Justification for the UEBS proposal

(ECE/TRANS/WP.29/GRVA/2022/24)
General Motivation for the UEBS proposal

ˣ EC establishing ambitious direct vision requirements for heavy vehicles to address moving off accidents → massive cab redesigns
ˣ DE position: Reliable active safety systems possibly better in many aspects, no driver reaction to pedestrian required for avoidance

Accidents prevented by
Active Safety

Accidents prevented by
new Direct Vision
What is Active Vehicle Safety?

Active Vehicle Safety
Avoidance of Accidents!

Passive Vehicle Safety
Mitigation of Consequences

*Can we make active safety as safe, robust and reliable as a window?*
Overview of Scenarios - Crossing

CPNC: Hidden Child (5 km/h)
Initially hidden behind these cars

CPFA50: Running (8 km/h)

CPNA25: Walking (5 km/h)

CPNA75: Walking (5 km/h)
AEBS already can avoid accidents
The EU has fixed in their General Safety Regulation:

“Requirements should therefore be introduced to improve direct vision to enhance the direct visibility of pedestrians, cyclists and other vulnerable road users from the driver’s seat by reducing to the greatest possible extent the blind spots in front and to the side of the driver. The specificities of different categories of vehicles should be taken into account.”

“Greatest possible extend” is not verifyable, so there seems to be at least some technical flexibility

This interpretation will under the responsibility of GRSG
UEBS Strategy

- GRSG Discussions require a – still missing - definition of an active safety system (see GRSG-102, agenda item 4f discussions)

- Adjusting direct vision requirements for active safety vehicles requires information on expected performance

- Strategy: **establish a safe standard** – produce a regulation with ambitious performance thresholds so all stakeholders can know what to expect
Before the accident, participants move orthogonal

View fixed in world  View fixed on vehicle

Vehicle  Vehicle  Vehicle

VRU  VRU  VRU  VRU

VRU  VRU  VRU

Veh: 10 km/h  VRU: 5 km/h
Veh: 10 km/h  VRU: 0 km/h
Veh: 10 km/h  VRU: 10 km/h
„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
- Driver cannot react to threats appearing in the areas shown on right side →
- Typical crossing accidents will not be prevented with increased vision beyond the RTBS
- Key task of increased Direct Vision: Prevent moving off accidents
HGV vs Pedestrian
- Turn into pedestrian front / behind
- Pedestrian crossing nearside
- Pedestrian crossing farside

Direct vision: mainly moving off

Ego

n=170

n=38

n=83

German In-Depth Accident Study (GIDAS), 2005-2020.

Method: Analysis of GIDAS accidents with personal injuries. German fatalities and seriously injured based on DESTATIS total numbers and on accident distribution in GIDAS.
UN-R159 (Moving Off Information System) Specs

When vehicle moving (\(\leq 10\ \text{km/h}\)):
- Inform for VRU: stationary up to longitudinally 10 km/h

When vehicle stopped:
- Inform for VRU: crossing 3-5 km/h

In blue area as shown

\(\geq 15\ \text{lux ambient lighting}\)
R159 shortcomings

- Information requires timely driver reaction
- Vehicle moving: only reacting to longitudinally moving / stationary VRU
- Vehicle stopped: only reacting to crossing VRU 3-5 km/h
- → no wholistic requirements
- Gap between vehicle and blue area
Proposal – Perf Req’s

Stationary

- Motion inhibit when VRU in dark blue zone (new!)
- Motion inhibit when VRU in orange zone (total: 1.5 m)

Moving

- Avoid collision with all longitudinal VRU up to 10 km/h vehicle speed
- Avoid collision with all crossing VRU <=5 km/h vehicle speed <=5 km/h 0-100% impact
- Avoid collision with all crossing VRU <=5 km/h vehicle speed <=20 km/h for center impacts (connection to R131-02, starting 20 km/h)
- Avoidance of all cases R151, alt test procedure
Robustness Requirements

- No lux limit → not dependent on ambient lighting!
  → classifying RADAR, possibly 2x
  → low-cost LIDAR or ultrasonic for confirmation

- Rain/fog etc. should be ok for RADAR & close distances

- No deactivation foreseen; automatic deactivation if sensors are covered with ice (similar to R151, R159)
Basics – Cross Traffic AEB

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.
Avoidance possible when seen here

Vehicle

3.34m

1.67m

10 vs. 5 km/h

VRU

Conclusion: Close Proximity Vision is **not** relevant for crossing accidents!
AEB VRU is **relevant** for crossing accidents!

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

Avoidance possible when seen here

VRU

2.55m
Why no avoidance 0-100% impact at 10 km/h?

1. **Vehicle stopping distance from 10 km/h:**
   - Stopping dist. 3 m, braking starts at ~ 1 s TTC

2. **Pedestrian:**
   - 5 km/h → distance travelled in 1 s approx. 1.4 m

3. **Pedestrian stopping distance** is about 0.3 – 0.5 m

4. Ped position when braking needs to start is before (!) the pedestrian has reached its own stopping distance

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**Lower vehicle speed → lower stopping distance:**

1. Stopping distance from 5 km/h:
   - Braking distance 1.5 m, braking starts ~ 0.5 s TTC

2. Ped.: 5 km/h → travels approx. 0.7 m in 0.5 s

3. Pedestrian stopping distance ~ 0.3 – 0.5 s

4. Pedestrian stopping distance ~ = vehicle stopping distance, so vehicle needs to start braking when it is clear that pedestrian will not stop in time.
Why avoidance 20 km/h vehicle speed?

1. **Vehicle stopping distance** from 20 km/h: 
   → stopping dist. 13 m, braking starts at ~ 2.5 s TTC

2. Pedestrian: 5 km/h → distance travelled in 1 s approx. 1.4 m
3. Pedestrian **stopping distance** is about 0.3 – 0.5 m

4. But for center impacts: 
   Pedestrian is not able to prevent entering in vehicle path (orange line) when vehicle starts braking.