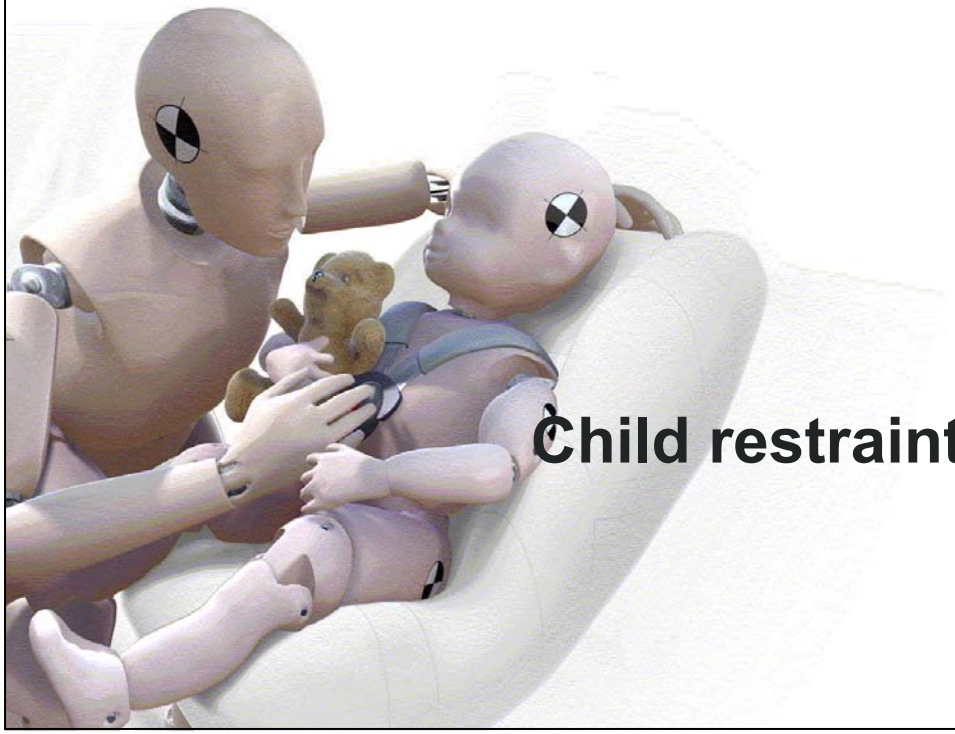
CRS-11-4



ISO/TC 22/SC 12/WG 1
Child restraint systems (in road vehicles)

TF4 CRS-Vehicle Compatibility

Brussel, July, 2nd, 2009

Introduction

- Even if :
- CRS are approved by ECE44 regulations (Universal CRS),
- Cars are approved by ECE16 regulations or 2005/40 european standards (directives) (Universal car seats)

Issues for fitting a CRS in a car can occurred. These issues can be classified into 3 groups :

- Fitting a CRS is impossible,
- Fitting some kind of CRS must be forbidden,
- Fitting a CRS correctly is difficult or not possible.

- The reason(s) for each issue can be geometric or mechanics, or both …
- At the minimum, the result is a dissatisfied customer, but can be more worrying if it leads to a misuse or not using a CRS.
- A particular fitting issue appearing for several CRS in differents cars is a **noncompatibility** between cars and CRS.
- In such a case, it is important to analyse and to understand what happens and why, in order to define some rules to avoid this issue in the future

TF4 CRS-Vehicle Compatibility

Based on this, it was decided to launch a task force on the subject "CRS-Vehicule Compatibility" on December, 2007.

SCOPE

Definition of CRS-car compatibility issues

A CRS-car compatibility issue occurs when a CRS cannot be fitted correctly or easily, so that there is a potential risk for child safety even if CRS and car passenger seat have got an approval that should ensure a correct and easy fitting.

PURPOSES

The objective of TF4 is to define rules and/or standards applying on both CRS and car to ensure that the CRS can be fitted correctly in the car (and therefore at the maximum safety for the child) in accordance with the user's CRS and car manuals.

TF4 Compatibility // 3 main parts

- **TF4 Compatibility Part1 Support Legs/Carfloor Interface**

  The aim of this part concerns mainly anti-rotational system both for semi-universal child restraint system with support leg (rearward ou forward facing CRS) and is to propose :

  - **Geometric rules for support leg (as surface contact) and method to define where it is applying on the carfloor**
  - **Test Methods to validate CRS with support leg (maximum SL load level) and for carfloor stiffness**

- **TF4 Compatibility Part 2 Boosters with isofix hooks**

  The aim of this part is to propose :

  - a fixture for booster seats (maximum dimensions, seatbelt lap positioning …)
  - geometric rules to define the relative positioning between seatbelt buckle, anchorages using isofix anchorages and seatbelt to restraint the child …

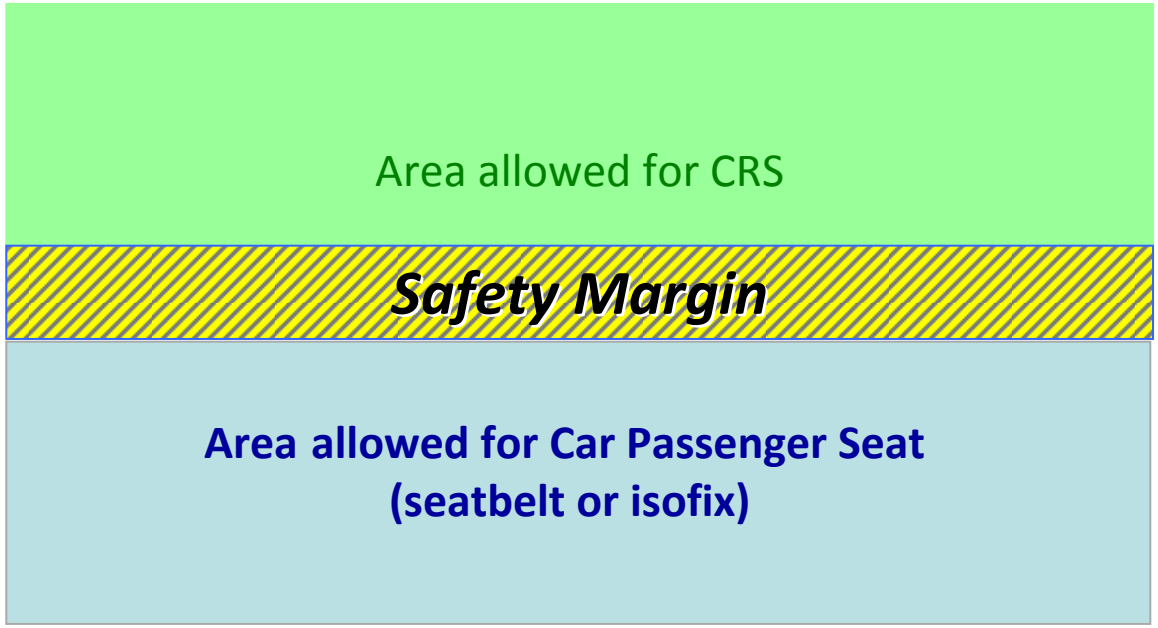
- **TF4 Compatibility Part 3 Seatbelt Child Restraint Systems**

