Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
sécurité routière

Informal Document No. GRSP-42-31
(42nd GRSP, 11-14 December 2007,
agenda item 17(b))

REGULATION No. 94
(Frontal collision)

Proposal for draft amendments

Proposal submitted by France

Aim

The expert from France announced that at the next session he will present a proposal for draft amendments to Regulation N°94 taking into account the outcome of the research on barriers carried out by the EEVC Working Group 15 “Frontal impact and Crash compatibility“

- Aim
  - reinforce passive safety performance of modern vehicles
  - harmonise front-end force of the future fleet

Background

- In 1997 Directive 96/ 79/ CE (Frontal collision) was first introduced (*Regulation N° 94 alignment in 1998)*, the European Commission wanted to review certain technical aspects, especially the test speed and the barrier design after a period of implementation.

- In 2000, EEVC WG16 (frontal impact) :
  - recommended “not to raise the test speed to 60 km/h until there is a better understanding of compatibility”.
  - reported: "barrier instability for new generation of car and a barrier stiffness too low for modern vehicles (as they bottom out the barrier), was not the original intent".

- In 2007, EEVC WG15 (frontal impact and compatibility):
  - recommended, "the test speed of the current offset test (Regulation N° 94) must not be raised to 60 km/h without modification of the current test procedure".
  - added: "the current test speed for regulation cannot be increased using the existing UNECE Regulation N° 94 barrier without increasing the existing discrepancy in frontal stiffness and aggressiveness for the vehicle fleet".

Today

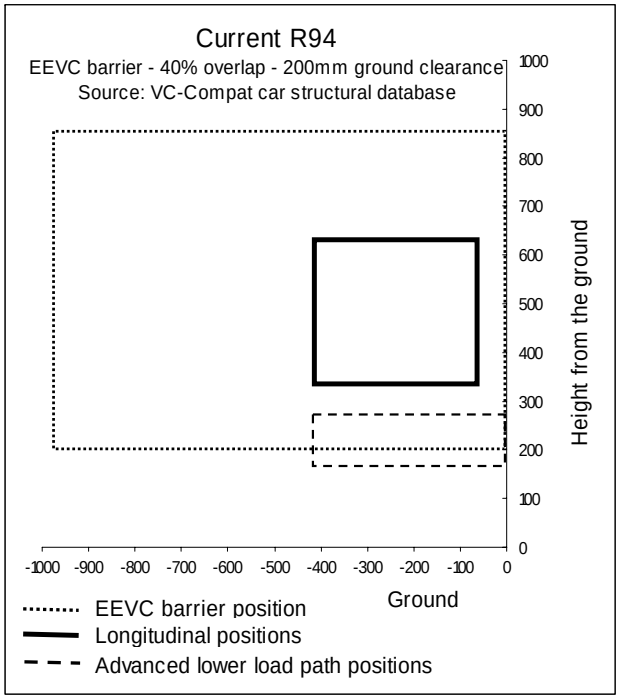
- Current Barrier problems in Regulation N° 94, (listed in EEVC WG15 final report):
  - Barrier instability for new generation of car, stiffness of barrier too low for modern vehicles.
  - Test severity increases with car mass with constant test speed and makes force matching unreachable.
  - Self-protection level depends on the vehicle size and mass.
  - Difficult to assess force levels with this barrier type and configuration with constant speed tests (bottoming out of barrier causes undesired inertial loads for measurement of a cars frontal force).
  - No structural interaction is potentially possible because of load spreading in the barrier and subsequent barrier bottoming out.

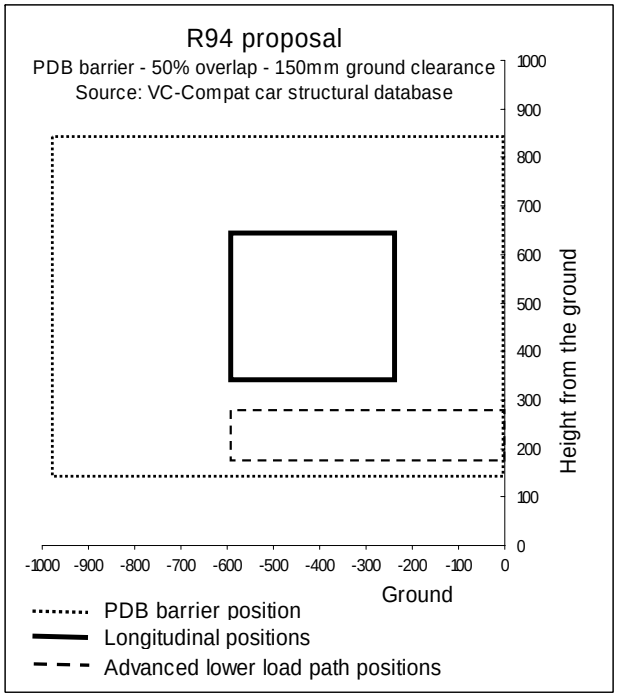
- Proposed changes:
  - Test parameters: test speed, overlap and barrier ground clearance.
  - Obstacle: new barrier design (PDB).

