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*

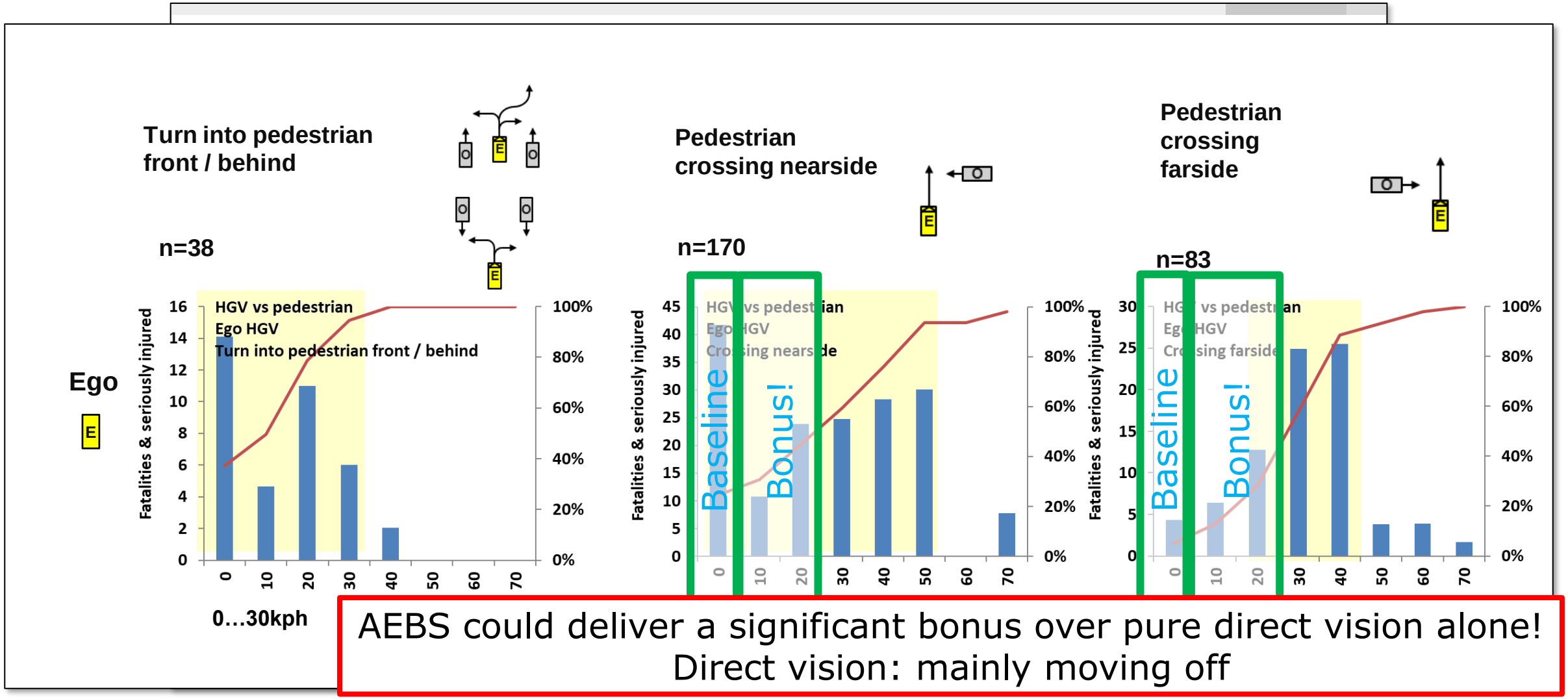
→ ***Put req's for close & BSIS & stationary VRU in a new? reg***

