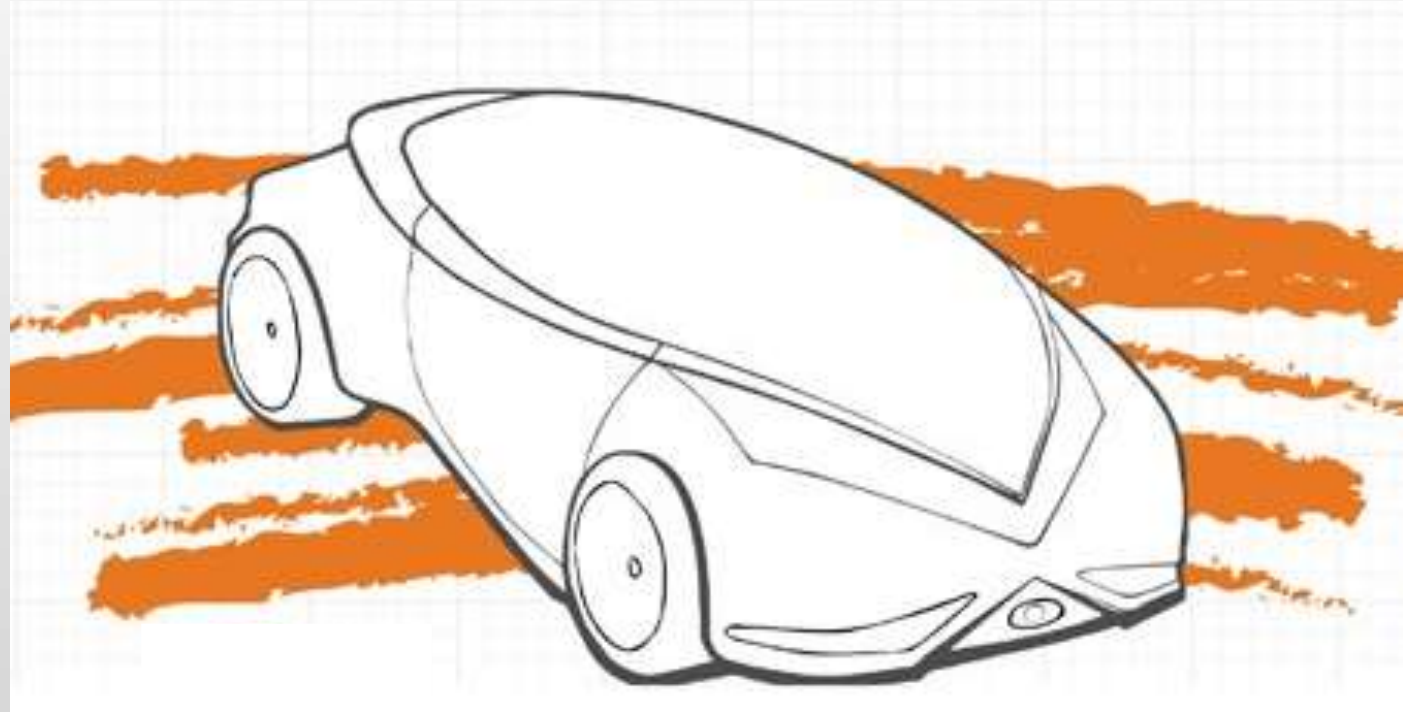
Common Themes Translation Overview

- Theme: Front/Rear of the Vehicle
- Challenge: Front and rear of the vehicle is assumed in the standards. Bi-directional vehicles no longer have a traditional front and rear. These vehicles will still need to communicate to other roadway and non-roadway users their travel directions/intentions.
- Options
 1. Define front and rear of vehicle in the context of travel direction
 2. Define bi-directional functionality and clarify requirements in both directions



Panel 3

Supporting Definitions





Candidate Definition (Section 571.3)

Definition for Front/Rear of the Vehicle (Option 1):

Front of the vehicle is defined as the face of the vehicle located in the primary direction of travel and the typical direction of traffic flow for the roadway.

Rear of the vehicle is defined as the face of the vehicle located opposite the primary direction of travel and the typical direction of traffic flow for the roadway.

Bi-directional (Option 2):

Bi-directional operation is an ADS which operates with equal speed and heading control in two directions.

For Bi-directional vehicles this standard must be met in both directions of travel.



