

**Ministry of Transportation and
Communications**

**Taiwan New Car Assessment Program
(TNCAP)**

Second Version

2.4 Assessment Protocol – Safety Assist

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2.4.1 Occupant Status Monitoring

2.4.1.1 Definitions

2.4.1.1.1 Seat Belt Reminder (SBR): Seat Belt Reminder that indicates the status of the seatbelt whether it is in use or not in use.

2.4.1.1.2 Driver State Monitoring (DSM): Driver State Monitoring system that is able to (in) directly determine the state of the driver.

2.4.1.1.3 Impaired driving: A driver who is disconnected from the driving task or not in a physical state that is sufficient for safe driving.

(1) Fatigue: State of the driver where he/she is not awake enough to properly perform the driving task.

(2) Distraction: Anything (e.g. secondary tasks) that avoid the driver to focus on the primary task of driving/controlling the vehicle.

(3) DUI: Driving Under the Influence of alcohol or drugs.

(4) Sudden sickness: An instant and unexpected illness wherein the driver is not able to perform his driving task.

2.4.1.1.4 Impaired driving warnings and interventions: Warning and/or adapted vehicle mode after an impaired driving has been detected.

(1) Impaired Driving Warning: Warning issued in case the system determines an impaired driver.

(2) High sensitivity mode: A more sensitive and earlier warning and/or intervention of Safety Assist systems to compensate for the driver state.

(3) Reduced speed mode: Vehicle state where the speed is limited and high system sensitivity.

(4) Emergency Stop Maneuver: Emergency maneuver where the vehicle will come to a controlled stop.

2.4.1.2 Preconditions

To be eligible for scoring points in DSM, the SBR requirements in section 2.4.1.3 must be met:

(1) Front seats including occupant detection.

(2) If applicable, at least one rear seats with unbuckling and/or occupant detection.

Only when the vehicle under assessment is equipped with an AEB, LSS and/or SAS system, points can be scored for DSM.

2.4.1.3 Seat belt reminder assessment

2.4.1.3.1 General requirements

All seating positions in the vehicle will be assessed including optional and removable seats.

The seatbelt reminder system shall "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 where passengers may remain in the vehicle.

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

2.4.1.3.1.1 Signal

All seatbelt reminder systems shall be audio-visual, where there must be a clear and obvious link between the audible and visual signals. 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.

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, centre console). Any final audible signal must be "Loud and Clear" for the driver.

2.4.1.3.1.2 Airbag deactivation switch

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

2.4.1.3.1.3 Occupant detection

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. For the front seat passengers, seat use must be detected. Systems that feature rear seat occupant detection are eligible for higher scores. TNCAP defines occupancy as use by an occupant larger, taller or heavier than a small female (5th percentile).

2.4.1.3.1.4 Secondary buckles

Monitoring of rear seat belt secondary buckles that require a tool to unlock, is not required.

2.4.1.3.1.5 Change of Status

During a change of status (from buckled to unbuckled) at speeds over 25 km/h, the system must immediately deploy the audio-visual signal meeting the requirements of section 2.4.1.3.2 for the front seats and that of section 2.4.1.3.3 for the rear seats.

Where the change of status occurs below 25km/h, and no doors are opened, the signal may be delayed until before at least one of the below requirements (at the choice of the manufacturer) are met):

- (1) The car has reached a forward speed of 25 km/h, or
- (2) The car has been in "Forward Motion" for 500 meters.

Where the change of status occurs below 25km/h, and doors are opened, the system shall consider this situation as a “new journey”, and warn accordingly. Where the system is able to track the number of buckled positions in the rear, no change of status signal (for the rear seats) is required as long as all doors remain closed, and the number of buckled positions remains the same. This is to minimize the number of false positives (ex: children remaining in the vehicle but swapping seats in the rear while at a traffic light).

2.4.1.3.1.6 End of signal

Once the audible part of the SBR signal has started, it must only stop under one of the following circumstances:

- (1) The signal has operated for the duration as specified in 2.4.1.3.2.3.
- (2) The related seat belts are put into use. Where the system is able to track the number of buckled positions in the rear, the change of status signal (for the rear seats) can be terminated as long as all doors remain closed, and the number of buckled positions remains the same.
- (3) The vehicle speed is below 10 km/h. When no doors have been opened, and the seatbelts remain unbuckled, the signal must resume again when the vehicle speed goes above 25 km/h.

2.4.1.3.2 Front seating positions

2.4.1.3.2.1 Visual signal

A visual signal must be activated when the ignition switch is engaged (engine running or not) and the seatbelt is not fastened, and in case of a change of status as defined in 2.4.1.3.1.5. This signal must remain until the seatbelt is fastened and recommence once a seatbelt is unfastened.

2.4.1.3.2.2 Initial Audible Signal

An Initial Audible Signal needs to be deployed before at least one of the following (at the choice of the manufacturer):

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

The duration of the initial audible signal can have a maximum duration of 30 seconds and must start with a positive audio-visual signal (not a gap). There must be no gaps greater than 10 seconds.

2.4.1.3.2.3 Final Audible Signal

A Final Audible Signal (Loud and Clear) is to be deployed before at least one of the following (at the choice of the manufacturer):

- (1) The car has reached a forward speed of 40 km/h, or
- (2) The engine has been running for 90 seconds, or
- (3) The car has been in "Forward Motion" for 90 seconds, or
- (4) The car has been in "Forward Motion" for 1000 meters, or
- (5) The Initial Audible Signal (lasting maximum 30 seconds) is finished.

The duration of the final audible signal must be at least 90 seconds not counting gaps exceeding 3 seconds and must start with a positive audible signal (not a gap). There must be no gaps greater than 10 seconds.

