

Annex:

Detailed discussion of the VDA position on the proposal for draft amendments to UN-ECE R94

Informal Group “List of Issues”

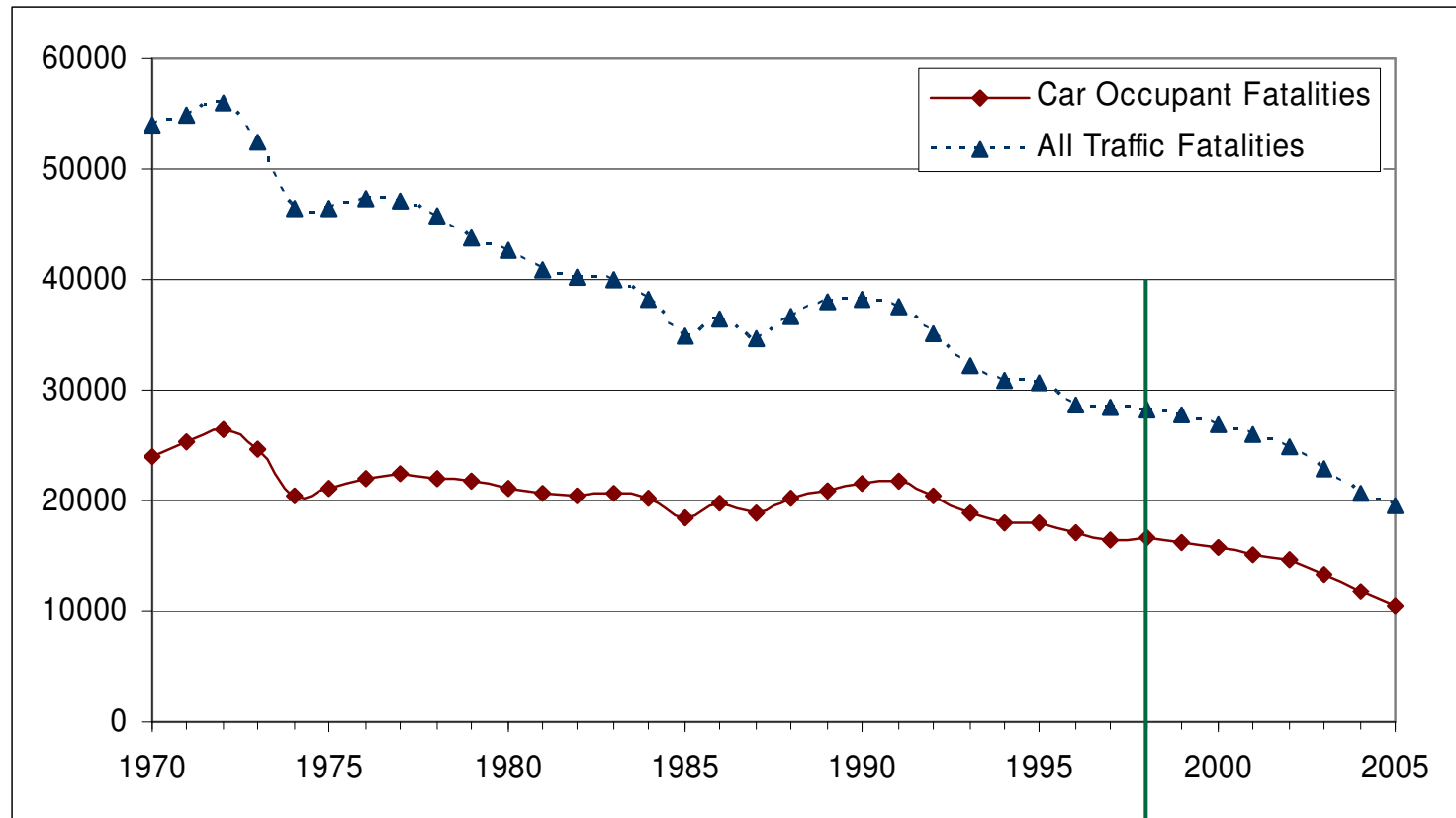
1. **Accident analysis – changing vehicle fleet**
2. Accident analysis – thorax injury in frontal impacts
3. **Harmonisation of frontal impact procedures**
4. Test severity required for a regulation test
5. **Test severity of PDB test**
6. Measurement of EES of PDB test
7. **Assessment of occupant restraint system with the PDB test**

Additional points:

8. **Testing with the current PDB design**
9. **Cost/Benefit**
10. **Design of future vehicles**

Issue 1:
**“Is an accident analysis needed to update
information on changing vehicle fleet?”**

Vehicle safety and the existing Regulation 94



Introduction of Regulation 94

Combined European accident statistics show a clear decrease in car occupant fatalities correlating with the introduction of the current test procedure. There is no evidence that this trend will change.

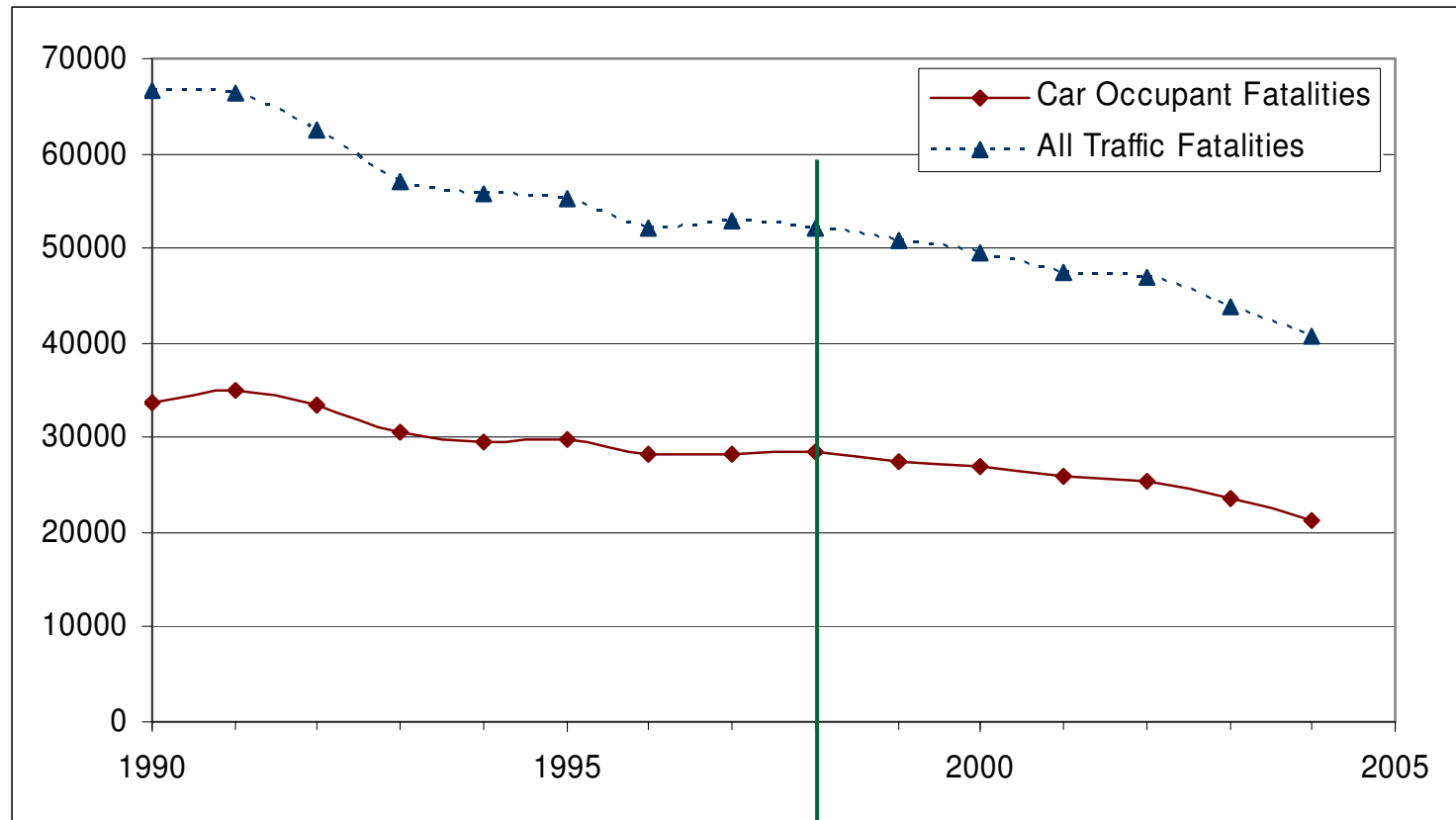
Included statistics:

