Mobile Progressive Deformable Barrier and Mobile Rigid Barrier Tests – MPDB and MRB

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IWG R94

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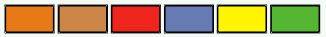

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Overview

- Background
- Tests
- Results
- Outcome
- Conclusions
- Side effects

Background

Hypothesis
Introduction of PDB will lead to lower self protection level in the vehicle fleet

Why?
PDB can absorb much more energy than current ODB

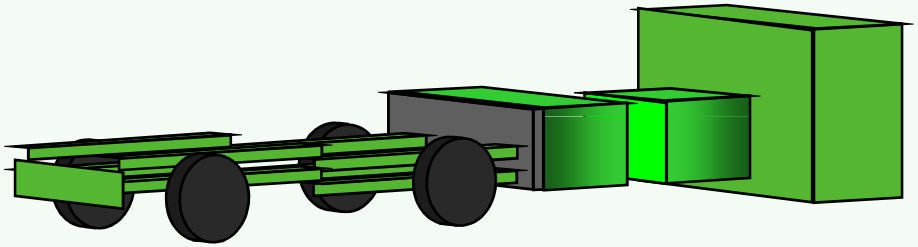
Consequences
Cars with reduced/shortened front-end deformation zone can fulfil the PDB test but not the current R94 ODB test

-> Shortened front-end reduces the energy absorption capabilities which leads to higher intrusion levels in the car

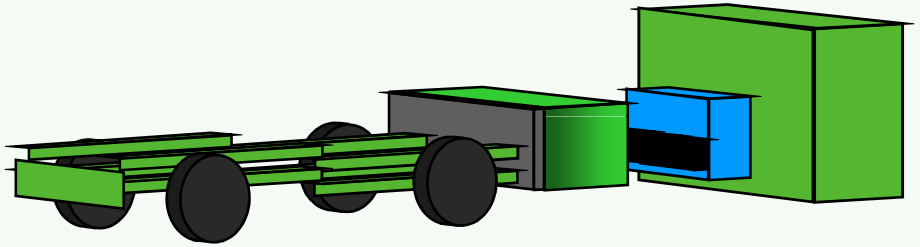
“A “car” without front deformation zone (and less weight) can fulfil the PDB test but not the R94-ODB test”

Test of hypothesis by performing 4 mobile barrier tests:

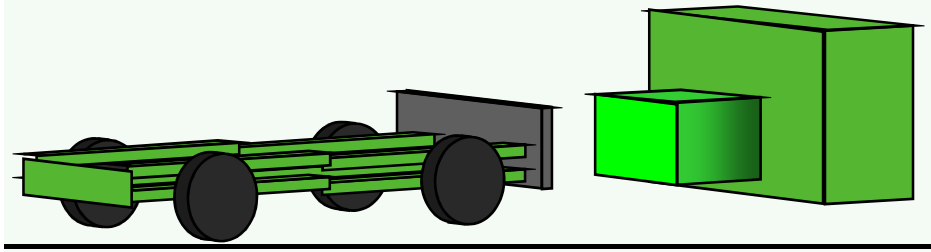
- **Full-Width Movable PDB vs. PDB**
  - 60 km/h : 50 % Offset



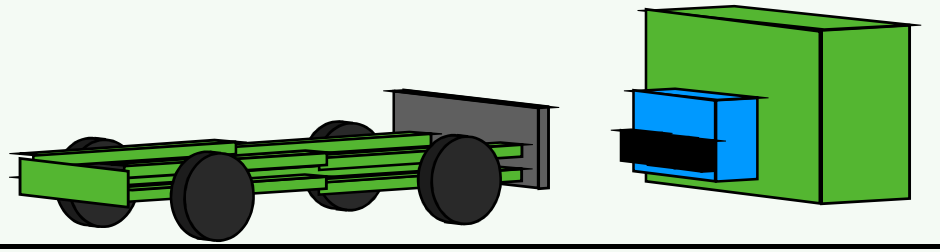
- **Full-Width Movable PDB vs. ODB**
  - 56 km/h : 40 % Offset



