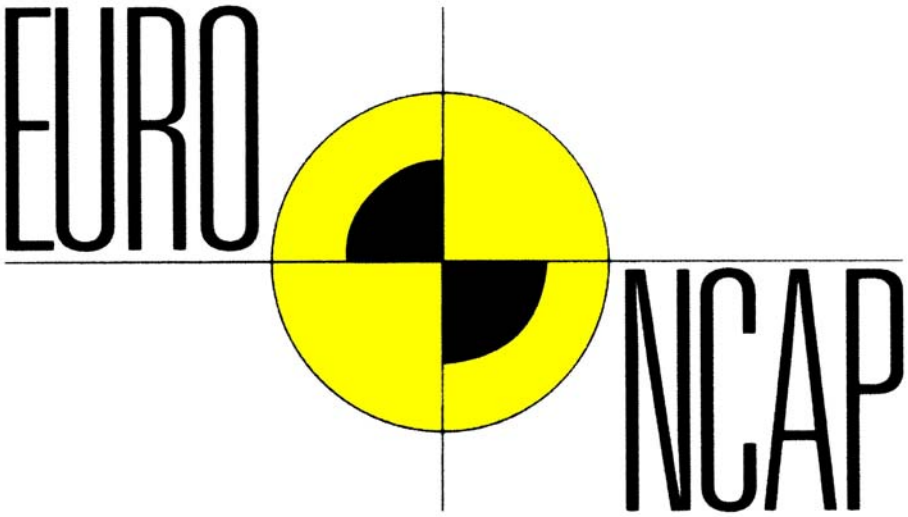

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EUROPEAN NEW CAR ASSESSMENT PROGRAMME (Euro NCAP)

Euro NCAP Protocol Changes and Additions - March 2004

Version 25th March 2004

Frontal Impact

Changes (in italics) and additions incorporated in version 4.1, March 2004

Section 1.4 Vehicle Preparation

Now reads:

1.4.5 An emergency abort braking system may be fitted to the vehicle. This is optional, the test facility may elect to test without an abort system. *Where such a system is fitted its inclusion shall not influence the operation or function of any of the foot controls, in particular the brake pedal. The position and the resistance to movement of the pedals shall be the same as prior to fitment of the system.* Remove as little as possible of the interior trim; any mass compensation will be made when all equipment has been fitted.

Section 2.1 Before Test

Now reads:

2.1.16 Record the position of the centre of the undepressed clutch, brake and accelerator pedals *and where applicable foot operated parking brake*. If the pedal is adjustable, set it to the mid position or a reasonable variation from this in accordance with the manufacturer's recommendations for the 50th percentile position.

2.1.17 Entire section of proposed footwell intrusion measurements deleted, including Figures 2.2 and 2.3.

2.1.18 Renamed as Section 2.1.17

Section 2.2 After Test

Now reads:

2.2.9 Working on the struck side of the vehicle, record the post-impact co-ordinates of the centre of the steering column, the centre of the clutch, brake and accelerator pedals, *and where applicable a foot operated parking brake,* with no load applied to them and in the blocked position (loaded with 200N to produce the maximum moment about the pedal pivot), the door aperture points. *Prior to the 'blocked' pedal measurement, i.e. with the 200N applied, the brake fluid shall be removed to avoid the build up of hydraulic pressure.* If the steering column has become detached during impact due to the operation of the shear capsules, *the column should be repositioned before measurement in the upward and lateral directions so that it is in contact with whatever structure(s) last constrained it from further movement. If any of the foot pedals become detached do not take a measurement of that pedal.*
Driver's seat rail measurements deleted.

2.2.10 Entire section of proposed footwell intrusion measurements deleted.

2.2.11 Renamed as Section 2.2.10 onwards

2.2.12 *(formerly 2.2.13)*

Now reads:

From the pre-impact and adjusted post-impact data collected, determine

i) the longitudinal, lateral and vertical movement of the centre of the top of the steering column.
ii) *the longitudinal and vertical movement of all of the foot operated pedals.*
iii) the rearward movement of the A-post at waist level.
iv) the reduction in width of the door aperture at waist and sill levels.

