bast
Federal Highway and
Transport Research Institute

Automatic Emergency Braking Systems (AEBS) for Heavy Vehicles

Patrick Seiniger,

Federal Highway and Transport Research Institute, Germany

bast
Federal Highway and
Transport Research Institute

Agenda

- Introduction
- “Old” Regulatory Requirements from UN R131-01
- Tests & Results for current vehicles
- UN Regulation Development Process for Regulation Update
- Future Technical Requirements (UN R131-02)

bast
Federal Highway and
Transport Research Institute

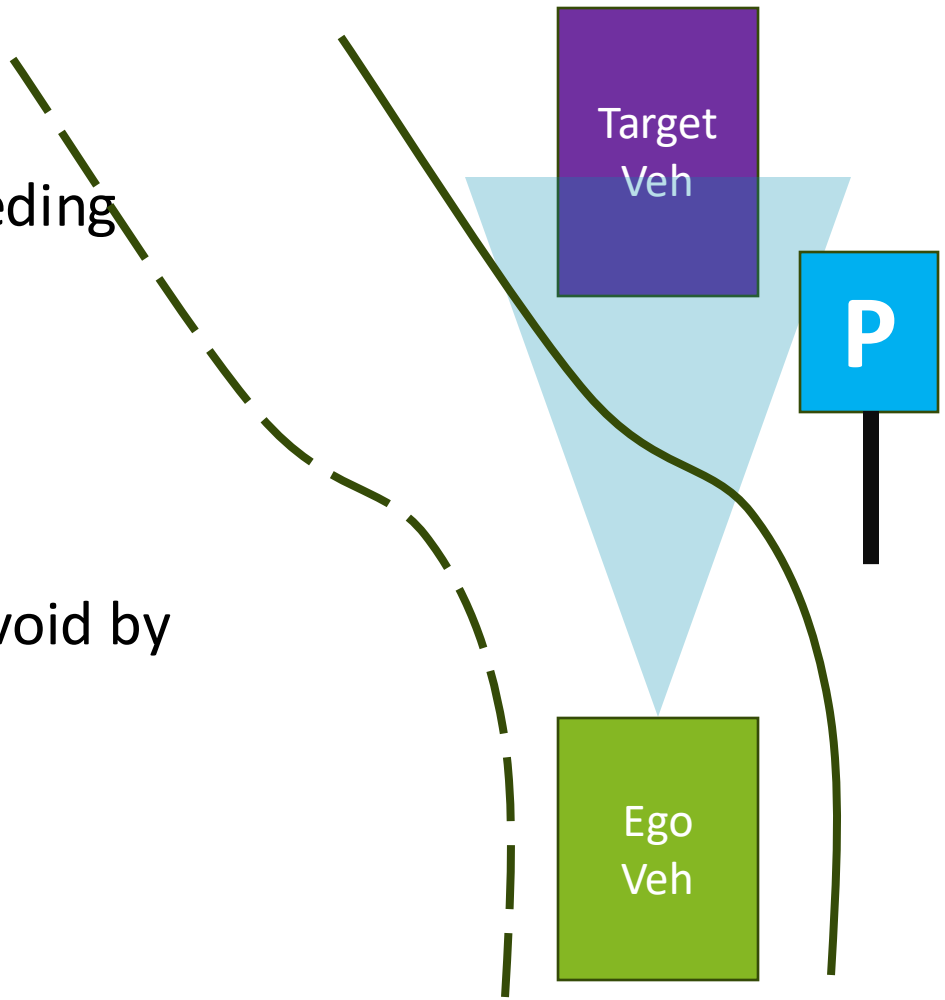
Autonomous Emergency Braking Systems AEBS

- Driver Assistance Systems: Driver always in command!
- Brake in the last moment – when no driver reaction
- Systems typically brake 1-2 seconds before calculated crash
- Can always be overruled – crash calculation may be wrong
- AEBS for other cars & for pedestrians

- Euro NCAP rating since 2014 (passenger cars)
- Mandatory: Heavy vehicles from 2014 (UN-R131), passenger cars from 2022 (UN-R152)

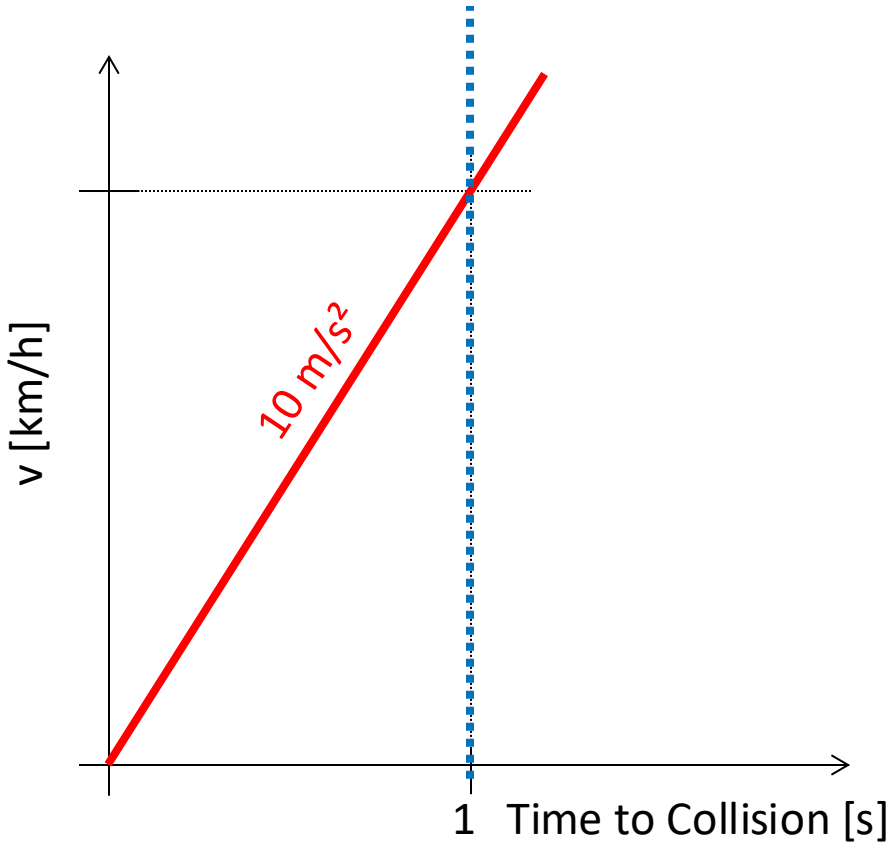
Limitations for AEBS Interventions (1)

