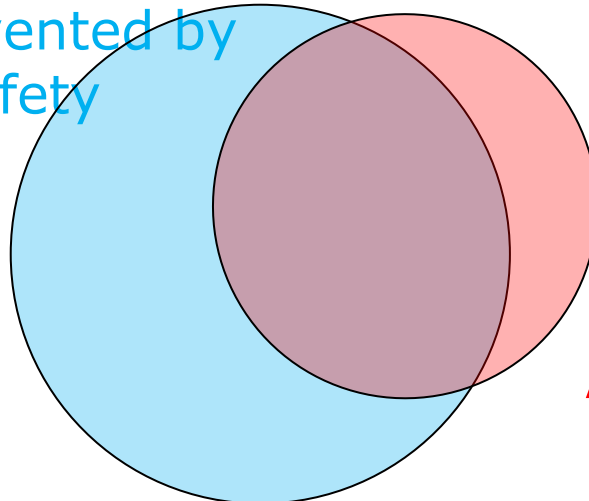




- ➔ EC establishing ambitious direct vision requirements for heavy vehicles to address moving off accidents → *massive cab redesigns*
- ➔ DE position: Reliable active safety systems possibly better in many aspects, no driver reaction to pedestrian required for avoidance

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)



CPFA50:  
Running (8 km/h)



CPNA25  
Walking (5 km/h)

