Justification for Manual Deactivation

Industry are concerned that by not providing a method for deactivate could cause low consumer acceptance and possibly dangerous situations in the real world. Long-term user acceptance is important to encourage the uptake of such systems and greater potential to save more lives.

At the last meeting a compromise reached. Manual deactivate may be possible by two deliberate actions, whilst the vehicle is travelling at less than 10km/h. This compromise was not unanimously supported by all Contracting parties.

1. By regulating a series of actions that are required, whilst the vehicle is in a certain condition will prevent drivers from manually deactivating the system during normal driving conditions, but will allow the deactivation of the system when its functioning could be extremely prohibitive.

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 (chassis dynamometer) during PTI and certification tests.
- Using the vehicle on a track.
- Vehicle is being towed
- Towing another vehicle
- Sensor or system malfunction: Impact on the AEBS sensor resulting from light collisions, stones chipping the sensor or accidents with small animals may disturb the alignment of a sensor. This may result in uncharacteristic behaviour of the system. The possibility to deactivate is necessary to give the driver the chance to complete their journey or travel to a garage for repair.

AEB IWG 06 – Industry Input

- Multiple unwanted interventions
- Sensors are temporarily covered by auxiliary equipment. e.g Bull bars
- Vehicle is being loaded e.g. truck, motorial trial, ferry.
- specific weather conditions and traffic situations may lead to an annoying number of false warnings.
- Undersized compact spare tyre or tyre repair kit usage

It was proposed that for these cases the vehicle could recognise it is in such a situation and automatically deactivate the AEBS function.

- However this would require a significant number of sensors to contribute to the AEBS
- It is very difficult for the manufacturer to determine an exhaustive list of all scenarios in which automatic deactivation is required.
- Even more difficult would be to coordinate these circumstances into the algorithms of the system.

AEB IWG 06 – Industry Input

2. The permission of a manual deactivation means is a very important part in defining the entire architecture and adjusting the underlying algorithms. Changing the regulation as proposed may lead to an even more cautious and conservative decision if a collision is imminent and requires warning and emergency braking. Following the performance of AEBS with restricted manual deactivation means performance may be decreased.

3. A field study carried out by the VDA in 2015 showed in their experience and through their internal accident research show that the emergency braking system for heavy commercial vehicles, for which the fitment of AEBS is mandated, drivers deactivated the system in only in very rare cases i.e. less than 1% system deactivated by the driver.

4. This optional possibility of manual deactivation was introduced due to concerns about technology readiness at the time of the development of Regulation No. 131. This is applicable to pedestrian and cyclist detection.

5. 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.

Why 2 step approach for pedestrian protection?

1st step (EIF i.e. ca 2020 in UNECE) 20-30km/h

2nd step (2023 in UNECE – i.e. 2023 in EU) 20-42km/h

1. After evaluating the results from ENCAP 2017, 70 vehicles were tested. 46 of which have AEB of which 33 vehicles had 5 star performance. But 5 star performance does not necessarily require full avoidance, speed reduction of 20km/h above 40km/h.

   In fact no cars from 2017 achieved full avoidance across the tested speed range.

   Other requirements are regulated and tested: Collision warning, activation speeds, deactivation switch, EMC, HMI (failure warnings etc), provisions for PTI.

NCAP vs Type Approval

- Performance determination vs minimum safety standard.
- Designed performance needs to take in account for different conditions in the real world when compared to the test track and designed with safety margin to cover variation in results.
- NCAP selection of vehicle is based on the most common variants available on the market, type approval vehicle selection is based on the worst case vehicle.

2. Subject vehicle speed not necessarily needs to reach zero in order to avoid a collision.

Regulating urban automated driving vs AEBS requirements

Industry would like to have urban driving regulated as soon as possible in order to understand what are the target for the future – regulating a minimum safety standard for the future. Does not imply that systems are close to market.

There is a concern over regulating cyclist detection now as it is an if fitted regulation for systems that are just entering the market. Industry would like a better understanding of the performance of those systems.

Why average Braking demand and peak level of deceleration?

