

R129 Completion of Envelopes for integral CRSs

- **Justification**

UN Reg. 44-04 Possibilities for **Universal Integral** Approval

GROUP CATEGORY		Universal		Semi-universal		Restricted		Specific Vehicle	
		Belt attached	ISOFIX	Belt attached	ISOFIX	Belt attached	ISOFIX	Belt attached	ISOFIX
0	Lateral facing (integral)	A	NA	A	A	A	NA	A	A
	Rearward facing (integral)	A	NA	A	A	A	NA	A	A
0+	Rearward facing (integral)	A	NA	A	A	A	NA	A	A
I	Rearward facing (integral)	A	NA	A	A	A	NA	A	A
	Forward facing (integral)	A	A	A	A	A	NA	A	A
	Forward facing (non-integral)	NA	NA	NA	NA	NA	NA	NA	NA
	Forward facing (non-integral – see point 6.1.12.)	A	NA	A	NA	A	NA	A	A
II	Rearward facing (integral)	A	NA	A	NA	A	NA	A	A
	Forward facing (integral)	A	NA	A	NA	A	NA	A	A
	Forward facing (non integral)	A	NA	A	NA	A	NA	A	A
III	Rearward facing (integral)	A	NA	A	NA	A	NA	A	A
	Forward facing (integral)	A	NA	A	NA	A	NA	A	A
	Forward facing (non integral)	A	NA	A	NA	A	NA	A	A

UN Reg. 129 Possibilities for **Universal Integral** Approval

	Orientation	Category	
		i-Size CRS (Universal)	Integral Specific Vehicle ISOFIX CRS
Integral RF and FF have a volume controlling size	Lateral facing (carry-cot)	NA	A
	Rearward facing	A	A
	Forward facing (integral)	A	A

	Orientation		Category	
			Universal Booster (vehicle belt attached, ISOFix only if stowable)	Specific Vehicle Booster (Built-In included)
Non Integral	Forward Facing Each has a volume controlling size	Booster Seat	A	A
		Booster Cushion	A	A
	Rearward Facing	Booster Seat & Booster Cushion	NA	NA

Lateral Facing Car Seats

- Medical need for Lateral facing CRS Globally
 - There are cases where children cannot use a RF infant carrier.
 - Special needs child considerations – inability to support head
 - Lay flat for small infants – premature babies – oxygen depletion
 - A **Universal** lie-flat solution must be made available!

Medical Needs – Premature Infants

Research studies for special medical situations that require lay flat seats

>> Risk of oxygen desaturation

infants, specifically premature infants and those with low-birthweight, who are transported in upright infant car seats.

— Bull MJ, Stroup KB. Premature infants in car seats. *Pediatrics* 1985; 75: 336-9.

— Bull MJ, Weber K, Stroup KB. Automotive restraint systems for premature infants. *J. Pediatr.* 1988; 112: 385-8.

>> Bradycardia and hypoxia – premature or sick newborns - upright in car seat.

— Bass JL, Mehta KA, Camara J. Monitoring premature infants in car seats: implementing the American Academy of Pediatrics Policy in a community hospital. *Pediatrics* 1993; 91: 1137-41. ★

— Bass JL, Kishor A, Mehta KA. Oxygen desaturation of selected term infants in car seats. *Pediatrics* 1995; 96: 288-90★.

>> Oxygen desaturation with or without the occurrence of apneic spells in premature infants positioned in an ordinary sitting type infant seat...

— Willett LD, Leuschen MP, Nelson LS, Nelson RM. Risk of hypoventilation in premature infants in car seats. *J. Pediatr.* 1986; 109: 245-8.

— Willett LD, Leuschen MP, Nelson LS, Nelson RM. Ventilatory changes in convalescent infants positioned in car seats. *J. Pediatr.* 1989; 115: 451-5.


American Academy of Pediatrics Recommendations

① Safe Transportation of Premature and Low Birth Weight Infants (RE9617)

【Pediatrics.vol97,No.5, May.1996】

The AAP Committee on Injury and Poison Prevention and Committee on Fetus and Newborn issued a recommendation in 1996 on the safe transport of premature infants and infants with low-birthweight.

Infants with documented desaturation, apnea, or bradycardia in a semi-upright position should travel in a supine or prone position in an alternative safety device.

