As a follow-up to the 9th FRAV informal group meeting, FRAV stakeholders are kindly requested to comment on the discussion topics derived from the five starting points. During the session, FRAV agreed and the secretary was directed to prepare a single document to gather comments for further FRAV consideration.

The aim of the following table is to gather stakeholder views on the meaning or underlying safety goals related to and/or derived from the performance topics. Based on those views, the table further requests stakeholder views on criteria, metrics, and performance indicators that might be used to define safety requirements that can be measured and/or verified.

The following example for filling in the table illustrates the desired level of detail (it does not propose comments for stakeholder response). The "Interpretation/Goals" column should be used to comment on the performance topic and views on its significance to the development of safety requirements. The "Measurable/Verifiable Criteria" column should be used to suggest indicators or performance metrics for safety goals proposed under the "goals" column. The intention is not to request technical proposals for requirements, limits, or values. The aim is to identify factors that might be useful in defining measurable/verifiable requirements to ensure desirable safety outcomes.

Performance Topic	Interpretation/Goals	Measurable/Verifiable Criteria
The ADS should control the longitudinal and lateral motion of the vehicle.	• The ADS should smoothly execute maneuvers. • The ADS driving behavior should meet public expectations. • The vehicle movements should be safe. • The ADS driving behavior should not cause collisions or disrupt traffic. • This topic should not be considered. • This topic should focus on safety. • This topic should include the impact on other road users and traffic flows. • ….	• Relative speed and distance from a preceding vehicle should be sufficient to avoid a collision. • Relative speed and distance from a preceding vehicle should be consistent with safe human driving performance data. • Lane positioning should ensure a safe lateral distance from an adjacent vehicle (consistent with safe human driving performance data). • Lane changes should be smooth with lateral acceleration compatible with/comparable to safe human driving. • ….

Performance Topic	Interpretation/Goals	Measurable/Verifiable Criteria
(Derived from ADS should drive safely)		
The ADS should perform the entire Dynamic Driving Task.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria
The ADS should control the longitudinal and lateral motion of the vehicle.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria
	• The ADS should smoothly run in the traffic flow. • The ADS should not achieve non-comfort levels of longitudinal and lateral acceleration and longitudinal deceleration (except for the case of the emergency braking) • The correct determination of a vehicle speed should be confirmed.	• The performance of the service, secondary and parking brake systems without control action from a driver's side should be ensured (Annex 4 to the UN Regulation No. 13, including Appendix). • The performance of the ABS, including that on slippery roads and with uneven adhesion coefficient on the sides of a vehicle should be ensured (Annex 13 to the UN Regulation No. 13).

The ADS should recognize the ODD conditions and boundaries of the ODD of its feature(s).	• The ODD conditions and boundaries (measurable limits) should be established by the manufacturer.
	• The ODD conditions to be recognized by the ADS should include:
	    • Precipitation (rain, snow)
	    • Time of day (light intensity, including the case of the use of lighting devices)
	    • Visibility (visibility distance - at least 1.5 braking distance)
	    • Adhesion to the road surface
	    • Possibility of recognition of the road marking line
		• Whatever ODD conditions could be set by a manufacturer, the measurable criteria and their limits should be provided, in particular:
		    • The amount of precipitation (rain, snow);
		    • Light intensity;
		    • Visibility;
		    • Adhesion to the road surface.

The ADS should detect, recognize, classify, and prepare to respond to objects and events in the traffic environment.	• The objects, which the ADS should recognize, and at which distance:	• Stationary vehicle

		• Relatively short and narrow object, compared to the width of the traffic lane • Car, motorcycle, bicycle, pedestrian moving in the same direction • Car, motorcycle, bicycle, pedestrian moving in the transverse direction • Merging traffic • Vehicles cutting-in from the left and from the right • Road accidents
The ADS should respect traffic rules.	• Immediate stop in the case of a road accident • Giving way to special services vehicles • Giving way to pedestrians • Follow the traffic lights • Follow the gestures of the traffic controller • Use the lights including the emergency lights • Staring motion and maneuvering on the road • Keeping the lane • Maintaining the allowed speed • Overtaking, advancing, passing of oncoming traffic • Stopping • Crossing intersections (regulated and non-regulated) • Crossing railways • Moving in living areas • Giving priority to public transport • Use the audible warning sygnal	• The specified traffic scenarios include pass/fail criteria

The ADS should interact safely with other road users.	• The ADS should be identified in the traffic flow at the conditions, when:
	  ◦ the ADS is active;
	  ◦ the ADS is inactive;
		• The specific means for identification

	• a minimum risk maneuver (MRM) is performed; • an emergency maneuver (EM) is performed.	
The ADS should adapt its behavior in line with safety risks.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria
The ADS should adapt its behavior to the surrounding traffic conditions.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria
The ADS driving behavior should not disrupt the flow of traffic.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria
The ADS behavior should not be the critical factor in causation of a collision.	• The ADS should smoothly run through the specified traffic scenarios.	• The specified traffic scenarios include pass/fail criteria

