EURO NCAP

#FORSAFERCARS

Version 0.9
December 2024

Crash Protection
Side Impact

Protocol

Implementation January 2026

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 setup, 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).

NOTE: All 2026 protocols with a version number 0.9 are under final review of the Working Group and might undergo minor changes.

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Definitions used in this protocol can be found in Euro NCAP Technical Bulletin TB 045.

1 MEASURING EQUIPMENT

1.1 Reference system

The sign convention used for configuring the transducers is stated in SAE J211 (2007).

1.2 Dummies

Test	ATD
AE-MDB	WorldSID 50th percentile male TB 051 Q6 and Q10 child TB 053
Pole	WorldSID 50th percentile male TB 051
Far side sled and VTC	WorldSID 50th percentile male TB 051

1.3 Collision partners

1.3.1 AE-MDB trolley

The trolley will be fitted with the Advanced European Mobile Deformable Barrier face (AE-MDB) and ventilation frame conforming to the specifications of Technical Bulletin TB 014.

The Mobile Deformable Barrier (MDB) includes both an impactor and a trolley. The trolley shall meet the specification detailed in TB 047.

1.3.2 Oblique pole impact vehicle carrier and pole

The rigid pole is defined in UN ECE Regulation 135, Annex 3, February 2016. It shall be set away from any mounting surface, such as a barrier, block 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.

A line must be marked along the vertical centreline of the pole which may be used to check the alignment of the test vehicle on the carrier.

The vehicle carrier shall meet the specification detailed in TB 047.

1.4 Measurement and variables

1.4.1 Instrumentation general

All instrumentation used in the test shall be (re-)calibrated within at least one year before each test and should be re-calibrated if it reaches its Channel Amplitude Class (CAC) during any test.

The measurement data shall be recorded according to ISO 6487 or SAE J211/1 at a minimum sample frequency of 20kHz.

1.4.2 VUT instrumentation

The vehicle under test (VUT) is to be fitted with an accelerometer on the unstruck B-pillar. The accelerometer is to be fitted in the lateral direction (Ay) and ensure it is horizontal to a tolerance of ±1 degree.

Location	Parameter	CAC
B-pillar - unstruck side	Acceleration, A_y	350g
Battery - including any secondary batteries	Supply voltage, V_{supply}	15V

1.4.3 AE-MDB trolley instrumentation

Location	Parameter	CAC
Trolley C of G	Acceleration, A_x	150g

1.4.4 Pole test vehicle carrier instrumentation

Location	Parameter	CAC
Carrier C of G	Acceleration, A_x	350g

2 TEST CONDITIONS

2.1 VUT preparation

Prepare the vehicle as defined in Technical Bulletin TB 046.

2.2 Occupant compartment adjustments

Position the seats as detailed below. Adjustments not specified as the Manufacturer's design position (MDP) shall be set to mid positions or the nearest position rearward, lowest or outboard.

2.2.1 Front seats

Front seats	Required setting
Fore/aft	UN ECE R135, Annex 4, Section 6, February 2016. Must not be further rearward than 95th percentile male position.
Front seat cushion tilt	UN ECE R135, Annex 4, Section 6, February 2016.
Front seat height	UN ECE R135, Annex 4, Section 6, February 2016.
Front seat torso angle	MDP otherwise 25° torso angle
Front seat lumbar support	UN ECE R135, Annex 4, Section 6, February 2016.
Front seat cushion length	Fully retracted
Front head restraint	Height: Mid position, when the headrest pushes the head forward, move to highest. See TB 028. Fore/aft or tilt: Mid position, when the headrest pushes the head forward, adjust the tilt and fore/aft position. If there is still contact use the height position to remove the contact. If there is still contact, proceed with the test. See TB 028.
Front seat belt anchorage	MDP or mid. Webbing must not be in contact with the neck.
Arm-rests	In use position. See TB 028.

2.2.2 Rear seats

Rear seats	Required setting **Must be the same for MPDB, FWT and AE-MDB**
Rear seat facing	Forwards
Rear seat lateral position	Most outboard
Rear seat fore/aft	Rearmost
Rear seat cushion tilt	MDP Permissible up to mid position, otherwise lowest

Rear seats	Required setting **Must be the same for MPDB, FWT and AE-MDB**
Rear seat height	MDP up to mid position, otherwise lowest
Rear seat back angle	MDP otherwise 25° torso angle
Rear seat lumbar support	Fully retracted
Rear seat cushion length	Fully retracted
Rear head restraint	Height: Lowest. When there is contact with the dummy head or child/CRS move to highest. Fore/aft or tilt: MDP, otherwise mid position, when there is contact with the child/CRS move to most rearward. See TB 028. Remove if the vehicle handbook allows for CRS use.
Rear seat belt anchorage	MDP otherwise mid
Arm-rests (Rear seats)	Not in use position, see TB 028.

2.2.3 Other seats

Other settings	Required setting
Steering wheel	Highest position and closest to driver
Side window glazing	All raised
Gear change lever	In the neutral position
Parking brake	Engaged
Pedals	Normal position of rest or fully forward for adjustable pedals
Doors	Closed, not locked. Rear child locks disengaged. See Post Crash protocol for ADL requirements.
Roof	Raised
Sunroof	Closed
Sun visors	Stowed
Rear view mirror	Normal position of use
Front passenger airbag	Enabled

2.2.4 Front passenger seat – O2O

Front passenger's seat O2O Pole impact only	Required setting
Seat Fore/Aft	Passenger seat in rearmost, the head CoG must be no further rearward than the impact line
Seat Base Tilt	UN ECE R135, Annex 4, Section 6, February 2016
Seat Height	UN ECE R135, Annex 4, Section 6, February 2016
Torso Angle	MDP otherwise at 25° torso angle
Seat Lumbar Support	UN ECE R135, Annex 4, Section 6, February 2016
Arm-rests (Front seats)	Not in use position. See TB 028.

2.3 Dummy positioning and measurement

It is the intention that the dummy is not 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 is checked no more than 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.

Measure the location of the H-point manikin on all relevant seats using the procedure defined in UN ECE R135, Annex 4, Section 7, February 2016.

2.3.1 Dummy Placement

If, after dummy positioning, the vehicle is moved or a test run is aborted ensure that the dummy has not moved from the intended pretest position. If there are difficulties with positioning of any dummy, the H-point location shall be the priority followed by the pelvic angle and then the torso angle.

2.3.2 WorldSID positioning

The seat settings shall not be adjusted for dummy positioning with the exception of the fore/aft travel to establish the knee gap where required. If the dummy cannot be positioned within the tolerances below after three attempts, then it is to be placed as close to the tolerance limits as possible.

Dummy part	Required setting
H-point	Within a square of ±10mm in X and Z of a point 20mm forward of that of the manikin H-point.
Torso angle	Thorax tilt sensor should coincide with the angle specified by the manufacturer or −2° (spine flexion) ±1°. When the torso angle is 25° ±1°. Otherwise no further adjustment of rib angle is required.

