BASt Tests: AEB VRU for HDV

Test Results of a Series Production Vehicle & some considerations for close proximity vision

(Based on GRVA-AEBS-HDV-04-03)

VRU-Proxi-19-02
Key take-away:
I want to show you what AEBS can already do...
... and what it could do!
Can & Can’t & Could

Can:
- AEBS can react robustly to crossing pedestrians
- AEBS can avoid accidents up to approximately 20 km/h
- AEBS can avoid accidents in many different configurations
- AEBS can avoid accidents with stationary pedestrians

→ Build on these characteristics!

Can’t:
- AEBS reacts to stationary pedestrians only if they have seen moving
- AEBS can’t react robustly to crossing bicyclists
- AEBS can’t react to corner impacting pedestrians
- AEBS can’t brake strong&fast*

→ Put req’s for close & BSIS & stationary VRU in a new? reg
→ *Change current AEBS R131
Structure

- Accidentology
- Introduction: Video showing AEBS in action
- Cross traffic accidents as example for AEBS effect
- Potential of AEBS for other situations
- Required next steps
- Conclusion & suggestion
AEBS could deliver a significant bonus over pure direct vision alone!

Direct vision: mainly moving off
Before the accident, participants move orthogonal

**View fixed in world**

- Vehicle
- VRU
- VRU
- VRU
- VRU

**View fixed on vehicle**

- Vehicle
- VRU
- VRU
- VRU
- Vehicle

- Veh: 10 km/h
- VRU: 5 km/h
- Veh: 10 km/h
- VRU: 0 km/h
- Veh: 10 km/h
- VRU: 10 km/h
Basics – Cross Traffic AEB (2)

10 km/h = 2.78 m/s
1.2 s reaction time → 3.34 m

5 km/h = 1.39 m/s
1.2 s reaction time → 1.67 m

Conclusion: Close Proximity Vision is not relevant for crossing accidents!
AEB VRU is relevant for crossing accidents!
„Reaction time blind spots!“ (RTBS)  
(for all impact positions, all VRU speeds)

- Human drivers need 1-1.2 seconds time to react to suddenly appearing obstacles
- Typical crossing accidents will not be prevented with increased vision beyond the RTBS.
- Proper AEBS will prevent those accidents.
Basics – Cross Traffic AEB (3)

- Tests are carried out with different impact positions
- Impact position is controlled by the timing the dummy starts
- The lower the number:
  - the later the dummy starts,
  - the less time the dummy travels in front of the vehicle,
  - **the more demanding is the situation.**
Overview of Euro NCAP Scenarios - Crossing

CPNC: Hidden Child (5 km/h)

CPFA50: Running (8 km/h)

CPNA25: Walking (5 km/h)

CPNA75: Walking (5 km/h)

Initially hidden behind these cars
Test Data

Phase 1
- "Haptic Warning"
- \( t_{AEB} \approx 1.4 \text{s} \)

Phase 2
- "Emergency Braking"

Deceleration limited due to current R131*

New R131 with AEBS-VRU under development until Feb 2022
Results when tested according to R152

Test Results

Avoidance on this line
Mitigation below this line

\( v_{VuT} \): "initial speed"
\( v_{Ped} \): 5 km/h
Expected Impact: Center
Accident configurations relevant for Close Proximity Vision

Accidents where vehicle was stationary or is not driving straight
- Moving-Off accidents (such as those targeted by MOIS):
  - Vehicle was stationary, obstructed VRU moves into blind spots
- Turning accidents (such as those targeted by BSIS):
  - Turn is initiated without proper visual contact to the VRU

These situations will benefit from increase close proximity vision, potentially to some extent even if driver is distracted

However, advanced AEBS systems have potential to provide comparable benefit even for completely distracted drivers

Bonus: Crossing accidents!
Potential new regulation & time line

- Sharpen requirements to include all VRU
- Allow fast & strong braking if necessary
- Define requirements for stationary vehicle, stationary pedestrian (= moving-off situations)

- Currently, UN R131 gets a major overhaul (→ Feb 2022):
  - Make systems more robust (!!!)
  - Increase performance requirements for stationary vehicles
  - Incorporate AEBS for pedestrians (at least)
  - Chaired by Japan & Germany (myself)

- This would be a good basis for a quick new? vol? reg (→2023?)
...but there's even more bonus!

- „Blind Spot“ accidents with bicyclists are of major concern, addressed by BSIS (UN Regulation 151)
- Direct vision has only a little effect on turning accidents (e.g. BSIS-relevant)
- Turning AEBS coming to the market just now (we were not yet able to test those)
- Current activities for alternative test procedure for BSIS would allow testing BSIS-AEBS-type systems for the first time
Conclusion

- Increased Close Proximity Vision lowers the Vision Blind Spots, but has little effect on Reaction Time Blind Spots (associated to crossing accidents)

- Remaining effect of Close Proximity Vision: *Moving-Off Accidents*

- Current AEBS VRU avoids up to approximately 20 km/h, including stationary Pedestrians in some situations

- **Suggestion:**
  - Lay down requirements for automatic & robust VRU braking, based on „new R131“ but targeting especially Low-Speed Moving-Off scenarios, until early 2023, (in a new GRSG-GRVA activity?)
  - AND Maintain stringent but not too stringent DV for equipped vehicles
  - **Justification:** Use the best tool for the job. Robust automatic braking addresses more accidents than vision only (>>> BCR!)
One last thought

AEBS for VRU has proven its effectiveness in retrospective analyses (e.g. IIHS for passenger cars)

Are there retrospective analyses of the effect of direct vision?
Thank you for your attention!

Please get back with any questions: seiniger@bast.de