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Updating the Child Restraint Systems Reference List for ASEAN NCAP

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Abstract – *Child car occupants must be secured using appropriate Child Restraint Systems (CRS) in order to reduce the risk of severe injuries in the case of crashes or emergency braking. As part of ASEAN NCAP protocol, the so-called "CRS Reference List" of widely available, well performing child seats was established to assess a vehicle's ability to safely and correctly accommodate child seats. In 2017, ASEAN NCAP introduced a new upper and lower limit crash pulse curve to better represent crashworthiness of cars available in the ASEAN market. With this new curve, the CRS Reference List must be reviewed accordingly; which is the aim of this project. This paper describes the process to update the CRS Reference List, starting from exploring the potential of CRS in three ASEAN markets (i.e., Malaysia, Thailand and Indonesia). The identified CRS were then evaluated based on several selection criteria (i.e., availability, regulation approved, weight group combination, price, size and installation direction). Based on the evaluation, several CRS are shortlisted for further technical assessment following ASEAN NCAP Child Occupant Protection (COP) protocol. The CRS shortlist is presented in this paper. However, the proposed CRS Reference List will not be disclosed in this work.*

Keywords: Child Restraint System, CRS Reference List, ASEAN NCAP, Child Occupant Protection, new crash pulse, child safety

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1.0 INTRODUCTION

Babies and children under 12 years old have been identified as the most vulnerable road users compared to older children (*i.e.*, 12 years and above) and adults. To reduce the risk of severe injuries in the case of crashes or emergency braking, it is important that this group of children are secured properly using age- or size-appropriate Child Restraint System (CRS) for as long as possible; whereas older children above the height and weight specifications for child restraints (Table 1) require a properly fitting three-point lap and diagonal seatbelt when travelling in a moving vehicle (FIA Foundation for the Automobile and Society, 2009).

Table 1: Weight categories for child restraints
(FIA Foundation for the Automobile and Society, 2009)

Group	Weight	Approximate Age
0	<10kg	<1 year
0+	<13kg	<1 year
I	9-18kg	1-4 years
II	15-25kg	4-6 years
III	22-36kg	6-11 years

In the ASEAN region, only three countries have implemented specific laws requiring the usage of CRS in a passenger vehicle, namely Brunei, Cambodia and Singapore; while there are no specific rules on CRS usage in Malaysia. A survey conducted by Noor Faradila et al. (2016) shows that most parents or guardians in central Peninsular Malaysia were unaware of CRS types especially for older children when a child has outgrown his/her initial CRS. Furthermore, a high rate of improperly installed universal CRS as well as unsecured children in a CRS have been observed.

Meanwhile, Original Equipment Manufacturers (OEM) for CRS have strived to ensure their products are capable of meeting the NCAP strict requirements. For example, Britax (Bendjellal, 2017) conducted a CRS development study with respect to EURO NCAP 2016 protocol requirements for Römer Kidfix XP. The original CRS was evaluated using CAE tools and sled tests. Later, several improvements were made and optimized through component testing as well as sled and crash testing to validate its performance for the latest COP protocol.

In order to ensure children travelling in vehicles are adequately protected using appropriate CRS, ASEAN New Car Assessment Programme (ASEAN NCAP) has conducted child occupant safety assessment since its very first test. The Child Occupant Protection (COP) protocol in ASEAN NCAP (May 2017) uses a selection of popular CRS to evaluate the child protection level in a particular vehicle. The so-called CRS Reference List contains a sample of widely available, well performing child seats that represent most common types of products available in at least three ASEAN markets – see Figure 1 for current Reference List used by ASEAN NCAP. Such a reference list shall be reviewed every two years and published in ASEAN NCAP's website.

Reference List	Category	CRS	Direction	Interface
	Group 0+	Maxi Cosi Cabriofix	Rwd	B _ _ _
	Group 0+/I/II	Combi Malgot	Fwd	B _ _ _
	Group 0+/I/II	Combi Malgot	Rwd	B _ _ _
	Group II/III	Combi Buon Junior Air	Fwd	B _ _ _
	Group 0+	Britax Baby Safe Plus ISOfix Base	Rwd	_ I L _
	Group 0+/I	Maxi Cosi Milofix	Fwd	_ I _ S
	Group 0+/I	Maxi Cosi Milofix	Rwd	_ I _ S
	Group I	Britax Duo Plus	Fwd	_ I _ S
	Group II/III	Britax KidFix XP	Fwd	B I _ _

(**Note:** Britax KidFix is a replacement for Britax Parkway SGL. However, Britax Parkway SGL is still acceptable for the assessment until the end of 2017)

Figure 1: CRS Reference List as published in ASEAN NCAP (May 2017)

In September 2017, ASEAN NCAP conducted a comparative study between the commonly used United Nation Economic Commission for Europe (UN ECE) R44 regulation crash pulse and the actual crash test data using additional acceleration measurement under the rear seat floor. From this study, the actual crash test data was found to be outside the upper and lower limit curve of ECE R44 as illustrated in **Error! Reference source not found.**. Hence, new upper and lower limit curves were proposed by ASEAN NCAP as depicted in Figure 3. Introduction of the new curve emphasizes the need for an updated CRS Reference List to comply with the newly proposed crash pulse. Therefore, the objective of this paper is to explain the process to revise the ASEAN NCAP CRS Reference List.

