Report of the Eighth Meeting of the Informal Working Group on Functional Requirements for Automated Vehicles (IWG FRAV)	
Venue	Web conference
Date	8 December 2020
Documents	Submissions for the session can be found on the FRAV-08 UNECE wiki page.
Status: Draft	

Agenda and previous session report adopted.	With the US co-chair presiding, FRAV adopted the draft agenda (FRAV-08-01-Rev.1) without change. FRAV adopted the report of the 6th session (FRAV-06-02) without revision and agreed to consider adoption of the report of the 7th session (FRAV-07-02) during its next session.
FRAV reviewed the group's status and consensus to date.	On behalf of the FRAV co-chairs (China, Germany, USA), the presiding co-chair presented a review of the FRAV working consensus to date (FRAV-08-03). Per the standing FRAV practice, stakeholders were invited to inform the secretary of any questions or disagreements with the listed points of consensus.
FRAV discussed a guiding principle for overall ADS safety.	Based on a proposal from Japan, FRAV discussed the establishment of a guiding principle for ADS safety. The purpose of the principle is to agree on the overall level of safety to be achieved by ADS to guide work on safety requirements. During the previous four sessions, FRAV had been discussing in increasing detail four general approaches to defining ADS safety: • Careful and competent human-driver models • ADS technology state-of-the-art • Safety envelope formulas • Statistical positive risk balance The co-chairs provided an initial proposal based upon the stakeholder discussions through the 7th session. The proposal was based on previously agreed aspects of ADS deployment: • ADS will be deployed into human-dominated traffic. • ADS will be used by humans. • Human error is the critical factor in more than 90% of crashes. • ADS use should not be a critical factor in causing crashes. These baselines suggest that ADS behavior should be consistent with human road-user expectations. The ADS behavior should be reassuring to vehicle users and consistent with their expectations. ADS human-machine interfaces should be designed for ease-of-use and to prevent misuse. ADS inherently omit many (but not all) of the human errors known to cause collisions such as distraction, fatigue, or intoxication. At the same time, ADS introduce a new element into driving that should be carefully considered to avoid introducing new risks. From this line of thought, the co-chairs offered the following guiding principle: ADS performance should be consistent with human driving behaviors while avoiding human recognition, decision, and performance errors and the introduction of new risks.

Stakeholders supported changes to highlight emphasis on safe driving behaviors and ADS-specific safety needs.	The expert from the UK agreed with the principle but proposed that the reference to human-driving behaviors should be clarified to stress a focus on positive human behaviors. The expert from the US agreed and proposed to use "safe human driving behaviors". The UK expert also noted that "errors" might be interpreted as an absolute "black or white" element where the safety level should capture behaviors that might not cause a collision but nonetheless degrade road safety. The OICA expert suggested that the phrase "introduction of new risks" should be focused to address unreasonable risks specific to the introduction of ADS technologies. The expert from SAE requested clarification on the interpretation of behavior being "consistent" with human driving. The expert preferred interpreting "consistent" to mean compatible rather than seeking normative specifications. The presiding co-chair and the secretary confirmed the intent that ADS driving behavior should be compatible with typical behaviors of safe human driving.
FRAV noted that commonality across user interfaces should be considered.	The expert from the Netherlands supported the guiding principle and stressed the need for harmonization across user interfaces to ensure correct use and avoid learning curves detrimental to safety. OICA agreed that a certain level of harmonization is beneficial such as in UN R121 on controls and telltales but cautioned prudence to avoid hindering innovation. Manufacturers operate under industry and legal standards that require attention to misuse risks, including SOTIF processes. The expert from Leeds University agreed, noting that the EU GEAR 2030 Final Report[1] used the term "commonality" to suggest a level of uniformity to meet safety needs while allowing reasonable flexibility in designs. The expert pointed to the level of uniformity maintained across vehicle controls and dashboards as a long-standing practice.
FRAV noted a need for data on human driving, crash causation, and ADS capabilities to define and justify safety requirements to fulfill the guiding principle.	FRAV considered the implications of this principle on its work. The principle suggests human performance as an outer boundary or general threshold for ADS performance to ensure behavior consistent with public and road-user expectations. ADS technologies address a range of known causes of crashes and outperform humans in certain instances. In this regard, within the envelope of safe human driving, ADS strengths may be leveraged. Information on typical human driving behavior, crash causation, and ADS capabilities would support the development of safety requirements that collectively improve road safety while avoiding undesirable consequences. The expert from Japan stated that the proposal was consistent with its concepts and data, including research identifying human errors as the primary factor in 97% of crashes. Therefore, Japan supported the proposal. The expert from OICA agreed that the principle is useful to frame initial discussions, especially in capturing the value of the various approaches to determining safety; however, the OICA expert expressed concern over a possible interpretation that ADS performance limits would necessarily be significantly more restrictive than human driving known to be safe. The expert noted that human drivers and ADS have differing strengths, such as the human capability to make logical inferences and the ADS capability to continuously monitor a wider range of the road environment.