Candidate Definition (Section 571.3)

Consideration/Challenge:

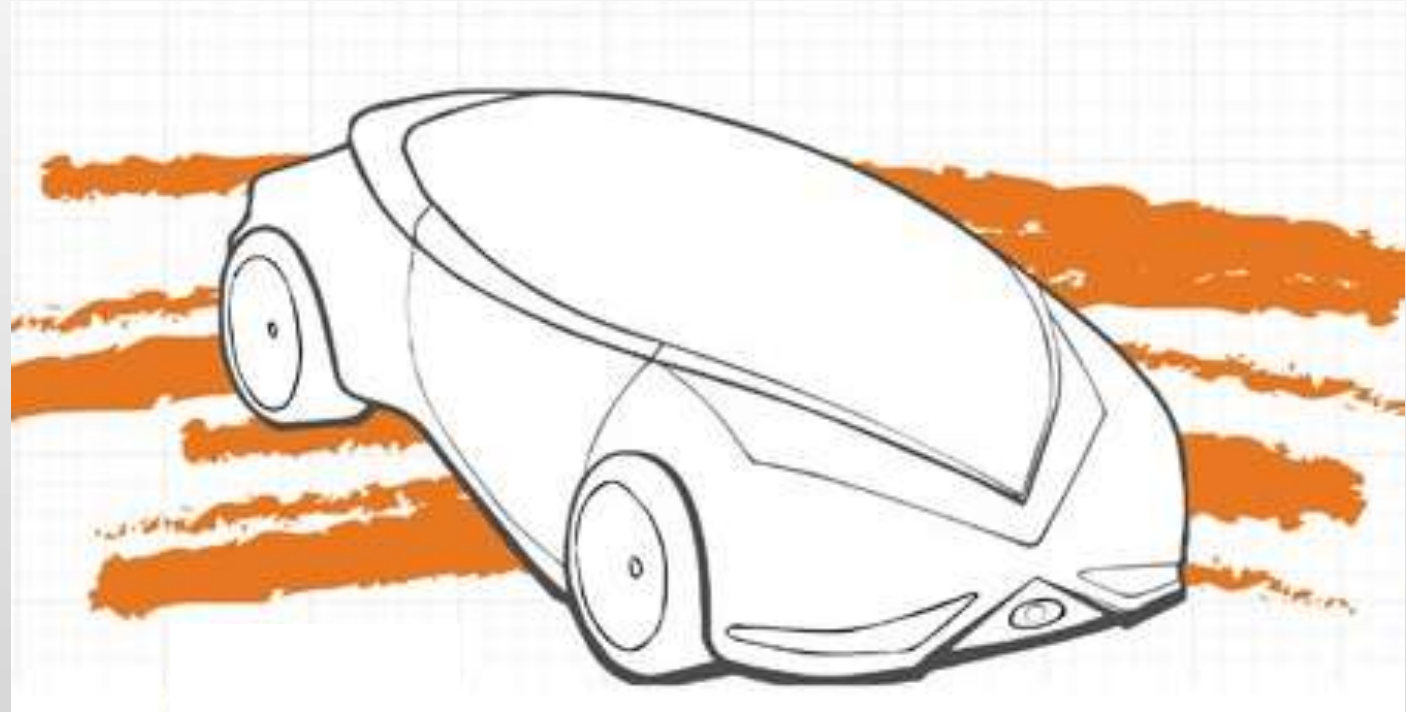
Defining the front of the vehicle maintains the same requirements (lighting, sound) already defined within the regulation, simplifying the need to rewrite portions of the document. Difficulties remain in terms of defining when a vehicle is simply moving backwards, versus when it is reversing. Defining bi-directional vehicles allows for interpreting this differentiation.

Challenges as a result of accounting for bi-directional vehicles may be more significant for safety and crash worthiness regulations (200-series) relative to crash avoidance (100-series).

Panel 3

Front/Rear of the Vehicle

FMVSS 108 Lamps, Reflective Devices, and Associated Equipment Example





108 Translation Example

FMVSS 108: Scope (S1) and Purpose (S2)

Scope: This standard specifies requirements for original and replacement lamps, reflective devices, and associated equipment.

Purpose: The purpose of this standard is to reduce traffic accidents and deaths and injuries resulting from traffic accidents, by providing adequate illumination of the roadway, and by enhancing the conspicuity of motor vehicles on the public roads so that their presence is perceived and their signals understood, both in daylight and in darkness or other conditions of reduced visibility.

Crosscutting Theme: Front/Rear of Vehicle

- The location and performance of lighting and reflective equipment is defined based on the front and rear of the vehicle.
- These were never defined but rather assumed to be obvious. For a bi-directional vehicle, standards would need to apply based on the direction of travel.



108 Translation Example

Current Text:

S4 Daytime running lamps (DRLs) are steady burning lamps that are used to improve the conspicuity of a vehicle from **the front and front sides** when the regular headlamps are not required for driving.



108 Translation Example

Option 1:

Steady burning lamps that are used to improve the conspicuity of a vehicle in the **direction of travel** when the regular headlamps are not required for driving.

Option 2:

No change with bi-directional vehicle definition

Consideration/Challenge:

- If the front and rear of the vehicle are defined as a bi-directional vehicle, no translation of the text is required.

