PRISSMA Project
Plateforme de Recherche et d’Investissement pour la Sûreté
et la Sécurité de la Mobilité Autonome
04/2021 04/2024

[L8.8] FINAL REPORT: PROGRESS OF THE POSITIONS EXPRESSED BY THE IDENTIFIED GROUPS AND PROVISION OF ESSENTIAL ELEMENTS TO THE ACTORS CONCERNED IN CHARGE OF FORMULATING THE FRENCH POSITIONS

RAPPORT FINAL : AVANCEMENT DES POSITIONS EMISES PAR LES GROUPES IDENTIFIES ET APPORT DES ELEMENTS ESSENTIELS AUX ACTEURS CONCERNES EN CHARGE DE LA FORMULATION DES POSITIONS FRANCAISES

Main authors : Rafael de Sousa Fernandes (UTAC)

Keywords: harmonization, stakeholders, safety, cybersecurity, transparency

Abstract :
The purpose of this deliverable is to provide a revision of the essential information and elements to be provided to the various stakeholders involved in the project and the administration. This should help to ensure that the work carried out at national level is consistent with the international regulatory bodies and to strengthen France's influence in these discussions.

Résumé :
Ce livrable vise à fournir une révision des informations et des éléments essentiels aux différents acteurs du projet et de l’administration. Cela doit contribuer à assurer la cohérence des travaux réalisés au niveau national avec les instances réglementaires internationales et à renforcer l'influence de la France dans ces discussions.

Authors	Rafael de Sousa Fernandes (UTAC), Pierre Jouve (STRMTG), Elodie Chateauroux (Transpolis), Michel Kaczmarek (Airbus Protect), Emmanuel Arbaretier (Airbus Protect)
Document ID	PRISSMA/L8.8/V1
Date	03/04/2024
Type of document	Report
Status	Deliverable
Confidentiality	Confidential
WP allocation	WP8-T8.5
Distribution	PRISSMA partners
History Version 0	 06/02/2024 Creation
Version 1	03/04/2024 Delivery

Table des matières

1 Introduction

2 Progress report on positions identified

2.1 List of the identified groups and their positions

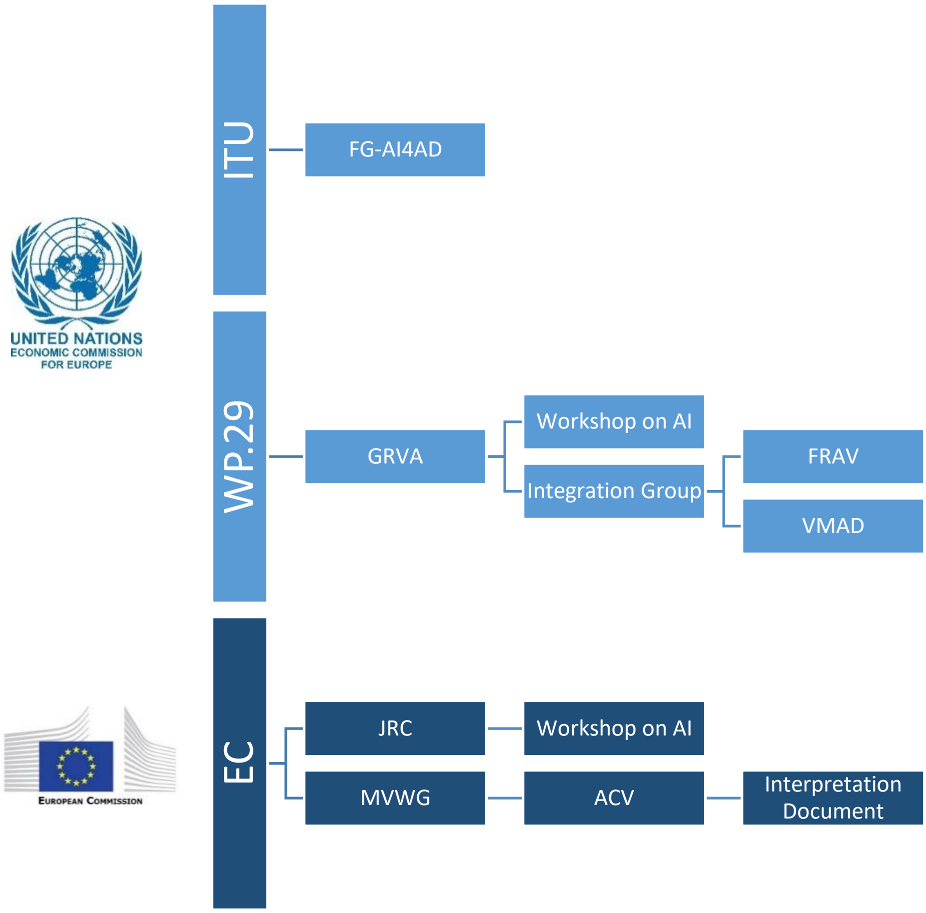

Figure 1: List of the main interest groups

2.2 Detailed analysis of each group's position

2.2.1 VMAD (Validation Method for Automated Driving)

The rapid advancement of technologies assisting drivers of road vehicles necessitates ensuring their safety and efficiency. Recognizing this, the global regulatory community, through the UN-ECE Working Party 29 (WP29) VMAD, has initiated efforts to establish a new assessment regime. This regime aims to provide assurance before introducing vehicles equipped with advanced systems into the market.

Its primary objective is to develop a regulatory testing regime that evaluates a vehicle's automated systems to realize the potential road safety and associated benefits under real-life traffic conditions.

The VMAD have been developing procedures to assess road vehicles in traffic situations involving conditional, high, and full driving automation. Initially targeting vehicle categories M and N, VMAD is proposing regulatory measures based on test scenarios, road tests, manufacturer audits, virtual testing and declarations.

The VMAD acknowledges three general traffic classifications and prioritizes developing proposals for urban and highway traffic initially. Evidence-based and performance-oriented regulatory solutions should be pursued, considering vehicle connectivity, geo-location recognition, and human-machine interaction aspects. Transfer of control between automated systems and drivers, along with in-service conformity assessments, have also been addressed. Provisions for monitoring system functionality in real-world are also given.

From these objectives, the work done by the informal working group VMAD has permitted to develop the NATM (New Assessment Testing Methodology).

