Transmitted by the expert from Germany

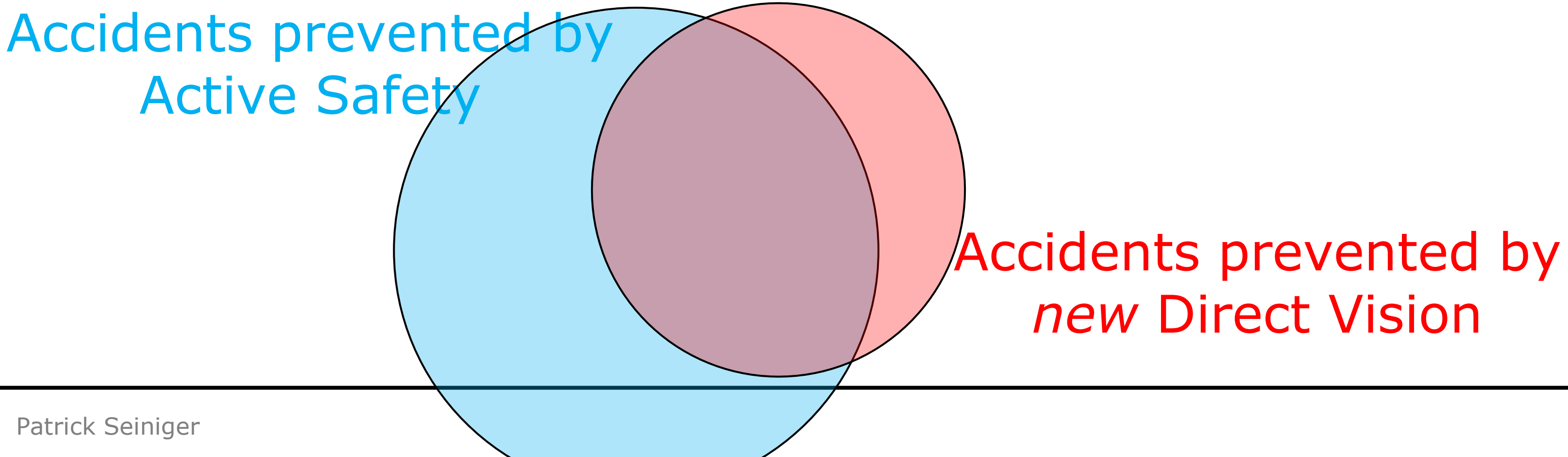
Informal document **GRVA-14-37**
14th GRVA, 26-30 September 2022
Provisional agenda item 7

Justification for the UEBS proposal

(ECE/TRANS/WP.29/GRVA/2022/24)

General Motivation for the UEBS proposal

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



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?

