EURO NCAP

#FORSAFERTRUCKS

Version 1.20
July 2025

HGV Assessment Protocol

Safe Driving

Implementation November 2024

PREFACE

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 Euro NCAP. Where a disagreement exists between the laboratory and manufacturer, the Euro NCAP secretariat should be informed immediately to pass final judgment. Where the laboratory staff suspect that a manufacturer has interfered with any of the set up, the manufacturer's representative 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 representative will be told to leave the test site and the Secretary General should be immediately informed. Any such incident may be reported by the Secretary General to the manufacturer and the person concerned may not be allowed to attend further Euro NCAP tests.

DISCLAIMER: Euro 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, Euro NCAP reserves the right to make corrections and determine the assessment and subsequent result of the affected requirement(s).

CONTENTS

1. OCCUPANT STATUS MONITORING – SEAT BELT REMINDER

1.1. Introduction

Volvo Trucks research shows that the number of truck drivers using seat belts varies considerably between different countries, from about 10 % in southern European countries to about 70 % in countries with the highest usage rates. A UK survey of seat belt wearing (Department for Transport, 2021) identified a usage rate for other vehicle types including Heavy Goods Vehicles (HGVs) of 85 %, whereas for passenger cars a 97 % rate was observed. The Volvo Trucks Safety Report (Volvo, 2017) reported that half of unbelted occupant deaths were preventable with seat belt use.

Typical incidents include the HGV colliding with other traffic, highway infrastructure or departing the road and the subsequent deceleration or instability resulting in partial or full ejection of the unbelted occupant. Seat belt wearing supports retaining the occupant in their seat, affording them the protection offered by the vehicle structure and Supplementary Restraint System (SRS).

To encourage occupants to wear their seat belt, vehicle manufacturers offer audio-visual reminders that monitor for seat occupancy and buckling of the belt. Euro NCAP call this technology Seat Belt Reminder (SBR).

A study of seat belt reminder effectiveness (ETSC, 2006) identified that 99 % of passenger car drivers can be persuaded to buckle up by state-of-the-art seat belt reminders that send out audio-visual signals.

Whilst regulation makes SBR a mandatory requirement for new HGVs, Euro NCAP strives to increase seat belt usage rates. To this end, the Euro NCAP scheme builds on the regulatory requirement by:

- Requiring an extended duration of operation
- Assessing all front row seating positions

This protocol specifies the HGV SBR vehicle assessment procedure for the HGV safety rating scheme.

1.2. Definitions

Throughout this protocol the following terms are used:

Seat Belt Reminder (SBR) – indicates the status of the seat belt whether it is in use or not in use

1.3. Criteria and Scoring

1.3.1. Eligibility

To be eligible for scoring points in SBR, each front row seating position must meet the assessment criteria of 1.3.2.

1.3.2. Assessment Criteria

1.3.2.1. General Requirements

The seat belt reminder system shall "start" at the commencement of each "journey" that the vehicle makes. The reminder system is not required to start again after a short break in the journey. Such short breaks, of duration up to 30 seconds, are to allow for events such as stalling of the engine where passengers may remain in the vehicle.

1.3.2.2. Signal

All seat belt 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 seat belt reminder signal starts, the visual signal needs to flash and be synchronised (not necessarily at the same frequency, but an integer multiple of each other, e.g. two flashes with every chime) with the audible part.

The first 8 seconds after ‘ignition on’ are not considered for initial and/or final audible signal quality assessments, and the synchronisation requirements above do not apply during this time.*

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

* This is to avoid conflict with some US FMVSS 208 compliant SBR warning configurations.

1.3.2.3. Visual signal

A visual signal must be activated when the ignition switch is engaged (engine running or not) and the seat belt is not fastened. A visual signal must also be activated in case of a change of status as defined in 1.3.2.9.

The visual signal must remain until the seat belt is fastened and recommence once a seat belt is unfastened.

1.3.2.4. Initial Audible Signal

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

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

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.

1.3.2.5. 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):

- The VUT has reached a forward speed of 40 km/h, or

- The engine has been running for 90 seconds, or
- The VUT has been in "Forward Motion" for 90 seconds, or
- The VUT has been in "Forward Motion" for 1000 meters, or
- The Initial Audible Signal (lasting maximum 30 seconds) is finished

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.

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 utilise 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.

1.3.2.6. 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 Euro NCAP for the passenger seat SBR to be disabled via the passenger airbag switch.

1.3.2.7. 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 all front seat passengers, seat use must be detected. Euro NCAP defines occupancy as use by an occupant larger, taller or heavier than a small female (5^{th} percentile).

1.3.2.8. Secondary buckles

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

1.3.2.9. 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 1.3.2.3 for the front 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:

- The VUT has reached a forward speed of 25 km/h, or
- The VUT has been in "Forward Motion" for 500 metres

Where the change of status occurs below 25km/h, and doors are opened, the system should consider this situation as a “new journey” and warn accordingly.

1.3.2.10. End of signal

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

- The signal has operated for the duration as specified in 1.3.2.5.
- The related seat belts are put into use
- The vehicle speed is below 10 km/h. When no doors have been opened, and the seat belts remain unbuckled, the signal must resume again when the vehicle speed goes above 25 km/h

1.3.3. Scoring

A maximum of 15 points is available for HGV SBR. SBR points can be achieved for the following features:

- SBR system start at the commencement of each journey 1.5 points
- Driver seat SBR compliant with the requirements of 1.3.2. 7.5 points
- Passenger seat(s) compliant with the requirements of 1.3.2. – points equally distributed across the number of front passenger seat positions 6.0 points

To aid understanding for passenger seats, in case of the VUT being fitted with one passenger seat, 6.0 points are awarded for a compliant SBR. In case of it being fitted with three passenger seats with only the outboard one being equipped with a compliant SBR, 2.0 points are awarded. In case no passenger seat is fitted, the 6.0 points are added to the 7.5 points available for the driver seat.

