

Transmitted by the chair and secretary of the GRSP DEOP Ad hoc group.

This document is the result of the discussion in the DEOP ad hoc group (formed under the GRSP) where experts representing both contracting parties and industries have participated.

Informal Working Group on Equitable Occupant Protection

Terms of Reference – Proposal

A. Introduction

An ad-hoc group on equitable occupant protection (founded by Canada, France, Germany, Japan, the Netherlands, Spain, and Sweden after the 70th session of the GRSP) started to review relevant data regarding equity of men and women in occupant protection, in early 2022.

Today, crash tests are carried out with dummies that represent a man who is 176cm tall and weighs 70kg and in frontal crashed additionally with a dummy that is a 5th percentile female is a downscaled man who is 151cm tall weighing 48kg. Both of them sit very straight in their cars with their seats perfectly adjusted.

The presented data indicate that the injury risk is higher for women than for men regarding several types of injuries and all types of crashes. The specific difference in fatality risk between female and male occupants has decreased with newer vehicle types but is still visible. Non-fatal injuries, which may lead to long-term consequences, e.g., neck injuries and injuries to extremities, remain a concern. The group has had a particular focus on neck injuries, including permanent disability, because there is evidence of significant differences in risk of injury between male and female occupants. Furthermore, the presented data give reason to assume that similar differences in risk occur for other significant diversity aspects, such as age, weight, and height. In conclusion, there is a larger equity issue. Further review is needed to be able to explain the injury differences that can be seen in crash statistics, (such as more likely to have lower leg injuries, abdomen, arms and necks), and it will be required to review other relevant data, in particular data from both physical and virtual crash tests, with the view to better understand equitability. Nonetheless, the visible inequitable outcomes so far underscore a need to start reviewing the current regulatory requirements.

The potential of virtual crash testing as one way to improve equitable occupant protection has also been considered. Virtual crash testing will make it possible to test vehicles for a wider range of occupants in different crash scenarios, including both the pre-crash event (including emergency braking and evasive steering) and the in-crash event (including occupants of different size and sex, different seating positions, impact severities and impact angles, etc.). Virtual testing will most likely become the most cost-effective procedure for society to evaluate crash safety safety; and also

reviewing possibilities to implement advanced crash test dummies existing today but there will be a need for a regulatory framework, standards and guidelines.

When numerical models (of vehicles, safety systems and humans) are developed and considered for regulation, it is crucial to ensure that they meet certain standards to ensure comparable and reliable results, for instance that a particular virtual testing leads to a similar level of safety performance regardless of which numerical human body model a vehicle has been assessed with.

In this regard, the ad-hoc group on equitable occupant protection has identified the following points to follow up on:

- Continue to collect and review relevant field accident data to further understand the reasons for the varying injury risks of different occupants. For the same reason, collect and review other relevant and available data, in particular data from the virtual testing performed today in research. The reason is to be able to separate the issues which current concerned regulations under GRSP could address directly (if upgraded) from the gaps where more research is needed.
- Explore and advance the current state-of-the-art of virtual crash testing to determine and increase its capability as a tool and process to evaluate equitability, including a specific assessment of the state-of-the-art virtual human body models, i.e., virtual models of humans, particularly the possibilities for a safety performance evaluation at a higher level of detail.
- Review the concerned UN regulations for crashworthiness and occupant protection (passive safety), and related regulations, with a view to identify opportunities for improvement of concerned UNECE regulations regarding equity; NB, equity in its expanded definition.
- Assess whether existing regulations are sufficiently flexible to allow new technical developments regarding occupant safety resulting from new assessment possibilities of particularly virtual crash testing.

B. Objective of the informal working group

The informal working group shall

1. Identify and present a map of issues which should be addressed by regulatory upgrades directly vs gaps where more research is needed regarding equitable occupant protection. Review previous work done in wp.29 regarding a female 50th percentile crash test dummy.
2. Determine how greater diversity in terms of representation of crashes and occupants should be implemented in concerned crash safety regulations, and if needed, propose well defined changes to those regulations and further activities in GRSP.
3. Assess virtual crash testing as a method in concerned regulations to improve equity in occupant protection further, through
 - a. mapping the gaps in terms of equity in the concerned regulations that virtual crash testing could potentially fill,

