Industry Position Summary

Vehicle detection

Static target

M1

- Active between 10-50km/h
- Full avoidance up to 35.1km/h
- Speed mitigation of at least 20km/h and Collision warning required between 35.1km/h and 50km/h.
- Collision Warning no later than 0.8 seconds before emergency braking procedure.

N1

- Active between 10-50km/h
- Full avoidance up to 24.3km/h for N1
- Speed mitigation of at least 10km/h and Collision warning required between 24.3km/h and 50km/h.
- Collision Warning no later than 0.8 seconds before emergency braking procedure.

Industry Position Summary

Vehicle detection

Moving target

M1
- Subject vehicle speed 60km/h
- Target vehicle speed 24.9km/h
- Full avoidance at test speeds
- No Collision Warning requirements

N1
- Subject vehicle speed 60km/h
- Target vehicle speed 35.7km/h
- Full avoidance at test speeds
- No Collision Warning requirements

Industry Position Summary

Pedestrian detection

M1/N1

- Active between 10-50km/h
- Subject vehicle speed 50km/h
- Required speed mitigation of 20km/h
- Crossing scenario and adult dummy only
- No collision warning required

Ref: http://www.unfallrekonstruktion.de/

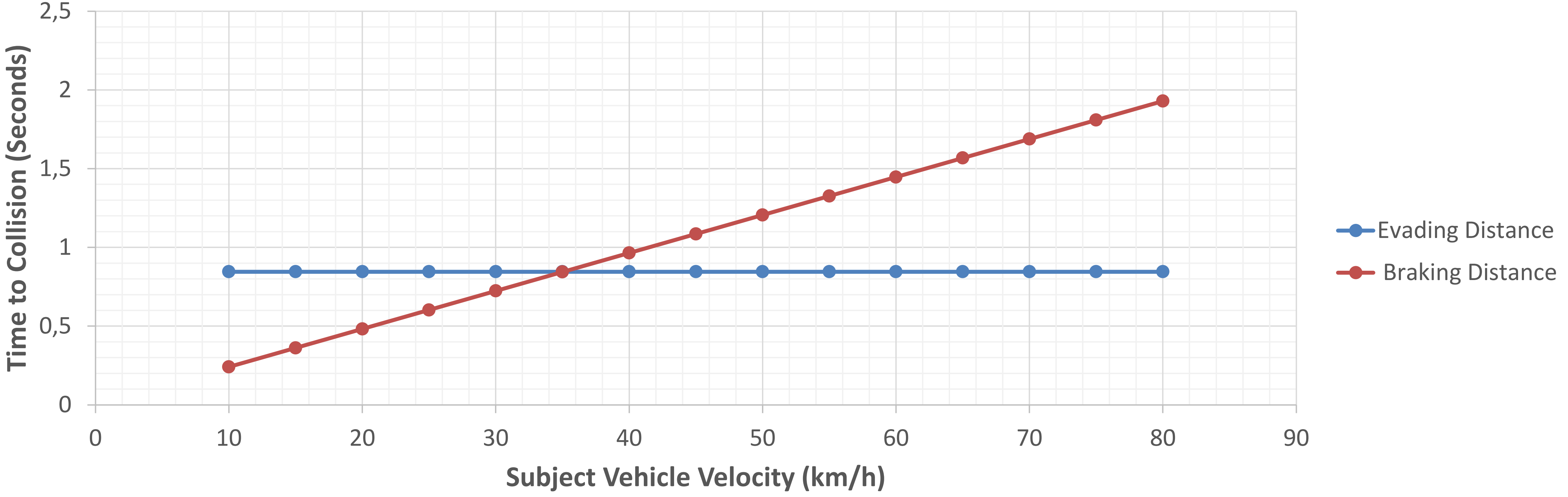
Industry Position Summary

AEBS requirements

M1/N1

- The regulation should not enforce a time threshold (TTC) in which AEBS should be activated.
- AEBS is default ON
- Driver has the ability to deactivate AEBS by a minimum of 2 presses of a button whilst the vehicle is stationary.
- Pre-conditioning defined by an agreement between the technical service and the manufacturer.
- Test targets are not specifically defined but may be a "soft target" and be representative of the attributes applicable to the sensor system of the AEBS under test
- Cycling detection requirements to be covered in Phase 2 of the regulatory development.

Activation Calculation



Values need to be agreed during AEBS 04

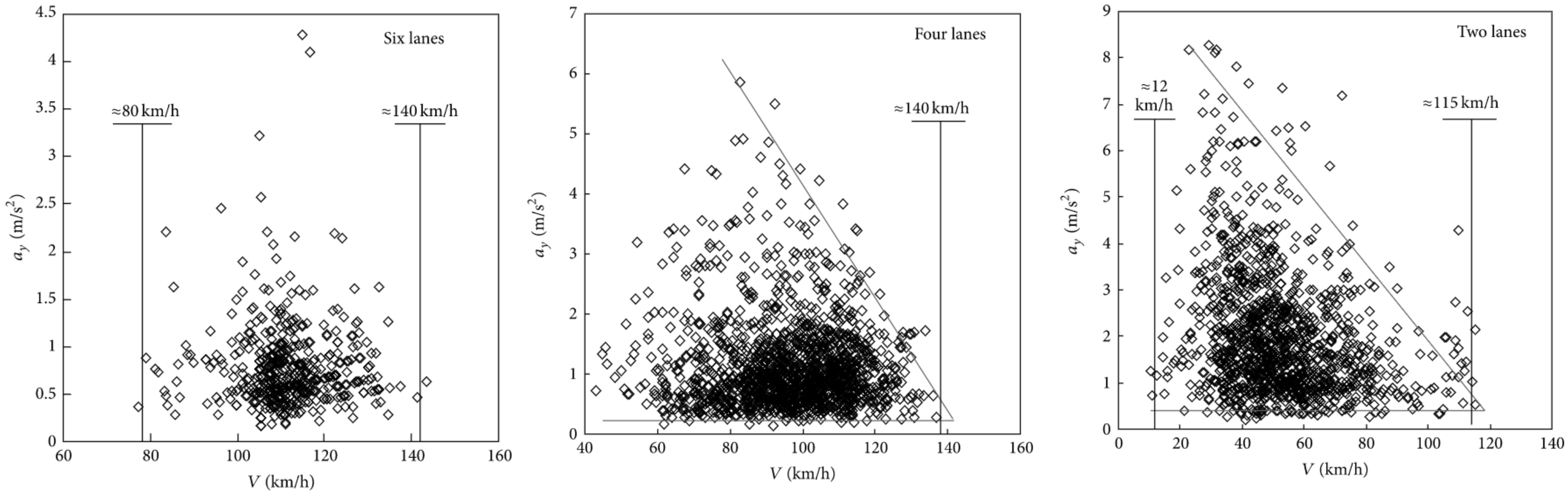
Assumptions M1:	*Braking Level = 5.76 m/s²*	*Lateral Acceleration = 7.00 m/s²*	*Lateral Offset = 2.5m*
Assumptions N1:	*Braking Level = 4.00 m/s²*	*Lateral Acceleration = 7.00 m/s²*	*Lateral Offset = 2.5m*

