

**Informal Working Group Meeting for Side Impact WorldSID Dummies  
6<sup>th</sup> Meeting  
Washington, D.C., United States of America  
June 8, 2011**

## **Draft Summary Report**

### **1. Welcome and Introductions**

The chairperson, Mrs. Susan Meyerson, opened the meeting and welcomed everyone. Informal group delegates and representatives were introduced.

### **2. Approval of Agenda**

The agenda was approved after a presentation from Humanetics was added.

### **3. Discussion**

#### **3.1 Injury Criteria and Risk Curves (WS-6-2)**

The ISO working group presented the status of their activities to develop injury risk curves for the 50<sup>th</sup> male and 5<sup>th</sup> female dummies. In addition to upcoming web meetings, a face-to-face meeting will be held in November 2011 in conjunction with the Stapp Conference.

For the 50<sup>th</sup> male, all the curves are ready, but the group still needs to assign AIS levels and determine the best measurements to use to predict risk of injury. Additionally, the group is finalizing recommended guidelines to build injury risk curves, which were evaluated using the WorldSID 50<sup>th</sup> samples. It is expected that ISO will approve the final version of the guidelines and risk curves at their November 2011 meeting. A vehicle manufacturer requested that the WorldSID group agree to preliminary injury risk curves for the 50<sup>th</sup> to aid those that are testing, by having a standard performance metric. The group did not feel that they had enough information to make these recommendations at this time.

For the WorldSID 5<sup>th</sup> female, the scaling of test conditions to build the risk curves is the group's main tasks. Transportation Research Labs (TRL) will conduct work on the effects of the different normalization possibilities, as sponsored by the European Commission. The group needs to find consensus on the scaled test conditions to be used before testing can start. NHTSA plans on conducting some of testing in the second half of 2011. Additionally, TRL will conduct some testing with a borrowed 5<sup>th</sup> female. Medical College of Wisconsin (MCW) also offered to conduct some testing, if they can borrow a dummy. Transport Canada offered their 2 dummies for loan. Once data for all the test conditions are available, the group can begin building the injury risk curves using the guidelines developed for the 50<sup>th</sup> male.

### **3.2 Technical Evaluation Group for the WorldSID dummies**

In the discussion of the 5<sup>th</sup> female testing, concern was expressed with the overall quality of the dummies and their reproducibility, specifically the IR-TRACCs. Additionally, Humanetics indicated that there will be some material changes coming. It was also noted that all 6 of the 5<sup>th</sup> female dummies need to be the same build level for future testing, including comparisons between the SIDII and the WorldSID. There was consensus in the group that a Technical Evaluation Group (TEG) be started to resolve many of the technical issues that arise during the development of the dummy. This group would meet more frequently, primarily via the web similar to the Bio-TEG which is working to develop the BioRID II. NHTSA agreed to look into developing/chairing the group.

### **3.3 NHTSA Evaluation of the 50<sup>th</sup> male and 5<sup>th</sup> female Dummies**

Concerning the 50<sup>th</sup> male, NHTSA is conducting fleet testing to compare results with the WorldSID to the current US FMVSS 214 on Side Impact Protection. Additionally, NHTSA is working with Humanetics to ensure that material changes in the pelvis don't cause changes in dummy response.

With respect to the 5<sup>th</sup> dummy, NHTSA has two dummies and is planning on purchasing a third; however, they have been unable to do much testing due to problems with delivery delays and troubles with IR-TRACCs. The potentiometers used in the 2D IR-TRACCs were not well seated in the housing and this led to calibration issues. Also, a rotation of the shaft about its axis changed the sensitivity. The first problem was temporarily resolved by gluing the potentiometers in place and Humanetics will redesign the 2D IR-TRACCs to incorporate new potentiometers. The second problem is resolved with a design change. NHTSA is waiting for the last few load cells. Due to these problems, VRTC is behind on the original schedule that was proposed for 5<sup>th</sup> evaluation testing in November 2009, but hopes to make up some of this time going forward.

### **3.4 EC WorldSID 5<sup>th</sup> Female Programme of Work (WS-6-3)**

TRL's work is focused in three areas: injury risk, biofidelity, and multi-point chest deflection measurement. With respect to injury risk and biofidelity, TRL is working closely with the ISO group. The programme is looking at Post Mortem Human Subjects (PMHSs) testing and comparing it to sled tests to see which PMHS align with the force plates in the same way. They are also reviewing the scaling methods to apply PMHS data to the dummy. Additionally, they will be performing biofidelity and/or injury risk tests to fill information gaps identified by ISO.

