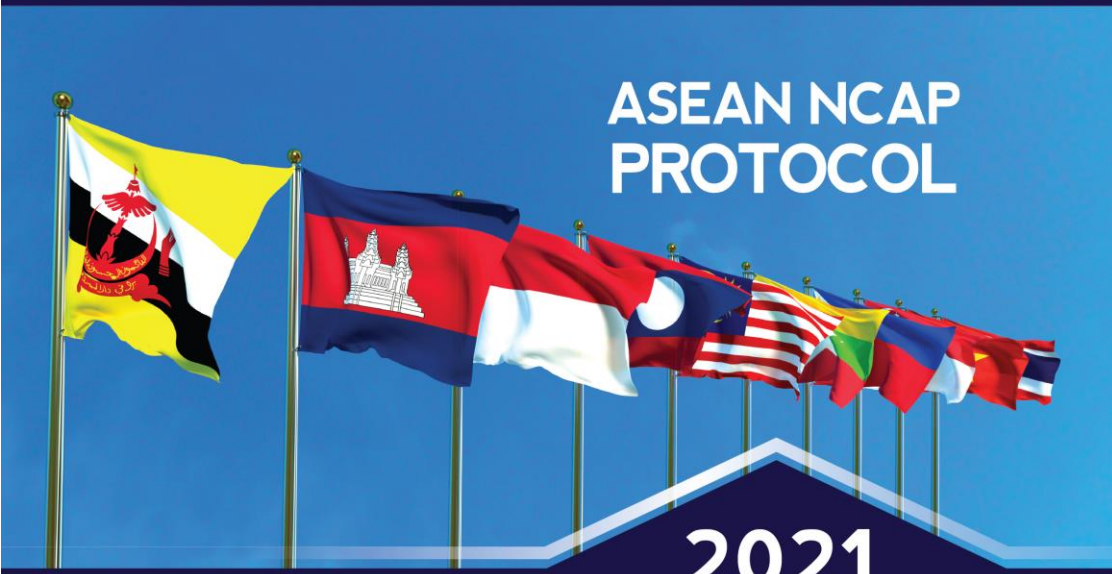
ASEAN NCAP
www.aseancap.org



ASSESSMENT PROTOCOL – SAFETY ASSIST

Version 2.0
November 2019

Preface

Where text is contained within square brackets this denotes that the procedure being discussed is currently being trialled in ASEAN NCAP. Its incorporation in the Test Protocol will be reviewed at a later date.

During the test preparation, vehicle manufacturers are encouraged to liaise with the laboratory and to check that they are satisfied with the way cars are set up for testing. Where a manufacturer feels that a particular item should be altered, they should ask the laboratory staff to make any necessary changes. Manufacturers are forbidden from making changes to any parameter that will influence the test, such as dummy positioning, vehicle setting, laboratory environment etc.

It is the responsibility of the test laboratory to ensure that any requested changes satisfy the requirements of ASEAN NCAP. Where a disagreement exists between the laboratory and manufacturer, the ASEAN NCAP secretariat should be informed immediately to pass final judgement. Where the laboratory staff suspect that a manufacturer has interfered with any of the setup, the manufacturer's representatives should be warned that they are not allowed to do so themselves. They should also be informed that if another incident occurs, they will be asked to leave the test site.

Where there is a recurrence of the problem, the manufacturer’s representatives will be told to leave the test site and the Secretariat should be immediately

informed. Any such incident may be reported by the Secretariat to the manufacturer and the persons concerned may not be allowed to attend further ASEAN NCAP tests.

DISCLAIMER: ASEAN NCAP has taken all reasonable care to ensure that the information published in this protocol is accurate and reflects the technical decisions taken by the organisation. In the unlikely event that this protocol contains a typographical error or any other inaccuracy, ASEAN NCAP reserves the right to make corrections and determine the assessment and subsequent result of the affected requirement(s).

In addition to the settings specified in this protocol, the following information will be required from the manufacturer of the car being tested in order to facilitate the vehicle preparation. A vehicle handbook should be provided to the test laboratory prior to the assessment.

ASSESSMENT PROTOCOL – SAFETY ASSIST

Table of Contents

NEW CAR ASSESSMENT PROGRAM FOR SOUTHEAST ASIAN COUNTRIES (ASEAN NCAP)

ASSESSMENT PROTOCOL – SAFETY ASSIST

1 INTRODUCTION

ASEAN NCAP shall focus on Auto Emergency Braking (AEB) Technology that is a feature to alert drivers to an imminent crash and help them use the maximum braking capacity of the car. ASEAN NCAP believes that AEB is an important technology, which has been well-received by most car manufacturers. In North America, 22 automakers have agreed to voluntarily fit their cars with standard AEB starting in 2022. ASEAN NCAP shall, in addition, place greater attention on AEB City and Interurban. Individual documents are released for the four main areas of assessment:

Assessment Protocol – Adult Occupant Protection;
Assessment Protocol – Child Occupant Protection;
Assessment Protocol – **Safety Assist**;
Assessment Protocol – Motorcyclist Safety;

In Safety Assist, ASEAN NCAP shall also pay close attention to the rear occupant detection. Hence in the new protocol, incentive is given to vehicles fitted with rear Seatbelt Reminder (SBR)s in addition to frontal SBRs. Such a decision also provides evidence that ASEAN NCAP will be focusing on the use of seatbelts as the primary protection for car occupants.

Finally, ASEAN NCAP shall be rewarding another 3 points under Safety Assist for Advance SAT with OEMs being able to select any technology that is suitable to reduce road casualties. In this area, car manufacturers are encouraged to introduce a technology that will benefit road users and help prevent a road crash.

Safety Assist contributes 20% to the overall rating with a maximum of 21 points focusing on four aspects; Effective Braking and Avoidance (EBA), Seatbelt Reminder (SBR) system, Autonomous Emergency Braking (AEB) and Advanced Safety Assist Technologies (SATs). The score calculation for specific elements in each domain is based on Fitment Rating System (FRS).

