

Direct Vision

Safe Driving

Technical Bulletin SD 1002

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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 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).

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1. INTRODUCTION

The Euro NCAP HGV safety rating scheme includes an assessment of the direct vision available to the driver. The measurement procedure described in the Euro NCAP HGV Vision test protocol are based on the Physical Test Method or Numerical Test Method defined in UNECE Regulation 167 on the Approval of Motor Vehicles with Regard to their Direct Vision (R167).

Annex 7 of R167 describes the Numerical Test Method. The purpose of this technical bulletin is to provide additional guidance to ensure that assessments carried out according to this method are undertaken in a repeatable and consistent manner, benefitting the reproducibility of the results.

2. NUMERICAL TEST METHOD DIRECT VISION ASSESSMENT

The R167 Numerical Test Method is defined on the basis that a suitable CAD model of the vehicle is available. Such a CAD model can not always be made available to Euro NCAP, therefore an alternative is for the test laboratory to produce a high quality 3D model of the vehicle, using laser scanning for example. R167 does not define the process for producing the 3D model. Practical experience of undertaking assessments using a 3D model derived from laser scanning identified that there are some parts of the process where additional detail would be beneficial for ensuring a repeatable process is adopted.

This technical bulletin must be considered alongside the requirements of the Euro NCAP HGV Vision test protocol.

2.1. VEHICLE SETUP

The following setup aspects support effective laser scanning for creating the 3D model.

2.1.1. Test Location

Bright/harsh light (e.g. direct sunlight or spotlights) can increase the level of reflection from some surfaces so the vehicle should ideally be scanned under diffused lighting with even illumination and no direct sunlight or harsh shadows.

2.1.2. Direct Vision Opening Lines

Any parts of glazing covered with dot-printed areas shall be considered as non-transparent. To ensure that the edge between transparent and non-transparent is captured as accurately as possible in the CAD model, apply masking tape to the outside of the window. Cover the dot-printed area with the masking tape, aligning the edge of the tape with the edge of the dot-printed area as shown in Figure 2-1.

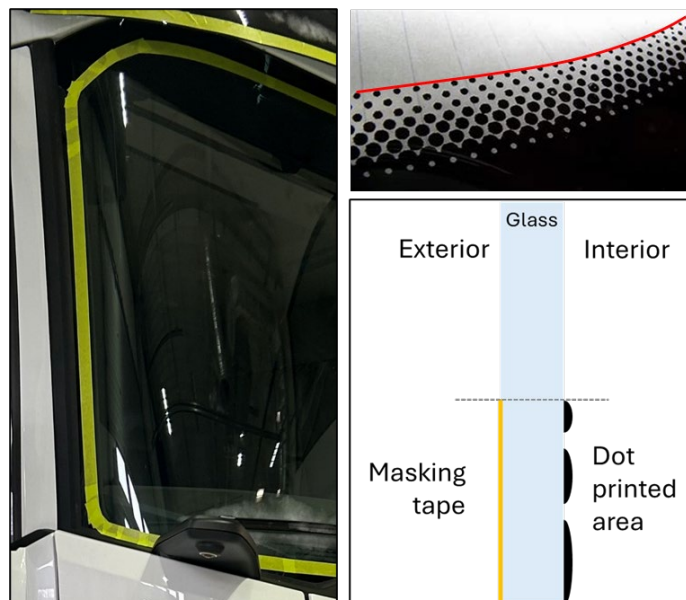


Figure 2-1 Alignment of masking tape to dot printed area of windows

Masking tape should also be applied to the outline of any other sensors or objects that form part of a window, as shown in Figure 2-2. Drawing on the masking tape support identifying it when developing the 3D model from the scan data.



Figure 2-2 Example of tape to outline windscreen sensor

2.1.3. Other Items in the Vehicle

Any aftermarket devices or any other objects not part of the ex-factory vehicle should be removed from the vehicle prior to scanning. If the device/object cannot easily be removed (e.g. additional monitors or displays) then it should be recorded in the test notes and photos taken of the item so that it can be digitally removed from the CAD model prior to the assessment volumes being calculated.

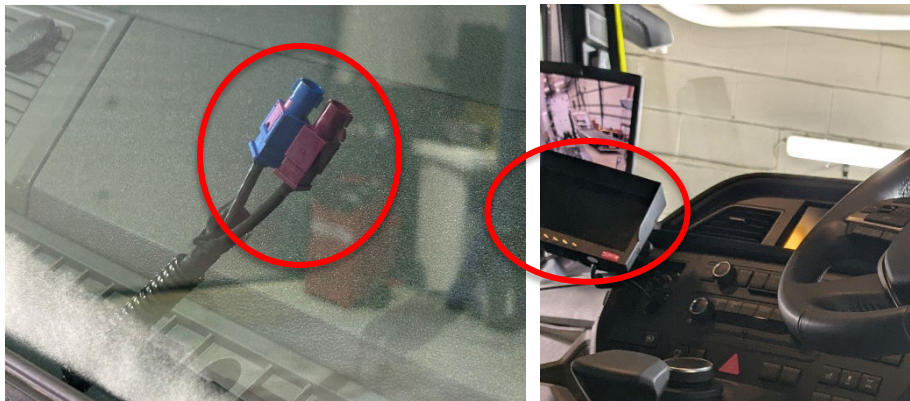


Figure 2-3 Examples of non-standard components to be removed, excluded or ignored during direct vision assessment

