Head Impact Time (HIT) of Human Body Models

1st Meeting of Informal Working Group on Deployable Pedestrian Protection Systems (IWG-DPPS)
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The newly established Informal Working Group on Deployable Pedestrian Protection Systems (IWG-DPPS) aims at developing a proposal for a test procedure for DPPS such as active bonnets, external airbags etc. for implementation within UN-GTR9 as well as UN-R 127.

The IWG will also develop requirements, ensuring deployable systems working during real world accidents as intended, i.e. as provided during impactor testing (actual performance of DPPS).

In an early stage of the former Task Force (TF-DPPS), BASt therefore had proposed a set of requirements and criteria, ensuring vehicles equipped with deployable bonnet systems to actually ensure the protection potential as provided within pedestrian impactor testing (compare DPPS/2/04).

Criterion #4 (System timing) describes a functionality check for contact based sensing systems related to a reliable total response time (TRT) of the DPPS in order to ensure the bonnet in the correct position at the time of head impact.
• For Euro NCAP, a Technical Bulletin (TB024) has been issued, establishing a set of requirements for human body models used to determine the head impact time (HIT) for individual vehicles.

• The corridors for contact forces and trajectories have been defined for different vehicle categories using THUMSv4 and GHBM at 40km/h and 50km/h.

• In a recent study, a remarkable difference in head contact times of those two HBM has been found (Steinert et al., n.d.).

• Furthermore, PMHS testing against a generic vehicle frontend, called SAE Buck (Pipkorn et al., 2012 and 2014; Takahashi et al., 2014), found the head contact time at a significantly earlier timing than both HBM (Forman et al., 2015).
Comparison of head contact times:

PMHS – 138ms [Forman et al., 2015]
THUMS V4 – 147ms [Wu et al., 2017]
GHBM PS – 155ms
Summary and conclusions

- Correct timing of DPPS is proposed to be ensured by comparing the TRT of the system with the HIT during HBM simulations (HIT > TRT).

- Requirement for the human body models to be used is the fulfilment of HCT corridors defined by THUMSv4 and GHBM.

- A comparison of HCT of both HBM with PMHS data resulted in both HBM having significant greater HCT.

- Prior to using HBM simulations within vehicle type approval or self certification, the existing corridors (Euro NCAP TB024) need to be carefully checked.

- A further validation of the used human body models will be done in the future.

- In the meanwhile, fixed requirements for the TRT of DPPS systems, as suggested in DPPS/4/10, are recommended to be further investigated.