- Austria**
 - Belgium
 - Cyprus
 - Czech Republic
 - Denmark
 - Estonia
 - Finland**
 - France**
 - Germany**
 - Greece**
 - Hungary
 - Ireland
 - Italy
 - Latvia
 - Lithuania
 - Luxembourg
 - Malta
 - Netherlands**
 - Poland
 - Portugal
 - Slovakia
 - Slovenia
 - Spain
 - Sweden
 - United Kingdom
- 52.5 %**
(of EU-25 Population)



Verband der
Automobilindustrie

Vehicle safety and the existing Regulation 94



Introduction of Regulation 94

Combined European accident statistics show a clear decrease in car occupant fatalities correlating with the introduction of the current test procedure. There is no evidence that this trend will change.

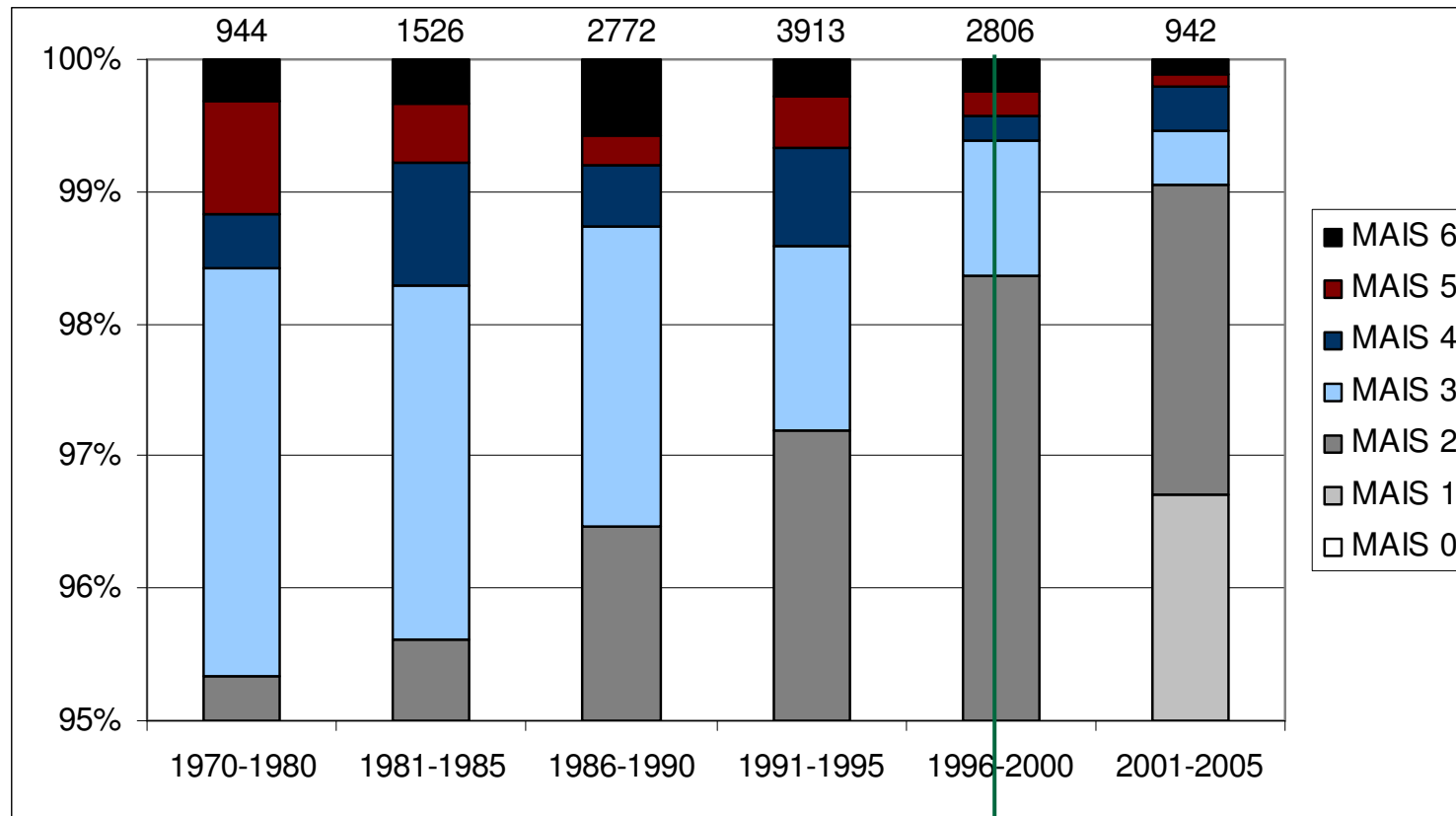
Included statistics:

- Austria**
 - Belgium**
 - Cyprus
 - Czech Republic**
 - Denmark**
 - Estonia
 - Finland**
 - France**
 - Germany**
 - Greece**
 - Hungary**
 - Ireland
 - Italy**
 - Latvia
 - Lithuania
 - Luxembourg
 - Malta
 - Netherlands**
 - Poland**
 - Portugal**
 - Slovakia
 - Slovenia
 - Spain**
 - Sweden**
 - United Kingdom**
- 95.6 %**
(of EU-25 Population)