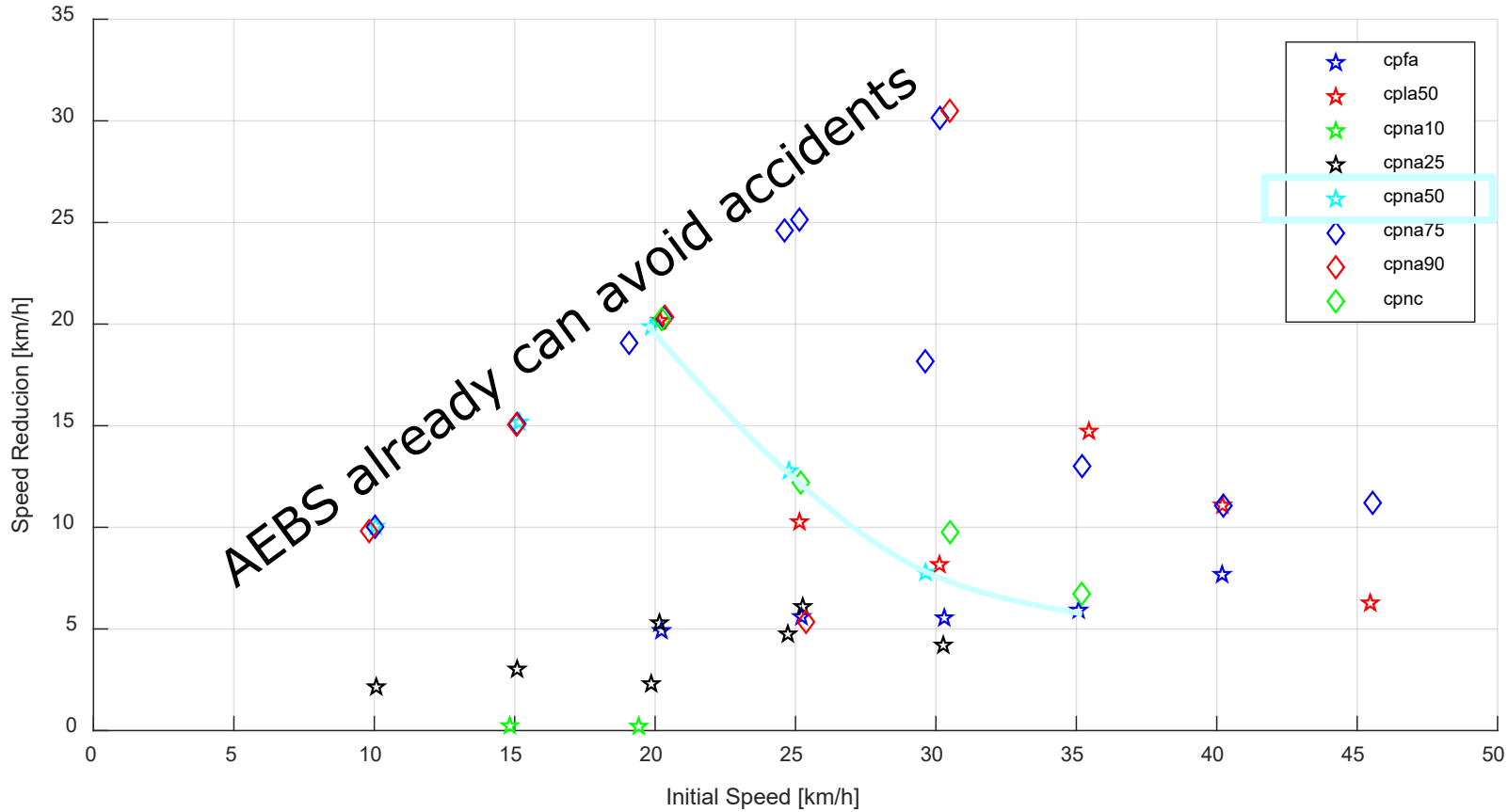


CPNA75  
Walking (5 km/h)





Test Results for Actros ABA5



## 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 verifiable, so there seems to be at least some technical flexibility
- ➔ This interpretation will fall under the responsibility of GRSG

## UEBS Strategy

- ➔ Adjusting direct vision requirements for specific, active safety-equipped vehicles requires information on expected performance
- ➔ Current discussions in GRSG suffered from an unclear expectation for possible performance & robustness
- ➔ Strategy: ***establish a safe active safety standard in GRVA*** – produce a regulation with ambitious performance thresholds and robustness as basis for following discussions on DV requirements

