EUROPEAN NEW CAR ASSESSMENT PROGRAMME
(Euro NCAP)

HEAVY VEHICLE TESTING PROTOCOL

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1 INTRODUCTION

Euro NCAP first issued protocols for frontal and side impacts and for pedestrian testing in 1996. The protocols were based on the work of the EEVC which, in the case of the frontal and side impacts, formed the basis of new legislative requirements. As no side impact requirement had previously existed in legislation, Euro NCAP's protocols were unchanged from the directive. In frontal impact, where a full-width test had previously been in force, the test speed for the offset deformable barrier test was increased from 56km/h to 64km/h to cover a greater proportion of real life accidents and to ensure some discrimination in the results.

In legislation, the frontal impact test became a requirement for M1 passenger cars only, while the side impact became mandatory for M1 and N1 (light commercial) vehicles. Euro NCAP also tested only M1 passenger cars for many years, and is widely accredited with stimulating a significant increase in the safety of cars' occupants in the last ten years or so. However, the increased structural stiffness needed to provide improved occupant protection also led to the increased 'aggressivity' of cars' front ends towards other vehicles. The problem becomes acute for heavy vehicles as Euro NCAP's test against an immovable concrete block requires them to absorb their own kinetic energy.

Against this background, there was some concern that the testing of heavy vehicles, some of which were derived from commercial variants, might encourage increasingly stiff front end structures in vehicles which already behaved aggressively towards others. Also, Euro NCAP's test protocols, developed with 'normal' passenger cars in mind, might not generate meaningful data when applied to vehicles developed from other design concepts.

Therefore, a subgroup was initiated in 2009 to investigate how Euro NCAP's existing protocols might be adapted to ensure that they provided sensible results when applied to heavy vehicles and at the same time mitigated any increases in aggressivity towards other cars. This protocol details the changes from standard protocols which should be applied when testing heavy vehicles and the scope of application: the vehicles which are considered by Euro NCAP to require use of the modified protocols. It is the Euro NCAP's intention that the protocol should apply only to heavy M1 vehicles derived from commercial variants. The protocol attempts to define such vehicles. However, it is recognised that it may not be possible to develop a rigid, objective definition and the Secretariat may apply the definition judiciously.

The protocol is an interim step: it is hoped that the issue of compatibility will be addressed in more detail at a later date and that a more complete suite of tests can be developed to encourage partner protection as well as occupant safety. Moreover, no attempt has been made by the group to extend Euro NCAP's protocols to purely commercial vehicles, for which more comprehensive changes would need to be made to cover typical payloads and how they are secured.

2 SCOPE

A vehicle type will fall within the scope of this protocol if there exists within the model range (see section 2.2 of CSSTR protocol) at least one variant meeting all of the following criteria:

- M1 category
- Maximum Mass (Gross Vehicle Weight) > 2500kg and <3500kg
- 8 or 9 seats, including the driver's seat.

The application of this definition and the way in which the test variant is identified is discussed in more detail in paragraph 3.1.

It is anticipated that application of the protocol may in time be extended to cover other heavy vehicles.

3 APPLICATION AND AMENDMENT OF PROTOCOLS

For testing vehicles which fall within the scope of this protocol, the amendments and interpretations of the following paragraphs shall be applied.

The use of alternative font indicates text taken from the protocol concerned. Paragraph references contained in such text refer to the numbering system of that protocol.

3.1 Car Specification, Selection, Testing & Retesting (CSSTR) Protocol Version 2.4

3.1.1 Base Safety Equipment

3.1.1.1 When identifying the Basic Level Safety specification (section 3 of the CSSTR protocol), the fitment of equipment to the following variants in the model range is considered:

Table 1: Variants

Item of Safety Equipment	**Variants to be included in sales**
Electronic Stability Control (ESC)	M1 (up to 3500kg) and N1 (excluding chassis cab variants of both categories)
Seatbelt Reminder (driver and passenger)	
Speed Limitation Device	
Frontal airbags	
All other safety equipment	M1 only (excluding chassis cab variants, <3500kg)

3.1.1.2 The minimum fitment required to qualify as 'basic level safety' equipment will be as follows for vehicles tested under this protocol:

Table 2: Minimum Fitment

Year*	**Minimum fitment (%)**
2011	Fitted in 50% of all sales (as standard or as an option)
2012	Fitted as standard in 50% of sales and at least optional on all variants defined in 3.1.1
2013	Fitted as standard in 60% of sales and at least optional on all variants defined in 3.1.1
2014	Fitted as standard in 80% of sales and at least optional on all variants defined in 3.1.1
2015	Fitted as standard in 100% of sales and at least optional on all variants defined in 3.1.1