  The aim of this part is to propose :

  - **<u>For car passenger seats</u> : a new fixture to check the seatbelt length usable to fit a child restraint system and the positioning of the buckle and tong system, with the associated methodology and criteria**
  - **<u>For child restraint systems</u> : a static bench with seatbelt anchorages representative of a car environment to check the used seatbelt length and the positioning of the load bearing points, with the associated methodology and criteria.**

Why Compatibility as title ?

Originality of this subject or the best way to solve this kind of issue …



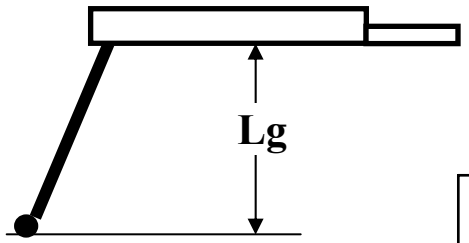
Another Particularity

New rules, standards shall be based on existing products to solve current compatibility issues

Main examples of non-compatibility for fitting isofix CRS

Support Leg and boxes on the floor

- The depth of the storage on the floor and the maximum length of the support leg are not in accordance to allow always the fitting of the support leg on the bottom of the storage, and to guarantee it in the future (with new cars or new CRS).



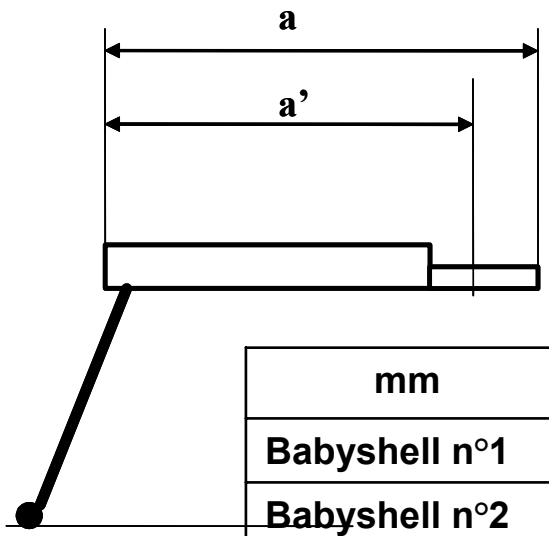
	Car n°1	Car n°2
Isofix seat n°1	☺	☹
Isofix seat n°2	☺	☹
Isofix seat n°3	☺	☹

length support leg Lg (mm)	mini	maxi
Support leg n°1	300	485
Support leg n°2	**285**	460
Support leg n°3	335	**505**

Main examples of non-compatibility for fitting isofix CRS

Support Leg and boxes on the floor

- The distances a and a' depends on the kind of isofix hooks (retractable or not) and the retraction mecanism is different for each Isofix CRS.

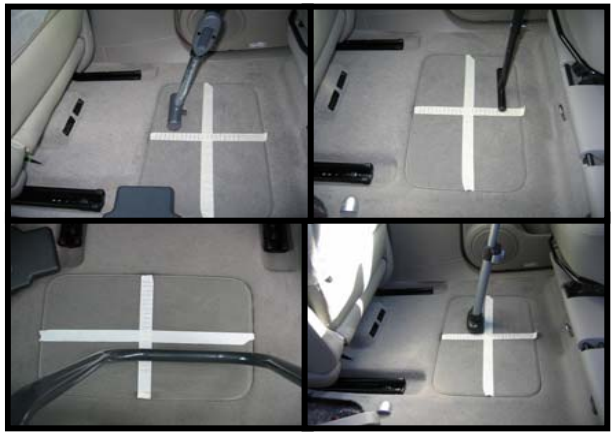


mm	a	a'
Babyshell n°1	680	680
Babyshell n°2	690	580
Babyshell n°3	655	565

⇒ If there is a step on the floor, some positions of the support leg could be forbidden.

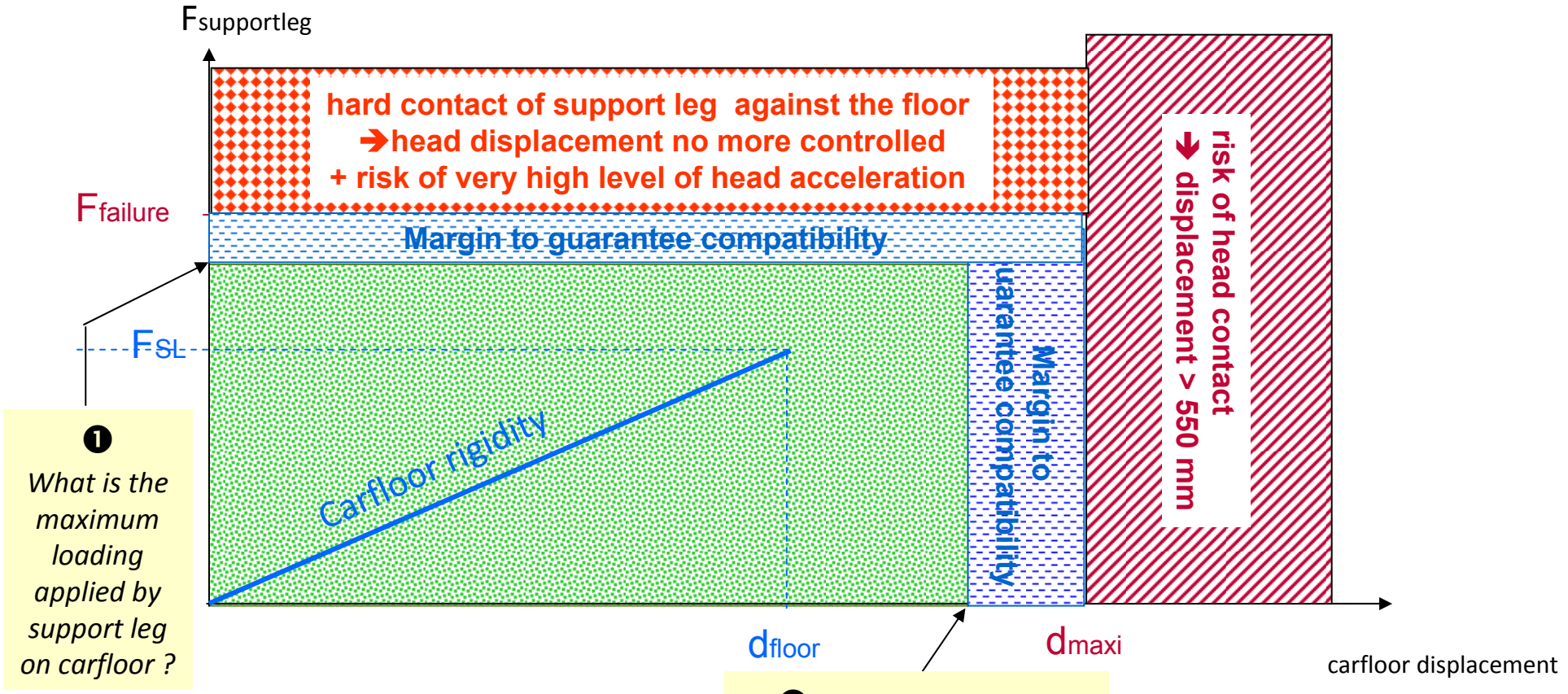
Main examples of non-compatibility for fitting isofix CRS