Dummy part	Required setting
Head	Adjust the neck bracket to level the head at the closest position to 0° ±1°. No other seat adjustments are shall be made to achieve this.
Arms	At the first detent downward of the most upward detent corresponding to a differential angle of 32° between rib angle sensor and the arm angle.
Legs	Place the right foot on the undepressed accelerator pedal, with the heel as far forwards as allowable. Place left foot flat on the footwell at an equal distance from the seat centreline. 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. - No distance is specified for the knee spacing. However, priority should be given to ensure the following: - There is 5 mm clearance between the knees/legs and the steering shroud and centre console. - There is a stable foot and ankle position. - The legs are as parallel as possible to the sagittal plane.

2.3.3 Seat belt – all dummies

Adjust the seatbelt D-loop for the relevant occupant as detailed in the tables above, carefully place the seat belt across the dummy and lock as normal. It will be necessary to re-position the hands as described above.

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

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.

After following the above steps, the seatbelt should lie in a natural position across the dummy sternum assembly and shoulder clavicle. Where this is not the case, and the D-loop is adjustable, the anchorage shall be adjusted and steps above repeated. For example, an unnatural position would be where the belt is in contact with the neck, neck shield or above the shoulder rotation adjustment screw (Hybrid III series only),

The upper anchorage should be adjusted by a sufficient amount to ensure a natural belt position, this may require multiple attempts.

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.

Where the fitment of the shoulder belt loadcell significantly influences the natural position of the belt, the loadcell may be supported from above with the use of a weak non-metallic wire or thread.

2.3.4 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.

2.3.4.1 Driver dummy measurements.

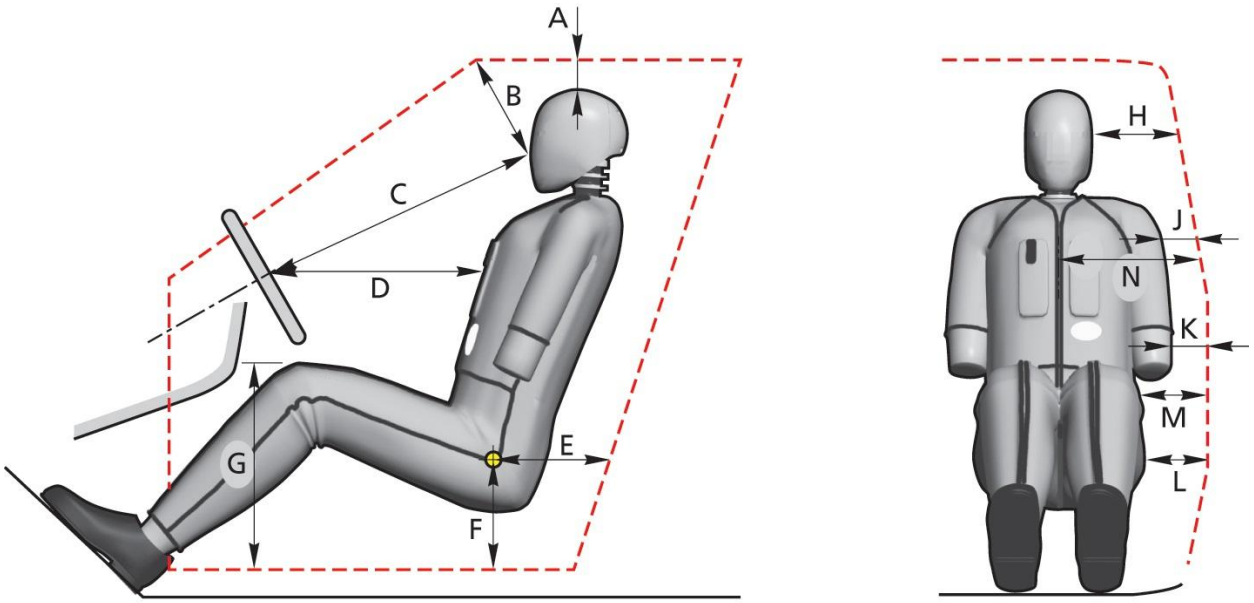


Figure 1: Driver dummy measurements – Note: Arm position NOT according to test setup.

Driver measurements	Description
A	Head/roof panel
B	Nose/windscreen joint
C	Nose/centre of the steering
D	Thorax strap/centre of the steering wheel centre (horizontal)
E	Hip-joint point/inside opening of the door (horizontal)
F	Hip-joint point/inside opening of the door (vertical)
	H-Point Co-ordinates (to vehicle reference)
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)
θ	Neck bracket angle

2.3.4.2 Passenger dummy measurements

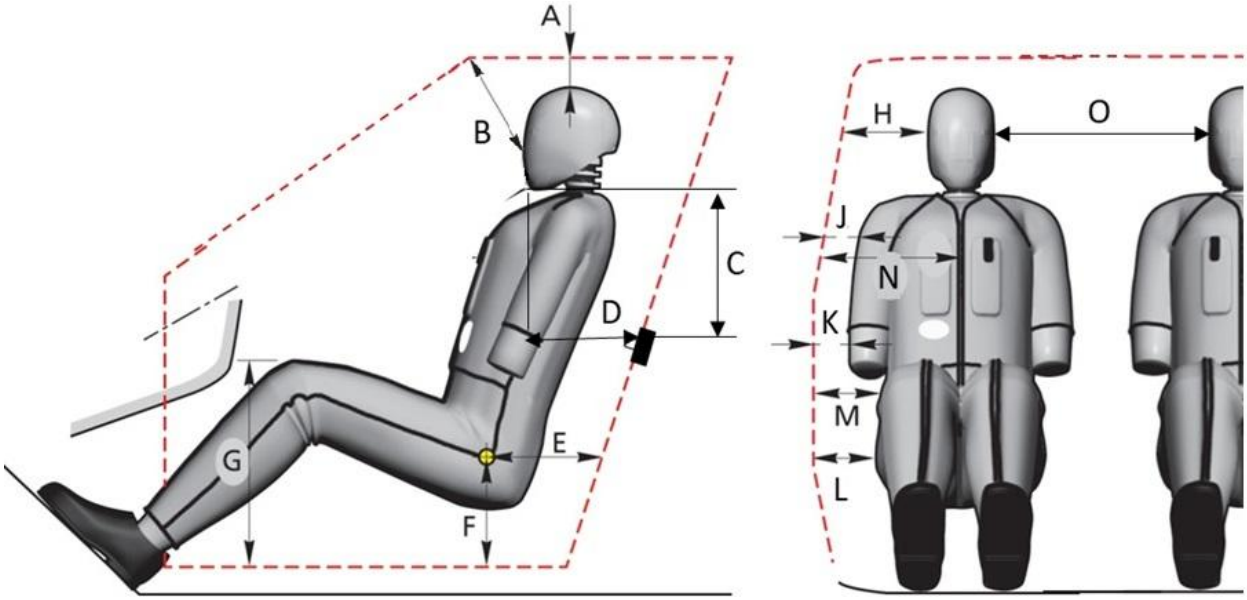


Figure 2: Driver dummy measurements

Passenger measurements	Description
A	Head/roof panel
B	Nose/windscreen joint
C	Chin/door hook plate top screw head (vertical)
D	Chin/door hook plate top screw head (horizontal)
E	Hip-joint point/inside opening of the door (horizontal)
F	Hip-joint point/inside opening of the door (vertical)
	H-Point Co-ordinates (to vehicle reference)
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)
O	Distance between CoG and impact line (horizontally)
θ	Neck bracket angle

