



**C L E P A**  
*European Association of  
Automotive Suppliers*

# 54<sup>rd</sup> Meeting Informal Group on Child Restraint Systems

## Booster Seat Width Development

27<sup>th</sup> October 2015

# KEY CHANGE IN INFORMAL GROUP DIRECTION AT ITS 50TH MEETING GERMANY

- Introduce only non-integral i-Size ECRS as booster seats with an integrated backrest for children up to a stature of 135 cm in phase 2 of R129
- Booster cushions without a backrest are kept in R44 at this stage
- Propose for the interim a modification of the requirements for booster cushions without a backrest in R44 that prohibits their use for children with a stature below 125 cm
- This proposal will:
  - facilitate the discussion and decision in the IWG CRS
  - allow a short-term decision for phase 2 of R129
  - allow the time for discussion about booster cushions without a backrest
  - improve child safety for large children

# KEY CHANGE IN INFORMAL GROUP DIRECTION AT ITS 50TH MEETING GERMANY

- Proposal for Phases 3 (and 4)
- Discuss strategy for the introduction of booster cushions without a backrest
- Discuss strategy for the future of Regulation no. 44
- Discuss promotion of installation of iSize and IsoFix in cars
- Promote and expand concept and use of i-Size

# KEY CHANGE IN INFORMAL GROUP DIRECTION AT ITS 50TH MEETING EC

- How will we be successful to promote ISOFIX?
  - i-Size is the key
  - Small car (Polo, Fiesta, C3, Clio, V40, ...)
  - 2x positions is acceptable
- Larger family car (S-max, Touran, XC90, ...)
  - 3x proposed gabarit side-by-side NEVER FITS
  - 3x side-by-side CRS IS A MUST for this type of cars
- Proposal
  - Create i-Size cars for i-Size products / adapt cars and CRS

# KEY CHANGE IN INFORMAL GROUP DIRECTION AT ITS 50TH MEETING EC

- Ease of use (plug & play)
  - Extend the i-Size philosophy
  - One size 'gabarit' fits all
- Avoiding misuse
  - Aim for plug & play solutions above to reduce the complexity of systems in the market
- Side impact & New dummies
  - Complete the analysis work
  - Make improvements where necessary
- Make i-Size standard across the board
  - Restrict the width of booster seat gabarit to 440 mm
    - Consistent with maximum width in Phase 1
    - Will fit 3-across larger family vehicles

# Booster Seat Design

Comparison of Regulation requirements:



R44 Booster Seat  
Average width 480-540mm

| Regulation 44<br>CRS   | Regulation 129<br>Enhanced CRS  |
|--|---|
| <ul style="list-style-type: none"> <li>• Frontal impact test (P3, P6, P10)</li> <li>• Energy absorption test</li> <li>• No side impact test</li> <li>• No external design restrictions</li> <li>• No internal design restrictions</li> </ul> | <ul style="list-style-type: none"> <li>• Frontal impact test (Q3, Q6)</li> <li>• Energy absorption test</li> <li>• Side impact test (Q3, Q6)</li> <li>• External geometry restrictions</li> <li>• Internal geometry restrictions</li> </ul> |



R129 Booster Seat  
width 440mm

• Subjected to same consumer tests (Q3, Q6, Q10)

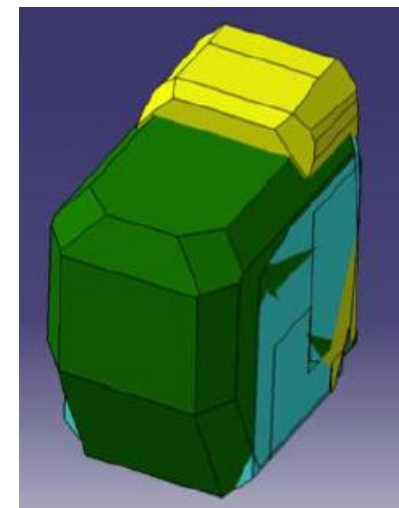
• Experience same real world use in vehicles & accidents