American Academy of Pediatrics  Policy Statement

Pediatrics Volume 97, Number 5 May, 1996, pp. 758-760

Safe Transportation of Premature and Low Birth Weight Infants (RE9617)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention and Committee on Fetus and Newborn

* **ABSTRACT.** Special considerations are essential to ensure the safe transportation of premature and low birth weight infants. Both physical and physiologic issues must be considered in the proper positioning of these infants. This statement discusses current recommendations based on the latest research and provides guidelines for physicians who counsel parents of very small infants on the choice of the best car safety seats for their infants.

Improved survival rates and earlier discharge of premature infants have increased the number of infants weighing less than 2500 g who are being transported in private vehicles. To ensure that these infants are transported safely, specific guidelines regarding the proper selection and use of car safety seats and other occupant restraint devices for this population are warranted.

Currently, Federal Motor Vehicle Safety Standard 213, which established design and dynamic performance requirements for child restraint systems, applies to children weighing up to 50 lb but has no minimum weight limit established in the standard. Most safety restraints on the market are designed for infants weighing more than 7 lb (3.1 kg).^[1,2] and only recently have studies been done that allow some prediction of the protective capabilities of restraint devices for infants weighing less than 7 lb. Research has indicated that some infants, particularly premature and low birth weight infants, may be subject to oxygen desaturation when placed in a semierect position in car safety seats.^[3-5] Both growth and neurologic maturation may influence the potential risk of respiratory compromise in seating devices. Further investigation is necessary to define precisely the population at risk and the situations in which risk occurs.

Several specific recommendations can be made regarding transportation of infants at possible risk of respiratory problems:

1. Current information suggests that each preterm infant born at less than 37 weeks' gestation should have a period of observation in a car safety seat before hospital discharge to monitor for possible apnea, bradycardia, or oxygen desaturation. An appropriate hospital staff person should conduct the observation. Hospitals should develop policies to include this evaluation in their discharge planning process.^[5] An Academy-endorsed video, "Special Delivery: Safe Transportation of Premature and Small Infants," contains additional information on this topic.^[6]
2. Families should minimize travel for infants at risk of respiratory compromise.
3. Infants with documented desaturation, apnea, or bradycardia in a semierect position should travel in a supine or prone position in an alternative safety device. The use of other upright equipment, including infant swings, infant seats, and infant carriers, should be avoided.

Alternative child restraint devices are available for infants who must travel in a prone, supine, or semierect position. Specific information regarding currently available restraint systems can be obtained from the American Academy of Pediatrics brochure, "Family Shopping Guide to Car Seats."^[7]

If a semierect position can be maintained safely by the infant, a conventional car safety seat that allows for proper positioning of the low birth weight infant should be selected. Better observation of the infant is possible when the child is in a rear-facing car safety seat adjacent to an adult rather than in a car bed. (See guideline 7 in this statement for information on passenger-side front air bags.)

4. Infants for whom home cardiac and apnea monitors are prescribed should use this monitoring equipment during travel and have portable, self-contained power available for twice the duration of the expected transport time.
5. Because commercially available securement systems for all portable medical equipment such as monitors and oxygen tanks are limited and not designed for use in motor vehicles, such equipment should be wedged on the floor or under the vehicle seat to prevent it from becoming a dangerous projectile in the event of a crash or sudden

American Academy of Pediatrics Recommendations

② Transporting Children With Special Health Care Needs (RE9852) 【Pediatrics.vol104,No.4, Oct.1999】

The AAP Committee on Injury and Poison Prevention and Committee

Infant-only car safety seats with capacity to recline are useful for infants with many medical problems, especially respiratory conditions.

Product Development ProDev Associates, LLC Project Management
Talking Ideas From Concept to Production™

Appendix C

American Academy of Pediatrics Policy Statement

Pediatrics Volume 104, Number 4 October 1999, pp 988-992

Transporting Children With Special Health Care Needs (RE9852)
AMERICAN ACADEMY OF PEDIATRICS
Committee on Injury and Poison Prevention
ABSTRACT. Children with special health care needs should have access to proper resources for safe transportation. This statement reviews important considerations for transporting children with special health care needs and provides current guidelines for the protection of children with specific health care needs, including those with a tracheostomy, a spica cast, challenging behaviors, or muscle tone abnormalities as well as those transported in wheelchairs.