The goal of the NATM guidelines document is to assess the safety of an ADS in a manner that is as repeatable, objective and evidence based as possible, whilst remaining technology neutral and flexible enough to foster ongoing innovation in the automotive industry.
The overall purpose of the NATM is to assess, based on the safety requirements, whether the ADS is able to cope with occurrences that may be encountered in the real world. In particular, by looking at scenarios linked to road users' behavior/environmental conditions in Traffic scenarios as well as scenarios linked to driver behavior (e.g. HMI) and ADS failures.
As previously noted, the multi-pillar approach recognizes that the safety of an ADS cannot be reliably assessed/validated using only one of the pillars. Each of the testing methodologies possesses its own strengths and limitations, such as differing levels of environmental control, environmental fidelity, and scalability, which should be considered accordingly.
It is important to note that a single assessment or test method may not be enough to assess whether the ADS is able to cope with all occurrences that may be encountered in the real world.
For instance, while real-world testing provides a high degree of environmental fidelity, a scenario-based testing methodology using only real-world testing could be costly, time-consuming, difficult to replicate, and pose safety risks. Consequently, track testing may be more appropriate methods to run higher risk scenarios without exposing other road users to potential harm. Further, test scenarios can also be more easily replicated in a closed track environment compared to the real-world. That said, test track scenarios can be potentially difficult to develop and implement, especially if there are numerous or complex scenarios, involving a variety of scenario elements.
Consideration should be given to the fact that simulation/virtual testing, by contrast, can be more scalable, cost-effective, safe, and efficient compared to track or real-world testing, allowing a test administrator to create a wide range of scenarios safely and easily, including complex scenarios, where a diverse range of elements are examined. However, simulations may have lower fidelity than the other methodologies. Simulation software may also vary in quality and tests could be difficult to replicate across different simulation platforms.
In-service monitoring and reporting should be used to confirm the pre-deployment safety assessment and fill the gaps between safety validation through virtual/physical testing and real-life conditions. Evaluation of in-service performance should also be used to update the scenario database with new scenarios deriving from increasing

deployment of driving automation. Finally, the feedback from operational experience can support ex-post evaluation of regulatory requirements.

In addition to the respective strengths and weakness of each test pillar, the nature of the safety requirements being assessed will also inform what pillars are used:

(a) For instance: the most appropriate method to assess an ADS’s overall system safety prior to market introduction may be the audit pillar, using a systematic approach to perform a risk analysis. The audit could include information such as safety by design confirmed validation outputs as well as analysis of data collected in the field by the manufacturer.
(b) Virtual testing may be more suitable when there is a need to vary test parameters and a large number of tests need to be carried out to support efficient scenario coverage (e.g., for path planning and control, or assessing perception quality with pre-recorded sensor data).
(c) tests may be best suited for when the performance of an ADS can be assessed in a discrete number of physical tests, and the assessment would benefit from higher levels of fidelity (e.g., for HMI or fall back, critical traffic situations).
(d) Real-world testing may be more suitable where the scenario may not be precisely represented virtually or on a test track (e.g., interactions with other road-users and perception quality may be assessed through real world evaluation).
(e) In-service monitoring and reporting of field data represent the best way to confirm the safety performance of an ADS in the field after market introduction over a wide variety of real driving traffic and environmental conditions.

Given these considerations, it should be noted that the sequence and composition of test pillars used to assess each safety requirement may vary. While some testing might follow a logical sequence from simulation to track and then to real world testing, there may be deviations depending on the specific safety requirement being tested.

It is therefore necessary for the NATM pillars to be used together to produce an efficient, comprehensive, and cohesive process, considering their strengths and limitations. The methods should complement one another, avoiding excessive overlaps or redundancy to ensure an efficient and effective validation strategy.

As previously noted, the NATM pillars not only include the three aforementioned test methods but also an aggregated analysis (e.g., an audit/assessment /in service monitoring/reporting pillar). Whereas the test methods will assess the safety of the ADS, the audit/assessment pillar will serve to assess the safety of the ADS as well as the robustness of organizational processes/strategies. Elements of the audit are:

(a) Assessment of the robustness of safety management system,
(b) Assessment of the (identified) hazards and risks for the system,
(c) Assessment of the Verification strategy (e.g. verification plan and matrix) that describe the validation strategy and the integrated use of the pillars to achieve the adequate coverage
(d) Assessment of the level of compliance with requirements achieved through an integrated use of all pillars, including consistency between the outcomes of one pillar as input for another pillar (forward and backward) and adequate use of scenarios. This level of compliance concerns both new vehicles as vehicles in use.
(e) The audit/assessment phase also incorporate results from the Simulation, Track test and Real-World tests carried out by the manufacturer.

2.2.2 The Informal Working Group on Functional Requirements for Automated and Autonomous Vehicles (FRAV)

As described in more detail in Deliverable 8.4, FRAV has held extensive discussions regarding expectations for ADS performance, criteria to guide the development of requirements, and methods for determining performance specifications. FRAV has also considered analysis of ADS technological capabilities under a « State-of-the-art » approach. Considering mathematical models to establish performance parameters and a « statistical positive risk balance » such that vehicles operating in automated mode demonstrate superior performance when compared statistically against human driving performance data. In some cases, combinations of these approaches offer paths towards defining optimal specifications. The outcome should be ADS performance that significantly improves road transport (including safety and efficiency) but also meets public expectations (social acceptance).
Considering this, we will detail here the progress made and the preliminary conclusions reached by the members of the group.

The WP.29, that stands for the World Forum for Harmonization of Vehicle Regulations, which is a working party of the United Nations Economic Commission for Europe (UNECE), is responsible for developing and maintaining international regulations and standards for vehicle safety, environmental protection, and energy efficiency. In November 2022, WP.29 directed FRAV to provide “guidelines for regulatory requirements and for verifiable criteria for ADS safety validation” for its June 2023 session (WP.29-188-12).
FRAV started its work on September 19th and has since then produced a document [FRAV-32-04] regrouping the recommendations concerning safety requirements for the assessment of Automated Driving Systems and ADS Vehicles. By regrouping the recommendations inside on same document and trying to respect some of the writing policies regarding regulation drafting, the group expects to highlight editorial issues, including formatting, that may arise in drafting the submission for the WP.29.
From this first set of recommendations, the group has lately provided additional information regarding the user interaction with the ADS. The interaction has defined in these recommendations is therefore, more than the interface and should include for example how an ADS ‘behaves’ in the perception of its user.
Even if the FRAV does not focus on AI issues, it is easy to establish parallels with the current issues surrounding AI, namely explicability and transparency.
However, the content of this proposal [FRAV-32-06] was not unanimously supported by the industry representatives present at the last session where the proposal was presented.
The next deliverable 8.8 will therefore be the place to review the latest advances in user interaction.

In parallel with this formalization of existing recommendations, the FRAV is continuing to work on the content of these recommendations and the addition of new ones, or the deletion of others deemed obsolete since the creation of the group and their writing. The current advancement of this work is available in the document [FRAV-33-38/Rev.1]. For instances where FRAV reached agreement on acceptable text, the resulting text was shaded in green, and where FRAV decided the paragraph and input needed further consideration, the text was shaded in blue. Paragraphs that were not considered during the session remained unshaded.

