

<u>Report of the first meeting of the Informal Working Group on Functional Requirements for Automated and Autonomous Vehicles (IWG FRAV)</u>	
Venue	Berlin, Germany Day 1 – Federal Ministry of Transport and Digital Infrastructure (BMVI) Day 2 – Representation of the Free State of Bavaria to the Federal Republic of Germany
Date	9-10 October 2019
Documents	Submissions for the session can be found on the FRAV-01 UNECE wiki page .
Status: Adopted	

<i>Agenda and previous session report adopted.</i>	FRAV adopted the draft agenda (FRAV-01-01). FRAV also adopted the draft report of the previous session without amendment. The adopted report has been posted as document FRAV-00-02 on the FRAV preparatory session web page.
<i>FRAV will address 3+ wheeled vehicles, including shuttles.</i>	FRAV considered the scope of its work. The group agreed to exclude two-wheeled vehicles; however, the group noted that driving automation includes unconventional vehicles (i.e., vehicles that do not fit within current definitions/categories). FRAV noted the recent French government legislation to establish a new “urban shuttle” category that falls in between the M ₁ and M ₂ conventional categories (GRSG-117-07 and GRSG-117-10). Therefore, the group agreed to include all vehicles with three or more wheels, including light L4-L7 vehicles and urban shuttles.
<i>UK will assess UN vehicle categories for AV coverage.</i>	Although the group discussed vehicle categories in terms of RE3 classifications, FRAV re-affirmed its intention to develop proposals applicable across all agreements. FRAV decided to review the vehicle categorizations in Special Resolution No. 1 (SR1) of the 1998 Global Agreement to determine whether SR1 covers all vehicles included in the scope defined above. The expert from the United Kingdom offered to conduct this review. The UK expert agreed to identify any issues for discussion at the next FRAV session.
<i>FRAV will pursue a top-down (stepwise) approach.</i>	<p>At the request of the expert from Russia who could not attend the session, the FRAV secretary summarized his recommendations for structuring FRAV work items (FRAV-00-03 and FRAV-01-08). FRAV broadly agreed with the Russia view that work should progress in a logical fashion from broad performance towards specific technical requirements. FRAV agreed with Japan that the Framework Document’s broad principles provided the guidelines for moving through this work. The UK noted that the Russia proposal captures the broad work and also goes beyond the eight elements noted in the FRAV terms of reference to cover areas such as in-use monitoring and performance over the life of the vehicle (important to several Contracting Parties).</p> <p>FRAV concluded that beginning from broader, high-level functional performance requirements (FPR) aligns with the anticipated output of the informal working group on Validation Methods for Automated Driving (VMAD). The VMAD scenario database concept will likely involve large numbers of driving tasks and environmental variables. FRAV will consider the VMAD assessment methods (once available) to identify scenarios that may be applicable for testing or certification purposes.</p>

<p><i>FRAV will address elements (a) through (e) of the Framework Document and will seek to correct item (l)</i></p>	<p>FRAV affirmed its mandate to address FPR for the following elements from the Framework Document (WP.29/2019/34/Rev.1):</p> <ul style="list-style-type: none"> a) System Safety b) Failsafe Response c) Human Machine Interface (HMI) /Operator information d) Object Event Detection and Response (OEDR) e) Operational Domain (OD) (automated mode) <p>In addition, FRAV noted that element (l) of the Framework Document contains a transcription error (the subject is “Crashworthiness and Compatibility” but the text is the same as item (k) on consumer information). FRAV will submit a proposal to WP.29 to amend the document in this regard.</p>
<p><i>FRAV will focus initially on high-level pass/fail functional performance requirements (FPR) to define a “safe vehicle”.</i></p> <p><i>VMAD should define methods to assess whether a vehicle meets these FPR and is “safe”.</i></p>	<p>OICA and CLEPA presented their view on the allocation of responsibilities between FRAV and VMAD (FRAV-01-12).</p> <p>The OICA-CLEPA presentation proposed that FRAV would define high-level FPR while VMAD would develop the assessment and test methods to determine compliance with the performance requirements. The European Commission affirmed that this allocation aligned with its view that FRAV should define what is meant by a “safe vehicle” while VMAD defines how to assess whether a vehicle is “safe” (FRAV-01-10). Japan agreed that it will be necessary to devise methodologies that capture all the performance capabilities across the various levels and configurations of automation and the diverse traffic conditions which can only be done at a high level.</p> <p>Japan suggested that VMAD would ideally define requirements for dynamic driving tasks that would lead to performance-based assessment methods. The expert from the US offered NHTSA’s “Framework for Automated Driving System Testable Cases and Scenarios” (FRAV-01-14) as one basis for this approach. As agreed in its preparatory session, FRAV will be considering combinations of vehicle control functions in the safe execution of responses to diverse, often dynamic, traffic conditions, which mandates a broad view to avoid getting bogged down in technical details that may prove unnecessary.</p> <p>Therefore, FRAV agreed that its main task is to develop descriptions for functional capabilities with high-level pass/fail performance requirements.</p>
<p><i>China preferred a more detailed and technical approach for FRAV.</i></p>	<p>During the discussions, China preferred to see FRAV develop the conventional third-party test methods (FRAV-01-04) while VMAD develops alternative methods. China argued that the experts defining technical requirements are best suited to define the methods for testing compliance with the requirements. Sweden agreed that from a strict engineering standpoint, this approach is logical. FRAV agreed that eventual detailed technical requirements should be defined together with methods to assess compliance. However, such detailed provisions would come at a later stage. Therefore, FRAV acknowledged China’s views and agreed that FRAV would collaborate with VMAD in the development of such technical provisions as may be needed (see “V model” comments below).</p>