Overlap and ground clearance

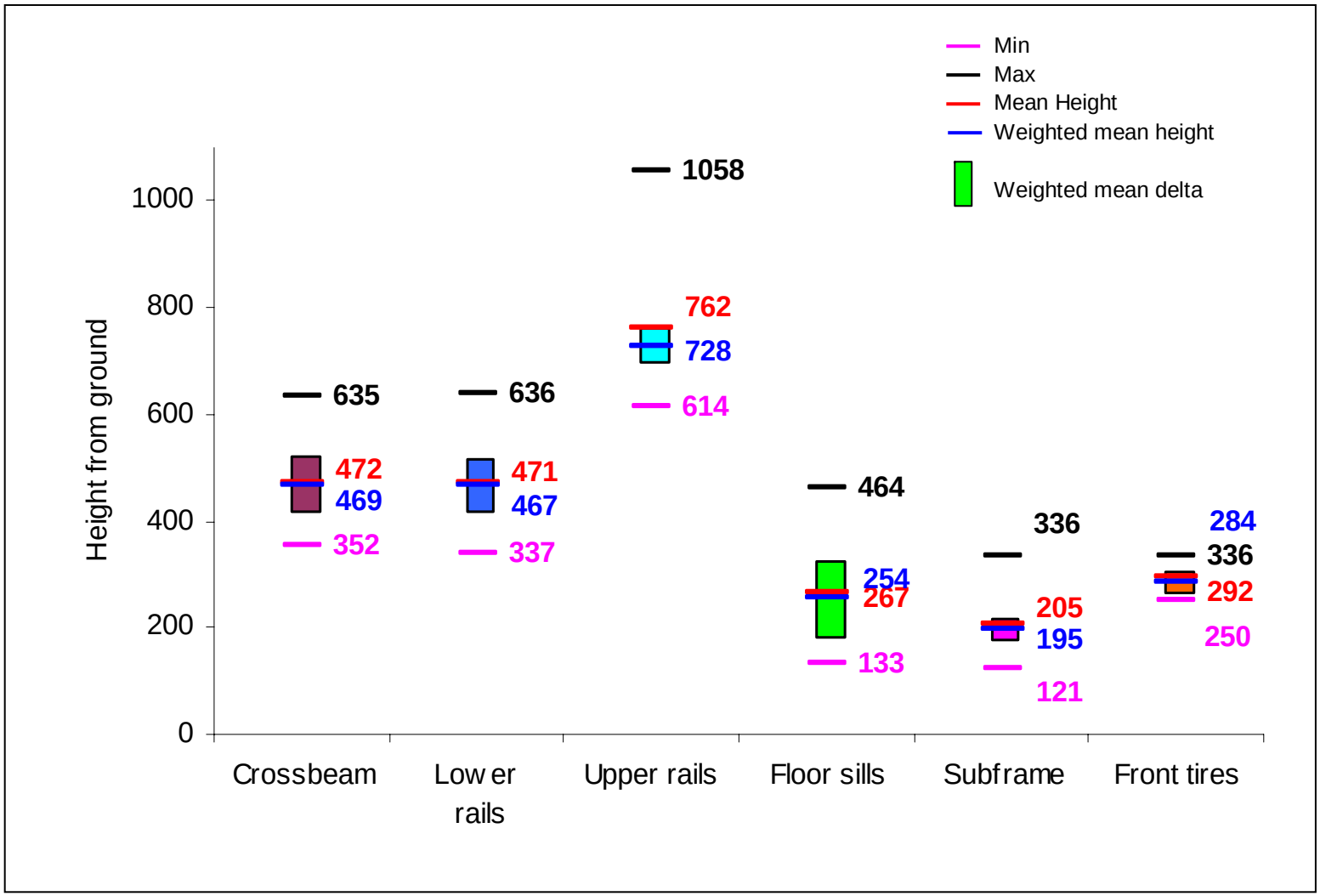
The 50 per cent overlap and 150 mm ground clearance ensures that the full front of the vehicle is in direct contact with the barrier when tested in offset conditions.

