



C L E P A

*European Association of
Automotive Suppliers*

Side impact protection in non-integral CRS – First feedback on 440 mm

52nd Meeting of the UN Informal
Group on Child Restraint Systems

18-06-15

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ISO BOOSTER VOLUME DEVELOPED IN CLOSE COLLABORATION BETWEEN OICA AND CLEPA



List of Interactions

10 **worst-case** vehicles selected by OICA (assessed during BAST workshop)
3 vehicles no interaction issues found

Vehicle	Attachment	Position	Issue	Comment
Audi A1	ISO Belt	Outer Outer	No Latch C-Pillar	
Ford Fiesta	Belt	Middle	Buckling	
Mitsubishi Space Star	ISO	Outer	C-Pillar	1 of 2 Fixtures
Suzuki SX4	Belt	Middle	Buckling	Waiting on vehicle availability (rare car)
Vauxhall Adam	ISO	Outer	C-Pillar	1 of 2 Fixtures
Vauxhall Zafira	Belt/ISO	Outer	Door	
Porsche Panamera	ISO	Front Outer	No Latch	Waiting on vehicle availability (rare car)

7



Summary of Interaction Investigation

5 vehicles assessed further

- 1 vehicle: the fixture fitted with no interactions – no action required
- 1 vehicle: the fixture did not fit in middle position – position not suitable
- 3 vehicles: had minor interaction – modifications proposed

Vehicle	Attachment	Position	Issue	Comment
Audi A1	ISO Belt	Outer Outer	No Latch C-Pillar	Propose modification
Ford Fiesta	Belt	Middle	Buckling	Position not suitable
Mitsubishi Space Star	ISO	Outer	C-Pillar	Propose modification
Vauxhall Adam	ISO	Outer	C-Pillar	Fixture fits
Vauxhall Zafira	Belt/ISO	Outer	Door	Propose modification

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Source: CRS-47-03e, Britax

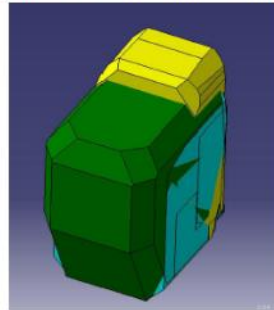
- Assessment volume adapted following two joint CLEPA-OICA workshops and further assessment by Britax
- Volume fits outboard seating position of cars

CRS MANUFACTURERS ARE BEING ASKED TO REDUCE WIDTH OF BOOSTER ASSESSMENT VOLUME

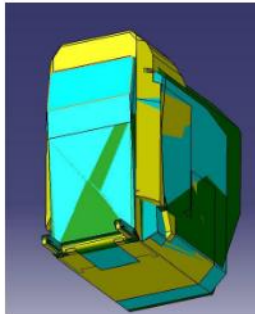


Make i-Size standard across the board

- And restrict the width to 440 mm
 - Consistent with maximum width in Phase 1
 - Will fit 3-across larger family vehicles



Internal market,
Industry,
Entrepreneurship
and SMEs



Source: CRS-50-04e,
European Commission

- Extend i-Size seating position to 135 cm
- Justification is to ensure three (max. size) CRS will fit in “larger family cars”
 - Euro NCAP incentive to include three i-Size positions

CAR MANUFACTURERS ARE BEING ASKED TO ALIGN SEAT BELT AND ISOFIX ANCHORAGES



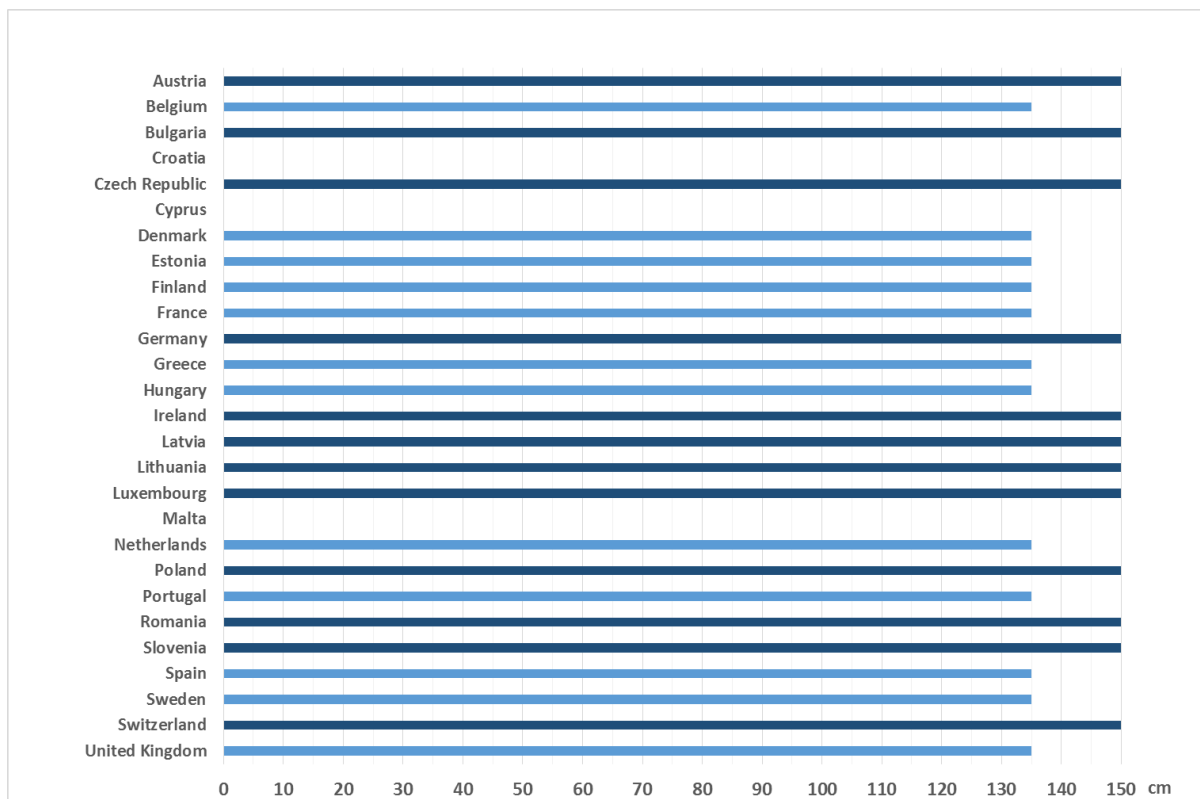
i-Size across the board -- way forward

- We need to think outside of the box
- Car manufacturers to install more ISOFIX when the smaller 'gabarit' facilitates this
- CRS manufacturers to make innovative products

Internal market,
Industry,
Entrepreneurship
and SMEs

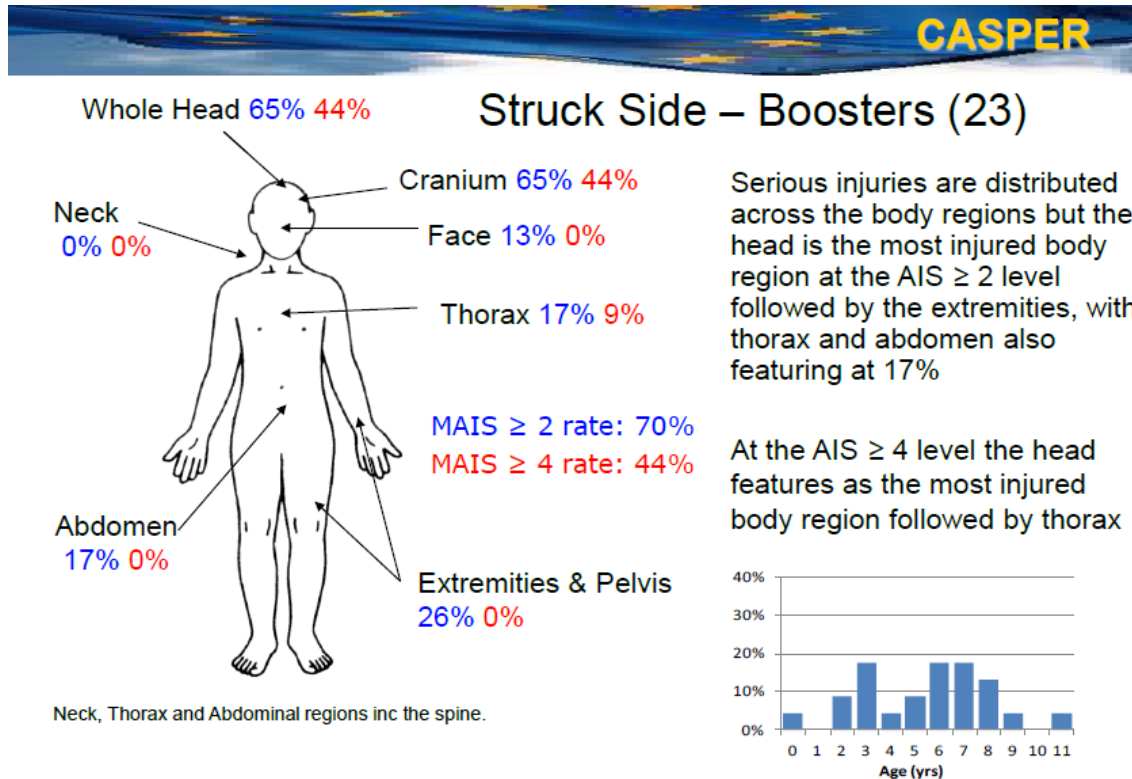
- Requires significant change to current vehicles

WE WELCOME 135 CM LIMIT IN R129, BUT BOOSTER SEATS ACCOMMODATE LARGER CHILDREN THAN INTEGRAL CRS AND SOME STATES ADOPT 150 CM



- EU seat belt wearing legislation specifies CRS use to 150 cm
 - Many member states choose not to take the 135 cm exemption

HEAD IS THE PRIORITY BUT BOOSTER SEATS MUST PROVIDE PROTECTION TO OTHER BODY REGIONS




















Source: Kirk 2012,
COVER – CASPER &
EPOCH Final Workshop

- Regulatory thresholds are applied to the head only, but CRS manufacturers aim to protect all body regions

OVERVIEW OF CLEPA INVESTIGATION



		Q3		Q6		Q10	
		440 mm	520 mm	440 mm	520 mm	440 mm	520 mm
R129	Dynamic						
	Simulations						
Consumer Test	Dynamic						
	Simulations						



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Implications of 440 mm and effect of CRS width in R129 test environment

- Simulation and testing**



Results R129 side impact

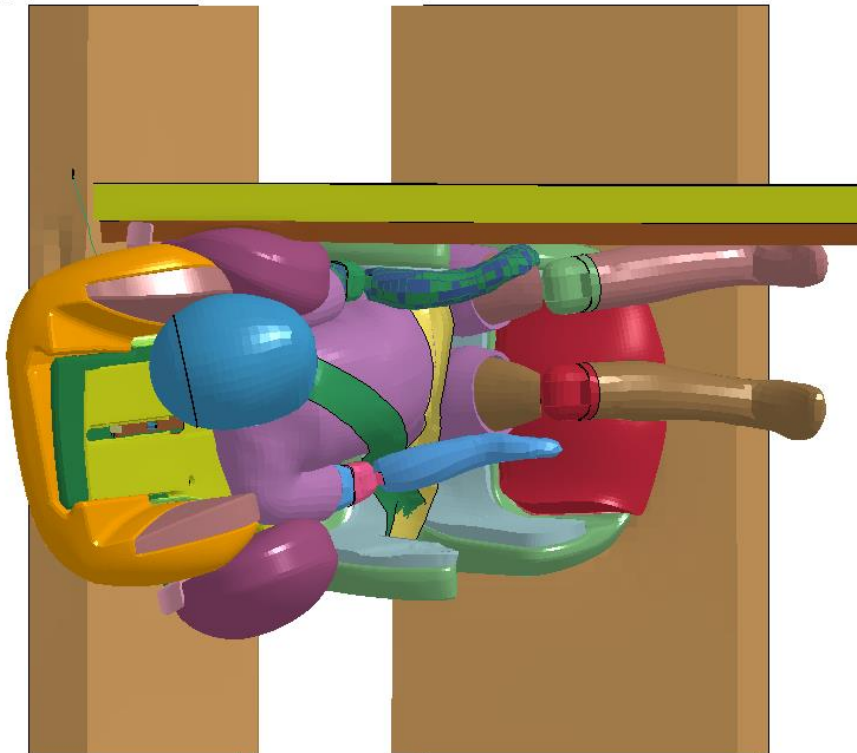
Q3

	HIC	Head Acceleration (g)	Chest Acceleration (g)	Upper Neck force (N)	Upper Neck Moment (Nm)
R129 threshold	174%	129%			
Q3 Standard seat	100%	100%	100%	100%	100%
Q3 Adapted seat	88%	124%	179%	100%	106%