The following protocol deals with the assessments made in the area of AEB (City & Inter-Urban), SBR system, EBA specifically Anti-lock Braking System (ABS) and Electronic Stability Control (ESC), and Advanced SATs.

2 METHOD OF ASSESSMENT

Unlike the assessment of protection offered in the event of a crash, the assessment of Safety Assist functions does not require destructive testing of the vehicle. Assessment of Safety Assist functions can be based both on fitment and performance requirements verified by ASEAN NCAP (as is the case for SBR and AEB) or verified using in-house test data/related regulation (as is the case of Advanced SATs and EBA) or fitment requirements only, where functionality is demonstrated by the

manufacturer. The intention is to promote standard fitment across the car variants sold in the ASEAN region in combination with good functionality for these systems, where this is possible.

For the performance assessment of SBR systems, the car is subjected to a number of trial sequences designed to highlight the effectiveness of the systems. The car performance is measured using the observations conducted by the Inspector during a driving test/session. Aside from the basic ASEAN NCAP assessment, further information may be recorded that may add to the ASEAN NCAP assessment in the future.

3 SEATBELT REMINDER ASSESSMENT (SBR)

3.1 Introduction

3.1.1 It is well recognized that the correct use of seatbelts is the most effective way of providing protection to vehicle occupants in a crash. The use rates among car occupants vary greatly across the ASEAN region and research has shown that many of the non-wearers would use their seatbelt with some encouragement. Nevertheless, a small proportion of non-wearers will not be persuaded to use their seatbelts.

3.1.2 Seatbelt Reminder (SBR) systems are intended to encourage the first of these groups to use their seatbelts, whilst at the same time not be so annoying that the second group would take undesirable actions to disable

the systems. Such actions could include tempering with or cutting electrical connections which might have undesirable consequences.

3.1.3 It is intended that habitual users who always put their seatbelt on before starting their journey would hardly notice the existence of the system and would not be annoyed by it.

3.1.4 To refrain dedicated non-users from trying to tamper with the system, ASEAN NCAP recommends that SBR systems must be capable of being deactivated. Deactivation could be long term and/or short term for individual journey.

3.1.5 Although simple SBR systems have been available for some time, the technology behind the more sophisticated system is new. ASEAN NCAP has set some minimum requirements but wishes to allow the development of increasingly improved system.

3.1.6 Some recommendations are made on how improvements may occur and these may eventually become ASEAN NCAP requirements. The expectation is that the requirements will develop in light of further knowledge.

3.1.7 The terms used in this protocol are defined in Appendix I.

3.2 Information Required from Manufacturers

3.2.1 Before the SBR system can be evaluated by ASEAN NCAP, it is necessary for the manufacturer to explain which seating positions are covered by the system and how the system is intended to work. See Appendix II. This information should be supplied to ASEAN NCAP prior to the assessment.

3.2.2 Only those seating positions, as requested by the manufacturer, will be assessed by ASEAN NCAP, even if the system extends to other seats. However, where SBR systems are fitted to seats which have not been nominated for assessment, they should not adversely affect the seat being assessed.

3.3 Seat Occupancy Requirement

3.3.1 In the case of the driver's seat, occupancy can be assumed so the system does not have to be capable of detecting whether or not the seat is in use.

3.3.2 For front seat passengers, seat use must be detected. ASEAN NCAP defines occupancy as use by an occupant larger, taller or heavier than a small female (5th percentile).

3.3.3 Systems that feature rear seat occupant detection are eligible for higher scores.

3.4 Seatbelt Use

3.4.1 For all seats offered for assessment, seatbelt use must be monitored. Their use must be identified at the start of the journey and any change of use must be detected throughout the period of use of the vehicle.

3.4.2 Monitoring of rear seatbelt secondary buckles that require a key to unlock them is not mandatory.

Note: In some cases, systems are unable to reliably meet the requirements of Section 3.8.1. For example, if the seatbelt is used to retain a child restraint, the belt may be unbuckled but sufficient webbing has been drawn off the reel for the system to interpret the belt as being buckled, resulting in false indication of belt use. This potentially hazardous situation could also occur with CRS lock-offs and where the belt is left over the occupant's shoulder.

3.5 Removable Seats

3.5.1 Where seats, covered by the reminder system, are removable as part of the cars normal usage, ASEAN NCAP has minimum requirements for any electrical connections used by the reminder system.

3.5.2 It is recommended that such electrical connections are made automatically when the seat is installed in the vehicle.

3.5.3 Alternatively, a manual connection can be made by the installer. Where this is the case, all of the following requirements must be complied with,

- Connectors must be conspicuous and easily visible to the installer, during the installation process.
- Clear markings must indicate the purpose of the connection and show how the connection is made.
- The markings must be permanently attached to the vehicle.
- The markings must be conspicuous using contrasting colors.
- The markings must be easily visible to the installer during the installation process.

3.5.4 The presence or absence of the seat must not adversely affect the operation of other parts of the reminder system.

3.5.5 The SBR system must not give any false indication of belt use, whether the seats are installed in the vehicle or not. For example, when a seat is installed in the vehicle but the electrical system is not connected, the seat belt reminder system should not indicate that the seatbelt is being used, when it is not being used.

3.5.6 If the removable seat is optional, the assessment will be based on a car equipped with the optional removable seat.

3.6 Start and Duration of Signal

3.6.1 Front Seating Positions

3.6.1.1 The reminder system should “start” at the commencement of each “journey” that the vehicle makes. Short breaks in the journey are allowed, where the reminder system is not required to start again. Such short breaks, of up to 30 seconds, are to allow for events such as stalling of the engine.

3.6.1.1.1 Initial Signal

It is recommended that an audio and/or visual signal is started, shortly after the ignition is switched on or shortly after the vehicle starts to move, where one or more seatbelts are not in use.

3.6.1.1.2 Intermediate Signal

Optionally, an intermediate signal may be given, at some time before the “Final Signal” is required, where one or more seatbelts are not in use. If this “Intermediate Signal” is more sophisticated than a simple audio-visual signal, the start of the Final Signal may be delayed. Such “Intermediate Signal” might be a clear, easily visible text message or a loud and clear voice message.

