

## MINUTES OF THE SECOND MEETING OF THE GRSP INFORMAL GROUP ON A POLE SIDE IMPACT GTR

Held at the European Commission Centre Borschette  
Rue Froissart 36, Brussels, Belgium  
3-4 March 2011

### Attendees

<b>Name</b>	<b>Organization</b>
Robert Hogan (Chair)	Department of Infrastructure and Transport (Australia)
Thomas Belcher (Secretary)	Department of Infrastructure and Transport (Australia)
Mark Terrell	Department of Infrastructure and Transport (Australia)
Suzanne Tylko	Transport Canada
Jean-Philippe LePretre	UTAC France
Richard Damm	German Federal Ministry of Transport
Tobias Langner	BASt
Dr. Jae-Wan Lee	Korea Automobile Testing & Research Institute
Kim Dae-Up	Korea Automobile Testing & Research Institute
Dr Eun Dok Lee	Korea Automobile Testing & Research Institute
Tim Guiting	RDW Netherlands
Hans Ammerlaan	RDW Netherlands
Ton Versmissen	TNO Netherlands
David Francis	UK Department for Transport
David Hynd	TRL, UK
Susan Meyerson	NHTSA, US Department of Transportation
Stephen Ridella	NHTSA, US Department of Transportation
Kevin Moorhouse	NHTSA, US Department of Transportation
Peter Broertjes	European Commission
Katsutoshi Ishida	JASIC
Akihiko Akiyama	Honda
Keiji Hatano	Nissan
Thomas Loew	Audi
Ralf Limmer	Audi
Philipp Wernicke	BMW Group
Thomas Slaba	BMW Group
André Haas	Daimler AG
Markus Hartlieb	Daimler AG
Danilo Barberis	Fiat - Italy
James Abraham	Ford Motor Company
Dr Sascha Pfeifer	German Association of Automotive Industry (VDA)
Ansgar Pott	Hyundai Motor Europe Technical Center

Philippe Petit	LAB PSA-Renault
Thomas Kinsky	Opel GmbH
Myriam Constant	PSA Peugeot Citroen
Irina Dausse	Renault
Ajit V Gokhale	Tata Motors
Peter Davis	The Society of Motor Manufacturers and Traders Limited
Thomas Herpich	TRW Automotive
Martin Delin	Volvo Cars
By phone	
Chris Wiacek (remote)	NHTSA, US Department of Transportation
Lan Xu (remote)	Chrysler

## **1. Welcome and Introductions**

(Attendees as noted above)

## **2. Adoption of the Agenda**

The agenda (PSI-02-04) circulated by the chairman immediately prior to the meeting was adopted.

## **3. Minutes of the First Meeting and First Progress Report to WP29**

The minutes (PSI-02-03) and progress report (PSI-02-02) from the first meeting held in Bonn, Germany and circulated by the chairman prior to the meeting were agreed.

## **4. US Ejection Mitigation Rule (NHTSA)**

Mrs Meyerson made a presentation on the new US ejection mitigation rule - FMVSS 226 (PSI-02-05). The goal of the rule is to increase occupant protection in rollovers and side crashes. It is expected that the rule will lead to larger airbags, longer inflation times and improved sensors.

Mr Hogan noted that the NHTSA had assumed no benefits in relation to rollovers and ejections when it amended FMVSS 214 and queried whether any of the benefit data for FMVSS 226 might have relevance to a Pole Side Impact GTR and whether this could be extracted.

## **5. Safety Need**

### 5.1 Presentation of consolidated data

Mr Belcher presented a consolidated summary of the crash data provided to Australia by the various contracting parties (PSI-02-06).

Mr Loew asked why fatal pole/tree side impact crashes are so common in Australia.

Mr Hogan explained that road conditions are different for each country, and in the case of Australia there is a very large road network, including in rural areas.

Ms Dausse presented a summary of initial French national and LAB pole side impact data (PSI-02-07). Further data will be provided.

## 5.2 Proposed scope and application

Mr Belcher presented a draft pole side impact GTR scope (based on the current scope of the FMVSS 214 pole test and the scopes of GTRs 7, 8 and 9) for discussion (PSI-02-08). Mr Pott suggested that we should continue analysis of safety need before moving to agree a scope. Mrs Meyerson stated that the US is ready to go forward and ready to start working on the text of the GTR. Mr Abraham suggested that the scope could simply be the same as GTR 7, which would remove the need for the last sentence of the proposed scope.