Results R129 side impact

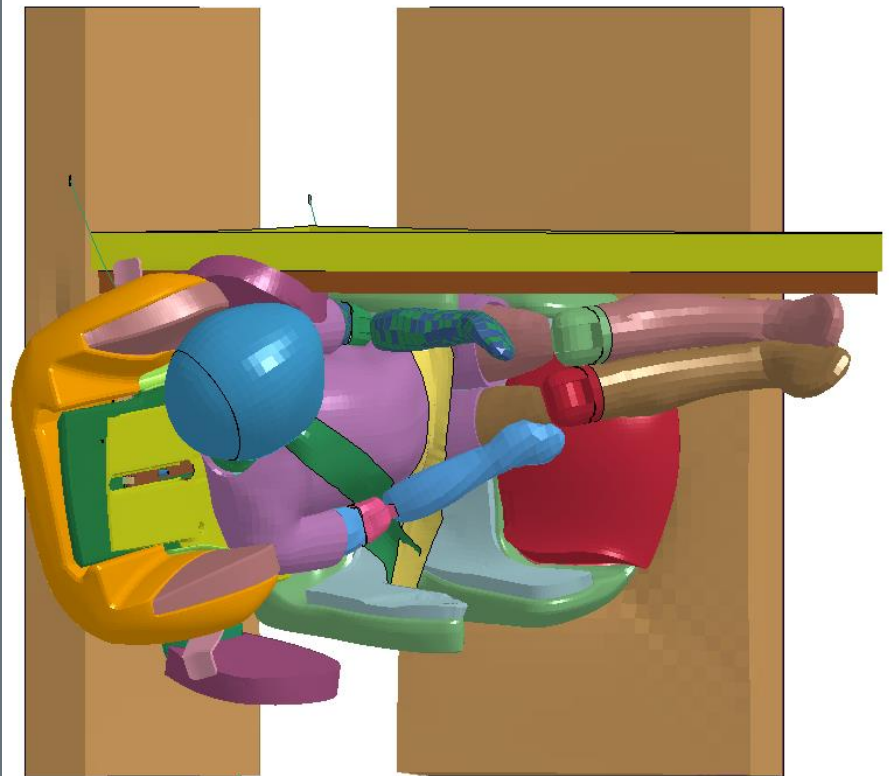
Q3

Post



Standard seat

Post



Adapted seat



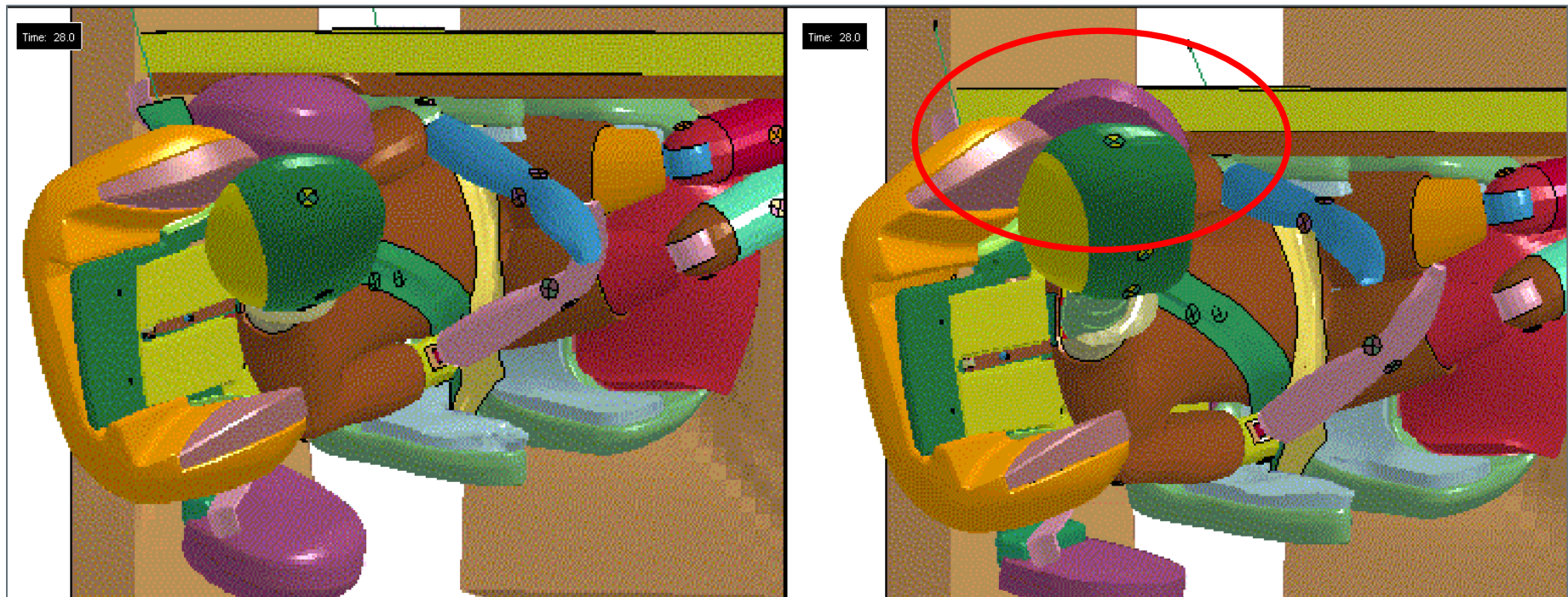
Results R129 side impact

Q6

	HIC	Head Acceleration (g)	Chest Acceleration (g)	Upper Neck force (N)	Upper Neck Moment (Nm)
R129 threshold	254%	133%			
Q6 Standard seat	100%	100%	100%	100%	100%
Q6 Adapted seat	107%	107%	144%	115%	132%

