

UNECE GRSP Task Force

Deployable Bonnet Systems for Pedestrian Safety

1st meeting, 7 – 8 Feb. 2017
Paris, OICA offices (4 Rue de Berri, 75008 Paris, France)

Notes (Final)

1. Welcome and introduction (Chair)

The Chair, Mr. Park (Korea Transportation Safety Authority), welcomed the participants at the International Organization of Motor Vehicle Manufacturers OICA in Paris and on the WebEx to the 1st meeting of this Task Force. A round of introduction was held to let the participants know the backgrounds of each other. Government representatives, OEMs and suppliers attended the meeting (see annex Attendance List). Dr. Kinsky (General Motors Europe/Opel (Germany)) will provide the secretariat of the Task Force on behalf of OICA. He will support Mr. Park on organizational topics, such as web-meeting hosting, in order for Mr. Park to be able to focus on the technical discussion. Mr. Buenger (General Motors Europe/Opel (Germany)) kindly volunteered to draft the notes of the 1st meeting since it was not possible to do this in parallel to the WebEx hosting and document presenting due to technical reasons.

2. Review and approval of the agenda (Chair)

The agenda was reviewed and adopted. No further topics were added.

3. Work of the Task Force (Chair)

The outline of the Task Force was presented by the Chairman (see document [Deployable_Systems_for_Pedestrian_Safety_TF_Outline.pdf](#)). A clarified test procedure for Deployable Systems had been asked for by Korea to support the self-certification approach for vehicle introduction into the Korean Market. The gtr No. 9 needs to be more detailed to enable self-certification in this matter. An amendment to the gtr No. 9 is the objective of Korea. Paragraphs will be amended and others may be added for clarification. Changes will be considered in the UN R127 as a second step, based on a separate GRSP decision.

The Chair provided the timeline of the activities since the 56th session of GRSP in 2014, including the approval of the mandate in the 170th WP.29 session. The activities are planned to be completed in November 2018 when the Task Force's mandate ends. The timeline is tentative for now and will be adopted, based on the progress of the work. Two further meetings are planned for 2017.

Mr. Zander (Federal Highway Research Institute (BAST, Germany)) asked about a clarification of the timing to the vote, May 2018 GRSP is the planned date. Mr. Abraham (Ford of Europe (United Kingdom)) asked for a clarification of the Task Force's scope. The focus will be deployable systems' clarification as no changes in the non-deployable content of the regulation were mandated. Dr. Takahashi (representing the Japan Automobile Standards Internationalization Center (JASIC)) asked if a potential extension of the mandate was an option. Mr. Park replied that, if major decisions cannot be taken until the end of the current mandate, an extension of the same could be asked for at UNECE.

4. Previous discussion in UNECE (Chair and/or secretary)

(See UNECE documents INF GR/PS/141 Rev.1, GRSP-56-21, GRSP-58-31, ECE/TRANS/WP.29/2016/115)

Adding to Mr. Park's document on the amendment process, Mr. Buenger presented the industry understanding of basic principles to support the rulemaking and the Task Force's activities (see document 20170206_Industry Understanding on Rulemaking.pdf).

Mr. Buenger explained that these principles are meant to create a common understanding on the objectives and provide the grounds for any decision-making in the process. As the document was a first introduction, no comments were given initially. Mr. Park offered consideration of any questions or comments related to the document of OICA.

Mr. Park introduced the first structure proposal of the test procedure (see document Test Procedure of Deployable Systems for Pedestrian Safety.pptx), describing pre-requisites, verification and headform testing sections to create a common understanding of workflow and vocabulary in the procedure. First proposals for technical descriptions were introduced. The details will be subject of alignment in the discussions to come. Based on a request by Japan (see document Japan_Comments_on_Scope_of_TF-DBS_Discussion_draft.pdf), Mr. Park clarified that deployable bonnets are meant to be addressed by the Task Force first, yet keeping other deployable devices in mind, such as external airbags for pedestrians. Mr. Buenger welcomed the easily understandable wording but commented that the amendment should consider the language and layout to blend into the gtr No. 9.