2.0 REVISION PROCESS FOR CRS REFERENCE LIST

Figure 4 depicts the process undertaken to establish the new CRS Reference List. Important steps are explained in the following subsections.

2.1 Exploring available CRS in Malaysia, Thailand and Indonesia

The whole process started by exploring available CRS in Malaysia, Thailand and Indonesia via online shopping platforms (e.g., Amazon, Lazada, etc.) accessible in the three countries. The focus was on three types of CRS: (i) universal belted CRS, (ii) ISOFIX CRS, and (iii) combination of belted and ISOFIX CRS. The information collected was summarized into a database as shown in Table 2. Please note that the data presented in the database is valid upon publication.

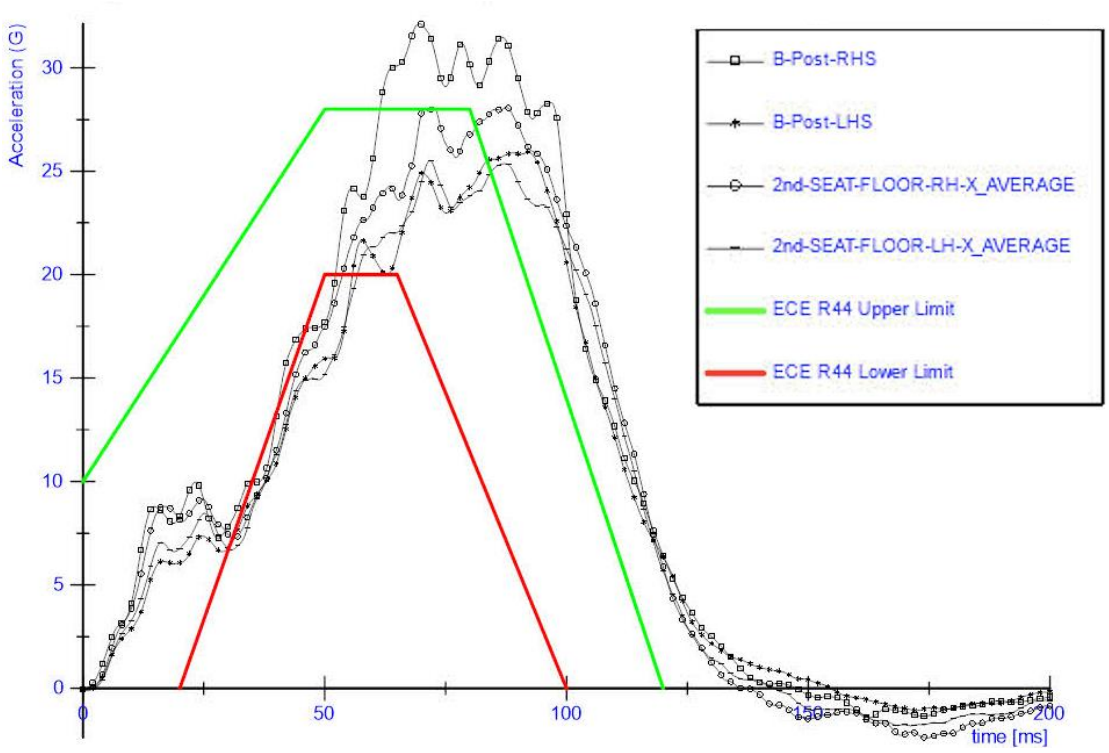

Figure 2: Acceleration data comparison to ECE R44 pulse (ASEAN NCAP, September 2017)

