CLEPA
European Association of Automotive Suppliers

Britax Römer

Considerations for A Side Impact Test Procedure for approving CRS in EU

Farid Bendjellal, Britax Childcare Group
7th GRSP Informal Group on CRS – BAST, Cologne 21 January 2009

Informal Group Objectives - Reminder

Develop definitions, performance criteria and test methods for an ISOFIX Integral “Universal” CRS

- Test bench
- Classification
- Dummies
- Dynamic tests [Including Side Impact]
- Interoperability with vehicle

Side Impact - Objectives

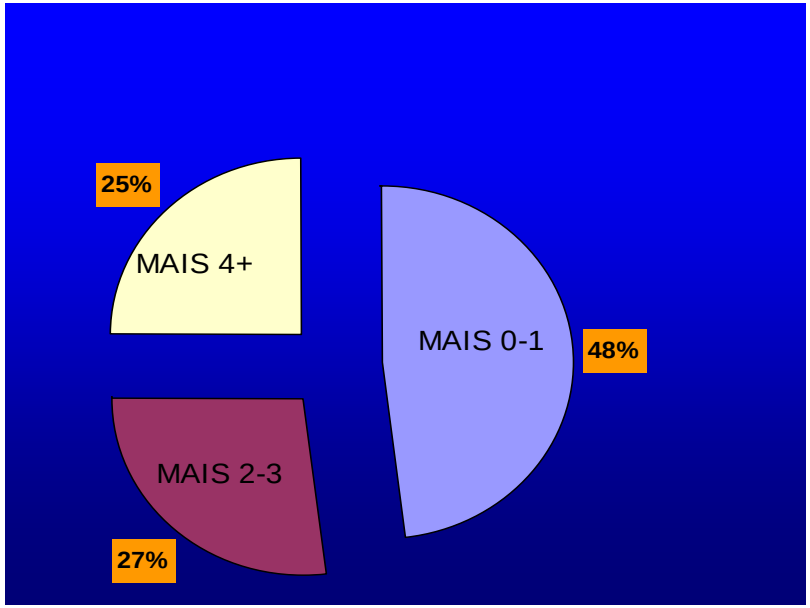
- Informal Group to review all existing methods to determine the one to be retained
- Informal Group to consider first methods delivering required energy level and:
  - » Promoting energy absorption in the seat
  - » Including measurable performance criteria
- Supported by ISO/TC22/SC12 (Alternative1)
  - » To provide essential input parameters only for a CRS side impact test method.
  - » Delivery date from ISO: June 2009

Field Studies & Key Findings

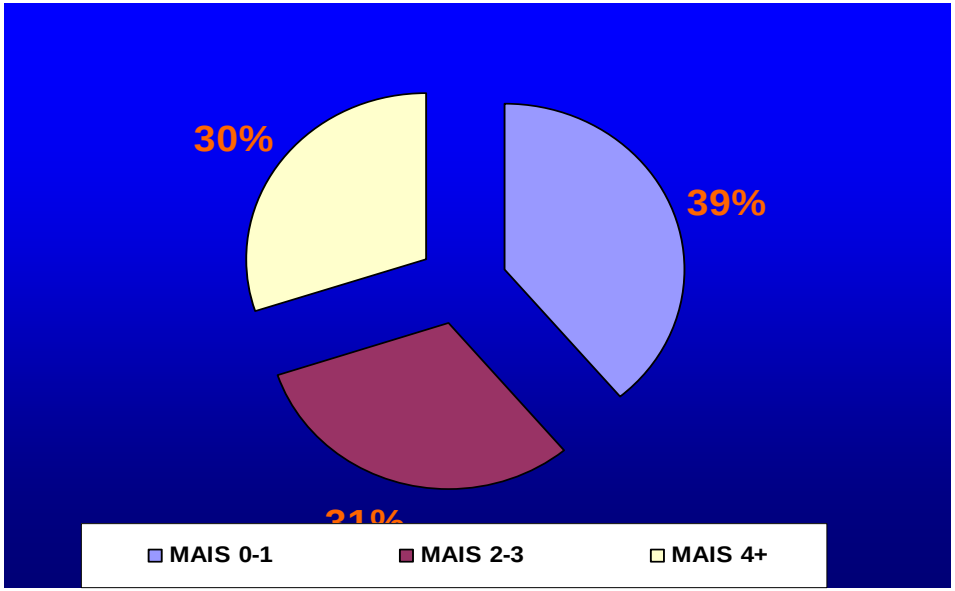
European Child Injury Led Design (CHILD) - 2006

