

UNECE GRSP IWG Equitable Occupant Protection (EqOP)

Draft Minutes of the 3rd Workshop of the informal working group on Equitable Occupant Protection, EqOP:

“Virtual Testing for Regulations”

Date: 14 November 2023

Place: BMW AG, FIZ, Knorrstr. 147, 80788 Munich

Participants: 24 experts from contracting parties (Austria, Netherlands, Germany, Spain, Sweden, France) and automotive industry (Audi, BMW, Renault, Stellantis of OICA and Autoliv, Joyson, Adient of CLEPA), Euro NCAP, IIHS, LMU, ADAC, TÜV SaaR, ATD Models and Humanetics.

1. Welcome words by the chair

- a. Short introduction on the long-term goals of our IWG and the defined tasks in the Terms of References. Task 3 of the ToR defines the scope of the Task Force Virtual Testing (VT).
- b. Introduction to the other task forces which have been defined in the 2nd EqOP workshop.

2. Introduction to the workshop by the co-chair (document EqOP-Workshop-03-03e-EqOP_Task_Force_VT)

- a. The EqOP approach was shortly explained to the participants (Field data study → use available tools to address identified problems if feasible → investigate usage of alternative tools to address left over problems).
- b. The scope of this workshop is to discuss existing ideas to use VT, share experience on applying or introducing Virtual Testing on type approval and list chances as well as challenges of VT. Self-certification will be covered in the first follow-up workshop end of January.
No detailed discussion on tools and related specific requirements within this workshop.

3. Roll call and introductions. What can you contribute to the workshop?

- a. All participants introduced themselves and how they can contribute to the workshop.

4. Workshop

- a. Impulse presentations
 - i. Motivation for VT in occupant safety assessment (BAST, *EqOP-Workshop-03-04e_BAST_Input_EqOP-VT-Workshop*)
 - ii. VT in consumer information testing (Euro NCAP, *EqOP-Workshop-03-05e_Euro NCAP VTC & EqOP Nov 2023*)
 - iii. Plans for VT in Whiplash assessment (IIHS, *EqOP-Workshop-03-06e_2023 IIHS_Rear Impact_Eqop*)

- iv. Status of Virtual Testing in regulations (TÜV-SGS, *EqOP-Workshop-03-07e_TUEV_Saar_Equitable Occupant Protection EqOP*)
 - v. Current procedure on validation of vehicle models for regulations (IDIADA, *EqOP-Workshop-03-08e_IDIADA_Virtual_testing_20_06*)
 - vi. Experience of IWG DPPS on VT (Renault, *EqOP-Workshop-03-09e_Renault_VT-DPPS for EQOP 14 Nov2023*)
 - vii. Validation requirements for vehicle models (BASt, *EqOP-Workshop-03-04e_BASt_Input_EqOP-VT-Workshop*)
 - viii. Validation of vehicle and component models (Autoliv, *EqOP-Workshop-03-10e_Autoliv_EqOP_Validation_03*)
- b. Joint discussion based on impulse presentations.
- i. What is the motivation for virtual testing? Which benefits of virtual testing can be used to overcome equity issues?
 - More robust evaluation considering human diversity & different load cases is possible. Usage of HBMs could overcome limitations of current ATDs (increased biofidelity, enhanced injury assessment). Real life safety assessment by applying new load cases (e.g., reclined, integrated systems (before t0)).
 - VT is expected to have a better cost benefit ratio and also a increased sustainability, but both fields needs to be evaluated.
 - ii. In which areas can we find barriers for the introduction of virtual crash testing into regulations?
 - In consumer information currently very interactive process between the partners to gain trust in the methods and processes. Exchange between Technical Services and industry is essential for currently applied cases. This might a difficulty for application of VT in self-certification countries.
 - Furthermore, the traceability of the methods, models and results are seen as a challenge as the validity need to be obtained for a longer time period (e.g. 10 years). The access to IP protected models could introduce difficulties for a transparent evaluation of the vehicle performance.
 - iii. What can we learn from other disciplines (e.g., aviation, medicine, emissions, autonomous vehicles, consumer information, ...)?
 - Virtual testing is already used to identify worst cases and for several UN ECE regulations for type approval.
 - Physical tests mandatory as reference and for market surveillance. Processes and methods need “golden standards” to get certified for use in virtual testing cases.
 - Relevant building blocks for VT in Occupant Crash Protection:
 - Models: Occupant model (ATD, HBM), Vehicle model (structure, interior, restraint systems)