Support Leg and boxes on the floor

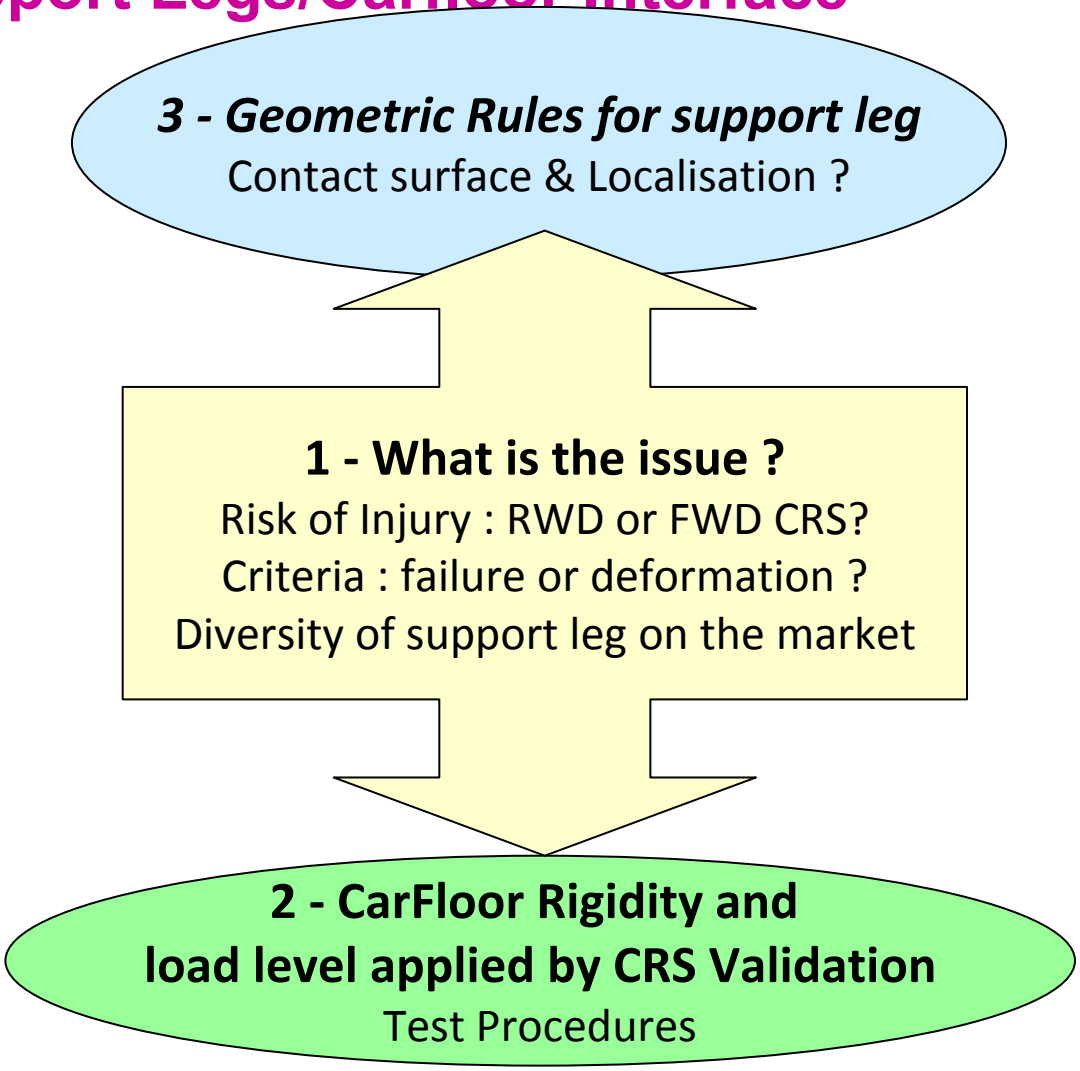


- A storage box or folding seats can/should lead to forbid all CRS with support legs.
- The position of the support leg on the car floor depends on the isofix anchorages position and the adjustement of the carseat (forward or backward).

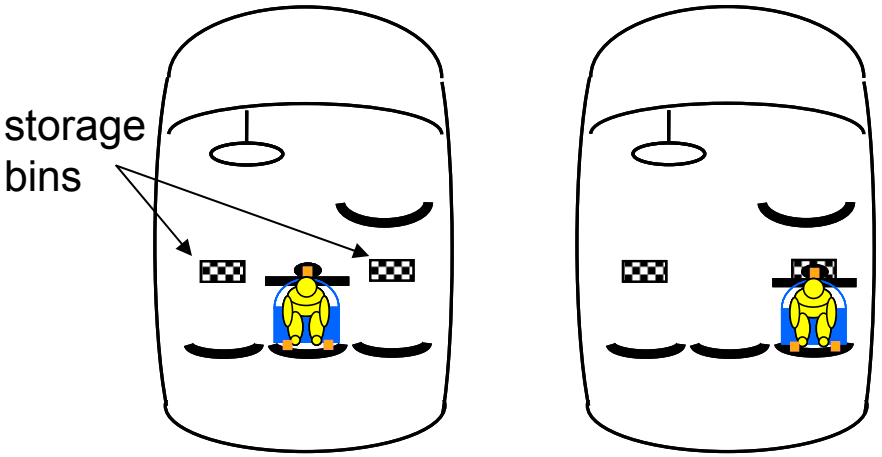
What is the compatibility concept for FWD CRS ?