# R129 Booster Seat External Geometry

Proposal : Limit TF4 fixture to 440mm width

Aim: Allow 3x Booster Seats in rear of family vehicles

| Positive  | Negative   |
|---|--|
| <ul style="list-style-type: none"><li>• Anticipated to improve compatibility<ul style="list-style-type: none"><li>• Same width as R2 &amp; F2X fixtures</li><li>• Believed to allow 3 Booster seats to fit in large family cars</li></ul></li><li>• Simplify vehicle handbook</li></ul> | <ul style="list-style-type: none"><li>• Potential decrease in safety<ul style="list-style-type: none"><li>• Reduced space to provide side impact protection material</li><li>• Not able to protect larger children</li><li>• Perform worse than equivalent R44 seats (480-540mm)</li></ul></li></ul> |



ISO Fixtures  
(440mm)

Compatibility with vehicles?

Consequences for safety?

# Compatibility with vehicles

- Aim: Allow 3x Booster Seats in rear of family vehicles
- Question: How many vehicles can fit 3x 440mm width CRSs?

## Measurement Investigations

- CLEPA (CRS-52-03e) presented findings from installation trails
  - 2x 520mm fixtures fitted in 49/49 vehicles
  - 3x 440mm fixtures fitted in 19/49 vehicles
  - With isofix 5/49
- Findings from German Workshop:
  - 3x 440mm fixtures fitted in small number of vehicles
  - 3x 520mm fixtures did not fit in any vehicles
  - Found 3x R44 child seats fit in more vehicles than 3x fixtures !

Compromise between 440mm and 520mm?





# Compatibility with vehicles

- Aim: Allow 3x Booster Seats in rear of family vehicles

Question: Is there a compromise between 440mm and 520mm?

## Measurement Investigations

- CLEPA measurements would suggest that different widths would still allow 3x CRSs
  - 520mm – 0 vehicles
  - 500mm - ?
  - 480mm - ?
  - 460mm - ?
  - 440mm – 5 vehicles
- This suggests XXXmm would still allow 3x CRSs in the rear of vehicle , pending the necessary in-car installation checks



# Consequences for safety – R129 Limits

Aim: Allow 3x Booster Seats in rear of family vehicles

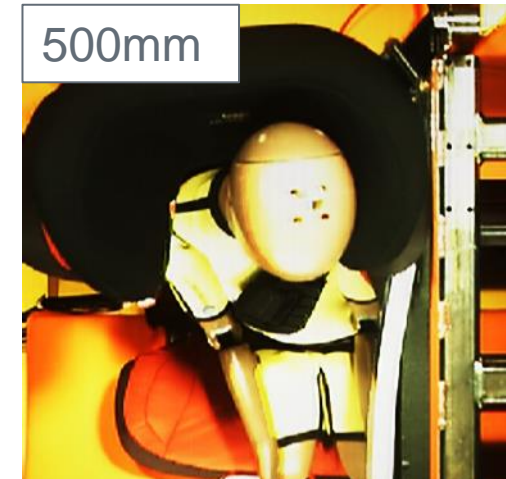
Question: What is potential safety reduction?

General trends seen from reducing the width of the booster seat R44 (~500mm) compared to 440mm

| Body Region          | Q3 | Q6 | Q10 |
|----------------------|----|----|-----|
| Head Movement        | ↑  | ↑  | ↑*  |
| Head Resultant (3ms) | ≈  | ↓  | ↑   |
| HPC15                | ≈  | ↓  | ↑   |
| Neck Fz              | ↑  | ↑  | ≈ ↑ |
| Neck Mx              | ↑  | ↑  | ↓   |