## Related Documents in GRVA

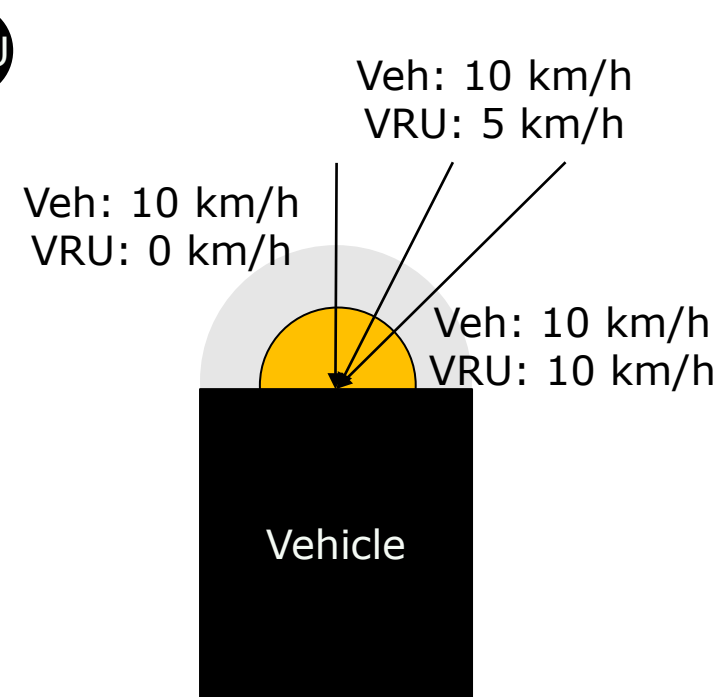
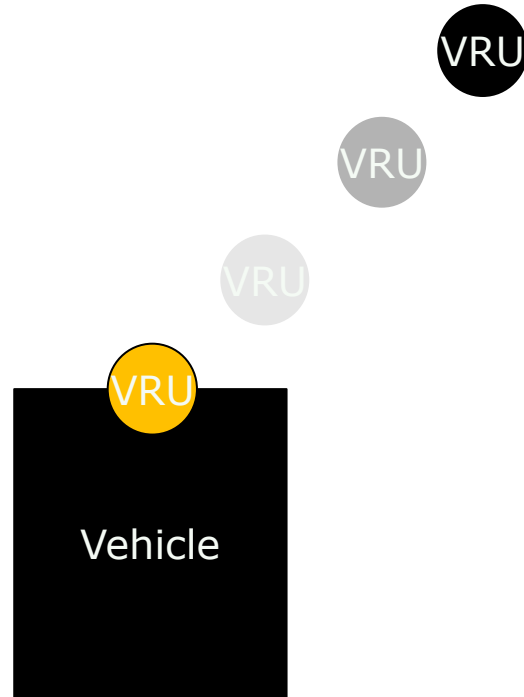
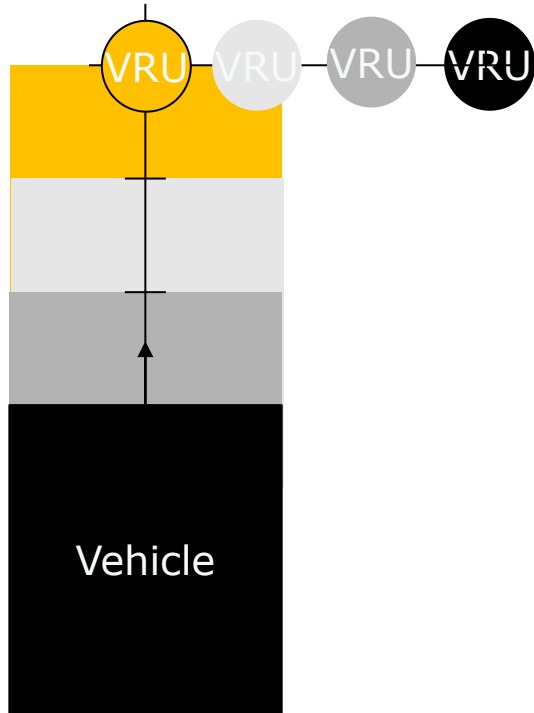
- ➔ ECE/TRANS/WP.29/GRVA/2022/24 – proposal for a regulation
- ➔ GRVA-14-37 – introduction presentation to the proposal
- ➔ GRVA-14-10 – position paper from Denmark