Performance Topic	Interpretation/Goals	Measurable/Verifiable Criteria
(Derived from the ADS should interact safely with the user)		
General: The ADS should interact safely with the user	• What kinds of users are involved in an automated vehicle operation, their functions and expected performance (from SAE J3016: Conventional Driver (term 3.29.1.1), Remote Driver (term 3.29.1.2), Passenger (term 3.29.2), DDT Fallback-Ready User (term 3.29.3) and Driverless Operation Dispatcher (term 3.29.4))	• The information in the manufacturer's documentation • Verification of the correct interaction at the specific scenarios
New: The ADS should provide for specific measures allowing safe transportation of passengers (e.g., in a driverless shuttle)	• To provide stops in the places required by the route. • To provide opening the service doors at the bus stop and closing them before motion after a stop. • To provide audio messages to passengers about approaching a stop and start motion after a stop. • To provide a possibility for the emergency stop of a vehicle by passengers («emergency brake»). • To ensure passengers' comfort during normal acceleration and deceleration of a vehicle and its lateral acceleration at cornering. • To provide audible (sound) notification of passengers during emergency braking.	• The information in the manufacturer's documentation • Verification by testing

Activation of an ADS feature should only be possible when the conditions of its ODD have been met.	• The ODD conditions and boundaries (measurable limits) should be established by the manufacturer.
	• The ODD conditions to be recognized by the ADS should include:
	  • Precipitation (rain, snow)
	  • Time of day (light intensity, including the case of the use of lighting devices)
	  • Visibility (visibility distance - at least 1.5 braking distance)
	  • Adhesion to the road surface
		• Whatever ODD conditions could be set by a manufacturer, the measurable criteria and their limits should be provided, in particular:
		  • The amount of precipitation (rain, snow);
		  • Light intensity;
		  • Visibility;
		  • Adhesion to the road surface.

	• Possibility of recognition of the road marking line	
The ADS should signal when conditions indicate a probable ODD exit.	• A manufacturer should specify actions of the ADS after reaching the boundaries of the ODD (e.g., executing a minimum risk maneuver).	• The information in the manufacturer's documentation • Verification by testing
The user should be permitted to override the ADS to assume full control over the vehicle.	• A manufacturer should specify actions that allow deactivating an automated vehicle and/or the ADS by a person directly in the vehicle and a remote operator.	• The information in the manufacturer's documentation • Verification by testing
The ADS should safely manage transitions of control to the user.	• A manufacturer should set up the conditions and the process of transmitting the vehicle control from the ADS to the human user.	• The information in the manufacturer's documentation • Verification by testing
Prior to a transition of control to the user, the ADS should verify the availability of the user to assume control.	• A manufacturer should provide the means for detection of the availability of the user.	• The information in the manufacturer's documentation • Verification by testing
Pursuant to a transition, the ADS should verify full control of the vehicle by the user prior to deactivation.	• A manufacturer should provide the means for the confirmation by the user on taking control over the vehicle (e.g., a button or a command in the interface).	• The information in the manufacturer's documentation • Verification by testing
New: The ADS interface should enable interaction between the human user and the ADS.	• A manufacturer should provide the HMI allowing all required interactions between the human user and the ADS.	• The complete description of the HMI in the manufacturer's documentation.
The ADS should tolerate user input errors.	• The HMI should distinguish the unintentional actions by the user.	• The complete description of the HMI in the manufacturer's documentation.
The ADS should provide feedback to the user on its operational status.	• The HMI should provide the information for the user about the ADS operational status.	• The complete description of the HMI in the manufacturer's documentation.
The ADS should warn the user of failures to fulfill user roles and responsibilities.	• The HMI should provide the information for the user about the ADS failures	• The complete description of the HMI in the manufacturer's documentation.
The user should be provided with information regarding user roles and responsibilities for the safe use of the ADS.	• ADS operation modes in the ADS operation manual	• The information in the manufacturer's documentation

	• The user should be provided for the information on the peculiarities of the ADS and about the functions, which it performs.	
ADS vehicles that may operate without a user-in-charge should provide means for occupant communication with a remote operator.	• The presence end efficiency of the means for occupant communication with a remote operator	• Availability of the means for communications • Audio quality in the bilateral communications
Upon completion of an MRM, a user may be permitted to assume control of the vehicle.	• Availability of the control transfer mode from the ADS to the user after performing an MRM	• The information in the manufacturer's documentation

Performance Topic	Interpretation/Goals	Measurable/Verifiable Criteria
(Derived from the ADS should manage safety-critical situations)		
The ADS should recognize and respond to road-safety agents.	• Cannot interpret	•
The ADS should mitigate the effects of road hazards.	• Cannot interpret	•
The ADS should execute a safe fallback response as conditions warrant.	• A manufacturer should set up the conditions and the process of transmitting the vehicle control from the ADS to the human user. • In the absence of a fallback-ready user, the ADS should automatically achieve a Minimal Risk Condition (MRC).	• The information in the manufacturer's documentation • Verification by testing
In the absence of a fallback-ready user, the ADS should automatically achieve a Minimal Risk Condition (MRC). *	• In the absence of a fallback-ready user, the ADS should automatically achieve a Minimal Risk Condition (MRC).	• Verification by testing
The ADS should place the vehicle in an MRC in the event of a failed transition of full control to the user. *	• If the fallback-ready user did not take the full control over the vehicle (what does that mean?), the ADS should automatically achieve a Minimal Risk Condition (MRC).	• Verification by testing