4.1 Dummy Instrumentation

Now reads:

TNO P1½

Location	**Parameter**		**Minimum Amplitude**	**No. of Channels**
Head	Accelerations, A_x A_y A_z		150g	3
Neck	*Forces*	F_x F_y	*1kN*	*2*
		F_z	*2kN*	*1*
Chest	Accelerations, A_x A_y A_z		150g	3
	Total Channels per Dummy			*9*

TOTAL CHANNELS

1× Driver Hybrid-III	36
1× Passenger Hybrid-III	36
1× TNO P3	6
1× TNO P1½	*9*
1× Vehicle	4
Total Channels per Test	*91*

Section 6.4 Use of the Gabarit and Marking for Child Head Excursion Measurement
Now reads:
Position the Gabarit in all seating positions within the vehicle, excluding the driver's, as specified in ECE Regulation 16. Photographs of the installation, and in particular, the position of the lap section of the belt (both sides) and buckle tongue slot in relation to the 150mm radius shall be taken. The position of the base of the Gabarit relative to the front of the car seat base cushion should also be photographed for each seating position examined. The photograph should be taken from a point in a horizontal plane passing through the top of the car seat base cushion, to illustrate if there is an air gap between the gabarit base and car seat base cushion and any other indication of insufficient belt webbing.

The test laboratory shall specify in the test report whether the three point seat belts fitted to the vehicle are in accordance with ECE Regulation 16, Section 8.2.2.5.

7.6.10 *For "ISOFIX" type seats*
The installation protocol for these seats is under development. If any manufacturers request the use of this type of seat the Euro NCAP Secretariat must be contacted for installation instructions.

Where a tensioning/ratchet device is provided to secure the child restraint against the rear seats and/or floor etc, a force not exceeding 100N shall be applied in the direction of the tensioning system's movement. Where a top tether is present it should be attached to the anchorage, a maximum force of 50N ± 5N should be applied to the webbing from a position where the user would be expected to install the tether. The angle of pull on the webbing should be as indicated in the fitting instructions. Note: the 50N load is applied directly to the free end of the tether, and intentionally does not take account of the internal frictional characteristics of the adjuster.

Section 10 Calculation of Injury Parameters
Now reads:

TNO P3

Location	***Parameter***	***CFC³***	*Injury Calculation*
Head	*Accelerations, A_x A_y A_z*	*1000*	*Peak Resultant acceleration* *Resultant (+ve) 3msec exceedence*
Chest	*Accelerations, A_x A_y A_z*	*180*	*Peak resultant acceleration* *Resultant (+ve) 3msec exceedence*

TNO P1½

Location	***Parameter***	***CFC³***	*Injury Calculation*
Head	*Accelerations, A_x A_y A_z*	*1000*	*Peak Resultant acceleration* *Resultant (+ve) 3msec exceedence* *Vertical (+ve & -ve) 3msec exceedence*
Neck	*Forces, F_x F_y F_z*	*1000*	
Chest	*Accelerations, A_x A_y A_z*	*180*	*Peak resultant acceleration* *Resultant (+ve) 3msec exceedence* *Vertical (+ve & -ve) 3msec exceedence*

Section 10.7 Child Dummies

Now reads:

10.7.1 *For the P3 and P1½ dummies, calculate the resultant head and chest acceleration A_R from the three components A_x, A_y and A_z <u>after</u> they have been filtered and determine the maximum value of A_R*

$$A_R = \sqrt{A_X^2 + A_Y^2 + A_Z^2}$$

10.7.2 For the P3 and P1½ dummies, determine the level which head and chest resultant accelerations ($+A_R$) exceed for a cumulative time of three milliseconds.

10.7.3 For the P1½ dummy, determine the level which head and chest vertical accelerations (+ve & -ve A_R) exceed for a cumulative time of three milliseconds.

Side Impact

Changes (in italics) and additions incorporated in version 4.1, March 2004

Section 5.5 Use of the Gabarit

All items under Section 5.5 deleted as the measurements are performed under the frontal impact testing protocol.