3.6.1.1.3 Final Signal

The audio-visual Final Signal is the only signal which ASEAN NCAP considers for assessment, where one or more seatbelts are not in use.

The start and duration requirements are defined as follows:

(1) Start

The Final Signal must begin before at least one of the followings:

- The engine has been running for 60 seconds, or
- The car has been in "Forward Motion" for 60 seconds, or
- The car has been in "Forward Motion" for 500 meters, or
- The car has reached a forward speed of 25 km/h.

(2) Where an Initial Signal is employed, the start of the Final Signal may be delayed provided that the Initial Signal meets one of the requirements detailed below. In this circumstance, the Final Signal must start within 30 seconds of the car having reached a forward speed of 25 km/h.

- A constant, flashing or intermittent visual signal for at least 30 seconds.
- A text message for at least 5 seconds.
- A clear voice messages.

The duration of the Initial Signal may be reduced provided the Final Signal commences immediately after the Initial Signal stops.

For systems which have Initial, Intermediate and Final Signals, the start of the Intermediate and/or Final Signal may be delayed provided that the Initial signal meets one

of the requirements detailed above. In this circumstance, the Intermediate Signal must start within 30 seconds of the car having reached a forward speed of 25 km/h and lead into the Final Signal after an additional 30 seconds.

The duration of the Initial Signal may be reduced provided that either the Intermediate or Final Signal commences immediately after the Initial Signal stops.

(3) Where a "more sophisticated Intermediate Signal" is employed, the start of the Final Signal may be delayed. However, the Final Signal must start before at least one of the followings:

- The engine has been running for 90 seconds, or
- The car has been in "Forward Motion" for 90 seconds, or
- The car has been in "Forward Motion" for 1000 meters, or
- The car has reached a forward speed of 40 km/h.

(4) For the purpose of defining the start of the Final Signal, a forward motion of less than 10 km/h, or rearward motion, is not deemed to be in motion.

(5) Duration

The duration of the Final Signal must be at least 90 seconds. If the audio-visual Final Signal is not continuous:

- The signal must start with a positive audio-visual signal, for at least 5 seconds.

- Gaps of more than 1 second in the signal must not occur more frequently than every 5 seconds.
- Gaps of less than 1 second, which allow for visual signals which flash and audio signals which "beep," are ignored.
- If gaps in the signal exceed 3 seconds, that time is not included in the "Duration" time.
- No gap must last for more than 25 seconds.

(6) Once the Final Signal has started, it must only stop under one of the following circumstances:

- The signal has operated for the Duration specified.
- The related seatbelts are put into use.
- The engine has stopped.
- Reverse gear has been selected.

Note: When forward gear is re-selected and forward motion commences (>10 km/h), the Final Signal must resume again.

- The occupant leaves the car, unless the signal is required to indicate the belt use status of others.

3.6.1.2 The signal requirements when there is a change of belt status are described in Section 3.8.

3.6.2 Rear Seating Positions

3.6.2.1 The reminder system should "start" at the commencement of each" journey" that the vehicle makes. Short breaks in the journey are allowed, where the reminder system is not required to start again. Such short

breaks, of not more than 30 minutes, are to allow for events such as stalling of the engine or re-fueling, where passengers may remain in the vehicle.

3.6.2.1.1 For rear SBR, it is acceptable for a journey to be considered as having been completed when 30 minutes have elapsed after the engine has stopped.

3.6.2.1.2 In the absence of seat occupancy information, only a visual signal is required by ASEAN NCAP, unless there is a change of status. See Section 3.8 for further requirements.

3.6.2.1.3 The start and duration requirements of the signal are defined as follows.

(1) Start

The signal must start within 5 seconds of at least one of the followings:

- The engine starts, or
- The start of forward motion (>10 km/h)

(2) Where seat occupancy is monitored, the start of the signal may be delayed by 10 seconds. With good justification, longer delays may be acceptable.

(3) For the purpose of defining the start of the signal, forward motion at less than 10 km/h, or rearward motion, is not deemed to be motion.

(4) Duration

The duration of the visual signal must be at least 30 seconds.

If the visual is not continuous:

- Gaps of more than 1 second in the signal must not occur more frequently than every 5 seconds.
- Gaps of less than 1 second that allow for visual signals of which flashes are ignored.
- If gaps in the signal exceed 3 seconds, that time is not included in the "Duration" time.
- No gap must last for more than 25 seconds.

3.6.2.2 The system may allow the driver to acknowledge the signal, so switching it off.

3.6.2.3 No signal is required if the system is able to determine that there are no occupants in the rear seating positions.

3.6.2.4 The signal requirements when there is a change of belt status are described in Section 3.8.

3.7 Signal

3.7.1 ASEAN NCAP only requires the provision of simple audio-visual or visual signals. However, manufacturers are recommended to use the best possible means of communicating the reminder message to the driver and all the passengers. The provision of a visual signal for the user of each seat, the use of a loud and clear voice message or the use of a prominent text

message on satellite navigation or other LCD screen is recommended.

3.7.2 As soon as the audible part of the seatbelt reminder signal starts, the visual signal needs to flash and be synchronized (not necessarily at the same frequency, but an integer multiple of each other, e.g. two flashes with every chime) with the audible part.

3.7.3 The signal should not annoy the users, to the extent that they may be tempted to tamper with the restraint or the vehicle's electrical system. Any final audible signal must be "Loud and Clear" for the driver.

3.7.4 A progressive or stepped audible signal is recommended. However, there is no requirement regarding the volume of any audible signal other than the Final Signal.

3.7.5 If for any reason, multiple audible signals are being generated at the time that the reminder signal is operating, they must not interfere with each other, to the extent that the message is less clear, unless a more critical safety warning is being developed.

3.7.6 Any visual signal must be clearly visible to the driver, without the need for the head to be moved from the normal driving position (e.g. instrument panel, head-up display, rear-view mirror, center console).

