



**EUROPEAN
ENHANCED
VEHICLE-SAFETY
COMMITTEE**

**Status Report for the 19th ESV
Conference**

Dr. Dominique Cesari, Chairman

The EEVC, European Enhanced Vehicle-Safety Committee, has been active participants in the ESV-programme since June 1974 – for more than 30 years – and we welcome this opportunity again to present the EEVC Status report and to report on recent developments of the European Enhanced Vehicle-safety Committee.

Advanced Anthropometric Crash Dummies

This group was dealing with adult dummies, and its scope has been recently expanded to child dummy.

Frontal Impact Dummy

After completion of the EC FID project, the THOR-FT prototype has been re-engineered to solve outstanding technical issues. The group has been kept up to date on the latest design changes and news regarding THOR tests in the US and elsewhere. As harmonisation with the US is crucial, initiatives were taken to create a forum of discussion that ultimately should lead to merger of two competitive designs that have become apparent last year. A Task Group has been set up under the Human Biomechanics Subcommittee of the SAE and various organisations with EEVC WG12 have expressed interest to participate.

In addition, WG12 has been reviewing the THOR-Lx legs. It is preparing a comprehensive report for the SC that will include accidentology review, the design features of the Lx legs and a proposal for injury risk functions to be used with the legs.

EEVC has met with NHTSA in order to promote the harmonisation between the two versions of the THOR dummy.

Activities in Side Impact Dummies have dealt with EuroSID II and WorldSID through the SIBER project.

The development and validation of ES2 has been completed and a modified version (EuroSID 2RE) of this dummy is now included in a NPRM to add it to 49CFR Part 572.

SIBER/WorldSID Dummy

The EC SIBER project has terminated. Last May, the WorldSID dummy specification was approved by ISO and currently the documentation is out for balloting. The remaining dummy issues that were raised by EEVC have been discussed with the WorldSID committee and put on a priority list for

Revision 1. The dummy is extensively used by OEM's in North America, Japan and Europe and will be used in the APROSYS EC project test program as well. EEVC will review any new data generated and design modification in the upcoming time, but focuses on establishing injury risk curves for the dummy. Work on a small female version has started as part of APROSYS.

EEVC representatives to IHRA biomechanics group have extensively contributed to the final report on side impact dummies which will be presented during this conference.

Side Impact Protection

WG13 has been working in two areas of side impact protection. The first is related to the development of an interior surface test procedure. Initially this was work aimed towards the enhancement of safety systems in Europe, possibly supplementing that assessed in Regulation 95. It has also been adopted by the IHRA Side Impact Working Group, as one of their procedures, but it is extended to cover both front and rear seat occupants. WG13 had also been carrying out research in pursuit of an advanced MDB side impact test procedure replicating the type of car to car impacts seen in Europe which could lead to the encouragement of improved protection for both front and rear seat occupants. This second area of work has again been carried out as part of the European contribution to the IHRA suite of side impact tests.

WG 13 has recently published details of the new headform test procedure which includes the assessment of active head protection systems through both a pole test and with an assessment of a deployed airbags to encourage good protection, irrespective of occupant seating position. A WG13 paper on this is being presented within the conference updating that presented at the previous ESV conference on 2003.

The second area of WG13 research, the development of an advanced mobile deformable barrier face, is also reported to this ESV conference. Side impact loading conditions are complex, particularly when trying to load simultaneously both the front and rear occupants in a simple highly repeatable procedure, which is typical of real world accidents. Since the previous reporting on this subject (ESV 2003) further moving car to moving car base line tests have been performed, within the group, as well as studies of the stiffness of modern cars. The specification of the barrier face has improved, since 2003, aligning

its manufacture and construction to that of the barrier face now used in Regulation 95. Research has not progressed to a level where WG13 are happy to release the AE-MDB design for wider evaluation. Recent tests are suggesting that the barrier may be loading some vehicles in a manner that is not consistent with the car to car tests and not applying sufficient loading into the bullet vehicle's 'B post'. Further inventions are being made into a barrier face, based on the published AE-MDB design, but incorporating some from of bumper/beam element. No decisions have been made regarding the precise nature of this additional element.

Compatibility and Frontal Impact

The research activity on compatibility is supported by the EU project VC Compat.

The group has started a test program with two different vehicles in order to investigate the two proposed methods: the full face barrier with load cells, and the offset barrier with deformation analysis. It is expected that this activity will become more important in the near future in order to fulfil the following objectives:

General :

- Proposed test procedures must address both partner and self protection in frontal impacts without decreasing current (regulatory?) self protection levels in other impacts, in particular frontal and side impact.
- Number of additional test procedures should be kept to a minimum.
- Test procedures should be internationally harmonised.

Short Term (to be completed by 2006):

- Improve structural interaction.
- Control new requirements for passive safety (regulatory and rating) to ensure that frontal force mismatch does not become greater than current self protection force in particular to stop the increase of frontal force level of heavy vehicles.
- Control new requirements for passive safety (regulatory and rating) to ensure that compartment strength does not become less than current levels, especially for light vehicles.

Medium Term (to be completed by 2010):

- Improve compartment strength, especially for light vehicles.
- First steps to improve frontal force matching.
- Further improve structural interaction.

Pedestrian Protection

The question of pedestrian protection recently became a very important topic, and EEVC has revised the terms of reference of the working group dealing with this topic: especially, the group has to deal with two new issues, the protection of head injuries against A pillar and windscreen contacts, and the integration of new approaches such as virtual testing for pedestrian protection.

The group is collecting accident data to understand the importance of windscreen contacts and their conditions; it also analyses how simulation can help in the determination of head test conditions as well as other subsystem test procedures such as high bumper tests.