ABBREVIATION. FMVSS, Federal Motor Vehicle Safety Standard.

All children, including those with special health care needs, should have access to proper resources for safe transportation. Families and health care professionals should be informed of basic guidelines for selecting restraints, positioning children into them, and securing these restraints in all types of vehicles, primarily the family vehicle and school bus.¹ Parents should be informed of the resources available for proper restraint of children with special health care needs during travel² and thereby avoid use of substandard products, nonwhirl restraint systems, or unsafe methods of assessment in motor vehicles. Federal Motor Vehicle Safety Standard (FMVSS) 213, which regulates design and performance of child restraint systems, does not recognize that children with special needs may require the use of special occupant restraint systems.³ The standard also does not regulate specific design and performance criteria for occupant protection devices that can provide safe seating for children with disabilities. Crash testing of car safety seats that meet FMVSS 213 has been done with test dummies representing children without special medical problems that would affect restraint use in motor vehicles. The biomechanical effects of a crash on test dummies representative of children with special medical needs in any restraint system have not been studied. Further research is needed, including development of such test dummies by the National Highway Traffic Safety Administration to address these concerns.

Children with special needs should not be exempt from the requirements of each state's laws regarding child restraint and seat belt use. Pediatricians can serve as resources for information to legislators, policy makers, and law enforcement professionals, as well as school officials who may be unaware of the importance and availability of occupant protection systems for children with special needs.

IMPORTANT CONSIDERATIONS

1. The rear seat is the safest place for all children, and rear-facing car safety seats must never be placed in the front seat of a vehicle that has a front passenger air bag. The impact of a deploying air bag can severely injure or kill an infant or small child. Children may also be at risk of injury if they are out of position or lie against the door of a vehicle with a side air bag.
2. For a child with special health care needs who requires frequent observation during travel and for whom no adult is available to accompany the child in the back seat, an air bag on/off switch should be considered for the vehicle.
3. Instructions provided by the manufacturer of the vehicle and the manufacturer of the car safety seat must be followed.
4. Plans for procurement of the most appropriate restraint and training for the proper use of the device and its installation in the vehicle should be incorporated into hospital discharge planning for all children with special

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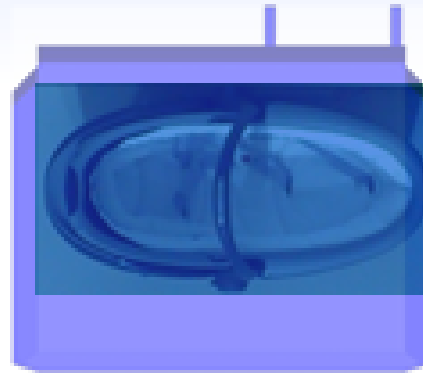
However, the current lateral envelope is too large

- The current ISOFix fixture in UN Reg. 44 is very large and has been criticised as being too large.

Current lateral envelope is too large



Britax Baby Safe Sleeper
(belt attached)



The belt routing of Baby Safe Sleeper largely differs from that of other products. Also, the product does not have a base that the most ISO-FIX type CRS have. Therefore, Baby Safe Sleeper does not fit into the lateral envelope which is designed for products with a base.