NOTE: The manufacturer has the option to utilize the Initial Audible Signal as the Final Audible Signal, as long as it is "Loud and Clear", and the duration is at least 90 seconds not counting gaps exceeding 3 seconds and must start with a positive audible signal (not a gap). There must be no gaps greater than 10 seconds.

2.4.1.3.3 Rear seating positions

2.4.1.3.3.1 Visual signal

2.4.1.3.3.1.1 A visual signal must be activated when the ignition switch is engaged (engine running or not), and any of the rear seatbelts are not fastened. No signal is required if the system is able to determine that there are no occupants in the rear seating positions. The signal must remain for at least 60 seconds or until the rear belts are buckled for the seats in use.

2.4.1.3.3.1.2 For systems with seat occupant detection on all rear seating positions, the visual signal does not need to indicate the number of seat belts in use or not in use, but the signal must remain as long as the seatbelt remain unfastened on any of the occupied seats in the rear.

2.4.1.3.3.1.3 For all rear seats equipped with an occupant detection system, the visual warning signal does not need to indicate the number of seat belts fastened or unfastened, and if the rear seats are occupied but the seat belts are unfastened, the warning signal shall persist.

2.4.1.3.3.1.4 For systems without occupant detection on all rear seating positions, the visual signal must clearly indicate to the driver the seating positions showing the rear seat belts in use and not in use. No signal is required if all of the rear occupants are belted.

2.4.1.3.3.2 Audible signal

2.4.1.3.3.2.1 In addition to a visual signal, a "Loud and Clear" audible signal is to be deployed for all rear seating positions in case of a change

of status (from buckled to unbuckled) as defined in 2.4.1.3.1.5.

2.4.1.3.3.2.2 Except for change of status events, the system may allow the driver to acknowledge the signal, switching it off for this unique event (a new trigger of the warning shall not be prevented).

2.4.1.3.3.2.3 For systems with occupant detection on any rear seating positions, a “Loud and Clear” audible signal needs to be deployed before at least one of the following (at the choice of the manufacturer) when any of those seats are occupied and the belt of the occupied seat is unbuckled:

(1) The car has reached a forward speed of 25 km/h, or

(2) The car has been in "Forward Motion" for 500 meters.

The duration of the audible signal must be at least 30 seconds not counting gaps exceeding 3 seconds and must start with a positive audible signal (not a gap). There must be no gaps greater than 10 seconds. The system may allow the driver to acknowledge the signal, so switching it off.

Alternatively, the manufacturer may use the same warning strategy (including initial and final warning) as described in Section 2.4.1.3.2 in case of occupant detection in all rear seating positions.

2.4.1.4 Driver Monitoring Systems

For the evaluation of Driver Monitoring Systems, the manufacturer must provide a dossier containing a detailed technical assessment.

The dossier shall contain:

- (1) Technical detail about the system, to fully understand its functionality, relevant components, and intended availability.
- (2) Test procedures, criteria and limits by which the performance of the system was verified.
- (3) If available, the dossier shall summarize the findings from real-world or simulated real-world evaluations.

2.4.1.4.1 General requirements

To be eligible for scoring points in DSM, the system needs to be default ON at the start of every journey and deactivation of the system shall not be possible with a momentary single push on a button.

2.4.1.5 Scoring & Visualization

A maximum of 3.0 points can be scored for Occupant Status Monitoring:

- (1) 1.0 point for DSM
- (2) 2.0 points for SBR on rear seating positions

2.4.1.5.1 Driver State Monitoring

The TNCAP executive agency will review the DSM dossier as provided by the manufacturer and will decide on the applicability of awarding the point for DSM. It shall be noted that systems using Time-on-Task only will not be awarded.

2.4.1.5.2 Seatbelt Reminder

All front row seating positions must meet the assessment criteria of section 2.4.1.3.1 and 2.4.1.3.2 as a prerequisite of scoring SBR point for the rear seating positions and DSM.

2.4.1.5.2.1 Rear seating positions

Rear seating positions (including optional third or more rows of seats) are eligible for scoring $1.0/n$ points (with n the number of rear seating positions) for seating positions without occupant detection. An additional $1.0/n$ points is available for rear seating positions with occupant detection systems.

2.4.1.5.2.2 SBR Scoring examples

(1) 5-seater (2 front + 3 rear), with occupant detection on all seats.

(A) Driver & Passenger	Prerequisite
(B) Rear Seats	1.000 points
(C) Rear Occupant Detection on 3 Seats	1.000 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats with detection} = \left(\frac{1.0}{3}\right) * 3$$

Total SBR Score 2.000 points

(2) 5-seater (2 front + 3 rear), with occupant detection on outboard rear seats.

(A) Driver & Passenger	Prerequisite
(B) Rear Seats	1.000 points
(C) Rear Occupant Detection on 2 Seats	0.667 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats with detection} = \left(\frac{1.0}{3}\right) * 2$$

Total SBR Score 1.667 points

(3) 7-seater (2 front + 3 2nd row + 2 3rd row), with occupant detection across all seats in the 2nd row.

(A) Driver & Passenger	Prerequisite
(B) Rear Seats	1.000 points
(C) Rear Occupant Detection on 3 Seats	0.600 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats with detection} = \left(\frac{1.0}{5}\right) * 3$$

Total SBR Score 1.600 points

(4) 7-seater (2 front + 3 2nd row + 2 3rd row), with occupant detection on outboard seats in the 2nd row.

- (A) Driver & Passenger Prerequisite
- (B) Rear Seats 1.000 points
- (C) Rear Occupant Detection on 2 Seats 0.400 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats with detection} = \left(\frac{1.0}{5}\right) * 2$$

Total SBR Score 1.400 points

(5) 7-seater (2 front + 3 2nd row + 2 3rd row), with occupant detection on outboard seats in the 2nd row and lacking a SBR in the 3rd row.