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Automobilindustrie

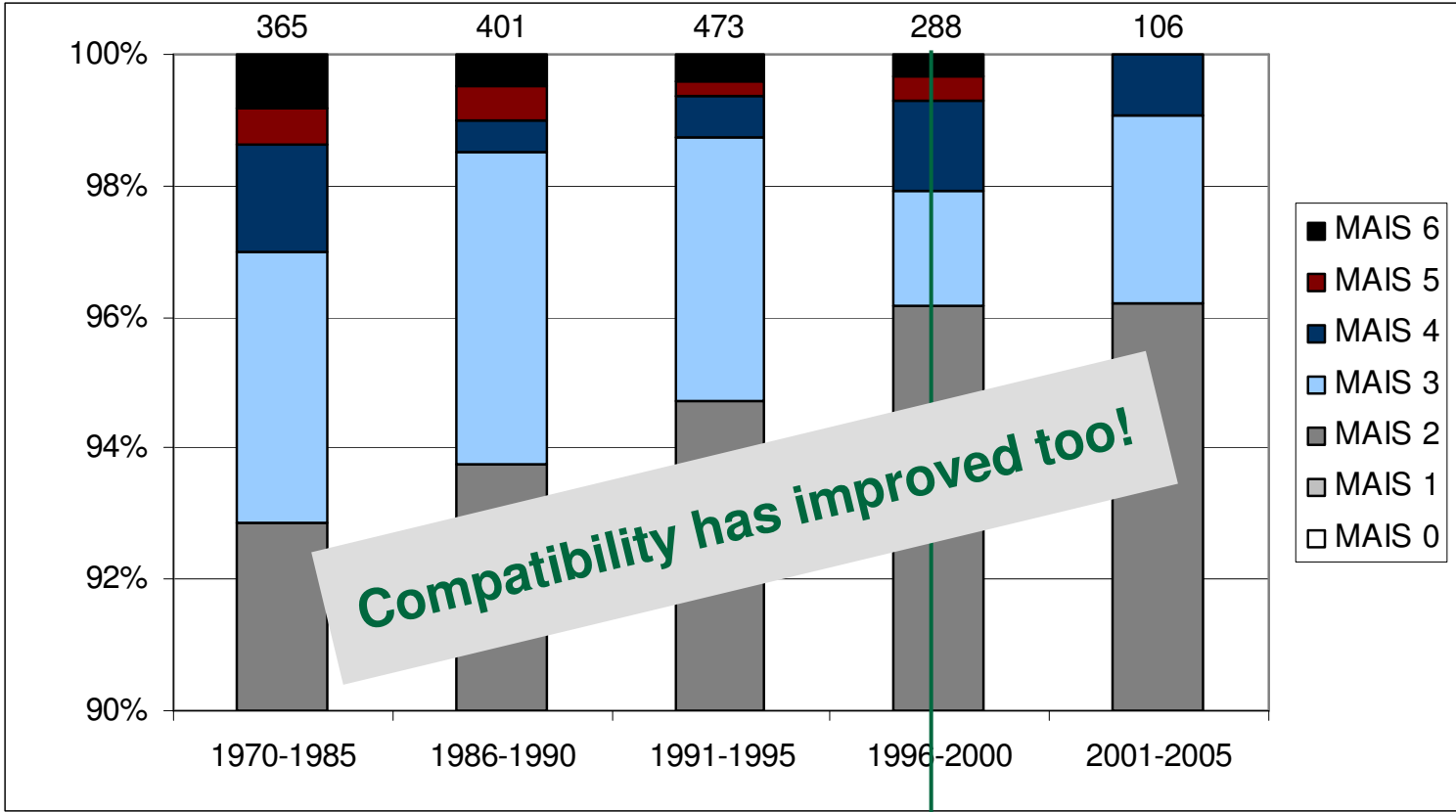
Vehicle safety and the existing Regulation 94



GIDAS Data:
 Belted passenger
 vehicle occupants
 in frontal collisions
 Maximum AIS vs.
 Vehicle build year

Introduction of Regulation 94

Vehicle safety and the existing Regulation 94



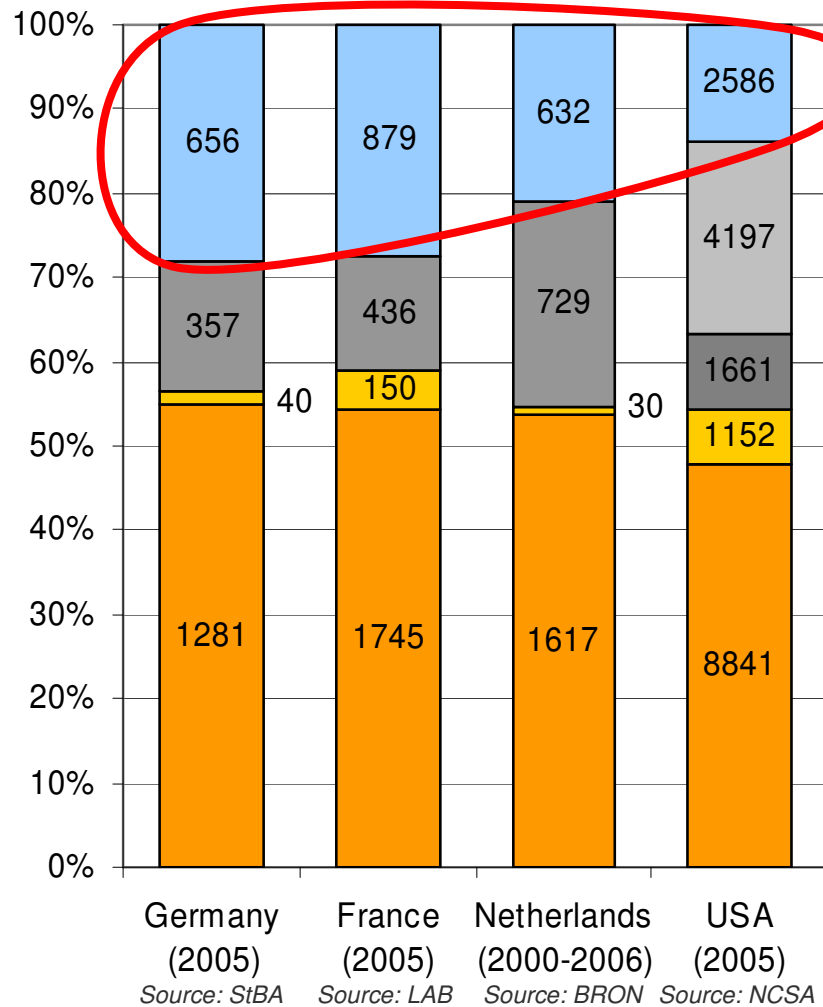
GIDAS Data:
 Belted passenger
 vehicle occupants
 in front-to-front
 car-to-car collisions
 Maximum AIS vs.
 Build year of
opponent vehicle

Compatibility has improved too!

Introduction of Regulation 94

Vehicle safety and the existing Regulation 94

Car occupant fatalities and accident type



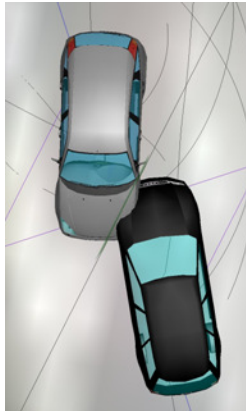
The PDB test procedure only addresses car-to-car collisions.

The existing Regulation 94 test procedure is a compromise between car-to-car collisions and other collision types. This provides a much broader assessment of a vehicle's safety. National accident statistics show that car-to-car collisions are a relatively minor cause of occupant fatalities.

Vehicle safety and the existing Regulation 94

Crash testing with the ECE-R94 barrier has led to a good balance between compartment stiffness and deceleration pulse in vehicle front end design

Real Accident



Alle Werte im km/h	V_k	Δv	EES
Ford Focus (01) (silber)	65	76	79
Audi A4 Avant (02) (schwarz)	85	57	58

AARU Audi Accident Research Unit
Verkehrsunfallforschung

Audi: Driver MAIS 2,
 Rear seated child
 MAIS 1
 Ford: Driver MAIS 3,
 Passenger MAIS 2

Crash test Car-Truck



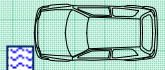
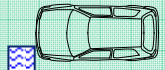

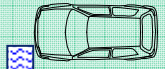
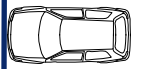
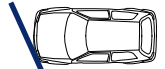
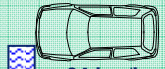
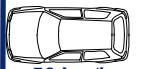




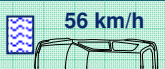





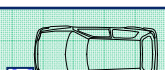



Audi A3: 65 km/h vs. Scania



Audi A3: stable compartment, low occupant loading

Issue 3:
**“Assess potential for harmonisation
of frontal impact procedure”**

Global harmonisation

	Regulation		Consumer Testing		
Europe	 56 km/h ECE R94 - 96/79/EC		 64 km/h EuroNCAP		 Tests with the ECE-R94-Barrier
USA	 40 km/h FMVSS 208	 27-56km/h FMVSS 208  32-50km/h FMVSS 208	 64 km/h IIHS	 56 km/h US-NCAP	
Japan	 56 km/h TRIAS 47-4	 50km/h TRIAS 47	 64 km/h JNCAP	 56 km/h JNCAP	
Australia	 56 km/h ADR 73	 50km/h ADR 69	 64 km/h ANCAP		
China		 50km/h CB 11551-2003	 56 km/h C-NCAP	 50 km/h C-NCAP	
Taiwan	 56 km/h MOTC Att.2 Item 25				
India	 56km/h AIS 098/D3				
Gulf States	 56 km/h GS 36/2005	alternative  50km/h GS 36/2005			