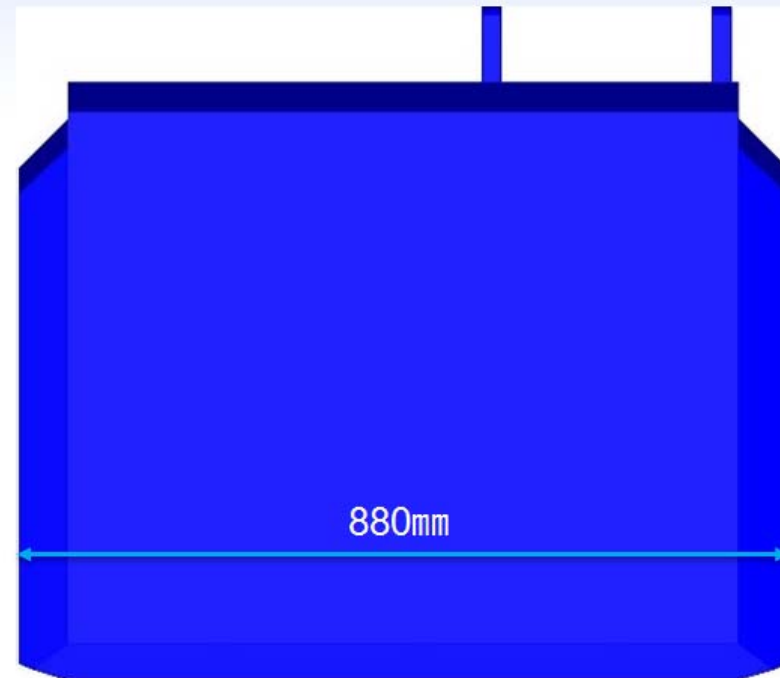
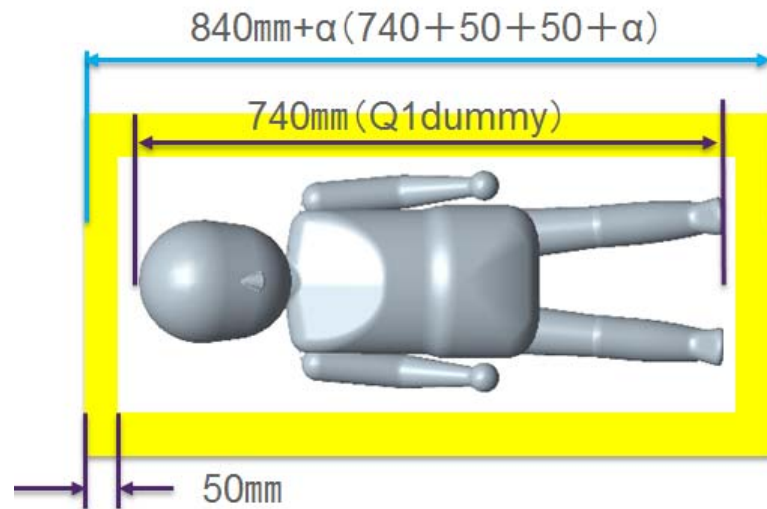
Lateral Facing Car Seats Proposal

	Orientation	Category		
		i-Size CRS	Universal	Integral Specific Vehicle ISOFIX CRS
Integral Each has a volume controlling size	Lateral facing (carry-cot)	N/A	A	A
	Rearward facing	A	N/A	A
	Forward facing (integral)	A	N/A	A

- Develop a volume that is within the RF and FF volumes, apart from the side that uses the centre seating position, no conflict with vehicle space.
- No added complexity for consumer

Internal CRS space

Validation based on the inside dimension

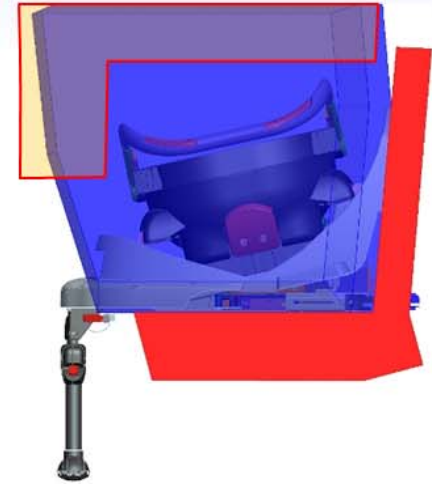
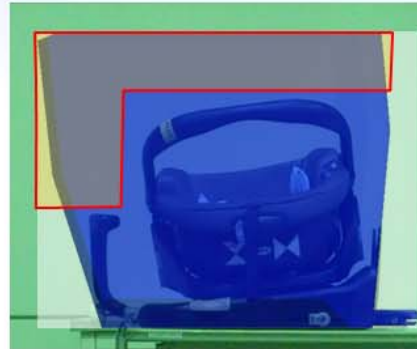
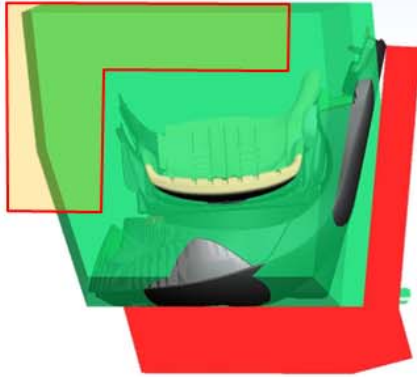


