EUROPEAN NEW CAR ASSESSMENT PROGRAMME (Euro NCAP)

OBLIQUE POLE SIDE IMPACT TESTING PROTOCOL

Version 7.0.4
September 2018

Copyright ©Euro NCAP 2018 - This work is the intellectual property of Euro NCAP. Permission is granted for this material to be shared for non-commercial, educational purposes, provided that this copyright statement appears on the reproduced materials and notice is given that the copying is by permission of Euro NCAP. To disseminate otherwise or to republish requires written permission from Euro NCAP.

Preface

• Where text is contained within square brackets this denotes that the procedure being discussed is currently being trialled in Euro NCAP. Its incorporation in the Test Protocol will be reviewed at a later date.

• 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

Page No.

Side Impact Pole Test

1	**Vehicle Preparation**		**4**
	1.1	Unladen Kerb Mass	4
	1.2	Rated cargo and luggage mass	4
	1.3	Reference Loads	4
	1.4	Impact location	5
	1.5	Vehicle Preparation	5
2	**DUMMY PREPARATION AND CERTIFICATION**		**7**
	2.1	General	7
	2.2	Certification	7
	2.3	Additions and Modifications to the Dummies	7
	2.4	Dummy Clothing and Footwear	7
	2.5	Dummy Test Condition	7
	2.6	Dummy painting	8
	2.7	Post Test Dummy Inspection	8
3	**INSTRUMENTATION**		**9**
	3.1	Dummy Instrumentation	9
	3.2	Vehicle Instrumentation	10
	3.3	Carrier Instrumentation	10
4	**PASSENGER COMPARTMENT ADJUSTMENTS**		**11**
	4.1	Overview of Settings	11
	4.2	Seat adjustments	12
	4.5	Setting the Steering Wheel	12
	4.6	Setting the rear seat (if adjustable)	13
5	**DUMMY POSITIONING AND MEASUREMENTS**		**14**
	5.1	Determine the H-point of the driver’s seat	14
	5.2	Head Protection Device marking	15
	5.3	Dummy Placement	17
	5.4	Dummy Positioning Measurements	19
6	**Carrier and PoLE**		**20**
	6.1	Carrier	20
	6.2	Pole	20
7	**TEST PARAMETERS**		**21**
	7.1	Impact Speed	21
	7.2	Alignment	21
	7.3	After test	22
	7.4	Dummy Removal	22
	7.5	Side Airbag Head Protection Evaluation	23

1 VEHICLE PREPARATION

1.1 Unladen Kerb Mass

1.1.1 The capacity of the fuel tank will be specified in the manufacturer's booklet. This volume will be referred to throughout as the "fuel tank capacity".

1.1.2 Siphon most of the fuel from the tank and then run the car until it has run out of fuel.

1.1.3 Refill the tank with fuel, water or other ballast to a mass equivalent to 100% of the tank's capacity of fuel.

1.1.4 Check the oil level and top up to its maximum level if necessary. Similarly, top up the levels of all other fluids to their maximum levels if necessary.

1.1.5 Ensure that the vehicle has its spare wheel on board along with any tools supplied with the vehicle. Nothing else should be in the car.

1.1.6 Ensure that all tyres are inflated according to the manufacturer's instructions for half load.

1.1.7 Measure the front and rear axle masses and determine the total mass of the vehicle. The total mass is the 'unladen kerb mass' of the vehicle. Record this mass in the test details.

1.1.8 Measure and record the ride heights of the vehicle at all four wheels.

1.2 Rated cargo and luggage mass

1.2.1 Calculate the rated cargo and luggage mass as follows: Subtract the measured unladen kerb mass and the rated occupants mass from the maximum permitted laden mass. The rated occupant mass is equal to rated number of occupants times 68 kg. The maximum permitted laden mass can be found on the Manufacturer's Plate, usually in the engine compartment.

1.3 Reference Loads

1.3.1 Place both front seats in their mid-positions, this may not be the same. If there is no notch at this position, set the seat in the nearest notch rearward.

1.3.2 Place weights equivalent to a WorldSID 50th dummy (75kg) in the front driver's seating position.

1.3.3 Place weights with a mass of the rated cargo and luggage mass or 136kg whichever is less, in the luggage compartment of the vehicle. The normal luggage compartment should be used i.e. rear seats should not be folded to increase the luggage capacity. Spread the weights as evenly as possible over the base of the luggage compartment. If the weights cannot be evenly distributed, concentrate weights towards the centre of the compartment.

1.3.4 Roll the vehicle back and forth to 'settle' the tyres and suspension with the extra weights on board. Determine the front and rear axle loads of the vehicle. These loads are the "axle reference loads" and the total mass is the "reference mass" of the vehicle.

1.3.5 Record the axle reference loads and reference mass in the test details.

1.3.6 Measure and record the ride-heights of the vehicle at a point on the wheel arch in the same transverse plane as the wheel centres. Do this for all four wheels.

1.3.7 Remove the weights from the luggage compartment and the dummy weights from the front seat.

1.4 Impact location

1.4.1 To measure vehicle dimensions and to apply markers, a pointer used to measure co-ordinates in three dimensions will be used.

1.4.2 The 'Impact Reference Line' is the line formed on the driver side of the test vehicle by the intersection of the exterior surface of the vehicle and a vertical plane passing through the centre of gravity of the head of the dummy positioned in accordance with Section 5, in the driver seating position. The vertical plane forms an angle of 75° with the vehicle longitudinal centreline, see Figure 1.

1.4.3 Mark the impact reference line on the side of the vehicle on the exterior, from roof to sill.

1.4.4 Using a piece of sticky tape in a colour to contrast with the body-colour, join the points with one edge of the tape. Mark clearly on the tape, which of its edges aligns with the impact reference line. This edge may be used to assess the alignment of the vehicle with the pole.