- (A) Driver & Passenger Prerequisite
- (B) Rear Seats 0.600 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats} = \left(\frac{1.0}{5}\right) * 3$$

- (C) Rear Occupant Detection on 2 Seats 0.400 points

$$\left(\frac{1.0}{n}\right) * \# \text{ of seats with detection} = \left(\frac{1.0}{5}\right) * 2$$

Total SBR Score 1.000 points

2.4.1.5.3 The OSM scores are presented separately using a color for the different OSM functions. The colors used are based on the function scores respectively, rounded to three decimal places.

The score color presentation for sub-test items such as SBR and DSM shall be handled in the same manner as described above.

Color	Verdict	Applied to Total Score	For sub Scores
Green	Good	2.251 - 3.000 points	75.0% - 100.0%
Yellow	Adequate	1.501 - 2.250 points	50.0% - 75.0%
Orange	Marginal	0.751 - 1.500 points	25.0% - 50.0%
Brown	Weak	0.001 - 0.750 points	00.0% - 25.0%
Red	Poor	0.000 points	00.0%
Grey	Not available	0.000 points	00.0%

2.4.2 Assessment of Speed Assist Systems

2.4.2.1 Definitions

2.4.2.1.1 Vindicated: The speed the vehicle travels as displayed to the driver by the speedometer as in Vehicle Safety Testing Directions "22-1 Speedometer."

2.4.2.1.2 Vlimit: Maximum allowed legal speed for the vehicle at the location, time and in the circumstance the vehicle is driving.

2.4.2.1.3 Speed Limit Information Function (SLIF): – SLIF means a function with which the vehicle knows and communicates the speed limit.

2.4.2.1.4 Adjustable speed (Vadj): Adjustable speed Vadj means the voluntarily set

speed for the speed control functions, which is based on Vindicated and includes the offset set by the driver.

2.4.2.1.5 Speed Limitation Function (SLF): SLF means a system which allows the driver to set a vehicle speed V_{adj} , to which he wishes the speed of his car to be limited and above which he wishes to be warned.

2.4.2.1.6 Intelligent Speed Assistance (ISA): ISA is a SLF combined with SLIF, where the V_{adj} is set by the SLIF with or without driver confirmation.

2.4.2.1.7 Intelligent Adaptive Cruise Control (iACC): iACC is an ACC combined with SLIF, where the speed is set by the SLIF with or without driver confirmation.

2.4.2.1.8 Stabilized speed (V_{stab}): Stabilized speed V_{stab} means the mean actual vehicle speed when operating. V_{stab} is calculated as the average actual vehicle speed over a time interval of 20 seconds beginning 10 seconds after first reaching $V_{adj} - 10$ km/h.

2.4.2.2 Requirements for SLIF and Speed Control Functions

The Speed Assist Systems is developed in such a way that it allows different types of Speed Assist Systems to be assessed in two areas; SLIF and Speed Control functions which may be combined.

2.4.2.2.1 Speed Limit Information Function

- (1) Basic SLIF meeting the General Requirements
- (2) Advanced Functions
- (3) System Accuracy
- (4) Warning Function

2.4.2.2.2 Speed Control function

- (1) Speed Limitation function (standalone function or combined with SLIF without coupling).
- (2) Intelligent Speed Assistance (SLIF and Speed Limitation function coupled).
- (3) Intelligent ACC (SLIF and ACC coupled).

2.4.2.3 Speed Limit Information Function

The Speed Limit Information Function can be a standalone function or an integrated part of a speed control function. Any SLIF, camera or map based or a combination of both, is eligible for scoring points of this section when meeting the General Requirements when the SLIF is default ON at the start of a journey.

The speed limit information could either be provided by vehicle-integrated devices or by mobile devices connected to the vehicle network. A list of compatible devices needs to be mentioned in the vehicle handbook.

2.4.2.3.1 General Requirements

- 2.4.2.3.1.1 The speed limit shall be shown using a traffic sign and shall be

clearly seen in the direct field of view of the driver, without the need for the head to be moved from the normal driving position, i.e. instrument cluster or head-up display.

2.4.2.3.1.2 The speed limit information must be shown or accessible at any time with a simple operation and needs to be shown at the start of the next journey (excluding the initialization period).

2.4.2.3.1.3 The indicated speed limit information may indicate the level of reliability of the speed limit.

2.4.2.3.1.4 In the presence of conditional speed limits (refer to 2.4.2.6) the system needs to either properly identify and show (for example when raining) the applicable speed limit or alternatively, needs to indicate the presence of a conditional speed limit which the system is not able to compute, in addition to the non-conditional speed limit.

2.4.2.3.1.5 Manufacturers need to supply TNCAP with background information of the SLIF (if applicable to the technology).

2.4.2.3.2 Advanced Functions

2.4.2.3.2.1 Systems that are able to properly identify conditions and act accordingly can attract additional points based on the number of advanced functions. These functions are listed in the table below and example traffic signs of a limited number of countries are specified in 2.4.2.6.

Advanced Functions		Points	Required Action
Weather	Rain / Wetness	2	Warning only and ignore if irrelevant
	Snow / Icy	2	Warning only and ignore if irrelevant
Time	Time	3	Show correct speed limit
Distance	Distance for	1	Show correct speed limit
	Distance in		Show correct speed limit or warning
Vehicle Categories	Other vehicle / weight categories	1	Show correct speed limit or warning
Implicit Speed Limits	Highway	1	Show correct speed limit or warning
	Motorway	1	
	Pedestrian priority zones	2	
	Residential zones	2	
Dynamic Speed Limits	Dynamic speed signs	2	Show correct speed limit
	Roadworks	1	Show correct speed limit or warning
Lane	Road shoulder	2	Warning only and ignore if irrelevant
	Ramp		
	Loop		
TOTAL		20	

2.4.2.3.2.2 The Advanced Functions score is calculated by multiplying the points achieved by 0.025.

2.4.2.3.3 System Accuracy

2.4.2.3.3.1 A system that achieves more than 12 out of 20 points from the Advanced Functions will be awarded the score for System Accuracy. If map-based data is required to achieve any of the points up to 12 the speed limits must be updated frequently (at least quarterly) and automatically for the first six years, without user action. (Ex. sending DVD/USB to customer allowed).