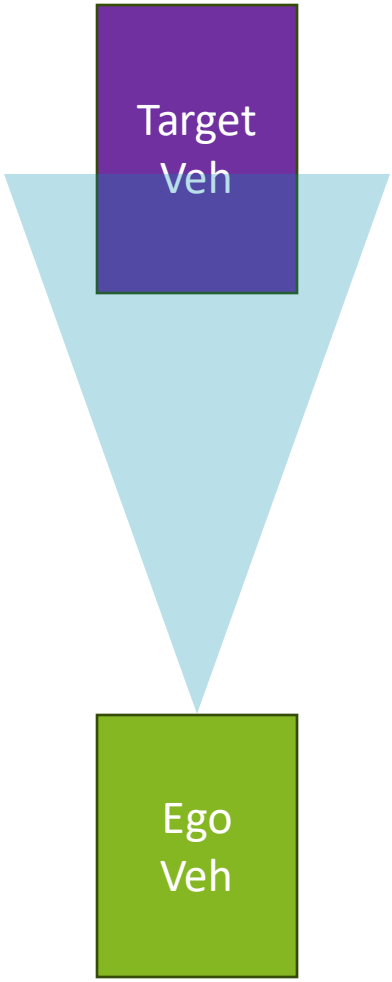
- AEBS see the targets quite well
- False interventions could be dangerous for proceeding traffic
- AEBS cannot robustly know the driver intentions
- AEBS typically do not know the whole scenery
- AEBS intervention safe as soon as driver cannot avoid by steering anymore



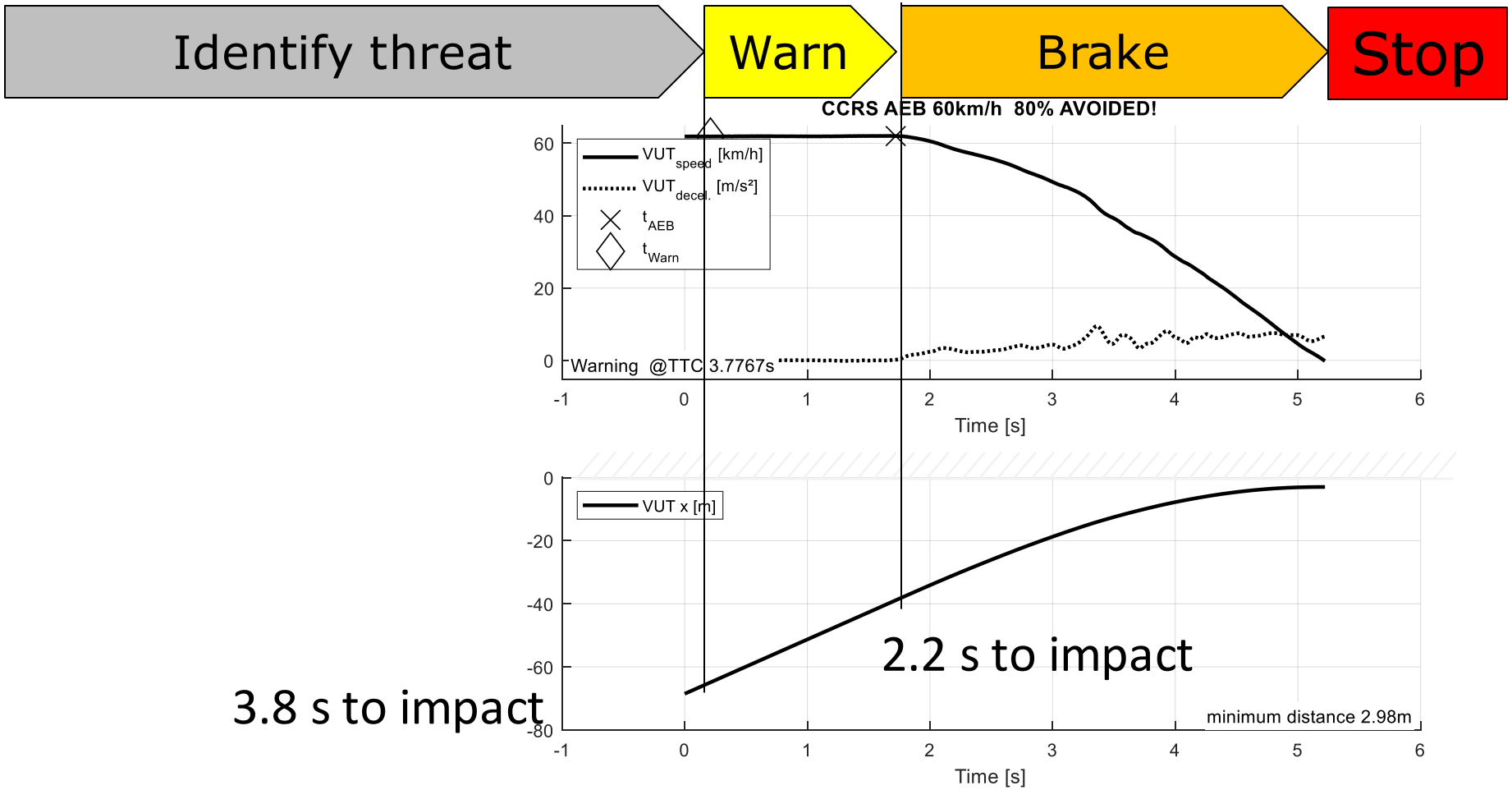
Limitations for AEBS Interventions (2)

- Brake Intervention Timing increases with speed
- Avoidance Timing mostly constant:
  Cars ~ 1 s, Trucks ~2 s
- AEBS intervention can only **be required below** these times
- <u>AEBS performance limited by braking at TTC~1 | 2 s</u>