→ ***Change current AEBS R131**

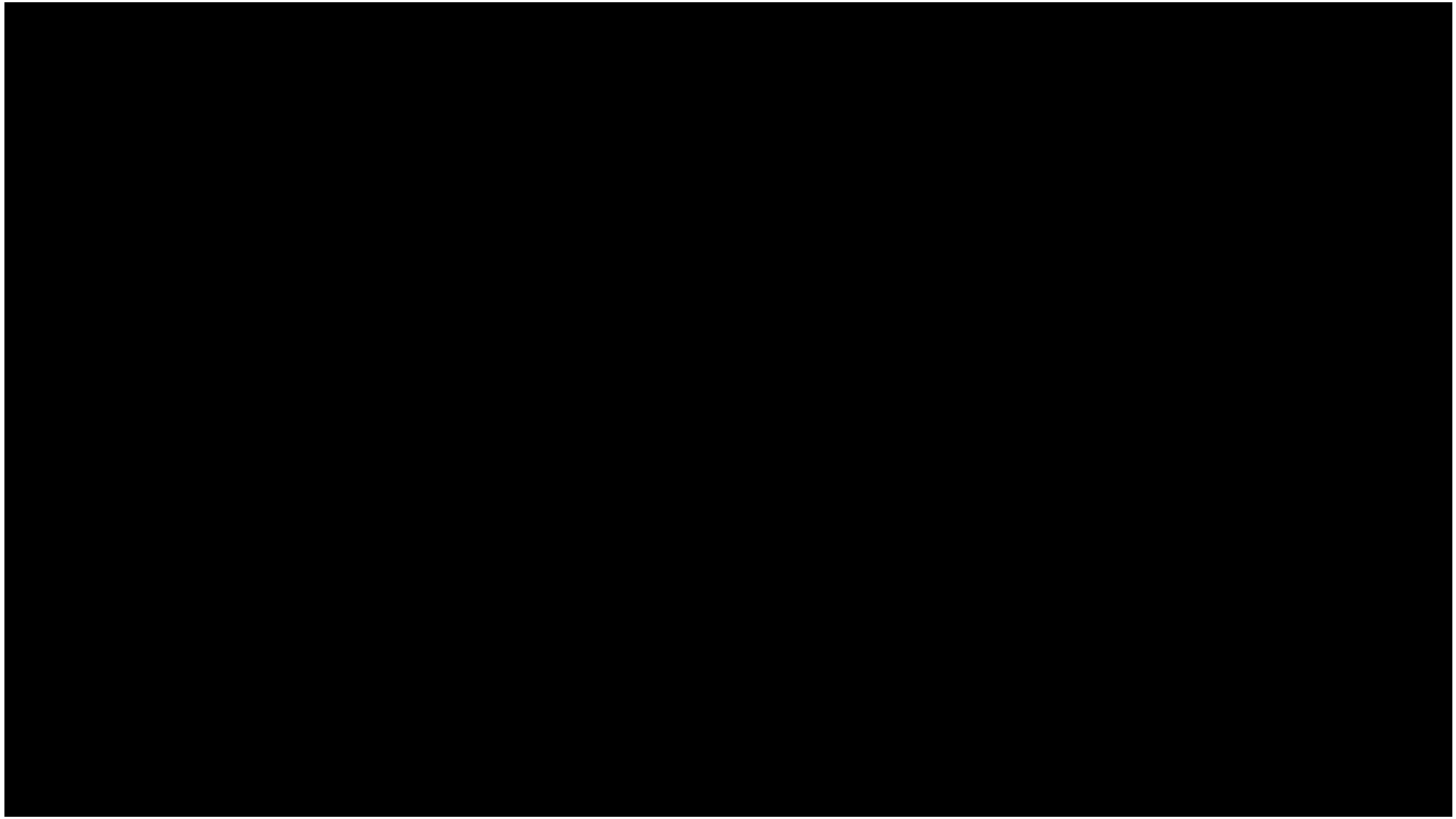
Structure

- 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