3.7.6 Front Seating Positions

3.7.6.1 The Final Signal used for the front seating position must be both audio and visual.

3.7.6.2 The audible component of the Final Signal must be “Loud and Clear” for the driver and all relevant passengers.

3.7.6.3 The visual signal and its message must be clearly visible to the driver, without the need for the head to be moved away from the normal driving position.

3.7.6.4 There must be a clear obvious link between the audible and visual signals. In the case of flashing or intermittent visual or audible signals, this may be achieved by having them in synchronization.

3.7.6.5 It is recommended that all front seat passengers can see the visual signal relevant to their seating position.

3.7.6.6 It is recommended that the relevant visual signals are illuminated during the whole time the seat is occupied without the seatbelt being used.

3.7.6.7 Where text messages are used, they must be in at least one of the languages of each of the countries in which the car is offered for sale.

3.7.7 Rear seating positions

3.7.7.1 The start signal(s) for the rear seating position (as defined in Section 3.6.2.1.3) need only in visual form.

3.7.7.2 An immediate audible component for change of status is required; the signal must be “Loud and Clear” for the driver. An audible signal, such as a chime or a beep, when each belt is unbuckled is acceptable. The requirements for change of status are detailed in Section 3.8.

3.7.7.3 The visual signals and their messages must be clearly and easily visible to the driver, without the need for the head to be moved away from the normal driving position.

3.7.7.4 It is recommended that all rear seat passengers can see the visual signal relevant to their seating position. It is recommended that the relevant visual signals are illuminated during the whole time that the seat is occupied without the seatbelt being used.

3.7.7.5 The visual signals must clearly indicate to the driver the number of seatbelts in use or not in use. No signal is required if all the rear occupants are belted.

3.7.7.6 No signal is required if the system is able to determine that there are no occupants in the rear seats.

3.7.7.7 Where text messages are used, they must be in at least one of the languages of each of the countries in which the car is offered for sale.

3.8 Change of Status

3.8.1 If during the journey, any seatbelt experiences a "change of status", where a buckled belt is unbuckled, the reminder must indicate this immediately with an audiovisual signal.

3.8.2 A change of status signal for all seating positions is required at vehicle speed above 25 km/h.

3.8.3 Front Seating Positions

3.8.3.1 An audio-visual signal must commence immediately once any front row seatbelt is unbuckled. This must be indicated with the use of an "Intermediate Signal" or the Final Signal.

3.8.3.1.1 Where the Final Signal is used, the following requirements must be met.

- The signal must meet the requirements detailed in Section 3.7.5.
- The signal must meet the requirements detailed in Section 3.6.1.1.3 (5) & (6).
- The signal must start immediately with a positive audio-visual signal, for at least 5 seconds.

3.8.3.1.2 Where an “Intermediate Signal” is used, the following requirements must be met.

- The signal must be audio-visual.
- The signal must start with a positive audio-visual signal, for at least 5 seconds.
- There must be no gap greater than 10 seconds.
- The final signal must commence after a maximum duration of 30 seconds.

3.8.4 Rear Seating Positions

3.8.4.1 An audio-visual signal, meeting the requirements of 3.7.6 and 3.8.1, must commence immediately when any rear seatbelt is unbuckled.

3.8.4.2 The visual signal must continue for its full duration of 30 seconds or until the rear belts are buckled for the seats in use.

3.8.4.3 The audible component must also commence immediately and be “Loud and Clear” to the driver. A single audible signal, such as one ‘chime’ or ‘beep’, when each belt is unbuckled is acceptable.

3.8.4.4 Where two or more belts are unbuckled within 5 seconds of each other, a signal chime or beep is acceptable. Where more than 5 seconds elapses between belts being unbuckled, an audible signal for each unbuckled belt is required.

3.8.4.5 For the rear seats, the system may allow the driver to acknowledge the signal, by switching it off.

3.9 Test Conditions for Assessment of Loud and Clear Audible Signals

3.9.1 The sound level will be assessed by a user, having normal hearing acuity, sitting in the relevant seat.

3.9.1.1 The assessment will be made with the vehicle being driven at constant speed, of 25 km/h, in second gear. Vehicles with automatic transmission will have it locked in second gear, if this is possible.

Note: Where a more sophisticated Intermediate Signal is employed, it may be necessary to travel at 40 km/h before returning to 25 km/h, to assess the audible signal.

3.9.1.2 The ventilation fan will be set to its maximum setting.

3.9.1.3 All ventilation vents will be fully opened, if this is possible.

3.9.1.4 The radio/ audio system will be switched off.

Note: It is recommended that reminder systems are designed so that, if they sound whilst the radio/ audio system is playing, the sound from the radio/ audio system should be interrupted by the reminder systems.

Alternatively, the radio/ audio system could be used to convey the reminder message.

3.9.1.5 The air conditioning will be switched off, if this is possible.

3.9.1.6 With convertibles, the roof will be closed.

3.9.1.7 All windows will be closed.

Note: It is recommended that the reminder system is designed so that the audible signal can be easily heard under any normal usage conditions.

3.10 Deactivation

3.10.1 The reminder system may be designed to allow deactivation. Short term deactivation can cover a single journey. Long term deactivation may be used for seatbelts of dedicated non-users. It is intended that this would reduce the likelihood that users might temper with the system.

3.10.2 The Seatbelt Reminder system must not be deactivated at the time the car is offered for sale.

3.10.3 Short term single journey deactivation

3.10.3.1 Short term deactivation must be more difficult than putting the seatbelt on and off once. Short term

deactivation must only affect the seating position for which deactivation had been chosen.

3.10.3.2 The reminder system must reactivate if ignition is switched off for more than 60 seconds.

3.10.4 Long term deactivation

3.10.4.1 Long term deactivation must require a sequence of operations, which could not be guessed at or carried out accidently.

3.10.4.2 Reactivation must be simple. It should not be more difficult to reactivate than it was to deactivate. No new components or special tools should be required.

3.10.4.3 It is recommended that seating positions can be deactivated individually.

3.10.4.4 Instructions for long term deactivation must be supplied with the car. However, they can be supplied to the user upon request.