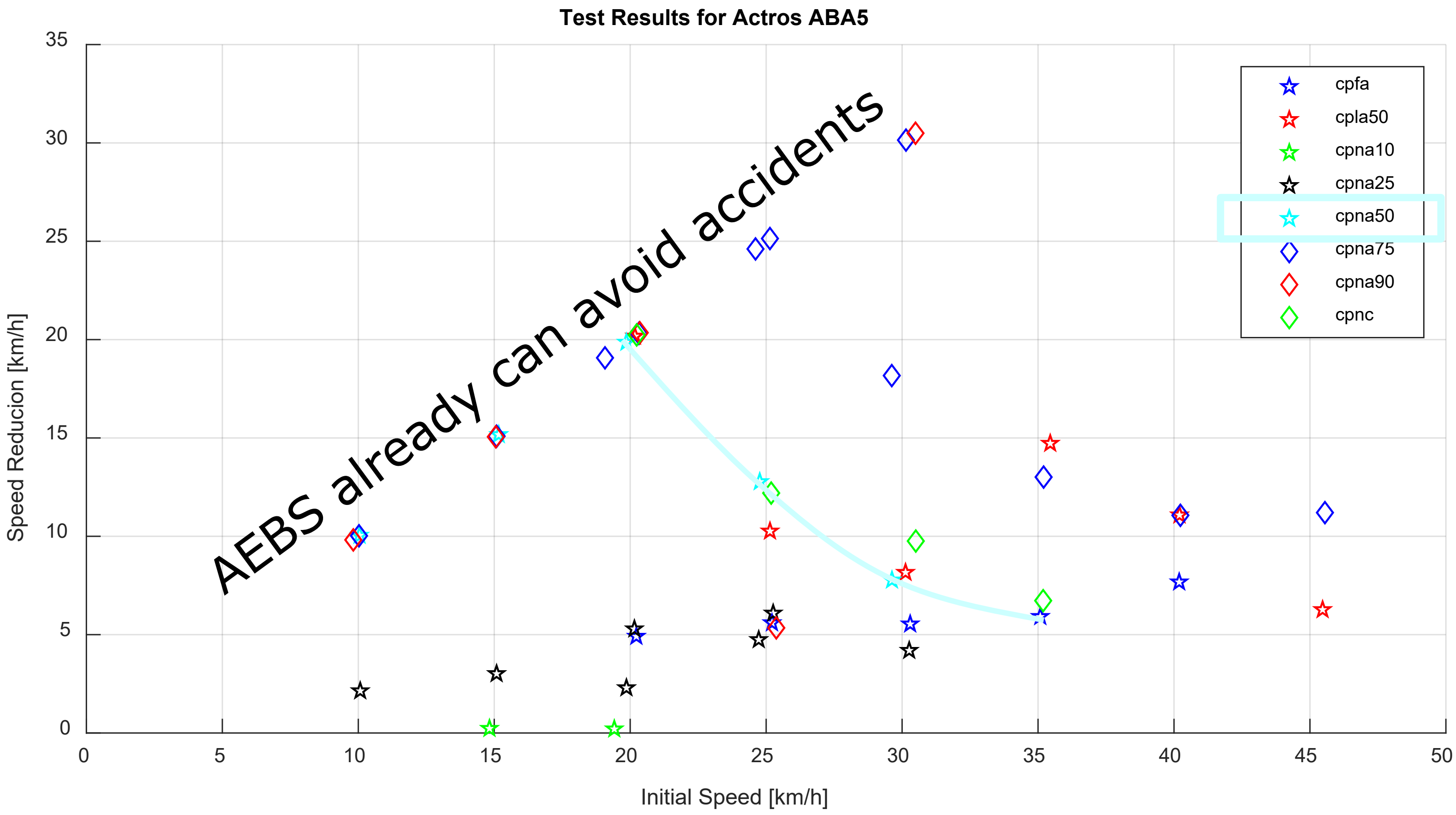
Overview of Scenarios - Crossing

CPNC: Hidden Child (5 km/h)

CPFA50:
Running (8 km/h)

CPNA25
Walking (5 km/h)

CPNA75
Walking (5 km/h)


Test Results for Actros ABA5
AEBS already can avoid accidents
Speed Reducion [km/h]
Initial Speed [km/h]
0
5
10
15
20
25
30
35
40
45
50
cpfa
cpla50
cpna10
cpna25
cpna50
cpna75
cpna90
cpnc