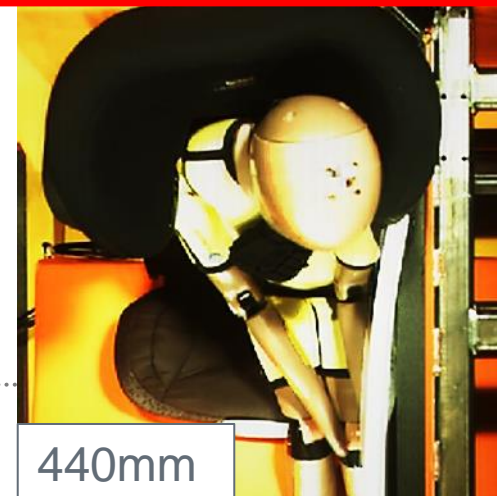
|   |   |                      |
|---|---|----------------------|
| ≈ | = | Similar              |
| ↓ | = | Reduction (Positive) |
| ↑ | = | Increase (Negative)  |

\*Q10 exceeds excursion plane



500mm

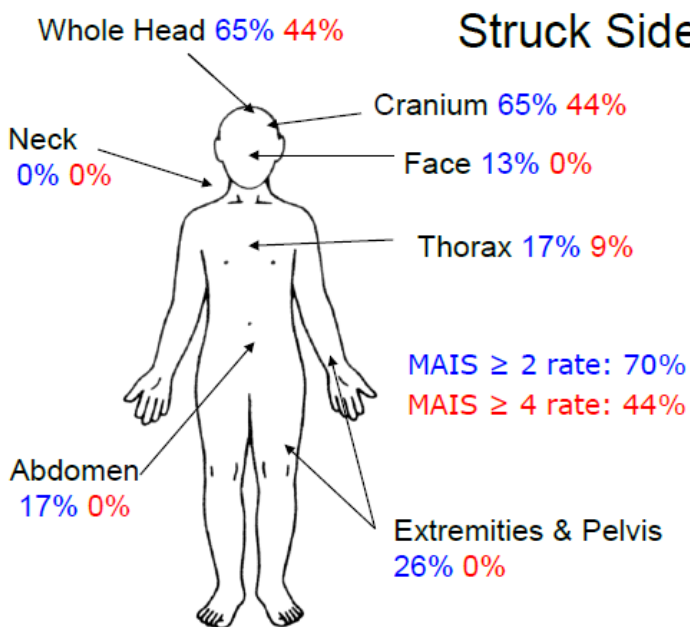
All dummies have poorer head support



440mm

# Additional body regions

R129 focuses on head, other important body regions should be considered:

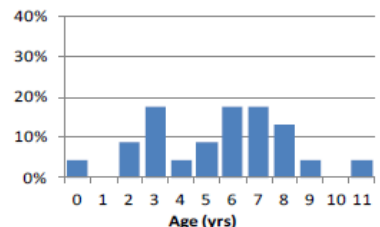


Neck, Thorax and Abdominal regions inc the spine.

## Struck Side – Boosters (23)

Serious injuries are distributed across the body regions but the head is the most injured body region at the AIS  $\geq 2$  level followed by the extremities, with thorax and abdomen also featuring at 17%

At the AIS  $\geq 4$  level the head features as the most injured body region followed by thorax