Results R129 side impact

Q6



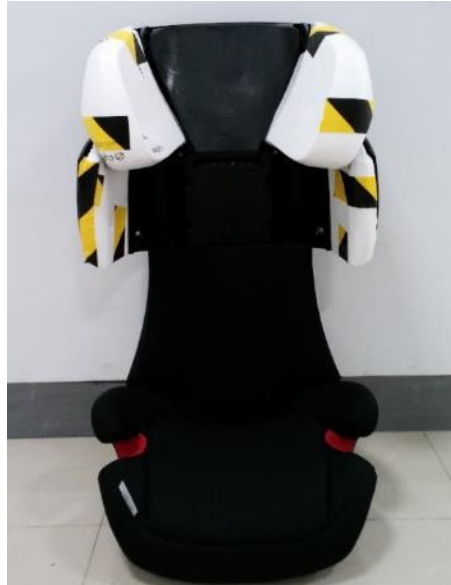
Standard seat

Adapted seat

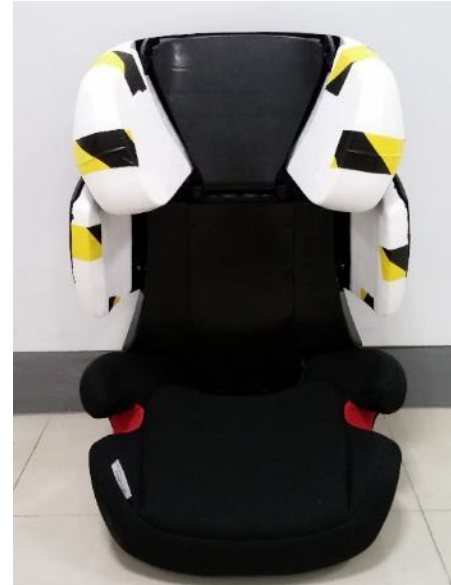
OVERVIEW OF CYBEX PROTOTYPES



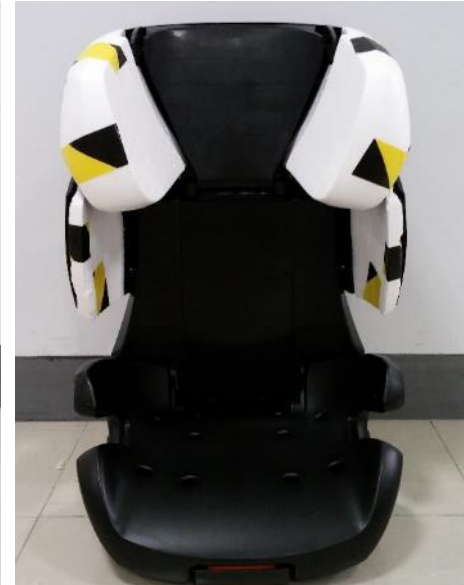
520 mm



473 mm



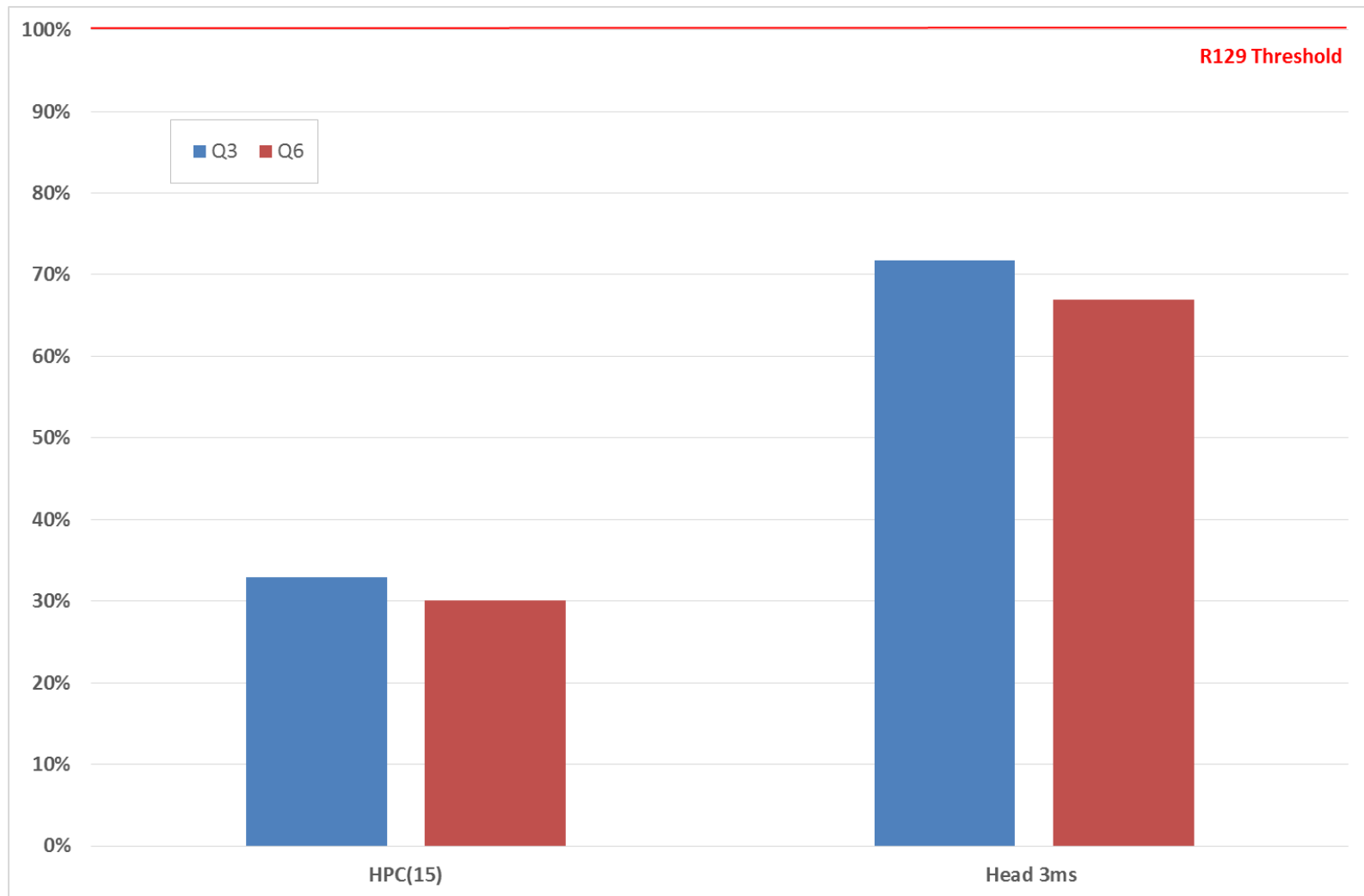
460 mm



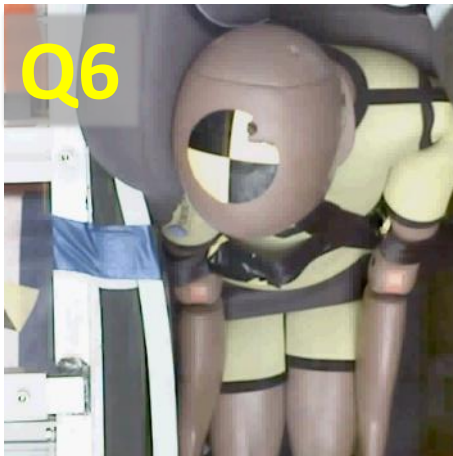
440 mm

- Internal dimensions – 95th percentile 135 cm
- Prototypes differ in shoulder / chest side wings only
 - Head wings / padding consistent across prototypes
- R129 side impact tests with Q3 and Q6

R129 PERFORMANCE REQUIREMENTS ACHIEVED WITH 440 MM – HEAD SPECIFIED ONLY



HEAD CONTAINMENT ACHIEVED WITH 400 MM, BUT HEAD IS CLOSER TO PANEL



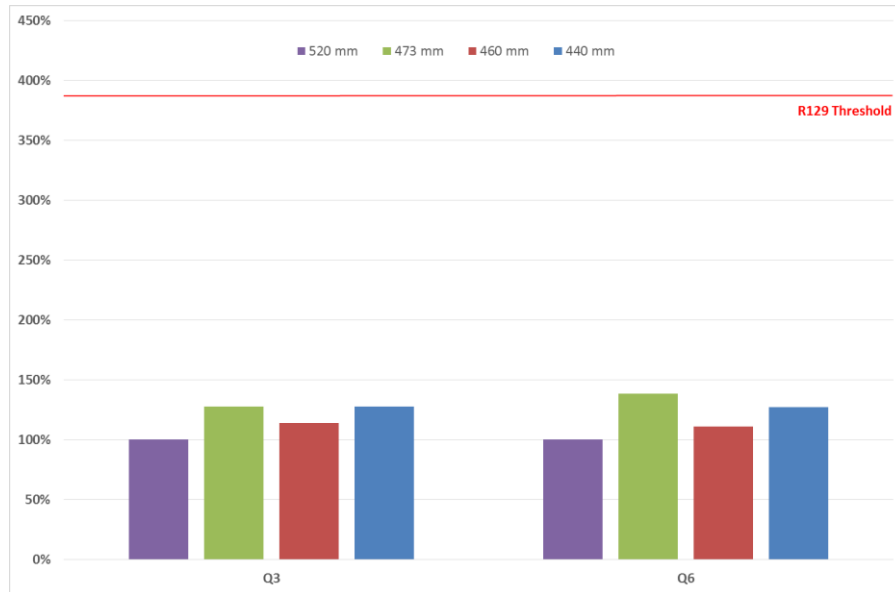
440 mm

460 mm

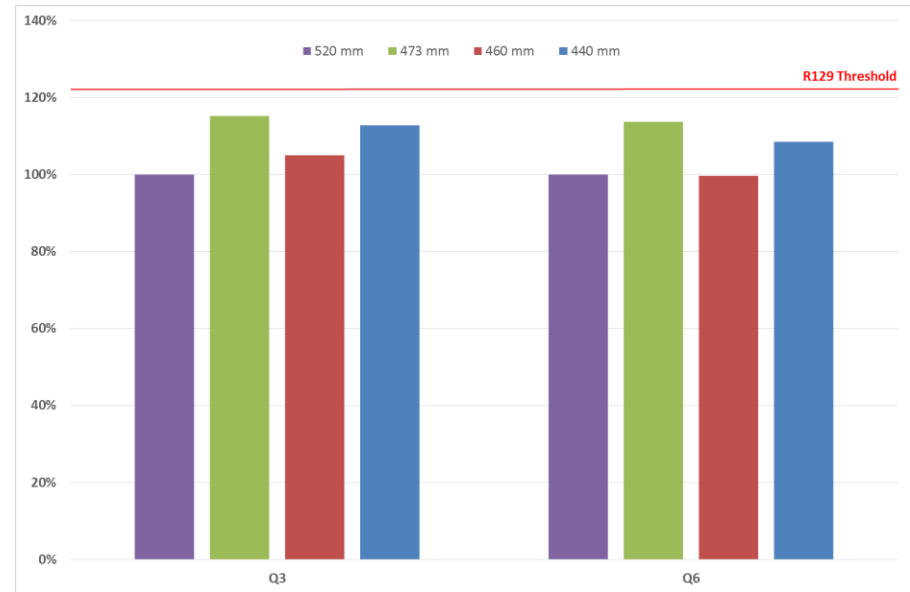
473 mm

520 mm

R129 HEAD REQUIREMENTS CAN BE MET BUT ENHANCED PROTECTION OFFERED BY LARGER BOOSTER



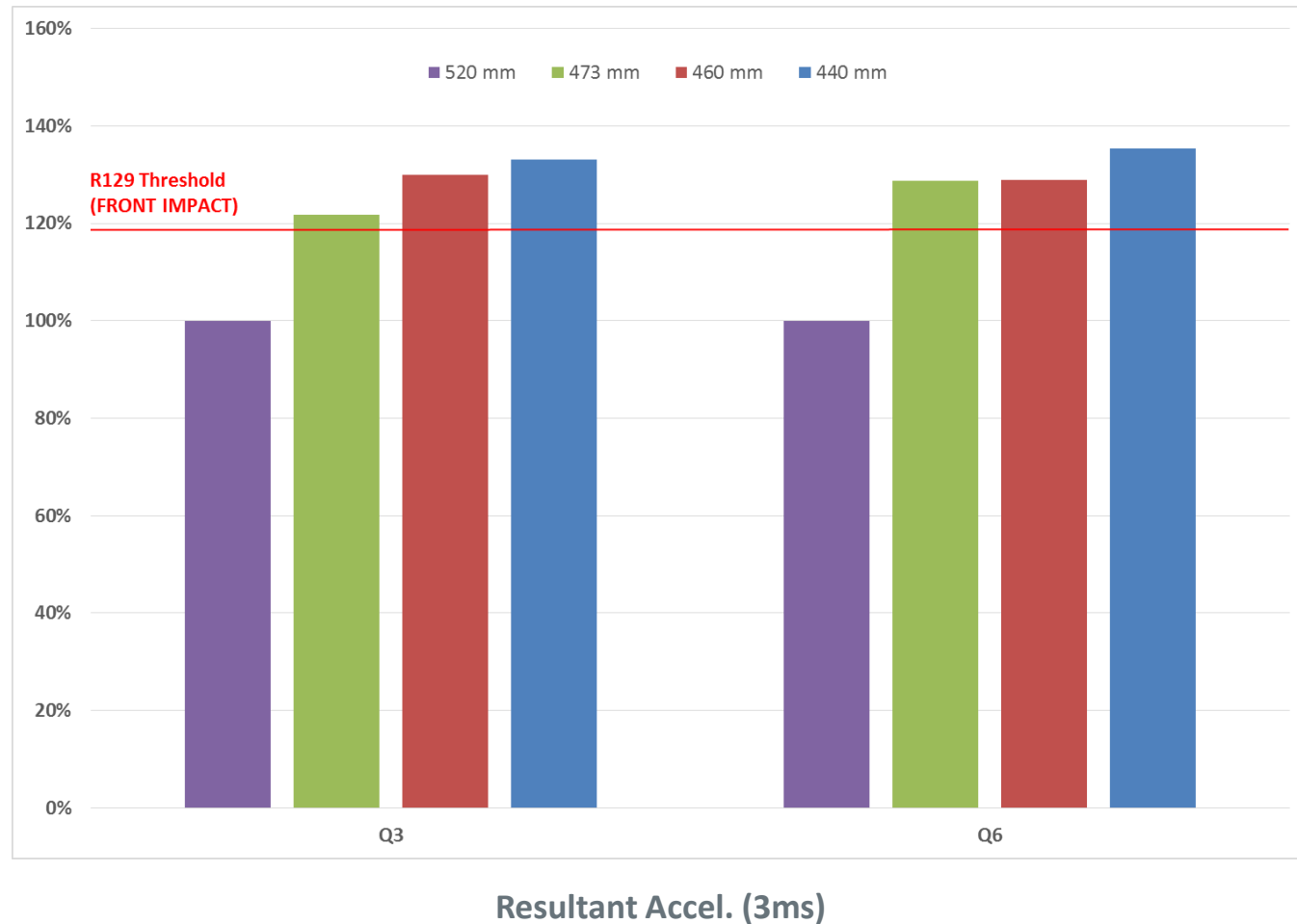
HPC(15)



Resultant Accel. (3ms)

