

Head Impact Time (HIT) of Human Body Models

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Background



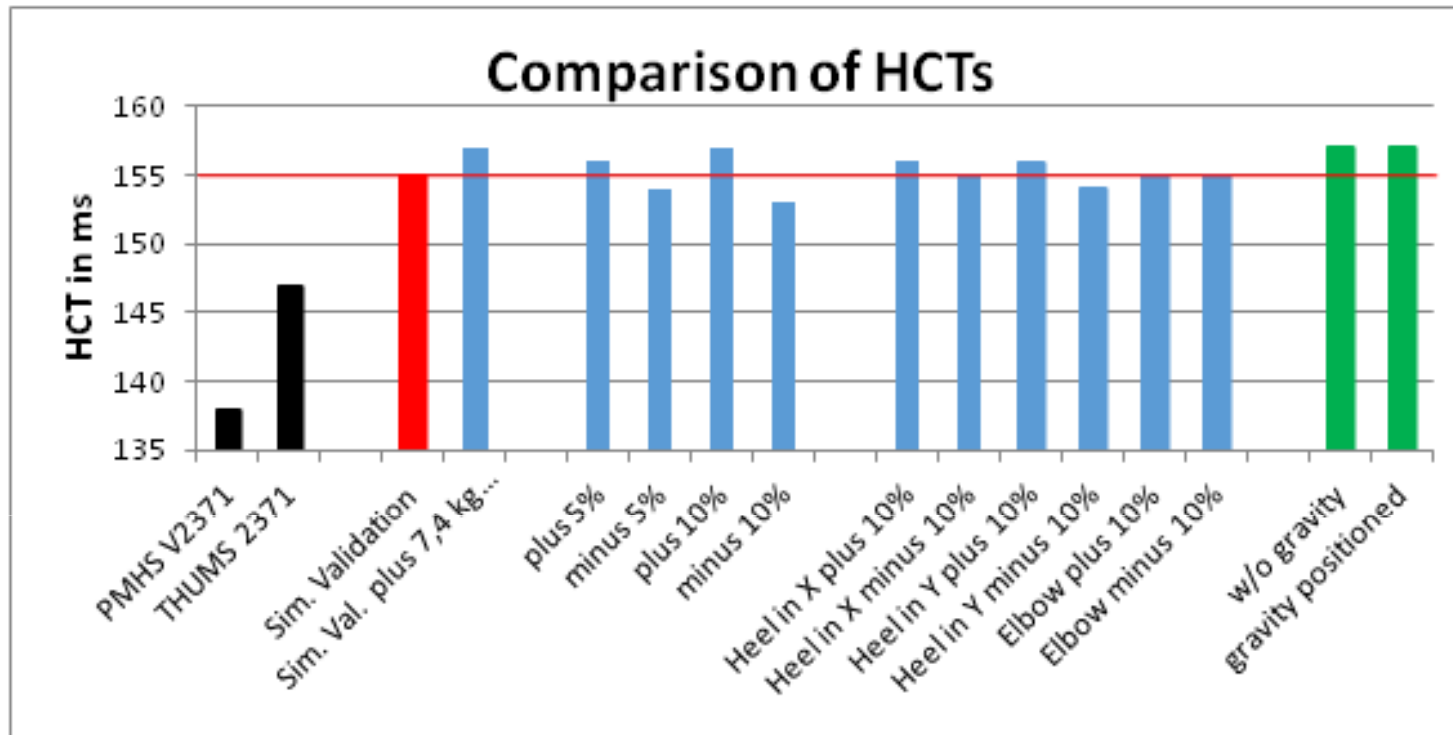
- **The newly established Informal Working Group on Deployable Pedestrian Protection Systems (IWG-DPPS) aims at developing a proposal for a test procedure for DPPS such as active bonnets, external airbags etc. for implementation within UN-GTR9 as well as UN-R 127.**
- **The IWG will also develop requirements,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

Issue



Steinert et al., n.d.:



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.**