1.4. Visualisation

The SBR score is presented using a colour for the function. The colours used are based on the function score, rounded to three decimal places, as shown in Table 1-1.

Colour	Verdict	Applied to Score
Green	Good	11.251 to 15.000 points
Yellow	Adequate	7.501 to 11.250 points
Orange	Marginal	3.751 to 7.500 points
Brown	Poor	0.001 to 3.750 points
Red	Weak	0.000 points

Table 1-1 HGV SBR scoring visualisation

2. OCCUPANT STATUS MONITORING – DRIVER STATE MONITORING

2.1. Introduction

An analysis of UK police reported collisions included driver inattention as a factor in 8 % of fatal collisions involving an HGV. An in-depth study on the same topic (Knight et al, 2006) suggests a figure of 20 %. Such contributory factors are notoriously underreported because of the challenge of identifying evidence confirming the factor and the self-incriminating aspect of drivers confessing to being inattentive to the driving task.

The professional nature of HGV driving, navigating urban environments among busy traffic or monotonous highway driving for long periods of time between breaks, can result in inattention in the forms of impairment through fatigue or substance abuse, or distraction with route finding or other activities. With an ageing driver population, sudden medical incapacitation is also a growing cause of road crashes. When inattentive, drivers can fail to identify and react to developments in the road and traffic environment, straying from safe driving practices into potentially critical situations.

To support the driver with identifying when they may be inattentive, vehicle manufacturers offer technology that monitors the driving and alerts the driver in case of a degradation in the control with which they are driving the HGV. Euro NCAP call this technology Driver State Monitoring (DSM). DSM can be categorised as indirect, in which the system observes the general control of the vehicle and/or driver inputs, or direct, in which the technology directly observes the driver. Already, driver advisory systems such as DSM target the human element in crashes by alerting the driver in developing situations and, ultimately, by supporting the driver to improve their behaviour. In addition, adapting crash avoidance intervention criteria to individual drivers and the driver's state may provide significant potential for more effective interventions targeting critical situations without compromising false positive warning or intervention rates.

Whilst regulation makes indirect DSM a mandatory requirement for new HGVs, Euro NCAP strives to drive performance improvements to ensure robust and effective DSM operation. The Euro NCAP scheme builds on the regulatory requirement by:

- Rewarding higher sensitivity to drowsiness
- Introducing a false warning per hour limit to the benefit of accurate detection whilst encouraging driver acceptance of the technology

This protocol specifies the HGV indirect DSM vehicle assessment procedure for the HGV safety rating scheme.

2.2. Definitions

Throughout this protocol the following terms are used:

Driver State Monitoring (DSM) – system that is able to determine the state of the driver
Indirect monitoring – where driver state determination is achieved indirectly through means other than sensor(s) directly observing the driver (e.g. steering input).

2.3. Criteria and Scoring

2.3.1. Eligibility

To be eligible for scoring points in DSM, the system detecting drowsy driving behaviour shall be default on at the start of every journey. A learning period of up to 30 minutes is permitted from the start of every journey and the system must be active when the vehicle is in forward motion at speeds greater than 65 km/h.

2.3.2. Assessment Criteria

A maximum of 10 points is available to be awarded for driver state monitoring. Driver state monitoring points can be achieved for the following features.

- VUT equipped with a General Safety Regulation II (GSR 2) compliant Driver Drowsiness and Attention Warning (DDAW) system 5 points
- DDAW system with a sensitivity greater than 50 % and less than one false warning per 4.5 hours of driving 5 points
- Novel driver state monitoring feature promoting real world safety 5 points

Where fitted, the vehicle manufacturer is requested to provide supporting evidence describing the DDAW system sensitivity and false warning rate.

Where fitted, the vehicle manufacturer is requested to provide supporting evidence describing the novel feature and illustrating how it supports improved real world safety.

To aid understanding, if a vehicle is equipped with a GSR2 compliant DDAW system (5 points) with a sensitivity greater than 50 % and a false warning rate of less than 1 false warning per 4.5 hours of driving (5 points), a total of 10 points would be awarded. If the same vehicle is also equipped with a novel driver state monitoring feature promoting real world safety (5 points), a total of 15 points would be scored but only 10 awarded.

2.4. Visualisation

The final driver state monitoring score is presented to one decimal place and visualised using the colour scheme shown in Table 4-1.

Colour	Verdict	Applied to Score
Green	Good	7.501 to 10.000 points
Orange	Marginal	2.501 to 5.000 points
Red	Weak	0.000 points

Table 2-1 Driver state monitoring scoring visualisation

3. SPEED ASSISTANCE SYSTEMS

3.1. Introduction

Excessive and inappropriate speed is a factor in the causation and severity of many road accidents. Speed restrictions are intended to promote safe operation of the road network by keeping traffic speeds below the maximum that is appropriate for a given traffic environment, thereby protecting vehicle occupants and other road users, both motorised and non-motorised. These maximum speeds are intended to control energy levels in typical crashes and to allow sufficient time for drivers to react to traffic situations. Properly selected speed limits should facilitate efficient traffic flow, reduce violations and promote safe driving conditions. Greater adherence to speed limits would avert many accidents and mitigate the effects of those that occur.