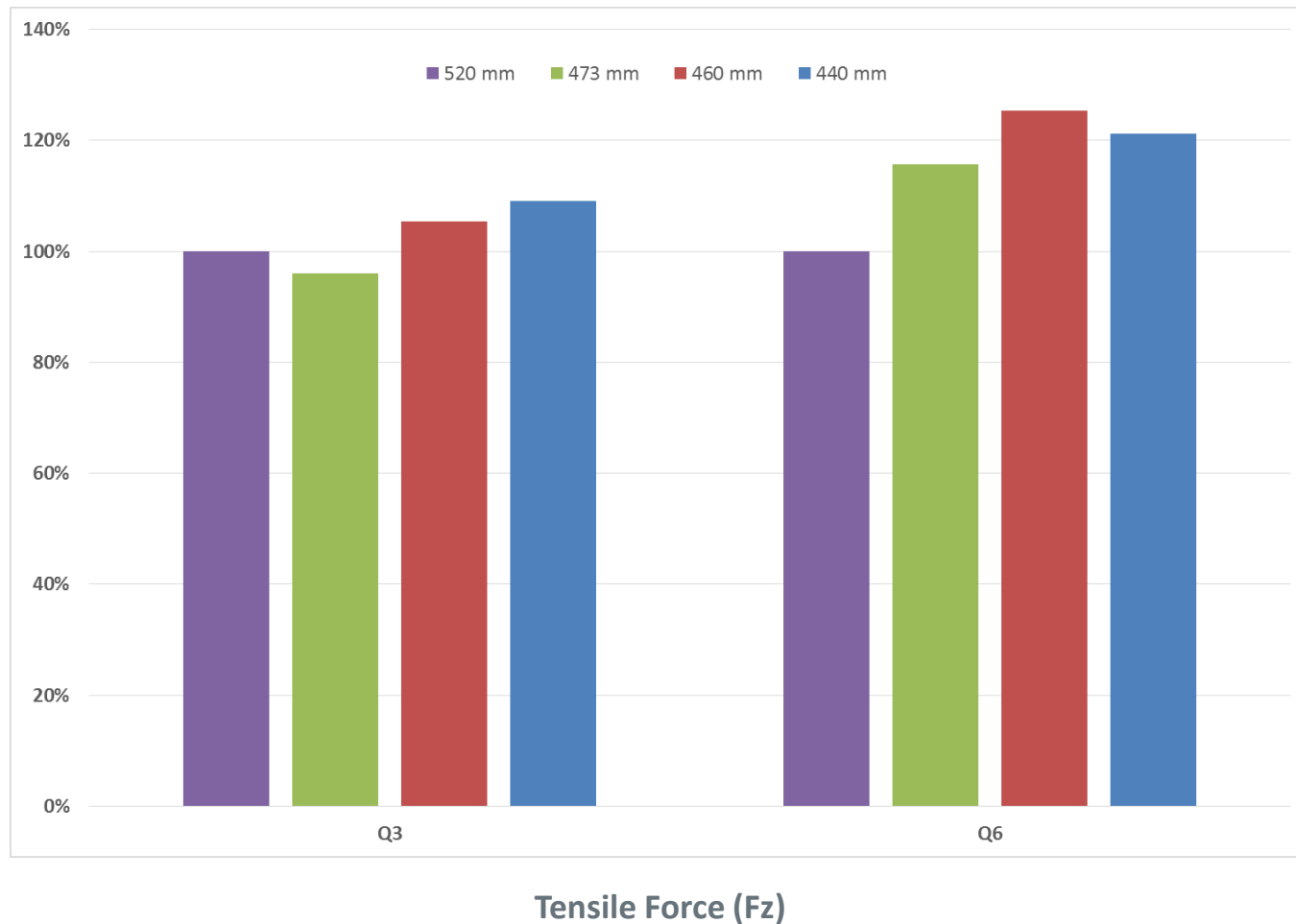
- Shoulder / chest wing width influences head protection
- Step improvement in performance offered by 520 mm

CHEST PROTECTION IS SEVERELY COMPROMISED WHEN BOOSTER WIDTH IS REDUCED



- Step improvement in performance offered by 520 mm

NECK PROTECTION IS ALSO COMPROMISED WHEN BOOSTER WIDTH IS REDUCED



- Step improvement in performance offered by 520 mm

Test Matrix - Britax



R129 side impact test method

CRS Version	Q3	Q6	Q10
500mm wide Booster	Lab 1 & Lab 2	Lab 2	Lab 1
460mm wide Booster	Lab 1 & Lab 2	Lab 2	Lab 1
440mm wide Booster	Lab 1 & Lab 2	Lab 2	Lab 1

Modified Kidfix XP - Width of backrest varied





Testing Results Summary

General Trends seen from reducing the width of the booster seat:

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

≈	=	Similar
↓	=	Reduction
↑	=	Increase

Q3 Kinematics

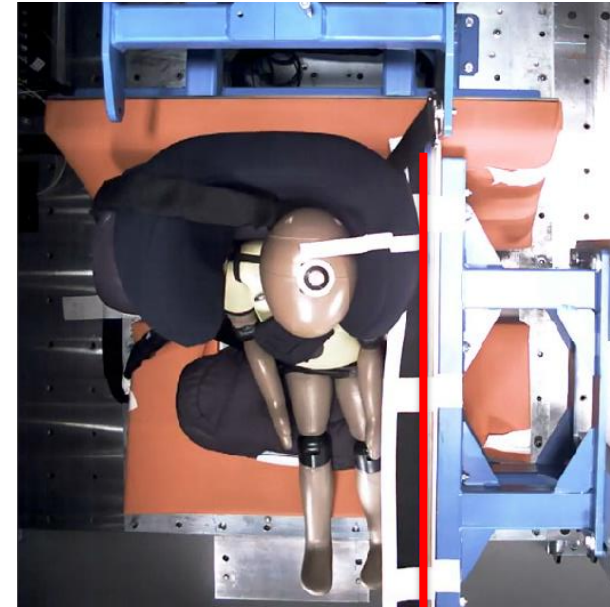
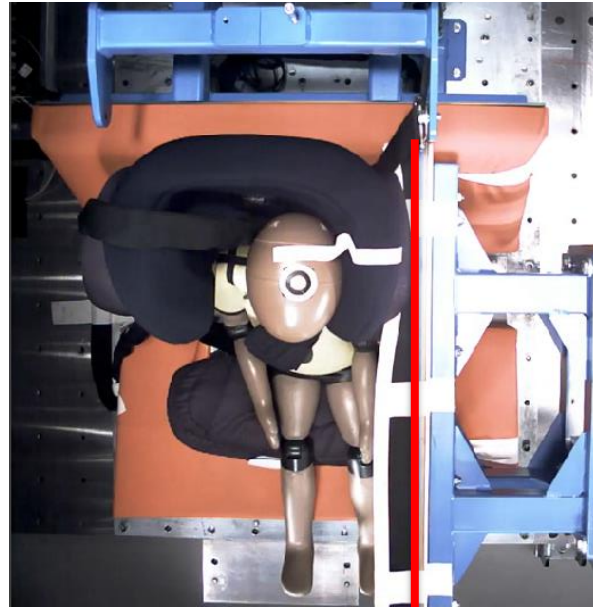
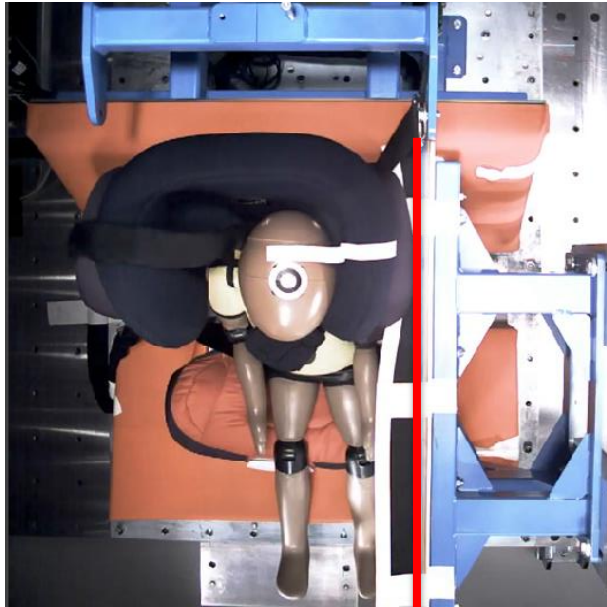
Excursion increases as
booster width decreases



Standard

460mm

440mm



Distance to containment plane:

123mm
@ 45 ms

113mm
@ 46 ms

98mm
@ 49 ms

Q6 Kinematics

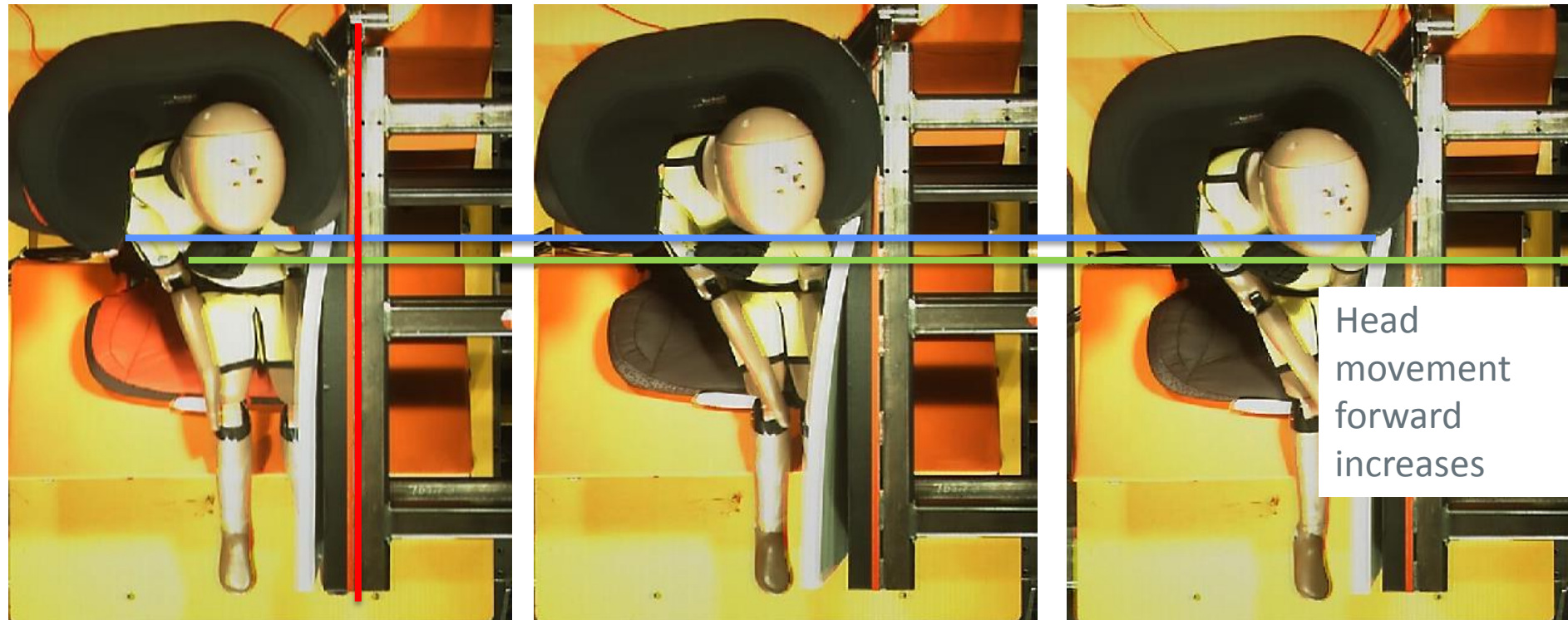
Excursion and head roll increases as booster width decreases



Standard

460mm

440mm



Distance to containment plane:

