

UNECE-R 22 - View of BAST

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Points for possible improvement

- Impact speed
- Impact surface
- Test conditions
- Headforms
- Injury criteria and thresholds



Impact speed

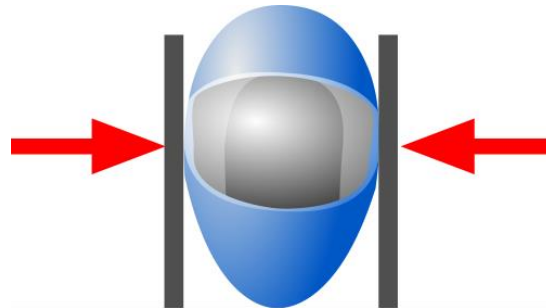
- The impact speeds in accidents are varying between low and high speeds
- For linear impacts the impact speed of **7.5 m/s is deemed reasonable**
 - Lower speeds would not represent the accident situation
 - Higher speeds could lead to stiffer helmets
- The ideal helmet would be able to protect at high and low speeds to address the severe as well as the slight but frequent injuries
 - > **low and high speed test in combination?**

Impact surface

- Currently the helmet impacts a flat and a curb shaped anvil
- In reality the shape and stiffness of the impacted surfaces can vary. However, it is difficult to reproduce this variety
- Rotation is currently only addressed indirectly by measuring the forces in an angled anvil
- To assess the protection against rotational components or the combination of rotational and linear acceleration an **additional** test with an **tangential impact is needed**
- The impact has to be recorded inside the headform

Extent of testing

- Add tangential test as stated before
- Check the rigidity test for relevance:
 - **The rigidity test should be deleted or replaced** by a more suitable test if there is no justification or reason to proof its relevance
 - This test is a requirement which could lead to stiffer helmets

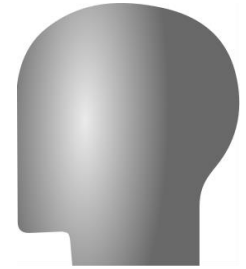




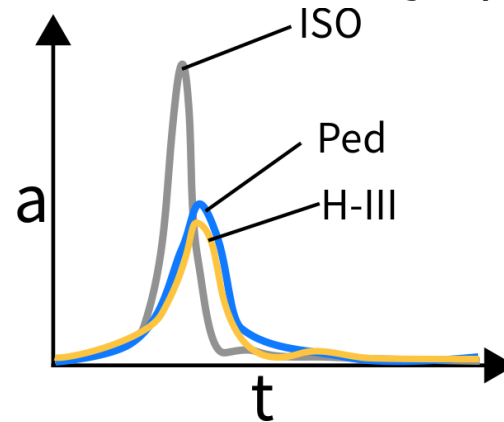
Test conditions

- Currently the impact absorption tests are performed in three different temperatures:
 - -20°C , ambient (25°C) and $+50^{\circ}\text{C}$
- As helmets are mainly used in “normal” temperatures the tests at -20°C are not that relevant for safety
 - Change from -20°C to -10°C or 0°C to gain relevance or
 - Use different limits
- To fulfill the same requirements from -20°C to $+50^{\circ}\text{C}$ could prevent the use of materials more appropriate than EPS
 - > **Better protection in relevant conditions**

Headforms (1)

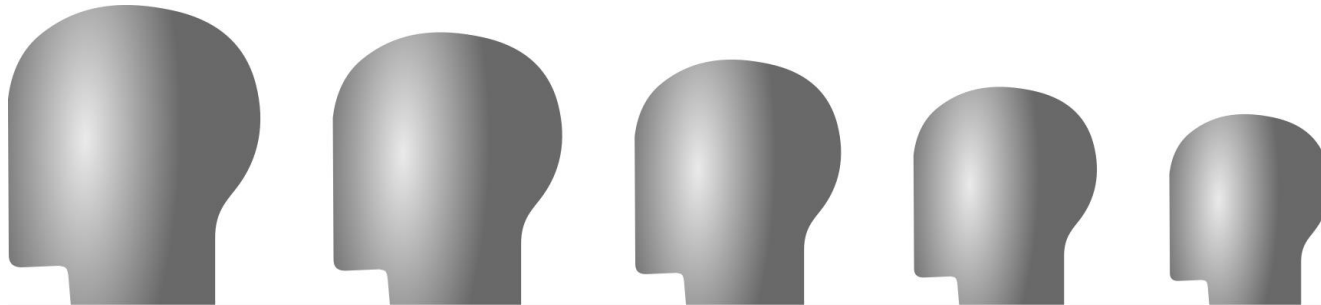


- Currently the headform is a rigid metal head with the upper portion of the neck
- The rigid and stiff structure transmits accelerations more than other headforms
 - > comparability of thresholds and injury mechanisms



