Report of the Seventh Meeting of the Informal Working Group on Functional Requirements for Automated Vehicles (IWG FRAV)	
Venue	Web conference
Date	17 November 2020
Documents	Submissions for the session can be found on the FRAV-07 UNECE wiki page.
Status: Draft	

Agenda and previous session report adopted.	With the US co-chair presiding, FRAV adopted the draft agenda (FRAV-07-01-Rev.2) without change. FRAV adopted the report of the 5th session (FRAV-05-02) without revision and provisionally adopted the draft report of the previous session (FRAV-06-02). Adoption of the 6th session report will be confirmed during the 8th session to allow additional time for any comments.
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-06-03). Per the standing FRAV practice, stakeholders were invited to inform the secretary of any questions or disagreements with the listed points of consensus.
FRAV agreed to separate the background section of Document 5 into a new Document 4 tracking tool.	FRAV discussed comments on the group's tracking tool, Document 5 (FRAV-06-05). Per a proposal from Germany, FRAV agreed to separate the background section of Document 5 into a separate document (document reference "-04" will be reserved for this purpose). Henceforth, "Document 4" will track FRAV discussions and outcomes while Document 5 provides the current working text under discussion. Therefore, Document 4 will provide the context and justifications that enable fuller understanding of the provisions in Document 5.
FRAV agreed to revise the background section to better reflect Japan's input the overall level of ADS safety during the 4th session.	FRAV agreed to revise paragraph 1.14.2. in the Background section of FRAV-06-05 to remove a concern over interpretation. FRAV is focused on defining safety requirements for ADS, not methods used to assess ADS safety. FRAV agreed to convey this point by noting that terms like "safety requirements" or "performance requirements" refer to functional requirements and operational requirements for ADS performance. FRAV agreed to revise paragraph 1.14.4. to better reflect the intentions of Japan's proposal regarding the overall level of safety to be achieved by ADS during the 4th session. FRAV agreed to consider modified text to be agreed with Japan in the next iteration of the text (to be presented in document FRAV-07-04). FRAV similarly agreed to modify paragraph 1.15.3. regarding Japan's proposal to consider the baseline methods in terms of their suitability to achieve six goals (road transport improvement; measurable, performance-based and technology-neutral requirements; alignment with social expectations, and feasible).
FRAV noted a need to further consider the different methods for determining ADS performance limits.	JRC noted its view that a statistically positive risk balance can be achieved by a combination of the proposed methods (careful and competent human driver, state-of-the-art feasibility, safety envelope models). CLEPA noted that the statistical approach can also be used independently as a benchmark for assessing ADS performance. SAE noted that the three methods would eventually need to be clarified to understand whether they address scenario-based evaluations or aggregate benchmarks for performance.

The ETSC stated that ADS performance limited to "better than a human driver" is insufficient.	The expert from ETSC stated his view that ADS performance better than a human driver would be insufficient. ETSC expects huge safety improvements from ADAS and would expect even more from ADS. As an ADS transforms the vehicle driver into a passenger, the ADS user would view the ADS as a public transport provider with the same level of safety expected from public transport services (e.g., train, aircraft). This level would be an order of magnitude higher than a human driver.
FRAV simplified the ADS feature definition.	FRAV agreed to simplify the definition of ADS feature to remove the reference to "hardware and software". The ADS definition includes the reference to hardware and software such that the definition of a feature as an ADS application is understood to refer to the ADS hardware and software.
FRAV confirmed that a feature is defined by the ODD as determined by the manufacturer. FRAV does not intend to define discrete sets of ODD conditions as a means to prescribe terms for individual features.	FRAV noted that the definition of ADS feature refers to ODD and vice versa. A concern was raised that the definitions might be circular. The secretary explained that the definitions were not strictly circular in the sense of each definition defining the other. A feature is an ADS application. An ODD is a set of operating conditions. Nonetheless, the two concepts are intertwined because a feature is circumscribed by an ODD and FRAV uses the ODD description specifically to understand the operating conditions the feature. Pending further interest, FRAV did not change the cross-references. The expert from the Netherlands raised a concern that the definitions might incorrectly imply that an ODD is defined and then a feature is defined with respect to the prescribed ODD. The secretary confirmed that the definitions should be interpreted as meaning that a feature is defined by its intended uses and limitations on its uses as described by its ODD. FRAV intends to define possible ODD conditions and would require the manufacturer to explain the relevance of each ODD condition to the ADS. If the ADS is designed to operate in more than one distinct set of ODD conditions, the term "feature" provides a means to distinguish these different ODD-specific uses of the ADS. The ADS can then be assessed in terms of these features intended for use under unique sets of conditions.
FRAV discussed a definition for Dynamic Driving Task (DDT).	FRAV agreed to use the term Dynamic Driving Task based on the definition of DDT provided in SAE J3016. A simplified definition of DDT proposed under FRAV-06-05 was modified to follow the J3016 use of "tactical and operational functions". Several stakeholders requested clarification of the differences between "tactical" and "operational" functions. SAE noted that J3016 provides additional information. FRAV requested reflection of the full SAE text in Document 5 for further consideration.