108 Translation Example - Table I-a

Table I-a Required Lamps and Reflective Devices

Lighting Device	Number and color	Mounting location	Mounting height	Device activation
All Passenger Cars, Multipurpose Vehicles (MPV), Trucks, and Buses				
Upper Beam Headlamps	White, of a headlighting system listed in Table II	On the front, at the same height, symmetrically about the vertical centerline, as far apart as practicable	Not less than 22 inches (55.9 cm) nor more than 54 inches (137.2 cm)	Steady burning, except may be flashed for signaling purposes
Turn Signal Lamps	2 Amber	At or near the front, at the same height, symmetrically about the vertical centerline, as far apart as practicable	Not less than 15 inches, nor more than 83 inches	Flash when the turn signal flasher is actuated by the turn signal operating unit



108 Translation Example - Table I-a

Option 1 and 2:

No change with bi-directional vehicle or front/rear face definition

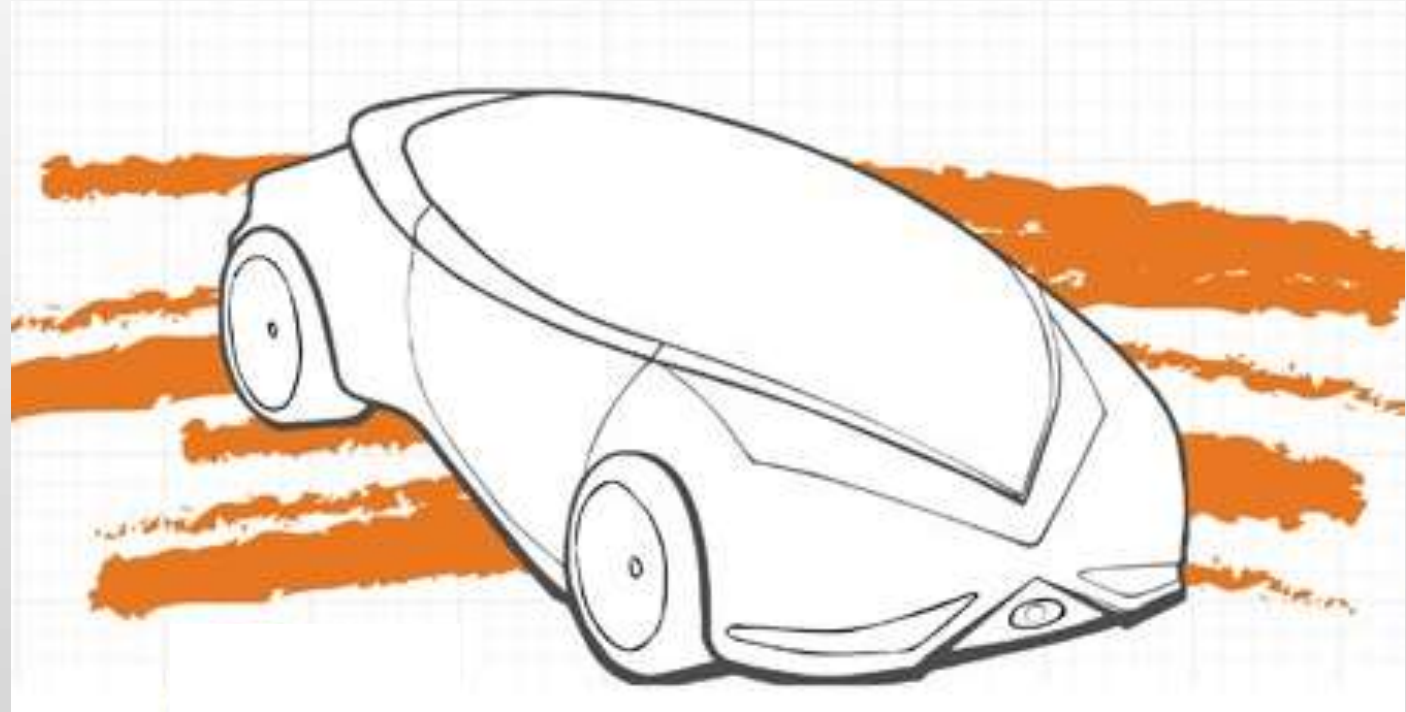
Consideration/Challenge:

- If the front and rear of the vehicle are defined as a bi-directional operation, no translation of the text is required.
- Some lamps may not be required based on the vehicle activity, e.g., backup lamps.

Panel 3

Front/Rear of the Vehicle

FMVSS 141 Minimum Sound Requirements for Hybrid and Electric Vehicle Example





141 Translation Example

FMVSS 141: Scope (S1) and Purpose (S2)

Scope: This standard establishes performance requirements for pedestrian alert sounds for motor vehicles.

Purpose: The purpose of this standard is to reduce the number of injuries that result from electric and hybrid vehicle crashes with pedestrians by providing a sound level and sound characteristics necessary for these vehicles to be detected and recognized by pedestrians.