VDA

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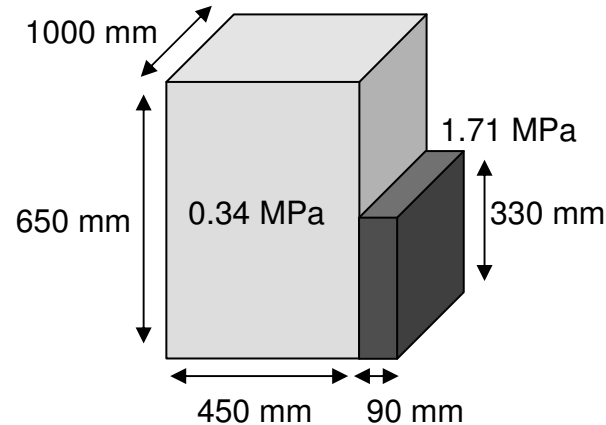
Issue 5:

“Validate that the PDB test guarantees a minimum EES test severity for all vehicles”

Issue 7:

“Validate that the PDB provides the required test requirements for interior restraints”

Self-protection and energy absorption in the PDB

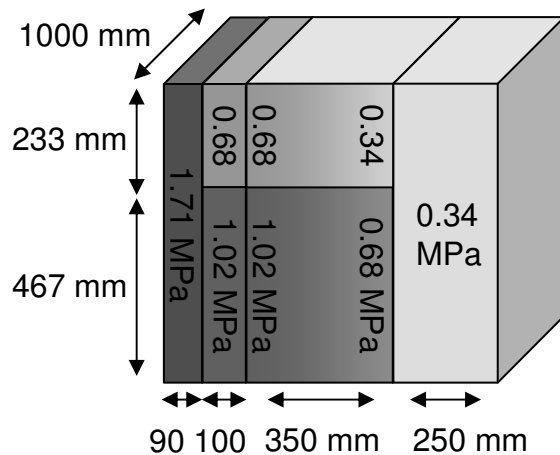


ECE-R94 Barrier:

Total energy available: 150 kJ

Energy available with 560 mm overlap (excluding "bumper" element): 56 kJ

At 56 km/h test speed equal to kinetic energy of car with mass: **460 kg**



PDB:

Total energy available: 411 kJ

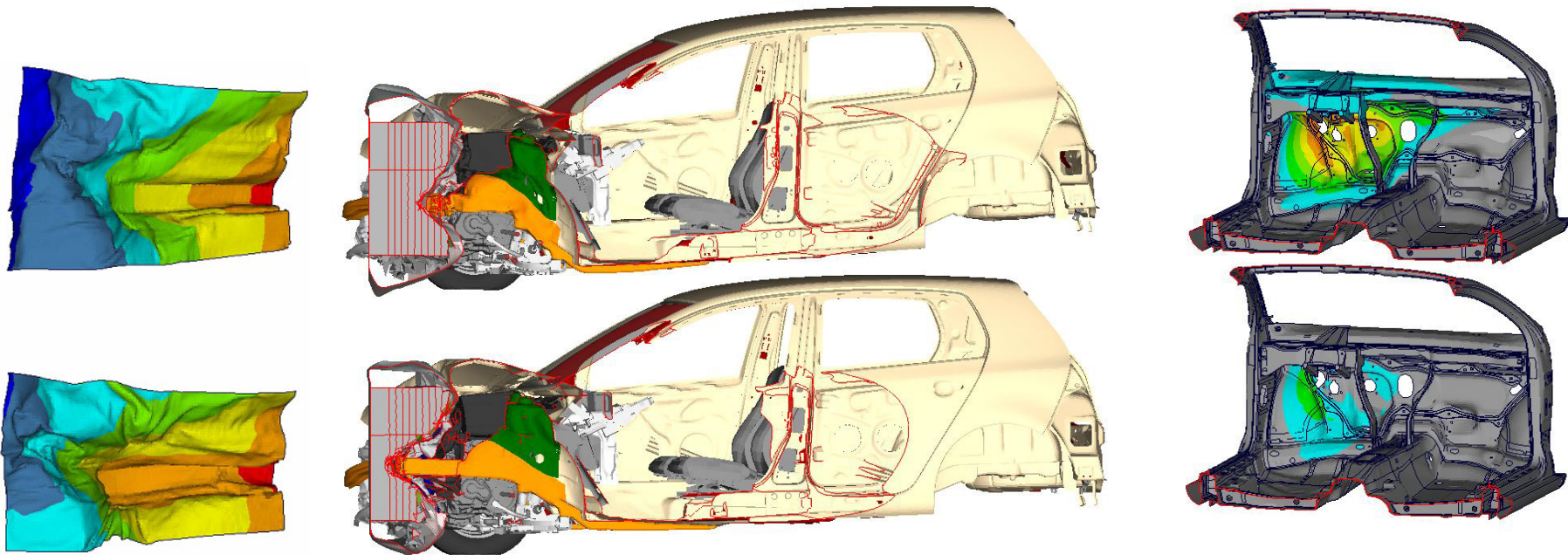
Energy available with 700 mm overlap (excluding rear layer): 212 kJ