Analysis of CHILD Data Related to Side Impacts*

Injury Severity Struck Side & Non Struck Side
284 Restrained Children



Injury Severity Struck Side
157 Restrained children

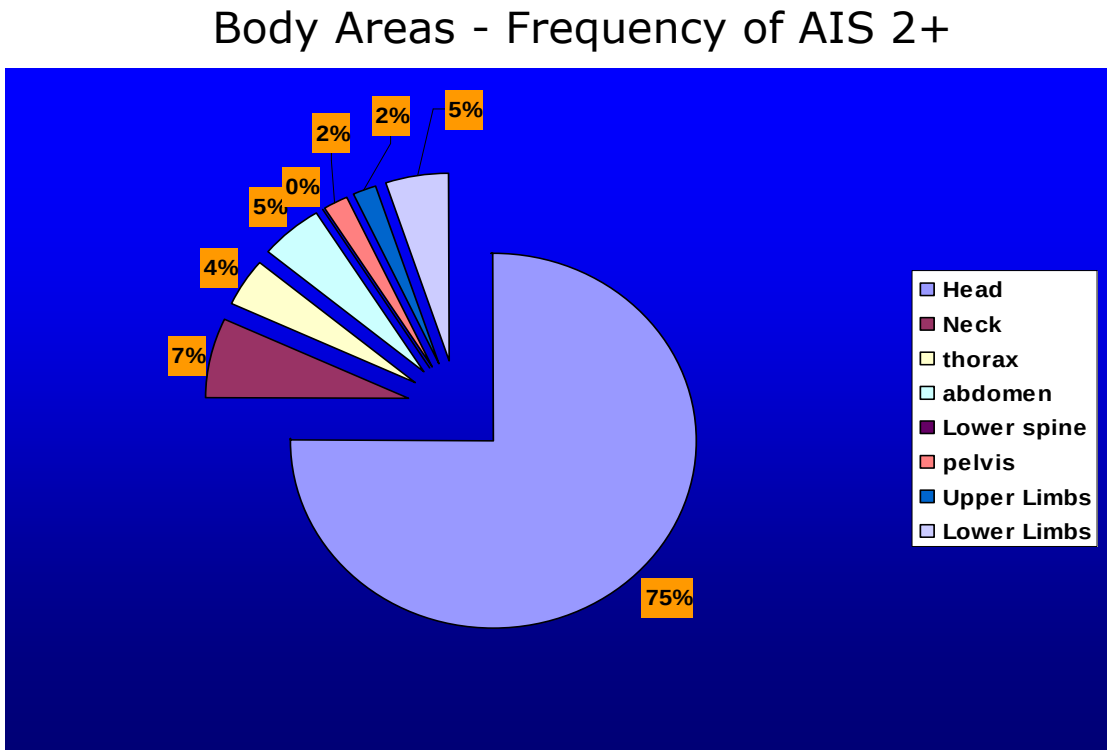


Higher risk on struck side !

** Analysis of CHILD Data Related to Side Impacts :Philippe Lesire -Protection of Children in Cars – 7/8 December 2006 - Munich*

European Child Injury Led Design (CHILD) - 2006

Analysis of CHILD Data Related to Side Impacts*



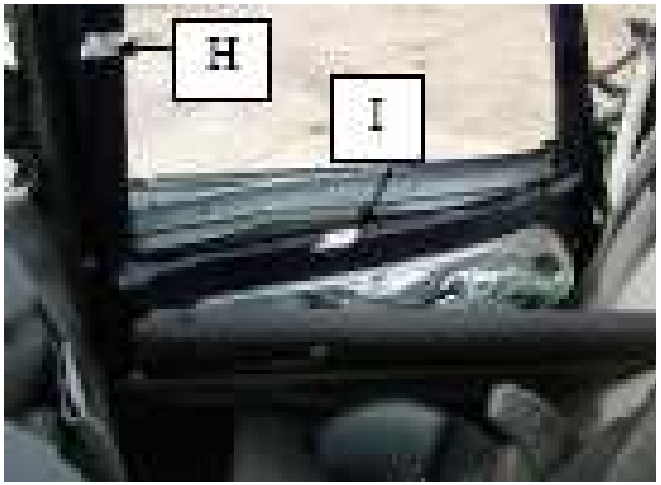
- *¾ of injuries to the head and face (seat group 0 to 1)*
- *Neck in 2nd position*
- *Abdomen & lower limbs in 3rd position*

** Analysis of CHILD Data Related to Side Impact (Philippe Lesire) -Protection of Children in Cars –7/8 December 2006 - Munich*

European Child Injury Led Design (CHILD) - 2006

Involved Vehicle or CRS Components *

- Struck Side (Ranking)
  - Head (impact on rigid part of the vehicle
  - Neck (often with brain injury)
  - Chest (shell, boosters, Seat Belt)
- Non Struck Side
  - Head - impact on rigid part of the car
  - Chest
- Intrusion >300 mm
  - 50% of children MAIS4+