Boundary Condition: General Safety Regulation 2

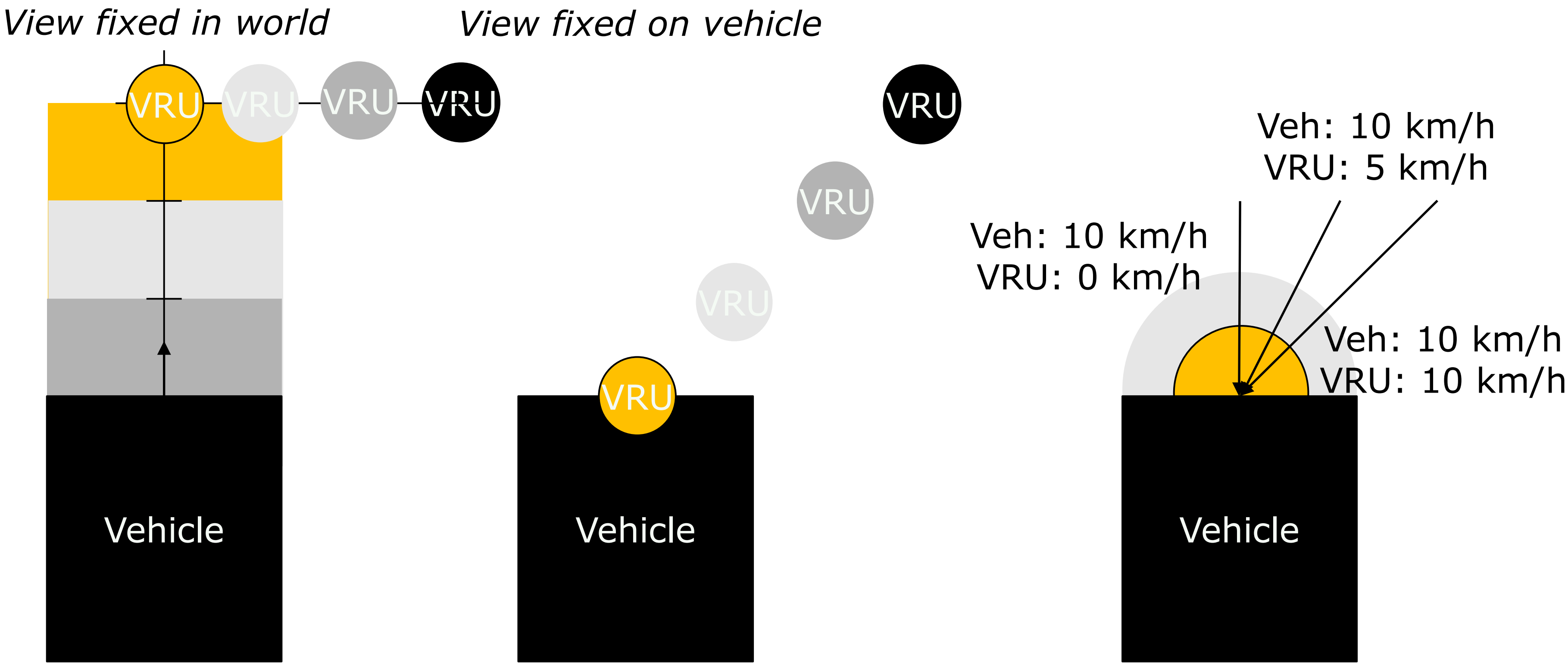
- The EU has fixed in their General Safety Regulation:
  "Requirements should therefore be introduced to improve direct vision to enhance the direct visibility of pedestrians, cyclists and other vulnerable road users from the driver's seat by reducing to the greatest possible extent the blind spots in 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 <u>safe</u> standard*** – produce a regulation with ambitious performance thresholds so all stakeholders can know what to expect

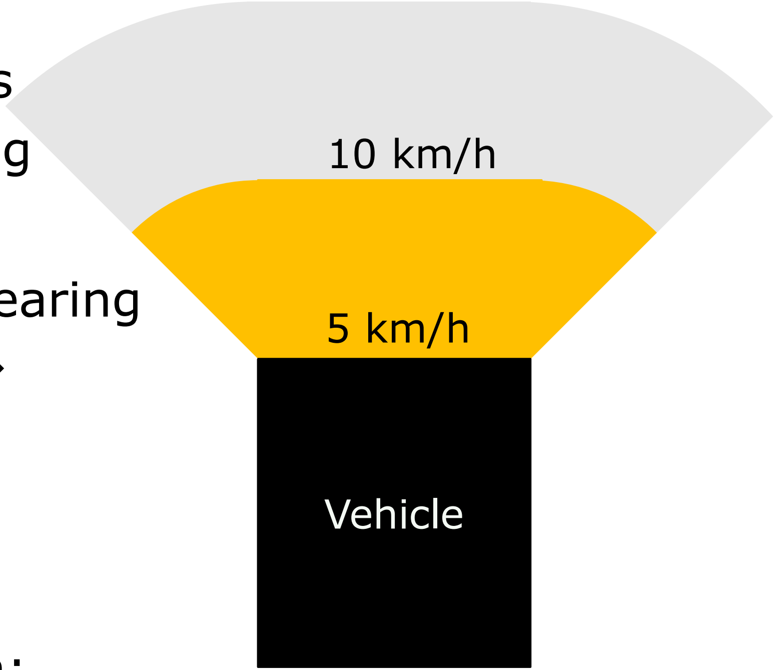
- Before the accident, participants move orthogonal