Based on the request by Japan, the name of the Task Force (Deployable Bonnet Systems, DBS) was discussed. A number of alternatives were suggested. Mr. Pott (Hyundai Motors Europe (Germany)) suggested to keep the initial name TF-DBS since this follows the mandate of UNECE WP.29 (see documents ECE-TRANS-WP29-2016-115e.pdf and ECE-

TRANS-WP29-AC3-45e.pdf). After some discussion, the final decision was to change the name to Task Force Deployable Pedestrian Protection Systems (DPPS). However, it was noted that the adjustment of the name does not expand the mandate beyond head impact protection.

Mr. Nguyen (National Highway Traffic Safety Administration (NHTSA, United States of America) wondered whether there could be a centralized website for the Task Force to increase transparency? The secretary noted that, according to his knowledge, it was not foreseen to post documents on the UNECE website. This will be followed up on by the Chair and Mr. Nguyen.

5. Ideas for amending gtr No. 9 (and UN R127) (All)

The proposal of Korea to GRSP with amendments/comments from OICA was read out to the attendees (see document OICA_proposal_GTR9_GRSP-58-31_Rev.docx). The document includes a section with definitions of the technical language used. Furthermore, the document contains a new Annex 1, describing the procedure for static and dynamic testing. Mr. Zander asked for clarification if a “hardest to detect impactor” is included? This had not been done so far. Mr. Gehring (BGS Boehme and Gehring (Germany)) asked about how to convey the timing information for head impact for self-certification. This is an open item and needs to be discussed. The definition of the “deployed position” was clarified to be the height required for a system to meet gtr based injury limits. Higher actuation may occur for additional protection performance. Yet, this movement should not be considered for timing decisions static vs. dynamic testing but is motivated for further protection enhancement. Mr. Zander wondered whether the CAE Human Body Models (HBM) to be used should be specified. In the discussion it was explained that no CAE HBMs are used in and validated for regulations in UNECE so far. Some further comments were made regarding the choice of the legform impactor – a definition or a reference to the gtr No. 9 are needed on whether the lower or the upper legform impactor are to be used. Also, the location of the testing width needs to be more clearly defined. The requested modifications were included in the document and saved under a revised name (see document OICA_proposal_GTR9_GRSP-58-31_Rev20170208.docx).

Mr. Nguyen asked to clarify the relation between Total Response Time (TRT) and Head Impact Time (HIT). Mr. Buenger explained that this also refers to the definition of the “deployed position”: Systems may have a minimum lifting height needed for compliance with regulatory injury thresholds and a maximum deployment being higher to meet different performance demands from regulation vs. consumer testing. Testing should be carried out statically at the deploy height specified by the manufacturer, not at the higher maximum deployment height/end position. Mr. Nguyen requested drawings and eventually performance data to more clearly describe the background of this proposal.

Mr. Yanaoka (representing the Japan Automobile Standards Internationalization Center (JASIC)) presented Japan's comments (see document [Japan_Comments_on_Scope_of_TF-DBS_Discussion_draft.pdf](#)) on the original GRSP proposal (see document [GRSP-58-31.pdf](#)). Also, a comparison on current approaches in deployable systems testing, considering Euro NCAP, Japan NCAP and the Korea plus OICA proposal was shown (see document [Japan_Comments_on_Scope_of_TF-DBS_Discussion_appendix.pdf](#)). The recommendation of Japan is to use the JNCAP approach as a starting point for the gtr No. 9 procedure development. Japan furthermore described challenges of consumer metric protocol adoption. Marking of the head test area in deployed and non-deployed position was discussed. The secretary reminded the group that in the former certification standard from the original gtr No. 9 discussion (see document [ps-141r1e.pdf](#)), the deployed position had been recommended since this is the position where an accident victim hits the bonnet. However, it was noted that the NCAPs use the non-deployed position for practical reasons but Mr. Roth (Audi (Germany)) explained that this may create issues with untestable points etc. Mr. Sutula (NHTSA) commented that he would prefer the approach where the same test areas are marked for the same vehicles with or without deployable bonnets. Mr. Nguyen added that the opened bonnet influences the geometry of the bonnet.