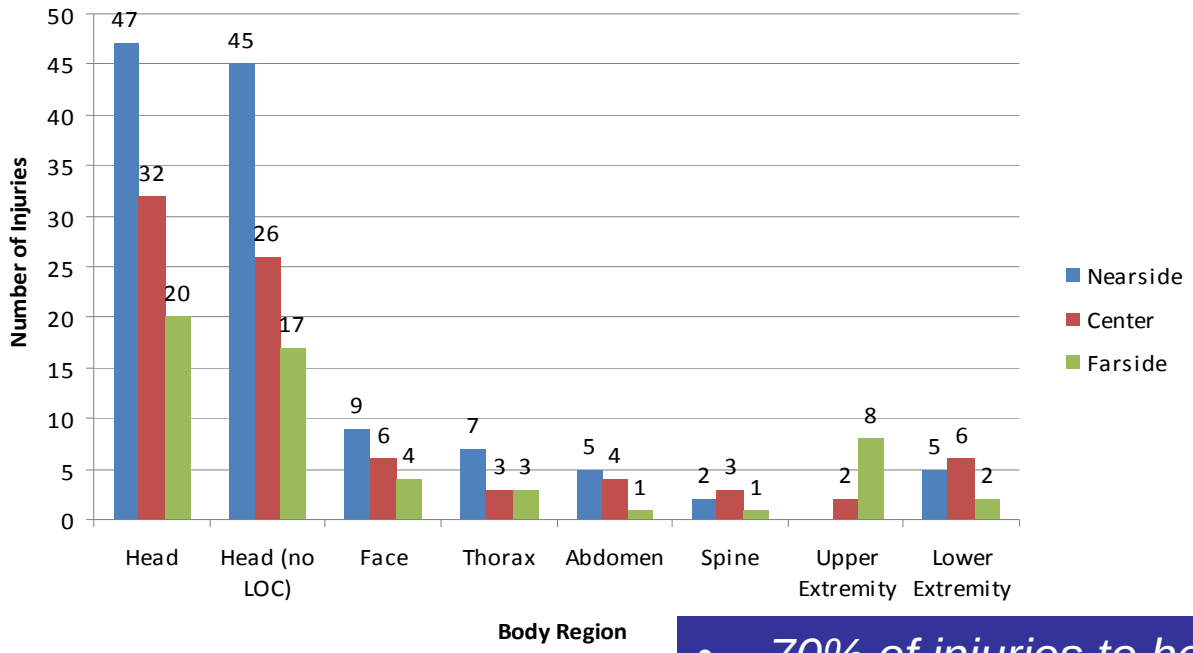
Britax Database 2007 Case – Head contact with intruding door structure – Restrained Occupant

** Analysis of CHILD Data Related to Side Impact (Philippe Lesire) -Protection of Children in Cars –7/8 December 2006 - Munich*

Children's Hospital Philadelphia – USA 2008

62 crashes investigated – Nearside, Center & Farside*

Body Regions of Injury (AIS2+, n=170)



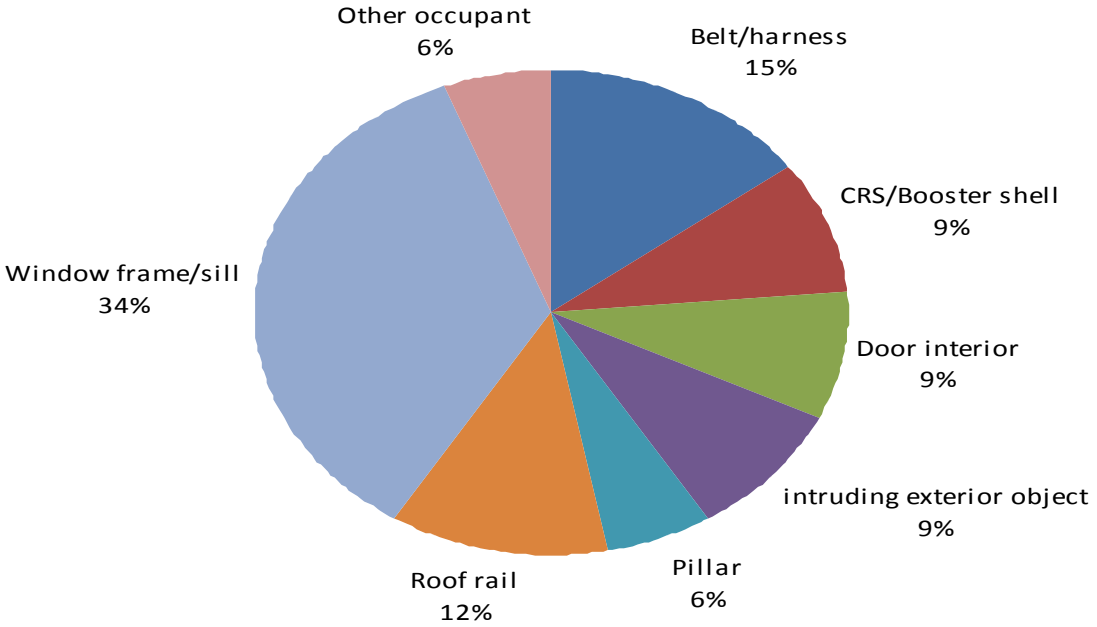
- *70% of injuries to head and face (118/170)*
- *Thorax in 2nd position (13/170)*
- *lower limbs & Abdomen in 3rd & 4th position (13/170; 10/170)*