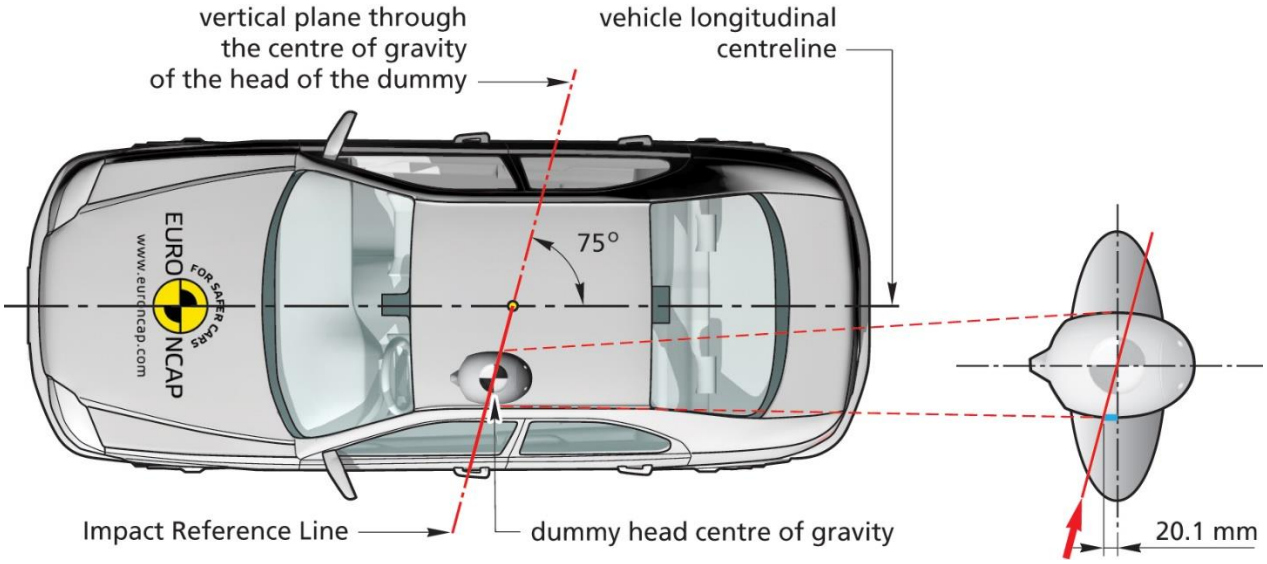


Figure 1: Impact reference line

1.5 Vehicle Preparation

Care should be taken during vehicle preparation that the ignition is not switched on with the battery or any airbag or pretensioner disconnected. This will result in an airbag warning light coming on and the airbag system will need to be reset. Manufacturers will be asked to provide instructions for resetting the airbag so that this may be done 'in-house' in the event that it becomes necessary.

1.5.1 Remove the carpeting, spare wheel and any tools or jack from the luggage area. The spare wheel should only be removed if it will not affect the crash performance of the vehicle.

1.5.2 Ensure that the vehicle's battery is connected, if possible in its standard position. Check that the dashboard light for the airbag circuit functions as normal.

1.5.3 Fit the on-board data acquisition equipment in the boot of the car. Also fit any associated cables, cabling boxes and power sources.

1.5.4 Place weights with a mass of approximately the rated cargo and luggage mass in the luggage area.

1.5.5 Place weights equivalent to a WorldSID 50th dummy (75kg) in the front driver's seat of the car (with the front seats in their mid-positions).

1.5.6 Weigh the front and rear axle loads of the vehicle. Compare these loads with those determined in Section 1.3.5.

1.5.7 The total vehicle mass shall be within 1% of the reference mass (Section 1.3). Each axle load shall be within the smaller of 5% or 20 kg of its respective axle reference load. If the vehicle differs from the requirements given in this paragraph, items may be removed or added to the vehicle which has no influence on its structural crash performance. The levels of ballast in the fuel tank (equivalent in mass to 100% (should be 100%) capacity of fuel) may also be adjusted to help achieve the desired axle loads. Any items added to increase the vehicle mass should be securely attached to the car.

1.5.8 Repeat Sections 1.5.6 and 1.5.7 until the front and rear axle loads and the total vehicle mass are within the limits set in 1.5.7.

1.5.9 For fully electric vehicles, if a total vehicle mass within 25kg of the reference mass cannot be achieved, it is acceptable for the total mass to be within 2% of the reference mass. A heavier test mass may be used with the agreement of the OEM, the test mass must not be below the minimum value of the specified tolerances.

1.5.10 Record the final axle loads in the test details.

2 DUMMY PREPARATION AND CERTIFICATION

2.1 General

2.1.1 A WorldSID 50th percentile male test dummy shall be used in the front driver's position. It shall conform to the specification detailed in ISO 15830, parts 1-5.

2.2 Certification

Full details of the WorldSID certification requirements are available in the documents mentioned in Section 2.1.1 above. No manufacturer shall have access to any pre-test information regarding any of the test equipment to be used by Euro NCAP, or be permitted to influence its selection in any way.

2.2.1 The WorldSID shall be re-certified after every FOUR impact tests.

2.2.2 Deatils of the IR Tracc length calculation procedure are described in Technical Bulletin TB017.

2.2.3 If an injury criterion reaches or exceeds its normally accepted limit (e.g. HIC of 700) then that part should be re-certified.

2.2.4 If any part of the dummy is broken in a test then the part shall be replaced with a fully certified component.

2.2.5 A copy of the dummy certification certificate will be provided as part of the full report for a test.

2.3 Additions and Modifications to the Dummies

2.3.1 The WorldSID dummy shall be equipped with the half arm assembly on both sides.

2.3.2 It is acceptable for the dummy to be equipped with build level E ankle joins.

2.4 Dummy Clothing and Footwear

2.4.1 The dummy shall be clothed in a sleeveless suit or a modified version of the sleeved suit with sleeves removed.

2.5 Dummy Test Condition

2.5.1 Dummy Temperature

2.5.1.1 The dummy shall have a stabilised temperature in the range of 20.6ºC to 22.2ºC.

2.5.1.2 A stabilised temperature shall be obtained by soaking the dummy in temperatures that are within the range specified above for at least 1 hour prior to the test.

2.5.1.3 Measure the temperature of the driver dummy for at least 5 hours before test at intervals not exceeding 10 minutes and not exceeding 5 minutes before test.

2.5.1.4 A copy of the temperature readings is to be supplied as part of the standard output of the test.

2.5.1.5 The temperature shall be measured using an onboard sensor located on the blue band of first thoracic non struck side rib as far from the spine box as possible.

2.5.2 Dummy Joints

2.5.2.1 Stabilise the dummy temperature by soaking in the required temperature range for at least 5 hours.

2.5.2.2 Set the torque on the shoulder screws to obtain a 1-2g holding force of the arm on its pivot.

2.5.2.3 For adjustable joints in the legs, the tensioning screw or bolt which acts on the constant friction surfaces should be adjusted to obtain a 1-2g holding force.

2.5.2.4 The dummy joint stiffnesses should be set as close as possible to the time of the test and, in any case, not more than 24 hours before the test.

2.5.2.5 Maintain the dummy temperature within the permissible temperature range between the time of setting the limbs and up to a maximum of 10 minutes before the time of the test.

2.6 Dummy painting

2.6.1 The dummy shall have masking tape placed on the areas to be painted using the sizes detailed below. The tape should be completely covered with the following coloured paints. The paint should be applied close to the time of the test to ensure that the paint will still be wet on impact.