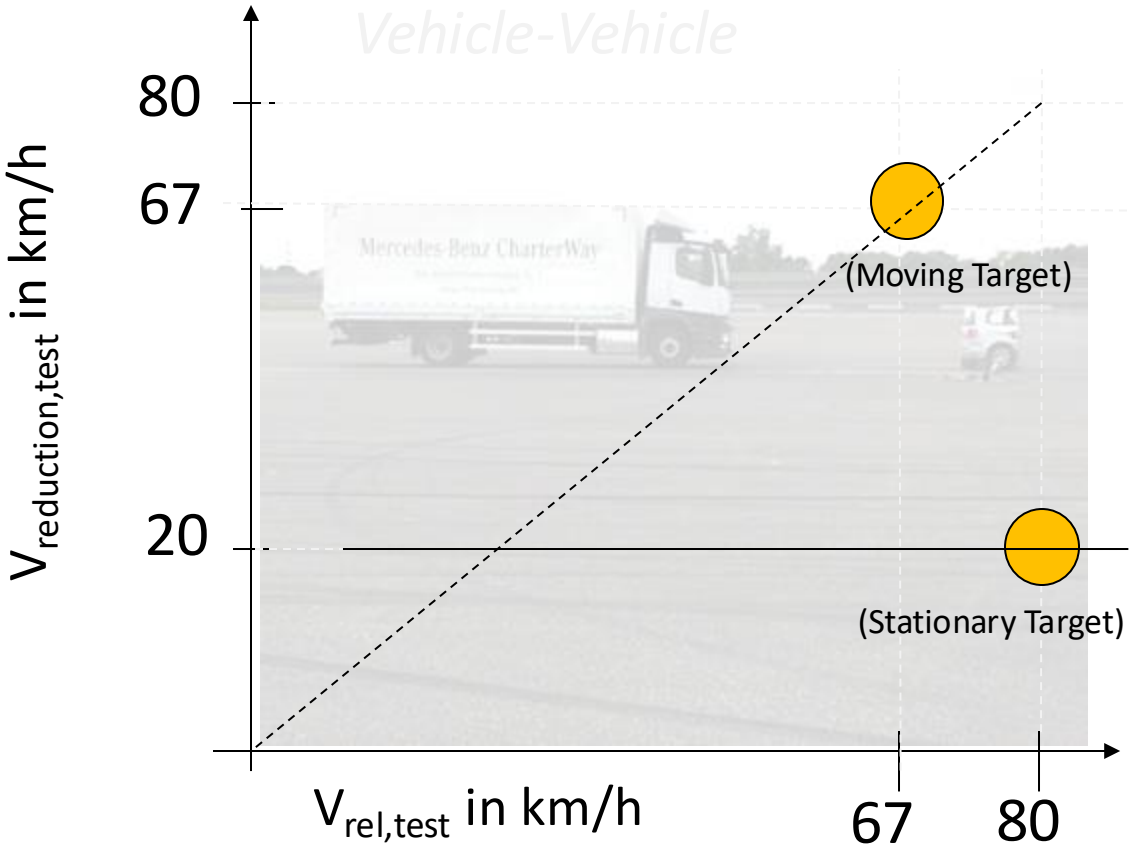
Concept & Ex. for AEBS (passenger car)

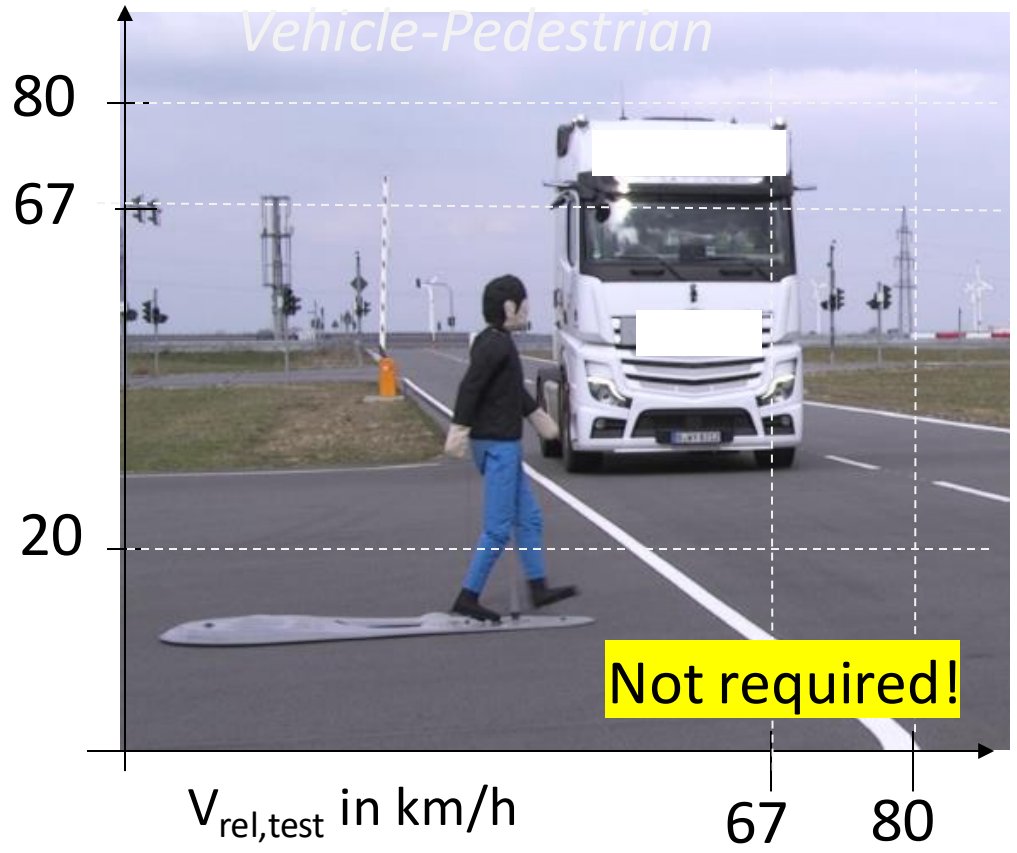


3.8 s to impact

2.2 s to impact

Status of R131-01 (mandatory in EU 2016+/2018+)