Ref: https://www.hindawi.com/journals/ddns/2015/494130/fig3/

Activation Calculation – Parameter, Lateral Acceleration

An Experimental Study on Lateral Acceleration of Cars in Different Environments in Sichuan, Southwest China – 2014

The lateral accelerations, speeds, and trajectory curvatures of a passenger car on twelve road types with different design speeds.



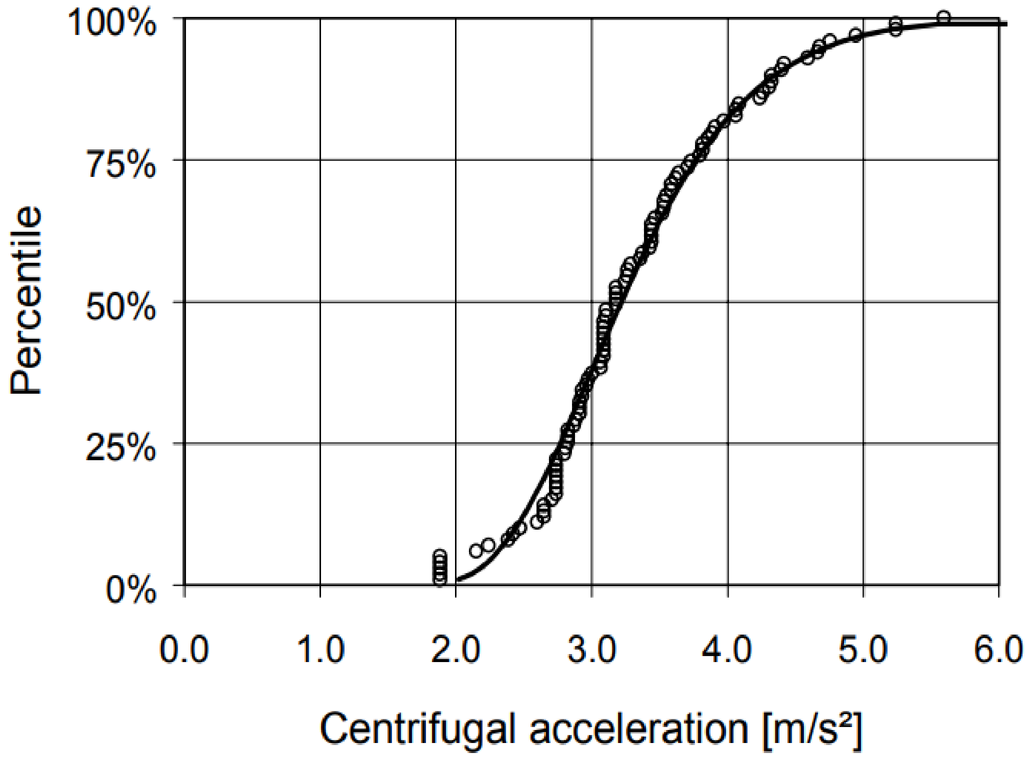
(a) Highway with six lanes (b) Highway with four lanes (c) Highway with two lanes

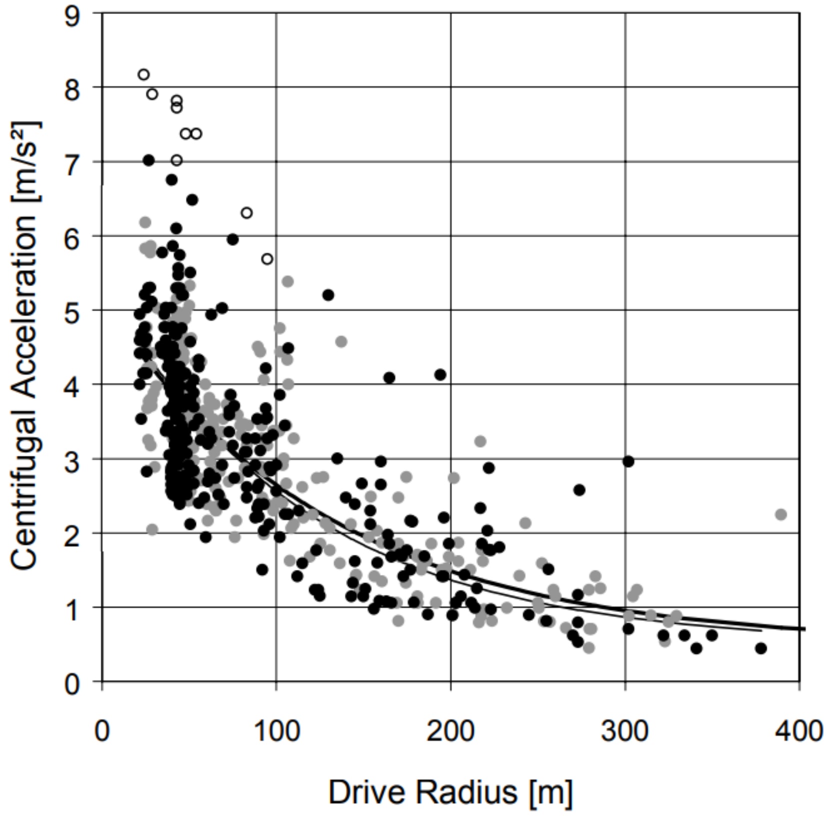
Ref: http://www.unfallrekonstruktion.de/