The discussion on what is defined as nominal or critical scenarios is for example still open (no consensus found, shaded in blue). And the question whether the ADS should be deactivated in the event of a collision or not, remains unclear and yet to be discussed (unshaded).

FRAV also discussed coordination with VMAD towards meeting the WP.29 mandate to provide a consolidated set of guidelines (including requirements and assessments) for consideration during its June 2024 session.
The FRAV and VMAD leaderships presented [FRAV-33-44], introducing a matrix for managing coordination between the informal groups and their subsidiary bodies. The matrix would provide a framework for an iterative process of coordination between the groups.
Following this matrix, FRAV would provide its recommended requirements for ADS safety with a request for VMAD to determine the assessment method(s) for verification of compliance. Based on the FRAV 2023 submission to WP.29, VMAD would confirm its understanding (or lack thereof) of the requirements and assessment criteria. VMAD might request clarification of certain requirements which would support FRAV refinements to its sections of the joint 2024 submission to WP.29.
Once VMAD and FRAV reach a common understanding of the requirements and criteria, VMAD would determine the assessment method(s) and procedures for assessing fulfilment. FRAV would review the VMAD method(s) to confirm that the method(s) or combinations of methods capture the safety objectives of the requirements.
The aim of this process is to enable tracking of progress towards aligning FRAV requirements and VMAD methods in a consolidated text. Given the conceptual goal to provide WP.29 with a "blueprint" for future work on regulatory texts, the leaderships expect this process to ensure consistency across the consolidated submission while providing visibility over elements that may require special attention.
The leaderships noted the "division of labor" where FRAV and VMAD activities overlap, especially with regard to the role of traffic scenarios. The leaderships noted the role of processes for the establishment of elements such as traffic scenarios, safety models, and codified rules of the road factors into this work.

2.2.3 Revision of progress made by the group

On the one hand, the discussion on the majority of fundamental points has not evolved much in 1 year, but on the other hand, some of them, such as the recording of data in the event of accidents, have been further explored. In particular, it was pointed out that by automating the performance of the perception, planning, decision, and control functions, it becomes even more necessary to ensure comprehensive recording capabilities through Event Data Recorders (EDRs) that would be essential to understand and keep track of system performance, user interactions, and safety measures.

Key Elements Recorded by EDR would therefore be:

- DDT Execution:
  - Perception, planning, decision, and control functions executed by ADS should be recorded.
  - EDR should capture the entire Dynamic Driving Task (DDT) necessary to navigate the Operational Design Domain (ODD) specific to the ADS feature(s).
  - Feature-specific Data:

    - Each feature within the ODD should have its specific set of DDT capabilities recorded by the EDR.
- Object and Event Detection and ADS Response (OEDR):
    - Detection, recognition, classification of objects; subsequent ADS responses should be recorded for analysis.
- User-Safety Provisions:
    - Interactions between ADS and users, including drivers, fallback users, and passengers, should be documented to ensure safety protocols are followed.
- Signal Faults and Operational Status:
    - Signal faults, ADS-initiated fallbacks, operational status changes, and activation feedback must be recorded for diagnostic and performance evaluation purposes.
- Evaluation of User Inputs:
    - EDR should evaluate user inputs to vehicle controls, ensuring proper integration with ADS functionalities.
- Triggered Recording:
    - EDR should support triggered recording of ADS data based on specific events or conditions such as the activation of a non-reversible restraint system as already stated inside the regulation UNR160.
- Comprehensive Sensor Data:
    - Essential vehicle parameters such as speed, steering, braking, and sensor data should be continuously recorded.
- Functional Actions Sequences:
    - Sequence of ADS functional actions along with user interactions should be captured to analyze system performance.
    - Example sequence: Feature availability confirmation → User activation → DDT performance confirmation → Speed adjustment → ODD zone detection → Control verification → Feature deactivation.
- Crash Event Data:
    - Trip data during crash events should be stored locally on the vehicle for post-accident analysis and investigation.
- Non-Crash Performance Data:
    - General performance data, including non-crash incidents, should be uploaded to the manufacturer for system improvement and maintenance purposes.

2.2.4 FG-AI4AD

2.2.4.1 <u>FG-AI4AD-01</u>

The first of the three Technical Reports presents the outcomes of the ITU Focus Group on artificial intelligence (AI) for autonomous and assisted driving, emphasizing the importance of safe interaction between road users and automated systems. It focuses on behavioral evaluation, in-use assessment, and field monitoring crucial for validating safety performance in automated vehicles. The report standardizes a safety data protocol for measuring interactions, using real-time monitoring to identify safety-critical scenarios and potential collisions. The protocol establishes a foundation for assessing driving behavior, supporting the development of safety metrics and thresholds.

Furthermore, the report details the specification of data elements and frames necessary for analyzing the interaction of road users across space and time, aligning with V2X standards for connected mobility. It introduces a protocol for real-time communication, storage, and processing of safety data, aiming to simplify system design and enable comprehensive safety evaluations. The document emphasizes the need for a standardized approach to expose data from automated systems in an open, interoperable manner while ensuring privacy protection and intellectual property rights.

2.2.4.2 FG-AI4AD-02

The second Technical Report by ITU-T Focus Group on AI for autonomous and assisted driving (FG-AI4AD) delves into ethical and legal considerations regarding continual monitoring, particularly in scenarios like the "Molly problem" where a self-driving vehicle is involved in an accident. The report discusses the importance of continuous monitoring, public expectations, ethical and legal frameworks, regulations, and standards concerning automated driving safety data. It also addresses the survey results on public opinions and the moral value of post-collision behavior in autonomous vehicles.

Additionally, recommendations from the EC independent expert group on ethics of connected and automated vehicles are highlighted, emphasizing the need for proactive measures to ensure road safety, prevent discrimination, protect privacy, and address ethical dilemmas. The report underscores the importance of transparency, user consent, data protection, algorithm auditing, and open access to high-value datasets for the advancement of connected and automated vehicle technologies.

The aspect regarding why the collision happened, where the responsibility lies, and if there are necessary improvements in systems to prevent such incidents, it is recommended to promote data literacy, algorithms, AI literacy, and public participation to inform individuals adequately. The implications of Recommendation 15 for the Molly problem emphasize the importance of providing sufficient information to all road users, especially regarding safety issues associated with CAV operation. Furthermore, identifying the obligations of different agents involved in CAVs (Recommendation 16) stresses the need for a shared map of responsibilities towards the ethical design, deployment, and use of CAVs. This includes ensuring that all parties involved understand and comply with the established standards and norms related to CAV operation.