* *Refers to the calendar year in which the Euro NCAP result is released*

3.1.2 Test Variant

3.1.2.1 The manufacturer shall identify the M1 variant (excluding chassis cabs) which sells better than any other single M1 variant (excluding chassis cabs). The test vehicle shall be the variant which is nearest to the best seller having the following characteristics:

- Is equipped only with the base safety equipment identified in 3.1.1
- Has two distinct front seats (no bench seats)

For further information on which parameters can be changed if the test variant is different from the best-selling variant, see the CSSTR protocol.

3.2 Euro NCAP Frontal Impact Testing Protocol

3.2.1 Child Dummy Positioning

3.1.2 A TNO/Ogle P1½ child dummy, in a suitable Child Restraint System (CRS) (see Section 7.6), shall be used in the second row passenger side seating position.

3.1.3 A TNO P3 child dummy, in a suitable CRS (see Section 7.6), shall be used in the second row outboard driver side seating position.

And the first sentence of paragraph (7.6):

7.6 Two CRS's are to be fitted in the second row seat, one suitable for a 3 year old child, the other for an 18month old infant.

3.2.2 Test Speed

9.2.2 This speed should be 56km/h (35mph) ± 1km/h. Record the actual test speed in the test details.

TARGET SPEED = 56km/h ± 1km/h

3.2.3 Scoring

The scoring in the frontal impact test is unchanged.

3.3 Euro NCAP Side Impact Testing Protocol

3.3.1 Child Dummy Positioning

2.1.2 A TNO/Ogle P1½ child dummy, in a suitable Child Restraint System (CRS) (see Section 6.4), shall be used in the second row driver side seating position.

2.1.3 A TNO P3 child dummy, in a suitable CRS (see Section 6.4), shall be used in the second row passenger side seating position.

And the first sentence in section (6.4) is amended as follows

6.4 Two CRS's are to be fitted in the second row seat, one suitable for a 3 year old child, the other for an 18 month old infant.

3.3.2 Scoring

The scoring in the side impact test is unchanged.

3.4 Euro NCAP Whiplash Test Protocol v 2.9

3.4.1 No dynamic tests are performed and references to dynamic tests shall not apply.

3.4.2 Head Restraint Geometry

3.4.2.1 The backset and height of the head restraint shall be determined according to the procedures detailed in (6.4) and (6.5) of the protocol. However, in paragraphs (6.4.6) and (6.4.7), a torso angle of 20º should be used instead of 25º. If the seatback angle is not adjustable, the fixed design angle should be used.

Paragraph (6.4.8) is amended as follows:

Some indexed seatback adjustments may have more than 2° between adjustments with none giving a torso angle between 20°±1°. In such cases, adjust the seatback to the most reclined position that supports a torso angle less than 19°.

3.4.2.2 Backset and height should be measured in two head restraint positions (or one if no adjustment is possible): test position and 'down and back'. See section (7) of the whiplash protocol for definitions of these terms.

3.4.3 Head restraints for the rear seats may also qualify for assessment if they are fitted as standard on all rear seating positions in at least the 'base safety specification' percentage of sales (see section 3.1). In this case, the test laboratory shall measure the geometry of the worst case seat according to section 3.4.2.

3.4.4 Whiplash Scoring

A flowchart in Appendix 1, Figure 1 illustrates the way in which whiplash tests are scored.

3.4.4.1 A maximum of two points is available for the front seating positions. This is calculated as follows. For each front seat, a maximum of two points is available: one point when measured in the test position and one point when measured in the 'down and back' position. For each seat the scores in these two positions are added. The score for the front seats is taken as that of the seat which scores most poorly.

3.4.4.2 A maximum of two points is available for the rear seating positions, where they qualify for assessment. Each rear seat is measured, by a single HRMD drop, in the test position and the down/back position. The rear seat which scores most poorly is then measured, using an average of three HRMD drops, in the test position and in the fully down and back position. A maximum of one point can be scored in each restraint position. The scores from each position are summed.

3.4.4.3 If the head restraint of a seat (front or rear) is not adjustable, the geometry will only be measured in the fixed, design position. The score from that test will be taken instead of the two measurements described above. In effect, the score of the single test will be doubled.

