Alternative Determination of Head Impact Time (HIT)

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Motivation

- Two issues where the head impact time (HIT) is necessary:
1. Requirement for active bonnets:
   - The total response time (TRT) of the deployable bonnet system must be compared with the HIT of the pedestrian
2. Physical testing with activated deployable system:
   - HIT is necessary for the correct timing between activating the bonnet deployment and triggering the headform propulsion system.
- Determination of HIT only possible during simulation
- TF-DPPS Meeting Minutes of Sept 9, 2017:
  - „There was no suggested alternative to replace the simulation method for HIT"
- But: Verification of simulation difficult for third parties (technical services, authorities, etc.)
  - Usually vehicle simulation model not provided by OEM
  - If vehicle simulation model provided by OEM: No possibility to verify the properties of the provided model with reasonable efforts

Considerations

- Currently no possibility to measure the exact HIT for any possible impact point in physical tests
- Exact HIT measurement not necessary: Evidence is needed that HIT is less than TRT
- HIT mainly depending on bonnet leading edge height (BLEH), bonnet angle (BA*) and the wrap around distance (WAD) of the test point
- A database consisting of the BLEH, BA, WAD and HIT for a high number of test points on different vehicles could provide a possibility to approximate the HIT for a new vehicle/test point
- Several vehicles with deployable bonnets currently on the market
- HIT for numerous test points already at manufacturer's databases

* BA is determined by a line between a point on the bonnet leading edge reference line and a point on the bonnet rear edge, with both points at the same Y-position

Solution

- Establishment of a database consisting of datasets with BLEH, BA, WAD and HIT, *no vehicle type information necessary*

- Filling of the database with data provided by vehicle manufacturers and possibly other sources (authorities, technical services, consumer organisations, …)

- Creation of an algorithm to determine the HIT based on the BLEH, the BA and the WAD of a test point

- Usage of the database in order to achieve a close approximation of a realistic HIT after stating BLEH, BA and WAD of test point

Procedures

- Issue 1: TRT vs. HIT:
  - TRT is measured, e.g. by video analysis of impact tests with a pedestrian object (e.g. dummy, legform, …)
  - Measurement of WAD of the test point as well as BLEH and BA at the Y-position of the test point
  - HIT is obtained by means of the database
  - Comparison of HIT and TRT
  - If TRT > HIT, the test is performed with activated bonnet

- Issue 2: Triggering in activated tests:
  - Measurement of WAD of the test point as well as BLEH and BA at the Y-position of the test point
  - HIT is obtained by means of the database
  - Propulsion system is triggered accordingly

Advantages

- The comparison between HIT and TRT as well as all headform testing can be performed without simulation, i.e. without information exchange between OEM and test institute (although desirable)

- The HIT-related parameters for headform testing can also be obtained easily
  - Decision between testing in deployed state or with activated bonnet
  - Triggering time information for the headform propulsion system

- Database can always be checked, verified and updated

- Datasets will be added continuously to improve the approximation

- If necessary, a correction factor (5%?) can be added for the first (5?) years of implementation

Thank you