FRAV discussed a generic definition of an ADS "user" along with definitions for different types of users.	FRAV considered starting points for defining a "user" generically and for distinguishing between different types of user. The proposed definitions were based on the UK concept of a "user-in-charge" and the various roles of users described in SAE J3016. FRAV considered the following definitions: • *"ADS vehicle"* means a vehicle equipped with an ADS. • "User" means a human being responsible for the ADS vehicle who is qualified, fit, and capable of performing the DDT. • "User-in-charge" means a user in or with a line of sight to the vehicle. • "Remote operator" means a user other than a user-in-charge. The "user" definition includes the following concepts: • A user is a human being (to avoid confusion with legal definitions of "person" that may extend to other entities. • The user is responsible for other vehicle-use obligations as may be required under law (reporting traffic incidents, securing children in the vehicle, etc.). • The user must be qualified (i.e., authorized to operate a vehicle). • The user must be fit at the time of operation (e.g., not otherwise unable to drive or intoxicated). • The user has means to assume control of the DDT. The "user-in-charge" and "remote operator" definitions provide further classes of user, respectively, a user in or within sight of the vehicle and a user without direct access to in-vehicle controls but nonetheless with a means to control the DDT at a distance beyond the line of sight. Stakeholders suggested possible additions to the classes of users and possibly separating a user in the vehicle and a user with a line of sight to the vehicle. Stakeholders recognized that roles may change during a trip. A user may not initially have a line of sight to a vehicle (e.g., while the ADS drives the vehicle from a remote parking location to the user) where she or he would only meet the "user-in-charge" definition after the ADS vehicles comes into the line of sight.
FRAV agreed with the definitions as a basis for further work but expects a need for additional definitions to cover specific types of ADS vehicle users.	The expert from SAE noted the absence of a definition for a passenger. J3016 defines a passenger as a user with no role in the operation of the vehicle. A passenger may change position or be accorded a means to move or guide the vehicle by a supervisor of some kind. SAE suggested to consider the definition of "user" to include other users of the vehicle besides the ADS user. SAE noted that a user could be limited to strategic functions such as selecting a destination and/or a user unfit to perform the DDT. SAE also noted that J3016 has a definition for "remote driver". SAE has been discussing distinctions between remote driving and remote assistance. The expert from the UK viewed remote operation as involving a different legal framework from that applied to the user-in-charge, necessitating a distinction between users. The UK also distinguishes between a remote user qualified to operate the vehicle and a remote operator fulfilling a supervisory/assistance role without DDT control. Germany agreed the further breakdown of definitions would be useful to improve understanding and interpretation of terms but supported the initial proposals. FRAV agreed that the proposed definitions provided a basis for further elaborating users roles that may need to be defined with respect to eventual performance requirements.

