

Safe Driving Vehicle Assistance

Speed Assist Systems

Test Protocol

Implementation November 2024

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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 Euro NCAP secretariat should be immediately informed. Any such incident may be reported 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).

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DEFINITIONS

Throughout this protocol the following terms are used:

V_{VUT} – The true speed of the vehicle under test

$V_{indicated}$ – 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 manually 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 Speed Limitation Function where the V_{adj} is set automatically by the Speed Limit Information Function or offered by the function for driver acceptance.

Intelligent Adaptive Cruise Control (iACC) is an Adaptive Cruise Control (ACC) combined with Speed Limit Information Function, where the maximum speed is set by the Speed Limit Information Function with or without driver confirmation. Below V_{adj} , the ACC function will control the speed.

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 actual vehicle speed 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} .

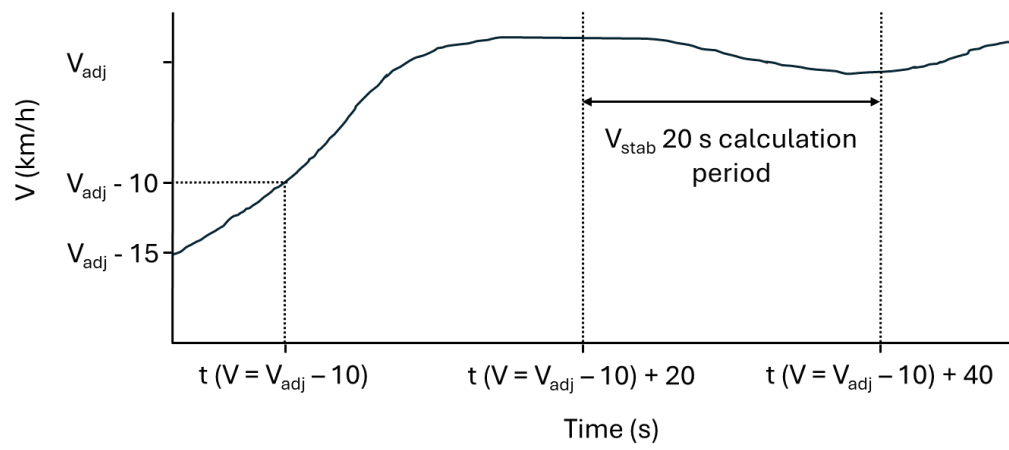


Figure 0-1 V_{stab} calculation period

1 INTRODUCTION

Exceeding the speed limit and driver inattention, whether through distraction or impairment by fatigue or alcohol, are widely regarded as being among some of the biggest factors contributing to the cause of road collision. In the case of excess speed, it also makes collisions more severe.

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. Type approval Regulation from 2024 will require them to be fitted with a speed assist system that informs the driver of the prevailing road speed limit and imposes certain technical standards if the manufacturer offers the driver the option to automatically control the speed to be within the limit. Euro NCAP aims to increase the standard of those systems by encouraging recognition of more conditional and implicit speed limits, encouraging the use of speed control functions, and helping to encourage high levels of accuracy across Europe.

The test described by this protocol is not intended to provide statistically significant evidence that the required effectiveness levels are met across Europe but is intended to provide additional independent confirmation (or otherwise) of evidence presented by the manufacturer.

2 REFERENCE SYSTEM

2.1 Convention

For both the VUT and the GVT use the convention specified in ISO 8855:1991 in which the x-axis points towards the front of the vehicle, the y-axis towards the left and the z-axis upwards (right hand system), with the origin at the most forward point on the centreline of the VUT for dynamic data measurements as shown in Figure 2-1.

Viewed from the origin, roll, pitch and yaw rotate clockwise around the x, y and z axes respectively. Longitudinal refers to the component of the measurement along the x-axis, lateral the component along the y-axis and vertical the component along the z-axis.