**Child Restraint Systems in Side Impact Crashes: Injury Patterns and Causation, Kristy B. Arbogast et All 2008*

Children's Hospital Philadelphia – USA 2008

In Depth analysis of 21 nearside cases

Involved Physical Components – Head and Face (n=34 injuries)



Key Message

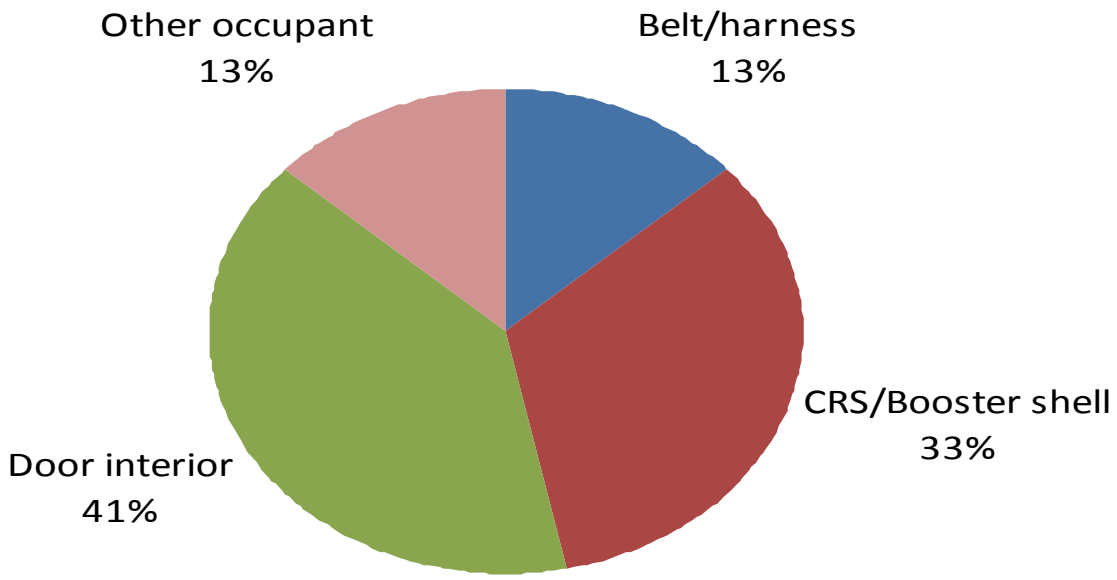
- *Vehicle Components 61%*
- *CRS Components 24 %*
- *External Intruding Objects 9%*
- *Other Occupants 6%*

Child Restraint Systems in Side Impact Crashes: Injury Patterns and Causation, Kristy B. Arbogast et All 2008

Children's Hospital Philadelphia – USA 2008

In Depth analysis of 21 nearside cases

Involved Physical Components – Other Body Regions Thorax Abdomen & Lower Extremity (n=15 injuries)



Key Message

- *CRS Components 46 %*
- *Vehicle Components 41%*
- *Other Occupants 13 %*

Child Restraint Systems in Side Impact Crashes: Injury Patterns and Causation, Kristy B. Arbogast et All 2008

Children's Hospital of Philadelphia -

In Depth Study of 8 side Impact crashes

- Most frequently injured body areas
  - » Head, Face, Lower Extremity
  - » Need for a biofidelic dummy
- Side crashes, in addition to lateral component
  - » Include a forward component
- Intrusion can be direct or indirect
  - » Direct : Car structure contacting the occupant (direct)
  - » Indirect : Vehicle part such as front seat intruding into occupant space
- CRS rotates towards the site of impact