FRAV discussed the concept of "foreseeable" as used in the phrase "An ADS should not cause collisions that are foreseeable and preventable".	Pursuant to comments from Germany during the 6th session, FRAV discussed the term "foreseeable" ("foreseeable by whom or what?"). The FRAV leadership noted that ODD conditions as defined in ADS descriptions and the VMAD scenarios would be foreseeable (while acknowledging the current absence of details and presence of open issues regarding these two tools). The leadership suggested that "foreseeable" might be clarified by reference to ODD conditions and the VMAD Scenario Catalogue such as "the ADS driving response to a scenario and/or ODD condition should not cause a collision". In the absence of a body of ODD element definitions and scenarios, the general idea is only that the ODD conditions and the Catalogue might eventually provide satisfactory coverage. Whether this idea holds true could only be assessed after FRAV has defined ODD conditions and VMAD has defined contents for the Catalogue. The presiding co-chair noted that neither FRAV nor (to his understanding) VMAD has defined what is foreseeable. The aim of the suggestion is to generate discussion and gather views in response to Germany's original question.
Germany sees "foreseeability" as related to ADS technological capabilities to detect and respond to conditions.	The expert from BASt did not view the suggestion as answering the question of "foreseeable by whom?" He asked if a situation is not in the Scenario Catalogue, would that mean that it was not "foreseeable". The expert did not see the relationship as VMAD defining scenarios for which FRAV defines performance requirements. The expert viewed foreseeability as involving the sensors and other technologies used by the ADS and their capacity to navigate traffic conditions. Given the complexity of this subject, he suggested that FRAV devote time at a future session for a detailed discussion.
Japan views "foreseeability" as a matter of law decided by courts (e.g., product liability).	The expert from NTSEL agreed that "foreseeable by whom" is an important question. Japan sees foreseeability as involving public perceptions of what the manufacturer of an ADS can reasonably be expected to foresee. Courts (such as in product liability cases) normally reach decisions on whether outcomes were foreseeable. NTSEL believes that ADS would be judged in this manner. These decisions are based on whether a collision is considered reasonably foreseeable (i.e., that a person or the public can reasonably expect the ADS to avoid a collision under the given conditions). Foreseeability would therefore be judged in courts on a case-by-case basis to provide a body of law defining "foreseeable" (as has been the case for other products).
FRAV noted the work under VMAD to define scenarios for foreseeable traffic situations.	The expert from CLEPA noted that VMAD does have ongoing work related to scenarios and determining what is foreseeable. VMAD is also looking at tools manufacturers might use to define scenarios that are representative of conditions and situations that may be encountered in real-world driving. CLEPA viewed this work as exclusive to VMAD. The presiding co-chair acknowledge this view but expected that overlaps between FRAV and VMAD activities will likely be unavoidable as the groups move deeper into their work. The co-chair directed the secretary to reflect the discussions in the session report for further consideration at future FRAV sessions.

FRAV discussed the categorization of the 142 candidate statements on ADS safety requirements and the further classification prepared by OICA/CLEPA.	FRAV considered the elaboration of its five starting points for ADS safety requirements. The secretary noted the work of MLIT to categorize the raw list of 142 candidate requirements gathered in January under the five points (FRAV-06-07). The expert from Japan explained that its effort to analyze the 142 candidates required more time to complete. The expert suggested that further work was needed to properly understand the 142 candidates and their relationships to the five starting points. Japan hoped to provide further input at the next session. The secretary further noted the administrative exercise from OICA/CLEPA (FRAV-05-06) to list items taken from the various Contracting Party guidelines and other documents under the starting points (transposed into an FRAV base document FRAV-06-04). On behalf of OICA and CLEPA, the expert from CLEPA presented an analysis of the MLIT categorization to further classify the candidates (FRAV-07-09). This document noted items that were included in document FRAV-06-04 (green), items that appeared repetitive or covered by the “green” items (yellow), and items that were either not considered under the sources assessed for the administrative exercise or considered not applicable to FRAV’s mandate (red). The expert requested that stakeholders review the classifications to suggest whether items in red should be changed and offer any additional comments. The aim would be to revise FRAV-06-04 to ensure coverage of the candidates of interest. The expert stressed the importance of transparency in deciding which items to include and the reasons for their inclusion.
The FRAV secretary request further input to support consensus.	The secretary suggested that FRAV stakeholders respond to the OICA/CLEPA request. The aim would be to identify any items that should be classified as “green” meaning that the items should be added in a revision of document FRAV-06-04 for consideration at the next session. In addition, given that the MLIT categorizations note overlaps across the starting points for many of the candidates, FRAV should seek to refine the items for precision.