For low speed testing, a comment on the impactor validation of the headforms was raised by Mr. Roth: The headforms had been validated for impact speeds of 35 – 40 km/h, for other velocities this is not the case. Consequently, the performance data output may be questionable. A reference was asked for by Mr. Zander with respect to velocity of 35 km/h and 40 km/h. He added that 32 km/h were used in Japanese legislation. The secretary noted that 32 km/h is close to the original test velocities of 35 to 40 km/h. Dr. Konosu (representing the Japan Automobile Standards Internationalization Center (JASIC)) replied that the validation of the headform impactors was using a simplified procedure based on one drop test only, without any correlation to any defined impact speed such as 35 km/h or 40 km/h or full scale test data, and that this was similar for the HIII dummy. Japan was requested to double-check, if possible, the 32 km/h validation (activities in the International Standardization Organization ISO and in the International Harmonized Research Agenda IHRA). In addition, Mr. Zander was requested to also check historical data, if still available, from headform validation activities in the European Enhanced Vehicle-Safety Committee EEVC since BAST had been the developer of the EEVC headforms. It was commented that also Human Body Models may not be validated in low speed conditions. Mr. Park clarified that low speed refers to testing at the speeds of the lower deployment threshold of deployable bonnets.

For reference, the unofficial translation of the Japan NCAP procedure provided by Japanese OEMs was shown as Japan recommended to use JNCAP as a starting point for discussion (see document [JNCAP Ped Active Device Test Protocol \(E\)_unofficial.pdf](#)).

A summary of the Euro NCAP requirements for deployable devices was given by Mr. Zander (see document [2017.01.31 - Testing DBS within Euro NCAP.pdf](#)). The presentation highlighted the five principal prerequisites defined by Euro NCAP for deployable systems

being tested in the deployed position: a) detection of the hardest to detect (HTD) pedestrian, b) timing of system deployment, c) protection below deployment threshold, d) protection at higher impact speeds, e) bonnet deflection due to body loading. In consumer metrics testing, additional requirements to those in the amendment proposal are in place. The main differences are a head performance requirement below the activation speed of deployable systems, a test of the bonnet and its supporting structures' integrity as well as an activation requirement at a higher velocity exceeding regulated speeds. The fulfillment is validated, by choice of the manufacturer, either with a FlexPLI or EEVC legform impactor test at 50 km/h. The latter assessment is not associated with any protection performance targets but just a system activation signal. Mr. Zander also went into the details of the hardest to detect (HTD) section of the Euro NCAP protocol for choosing between different impactors to assess the minimum activation behavior of the deployable system. He explained that, if the so-called Pedestrian Detection Impactor Version 2 (PDI-2) is specified by the OEM as HTD impactor, no further information from the vehicle manufacturer is required by Euro NCAP. Mr. Buenger added that this is because the PDI2 was developed to be very conservative in signal generation. Mr. Zander went on, explaining that in case this impactor is not nominated, a procedure needs to be followed to generate and convey additional data. This data is derived from HBM simulation for all four percentile humanoids and includes information on the effective mass of the bumper fascia, reaction forces, absorbed impact energy, bumper intrusion and acceleration. Mr. Buenger asked to clarify what the procedure is, in brief, for the exchange of all the information required. Is it different to passive systems? Mr. Zander replied that the Euro NCAP procedure related to the prerequisites for testing active systems in the appropriate state is based on bilateral discussion with the NCAP secretariat and the manufacturer before the actual testing. Due to the different possible states of the deployable system when being tested, it contains additional communication and decisions compared to passive systems. Mr. Buenger asked whether there is the risk of different interpretations of the data between OEM and Euro NCAP secretariat. Mr. Zander replied that the system will be tested in the non-deployed position if Euro NCAP do not agree to the argumentation of the OEM or if there is no information provided at all. Mr. Pott mentioned his concerns on using this procedure for regulatory approval, either for self-certification or for type approval, based on detailed definitions and objectives. Mr. Zander confirmed the need for objective and evidence based criteria, easily understandable with least room for interpretation. The Chair commented Korea NCAP to be similar to Euro NCAP. However, not all requirements were taken over, such as e.g. the 75% bonnet deflection criteria, since justification for this criterion seemed insufficient.