On the other hand, promoting a culture of responsibility with respect to the obligations of CAVs (Recommendation 17) aims to foster an environment where safety issues are taken seriously without any negative consequences for those reporting concerns. Accountability for the behavior of CAVs (Recommendation 18) touches upon the importance of explaining incidents and allocating accountability appropriately. Additionally, creating fair mechanisms for granting compensation to victims of crashes involving CAVs (Recommendation 20) is crucial in ensuring fair legal rules in case of any mishaps. These recommendations underline the necessity of a responsible and transparent approach in the development and operation of CAVs to mitigate risks and ensure public safety.

Individuals injured due to defective software in autonomous vehicles may pursue strict liability against the vehicle manufacturer, rather than the software manufacturer. Legal theories allow suing multiple members of the supply chain but recovery is limited to once. Proving liability involves demonstrating a defect in the product causing harm, regardless of care exercised. Various states model their laws on Section 402A of the Second Restatement of Torts, where specific elements like product defect and proximate cause must be proven. Defective autonomous vehicles' design or manufacturing faults can establish liability, with tests like risk-utility and consumer expectation crucial in determining defectiveness. Negligence claims can also be made, showing the breach of duty and proximate cause of the injuries. Causation is vital in product liability, requiring proof that the defective product directly caused the injuries. The manufacturer can outline defense strategies asserting no product defect, intervening events, or contributory negligence by the injured party.

The EU Product Liability Directive imposes liability on producers for product defects, allowing consumers a harmonized level of protection across Member States. Producers are liable unless one of the six defenses is invoked, with a broad definition of producers beyond just manufacturers. Additional EU Directives cover aspects of digital services, goods contracts, and mandatory motor vehicle insurance requirements, ensuring consumer protection in case of non-conformities or accidents. National conversion of EU Directives varies, impacting the consistency of liability laws among Member States.

The discussion revolves around the determination of who qualifies as the producer of an automated vehicle under the Product Liability Directive. It is highlighted that putting one's name or logo on the vehicle can establish one as the producer. The concept of joint and several liability is explained, emphasizing that even in cases involving multiple producers, a consumer can seek damages from any one of them. The limitation of damages under the directive is outlined, particularly focusing on harm exceeding 500 ECU for private use items. Additionally, the definition of "damage" and what constitutes a defect within the directive are detailed, with an emphasis on consumer protection.

Further, the text delves into the considerations around the justified expectations of automated vehicles and how they align with the rules of the road conventions. The impact of Working Party 1 and 29 on establishing these expectations is explored, pointing out how type approval processes influence consumer expectations related to safety and behavior on the road. The implications of splitting an automated vehicle into its components, such as the body and the software 'driver,' are discussed, highlighting the challenges it poses in terms of liability determination. The possible categorization of software updates as products under the directive is touched upon, raising questions about distinct expectations in cases where a vehicle is updated post-circulation. Ultimately, the defenses available to producers to evade liability under the directive are mapped out, reiterating the intricate web of considerations surrounding product liability in the context of automated vehicles.

In the realm of automated driving, various defenses are pertinent to product liability, with a focus on the EU Product Liability Directive. Particularly crucial is the defense outlined in articles 7(b) and 7(f) of the Directive, especially concerning scenarios where existing vehicles undergo retrofitting. Moreover, article 7(e) of the Directive, denoting the development risk defense, offers protection to producers against unknown risks inherent in new product development. This defense underscores the significance of scientific and technical knowledge accessible at the time of product circulation in determining liability.

The paper delves into the liabilities surrounding automated vehicles, emphasizing their classification as products within the Product Liability Directive's purview. It also sheds light on key findings and regulations governing event data recorder (EDR) and data storage systems for automated driving. Furthermore, it discusses different standards, regulations, and directives, underscoring the essence of compliance concerning liability in instances of fault or negligence in the context of EU product liability.

2.2.4.3 FG-AI4AD-03

The document provides a comprehensive overview of the testing approach for autonomous transport systems, focusing on pilot projects conducted in the Netherlands. These pilots serve as a platform to evaluate the robustness, reliability, and safety of autonomous vehicle (AV) technologies within real-world traffic scenarios. The testing framework places a significant emphasis on assessing user interactions, road user dynamics, and the efficacy of enabling technologies crucial for AV deployment.

Collaborative efforts between scientific and industry partners are instrumental in implementing structured testing protocols to ensure thorough evaluation of AV systems. Standardized testing procedures are employed to facilitate a systematic assessment of AV performance under varying conditions, aiming to enhance the overall safety and efficiency of autonomous transport solutions.

Sensor calibration and data collection processes are integral components of the testing methodology, with vehicles undergoing rigorous testing on urban roads to capture and analyze data related to traffic interactions. Prior to piloting activities in the Jurong-West area, meticulous sensor calibration procedures are carried out on the CETRAN test track to optimize data accuracy and reliability.

The significance of infrastructure and connectivity in AV testing is highlighted, particularly through the utilization of the Smart Mobility Living Lab (SMLL) testbed in London. This advanced testbed offers a sophisticated environment for testing Cooperative Automated Mobility (CAM) systems, featuring state-of-the-art roadside monitoring equipment, a robust data platform, and intricate road configurations to simulate diverse driving scenarios effectively.

Moreover, the document underscores the innovative approach of the COLUMBUSS project, which integrates insights from social sciences and humanities disciplines to evaluate the broader societal implications of AV technologies. By engaging business modeling experts from public transport organizations, the project aims to enhance the understanding of how AV solutions can positively impact urban mobility and transportation systems. Additionally, the adoption of zero-emission technologies across all vehicles underscores a commitment to sustainable practices and the exploration of Connected and Cooperative Automated Mobility (CCAM) concepts for future transport solutions.

2.2.5 MVWG ACV (Automated and Connected Vehicles)

This group is a sub-working group of the MVWG that is devoted to discussions between all stakeholders from governments, industry and consumer associations interested in the regulatory activities related to the automated and connected vehicles.
The group presented the following elements during the last session that occurred in October 2021. It is interesting to consider them in the understanding of the validation

context of an ADS and later of an ADS embedding AI but they do not strictly represent the PRISSMA approach.

From the industry's perspective (OICA, ACEA), the certification of an ADS is a complex matter that goes beyond the application of prescriptive requirements and their assessment through a series of repeatable and reproducible tests, as common in the traditional certification regimes. Thus, the introduction of a scenario-based approach leveraging audit, simulations, and physical testing is deemed appropriate to assess the system performance against relevant requirements.
However, it is also true that given the multiplicity of variables, differences in the ODDs and functionalities offered by the manufacturers, ensuring a set of scenarios that is “fit-for-all applications” would be impracticable.
Therefore, this approach aims to suggest the use of harmonized tools and procedures to ensure that each ADS – identified with a unique ODD – is assessed within a range of scenarios that is representative of its specific performance, operational limits, and functionalities.
In addition, they pointed out the fact that providing some standardization in the assessment criteria, whilst ensuring the necessary flexibility to address the uniqueness of the ADS and its functionality, seems the most viable solution to ensure appropriate coverage when deriving scenarios for testing.