Mr Hynd asked how well the WorldSID seating procedure will work for some of the more upright seats in Category 2 vehicles. Ms Tylko advised that the WorldSID can be physically positioned / installed in upright Category 2 vehicle seats, but that the validity of the dummy responses obtained from testing in such a position is not clear.

Mr Broertjes expressed some support for the wording of the proposed scope, noting it currently had everything in it, but that there was a need to be able to account for the different ways vehicles of each category are used in different countries.

## **6. Existing Research (including crash tests)**

### 6.1 APROSYS

Mr Versmissen presented a summary of the APROSYS car-to-pole side impact research activities (PSI-02-09), which noted that there were around 10,000 car occupant fatalities in side impact crashes in Europe annually. APROSYS had compared full-scale oblique and perpendicular pole side impact test results and had also used computer simulation to investigate the influence of impact speed, impact angle, pole diameter and impact alignment.

Mr Versmissen stated that the APROSYS group had expressed a preference for a perpendicular impact angle, mainly because of oblique rib loading concerns, but that there was no major objection to an oblique test if necessary for harmonization.

The APROSYS oblique tests had generally resulted in slightly higher numbers overall than the perpendicular pole tests. There was good repeatability for the oblique tests, but there was a need to update some test facility equipment (e.g. a need for larger carrier sleds), but this was not considered an unreasonably high cost / impost for test facilities. It was found that moving the perpendicular impact location forward 100 mm (i.e. an offset perpendicular test method) would produce similar rib deflection values as a 75 degree oblique test method. Mr Versmissen suggested that impact location was more important than impact angle.

The APROSYS group also investigated the suitability of the pole diameter and had concluded that the current 254 mm (10 inch) pole diameter was an appropriate pole diameter to be using in a vehicle-to-pole side impact test.

The APROSYS group had concluded that a 100 mm offset perpendicular vehicle-to-pole test may be better than 75 degree oblique on the basis that the ES-2 and WorldSID dummies were both considered likely to provide more accurate measurements of injury risk in perpendicular impact. However, Mr Versmissen noted that recent multi-dimensional rib deflection measurement systems for WorldSID, such as RibEye and 2D-IRTRACC would be able to be used to overcome any oblique rib loading concern the APROSYS group had at the time the APROSYS study was concluded.

Mr Terrell commented that recent oblique pole tests undertaken by Australia and Transport Canada with the WorldSID 50<sup>th</sup> percentile male dummy (WorldSID 50<sup>th</sup>) fitted with RibEye had shown predominantly lateral rib deflection responses, while perpendicular pole tests had produced considerable forward movement of the WorldSID 50<sup>th</sup> ribs.

Mr Damm asked if the APROSYS group had considered the inclusion of rear seat occupants in the test procedure. Mr Versmissen advised that a struck-side front-row 50<sup>th</sup> percentile male dummy only was considered given that a separate test would be necessary for rear seat occupants. Mrs Meyerson then commented that the FMVSS 214 pole test requirements apply to a 50<sup>th</sup> percentile male and 5<sup>th</sup> percentile female dummy positioned in the front-row only. Placement of dummies in the second row had been considered but was not justified.

## **7. Examination of Possible Test Procedures**

### 7.1 WorldSID update

Mrs Meyerson summarized the progress and activities of the informal group for the harmonization of side impact dummies (WorldSID group). Notably, the materials used for the WorldSID head, skin and pelvis will need to be updated given that the current materials are ceasing to be produced/sold due to more stringent environmental regulations. Mrs Meyerson added that this is a problem for crash test dummies in general and not just limited to the WorldSID family of dummies.

A sub-group chaired by Audrey Petitjean will be commencing the process for developing the injury risk curves for the WorldSID 5<sup>th</sup> percentile female dummy. The WorldSID group timeline currently forecasts that the WorldSID 50<sup>th</sup> and 5<sup>th</sup> dummies should both be ready for use in regulation by the end of 2013. Mrs Meyerson noted that the next meeting of the WorldSID group would be held 8 June 2011 (the week before ESV) in Washington DC.