2.4 CRS installation and child dummy placement

The use of additional belt guides, clips or other components that are not an integral part of the CRS is prohibited. Belt guides that are fitted to the vehicle must be permanently attached and information on their use must be contained in the vehicle handbook, where this is not the case they MUST NOT be used for testing.

2.4.1 Q10 dummy installation

Attach a foam pad of 125mm x 90mm with a thickness of 20mm ±2mm to the rear of the dummy pelvis, outside the suit, using tape to hold it in place. The pad shall be centred on the midsagittal plane with the upper edge at the same height as the top of the pelvis flesh. This pad shall remain on the dummy for the test unless it can be removed without the need to move the dummy. The foam pad shall have the following properties:

Density of 152-200kg/m^3

Compression deflection 25% of 89-118kPa

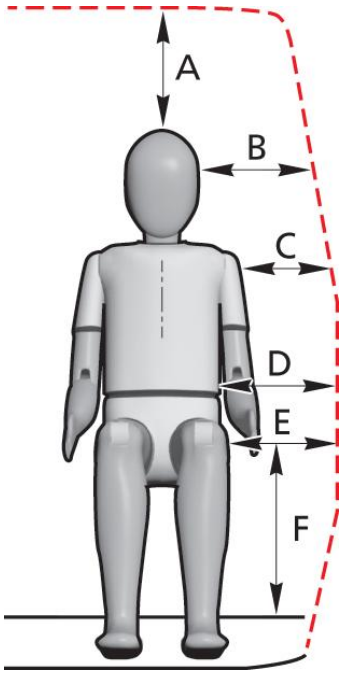
Dummy part	Required setting
Booster cushion	Place the booster cushion on the relevant seating position and mark the fore/aft position on the side of the CRS and vehicle. Align the CRS with the vehicle seat centreline and check that there is no interaction between the CRS and side door when it is closed. If there is interaction, the CRS may be moved inboard by up to 50mm. If an ISOFIX CRS is used no markings are needed, the CRS shall be aligned with the anchorages and engaged with the vehicle.
Q10 placement	Place the dummy on the CRS with both aligned to the seat centreline. Ensure that the suit has not moved in the gap between femur and hip by pulling the suit towards the knees. Buckle the seatbelt. If the buckle is not accessible because of interaction with the CRS, move the CRS and dummy outboards a little as possible (max 50mm) to get free access to the buckle. Remove the slack from the webbing but do not tighten the webbing. Realign the CRS with the marks on the vehicle seat. If the CRS cannot easily be aligned with the original marks due to the shape of the vehicle seat or position of the seat belt buckle, then re-mark the new lateral position of CRS relative to vehicle seat. Ensure that the rear of the CRS is in contact with the seat back by pressing the CRS backwards against the seat and making sure that the fore/aft markings are still aligned. Where applicable, place the hip shields on the Q10 dummy. Ensure that the distance between the hip shields is no less than 154mm. If needed, a larger gap should be used to establish the best fit.
Torso	Ensure that the dummy's lower back is in contact with the vehicle seat back by bending the dummy's back into an upright position and then rocking the dummy sideways while at the same time pushing the pelvis backwards. Ensure that the booster cushion is aligned with the new reference marks and that the dummy is on the centreline of the CRS and not rotated about the vertical axis.

Dummy part	Required setting
	Push the dummy's shoulders toward the seat back until either the shoulders contact the seat back or the head is in contact with the head restraint. The top of the rear head restraint shall be positioned within ±20mm of the top of the dummy head or in the nearest notch above. If the head restraint cannot be raised sufficiently to be within 20mm, put it in the highest position. Ensure that the dummy is sitting in an upright position and is aligned with the centreline marks on the head restraint (if applicable) or is parallel to the marks of the centreline. Ensure that the CRS position did not change relative to the marked position
Arms	The upper arm shall be positioned parallel to the chest. The measurements shall be taken on the neoprene suit along the front surface of the arm (bicep) and between the two IR-TRACCs on the chest. Position the lower arms parallel to the upper legs resting on the booster cushion or armrest as close as possible to the side of the femur. The elbows shall be kept as close as possible to the torso. Where possible, the tip of fingers should be in x-direction in line with the screws of the knee joint.
Legs	Position the femurs straight forward with a distance of 130mm ±5mm between the centres of the knees. If the CRS prevents this gap from being achieved, position the knees as close to the target values as possible. Where possible, allow the lower legs to rest naturally. The tibias shall be parallel to the vehicle centreline and the feet shall be separated by the same distance as the knees.
Seatbelt	Follow the CRS installation instructions when routing the seat belt and ensure that the belt is routed correctly through any necessary belt guides. Remove the slack of the lap belt by pulling on the diagonal belt near the buckle with a force of 150N. Ensure that the belt is not twisted in the guidance of the booster cushion. The belt shall initially be positioned over the IR-TRACC (upper for Q10) if possible, a load of 50N shall be applied to the diagonal section of the belt in towards the D-loop to achieve a natural and flat position across the chest. The belt may have moved away from the initial position, there is no need for further adjustment. The use of any non-permanent belt guides or clips on either the vehicle or CRS is prohibited. There must be no tape or stickers applied to the diagonal section of the adult belt.

Once the Q10 dummy has been correctly positioned, the two IR-TRACC holes shall be clearly marked on the suit of the dummy. See Section 2.5 for details on establishing if the vehicle qualifies as limited rear space.

2.4.2 Q10 dummy positioning measurements

The following measurements are to be carried out prior to test but after positioning procedures have been carried out.