3.10.4.5 Included with deactivation instructions must be the instructions on how to reactivate the system.

3.10.4.6 If deactivation has to be carried out by a dealer, reactivation may also be carried out by the same dealer.

3.10.4.7 In the case of low volume, special purpose vehicles, ASEAN NCAP Secretariat may give ad hoc

approval to remove ASEAN NCAP requirement for the fitting of SBR system to those vehicles.

3.10.5 Installing child restraint system

3.10.5.1 Where a vehicle can automatically detect the installation of a child restraint system i.e. adult seatbelt system is not used, the SBR for that individual seat position may be disabled. For example, using a switch on the ISOFIX anchorage which would be activated when the ISOFIX latches are attached to the anchorages.

3.10.5.2 The SBR must only be deactivated by the specific action of installing a CRS in that seating position.

3.10.5.3 The reminder system must reactivate immediately once the CRS had been removed regardless of whether the ignition is switched on or off at the time.

3.10.5.4 There must be no link between the front seat passenger airbag and the front seat passenger SBR signals. It is NOT acceptable to ASEAN NCAP for the passenger seat SBR to be disabled via the passenger airbag switch.

3.11 Scoring and Visualisation

3.11.1 For Seatbelt Reminder systems which fully comply with ASEAN NCAP requirements, the following

points will be awarded to the overall occupant score for that vehicle.

3.11.1.1 Front and Rear Row Seats
Where ALL front and rear row seating positions meet the assessment criteria, the final score will be determined based on Fitment Rating System (FRS). Refer ASEAN NCAP Fitment Rating System Version 1.1.

3.11.1.2 If the third or more row of seats is optional, on any variant, the assessment will be based on a vehicle fitted with optional seats.

3.11.1.3 The maximum score for SBR is 6 points considering both front and rear seats.

3.12 Future Developments

3.12.1 It is expected that the protocol will continue to develop, in the light of experience with these new systems. Consideration will also be given to converting some of the current recommendations into requirements.

4 ASSESSMENT OF ANTI-LOCK BRAKING SYSTEM (ABS)

4.1 Introduction
Anti-lock Braking System (ABS) is an active safety technology that allows the wheels on a motor vehicle to maintain tractive contact with the road surface according

to driver inputs while braking, preventing the wheels from locking up and avoiding uncontrolled skidding.

Previously, ABS was not part of ASEAN NCAP rating. Based on ASEAN NCAP's observation, the fitment rates of ABS in certain ASEAN countries is still lacking where it is still offered as optional rather than standard equipment. Thus, since 2017, ABS is included into the overall rating as part of Effective Braking and Avoidance (EBA) in ASEAN NCAP protocol.

This system uses different schemes depending on the types of brake in use. For this case, ASEAN NCAP only considers 4-channel ABS.

4.2 Requirements for ABS

4.2.1 The manufacturer must provide a certificate showing UN Regulation No.13H approval of the vehicle type being assessed.

4.2.2 A technical report from a laboratory or technical service is acceptable as, at the time the vehicle is assessed by ASEAN NCAP, all homologation should be completed and a certificate should have been obtained. Refer to ASEAN NCAP Guideline In-House Test Report Documentation Submissions version 1.0.

4.2.3 The variant tested by Technical Service during type-approval does not need to be the same as ASEAN NCAP test variant. However, if it is not, it should be

clear that the certificate of approval covers all variants, including ASEAN NCAP test variant.

4.3 Scoring

4.3.1 Vehicles of which ABS meet the requirements, as defined in paragraph 4.2, will be eligible for a maximum score of 6 points (to consider ESC as well). Refer ASEAN NCAP Fitment Rating System Version 1.1.

4.3.2 Vehicles of which system do not meet the above requirements or are not eligible for ABS assessment receive no points.

5 ASSESSMENT OF ELECTRONIC STABILITY CONTROL (ESC)

5.1 Introduction

Electronic Stability Control (ESC) system is an evolution of ABS designed to assist drivers in maintaining heading control of their vehicles in high-speed or sudden maneuvers and on slippery roads. Based on extensive literature review study, ESC has been shown to effectively reduce single vehicle crashes involving cars and SUVs by 30-50% and 50-70% respectively. The reduction is even higher (70-90%) for fatal rollover crashes regardless of vehicle type.

ASEAN NCAP has promoted the fitment of ESC since its establishment in 2012. In order for a vehicle to obtain a 5-star Adult Occupant Protection (AOP) rating, it needs

to be equipped with ESC and also SBR for frontal occupants. Since 2017, ASEAN NCAP has included ESC into the overall rating as part of Effective Braking and Avoidance (EBA).

5.2 Requirements for ESC

5.2.1 The manufacturer must provide a certificate showing UN Regulation No. 13H/00 or UN Regulation No. 140 approval of the vehicle type being assessed.

5.2.2 A technical report from a laboratory or technical service is acceptable as, at the time the vehicle is assessed by ASEAN NCAP, all homologation should be completed and a certificate should have been obtained. Refer to ASEAN NCAP Guideline In-House Test Report Documentation Submissions version 1.0.

5.2.3 The variant tested by Technical Service during type-approval does not need to be the same as ASEAN NCAP test variant. However, if it is not, it should be clear that the certificate of approval covers all variants, including ASEAN NCAP test variant.

5.3 Scoring

5.3.1 Vehicles of which ESC system meet the requirements, as defined in paragraph 5.2, will be eligible for a maximum score of 6 points (to consider ABS as

well). Refer ASEAN NCAP Fitment Rating System Version 1.1.

5.3.2 Vehicles of which ESC system do not meet the above requirements or are not eligible for ESC assessment receive no points.

6 ASSESSMENT OF AUTONOMOUS EMERGENCY BRAKING (AEB)

6.1 Introduction

For the assessment of Autonomous Emergency Braking (AEB) system, two types of AEB system are assessed, namely:

I. AEB Inter Urban system.
II. AEB City system.

6.2 Definitions

Throughout this protocol the following terms are used:

Autonomous emergency braking (AEB) – braking that is applied automatically by the vehicle in response to the detection of a likely collision to reduce the vehicle speed and potentially avoid the collision.