Section 6.3 Dummy placement

Now reads:

6.3.1 Note that the H-point of the ES-2 dummy is situated *21mm* forward of that of the H-point determined by the H-point manikin (Section 6.1). The H-point of the manikin is indicated by 'Hm' on the H-point back plate of the dummy.

6.3.1.3 Manoeuvre the dummy until its *"Hm" position is in a circle with a radius of 10 mm round the H-point of the H-point Manikin as determined in Section 6.1*.

6.4.10 *For "ISOFIX" type seats*
The installation protocol for these seats is under development. If any manufacturers request the use of this type of seat the Euro NCAP Secretariat must be contacted for installation instructions.

Where a tensioning/ratchet device is provided to secure the child restraint against the rear seats and/or floor etc, a force not exceeding 100N shall be applied in the direction of the tensioning system's movement. Where a top tether is present it should be attached to the anchorage, a maximum force of 50N ± 5N should be applied to the webbing from a position where the user would be expected to install the tether. The angle of pull on the webbing should be as indicated in the fitting instructions. Note: the 50N load is applied directly to the free end of the tether, and intentionally does not take account of the internal frictional characteristics of the adjuster.

Section 7 Barrier and Trolley

Now reads:

The trolley will be fitted with a deformable barrier face and ventilation frame conforming to the specifications of *Amendment 3, July 2003,* Regulation ECE R95 (lateral collision protection). See also Appendix I.

Section 10 Calculation of Injury Parameters

Now reads:

ES-2

Location	Parameter	CFC	Injury Calculation
Head	Accelerations, A_x A_y A_z	1000	HIC Peak acceleration 3msec exceedence (cumulative)
Shoulder	Forces, F_x F_y F_z	600	Peak shoulder forces *Resultant*
Thorax T1	Accelerations, A_x A_y A_z	180	Peak lateral acceleration on T1 and T12
Thorax T12	Acceleration, A_y	180	
Ribs - Upper Middle Lower	Acceleration, A_y	180	Viscous Criterion Peak rib acceleration Peak rib deflection
	Deflection, D_{rib}	180	
Abdomen - Front Middle Rear	Force, F_y	600	Peak of sum of 3 abdomen forces

Backplate	Forces, F_x F_y	600	Peak forces and moments *F_x F_y Resultant*
	Moments, M_y M_z	600	
T12	Forces, F_x F_y	600	Peak forces and moments
	Moments, M_x M_y	600	
Pelvis	Accelerations, A_x A_y A_z	180	Peak lateral acceleration
Pubic Symphysis	Force, F_y	600	Peak Force
Femurs (L & R)	Forces, F_x F_y F_z	600	Peak forces and moments
	Moments, M_x M_y M_z	600	

TNO P3

Location	***Parameter***	***CFC³***	*Injury Calculation*
Head	*Accelerations, A_x A_y A_z*	*1000*	*Peak Resultant acceleration* *Resultant (+ve) 3msec exceedence*
Chest	*Accelerations, A_x A_y A_z*	*180*	

TNO P1½

Location	***Parameter***	***CFC³***	*Injury Calculation*
Head	*Accelerations, A_x A_y A_z*	*1000*	*Peak Resultant acceleration* *Resultant (+ve) 3msec exceedence*
Chest	*Accelerations, A_x A_y A_z*	*180*	

Section 10.6 Child Dummies

Now reads:

10.6.1 *For the P3 and P1½ dummies, calculate the resultant head and chest acceleration A_R from the three components A_x, A_y and A_z <u>after</u> they have been filtered and determine the maximum value of A_R*

$$A_R = \sqrt{A_X^2 + A_Y^2 + A_Z^2}$$

10.6.2 For the P3 and P1½ dummies, determine the level which head resultant acceleration ($+A_R$) exceeds for a cumulative time of three milliseconds.

Pole Impact

Changes (in italics) and additions incorporated in version 4.1, March 2004

Section 6.3 Dummy placement

Now reads:

6.3.1 Note that the H-point of the ES-2 dummy is situated *21mm* forward of that of the H-point determined by the H-point manikin (Section 6.1). The H-point of the manikin is indicated by 'Hm' on the H-point back plate of the dummy.