Driver

Head (Paint tape outline)	Red
Head CoG (circle Ø40mm)	Yellow
Head top along mid sagittal plane	Green
Shoulder/Arm	Blue
2nd Thorax Rib	Green
3rd Thorax Rib	Red
1st Abdomen Rib	Blue
2nd Abdomen Rib	Green
Pelvis	Orange

NOTE: The tape should be completely covered with the coloured paints specified, with the exception of the driver head which should have only the outer edge of the tape painted.

Tape Sizes:

Driver

Head = 100mm square, centreline of head with lower edge at C of G.
Arm = 25mm x 150mm, starting at bottom edge of shoulder fixing hole.
Ribs = 25mm x 150mm strip, starting at the rearmost accessible point at seat back.
Pelvis = 50mm x 100mm, centred on hip joint point.

2.7 Post Test Dummy Inspection

2.7.1 The dummy should be visually inspected immediately after the test. Any lacerations of the skin or breakages of the dummy should be noted in the test details. The dummy may have to be re-certified in this case. Refer to Section 2.2.

2.7.2 Any screws that have become loose or detached shall be re-tightened to the required torque or replaced as necessary.

3 INSTRUMENTATION

All instrumentation shall be calibrated before the test programme. The Channel Amplitude Class (CAC) for each transducer shall be chosen to cover the Minimum Amplitude listed in the table. In order to retain sensitivity, CAC's which are orders of magnitude greater than the Minimum Amplitude should not be used. A transducer shall be re-calibrated if it reaches its CAC during any test. All instrumentation shall be re-calibrated after one year, regardless of the number of tests for which it has been used. A list of instrumentation along with calibration dates should be supplied as part of the standard results of the test. The transducers are mounted according to procedures laid out in SAE J211. The sign convention used for configuring the transducers is stated in SAE J211 (2007).

3.1 Dummy Instrumentation

3.1.1 The WorldSID dummy shall be instrumented to record the channels listed below. Additional channels may be recorded.

3.1.2 Where the number of channels in the WorldSID dummy is 45 or more, only in-dummmy data acquisition systems may be used. Where there are less than 45 channels, the use of umbillical cables is at the laboratories discretion.

Location	**Parameter**	**Minimum amplitude**	**Channel count**
Head	Linear acceleration, Ax, Ay, Az	250g	3
Upper neck	Forces and moments Fx, Fy, Fz, Mx, My, Mz	5kN, 300Nm	6
Shoulder – Joint	Forces, Fx, Fy, Fz	8kN	3
Shoulder – Rib	Displacement & rotation	100mm	2
Thorax - Upper rib	Displacement & rotation	100mm	2
Thorax - Mid rib	Displacement & rotation	100mm	2
Thorax - Lower rib	Displacement & rotation	100mm	2
Thoracic temperature*	Temperature, see 2.5.1.3	30°C	1
Abdomen - Upper rib	Displacement & rotation	100mm	2
Abdomen - Lower rib	Displacement & rotation	100mm	2
Spine - T12	Acceleration, Ax, Ay, Az	200g	3
Pelvis	Acceleration, Ax, Ay, Az	200g	3
Pelvis – Pubic	Force	5kN	1
Femoral neck – struck side only	Force, Fx, Fy, Fz	5kN	3
	Total Channels		**35**

* It is not necessary for this channel to be recorded through the dummy onboard DAU.

3.2 Vehicle Instrumentation

3.2.1 The vehicle is to be fitted with an accelerometer on the unstruck B-pillar. The accelerometer is to be fitted in the lateral direction (A_y).

3.2.2 Remove carpet and the necessary interior trim to gain access to the sill directly below the B-pillar.

3.2.3 Securely attach a mounting plate for the accelerometer horizontally on to the sill.

3.2.4 Fix the accelerometer to the mounting plate. Ensure the accelerometer is horizontal to a tolerance of ±5 degrees.

VEHICLE

Location	**Parameter**	**Minimum Amplitude**	**No of channels**
B-Post (unstruck)	Acceleration, A_y	350g	1
Battery (including any secondary batteries)	Supply voltage, V	15V	1
	Total Channels per Vehicle		2

3.3 Carrier Instrumentation

3.3.1 The carrier is to be fitted with an accelerometer at its structure at the centre line, near the centre of gravity. The accelerometer is to be fitted in the direction of movement (A_X).

CARRIER

Location	**Parameter**	**Minimum Amplitude**	**No of channels**
Carrier C of G	Acceleration, A_X	350g	1
	Total Channels per Carrier		1

TOTAL CHANNELS

1x WorldSID	35
1x Vehicle	2
1x Carrier	1
TOTAL	**38**

4 PASSENGER COMPARTMENT ADJUSTMENTS

4.1 Overview of Settings

Adjustment	Required Setting	Notes	Methods
Seat Fore/Aft	As defined in 4.4		
Seat Base Tilt	As defined in 4.4		
Seat Height	As defined in 4.4		
Torso Angle	Manufacturer's design position	Otherwise 23° to Vertical	See Section 5.1
Seat Lumbar Support	Fully retracted		See Section 0
Front Head Restraint Height & Tilt	Mid locking position	As whiplash test position. If there is any interference with the rear of the dummy head, move the HR to the most rearward position.	See Section 6.2 Whiplash testing protocol.
Steering wheel	Highest position and most outward		See Section 4.5
Rear Seat Fore/Aft	Fully rearward		See Section 4.6
Rear Seat Back Angle	Manufacturer's design position	Otherwise 25° to Vertical	See Section 4.6
Rear Seat Facing	Forward		
Rear Head Restraint Height & Tilt	As recommended in vehicle handbook.	Where no details are provided in the handbook, set to mid or next lowest position for height and mid locking position for tilt.	See Section 6.2 Whiplash testing protocol.
Arm-rests (Front seats)	Lowered position	May be left up if dummy positioning does not allow lowering. Where adjustable place in horizontal position.	
Arm-rests (Rear seats)	Stowed position		
Side Window Glazing	All raised		
Gear change lever	In the neutral position		
Parking Brake	Engaged		
Pedals	Normal position of rest	Adjustable pedals fully forward	See Section 0
Doors	Closed, not locked		
Roof / sunroof	Raised / fully closed	Where applicable	
Sun Visors	Stowed position		
Rear view mirror	Normal position of use		
Seat belt anchorage (where adjustable)	Initially, manufacturer's 50th percentile design position	If no design position then set to mid position, or nearest notch upwards	See Section 5.3.6

Adjustments not listed will be set to mid-positions or nearest positions rearward, lower or outboard.

4.2 Seat adjustments

4.2.1 Position the seat's adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment positions.

4.2.2 Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.