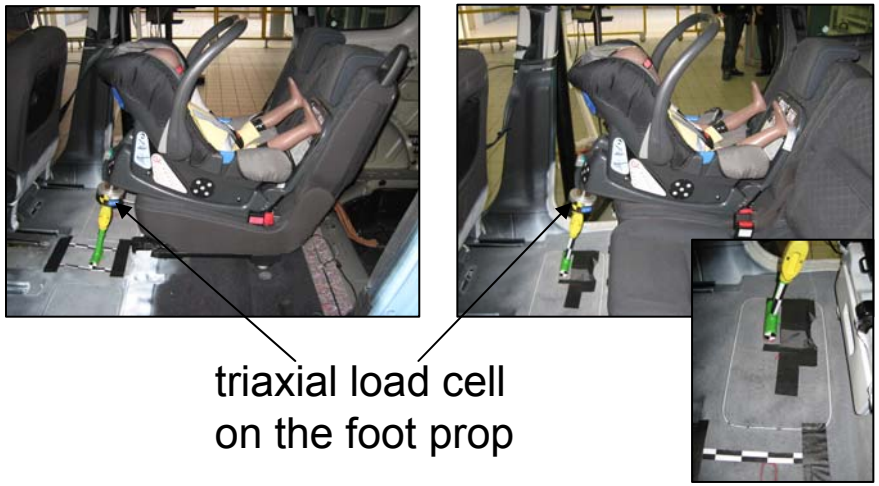
Part1 : Support Legs/Carfloor Interface

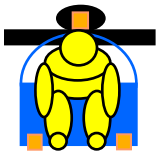


Test configurations n°1, ECE-R44 sled tests

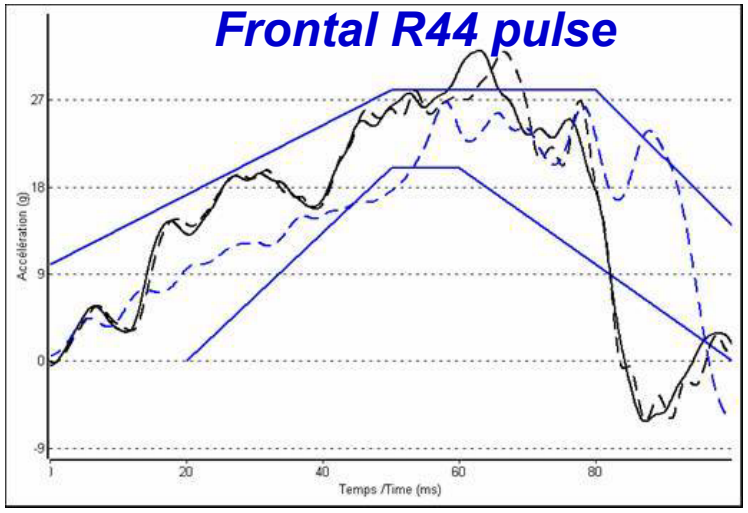


RWD facing Isofix CRS with foot prop, gr0+



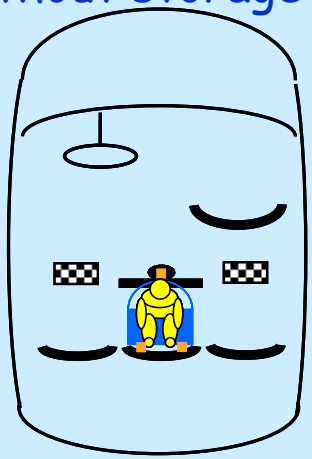


ROMER-BRITAX BabysafePlus
Semi universal isofix
Gr0+, RWD fcaing CRS
dummy P18m (11 kg)



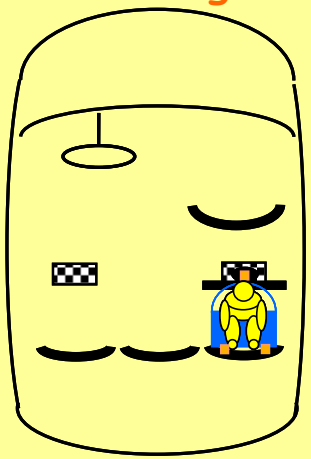
Floor Strength Results, ECE-R44 sled tests