Car-to-Car Rear Stationary (CCRs) – a collision in which a vehicle travels forwards towards another stationary vehicle and the frontal structure of the vehicle strikes the rear structure of the other.

Car-to-Car Rear Moving (CCRm) – a collision in which a vehicle travels forwards towards another vehicle that is travelling at constant speed and the frontal structure of the vehicle strikes the rear structure of the other.

Vehicle under test (VUT) – means the vehicle tested according to this protocol with a pre-crash collision mitigation or avoidance system on board.

Euro NCAP Vehicle Target (EVT) – means the vehicle target used in this protocol as specified in Annex A of the ASEAN NCAP AEB Test Protocol (=EURO NCAP AEB Test Protocol v.1.1).

Vrel_test – the relative speed between the VUT and the EVT by subtracting the velocity of the EVT from that of the VUT at the start of test.

Vimpact – the speed at which the VUT hits the EVT.

Vrel_impact – the relative speed at which the VUT hits the EVT by subtracting the velocity of the EVT from Vimpact at the time of collision.

Vrel_threshold – the minimum Vrel_impact at which a full score is given in each test speed.

6.3 Assessment of AEB CITY System

6.3.1. Criteria and Scoring

The assessment criteria used is the relative impact speed Vrel_impact. The available points per test speed are awarded based on the relative speed reduction achieved at every test speed.

In case that Vrel_impact exceeds Vrel_threshold, a linear interpolation is applied to calculate the score for every single test speed.

$Score_{tes\ tspeed}$=((*Vrel_test-Vrel_impact*)/(*Vrel_test-Vrel_threshold*)) × $points_{test\ speed}$

The points available for the different test speeds for CCRs are detailed in the table below:

Test speed	CCRs	
	Vrel_threshold	Point
10 km/h	0 km/h	1.000
15 km/h	0 km/h	2.000
20 km/h	0 km/h	2.000
25 km/h	0 km/h	2.000
30 km/h	0 km/h	2.000
35 km/h	0 km/h	2.000
40 km/h	0 km/h	1.000
45 km/h	15 km/h	1.000
50 km/h	25 km/h	1.000
55 km/h	30 km/h	1.000
60 km/h	35 km/h	1.000
Total		16.000

6.4 AEB City Score

The scoring is based on normalized scores of the AEB function. The test results are used to calculate a normalized AEB score. This results in a single percentage for AEB.

The AEB City score in points is as shown below.

AEB City score = AEB normalized score x 2.5

6.5 Assessment of AEB INTER-URBAN System

6.5.1. Criteria and Scoring

6.5.1.1 To be eligible for scoring points in AEB Inter-Urban, the AEB system must operate up to speeds of at least 60 km/h.

6.5.1.2 For AEB system test, the assessment criteria used is the relative impact speed Vrel_impact. The available points per test speed are awarded based on the relative speed reduction achieved at every test speed.
In case that Vrel_impact exceeds Vrel_threshold, a linear interpolation is applied to calculate the score for every single test speed.

$Score_{tes\ tspeed}$=(($Vrel\_test$-$Vrel\_impact$)/($Vrel\_test$-$Vrel\_threshold$))× $points_{test\ speed}$

The maximum points available for the different test speeds for CCRm are detailed in the following table.

Test speed	CCRm	
	Vrel_threshold	Point
30 km/h	0 km/h	1.000
35 km/h	0 km/h	1.000
40 km/h	0 km/h	1.000
45 km/h	0 km/h	1.000
50 km/h	0 km/h	1.000
55 km/h	0 km/h	1.000
60 km/h	0 km/h	1.000
Total		7.000

6.5.1.3 AEB Inter-Urban Score

The scoring is based on normalized scores of the AEB function. The test results are used to calculate a normalized AEB score. This results in a single percentage for AEB.

The AEB Inter Urban score in points is as shown below.

AEB Inter Urban score = AEB normalized score x 3.5

6.6. Scoring Example

6.6.1 AEB City

Test speed	Vrel_ threshold	$Points_{test\ speed}$	Vrel_ impact	$Score_{test\ speed}$
10 km/h	0 km/h	1.000	0 km/h	1.000
15 km/h	0 km/h	2.000	0 km/h	2.000
20 km/h	0 km/h	2.000	0 km/h	2.000
25 km/h	0 km/h	2.000	0 km/h	2.000
30 km/h	0 km/h	2.000	0 km/h	2.000
35 km/h	0 km/h	2.000	0 km/h	2.000
40 km/h	0 km/h	1.000	5 km/h	0.875
45 km/h	15 km/h	1.000	15 km/h	1.000
50 km/h	25 km/h	1.000	25 km/h	1.000
55 km/h	30 km/h	1.000	35 km/h	0.800
60 km/h	35 km/h	1.000	45 km/h	0.600
Total		16.000		15.275
Normalized score			95.5%	

AEB City score. Applying the formula above, the total score equals: 2.5 x 95.5% = 2.39 points.

6.6.2 AEB Inter-Urban

Test Speed	Vrel_ test	Vrel_ threshold	Points test speed	Vimpact	Vrel_ impact	Score test speed
30 km/h	10 km/h	0 km/h	1.000	0 km/h	0 km/h	1.000
35 km/h	15 km/h	0 km/h	1.000	0 km/h	0 km/h	1.000
40 km/h	20 km/h	0 km/h	1.000	0 km/h	0 km/h	1.000
45 km/h	25 km/h	0 km/h	1.000	0 km/h	0 km/h	1.000
50 km/h	30 km/h	0 km/h	1.000	30 km/h	10 km/h	0.667
55 km/h	35 km/h	0 km/h	1.000	45 km/h	25 km/h	0.286
60 km/h	40 km/h	0 km/h	1.000	55 km/h	35 km/h	0.125
Total			7.000			5.078
Normalized score						72.5%

AEB Inter-Urban score. Applying the formula above, the total score equals: 3.5 x 72.5% = 2.54 points.