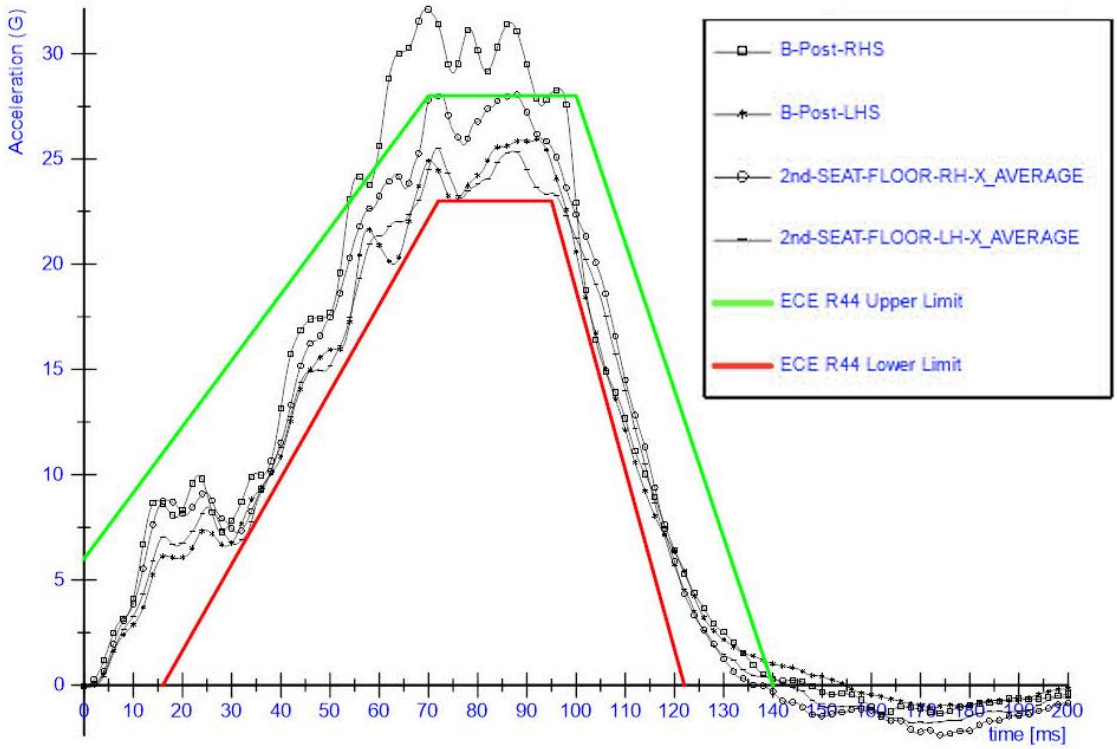

Figure 3: Proposed new upper and lower limit curve by ASEAN NCAP (ASEAN NCAP, September 2017)