<p><i>FRAV agreed that detailed technical requirements and test procedures may be needed in some cases.</i></p>	<p>FRAV recognized that conventional technical requirements will likely have a role in the assessment of automated vehicles. CLEPA anticipated that some FPR will require technical provisions (for example, a level of standardization in user interfaces to reduce the risk of user confusion, especially at levels where the driver is a fallback option). Japan noted that, under VMAD, third-party track tests would be used not only to physically test a vehicle under defined conditions but also to provide independent data for the validation of manufacturer data generated by simulation tools. OICA recommended that each selected track test be designed to serve both purposes (i.e., avoid separate tests for direct vehicle assessment and for validation of simulation outputs).</p> <p>Nonetheless, FRAV concluded that conventional methods cannot be expected to adequately assess automated vehicle performance. FRAV expects VMAD to develop more robust methods such that conventional technical methods would apply in specific cases to serve defined purposes.</p>
<p><i>FRAV agreed that, in cases where an FPR includes detailed technical prescriptions, close collaboration with VMAD on the test procedure(s) will be necessary. FRAV illustrated this concept using a “V model”.</i></p>	<p>Japan expected that once VMAD addresses the high-level assessment, it will be able to consider whether additional measures (i.e., at a next level of detail) are needed. Eventually, situations may arise where a need for prescriptive requirements and test procedures is evident. The US co-chair agreed that in order to define whether a vehicle is safe, FRAV will similarly need to define the things the vehicle will need to be able to do and then “drill down” as far as needed to adequately describe each function and its FPR. The UK suggested that FRAV might indeed be asked by VMAD to help in the development of test procedures at these detailed technical levels.</p> <p>FRAV recognized the possibility for the development of FPR that could include specific technical requirements for assessment under highly defined third-party test procedures. At the same time, the diversity of driving conditions and possible strategies that ensure safety prohibit contemplation of detailed prescriptions for every condition and outcome. FRAV and VMAD will be obliged to seek a balance.</p> <p>To the extent that FRAV (or VMAD) identifies a need for such technical assessments, the two groups would benefit from close collaboration. FRAV prepared a “V model” visual representation of its concept for collaboration with VMAD (FRAV-01-15/Rev.1). FRAV requested China to consider whether this recognition of the need for FRAV and VMAD joint development of such detailed technical specifications and test methods would be compatible with its views.</p>
<p><i>FRAV will use the OICA/CLEPA safety elements list as a starting point.</i></p> <p><i>FRAV tasked OICA to ensure alignment between the safety elements list and the Framework Document.</i></p>	<p>The group discussed the interpretation of “high-level”. For example, a vehicle must stop for a stop sign. Stopping for a stop sign involves object detection, classification, and system response (i.e., OEDR) to activate longitudinal controls for appropriate vehicle deceleration to a stop at an appropriate distance from the stop sign. Stopping for a stop sign could be considered a performance goal to be defined under the VMAD scenario database. The “high-level” FPR could be defined in terms of the vehicle OEDR capability to detect and classify objects and generate appropriate signals to control the vehicle longitudinal behavior. “High level” could refer to compliance with traffic laws (such as stopping for a traffic signal).</p> <p>FRAV agreed to use the OICA/CLEPA list of safety elements (FRAV-01-13) as its starting point. FRAV requested OICA to review the safety elements list and the Framework Document to ensure alignment between the two by 2 December (to be posted as FRAV-01-13/Rev.1). Stakeholders should consider this updated list for consideration at the next session as the basis FRAV fulfilling its task to deliver a list of common safety elements or principles (based upon Contracting Party policies and guidelines) by March 2020. Once approved, Japan proposed that FRAV submit this list to WP.29 as a proposal for an annex to the Framework Document.</p>