The work from this sub-group has led to the publication of the European Union Regulation 2022/1426 in early August and over the course of four specific Annexes, that details regulations and specifications that need to be followed in order to gain type-approval in the EU.

These four Annexes detail:

- The information needed to be supplied by ADS manufacturers in support of their type-approval request.
- Under various scenarios and conditions, the performance requirements and regulations specific to ADS are outlined.
- Expansive detail on the review process officials will use to assess and approve ADS for compliance, including scope of testing and reporting.
- Specific requirements that are to be followed in drafting supporting documentation and actual drafting of the type-approval certificate once compliant test data has been established.

The requirements main requirements from the regulation are the following;

DDT under nominal operating conditions:
- Obey the speed limits imposed by the Highway Code in force and drive at an appropriate speed
- Maintain a safe distance from other road users by controlling lateral and longitudinal movements
- Adapt your behaviour to traffic conditions
- Adapt behaviour to safety risks and prioritise human life
- Be able to anticipate the behaviour of other users in order to ensure stable operation and minimize the risk of critical situations occurring

DDT in Critical Traffic Scenarios:

- Detect the risk of collision with other road users, or an imminent obstacle and must be able to carry out an appropriate emergency manoeuvre to avoid collisions and minimise risks to the safety of vehicle occupants and other road users
- Avoid any collisions that could be safely avoided
- Be able to take into account the vulnerability of the users involved in the avoidance or mitigation strategy and not privilege certain lives over others

DDT at the limits of the ODD:

- Anticipate ODD outputs (precipitation, time of day, light intensity including use of lighting, mist or fog, absence of markings, geographical area)
- Check if the conditions for its activation are met and react if one or more conditions are no longer met

Minimum Risk Maneuvers & Minimal Risk Condition:

- During a minimally risky maneuver;
    - Deceleration not exceeding 4 m/s^2 until the vehicle is stopped in a safe place (MRC);
    - The vehicle must signal its intention to perform an MRM to its occupants and other road users

Human Machine Interface (HMI):

- The ADS shall provide the vehicle occupants with the means to request a minimally risky maneuver to stop the automated vehicle. In case of emergency:
    - for vehicles equipped with automatically operated doors, the unlocking of the doors must be carried out automatically when it is possible to do so safely;
    - Passengers must be given a means to exit a stationary vehicle (by opening the doors or through an emergency exit).
- If a remote operator is present:
    - The occupants of the vehicle must be able to reach it at all times and it must be marked in an unambiguous manner;
    - the automated vehicle shall provide systems for viewing the interior of the vehicle and the external environment to enable the remote response operator to assess the situation inside and outside the vehicle;
    - The remote operator must be able to open the doors remotely

Operational and functionnal safety:

- The manufacturer must have processes in place to manage the safety and ongoing compliance of the ADS throughout its life cycle (wear and tear of components, including sensors, new traffic scenarios, etc.)

Software Update & Cybersecurity:

- Compliance with UNR155 and UNR156 requirements is expected with an associated RxSWIN

Event Data Recorder (EDR):

- ADS data requirements and specific data elements for EDR for fully automated vehicles. For each record, the software versions present must be clearly identifiable.
- The stored data must be easily readable and standardized by the use of an electronic communication interface, at least by the standard interface (OBD port). The manufacturer must provide instructions on how to access the data.

Driving in manual mode:

- If the speed limit for manual driving is 6 km/h, the driver does not need to remain inside the fully automated vehicle. The operation may be carried out by a person in the vicinity of the vehicle within a limit of 10 m, provided that the vehicle remains within the operator's direct field of vision.
- If, in manual driving, the vehicle is intended to be controlled at speeds above 6 km/h, the vehicle shall be considered a dual-mode vehicle and shall comply with the technical requirements for conventional motor vehicles in Regulation (EU) 2018/858.

2.2.6 Workshop on AI at the GRVA

As part of UNECE's efforts to develop regulations for automated vehicles, the GRVA organized a workshop aimed at highlighting the issues that could potentially arise from the arrival of AI in vehicles, and in particular in this type of new mobility.
During this, workshop, it has been said that, In the domain of Cooperative, Connected, and Automated Mobility (CCAM), the integration of AI technologies into automotive engineering is revolutionizing the landscape of road safety, traffic efficiency, and driving comfort. The current focus lies on Automated Driving, ranging from partial automation (level 2) to upcoming advancements in level 3 and level 4 vehicles.

Data-Based Iterative Development Cycle:

- The complexity of Connected Autonomous Vehicles (CAVs) necessitates an iterative development cycle fueled by high-quality and high-quantity data. This includes data from accident analyses, which plays a crucial role in enhancing the safety and performance of these systems.

Situatedness: Interaction with the Environment:

- Modern vehicles can interact and communicate with their environment, encompassing road infrastructure, traffic management systems, and other road users, thus enhancing situational awareness and adaptability.

Embedding relevant Software and Hardware components:

- Hardware:
  - Sensors: Proprioceptive, exteroceptive, and virtual sensors provide critical input for perception and decision-making processes.
  - Computing Units and Network Technology: From onboard computing to cloud-based processing, various networking technologies facilitate seamless communication between vehicle components.
  - Actuators: Engines, steering, braking systems, and communication systems translate decisions into actions.

Software:

- AI-based modules, alongside classical IT systems, form the software backbone of modern vehicles. These modules interact with hardware components to enable functionalities ranging from perception to planning and actuation.
- AI Technology in Automotive Engineering:

Perception:

- AI is predominantly employed in processing sensor information, facilitating tasks such as scene understanding, object recognition, and localization.

Planning:

- AI aids in route planning, behavioral planning, and motion trajectory planning, optimizing driving decisions and ensuring safe navigation.

Actuation:

- While AI plays a limited role in actuation due to the necessity of explainability and compliance with regulations, it supports automated driving functions, infotainment, and human-machine interactions.