## Body Regions:

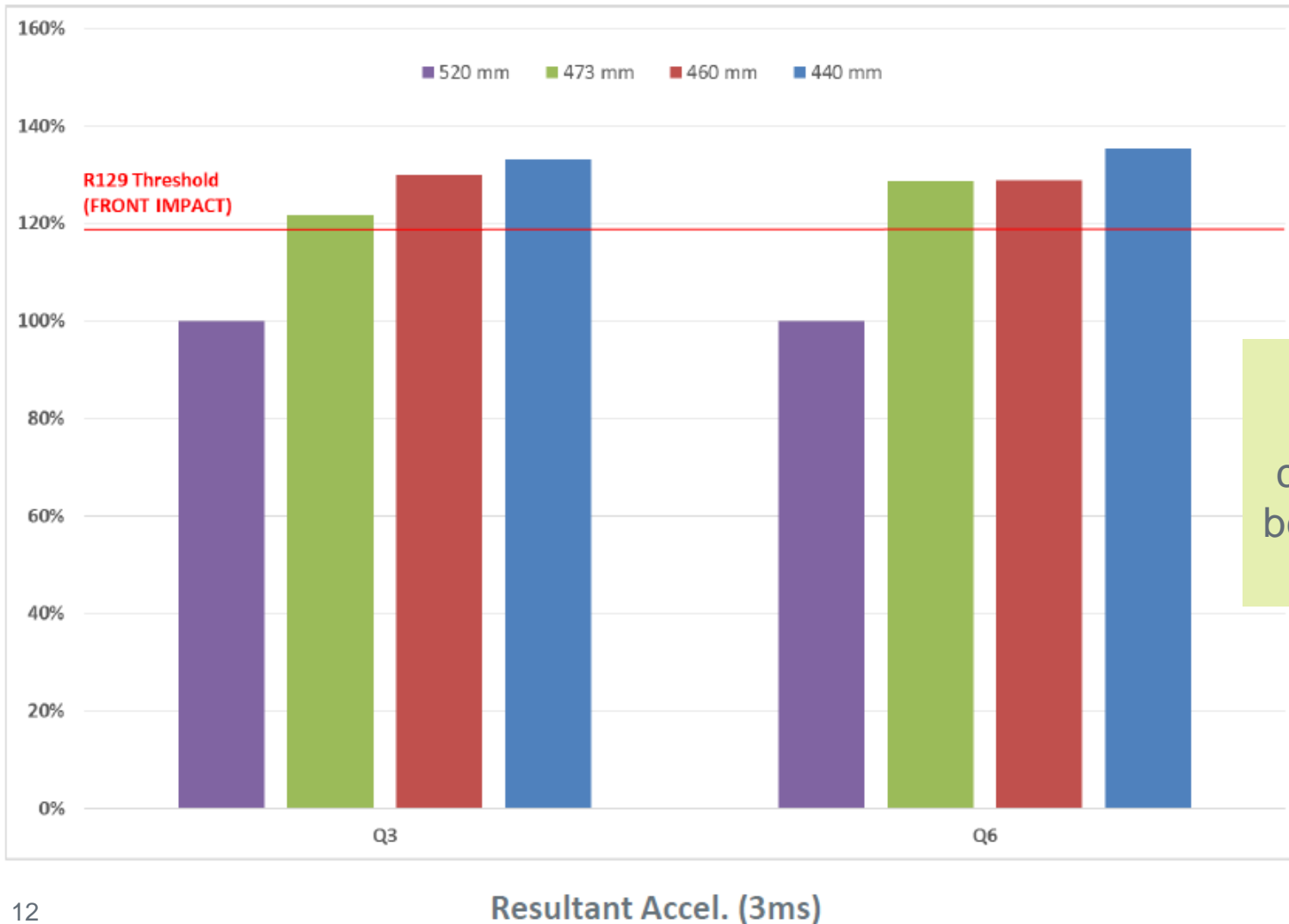
- Head – R129
- Chest Acceleration
- Chest Deflection
- Pelvis

Most are assessed by consumer testing

# Consequences for safety

## Chest accelerations

Chest loading is increased when booster width is reduced



Data suggests compromise between 473-520mm

# Consequences of amending stature range

Range that Q6 represents was modified to 105-135cm

Comparison of Q6 and Q10 to 125cm and 135cm children

| Measurement     | Q6       | 125  |  | 135  | Q10       |
|-----------------|----------|------|--|------|-----------|
| Stature         | 1143 ± 9 | 1250 |  | 1350 | 1443 ± 9  |
| Sitting Height  | 601 ± 9  | 702  |  | 744  | 748 ± 9   |
| Shoulder Height | 362 ± 7  | 443  |  | 479  | 473 ± 7   |
| Shoulder Width  | 305 ± 7  | 333* |  | 333* | 334.8 ± 7 |
| Hip Width       | 223 ± 7  | 291* |  | 291* | 270 ± 7   |

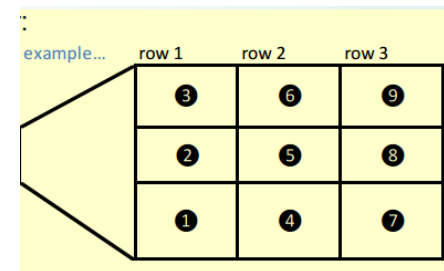
Q6 not representative of a seated 135cm child