2.1.4. Reference Media

It is recommended that photographs are taken of both the interior and exterior of the vehicle. Although not necessary for the assessment they can prove useful to confirm the presence of aftermarket items in the vehicle and determine if objects included in the scan data are real or are data errors possibly caused by reflections. This is especially important if the scanning process is done by a different team or at a different time to when the visible volumes are assessed using the vehicle model.

Photos should include images of the overall exterior and interior of the vehicle. Particularly photos showing details of the windows and any objects that may obstruct the view through the windows should be photographed. Images taken from the driver's seat towards each of the windows being assessed are also beneficial to compare to the calculated volumes.

2.2. VEHICLE SCANNING

This section is not intended to be a step-by-step guide about how to scan a vehicle as the exact process will vary depending on the type of scanner used and the preferred method of the person undertaking the scanning. Instead, this section includes items worth considering when undertaking the scanning to ensure that the best possible quality data is captured.

2.2.1. Reflective Surfaces

Scanning highly reflective surfaces such as windows or components with a chrome finish can be difficult to scan accurately because light reflections can distort data accuracy and make capturing intricate details more difficult.

Applying a scanning spray can help to reduce reflections by creating a matte coating. Many different types are available on the market, but some are designed to evaporate completely after use, requiring no cleaning and leaving no lasting residue.



Figure 2-4 Examples of scanning spray used on reflective surfaces

2.2.2. Exterior Features Visible Through Glazing

For any exterior items that are visible through one of the windows (e.g. windscreen wipers or mirrors) it is important to capture scan data from inside the vehicle too. Only scanning from the exterior will produce a digital model of the outer shell of the object and may miss some of the detail visible only when looking from within the cab. For example, Figure 2-5 shows how some of the details of the windscreen wiper has not been captured when viewed from inside the vehicle.

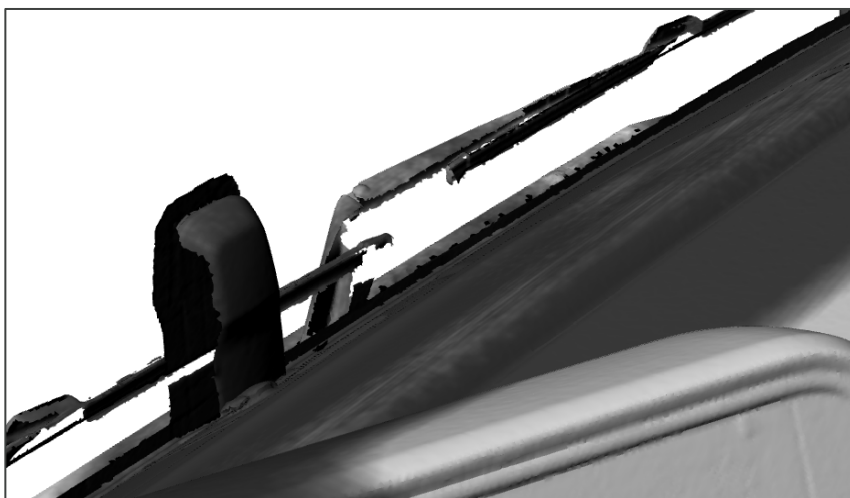


Figure 2-5 Example of wipers viewed from within the cab but only scanned from an exterior perspective

Care should be taken when scanning through the glass as its reflective nature can produce errors in the data. It is also important to ensure that the item is not obscured by any residue from the scanning spray (if used).

2.2.3. Passenger Seat and Arm Rests

If the passenger seat is foldable and is intended to be assessed in its stowed position to maximise vision, then ensure that the seat is secured in that position prior to starting the scanning process, otherwise it may require additional work to digitally remove it from the model during post-processing of the scan data. Similarly arm rests if adjustable, assess in the position that maximises vision. Maintain the passenger seat and arms rests in the same position for the duration of the assessment.



Figure 2-6 Example of passenger seat in deployed (left) and stowed (right) positions

2.2.4. Driver Footwell Detail

Direct vision volumes are measured from the driver's eye-points (E-points) as defined in R167. The location of these eye points is defined relative to the Accelerator Heel Point (AHP) and the centre line of the driver's seat. Therefore, it is important to ensure that the scan data includes detail of both the pedals, the surrounding footwell area and the driver's seat to allow accurate measurement of those parameters. Accurate measurement of the height of the driver's footwell above the ground is needed to allow for any correction to the height of the model that might be needed (see section 2.3.2).