- b. assessing the current state-of-the-art of virtual crash testing tools and processes, e.g., understand the readiness of virtual human body models regarding their validation level of occupant kinematic and potential to predict injury,
 - c. Review existing ATDs and other tools (incl. injury risk curves and test conditions) and the possibilities they provide to more diverse crash testing.
 - d. drafting preliminary global guidelines for virtual models to ensure that they are inclusive,
 - e. reaching a common understanding of basic requirements that virtual crash testing models should fulfill, particularly regarding car occupants of different sex and size,
 - f. reviewing whether current regulations are sufficiently flexible to allow the new technical developments resulting from the new assessment possibilities created by virtual crash testing, for example for advanced adaptive protective systems,
 - g. assessing the possibilities, and shortcomings, of virtual crash testing when it comes to
 - i. different kind of injuries for example:
 - 1. neck injuries, including the soft tissues of the head, neck, and spine,
 - 2. thoracic injuries,
 - 3. injuries to the extremities
 - ii. the value of new types of crash test, e.g., low-speed rear impact sled tests,
 - iii. increased protection of vulnerable road users (if identified as an equity issue),
 - iv. preventing misapplication of crash test protocols,
 - v. advanced human body models that enable the assessment of all types of crashes in greater detail (omni-directional crash impacts; different seat configurations and seat positions; all types of occupants from child to senior, from short to tall, women and men, etc.)
 - h. Definition of requirements for simulation models and procedures to enable virtual testing
 - i. Requirements to ensure comparability of simulation results (by standardizing requirements for human models, which can be used for virtual assessments)
 - ii. Definition of Anthropometry Catalogues for future safety assessments
 - iii. Definition of validation procedures for virtual models of relevant vehicle parts
 - iv. Definition of procedures to ensure integrity of virtual assessments
4. Identify any shortcomings of existing regulations and related standards, such as whether the current test protocols can be misapplied to optimise crash performance for the specific test conditions and test dummies in a narrow way that is detrimental to the protection of a diverse population.

C. Operating principles

1. The informal working group on equitable occupant protection is open to all Contracting Parties and Non-Governmental Organisations.
2. A Chair, a Vice Chair and a Secretary, will manage the informal working group.
3. The working language of the informal working group will be English.

4. An agenda and related documents shall be made available on the website of WP.29 by the Secretary of the group in advance of all scheduled meetings.
5. All documents and/or proposals shall be submitted to the Secretary of the group in a suitable electronic format in advance of the meetings. The group may postpone discussion on any item or proposal which has not been circulated 5 working days in advance of the scheduled meeting.
6. The Secretary of the group will distribute the meeting minutes to the informal group members within 15 working days after the meeting of the group.
7. Decisions and proposals of the group shall be reached by consensus within the participating contracting parties. When consensus cannot be reached, the Chairman of the group shall present the different points of view to GRSP. The Chairman may seek guidance from GRSP as appropriate.
8. Sessions shall be held in agreement with a majority of the participants after the group has been established in a constitutional meeting. Sessions may be in person or virtual using web-based technology.
9. A provisional agenda shall be drawn up by the Secretariat in accordance with the participants of the group. The first item upon the provisional agenda for each session shall be the adoption of the agenda.
10. The second item on the provisional agenda will be discussion, matters arising and adoption of the minutes of the previous session.
11. The Chair of the group or his/her representative will report back to GRSP on the progress of work on regular basis.

D. Work plan and time schedule until December 2027

- Task 1 – Identify and present a map of issues which should be addressed by regulatory upgrades directly vs gaps where more research is needed regarding equitable protection – Report to GRSP in December 2023.
- Task 2 – Determine how greater diversity in terms of representation of crashes and occupants should be implemented in concerned crash safety regulations, and if needed, propose well defined changes to those regulations and further activities in GRSP. Report to GRSP in May 2025. Report out in two phases:
 - In order to benefit female populations as soon as possible with available tools, the IWG should first provide a recommendation on the usage of existing ATDs (together with options for related injury assessment and test conditions) - by dec 2023.
 - Full report on attaining equity in crash safety regulations to GRSP in May 2025.
- Task 3 – Assess virtual crash testing as a method in concerned regulations to improve equity in occupant protection further and define related requirements for the models and procedures, including how virtual testing can be validated with existing ATDs. Report to GRSP in December 2027.
- Task 4 – Identify any shortcomings of existing regulations and related standards, such as whether the current test protocols can be misapplied to optimise crash performance for the

specific test conditions and test dummies in a narrow way that is detrimental to the protection of a diverse population. Report to GRSP in December 2027.

- The IWG will report to the GRSP continuously until December 2027 in the following task:
 - Continue to collect and review relevant field accident data to further understand the reasons for the varying injury risks of different occupants. For the same reason, collect and review other relevant and available data, in particular data from virtual testing. The reason is to be able to separate the issues which current concerned regulations under GRSP could address directly (if upgraded) from the gaps where more research is needed.
 - Explore and advance the current state-of-the-art of virtual crash testing to determine and increase its capability as a tool and process to evaluate equitability, including a specific assessment of the state-of-the-art virtual human body models, i.e., virtual models of humans, particularly the possibilities for a safety performance evaluation at a higher level of detail considering diversity.
 - Review the concerned UN regulations for crashworthiness and occupant protection (passive safety), and related regulations, with a view to identify opportunities for improvement of concerned UN regulations regarding equity; NB, equity in its expanded definition.
 - Assess whether existing regulations are sufficiently flexible to allow new technical developments regarding occupant safety resulting from new assessment possibilities of particularly virtual crash testing.