➡ Before the accident, participants move orthogonal

*View fixed in world*

*View fixed on vehicle*

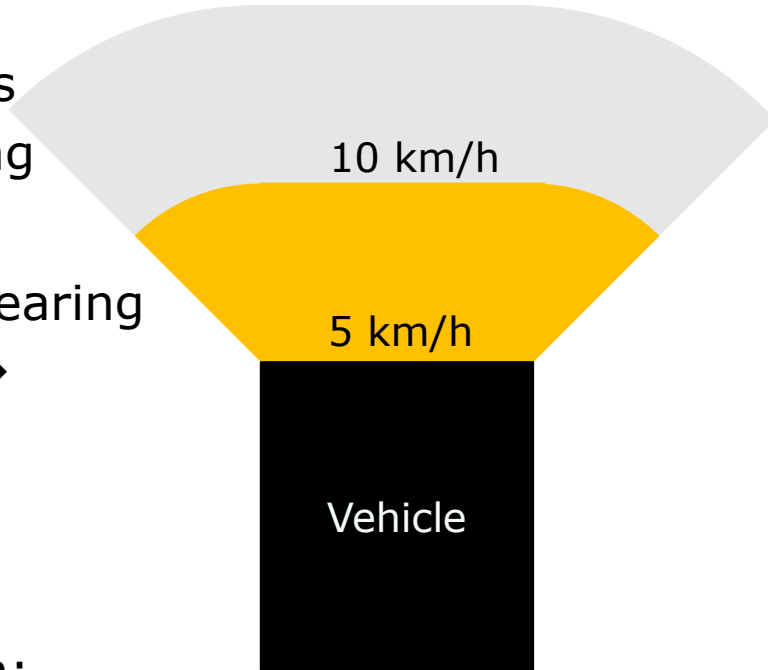




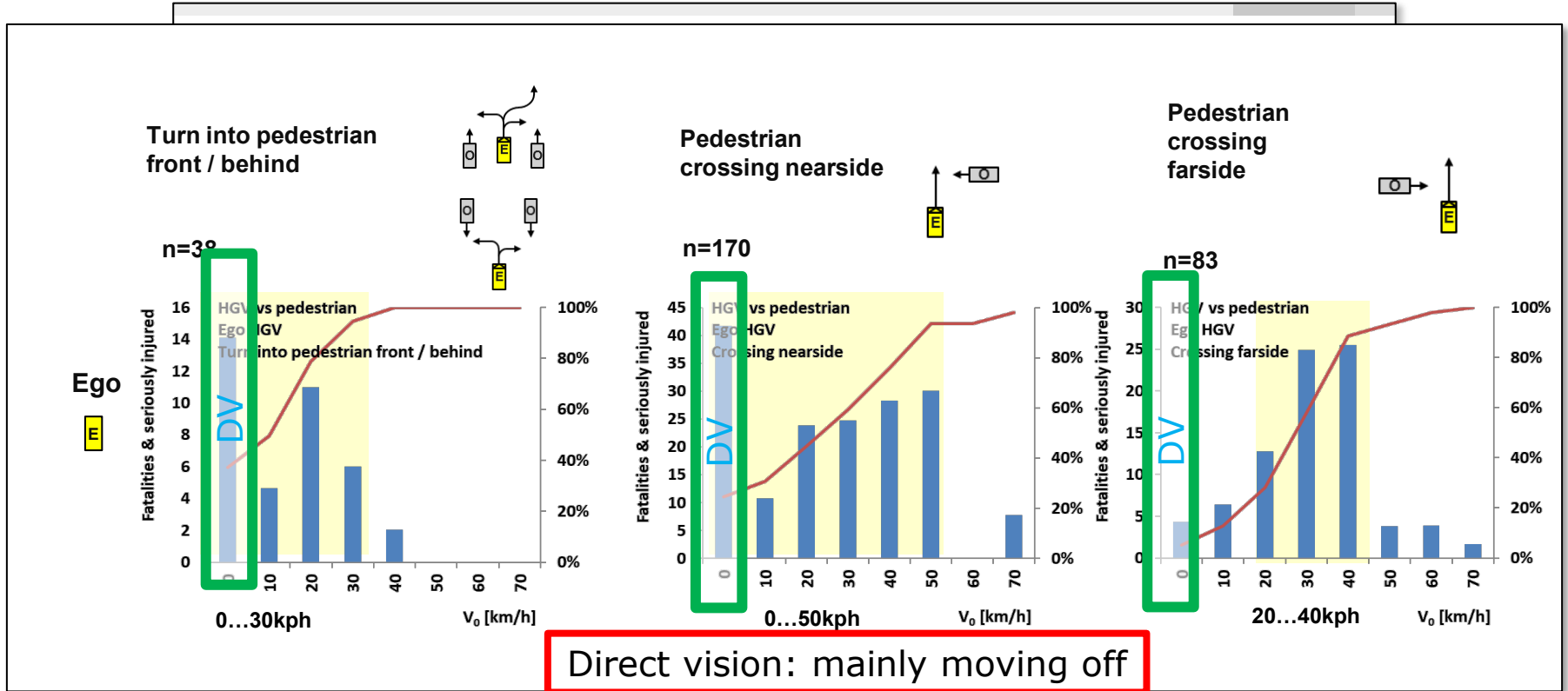
# „Reaction time blind spots!“ (RTBS)