[1] https://ec.europa.eu/docsroom/documents/26081/attachments/1/translations/en/renditions/native

FRAV was informed on WP.29 discussions concerning updates to the AV Framework Document and development of UN R157 on ALKS.	The presiding co-chair informed FRAV of discussions at the WP.29 (AC.2) level to consider updates to the AV Framework Document. The special GRVA session scheduled for 14-16 December is expected to include discussion of FRAV deliverables. FRAV should provide additional information on topics to be considered under the five starting points to inform these discussions. The presiding co-chair also noted interest in pursuing a second-phase development of the recently adopted UN Regulation on Automated Lane-Keeping Systems (UN R157). The co-chair noted the relevance of FRAV's work to the ALKS deliberations but reminded stakeholders of FRAV's mandate to develop provisions useful globally (i.e., across the 1998 and 1958 Agreements). The German co-chair who also serves as the chair of GRVA confirmed the intention to discuss the FRAV and VMAD work as well as further development of the ALKS regulation.
Japan presented comments on the initial list of ADS safety starting point sub-elements.	The presiding co-chair invited Japan to present its document FRAV-07-08, commenting on documents FRAV-06-04 and FRAV-06-11 regarding elaboration of the five starting points for development of ADS safety requirements. Japan proposed several changes the proposed sub-elements under the agreed starting points and raised concerns over the meaning of "foreseeable", the reference to "scenarios" (viewed as a validation tool for assessing fulfillment of safety requirements), and insufficient attention to transfers of control.
FRAV confirmed the use of "should" in draft provisions until the group reaches agreement on text expressing a requirement (i.e., using "shall").	The expert from Japan noted the use of "should" and "shall" in the proposed safety items. The secretary clarified that FRAV uses conditional grammar such as "should" to avoid premature interpretation of proposals as defined requirements. FRAV is presently considering recommendations for safety requirements, not specifying requirements. The expert from China noted that this practice was consistent with ISO/IEC Directives, Part 2, 2016 (Principles and rules for the structure and drafting of ISO and IEC documents), section 7 (Verbal forms for expressions of provisions). "Shall" expresses a requirement, "should" expresses a recommendation, "may" expresses a permission, "can" expresses a possibility or capacity, and "must" expresses an external constraint.
Japan proposed to focus on Level 3 ADS with Level 4 ADS postponed to a later phase. *FRAV confirmed its goal to address all ADS while acknowledging practical needs to differentiate levels in some instances and/or to prioritize work.*	Japan proposed to organize FRAV's work in two phases where the first phase would address Level 3 systems and a second phase would address Level 4 (i.e., driverless vehicles). The expert from OICA noted previous agreement based on the FRAV terms of reference to address all ADS regardless of vehicle type or level of automation. Therefore, the expert had reservations regarding the proposal to split work between Level 3 and Level 4 systems. The expert from Japan agreed with the OICA expert on FRAV's mandate but suggested that Level 3 systems may provide a good starting point because these systems and their uses are better understood. FRAV could expand its considerations to higher level systems later in the discussions. The expert from SAE believed that it will be necessary at some point to distinguish between levels of automation given the different roles of the users. Initially considering vehicles with human occupants using the ADS may be useful. OICA reiterated its reservation over structuring the work by level of automation. FRAV agreed to pursue a top-down approach and should be able to address aspects specific to a particular automation level or use case as the work progresses.