Mr. Bilkhu (Mahindra North America Test Center) commented on the assumed redundancy of the high-speed requirement in Mr. Zander's presentation: Most systems should deploy at speeds above the speed used for pedestrian testing. In addition, research in the early days showed that high velocity impacts lead to different kinematics of the pedestrians resulting in the impact well out of bounds of any typical head test zone. Mr. Bilkhu also highlighted the different scope of consumer metrics testing and regulations. Mr. Zander replied that there are systems on the market shutting off at higher speeds. Systems are

switched off for different reasons, such as meeting crash requirements etc. Hence, this was addressed in the Euro NCAP protocol. Mr. Bilkhu wondered whether a simple sentence that initiation is expected also above 40 km/h could serve for the purposes of this group.

Mr. Buenger asked why 50 km/h were chosen for the higher threshold speed. Mr. Zander explained that this decision was based on feasibility and minimizing conflicts with occupant load cases. The initiation is assumed to be beneficial, even if deployment is not fully completed. Mr. Bilkhu wondered whether there are accident data to support this position. Mr. Roth added that currently more than 4 million vehicles with deployable bonnets are in service on European roads and that those vehicles seem not to cause any additional issues with regard to accidentology. Mr. Zander replied that market penetration of active bonnets will still take several years so that either positive or negative effects within representative in-depth accident data cannot be expected at this point in time already.

The secretary pointed out that the focus of the Task Force is to develop a clarified test procedure that leads to a comparable performance assessment of a deployable system and a non-deployable system for entry into markets. Accident data may be beneficial, yet the task is not to sense-check deployable systems but to develop an assessment procedure. The chair added that in fact no new data should be needed since the test procedure itself had already been discussed in all details and agreed in the gtr No. 9 groups.

Mr. Abraham proposed to use the GRSP informal document of Korea (GRSP-58-31) including the OICA comments/amendments as a starting point, possibly adapting to the structure proposed by the Chair. The so-called OICA proposal is based on the INF GR/PS/141 Rev1, which was already recognized in the gtr No.9, but in a format closer aligned to common regulatory language. Mr. Buenger suggested to first of all align on a high level on overall system requirements rather than including all possible ones in detail before discussing which paragraphs to abstain from. Mr. Pott highlighted the differences in the scopes of consumer metrics and regulations. The secretary wondered whether also high-speed requirements extend the range of assessment beyond the scope of non-deployable systems. Mr. Zander stated that the high-speed requirement is not a performance requirement but just a prerequisite for the HIC assessment at 35 km/h. The 50 km/h high-speed threshold velocity value is open for discussion. Mr. Bilkhu again highlighted kinematics of dummies being lifted above the vehicle resulting in impacts off of the vehicle. Mr. Zander answered that the aim is to ensure active systems providing a certain additional clearance also at impact speeds beyond regulatory testing, as it is also the case for passive systems. Mr. Sutula also stated that consumer metric programs differ greatly from regulations: Regulations shall care for a minimum requirements for all vehicles under consideration rather than apply the maximum out of the set of requirements available.

On a question of Mr. Pott regarding the US legislation process, Mr. Sutula stated that the US rely on data showing the need for a regulation to establish decisions for the regulation.