Further detail on AHP measurement is provided in section 2.4.1.

2.3. MODEL POST-PROCESSING

2.3.1. Direct Vision Opening Lines

When glass areas are scanned then the resulting data can sometimes be a combination of the glass surface, reflections seen in the glass and/or the interior of the vehicle (Figure 2-7, middle). Therefore, before calculating the visible volume, it is important to ensure that the model includes a clean outline of each window/opening (Figure 2-7, right).



Figure 2-7 Example of vehicle window(left), original scan data (middle) and the model processed to produce a clean outline of the opening (right)

2.3.2. Model Alignment

R167 6.2.2. states that *“the vehicle shall be assessed with the accelerator heel point positioned at a height from the ground that is no lower than the midpoint between the height that the manufacturer calculates it would be at for an unladen chassis cab (without body) and that which the manufacturer calculates it would be at when the vehicle is loaded to its technically permissible design maximum”*. In the absence of vehicle manufacturer information, AHP height from the ground shall be measured in accordance with the method specified in the Euro NCAP HGV Vision test protocol, namely at a height equivalent to half laden.

R167 6.2.3.states that the vehicle cab shall be positioned at its intended mounting angle. This is important when calculating the visible volumes because if, for example, a model out of alignment by only one degree across its width, this can mean that the lower edge of one side window is 20 to 30 mm higher/lower than the other side.

Therefore, the vehicle needs to be corrected for roll, pitch, yaw and height.

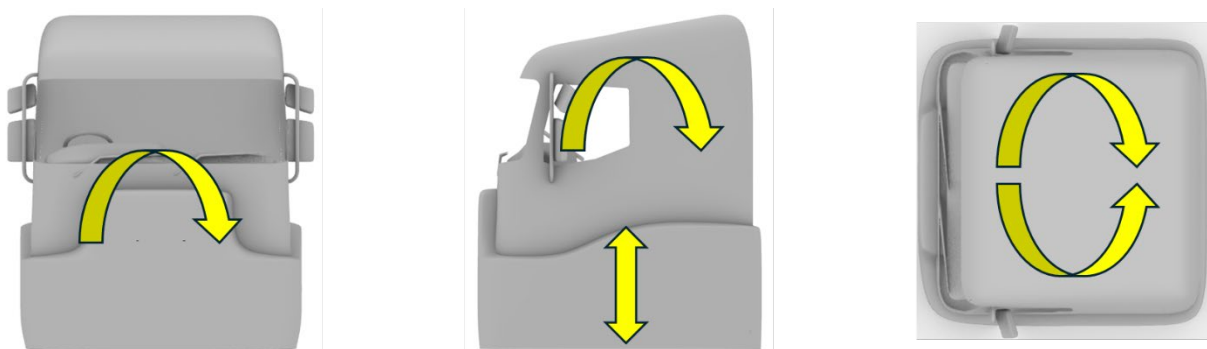


Figure 2-8 Roll (left), pitch and height (middle) and yaw (right) corrections

2.3.2.1. Roll Correction

Within the digital model, find a point or edge of a component that is present on both the nearside and offside of the vehicle. Possible examples could include the centre of the bolt head on the B-pillar door latch hooks or the keyhole/edge of a door handle.

The XYZ coordinates of the selected points shall be measured for both sides of the vehicle. Any difference in vertical position (Y) should be recorded and the roll angle of the vehicle model adjusted until both points have the same vertical position (Y-coordinate).

2.3.2.2. Yaw Correction

Remeasure the XYZ co-ordinates of the same component/point again after the roll adjustment and any difference in horizontal position (X) should be recorded and the yaw angle of the vehicle model adjusted until both points have the same horizontal position (X-coordinate).

2.3.2.3. Pitch Correction

On one side of the vehicle, find two points that should be nominally vertical (e.g. upper and lower corners of the vertical edge of a body panel). The further apart these points can be the better to reduce measurement error. Measure the XYZ co-ordinates of the two points and any difference in horizontal position (X) should be recorded and the pitch angle of the vehicle model adjusted until both points have the same horizontal position (X-coordinate).

2.3.2.4. Recheck

Recheck all the above measurement points again to confirm that the vehicle is correctly aligned for pitch, roll and yaw angles.

2.3.2.5. Height Correction

When independently scanning the vehicle at a height equivalent to half laden, identify a height reference point on the vehicle that can be accurately measured both physically on the vehicle and in the digital model of the vehicle. For example, this could be the height of the corner of one of the cab steps or an identifiable point on a flat section of the footwell floor.

In the digital model measure the height of this reference point above the ground plane and compare it to the measured value. Any difference in the height (Z-coordinate) should be recorded and the model moved in the vertical (Z) direction until the reference point in the digital model is at the same height above the ground plane as it was when measured on the physical vehicle.