Activation Calculation – Parameter, Lateral Acceleration

Study based on 11 subjects using their personal cars, monitoring

Tested on different road sections (e.g. country road, highway intersection, inner-city and round course)

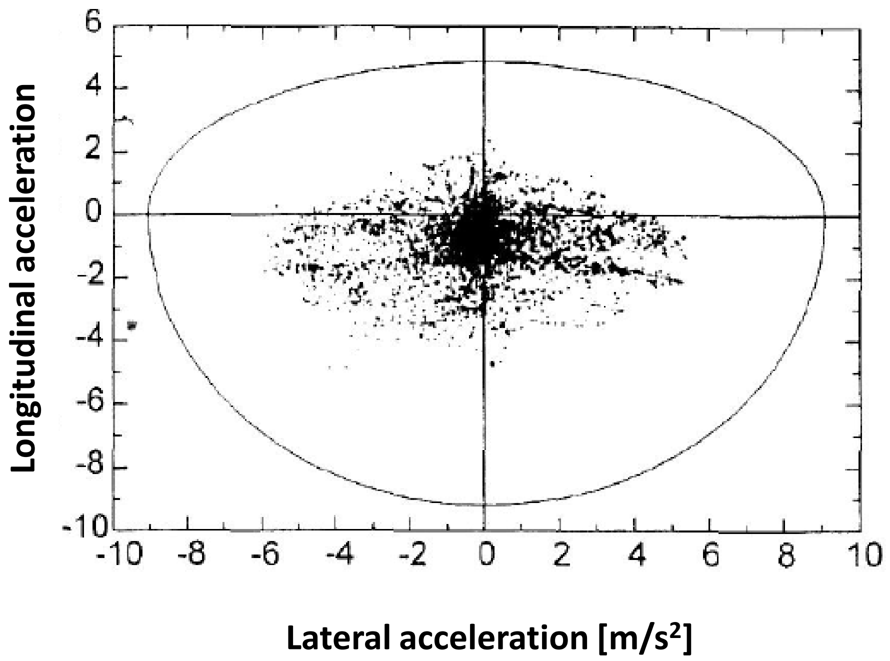




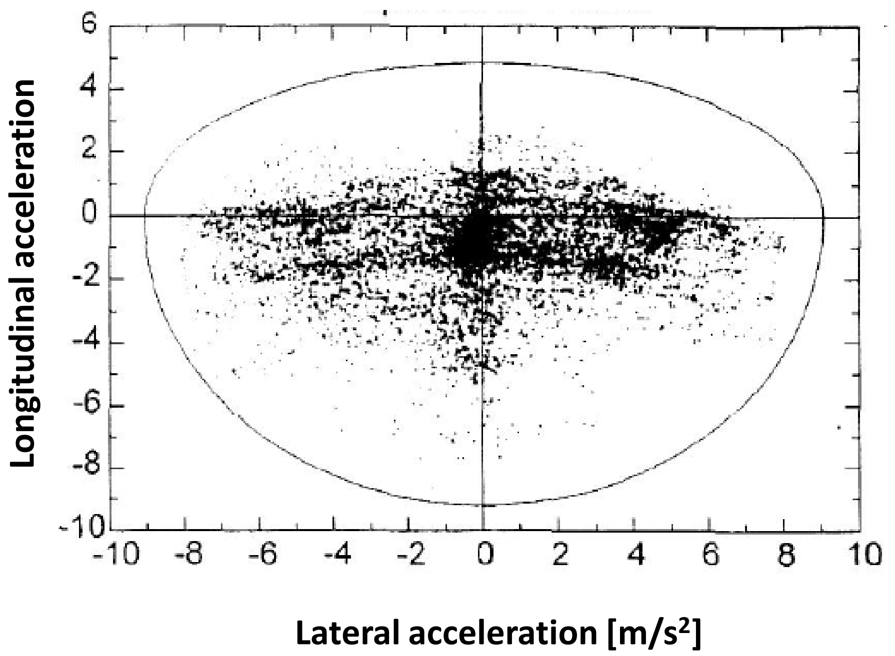
Ref: http://www.unfallrekonstruktion.de/pdf/nickel.pdf

Activation Calculation – Parameter, Lateral Acceleration and Deceleration

normal driver



sportive driver



Normal drivers use lateral acceleration from 0 to 6 m/s^2.

Sportive drivers use lateral acceleration from 0 to 9 m/s^2.

Activation Calculation – Parameter, Deceleration

- Regulated average deceleration value

R13-H
Type-0 test with engine disconnected; The mean fully developed deceleration > 6.43m/s/s
Type-0 test with engine connected; The mean fully developed deceleration > 5.76m/s/s

R13
Type-0 test with engine disconnected; The mean fully developed deceleration > 5.00m/s/s
Type-0 test with engine connected; The mean fully developed deceleration > 4.00m/s/s

$$d_m = \frac{{v_b}^2 - {v_e}^2}{25.92 - (s_e - s_b)}$$

v_o = initial vehicle speed in km/h
v_b = vehicle speed at 0.8 v_o in km/h
v_e = vehicle speed at 0.8 v_o in km/h
s_b = distance travelled between v_o and v_b in meters
s_e = distance travelled between v_o and v_e in meters

The stopping distance shall be the distance covered by the vehicle from the moment when
the driver begins to actuate the control of the braking system until the moment when the
vehicle stops; the initial speed shall be the speed at the moment when the driver begins to
actuate the control of the braking system

Activation Calculation – Parameter, Deceleration

- UNECE Regulation No.13-H/R13 the minimum service brake performance of the vehicle (Type 0 with the engine connected) is 5.76 or 4m/s^2 for M1 or N1 category vehicles respectively.