Crosscutting Theme: Front/Rear of Vehicle

- FMVSS 141 defines front and rear plane of vehicle with respect to forward or reverse operation.
- Compliance with regulation is based on sound level output while vehicle is stationary, moving in reverse, and moving forward.



141 Translation Example

Current Text:

S7.3.1 Execute pass-by tests at 11 km/h (± 1 km/h) and collect acoustic sound files.

- (a) For each test, measure the sound emitted by the test vehicle while at a constant speed of 11 km/h (± 1 km/h) throughout the measurement zone specified in S6.4 between lines AA' and PP'. Execute multiple test runs at 11 km/h (± 1 km/h) to acquire at least four valid tests within 2 dBA in accordance with S7.3.2 and S7.3.3.
- (b) During each test, record a left (**driver's side**) and a right (**passenger side**) acoustic sound file.



141 Translation Example

S7.3.1 (b) During each test, record a left (**driver's** side) and a right (passenger side) acoustic sound file.

Option 1:

(b) During each test, record a left ~~(driver's side)~~ and a right ~~(passenger side)~~ acoustic sound file. For bi-directional vehicles, record a left side and a right side acoustic sound file in both directions.

Option 2:

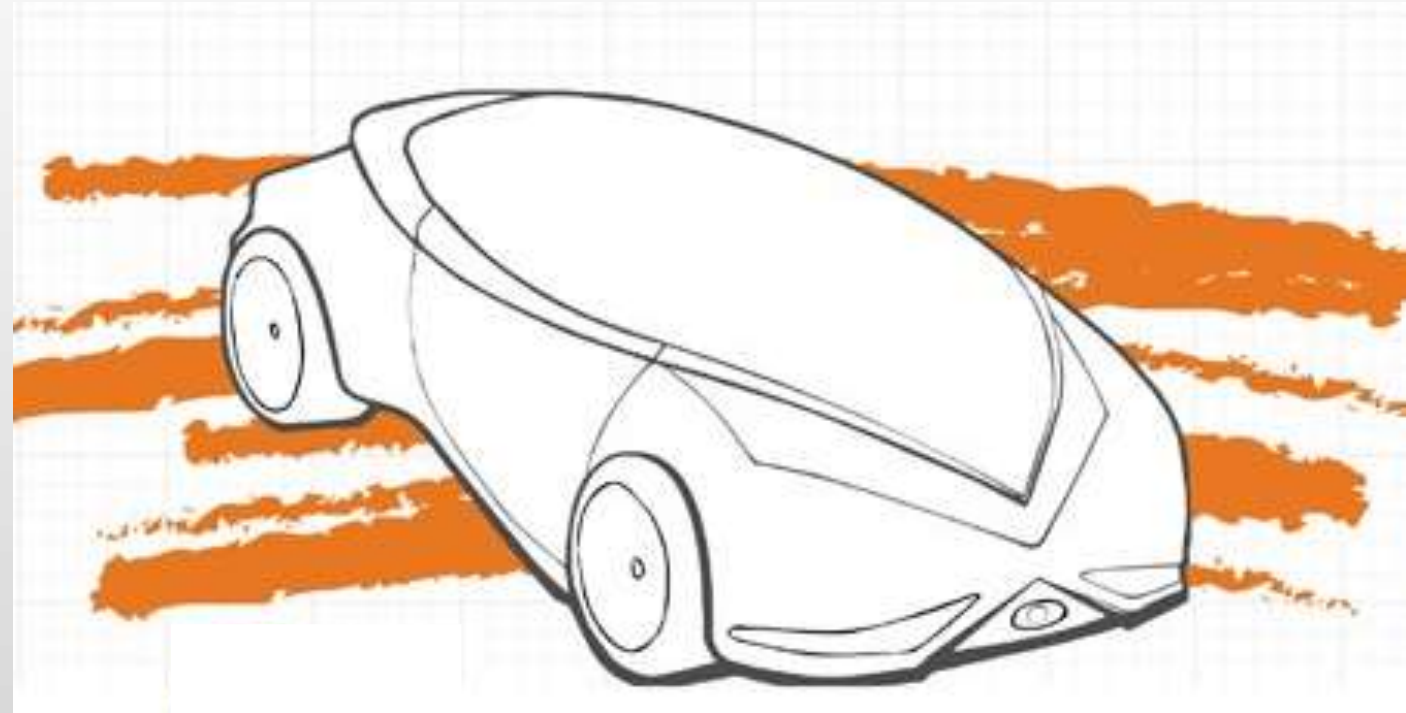
(b) During each test, record an acoustic sound file for both sides of the vehicle ~~left (driver's side) and a right (passenger side) acoustic sound file~~. For bi-directional vehicles, record an acoustic sound file for both sides of the vehicle in both directions.

Consideration/Challenge:

Removes reference to driver and passenger sides.