### *Seating procedure*

Ms Tylko provided an update on the ISO positioning procedure for the WorldSID 50<sup>th</sup>. Ms Tylko advised that the ISO WorldSID Positioning Sub-Committee had agreed a final procedure for positioning the WorldSID 50<sup>th</sup>. The agreed procedure would specify that the seat base be adjusted to the lowest available position. The procedure would also

specify that the seat base be positioned at the first seating track position at least 20 mm rearward of mid-track as a result of the longer and more human like femurs of the WorldSID 50<sup>th</sup> male (compared to ES-2 / ES-2re).

Since the last PSI meeting, the ISO group had agreed that the procedure would allow manufacturers to recommend both a seat back angle and a dummy thorax tilt sensor angle. In cases where no recommendation is provided by the manufacturer, the default manikin torso seat back angle would be 23° and the default thorax tilt sensor angle would be 2° ± 2°. This would ensure independent test facilities can test vehicles in cases where no recommendation is provided by the manufacturer.

### 7.2 Recent crash tests

Mr Ridella presented a summary of recent US oblique pole side impact crash tests using a WorldSID 50<sup>th</sup> with IRTRACC (PSI-02-10). Mr Ridella advised that NHTSA intends to make the test data available online.

### 7.3 Angle of impact and body regions

Mrs Meyerson presented an updated analysis of injuries in US pole side impact crashes (PSI-02-11). Mrs Meyerson advised that the FMVSS 214 pole test benefits analysis presented at the Bonn meeting (PSI-01-16) had conservatively not included any benefits for the abdomen and pelvis in vehicle to pole/tree side impact crashes as the MAIS had always occurred at the head or thorax.

There were serious abdomen and pelvis injuries in the US pole/tree side impact statistics, but the abdomen and pelvis had not been recorded as the location of the Maximum AIS (MAIS) injury in these crashes. The US should therefore be seeing some benefits by way of reduced abdomen and pelvis injuries in pole/tree side impact crashes, although no benefits had been claimed in the FMVSS 214 pole test benefits analysis.

Mr Langner presented an update of GIDAS and CCIS in-depth pole side impact data, by angle of impact, injured body region and casualty age (PSI-02-12). Mr Langner undertook to provide further analysis based on vehicles manufactured in the last 5 years only and including serious injuries.

Mr Belcher presented an analysis of vehicle structural deformation in oblique, perpendicular and offset perpendicular pole side impact crash tests conducted by Australia (PSI-02-13). All tests had been conducted at 32 km/h. Mr Belcher noted that the perpendicular and offset perpendicular tests produced marginally more structural deformation than the oblique test at 32 km/h, but the 32 km/h oblique test was theoretically predicted to produce more structural deformation than a perpendicular or offset perpendicular test conducted at 29 km/h.

Mr Belcher also noted that the oblique impact looked very much like a perpendicular impact and, in that respect, it would be easy for an oblique impact to be mistaken for a perpendicular impact in the statistical coding of field crashes.

Mrs Meyerson presented a summary of NHTSA's motivations for including an oblique pole test in FMVSS 214 (PSI-02-14). Mrs Meyerson advised that NHTSA had analysed

NASS/CDS field crash cases where the side airbags should have deployed, but did not. NHTSA had decided on the oblique impact angle as a result of side airbag system failures / limitations observed in lab tests and from analysis of field crash data.

Mr Terrell asked if NHTSA knew what sensors were being used in the case study vehicles and commented that he did not notice pressure sensors in the vehicles on display at the EuroNCAP exhibition in Brussels he had attended the day before.

Mr Wiacek advised that he had noticed that many manufacturers of US market vehicles were now moving towards multiple pressure sensors instead of single b-pillar acceleration type sensors.

Mr Limmer advised that two sensors are generally required to fire a side airbag, including one at the airbag control module near the vehicle centre of gravity. In an oblique impact the signal at the airbag control module can sometimes be a bit noisier than in a perpendicular impact. Mr Limmer stated that some cars give really good b-pillar acceleration signals while other cars do not and noted that impacts that occur at the end of the door can be difficult to detect with pressure sensors. It is therefore a matter of designing the most appropriate sensing system for each vehicle model.