2.4.2.3.4 Warning Function

Speed Limit Information Functions that meet the warning requirements below to indicate the driver that Vlimit is exceeded will score for Warning Function. The warning function may be switched ON/OFF by the driver where the last user mode may be used.

2.4.2.3.4.1 The warning shall be a flashing traffic sign used to communicate the speed limit or an additional visual signal adjacent to the traffic sign.

2.4.2.3.4.2 The warning commences when Vindicated is exceeding Vlimit by more than 5km/h (3 mph). A negative and/or positive offset with respect to the known speed limit is allowed but may not be larger than 10 km/h (5 mph).

2.4.2.3.4.3 The driver continues to be informed for the duration of the time that Vlimit is exceeded by more than 5 km/h, with a total duration of at least 10 seconds. Gaps of less than 1 second, which allow for signals which flash are ignored, but the signal may not start with a gap. If the signal is not continuous for the first 10 seconds, it needs to be repeated every 30 seconds or less, resulting in a minimum total duration of at least 10 seconds.

2.4.2.3.4.4 The warning sequence does not need to be reinitiated for each exceedance of Vlimit until Vindicated has reduced to more than 5km/h below Vlimit.

2.4.2.4 Speed Control Function

Three speed control functions are considered in this section; Speed Limitation Function (manually set), Intelligent Speed Assist and Intelligent Adaptive Cruise Control which need to meet the following requirements to score points:

Speed Control Function Type	Sections
Speed Limitation Function (SLF)	2.4.2.4.1, 2.4.2.4.2.1 & 2.4.2.4.3
Intelligent Speed Assist (ISA)	

2.4.2.4.1 Activation / de-activation of the function

- (1) At the start of a new journey, the system shall be de-activated by default.

2.4.2.4.2 Setting of Vadj

2.4.2.4.2.1 Manually setting the speed

- (1) It shall be possible to set Vadj, by a control device operated directly by the driver, by steps not greater than 10km/h (5mph) between 30km/h (20mph) and 130km/h (80mph).
- (2) It shall be possible to set Vadj independently of the vehicle speed.
- (3) If Vadj is set to a speed lower than the current vehicle speed, the system shall limit the vehicle speed to the new Vadj within 30s or shall initiate a warning (refer to 2.4.2.4.3.6) no later than 30s after Vadj has been set.
- (4) The Vadj value shall be permanently indicated to the driver and visible from the driver's seat. This does not preclude temporary interruption of the indication for safety reasons or driver's demand.

2.4.2.4.2.2 Automatic setting the speed

An automatic setting is using the speed limit information from the SLIF to set the Vadj with or without driver confirmation. Both ISA and iACC functions fulfilling the requirements from this section are eligible for scoring points:

- (1) The system shall adopt, or offer the driver to adopt, an adjusted Vadj within 5s after a change in the speed limit.
- (2) If Vadj is set to a speed lower than the current vehicle speed, the system starts to limit the vehicle speed to the new Vadj or shall initiate a warning (refer to 2.4.2.4.3.6) no later than 30s after Vadj has been set.
- (3) A negative and/or positive offset with respect to the known speed limit is allowed but may not be larger than 10 km/h (5 mph). This offset is included in Vadj.
- (4) The Vadj in the automatic mode of an ISA system may be retained at the end of a journey.
- (5) Where Vadj is set to the speed limit advised by the SLIF, the indication of Vadj may be suppressed.

2.4.2.4.3 Speed Control

2.4.2.4.3.1 The vehicle speed shall be limited or controlled to Vadj.

2.4.2.4.3.2 It shall still be possible to exceed Vadj by applying a positive action – e.g. kickdown (SLF/ISA) or depressing the accelerator (iACC).

2.4.2.4.3.3 After exceeding Vadj by applying a positive action, the speed control function shall be reactivated when the vehicle speed drops to a speed

less than or equal to V_{adj} .

2.4.2.4.3.4 The speed control function shall permit a normal use of the accelerator control for gear selection.

2.4.2.4.3.5 The speed control function shall ensure that when stable speed control has been achieved, V_{stab} shall be within $-5/+0$ km/h of V_{adj} (see test protocol).

2.4.2.4.3.6 When the speed control function is not able to limit to and/or maintain V_{adj} and V_{adj} is exceeded by more than 5 km/h an audio-visual warning is issued, with a total duration of at least 10 seconds. No warning needs to be given when V_{adj} is exceeded as a result of a positive action.

2.4.2.4.3.7 Gaps of less than 1 second, which allow for signals which flash are ignored, but the signal may not start with a gap. If the signal is not continuous for the first 10 seconds, it needs to be repeated every 30 seconds or less, resulting in a minimum total duration of at least 10 seconds.

2.4.2.4.3.8 For systems where active braking is applied to maintain and/or limit the speed, this warning requirement does not apply.

Note: The warning signal does not preclude temporary interruption of the indication for safety reasons.

2.4.2.5 Scoring and Visualization

The following points are awarded for systems that meet the requirements. These points will contribute to the Safety Assist Score.