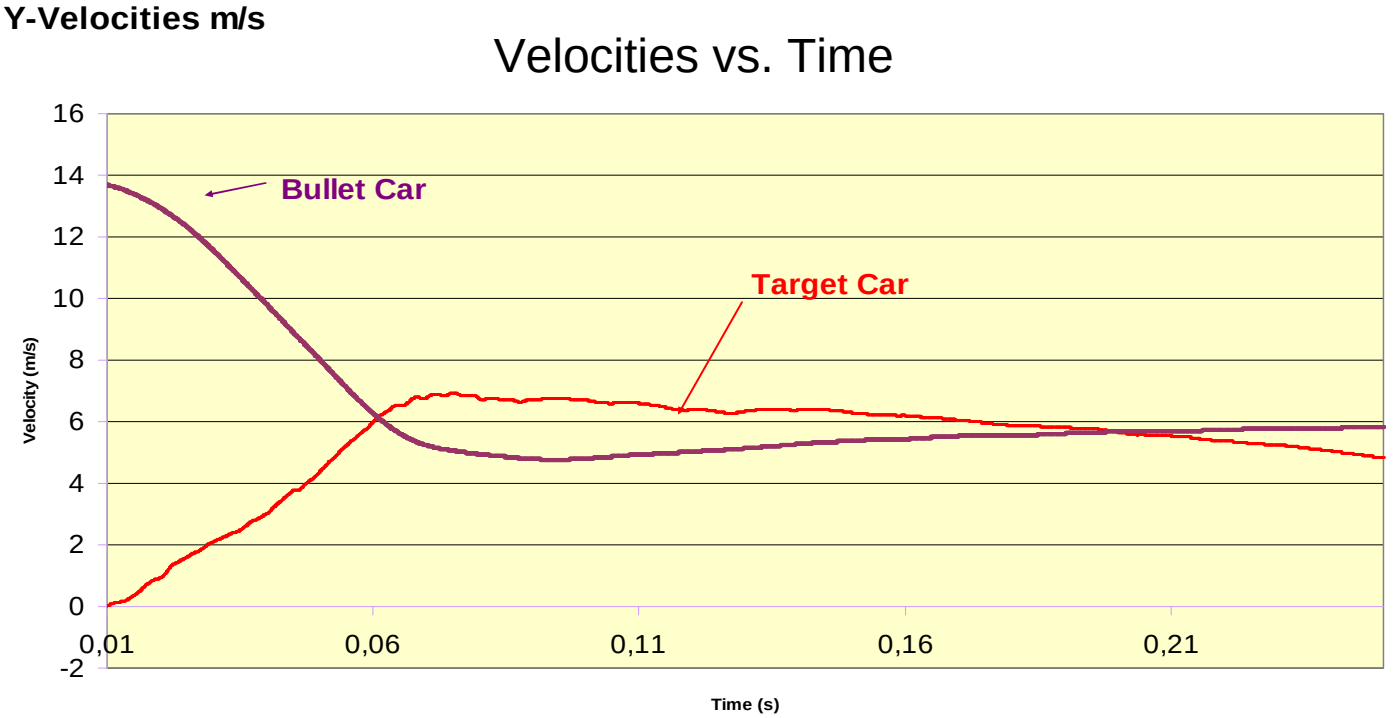
Field Investigations of Child Restraints in Side Impact Crashes : KRITY ARBOGAST, **YOGANAND GHATI, and RAJIV A. MENON,** TraumaLink, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA
SUZANNE TYLKO, Transport Canada, Ottawa, Ontario, Canada
NICHOLAS TAMBORRA and RICHARD M. MORGAN, FHWA, NHTSA - Traffic Injury Prevention 2005