88mm
@ 45 ms

67mm
@ 48 ms

52mm
@ 51 ms

Q10 Kinematics

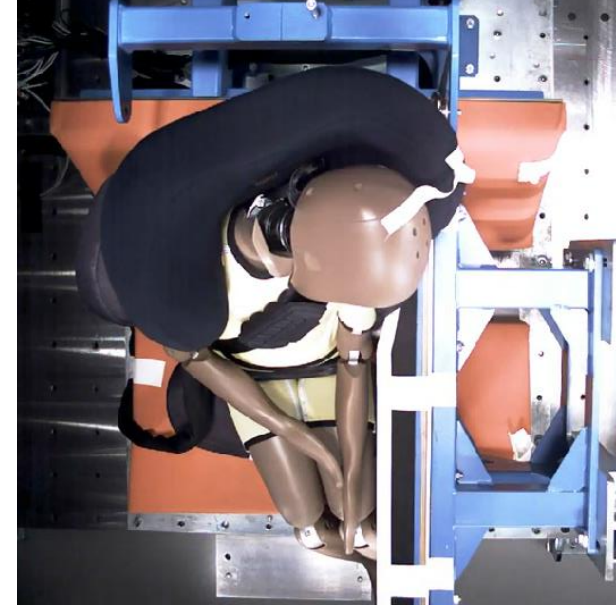
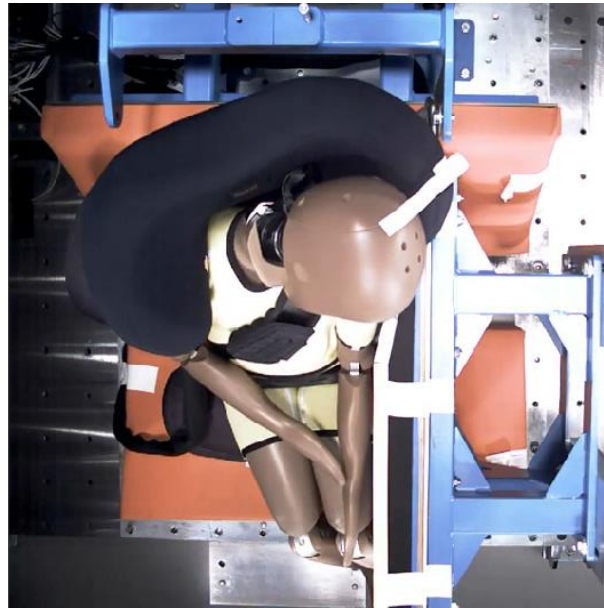
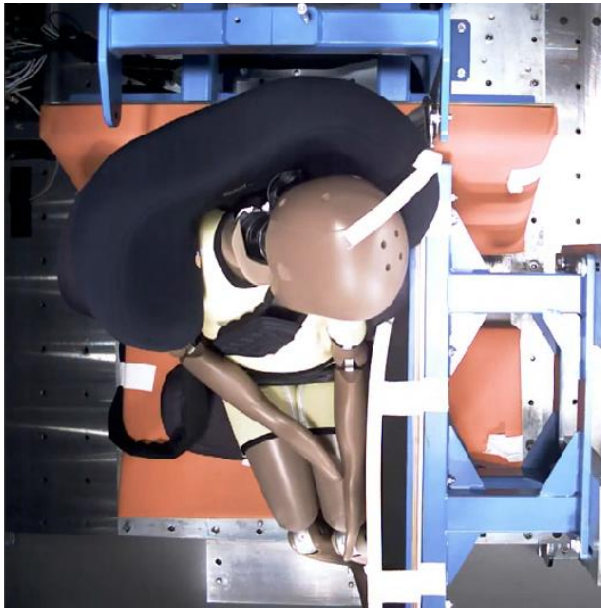
Excursion increases as
booster width decreases



Standard

460mm

440mm



Distance to containment plane:

0mm
@ 65 ms

-18mm
@ 68 ms
(Containment plane crossed)

-23mm
@ 70 ms
(Containment plane crossed)

Summary – Implications of 440 mm and effect of booster width in R129 environment



1. 440mm Booster:
 - a. Q3 – Passed R129 side impact requirements
 - b. Q6 – Passed R129 side impact requirements
 - c. Q10 – **Failed** R129 side impact requirements (Head not contained)
2. Q10 head not contained by any narrower booster seats
3. CRS performance degradation observed in other body regions
 - a. Neck and chest loadings increased for Q3, Q6
4. Dummy kinematic affected differently by backrest width reduction:
 - a. Q3 – Consistent kinematics, slight increase in neck bending
 - b. Q6 – Head movement around the head pad and towards the door increases
 - c. Q10 – Containment problems



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Implications of 440 mm and effect of CRS width in consumer test environment

- Simulation and testing

INTRODUCTION



Child Restraint System offers protection for children in cars fulfilling :

- Performance criteria in selected configurations representing car accidents
- Compatibility rules to be sure that the CRS fits properly in cars (universality)

CRS must be homologate according R44 or R129 to be sold in the Market.

Consumer Ratings distinguish products on the markets. CRS must reach a good or a very good rating to be a commercial success.

CONSUMER TESTS ARE AN IMPORTANT DESIGN CONSTRAINT – POOR PERFORMANCE CAN LEAD TO NEGATIVE PUBLICITY AND PRODUCT WITHDRAWALS



Which? advice: Don't Buy ...

rs/2015/05/which-advice-dont-buy -car-seat-404405

You are here: Which? home > News > 2015 > May > Which? advice: Don't Buy car seat

In this section

2015

- > June
- > **May**
- > April
- > March
- > February
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2014 >

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2010 >

2009 >

2008 >

2007 >

2006 >

2005 >

Which? advice: Don't Buy car seat

Belted base fails our frontal crash tests

28 May 2015

Which? is advising parents who own the [redacted] child car seat – and are using it with the base belted-in, forward-facing – to replace it. This seat was downgraded to our lowest test score of 0% following a failure in one of our key crash tests.


The [redacted] seat is sold as a package with a base included. The base can be fixed to your car by using Isofix connectors, or by using the car's adult seat belt.

If you have this car seat and are using it in a forward-facing, Group 1 mode, with the base attached to your car using the seat belt (and your car does not have Isofix connectors), our advice is to replace this car seat as soon as possible, following poor frontal-crash test results in this mode.

[redacted] crash test results

The [redacted] is an affordable, extended, rear-facing child car seat. It costs around £180 and the fact that it can be used rearward-facing up until 18kg, or your child is around four years of age, means many parents may be tempted to buy this car seat to keep their children rearward-facing for longer.

This child car seat has passed the official regulatory tests required by ECE R44/04 to be sold as suitable for children from birth up to 18kg (around four years old). But in our own, more demanding, crash tests it scored 0% overall for safety – the lowest test score possible. Our crash tests are conducted at higher speeds and forces than the current R44.04 UK standards require.



Group 1 forward-facing, belted base: the seat of the [redacted] tips forward from the base during the crash

Latest News

What is RSS?

NHS dentist access: real choice is out of reach

Top 5 cheapest energy deals for June

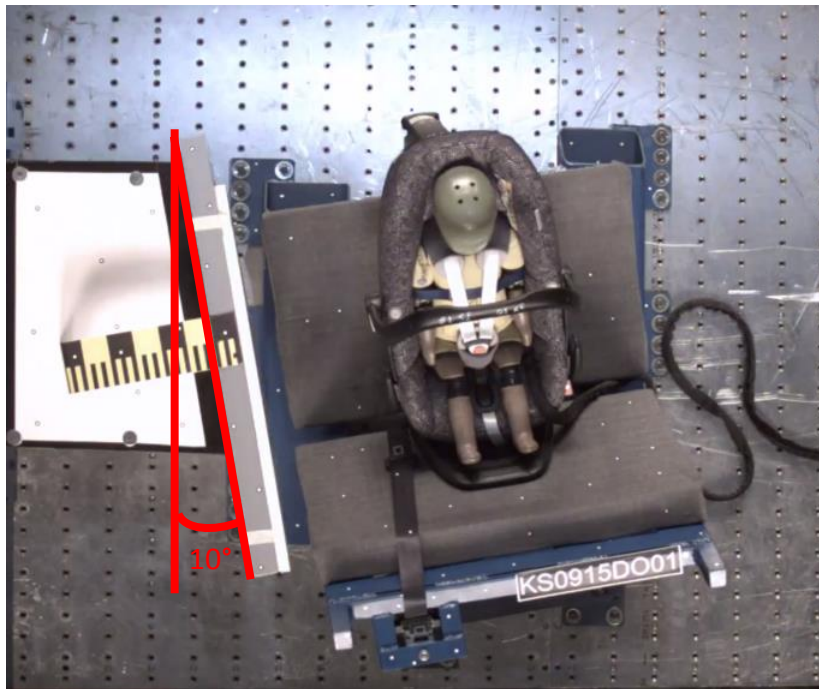
Public warned of bank scam texts threat

COMPARISON ETC/R129 SIDE IMPACT

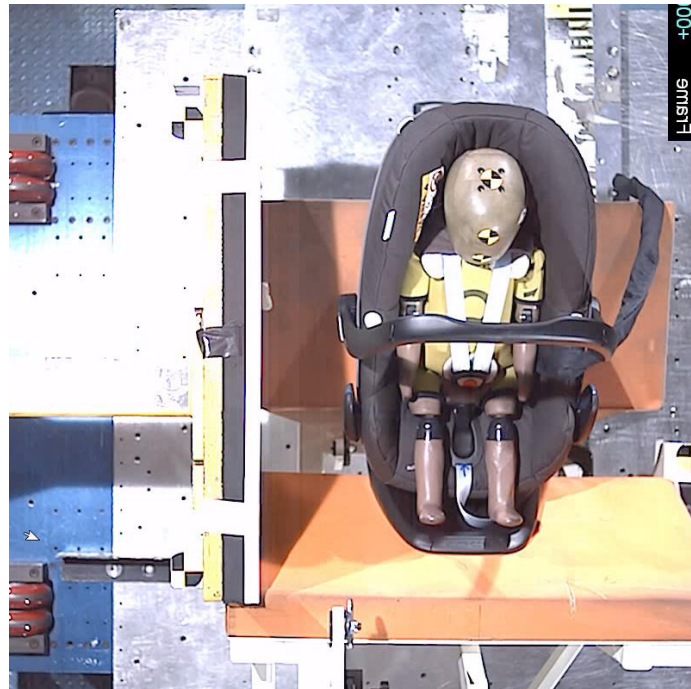


Overall Setup

ETC 2015



R129

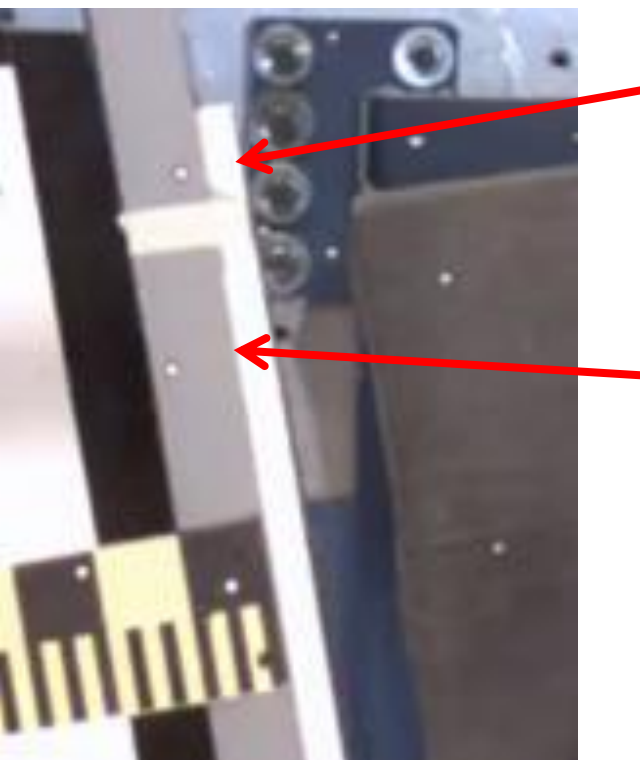


COMPARISON ETC/R129 SIDE IMPACT



Less padding in intruding door to represent door panel

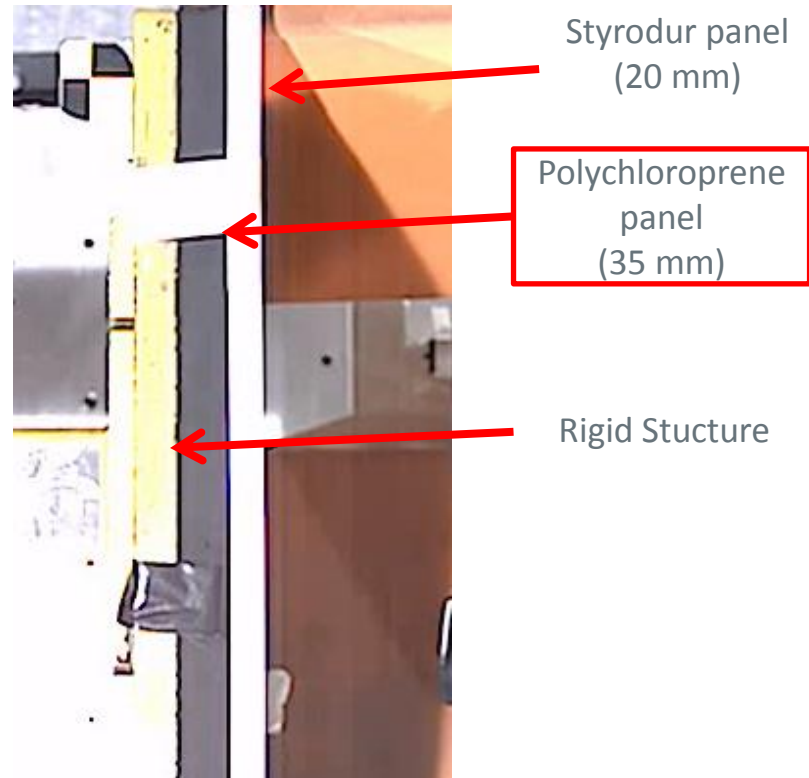
ETC 2015



Styrodur panel
(20 mm)