Speed Limit Information Function (SLIF)	1.50
Basic SLIF	0.50
Advanced SLIF	0.50
System Accuracy	0.25
Warning Function	0.25
Speed Control Function (SCF)	1.50
Speed Limitation Function (SLF)	
For cars without SLIF	1.25
For cars with SLIF	0.75
ISA and / or Intelligent ACC	1.50


The SAS scores are presented separately using a color for the different SAS functions. The colors used are based on the function scores respectively, rounded to three decimal places.



Color	Verdict	Applied to Total Score	For sub Scores
Green	Good	2.251 - 3.000 points	75.0% - 100.0%


Yellow	Adequate	1.501 - 2.250 points	50.0% - 75.0%
Orange	Marginal	0.751 - 1.500 points	25.0% - 50.0%
Brown	Weak	0.001 - 0.750 points	00.0% - 25.0%
Red	Poor	0.000 points	00.0%
Grey	Not available	0.000 points	00.0%





2.4.2.6 Conditional Speed Limit Examples



Weather Conditions	
Rain and/or Wetness	Snow and/or Icy
	




Time Condition

7:00-9:00am 3:00-5:00pm Class Hours

Distance Conditions		
Distance For	Distance In	
		
1km Steep Uphill with 8% Gradient	10km Continuous Bends	Reduced Speed Limit Ahead

Other Vehicle & Vehicle Categories	
	
Other Vehicle Types	

Implicit Speed Limits			
Highway	Motorway	Pedestrian priority zones	Residential Zones
			
			Traffic Calming Zone

Dynamic Speed Limits	
Dynamic Speed Signs	Roadworks
	

Lane		
Road Shoulder	Ramp	Loop
		
Road Shoulder Speed Limit	Ramp Speed Limit	Loop Speed Limit

2.4.3 Assessment of AEB Inter-Urban

2.4.3.1 Definitions

2.4.3.1.1 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.

2.4.3.1.2 Forward Collision Warning (FCW): an audiovisual warning that is provided automatically by the vehicle in response the detection of a likely collision to alert the driver.

2.4.3.1.3 Dynamic Brake Support (DBS): a system that further amplifies the driver braking demand in response to the detection of a likely collision to achieve a greater deceleration than would otherwise be achieved for the braking demand in normal driving conditions.

2.4.3.1.4 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.

2.4.3.1.5 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.

2.4.3.1.6 Car-to-Car Rear Braking (CCRb): a collision in which a vehicle travels forwards towards another vehicle that is travelling at constant speed and then decelerates, and the frontal structure of the vehicle strikes the rear structure of the other.

2.4.3.1.7 V_{rel_test} : means 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.

2.4.3.1.8 V_{impact} : means the speed at which the VUT hits the EVT.

2.4.3.1.9 V_{rel_impact} : means the relative speed at which the VUT hits the EVT by subtracting the velocity of the EVT from V_{impact} at the time of collision.

2.4.3.2 Criteria and Scoring

2.4.3.2.1 To be eligible for scoring points in AEB Inter-Urban, the AEB and/or FCW system must operate up to speeds of at least 80 km/h, needs to be default ON at the start of every journey and deactivation of the system shall not be possible with a single push on a button.

2.4.3.2.1.1 The audible component of the FCW system (if applicable) needs to be loud and clear.

2.4.3.2.2 Assessment Criteria

For both AEB and FCW system tests, the assessment criteria used is the relative impact speed V_{rel_impact} . For CCRb scenarios, the relative test speed is

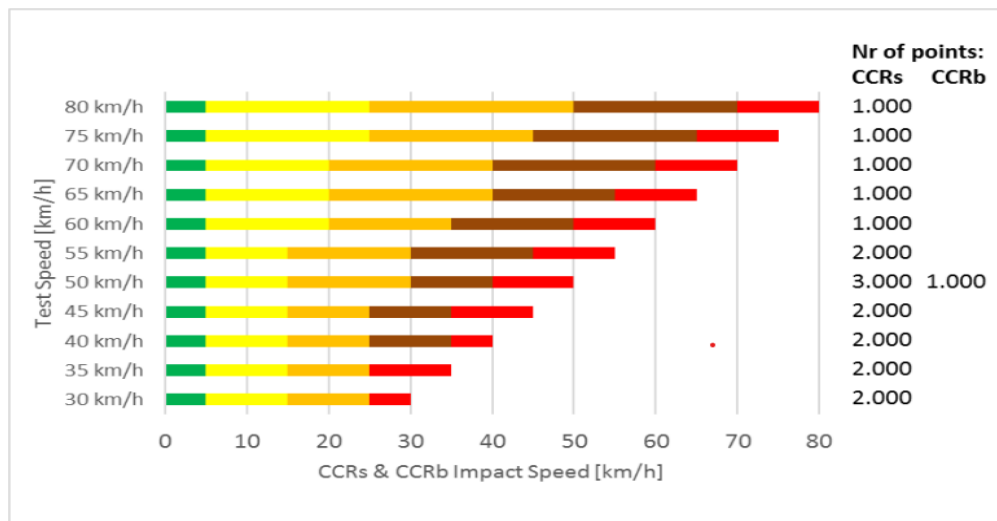
assumed equal to the initial test speed.