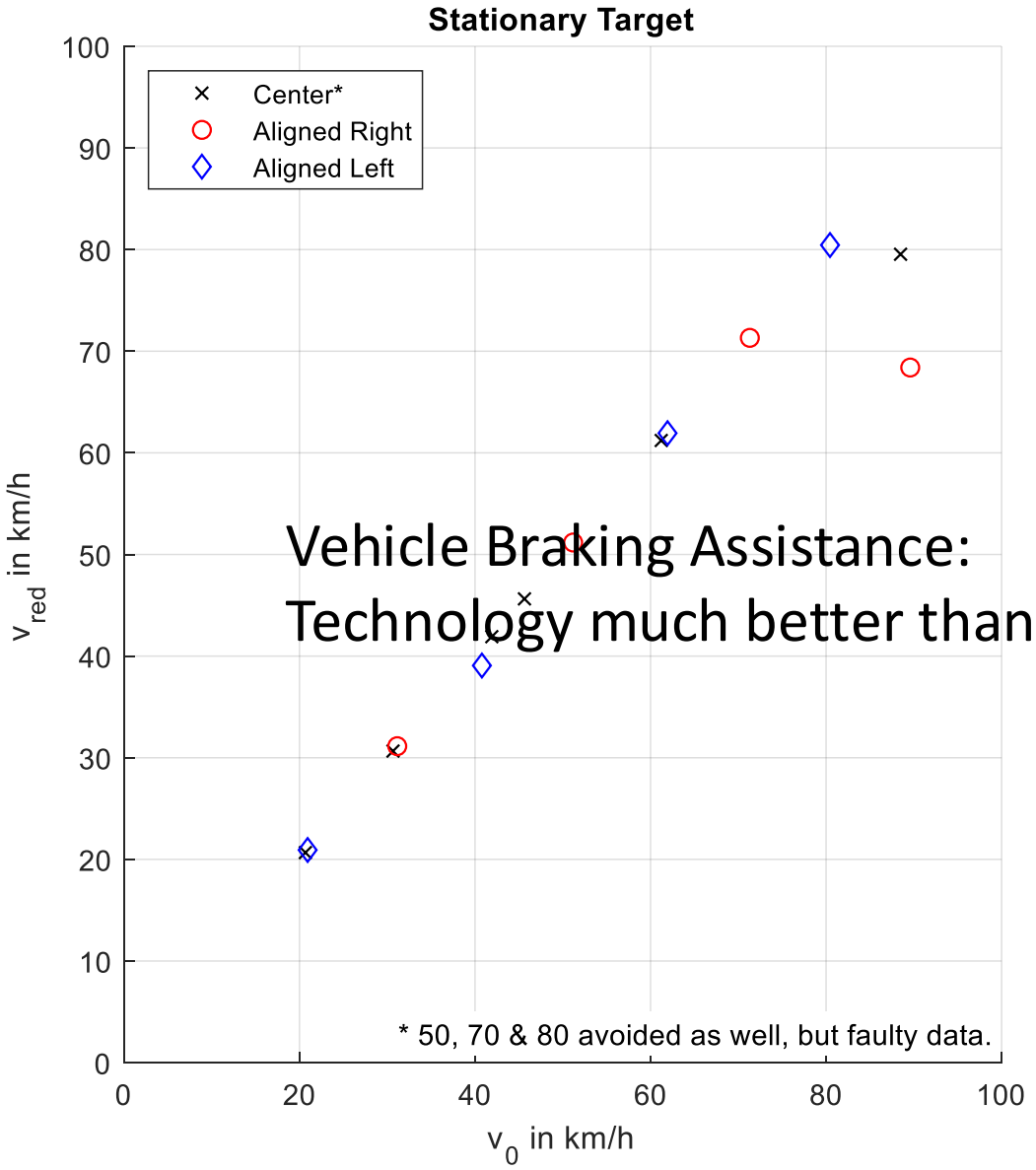


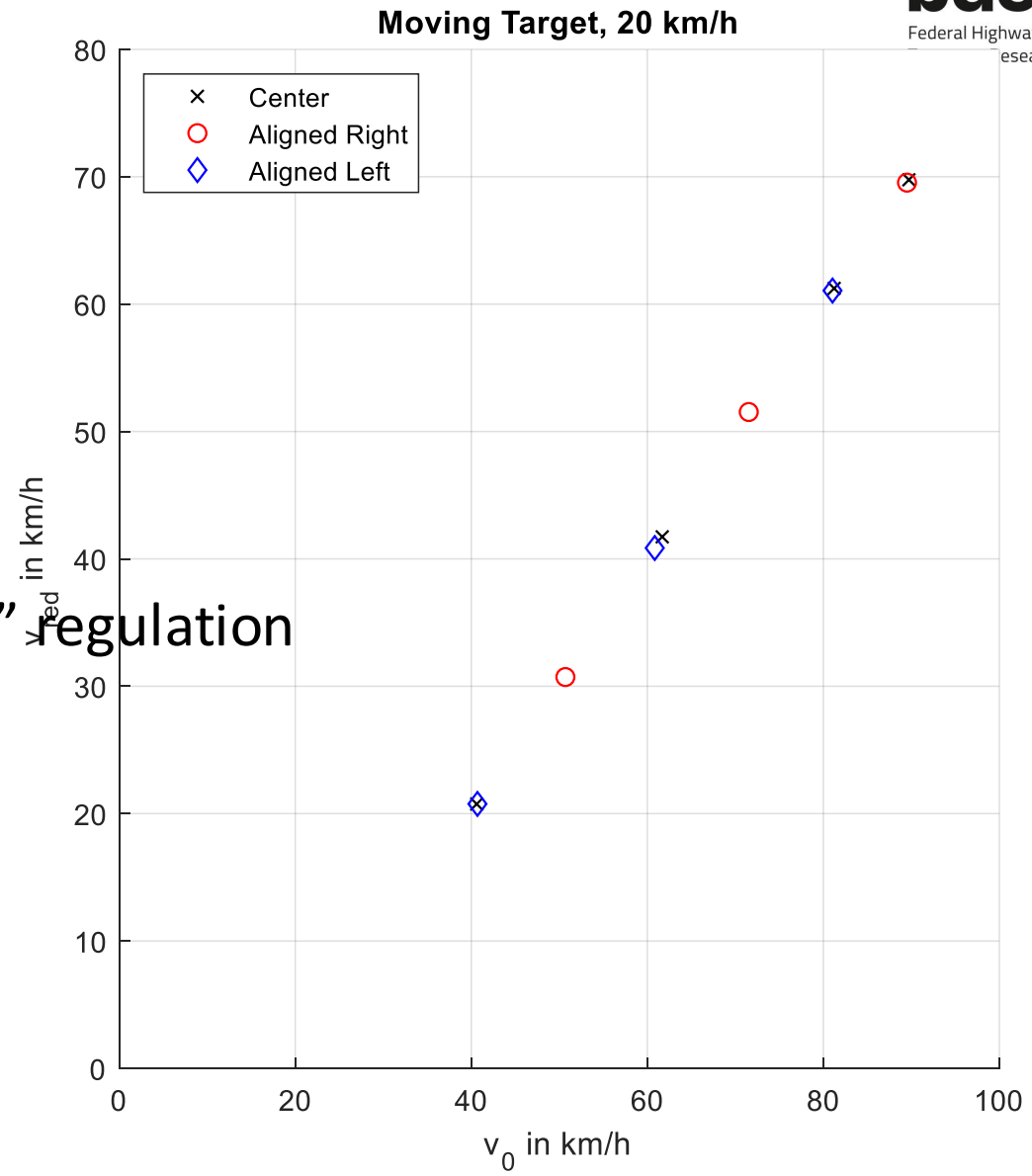


bast
Federal Highway and
Transport Research Institute

Emergency Brake Assistance for Heavy

Test Results for Vehicle A (Std. Equipment, 2021)