- Reference data for homologation
 - FE-Software
 - Validation Process & Conformity of Production checking methods
- c. Break-out sessions:
- i. Participants divided into four groups to discuss following questions:
- In which areas can we find barriers and opportunities for the introduction of virtual crash testing into regulations?
 - What are possible solutions to overcome the barriers?
 - How can we develop **trust** in virtual testing for regulations?
 - How could virtual testing fit in regulatory frameworks and processes for type approval?
 - After each groups put their thoughts on whiteboards (see *EqOP-Workshop-03-11e_EqOP_workshop#3_Break_out_sessions*), these were presented to all participants which lead then to a joint discussion on necessary next steps to reach our EqOP goals when it comes to virtual crash testing (see *EqOP-Workshop-03-03e-EqOP_Task_Force_VT*):
 - Introduction of VT in regulation could potentially result in a speedup of approval process (after initial investment) or increase of real-life relevant scenarios which could lead to more robust vehicle safety. The reduction of physical tests and exploration of new opportunities were also seen as chances in using VT.
 - Multiple barriers and challenges have been identified by the participants: such as missing standardization of methods and processes, intellectual property issues, complexity of designs and load case, effect on COP, data storage and limited knowledge of applying methods outside of industry. The participants found proposals for concrete measures to overcome these mentioned barriers (e.g. traceability methods, certification of software and models, sharing encrypted models, CoP of validation tests to compare with simulation results stored at type approval authority,...) and to enable the use of virtual tools in type approval.
 - The topic of gaining trust in the application of VT and resulting approvals was seen as focal point for the introduction of VT in any regulation.
 - Solutions implemented in other regulations regarding responsibilities and documentation of validation have been discussed:
 - UN R13: “ANNEX 21, §2.1.3. The vehicle stability function shall be demonstrated to the Technical Service [...]. As an alternative to carrying-out dynamic manoeuvres for other vehicles and other load conditions, fitted with the same vehicle stability system, the results from actual vehicle tests or computer simulations may be submitted. The use of the

simulator is defined in Appendix 1 to this annex. The specification and validation of the simulator is defined in Appendix 2 to this annex”

Appendix 1 §1.4: “The availability of the simulation tool software, to the software version used, shall be maintained for a period of not less than 10 years following the date of the approval of the vehicle.”

Appendix 2 §2.5: “A simulation tool test report shall be produced, a model of which is defined in Appendix 3 to this annex, and a copy attached to the vehicle approval report”

- EU Regulation 2018/1832: §4.7.”Compliance of the software tool used to verify the trip validity and calculate emissions in accordance with the provisions laid down in Appendices 4, 5, 6, 7a, and 7b shall be validated by the tool provider or a type approval authority. Where such software tool is incorporated in the PEMS instrument, proof of the validation shall be provided along with the instrument.”
- Finally, the group discussed requirements and prerequisites for implementation of VT into type approval procedures.

5. Following next steps for the task force have been identified and will be discussed in the following meetings:

- a. Agreement on wording and glossary.
- b. First outlines of general process for VT in regulation.
- c. Definition of relevant load cases. This will be done in conjunction with the other task forces.
- d. Requirements and standardization of occupant and vehicle models as well as their combination towards VT scenarios / load cases.
- e. Definition of transparent processes to ensure trust in VT application, results and documentation.
- f. Collaboration with groups/experts of other disciplines where VT is also discussed or even already applied.

6. Next meetings:

- a. Follow up meetings of the task force will be held online in order to enable participation of experts from all interested parties.
- b. Proposal for first follow-up workshop: end of January (30th+31st January 2024, 12:00 – 1:00 pm).