The secretary presented hypothetical examples of safety descriptions to clarify the scope of the five starting points for safety requirements.	In response to questions raised prior to the session, the FRAV secretary reviewed the intentions of the five starting points. The secretary provided examples of the issues that might be addressed under each starting point to clarify their meaning. "The ADS should drive safely" refers to the performance of the ADS as the driver of the vehicle. This starting point should address performance that is under the control of a driver, such as respecting traffic rules, signaling intentions to other road users, and adapting its driving behavior to traffic conditions. "The ADS should interact safely with the user" refers to the cooperation between the ADS and its user necessary to ensure safe and correct use of the ADS. This starting point should address areas such as communications between the ADS and the user, user inputs and responses, misuse prevention, conditions for activating the ADS, and ensuring safe transitions of control from the ADS to the user. "The ADS should manage safety-critical situations" addresses situations that may arise outside the control of the ADS as the driver. This starting point is intended to address areas such as Minimal Risk Maneuvers (MRM), responses to unusual actions by other road users, collision events, and safety-critical conditions that may arise or failures of a user to respond correctly to transition demands. "The ADS should safely manage failure modes" refers to failures in the system itself. The concerns might include malfunctions or damage to equipment. This starting point would likely distinguish between failures that prevent the ADS from performing the DDT and failures that might, given the ADS design, require maintenance but do not prevent the ADS from continuing to operate until the maintenance can be carried out.
SAE suggested that MRM and MRC may need to be considered separately.	The expert from SAE suggested that the examples were confusing due to the inclusion of MRM (and the related Minimal Risk Condition). MRM and MRC are outcomes of system failures or ODD exits. The expert viewed the starting point as concerned with responses to conditions that warrant exceptional reactions such as responses to abrupt actions of other road users, incapacitation of the user, and so forth as described in FRAV-06-04.
CLEPA suggested clarifications to the section on ADS failures.	The expert from CLEPA clarified that the ADS would be expected to detect failures rather than "failure modes" since a failure is the condition to be detected that puts the ADS in a failure mode. The expert further clarified that a safe fallback could be more precisely described as a response to detection of a failure than as a response to the detection of an unsafe operational state.
JRC noted that failure may not always prohibit ADS use.	JRC noted that a failure may not necessarily prohibit the ADS from continuing to operate safely. The ADS could have a redundant system to enable continued operation; however, the ADS might no longer have further redundancies to fall back on which would increase the risks in the event that the redundant system also fails. The expert from the United Kingdom agreed with the JRC comments.

Japan presented additional information on its "C&C human driver model".	The expert from NTSEL presented document FRAV-06-10 regarding the Careful and Competent Driver Model as a basis for setting criteria for performance requirements. The concept is based on three parameters: • Risk perception • Human delay • Maximum performance Japan's traffic data shows that 97% of accidents have been related to human factors, broken down as follows: • 27% due to delay in perception (external inattention) • 25% due to misjudgment of movement • 19% due to delay in perception (internal inattention) • 14% due to delay in perception (insufficient safety check) • 10% due to a mistake in operation 85% of collision related to inattentiveness and 60% of collisions result from delays in perception due to such inattentiveness.
Japan explained its application of the model to a cut-in scenario.	The presentation provided an example based on braking performance in response to a cut-in scenario with values of 0.375 meters, 0.72 meters and 0.75 seconds, and 0.774G/0.6 seconds, respectively. The C&C driver model covered the following phases: • Perception of a safety risk • Human reaction delay (time to respond to perceived risk and time to shift the foot to the brake pedal) • Time for brake actuation to achieve the desired deceleration Japan's traffic data suggests a median (50th percentile) perception of a target vehicle's lateral movement at 0.75m. Based upon this measure, Japan derives 0.375m (=0.75m/2). Detection criteria would be based upon the lateral movement of the target vehicle. The presentation used a longitudinal zone for the "emergency braking area" based on a time-to-collision of less than or equal to two seconds (reference: Guidelines on establishing requirements for high-priority warning signals, WP.29/2011/90, para. 21 as reproduced as an annex to the report of the 150th WP.29 session, WP.29/1091/Add.1). In legal proceedings in Japan, 0.75 seconds is the common standard used for brake actuation delays. Japan referred to research on human risk-perception delays. In these experiments, the average delay in the first trial of an individual was 0.8 seconds which fell to 0.4 seconds in repeated runs thereafter. A high-speed cut-in at a lateral acceleration of 1.8m/sec multiplied by the 0.4 second risk perception delay produces a 0.72m limit for perception of lateral movement by the ADS during a cut-in scenario. Japanese research on human maximum g in brake deceleration produced a figure of 0.774G force (close to the 0.74G peak deceleration in NHTSA research). Similarly, a study of 183 trained drivers between 21 and 65 years of age showed a relatively consistent time to reach this level of maximum deceleration around 0.6 seconds.[1]