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

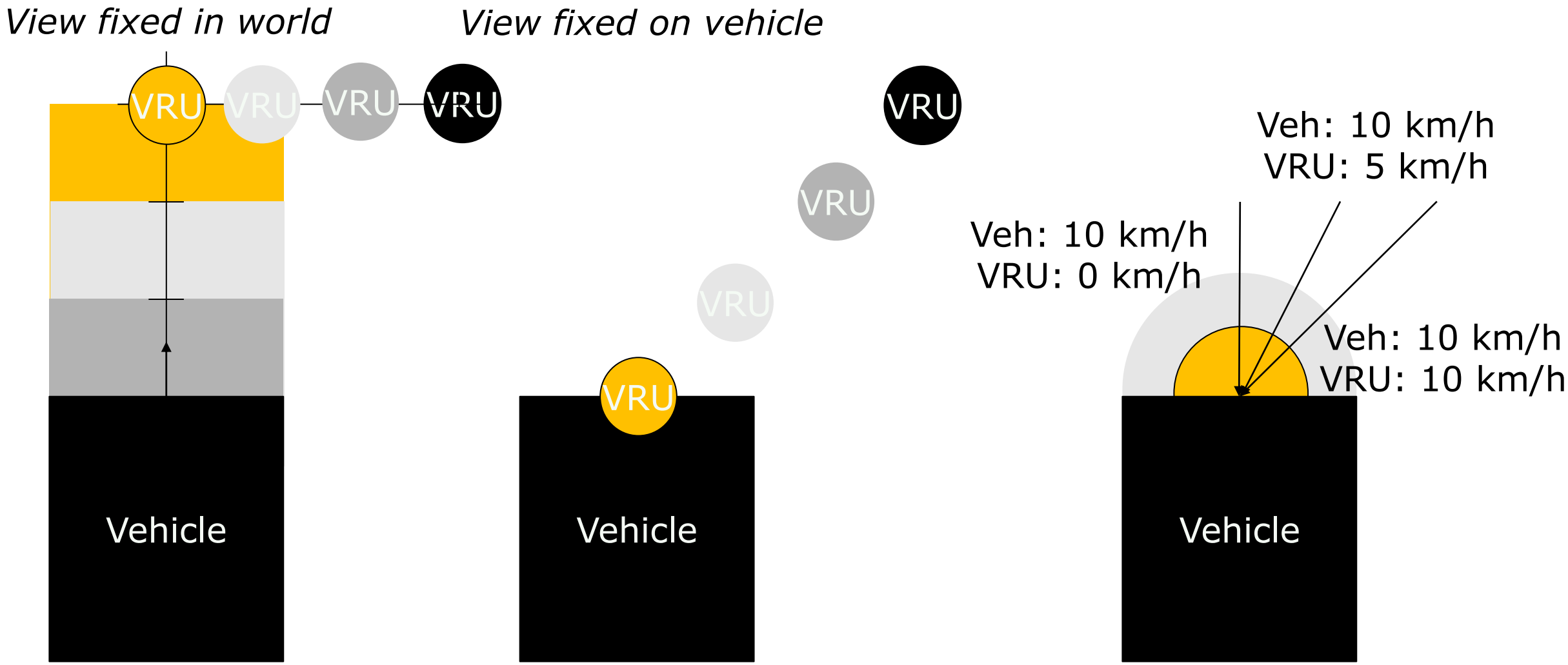


Introduction

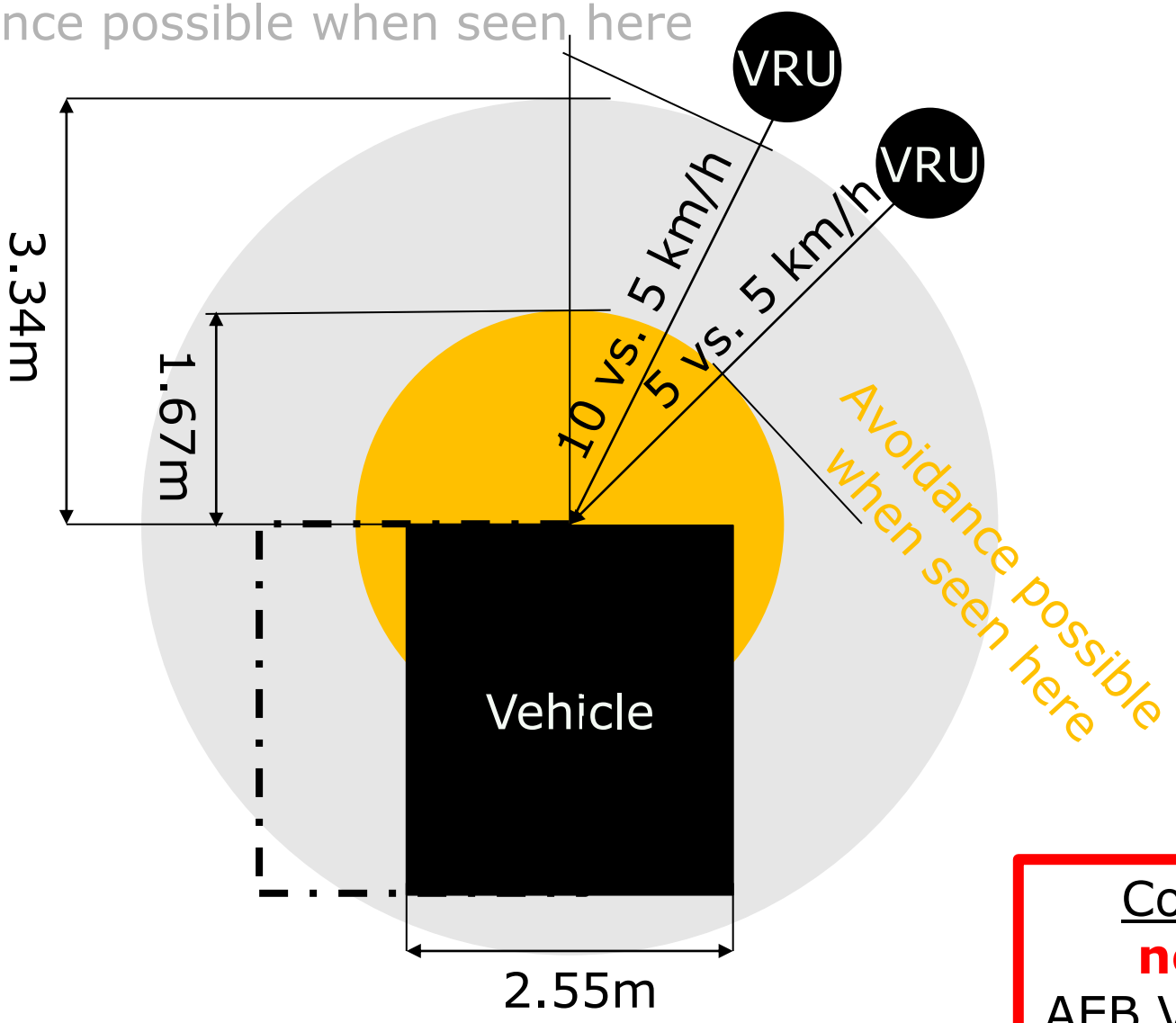


Basics – Cross Traffic AEB (1)