4.2.3 Position an adjustable seat cushion length to the retracted position.

4.2.4 Position an adjustable leg support system in its rearmost position.

4.2.5 Place adjustable pedals in the full forward position (towards the front of the vehicle.)

4.3 Seat markings

4.3.1 Identify and mark one seat reference point (SRP_1) at the rear side of the seat cushion.

4.3.2 Where the seat cushion pitch is adjustable, identify and mark a second reference point, SRP_2, that is at least 300mm forward of the rear reference point ($SRP_{1)}$ and draw a line through the two reference points.

4.3.3 Locate and mark the longitudinal centreline of the seat cushion. The intersection of the vertical longitudinal plane that passes through the SRP_1 and the seat cushion upper surface determines the longitudinal centreline of a bucket seat cushion.

4.3.4 Where the front seats are bench seats, locate and mark the longitudinal line on the seat cushion that marks the intersection of the vertical longitudinal plane through the centreline of the steering wheel and the seat cushion upper surface.

4.4 Positioning the seat

4.4.1 Use the seat control that primarily moves the seat vertically to adjust the rearmost seat reference point, $SRP_{1,}$ defined in 4.3.1 to the upper most vertical location.

4.4.2 Use the seat control that primarily moves the seat fore-aft to adjust the rearmost seat reference point, $SRP_{1,}$ defined in 4.3.1 to the rearmost location.

4.4.3 Determine and record the range of angles of the seat cushion pitch and using only the control(s) that primarily adjust(s) the cushion pitch, set cushion pitch to the mid-angle

4.4.4 Use the seat control that primarily moves the seat vertically to adjust the rearmost seat reference point, $SRP_{1,}$ defined in 4.3.1 to the lowest vertical location. Verify that you are still at the rearmost seat track location. Record the X position of SRP_1.

4.4.5 Use the seat control that primarily moves the seat fore-aft to adjust the rearmost seat reference point, $SRP_{1,}$ to the rearmost location. Record the X position of SRP_1.

4.4.6 Use the seat control that primarily moves the seat fore-aft to adjust the rearmost seat reference point, $SRP_{1,}$ to the forward most location; Record the X position of SRP_1.

4.4.7 Measure and mark an X position 20mm rearward of the midpoint (MP +20mm).

4.4.8 Use the seat control that primarily moves the seat fore-aft to adjust the rearmost seat reference point, $SRP_{1,}$ to the X position marked in 4.4.7 or, if this is not possible, to the first X possible position rearward the marked position in 4.4.7. If the seat cannot be placed at exactly 20mm rearward of the midpoint select the next closest available rearward setting.

4.4.9 For some vehicles this final step may change the cushion pitch as established in 4.4.8, this is acceptable.

4.4.10 Record test seat position using the seat reference point, SRP_1.

The settings for the passenger seat should be as near as possible to being the same as that of the driver's seat.

4.5 Setting the Steering Wheel

4.5.1 Set the steering wheel at the geometric highest driving position considering the full range of telescopic and tilt adjustment possibilities, in order to provide clearance for the legs and

thorax.

4.6 Setting the rear seat (if adjustable)

4.6.1 If the vehicle rear seat position is adjustable put it in the most rearward fore/aft position and the same seat back angle (where adjustable) as that used in the frontal ODB impact.

5 DUMMY POSITIONING AND MEASUREMENTS

5.1 Determine the H-point of the driver's seat

The device to be used is the H-point machine as described in SAE J826.

If the seat is new and has never been sat upon, a person of mass 75 ± 10kg should sit on the seat for 1 minute twice to flex the cushions. The seat shall have been at room temperature and not been loaded for at least 1 hour previous to any installation of the machine.

5.1.1 Set the seat back so that the torso of the H-point manikin is as close as possible to the manufacturer's recommendations for normal use. In absence of such recommendations, an angle of 23 degrees ±1° towards the rear from vertical will be used.
5.1.2 The driver and passenger seatback angle and seat base shall be set to the same position.
5.1.3 Place a piece of muslin cloth on the seat. Tuck the edge of the cloth into the seat pan/back join, but allow plenty of slack.
5.1.4 Place the seat and back assembly of the H-point machine on the seat at the centre line of the seat.
5.1.5 The length of the lower leg and thigh segments of the H-point manikin shall be adjusted to the 50th percentile (418mm) and 10^{th} percentile (408mm) positions respectively.
5.1.6 Attach lower legs to machine, ensuring that the transverse member of the T-bar is parallel to the ground.
5.1.7 Place the right foot on the undepressed accelerator pedal, with the heel as far forwards as allowable. The distance from the centre line of the machine should be noted.
5.1.8 Place left foot at equal distance from centre line of machine as the right leg is from centre line. Place the foot flat on the footwell.
5.1.9 Apply lower leg and thigh weights.
5.1.10 Tilt the back pan forwards to the end stop and draw the machine away from the seatback.
5.1.11 Allow the machine to slide back until it is stopped by contacting the seat back.
5.1.12 Apply a 10kg load twice to the back and pan assembly positioned at the intersection of the hip angle intersection to a point just above the thigh bar housing.
5.1.13 Return the machine back to the seat back.
5.1.14 Install the right and left buttock weights.
5.1.15 Apply the torso weights alternately left and right.
5.1.16 Tilt the machine back forwards to a vertical position and, while holding the T-bar, rock the pan by 5 degrees either side of the vertical. The feet are NOT to be restrained during the rocking. Holding the T-bar to prevent the H-Point machine from sliding forward on the seat cushion, return the machine back to the seat back..
5.1.17 Reposition the feet by lifting the leg and then lowering the leg so that the heel contacts the floor and the sole lies on the undepressed accelerator.
5.1.18 Check the lateral spirit level and if necessary apply a lateral force to the top of the machine back, sufficient to level the seat pan of the machine.
5.1.19 Adjust the seat back angle to the angle determined in 5.1.1, measured using the spirit level and torso angle gauge of the H-point machine. Ensure that the torso remains in contact with the seat back at all times. Ensure that the machine pan remains level at all times.
5.1.20 If the measured angle is not within ±1° of the target, the chest and buttocks weights shall be removed, the seat back readjusted, and the steps to position the H-point manikin shall be repeated, beginning with tilting the back pan forward as in 5.1.10.
5.1.21 Measure and record in the test details the position of the H-point relative to some easily identifiable part of the vehicle structure.