TRL also looked into installing RibEye into the 5<sup>th</sup> female to have multi-point sensing of the thorax deflection, but cited major problems technically and financially. The group felt it was important to install RibEye into the 5<sup>th</sup> female dummy to fully understand the biofidelity responses of the dummy and to help interpret the information recorded from the 1D- and 2D-IR-TRACC systems. Humanetics would provide a quote for the cost to develop a RibEye for the 5<sup>th</sup> Female. NHTSA and the European Commission are considering funding the development/purchase of the system for the 5<sup>th</sup> female. MCW offered to perform testing with the RibEye system and to determine if an algorithm could be developed to correlate the 2D-IR-TRACC system results with the RibEye results.

### **3.5 Autoliv Testing of WorldSID 50<sup>th</sup> male and 5<sup>th</sup> female (WS-6-4)**

Autoliv presented analysis from a series of sled tests and vehicle-to-vehicle crash tests. Results from the 5<sup>th</sup> female testing in the rear seating positions showed that the WorldSID 5<sup>th</sup> female had different kinematic behavior and different deflection measurements than the SIDIIIs. It was noted to fully compare the results we need reliable risk functions and more measurements in the pelvis.

They conducted a series of sled tests using the EuroNCAP side impact pulse and a fixture with a generic intruding side door. The WorldSID 50<sup>th</sup> and 5<sup>th</sup> dummies were positioned on a seat fitted with a thorax side airbag. Several durability issues were noted after the testing, including problems with the pelvis measurements and the 50<sup>th</sup> shoulder IR-TRACC.

In the vehicle-to-vehicle tests, they investigated a number of different aspects of the crash including the influence of impact speed, mass ratio, and compatibility. Conclusions from the testing showed that the WorldSID dummy is a good tool and that side airbags reduce the risk of thoracic injury. It also directed focus of future testing to pelvis loading, occupant-to-occupant interaction, rear seat occupants, and senior occupants.

### **3.6 University of Virginia/Autoliv Comparison Testing of WorldSID 50<sup>th</sup> and PMHS Thorax (WS-6-5)**

Objectives of the testing were to compare constant velocity impacts to the shoulder and thorax, compare results to previously published PMHS testing, and examine chest deflections. Results indicated that the peak impact force and peak chest lateral deformation for the WorldSID 50<sup>th</sup> tend to increase when the impact location moves from shoulder to mid-thorax, while the PMHS testing shows the opposite trend for peak force but similar results for deflection. Future research will include an investigation into deflection differences, differences in load/deflection trends, and spine kinematics/rib cage deformation.

### **3.7 Material Changes for WorldSID (WS-6-6)**

Humanetics provided an update on the material changes for the WorldSID dummies. Due to environmental concerns, a number raw materials used for dummy construction are being banned by the US Environmental Protection Agency. The foams are a specific problem and Ureol, used in the WS pelvis is in short supply. They are looking at Thermoset as a replacement, because it can be tuned during fabrication. The WorldSID 50<sup>th</sup> pelvis will now be made out of Thermoset. They also noted that when they moved the battery out of the pelvis and changed the pubic spacer, the response changed. A redesigned spacer has solved this problem. Humanetics is preparing a process to make pelvises with the new material and then develop a test plan to “validate” the new material. The WS skull also is undergoing a material change and head drop tests will be done to compare responses and check resonance.

Humanetics has also been working with NHTSA to resolve IR-TRACC sensitivity issues. All IRTRACCs will need to be refurbished/repared with new potentiometers and a diffuser to resolve the shaft axial rotation issue. Finally, the bolts in the femur have been redesigned such that the legs can be removed/installed in a car for convenience.

### **3.8 UMTRI Testing to Compare PMHS and WorldSID 50<sup>th</sup> male dummy in Lateral Impacts (WS-6-7)**

UMTRI reported on PMHS and WorldSID 50<sup>th</sup> male dummy abdomen comparison testing using a two-mass sled system to obtain the typical side impact crash signature. Biofidelity targets were generated using the techniques from the ISO frontal biofidelity group chaired by Matthieu Lebarbe. Results indicate that the WorldSID abdomen does not deform as much as the PMHS under similar loading conditions. The WorldSID pelvis may need to be less stiff and have a less tightly coupled mass. Additionally, the thigh flesh may also be too stiff. The full analysis and results are published in ESV Paper 11-0080.

### **3.9 MCW – Oblique Testing with PMHS and WorldSID (WS-6-8)**

MCW reported on the side impact sled work being conducted using a new, sophisticated instrumented wall system that adjusts to the PMHS or dummy anthropometry. The focus of the study is oblique responses in specific body regions, since oblique responses result in greater injury metrics than pure lateral. In the first phase of testing, chest bands were used to compare loading of the PMHS and dummy. Further testing will be conducted to develop biofidelity characteristics, develop PHS response corridors, and assess WorldSIDs potential to sense injury metrics using deflection sensors.