[1] Hiroshi MAKISHITA, Katsuya MATSUNAGA, Various drivers' braking behaviors and braking distances, The Japanese Journal of Ergonomics, 2001, Volume 37, Issue 5, Pages 219-227.

The method resulted in quantified limits for performance.	As a result, the driver would perceive the target vehicle motion after 0.375m of lateral motion with a further delay of 0.72m to recognize the risk followed by a 0.75 second delay to actuate the brakes and 0.6 seconds to reach maximum deceleration of 0.774G. This sequence results in a C&C driver model for the cut-in scenario. The expert noted that an AEB system could achieve 0.85G maximum deceleration in this scenario.
Japan proposed that braking performance should be the first priority.	The expert from CLEPA asked how many test subjects were used to derive the human-driver model and whether Japan had considered the effect of the model across different vehicle types. The expert from NTSEL explained that the model was based on multiple research activities and reports, so he could not precisely state the number of subjects involved in each activity. The presentation only concerned a cut-in scenario because Japan believes that braking scenarios should be prioritized in the first step in setting ADS performance limits. Japan believes that the methodology used for this scenario can be applied across other situations such as those involving steering responses. The expert from CLEPA asked whether Japan had ambitions to expand the model to cover additional vehicle types and ODD. Japan affirmed its expectation that the model would be extended to address other vehicle types and environments.
Japan urged that FRAV agreed on an overall level of safety principle before going into details on methods to determine performance limits.	The expert from MLIT presented FRAV-07-07, “Japan input for safety level discussion”. Japan wishes FRAV to discuss which collisions must be avoided and which collisions cannot always be avoided. Japan believes that FRAV should agree on a fundamental and high-level concept for the level of safety such as the C&C driver level or state-of-the-art level. After agreeing on the level of safety, FRAV can discuss the details of the methodology such as specifications for reaction time or delay time. In this regard, the details of the human-driver model would be discussed as a second step after agreement on the fundamental concept for safety. Therefore, Japan would like FRAV to discuss the matrix presenting criteria the overall level of safety should meet in order to reach agreement on the fundamental concept: improvement of road transport (individual and fleet), performance-based, technology-neutral, measurable, social acceptance, and feasibility. Secondly, FRAV would discuss the methodology or methodologies to set performance limits such that VMAD can define scenarios at the logical level of abstraction based on the limits.
JRC agreed on the need for an overall principle but believes multiple methods will be needed to set limits.	JRC agreed that FRAV had a more immediate need to reach agreement on a high-level concept for ADS safety. JRC has studied Japan’s proposal and appreciates its basis in factual evidence and quantified data. JRC agreed with CLEPA that the model should be validated against real-world scenarios and parameters. JRC has some concerns over whether the model covers driving behaviors in cases such as the presence of multiple vehicles around the ADS vehicle or other responses, which is why JRC believes additional approaches should be combined to determine performance limits.
Next FRAV session scheduled for 8 December.	FRAV has scheduled its next session for 8 December. FRAV expects to consider an overall concept for ADS safety and input elaborating the five starting points based on the version of the MLIT categorization of the 142 candidates as further classified by OICA/CLEPA. FRAV may also consider comments on Documents 4 and 5 and on the OICA/CLEPA administrative exercise (FRAV-06-04). A session will be organized for early January. A further session may be scheduled for late January or early February before the 8-12 February GRVA session.