Rigid Structure

R129



Styrodur panel
(20 mm)

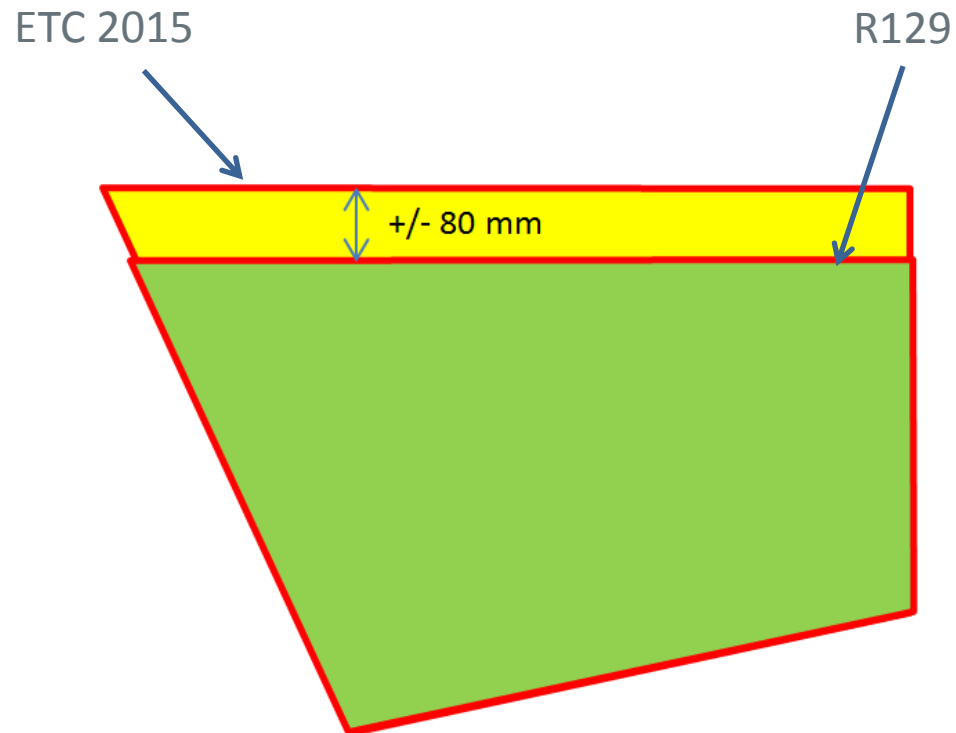
Polychloroprene
panel
(35 mm)

Rigid Structure

COMPARISON ETC/R129 SIDE IMPACT



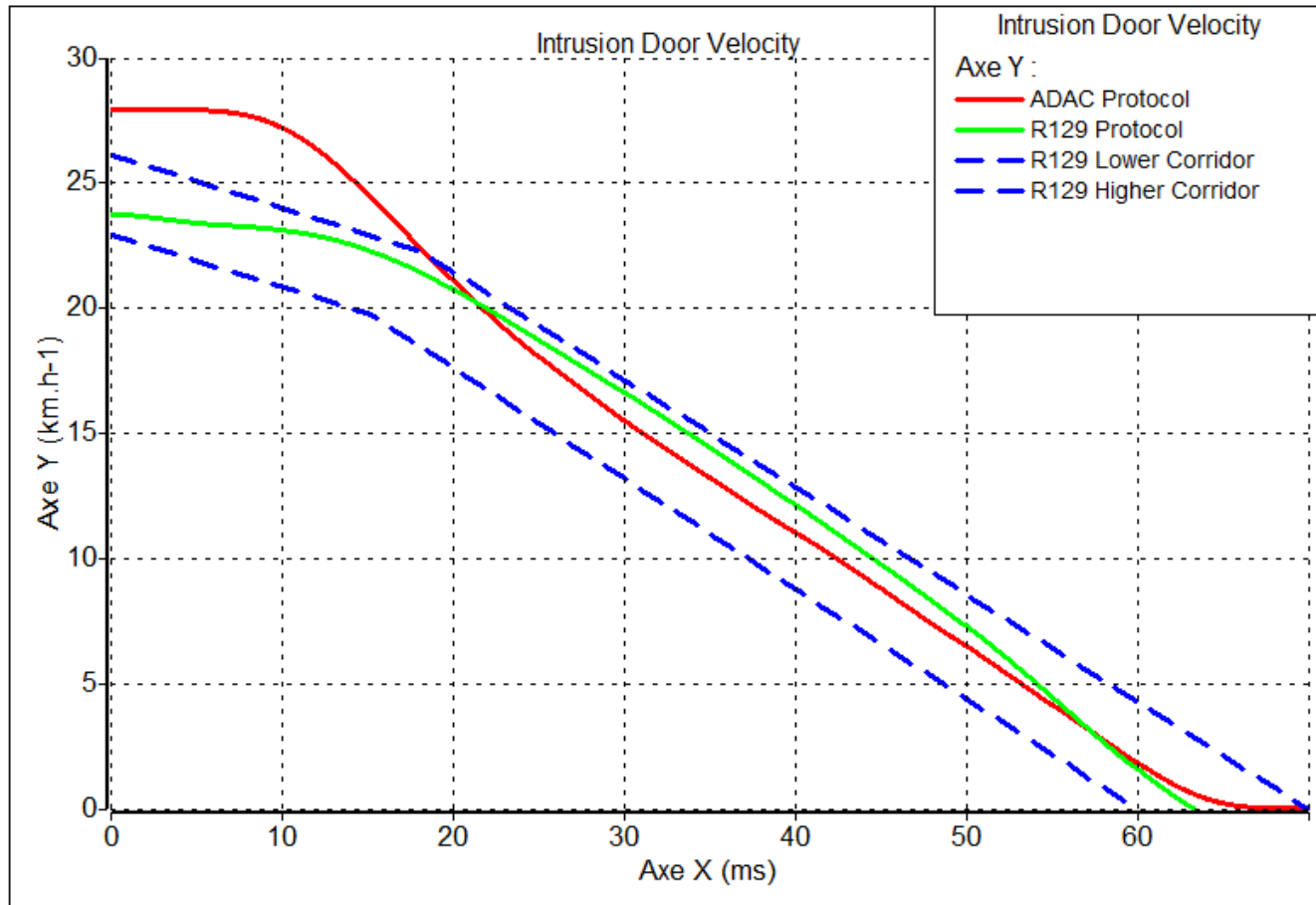
Higher Door



COMPARISON ETC/R129 SIDE IMPACT



Higher Intrusion speed

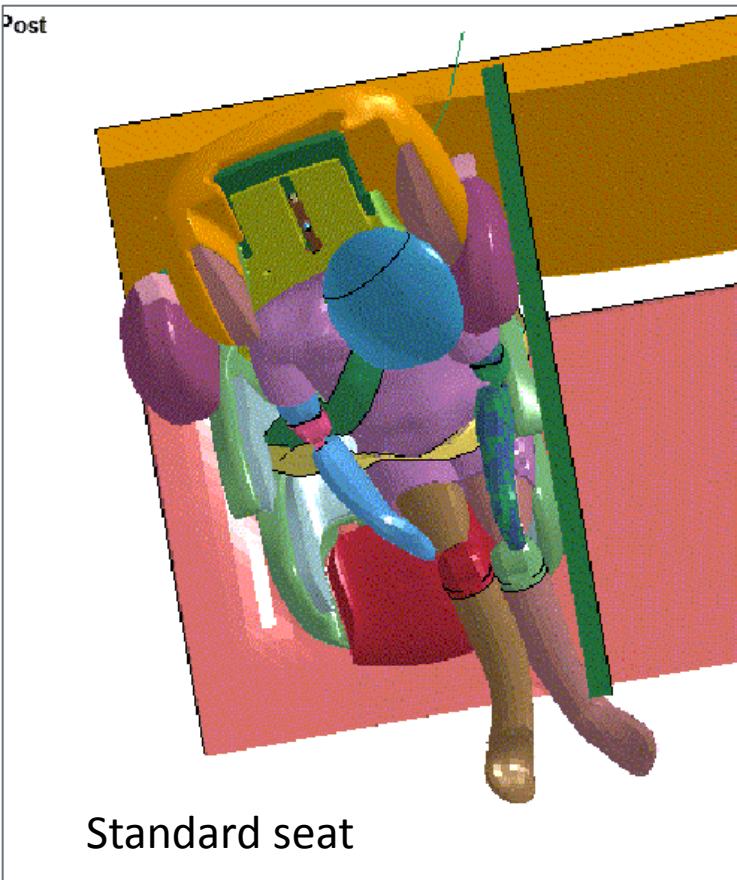




Results ETC-2015 side impact Q3

	HIC	Head Acceleration (g)	Chest Acceleration (g)	Upper Neck force (N)	Upper Neck Moment (Nm)
Q3 Standard seat	100%	100%	100%	100%	100%
Q3 Adapted seat	111%	168%	196%	84%	118%