For bi-directional ADS-DVs, requires testing for compliance if multiple forward movement directions exist (and clarifies recording requirements).

Panel 4 Visibility Session



FMVSS 103, 104, 111, and 113 Translation Discussion

Panel 4 Session Focus

Panel	Themes	Phase 1.1						Phase 1.2								
		102	108	114	118	138	141	101	103	104	110	111	113	124	125	126
1	Driver (Operator)	X	X	X		X		X			X	X	X			X
	Driver/Passenger Position(s) or Driver Presence			X	X			X		X	X	X				X
	Service Brake Application	X	X	X		X					X					X
	Shift Position (gear, selects, reverse)	X	X	X			X		X							X
2	Controls and Displays		X	X		X		X						X		X
3	Front/Rear of Vehicle		X				X				X	X	X			
4	Visibility		X					X	X	X		X	X			



Common Themes Translation Overview

Theme: Visibility

Challenge: The standards which cover driver visibility were developed specifically to support the human driver. These standards may not be needed in order for the ADS-DV to maintain driving visibility.

Options:

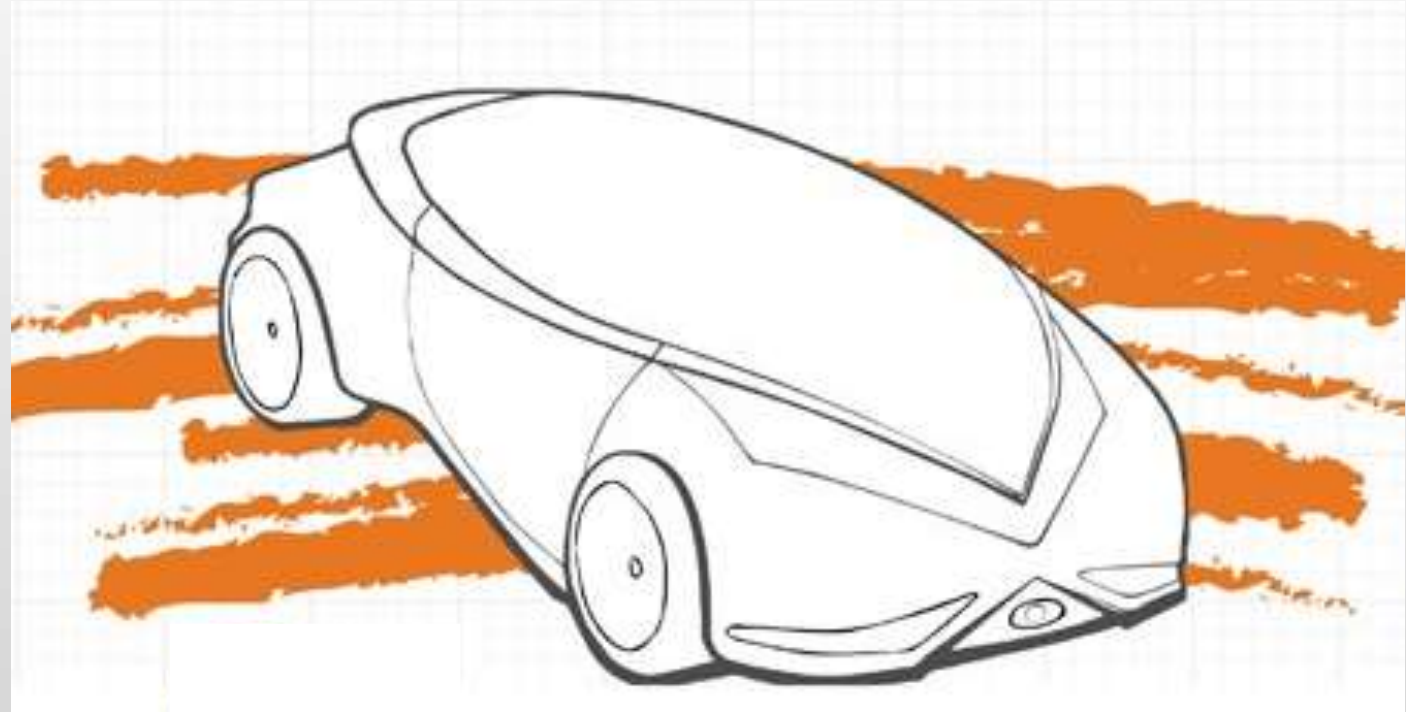
1. Clarify the requirements which may be specific for human driver operation
2. Translate requirements which may be appropriate for ADS-DVs and human drivers

Panel 4

Visibility

**FMVSS 103
Windshield Defrosting and
Defogging Systems**

**FMVSS 104
Windshield Wiping and
Washing Systems Examples**





103 [104] Translation Example

FMVSS 103 [104] (S1): Purpose and Scope

This standard specifies requirements for windshield defrosting and defogging [wiping and washing] systems.