<p><i>FRAV will be attentive to prioritizing solutions for technologies coming to market.</i></p>	<p>CLEPA cautioned that the “bottom-up” approach should not be ignored; “high” and “low” levels are interoperative. FRAV should be careful to focus on current technologies and immediate needs to avoid losing time in discussions of future capabilities not yet ready for commercialization. OEDR, for example, implies the need for a system capable of detecting and recognizing traffic signals. However, the immediate interest in on-highway ALKS does not require this capability as much as the capability to respond to highway conditions and the behavior of other vehicles. CLEPA agreed the with co-chair from Germany that this approach allows FRAV to prioritize simpler functions applicable to current technologies. In this manner, FRAV can lay the foundations for the shift from reliance on conventional third-party testing to the more comprehensive assessment of ADS performance being developed by VMAD.</p> <p>FRAV concurred with this view. Nonetheless, even while prioritizing immediate needs, the group reiterated its intention to proceed from the “high level” down to achieve its long-term objective to define requirements applicable to all forms of ADS across all levels of automation consistent with the anticipated VMAD assessment methods.</p>
<p><i>FRAV and VMAD are co-equal; FRAV recommended joint meetings with VMAD.</i></p>	<p>The group concluded that FRAV and VMAD play equally important roles in establishing the complete system for determining whether a vehicle equipped with an automated driving system is safe. FRAV recommended that the group hold meetings in conjunction with VMAD sessions, including half-day joint meetings, to ensure appropriate alignment and collaboration between the development of FPR and the methods selected to determine compliance.</p>
<p><i>Canada recommended a process for moving from general requirements to function-specific requirements.</i></p>	<p>Canada reviewed its guidelines for the “Safety Assessment of Automated Driving Systems in Canada” (FRAV-01-07) and offered recommendations to FRAV on “where to start” (FRAV-01-09) based on its experience. FRAV agreed with Canada’s assertion that “everything involves risk” (even risk reduction). Canada reminded FRAV that “all models are wrong, but some are useful”. Functional performance requirements will need to address not only nominal performance but also performance under degraded or temporary conditions where acceptance of a short-lived increase in risk may be preferable the risks entailed by a more complex response (e.g., transition of control to the driver or activation of a minimal risk maneuver). Canada recommended that FRAV begin with general requirements applicable across different functions and then determine the level of sophistication needed for each function, including fallbacks in the case of failures or degraded conditions. FRAV can record and re-use these “layers” of conditions and performance requirements in developing specifications for each function it considers.</p>