This reference system should be used for both left hand drive (LHD) and right hand drive (RHD) vehicles tested. Figure 2-1 shows the near and far side of the vehicle for a left hand drive (LHD) vehicle. The far side always corresponds to the hand of drive, and therefore swaps sides accordingly for a right hand drive (RHD) vehicle.

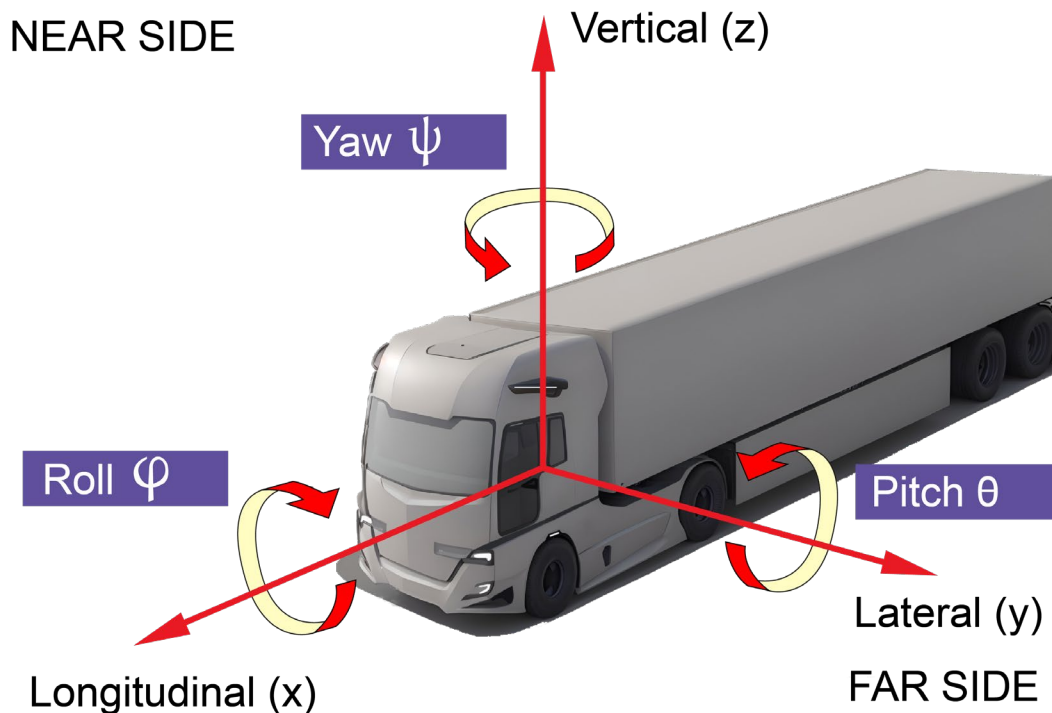


Figure 2-1 Coordinate system and notation

3 MEASURING EQUIPMENT

Sample and record all dynamic data at a frequency of at least 10 Hz.

3.1 Measurements and Variables

Time	T
Velocity of the vehicle under test	V_{VUT}

For public road tests V_{VUT} shall be recorded for the entire duration of the test.

For specific track tests of speed control functions, V_{VUT} shall be recorded for at least 20 seconds before and 40 seconds after reaching V_{adj} minus 10 km/h.

3.2 Measuring Equipment

Equip the VUT with data measurement and acquisition equipment to sample and record data with an accuracy of at least:

VUT longitudinal speed to 0.1 km/h

4 TEST CONDITIONS

4.1 Vehicle preparation

4.1.1 Trailer for Drawing Vehicles

Where the VUT is designed as a prime mover intended for drawing a trailer, complete testing with the VUT coupled to an appropriate trailer of the following specification:

- Of length and height approaching but not exceeding the maximum permitted by Annex 1 of Directive 96/53/EC

- Equipped with a three axle bogie (lift and/or steer axles are permitted to aid manoeuvrability however all axles must be deployed in their regular operating position during testing)