Russia presented comments on the 142 safety candidates list.	The presiding co-chair invited expert from the Russian Federation to explain the input regarding the categorization of the 142 candidate proposals for requirements (FRAV-08-06). Russia proposed the reclassification of certain items as "green" to ensure their discussion.
The Netherlands noted concerns to ensure correct user understanding of ADS.	The presiding co-chair invited the expert from the Netherlands to present its document FRAV-08-07 commenting on FRAV-06-04. The expert stressed interest in integrating the concept of user "mental models" as explained during the 7th session and to promote harmonized interfaces to facilitate correct use of ADS regardless of the vehicle. Use of different ADS vehicles should not involve retraining the user on correct operation for each ADS.
FRAV considered a co-chair proposal for 38 safety topics to be addressed in future sessions.	The presiding co-chair noted the dense meeting schedule generated by the various groups in which FRAV stakeholders participate. The relatively short periods in between FRAV sessions combined with these other obligations appear to limit the ability of stakeholders to consider and respond to FRAV proposals. In addition, FRAV had generated multiple documents, including the work on the 142 candidate requirements and FRAV-06-04 based on the OICA/CLEPA effort to align its review of national/regional guidelines with the five starting points. The co-chairs had concerns about FRAV losing its focus, making it difficult to reach consensus decisions. For these reasons, the co-chairs prepared FRAV-08-09 proposing a breakdown of FRAV discussion topics to guide further work. The 38 topics were derived from the 142 candidates for safety requirements generated by FRAV stakeholders (FRAV-03-07), FRAV-06-04, and other input from previous sessions. An appendix to FRAV-08-09 detailed the basis for deriving the topics. The document aims to consolidate a list of topics raised through the 7th session categorized under the five agreed starting points. FRAV accepted the leadership proposal to consider these topics individually during future sessions and to consolidate outcomes in Document 5.
FRAV agreed that MRM/MRC are possible responses that should be discussed within the context of other safety requirements.	FRAV recalled comments received during the 7th session regarding discussions on Minimal Risk Maneuvers (MRM) and Minimal Risk Conditions (MRC). Under the earlier discussions, MRM and MRC were considered responses to safety-critical situations; however, the expert from SAE noted that these could be responses to other conditions and seemed to blur the focus of the safety-critical situations on events requiring an emergency response by the ADS. The expert from SAE clarified that an MRC is an outcome achieved in response to certain types of failures or ODD exits. The expert cautioned against equating a crash-avoidance (emergency) maneuvers in response to actions of other road users with achieving an MRC through an MRM. An MRC may need to be achieved in response to certain failures or ODD exits. Singling out MRM as a separate subject seems to be a distraction from the more important question of addressing MRC. SAE has been holding discussions debating whether a specific action or procedure that can be called an MRM exists and/or whether the focus should rather be on understanding conditions where it is necessary to achieve an MRC. The discussions include consideration of failure mitigation strategies that may not necessarily result in an MRC. Therefore, consideration of MRM/MRC as a separate topic from discussions of failure mitigation and ODD exits does not seem suitable. FRAV agreed that MRM/MRC would not be a stand-alone topic. FRAV will address MRM/MRC based on identification of items where an automated ADS fallback response may be warranted.

	The secretary informed FRAV of changes to Document 5. As agreed during the 7th session, Document 5 has been split into two documents. Henceforth, FRAV will maintain a Document 4 providing a record of FRAV decisions and justifications. Document 5 will provide the working document recording interim proposals and consensus. Pursuant to the 7th session, Document 5 was updated with additional proposals for definitions of DDT, various users, transition of control, MRM, and MRC. Explanations of the scope of the five starting points have also been added.
JRC highlighted "roadmanship", external HMI, systems-theoretic safety models, and lifetime safety, including end-of-life provisions as areas of interest.	The presiding co-chair invited the experts from JRC to present their comments on ADS safety requirements and definitions (FRAV-08-08). The presentation contained two sections: a) safety requirements and terms, and b) ADS impact on traffic flows and human driver behaviors. JRC highlighted the importance of safe ADS interactions with other road users and ADS safety through the vehicle lifetime. JRC suggested that the "drive safely" starting point consider "roadmanship" and nominal driving.[2] As noted in the guiding principle discussion, ADS vehicles will be deployed into a human-dominated environment with unwritten codes of "good driving" behavior. JRC wondered whether, in addition to performance requirements, some form of behavioral assessment (such as a scoring system) might be useful. JRC echoed Japan's comments about the need to ensure safe ADS interactions with other road users in addition to safe interactions with the user of the ADS. JRC views these external interactions as an issue of human-machine interfaces and did not see a need to separate ADS user interactions from external interactions with humans outside the vehicle. Nonetheless, JRC accepted separating the two aspects of human interactions as proposed under the starting points since this approach would ensure attention to both aspects. JRC commented on the concept of "foreseeable", suggesting the use of multiple approaches, including data from real-world events and System-Theoretic Process Analysis (STPA) of such events.[3] JRC recalled a presentation by SAFE regarding its Coverage-Driven Verification (CDV) method to measure and quantify the maturity of complex hardware and software systems through scenario analysis.[4] JRC proposed an additional safety topic under maintenance of a safe operational state throughout the life of the vehicle to address end-of-vehicle-life issues such as handling of vehicle data or permanent deactivation. The requirements should address issues such as end of production, discontinuation of support, and inability to maintain an ADS (i.e., obsolescence).

[2] "Roadmanship" dates back to the early days of motorization and refers to driving etiquette and attentiveness to the safety and interests of others in the road environment.
[3] STPA is a hazard-analysis technique under the Systems-Theoretic Accident Model and Processes (STAMP) methodology. STAMP analyzes accidents as a system-control problem. In this concept, accidents occur when external disturbances, component failures, or dysfunctional interactions among system components result from inadequate control or enforcement of safety-related constraints. Safety is managed by a control structure embedded in an adaptive socio-technical system. (See Nancy Leveson, A new accident model for engineering safer systems, Safety Science, Volume 42, Issue 4, 2004, Pages 237-270).
[4] Document VMAD-05-04.