foot prop on floor
without storage bin



after test

foot prop
on the storage bin

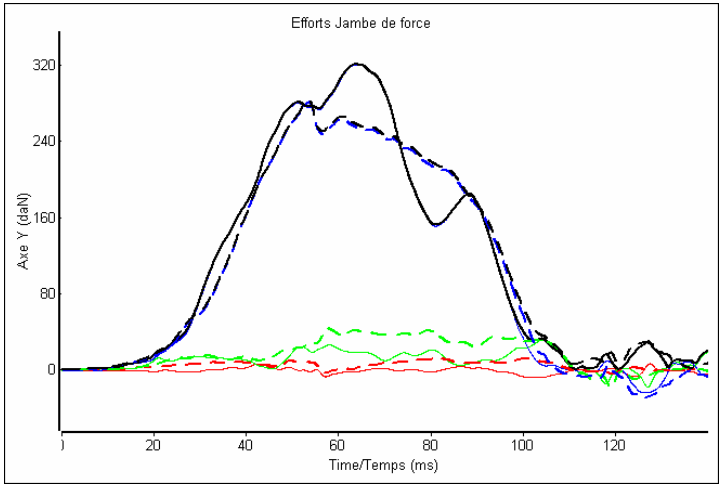


after test

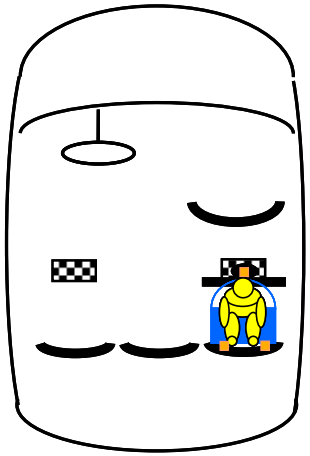
☺ no failure

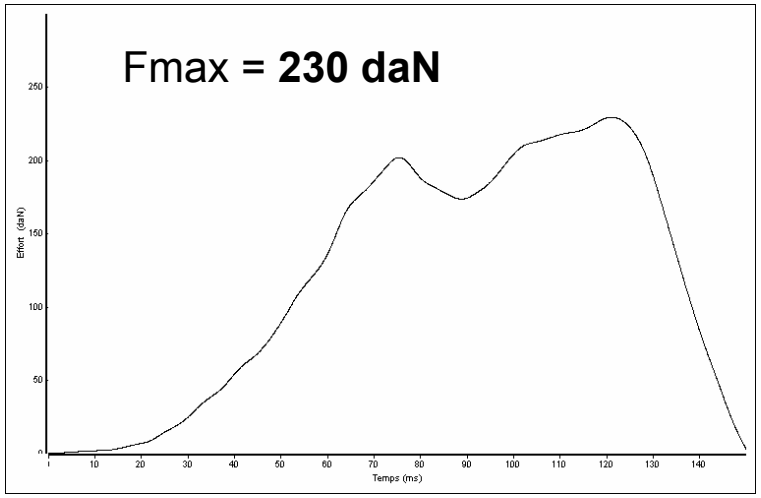
☺ Head containment

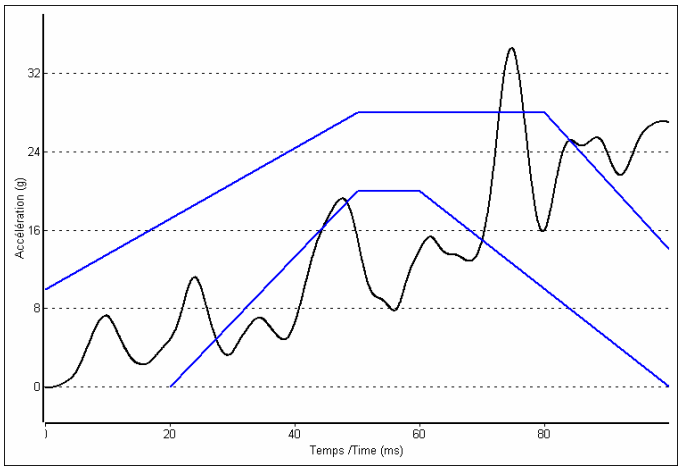
foot prop max loading
320 daN on center car seat
280 daN on side car seat (storage bin)



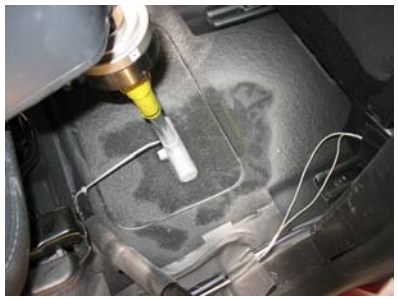
Configuration n°2 : Frontal EuroNcap Test







before test



after test

☺ no failure

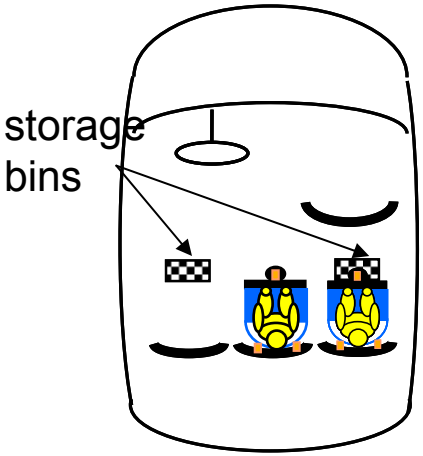
Dummies Criteria

HEAD CRITERIA Frontal Pulse	center ECE R44	side ECE R44	rigid floor BFD65	side BFD65
HIC 15 ms	241	278	171	124
Accélération résultante 3 ms (g)	52,9	54,3	46,1	37
Accélération résultante max (g)	54,6	54,7	47,4	37,3

CHEST CRITERIA Frontal Pulse	center ECE R44	side ECE R44	rigid floor BFD65	side BFD65
Accélération résultante 3ms	46,6	47,1	36,4	33,4
Accélération Verticale 3ms	39,6	39,1	23,8	21,5

In these tests, criteria are similar between rigid floor and « soft » floor

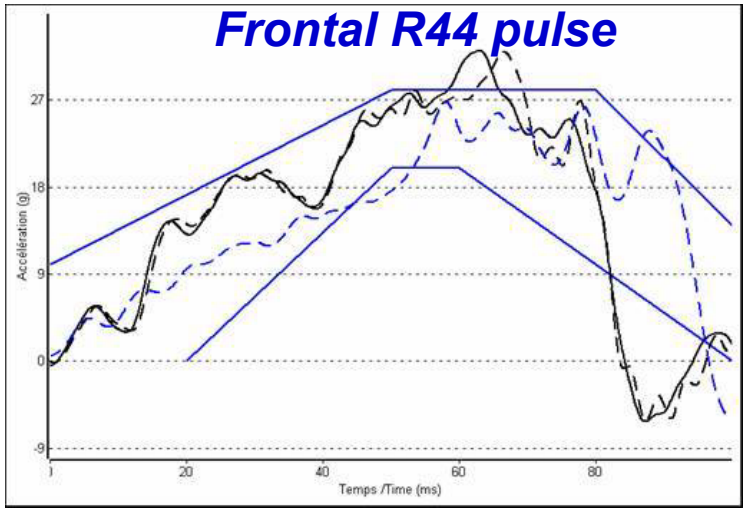
Test configurations for FWD facing CRS, ECER44 sled tests