Relative position of the vehicle front end structure in front of the barrier (side members and lower load paths):





Structural database of the "Vehicle Crash Compatibility" project (VC−Compat)

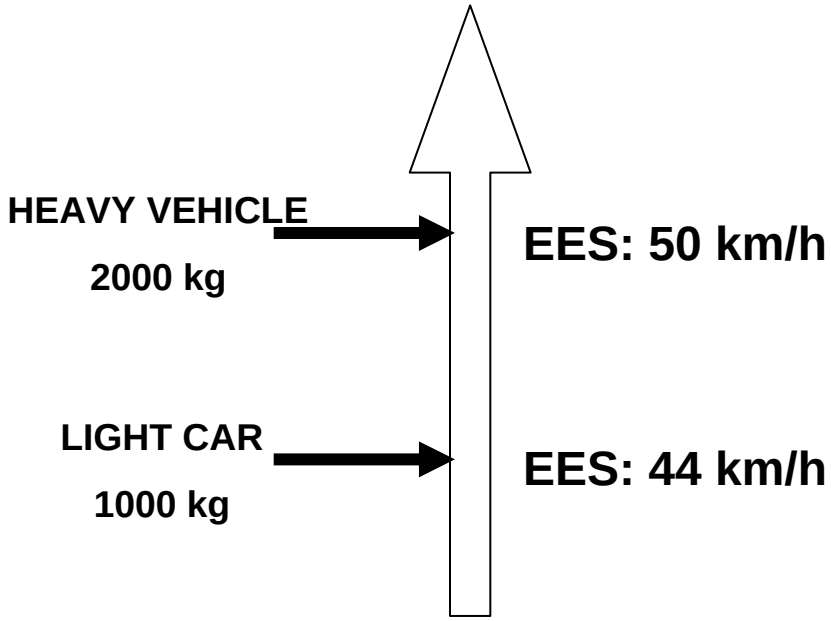


validated by EEVC WG15 and presented on informal document GRSP−41−25 (41st GRSP session)

Comparison of the two deformable elements

- Current ECE R94 barrier with constant stiffness
- Proposed barrier with Progressive Stiffness