- **Movable Rigid Barrier vs. PDB**
  - 60 km/h : 50 % Offset



- **Movable Rigid Barrier vs. ODB**
  - 56 km/h : 40 % Offset

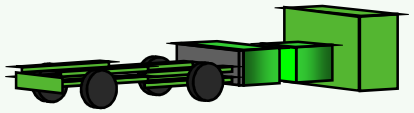


Test Setup

- Mobile barrier (“car”)
- Front design: Rigid / PDB (“PDB looks like a car”)
- Mass:
  - 1600 kg with PDB front
    (Average of vehicle fleet structural database of VC-Compat)
  - 1450 kg without deformable element
- Width:
  - 1750 mm (Average from VC-Compat database)

Calculations (statically)

Full-Width Movable PDB vs. PDB

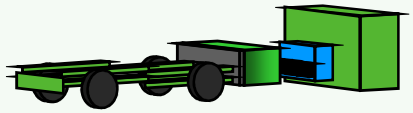


EES = 42.4 km/h

a_{max} = 27.4 g F_{max} = 430 kN

s_{max} = 415 mm $s_{barrier}$ = 415 mm

Full-Width Movable PDB vs. ODB

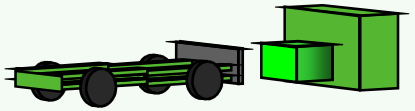


EES = 44.5 km/h

a_{max} = 22.4 g F_{max} = 351 kN

s_{max} = 591 mm $s_{barrier}$ = 512 mm

Movable Rigid Barrier vs. PDB

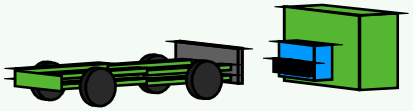


EES = 0 km/h

a_{max} = 38.9 g F_{max} = 572 kN

s_{max} = 0 mm $s_{barrier}$ = 609 mm

Movable Rigid Barrier vs. ODB



The MRB still has 55 % of its kinetic energy (74 % of its velocity) when the ODB bottoms out.