Q10	
A	Top of head to roof (vertically)
B	Head CoG to door/window (horizontal)
C	Shoulder (pivot point) to door/window (horizontal)
D	Lower rib to door (horizontal)
E	Hip joint (femur mounting hole) to door (horizontal)
F	Hip joint (femur mounting hole) to floor (vertical)
α	Head angle (where fitted)
β	Pelvic angle (tilt sensor)

Figure 3: Q10 dummy measurements

2.4.3 Q6 dummy installation

Dummy part	Required setting
Booster seat	Follow the procedure for Q10 detailed above.
Q6 placement	Follow the procedure for Q10 detailed above. Where the rear head restraints interfere with the CRS, they should be repositioned as necessary to avoid this. They may only be removed if instructed to do so in the vehicle handbook.
Torso	Ensure that the dummy's upper back is in contact with the vehicle seat back if seated on a booster cushion or the back of the CRS if seated in a booster seat. This is done by bending the dummy's back into an upright position and then rocking the dummy sideways while at the same time pushing the pelvis backwards. Ensure that the CRS is aligned with the new reference marks and that the dummy is on the centreline of the CRS and not rotated about the vertical axis. Push the dummy's shoulders toward the seat back or CRS until either the shoulders contact the seat back or the booster seat back. Ensure that the dummy is sitting in an upright position and is aligned with the centreline marks on the head restraint (if applicable) or is parallel to the marks of the centreline. Ensure that the CRS position did not change relative to the marked position.

Dummy part	Required setting
Arms	The upper arm shall be positioned parallel to the chest. The measurements shall be taken on the neoprene suit along the front surface of the arm (bicep) and along the IR-TRACC on the chest. Position the lower arms parallel to the upper legs resting on the booster or armrest as close as possible to the side of the femur. The elbows shall be kept as close as possible to the torso.
Legs	Position the femurs straight forward with a distance of 150mm ±5mm between the centres of the knees. If the CRS prevents this gap from being achieved, position the knees as close to the target values as possible. Where possible, allow the lower legs to rest naturally. The tibias shall be parallel to the vehicle centreline and the feet shall be separated by the same distance as the knees.
Seatbelt	Ensure that the lap belt is routed through the belt guidance of the booster seat. Remove the slack of the lap belt by pulling on the diagonal belt near the buckle with a force of 150N. Route the diagonal belt through the belt guidance of the booster for boosters with high back. Ensure that the belt is not twisted in the guidance of the booster. The belt shall lie naturally across the chest and be allowed to sit as it falls. A load of 50N shall be applied to the diagonal section of the belt towards the D-loop to achieve a natural and flat belt position across the chest. The use of any non-permanent belt guides or clips on either the vehicle or CRS is prohibited. There shall be no tape or stickers applied to the diagonal section of the adult belt.

No dummy positioning measurements are taken for the Q6.

2.5 Determining limited rear space

In advance of test preparation, the OEM shall inform Euro NCAP and the test laboratory if they anticipate the vehicle qualifying for limited rear space assessment. See TB 018.

Reposition the front seat track 30mm forward of its test position. If there is no notch at this position, set the seat in the nearest notch forwards of 30mm. During repositioning, check for interaction between the Q dummy lower legs, feet and the front seat.

With the front seats 30mm forward, if there is no contact between the front of the dummy toes and the seat in front, it is acceptable for the top of the foot/toes to contact the underside of the front seat, reposition the front seats in their test positions. The interaction between the Q dummy lower legs, feet and the front seat is acceptable. Record the pelvic angle.

If there is contact between the dummy and the front seats when they are 30mm forward of their test position, follow the steps below to limit contact between dummy and front seat. This is not relevant if there is only contact between the top of the foot/toes and the underside of the front seat.

Try to reposition the feet and tibias by pushing them beneath the front seat or rotating the tibias about the Z axis. If this is not sufficient then move the pelvis of the dummy forwards while keeping the CRS in place until there is no contact with the seat in front. It is permitted to change the pelvic angle up to 5 degrees relative to the initial pelvic angle. This should be done in incremental steps until the contact between the toes and front seat is removed. It is acceptable for the top of the foot/toes to contact the underside of the front seat. Record the final pelvic angle.

When the dummy toes remain in contact with the front seat after repositioning the dummy as mentioned above, the vehicle will be treated as limited rear space for that particular test. It is acceptable for the top of the foot to contact the underside of the front seat.

The front seat must be returned to the test position.

3 TEST PROCEDURE

3.1 Summary

Loadcase	Occupant	Head	Chest	Abdomen	Pelvis	Total points
AE-MDB	Driver	2.50	2.50	2.50	2.50	**10**
	Rear passengers	Head 2.5 Neck 0.625	0.625	-	-	**5**
Pole	Driver	2.50	2.50	2.50	2.50	**10**
Far side	Sled	AE-MDB		2.0		**4**
		Pole		2.0		
	Occupant to occupant interaction	2		-		**2**
	Virtual testing	AE-MDB		2.0		**4**
		Pole		2.0		

Where no side curtain head protection systems are present, the pole test will not be performed and the points for that test set to zero.

3.2 Colour band scheme

Body region	Criterion		Green	Yellow	Orange	Brown	Red
	Limit value points		< HPL 100%	80%	40%	20%	> LPL 0%
Head & Neck	HIC_{15}	-					
	A_{res}-3ms	g					
	$F_{Z,tension}$	kN					
Chest	$D_{chest\ compression}$	mm					
	A_{res}-3ms	g					
Abdomen	$D_{abdomen\ compression}$	mm					
Pelvis	F_{pubis}	kN					

3.2.1 Prediction by OEM

The vehicle manufacturer may provide the Euro NCAP Secretariat with data detailing the protection offered by the vehicle, which may then be used in the vehicle rating. This data must be provided to the Euro NCAP Secretariat before any test preparation begins. In order for ANY predicted data to be used in the rating, all of the following requirements must be met:

Data is provided for ALL full-scale tests – MPDB, FWT, AE-MDB, Pole.

Data is provided for all applicable dummy assessment criteria detailed in Section 3.3.

Data is provided based on dummy performance without modifiers applied.

The predicted level of protection offered by the vehicle is verified by Euro NCAP with the use of the full-scale tests. The difference between the predicted data and that recorded in the official test must be within [25%] of the colour band width for each assessment criterion (LPL-HPL)/3.

Example: WorldSID 50th male, AE-MDB:

The predicted level of protection offered by the vehicle is verified by Euro NCAP with the use of the full-scale tests.

Body region	Criterion		Green	Yellow	Orange	Brown	Red
Chest & Abdomen	$D_{chest\ compression}$	mm	< 28	28.0 – 35.33	35.33 – 42.67	42.67 – 49.99	≥ 50.0
			OEM prediction	Test result = 28.0mm			
	Subsequent rating		With OEM prediction	Without OEM prediction			

When a measured dummy parameter performs better than predicted, but within the tolerance, the predicted result is used in the rating. When a measured dummy parameter performs worse than predicted and is outside the tolerance, the measured value shall be used in the rating. After the results comparison has been made, any modifiers identified will then be applied to the relevant body regions and test scores.

Where the OEM provides no predicted data or the data provided does not meet the requirements detailed above in this section, the vehicle rating shall be based on the measured results obtained in the official tests for ALL areas of the assessment.