Results ETC-2015 side impact Q3



LS-DYNA keyword deck by LS-PrePost
Time: 30.0 0.06





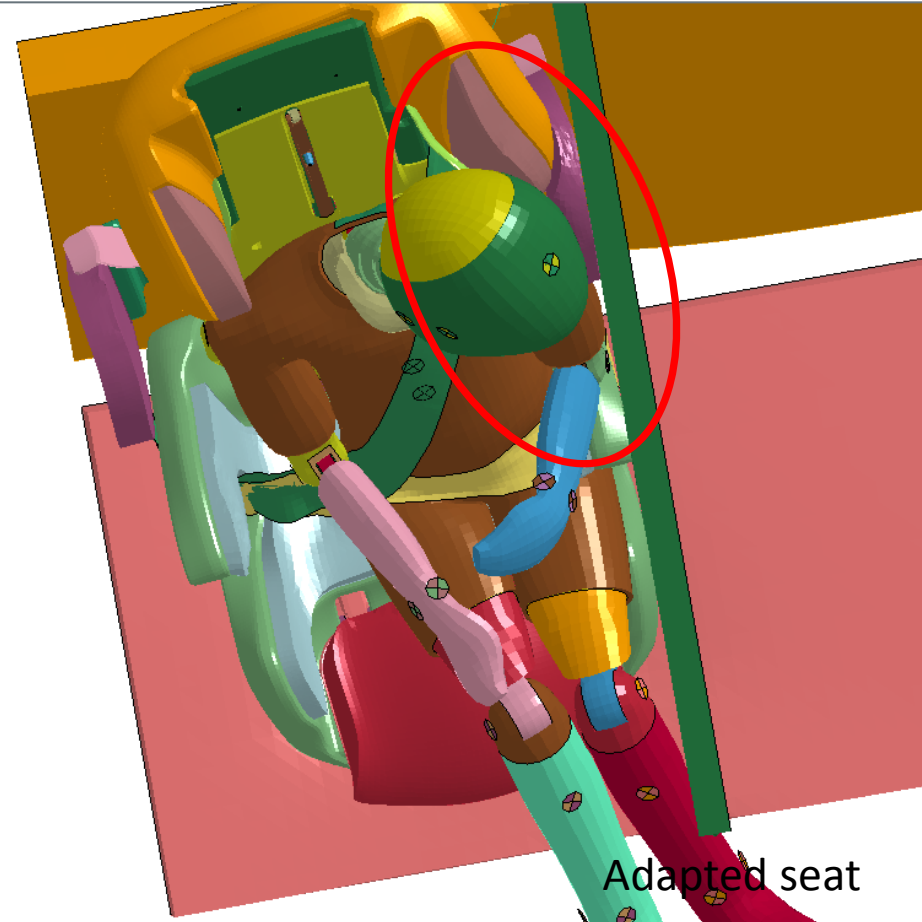
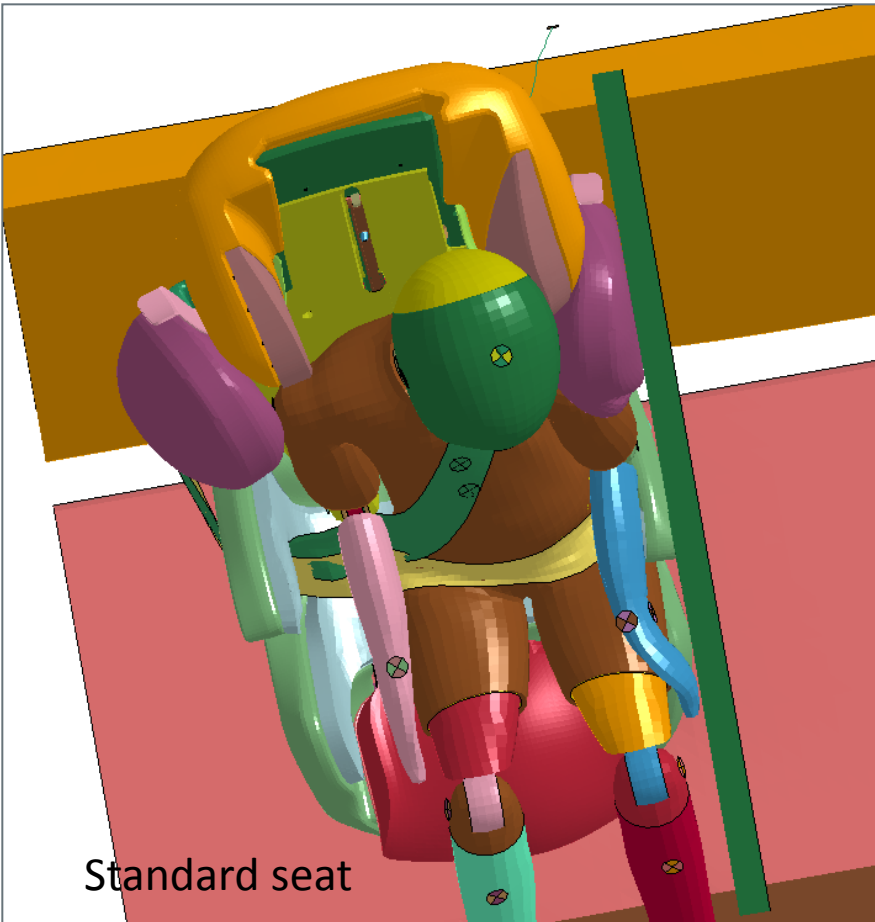
Results R129 side impact

Q6

	HIC	Head Acceleration (g)	Chest Acceleration (g)	Upper Neck force (N)	Upper Neck Moment (Nm)
Q6 Standard seat	100%	100%	100%	100%	100%
Q6 Adapted seat	153%	158%	225%	157%	120%

Results R129 side impact

Q6



COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



Tests with 440 mm wide prototype



Q3



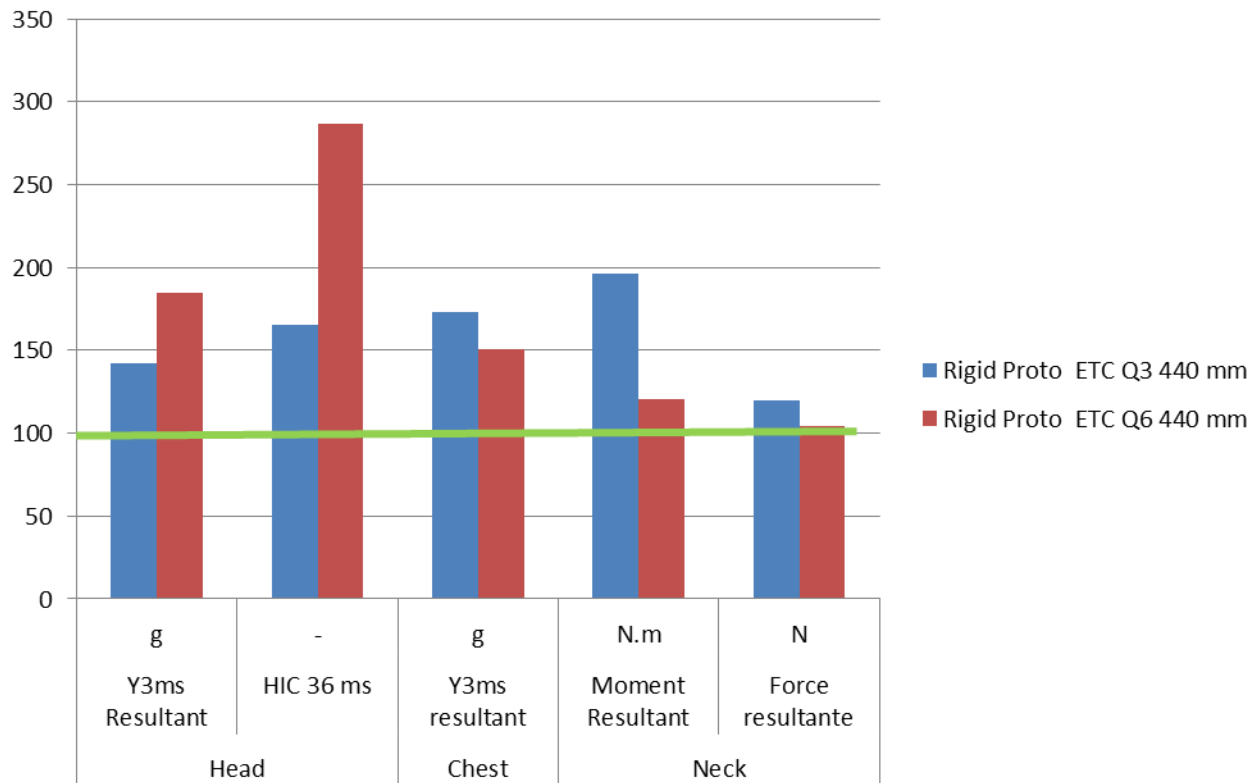
Q6

COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



Tests with 440 mm wide prototype – Comparison with ETC side impact criteria

Side Impact - Comparison ETC 2015 - R129
(reference 100 for R129)



Severity Increase
59 % for Q3
69 % for Q6

COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



ETC Side impact – Influence of product width with Q3



440 mm



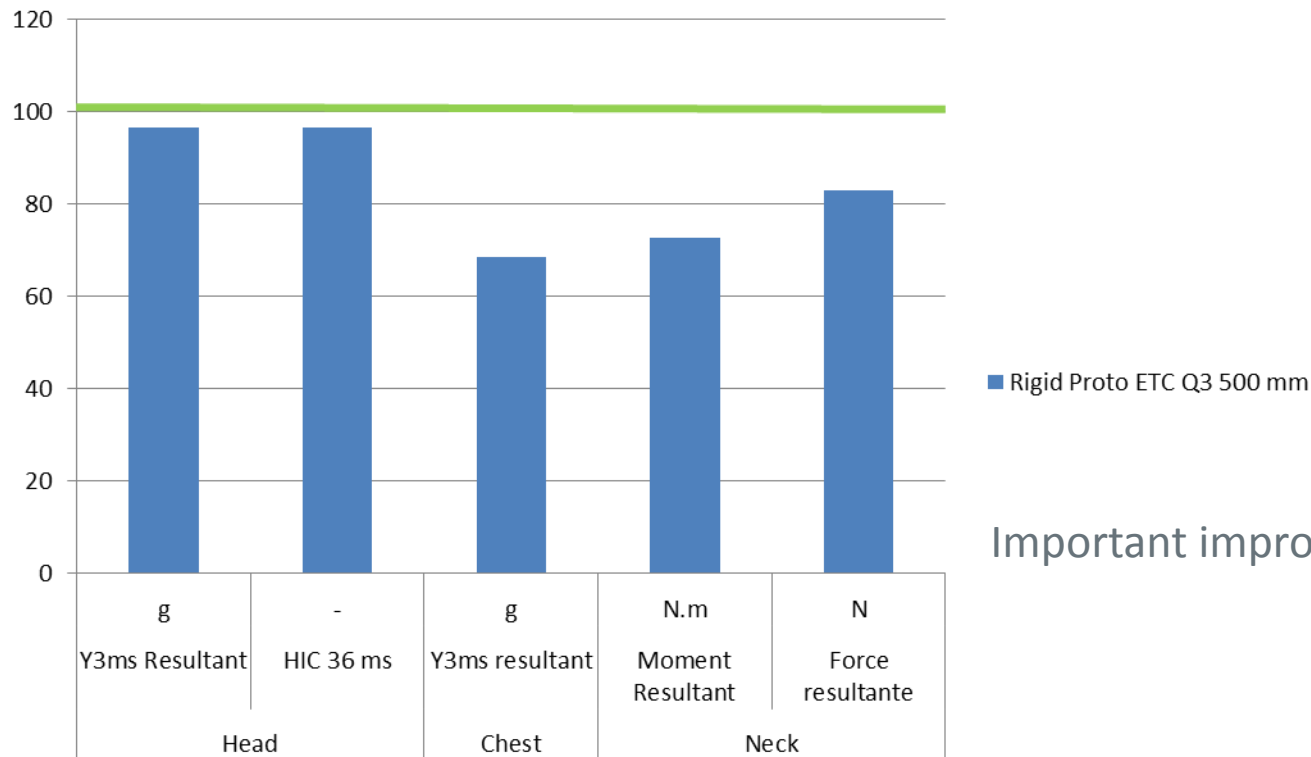
500 mm

COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



Side Impact ETC - Effect of width Increase Q3

(reference 100 for 440 mm width)