Prevents manufacturers implementing different braking strategies dependent on the vehicles speed and scenario. Manufacturers tend to ramp up the level of deceleration provided by the system over several phases. Lower speed may be different to the strategy used at higher speed.

Especially at lower speeds LTB is behind LTS. So it’s possible to brake safe and less harsh after LTS has passed.

May only need slight speed reduction in order to avoid the collision, particularly in crossing scenarios.

Example (current AEBS):

Braking from 30 km/h to 20 km/h on a moving vehicle

Peak approx. -4,6 m/s²

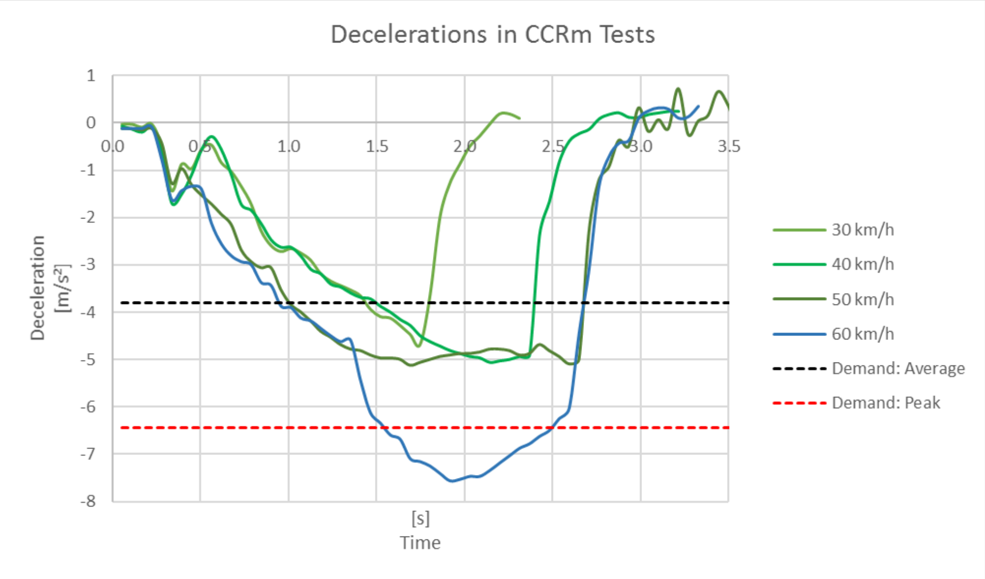
Average approx. -2,3 m/s²

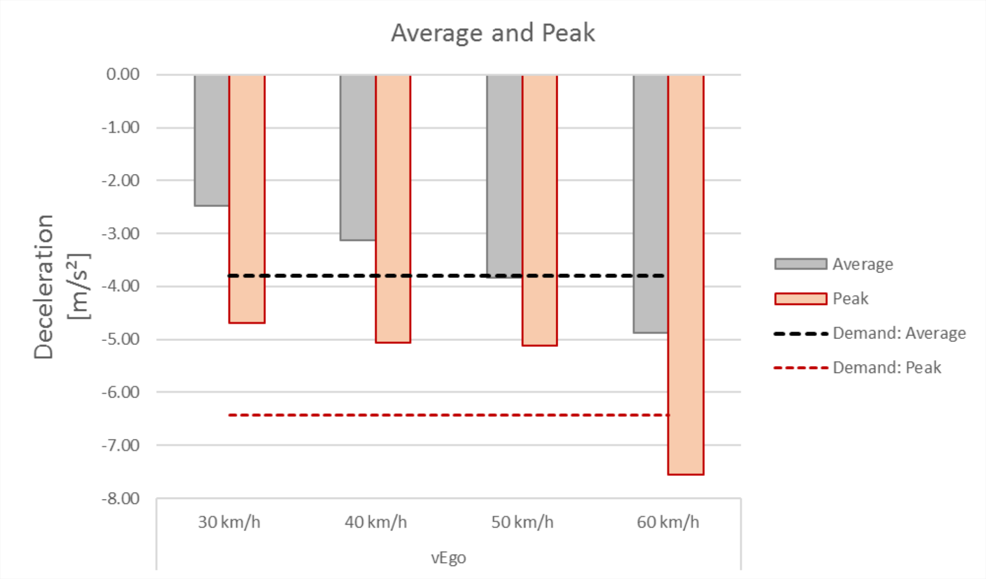
Speeds up to 30km/h relative speed did not achieve the vehicle deceleration required by the draft regulation.