6.3.1.4 Manoeuvre the dummy until its *"Hm" position is in a circle with a radius of 10 mm round the H-point of the H-point Manikin as determined in Section 6.1*.

Pedestrian Testing

Changes (in italics) and additions incorporated in version 4.1, March 2004

Section 2.2 Bumper Reference Lines

Now reads:

For vehicles with an identifiable bumper structure it is defined as the geometric trace of the upper most points of contact between a straight edge and the bumper, when the straight edge, held parallel to the vertical longitudinal plane of the car and inclined rewards by 20 degrees, is traversed across the front of the car whilst maintaining contact with the upper edge of the bumper. For a vehicle with no identifiable bumper structure it is defined as the geometric trace of the upper most points of contact between a straight edge 700 mm long and the bumper, when the straight edge, held parallel to the vertical longitudinal plane of the car and inclined rewards by 20 degrees, is traversed across the front of the car, whilst maintaining contact with the ground and the surface of the bumper. See Figure 2.1a.

Section 2.3 Bumper Corners

Add text:

....Where multiple or continuous contacts occur the most outboard contact shall form the bumper corners.

Section 2.5 Bonnet Side Reference Line

Add text:

....Where multiple or continuous contacts occur the most outboard contact shall form the side reference line.

Section 2.6 Corner Reference Point

Add text:

Where multiple or continuous contacts occur the most outboard intersection shall form the corner reference point.

Section 3.1 Legform to Bumper Test

3.1.1.2

Add text:

....Where there are structures outboard of the corner reference points, which are deemed to be injurious, Euro NCAP reserve the right to perform a test to those structures.

Section 3.2 Upper Legform to Bumper Test

Now reads:

3.2.1 These tests are conducted, instead of the legform to bumper tests, if the Lower Bumper Reference Line at *the position(s) defined in Section 3.1.1.4*, is greater than 500mm vertically above the ground at the vehicle's normal ride attitude.

3.2.1.1 The upper legform to bumper tests must be carried out at the *same lateral* position as the points selected in Paragraph 3.1.1.4, *with the intersection of the longitudinal and lateral planes, at the centre of the impactor, aimed mid way between the Upper Bumper Reference Line and the Lower Bumper Reference Line.*

Section 6 Legform to Bumper Tests

Now reads:

6.1.1 The legform impactor used shall conform to that specified in EEVC WG17 Report, 'Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars', December 1998. This test shall be performed if the Lower Bumper Reference Line (see section 2.2.7) is less than 500mm above the ground at the impact point. All impact points shall be a minimum of 66mm inside the Bumper Corners (Section 2.3), and be a minimum of 132mm apart. *These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.*

Section 7 Upper Legform to Bumper Tests

Now Reads:

7.1.1 The upper legform impactor used shall conform to that specified in EEVC WG17 Report, 'Improved test methods to evaluate pedestrian protection afforded by passenger cars', December 1998. This test shall be performed if the Lower Bumper Reference Line (see section 2.2.7) at the impact point is more than 500mm above the ground. All tests will be performed at the same lateral position of the impact points determined in Section 3.1. *The minimum distances to be used for this impactor are specified in 6.1.1, they shall be set with a flexible tape held tautly along the outer surface of the vehicle.*

7.3.7 Align the vehicle so that the propulsion system can aim at the *impact position as defined in Section 3.2.1.1* and the propulsion system can propel and guide the upper legform in a direction that is parallel to the vehicle centre line ±2°. At the time of first contact the impactor centre line shall be midway between the Upper Bumper Reference Line and the Lower Bumper Reference Line with ±10 mm tolerance and laterally with the selected impact location with a tolerance of ±10 mm.

7.3.10 The direction of impact shall be in the horizontal plane and parallel to the longitudinal vertical plane of the vehicle. The axis of the upper legform shall be vertical at the time of first contact. The tolerance to these directions is ±2°.