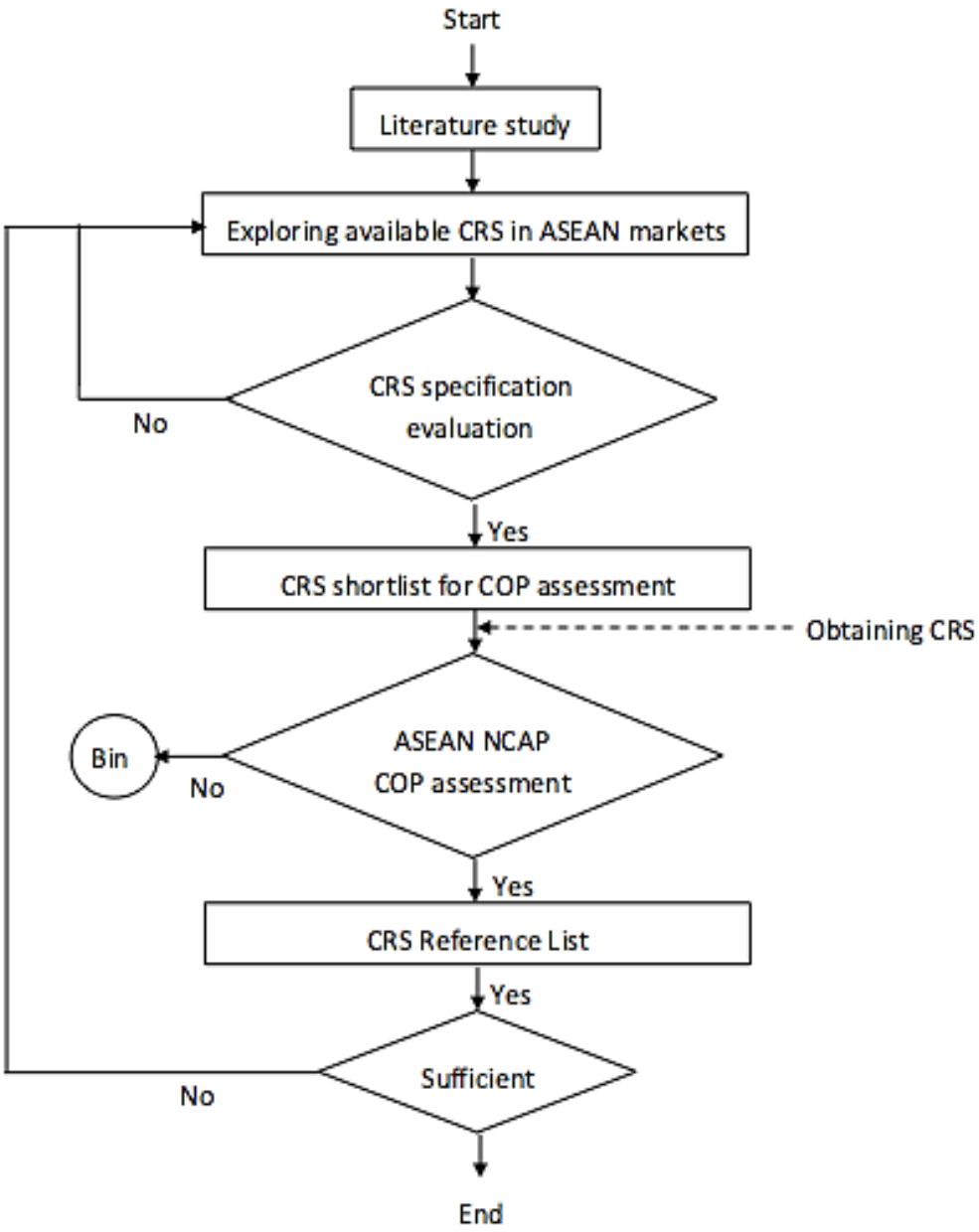

Figure 4: Revision process for new CRS Reference List (Abu Husain, 2018a)

Table 2: Database of CRS available in Malaysia, Thailand and Indonesia
(**Disclaimer:** All data presented is valid upon publication date)

Type	Brand	Group				Regulation Approved		Weight (KG)	Direction	Interface	Price (USD)	Size (WxDxH cm)
		0	I	II	III	R44	R129					
Universal Belted												
	Safety 1st Continuum 3-in-1	√	√	√	√	√		8.5	Convertible	B _ _ S	USD 449.00	61 x 49 x 61
	Chicco Oasys		√	√	√	√		7.2	Forward	B _ _ _	USD 442.50	53 x 41 x 84
	Joie - Every Stage	√	√	√	√	√		8.24	Convertible	B _ _ S	USD 429.60	54 x 52.6 x 85.5
	Cybex Pallas		√	√	√	√		5	Forward	B _ _ _	USD 328.60	54 x 42 x 63
	Peg-Perego-Primo Viaggio Tri-Fix	√				√		3.8	Rearward	B _ _ _	USD 379.05	43 x 65 x 60
	Maxi Cosi Pebble Plus	√					√	12.5	Rearward	B _ _ _	USD 353.80	44 x 69 x 39
	Safety 1st Guide 65	√	√	√		√		6.68	Convertible	B _ _ S	USD 321.90	51 x 46 x 60
	Joie - Stages	√	√	√		√		8.86	Convertible	B _ _ _	USD 315.90	54.5 x 58 x 76
	Cosatto Hold 0+	√				√		3.9	Rearward	B _ _ S	USD 252.65	43 x 59 x 69
	Cosatto Zoomi		√	√	√	√		5.3	Forward	B _ _ _	USD 240.00	44 x 46 x 70
	Welldon Smart Sport II BS02-T	√	√	√		√		7	Convertible	B _ _ _	USD 227.35	48 x 52 x 60
	Sweet Heart Paris CS286	√	√	√		√		7	Convertible	B _ _ _	USD 175.30	43 x 46 x 71
	Mothercare Madrid	√	√			√		6.8	Convertible	B _ _ S	USD 133.80	58 x 48 x 63.5
	Babyzen - BeSafe iZi Combi X3	√	√			√		9.1	Forward	B _ _ S	USD 133.50	48 x 63 x 70
	Sweet Heart Paris CS375	√				√		2.7	Rearward	B _ _ _	USD 55.40	68x 41 x 58

Table 2 (cont.): Database of CRS available in Malaysia, Thailand and Indonesia
(**Disclaimer:** All data presented is valid upon publication date)

ISOFIX CRS	Maxi-Cosi AxissFix Air	√	√				√	14.05	Convertible	_ I _ S	USD 1,009.10	45 x 65 x 71
	Aprica - Fladea Grow	√	√			√		14.3	Convertible	_ I L S	USD 933.40	45 x 67.5 x 76.5
	Joie - Stages ISOFIX	√	√	√		√		8.86	Convertible	_ I L _	USD 556.20	54.5 x 58 x 76
	Kiddy Evo-Luna	√					√	10.9	Rearward	_ I L S	USD 536.70	60 x 44 x 79
	Peg-Perego -Primo Viaggio Tri-Fix K (ISOFIX Base)	√				√		8.8	Rearward	_ I L _	USD 528.40	43 x 65 x 118
	Joie - Every Stage FX	√	√	√	√	√		14.6	Convertible	_ I _ S	USD 480.35	55 x 52.6 x 85.5
	Maxi Cosi Pebble Plus	√					√	12.5	Rearward	_ I L _	USD 480.35	35 x 69 x 73.5
	Chicco KeyFit 30	√				√		8	Rearward	_ I _ S	USD 406.60	61x 43 x 69.9
	Meinkind - Sonata		√	√	√	√		8.8	Convertible	_ I _ S	USD 278.00	48 x 50 x 75
	Meinkind - Cyclon 360	√	√			√		15	Convertible	_ I L S	USD 202.10	43 x 66 x 112
Universal Belted & ISOFIX CRS	Maxi-Cosy Pria 85		√	√	√	√		10	Convertible	B I _ S	USD 785.10	47x 51.3 x 75.7
	Chicco Fit2	√	√			√		9.35	Rearward	B I _ S	USD 761.40	40.6 x 43 x 71
	Britax Römer - DUALFIX	√	√	√	√	√		14.7	Convertible	B I L S	USD 758.60	53 x 45 x 63
	Safety 1ST Grow'N'Go	√	√	√	√	√		8.46	Convertible	B I _ S	USD 561.00	61 x 48.3 x 60.3
	KIDDY Guardian Pro 2		√	√	√	√		8.5	Forward	B I _ _	USD 456.00	60 x 52 x 81
	Babyzen - Besafe iZi Go Modular i-Size	√					√	4.3	Rearward	B I L S	USD 430.15	34 x 44 x 72
	Britax Romer - Evolva 123 Plus		√	√	√	√		8	Convertible	B I _ S	USD 430.15	48 x 49 x 86
	Cybex Pallas S Fix		√	√	√	√		10	Forward	B _ _ S	USD 409.60	50 x 43 x 68.5
	Chicco - Autofix	√				√		14.8	Rearward	B I L S	USD 354.20	44 x 67 x 61
	Maxi-Cosi - Cabriofix	√				√		4.2	Rearward	B I _ S	USD 318.75	34 x 46 x 71