Using AEBS as a comfort function is unlikely. The peak deceleration of more than 4 m/s² and a remaining gap to another vehicle less than 1 m in an AEB event are uncomfortable for the driver and very uncommon considering normal driving.

Presenting CCRm-Tests

- Part of NCAP are CCRm-Tests (Car2Car Rear moving): Ego-vehicle moves with constant speed on an object with $v_{Target} < v_{Ego}$. NCAP-Points for collision avoidance or mitigation.
- NCAP-Tests: 200 kg vehicle load capacity (incl. driver and equipment), min. 90 % tank capacity
- Measurements of passed CCRm-Tests (v_{Target} = 20 km/h):



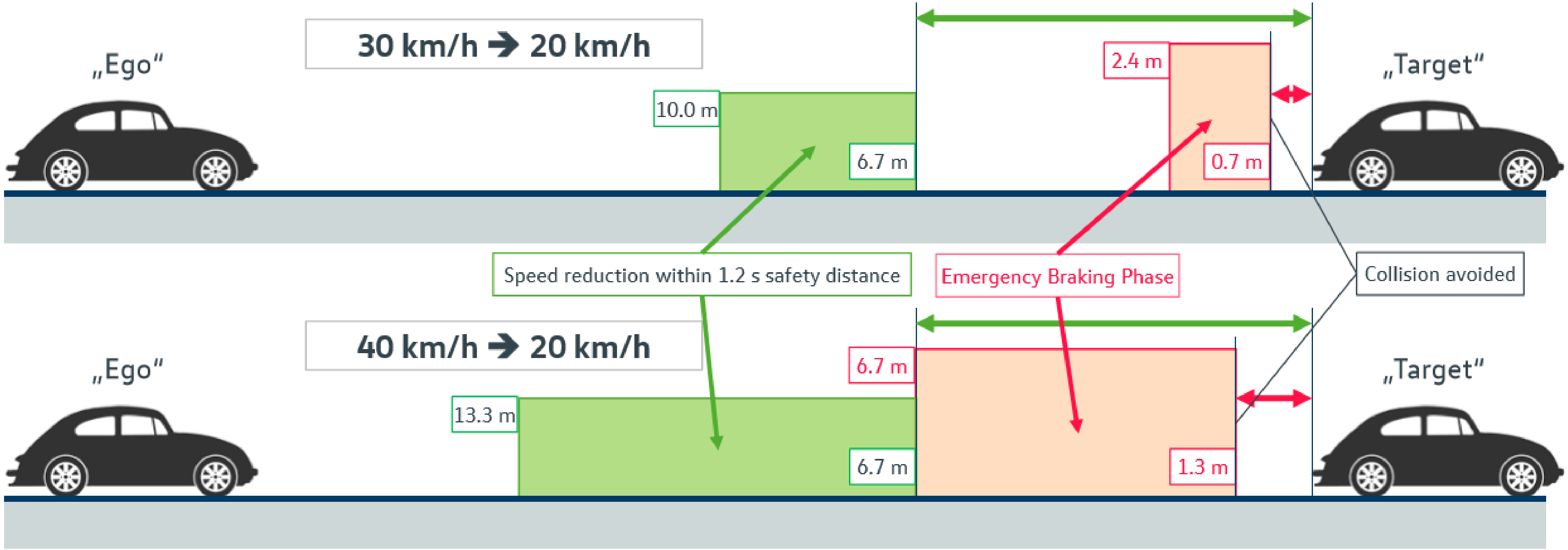


- <u>Conclusion:</u>
- In some CCRm-scenarios with $v_{Ego} \leq 50$ km/h collision avoidance in an AEB event is achieved with an average and peak deceleration, which is lower than the demand of -3.8 m/s² minimum average and -6.43 m/s² minimum peak.
- → Regulating minimum average and peak deceleration should be avoided

AEB IWG 06 – Industry Input

CCRm-Scenarios

In both scenarios collisions are avoided with decelerations below the demanded average (-3.8 m/s²) and peak (-6.43 m/s²) deceleration values.