Summary Field Accident Studies

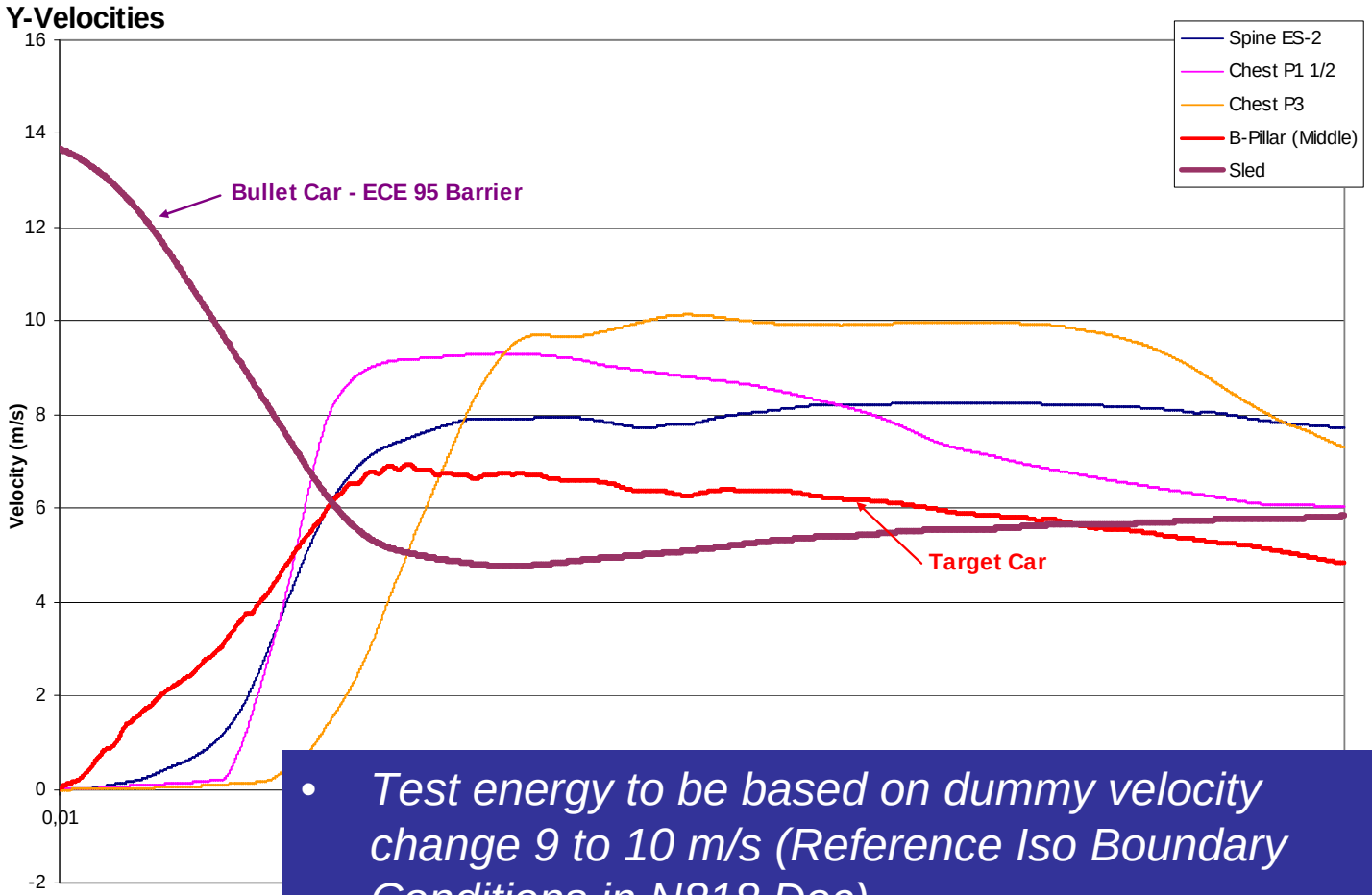
- Body Areas requiring attention
  - » Head & Face
  - » Lower extremity
- Test procedure
  - » Dynamic (sled test) with assessment of interactions of intruding door
  - » With lateral and forward components
  - » With lateral rotation of the CRS (armrest contact)
- Dummy
  - » With design capability and appropriate injury criteria

The Physics

Barrier to car Side Impact –EuroNCAP 50 km/h - 90° barrier test to vehicle



Driver & CRS Occupants Chest Responses



- *Test energy to be based on dummy velocity change 9 to 10 m/s (Reference Iso Boundary Conditions in N818 Doc)*
- *EuroNCAP Side Impact can be considered as a basis for a energy definition for a test procedure for CRS*