2.2 Evaluation Criteria

Each type of CRS listed in Table 2 is evaluated based on the criteria tabulated in Table 3 and explained as below.

2.2.1 Availability in ASEAN Countries

The Association of Southeast Asian Nations (ASEAN) consists of 10 member countries, as illustrated in Figure 5. As stated in Section 2.1, the revision of CRS Reference List only focuses on potential CRS from selected ASEAN markets namely Malaysia, Thailand and Indonesia which were chosen based on their similarities in terms of road safety scenario and automotive industry, as well as high vehicle sales volume and economies of scale. This criterion is given Importance Level 5 and a Base Score of 3.

Table 3: Evaluation criteria used for shortlisting CRS (Abu Husain, 2018b)

		Importance Level: Less Important (1) to Most Important (6)	Importance	Base Score
Evaluation Criteria	Availability in ASEAN Country	Available in MY, ID, TH	5	3
	Regulation Approved	R129 only	6	1
		R44 only		3
	Group Combination	0+	3	3
		0, I, II, III		3
		0/I		1
		0/I/II		2
		I/II/III		2
	Price	Low Price	4	3
		Intermediate Price		2
		High Price		1
	Size	Weight (Light)	1	3
		Weight (Heavy)		1
		Dimension (Compact)		3
		Dimension (Big)		1
	Direction	FWD/RWD Only	2	1
		Convertible		3

Figure 5: ASEAN countries

2.2.2 Regulation Approved

It is important to ensure that all identified CRS have obtained regulatory approval. Henceforth, CRS listed in Table 2 are filtered further to ensure the selected child restraints comply with several design, construction and production conformity standards to meet the regulation. For ASEAN NCAP CRS Reference List, ECE R44 and ECE R129 for Enhanced Child Restraint Systems (ECRS) are given priority. Figure 6 shows the difference between the two regulations, while Figure 7 shows the labels associated with each regulation. The "Regulation Approved" evaluation criterion is given Importance Level 6. CRS that comply with ECE R129 are given a Base Score of 1, while CRS that comply with ECE R44 are given a Base Score of 3.

2.2.3 Group Combination

It is important to ensure that a child travels in an appropriate child restraint, which suits his or her weight and size. There are many different CRS types available, where they are divided into categories according to a child's weight (Table 4). These correspond broadly to different age groups, but it is the weight of the child that is most important when deciding what type of child seat to use. The "Group Combination" evaluation criterion is given Importance Level 3. CRS for Group 0+ is always given Base Score 3 due to its exclusivity, while Base Score from 1 to 3 is assigned to the other groups according to the range of weight combinations.