(for all impact positions, all VRU speeds)

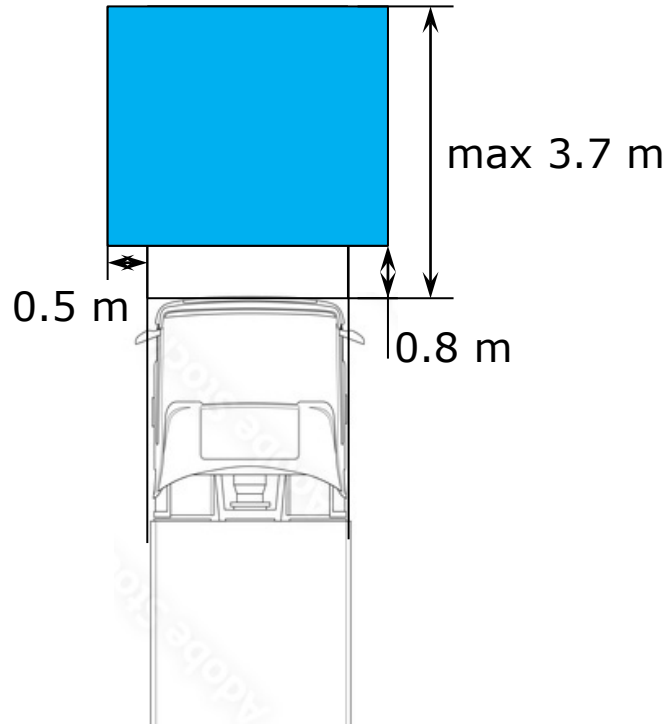
- ➔ Human drivers need 1-1.2 seconds time to react to suddenly appearing obstacles
- ➔ Driver cannot react to threats appearing in the areas shown on right side →
- ➔ Typical crossing accidents will not be prevented with increased vision beyond the RTBS
- ➔ Key task of increased Direct Vision: Prevent moving off accidents



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



# UN-R159 (Moving Off Information System) Specs

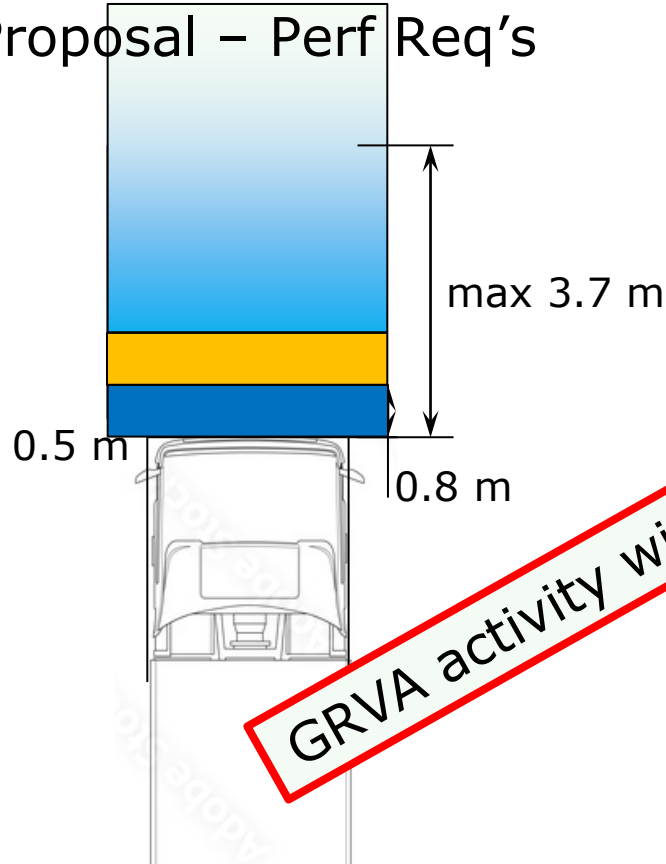


- ➔ When vehicle moving ( $\leq 10$  km/h):
  - Inform for VRU: stationary up to longitudinally 10 km/h
- ➔ When vehicle stopped
  - Inform for VRU: crossing 3-5 km/h
- ➔ In blue area as shown
- ➔  $\geq 15$  lux ambient lighting