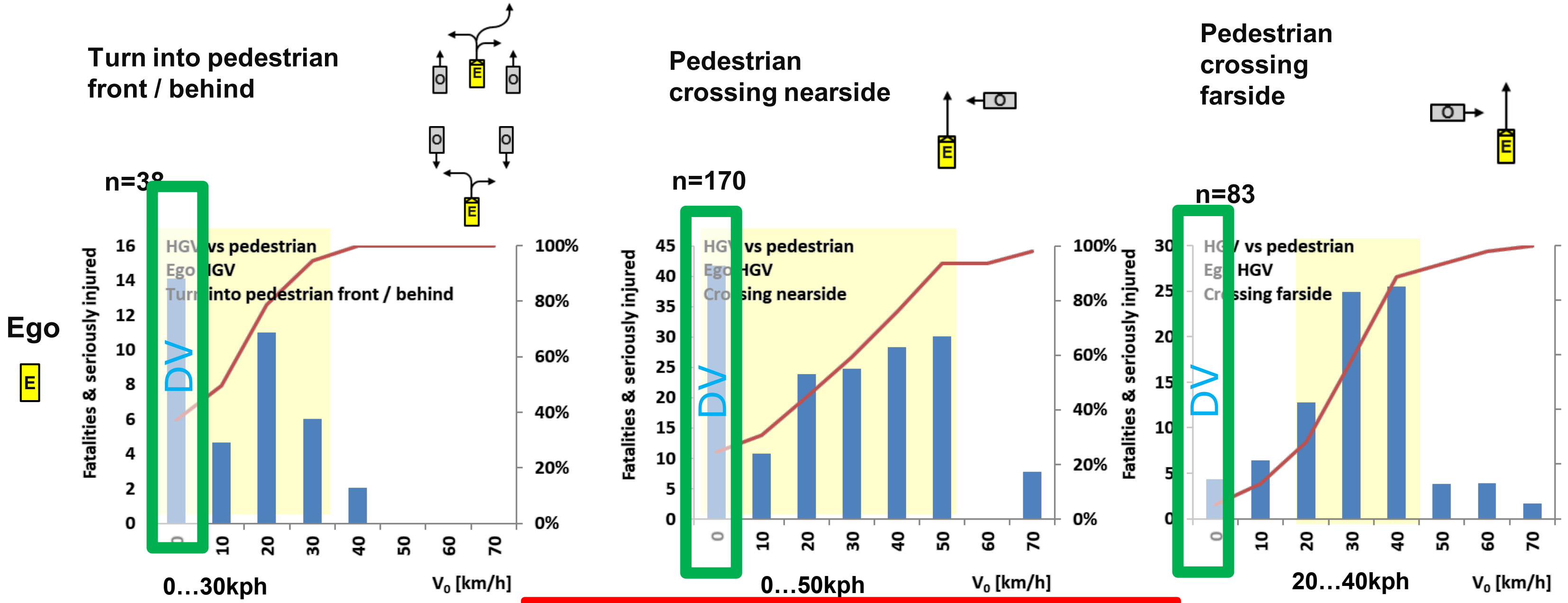
„Reaction time blind spots!“ (RTBS)

(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

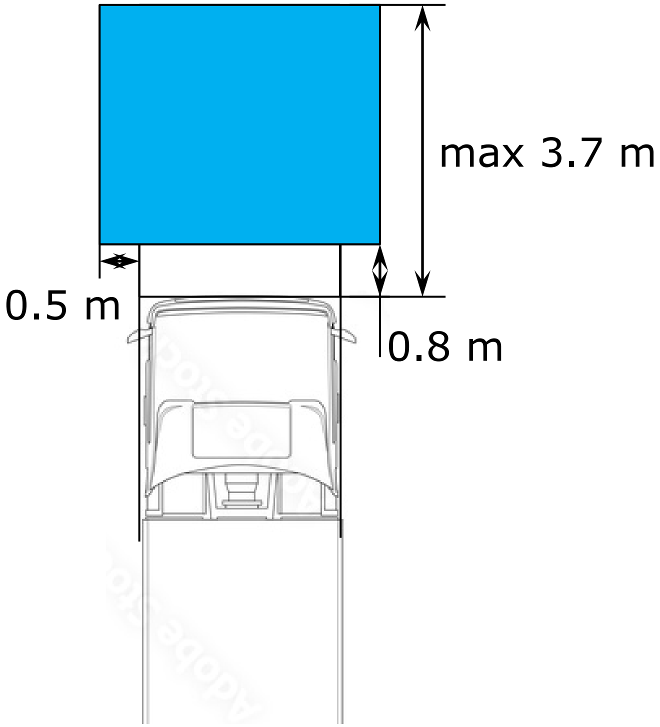


GIDAS Accidentology: AEBS-HDV-SP-02-05 (CLEPA)