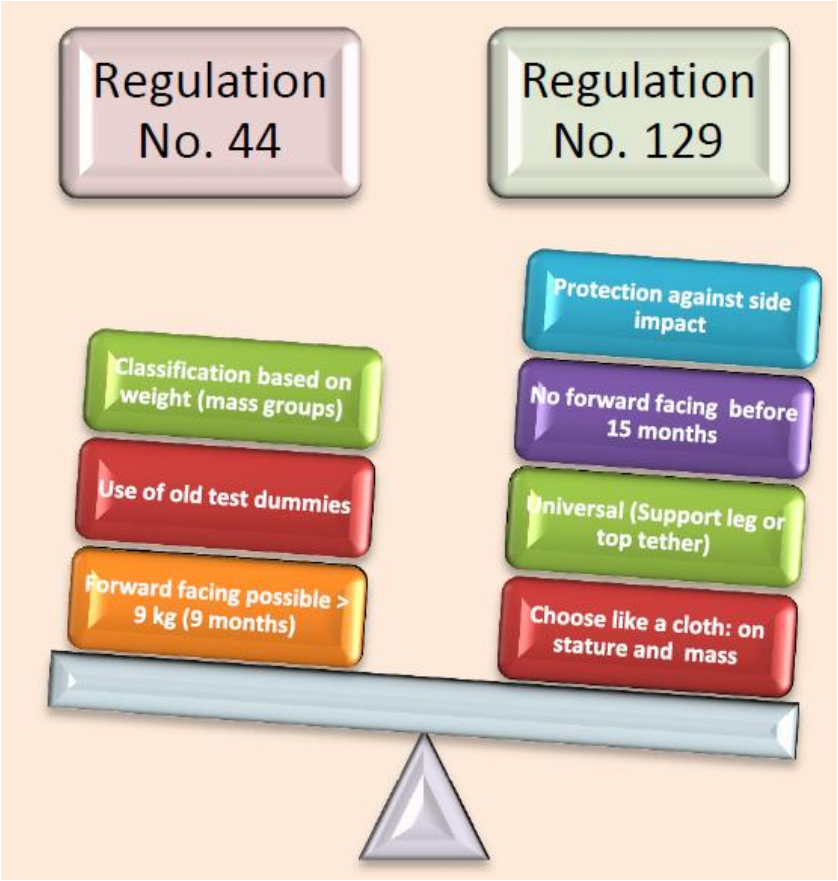

Figure 6: ECE R44 v ECE R129 (UNECE, n.d.)

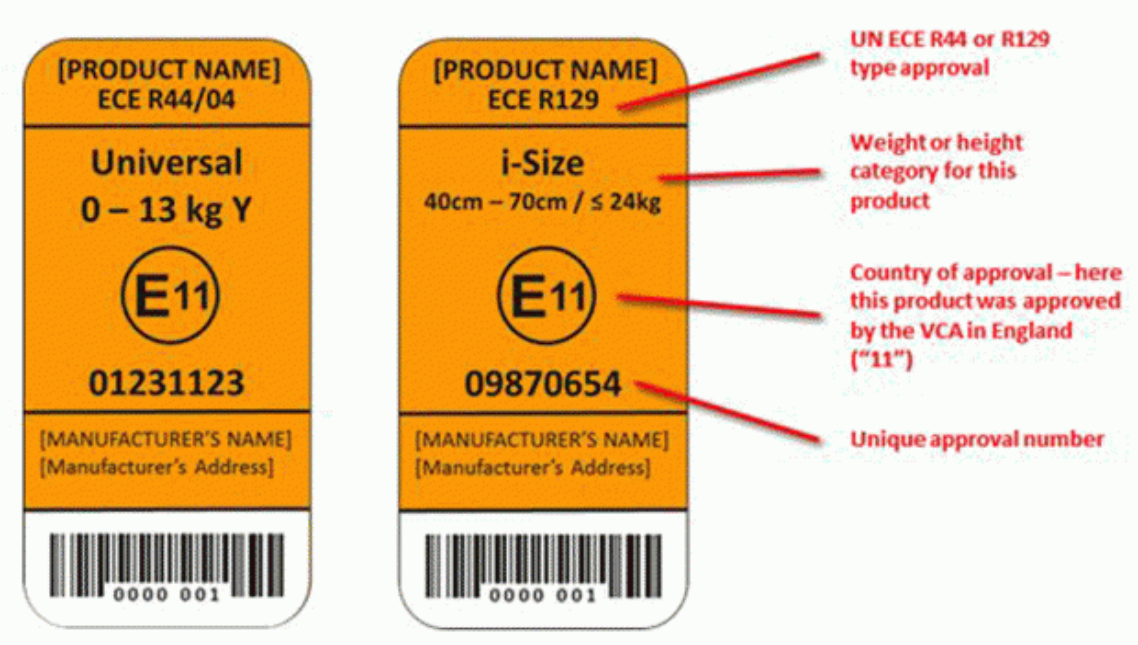

Figure 7: Labels associated with ECE R44 and R129 (UNECE, n.d.)

Table 4: Groups for CRS selection and proposed seat installation ("Child Car Seats: The Law", October 2018)

Child's weight	Group	Seats
0kg to 10kg	0	Lie-flat or 'lateral' baby carrier, rear-facing baby carrier, or rear-facing baby seat using a harness
0kg to 13kg	0+	Rear-facing baby carrier or rear-facing baby seat using a harness
9kg to 18kg	1	Rear- or forward-facing baby seat using a harness or safety shield
15kg to 25kg	2	Rear- or forward-facing child car seat (high-backed booster seat or booster cushion) using a seat belt, harness or safety shield
22kg to 36kg	3	Rear- or forward-facing child car seat (high-backed booster seat or booster cushion) using a seat belt, harness or safety shield

2.2.4 Price

Malaysia, Indonesia and Thailand use different local currencies. For standardization, the USD is used when comparing the CRS prices. The CRS retail prices were recorded during online market survey and tabulated according to CRS types (i.e., universal belted, Isofix, or combination of both) – refer to Table 2. Simple statistical analysis was performed to categorize the CRS prices into LOW, INTERMEDIATE and HIGH price categories. The "Price" evaluation criteria is given Importance Level 4, while Base Score from 1 to 3 is assigned to HIGH<INTERMEDIATE<LOW price accordingly. For fairness of evaluation, please note that CRS for Group 0+ are evaluated separately from the other group combinations since it is most likely that CRS for Group 0+ would always be smaller, cheaper and lighter to CRS in the other group combinations.