Crosscutting Theme: Visibility

- Suggests that the safety objective in mind (see p-19107) cited in FMVSS 103 **“is** to maintain driving visibility under conditions which would otherwise obscure vision through the windshield.” (49 CFR, Section 571, 4/19/1999, Denial of Petition for Rulemaking)
- In accordance with other suggested translations in this effort, proposing the ADS as the driver is applicable for this standard as well.
- The windshield might not be needed in order for the ADS to maintain driving visibility.



103 [104] Translation Example

Current Text:

S4.1 Operating requirements. **Each vehicle shall** have a windshield defrosting and defogging [power-driven windshield wiping] system.

Option 1:

“Each vehicle operated by a human driver shall...”

Option 2:

“Each vehicle operated by a driver shall...”

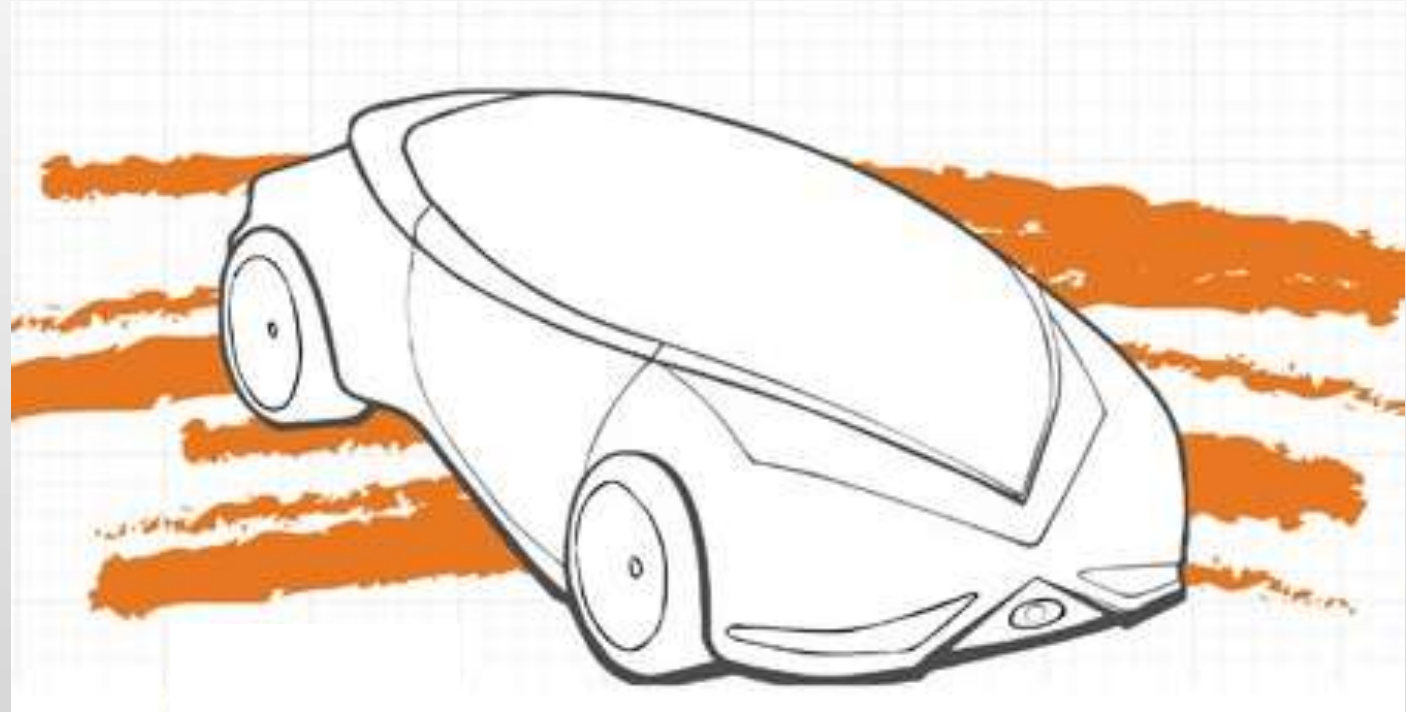
Consideration/Challenge:

- This FMVSS provides for a minimum area of the window where visibility clearance for human drivers is needed.
- The detection systems do not require the area(s) that are specific to human drivers.

Panel 4

Visibility

FMVSS 111 Rearview Mirrors Example





111 Translation Example

FMVSS 111: Scope (S1) and Purpose (S2)

Scope: This standard specifies requirements for rear visibility devices and systems.

Purpose: The purpose of this standard is to reduce the number of deaths and injuries that occur when the driver of a motor vehicle does not have a clear and reasonably unobstructed view to the rear.

Crosscutting Theme: Visibility

- Rearward visibility offered by rearview mirrors and camera-based systems, **intended to support a driver's decision**-making during applicable driving maneuvers.



111 Translation Example

Current Text:

S3. Application

This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, school buses, motorcycles and low-speed vehicles.