Improvement
17 % with 500 mm

Important improvement for chest and neck

COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



ETC Side impact – Influence of product width with Q6



440 mm



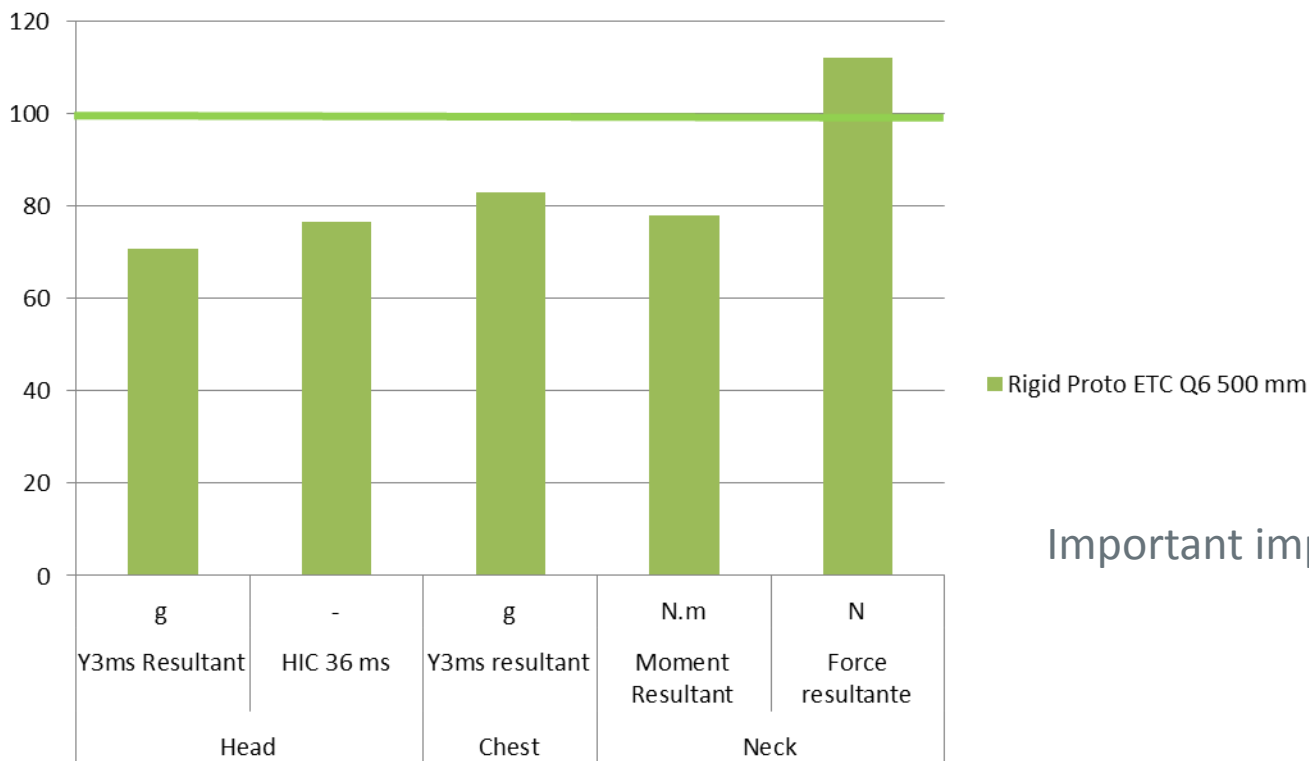
500 mm

COMPARISON ETC/R129 SIDE IMPACT – DOREL TESTING



Side Impact ADAC - Effect of width Increase Q6

(reference 100 for 440 mm width)



Improvement
16 % with 500 mm

Important improvement for head and chest

SUMMARY - IMPLICATIONS OF 440 MM AND EFFECT OF BOOSTER WIDTH IN CONSUMER TEST ENVIRONMENT



- ETC and Regulation side impact differ substantially :
 - Less door padding
 - More important intrusion speed
- ETC is much more severe compared to Reg 129.
- Increased product width offers possibility to reach better results.
- ETC seems to favor performance results in side impact when GRSP would like to favor car compatibility. These 2 requirements may be contradictory.
- Unintended consequences:
 - CRS manufacturers may be unable to produce i-Size boosters that achieve reasonable performance in consumer tests
 - CRS manufacturers may produce specific to vehicle boosters only, with potentially better ratings compared to i-Size universal products
 - Few i-Size boosters may come to the market

OVERALL SUMMARY



- R129 performance thresholds can be met with 440 mm with Q3 and Q6
- R129 performance thresholds cannot be met with 440 mm with Q10
- Reducing width of CRS leads to significant performance degradation in non-regulated body regions
- Acceptable consumer test performance cannot be achieved with 440 mm for all dummy sizes
 - CRS manufacturers reluctant to bring products to the market with such a risk
 - This may limit the penetration of i-Size booster seats



AVENUES FOR FURTHER INVESTIGATION - INTERNAL DIMENSIONS

INTRODUCTION



In order to be sure that ECRS accept children of a certain stature, 95th centile dimensions are checked in the ECRS.

This requirement is very demanding for the higher stature :

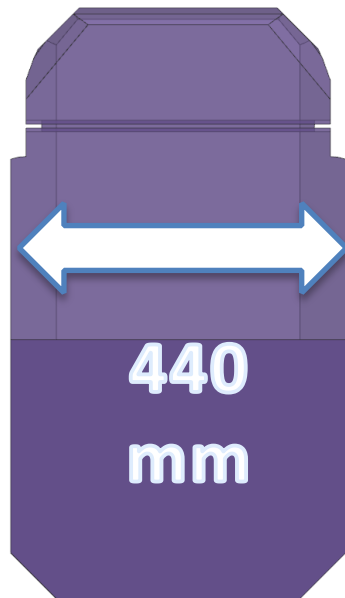
	HIII 5th	135 cm 95th	150 95th
Hip Breadth (mm)	307	330	379
Shoulder Breadth (mm)	358	369	415



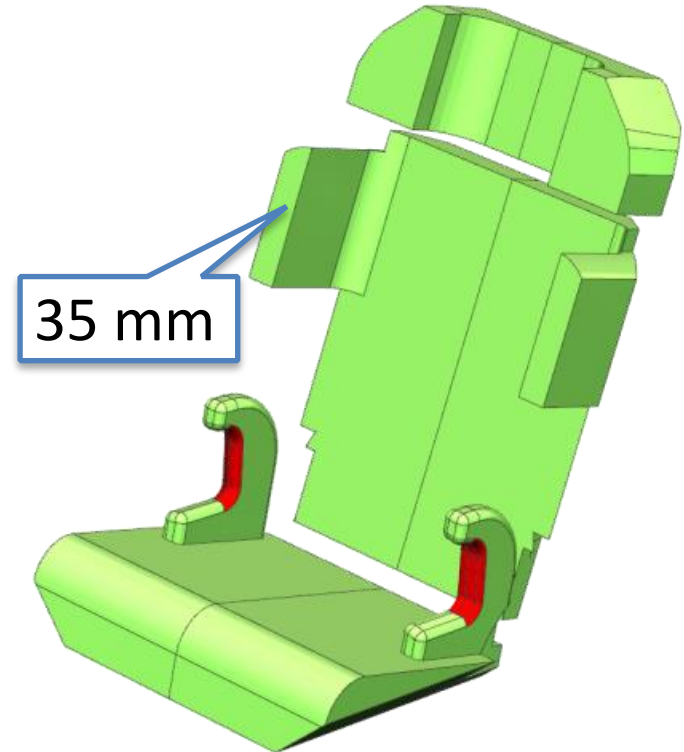
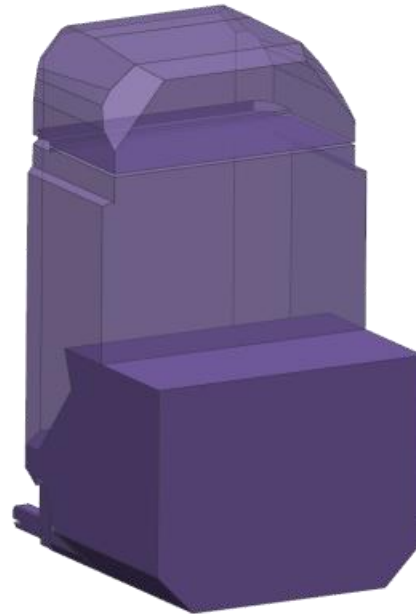
INTRODUCTION



Since design space is also limited by ISO envelope, available lateral space to offer side protection is very limited.

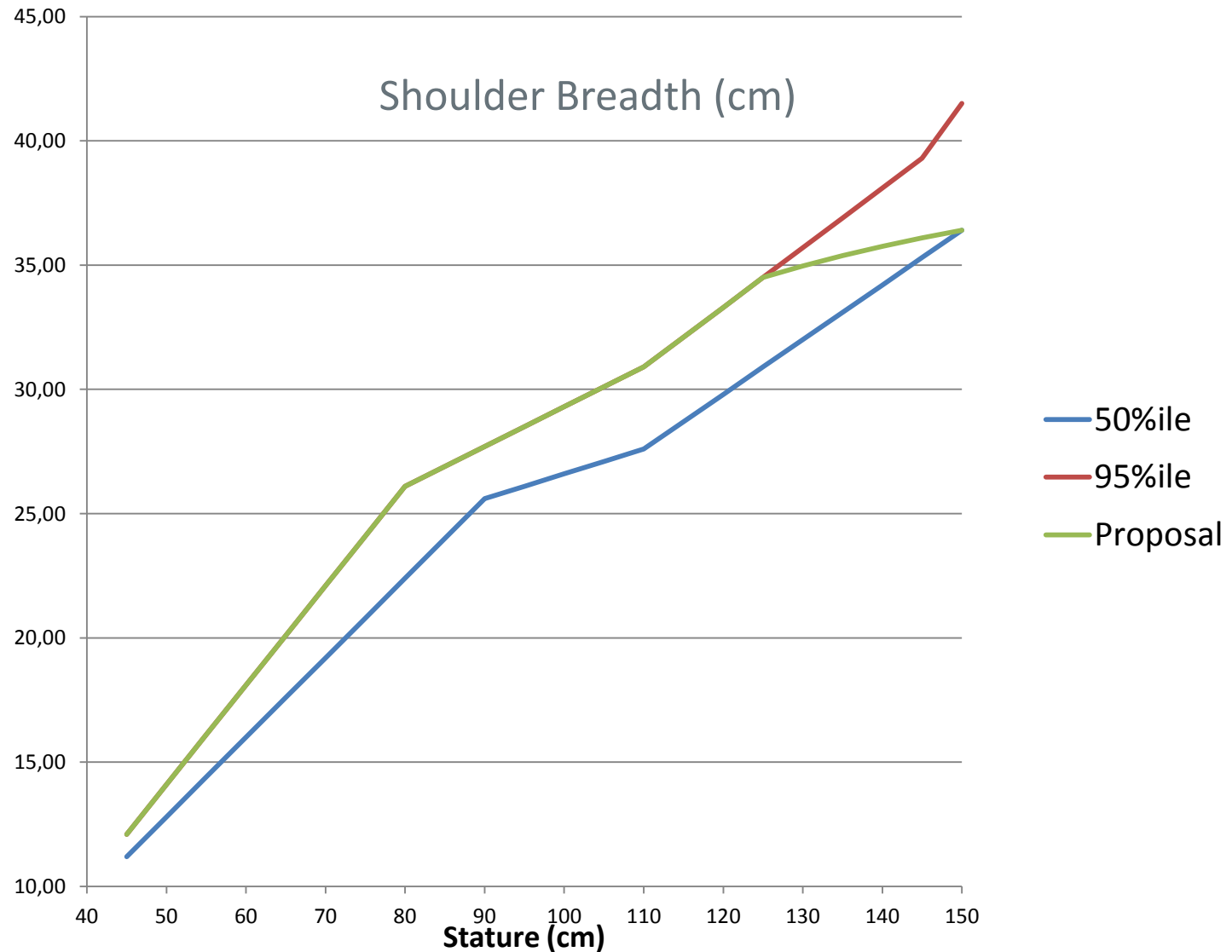


440 mm booster envelope



Available volume for 135 cm size in
440 mm envelope

POSSIBLE CONCEPT





AVENUES FOR FURTHER INVESTIGATION – F4 DEPTH

F4 DEPTH MODIFICATION REQUEST



Why ?

More cushion depth needed for the comfort of older children :

More lateral protection needed with side wing

Concept

Align F4 fixture depth with F2X

F4 DEPTH MODIFICATION REQUEST