The ADS should achieve a Minimal Risk Condition (MRC) prior to deactivation. *	• Specify the reasons for the ADS deactivation:
	   • Reaching ODD boundaries
	   • ADS failure not allowing performing the DDT
	   • Remote deactivation by the Driverless Operation Dispatcher
	   • Etc.
		• Verification by testing

The ADS should signal its intention to place the vehicle in an MRC. *	• Signal to other road users (The ADS should interact safely with other road users)	• The specific means for identification • The complete description of the HMI in the manufacturer's documentation.

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* These topics were modified from the original proposals in response to the 7th session discussion on minimal risk maneuvers.

	• Signal to the vehicle user (The HMI should inform the user about the ADS operational status)	
The ADS should safely manage short-duration ODD exits.	• If the ODD boundaries are set, the ADS may be allowed to operate outside the ODD boundaries for [X minutes] after which the MRC should be achieved.	• The information in the manufacturer's documentation
Pursuant to a collision, the ADS should stop the vehicle and deactivate.	• Pursuant to a collision, the ADS should stop the vehicle and deactivate	• The information in the manufacturer's documentation

Performance Topic	Interpretation/Goals	Measurable/Verifiable Criteria
(Derived from the ADS should safely manage failure modes)		
The ADS should detect system malfunctions and abnormalities.	• A manufacturer should provide the list of ADS malfunctions and abnormalities, which are detected by the ADS and the ADS responses on each item from the list • The ADS as a complex electronic system should be built in accordance with the safety concept implying the presence of design measures providing for the possibilities of switching to a backup control option or to using a backup control system that ensure the reliability of systems even in the event of damage to the electrical circuit. • The ADS should provide for self-diagnosis of faults in accordance with the prescribed list (e.g. battery discharging, wheel puncturing, etc.) with communication to the Driverless Operation Dispatcher followed the execution of the minimum risk maneuver, a safe vehicle stop and disembarkation of passengers.	• To reflect on that in the Manufacturer's ADS safety concept.
New: The ADS should be protected from an unauthorized access	• The measures ensuring protection form an unauthorized access should be provided.	• To reflect on that in the Manufacturer's ADS safety concept.
The ADS should execute a safe fallback response upon detection of a failure that compromises performance of the DDT.	• A manufacturer should set up the list of the ADS failures requiring safe fallback response.	• To reflect on that in the Manufacturer's ADS safety concept.
Provided a failure does not compromise ADS performance of the entire DDT, the ADS should respond safely to the presence of a fault in the system.	• A manufacturer should set up the list of the ADS faults, which would lead to its limited operation and specify the ODD for the limited operation including duration of such operation.	• To reflect on that in the Manufacturer's ADS safety concept.
The ADS should signal faults and resulting operational status.	• The HMI should provide the information for the user about the ADS operational faults.	• The complete description of the HMI in the manufacturer's documentation.

	• The HMI should provide the information for the user about the ADS operational status.	
(Derived from the ADS should maintain a safe operational state)		
General: The ADS should maintain a safe operational state	• A description of the checks allowing evaluating the serviceability and correctness of the operation of an ADS, including the functioning of the human-machine interface (HMI), during the periodic technical inspection shall be provided. Performing those checks shall not be costly or time-consuming. • The list of considerable system failures, description of failures and relevant actions by the automated vehicle shall be established.	• The information in the manufacturer's documentation
The ADS should be permanently disabled in the event of obsolescence.	• This topic should not be considered.	•
Pursuant to a collision and/or a failure detected in DDT-related functions, ADS activation should not be possible until the safe operational state of the ADS has been verified.	• The manufacturer should specify how the ADS detects collisions and failures in DDT-related functions, which would not allow the further ADS activation.	• The information in the manufacturer's documentation
The ADS should signal required system maintenance to the user.	• The ADS should provide for self-diagnosis of faults in accordance with the prescribed list (e.g. battery discharging, wheel puncturing, etc.) with communication to the Driverless Operation Dispatcher followed the execution of the minimum risk maneuver, a safe vehicle stop and disembarkation of passengers.	• The information in the manufacturer's documentation
The ADS should be accessible for the purposes of maintenance and repair to authorized persons.	• The manufacturer should provide the information for the ADS maintenance and repair.	• The information in the manufacturer's documentation
ADS safety should be ensured in the event of discontinued production/support/maintenance.	• The manufacturer should ensure the ADS correct operation until the end of its service life or its failure that could not be fixed.	• To reflect on that in the Manufacturer's ADS safety concept