Heavy Goods Vehicles (HGVs) are no exception to these key safety facts, but the relative priority and importance can vary, as can the availability of technologies to address the problems. Relative to passenger cars, exceeding the speed limit was less frequently coded as a contributory factor in HGV collisions (6 %) than was the case for passenger cars (3 %) (based on GB national collision statistics). However, it is also thought that police reported data underestimates the extent to which speed contributes to the causes and consequences of collisions. Evidence considering correlations between average speed and injury risks on different road types predict a much higher influence (Elvik & Vaa, 2004).

HGVs have been required to be equipped with fixed speed limiters governing their maximum speed to 90 km/h on any road. From July 2022, Intelligent Speed Assistant (ISA) has been made mandatory for new types of vehicles under EU 2021/1958 due to the update of the EU 2019/2144 General Safety Regulation (GSR). All vehicles in the market follow in July 2024. Euro NCAP requirements for speed limitation devices are a means to improve accuracy and reliability of this kind of systems and to promote best practice while using them. Euro NCAP hopes to encourage manufacturers to promote such enhanced speed-limitation functionalities and to fit them as standard equipment. This, it is hoped, will lead to greater demand by consumers and an increased introduction of speed limitation systems.

This version of the protocol contains technical requirements for both speed limit information functions to continuously inform the driver of the speed limit and speed warning and control functions supporting the driver in his driving task by limiting or maintaining the set speed.

3.2. Definitions

Throughout this protocol the following terms are used:

V_{VUT} – The true speed of the vehicle, as measured by an accurate independent measurement device to an accuracy of 0.1 km/h.
$V_{indicated}$ – The speed the vehicle travels as displayed to the driver by the speedometer as in ECE Regulation No. 39.
V_{limit} – Maximum allowed legal speed for the vehicle at the location, time and in the circumstance the vehicle is driving.
Speed Limit Information Function (SLIF) – means a function with which the vehicle identifies the prevailing speed limit and communicates it to the driver.

Adjustable speed (V_{adj}) – means the voluntarily set speed for the speed control functions, which is based on $V_{indicated}$ and includes the offset set by the driver.
Speed Control Function (SCF) – means any function that allows the vehicle to directly ensure that a defined speed is not exceeded. The functions include:

Speed Limitation Function (SLF) – a system which allows the driver to set a vehicle speed V_{adj}, to which they wish the speed of the VUT to be limited and above which they wish to be warned. Below V_{adj}, the speed of the vehicle is manually controlled by the driver.
Intelligent Speed Limiter (ISL) – is a SLF combined with SLIF, where the V_{adj} is set by the SLIF with or without driver confirmation.
Intelligent Adaptive Cruise Control (iACC) is an ACC combined with SLIF, where the ACC set speed is set to the SLIF speed, with or without driver confirmation. ACC will determine the vehicle speed, where there are no limiting factors, accelerating to the ACC set speed maximum.
Downhill Speed Limiter is a system that automatically limits the speed of the vehicle in a downhill condition.
Geofenced Speed Limiter is a system that limits the maximum drivable speed of the vehicle in a predefined area.

The following terms are used for the assessment of the Speed Limitation Function:

Stabilised speed (V_{stab}) means the mean true vehicle speed V_{VUT} when the speed control function is operating to limit speed to V_{adj}. V_{stab} is calculated as the average actual vehicle speed over a time interval of 20 seconds beginning 20 seconds after first reaching a speed 10 km/h less than V_{adj}.

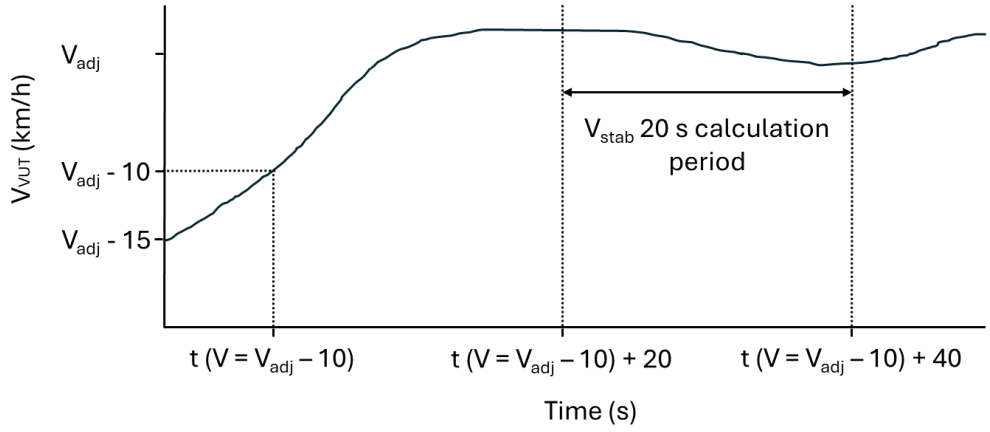


Figure 3-1 V_{stab} calculation period using V_{VUT}

3.3. Overall Speed Assist Systems requirements

The assessment of Speed Assist Systems considers two features, SLIF and SCF, which may be combined.