## 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 yellow range zone (total: 1.5 m)

### Moving

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

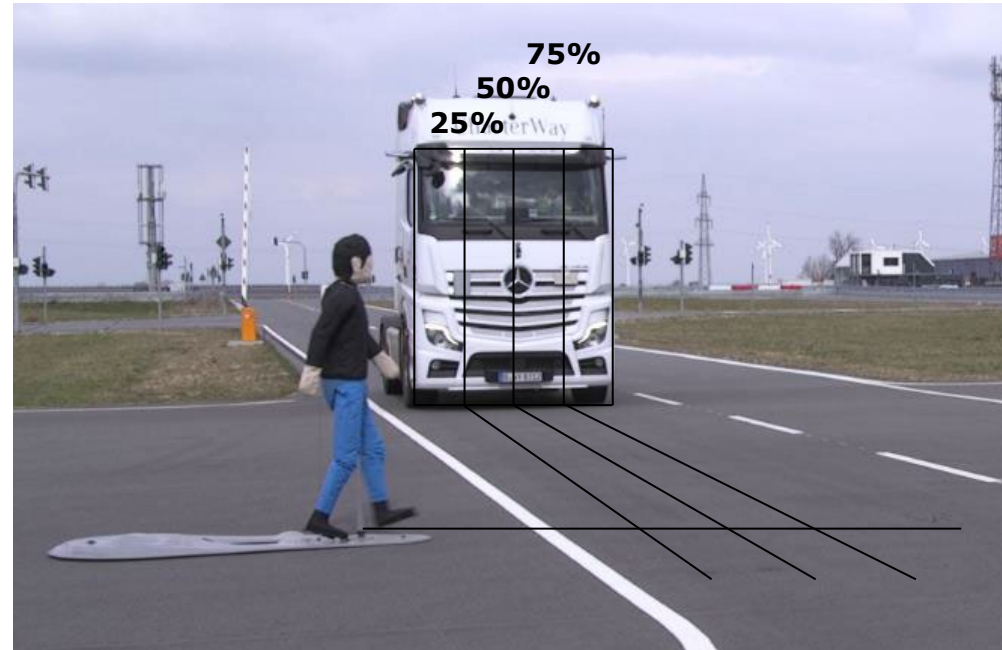
**GRVA activity with active safety experts started**