Use Cases / Applications:

- Infrastructure and Support Functionality:
    - Accident Analysis: AI-driven models can create detailed accident databases, enhancing research and safety measures.
    - Incident Management: AI assists in detecting, predicting, and managing incidents, improving safety and traffic flow.
    - Traffic Flow Management: Data-driven approaches optimize traffic flow, reducing fuel consumption and emissions.
    - Predictive Maintenance: AI predicts vehicle and infrastructure component failures, enabling proactive maintenance.
- Automated Driving:
    - High-Level Functions: From collision avoidance to driver assistance systems, AI supports a wide range of functionalities, enhancing safety and driving experience.
    - Low-Level Functions: AI aids in detecting roads, lanes, obstacles, and traffic signs, facilitating precise localization and navigation.

The integration of AI technology in automotive engineering represents a significant leap forward in enhancing road safety, traffic efficiency, and driving experience. From perception to planning and actuation, AI-driven systems empower vehicles to adapt to dynamic environments and make informed decisions. However, challenges such as auditability and cybersecurity vulnerabilities must be addressed to ensure the continued advancement and adoption of AI in the automotive sector.

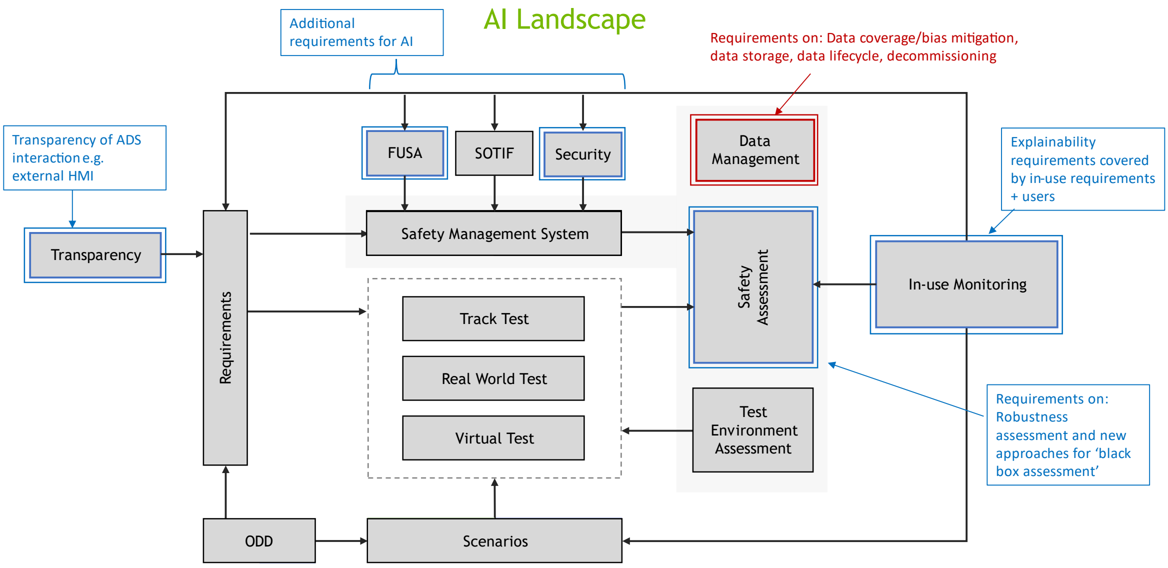

Figure 2: Impact of AI on the audit and evaluation process from the NATM

2.2.7 Exploratoty Workshop on AI

With a similar approach, the JRC (As the science and knowledge service of the European Commission) has organized a two days exploratory workshop dedicated to the safety and security of automated and autonomous vehicles and aiming to bring together leading scientist and engineers to explore and discuss the state-of-the-art research on accuracy, robustness, fairness and explainability of artificial intelligence (Al) and machine learning (ML) and testing of modern vehicles.

Automated Vehicles are supposed to bring the fusion of Artificial Intelligence (AI) and Machine Learning (ML) to the next level, promising heightened safety, efficiency, and convenience. However, as AVs ascend to prominence, the ascent brings forth unparalleled opportunities, accompanied by a downward spiral of challenges and risks. Continuous innovation in AI ML technologies fuels the evolution of AVs, enabling adaptive responses to dynamic traffic scenarios and enhancing user experience. The upward trajectory of AI ML components propels AVs towards the realization of fully autonomous driving capabilities.
However, and despite the promise of AI ML, AVs face formidable challenges. Complex environments pose hurdles for perception algorithms, while decision-making processes grapple with ethical dilemmas. Additionally, the reliance on AI ML components introduces concerns regarding explainability and robustness.
The inherent limitations of AI ML technologies, such as susceptibility to adversarial attacks and data biases, cast a shadow over the advancement of AVs. Uncertainty looms over the ability of AI ML components to operate reliably in diverse and unpredictable conditions.

The discussion as also highlighted the lack of standardized testing methodologies and regulatory frameworks for the moment.

The several concerns that have been highlighted regarding AI components can be listed as follow:

Cybersecurity Vulnerabilities:

- AI ML components in AVs are vulnerable to cyber threats, including adversarial attacks and data breaches. The interconnected nature of AV systems amplifies the potential impact of security breaches, posing significant risks to passenger safety and privacy.

Safety Concerns:

- The reliance on AI ML for critical decision-making introduces safety concerns, particularly regarding the robustness and reliability of algorithms. Malfunctions or errors in AI ML components could lead to catastrophic consequences, raising questions about liability and accountability.

Ethical Implications:

- AI ML algorithms may perpetuate biases and discrimination, exacerbating social inequalities. Fairness considerations and ethical dilemmas surrounding autonomous decision-making underscore the need for transparent and accountable AI ML systems.

2.2.8 Work of the Integration Group

The work from FRAV and VMAD has permitted to produce the guidelines addressing the assessment and validation of ADS safety within a regulatory context, focusing on risk management, competency, safe operations, response to conditions, and internal failures. Scenarios categorized as nominal, critical, and failure are designed to assess ADS competency and performance under diverse traffic conditions. The framework outlines behavioral competencies expected from ADS under various scenarios, with safety models proposed for challenging situations.
User interactions and relationships within ADS vehicles are detailed, delineating control transitions, ODD boundaries, and user roles during operation. The document recommended adherence to safety requirements for users and usage scenarios, with ADS performance assessed across five validation pillars. Documentation and audit, virtual testing, track testing, real-world testing, and in-service monitoring and reporting are identified as key pillars for efficient ADS safety validation and compliance assessments.

Virtual testing are highlighted as an efficient means to assess ADS performance under diverse traffic scenarios, with varying levels of parameter complexity and scenario coverage possible. Track testing are suggested for physical performance assessment under controlled conditions, particularly for critical scenarios with significant safety risks. The guidelines emphasized the importance of robust safety assessment methodologies in ensuring ADS compliance with safety requirements across all validation pillars.
When executing the same scenario, it enables the assessment of the accuracy of the virtual testing toolchain. Real-world testing assesses the capability of the ADS to perform the DDT and its interactions with its users while on public roads under real-

world traffic conditions. Real-world testing may be more suitable to ensure a level of fidelity that might not be represented virtually or on a test track, such as interactions with other road users and perception capabilities.