2.4.3.2.3 Scoring

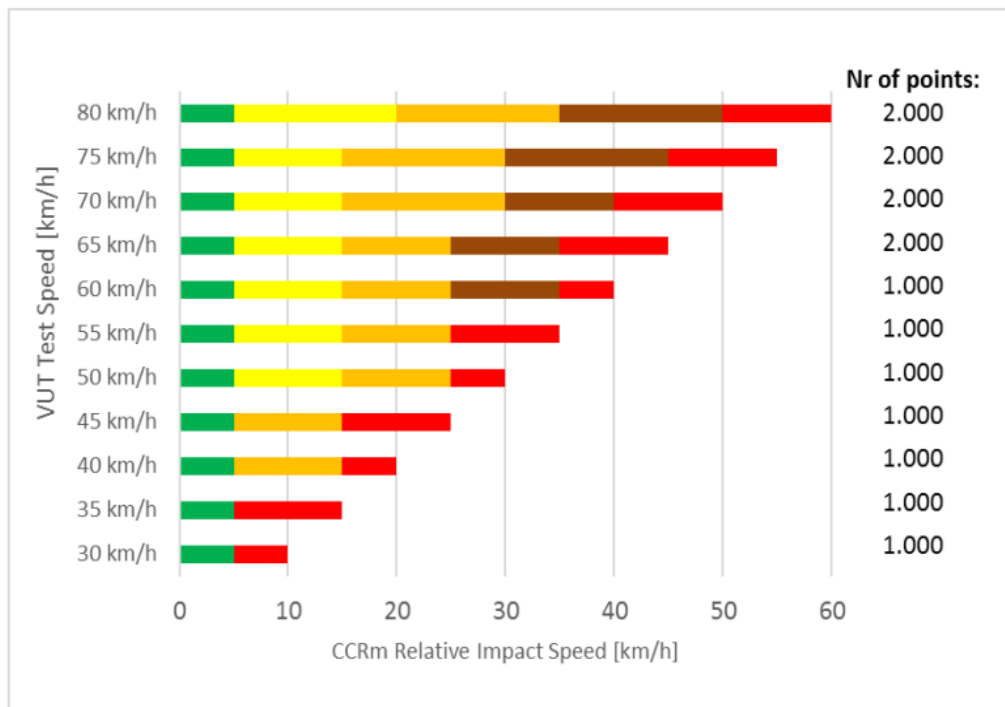
The scoring is based on normalized scores of the AEB and FCW functions, assessed in the CCRs, CCRm and CCRb scenarios.

For the CCRs and CCRm scenarios, the total score for all five grid points per test speed is calculated as a percentage of the maximum achievable score per test speed, which is then multiplied by the points available for this test speed. It shall be noted that the 100% overlap score is double counted.

The points available and the color distribution for the different test speeds for CCRs and CCRb (50 km/h only) are detailed in the graph below:



Similar for CCRm, where the relative impact speed is used:



For each predicted color the following scaling is applied to the grid point:

Green	1.000
Yellow	0.750
Orange	0.500
Brown	0.250
Red	0.000

2.4.3.2.4 AEB Inter-Urban Correction factors

The data provided by the manufacturer is scaled using two correction factors, one for AEB and one for FCW, which are calculated based on a number of verification tests performed. The vehicle sponsor will fund 20 verification tests, 10 for AEB and 10 for FCW where applicable. The vehicle manufacturer has the option of sponsoring up to 10 additional verification tests for AEB and 10 for FCW.

The verification points are randomly selected grid points, distributed in line with the predicted color distribution (excluding red points).

The actual tested total score of the verification test points is divided by the predicted total score of these verification test points. This is called the correction factor, which can be lower or higher than 1.

Correction Factor = Actual Tested Score / Predicted Score

The correction factor is used to calculate the AEB and FCW function scores. The final AEB and FCW scores for the vehicle can never exceed 100% (1.5 and 1.0 points respectively) regardless of the correction factor.

2.4.3.2.5 Impact speed tolerance

As test results can be variable between technical services and in-house tests and/or simulations a 2 km/h tolerance to the impact speeds of the verification test is applied. The tolerance is applied in both directions, meaning that when a tested point scores better than predicted, but within tolerance, the predicted result is applied. The tolerance only applies to verify whether the predicted color of the tested verification point is correct. When, including tolerance, the color is not in line with the prediction, the true color of the test point will be determined by comparing the actual measured impact speed with the color band in section 2.4.3.2.3 without applying a tolerance to the impact speed. As an example the accepted impact speed ranges for the 50km/h CCRs and CCRb tests are as follows:

Prediction	Impact Speed Range (km/hr)	Accepted Range (km/hr)
Green	$0 \leq V_{\text{impact}} < 5$	$0 \leq V_{\text{impact}} < 7$
Yellow	$5 \leq V_{\text{impact}} < 15$	$3 \leq V_{\text{impact}} < 17$
Orange	$15 \leq V_{\text{impact}} < 30$	$13 \leq V_{\text{impact}} < 32$
Brown	$30 \leq V_{\text{impact}} < 40$	$28 \leq V_{\text{impact}} < 42$

Red	$40 \leq V_{\text{impact}}$	excluded
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2.4.3.2.6 Human Machine Interface (HMI)

HMI points can be achieved for the following:

Supplementary warning for the FCW system: 1 point

- (1) In addition to the required audiovisual warning, a more sophisticated warning like head-up display, belt jerk, brake jerk or any other haptic feedback is awarded when it is issued at a $TTC > 1.2s$. This is only valid for cases where the AEB system is not able to fully avoid the impact at full overlap.

Note: The supplementary warning point is not applicable to AEB only systems.

- (2) Reversible pre-tensioning of the belt in the pre-crash phase: 1 point

When the system detects a critical situation that can possibly lead to a crash, the belt can already be pre-tensioned to prepare for the oncoming impact.

The HMI score is calculated by dividing the points achieved by 2.