3.3 Injury criteria and limits

3.3.1 Head & neck

Criterion		WorldSID 50th male	
		HPL - LPL	Capping
HIC_{15}	-	500 - 700	700
A_{res}-3ms	g	72 - 80	80
Direct contact with pole	-	-	Capping
Upper neck $F_{tension}$	kN	-	3.74 far side
Upper neck $M_{flexion}$ Mx MxOC	Nm	-	248 far side
Upper neck $M_{extension}$ negative MyOC	Nm	-	50 far side
Lower neck $F_{tension}$	kN	-	3.74 far side
Lower neck $M_{flexion}$ Mx base of neck	Nm	-	248 far side
Lower neck $M_{extension}$ negative My base of neck	Nm	-	100 far side

3.3.2 Chest

Criterion	WorldSID 50th male	
	HPL - LPL	Capping
$D_{compression}$	28 - 50	50 AE-MDB & far side 55 Pole

3.3.3 Abdomen

Criterion	WorldSID 50th male	
	HPL - LPL	Capping
$D_{compression}$	47 - 65	65

3.3.4 Pelvis

Criterion	WorldSID 50th male	
	HPL - LPL	Capping
$F_{pubic\ symphysis}$	1.7 – 2.8	2.8

3.3.5 Child occupants

Body region	Criteria		Q6	Q10	Capping
Head	HIC_{15}	-	500 - 700	500 - 700	800
	A_{res}-3ms	g	60 - 80	80	80
Neck	$F_{Z,tension}$	kN	2.4	2.2	-
Chest	A_{res}-3ms	g	67	67	-

Chest acceleration peaks caused by the firing of seatbelt pretensioners early in the loading event will be ignored.

3.3.6 Far side occupant protection

Sled test

Head excursion	Capping	Red		Orange	Yellow	Green
		≤125mm	>125mm			
With countermeasure	0	0.5	1	1.5	2	2
Without countermeasure		0	0	0.5	1	2

In case of head excursion in the Capping Zone, both far side tests are capped.

VTC robustness simulations

In addition to the far side occupant sled tests, the robustness will be evaluated using different seating positions as detailed in the VTC Protocol.

Robustness is proven if head excursion in all cases differs by no more than one colour boundary as detailed below.

Head excursion				
Sled test	Red	Orange	Yellow	Green
Simulations	Red	< red line	Orange	Yellow

3.4 AE-MDB

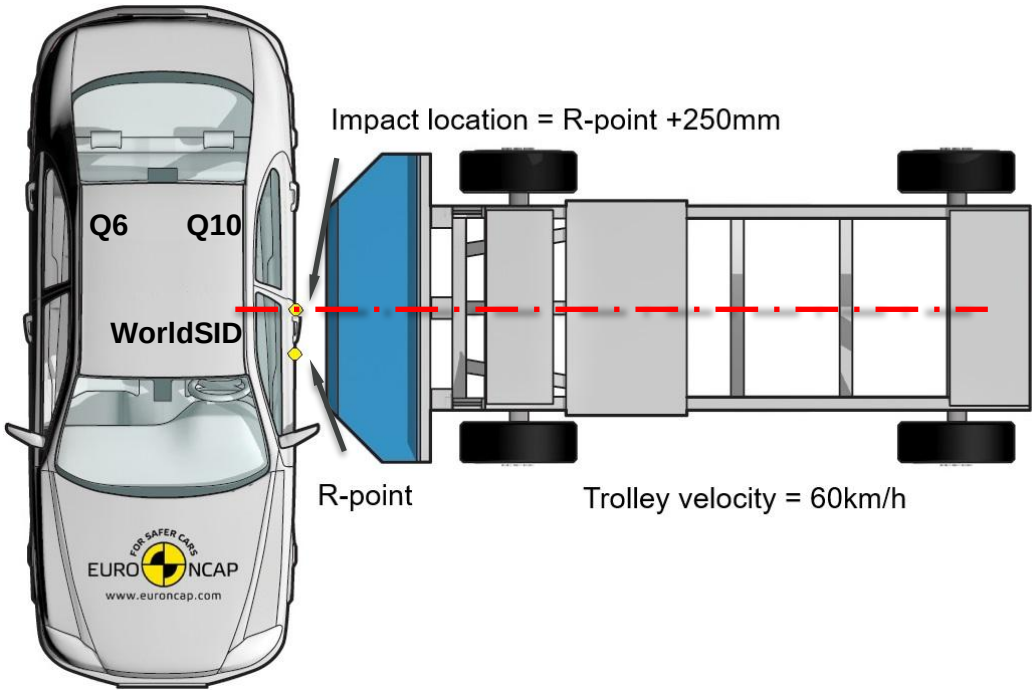


Figure 4 AE-MDB test – Drawing to be provided

3.5 Pole

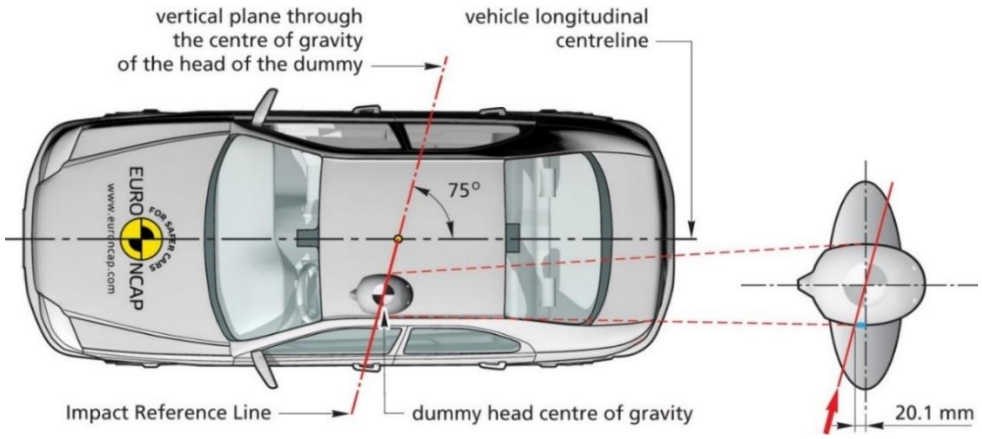


Figure 5 Pole impact reference line

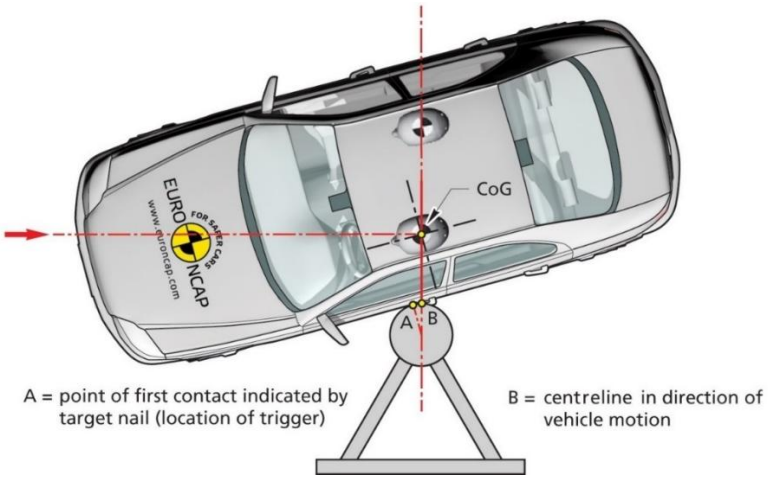


Figure 6 Pole impact location

During the acceleration phase of the test, the acceleration of the carrier shall not exceed 1.5m/s^2.