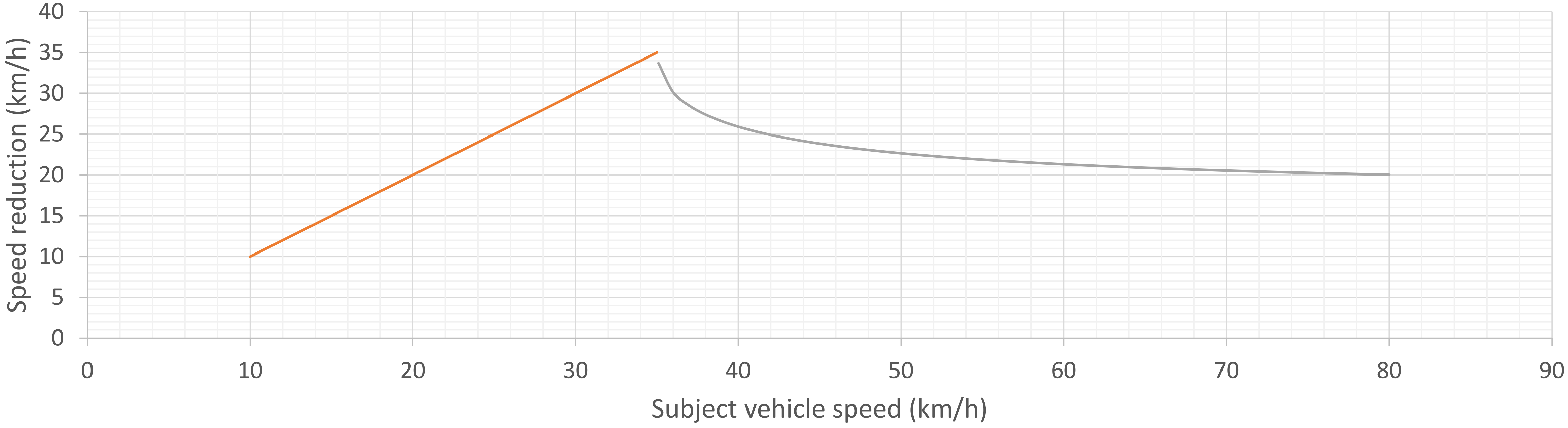
- The regulation for advanced emergency braking shall not specify any minimum deceleration for the vehicle, since this is already regulated in R13-H / R13, but should be implicit by the performance requirements of the AEBS equipped vehicle . i.e. by defining the conditions when a collision shall be avoided or mitigated. The very same principle applies to the performance of the sensors.

- AEBS emits a braking demand to the service braking system, higher values will require amendments for UNECE R13-H (& FVMSS135)

- To enable technically neutral requirements for every manufacturer.

- AEBS performance should be attainable in all vehicle and road conditions.

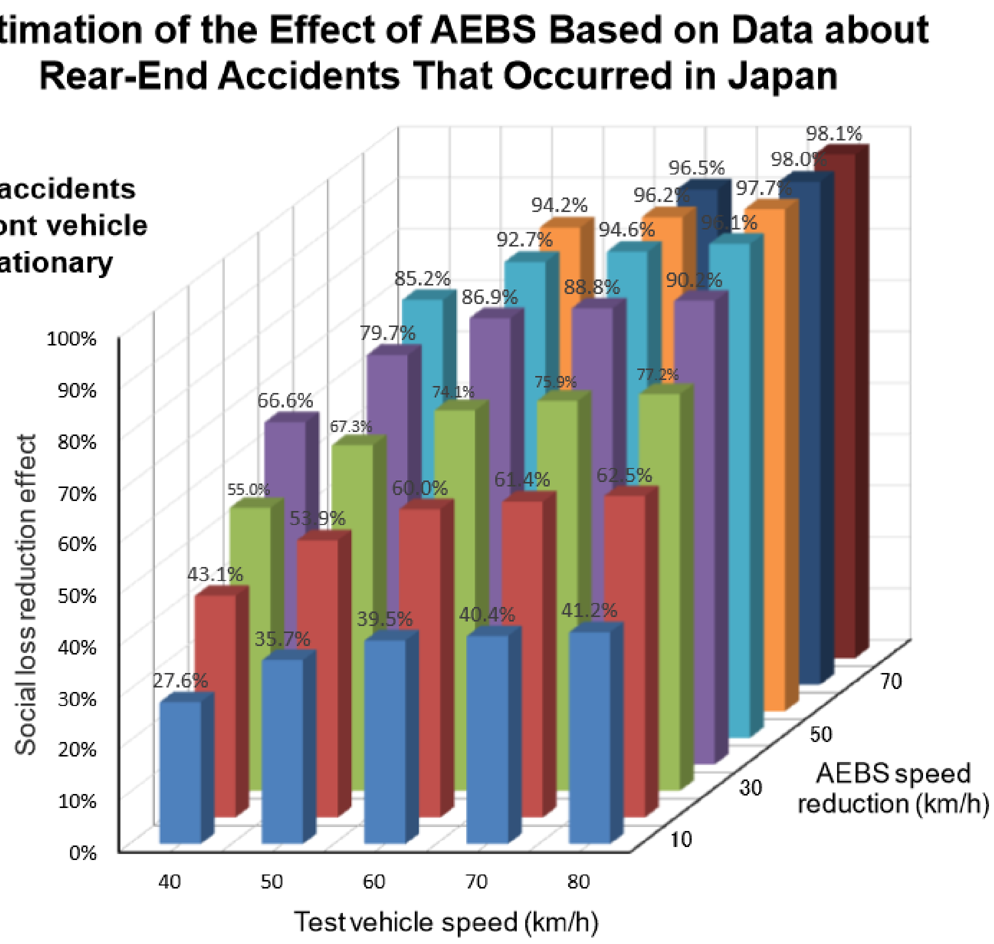
Activation Calculation – Calculation strategy relevant for C2C



Continuation of braking performance is not possible at subject vehicle speeds above LPS=LPS, as above this point the theoretical brake application is applied at the last point to steer.