The primary aim is to verify compliance with safety requirements for DDT performance under normal operational and road conditions and for nominal ADS interactions with its users. While this method provides a high degree of environmental fidelity for testing an ADS, constraints on time, cost, controllability, reproducibility, and safety assurance limit the feasibility of covering traffic scenarios in the strict sense.

Therefore, this method requires attention to designing test routes that capture predictable aspects of the ODD, elements found in related nominal scenarios, and typical dynamic conditions. The test routes should also enable verification of nominal requirements for the safety of user interactions.

To the extent that an ADS encounters critical or failure situations during a real-world test drive, the response of the ADS should be considered in conjunction with the outcomes of track and virtual testing. In-service monitoring and reporting are recommended for manufacturers to monitor the performance of their in-service ADS vehicles and report safety-relevant information to the safety authority.

It is crucial for manufacturers to evidence their capability to perform monitoring of their ADS vehicles during in-use scenarios for audit assessment. The safety assessment and manufacturer’s system documentation play a significant role in evaluating an ADS manufacturer’s safety management system, safety case, and safety concept. A robust process is needed to ensure safety throughout the vehicle’s lifecycle, including development, production, operation, and decommissioning.

The audit pillar involves assessing if the manufacturer has the right processes to ensure operational and functional safety of the vehicle throughout its lifecycle. The safety assessment pillar focuses on determining if the ADS is safe by design and has been adequately validated before market introduction. Manufacturers are required to provide specific documentation to facilitate the audit and safety assessment, including descriptions of the safety management system and safety case.

The safety policy should outline the organization’s aims and objectives to achieve desired safety outcomes and should be communicated to all staff. Risk management processes should be in place to identify, assess, and mitigate risks associated with human, organizational, and technical factors throughout the ADS lifecycle. Design and development processes must be well-established and documented to ensure robustness and compliance with safety standards.

Production and deployment processes should also be well-documented to ensure the robustness of the development and distribution phase, including quality management, liaison with other organizations, and criteria for acceptable subsystem components. Continuous improvement and gap analysis are essential for ensuring the effectiveness of the safety management system.

In-service monitoring and reporting processes should be established to track safety-relevant incidents and manage gaps during operation, with mechanisms for updating vehicles as needed. The safety assessment of the ADS should focus on identifying and mitigating hazards and risks relevant to the ADS, demonstrating compliance with safety requirements, and ensuring the ADS is free from unreasonable safety risks.

The safety concept and validation of the safety concept by the manufacturer should be supported by structured argumentation and evidence, including validation tests, to demonstrate the ADS's mitigation of risks and fulfillment of safety requirements. The documentation should cover various functions of the ADS, including fallback operations, redundancy, fault identification, and removal of automated driving functions. It should also address aspects such as cyber-attacks, driver misuse, and decision-making processes for dynamic driving tasks.
The ADS aims to maintain safety levels comparable to human drivers within the Operational Design Domain (ODD). It emphasizes the importance of scenario-specific safety assessments and documentation to verify implementation of safety concepts. The safety case should detail monitored parameters, evidence of meeting safety requirements, and strategies to mitigate risks posed by environmental conditions.

Furthermore, data storage systems should address crash survivability, data security, and authorized access protocols. Cybersecurity measures and software updates management need to identify risks, mitigation strategies, and software update procedures. Information provision to users, including operational descriptions, correct use terms, activation/deactivation instructions, roles/responsibilities, and safety precautions, is imperative for user understanding and safety.

Regarding ADS performance, requirements focus on validating safety under nominal, critical, and failure scenarios. Nominal traffic scenarios should ensure safe driving operations, adequate speeds, and proper adaptation to traffic conditions to prevent accidents or disruptions. Critical scenarios address potential accidents, while failure scenarios focus on responses to system faults compromising the ADS performance. Additionally, adherence to ODD boundaries and minimal risk conditions is crucial for safe ADS operation.

User interactions with ADS require clear communication, user-friendly controls, and safety information. Features allowing manual control should ensure user safety during activation, deactivation, and system-initiated processes. System design must prevent errors, enable safe transitions, and provide clear feedback during feature activation and deactivation.

In-Service Monitoring and Reporting (ISMR) post-deployment is critical to monitor safety performance, identify risks, and ensure continuous improvement in ADS safety. It aims to provide real-world data to confirm safety assertions and address potential safety concerns. ISMR processes involve monitoring occurrences, managing safety gaps, and reporting safety-relevant information to authorities. ISMR plays a crucial role in evaluating safety performance, sharing information for continuous improvement, and developing new scenarios based on operational experiences.

Overall, the ADS safety implementation focuses on thorough documentation, stringent monitoring, proactive reporting, and continuous improvement to ensure the safety and effectiveness of automated vehicles on the road.

Authorities expect manufacturers to report occurrences and ensure safety compliance. The defined safety case must be confirmed, and insights from incidents and near-miss analyses shared to improve automotive safety. Key Performance Indicators (KPIs) are crucial for measuring ISMR activities' effectiveness. In-service monitoring involves collecting and analyzing vehicle data to assess ADS safety performance. Data acquisition, retention, access, and security strategies are essential for monitoring programs. Manufacturers should identify operational risks, assess safety risks using metrics, and establish procedures for remedial action.

2.2.9 JRC's Policy Report

As a of the discussions and the contributions by the experts part of the Working Group on Motor Vehicles (MVWG), established 1970 to assist the European Commission (in particular DG GROW) in the preparation of legislative proposals and policy initiatives related to motor vehicles; the document summarizes the discussions among the participants of the workshops on national rules and legislation organized by the European Commission – DG GROW as well as the discussions within Automated and Connected Vehicles sub-group of the Working Group on Motor Vehicles (MVWG-ACV).

The Workshop aimed at collecting expertise and best practices on the amendments that member states should put in place for their national rules and legislation to accommodate EU legislation on ADS. For example, national legislations will need to allow the usage of ADS on national roads. Participants were mainly representatives from member states, but also other stakeholders were welcome to join.

The document lists the policy topics currently under discussion within MVWG – ACV as well as the proposed actions that to put into practise in the future. The reports also aim to foster further discussions with the involvement of the relevant actors.

The policy topics are divided in three broad categories:

- Topics relevant for Type Approval,
- Topics relevant for Traffic Rules,
- Topics relevant for Road Safety.