3.6 Far side

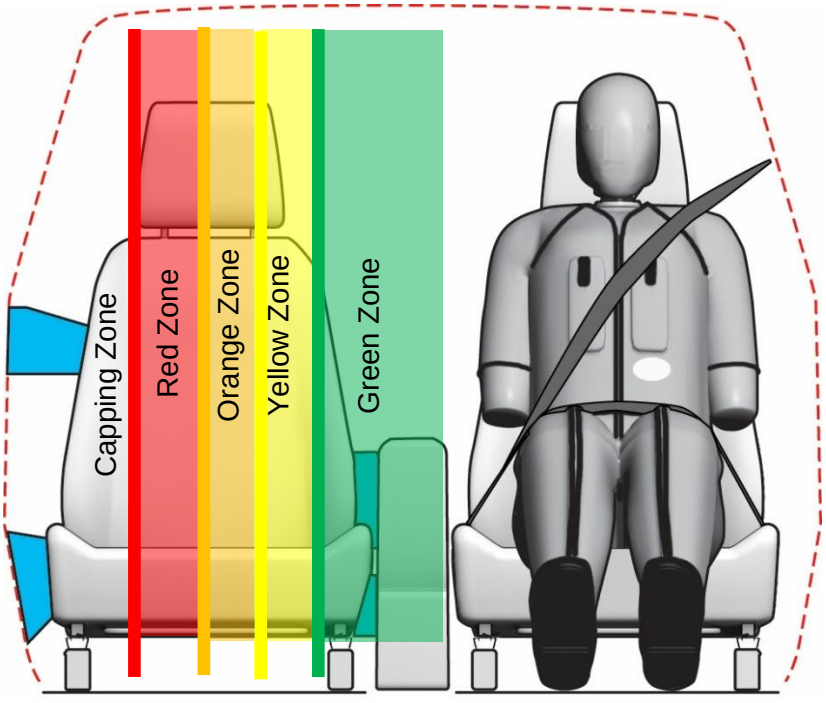


Figure 7: Head excursion zones

3.6.1 Occupant to occupant protection – pole test

Where a vehicle is equipped with a countermeasure against occupant to occupant contact, its efficacy will need to be demonstrated in the official Euro NCAP pole impact test with the use of two mid-sized WorldSIDs. The requirements are detailed see Section 4.1.4.

If the OEM can demonstrate that the presence of the passenger in the dual occupancy pole test will influence the results of the nearside driver, the OEM may sponsor an additional single occupant pole test to rate the near-side pole impact performance.

Where a vehicle is NOT equipped with a countermeasure against occupant to occupant contact, no points shall be awarded.

3.6.2 Far side VTC

The far side Virtual Testing Crashworthiness (VTC) simulation data must be supplied in advance of the physical AE-MDB and pole impact far side sled testing, refer to the VTC Simulation and Assessment Protocol for further details. When the simulation data has been approved, a unique far side test reference number will be provided to the vehicle manufacturer by Euro NCAP. This number must be placed physically on the sled/vehicle and visible all videos, photos and referenced in the .mme file.

3.6.3 Far side occupant sled tests

The far side occupant sled test data shall be supplied to Euro NCAP by the vehicle manufacturer prior to the official full scale crash tests. Far side test data will only be accepted in the form of physical sled tests; full scale tests and CAE data will not be accepted.

In house test vehicle variants may differ slightly from the official model tested by Euro NCAP e.g. engine etc. This is so that testing can be performed in advance of the official Euro NCAP tests. Vehicles with three positions on the front row will be assessed in the outboard positions, 1 and 3, only.

3.6.3.1 Prerequisites

Any of the following post-test conditions identified in either the full-scale AE-MDB or pole tests will disqualify the vehicle from any rewards in far side occupant protection.

a. Structural failure of the door; it’s attachments to the body, the roof/cant rail and sill.
b. Detachment of door latches/hinges, fully opened doors or structural failures of the roof/cant rail and sill.
c. Failure of restraint system failures that are intended for far side occupant protection. For example, incorrect deployment of centre (occupant to occupant) airbags.
d. Where the total score for the driver in the AE-MDB and pole impacts is below 17.0 points out of 20.

3.6.3.2 Sled test setup

For the purpose of this assessment, the ‘far side occupant’ is on the driver’s side of the vehicle which is also the non-struck side. The struck side is the passenger’s side of the vehicle. The assessment shall be performed on the specification of equipment fitted to the bestselling variant. This includes, but is not limited to, the transmission, front seats, restraints and interior trim/centre console. The seats of the bestselling variant (as per AE-MDB and pole impacts) will be used in the ‘body in white’ BIW. All features which may influence occupant kinematics and protection must be installed in the BIW.

Deceleration sleds may be permitted provided that clear evidence is given showing that the dummy remains in the initial position and that the duration of the pulse is as long as the vehicle pulse observed in the official tests.

The BIW may be either a right or left-hand drive vehicle and shall be mounted with the centreline at 75º ±3º towards the direction of travel. A BIW that is of a pre-production state will be accepted if it is shown to be representative of series production and that any differences have no influence on the far side assessment.

The bodyshell shall be mounted on the sled such that there will be no permanent deformation of the body or its mounts during the tests. Struck side intrusion will not be replicated on the BIW and neither driver nor passenger doors are required.

Structures forward of the A-pillar and windscreen cowl but rearward of the B-pillar may be removed from the BIW as long as the stability is not compromised. Reinforcement of the BIW is recommended but not required provided the BIW is sufficiently stable.

To ensure a clear view of dummy kinematics, fixed roofs above the front row seats shall be cut away between the cant rails and rearwards of the windscreen surround. Reinforcement shall subsequently be applied laterally across the BIW. Vehicles with removable roofs, panels or movable sunshine roofs shall be tested without the roof or with them in the open position. The windscreen shall be removed and sufficient reinforcement around the frame/periphery shall be provided.