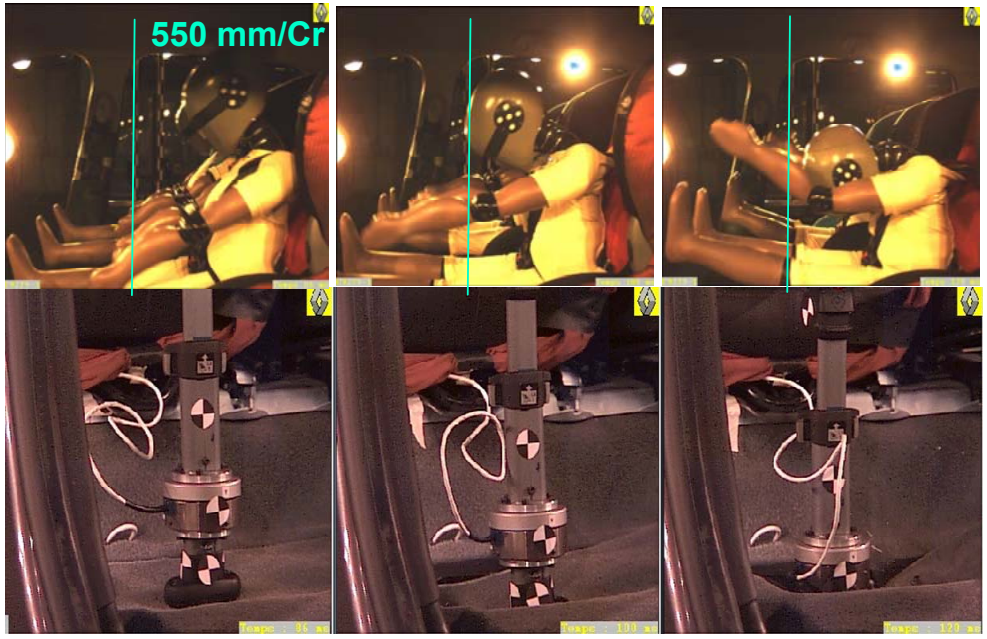
MAXI-COSI Priorifix
Semi universal isofix
gr1 forward facing CRS
dummy Q3y (15 kg)

FWD facing Isofix CRS with foot prop, gr1

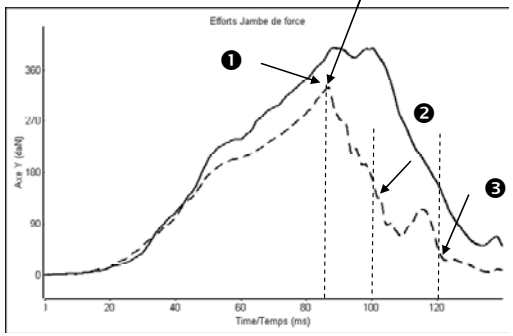
triaxial load cell
on the foot prop



Test configurations for FWD facing CRS, Foot Prop Strength



failure of the storage bin



Maximum foot prop loading
Ffloor = 398 daN
Fstorage bin = 328 daN

Dummies Criteria

Head Criteria	FWD facing CRS	
	center	**side**
HIC 15 ms	541	**434**
Accélération résultante 3 ms (g)	70,7	**67,5**
Accélération résultante max (g)	72,9	**73**

Chest Criteria	FWD facing CRS	
	center	**side**
Accélération résultante 3ms Limite ECER44 = 55g	46,8	**44,9**
Accélération Verticale 3ms Limite ECER44 = -30g	-21,2	**-22,7**

In these tests, criteria are similar between rigid floor and « soft » floor.

First Conclusions about Risk of Injury

Synthesis

- The load level seems to be higher with a R44 pulse than with a EuroNCap pulse
- Load level depends on the CRS (RF or FF and mass group)
- No significant differences between a rigid floor and a « soft » floor, so more tests are necessary to measure the negative effect of higher deformation on injury risk
- Even if no significant differences in case of a storage bin failure (to be confirmed with more tests), failure remains to be not acceptable

In progress

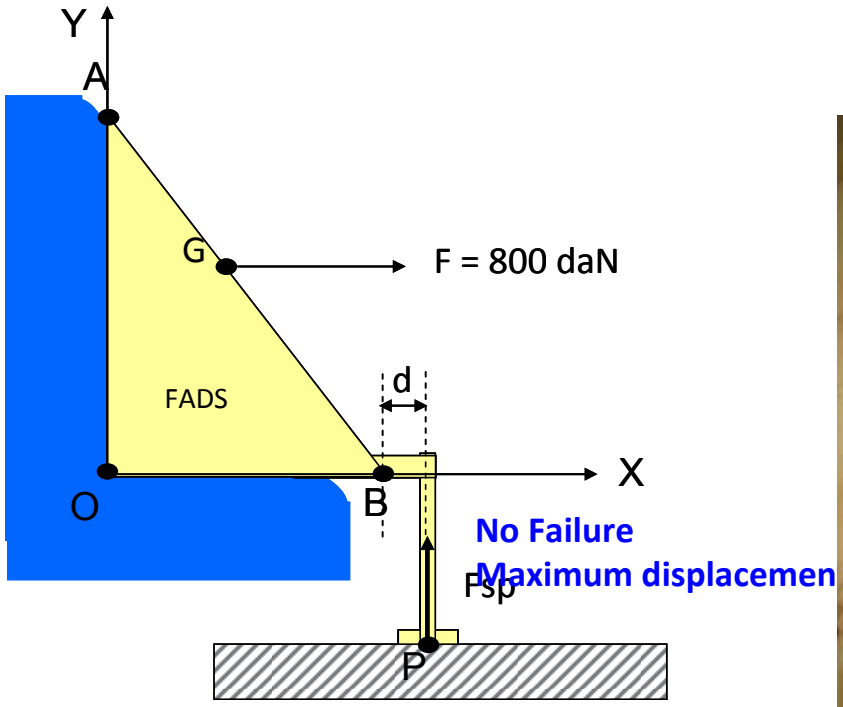
- Analysis about risk of injury to be continued in July by DOREL Europe with soft floor

Objectives :