Child Protection

The mandate of the working group on child protection is mainly focused on children in passenger cars but has been extended to coach and bus occupants.

In the area of frontal impact protection, a series of more than 300 sled tests using Q and P series dummies has been completed and is under analysis; this work is reported during this conference.

Side Impact

Recommendation of body segments to be considered in priority for the protection of children according to the type of Child Restraint System (CRS) used is in progress, and will be based on an overview of existing data for children involved in side impact: few data is available with a reasonably good level of detail to give guidelines to WG12 for side impact protection.

Available accident data for children in side impacts will be checked by each participant. LAB presented a first analysis on cases collected in CREST and CHILD programs. The sample includes 233 children, either correctly or incorrectly restrained. Intrusion seems to be a key factor for children injury; head and face are of the most concern, while head, chest and abdomen injuries are of the most frequent in children on boosters or with an adult

belt. Complementary analysis is needed to determine the relevant parameters in collision circumstances.

Buses and Coaches

There is very little data available concerning buses and coaches accidents in Europe, except some limited statistical data; the group is collecting the available data in order to determine the most relevant accident conditions.

Primary and secondary safety interaction

The working group dealing with the interaction between active and passive safety has recently issued a comprehensive report.

The primary and secondary safety interaction concept is the process to take a safety action during the unavoidable collision and collision phases with the aim of decreasing or eliminating the injury of car occupant or pedestrian. The safety action is based on information provided by systems, which sense outside or/and inside vehicle environment.

Whiplash Injuries

This Working Group is responsible for developing test procedures to mitigate injuries in low-speed rear impacts, with a focus on neck injury (whiplash). WG20 has recently issued a state-of-the-art report that forms the foundations for the future work of the Group. The main conclusions of this report are listed below:

- Rear impact and WAD-type (Whiplash Associated Disorder) injury is a serious problem in terms of both injury and cost to society. A lot of work has taken place in trying to quantify the problem and determine effective means of injury and cost reduction. The WAD symptoms are well documented, but the actual injury remains to be established, although several injury locations and injury mechanisms have been suggested. The dynamic motion of the human head-neck system during a low-speed rear impact is known from volunteer test data. To date, several special test dummies and test devices have been developed for the assessment of WAD injury and several test procedures have been developed, static and dynamic.
- Both mean and peak acceleration appear to be important crash severity parameters together with delta-v. Women have about twice the

injury risk compared to men. Energy absorbing seats, active head restraints and good head restraint geometry all seem to be beneficial, based on claims evidence. Multiple test severities must be considered to avoid optimisation for a single condition and to test seat integrity at higher severity.

- The proposed WAD risk assessment parameters NIC_{max} and N_{km} appear to correlate to real world risk of WAD causation and risk curves have been presented based on field accident findings from a limited number of car models from a single manufacturer. Further work is therefore needed before a WAD risk assessment parameter (LNL, N_{km} , T1-rebound velocity, NIC, NDC, IV-NIC, etc.) can be finally established. The exact injury site has still not been established and thus, no biomechanical explanation to the injury causation is available. A biomechanical evaluation of an injury criterion is not expected in the near future. Injuries other than neck injuries and impact types other than pure rear impacts need to be considered in the definition of the test procedure.
- The BioRID II and the RID2/RID3D are the best suited dummies for rear impact whiplash prevention testing.

Further work to select a dummy for a dynamic rear impact test procedure and to develop biomechanically-based injury criteria will be completed by EEVC WG12. WG20 will continue to develop and validate static and dynamic test procedures to reduce rear impact injuries, with a focus on WAD-type neck injury reduction.

Accident studies

A new working group aimed at supporting other working groups by providing coordinated analyses of accident databases, has been recently created. This group is currently developing its work plan and discussions with other working groups have already identified a number of specific topics to be investigated.

In side impact, the following points have raised from the discussions:

- Information on oblique impacts with reference to crabbed test procedures,
- Feedback on real-world experience of side airbags,
- Information on lower extremity injuries,
- Information on the injuries and circumstances of injury to non-struck side occupants,
- Side impact compatibility.

The group is also considering development of new knowledge from pedestrian accident analysis; more specifically, the questions dealing with head injuries to windscreen and A pillar contacts, and the risk of femur and pelvis injuries in relation to vehicle shape and design. The report on active and passive safety interactions has also raised specific issues to be investigated through accident analysis, such as:

- Effect of new technologies on injury reduction,
- Adaptive occupant protection systems,
- Brake assist systems,
- Pedestrian protection systems,
- Methods to assess the benefits of existing and future systems,
- Cost-benefit analysis methods.

A range of research issues concerning rear impact protection have also been identified including:-

- Injuries to other parts of the spine than the neck
- The effects of impact speed on injury risk
- The influence of vehicle age and occupant gender, stature and seating position/seat adjustment.

Virtual Testing

More recently, EEVC has set up a new working group in the area of virtual testing for safety assessment; as this group has just started, it is too early to get results; however, the EEVC steering committee believes that this approach is promising for future methods for safety assessment.

Future of EEVC

EEVC has contributed to IHRA activities from the beginning; two experts selected by EEVC participate in each IHRA working group and the EEVC chairman is also member of IHRA steering committee.

EEVC will continue to support IHRA activities; however, EEVC considers that IHRA should primarily focus its work on subjects not too close to existing or oncoming regulations, as the area of IHRA is research and not regulations.

EEVC has just moved to a legal status allowing the Committee to contract, and thus play a more important role in the coordination of research for the future of vehicle safety, and participate in official committees in the area of vehicle safety.