Each category includes relevant topics sorted according to their priority. The high priority topics were agreed among the participant of the MVWG – ACV. Each subparagraph reports:

- The main questions related to the topic that need to be answered,
- The on-going discussion concerning the topic,
- The proposed approach (centralized, harmonized, national),
- The kind of documents that could support and foster the discussion within the group, the sharing of experience and information,
- The actors that have been identified for a possible cooperation or working group (WG),
- Finally, at the end of the subparagraph, the proposed actions that could be put into practise in the future.

Testing innovative ADS technologies across Europe is not easy because there is a fragmented approach among different MSs. National authorities are facing the challenge of understanding the right framework to use depending on the kind of testing to be conducted, while industry is finding time consuming and sometimes difficult to get the permission to test. The discussion is on-going on different tables, involving also members of the subgroup MVWG-ACV as well as DG RTD, the Directorate-General for Research

and Innovation and the state representative groups under the CCAM (Cooperative, connected and automated mobility) partnership.
The second workshop on national rules and legislation has been dedicated to this high priority to better clarify national rules and legislation updates that are needed to accommodate the deployment of driving automation on public roads. Main questions related to this topic were formulated and circulated among the participants before the workshop.

And as a conclusion from this report, the EU Regulation 2022/1426 has opened the road to the market introduction and deployment of fully automated vehicles in Europe. It defines minimum safety requirements that vehicles needs to fulfil and different validation methods to assess their performance. Being the first regulation developed worldwide for the type-approval of fully automated vehicles, it introduces various elements of completely innovative character.
Member States should also put in place amendments to their national rules and legislation to accommodate ADS legislation. In order to ensure that related practices around the EU may be as harmonized as possible, the European Commission has initiated a series of workshop on national rules and regulations to identify and discuss on policy related topics to be addressed to support MSs as well as ADS developers in the implementation of the Regulation.
This document summarised the discussions among the participants of the workshops on national rules and legislation organised by the European Commission – DG GROW as well as the discussions within Automated and Connected Vehicles sub-group of the Working Group on Motor Vehicles (MVWG-ACV). It has been drafted with the active contribution of the experts of MVWG-ACV.
Several topics were identified and discussed among the participants. The document listed all the policy topics currently under discussion within MVWG – ACV as well as the proposed actions that could be put into practise in the future. However, the contents of this publication do not necessarily reflect the official/formal position or opinion of the European Commission, Member States and other stakeholders mentioned in this report.
This is still an ongoing work and some information might already be outdated at the time of the publication. However, the publication is an essential milestone to highlight the importance of policy topics to complement the EU Regulation 2022/1426 and to foster further discussions with the involvement of the other relevant actors.

3 Essential elements for formulating French positions

3.1 Essential elements to be taken out this initial report

This report on the ecosystem activities highlights the considerable progress and challenges in regulatory efforts necessary to deploy Automated Driving Systems. Initiatives such as the ones led by VMAD, FRAV play crucial roles in establishing safety recommendations and requirements, addressing ethical concerns, and advancing testing methodologies for automated vehicles. Continued collaboration and innovation are essential to ensure the safe and efficient integration of automated driving technologies into transportation systems worldwide.

The following list should be taken as fruit for thoughts in the upcoming discussions:

- Encouraging further collaboration between regulatory bodies, industry stakeholders, and research organizations to address emerging challenges in automated driving, seems to be, more than ever, crucial here.
- Advocating for transparency, user consent, and data protection in the development and deployment of automated driving technologies also.
- Plus, promoting standardized testing protocols and methodologies to ensure thorough evaluation of AV safety and performance should be considered a milestone.
- Supporting research initiatives that explore societal implications and ethical considerations of automated driving technologies shall also be considered.
- Because of the way France is divided up, it also appears necessary to include representatives of the various municipalities, who will be a key element in the deployment of these new mobility solutions.
- Data transparency also appears to be essential as by mandating transparency in data handling by manufacturers, it would ensure that data collected by ADS is accessible for regulatory review and public safety assessments but also well managed by the manufacturers themselves.
- Since the scenario-based approach is key here, current discussions on standardize sets of traffic scenarios should also be pushed forward.
- Last but not least, it is essential to develop guidelines for effective human-machine interaction (HMI), ensuring that users can understand and interact with ADS appropriately. This includes clear communication protocols for system status, alerts, and manual override functionalities. It would also be recommended to provide education and training for users on the proper use of automated vehicles, emphasizing safety practices and system limitations.

4 References

[1] FRAV document: FRAV-32-04
[2] FRAV document: FRAV-32-02
[3] FRAV document: FRAV-32-06
[4] FRAV document: FRAV-33-44
[5] VMAD document: NATM Guidelines
[6] FG-AI4AD deliverablet: FG-AI4AD-01
[7] FG-AI4AD deliverablet: FG-AI4AD-02
[8] FG-AI4AD deliverablet: FG-AI4AD-03
[9] Commission Implementing Regulation (EU) 2022/1426 of 5 August 2022: UE2022/1426
[10] ENISA / JRC: Cybersecurity challenges in the uptake of artificial intelligence in autonomous driving (2021)
[11] European Commission: Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT),2021,https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0206
[12] BSI, TÜV Verband und Fraunhofer HHI: Towards Auditable AI Systems - Current status and future directions, Whitepaper, 2021, https://www.bsi.bund.de/SharedDocs/Downloads/EN/BSI/KI/Towards_Auditable_AI_Systems.pdf
[13] BSI, TÜV Verband und Fraunhofer HHI: Towards Auditable AI Systems – From Principles to Practice, Whitepaper, 2022, TODO: add link after publication (May 2022)
[14] Berghoff C, Neu M and von Twickel A (2020) Vulnerabilities of Connectionist AI Applications: Evaluation and Defense. Front. Big Data 3:23. doi: 10.3389/fdata.2020.00023
[15] D. Hannah, P. Edwards and S. Khastgir, "Extended Updated Proposal for an Approach to Defining Rules of the Road: United Kingdom proposal," 19-20 4 2022. [Online]. Available: https://wiki.unece.org/download/attachments/161841375/FRAV-27-06.pdf?api=v2.
[16] [11] Ministère Chargé des Transports, 20 12 2021. [Online]. Available: https://www.strmtg.developpement-durable.gouv.fr/IMG/pdf/ga_stpa_demonstration_game_v1_en.pdf.
[17] M. c. d. Transports, "Automated driving regulation in France - Member States presentation," 2023.
[18] Zielonka, "German Approach for the Implementation of Level 4 Vehicles in Road Transport - Workshop by the European Commission on national rules and legislation on ADS," Digital Transformation of Mobility , Autonomous Driving, ITS - Federal Ministry of Digital and Transport, 2023.
[19] European Parliament and the Council, "Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles," Official Journal of the European Union, 2018.
[20] Implementation of EU 2022/1426 Summary Report on Policy-related Topics - JRC