3.3.1. Speed Limit Information Functions

- Basic SLIF meeting the General Requirements of this protocol described in 3.4.1 and the ones set by GSR ISA EU 2021/4455 (SLIF Technical Requirements – chapter 3.4)
- Advanced Functions, referring to conditional, implicit and dynamic speed limits
- System accuracy

- System updates

3.3.2. Speed Control Functions

- Speed Limitation Function (without SLIF coupling)
- Intelligent Speed Limiter (SLIF and Speed Limitation Function coupled)
- Intelligent ACC (SLIF and ACC coupled)
- Downhill Speed Limiter
- Geofenced Speed Limiter

3.4. Speed Limit Information Functions

The Speed Limit Information Function may be a standalone function or an integrated part of a Speed Control Function. Any SLIF using all relevant system inputs, for example camera input and electronic map based or a combination of both, is eligible for scoring points for Advanced Functions when meeting the General Requirements when the SLIF is default ON at the start of a journey.

3.4.1. General requirements

The speed limit shall be shown using a traffic sign and shall be clearly visible in the direct field of view of the driver, without the need for the head to be moved from the normal driving position, e.g. in the instrument cluster or a head-up display.

The speed limit information must be shown at all times (excluding the initialisation period and temporary interruption for safety reasons). The indicated speed limit information may indicate the level of reliability of the speed limit.

The speed limit information shall be correctly applied to the corresponding vehicle category. For example, in some countries a national speed limit sign might imply one speed limit for a passenger car and a different limit for an HGV. In these circumstances, the vehicle must display the relevant HGV limit.

In the presence of conditional speed limits (see for examples Appendix I) the system needs to either:

- Properly identify and show (for example when raining) the applicable speed limit

or

- Indicate the presence of a conditional speed limit which the system is not able to compute, in addition to the non-conditional speed limit.

Manufacturers are requested to supply Euro NCAP with background information of the SLIF (if applicable to the technology).

3.4.2. Warning function

Any Speed Limit Information Function requires a warning function to indicate to the driver that V_{limit} is exceeded through the whole vehicle speed range. The warning function shall be default on and operative through all the vehicle speed range. It may be switched off fully or partially by the driver, but it shall be reinstated in normal operation mode upon each activation of the vehicle master control switch.

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

SLIF meeting the requirements of 3.4.1 and 3.4.2 will be awarded the score of 2.5 points for SLIF.

3.4.3. Advanced functions

Systems that are able to properly identify conditions that refine the applicable speed limit (conditional, implicit and dynamic speed limits) and act accordingly will score additional points based on the number of conditions where it can identify, compute and show the correct limit.

For each advanced function show Table 3-1, in order to be awarded with the corresponding points, the manufacturer should provide evidence that the advanced functions operate as intended, unless the infrastructure would not enable these functions. The features shall support the driver with accurate speed limit information for at least 80 % of the distance driven on public roads in accordance with the Euro NCAP test protocol (minimum 30 % of the distance on each of Motorway, Urban and Rural roads). The manufacturer is requested to provide evidence and reasoning to Euro NCAP to support an assertion that the 80 % requirement will be achieved in at least:

- These specific countries: Austria, France, Germany, Italy, Luxemburg, the Netherlands, Norway, Spain, Sweden and the United Kingdom; and
- Half of the countries of the Euro NCAP Application Area (as defined in TB 1002).

An independent test will also be undertaken in a single country by the Euro NCAP test laboratory in accordance with the SAS test protocol. The overall result shall be assessed on the basis of the manufacturer information and the Euro NCAP test result in combination, giving due consideration to the fact that the deployment of speed limit signs in the real world is highly variable such that precise results statistically representative of all routes in all countries is unrealistic.

The speed limit identified by the advanced functions shall not be shown separately from the speed limit information requested in the general requirements (section 3.4.1).

These functions are listed in the table below and example traffic signs of a limited number of countries are specified in APPENDIX I.

ADVANCED FUNCTIONS			Points	Required Action
Conditional speed limits	Weather	Rain / Wetness	2	Show correct speed limit
		Snow / Icy	2	Warning only and ignore if irrelevant
	Time	Time / Season	3	Show correct speed limit
	Distance	Distance for / in	1	Show correct speed limit
	Arrows	Arrows	1	Show correct speed limit / ignore if irrelevant
	Vehicle Categories	Other vehicle / weight categories*	1	Show correct speed limit
Implicit Speed Limits		Highway / Motorway	2	Show correct speed limit
		City Entry / Exit	3	
		Residential zones	2	
Dynamic Speed Limits		Dynamic speed signs including roadworks	3	Show correct speed limit
		TOTAL	**20**	

Table 3-1 Advanced functions points available per function

*Correctly applying country-specific generic speed limits to the corresponding vehicle category is part of the general requirements for SLIF. Calculating a specific conditional speed limit related to a particular vehicle category or weight limit (usually defined by a sub-sign) is part of conditional speed limits under advanced functions.

The final advanced functions score is calculated by multiplying the sum of the points achieved by 0.125.

3.4.4. System accuracy

A system that achieves more than 12 out of 20 points from the Advanced Functions will be awarded the score of 1.25 points for System Accuracy.

3.4.5. System updates

Keeping systems updated is crucial for a high level of accuracy and acceptance over the lifetime of the vehicle. System updates might include map updates and/or any software updated related to the operation of the Speed Assist System in relation to speed limits, conditional speed limits and road features.
System updates with the latest and most-up-to-date knowledge can score points based on the frequency of updates when available without user action and free of charge for the duration of the rating.

A system will be awarded the appropriate score for update frequency in line with the points identified in Table 3-2.

SYSTEM UPDATE FREQUENCY	Points	Required Action
Less frequently than quarterly	0.000	-
At least quarterly but not continuous	0.625	Automatic update without user action
Continuous	1.250	Continuous (daily, weekly) update without user action
TOTAL	**1.250**	

Table 3-2 System updates points available per update frequency

3.5. Speed Control Functions

Three speed control functions are considered in this section; Speed Limitation Function (manually set), Intelligent Speed Limiter and Intelligent Adaptive Cruise Control must meet the requirements in Table 3-3 to score points.