5.2 Head Protection Device marking

5.2.1 Using the location of the H-point as measured in Section 5.1.21 for the front seating position, calculate and record the corresponding 5th female and 95th male head centre of gravity positions for the front seat to determine the corners of the head CoG-box:

5th female Head CoG:

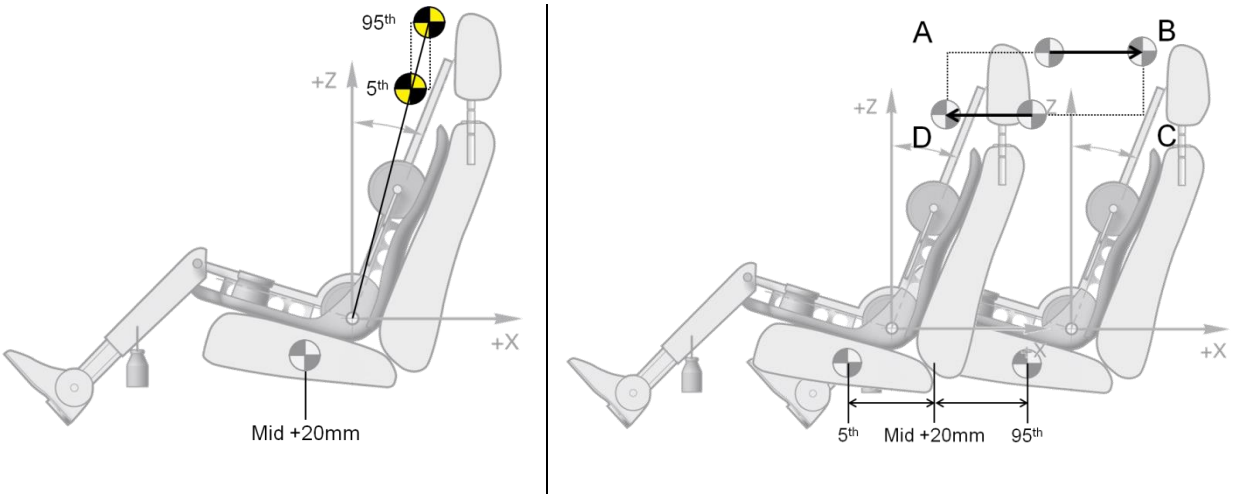
$X_{CoG,5th}$ = H-point(X) + 126 - seat travel 5th-50th

$Z_{CoG,5th}$ = H-point(Z) + 594

95th male Head CoG:

$X_{CoG,95th}$ = H-point(X) + 147 + seat travel 50th-95th

$Z_{CoG,95th}$ = H-point(Z) + 693



The four corners of the Head CoG-box are:

	X-position	Z-position
A	$X_{CoG,5th}$	$Z_{CoG,95th}$
B	$X_{CoG,95th}$	$Z_{CoG,95th}$
C	$X_{CoG,95th}$	$Z_{CoG,5th}$
D	$X_{CoG,5th}$	$Z_{CoG,5th}$

5.2.2 The seat travel for the 5th and 95th positions will be required from the vehicle manufacturer in Technical Bulletin TB018.

5.2.3 Using the location of the H-point for the rear seating position as measured for the Rear Whiplash protocol, calculate and record the corresponding head centre of gravity positions in the most forward and rearward seating positions:

5th female Head CoG in most forward seating position:

$X_{CoG,5th}$ = H-point(X) + 126 – remaining seat travel (if applicable)

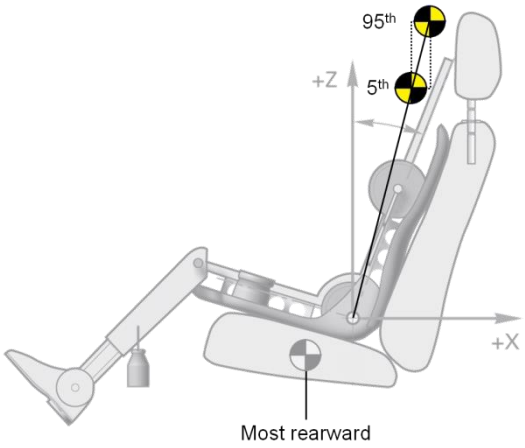
$Z_{CoG,5th}$ = H-point(Z) + 594

95th male Head CoG in most rearward seating position:

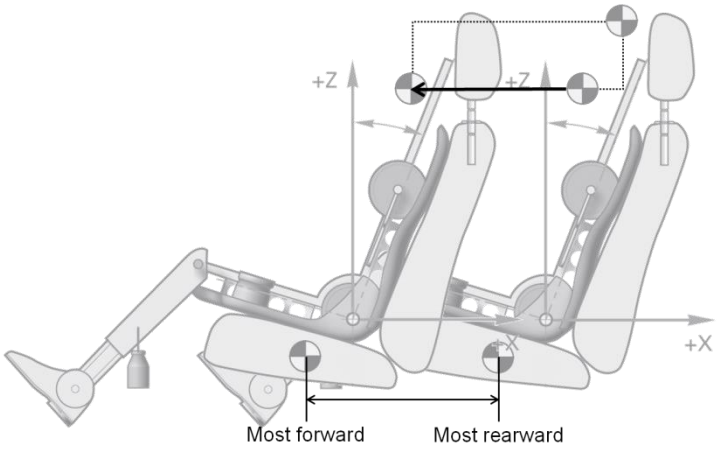
$X_{CoG,95th}$ = H-point(X) + 147 + remaining seat travel (if applicable)

$Z_{CoG,95th}$ = H-point(Z) + 693

Fixed rear bench



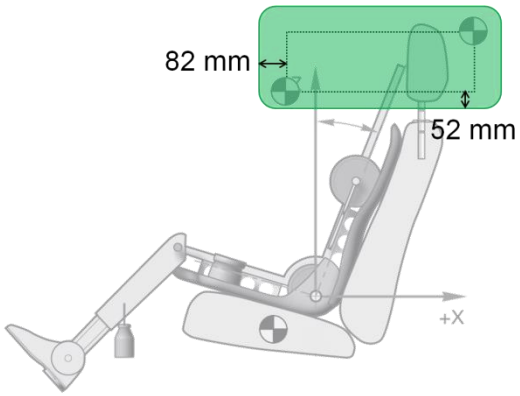
Movable rear bench

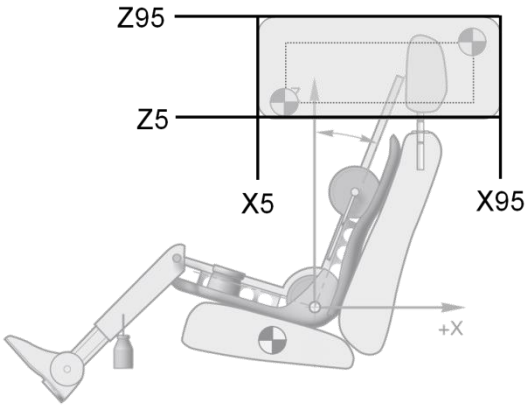


5.2.4 The head protection device (HPD) evaluation zone is defined as a rounded rectangle around the head CoG box at a distance of 82mm from the upper and fore/aft edges and 52mm below the bottom edge. It is acceptable for the 82mm radius in the lower corners of the airbag to be cut-off at 52mm below the CoG box.

