Erfahrungen bei der Nutzung des Primus-Dummys als Radfahrer und Fußgänger bei Crashtests mit niedriger und mittlerer Geschwindigkeit

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### Introduction

- Event Data Recorder (EDR) is a valuable tool for accident research and forensic accident analysis in the US since years
  - current trigger requirements are defined to detect accidents that are potentially dangerous for vehicle occupants
  - triggering in accidents with vulnerable road users are seldom
- Is it possible to define trigger requirements for detecting the majority of accidents with injured pedestrians and bicyclists?
  - accident analysis and test programme were conducted to help define a suitable trigger algorithm

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# Introduction

- BASt project "EDR-Trigger zur Detektion von Kraftfahrzeugkollisionen mit ungeschützten Verkehrsteilnehmern" (FE 82.0755/2021)
- Objectives of the project
  - Propose trigger algorithm for detecting impacts of vehicles of category M1 / N1 with VRUs (primarily pedestrians and cyclists)
  - Test programme to evaluate sensor data for trigger and no trigger events
  - The trigger must be able to differentiate between accidents and special dynamic driving events. The latter should not be recorded in the EDR.
- Supported by
  - Priester & Weyde
  - Continental Automotive Technologies GmbH Regensburg



### **Test Programme**

- Car and van impacts against pedestrians and cyclists
  - pedestrian impacts with stationary pedestrian
  - bicycle impacts with moving bicycle in perpendicular direction
- Impact locations and test speeds according to
  - accident data analysis
  - adjusted during testing in order to find critical accident severity for EDR triggering
  - for most of the configuration tests with and without wrapping up of pedestrians were planned



### Dummy selection

- Conventional pedestrian dummies are discussed to cause too much damage to the car in comparison to real world accidents
- It is expected that too much damage of the car results in higher car acceleration in dummy tests compared to realworld accidents
- CTS Primus dummy was developed in order to cause comparable damage to cars as seen from real world accidents
- CTS Primus dummy is available as breakable and unbreakable version

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# Dummy selection – breakable vs. unbreakable

- Leg fractures are expected to be a type of injury that may cause a difference in reaction force to the car compared to collisions without fractures
- GIDAS data show that leg fractures occur in only 20% of the cases with collision speeds below 30 km/h
- In order to avoid unnecessary dummy repair costs the unbreakable version was selected for tests below 30 km/h. For higher velocities a hybrid version with breakable legs was considered

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#### Test example



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- For the pedestrian impacts it was planned to simulate the pedestrian speed by forward bending of the dummy's thorax for specific configurations
  - initial impact with the leg at the vehicle front corner but also an impact of the head-thorax-complex with the bonnet or windscreen
  - no leg impact but impact of head-thorax-complex at apillar/windscreen







Additional hooks for different fixation and positioning options could be beneficial

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Cyclist

- the dummy tension (e.g. in knee joints) made dummy positioning difficult in cycling posture
- Countermeasures for testing
  - high saddle position
  - very steep saddle inclination (front facing upwards)
  - tape fixation
- In most of the tests dummy stood up before impact



#### Dummy positioning - cyclist



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- Additional fixation points at pelvis, arms and legs could support flexible dummy positioning
  - thorax forward leaning
  - lifted arm
  - lifted leg
- For cycling dummy use
  - more knee flexion would be beneficial
  - better fixation of hands at handlebar by finger flexion would be beneficial



### Wrapping up

- Whether or not a pedestrians is wrapped up depends on car velocity
- Accident data suggests wrapping up at higher velocity than observed in the dummy tests
- Reasons unclear





- ONE test with approx. 36 km/h was conducted using unbreakable dummy and hybrid dummy with breakable legs
  - unbreakable: PRIMUS
    - used for a large number of tests before
    - height 175 cm
  - hybrid: PRIMUS light
    - first test
    - height 172





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Airbag up-front sensor X



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### Conclusions

- Primus dummies appear to be a useable tool for the assessment of car reaction to collisions between cars and pedestrians / cyclists
- Fixation features could be added to support more variability in dummy positioning
  - pelvis
  - arms
  - legs
- In the tested dummy version the use as cycling dummy was difficult
- Leg fractures are seldom for impacts below 30 km/h according to GIDAS accident data
- For an impact speed of 36 km/h it was impossible to approve car response difference based on leg fracture

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#### Questions?



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