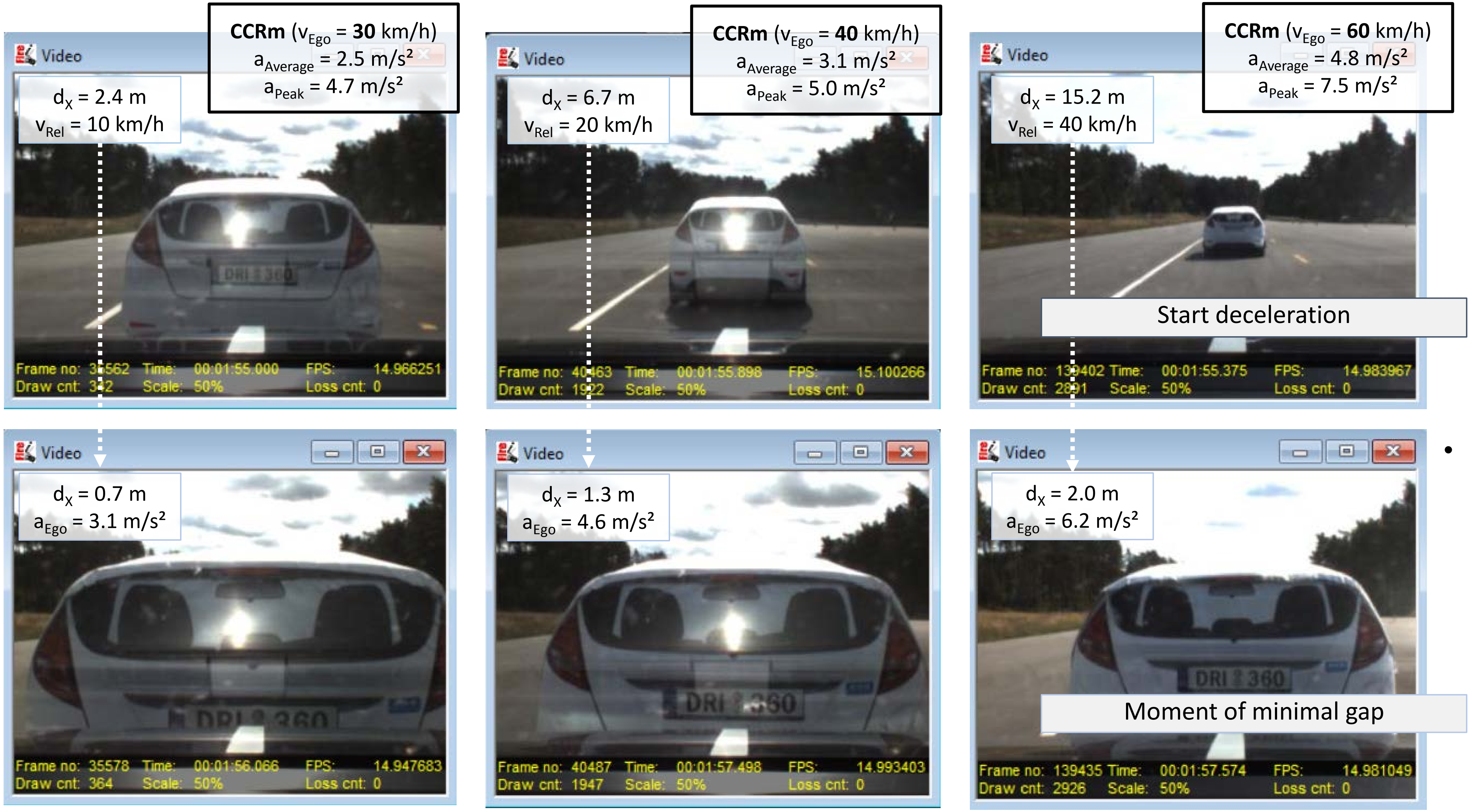


Nevertheless <u>those AEB are **not considered convenient**</u> – not only because of the level of the deceleration, but because of <u>**starting and ending distance** of the braking phase</u> itself.