7 ASSESSMENT OF ADVANCED SAFETY ASSIST TECHNOLOGIES

7.1 Introduction

In recent years, there is encouraging sign of manufacturers deploying innovative and Advanced Safety Assist Technologies (SATs) into the market and increasing initiative of autonomous vehicle worldwide. ASEAN NCAP intends to develop tests which complement any legislative requirements in order to be able to rate Advanced SATs in more detail in the future. In the meantime, as an encouragement for manufacturers to fit these systems more broadly, ASEAN NCAP has included these Advanced SATs into its rating starting 2017 where established test protocols are used to demonstrate the functionality and/or performance of the systems.

7.2 Functional Definitions of Technologies that are considered by ASEAN NCAP

7.2.1 Forward Collision Warning (FCW) – An audio-visual warning that is provided automatically by the vehicle in response to the detection of a likely collision to alert the driver.

7.2.2 Lane Departure Warning (LDW) – A system designed to warn a driver when the vehicle begins to move unintentionally out of its lane (unless a turn signal is ON in that direction) on highways and urban roads.

7.2.3 Lane Keep Assist (LKA) – A system designed to support a driver when the vehicle begins to move unintentionally out of its lane (unless a turn signal is ON in that direction). The systems support the driver with a haptic vehicle cue (e.g. steering nudge) which may help to keep the vehicle in lane.

7.2.4 Other Advanced SATs (Active Safety Belt etc.) proposed by manufacturers, subject to ASEAN NCAP approval.

7.3 Requirements for Advanced SATs

7.3.1 Currently, ASEAN NCAP will not perform any field test to assess the functionality and performance of Advanced SATs. Nevertheless, it is the responsibility of ASEAN NCAP to ensure that the system works and functions as intended. Therefore, as an alternative and to promote the fitment of Advanced SATs in the region, ASEAN NCAP assesses the compliance based on the "Functional Definitions" as described in Section 7.2. If needed, manufacturer is requested to perform full demonstration of the proposed technologies to ASEAN NCAP.

7.3.2 For final scoring, manufacturer may choose from two options (Option A or Option B).

7.4 Scoring (Option A)

7.4.1 A score of 1 point is awarded for each SAT proposed by manufacturer based on the following conditions.

- The SAT is equipped as standard or optional fitment.
- If the tested model is available in more than one country in any Sector, the technology shall be available in at least one country of the respective Sector. For example, Vehicle Model A is available in Malaysia and Thailand which are under Sector 1. If the technology is available in any other of the country, then the tested model qualifies for 1 point.

7.4.2 Manufacturer is encouraged to offer more SATs, however the maximum score for this section is 3 points (i.e. 3 SATs).

7.4.3 If there is any technical issue that may impede the performance of any technology due to various reasons in certain country and manufacturer wishes to waive the requirement, a detailed justification report shall be submitted to ASEAN NCAP for consideration.

7.5 Scoring (Option B)

7.5.1 Vehicles of which advanced SATs meet the requirements, as defined in paragraph 7.2, will be eligible for determination of final score according to ASEAN

NCAP Fitment Rating System Version 1.1. The maximum score for each advanced SAT is 1 point.

7.5.2 There is no limit on the number of Advanced SAT to be proposed, nevertheless the maximum score allocated for Advanced SATs is 3 points. If the total point is more than 3 points, the maximum score for this section is still 3 points.

8 REFERENCES

ECE Regulation 13H – Uniform provision concerning the approval of passenger cars with regard to braking, Date of entry into force; 17 March 2010.

ECE Regulation 140 - Uniform Provisions Concerning the Approval of Passenger Cars with Regard to Electronic Stability Control (ESC) Systems.

Ferguson, S. A. (2007). The effectiveness of electronic stability control in reducing real-world crashes: a literature review. *Traffic injury prevention*, *8*(4), 329-338.

APPENDIX I

SEATBELT REMINDER DEFINITIONS

Change of Status
The change in use of the seatbelt, where a buckled belt is unbuckled.

Deactivation
Short Term deactivation for a single journey or Long-Term deactivation for a longer period.

Final Signal
The only signal required by ASEAN NCAP.

Forward Motion
Forward motion of more than 10 km/h.

Initial Signal
A signal, for the front seating positions, which commences at the start of the journey. It is desirable but is not required by ASEAN NCAP. No specifications are given for the signal, leaving manufacturers the freedom to use the signal they believe is most effective.

Intermediate Signal
A signal, for the front seating positions, which does not commence at the start of the journey but which commences before the Final Signal. It is desirable but is not required by ASEAN NCAP. No specifications are

given for the signal, leaving manufacturers the freedom to use the signal they believe is most effective.

Journey
Movement of the vehicle under its own power.

Monitored
The continuous checking of the use, non-use or change in use of the seatbelt or seat occupancy.

More Sophisticated Intermediate Signal
An intermediate signal, with a clear, easily visible text message or a loud and clear voice message. No specifications are given for the signal, leaving manufacturers the freedom to use the signal they believe is most effective.

Occupancy
Use by an occupant larger, taller or heavier than a small female (5^{th} percentile).

Recommendation
A feature which is desirable but which is not required for ASEAN NCAP assessment.

Requirement
A feature that is necessary to be awarded points in ASEAN NCAP assessment.

Short Break
A short period of time during which the vehicle is stopped, where it would be unnecessary to start the reminder signal again when the journey recommences.

Start of Reminder System
The commencement of Seatbelt Reminder sequence.