- Before the accident, participants move orthogonal



Basics – Cross Traffic AEB (2)



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

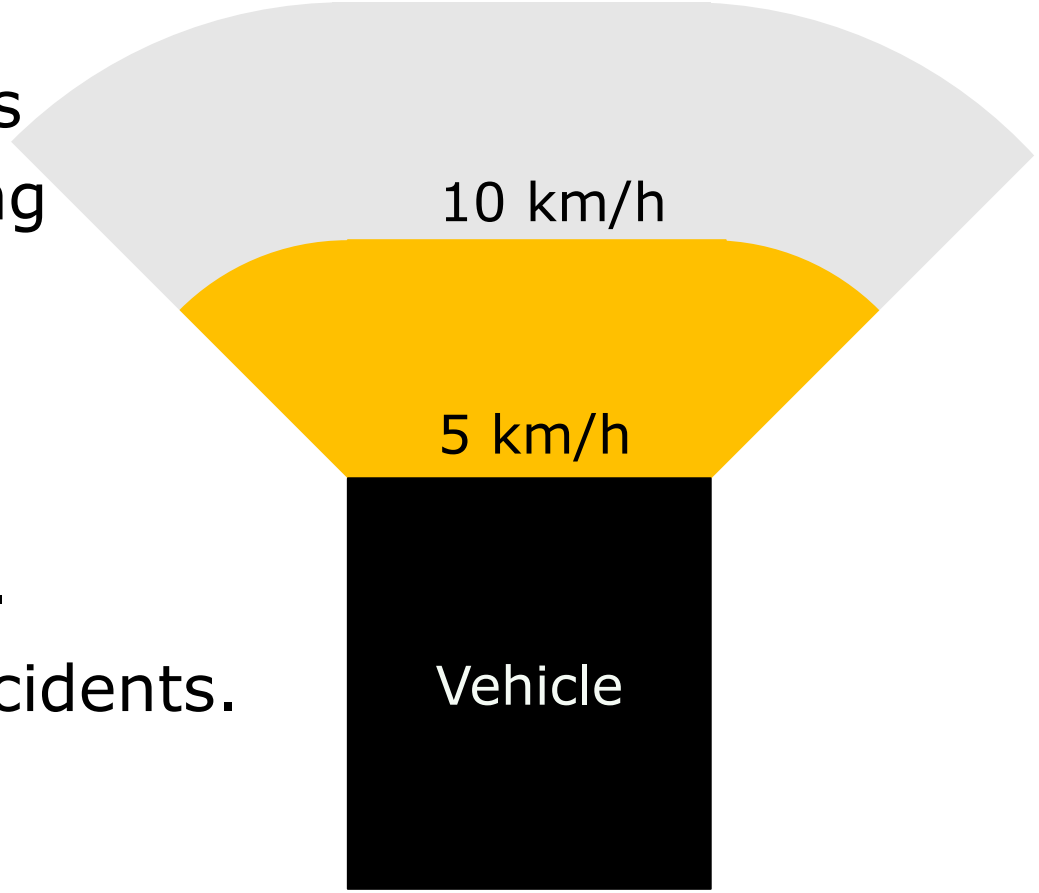
5 km/h = 1.39 m/s
1.2 s reaction time → 1.67 m

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

„Reaction time blind spots!“ (RTBS)