‘shark fin effect’ noted in AEBS-02-11 (D) AEB Car-Car and Pedestrian (2)

Activation Calculation – Calculation strategy relevant for C2C



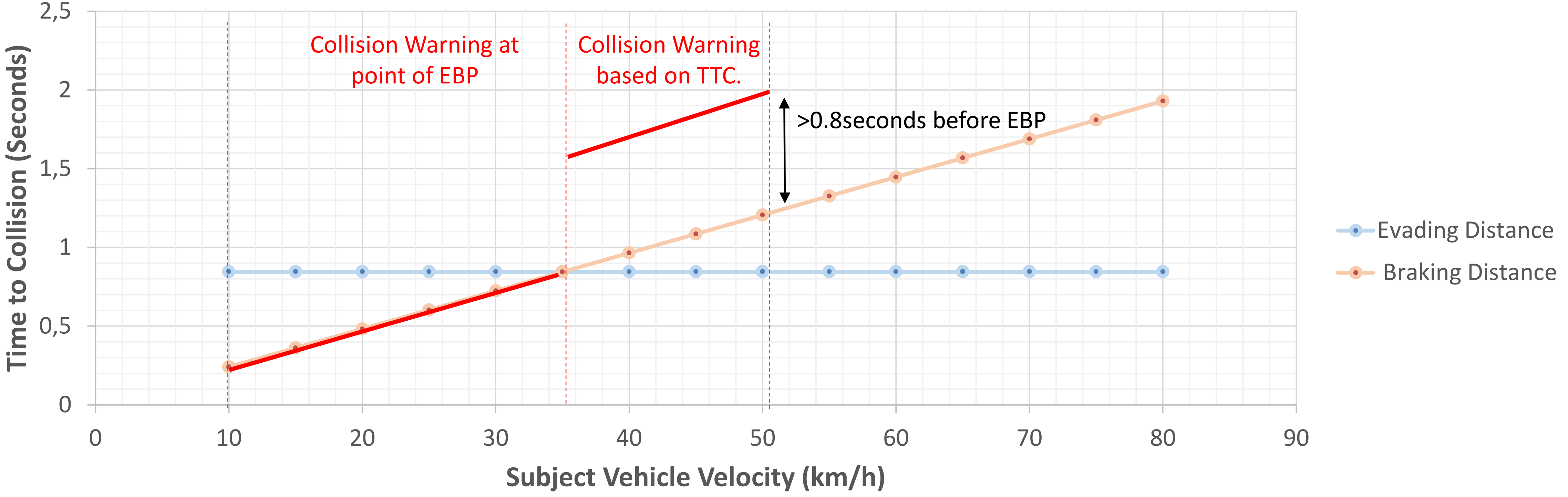
M1

- Speed mitigation of at least 20km/h at 50km/h.
- Minimum social loss reduction of 53.9%

N1

- Speed mitigation of at least 10km/h at 50km/h.
- Minimum social loss reduction of 35.7%

Activation Calculation – Collision Warning



Collision avoidance through automatic braking between 10km/h and [XX.X]km/h (LPS = LPB)

Collision avoidance by driver intervention in response to Collision Warning, or collision mitigation through automatic braking between [XX.X]km/h (LPS = LPB) and 50km/h

Activation Calculation – Calculation strategy relevant for C2P

AEBS 03 discussed using test scenario in ENCAP 2016 protocol in the new Regulation for AEBS.

Industry proposes to use the ‘CVNA 50’ test as it is the most common recorded pedestrian to vehicle collision.

- Daylight scenario
- Adult dummy target travelling at 5km/h.
- 50% impact position
- Impact at 0-5km/h = avoidance

Cannot account for steering to avoid the collision. LPS vs LPB phenomenon should not be consider for these scenarios. Performance requirements are based on accident data.

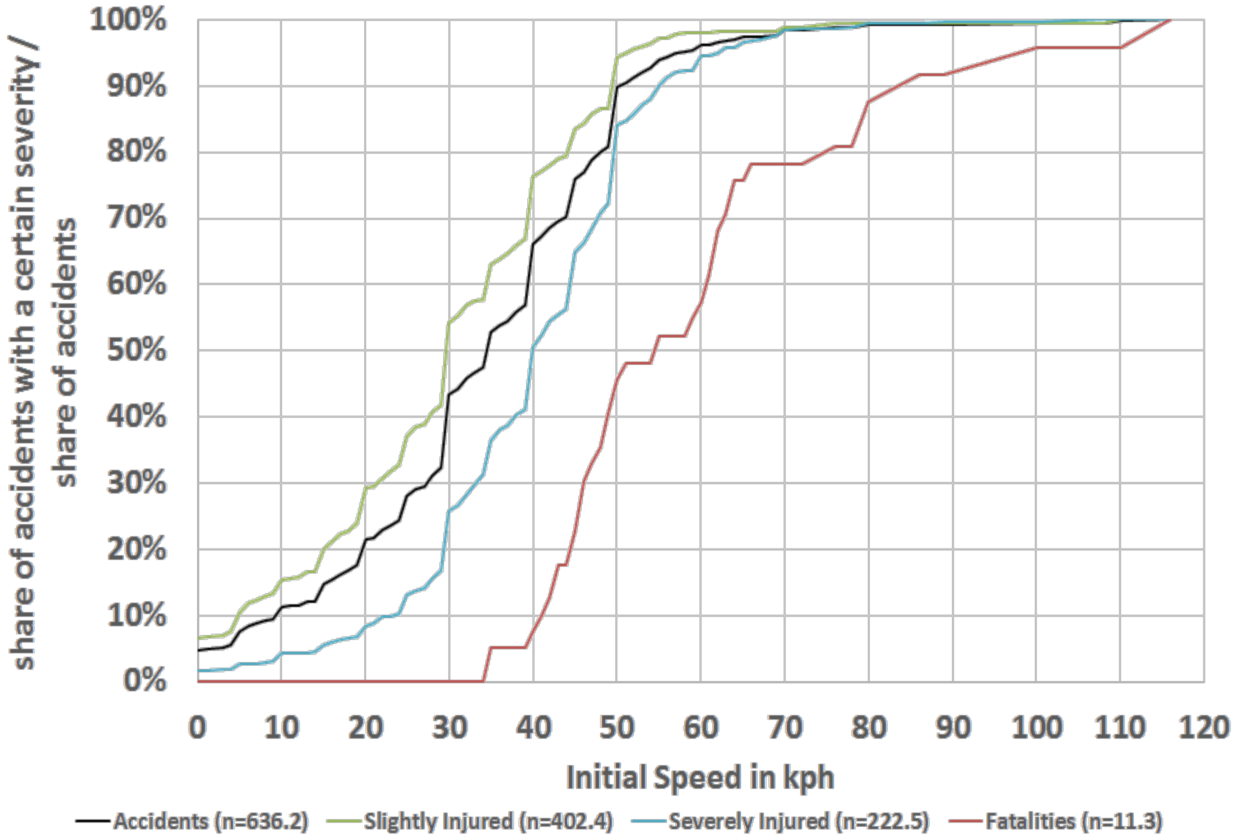
Performance requirements for both M1/N1 category vehicles is a speed reduction of at least 20km/h at 50km/h test speed.