Section 8 Upper Legform to Bonnet Leading Edge Tests

Now reads:

8.1.1 The upper legform used shall conform to that specified in EEVC WG17 Report, 'Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars', December 1998. All impact points shall be a minimum of 75mm inside the Corner Reference Points (Section 2.6), and be a minimum of 150mm apart. *These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.*

Section 9 Headform testing

Now reads:

9.1.1 The headforms used shall conform to that specified in EEVC WG17 Report, 'Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars', December 1998. The projected points for the adult headform impactor shall be a minimum of 82.5mm inside the Side Reference Lines (Section 2.5), and a minimum of 165mm apart. The projected points for the child headform impactor shall be a minimum of 65mm inside the Side Reference Lines (Section 2.5), and a minimum of 130mm apart. *These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.* Where testing on an A-pillar is involved the minimum distance inside the Side Reference Lines does not apply to either the adult or child headform tests.

Assessment Protocol

Changes (in italics) and additions incorporated in version 4.1, March 2004

Section 6 Frontal Impact Modifiers

Foot & Ankle

Pedal Blocking (additional - new section)

Where the rearward displacement of a 'blocked' pedal exceeds 175mm, a one point penalty is applied to the driver's foot and ankle assessment. A pedal is blocked when the forward movement of the intruded pedal under a load of 200N is <25mm. Between 50mm and 175mm of rearward displacement the penalty is calculated using a sliding scale between 0 to 1 points.

Door Opening during the Impact

Now reads:

When a door opens in a frontal test, a minus one-point modifier will be applied to the score for that test. A one-point modifier will be applied for every door (including the tailgate) that opens.

Concept: The intention is to ensure that the structural integrity is maintained. The underlying principle is to minimize the risks of occupant ejection occurring.

The "door opening" modifier will be applied if any of the following have occurred:

- the latch has fully released *or shows significant partial release*, either by release of its components from one another, or effective separation of one part of the latch from its supporting structure
- the latch has moved away from the fully latched condition
- if any hinge has released either from the door or bodyshell or due to internal hinge failure
- if there is a loss of structure between the hinges and latches
- if door or hinges fail whilst the door opening tests are being conducted post impact, as loading from an occupant could have a similar effect.

Section 8 Side Impact Modifiers

Backplate

Now reads:

Where the backplate load Fy exceeds 4.0kN, a two point penalty is applied *to the driver's chest assessment*. Between 1.0kN and 4.0kN the penalty is calculated using a sliding scale from 0 to 2 points.

Higher performance limit	
Fy	1.0 kN
Lower performance limit	
Fy	4.0 kN

T12 Modifier (additional - new section)

Where the T12 loads Fy and Mx exceed 2.0kN or 200Nm respectively, a two point penalty is applied to the driver's chest assessment. Between 1.5kN – 2.0kN or 150Nm – 200Nm the penalty is calculated using a sliding scale from 0 to 2 points. The assessment is based upon the worst performing parameter.

Higher performance limit			
Fy	*1.5 kN*	*Mx*	*150 Nm*
Lower performance limit			
Fy	*2.0 kN*	*Mx*	*200 Nm*

Section 11 Overall Assessments

Example:

Now reads:

Headform testing:

EuroNCAP test produces a HIC of 1300 = 0.07 points/quarter

Additional test produces a HIC of 1050 = 0.43 points/quarter

EuroNCAP test Score	**Extra Test Score**	**Number of *manufacturer* nominated quarters**	**Area Score**
0.07		*0*	*(0.07 x 4) = 0.29*
0.07	0.43	1	*(0.07 x 3)+(0.43 x 1) = 0.64*
0.07	0.43	2	*(0.07 x 2)+(0.43 x 2) = 1.00*
0.07	0.43	3	*(0.07 x 1)+(0.43 x 3) = 1.36*

Legform/upper legform testing (based upon the worst result):
EuroNCAP test produces a knee bending angle of 19° = 0.2 points/half
Additional test produces a knee bending angle of 16° = 0.8 points/half

EuroNCAP test Score	**Extra Test Score**	**Number of *manufacturer* nominated halves**	**Area Score**
0.20		0	0.20 x 2 = 0.40
0.20	0.80	1	0.20+0.80 = 1.00