<p><i>Continental presented a white paper on behalf of an industry consortium aimed at eventually developing an industry standard for ensuring AV safety.</i></p>	<p>The expert from Continental AG presented a white paper entitled “Safety First for Automated Driving” (FRAV-01-11). The white paper was prepared by Aptiv, Audi, Baidu, BMW, Continental, Daimler, FCA, Here, Infineon, Intel, and Volkswagen. Work on a second edition of the paper is planned from November 2019.</p> <p>An initial aim of the paper is to promote common understanding and standardized terms of reference, especially across industry tiers, towards establishing a common safety vision based on achieving a “positive risk balance” in ADS vehicle performance. The paper addresses Level 3+ automation, building from principles (drawn from NHTSA, Thatcham Research, the German Ethics Commission, and other sources) to define expected behaviors. From the nominal performance expectations, the paper discusses degradation modes in response to inadequate conditions to ensure nominal behavior, including safe transitions across modes. Ultimately, the paper proposes approaches to verification and validation of ADS capabilities through a comprehensive testing strategy broken down into specific test goals and phases that apply appropriate methods (e.g., software and simulation testing, hardware tests, proving ground and open road testing). The paper proposes a process to define, specify, develop and evaluate, and deploy and monitor the performance of systems.</p> <p>The consortium (still open to participation) hopes to develop its next edition in line with ISO towards use as an industry standard with a late 2020 or 2021 timeline. The effort itself particularly revealed the lack of clear and mutually understood terminology among the stakeholders. Even when using the same terms, stakeholders found that they each held different interpretations. Terms such as “safe” proved inadequate, leading to the use of “positive risk balance” as a more definable concept. FRAV discussed the challenge in defining safety and risk. Japan referred the group back to the Framework Document where the concepts of safety and acceptable/unacceptable risk have been defined in terms of avoiding death or injury in a crash scenario that was foreseeable and preventable. FRAV also noted that regulatory standards serve different purposes from industry standards; regulators have different elements that require verification.</p>
<p><i>China’s proposals for FRAV will be elaborated during future work.</i></p>	<p>China presented its “Proposal for key works of FRAV” (FRAV-01-03). The US appreciated the proposal as an elaboration on the Framework Document. The European Commission viewed the proposal as similar to its own approach to vehicle automation.</p> <p>FRAV expressed particular interest in questions identified in the China proposal:</p> <ul style="list-style-type: none"> • What is the transition demand in normal driving? • What is the transition demand when the automated system fails or exceeds the ODD? • Should the automated system monitor and evaluate the driver's ability? • What are the requirements of the “monitor and evaluate” function? • What is the definition of minimum risk maneuver? • How to use a consistent standard to evaluate the rationality of the maneuver? <p>Given the efforts devoted to reaching agreements on the Framework Document and informal group terms of reference, FRAV concluded that its work needed to remain within the structure of the WP.29-adopted Framework Document. At the same time, FRAV agreed that the China proposal presented questions that would be useful in identifying issues. Therefore, FRAV agreed to abide by the Framework Document and its application under the group’s terms of reference while referring to the China proposal as it elaborates on its work.</p>

<p><i>FRAV stakeholders tasked to draft descriptions for common FPR.</i></p>	<p>In preparation for the next FRAV session, the co-chairs tasked all stakeholders to input draft high-level descriptions for common functional performance requirements. The co-chairs directed the stakeholders to consider existing regional/national guidelines and documents VMAD-01-04 (comparison of guidelines), FRAV-01-14 (NHTSA testable cases), and FRAV-01-13/Rev.1 (updated safety elements list when available). This input should be submitted to FRAV by 20 December to allow for consideration by all stakeholders prior to the next FRAV session.</p>																		
<p><i>The next FRAV session will be held in Tokyo during 15-16 January.</i></p>	<p>The second FRAV informal group session is scheduled for 14-15 January 2020 in Tokyo. This session will coincide with the 5th VMAD session, scheduled for 16-17 January. A joint session of FRAV and VMAD will take place on the afternoon/evening of 15 January.</p> <p>Similarly, the third FRAV session is planned for 14-15 April 2020 in Paris with VMAD meeting during the 16th and 17th.</p>																		
<p><i>FRAV tasks in preparation for the next session.</i></p>	<p>FRAV concluded the session with agreement on action items to prepare for its next session:</p> <table border="1" data-bbox="459 857 1453 1263"> <thead> <tr> <th>Item</th> <th>Responsibility</th> <th>Deadline</th> </tr> </thead> <tbody> <tr> <td>1. Draft FRAV roadmap</td> <td>Co-chairs</td> <td>2 Dec</td> </tr> <tr> <td>2. Review SR1 coverage of AV configurations</td> <td>UK</td> <td>2 Dec</td> </tr> <tr> <td>3. Framework Document correction for WP.29-179</td> <td>Co-chairs</td> <td>12 Nov</td> </tr> <tr> <td>4. Align Safety Elements and Framework Document</td> <td>OICA</td> <td>2 Dec</td> </tr> <tr> <td>5. Draft common FPR descriptions based on item 4</td> <td>All</td> <td>20 Dec</td> </tr> </tbody> </table>	Item	Responsibility	Deadline	1. Draft FRAV roadmap	Co-chairs	2 Dec	2. Review SR1 coverage of AV configurations	UK	2 Dec	3. Framework Document correction for WP.29-179	Co-chairs	12 Nov	4. Align Safety Elements and Framework Document	OICA	2 Dec	5. Draft common FPR descriptions based on item 4	All	20 Dec
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