Q1 Dummy (9.6kg) height: 740mm

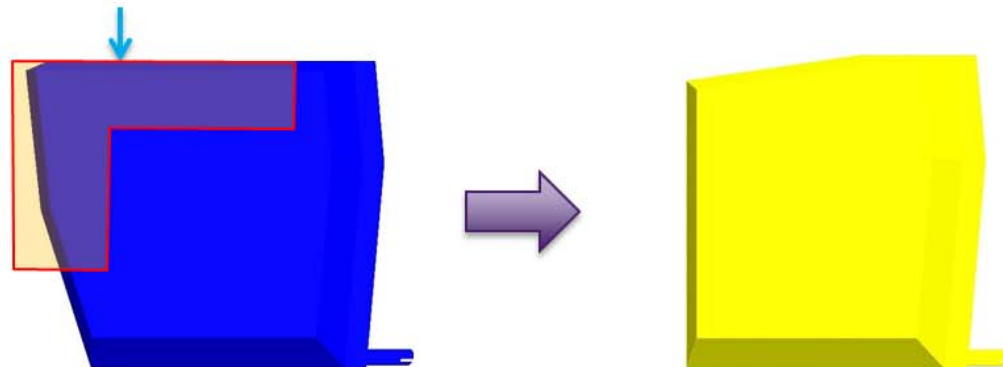
The envelop should be at least 840mm wide based on the assumption that Q1 dummy lays down and the thickness of the wall and cushion are 50mm.

Given that there are differences in room and wall thickness by manufacturer, **the current lateral envelope width (880mm) should be considered appropriate. Reduction in this dimension**

Unnecessary Volume

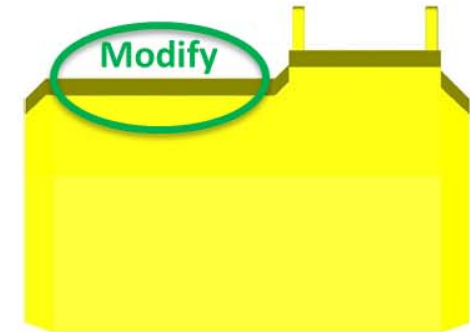
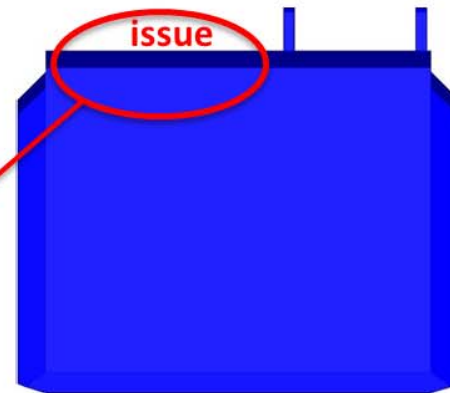


Unnecessary part for bed type CRS

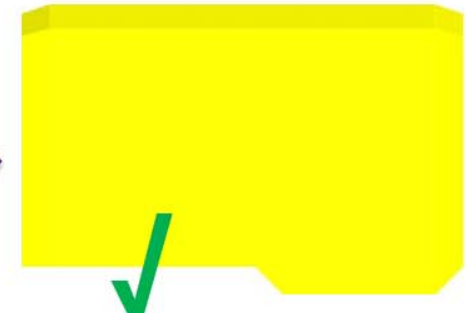
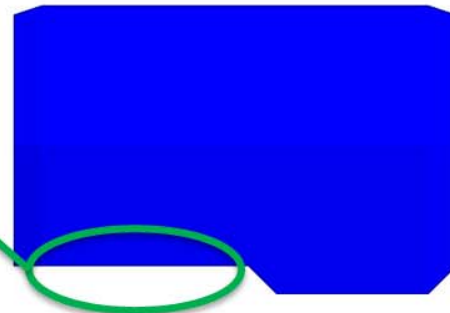