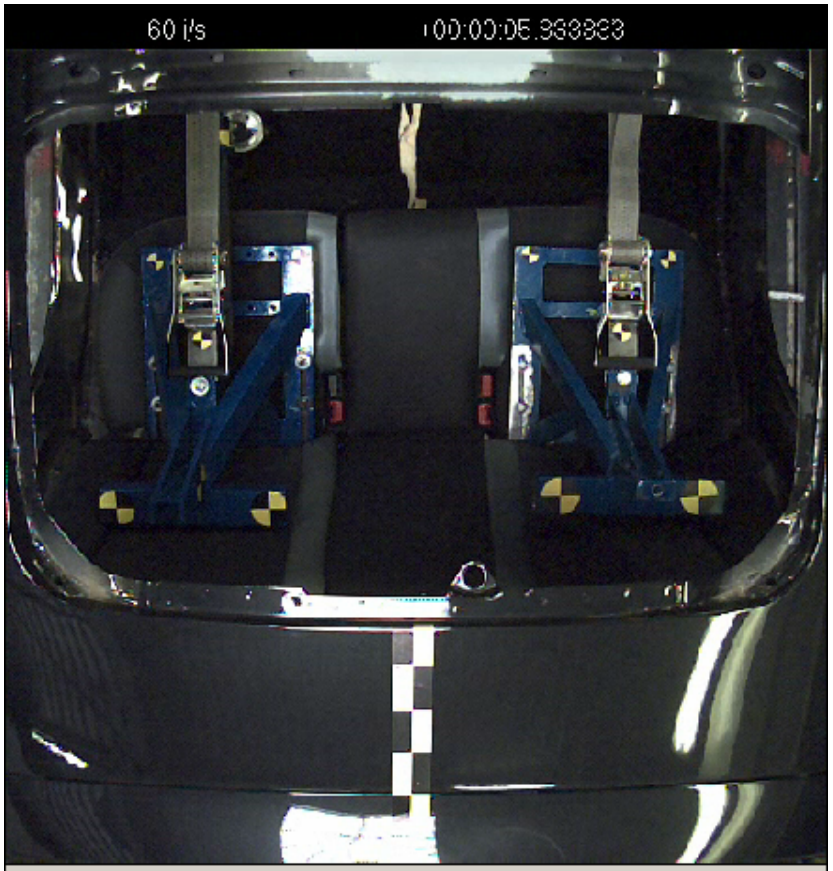
- determinate the maximum load level applied we need big RF CRS samples !!
- determinate the maximum deformation allowed (linked with the risk of injury)
- propose a « soft » floor for a test bench representative of a carfloor with a minimum rigidity allowed (the « worst case »)

Tests for carfloor strength

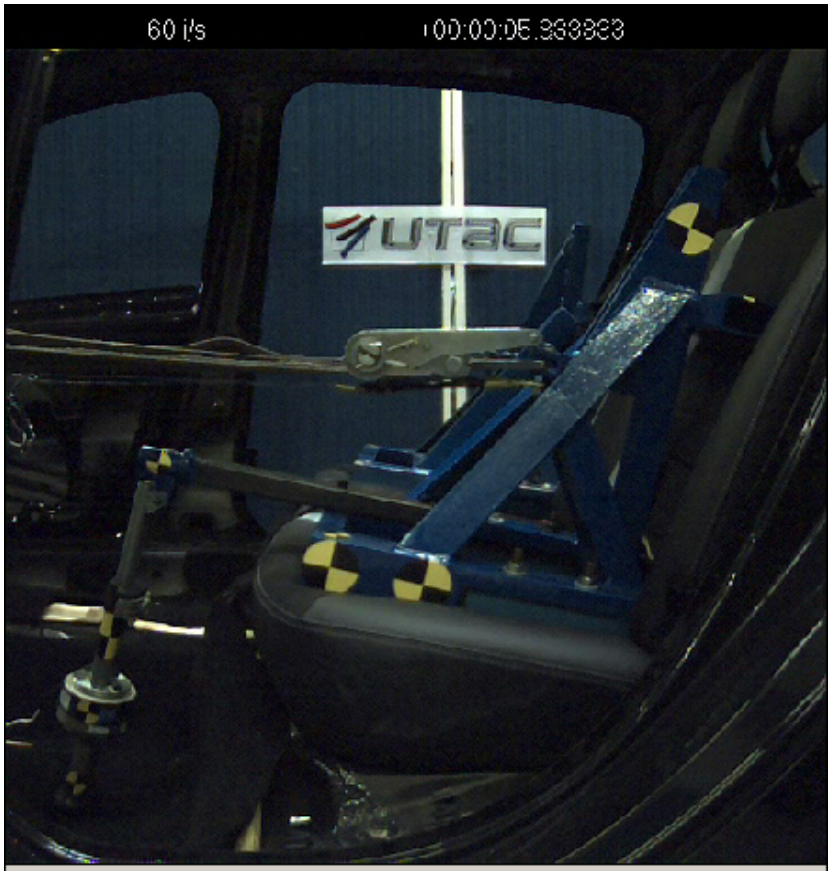
Static Tests based on ECE14 static tensile strength for isofix anchorages