In order to reach the demanded deceleration values the AEBS

- has to **brake later** (= <u>loss of safety</u> in case of wet street, braking target, …) **or**
- will **stop** the vehicle **in greater distance** to the target (=<u>no acceptance</u> of the customer)

CCRm-scenarios: v_{Ego} = 30 km/h, 40 km/h and 60 km/h with v_{Target} = 20km/h

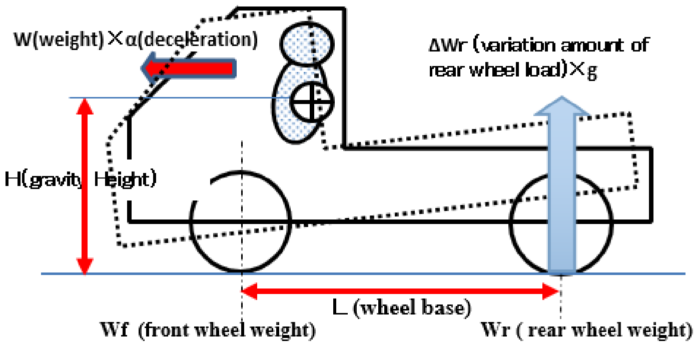


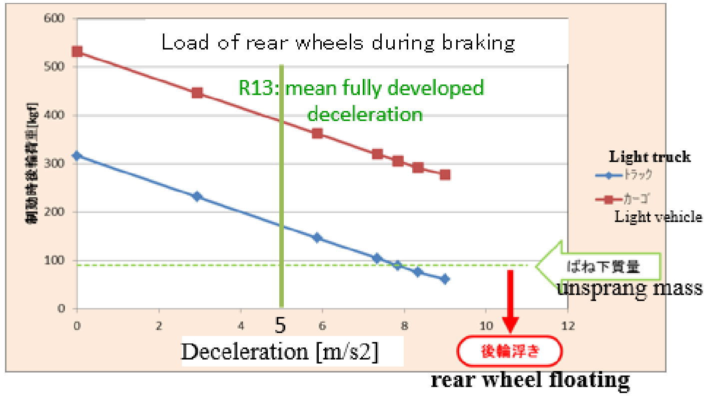
- → Data and pictures from CCRm-measurements show that de-escelation of these scenarios is not comfortable.

Alternative requirements for N1 category vehicles

Deceleration of light truck

The deceleration of the light truck is limited up to around 7 m/s2 because of the rear wheel load reduction.





❶Variation of rear wheel load during braking

$$\triangle Wr \times g \times L = W \times \alpha \times H$$

$$\triangle Wr = \frac{W}{g} \times \alpha \times \frac{H}{L}$$

As the wheel base L is small (H / L is large), the rear wheel load fluctuation amount ΔWr increases. Further, when the rear wheel load Wr is small, the rear wheel load greatly decreases.