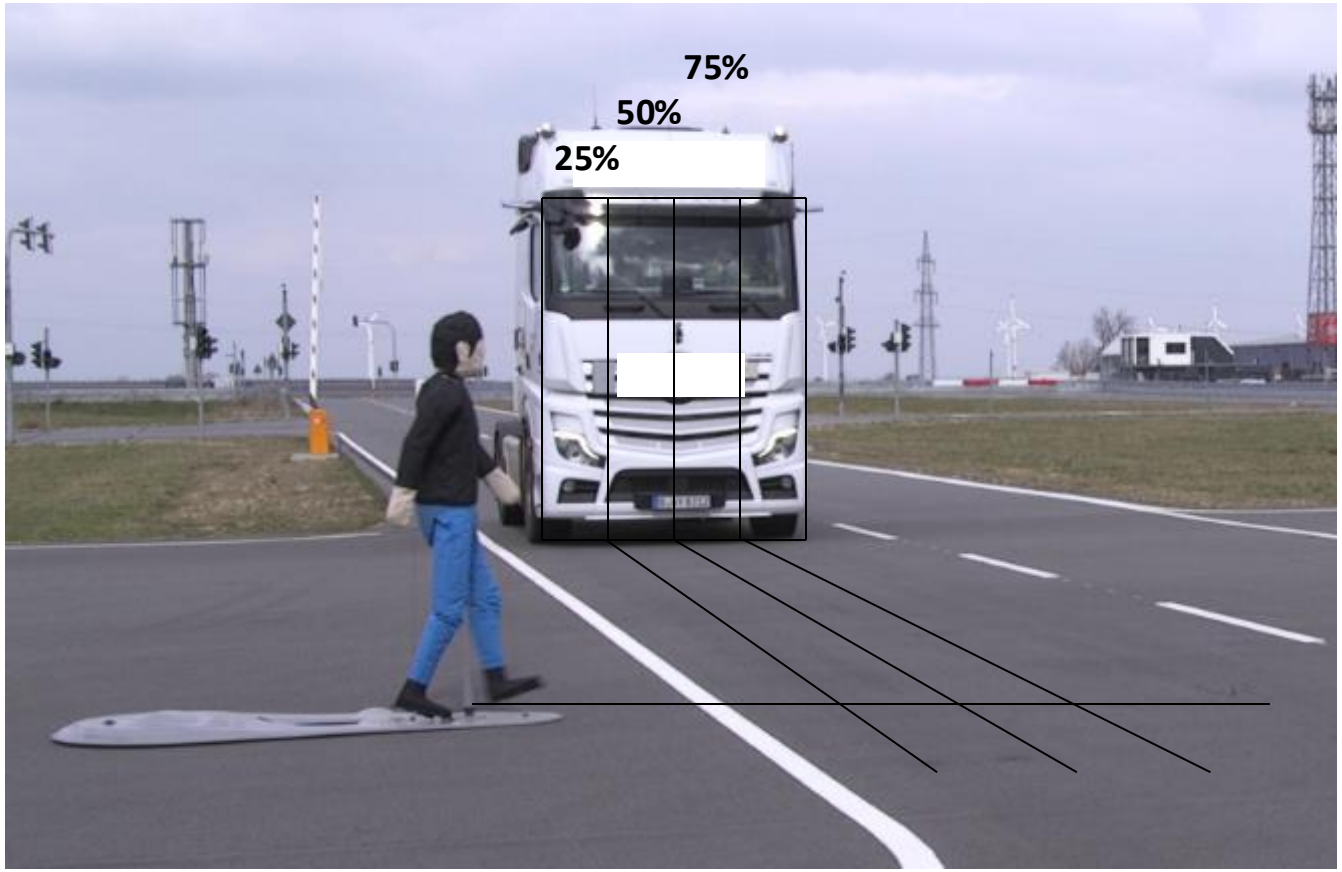




Vehicle Braking Assistance:
Technology much better than “old” regulation

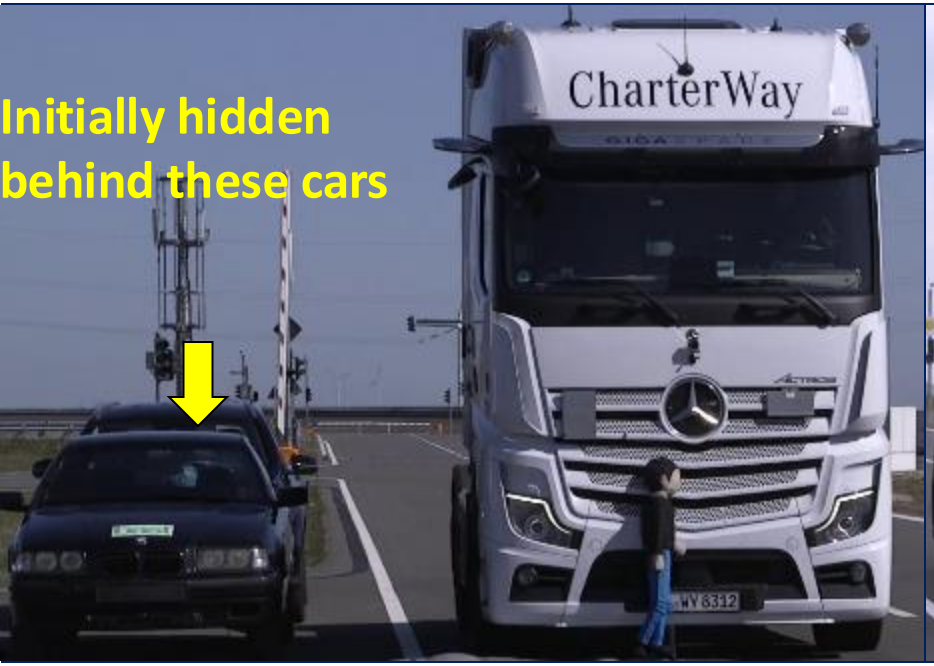
Basics – Cross Traffic AEB

- 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.