At 60 km/h test speed equal to kinetic energy of car with mass: **1530 kg**

Misuse of the PDB: Volkswagen simulations

PDB v7
60 km/h

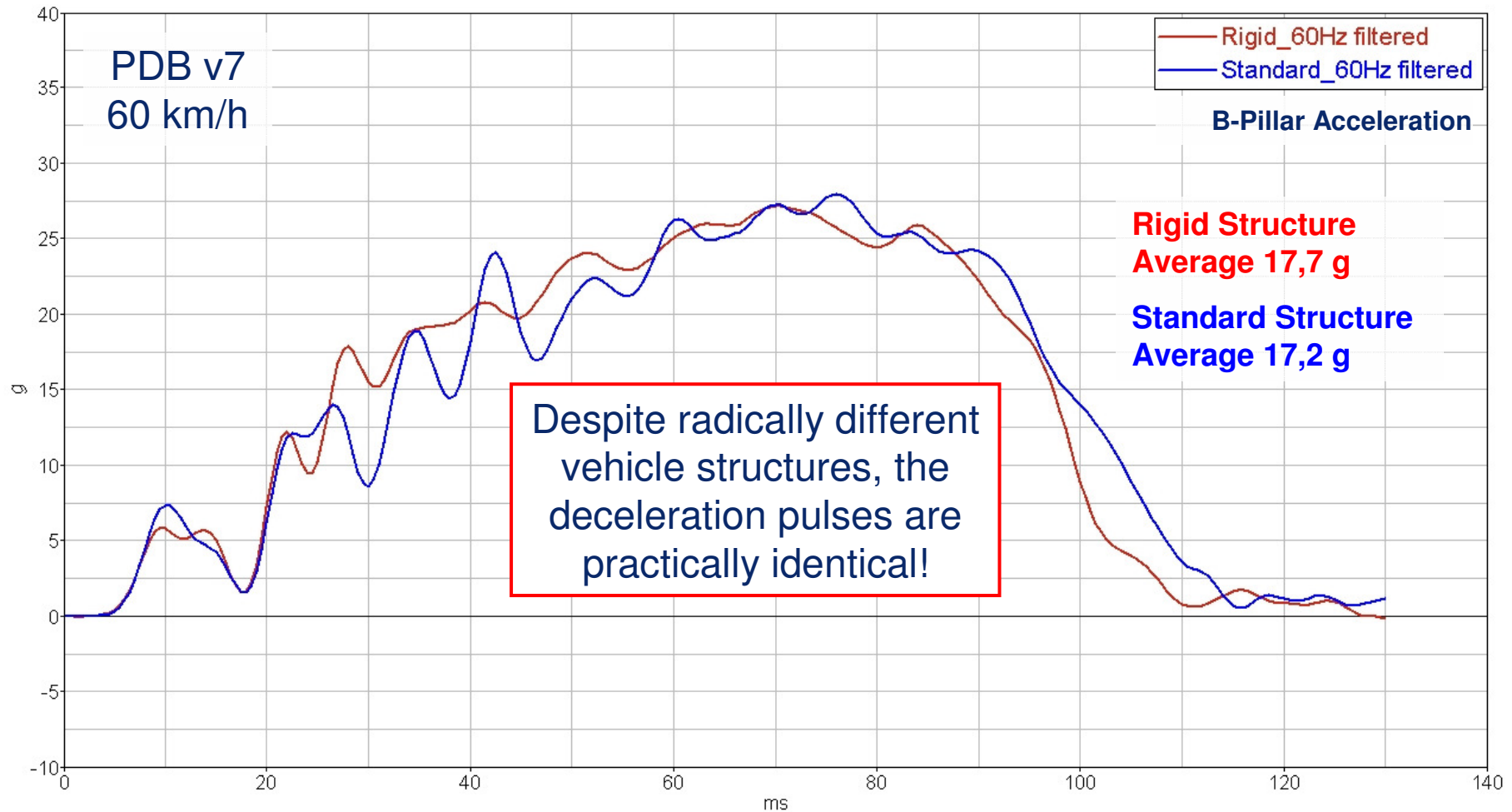
Standard vehicle model



Time of max. intrusion

Rigid left longitudinal and shotgun

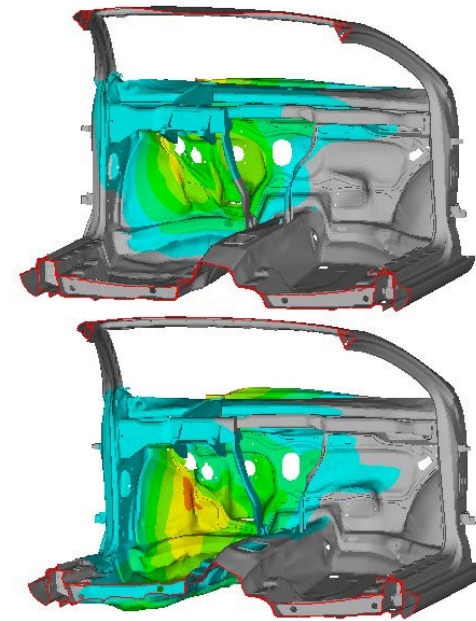
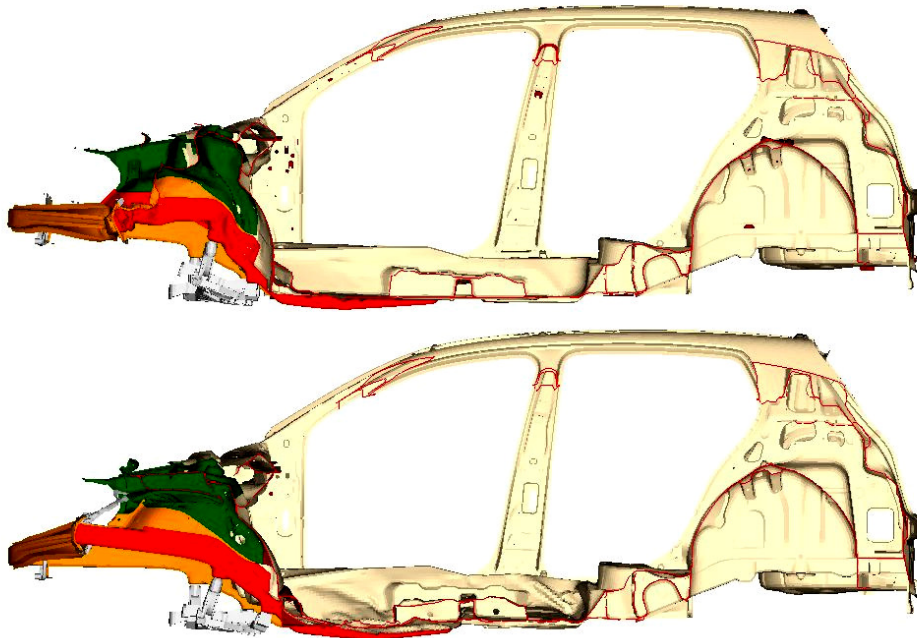
Misuse of the PDB: Volkswagen simulations