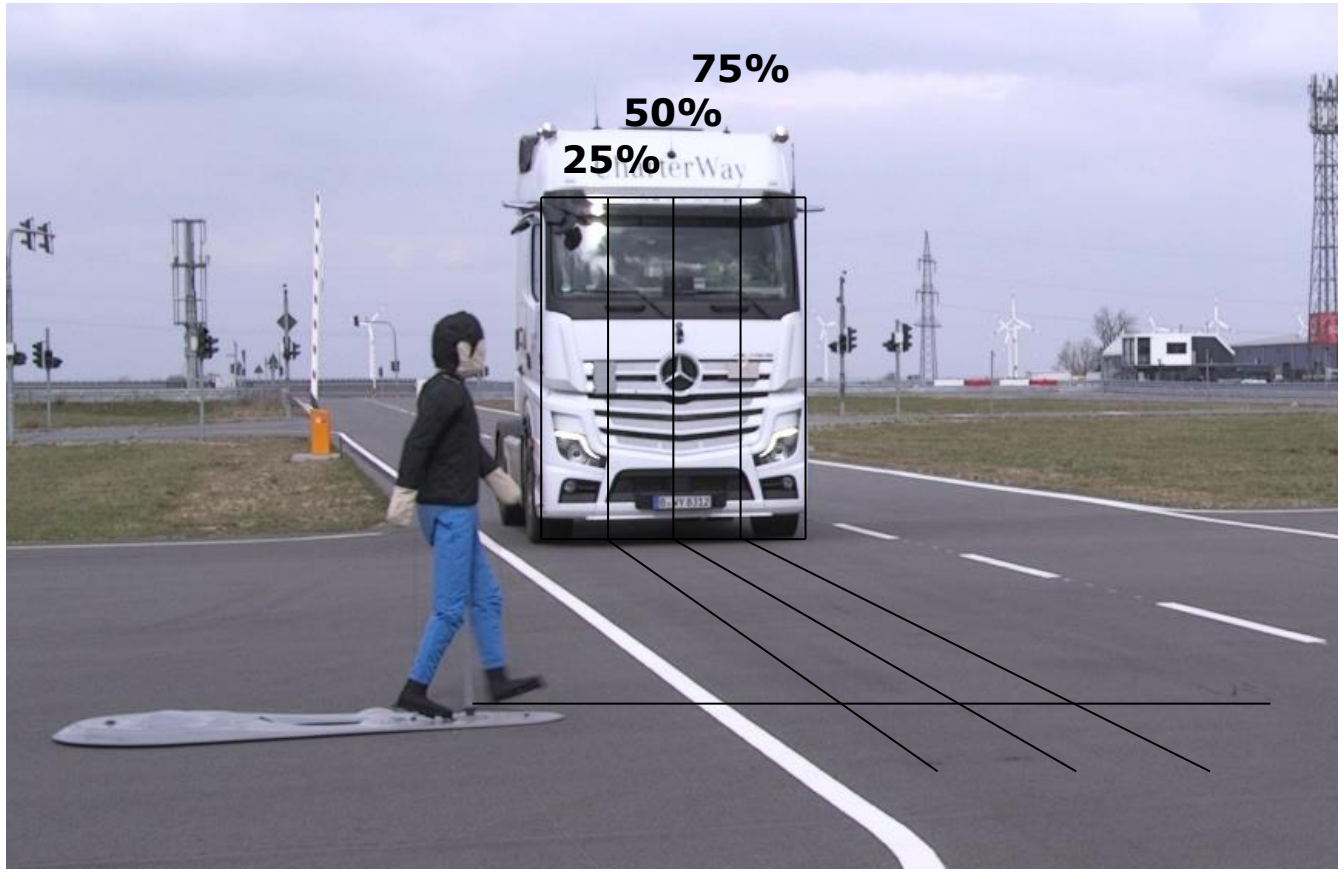
(for all impact positions, all VRU speeds)

- 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 <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.**



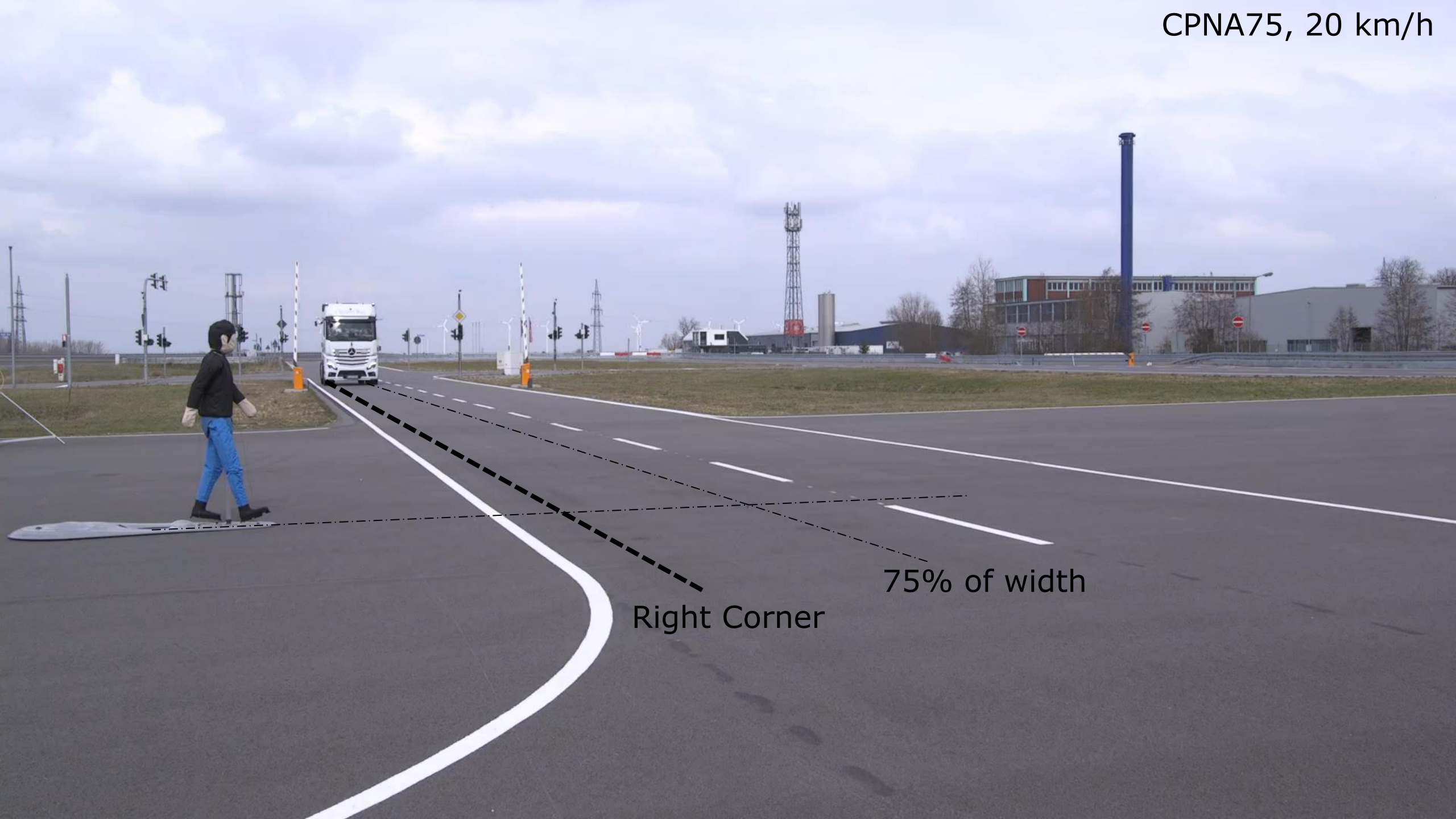
Overview of Euro NCAP Scenarios - Crossing