Overview of Scenarios - Crossing

CPNC: Hidden Child (5 km/h)

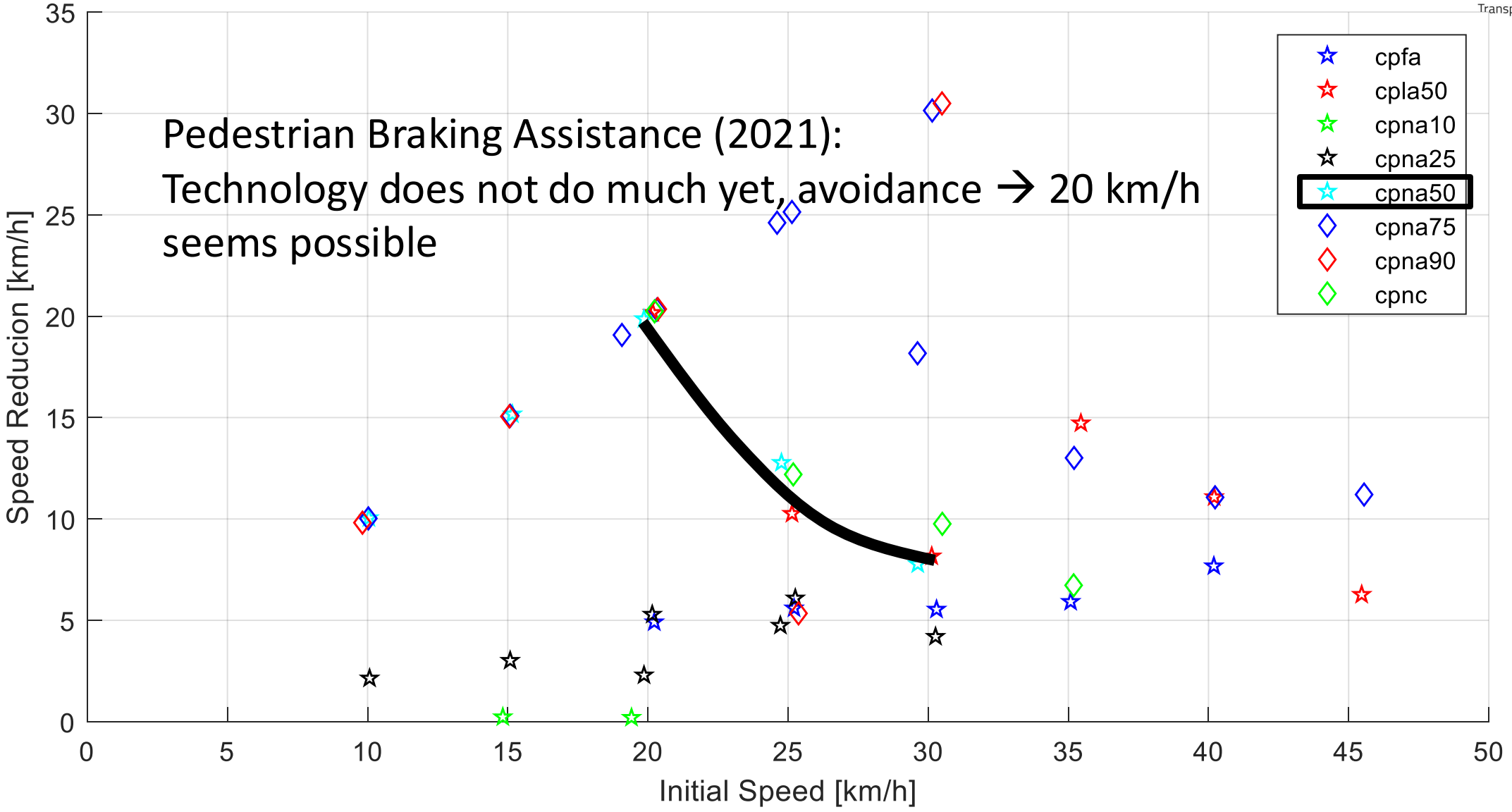


CPFA50:
Running (8 km/h)

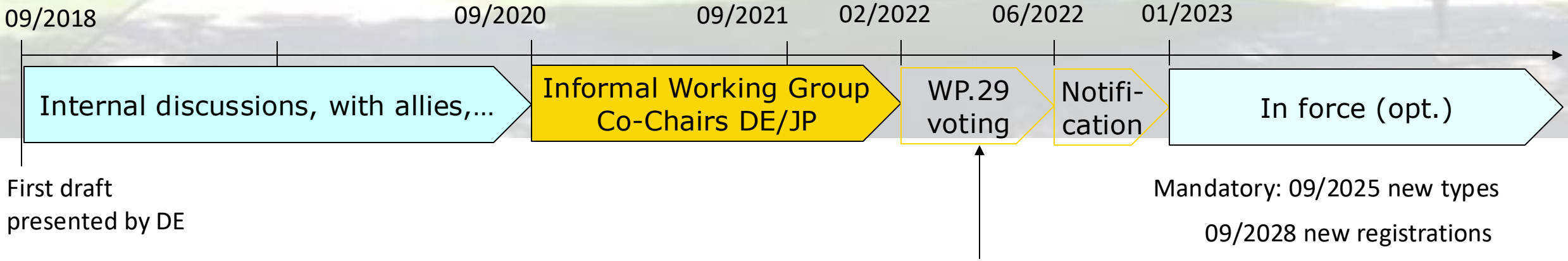
CPNA25
Walking (5 km/h)

CPNA75
Walking (5 km/h)