111 Translation Example

S3. Application

This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, school buses, motorcycles and low-speed vehicles.

Option 1:

This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, school buses, motorcycles and low-speed vehicles **operated by a human driver**.

Option 2:

This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, school buses, motorcycles and low-speed vehicles **operated by a driver**.

Consideration/Challenge:

- Options are based on working assumption that this standard should be updated such that it is specific to human-driven vehicles.
- Options do not directly translate the standard for ADS-DV applications.



111 Translation Example

Current Options Approach:

Rear visibility devices, in this context, are intended to provide a human driver with a clear and reasonable rearward view to support driving-related decision-making.

- The human **driver's** capability to see what is behind them is limited by glass openings and ability to turn their head.
 - FMVSS 111 supports these limitations, ensuring that rearward views are provided to drivers through mirror and/or rear video performance requirements.



111 Translation Example

- ADS-DVs will instead rely on a variety of sensors to perceive the surrounding environment for system-based decision-making across all driving maneuvers, accounting for obstacles in all directions.
 - The field of view (FOV) covered by this standard may not be translatable based on expectations of an ADS-DV's **360**-degree perception capabilities. If a basic translation were applied, it would not provide the equivalent FMVSS 111 safety intent.

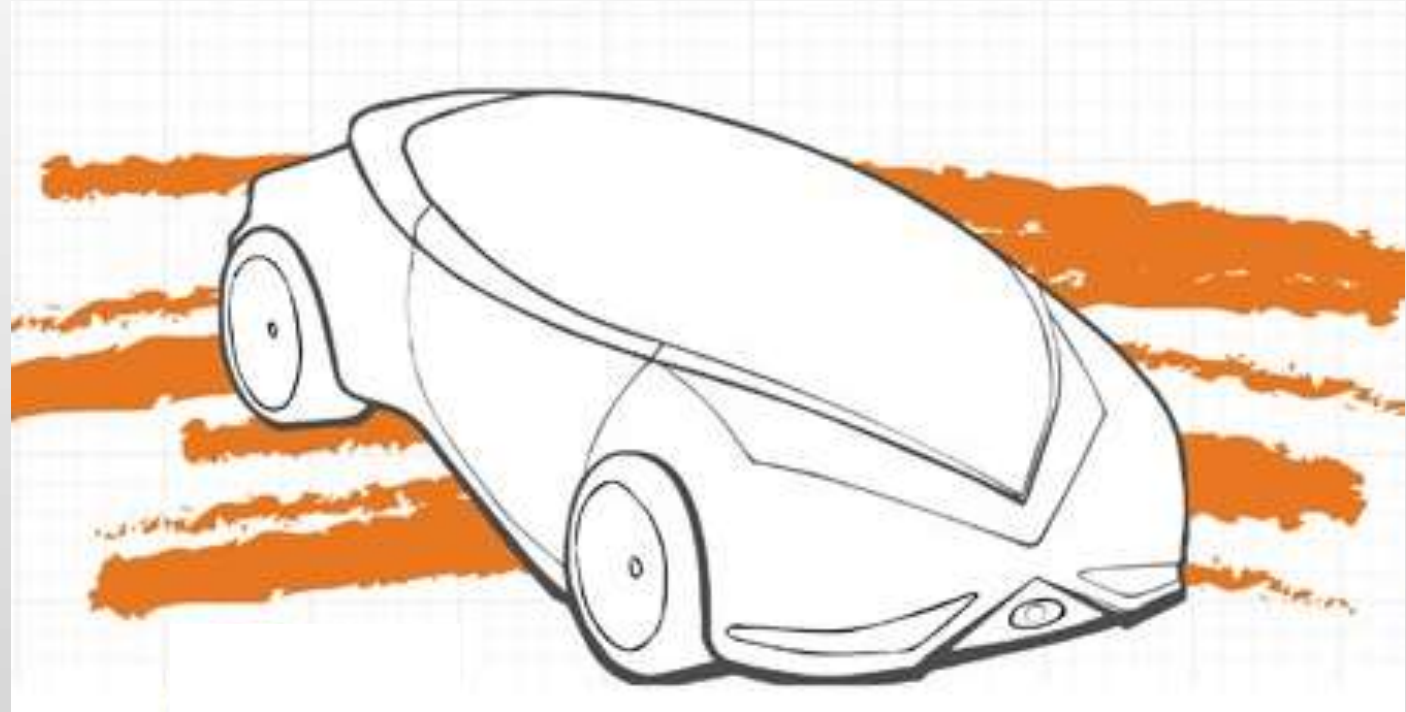
Additional Option Consideration:

A potential option may be to modify the current FOV requirements, expanding to **account for the visibility "required" by ADS-DVs**. Additional thought and discussion is welcomed. Current plans are to investigate further under phase 2.