Compatibility with the vehicle seats

Compatibility with the shape of vehicle seat

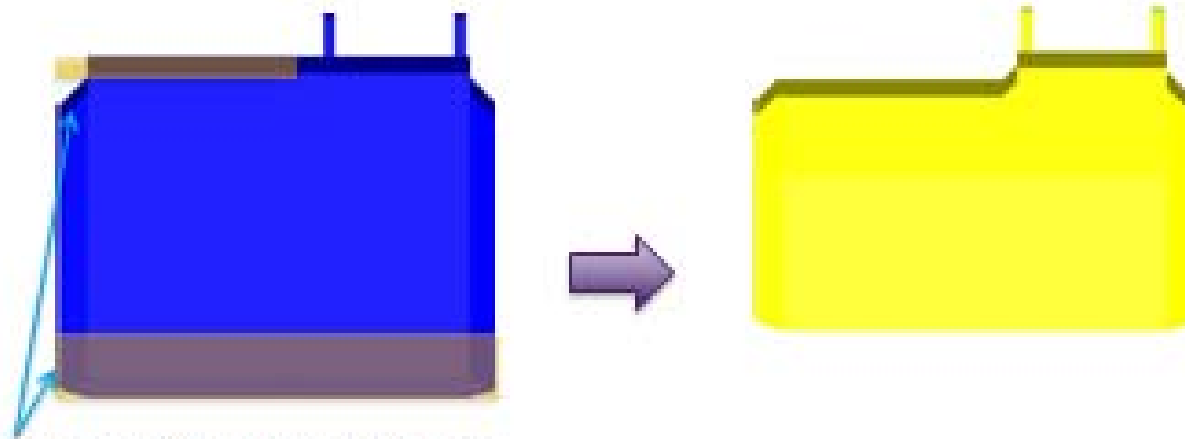


Modification to be more compatible with the vehicle, centre seat back



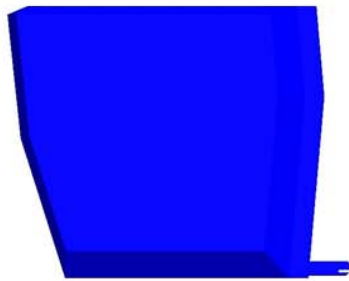
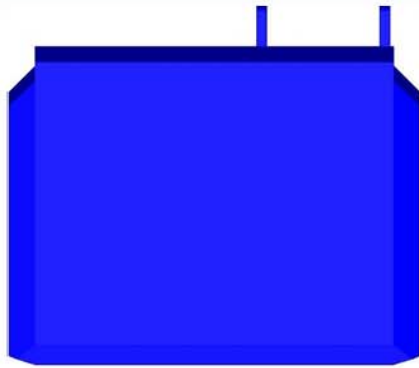
No change required as the current envelope
Already fits into the projected part of the center seat.