2.4.3.2.7 Total AEB Inter-Urban Score

The total score in points is the weighted sum of the AEB score, FCW score and HMI score as shown below:

$$(\text{AEB score} \times \text{AEB correction factor} \times 1.5) + (\text{FCW score} \times \text{FCW correction factor} \times 1.0) + (\text{HMI score} \times 0.5) = \text{AEB Inter-Urban total score}$$

2.4.3.2.7.1 Scoring Example

Manufacturer X has provided the following prediction to TNCAP, where the predicted score is 2.669 points:

AEB Inter-Urban		AEB					FCW						
TESTNUMBER													
CCRs							-50%	-75%	100%	75%	50%		
Test Speed	30 km/h												
	35 km/h												
	40 km/h												
	45 km/h												
	50 km/h												
	55 km/h												
	60 km/h												
	65 km/h												
	70 km/h												
75 km/h													
80 km/h													
Predicted CCRs score							75.93%						
CCRm		-50%	-75%	100%	75%	50%	-50%	-75%	100%	75%	50%		
Test Speed	30 km/h												
	35 km/h												
	40 km/h												
	45 km/h												
	50 km/h												
	55 km/h												
	60 km/h												
	65 km/h												
	70 km/h												
75 km/h													
80 km/h													
Predicted CCRm score		76.11%					75.00%						

The randomly chosen verification points and test results provide the following scores:

	Predicted score	Actual tested score	Correction Factor
AEB	9.250	9.000	0.973
FCW	7.750	8.000	1.032

Using the following AEB Inter-Urban scenario and HMI scores:

Summary			
	CCRs (prediction × correction factor)		78.4%
	CCRm (prediction × correction factor)	74.1%	77.4%
	CCRb	100.0%	100.0%
	HMI	100.0%	
TOTAL			
	AEB	1.305	
	FCW	0.853	
	HMI	0.500	
TOTAL AEB INTER-URBAN		2.658	

2.4.3.3 Visualization

The AEB Inter-Urban scores are presented separately using a colored top view of the scenario for the different overlap situations (where applicable); left overlap, full overlap and right overlap. The colors used are based on the overlap scores respectively, rounded to three decimal places.

Color	Verdict	Applied to Total Score	For sub Scores
Green	Good	2.251 - 3.000 points	75.0% - 100.0%
Yellow	Adequate	1.501 - 2.250 points	50.0% - 75.0%
Orange	Marginal	0.751 - 1.500 points	25.0% - 50.0%
Brown	Weak	0.001 - 0.750 points	00.0% - 25.0%
Red	Poor	0.000 points	00.0%
Grey	Not available	0.000 points	00.0%

2.4.4 Assessment of Lane Support Systems

2.4.4.1 Definitions

2.4.4.1.1 Emergency Lane Keeping (ELK): default ON heading correction that is applied automatically by the vehicle in response to the detection of the vehicle that is about to drift beyond the edge of the road or into oncoming or overtaking traffic in the adjacent lane.

2.4.4.1.2 Lane Keeping Assist (LKA): heading correction that is applied automatically by the vehicle in response to the detection of the vehicle that is about to drift beyond a delineated edge line of the current travel lane.

- 2.4.4.1.3 Lane Departure Warning (LDW): a warning that is provided automatically by the vehicle in response to the vehicle that is about to drift beyond a delineated edge line of the current travel lane.
- 2.4.4.1.4 Vehicle under Test (VUT): means the vehicle tested according to this protocol with a Lane Keep Assist and/or Lane Departure Warning system.
- 2.4.4.1.5 Time To Collision (TTC): means the remaining time before the VUT strikes the GVT, assuming that the VUT and GVT would continue to travel with the speed it is travelling.
- 2.4.4.1.6 Lane Edge: means the inner side of the lane marking or the road edge.
- 2.4.4.1.7 Distance To Lane Edge (DTLE): means the remaining lateral distance (perpendicular to the Lane Edge) between the Lane Edge and most outer edge of the tire, before the VUT crosses Lane Edge, assuming that the VUT would continue to travel with the same lateral velocity towards it.
- 2.4.4.2 Criteria and Scoring
- 2.4.4.2.1 To be eligible for scoring points in Lane Support Systems, the vehicle must be equipped with an ESC system that complies with Vehicle Safety Testing Directions "85, Electronic Stability Control Systems".
For any system, the driver must be able to override the intervention by the system.
- 2.4.4.2.2 Human Machine Interface (HMI)
HMI points can be achieved for the following:
- (1) Lane Departure Warning: 0.25 points
Any LDW system that issues an audible and/or haptic warning before a DTLC of -0.2m is awarded.
Where an LKA system fulfils the requirements of all the single line marking tests, the LDW points are awarded automatically.
- (2) Blind Spot Monitoring: 0.25 points
The vehicle is additionally equipped with a Blind Spot Monitoring system to warn the driver of other vehicles present in the blind spot.
Where the vehicle is fitted with an ELK system fulfilling the requirements of the overtaking tests, the BSM points are awarded automatically.
- 2.4.4.2.3 Lane Keep Assist (LKA)
- 2.4.4.2.3.1 For LKA system tests, the assessment criteria used is the Distance to Lane Edge (DTLE).
- 2.4.4.2.3.2 The limit value for DTLE for LKA tests is set to -0.3m for testing against lines, meaning that the LKA system must not permit the VUT to cross the inner edge of the lane marking by a distance greater than

0.3m.

2.4.4.2.3.3 The limit value for DTLE for LKA Road Edge tests is set to -0.1m for testing against the road edge, meaning that the LKA system only allows the VUT to have a part of the front wheel outside of the road edge.

2.4.4.2.3.4 The available points per test are awarded based on a pass/fail basis where all tests within the scenario and road marking combination need to be a pass. The points available for the different LKA scenario and road marking combinations are detailed in the table below:

LKA Scenario	Road Marking	Points
Road Edge	Road edge only	0.25
	Road edge with center lane marking	0.25
Dashed Line	Single lane marking	0.25
	Fully marked lane	0.50
Solid Line	Single lane marking	0.25
	Fully marked lane	0.50
TOTAL		2.00

2.4.4.2.4 Emergency Lane Keeping (ELK)

2.4.4.2.4.1 To be eligible for scoring points in ELK, the ELK part of the LSS system needs to be default ON at the start of every journey and deactivation of the system shall not be possible with a single push on a button.