Panel 4

Visibility

FMVSS 113 Hood Latch System Example





113 Translation Example

FMVSS 113 (S1): Purpose and Scope

This standard establishes the requirement for providing a hood latch system or hood latch systems.

Crosscutting Theme: Visibility

- FMVSS 113 sets latch requirements for the front hood opening that may **obstruct a driver's forward** view through the windshield.



113 Translation Example

Current Text:

A **front** opening hood which, in any open position, partially or completely obstructs a **driver's forward view** through the windshield must be provided with a second latch position on the hood latch system or with a second hood latch system.



113 Translation Example

Option 1:

For a vehicle operated by a human driver, a front opening hood which, in any open position, partially or completely obstructs a **driver's** forward view through the windshield must be provided with a second latch position on the hood latch system or with a second hood latch system.

For a vehicle operated by an ADS driver, a hood opening which, in any open position, partially or completely obstructs the **ADS'** perception system(s) in the forward travel direction must be provided with a second latch position on the hood latch system or with a second hood latch system.

Option 2:

Any front opening hood must be provided with a second latch position on the hood latch system or with a second hood latch system.

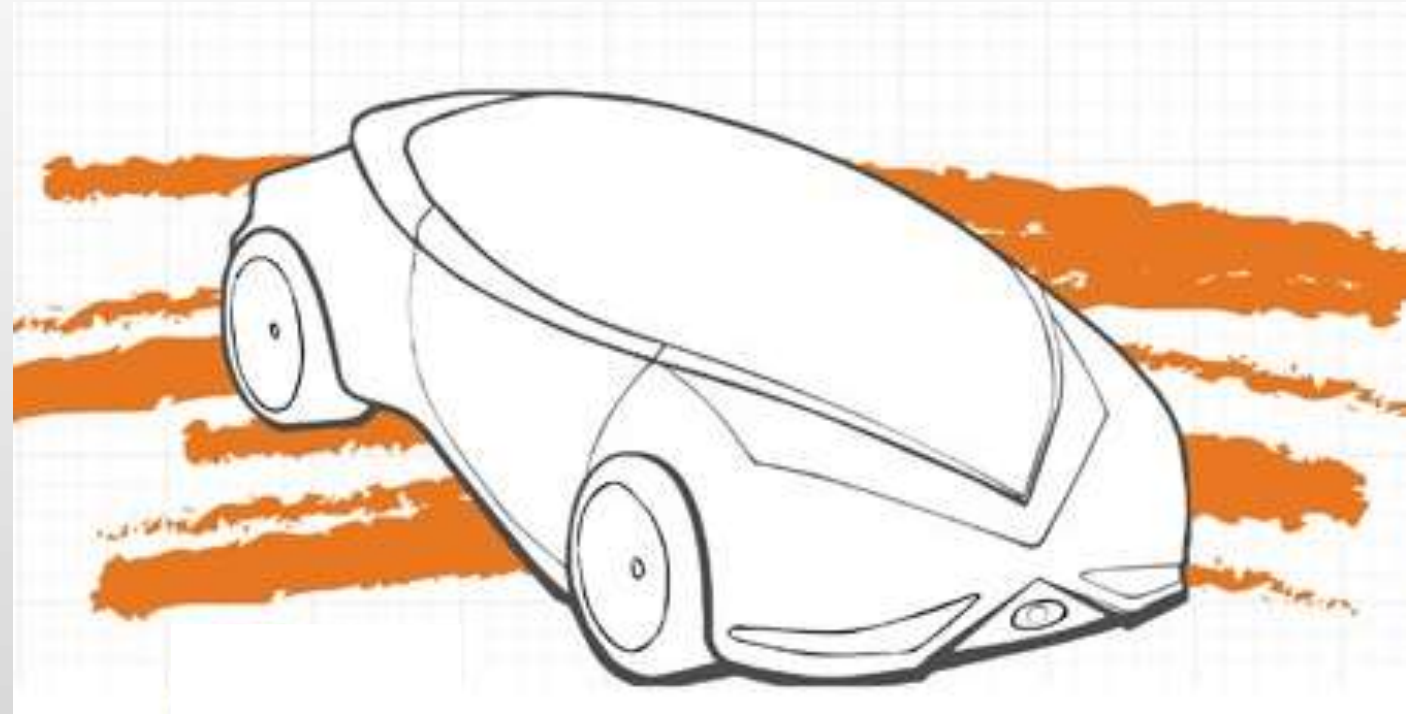


113 Translation Example

Considerations/Challenges:

- The hood obstructing the human **driver's** view through the windshield opening is translated to the hood obstructing the forward detection (view) of the ADS sensors, radar, LiDAR, etc.
- Perception systems and forward obstructions may need further definition.
- Common practice is to provide some type of secondary hood latches.
- It may be more straightforward to required the secondary latch for all front opening hoods.

**Thank You
for Your
Participation**



100-Series Breakout Sessions