AEBS for pedestrian detection shall be regulated between 10 and 50km/h

Activation Calculation – Calculation strategy relevant for C2P (Test Scenario)

German In-Depth Accident Study (GIDAS), 2005-2017, weighted to German Federal Statistical Office (DESTATIS), 2016

DESTATIS, GIDAS analysis				
Configuration		Accident scenarios		Casualties, Germany
				399 872
Car vs car	40%	Rear-end	46%	73 567
Car vs truck	6%	Rear-end	18%	4 319
Car vs motorcycle	7%	Rear-end	4%	1 120
Car vs pedestrian	**6%**	**Crossing**	**53%**	**12 716**
Car vs bicycle	12%	Crossing	50%	23 992
Total				**115 723 29%**



Activation Calculation – Calculation strategy relevant for C2P (Test Scenario)

STATS 19 (2008) and the in-depth On-the-Spot database (2000-2009))

Pedestrian Impacts:
The study reviewed 28,482 collisions with pedestrians from STATS19. It was found that the highest proportion of incidents were frontal collisions with passengers cars and taxis (81%). Within this field the following information was obtained regarding the vehicles speed:

16-48kmh = 92%,
64-80kmh = 5%
97-113mph = 3%

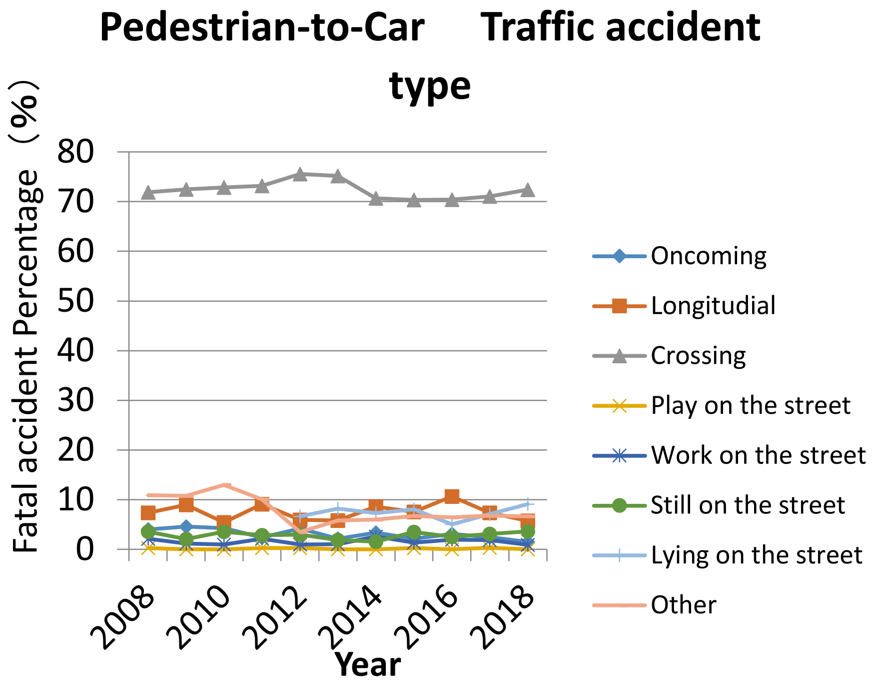
OTS randomly reviewed 175 cases matching that scenario chosen for the STATS19 review, and found the **mean vehicle speed = 44km/h**

AEB IWG 04

Activation Calculation – Calculation strategy relevant for C2P (Test Scenario)

National Police Agency Traffic Section Traffic accident statistics March 2018

- The percentage of pedestrian traffic accidents in crossing in Japan accounts for approximately 70%.
- The percentage of Crossing from obstruction vehicles is only 22%.
- The percentage of adults who died in traffic during walking was 97.5%.