#### 7.4 Injury curves

Mr Petit provided an update on the progress on the development of the ISO/WG6 WorldSID 50<sup>th</sup> injury risk curves (PSI-02-15). Mr Petit advised that the ISO/WG6 had agreed to use the survival analysis statistical method to construct the injury risk curves. To enable injury criteria limits to be finalised the ISO/WG6 will now need to establish the most suitable injury risk predictors for each body region (e.g. pelvis injury risk could be predicted by 3ms pelvis acceleration and/or pubic force) and the recommended thresholds. The same process would need to be followed for the WorldSID 5<sup>th</sup>. WG6 would meet again in May.

Mr Belcher presented data (2000-2009) on fatalities and serious injuries in Victorian (Australian state) side impact crashes by occupant age (PSI-02-16). It was noted that the 45 year age, which is currently used for the age scaling of current side impact dummy injury risk curves, exceeds (by age) around 85% of Victorian pole/tree side impact crash fatalities, but only around 50% of other side impact fatalities.

Mr Ridella presented a summary of an UMTRI investigation of the effects of occupant age on AIS 3+ injury outcomes (PSI-02-17). Mr Ridella undertook to investigate with UMTRI the possibility of separating pole side impacts from other side impacts in the data presented in this study. In response to a question from Ms Tylko, Mr Ridella indicated that while it would decrease the number of available cases, it was possible to identify contact point in the NASS data base.

## **8. Side Pole Impact: Accidents and Vehicle Testing (BMW)**

Mr Slaba presented an analysis of GIDAS data and internal BMW oblique and perpendicular vehicle-to-pole side impact crash testing (PSI-02-18). This BMW GIDAS analysis was intentionally restricted to vehicles not registered before 2000 with damage to the occupant compartment.

Mr Slaba noted that vehicles fitted with ESC (as will be required by regulation) showed an increased tendency towards oblique impact as ESC acts to bring the vehicle more on track.

Mr Slaba also noted that the ES-2re dummy readings from internal BMW 32 km/h oblique tests were generally more severe than the ES-2 readings from 29 km/h perpendicular tests and that the oblique test had proven practicable to conduct.

## **9. Discussion of candidate test procedures**

Mr Hogan asked the members of the informal group to comment on the candidate test procedures.

Mr Haas said that he did not have a strong position, but his preference was for a test conducted at 75<sup>0</sup> at 32 km/h.

Mr Limmer stated that as a new dummy was being introduced it was important to limit changes. He believed that both perpendicular and oblique tests were acceptable, but that only one should be incorporated in a standard and that there were currently more arguments for an oblique impact than a perpendicular impact.

Mr Loew concurred with Mr Limmer and stated a preference for an oblique test given the extra sensing robustness it promotes.

Ms Tylko stated that Canada has no objection to an oblique pole test where the testing is conducted with WorldSID dummies.

Ms Constant, Ms Dausse and Mr LePretre, all stated that it was too early to indicate a preference and that more time was required to digest the information presented so far. Safety need and benefit-cost would need to be considered. Mr LePretre also suggested the group should discuss the issue of the 5<sup>th</sup> percentile female at the next meeting.

Mr Kinsky also said it was too early to indicate a preference. He was not convinced the safety need was established, particularly with regard to heavier vehicles. Mr Abraham agreed with his comments.

Mr Davis indicated that he would need to consult and it was too early to form a judgement.

Mr Pott stated that it was too early to indicate a preference and the group should focus on the safety need first. Mr Pott also questioned if it would be possible to get the group to accept one test method.

Mr Delin stated that further study was required but that he had a preference for a harmonized standard including an oblique test.

Mr Ammerlaan stated that he had difficulties with scope and would need to consider this further. He was relaxed with either an oblique test or a perpendicular test, noting that there are other issues the group could consider rather than focusing on the angle of impact

issue. EEVC had conducted an analysis of several regulatory amendments to UNECE R95 and had concluded that a pole test would produce the greatest benefits. A pole test would also produce benefits in more than just pole side impacts. Mr Ammerlaan stated that the 5<sup>th</sup> female could be used to encourage manufacturers to design curtain airbags that deploy to a lower and more forward location ensuring better coverage.

Mr Guiting noted that some of the presentations seemed to conflict and further study was required.

Mr Broertjes stated that he was taken by the information presented at the meeting showing how ESC could influence the angle of pole/tree side impacts and that the oblique test required added protection. Broertjes also stated that it would be important to ensure the industry of the EU is not faced with an unnecessary cost burden as a result of diverging test procedures.