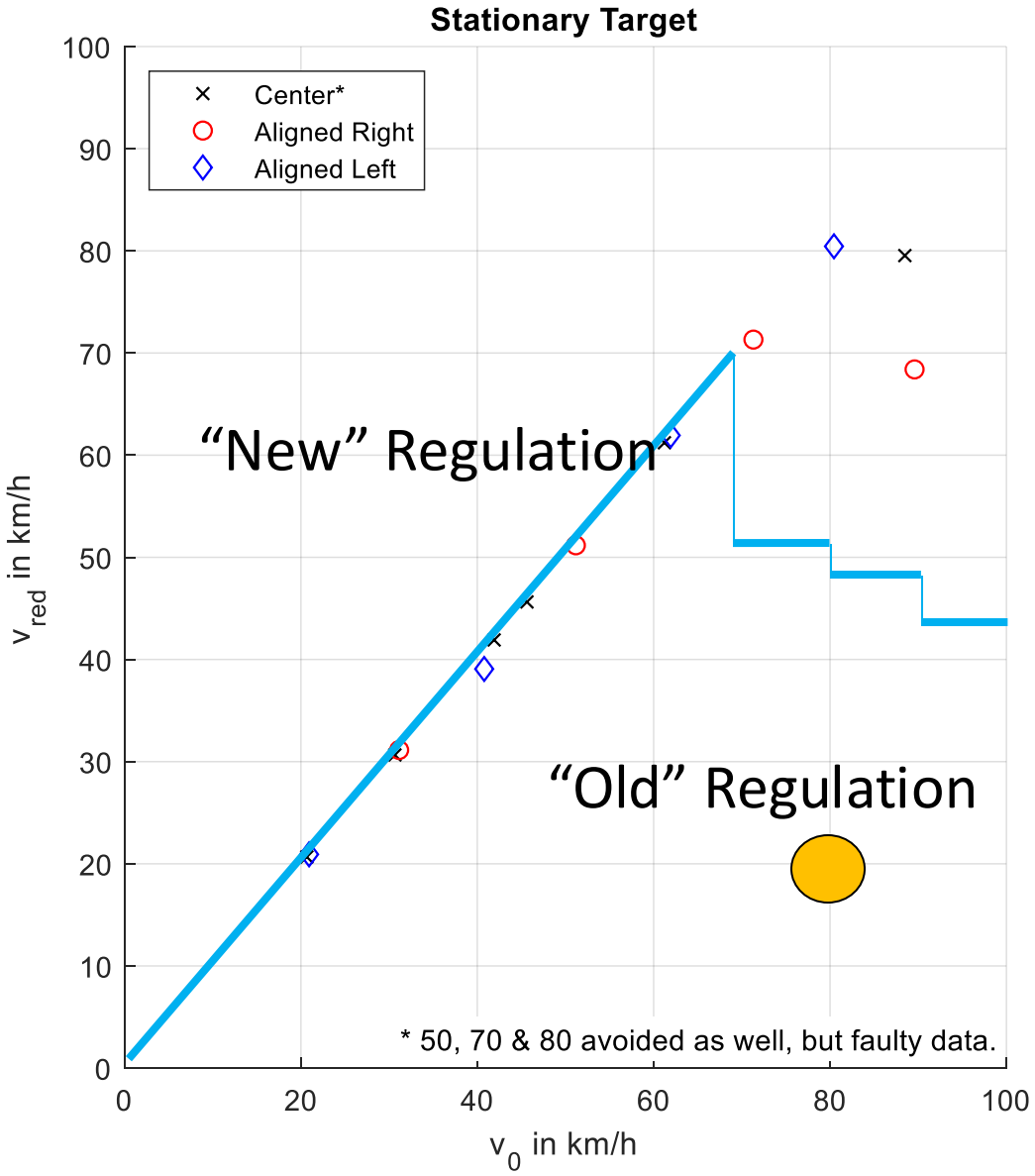
Pedestrian Braking Assistance (2021):
Technology does not do much yet, avoidance → 20 km/h seems possible