Test severity: Self protection level



TEST SEVERITY

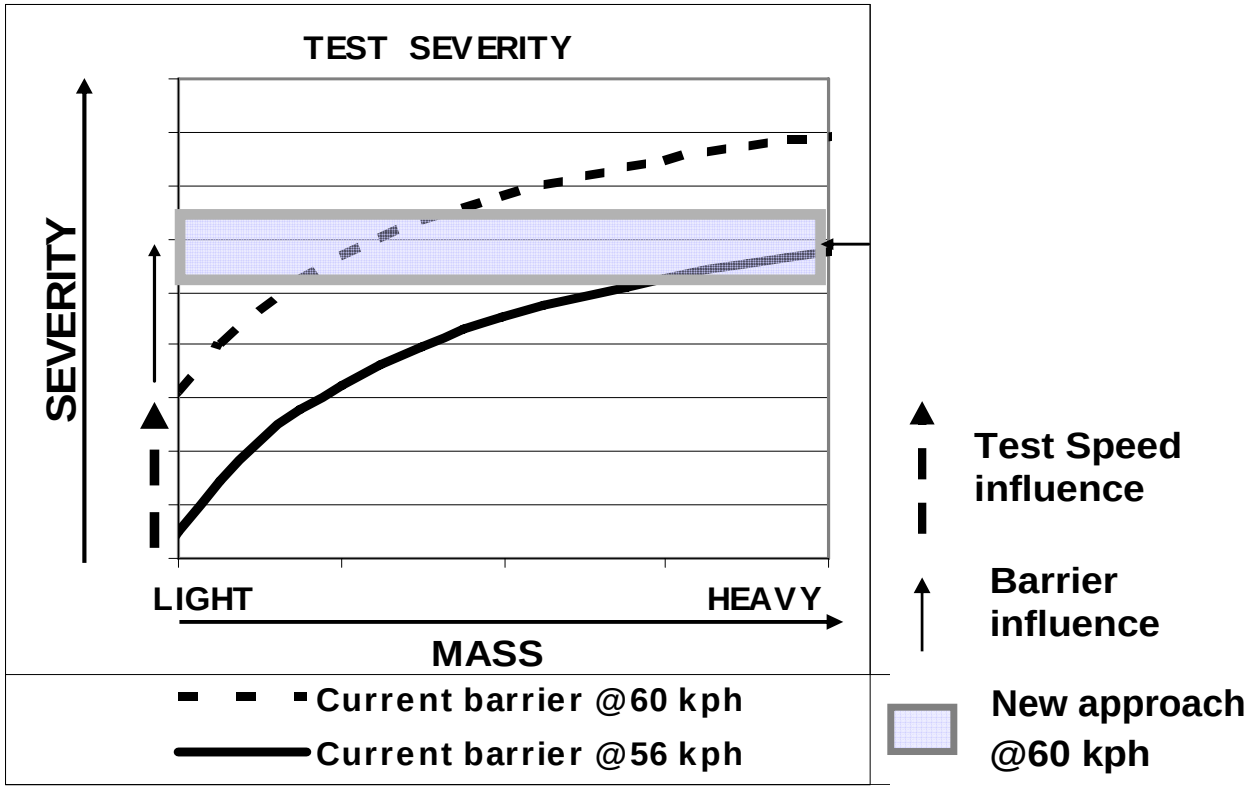
Current ECE R94

Self protection level depends on the vehicle mass / size

⇨ **NEED TO HARMONISE TEST SEVERITY**

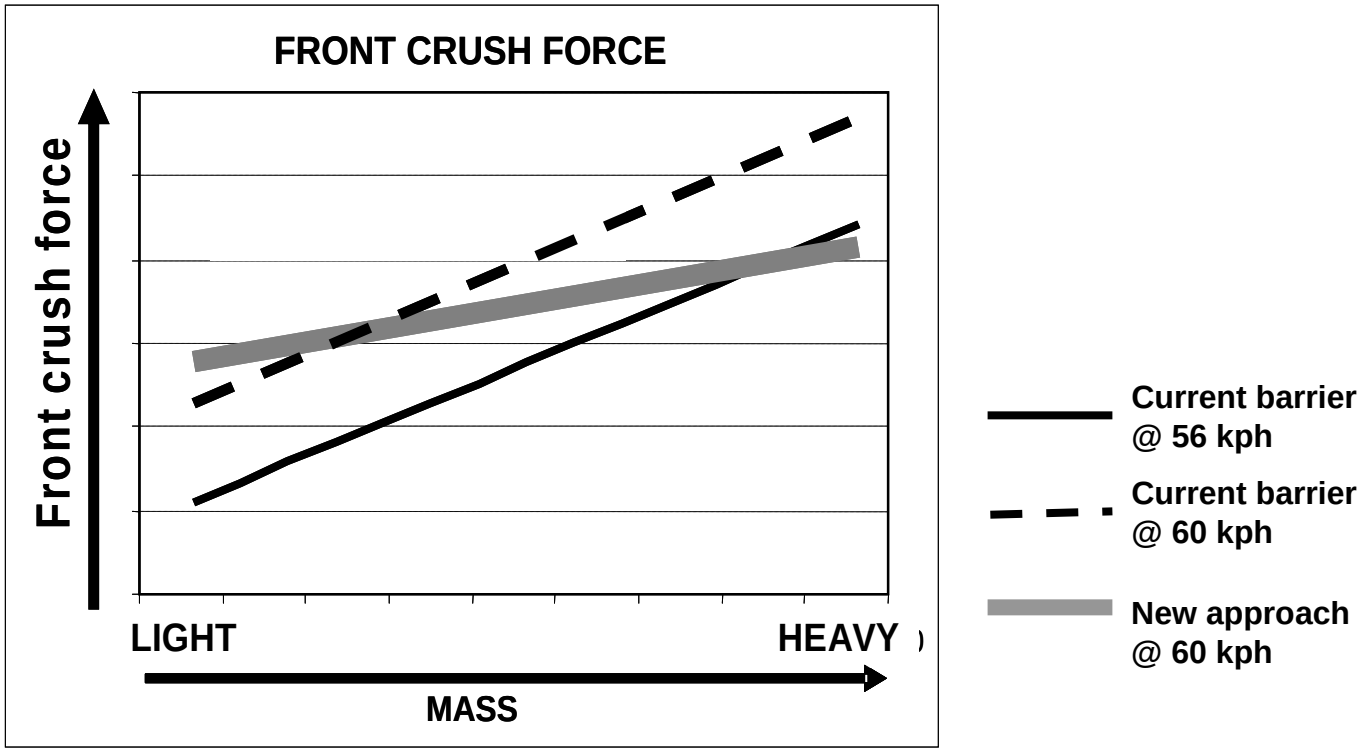
⇨ **NEED TO IMPROVE SELF PROTECTION OF LIGHT CARS**