3.4.4.4 The scores of front and (if applicable) rear seating positions are added. The minimum score possible is zero.

3.5 Pedestrian Protection

3.5.1 Definitions

3.5.1.1 The bonnet angle is defined as the angle to the ground reference level, of a straight edge connecting the intersection point of the Bonnet Leading Edge Reference Line and the medial longitudinal vertical plane and the intersection point of the bonnet panel rear edge (if the vehicle has no bonnet panel, the front panel rear edge) and the medial longitudinal vertical plane. The angle designated by the manufacturer may be deemed as the bonnet angle if it deviates within ±2° from the actual measurement.

3.5.1.2 Amendments

3.3.1 A test is not required if the calculated impact energy would be 200 J or less, nor if the height of the Bonnet Leading Edge Reference Line as defined in Section 2.13 is, at all points, greater or equal to 835 mm vertically above the ground at the vehicle's normal ride attitude.

3.4.3.3 Where test locations are on the movable/hinged bonnet top or grille/bumper area between 1500 mm and 1700 mm WAD the child/small adult impactor shall be used. Where test locations are on the windscreen/windscreen base area between 1500 mm and 1700 mm WAD the adult impactor shall be used. […]

3.4.3.6 […] Areas forward the bonnet (grille and bumper area): underlying stiff structures such as bumper beam, frame rail, towing eye, crumple cans, cooling components, front spoiler mounted lights, radiator/intercooler edges or fixation mounts, licence plate mounts

9.3.4 Fit the required headform to the propulsion system. A child/small adult headform impactor shall be used for tests to the bonnet top, grille and bumper area, A-pillars, windscreen, roof (labelled C in Section 2.9), with the test locations lying between boundaries described by wrap around distances of 1000 mm and 1500 mm. An adult headform impactor shall be used for tests to the bonnet top, A-pillars, windscreen, roof, grille and bumper area (where applicable) (labelled A in Section 2.9), with the test locations lying between boundaries described by wrap around distances of 1700 mm and 2100 mm. Where test locations lie between 1500 mm and 1700 mm the structure being tested will determine the headform to be used, see Section 3.4.3.3.

9.3.8 The direction of impact shall be in the fore and aft vertical plane of the section of the vehicle to be tested. The tolerance for this direction is ±2°. The direction of impact of headform tests shall be downward and rearward, as if the vehicle were on the ground. The angle of impact for tests rearward the Bonnet Leading Edge Reference Line shall always be 50° to the ground reference level. For tests forward the Bonnet Leading Edge Reference Line the impact angle shall always be 20° to the ground reference level. The impact angles apply likewise for both the child/small adult as well as the adult headform impactor […]

3.5.2 Pedestrian Scoring

3.5.3 Scoring in the pedestrian protection test is unchanged, except:

3.5.3.1 If the Bonnet Leading Edge Reference Line as defined in Section (2.13) is, at all points, greater or equal to 835 mm vertically above the ground at the vehicle's normal ride attitude, no upper legform tests are performed. Accordingly, the maximum score available for pedestrian testing in such cases is 30. The way this is incorporated into the overall rating scheme is dealt with in section 4**.**

4 SCORING AND OVERALL RATING

4.1 Scores for the four areas of overall assessment – adult occupant, child occupant, pedestrian and safety assist – shall be incorporated into the overall rating scheme as defined in 'Euro-NCAP-Assessment-Protocol---Overall-Rating'.

4.2 For pedestrian testing, if no tests have been performed to the bonnet leading edge (see section 3.5.3.1), the maximum score available is 30, not 36. The percentage score for this box is calculated by dividing the test score by 30.

4.3 Overall Score and Balance Thresholds are shown in Table 3.

Table 3a: Thresholds for year 2011

2011	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist	Total Weighted
5 stars	80%	75%	25%	60%	70%
4 stars	65%	60%	15%	40%	55%
3 stars	35%	30%	10%	0%	45%
2 stars	30%	25%	5%	0%	35%
1 star	20%	15%	0%	0%	20%

Table 3b: Thresholds for year 2012

2012	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist	Total Weighted
5 stars	80%	75%	40%	60%	75%
4 stars	70%	60%	25%	40%	60%
3 stars	40%	30%	15%	25%	50%
2 stars	30%	25%	10%	0%	35%
1 star	20%	15%	5%	0%	25%

Table 3c: Thresholds for year 2013

2013	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist	Total Weighted
5 stars	80%	75%	40%	60%	75%
4 stars	70%	60%	25%	40%	60%
3 stars	40%	30%	15%	25%	50%
2 stars	30%	25%	10%	15%	35%
1 star	20%	15%	5%	0%	25%