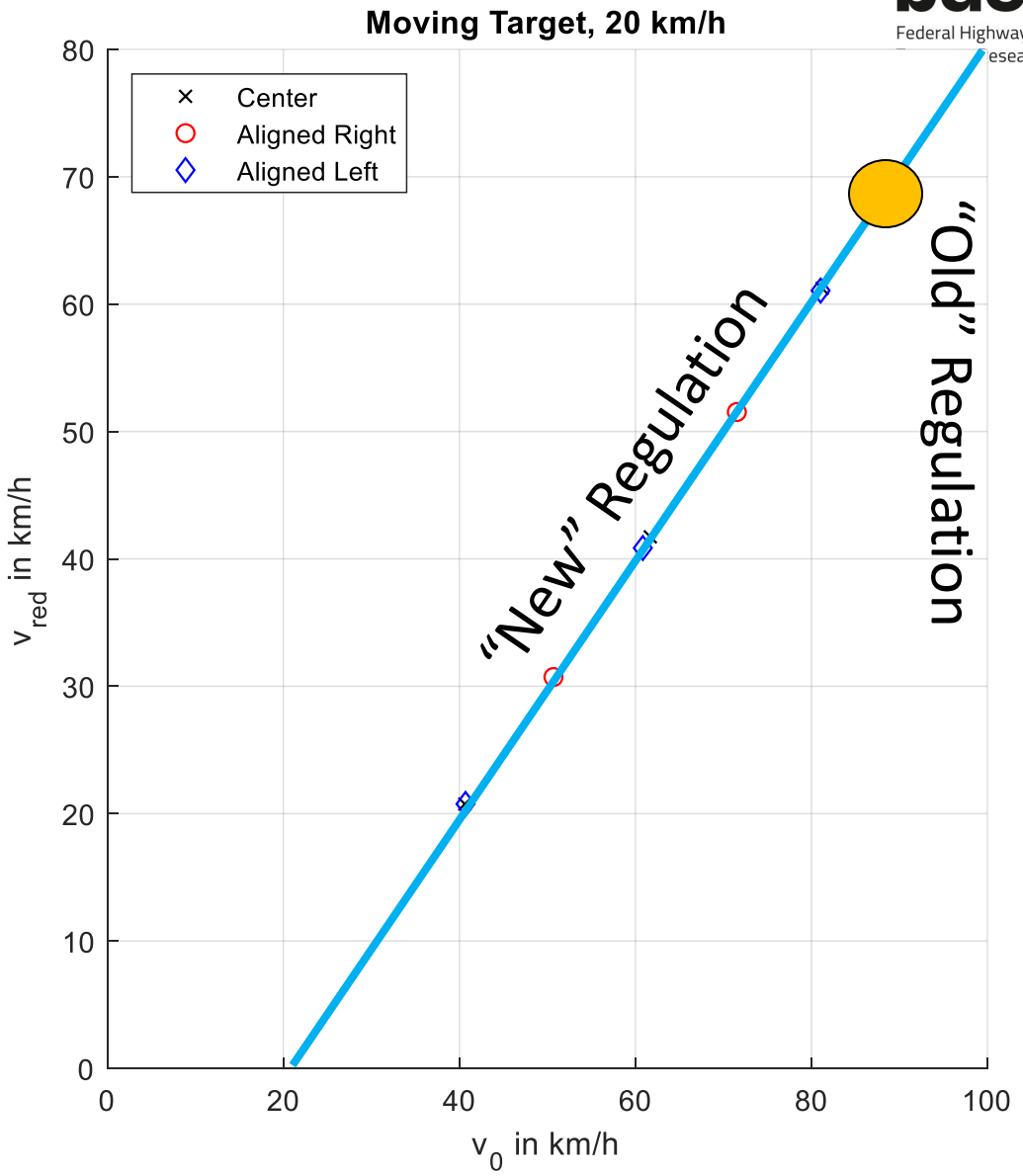


United Nations Process To Change Current Regulation



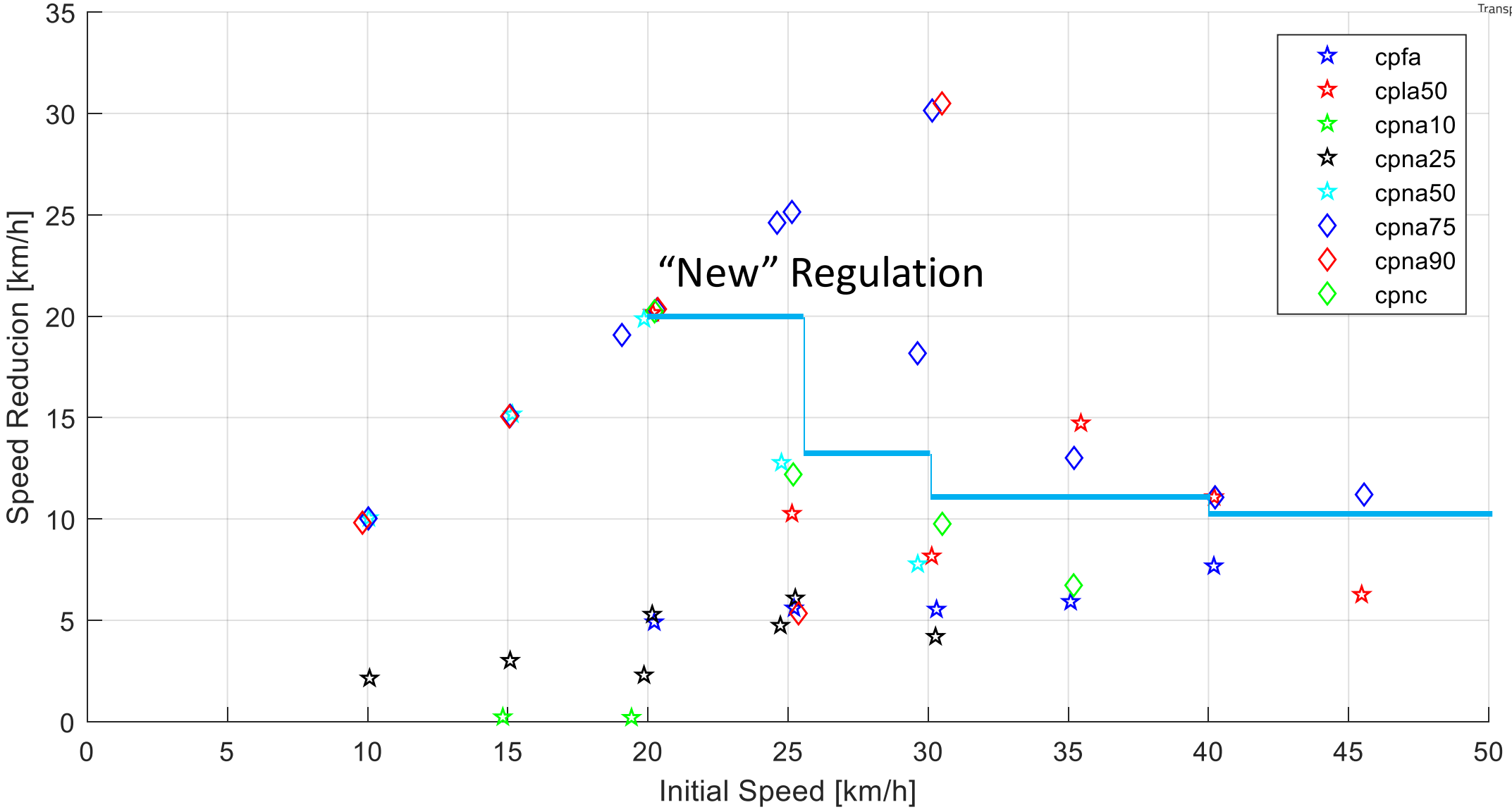
Test Results for Vehicle A – Vehicle - Vehicle





Test Results for Vehicle B – Vehicle - Pedestrian

bast
Federal Highway and Transport Research Institute



Robustness

- Systems should be working in real traffic situations
- Regulatory tests typically on ideal test tracks

- New regulation defines broad ranges for requirements rather than a single test run
- New regulation makes clear this performance is expected in real situations, not only on test track

bast
Federal Highway and
Transport Research Institute

Summary

- Automatic emergency braking for heavy vehicles
- Experiments: Current technology is much better than regulatory requirements from UN Regulation 151-01
- R151-01 had some shortcomings w.r.t. robustness
- New regulation has been developed at the United Nations World Forum for Harmonization of Vehicle Regulations
- Increased performance requirements for more safety on highways, especially: end of traffic jam accidents
- Implemented performance requirements for pedestrian AEB
- Mandatory for new types from 09/2025!