CPNC: Hidden Child (5 km/h)

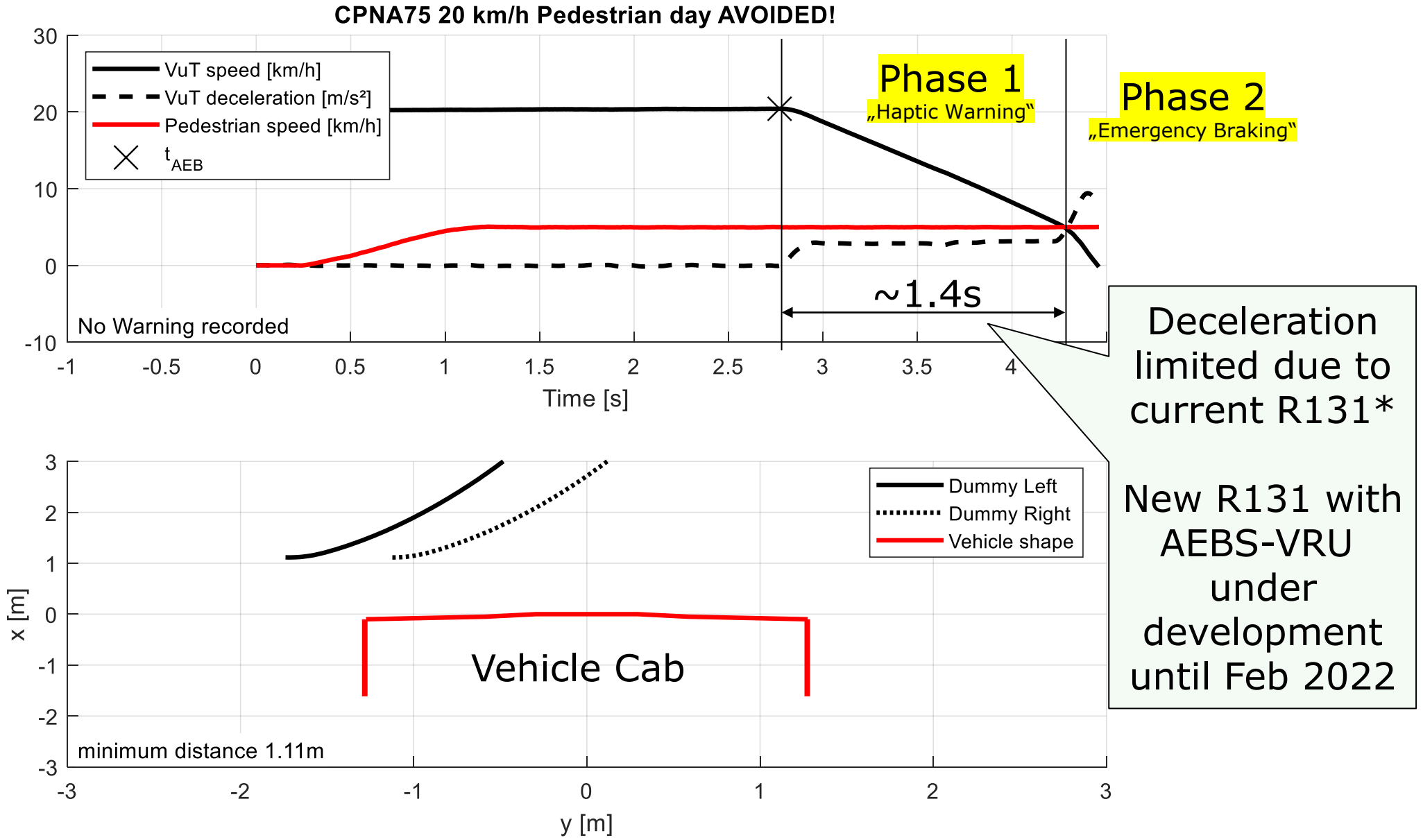
CPFA50: Running (8 km/h)