APPENDIX II

SEATBELT REMINDER INFORMATION FORM

1. Vehicle information

Make	
Model	
Variant	

2. Which seats are protected by the SBR system and whether respective seats have seat occupancy detection? (Tick X as appropriate)

	Availability of SBR			Seat occupancy detection*		
	Yes	No	N/A	Yes	No	N/A
Driver						
Front Passenger						
2nd row						
3rd row and more						

*seat occupancy detection – defines as whether any respective seat can automatically detect whether there is occupant or not

3. Please specify the display location of the SBR signal (whichever applicable) and indicate which seat it applies (e.g. driver/ front passenger/ rear passengers)

Display location	***Please insert photo of the display location***
Driver front panel	
Centre console area	
Rear mirror area	
Glove box area	
Back of front seat	
Other location, please specify: _____ _____	

4. Overall system description (Tick X as appropriate)

	Driver		**Front Pass-enger**		**2nd Row**		**3rd row and more**		
	Y	N	Y	N	Y	N	Y	N	NA
Does the system have multiple stages?									
Initial signal									
Intermediate signal									
Final signal									

Y = Yes
N = No
NA = Not Available

5. Specific description of the system signal & trigger for driver (Tick X as appropriate)

a. Type of signal and triggering system

	Applicable?		Signal		Trigger			
	Yes	No	Visual	Audible	Ignition [1] ON	Speed (km/hr)[2]	Distance (m)[3]	Time (s)[4]
Initial signal								
Inter-mediate signal								
Final signal								

[1]The trigger will start once the ignition is ON
[2]The trigger will start once the vehicle reaches certain speed in forward motion
[3]The trigger will start once the vehicle reaches certain distance in forward motion
[4]The trigger will start once certain duration of time of either through engine running or vehicle in forward motion is reached

b. Visual signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

c. Audible signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

d. Does the system have the progressive audible signal, for example a change in volume/frequency? If yes, give details of the various amplitudes/ frequencies.

e. Does the system times out? If yes, the system times out after _____ seconds.

6. Specific description of the system trigger for front passenger (Tick X as appropriate) - if different from driver

a. Type of signal and triggering system

	Applicable?		**Signal**		**Trigger**			
	Yes	No	Visual	Audible	Ignition[1] ON	Speed (km/hr)[2]	Distance (m)[3]	Time (s)[4]
Initial signal								
Inter-mediate signal								
Final signal								

[1]The trigger will start once the ignition is ON
[2]The trigger will start once the vehicle reaches certain speed in forward motion
[2]The trigger will start once the vehicle reaches certain distance in forward motion
[4]The trigger will start once certain duration of time of either through engine running or vehicle in forward motion is reached

b. Visual signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

c. Audible signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

d. Does the system have the progressive audible signal, for example a change in volume/frequency? If yes, give details of the various amplitudes/ frequencies.

e. Does the system times out? If yes, the system times out after _____ seconds.

7. Specific description of the system trigger for 2nd row passengers (Tick X as appropriate) - if different from driver/ front passenger

a. Type of signal and triggering system

	Applicable?		Signal		Trigger			
	Yes	No	Visual	Audible	Ignition [1] ON	Speed (km/hr)[2]	Distance (m)[3]	Time (s)[4]
Initial signal								
Inter-mediate signal								
Final signal								

[1]The trigger will start once the ignition is ON
[2]The trigger will start once the vehicle reaches certain speed in forward motion
[2]The trigger will start once the vehicle reaches certain distance in forward motion
[4]The trigger will start once certain duration of time of either through engine running or vehicle in forward motion is reached

b. Visual signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

Audible signal characteristic

	Appli-cable?		**Signal characteristic**		
	Yes	No	Frequency	Total duration (s)	Gap(s) in the signal?
Initial signal					
Inter-mediate signal					
Final signal					

c. Does the system have the progressive audible signal, for example a change in volume/frequency? If yes, give details of the various amplitudes/ frequencies.

d. Does the system times out? If yes, the system times out after _____ seconds.

Can this system be deactivated?
If yes, please explain the mechanism.

Summary of the SBR system (please explain in details)

ACKNOWLEDGEMENT

Editors

Ir. Dr. Khairil Anwar Abu Kassim (Adjunct. Prof)
Malaysian Institute of Road Safety Research (MIROS)

Yahaya Ahmad
Malaysian Institute of Road Safety Research (MIROS)

Mohd Hafiz Johari
Malaysian Institute of Road Safety Research (MIROS)

Salina Mustaffa
Malaysian Institute of Road Safety Research (MIROS)

Zulhaidi Mohd Jawi
Malaysian Institute of Road Safety Research (MIROS)

Ir. Adrianto Sugiarto Wiyono
Politeknik APP

Dr. Annisa Jusof
Institut Teknologi Bandung (ITB)

Dr. Ir. Sigit P. Santosa
Institut Teknologi Bandung (ITB)

Dr. Atsuhiro Konosu
Japan Automobile Research Institute (JARI)

Ahmed Ismail Hj. Ismail
Automobile Association of Malaysia (AAM)

Dr. Mohd Radzi Abu Mansor
Universiti Kebangsaan Malaysia (UKM)

Assoc. Prof. Dr. Wira Jazair
Universiti Teknologi Malaysia (UTM)

ACKNOWLEDGEMENT

Assoc. Prof. Dr. Julaluk Carmai
The Sirindhorn International Thai German Graduate School of Engineering (TGGS)

Assoc. Prof. Dr. Saiprasit Koetniyom
The Sirindhorn International Thai German Graduate School of Engineering (TGGS)

Assoc. Prof. Dr. Ly Hung Anh
Ho Chi Minh City University of Technology (HCMUT)

Dr. Siti Zaharah Ishak
Malaysian Institute of Road Safety Research (MIROS)

Special Acknowledgement:
This protocol is based on Euro NCAP Assessment Protocol – Safety Assist Version 6.1 which is the intellectual property of Euro NCAP. Permission is granted for this material to be shared for non-commercial and educational purposes. Copying of parts of the original text is by permission of Euro NCAP.

ASEAN NCAP PROTOCOL 2021 - 2025

ASEAN NCAP
Ground Floor, Lot 127,
Jalan TKS 1,
Taman Kajang Sentral,
43000 Kajang,
Selangor, Malaysia.

+603-8924 9200 (ext. 425)

+603-8733 2005

enquiries@aseancap.org

www.aseancap.org

https://www.facebook/AseanNcap

https://twitter.com/aseancap

https://youtube.com/ (Search: ASEAN NCAP)

https://www.flickr.com/photos/aseancap/

ASEAN NCAP
www.aseancap.org