5.2.5 The zone shall be constructed parallel and perpendicular to the ground reference level.

5.2.6 Mark the vertical lines X5 and X95 and the horizontal lines Z95 and Z5 on both the vehicle interior at the struck side and on the vehicle exterior on the non-struck side.





5.3 Dummy Placement

5.3.1 It is the intention that the dummy should not be left to sit directly on the seat for more than 2 hours prior to the test. It is acceptable for the dummy to be left in the vehicle for a longer period, provided that the dummy position is checked no more then one hour prior to test. It is not acceptable for the dummy to be left in the vehicle overnight or for a similarly lengthy period.

5.3.2 *H-point*

Note that the H-point of the WorldSID dummy is situated 20mm forward of that of the H-point determined by the H-point manikin.

5.3.2.1 Using only the controls that move the seat fore-aft, move the test seat to the rearmost position to facilitate placement of the dummy.

5.3.2.2 Position the dummy in the seat such that the mid-sagittal plane is coincident with the centreline markings and the upper torso resting against the seat back.

5.3.2.3 Apply a fore-aft and lateral rocking motion to settle the pelvis rearward in the seat.

5.3.2.4 To ensure a repeatable and stable pelvis position, ensure that the pelvis is in contact with the seat cushion over the whole length.

5.3.2.5 To ensure a repeatable placement of the lower abdominal rib, make sure it is inside the pelvis flesh and not on top of it.

5.3.2.6 Move the seat together with the dummy to the test seat position defined in 4.4.9. If it is not possible to reach the seat test position due to knee contact, shift the targeted test seat position rearwards in the stepwise increments to the closest position where the knee clearance is at least 5mm. Modify the target H-point accordingly.

5.3.2.7 Verify that the H-point is reasonably close (±10mm) to the target H-point 5.1.21 or as defined in 5.3.2.6 if the target H-point has been modified. If not, repeat step 5.3.2.3. If it is still not possible, record the rearmost seat cushion reference point and the dummy H-point and proceed to the next step.

5.3.2.8 Extend the right leg without displacing the thigh from the seat cushion. Allow the sole of the foot to settle on the accelerator pedal; the heel of the shoe should be in contact with the floor pan. Where a lack of ankle articulation prevents the foot from sitting flat on the accelerator pedal, keep the foot at a 90 degree angle to the tibia and ensure that the heel is in contact with the floor

5.3.2.9 Extend the left leg without lifting the thigh from the seat cushion and allow the sole of the foot to settle on the footrest or floor if no footrest is present. The heel of the shoe should be in contact with the floor. In case of tibia contact, slide the foot rearward toward the seat until a 5mm clearance is obtained. Where a lack of ankle articulation prevents the foot from sitting flat on the floor, keep the foot at a 90 degree angle to the tibia and ensure that the heel is in contact with the floor.

5.3.2.10 Position the H-point of the dummy to match the WorldSID H-point coordinates recorded following Section 5.1 to within ±10mm. Prioritise the X coordinate.

5.3.3 Head and torso

5.3.3.1 Adjust the dummy until the thorax tilt sensor coincides with the angle specified by the manufacturer.

5.3.3.2 If the rib angle is not specified by the manufacturer and the torso angle is 23° ± 1°, adjust the dummy until the thorax tilt sensor reads −2° (2° downwards) ± 1°.

5.3.3.3 If no rib angle is specified and the seat back angle is not 23° ± 1°, no further adjustment of rib angle is required.

5.3.3.4 Adjust the dummy neck bracket to level the head at the closest position to 0° ± 1°.

5.3.4 Legs and feet

5.3.4.1 Proceed to the final foot and leg positioning by repeating Section 5.1.7 and 5.1.8. Where a lack of ankle articulation prevents the foot from sitting flat on the accelerator pedal/floor, keep the foot at a 90 degree angle to the tibia and ensure that the heel is as far forward as possible and in contact with the floor.

5.3.4.2 No distance is specified for the knee spacing. However, priority should be given to ensure the following:

5.3.4.3 There is 5 mm clearance between the knees/legs and the steering shroud and centre console.

5.3.4.4 There is a stable foot and ankle position.

5.3.4.5 The legs are as parallel as possible to the sagittal plane.

5.3.5 Arms

5.3.5.1 Place both arms at the first detent downward of the most upward detent that corresponds to a differential angle of 32° between rib angle sensor and the arm angle.

5.3.6 Seat belt

5.3.6.1 Where possible, initially position the upper seat belt anchorage in the manufacturers 50th percentile design position. If no design position is provided, set the adjustable upper seat belt anchorage to the mid-position or nearest notch upward.

5.3.6.2 Carefully place the seat belt across the dummy and lock as normal.

5.3.6.3 Remove the slack from the lap section of the webbing until it is resting gently around the pelvis of the dummy. Only minimal force should be applied to the webbing when removing the slack. The route of the lap belt should be as natural as possible.

5.3.6.4 Place one finger behind the diagonal section of the webbing at the height of the dummy sternum. Pull the webbing away from the chest horizontally forward and allow it to retract in the direction of the D-loop using only the force provided by the retractor mechanism. Repeat this step three times, only.

5.3.6.5 After following the above steps, the seatbelt should lie in a natural position across the dummy sternum and shoulder clavicle. Where this is not the case, for example the belt is close to or in contact with the neck or the belt is above the shoulder rotation adjustment screw, and the upper belt anchorage is adjustable the anchorage should be lowered and steps 5.3.6.3 and 5.3.6.4 repeated.

5.3.6.6 The upper anchorage should be lowered by a sufficient amount to ensure a natural belt position following the repetition of steps 5.3.6.3 and 5.3.6.4. This may require multiple attempts.

5.3.6.7 Once the belt is positioned the location of the belt should be marked across the dummy chest to ensure that no further adjustments are made. Mark also the belt at the level of the D-loop to be sure that the initial tension is maintained during test preparation.