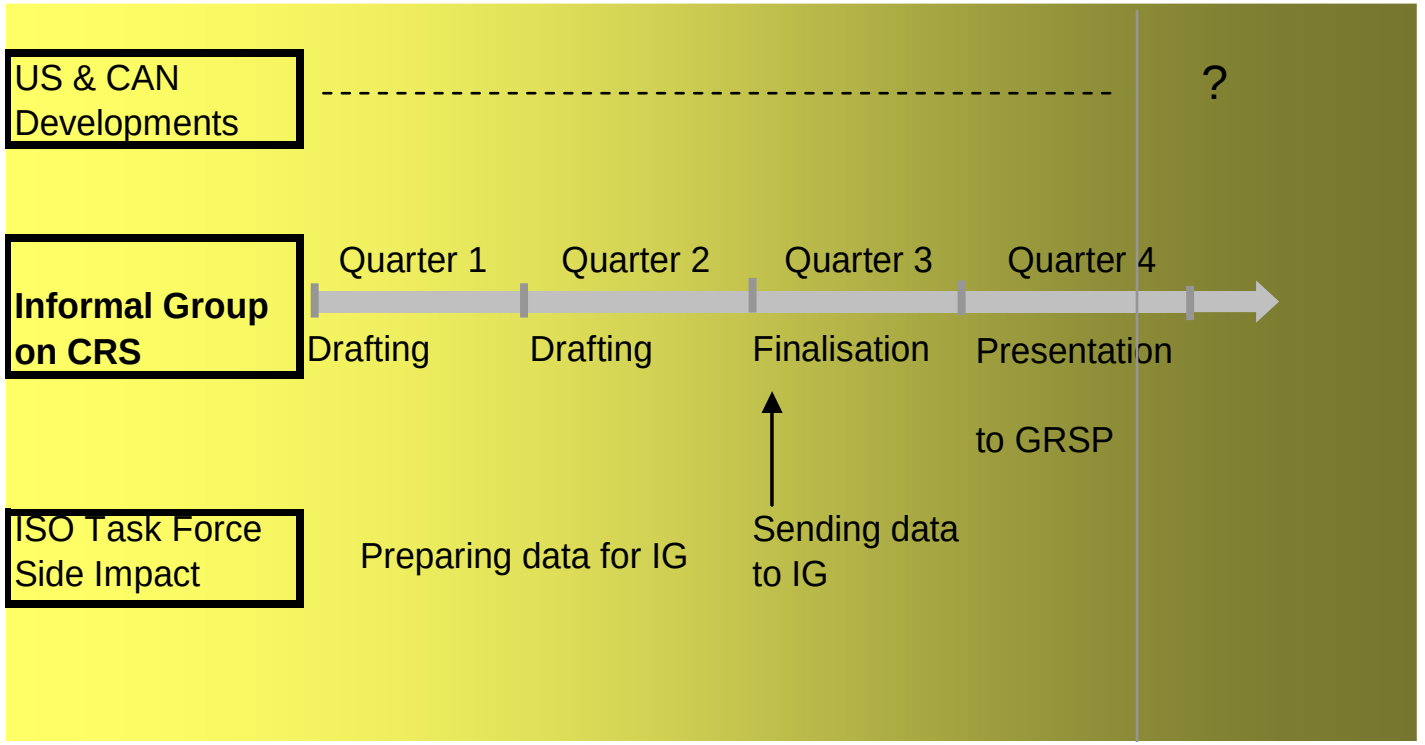
Status of existing test methods

Status of existing test methods

Country / Organisation	Australia	USA	ISO	NPACS EU	Stiftung Warentest ADAC EU	EuroNCAP EU
Regulatory	√					
Consumer Testing				√	√	√
Set Up	Sled Test	Sled Test	Sled Test	Sled Test	Sled Test BIW Astra	Full Scale Test
Door to occupant	with & wo fixed door	Sliding door	swinging door	swinging door	Fixed door	-----
Angle °	90	TBD	90	90	80	90
Dummy	P 9m ; P3	Q3S + New Neck	Awaiting ISO SC12 WG5	Q Dummies and P10	Q Dummies & P10	P1 1/2 & P3
Status	In Use since 2004,upgrade 2009	Research Stage	Disapproved	in use in UK 07	in use since 2002	EU since 1997**
* Body in white and deceleration pulse modified from Golf 4 to Astra						
** Child assessment protection protocol introduced in 2003						

- *Fixed Door approach: SV ADAC (long experience) & Australia*
- *Dynamic Intrusion approach: 3 methods*
  - *1 in use in 1 country NPACS*
  - *1 in development USA , CAN*
  - *1 ISO dissaproved*

Side Impact Test Procedure – Timeline Constraints



Keys

- ❑ Draft to GRSP must be circulated and discussed prior sending to GRSP
- ❑ Draft Ready by September to be considered as formal document
- ❑ Allows July & August for discussion of the draft
- ❑ Text ready by June 09

6 months to do the drafting work !

Need to have a pragmatic approach to reach concensus before sending the doc to GRSP!

Need for a pragmatic approach to deal with side impact test procedure

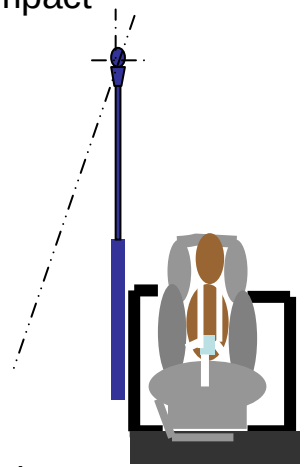
- 1. Real world data point at a dynamic sled test with intrusion simulation, including biofidelic dummy and appropriate injury criteria.
- 2. Real word data also point at the need to reduce vehicle intrusion and improve vehicle interior energy absorption
- 3. Today such a test method for CRS as in 1 is not available and for vehicles , test method to control direct intrusion exist worldwide (ECE95, FMVSS 214 etc...), but no provision exist for instance for door energy absorption
- 4. Let us aim at a simple, feasible and comprehensive approach involving improvements both CRS and vehicle
- 5. Let us consider head protection as a key fundamental objective to achieve
- Approach proposed:
  - » 2 step approach to deal with the issue