Unnecessary Volume

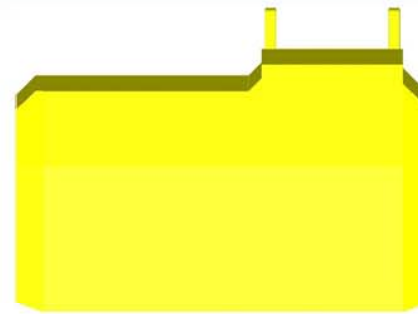


Unnecessary parts for bed type CRS

Proposal of New Lateral Envelope Shape



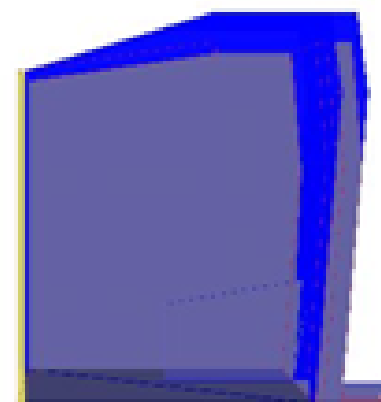
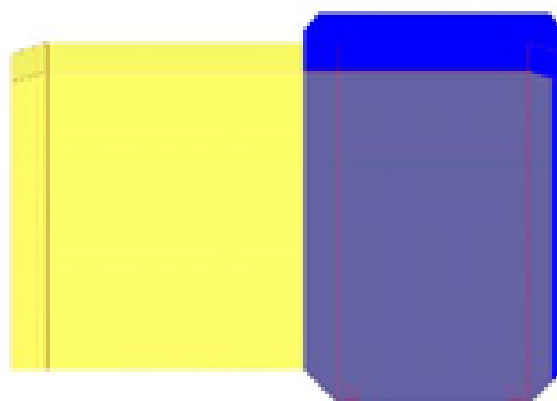
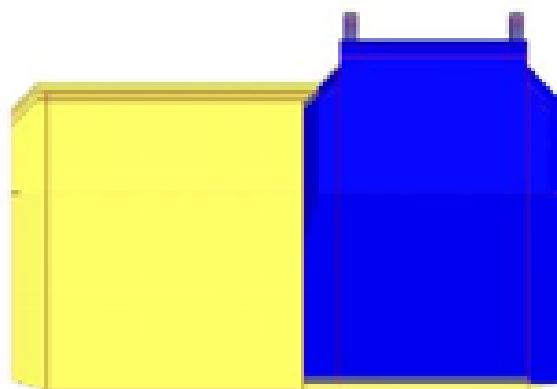
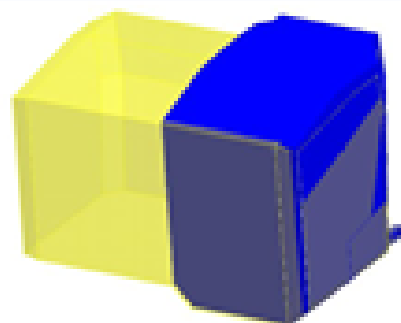
Current lateral envelope



New lateral envelope

Overlay of the R129 Forward facing and new lateral envelope

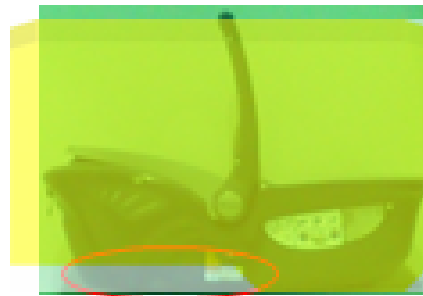
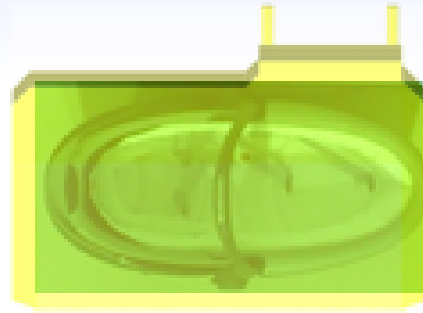
Forward facing and new lateral envelopes



CRS fit into proposed new envelope



Britax Baby Safe Sleeper



The belt routing of Baby Safe Sleeper largely differs from that of other products. Also, the product does not have a base that the most ISO-FIX type CRS have. Therefore, Baby Safe Sleeper does not fit into the lateral envelope which is designed for products with a base.

Dimensional, Vehicle Fit Comparison with R44 Fixture – 268 Vehicles

UN Reg. 44

U=Distance from the front seat to the intersection of the rear seat and rear seat backrest when the position of the front seat is set at middle