- Of adequate gross trailer mass to fulfil the gross train mass of the VUT

- With a flat floor i.e. not stepped, gooseneck or double deck

- With curtain side body in plain colour without branding

- Suitable for 5th wheel height of the VUT

- Equipped with disc brakes, an UN ECE Regulation 13 Category 1 Antilock Braking System (ABS) and an Electronic Braking System (EBS)

- Equipped with super single tyres (385/65R22.5) in good condition corresponding to the new original fitment tyres of the make, model, size, speed and load rating as specified by the trailer manufacturer

- Maintained in a fully operational condition in accordance with the manufacturer's documentation and specifications with supporting evidence



Figure 4-1 Example of a suitable trailer for testing

For the purposes of determining drawing vehicle and trailer loading, a nominal trailer mass of 6,700 kg is considered. Weigh the trailer used for testing and account for any variation from the nominal trailer mass when applying the load as illustrated in section 4.1.4.

4.1.2 Tyres

Perform the testing with good condition original fitment tyres of the make, model, size, speed and load rating as specified by the vehicle manufacturer. Use inflation pressures corresponding to the manufacturer's instructions for the appropriate loading condition. The tyres must be run-in before formal testing commences.

4.1.3 Running Order

Confirm that all VUT safety and operational systems are functioning correctly with no warning messages or indicators displayed to the driver. Rectify any faults before commencing testing.

Set any configurable driving controls to their automatic setting e.g. ride height setting. If an automatic setting is not available, set to a middle setting.

4.1.4 Loading and Vehicle Preparation

If only SLIF is to be tested, then the vehicle may be tested in any loading condition.

When tests of a speed control function are to be undertaken, then complete testing with the VUT half laden by mass to represent average category N vehicle operation. The procedure to prepare the VUT load requirement for testing is:

- If applicable, fill up the tank with fuel to at least 90 % of the tank's capacity of fuel, or in case of large tank capacity, partially fill the tank with adequate fuel to perform the testing, noting the fuel level and the vehicle manufacturer specified tank capacity
- Check that the levels of all fluids are within operating limits and top up where necessary
- Ensure that the VUT has all its bodywork and spare wheel on board, if fitted, along with any equipment or tools supplied. Nothing else should be in the VUT
- Ensure that all tyres are inflated according to the manufacturer's instructions for the appropriate loading condition
- Measure the VUT axle masses (without trailer for a drawing vehicle – unladen test trailer mass to be determined separately) to determine the 'measured kerb mass'
- If applicable, calculate the total mass including full fuel tank (accounting for absent fuel as necessary) and for drawing vehicles, adding the 'nominal trailer mass' in 6.2.3
- The total mass is the 'unladen kerb mass' of the VUT. Record calculation details and this mass in the test details

Determine the 'maximum permitted mass' for the VUT as the lesser of:

- The vehicle manufacturers maximum design mass, or
- The maximum permitted mass of the relevant vehicle or vehicle combination that is legally compliant for international transport under the terms of Annex 1 of Directive 96/53/EC

Note the 'maximum permitted mass' must include any applicable allowance to compensate for the mass of equipment associated with alternative fuel or zero emission technologies, clearly identified from a section on the vehicle plate titled 96/53/EC article compliant.

Calculate the 'nominal as tested mass' as follows:

- $\text{Nominal as tested mass} = (\text{unladen kerb mass} + \text{maximum permitted mass}) / 2$

Calculate the 'load mass' required to achieve the 'nominal as tested mass', accounting for absent fuel, and for drawing vehicles, any difference between the 'nominal trailer mass' and 'actual test trailer mass'.

- $\text{Load mass} = \text{nominal as tested mass} - \text{measured kerb mass} - \text{actual test trailer mass}$

Apply the 'load mass' to the vehicle comprising of the occupant(s), test equipment (i.e. on-board test equipment and instrumentation, associated cables, cabling boxes and power sources) and ballast, density of no less than 1,000 kg/m³, placed directly on the load bed.