Misuse of the PDB: Volkswagen simulations

ECE-R94 Barrier
56 km/h

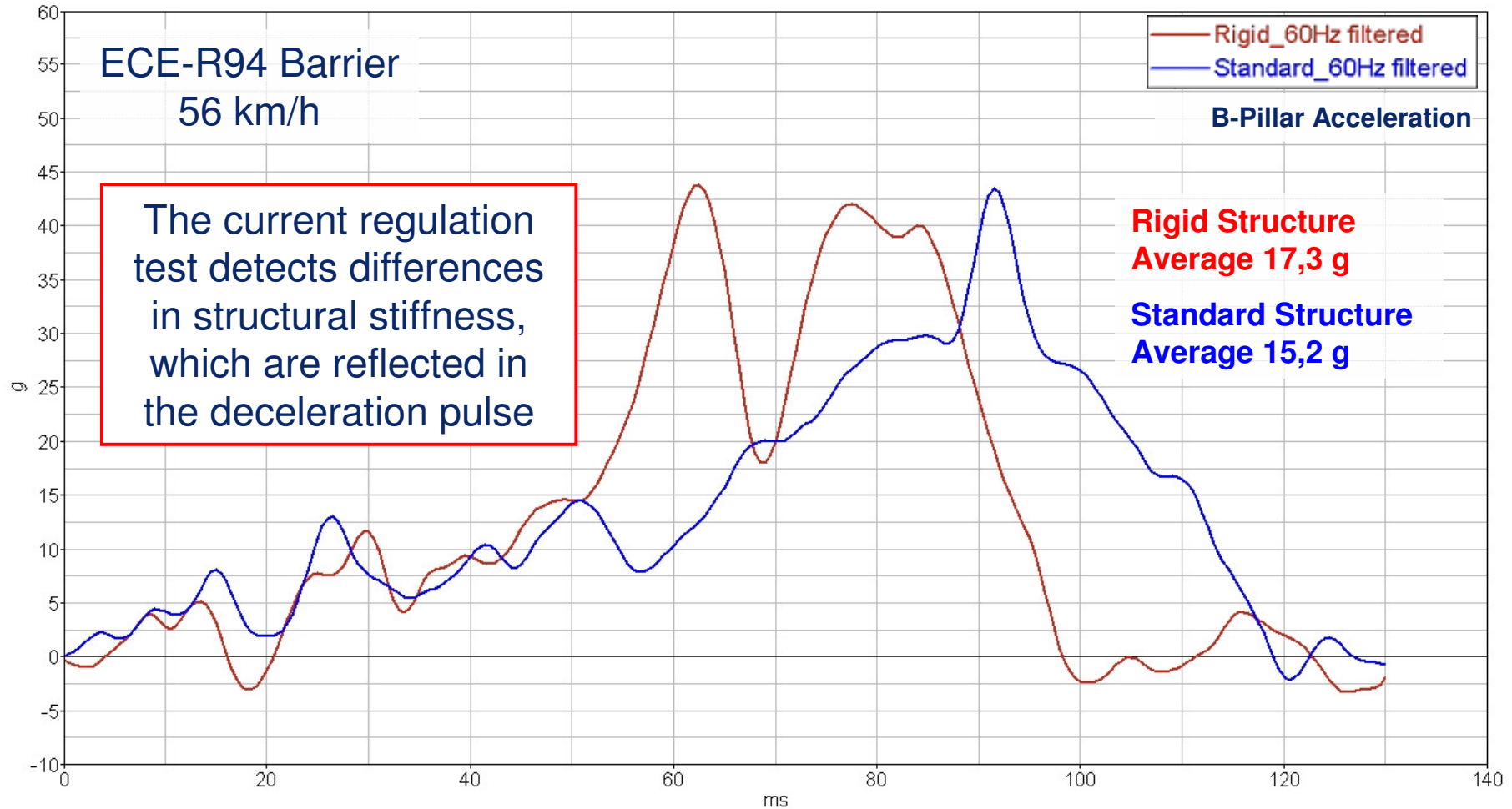
Standard vehicle model



Time of max. intrusion

Rigid left longitudinal and shotgun

Misuse of the PDB: Volkswagen simulations



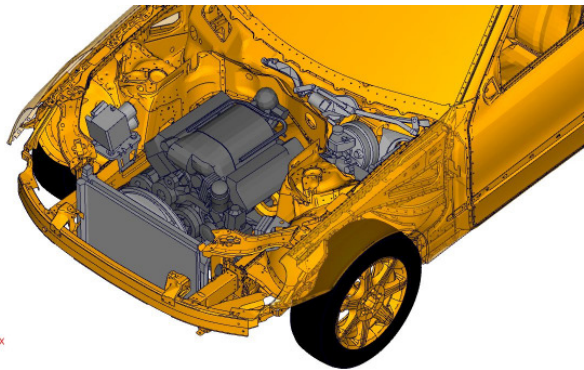
Misuse of the PDB: Volkswagen simulations

Conclusions:

- The PDB test procedure does not punish aggressively stiff structures:
 - The barrier deforms to compensate for a lack of deformation travel in the vehicle front end
 - Compartment intrusions may be reduced
- The compartment accelerations that occur in a PDB test are based on the barrier stiffness, rather than the real stiffness of the vehicle front-end
- The ECE-R94 barrier punishes aggressively stiff structures because the barrier bottoms out and the vehicle must deform
- The compartment accelerations that occur with the ECE-R94 barrier reflect the design of the vehicle front-end and are more severe for the stiffened structure

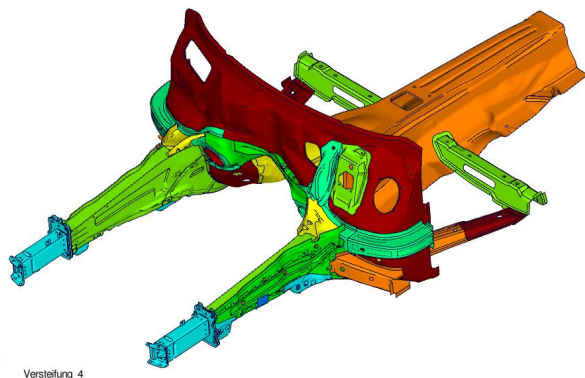
Misuse of the PDB: Daimler simulations

E-Class (basic weight: 2018 kg)



- Some body structures have been reinforced
- This parts were stiffened in mean by +117 %
- Additional weight: 66 kg

Percentage of stiffening



Verstellung_4

Vehicle deceleration pulse

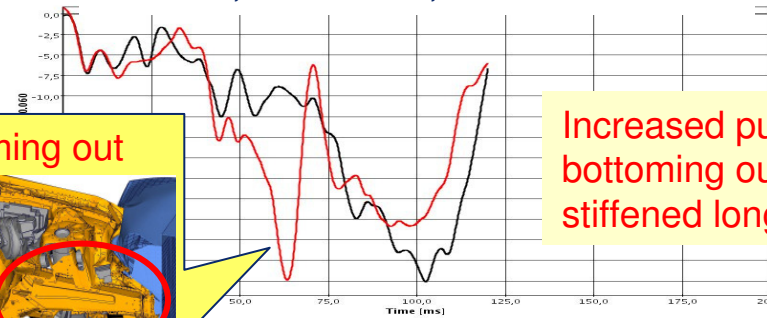
(Filtered with CFC 60)

60 km/h, 50% offset, **PDB**

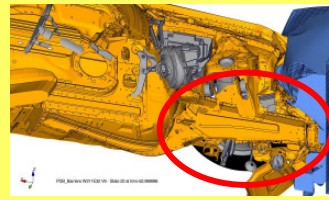
basic
reinforced



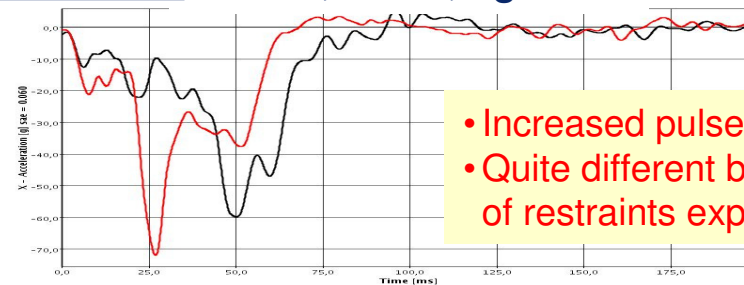
56 km/h, 40% offset, **ECE-R94 barrier**



Bottoming out

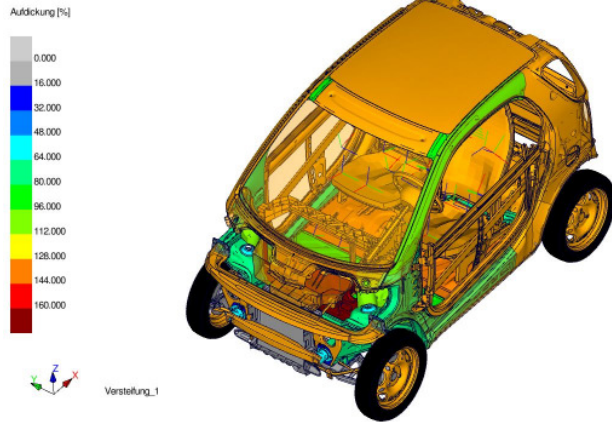


56 km/h, 100 %, **rigid wall**



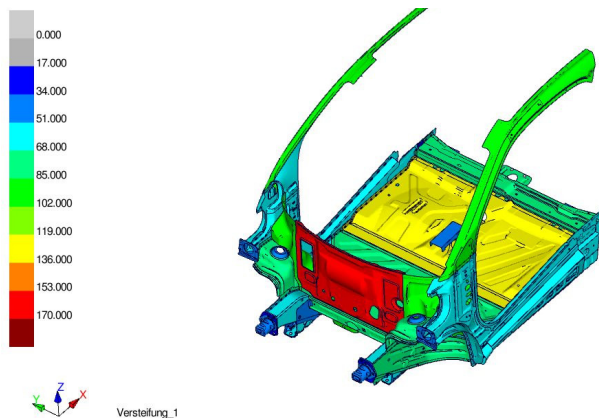
Misuse of the PDB: Daimler simulations

SMART (basic weight: 980 kg)



- Some body structures have been reinforced.
- These parts were stiffened in mean by +75 %.
- Additional weight: 66 kg