SPEED CONTROL FUNCTION TYPES	Applicable Sections
Speed Limitation Function (SLF)	3.5.1, 3.5.2 and 3.5.4
Intelligent Speed Limiter (ISL)	3.5.1, 3.5.3 and 3.5.4
Intelligent Adaptive Cruise Control (iACC)	

Table 3-3 Speed control function requirements

Two additional functions related to speed control allow to score additional points: Downhill Speed Limiter and Geofenced Speed Limiter must meet the requirements in Table 3-4.

ADDITIONAL SPEED CONTROL FUNCTIONS	Applicable Sections
Downhill Speed Limiter	3.5.4 and 3.5.5
Geofenced Speed Limiter	3.5.4 and 3.5.6

Table 3-4 Additional speed control function requirements

All speed control functions must be capable of being activated/de-activated by the driver at any time with a simple operation.

3.5.1. Activation and deactivation of the function

Functionalities above GSR ISA requirements could be configurable by customer, with the possibility of being defined as default on or off.

3.5.2. Manual setting of adjusted speed

It shall be possible to set the adjusted speed by means of a control device operated directly by the driver. It must be possible to set the speed in increments of no more than 10 km/h (5 mph) between 30 km/h (20 mph) and 90 km/h (55 mph).

It shall be possible to set it independently of the current vehicle speed.

If V_{adj} is set to a speed lower than the current vehicle speed, the system shall limit the vehicle speed to the new level within 30 s, or it shall initiate a warning (section 3.5.4, paragraph 7) no later than 30 s after V_{adj} has been set.

The V_{adj} 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.

3.5.3. Automatic setting of adjusted speed

An automatic setting is using the speed limit information from the SLIF to set the V_{adj}. iACC and ISL automatic adjustments can be introduced with or without driver confirmation. Both ISL and iACC functions fulfilling the requirements from this section are eligible for scoring points:

- In case of ISL, the activation time for speed reduction and warning shall be according to the general requirements of GSR ISA. In case of iACC, the system should adopt, or offer the driver to adopt, an adjusted V_{adj} within 5 s after a change in the speed limit.
- If V_{adj} is set to a speed lower than the current vehicle speed, the system shall start to limit the vehicle speed to the new V_{adj} or shall initiate a warning (section 3.5.4, paragraph 7) no later than 30 s after V_{adj} has been set.
- A negative offset with respect to the known speed limit is allowed. In particular scenarios, with the objective of energy efficiency, a positive offset is also allowed. Positive offsets shall not be larger than 15 km/h (9 mph) and shall only be applied during particular conditions in the route, never during the whole driving period. These offsets are included in V_{adj}.
- V_{adj} in the automatic mode of an ISL or iACC system may be retained at the end of a journey.
- Where V_{adj} is set to the speed limit advised by the SLIF, the indication of V_{adj} may be suppressed.

3.5.4. Speed control

When any of the speed control functions are active, the vehicle speed shall be limited or controlled to V_{adj}.

Systems shall be able to control the vehicle speed by means of engine throttle and any kind of endurance brake (e.g. exhaust brake, speed retarders or regenerative braking etc.). The use of service brakes for speed control purposes is not required.

It shall still be possible to exceed V_{adj} by applying a positive override action – e.g. pressing the accelerator harder/deeper or kickdown.

After exceeding V_{adj} by applying a positive override action, the speed control function shall be reactivated when the vehicle speed drops to a speed less than or equal to V_{adj}.

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

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).

When the speed control function is not able to limit to and/or maintain V_{adj} and V_{adj} is exceeded, a warning will be issued according the SLWF Requirements of GSR ISA (i.e. warning type and total duration). No warning needs to be given when V_{adj} is exceeded as a result of a positive action.

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

3.5.5. Additional function – Downhill Speed Limiter

Systems able to limit the vehicle speed in a downhill condition are eligible for scoring additional points when fulfilling the following requirements:

- Systems may be automatically activated according to the route profile or manually activated by the driver. Once engaged, the system shall operate to automatically keep the adjusted speed during the downhill condition, independently from any slope profile variation.
- Speed control shall be done according to the requirements specified in 3.5.4.

3.5.6. Additional function – Geofenced Speed Limiter

Systems able to limit the maximum drivable speed of the vehicle in a predefined area are eligible for scoring additional points when fulfilling the following requirements:

- This function is intended for fleet operators. Maximum speed and geographical operation area shall be configurable remotely by the fleet operator.
- Once enabled by the operator, the function shall limit the maximum drivable speed of the vehicle without any further driver action.
- The driver shall not be able to override the system without any specific operator authorisation.
- Speed control shall be done according to the requirements specified in 3.5.4.

3.6. Scoring

The points in Table 3-5 are awarded for systems that meet the requirements. These points will contribute to the Safe Driving pillar score.