Table 3d: Thresholds for year 2014

2014	Box 1: Adult Occupant	Box 2: Child Occupant	Box 3: Pedestrian	Box 4: Safety Assist	Total Weighted
5 stars	80%	75%	60%	60%	80%
4 stars	70%	60%	50%	40%	70%
3 stars	40%	30%	25%	25%	60%
2 stars	30%	25%	15%	15%	55%
1 star	20%	15%	10%	5%	45%

APPENDIX I

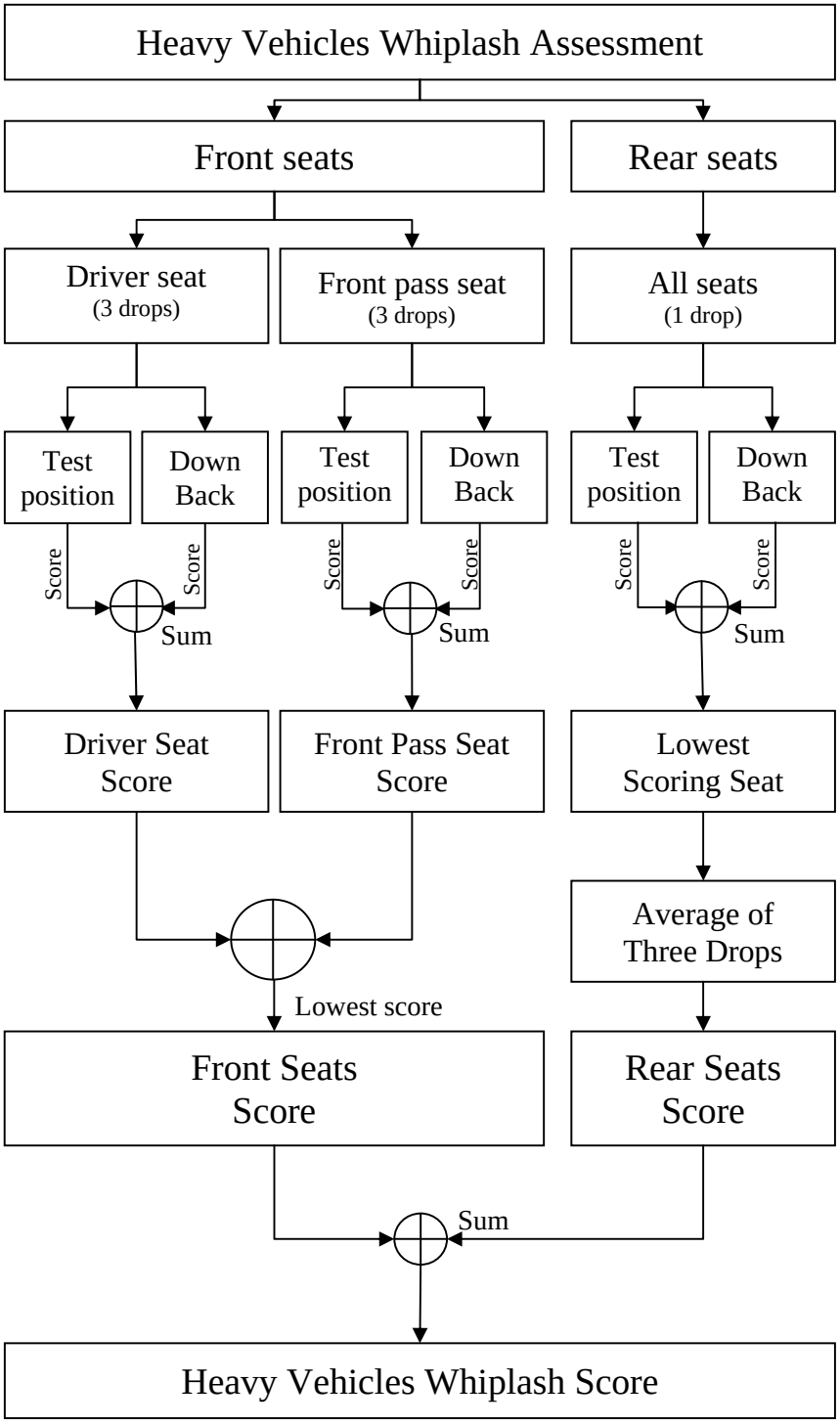

Figure 1: Flowchart for the Calculation of the Whiplash Score