Percentage of stiffening

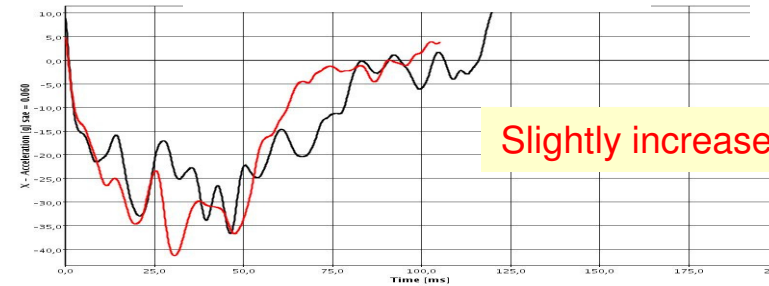


Vehicle deceleration pulse

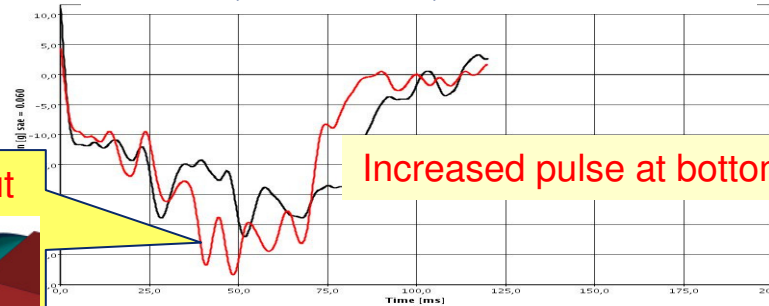
(Filtered with CFC 60)

60 km/h, 50% offset, PDB

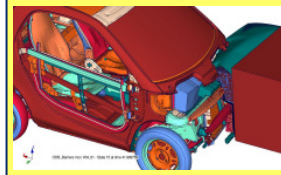
basic
reinforced



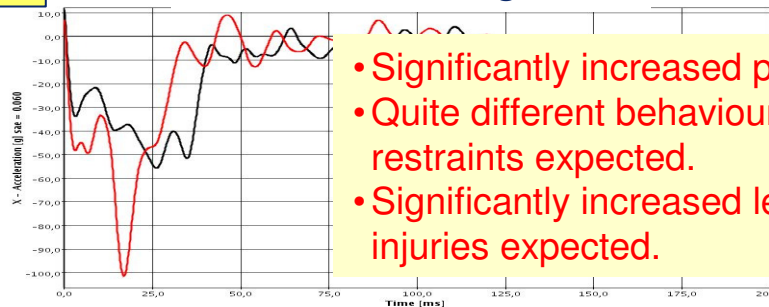
56 km/h, 40% offset, ECE-R94 barrier



Bottoming out



56 km/h, 100 %, rigid wall



Misuse of the PDB: Daimler simulations

Conclusions:

- The vehicle stiffness could be increased without significant change of crash severity assessed by the PDB test procedure.
- Even an opposite effect could be detected in the E-Class.
- The same reinforced vehicle exhibits an increased crash severity in the current ECE-R94 test and rigid wall test.
- Especially in the rigid wall test such a reinforced vehicle exhibits an insufficient safety level.

Misuse of the PDB – Audi simulations

Effects of front-end stiffness in vehicle to barrier tests:

Deformation in passenger compartment

In the current ECE-R94 barrier a stiffer front-end causes more deformation in the passenger compartment in comparison to the PDB-barrier

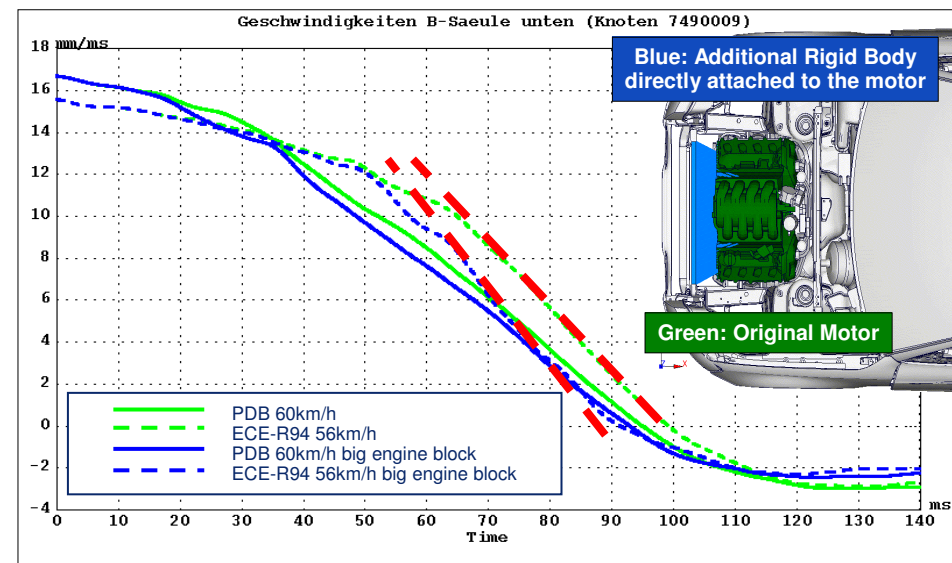
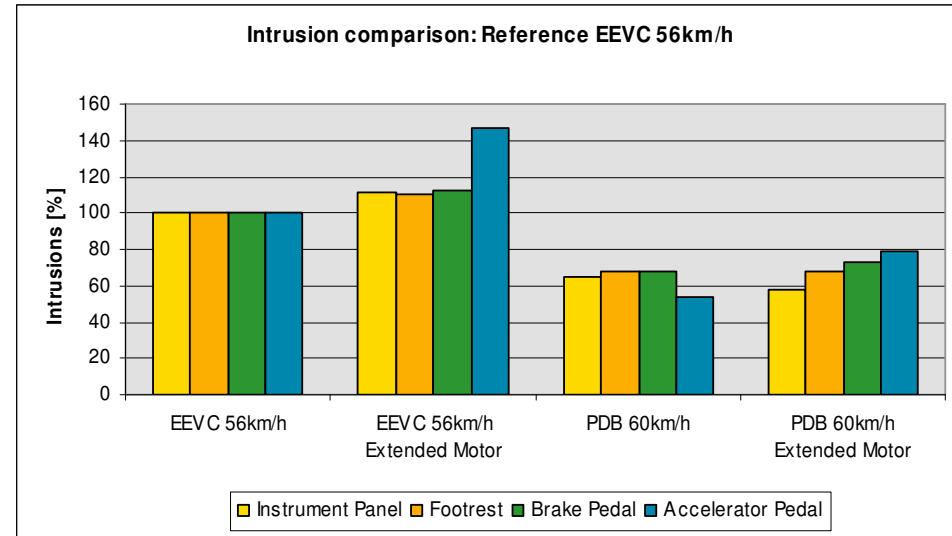
Crash Pulse

PDB: Engine block leads to small effect

ECE-R94: Bigger engine block causes higher crash pulse

Summary and drawbacks of PDB test:

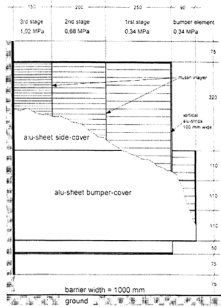
- Deceleration pulse und deformation are not influenced by the front-end package
⇒ Opponent must absorb remaining energy
- PDB test procedure does not force vehicle front ends to be stiffer, but also fails to penalise designs where deformation length is removed from the crumple zone
- Designs optimised for the PDB test procedure will lead to lower safety in car-to-car and car-to-rigid object collisions



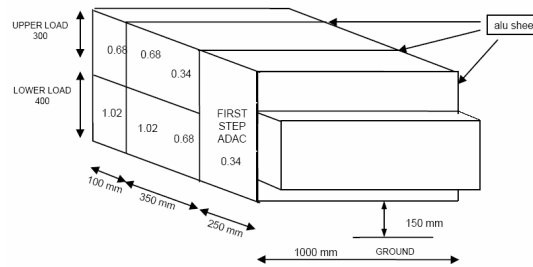
Issue 8:
**Insufficient testing has been performed to
validate the proposed barrier specification**

What exactly is the Progressive Deformable Barrier?

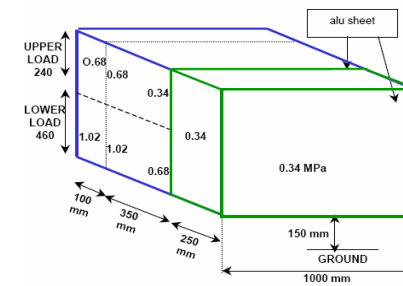
The PDB is put forward as an accepted and well established barrier, but the new specifications described in the draft amendments are largely unknown and untested in Europe.