❷Load of rear wheels during braking

$$WrB = Wr - \triangle Wr$$

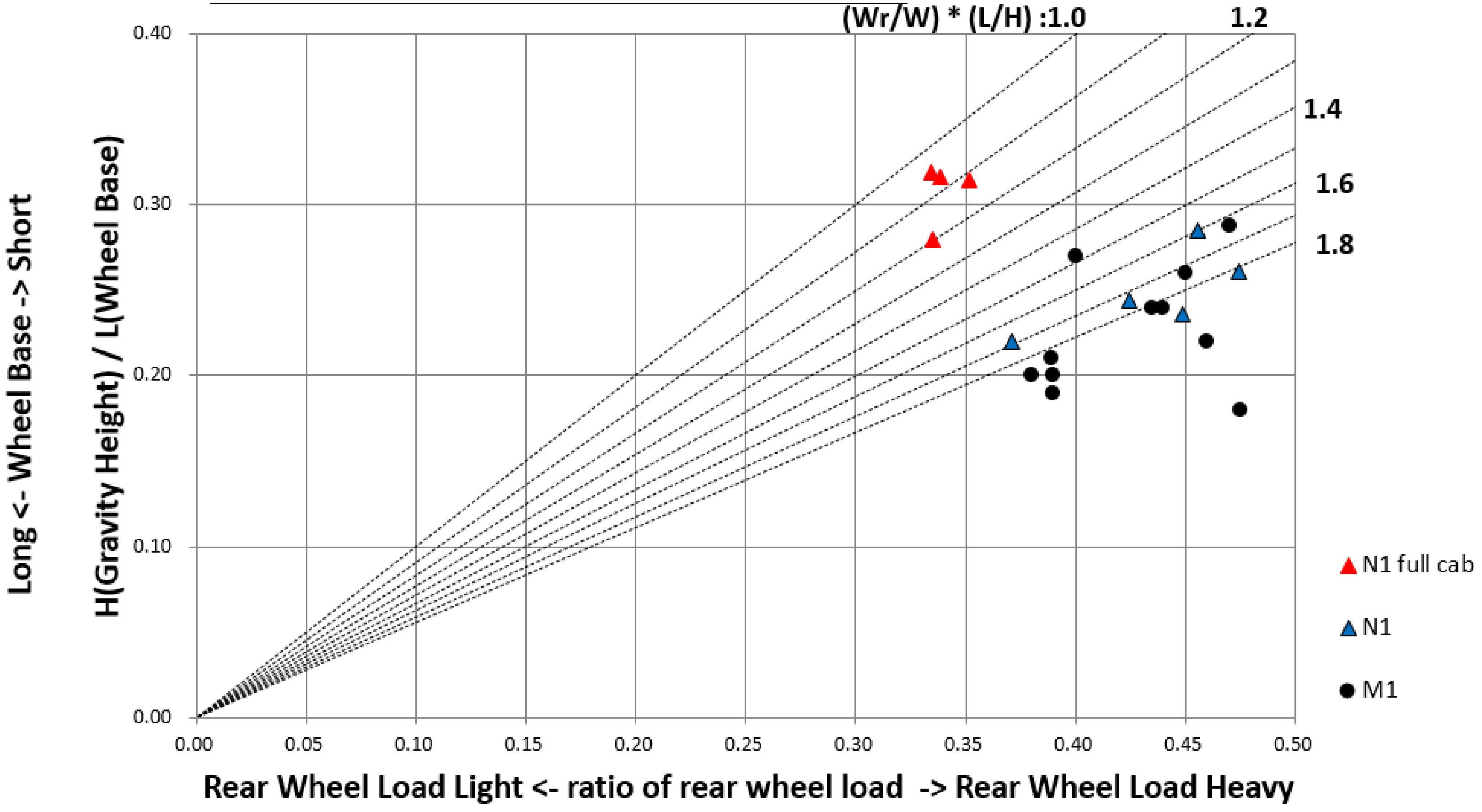
If the rear wheel load WrB of braking falls less than the rear wheel unsprang mass wr, the rear wheel floats. That is, if WrB-wr = negative, the rear wheel floats.

	Light loading (2 persons)													
	Wheel base L	Gravity height H	Front wheel weight Wf	Rear wheel weight Wr	Vehicle weight W	Rear unsprang mass wr	Load of rear wheels during braking : WrB[kgf]							
								Deceleration : α[m/s2]						
								0	2.94	5.88	7.35	7.84	8.33	9
Light truck	1900	560	644	316	960	90	WrB	316	231	146	104	89	75	61
							WrB−wr	226	141	56	14	−1	−15	−29
Light vehicle	2450	595	629	531	1160	90	WrB	531	446	362	319	305	291	277
							WrB−wr	441	356	272	229	215	201	187

Influence of Short Wheel Base

As for the vehicles of short wheel base , the braking force is controlled due to decrease the rear wheel load.

FIG1. Index of the rear wheel load decrease



AEB IWG 06 – Industry Input

FIG2. Enlarged FIG.1