TEST SCENARIO

Adult Crossing, without obstruction

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3503411/

Activation Calculation – Calculation strategy relevant for C2P (Performance)

Exploration of vehicle impact speed – injury severity relationships for application in safer road design Chris - Jurewicz et al. 2016

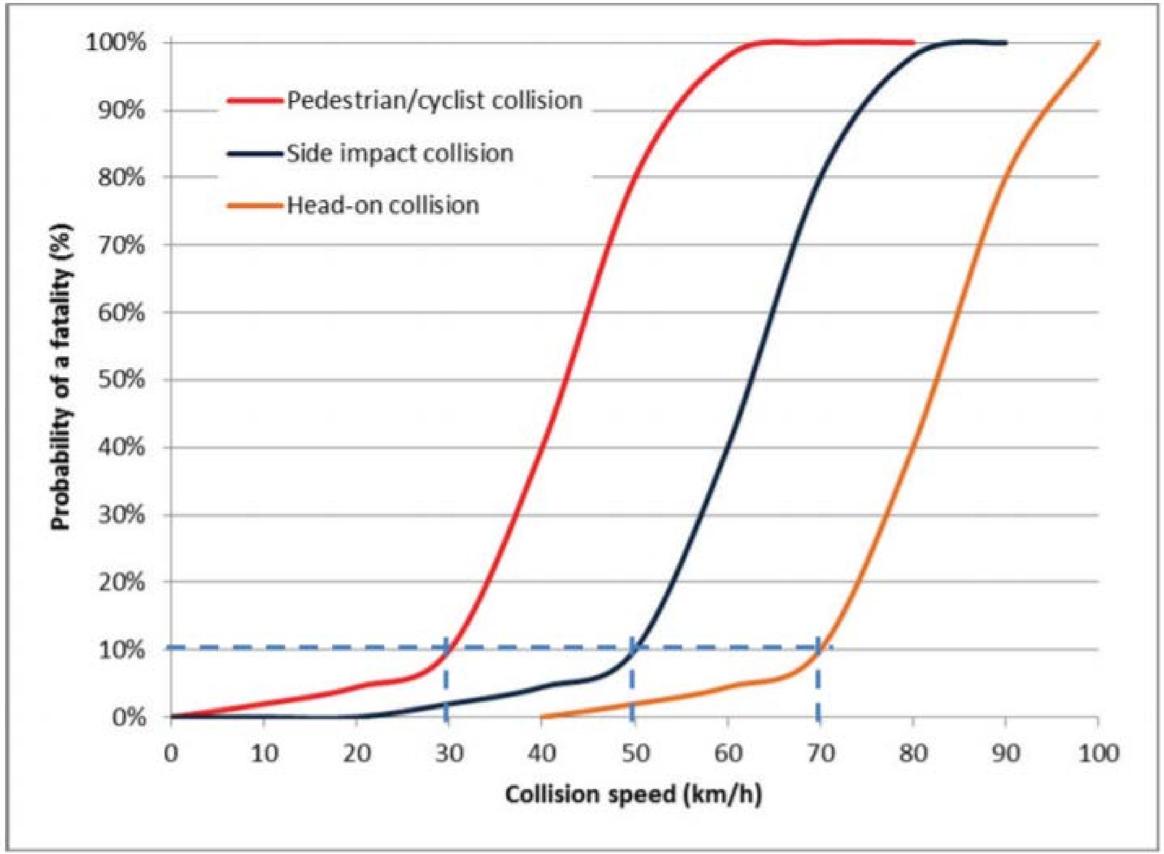


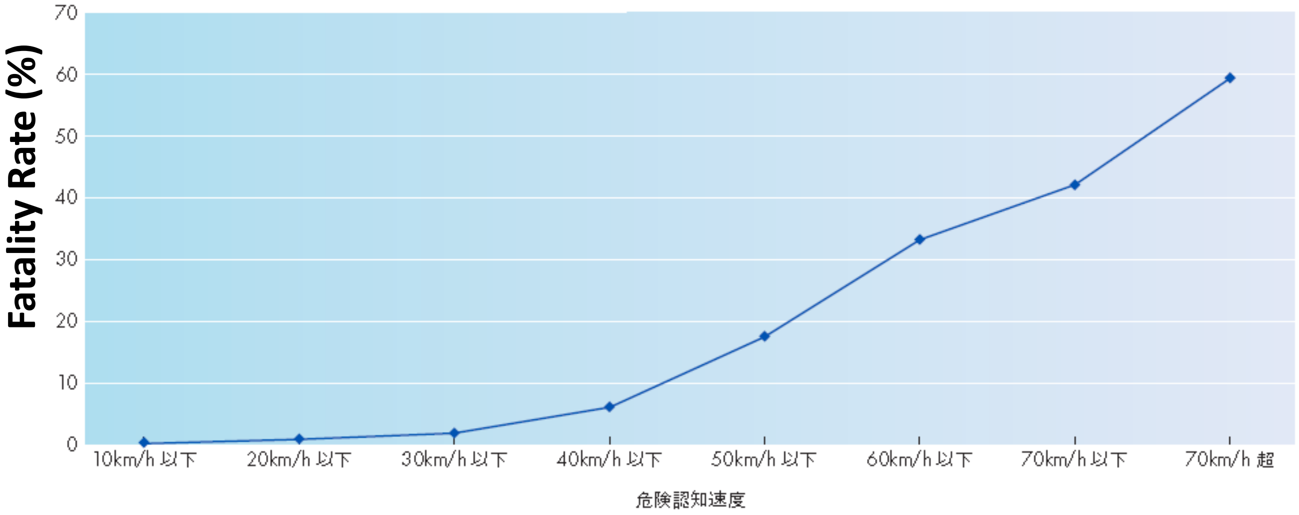
Fig. 1. Wramborg's model for fatality probability vs. vehicle collision speeds. Source: based on Wramborg (2005).