Direct vision: mainly moving off

UN-R159 (Moving Off Information System) Specs

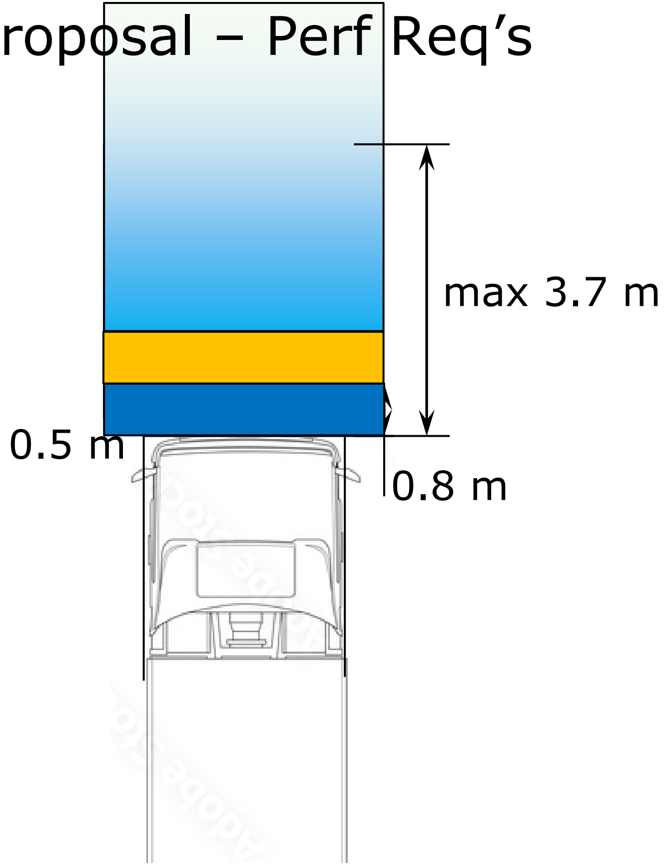


- When vehicle moving (<= 10 km/h):
  - Inform for VRU: stationary up to longitudinally 10 km/h
- When vehicle stopped
  - Inform for VRU: crossing 3-5 km/h
- In blue area as shown
- >= 15 lux ambient lighting

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

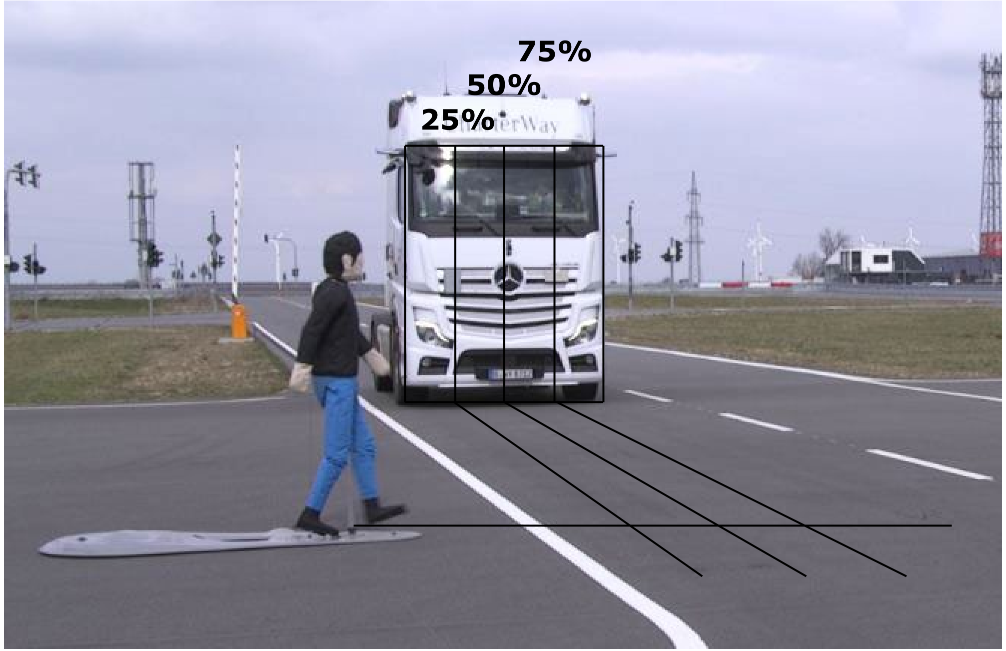
Robustness Requirements

- 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)