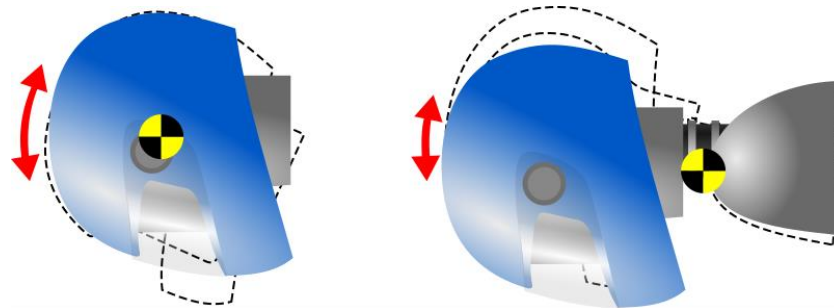
Headforms (2)

- Headform needs to accommodate sensors for **linear and rotational accelerations**
- Headform needs to have a **realistic moment of inertia, mass distribution, geometry and surface**
- Need to address **different sizes** of helmets and helmet fits



Headforms (3)

- The test describes a free fall with no limitation of movement
-> Head can spin due to the rotational components
- Investigation of the influence of an attached neck or body mass
- More realistic loading due to the neck and interactions?
- Neck relevant in the short period of impact?

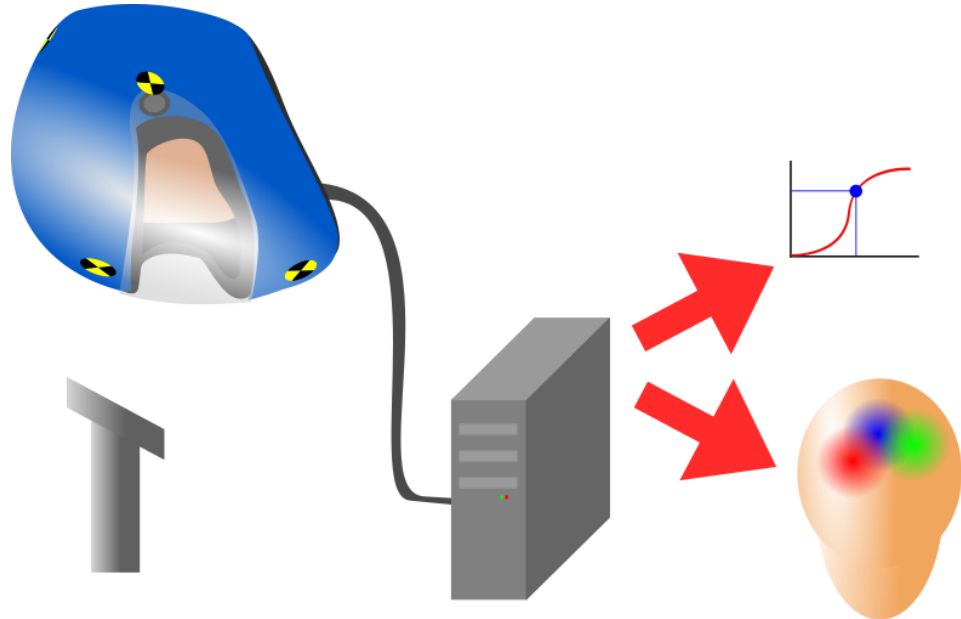


Criteria and thresholds (1)

- Introduction of injury and assessment criteria based on translational and rotational components
 - > **separate tests** for linear and tangential loading
 - > **separate or combined criteria** for linear and tangential loads?
- Existing criteria (HIC, a_{\max}) have to be adapted, replaced or discussed
 - > **Criteria and thresholds have to consider the characteristics of the headform and the sensors**


Criteria and thresholds (2)

- Combination of physical test and simulation has to be discussed
 - Model
 - Measurements
 - Criteria
 - Validation
 - Availability
 - etc.





Thank you for your attention

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