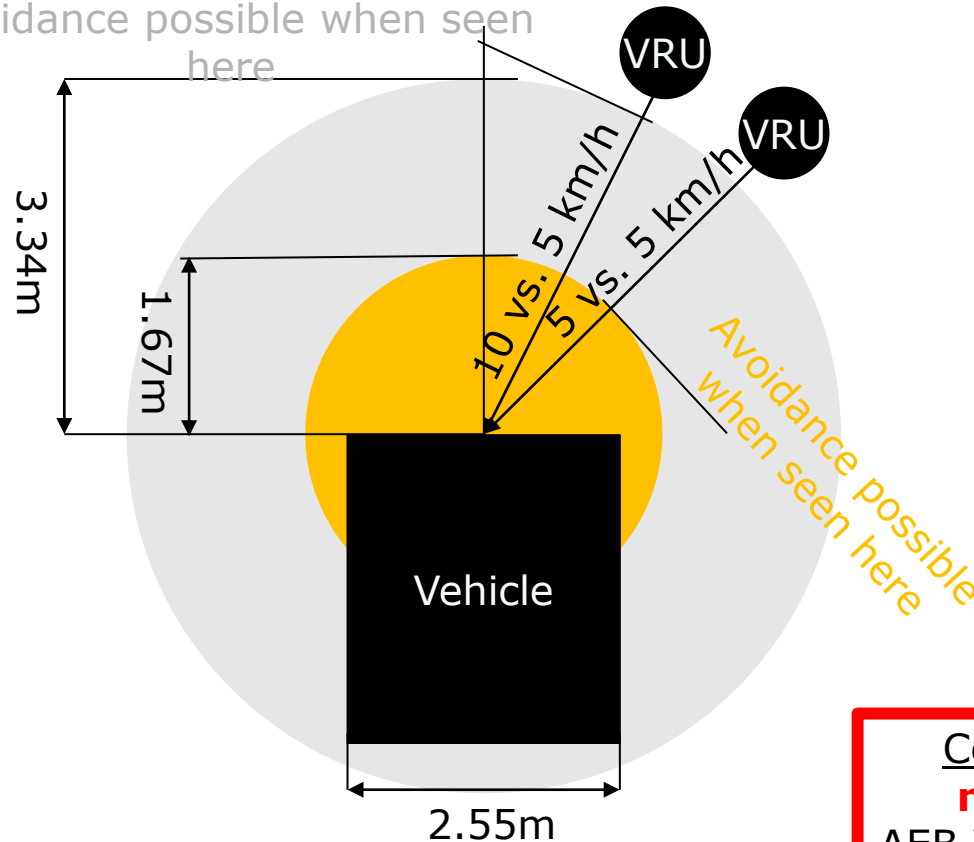
# Backup

## 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

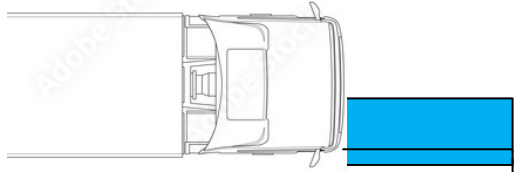


10 km/h = 2.78 m/s  
1.2 s reaction time → 3.34 m

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!





Pedestrian stopping distance

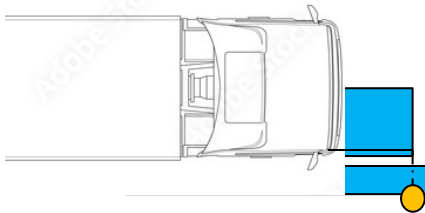


1. Vehicle stopping distance from 10 km/h:  
→ stopping dist. 3 m, braking starts at  $\sim 1$  s TTC

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:

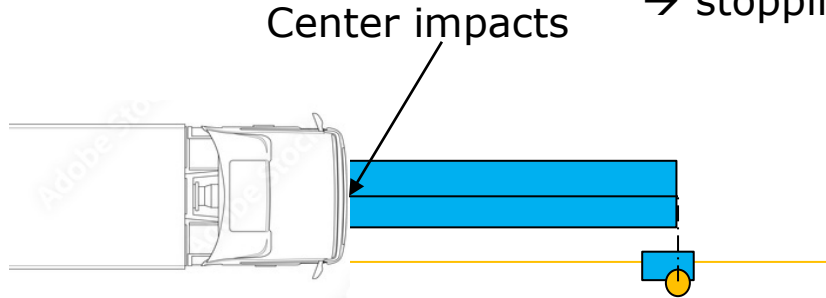
1. stopping distance from 5 km/h :  
→ braking distance 1.5 m, braking starts  $\sim 0.5$  s TTC

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

3. Pedestrian stopping distance  $\sim 0.3 - 0.5$  s

4. Pedestrian stopping distance  $\sim$  vehicle stopping distance, so vehicle needs to start braking when it is clear that pedestrian will not stop in time.

1. Vehicle stopping distance from 20 km/h:  
→ stopping dist. 13 m, braking starts at  $\sim 2.5$  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.

# 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)