Test severity



- Increase the test severity for light vehicles without changing heavy one's.
- Test severity for all vehicle mass range will be harmonised

Front crush force



- Better force harmonisation between light and heavy vehicles

Current Self protection level

INFLUENCE ON VEHICLE FRONT END STIFFNESS		
	LIGHT	HEAVY
TEST SPEED EFFECT 56 km/h >> 60 km/h	+	+ +
DEFORMABLE ELEMENT EFFECT Current barrier >> PDB	+	- -
GLOBAL EFFECT	**++**	**=**

⇨ **LIGHT CARS SELF PROTECTION IS IMPROVED**

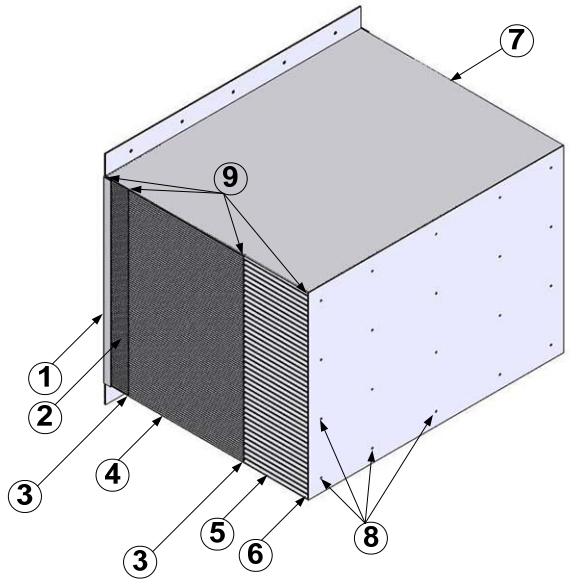
⇨ **HEAVY VEHICLES ARE NOT PENALISED**

Definition of deformable barrier

Characteristics of the deformable barrier

The PDB barrier is composed of the following components:

(1) One back plate,
(2) One back deformable core,
(3) Two intermediate plates,
(4) One progressive deformable core,
(5) One front deformable core,
(6) One contact plate,
(7) One outer cladding,
(8) Blind rivets,
(9) Epoxy resin.



Definition of deformable barrier

Barrier validation

- Adhesive bonding procedure
- Construction
- Mounting
- Conformity of production (dynamic tests)

Potential for the future

- Compatibility
  - Criteria assessment still in progress in EEVC

- Application to N1 and M1 vehicles greater than 2,5 tonnes
  - Research in progress for light truck with NHTSA

  >> world wide harmonisation possibility

- Possible future applications to MDB

Conclusion

France proposes to set up a new informal group on this subject and is ready to take the lead of this group