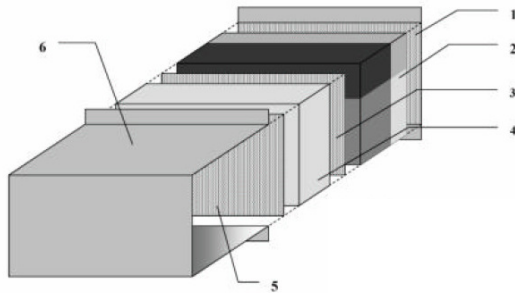
1996: ADAC Barrier
40% overlap



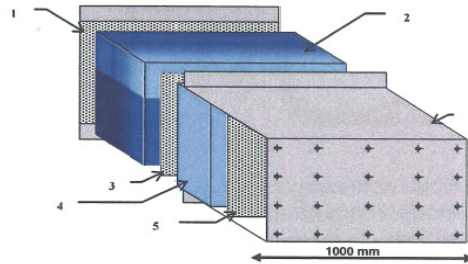
2000: PDB
750 mm overlap



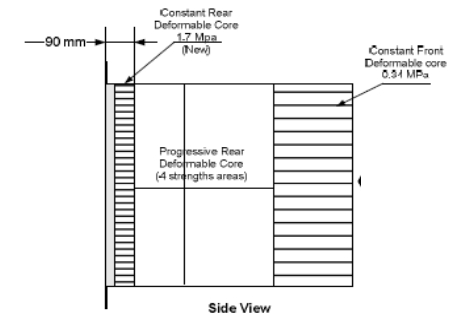
2002: PDB v6
750 mm overlap



2003: PDB v7
50% overlap



2006: PDB v8
50% overlap



2006: PDB +
50% or 100% overlap

Why is the PDB the way it is?

The proposed amendments include several significant deviations from the existing test procedure:

- Barrier stiffness profile Current barrier → PDB
- Test speed 56 km/h → 60 km/h
- Overlap 40% → 50%
- Barrier ground clearance 200 mm → 150 mm

The goals of the two procedures are, however, identical: to reproduce the behaviour of a particular real world collision:

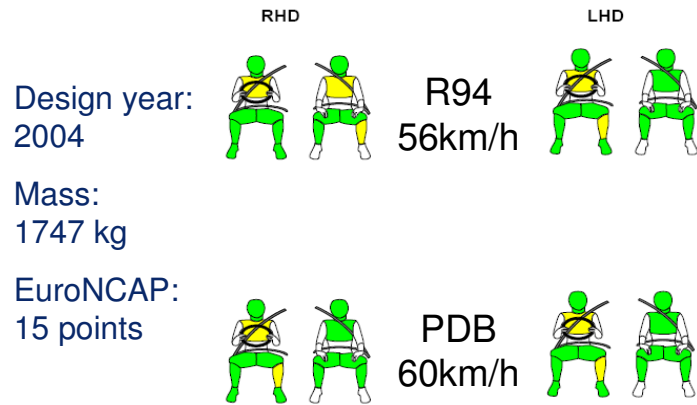
- Car-to-Car
- 100 km/h closing speed
- 50% offset
- 0° impact angle

The current ECE-R94 barrier has been validated for these conditions but the PDB has not

Issue 9: Cost/Benefit

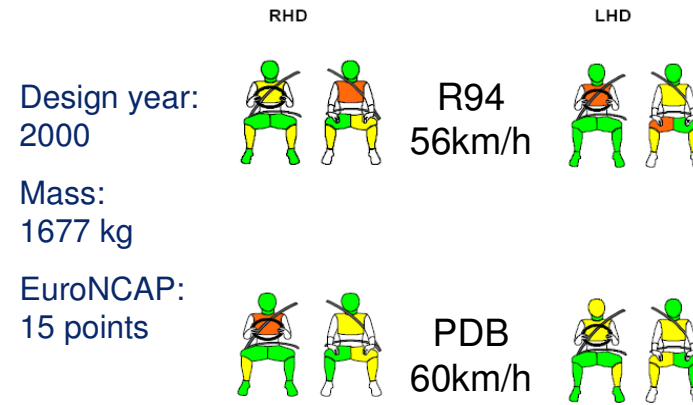
What benefit can be derived from the proposed amendments?

2- SELF PROTECTION: Dummies FC1



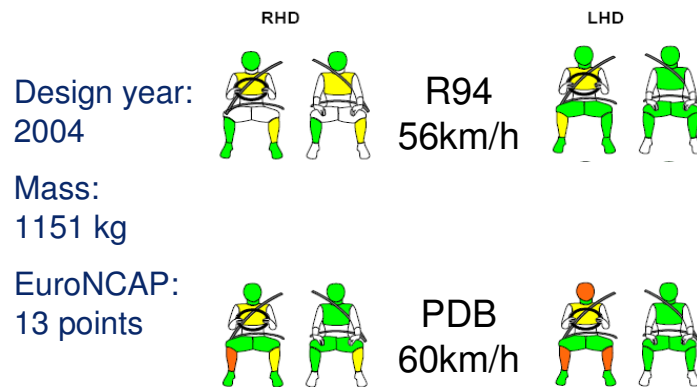
⇒ No difference for Family cars

2- SELF PROTECTION: Dummies FC2



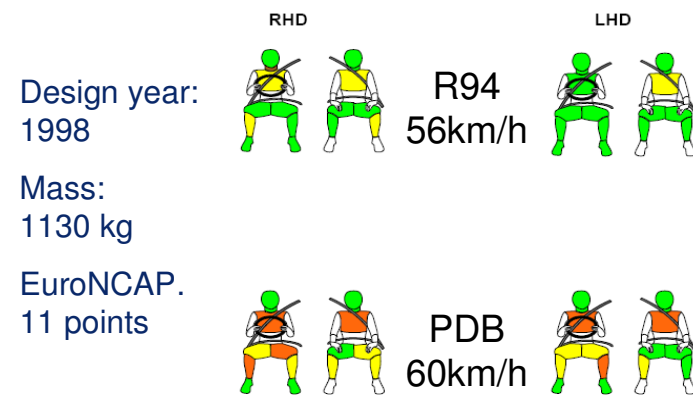
⇒ No difference for Family car

2- SELF PROTECTION: Dummies SMC1



⇒ Light difference for super mini car (new generation)

2- SELF PROTECTION: Dummies SMC 2



⇒ Moderate difference for super mini car (old generation)

What benefit can be derived from the proposed amendments?

2- SELF PROTECTION: Dummies FC1

Design year:
2004

Mass:
1747 kg

EuroNCAP:
15 points

⇒ No difference for Family car

2- SELF PROTECTION: Dummies SMC 2

Design year:
2004

Mass:
1151 kg

EuroNCAP:
13 points

⇒ Light difference for super mini car (new generation)

2- SELF PROTECTION: Dummies FC2

Design year:
2000

Mass:
1500 kg

EuroNCAP:
15 points

⇒ No difference for Family car

2- SELF PROTECTION: Dummies SMC 1

Design year:
1993

Mass:
1100 kg

EuroNCAP:
11 points

⇒ Moderate difference for super mini car (old generation)

French test program shows that the existing barrier delivers the same results as the PDB when tests are performed with modern vehicles.

A “moderate” benefit is only seen when testing with an outdated small vehicle design.

These results indicate that the PDB test procedure offers no benefit for a modern fleet.

Issue 10:

If the PDB is introduced, how should and how could the cars of the future be designed?

How does this compare to the current situation and will it lead to a reduction in injuries and fatalities?

Conclusion:

The VDA does not oppose the improvement of regulatory requirements, but does not believe that the current proposals to amend ECE-R94 would improve safety in frontal impacts.