2.2.5 Size

The "Size" evaluation criterion was divided further into two sub-criteria, namely Weight and Dimension. Simple statistical analysis was performed to categorize the CRS "Weight" into LIGHT and HEAVY, while "Dimension" was classified into COMPACT and BIG. As in previous criteria, CRS for Group 0+ were evaluated separately from the other group combinations since it is most likely that CRS for Group 0+ would always be smaller, cheaper and lighter to CRS in other weight group combinations. The "Size" evaluation criterion is given the lowest Importance Level of 1 since CRS will only be moved occasionally after installation. Base Score of either 1 or 3 is assigned accordingly as tabulated in Table 3.

2.2.6 Direction of Installation

To ensure the safety of young children while travelling in vehicles, they must be seated in rear-facing CRS for as long as possible until they reach the CRS's maximum rear-facing height and

weight limits (Durbin and Hoffman, 2018). Once the child outgrows the CRS rear-facing capabilities, he/she can ride facing forward. Hence, CRS with only one option for direction of installation (i.e., forward o rear facing) will be given a Base Score of 1, while convertible CRS will be given Base Score of 3. The "Direction of Installation" criterion is assigned Importance Level 2.

2.3 Evaluating and Shortlisting CRS

Based on the evaluation criteria, each of the CRS was evaluated accordingly based on the CRS type (i.e., universal belted/isofix/combination) using the evaluation template as provided in Figure 8. As previously mentioned, Group 0+ CRS was assessed separately to ensure fairness in evaluation. Evaluation rate ranging from 1 to 3 (low to high, respectively) for each CRS was determined by examining its respective specifications. Based on the rating given, CRS Score was computed by multiplying the evaluation rate to importance level. Top performing CRS were chosen for shortlisting as tabulated in Table 5.

				Universal Belted CRS												
			Base Score	Mothercare Madrid	Babyzen - BeSafe iZi Combi X3	Welldon Smart Sport II BS02-T	Safety 1st Guide 65	Joie - Stages	Sweet Heart Paris CS286	Chicco Oasys	Cybex Pallas	Cosatto Zoomi	Safety 1st Continuum 3-in-1	Joie - Every Stage		Importance
Evaluation Criteria	Availability in Asean Country	Available in MY, ID, TH	3													5
	Regulation Approved	R129 only	1													6
		R44 only	3													
	Group Combination	(0, I, II, III)	3													3
		0/I	1													
		0/I/II	2													
		I/II/III	2													
	Price	Low Price	3													4
		Intermediate Price	2													
		High Price	1													
	Size	Weight (Light)	3													1
		Weight (Heavy)	1													
		Dimension (Compact)	3													
		Dimension (Big)	1													
	Direction	FWD/RWD Only	1													2
		Convertible	3													
		Score (Rate x Importance)														
		Shortlisted (Y/N)														

Figure 8: Evaluation template listing Universal Belted CRS and its evaluation criteria

Table 5: Shortlisted CRS according to type

Type	Brand	Group				Direction	Interface
		0/0+	I	II	III		
Universal Belted	Sweet Heart Paris CS375	√				Rearward	B _ _ _
	Cosatto Hold 0+	√				Rearward	B _ _ S
	Peg-Perego-Primo Viaggio Tri-Fix	√				Rearward	B _ _ _
	Welldon Smart Sport II BS02-T	√	√	√		Convertible	B _ _ _
	Joie - Stages	√	√	√		Convertible	B _ _ _
	Mothercare Madrid	√	√			Convertible	B _ _ S
	Cybex Pallas		√	√	√	Forward	B _ _ _
	Cosatto Zoomi		√	√	√	Forward	B _ _ _
	Safety 1st Continuum 3-in-1	√	√	√	√	Convertible	B _ _ S
	Safety 1st Guide 65	√	√	√		Convertible	B _ _ S
	Sweet Heart Paris CS286	√	√	√		Convertible	B _ _ _
ISOFIX CRS	Chicco KeyFit 30	√				Rearward	_ I _ S
	Peg-Perego-Primo Viaggio ISOFIX	√				Rearward	_ I L _
	Joie - Stages ISOFIX	√	√	√		Convertible	_ I L _
	Meinkind - Sonata		√	√	√	Convertible	_ I _ S
	Joie - Every Stage FX	√	√	√	√	Convertible	_ I _ S
Universal Belted & ISOFIX CRS	Chicco - Autofix	√				Rearward	B I L S
	Maxi-Cosi - Cabriofix	√				Rearward	B I _ S
	Britax Romer - Evolva 123 Plus		√	√	√	Convertible	B I _ S
	Cybex Pallas S Fix		√	√	√	Forward	B _ _ S
	KIDDY Guardian Pro 2		√	√	√	Forward	B I _ _
	Safety 1ST Grow'N'Go	√	√	√	√	Convertible	B I _ S