SPEED LIMIT INFORMATION FUNCTION	Points
Basic SLIF (Compliant with Euro NCAP & GSR SLIF General Requirements)	2.5
Conditional Speed Limits	2.5
System accuracy	1.25
System updates	1.25
SLIF TOTAL	**7.50**
SPEED CONTROL FUNCTION	**Points**
Speed Limitation Function	2.5
Intelligent Speed Limiter, not default ON	5.0
Intelligent ACC (driver activated) or Intelligent Speed Limiter (default ON)	7.5
Additional function – Downhill Speed Limiter	2.5
Additional function – Geofenced Speed Limiter	2.5
SPEED CONTROL FUNCTION TOTAL	**7.5**
SPEED ASSIST SYSTEM TOTAL	**15.00**

Table 3-5 HGV SAS points available

- The maximum available score for Speed Limit Information Functions is 7.5 points. The SLIF score is calculated as the sum of all system capabilities.
- The maximum available score for Speed Control Functions is 7.5 points out of the total of 20.0 points available. The SCF score is the provided by the most complex function available in the vehicle and is complemented by additional functions. The additional functions Downhill Speed Limiter and Geofenced Speed Limiter provide additional points in Speed Limitation Functions section.

3.7. Visualisation

The SAS scores are presented separately using a colour for the different SAS functions: SLIF and SCF. The colours used are based on the function scores respectively, rounded to three decimal places, as shown in Table 3-6.

Colour	Verdict	Applied to Score
Green	Good	11.251 to 15.000 points
Yellow	Adequate	7.501 to 11.250 points
Orange	Marginal	3.751 to 7.500 points
Brown	Poor	0.000 to 3.750 points
Red	Weak	0.000 points

Table 3-6 HGV SAS scoring visualisation

4. VISION

4.1. Introduction

Collisions between Vulnerable Road Users (VRU) and large commercial vehicles that are undertaking low speed manoeuvres, such as a turn to the nearside or moving off from rest, typically occur at low driving speeds. They usually have serious consequences for the VRU.

The cause of this type of collision can be contributed to by many factors. The VRU may have been positioned in a blind spot where they could not be seen directly through the windows or via mirrors. Alternatively, they may have been available to be seen during the build-up to the collision, but the driver may have detected their presence too late to avoid collision, or may have failed to detect their presence at all. This late detection, or failure to detect, could be a result of the driver failing to look, looking but failing to see, or seeing but failing to correctly judge the risk.

Aligned with these multi-factor causes, there are also a number of potential solutions to the problem, including the eliminating of blind spots, increasing the areas that can be seen directly through the windows, blind spot information systems, collision warnings and automated intervention to either stop, if moving already, or to prevent movement if stationary and a collision with a vulnerable road user would otherwise be imminent.

In some circumstances, the different solutions will offer synergies. An effective collision warning can alert an attentive driver to the existence of a problem, but that driver is more likely to respond quickly and appropriately if the warning draws their attention to the presence of a VRU that is clearly visible by direct line of sight through a window, rather than to a small, distorted image of the VRU in a blind spot mirror, or where the VRU is not visible at all.

At the other end of the scale, where a moving off from rest collision occurs purely because the VRU was completely invisible to a largely attentive driver who just failed to check the class VI front mirror, then the collision would certainly be avoided by improved direct vision. It would also be certain to be avoided if the vehicle detected the presence of the VRU and prevented motion automatically. The VRU cannot be saved twice and in this circumstance, the benefits are not additive.

Euro NCAP recognises this complexity and has implemented test protocols intended to drive vehicles towards high standards of vision as well as towards high performance collision avoidance systems. These will be applied flexibly in the rating so that manufacturers can choose the most cost-effective way of solving the problems in their specific freight application and vehicle design.

This protocol specifies the HGV Vision assessment procedure for the HGV safety rating scheme. Two areas of assessment are considered: Direct Vision and Indirect Vision.

4.2. Definitions

Throughout this protocol the following terms are used:

Heavy Goods Vehicle (HGV) – a category N2 or N3 vehicle with gross mass exceeding 3,500 kg.
Direct Vision – means the field of vision from the driver's eye point that can be seen without the aid of indirect vision devices such as mirrors or camera monitor systems.
Indirect Vision – means the vision from the driver's eye point that is obscured and can only be seen with the aid of indirect vision devices such as mirrors or camera monitor systems.
Camera Monitor System (CMS) – means a system which uses camera and digital display technology to provide indirect vision
Total Visible Volume – means a volume of space, contained entirely within the assessment volume, that is visible via sightlines projected from one of the E-Points through the direct vision opening lines. It is the sum of volumes visible within the assessment zone from the driver's eye point through any window in the vehicle cab.
Vehicle Under Test (VUT) – means the vehicle tested according to this protocol.

4.3. Criteria and Scoring

4.3.1. Direct Vision

A maximum of 35 points is available to be awarded for direct vision. For direct vision, the assessment criteria used is the total visible volume (TVV).

If the TVV is less than or equal to 5.000 m^3, then zero points shall be scored. If the TVV is more than 20.500 m^3, then 35 points shall be scored. For TVVs of more than 5.000 m^3 and no more than 20.500 m^3, the number of points shall be determined by the following equation:

$$\text{Direct vision points scored} = -0.14566*TVV^2 + 5.97240*TVV - 26.22057$$

4.3.2. Indirect Vision

A maximum of 15 points is available to be awarded for indirect vision. Indirect vision points can be achieved for the following features. In the case of both a conventional reflective mirror and a CMS covering the same class fields of view as defined by UNECE Regulation No. 46, the points awarded for that view are halved.

- CMS covering the class II view equipped with adjustable markings illustrating the rearmost point of the of the vehicle and safe distances behind the vehicle 3 points
- CMS covering the class IV view 3 points
- CMS covering the class V view 3 points
- CMS view covering the class VI view 3 points
- Novel CMS feature(s) promoting improved real world safety and/or driver acceptance – one point available per feature for up to a maximum of three features 3 points

Where fitted, the vehicle manufacturer is requested to provide supporting evidence describing the novel feature(s) and illustrating how they support improved real world safety and/or driver acceptance.