Locate the centre of mass of the ballast centrally within the cargo space (longitudinally and laterally) as far as is as practically possible. Ballast must be securely attached to the VUT and regularly checked during testing to confirm security. If water is used as ballast, it should be used in full containers to prevent the movement under acceleration.

Measure the VUT axle masses with the occupant(s), test equipment and ballast on board and determine the 'as tested mass', confirming that individual axle weights do not exceed their permitted maximums.

The difference between the 'actual as tested mass' and the 'nominal as tested mass' shall be no more than the lesser of $\pm 2.5\%$ of the VUT maximum permitted mass or ± 500 kg.

4.2 Characteristics of the Test Track

Track tests shall be undertaken on a road surface suitable for enabling stabilized speed to be maintained and shall be free from uneven patches. Gradients shall not exceed 2 %. The test surface shall be free from standing water, snow or ice.

4.3 Ambient wind conditions

The mean wind speed measured at a height of at least 1.0 m above the ground shall be less than 6.0 m/s with gusts not exceeding 10.0 m/s.

5 TEST PROCEDURE

5.1 Test for the SLIF

Drive the vehicle on public roads for a distance of at least 100 km. At least 30 % of the distance covered shall be driven on each of Urban Roads, Rural Roads, and Motorways. The route shall be selected to ensure that as many different speed limits and different types of signs are encountered as possible, without being unduly unrepresentative in terms of the ease or difficulty of achieving accurate speed limit information. During the drive, the reaction of the SLIF with respect to each explicit, implicit and/or conditional speed limit encountered along the route shall be verified and recorded.

Observe the reaction of the SLIF with respect to the inappropriate detection of other speed limits in the vicinity of the route e.g. side roads, crossing roads at the same or elevated levels, vehicle decals etc.

Identify any major discrepancies between the signposted speed limit, any implied speed limit specifically applied for HGVs in those circumstances (where different to the signposted limit) and the speed limit indicated by the SLIF.

Where one or more speed control functions are present, the VUT should be driven in manual mode for part of the drive and with each SCF activated in a representative part of the route to enable the required assessments.

5.2 Test for the SLIF Warning Function

The tests may be performed during the public road test, for example if an error in the SLIF results in identification of a speed limit lower than the relevant signposted or implicit limit, but the test shall not deliberately involve exceeding the speed limit on a public road. Alternatively, the test should be undertaken on a private test track where speed signs are installed. Tests shall be undertaken in response to at least three different speed limits.

The vehicle shall be accelerated up to a speed at least 10 km/h greater than V_{limit} .

This speed shall be maintained long enough to be able to assess the complete warning sequence.

5.3 Test for the Speed Control Function

The tests will be performed at two different test speeds typical for the following road types:

- City roads (50 km/h or 30 mile/h)
- Inter-Urban roads (80 km/h or 50 mile/h)

With the Speed Control Function activated, set V_{adj} to 50 km/h. In case of a Speed Limitation Function the vehicle shall be driven at a speed of 15 km/h below V_{adj} . The vehicle shall then be accelerated to engage the SLF, without applying any positive action defined as an override mechanism. Conduct testing on a road with minimal longitudinal gradient. Repeat the test with a V_{adj} of 80 km/h. Analyse results with respect to the requirements for V_{stab} .

Set V_{adj} to 50 km/h and accelerate the vehicle to engage the SLF. Lower V_{adj} to a speed low enough to trigger the audiovisual warning and measure how long it takes for the vehicle to initiate this warning. Repeat the test with the V_{adj} set to 80 km/h.

Set V_{adj} to 80 km/h or a speed applicable at the road where the vehicle is tested. With endurance braking and/or regeneration switched off and starting from a speed below V_{adj} , force the vehicle into an overrun condition where the engine braking/powertrain losses are not able to maintain the speed of V_{adj} (e.g. driving downhill with the accelerator pedal released and gravity accelerating the VUT). Measure the speed at which the warning is initiated.