JRC raised FRAV awareness of potential disparities in the interpretation of terms and concepts under ISO 26262	JRC reviewed ADS concepts and definitions based on ISO 26262 (Road vehicles – Functional safety) to raise awareness of potential differences in terminology. While noting that ISO 26262 does not explicitly define "function" and "feature", the standard uses language that suggests a use of the terms that differs from FRAV's approach.[5] ISO 26262 refers to a safety function as a high-level purpose where a safety feature performs a safety function. This definition would include the collection of equipment that provides services such as cooling, lubrication and energy supply required by the protection system and the safety actuation systems. Consequently, ADS safety would extend beyond the ADS to include dependencies on systems, subsystems, and/or features outside the ADS. A feature might be the last item in a chain of safety functions. JRC provided definitions (ODD, safety function, fundamental safety function, and safety feature) derived from its understanding of ISO 26262 and diagrams for function-feature hierarchies to illustrate its points. The expert from OICA noted that Functional Safety and SOTIF standards provide generic methods to address hazards and risks, but do not look at specific functionalities. The FRAV terminology and definitions had been agreed based on ADS-specific intents, including to avoid unnecessary or detrimental design restrictions. The definitions enable FRAV to easily filter down to specific requirements. The expert from the Netherlands supported alignment with existing standards but did not see a need to change the current FRAV definitions. The expert from SAE confirmed that the FRAV definitions were consistent with the J3016 recommended taxonomy and definitions. The presiding co-chair noted the previous considerations that enabled FRAV to reach consensus on the current definitions and understanding of an ADS. The overall aims seemed consistent, but FRAV appreciated JRC bringing possible risks of misinterpretation to the attention of the group.
JRC provided information on its research into traffic flows and driving automation.	In the second part of the presentation, JRC focused on traffic flows and the potential for ADS specifications to result in traffic disturbances. In particular, the expert explained widely used formulas describing road capacities and traffic flows as a function of traffic densities. JRC illustrated that current ALKS and other ADAS specifications result in performance close to human-dominated traffic patterns under some traffic densities but result in large deviations under other densities. At low densities, Adaptive Cruise Control systems perform well even though the maximum point where traffic flow begins to degrade in terms of vehicles per hour is about 10% lower than what is observed in real-world traffic. At the lower speeds defined under UN R157, the specifications for automated lane-keeping systems would produce significantly better traffic flow. However, at lower densities (i.e., higher speeds in free-flowing traffic), the specifications of proposed amendments to UN R157 suggest traffic flows in terms of vehicles per hour that are about half the flow of real-world traffic. JRC noted that ADS driving behaviors inconsistent with observed traffic patterns could result in human drivers changing their behaviors in ways that could increase safety risks. JRC referred FRAV to its previous presentation on string stability (FRAV-06-13) for additional information.

[5] FRAV has defined a feature as an application of ADS technologies for use within a defined ODD where the feature relies on the ADS functions to perform the DDT.

JRC recommended to consider ADS impact on traffic flows and on human-driver responses in addressing safety requirements.	Based on its analysis of traffic flows, JRC recommended that FRAV balance safety considerations and impact of ADS use on traffic flows (including impact on human-dominated traffic patterns and behaviors): • Take into account traffic-related requirements (e.g. ensure vehicles' string stability) • Focus on performance rather than behavioral/operational requirements • Set performance levels in a transparent way so that both impact on safety and impact on traffic can be assessed • Use basic traffic theory to make simple considerations on potential traffic impacts (e.g. impact on motorway capacity) JRC supported the FRAV guiding principle on the overall level of ADS safety as consistent with the need to consider safety within the context of traffic behaviors observed in safe human driving. The co-chair from Germany agreed that FRAV should further consider this aspect of ADS performance but suspected some difficulty in defining performance specifications that avoided design restrictions. The co-chair posited that artificial intelligence and machine-learning programs might provide insights. In any case, the co-chair urged careful consideration in deciding ways to address the issues raised by the JRC research.
FRAV will hold its next session on 12 January.	FRAV noted its next session scheduled for 12 January and requested stakeholders to submit any comments on the ADS level-of-safety principle and on the updated Document 5 (FRAV-07-05). The secretary committed to providing an updated Document 5 (FRAV-08-05) to reflect the discussions by December 18. During the next FRAV session, FRAV agreed to seek consensus on the level-of-safety principle and to focus on its initial consideration of the safety topics identified under the "ADS should drive safety" starting point.