Such a regulation then must be meaningful and appropriate but must not be design restrictive.

Finally, Mr. Roth stretched the fact that the PDI-2 impactors are not validated for biofidelity. Mr. Zander asked whether this referred to contact biofidelity also, which was answered with yes. More details on this are to be also discussed in the future.

Mr. Zander presented the file on deflection of deployable bonnets (see document 2017.01.31 - Bonnet Deflection of DB Systems.pdf). It shows a study including, amongst other things, a presumed outer surface deflection by the MADYMO CAE HBM impact to a generic vehicle front end and a head impact performance difference between the pre-deflected and the undeflected bonnet surface. Mr. Zander stated that BAST sees a need to address the pre-deflection of the bonnet at head contact point at the time of head contact. Based on tests with the 3.5 kg child headform impactor on a bonnet with different clearances to underlying structure a way forward would be to define a perpendicular clearance requirement at head contact point and time. If the clearance would be less than required, it should be demonstrated that the remaining clearance would be nevertheless sufficient to avoid under bonnet contact. Another option could be to prove that in case of under bonnet contact the obtained HIC values still provide a sufficient protection level. Mr. Buenger noted that in 2015 the issue had been forwarded by the BAST for inclusion into the Euro NCAP protocol but was not agreed. He asked why the requested distance in impact direction is less for adults than for child heads. Mr. Zander explained that the requirement is identical in vertical direction and the differences in impact direction would result from geometry of the test setup with steeper adult head impact angles.

The Chair summarized the proposal to include a fixed clearance value (80 mm in vertical direction, which is to be discussed) at the time and location of the head impact of the HBM. Mr. Sutula asked if the baseline assumption was that clearance is directly associated to HIC performance? Mr. Zander replied that 80 mm could possibly but not necessarily be related to HIC1000. Mr. Sutula stated that not just clearance but also structure matters. Mitigating impact energy can be achieved by different means so, if such a requirements were to be implemented, NHTSA's recommendation were to rather set a performance requirement than a clearance requirement. Mr. Zander noted that BAST's clearance requirement proposal was a suggestion only, driven by practicability.

Mr. Buenger asked which bonnet had been used for the tests in the study shown by BAST. Mr. Zander replied that he does not have this information. Also, he did not have details on which location on the bonnet had been chosen for the tests. Mr. Buenger noted that this information is important since the under-bonnet structure also matters. The clearance proposed by BAST is more than needed for a "green" rating at Euro NCAP. Mr. Zander replied that the aim was here to show the general principle that HIC values can be reduced with higher under bonnet clearance, independently from the type of bonnet that was used and the chosen impact location in that particular case. He offered to closer look into the

definition of a clearance requirement, also considering more tests, if this requirement would be voted for by the group as the preferred way forward.

Mr. Pott stated to also see issues with design restrictive targets. He wondered whether Euro NCAP already made a decision on the proposal shown. Mr. Zander replied that Euro NCAP declined the proposed requirement for the time being, based on majority vote. However, Euro NCAP already had two bonnet deflection requirements as outlined in the presentation on Euro NCAP prerequisites for testing active bonnets in the deployed position.

Also, Mr. Pott asked whether there are similar tests for a passive – meaning non-deployable – bonnet systems. Mr. Zander answered that this is not the case because it is assumed that undeployable systems being less deflected due to pedestrian body loading than deployable systems. So, discussion came up whether such a requirement would also expand the scope of the gtr No. 9. Mr. Pott stated also that any deflection of the structure absorbs impact energy and Mr. Buenger highlighted that the gtr No. 9 already reflects acceptance of deployable systems. All assessments need to be comparable to non-deployable systems. Mr. Zander stated that current gtr No. 9 requirements do not address real world protection performance and that deployable bonnets, according to BAST's understanding, may not work in real life accidents, different to what is suggested in the test procedures. Therefore, the protection provided by deployable bonnets should be at least the same or even higher than the one provided by non-deployable bonnets, as it is done e.g. within European legislation for different vehicles additionally equipped with frontal protection systems. Mr. Zander was asked by Mr. Buenger whether he possibly could provide data to support the hypothesis that deployable bonnets pose a higher injury risk than non-deployable systems. Mr. Zander replied that he did not make such a statement. The point is to make sure that the systems work as intended, which is the reason why five additional prerequisites were introduced by Euro NCAP.