2.4.4.2.4.2 For ELK Road Edge tests, the assessment criteria used is the Distance to Lane Edge (DTLE).

The limit value for DTLE for ELK Road Edge tests is set to -0.1m, meaning that the vehicle is only allowed to have a part of the front wheel outside of the road edge.

2.4.4.2.4.3 For ELK tests with oncoming and overtaking vehicles, the assessment criteria used is no impact, meaning that the VUT is not allowed to contact the overtaking or oncoming vehicle target at any time during the test.

2.4.4.2.4.4 The available points per test are awarded based on a pass/fail basis where all tests within the scenario and road marking combination need to be a pass. The points available for the different ELK scenario and road marking combinations are detailed in the table below:

ELK Scenario	Road Marking	Points
Road Edge	Dashed centerline & no line next to road edge	0.375
	Dashed centerline & solid line next to road edge	0.375

Oncoming Vehicle	Fully marked lanes	0.50
Overtaking Vehicle	Fully marked lanes	0.25
TOTAL		1.50

2.4.4.2.5 The total score in points is the sum of the HMI score, LKA score and ELK score.

LSS Function		Points
HMI	Section 2.4.4.2.2	0.50
LKA	Section 2.4.4.2.3	2.00
ELK Scenario	Section 2.4.4.2.4	1.50
TOTAL		4.00

2.4.4.3 Visualization

The LSS scores are presented separately using a color for the different LSS functions; HMI, LKA and ELK. The colors used are based on the function scores respectively, rounded to three decimal places.

The score color presentation for sub-test items such as HMI, LKA and ELK shall be handled in the same manner as described above.

Color	Verdict	Applied to Total Score	Applied to Scenario
Green	Good	3.001 - 4.000 points	75.0% - 100.0%
Yellow	Adequate	2.001 - 3.000 points	50.0% - 75.0%
Orange	Marginal	1.001 - 2.000 points	25.0% - 50.0%
Brown	Weak	0.001 - 1.000 points	00.0% - 25.0%
Red	Poor	0.000 points	00.0%
Grey	Not available	0.000 points	00.0%

2.4.5 Assessment of Blind Spot Assist Systems (BSS)

2.4.5.1 Functional Definitions

2.4.5.1.1 The detection type, termed by ISO 17387 as Lane Change Decision Aid Systems (LCDAS), is fundamentally intended to “warn the driver of the subject vehicle against potential collision with vehicles to the side and/or rear of the subject vehicle, and moving in the same direction as the subject vehicle during lane change maneuvers”.

2.4.5.1.2 As for non-detection type (visualization), the system shall be able to provide a live visual of the vehicles static in the same direction, and on the side and/or rear of the subject vehicle which can be activated manually or via a turn signal action. The system must be able to perform well during the day and at night.

2.4.5.2 BSS Assessment

The official provisions are written in Chinese, this English edition is for your reference only.

2.4.5.2.1 To encourage broader adoption by vehicle manufacturers, both detection and non-detection types receive a maximum rating score of 2 points from the TNCAP executive agency.

For vehicles equipped with both detection and non-detection types BSS, the type with the higher score will be used as the score for BSS.

2.4.5.2.2 The TNCAP executive agency conducts assessments based on section 2.4.5.1 "Functional Definitions."

2.4.5.3 Scoring and Visualization

2.4.5.3.1 Vehicles of which BSS meet detection or non-detection type requirements, will be eligible for 2 points.

Table 1 Blind Spot Detection Test scoring point

Side	Lateral Distance from Vehicle Target to VUT (meter)	Status	Point
Driver	2 to 3	Detect (total of 3 runs)	1 (max)
	6.5	Cannot be detect (1 run)	
Passenger	2 to 3	Detect (3 total of 3 runs)	1 (max)
	6.5	Cannot be detect (1 run)	

Table 2 Blind Spot Visualization Test scoring point

Side	Lateral Distance from Vehicle Target to VUT (meter)	Status	Point
Driver	2 to 3	Clearly Visible	1 (max)
Passenger	2 to 3	Clearly Visible	1 (max)

2.4.5.3.2 The BSS scores are presented separately using a color for the different BSS functions. The colors used are based on the function scores respectively, rounded to three decimal places.

Color	Verdict	Applied to Total Score	For sub Scores
Green	Good	1.501 - 2.000 points	75.0% - 100.0%
Yellow	Adequate	1.001 - 1.500 points	50.0% - 75.0%
Orange	Marginal	0.501 - 1.000 points	25.0% - 50.0%
Brown	Weak	0.001 - 0.500 points	00.0% - 25.0%
Red	Poor	0.000 points	00.0%
Grey	Not available	0.000 points	00.0%

2.4.5.4 Performance Testing

2.4.5.4.1 Performance testing is conducted in order to evaluate the functionality and performance of both BSS types with regard to detection of

motorcyclists.

- 2.4.5.4.2 For detection type BSS, ISO 17387 will be used as the basis to demonstrate the functionality and performance of the system equipped in the subject vehicle. The target vehicle (i.e. vehicle closing in on the subject vehicle from behind, or any vehicle that is located in one of the adjacent zones) will be a motorcycle as specified in the ISO 17387. The dimension of the motorcycle (length, width and height) will be based on one of the most common motorcycle models by body type (under bone), as well as its make (brand) in the region. Refer to "3.14 Blind Spot Assist Systems".
- 2.4.5.4.3 For non-detection BSS, functionality assessment is based on the system requirement. The car will be subjected to a number of trial sequences designed to highlight the effectiveness of the system. Refer to "3.14 Blind Spot Assist Systems".