CPNA25 Walking (5 km/h)

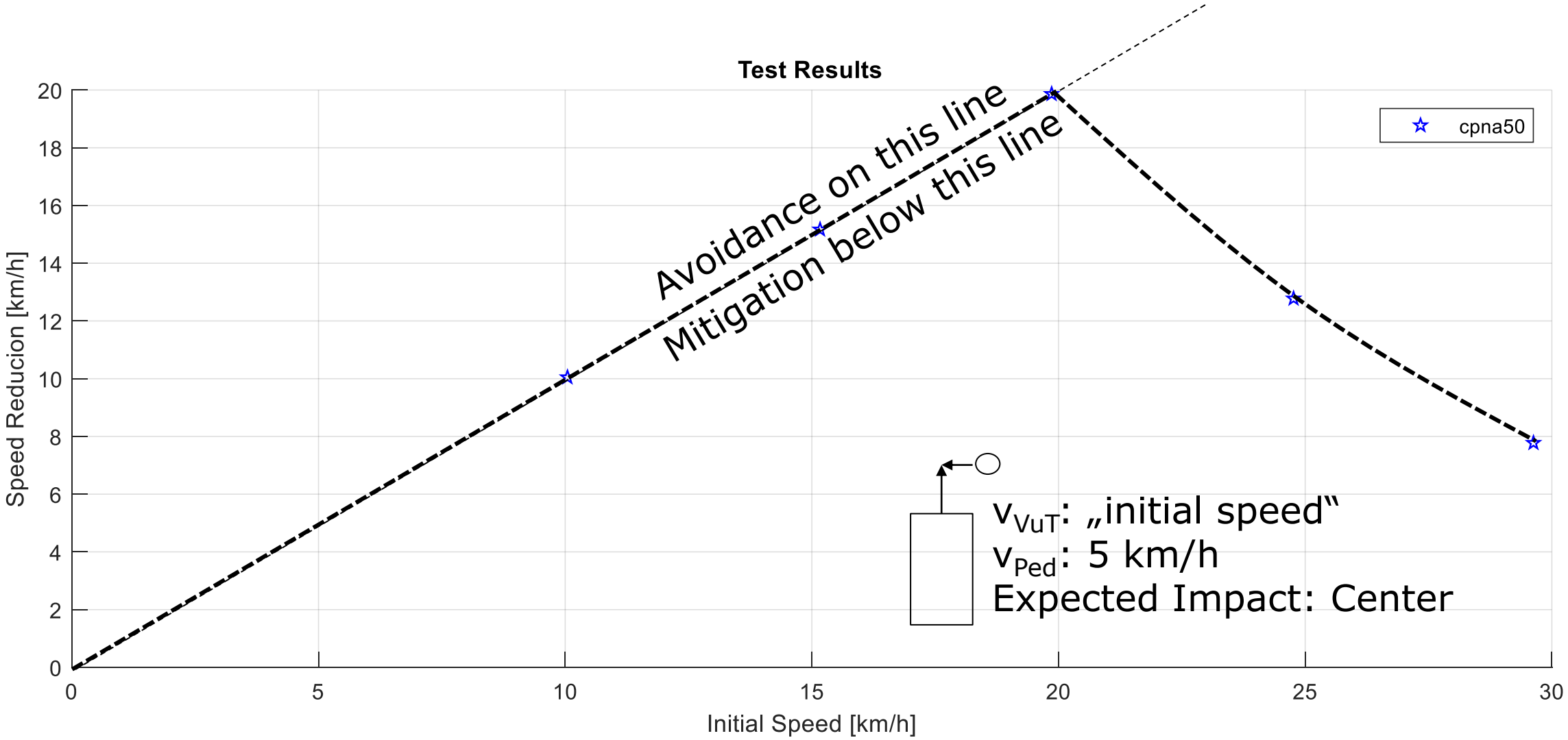
CPNA75 Walking (5 km/h)