As a reply to BAST's study, Mr. Buenger presented the OICA presentation (see document 20170206_OICA input bonnet deflection discussion.pdf). Key items are the challenges in representativeness and method. The conclusions derived should be discussed in more detail. Most of all, challenges are seen with the implementation of a design space requirement, not a performance based assessment. Also, this is not a requirement for non-deployable systems and hence a restriction of a technical solution already accepted in gtr No. 9.

A discussion of marking of the test area took place. Justification of the deployed state marking with reference to gtr No. 9 was given. The secretary listed the benefits of the non-deployed position marking: Easy to perform, possible for all technologies. Mr. Park noted that Korea is in favor of the marking in non-deployed position. In the following discussion, the opinion was brought up that accepting this could possibly imply a change of the gtr No.9 main document. A solution for the split of the 1/3rd and 2/3rd area calculation needs to be found if impact points were marked in an area that cannot be hit anymore. Also,

glancing blow conditions need to be avoided. Any ambiguous condition by regulation language shall be avoided.

Use of CAE models is currently not foreseen in any regulation. Criteria for “appropriate simulation tools” are not developed or discussed so far. This is an item best to be solved in Geneva at the GRSP and/or WP.29. Mr. Ballaux (Honda Motor Europe (Belgium)) noted that discussion on this is already taking place. He kindly volunteered to check whether references for this can already be provided.

Mr. Park mentioned that document GRSP-58-31 may not be the best starting point but suggested to use the document of Korea including the modifications of OICA (Informal document GRSP-58-31_OICA). This does not imply this document to be accepted as ready-to-use but to use it as a starting point for the work of the task force. One of the things to be discussed further are details for dynamic testing.

The OICA supplemented Korea regulation document was discussed in more detail. Suggested modifications from the meeting have been included and changes were highlighted as tracked changes (see document OICA_proposal_GTR9_GRSP-58-31_Rev20170208.docx).

6. Development of task list (All)

Task List:

- All: Provide questions or comments related to the industry understanding of basic principles to support the rulemaking and the Task Force’s activities (see agenda item 4, presentation of OICA), if needed
- Chair/Mr. Nguyen: Check whether a centralized website or space for file sharing can be provided
- Chair: Further develop details of a milestone plan
- OEMs: Provide drawings/illustrations and eventually performance data to more clearly describe the background of deploy height vs. fully deployed height
- Japan: Check validation information of headforms for 32 km/h from ISO or IHRA respectively (see agenda item 5)
- BASt (Mr. Zander): Check historical data from headform validation activities (see agenda item 5)
- OEMs: Provide geometry data to highlight the differences between deployed and non-deployed marking
- Mr. Ballaux: Provide reference from non-pedestrian regulations working with simulation models, if available. Based on this, the Chair will ask for guidance of GRSP on the definition of “appropriate simulation models”
- Chair: Provide a proposal on the decision process for items to be included from the different sets of requirements into the regulation

Open Items:



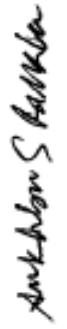




- How do manufacturers provide data required to conduct the testing for self-certification (like 1/3 and 2/3 area)? Or does the procedure need to avoid any information that cannot be derived independently?
- How to best synchronize the test system when conducting dynamic hardware testing?

7. Date and place of the next meeting, expected outcome (All)

The next meeting will be on 28 – 29 March 2017 at OICA offices in Paris (confirmed).

Annex: Attendance list of the 1st meeting

Name	First name	Title	Company (location)	E-Mail Address
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Signature


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