A Step by step approach Proposed To the Informal Group: Phase 1 – Option

Phase 1 : Head Containment & Energy Absorption for the CRS & Vehicle interior Energy Absorption

CRS

Head Containment & Energy Absorption – Pendulum Test – Impact energy TBD from EuroNCAP Side Impact



Performance Criteria
Using Q Dummy with acceptable Head Neck Kinematics
Head Containment Y/N from video analysis (NPACS or Stiftung Warentest)
For energy absorption , Head Acceleration based criterion

+

Vehicle

Energy Absorption of vehicle parts using ECE21 principle on door interior and rear of the front seat

Performance Criterion

Pendulum 3ms Acceleration < XX G's

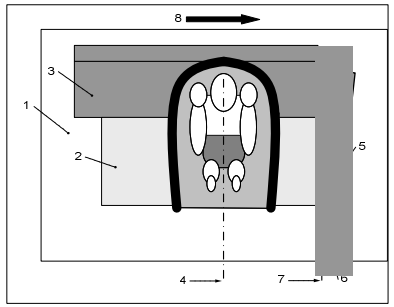
Analogy with ECE 21 energy dissipation of vehile interior

A Step by step approach Proposed To the Informal Group: Phase 1

Phase 1 : Head Containment & Energy Absorption for the CRS & Vehicle interior Energy Absorption

CRS

Head Containment & Energy absorption - Sled Test – Fixed door – ADAC Generic Pulse ΔV 28 km/h, 80°



Performance Criteria
Using Q Dummy with acceptable Head Neck Kinematics
Head Containment Y/N from video analysis (NPACS or Stiftung Warentest)

For energy absorption , Head Acceleration based criterion

+

Vehicle

Energy Absorption of vehicle parts using ECE21 principle on door interior and rear of the front seat

Performance Criterion

Pendulum 3ms Acceleration < XX G's

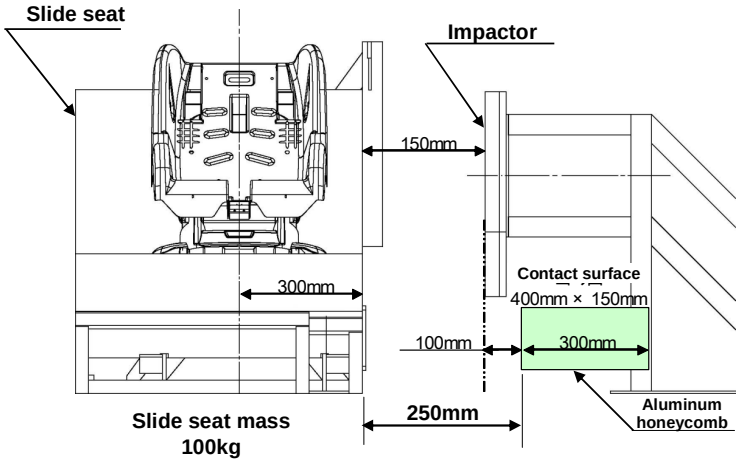
Analogy with ECE 21 energy dissipation of vehicle interior

Step by step approach Proposed To the Informal Group: Phase 2

Phase 2 -: Intrusion based sled test & Vehicle Energy Absorption & Vehicle Control of indirect intrusion

CRS

Intruding Door Test TDB (example below only)



Dummy TBD

Injury Criteria TBD in relation to dummy biofidelity

Vehicle

Energy Absorption of vehicle parts using ECE21 principle on door interior and rear of the front seat

Performance Criterion

Pendulum 3ms Acceleration < XX G's

Analogy with ECE 21 energy dissipation of vehile interior

Vehicle Control of indirect intrusion*

Objective : limit the intrusion into the rear occupant space of front seat back (situation seen in side impact accidents with frontal component)

Test Method to be defined

** Based on M. Maltese Stapp 07 Paper*

Summary of Proposed Options to GRSP Informal Group

- Informal group to consider for discussion proposed steps for both CRS and Vehicles

- Must find a compromise in terms of
  - » Timeline : Draft to be circulated, approved and circulated to GRSP by 2nd week of Sept
  - » Feasability of the procedure given available data and tools (dummies)
  - » Capacity of the both CRS andand test procedures to address the key body injury area: Head & Face!