To aid understanding, if a vehicle is equipped with only CMS covering the class II view with distance markings (3 points) and IV view (3 points) with image panning affording improved vision when the vehicle is turning (novel CMS feature 1 point), conventional mirrors covering the class

V and VI views (0 points) and a CMS covering the class V view (1.5 points), total of 8.5 points would be awarded.

4.4. Visualisation

The final direct vision score is presented to one decimal place and visualised using the colour scheme shown in Table 4-1.

Colour	Verdict	Applied to Score
Green	Good	26.251 to 35.000 points
Yellow	Adequate	17.501 to 26.250 points
Orange	Marginal	8.751 to 17.500 points
Brown	Poor	0.001 to 8.750 points
Red	Weak	0.000 points

Table 4-1 Direct vision scoring visualisation

The final indirect vision score is presented to one decimal place and visualised using the colour scheme shown in Table 4-2.

Colour	Verdict	Applied to Score
Green	Good	11.251 to 15.000 points
Yellow	Adequate	7.501 to 11.250 points
Orange	Marginal	3.751 to 7.500 points
Brown	Poor	0.001 to 3.750 points
Red	Weak	0.000 points

Table 4-2 Indirect vision scoring visualisation

5. LONGITUDINAL ASSISTANCE

5.1. Introduction

An analysis of European road traffic crash data (where at least one HGV was involved) revealed that Heavy Goods Vehicle (HGV) front-to-rear collisions account for 9 % of passenger car and Light Commercial Vehicle (LCV or van) occupant fatalities and 17 % of HGV occupant fatalities. Considering all injury severities, those figures increase to 20 % and 49 % respectively.

Typical incidents include the HGV colliding with the rear of slow moving or stationary traffic on highways at high relative speeds because of a range of factors including driver distraction, fatigue or misjudgement. Where the HGV collides with a light vehicle the large difference in weight means that the light vehicle sees almost all of the change in velocity putting the occupant(s) of that vehicle at very high risk. Where the collision partner is a heavy vehicle, the large collision energy presents a risk of serious injury to the HGV driver and the occupants of the struck vehicle(s).

Adaptive Cruise Control (ACC) is an increasingly available HGV feature which, similar to AEB, monitors the road and traffic environment. When engaged by the driver, it controls speed to maintain a safe following gap and can support avoiding collisions, albeit with more modest deceleration at comfort braking levels. Feeback from industry suggests this feature is commonly used by drivers and could potentially bring some safety benefits in certain circumstances by reacting to hazards ahead slightly earlier than might be the case for AEB.

This protocol specifies the longitudinal assistance test procedures, which are used to evaluate system performance in a repeatable and reproducible manner for the HGV safety rating scheme.

5.2. Definitions

Throughout this protocol the following terms are used:
Heavy Goods Vehicle (HGV) – a category N2 or N3 vehicle with gross mass exceeding 3,500kg.

Adaptive Cruise Control (ACC) – a system engaged by the driver which monitors the road and traffic environment and automatically adjusts speed to maintain a safe following distance

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.

ACC braking performance – the outcome of the automatically applied braking when ACC is operational along with AEB, in terms of whether the collision was avoided or the resultant (relative) impact speed.

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

HGV-to-Car Rear Braking (HCRb) – a scenario 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.

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.

T_{ACC} – the time when the ACC system inititates speed reduction in response to the target ahead. Activation time is determined by identifying the last data point where the filtered acceleration signal is below -1.0 m/s^2, and then going back to the point in time where the acceleration first crossed -0.3 m/s^2.

T_{impact} – the time at which the VUT hits the GVT.

V_{impact} – the speed of the VUT at T_{impact}.

V_{rel_impact} – the relative speed at which the VUT hits the GVT by subtracting the velocity of the GVT at T_{impact} from V_{impact}.

5.3. Criteria and Scoring

5.3.1. Scoring

5.3.1.1. ACC HCRs and HCRb Scenarios

For HCRs and HCRb tests, the assessment criteria used is the impact speed V_{impact}. For each test configuration, the V_{impact} result is given a colour based on the scheme illustrated in Figure 5-1. ACC HCRb tests are considered to be equivalent to an HCRs test with 50 and 80 km/h VUT test speeds.

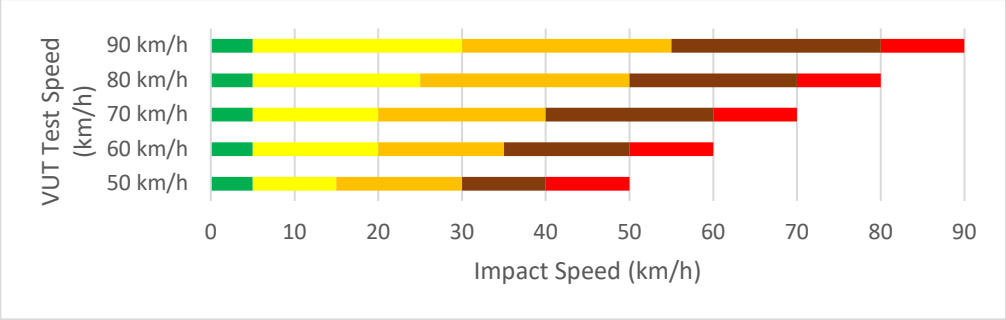


Figure 5-1 ACC HCRs and HCRb performance

To aid understanding, Table 5-1 illustrates the speed range for each colour in an HCRs and an HCRb test configuration with a VUT test speed of 50 km/h.