Activation Calculation – Calculation strategy relevant for C2P (Performance)

Speed is less than 30 km/h, the Fatality rate is very low

＜危険認知速度と致死率＞

図９に歩行者死傷事故55,926件について運転者が事故の危険を認識した時点の速度（以下、危険認知速度と呼ぶ）と致死率の関係を示します。これを見ると致死率は危険認知速度が30km/hを超えると徐々に上昇し、速度が増えれば増えるほど急激に大きくなっています。



Recognition speed of danger

Fig. 3 Recognition speed of danger vs Fatality Rate
(Car vs Pedestrian accidents N=55,926)

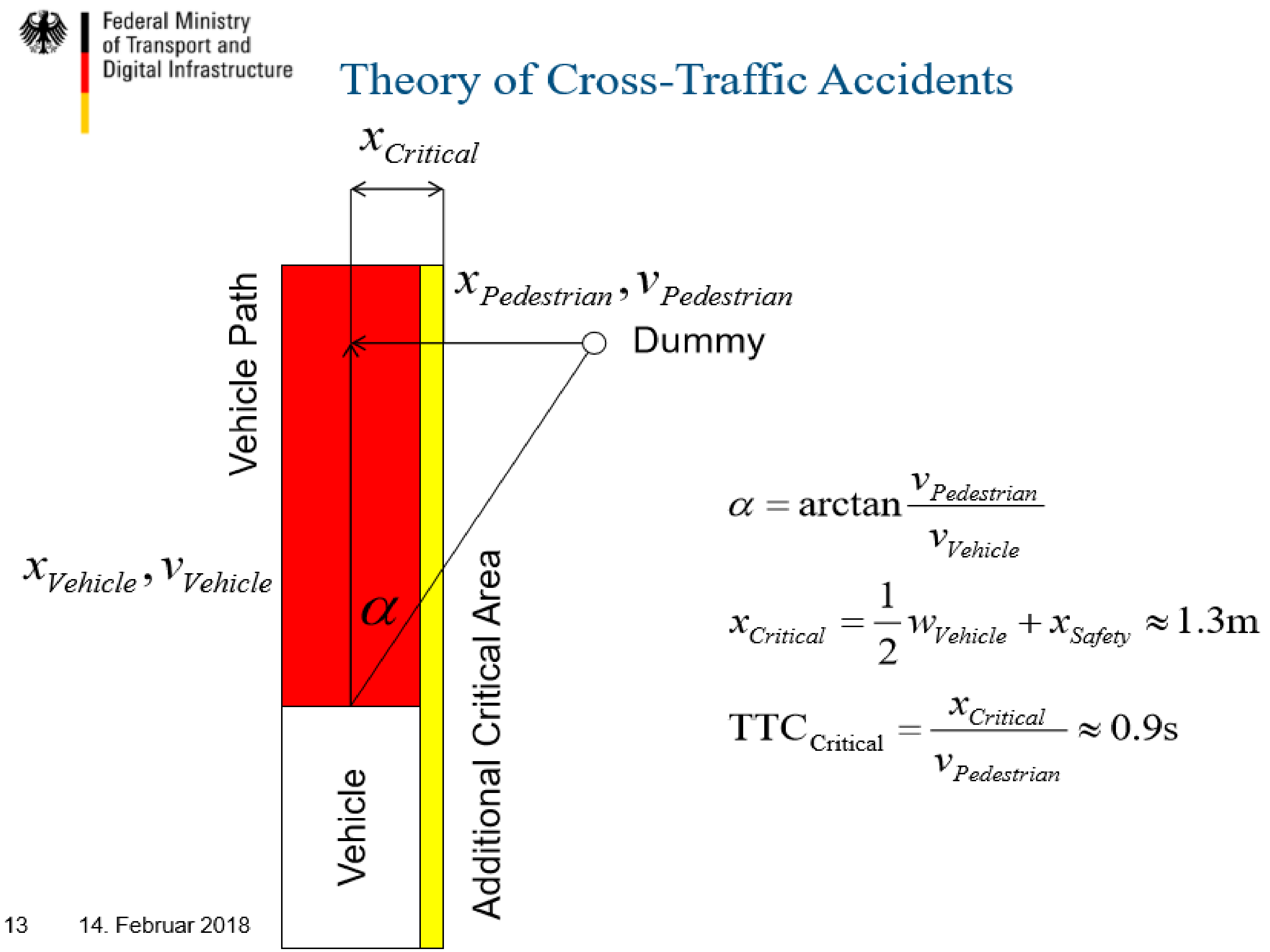
Activation Calculation – Calculation strategy relevant for C2P (Performance)

When compared to German proposal for the critical point for brake application in AEBS 03-04 Slide 13 (TTC critical=0.9 seconds)

If 5.76m/s/s or 6.43m/s/s is applied at 0.9 seconds TTC between 10-50km/h:

@ 5.76m/s/s deceleration
Subject vehicle avoids up to 18km/h
Subject vehicle impacts <5km/h up to 36km/h

@ 4m/s/s deceleration
Subject vehicle avoids up to 13km/h
Subject vehicle impacts <5km/h up to 31km/h



Reasons for AEBS deactivation.

Drivers are able to deactivate subcomponents for AEBS such as ESC and ABS, as the inability to this is extremely prohibitive in certain use-cases e.g. driving on snow. Drivers should be able to deactivate the AEBS for use cases such as:

- Allows for use of normal M1/N1 vehicles off road without activation of AEBS triggered by terrain or flora.
- Allows use vehicles on rolling roads during PTI and certification tests.
- Manufacturers should allow the costumers to switch AEB off when using the vehicle on a track.

It could be possible to not allow the deactivation of AEBS to be ‘easy’, so either through at least 2 button presses or one long press of a button whilst the vehicle is Stationary. (Infotainment system or physical buttons). *Ref. EuroNCAP bonus point for HMI + consolidated position from AEBS 03 Brussels.*

If customers are not given an official mechanism for deactivation it may encourage them to use unofficial and illegal methods to tamper with the vehicle.

Justification for not mandating AEBS above 50km/h absolute velocity.

- Accident data suggests that the majority of vehicle collisions with other vehicles in urban environments, therefore AEBS for M1/N1 should be regulated for these scenarios where speed differences more than 50km/h are uncommon.

- At higher speeds the difference in the which the last point to steer and last point to brake occur increases exponentially, this could lead to a greater possibility of false positives – at higher speeds a false positive will have a greater impact on the road user's safety and traffic flow.

- Greater alignment with voluntary commitment requirements from US manufacturers – ease the development of a GTR.

- Applicable to urban scenarios which is relevant to 50km/h and under

AEBS 02 Back up slides - Accident data summary mk2 (Slide 4)