Test 1 to 4

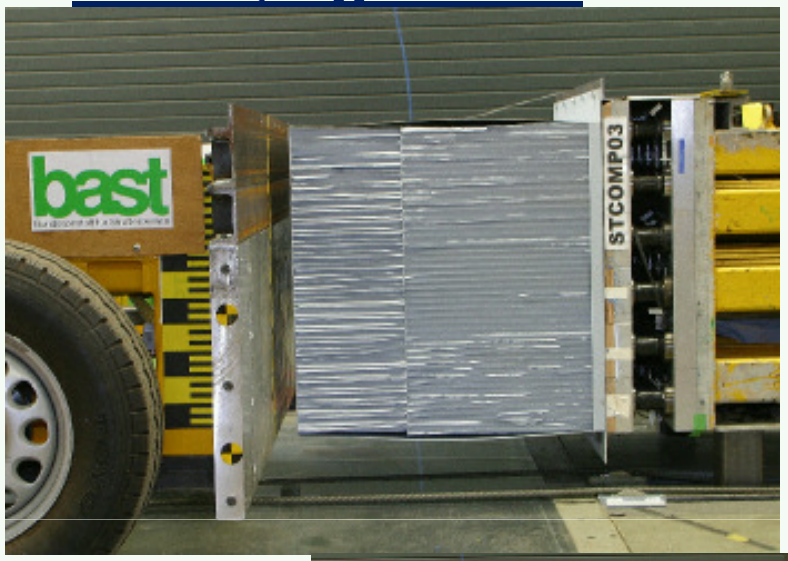
Troll. PDB - PDB

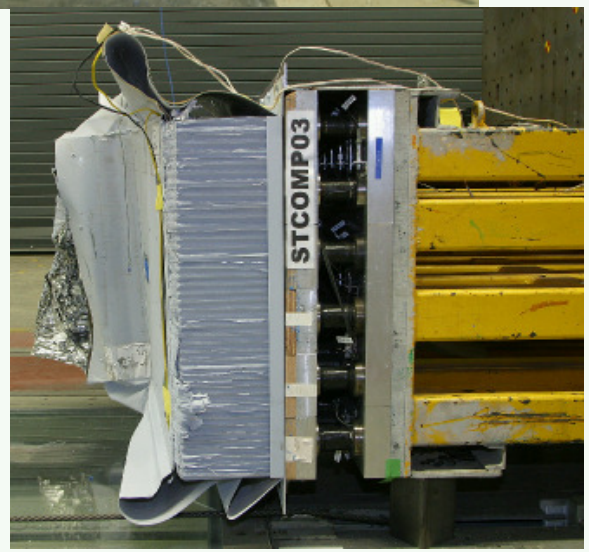
Troll. PDB - ODB

Troll. rigid - PDB

Troll. rigid - ODB

Test 3, rigid-PDB



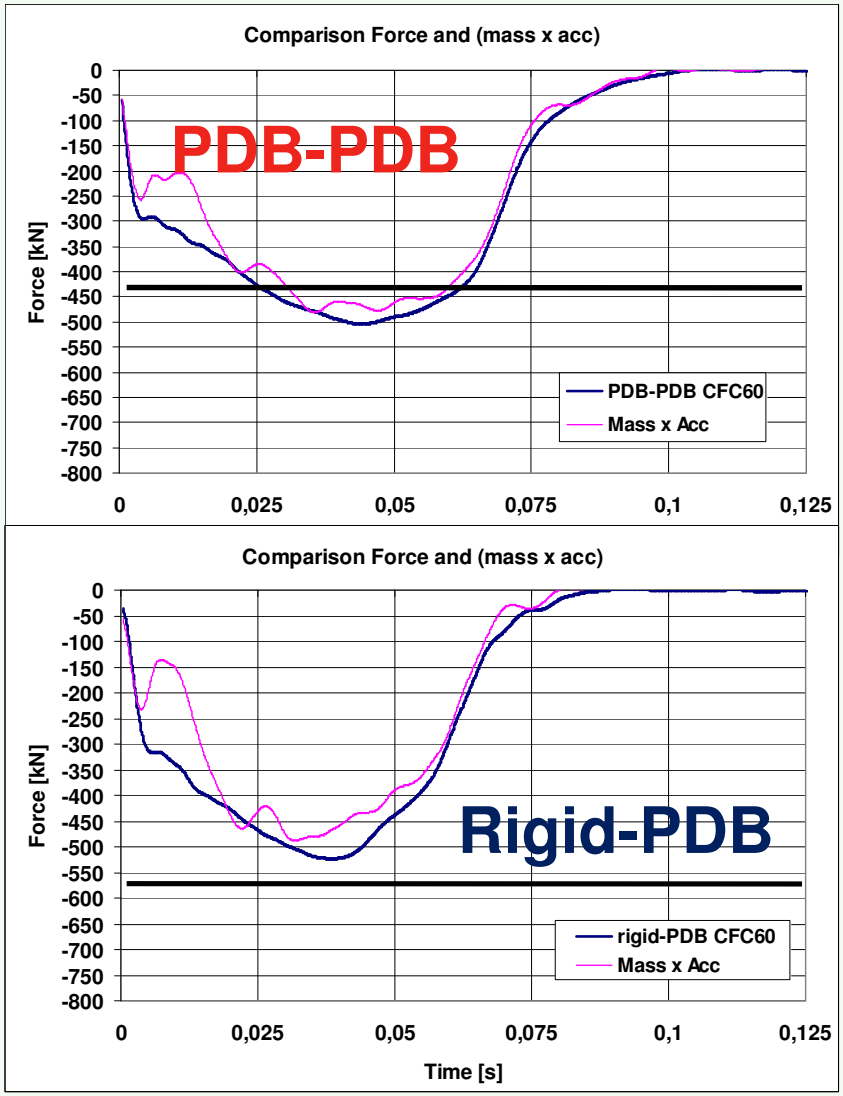


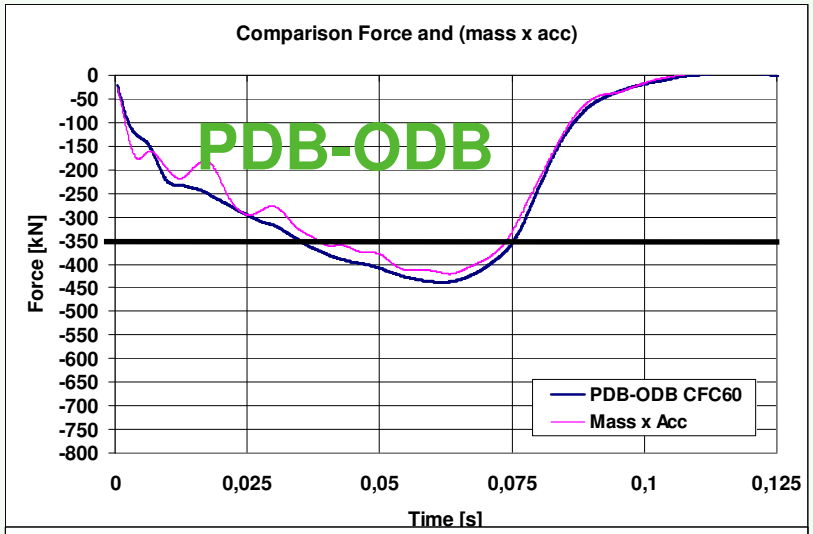
Test 4, rigid-ODB

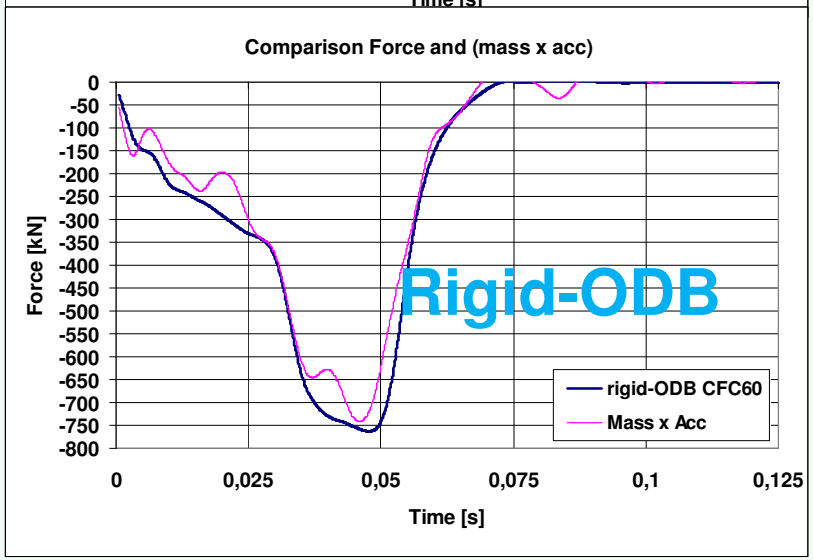
Results: Deceleration: PDB-PDB, PDB-ODB, Rigid-PDB, Rigid-ODB

Max. Acc. [g]
32
29
36
54

Results: Barrier Force







Outcome

- For the barrier-barrier tests the deceleration levels are higher than the values of the calculations (statically)
- For rigid-PDB test the acceleration level is lower than the calculated value
- PDB **can not** detect rigid impactor
- ODB **can detect** rigid impactor, although

  Rigid impactor vs. ODB has less initial speed, less overlap, less mass -> 60km/h initial speed, 50% overlap, equal mass to PDB impactor would further increase the deceleration level

Conclusions

- PDB can absorb much more energy than current ODB
- Cars with reduced/shortened front-end deformation zone can fulfil the PDB test but not the current R94 ODB test

-> Shortened front-end reduces the energy absorption capabilities which is expected to increase intrusion levels in the car

-> Introduction of PDB and cancellation of ODB will lead to lower self protection level in the vehicle fleet

Outlook/Side effects by stiffening/shorten front-ends

- Pros
  - Mass reduction
  - CO_2 reduction
  - Freedom to change Design
- Cons
  - Pedestrian protection level decreases (-> WAD changes)
  - Compatibility in side impact will be worse
  - Self protection level will be decreased
  - Compatibility in truck under-run situations will be worse

Thank you for your Attention!