



Department
for Transport

Submitted by the expert from the United Kingdom
of Great Britain and Northern Ireland

Informal document **GRVA-19-59**
19th GRVA, 25 June 2024
(For review at the
Troy meeting 20-24 May 2024
Agenda item 7)

Virtual Testing for AEBS - Summary of GRVA-19-42

Summary of changes compared to ECE-TRANS-WP.29-GRVA-2024-19e

- **Section 1 has been renamed to ‘The development, management, verification and validation of the virtual testing method and has now been split into 5 sub-sections:**
 - **1.1 – General Specifications**
 - **1.2 – Toolchain management**
 - **1.3 – Description and analysis of toolchain and components**
 - **1.4 – Verification**
 - **1.5 – Validation**
- **Section 2 has been renamed to ‘The use of virtual testing to conduct part of the testing required for type approval’**
- **Amendments made to 6.11.3. on physical testing**
- **Definitions added for Model, Tool and Toolchain**

Section 1 changes

- **Section 1 has been rearranged based on the work in Annex 5 from the VMAD document [ECE/TRANS/WP.29/2024/39](#) - Virtual testing and credibility assessment. The current [GRVA/2024/19](#) proposal lacks sufficient coverage and detail of the topics that VMAD has identified as being necessary to ensure a robust approach to the use of Modelling and Simulation (M&S).**
- **The UK proposal addresses the missing topics and provides a comprehensive approach that maintains the alignment with the recommendations of VMAD. This proposal establishes clearer processes, requirements and terminology.**
- **It should be noted that some numbering and headings have changed.**

Section 1.1 – General specifications

- This proposal removes or alters sections 1.1.1 and 1.1.2 from GRVA/2024/19 (FR) to make the focus of this initial section the five criteria that are now listed in 1.1.1.
- Sections 1.1.1 & 1.1.2 (FR), regarding the manufacturer’s responsibility to prove the credibility and establish the validity domain of the toolchain, have been moved to other parts of the proposal that seem more appropriate (see 1.3.1.1 (UK)).
- Section 1.3.1 (FR), on the manufacturer’s responsibility for the “simulation model”, have been included in section 1.1.2 (& 1.3.1.5) of this proposal.
- Section 1.1.2 was added in this proposal to make it clear that the manufacturer is the responsible for the toolchain. This also incorporates the intent of sections 1.1.1 & 1.1.2 (FR).
- The structure of this proposal ensures that the concept of the toolchain and the virtual testing activity are distinct.

Section 1.2 – Toolchain management

- This section now describes the overall approach to how the toolchain should be developed, deployed, its constituent parts, supporting processes, expertise, data management, etc.
- Sections 1.5.2, 1.5.6 and 1.5.7 (FR), covering the request for additional data and information that is relevant to the parameters, methodology and data management associated with the toolchain, have now been moved to this section.
- The section ensures that the manufacturer understands that the lifecycle of the toolchain must be properly managed and that all aspects of that lifecycle should be documented. This reflects the VMAD requirements of developing a credible simulation capability.

Section 1.3 – Description and analysis of toolchain and components

- This section describes the various elements that are needed to develop a robust and fit for purpose toolchain. Additional elements from the VMAD framework are included to ensure this is achieved.
- GRVA/2024/19 (FR) refers to this section as “Simulation Model” but it seems more appropriate to use the term “toolchain” which incorporates the models, tools and processes:
- Sections 1.3.1, 1.3.2 & 1.5.3 (FR), covering the simulation model and the validity domain, are addressed under various point in this section.
- These changes more closely align the AEBS proposal with the VMAD framework by including requirements and documentation around accuracy, assumptions, limitations and acceptance criteria.

Section 1.4 – Verification

- This new section now describes the verification process which was not covered in the GRVA-18 proposal. Verification is a key tenet of Modelling and Simulation development. Both Verification & Validation (V&V) are critical to a robust and reliable simulation capability.
- The content in 1.3.2 (FR), covering the appropriate mathematical representation of the AEBS system, is included in 1.4.1 (UK) & also 1.3.1.1 (UK)
- The inclusion of verification provides assurance that the models and tools have been developed and implemented correctly. It will also provide information about any assumptions and limitations of those models and tools. Without a verification activity the assurance of the toolchain is only based on the validation activity.

Section 1.5 - Validation

- This section, which was previously 1.4 in (FR), provides more details about the requirements for validation and the strategy and the documentation that supports this. It also provides clarity about the responsibilities of the manufacturer and the technical service.
- Sections 1.2.1, 1.2.1.1, 1.2.2 , 1.4 & 1.5.5 (FR), covering the physical validation tests and the simulation validation process are captured in section 1.5 (UK).
- The section now requires the manufacture to provide documentation for the overarching strategy, the performance and acceptance criteria, the scenarios and the evidence that demonstrates that the validation activity has been successful. Documentation is also required to show that manufacturer has assessed the uncertainty in the results, identified the validity domain and the potential errors.
- Evidence showing the manufacturer's approach to validation will be a key part of the evidence that the toolchain can be used for virtual testing, so it is critical that this activity is undertaken and documented comprehensively.

Section 2 - The use of virtual testing to conduct part of the testing required for type approval

- The purpose of this section is to identify the activity associated with using the accepted toolchain to perform virtual testing. The main changes in this proposal is the consistent use of the terms virtual testing and toolchain and the introduction of a section for the manufacturer to confirm information associated with virtual testing (see section 2.3 (UK)).
- The contents of section 2.3(FR) ,concerning “Additional data and information” have been moved to the relevant sections in the current proposal about which the additional information is being requested.
- Section 2.3 (UK) ensures that the manufacturer includes a clear statement (declaration) about the toolchain and that it is fit for purpose to undertake virtual testing and that the virtual testing results are traceable to a validated toolchain.
- It is important that virtual testing is undertaken correctly. The additional aspects added in 2.3 (UK) ensure there is a clear record of the toolchain’s validity and applicability are available and recorded.

Other changes

- **Changes to 6.11.3. were made to reflect the need to retain physical testing alongside virtual testing and not permit an approval to be undertaken using only virtual testing.**
- **Definitions have been added for model, tool and toolchains:**
 - **“2.19. “Model” is a description or representation of a system, entity, phenomenon or process.**
 - **“2.20. “Tool” is the implementation of a model**
 - **“2.21. “Toolchain” is the combination of tools that emulate a vehicle function**
- **These provide the necessary clarification of the terminology that is introduced and used within this proposal.**