\*As modified by CLEPA proposal CRS-53-06

Based on CLEPA proposal Q10 should still be used to test booster seats – enhanced safety over R44 CRSs

# Vehicle handbook proposal

- R16 compatibility table (Annex 17, Appendix 3, Table 3) is complicated for consumer i.e. (i-U, U-B, UC, i-UF)
- Simplify: Yes/No or ✓ / x
- State which Specific ISOFIX Class (A, B etc.)



|  | Row 1 |                |             | Row 2             |   |                   | Row 3          |   |   |
|--|-------|----------------|-------------|-------------------|---|-------------------|----------------|---|---|
| CRS Type                                     | 1     | 2              | 3           | 4                 | 5 | 6                 | 7              | 8 | 9 |
| R129 i-size Child Restraint System           | X     | Not Applicable | X           | ✓                 | X | ✓                 | Not Applicable |   |   |
| R129 Universal (i-size) Booster Seat         | X     |                | ✓           | ✓                 | X | ✓                 |                |   |   |
| R129 Specific Vehicle (ISOFIX & Top Tether)  | X     |                | X           | B,B1              | X | B,B1              |                |   |   |
| R129 Specific Vehicle (ISOFIX & Support Leg) | X     |                | B,B1<br>D,E | A,<br>B,B1<br>D,E | X | A,<br>B,B1<br>D,E |                |   |   |

# Summary

Proposal: Limit TF4 fixture to 440mm width

Aim: Allow 3x Booster Seats in rear of family vehicles

| Issues   | Result   |
|--|--|
| <ul style="list-style-type: none"><li>• How many vehicles can fit 3x 440mm width fixtures ?</li><li>• What is potential safety reduction?</li><li>• Does Q6 represent a 135cm child?</li><li>• Can the vehicle handbook be simplified?</li></ul> | <ul style="list-style-type: none"><li>• Very few (5/49)</li><li>• Poorer containment for Q3, Q6</li><li>• No containment for Q10</li><li>• Increased chest loading (all)</li><li>• Perform worse than R44 CRSs</li><li>• Q6 does not represent a seated 135cm child, Q10 should be used</li><li>• Yes, remove need for complicated key</li></ul> |

# Conclusions

- The IG targets have been re oriented in March 2015 with important propositions , one of which is the reduction of the F4 fixture width.
- Limiting TF4 fixture to 440mm width only allows 3x fixtures in a small minority of current vehicles
- Need to assess seating position for i-size and Universal Booster Seat
- 440mm width will result in a reduction in safety (head containment & chest protection) compared to current R44 CRSs (not enhanced)
- The German workshop has shown that fitting 3 R44 seats in a row today ( 500 mm width ) is possible.
- Compromise width of 480 - 500 mm (?) would mean no reduction in safety compared to current R44 CRSs



# Conclusions (2)

- Q10 should be used to evaluate CRSs designed for 135cm children in front & side impact\* – will improve design
- A simplified vehicle handbook approach can still be applied (compared to today)
- Approval modes as a function of size
  - 100 – 135 cm : Universal
  - 136 – 150 cm : Vehicle Specific (in the sense of semi universal)

*\*When injury criteria will be available*

# Proposal

- Current TF4 fixture is 520 mm wide
- Clepa needs a minimum of 500 mm
  - [95 P of 135 cm shoulder width 369 mm + Side wing current R44 products 70 mm + 70 mm ] = 509 mm
- Suggest to IG to wait for full conclusions from the German worksho before deciding the final width
- This compromise should mean:
  - Protection for 3, 6, 10 year-olds
  - Higher or comparable performance relative to existing R44 CRSs
  - Promoting 2 i-size CRSs in every vehicle
  - 3 i-size 440 mm CRSs may fit in a small number of larger vehicle
- ~~IG to discuss the naming of non integral R129 seats : i-Size ?~~

R129 Booster Seat  
Width XXXmm