Colour	Impact speed range (km/h)
Green	$0 < V_{impact} < 5$
Yellow	$5 \leq V_{impact} < 15$
Orange	$15 \leq V_{impact} < 30$
Brown	$30 \leq V_{impact} < 40$
Red	$40 \leq V_{impact}$

Table 5-1 Speed range for each colour in an ACC HCRs and HCRb 50 km/h test

For each test configuration result, Table 1-1 shows the scaling applied to the points available.

Colour	Scaling
Green	1.000
Yellow	0.750
Orange	0.500
Brown	0.250
Red	0.000

Table 5-2 Points scaling for each colour for ACC HCR

The points available for each HCR scenario test configuration are shown in Table 5-3. Note that the centrally aligned score is six times weighted for ACC HCRs.

VUT Test Speed (km/h)	ACC HGV-to-Car Rear (HCR)			
	ACC HCRs			ACC HCRb
	Left aligned -50%	Centrally aligned	Right aligned 50%	Centrally aligned
50	1	1	1	2 x 1
60	1	1	1	-
70	1	1	1	-
80	1	1	1	2 x 1
90	1	1	1	-
Weighting	**1**	**6**	**1**	**1**
Total	**40**			**4**

Table 5-3 HCR points available per scenario and test speed

The proportion of points scored in each scenario, known as the normalised scenario score, are carried forward for calculating the final ACC HCR score. To aid understanding, if 30 points are scored out of the total of 40 available for ACC HCRs, a normalised scenario score of 0.750 is carried forward.

5.3.1.2. Close Follow Distance Warning

The close follow distance warning point can be achieved for the following features:

- During manual driving (ACC not engaged) close follow distance warning displayed when following closely for speed ≥ 60 km/h 1 point

5.3.2. Final Longitudinal Assistance Score

A maximum of 10 points is available for longitudinal assistance in Safe Driving. The final longitudinal assistance score is calculated using the weighted sum of the normalised ACC scenario scores and the normalised close follow distance warning score.

Final longitudinal assistance score = $10 * \sum \begin{matrix} normalised\ ACC\ HCRs\ score * 0.3 \\ normalised\ ACC\ HCRb\ score * 0.4 \\ normalised\ close\ follow\ distance\ warning\ score * 0.3 \end{matrix}$

5.4. Visualisation

The final longitudinal assistance is presented to one decimal place and visualised using the colour scheme shown in Table 5-4.

Colour	Verdict	Applied to Score
Green	Good	7.501 to 10.000 points
Yellow	Adequate	5.001 to 7.500 points
Orange	Marginal	2.501 to 5.000 points
Brown	Poor	0.001 to 2.500 points
Red	Weak	0.000 points

Table 5-4 Longitudinal assistance scoring visualisation

OVERVIEW OF FIGURES

APPENDIX I – SAS EXAMPLES SPEED LIMIT SIGNS

Weather condition

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Rain and/or wetness						bij nat wegdek			
Snow and / or ice		PAR VERGLAS							

Date / time condition

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Time	20h-6h		16-18 h	7.30 - 19.00		06-19 h		8-18 (8-18) 8-18 *	
Date	Mo.-Fr. 7-19h Sa. 7-14h		Mo-Fr 16-18 h	lun - ven 21.00 - 4.00		ma t/m vr 18.00 - 21.30 h		15/5-15/9 **	

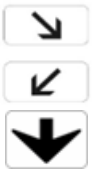
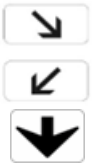
* Black: Mo-Fri except holiday or day before holiday)
(Black): Saturday or day before holiday
Red: Sunday or holiday
Note! Can be one, two or all three

** Could also be in words: “1 juni – 31 augusti”

Distance condition

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Distance for	3 km	15 km 2500 m	800 m	10,5 km	3 km fin	1,5 km	4 km		For 2 miles 250 yds
Distance in	100m	15 km 2400 m	100 m	300 m	200 m	100 m	150 m	100 m	400 yds

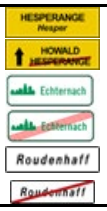
Arrows

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Arrows									

Other vehicle / weight categories

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Vehicle and/or weight									

Implicit speed limits

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Highway and/or motorway									
City entry and/or exit									
Residential zones									

Date / time condition

	Austria	France	Germany	Italy	Luxembourg	Netherlands	Spain	Sweden	United Kingdom
Time									

APPENDIX II – SAS TERMS ALIGNMENT

For Euro NCAP Speed Assist Systems and GSR Intelligent Speed Assist Systems EU 2021/4455

Concept	**Term used in Euro NCAP SAS**	**Term used in GSR ISA**
General name of the system	SAS – Speed Assist System	ISA – Intelligent Speed Assist
Information function	SLIF – Speed Limit Information Function	SLIF – Speed Limit Information Function
Warning function		SLWF – Speed Limit Warning Function
Manual speed limiter function	SLF – Speed Limitation Function	-
Automated speed limiter function	ISL – Intelligent Speed Limiter	SCF – Speed Control Function
Automated speed control function	iACC – Intelligent Adaptive Cruise control	-

Test variable	**Term used in Euro NCAP SAS**	**Term used in GSR ISA**
Driving speed of the vehicle	Vindicated	Speedometer Speed
Legal speed limit	Vlimit	Applicable Speed Limit
Manually adjustable speed for SLF	V_{adj} – Adjustable Speed	-
Average speed	V_{stab} – Stabilised Speed	Stabilised Speed