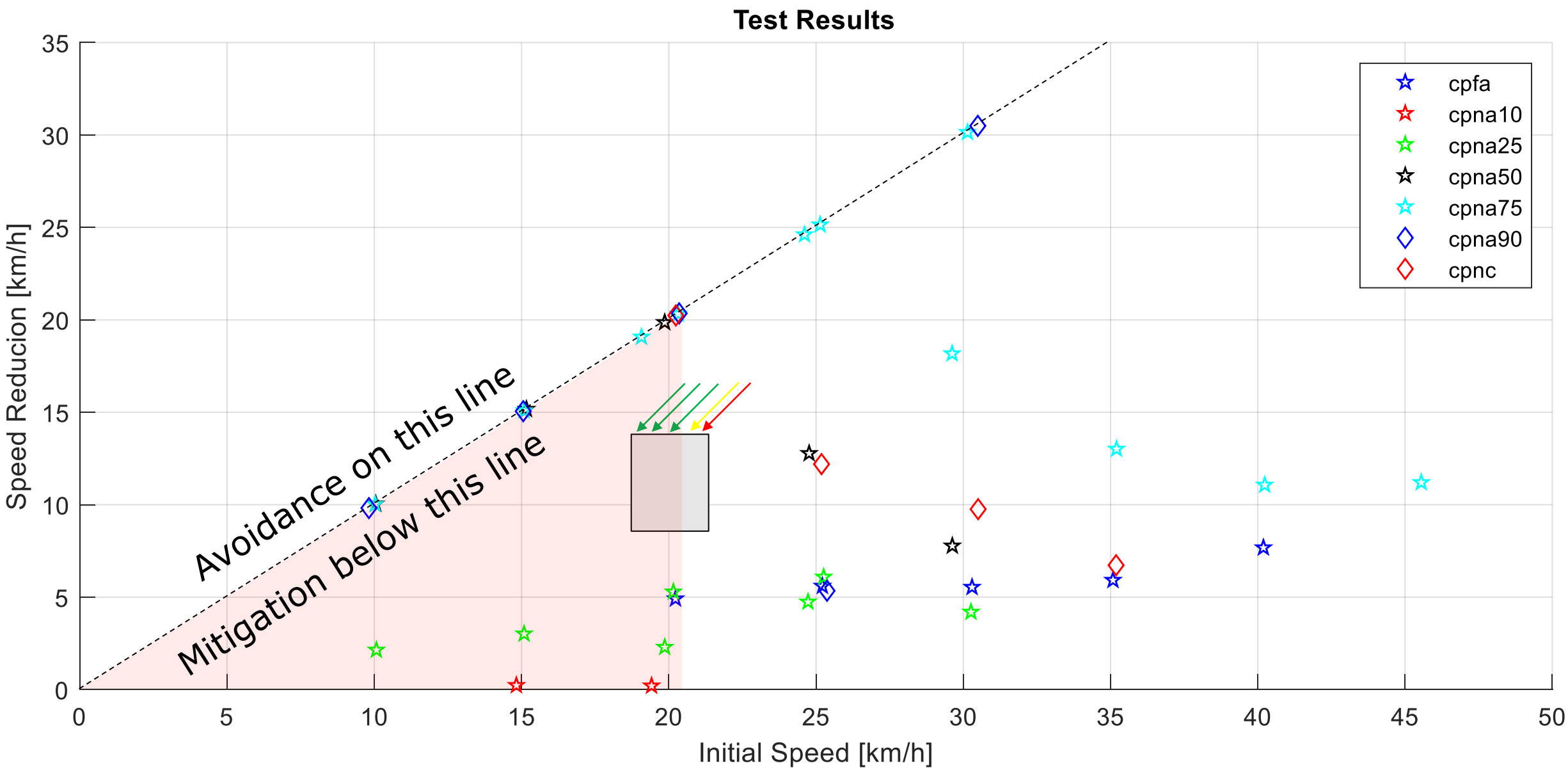

CPNA75, 20 km/h
75% of width
Right Corner

Test Data


CPNA75 20 km/h Pedestrian day AVOIDED!
VuT speed [km/h]
VuT deceleration [m/s²]
Pedestrian speed [km/h]
t AEB
Phase 1
„Haptic Warning“
Phase 2
„Emergency Braking“
~1.4s
No Warning recorded
Time [s]
Dummy Left
Dummy Right
Vehicle shape
Vehicle Cab
minimum distance 1.11m
x [m]
y [m]
Deceleration limited due to current R131*
New R131 with AEBS-VRU under development until Feb 2022

Results when tested according to R152




Test Results
Speed Reducion [km/h]
Initial Speed [km/h]
Avoidance on this line
Mitigation below this line
cpfa
cpna10
cpna25
cpna50
cpna75
cpna90
cpnc
0
5
10
15
20
25
30
35
40
45
50

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 ist effectiveness in restrospective analyses (e.g. IIHS for passenger cars)
- Are there restrospective analyses of the effect of direct vision?

Thank you for your attention!

Please get back with any questions:

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