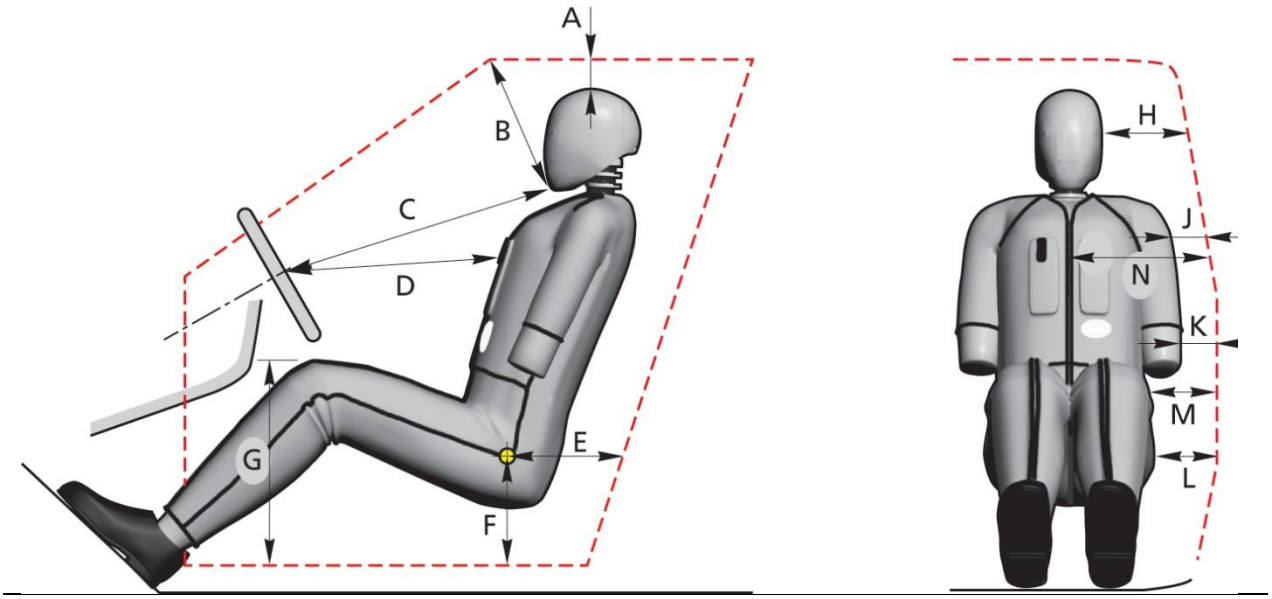
5.3.6.8 Measure the vertical distance between the dummy nose and the diagonal webbing.

5.3.6.9 Measure the horizontal distance between the diagonal webbing and the door/window.

5.3.7 After positioning the dummy measure and record the dummy position according to Section 6.4 and determine the impact location as described in Section 1.4.

5.4 Dummy Positioning Measurements

The following measurements are to be recorded prior to the test after the dummy settling and positioning procedures have been carried out.



Driver measurements	
A	Head/roof panel
B	Chin/windscreen joint
C	Chin/centre of the steering
D*	Thorax strap/centre of the steering wheel
E	Hip-joint point/inside opening of the door (horizontal)
F	Hip-joint point/inside opening of the door (vertical)
G	Knee/floor covering (vertical)
H	Head/side window pane (or padding)
J	Shoulder/window pane (or padding)
K	Elbow/door (or padding)
L	Pelvis/door (or padding)
M	Knee/door (or padding)
N	Belt webbing to door (horizontally)

* Horizontal distance from steering wheel centre

6 CARRIER AND POLE

6.1 Carrier

6.1.1 A carrier should be used which has a horizontal flat surface with a sufficiently large area to allow unobstructed longitudinal displacement of the vehicle of about 1000mm and rotation of the vehicle during the deformation phase of the impact.

6.1.2 To minimise effects of friction between the tires of the test vehicle and the surface of the carrier this friction is reduced to a minimum by placing the vehicle with each tyre on two sheets of PTFE.

6.1.3 To avoid vehicle movement prior to the impact, the vehicle may be fixed to the carrier until 5m before the point of impact. The impact speed should be reached 10m before the point of impact.

6.1.4 Crumple tubes or a comparable device will decelerate the carrier not earlier than 80ms after the moment / point of impact.

6.1.5 The carrier may be fitted with an emergency abort system. This is optional; the test facility may elect to test without an abort system.

6.2 Pole

6.2.1 The rigid pole is a vertical metal structure beginning no more than 102mm above the lowest point of the tires on the striking side of the test vehicle when the vehicle is loaded as specified in Section 1 and extending at least 100mm above the highest point of the roof of the test vehicle.

6.2.2 The pole is 254 ±3mm in diameter and set off from any mounting surface, such as a barrier or other structure, so that the vehicle will not contact such a mount or support at any time within 100ms of the initiation of the vehicle to pole contact.

6.2.3 Mark a line along the vertical centreline of the pole which may be used to check the alignment of the test vehicle on the carrier.

7 TEST PARAMETERS

An on-board data acquisition unit will be used. This equipment will be triggered by a contact plate at the point of first contact (t=0) and will record digital information at a sample rate of 20kHz (alternatively a sample rate of 10 kHz may be used). The equipment conforms to SAE J211 (2007).

BEFORE THE TEST, ENSURE THAT THE LIVE BATTERY IS CONNECTED, A SINGLE KEY IS IN THE IGNITION, THE IGNITION IS ON AND THAT THE AIRBAG LIGHT ON THE DASHBOARD ILLUMINATES AS NORMAL (WHERE FITTED).

If the vehicle is fitted with a suspension system, pedal retraction system or any other system which requires running of the engine just before test execution, the engine should be run for a predetermined time, specified by the manufacturer.

7.1 Impact Speed

7.1.1 During the acceleration phase of the test, the acceleration of the carrier shall not exceed 1.5m/s2.

7.1.2 Measure the speed of the vehicle as near as possible to the point of impact using an infra-red beam intercepting two markers at a measured distance apart.

7.1.3 Record the actual test speed in the test details.

TARGET SPEED = 32 ±0.5km/h

7.2 Alignment

7.2.1 The test vehicle shall be propelled so that, when the vehicle-to-pole contact occurs, the direction of vehicle motion forms an angle of 75° ± 3° with the vehicle longitudinal centreline.

7.2.2 The impact angle shall be measured between the vehicle longitudinal centreline and a vertical plane parallel to the vehicle impact velocity vector.

7.2.3 The impact reference line shall be aligned with the centreline of the rigid pole surface, as viewed in the direction of vehicle motion, so that, when the vehicle-to-pole contact occurs, the centreline of the pole surface contacts the vehicle area bounded by two vertical planes parallel to and 25 mm forward and aft of the impact reference line.

7.2.4 With the vehicle offered up against the pole, tape a small rivet on the centreline of the pole such that it is aligned with the vertical impact reference line marked in 7.2.3.

7.2.5 It should be noted that the point of first contact between the pole and vehicle does not align with the impact reference line marked on the vehicle, see Figure 2.