### **3.10 Onboard Data Acquisition System Specifications**

Two 50<sup>th</sup> WorldSID dummies are currently at Infoscitex having the mass properties of the various components measured for the on-board data acquisition specification study; results are expected in June 2011. The body segments being measured are head, thorax/abdomen with the arm, pelvis, thigh and the leg with the foot. Once the mass property work is complete, the sub group will meet again to define the modeling effort to be conducted by PDB. It is anticipated that a standard test will be selected for modeling (e.g., padded flat wall) and the parameters of mass, center of gravity and moment of inertia will be varied within the previously established gray zones. The allowed variance in the selected critical dummy response parameters will have to remain within an established limit (e.g., 5% of the maximum value of thoracic T12 acceleration, etc.). NHTSA/VRTC will propose a draft modeling plan and the members of the ad hoc group (representatives from OSRP, PDB, HIS) will review and modify the plan before it is implemented.

### **3.11 Other Discussions**

- OSRP Testing with 5<sup>th</sup> Female: The group has agreed to work on the project, and testing will follow ISO 9790 procedures. Testing results may be available for the next meeting.
- Transport Canada Testing: Transport Canada is conducting joint side pole impact testing, using the 50<sup>th</sup> male dummies, with Australia. They are still concerned about the low deflection results of the 5<sup>th</sup> thorax in vehicle crashes with lots of intrusion. They are currently reviewing the loading histories. It was recommended to do pendulum impacts for both SIDIIs and WS5th to compare responses in similar controlled loading conditions.
- Shoulder Interaction: There is concern that the WorldSID shoulder can absorb a lot of the load of the impact and deflect the load from the thorax. Is there real-world crash data, involving

newer vehicles, that shows shoulder injuries without severe thorax injuries? Is there other in-lab crash data that shows the WorldSID shoulder is protecting the thorax from injuries? Delegates were asked to look at their data so that the group can better understand the issue.

- ISO Seating Procedure: The ISO seating procedure is stable and it is recommended that delegates utilize it in testing to ensure it produces repeatable results. There are some differences between the procedures for the NHTSA and ISO set-up methods for the lower seat cushion (the rest of the procedures are the same). NHTSA would need to show that the ISO method is reproducible to change for their method, because it is already established in the FMVSS. This will require extensive fleet testing.

**4.0 Action Items**

- a. (All) Review shoulder interactions in crash tests using WorldSID.
- b. (All) Examine real-world crash data to see if shoulder loading without severe thorax loading is a common in newer vehicles.
- c. (All) In future testing, request 50ths and 5ths should be outfitted with angular rate sensors (in addition to linear triax) in head to get data for use in rotational brain injury assessment.
- d. NHTSA to develop population tables for pelvic ring fractures
- e. (All) In future testing, validate ISO seating procedure.
- f. NHTSA to develop sub-group to focus on chest deflections and RibEye.
- g. NHTSA will seek authority to develop/chair a WorldSID TEG.

**5.0 Next meetings**

- October/November 2011 – TBD

**6.0 Attendance**

Akiyama	Akihiko	Honda
Ammerlaan	Hans	RDW
Beebe	Mike	Denton ATD
Bortenschlager	Klaus	PDB
Broertjes	Peter	EC
Campbell	Sam	BMW of North America
Constant	Myriam	PSA Peugeot Citroen
Damm	Richard	Germany/BMVBS (MOT)
Dausse	Irina	Renault
Delin	Martin	Volvo
Depinet	Paul	Denton ATD
Donnelly	Bruce	NHTSA
Hallbauer	Karsten	Takata
Hynd	David	TRL/EEVC WG20
Ishida	Katsutoshi	JASIC Washington DC

Jensen	Jack	GM
Kim	Agnes	Ford
Lee	Eun Dok	KATRI
Lepretre	Jean-Philippe	France - UTAC
Martin	Peter	NHTSA
Meyerson	Susan	NHTSA
Okuda	Yuji	Humanetics
Petit	Philippe	LAB PSA-Renault
Pintar	Frank	Medical College of Wisconsin
Pott	Ansgar	Hyundai Motor Europe
Ridella	Steve	NHTSA
Rhule	Dan	NHTSA
Slaba	Thomas	BMW AG Munich
Subit	Damien	Univeristy of Virginia
Sunnevang	Cecilia	Autoliv
Takehisa	Yamakawa	JAMA
Terrell	Mark	Australia
Tylko	Suzanne	Transport Canada
Wernicke	Philipp	PDB
Xi	Lan	Chrysler
Yoganandan	N.	Medical College of Wisconsin

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