Static Tests

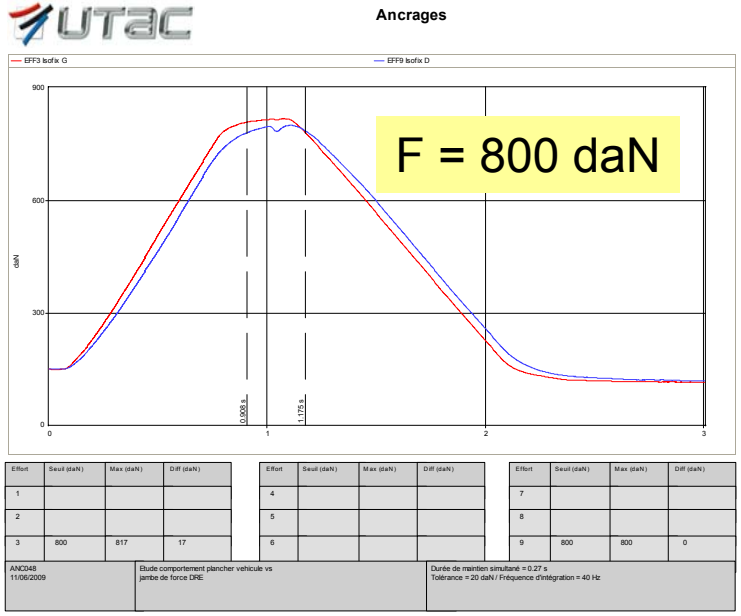


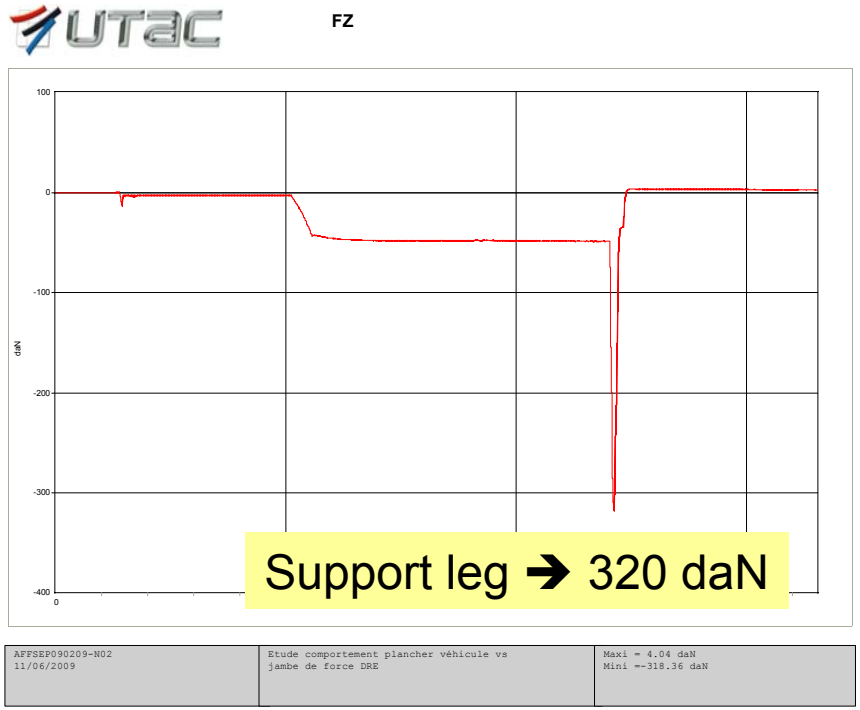
Essai n°2 jambe IsofixVue_de_dessus



Essai n°2 jambe Isofix_Vue_gauche

Results





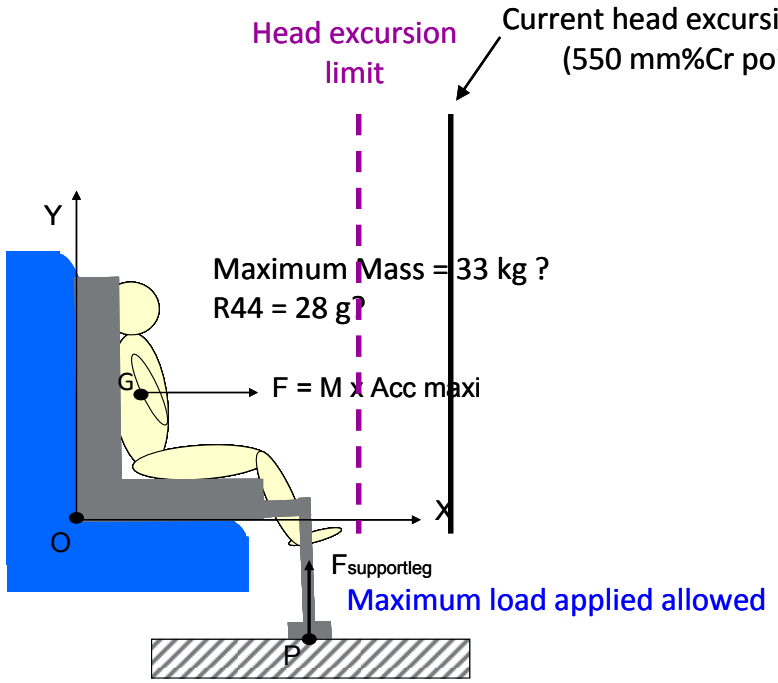
Maximum load measured
during ECER44 dynamic tests (rigid floor) :
RF CRS = 320 daN
FF CRS = 398 daN

☺ Good load level for RF CRS

😐 Which F for 400 daN ? ➔ more tests are necessary (rigid and “soft” floor)

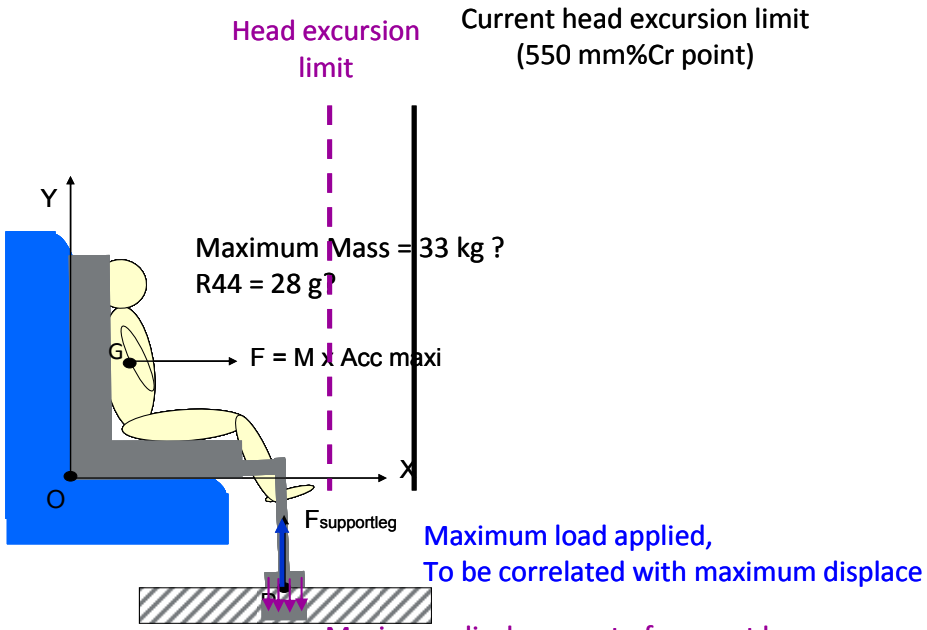
For FWD CRS with support leg

❶ Dynamic Test, case of rigid floor



loading surface (shape and dimension to be defined)

❷ Dynamic Test, case of NON rigid floor



loading surface (shape and dimension to be defined)

Main questions

- What is the maximum load level ?
- What is the geometry of the support leg ? (contact surface and localisation on carfloor)
- Rigid carfloor or not ? If non rigid carfloor, which rigidity for which deformation ?

ISO/
TF4

RENAULT

Future Actions

Injury Risks in case of a support leg applied on non rigid carfloor (storage bin)

- **Tests Results with RWD CRS, in particular gr1**
  - To evaluate the risk of injury
  - To define maximum load level (the threshold for car floor stiffness)
  - To define which criteria are apropriate for RWD CRS to avoid injury

Geometric Rules :

- **Car floor geometry** using :
  - SAAB device drawings are expected (and if not confdential available data from V
  - Data coming from Volvocars (feet point positions)
- **CRS Geometry**
  - GR1 RWD CRS are much more present in Scandinavian countries


SAAB device

Interface Validation Tests for carfloor and CRS

- **More Static tests with the modified FADS**
- **Dynamic Test for CRS : Severity Level, Criteria and Paramet**


FADS with support leg