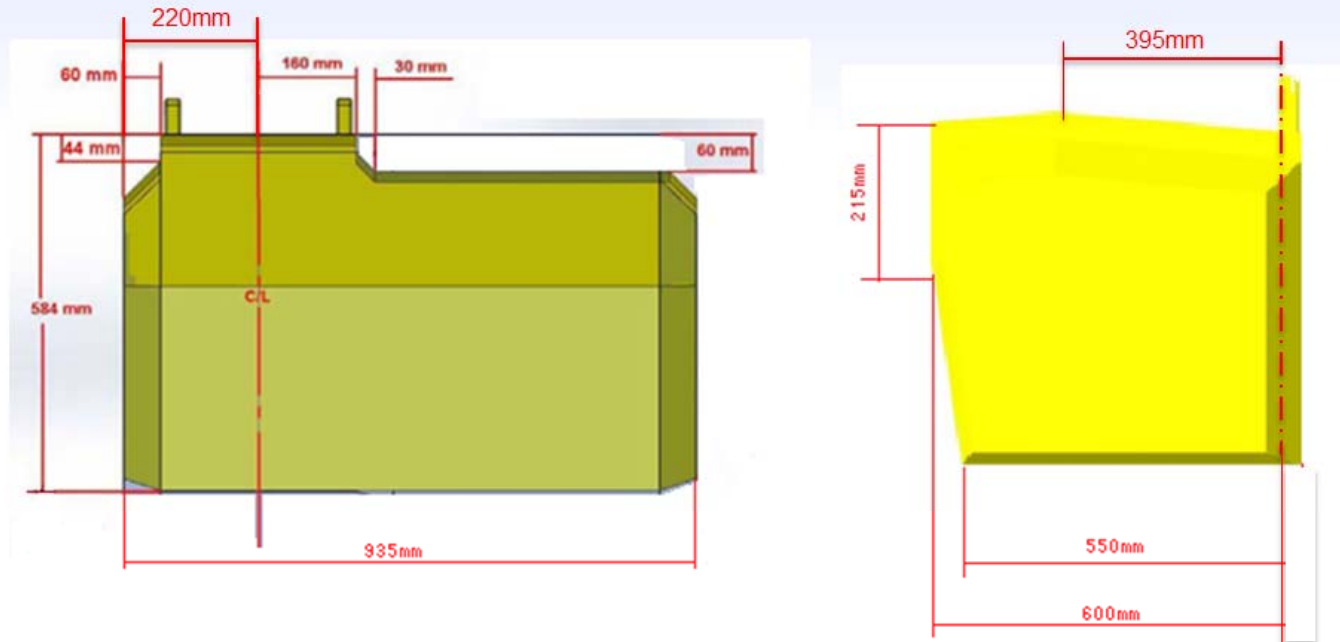
Measurement Criteria	M (Min 220MM)	I (Max 70MM)	X (Max 5MM)	I+X (Max 75MM)	V (Min 715MM)	U-V MIDPOINT (Min 715MM)	Z (Max 65MM)
Pass	267	246	21	132	251	167	240
Fall	1	10	233	124	5	89	16
Pass Ratio	99.6%	91.8%	7.8%	49.3%	93.7%	62.3%	89.6%
# of Compatible Vehicle	6 cars among 268 cars						
Compatibility Ratio	2.2%						

UN Reg. 129 Proposal

Vehicle compatibility is significantly improved from 2.2% to 87.3%

Measurement Criteria	M (Min 220MM)	I (Max 70MM)	X (Max 60MM)	I+X (Max 135MM)	V (Min 584MM)	U-V MIDPOINT (Min 584MM)	Z (Max 65MM)
Pass	267	247	239	246	256	251	240
Fall	1	9	17	10	0	5	16
Pass Ratio	99.6%	92.2%	89.2%	91.8%	95.5%	93.7%	89.6%
# of Compatible Vehicle	234 cars among 268 cars						
Compatibility Ratio	87.3%						

Physical, Vehicle Fit Check of envelope – 40 Vehicles



Investigation with physical model of interim envelope with 935mm width – it was possible to place the fixture through the door aperture of 40/47 vehicles for assessment. This width was reduced further (after this exercise) to 880mm



Result – 97.5% Compatibility

- 47 vehicles were available for assessment. It was possible to manipulate the fixture into 40 of the vehicles. 40 vehicles were assessed.

Item Checked	Interference with door interior	Interference with headrest	Interference with center console
No Issue	40	39	40
Have Issue	0	1	0
Pass Ratio	100%	97.50%	100%
# of compatible cars	39 cars /40cars		
Compatibility Ratio	97.5%		

	Distance to Front Seat (cm)	Space between inside of the door and head side (cm)	Space between inside of the door and leg side (cm)	Angle of the upper surface of envelope (degree)
Maximum	59	46	15	29.8
Minimum	13	7	4	5.7
Average	20.7	30.2	8.3	10.6

Summary

- There is a gap in R129 compared to R44 for Universal Lateral CRSs
- Reviewed the research and established a medical need for a Universal Lateral solution
- Reviewed the R44 fixture with current products, it is too large.
- Developed a Universal lateral envelope in line with R129 R2 and F2x
- Assessed the fit of new lateral envelope in 268 cars to show proposed envelope has **87% Compatibility**
- Assessment of physical fixture in 47 cars to show proposed envelope has **85% Compatibility**
- Current lateral products mostly fit within the proposed Envelope
- We would like to propose this envelope as completion of the integral Universal fixtures.