Mr Ishida indicated that it was too early to comment and further data was required.

Mr Slaba stated a preference for an oblique pole test with WorldSID.

Mr Pfeifer stated that it was important to avoid options. He agreed with Mr Ammerlaan that discussion needed to be broadened beyond impact angle. It would be for each contracting party to consider the case for introducing a GTR. Mr Pfeifer also requested that presentations be circulated before meetings to enable members adequate time to consider their contents.

Mr Francis stated that it was still a bit early to express a preference, but that the UK was open to oblique or perpendicular impact. The EEVC benefit analysis was based on a 29 km/h perpendicular pole test and a similar analysis would need to be done for a 32 km/h oblique pole test.

Mr Langner stated that he was open to either oblique or perpendicular, with perhaps a slight preference for perpendicular. Mr Langner also suggested that it would be important for small occupants to be addressed, but not necessarily by a full-scale crash test.

Dr Lee noted that a perpendicular test had been adopted in KNCAP but that Korea would prefer an oblique pole test in a GTR as it seemed more realistic.

Mr Gokhale said he would need to study the matter further, but that he felt the scope of the GTR was a real issue.

Mrs Meyerson stated that the US currently has a regulatory oblique pole side impact test and would require a compelling justification to move away from an oblique test. She had not seen this.

Mr Terrell stated that he appreciated pole side impacts were relatively infrequent in some countries, but the genesis of a pole test in IHRA had been to improve head protection. He noted that head injuries were common in vehicle to vehicle injuries. A pole side impact GTR should not just be seen as addressing pole side impacts, but would also address head injuries in side impacts more generally. He noted that other issues loomed larger than angle of impact, but that the robustness of sensors appeared to be improved in oblique

angle tests.

## **10. Establishment of Countermeasures (available and prospective technologies)**

Discussions were reserved for future meetings (included as a standing item on the agenda).

## **11. Benefit Cost Analysis**

Discussions were reserved for future meetings (included as a standing item on the agenda).

## **12. Future Work**

Mr Terrell presented an Australian side impact field data research study proposal for comments / feedback from members of the informal group (PSI-02-19).

Mrs Meyerson recommended that the study should include an analysis of detailed case studies as these can provide a more accurate understanding of injuries than more broad statistical databases. Mrs Meyerson then suggested that NASS case studies could be considered.

Ms Tylko suggested that the study should focus on crashes where there was side impact damage to the occupant compartment.

Mr Francis suggested that the effects of occupant age should be included in the study.

Mr Hogan advised that Australia would also complete a further round of pole side impact crash tests in collaboration with Transport Canada prior to the next meeting of the informal group and invited any suggestions from the informal group regarding the research focus of these tests.

## **13. Timetable**

Discussions were reserved for future meetings (included as a standing item on the agenda).

## **14. Next Meetings**

Mr Hogan advised that the next meeting of the pole side impact informal working group would be held in the week before ESV in Washington DC. Mr Hogan undertook to advise the date of the meeting following further discussions with Mr Frost and Mrs Meyerson.

Mr Hogan proposed that a subsequent meeting could be held sometime around September/October 2011 and suggested that the Asia/Pacific region may be an appropriate venue for such a meeting.

## **ACTIONS**

1. Copy of final rule FMVSS 226 to be provided
2. NHTSA to consider whether any of the benefit data for FMVSS 226 might have relevance to a Pole Side Impact GTR and whether this could be extracted
3. Safety need data to be further developed, including provision of further data by Germany and France
4. Safety need for Category 2 vehicles to be further considered
5. Pole Side Impact GTR scope to be further considered with regard to GTR7
6. Link to be provided for APROSYS benefit-cost analysis
7. BASt to provide to provide further analysis on angle of impact covering other years and serious injuries
8. Sub-Group to be formed to work on injury thresholds
9. NHTSA to investigate with UMTRI the possibility of separating pole side impacts from other side impacts in the UMTRI investigation of the effects of occupant age on AIS 3+ injury outcomes (for possible use Australian study proposal)
10. 5 <sup>th</sup> percentile female to be discussed at next meeting
11. Comments to be provided on Australian research proposal (PSI-02-19)