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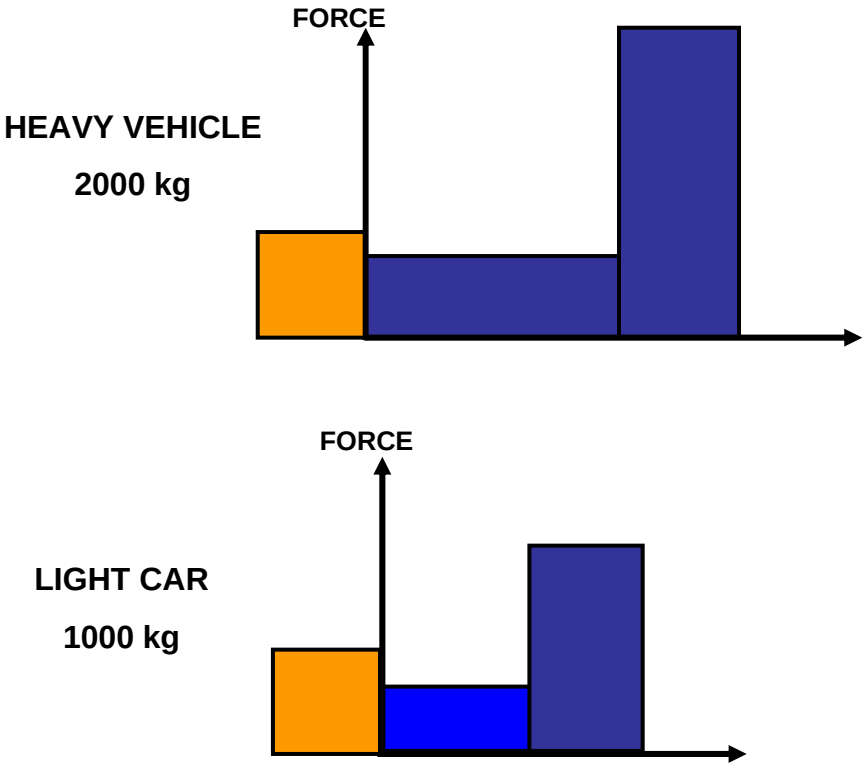
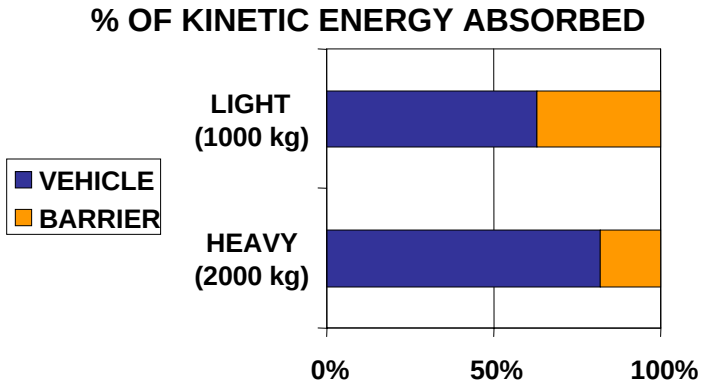
Test severity: Energy distribution



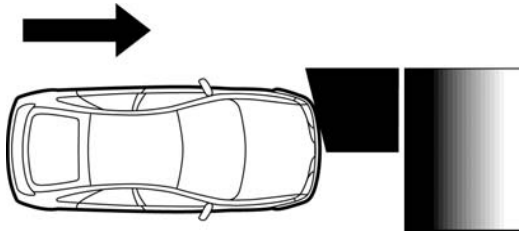


⇨ **HEAVY VEHICLE IS TWO TIME PENALISED: MASS + TEST CONFIGURATION**

⇨ **NEED TO INCREASE SELF PROTECTION OF LIGHT CARS**

$$Ek = \frac{1}{2} mV^2 \Rightarrow Ek = Eabs_{vehicle} + Eabs_{barrier} \Rightarrow Eabs_{vehicle} = \frac{1}{2} mEES^2$$

Rigid barrier

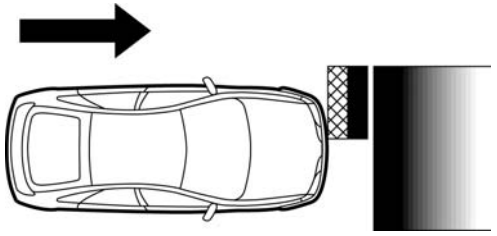


$Eabs_{barrier} = 0kJ$

$$Eabs_{vehicle} = Ek$$

$$Severity = f(V)$$

Deformable barrier



$Eabs_{barrier} \neq 0kJ$

$$Eabs_{vehicle} = Ek - Eabs_{barrier}$$

$$Severity = f(m, V, Eabs_{barrier})$$

$$Severity = f\left(m, V, Eabs_{barrier}\right)$$

if m ↗ >>> severity ↗

To compensate the severity for heavy vehicles

2 solutions

$Eabs_{barrier} = \text{constant}$ ⇨ variation on test speed (V)	***V fixed*** ⇨ Variation on $Eabs_{barrier}$

$$EES = f\left(m, V, Eabs_{barrier}\right)$$

if m ↗ then EES ↗

To compensate severity for heavy vehicles

2 solutions

~~$Eabs_{barrier} = cste$~~

~~⇨ variation on test speed (V)~~

Politically unacceptable

V fixed

⇨ Variation on $Eabs_{barrier}$