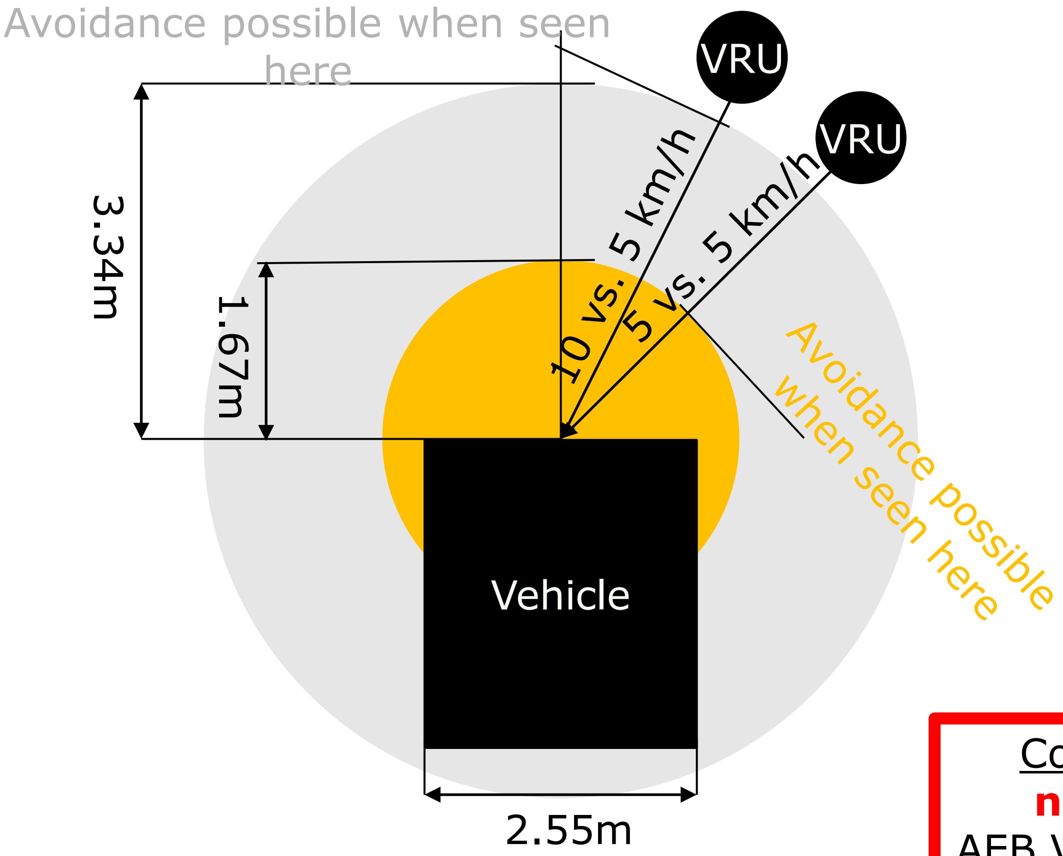
Backup

Basics – Cross Traffic AEB

- Tests are carried out with different <u>impact positions</u>
- 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.



Basics – Cross Traffic AEB (2)

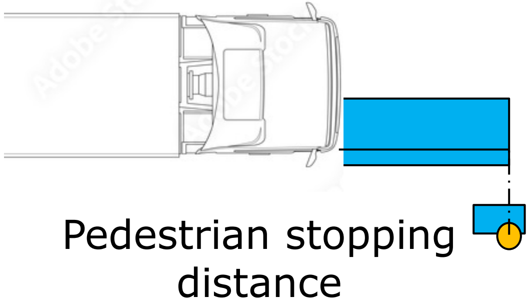


10 km/h = 2.78 m/s
1.2 s reaction time → 3.34 m

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!

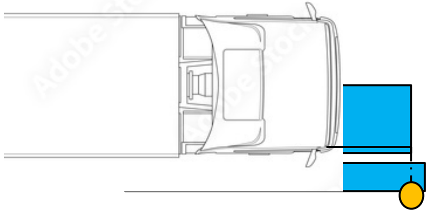
Why no avoidance 0-100% impact at 10 km/h?



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 it's own stopping distance



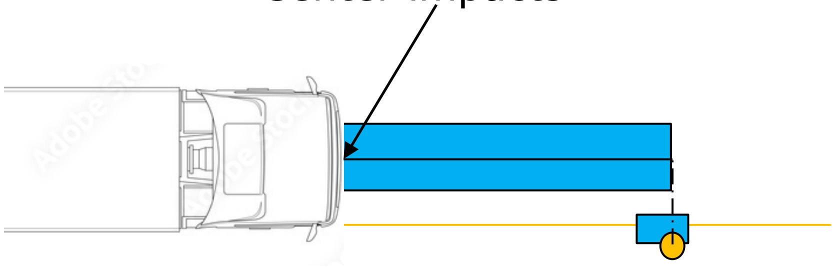
Lower vehicle speed → lower stopping distance:

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?

Center impacts



1. <u>Vehicle stopping distance</u> 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 <u>stopping distance</u> 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.