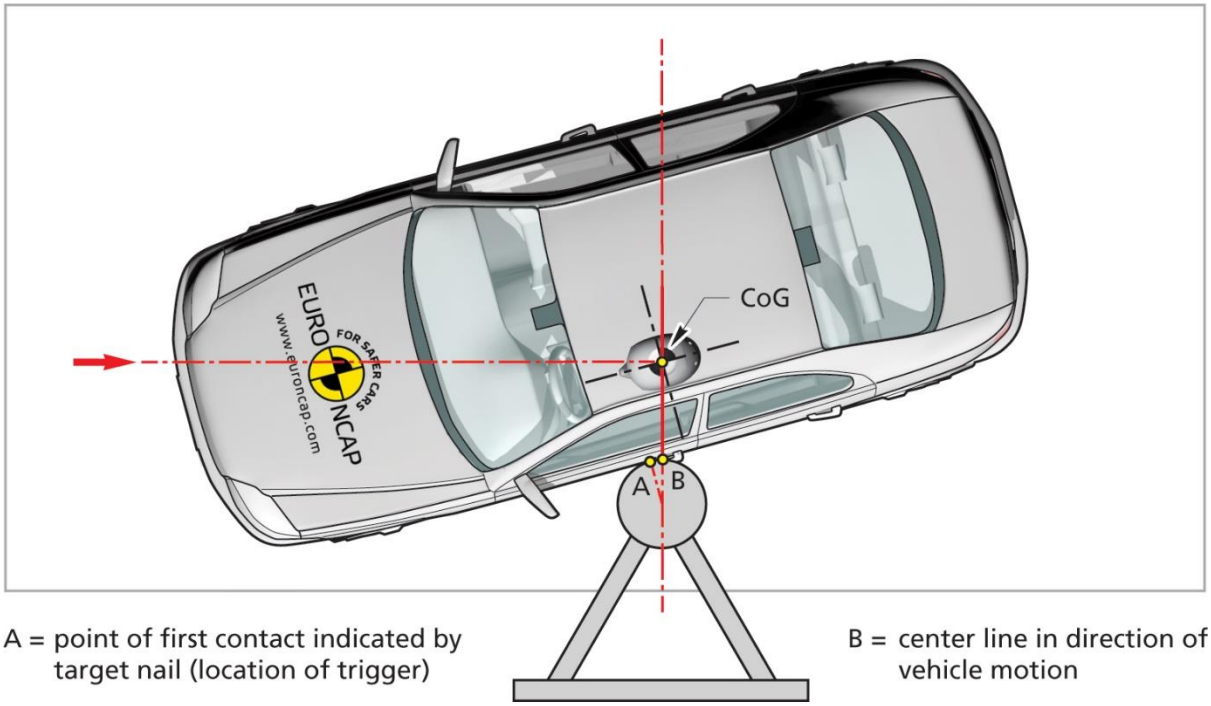


Figure 2: Point of first contact

7.3 After test

7.3.1 Door Opening

7.3.1.1 Check that none of the doors, including boot lids and any movable roofs, have opened or partially opened during the test. Where this is the case photographic evidence shall be obtained and provided in the test report.

7.3.1.2 Struck side doors handles shall be immediately covered with tape to prevent inadvertent opening. Reference measurements shall be taken between the door skin and aperture to ensure that the door has not move or been disturbed between the test and inspection.

7.3.1.3 Check that the unstruck side doors are not locked and open the doors by hand (front door followed by rear door).

7.3.1.4 If the doors do not open, record this in the test details.

7.4 Dummy Removal

7.4.1 Do not move the driver seat. Try to remove the dummy.

7.4.2 If the dummy cannot be removed with the seats in its original position, recline the seat back and try again.

7.4.3 If the dummy still cannot be removed, try to slide the seat back on its runners or remove the steering wheel.

7.4.4 If the dummy still cannot be removed, the seat can be cut out of the car.

7.5 Side Airbag Head Protection Evaluation

7.5.1 Curtain airbags

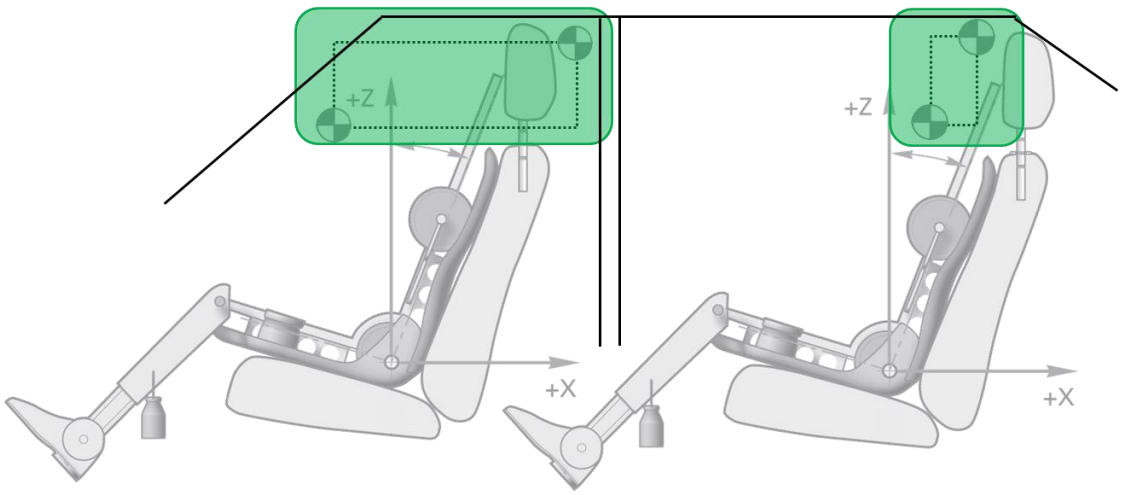
7.5.1.1 After the pole test, deploy the head protection device on the non struck side of the vehicle. Make sure that the airbags are identical on both sides of the vehicle. Where this is not the case, the assessment must be performed on both sides.

7.5.1.2 Inflate the airbag to the pressure recommended by the OEM.

7.5.1.3 Project the HPD assessment zone onto the inflated airbag, using a laser, for front and rear seating positions using the measurements marked/recorded in Section 5.2.

7.5.2 Seat mounted head protection devices

7.5.2.1 Based on the head CoG paint mark on the airbag, mark the HPD assessment zone defined as a rounded rectangle extending 95mm forward, 90mm rearward, 120mm upward and 115mm downward on the flattened airbag.

7.5.2.2 When the paint mark cannot be used, the OEM needs to supply Euro NCAP in-house data for the Side Airbag Head Protection Evaluation.

7.5.3 Evaluate coverage area of the airbag(s), record and check the dimensions of any joined, stitched or seamed areas.