2.4 Establishing the CRS Reference List

Shortlisted CRS would be procured from the OEMs and would then undergo the actual COP assessment before the CRS Reference List could be finalised. As part of the ASEAN NCAP's COP protocol (ASEAN NCAP, May 2017), child restraint systems are installed in a test car with an 18 month old and a 3-year-old sized Q-Series dummies and assessed according to three areas of assessment: (1) installation of child restraints, (2) dynamic performance, and (3) vehicle-based assessments. Maximum points for each assessment is tabulated in Table 6 where they contribute to the overall child protection rating. Details of the assessments could be obtained from ASEAN NCAP (May 2017). Based on the COP assessment data, only the best CRS from the shortlist would be selected for the final CRS Reference List. Nevertheless, the test data and the final CRS Reference List will not be disclosed in this paper.

Table 6: Assessment points (ASEAN NCAP, 2014)

Requirements	Score
Dynamic Assessment Pre requisites - no partial or full ejection of child dummy out of CRS / CRS must not be partially or wholly unrestrained by any of the vehicle interfaces	24
CRS Based Assessment •CRS marking - 8 points •CRS to Vehicle Interface - 4 points	12
Vehicle Based Assessment •Use of CRS on the Front Seat – 5 points •Provision of three-points seat belts (Passengers) - 1 points •Gabarit assessment (outboard Rear) – 1 points •Gabarit assessment (other passenger seats) - 1 points •ISOFIX - 3 points •Integrated CRS - 2 points	13
Total	49

3.0 CONCLUSION

The CRS Reference List is vital for ASEAN NCAP's Child Occupant Protection assessment. The revision process to establish the new Reference List has been explained in this paper, beginning with the development of database for CRS from the three ASEAN countries (Malaysia, Indonesia and Thailand). These identified CRS were evaluated according to specified evaluation criteria and a CRS shortlist is presented. Nevertheless, the final CRS Reference List is yet to be disclosed.

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REFERENCES

Abu Husain, N., Ahmad, Y. Mohd Zaki, N.I., Abu Kassim, K.A., & Che Hussin, S.M. (2018a). *Copyright No. LY2018003867*. Kuala Lumpur, Malaysia: Perbadanan Harta Intelek Malaysia.

Abu Husain, N., Ahmad, Y. Mohd Zaki, N.I., Abu Kassim, K.A., and Che Hussin, S.M. (2018b). *Copyright No. LY2018003868*. Kuala Lumpur, Malaysia: Perbadanan Harta Intelek Malaysia.

ASEAN NCAP (2014). *Children in the car – How safe they are?* Presented at ASEAN Automobile Safety Forum 2014, Bangkok, Thailand.

ASEAN NCAP (May 2017). *Assessment protocol – Child occupant protection, Version 1.2*. Kuala Lumpur, Malaysia: ASEAN NCAP.

ASEAN NCAP (September 2017). *ASEAN NCAP Passive Safety Group Discussion*.

Bendjellal, F., Frank, R., & Haas, M. (2017). *Child occupant protection in rear seats: An example of CRS development with respect to EURO NCAP 2016 protocol requirements*. Presented at 25th International Technical Conference on the Enhanced Safety of Vehicle (ESV), Detroit, Michigan, USA.

Child Car Seats: The Law. (October 2018). Retrieved from https://www.gov.uk/child-car-seats-the-rules.

Durbin, D.R., & Hoffman, B.D. (2018). Child passenger safety. *Pediatrics, 142*(5). doi: 10.1542/peds.2018-2460

FIA Foundation for the Automobile and Society (2009). *Seat-belts and child restraints: A road safety manual for decision-makers and practitioners*. London, UK: FIA Foundation for the Automobile and Society.

Noor Faradila P., Baba M.D., Aqbal Hafeez A., Azhar H., Rohayu S., Akmalia S., & Mohd Syazwan S. (2016). A survey among guardians on child restraint system (CRS) usage in Central Peninsular Malaysia. *Malaysian Journal of Public Health Medicine, Special Volume (1)*, pp. 1-6.

UNECE (n.d.). *Child restraint systems – Users' guide to protecting the world's children*. Geneva, Switzerland: United Nations Economic Commission for Europe (UNECE). Retrieved from https://www.unece.org/fileadmin/DAM/trans/publications/WP29/Leaflet_Child_Restraint_Systems.pdf