Sufficient spacers shall be fitted in the gaps between the struck side (B-pillar or other structure) and passenger seat frame, the passenger seat frame and centre console to stabilise the front passenger seat. This represents the behaviour of the struck side seat and centre console due to crash induced intrusion and deformation. The spacer shall support the full height of the centre console but does not need to be made from a single piece of foam. It will be necessary to cut the seat cover and foam to access the frame, an example how this can be done is shown in the picture below. The spacers shall have the stiffness characteristics from expanded polypropylene (EPP60) or stiffer with compression properties of about 340KPa for 25% of compression (determined according to ISO 844).

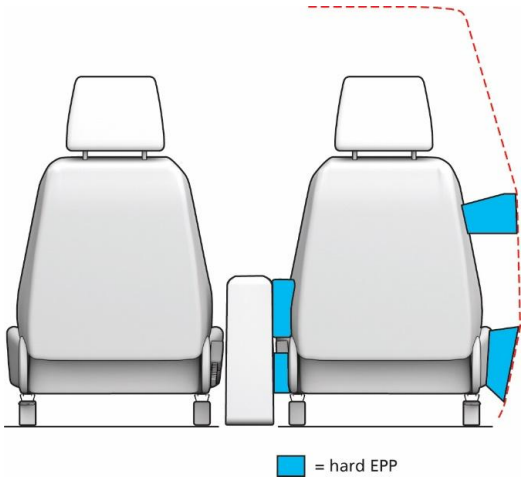


Figure 8: Seat spacers viewed from rear

Interior components required for testing will include, but are not limited to:

a. Driver and passenger front seats.
b. Full tunnel/centre console components consisting of the full tunnel trim, hand brake assembly, gear lever assembly and storage compartments.
c. Full facia assembly consisting of the facia, steering column and steering wheel. Infotainment systems may be omitted if appropriate.
d. Seat belt/pretensioner and anchorage attachments.
e. Struck side internal door trim assembly (if doors installed).

If fitted, the struck side door trim shall be painted white (or similar) to contrast with the passenger's seat. The head restraint on the unoccupied seat may be removed in order to get a better view of the grid board and excursion lines.

3.6.3.3 Active restraints

Active restraint systems shall be standard equipment and identical to those used in the Euro NCAP full scale tests. Pretensioners must be triggered if the firing strategy is such that they are triggered in the side and pole impact tests. Triggering of pretensioners will be accepted on the sled if the difference in deployment time from the official tests is no greater than +/-2ms. Where the difference is greater than 2ms, data must be supplied showing that this did not affect the result. Where there is a different firing strategy between near side and far side occupants, the OEM will have to provide justification in the far side dossier.

Triggering of other active restraints, such as the side curtain and seat mounted airbags, will not be permitted unless it can be shown that these systems have been designed as a countermeasure intended to lower the risk of far side occupant injury. For example, a head curtain airbag that extends beneath the door level, or a seat mounted airbag that can remain sufficiently inflated for the required length of time to limit occupant excursion.

3.6.3.4 Body in white markings

Th test reference number must be placed physically on the sled/vehicle and visible all videos. A chequered or similar grid measuring 50x50mm shall be rigidly mounted to the BIW directly behind, but not attached to the front seats in a way that does not result in interference during the test.

Four vertical and parallel excursion lines will be marked in the BIW for both sled test scenarios. The most inboard edge of each line shall be used as the excursion limit. All markings must be extended onto the chequered grid board positioned behind the front seats, the vehicle roof beam and facia.

Excursion line	Description
Red - Maximum intrusion	This line is marking the maximum post-test intruding point of the interior door panel from AE-MDB (60km/h) and 75º pole impacts respectively. The method to determine the maximum deformation is detailed in TB 046. Peak intrusion values will be compared to those observed in the official tests. The OEM shall provide details of the measurement point used for establishing the intrusion lines. Where the red line is further inboard than any of the other excursion lines, those lines will not be marked on the BIW.
Orange – Excursion limit	Struck side seat centreline, pre-test, without intrusion.
Yellow – Excursion limit	125mm inboard of the struck side seat centreline.
Green – Occupant interaction limit	250mm inboard from the struck side seat centreline
Blue – Vehicle centreline	Y=0

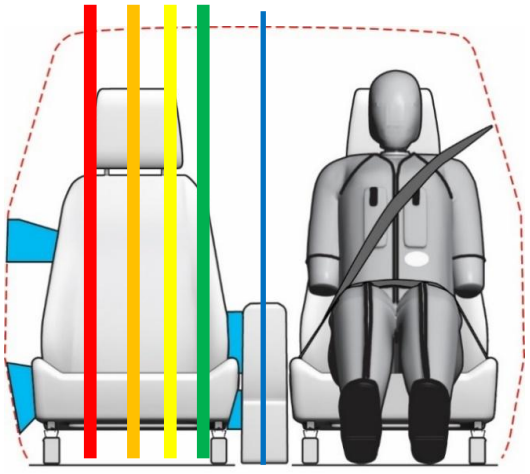


Figure 9: Excursion lines to be attached to sled

3.6.3.5 Sled tests

Two sled tests are required for the physical evaluation of far side occupant excursion. The suitability of the correlation between the vehicle and sled pulses will be checked according to the method detailed in TB 056.

Pulse	Description
60km/h AE-MDB	Representative non-struck side B-pillar base CFC60
32km/h 75º oblique pole	Representative non-struck side B-pillar base CFC60

The OEM shall specify the accelerometer location to be used in the official full-scale tests to ensure similar positioning.

The sled pulse shall be a scaled B-pillar pulse as measured in the AE-MDB test and pole test due to the angled test sled set-up. To ensure a similar B-pillar pulse between the full scale and sled tests the following scaling is applied:

$$A_{X,SLED} = A_{Y,VEHICLE(AE\text{-}MDB)} \times 1.035$$

$$A_{X,SLED} = A_{Y,VEHICLE(POLE)} \times 1.035$$

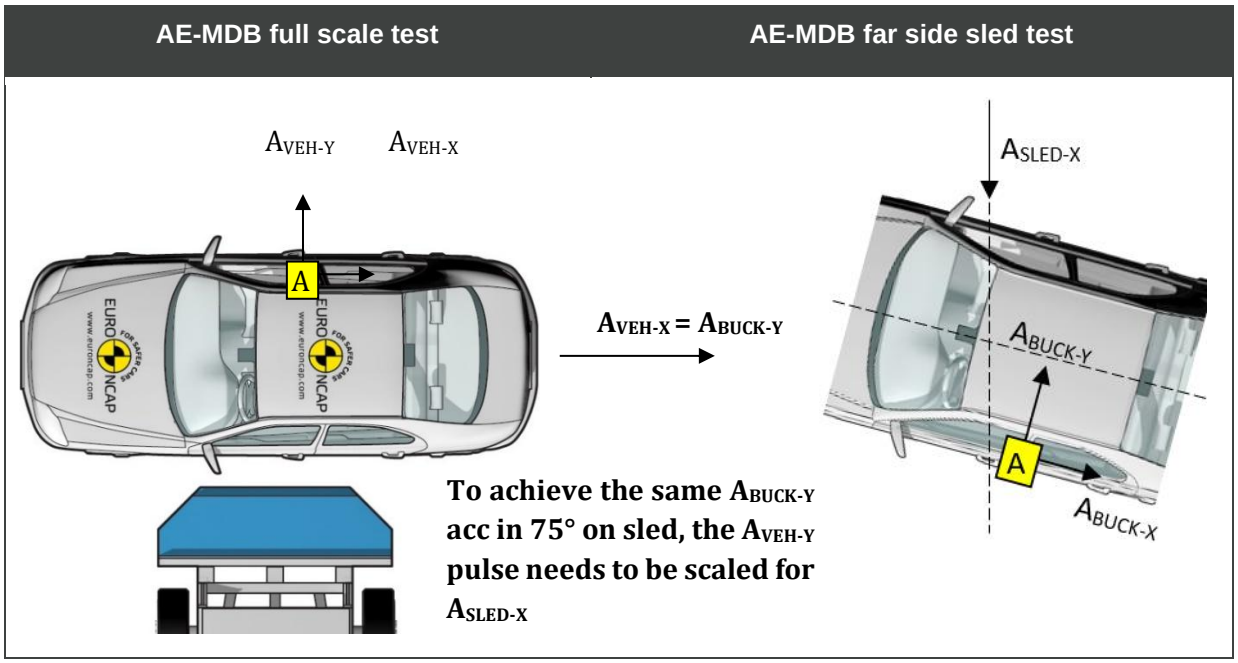


Figure 10: Sled pulse scaling

3.6.3.6 Dummy and instrumentation

The WorldSID 50th percentile male test dummy shall be used conforming to the specification detailed in Technical Bulletin TB 051.

Data processing shall be in accordance with Technical Bulletin 021. APPENDIX A details all channels required, both measured from hardware test and calculated.

Dummy umbilical routing must not affect the kinematics of the dummy. Additional channels may be recorded. In-dummy data acquisition system is recommended and in case of 45 or more channels it is required. All lower neck load data is to be supplied, lower neck Mx and My loads moments shall be corrected according to the correction factor in SAE J1733, detailed in Technical Bulletin TB 021.

3.6.3.7 Sled Instrumentation

Location	Parameter	CAC
B-pillar, non-struck side	Acceleration, A_x, A_y	150g
Sled	Acceleration, A_x	150g
Driver Seatbelt Shoulder and Lap* Sections	Force, $F_{diagonal,}$ F_{lap}	16kN

* Care must be taken to position the lap belt transducer outboard of the dummy so that it does not interfere with the dummy/interior during the impact.

3.6.3.8 Passenger compartment adjustments

Passenger compartment adjustments used in the BIW will be as per the relevant passenger compartment adjustments detailed in Section 2.2. The driver and passenger seat fore/aft and seat back angles shall be positioned identically. Where a vehicle has different seat travel between the driver and passenger side, the passenger seat travel will be positioned as close as possible to that of the driver and the seat back angle will also be the same as that of the driver.

Any arm-rests or centre console compartments shall be positioned to limit interaction with the dummy and maximise lateral excursion. See TB 028. Vehicles equipped with adjustable arm-rests on the seat back will have them positioned in the ‘not in use’ ‘up-folded’ position aligned with the seat back. Vehicles equipped with adjustable arm rests as part of the centre console will have them positioned fully down and fully retracted. The lid of any arm rest/storage compartment shall be closed.

Parts that can be removed from the centre console assembly must be present for the test provided they are equipped on the specification of vehicle tested by Euro NCAP.

The parking brake shall be in the disengaged position and the gear lever in D or in a gear position.

3.6.3.9 Driver dummy positioning

The dummy shall be installed on the driver's seat (non-struck side) in accordance with the H-point manikin and dummy positioning procedures detailed in Section 2.3.

3.6.3.10 Dummy painting & Markings

The WorldSID 50th percentile male test dummy shall be painted in accordance with Technical Bulletin TB 051.

The dummy shall have two markers at the front of the dummy head for video analysis, they shall be positioned on the head front mould split line at:

Centre of Gravity

100mm below Centre of Gravity

3.6.3.11 Pre-test measurements

To ensure repeatability of dummy seating & positioning, take detailed static 3D measurements as detailed in Section 2.3.4.1. Additionally, the locations of the WorldSID in the table below shall be taken prior to the physical test tests. These are to be used as a reference for comparison with the initial posture and position of the CAE dummy. A suitable origin for the CMM measurements is needed (e.g. door striker) and shall be specified by the vehicle manufacturer. See APPENDIX B for further information.

Measurement location	Description	Coordinates
Head CoG	Head skin outboard marking	X, Y, Z
Head	Tilt angle sensor	1 dimension
Neck bracket	Corner front	X, Y, Z
Neck bracket	Corner rear	X, Y, Z
Shoulder	Screw centre	X, Y, Z
Arm	Tip of foam centre	X, Y, Z
Arm	Upper arm angle	1 dimension
Thorax	Tilt angle sensor	1 dimension
H-point		X, Y, Z
Pelvis	Tilt angle sensor	1 dimension
Femur	Centreline of clevis	X, Y, Z
Femur	Angle	1 dimension

Measurement location	Description	Coordinates
Knee	Joint screw centre	X, Y, Z
Ankle	Screw centre	X, Y, Z
Head restraint	Hole	X, Y, Z
Seatback	Angle (OEM location)	1 dimension
Seatbelt	Upper belt edge at dummy centreline	X, Y, Z

3.6.3.12 Photographic record

Insufficient high speed or still photography could result in the data not being accepted by the Euro NCAP Secretariat. High speed film and post test still photography requirements are detailed in the Euro NCAP Film and Photo Protocol.

It is essential that the onboard cameras are attached to the sled in a way that minimises relative motion during the test. Sufficient lighting must also be provided to ensure that the maximum head excursion can be clearly seen on the high-speed film.

Two cameras must be positioned either side of the zone in which the head excursion is anticipated. For example, if the excursion is expected in the orange zone, cameras 2 & 3 will be the minimum required, camera 6 would be placed on the orange line. Where the camera positions are overlapping, the highest priority regarding camera positioning should be given to camera 1, but camera 2 is still required.

3.6.3.13 Data processing and reporting

Data processing and assessment criteria calculation shall be supplied to Euro NCAP in ISO-MME format in accordance with Technical Bulletin 021.

The key deliverables are as follows:

- Summary dossier
- Reference pulse data in ISO MME format
- B-pillar accelerometer position details
- BIW & test set-up data
- H-point and head CoG measurement and comparison with full scale test
- Restraint system time to fire and comparison with full scale test
- All sensor outputs in ISO MME format
- All sensor curves plotted in a single PDF file (sled and ATD)
- Photography, detailed in Film and Photo Protocol
- All excursion line measurements relative to vehicle centreline (in Y axis)
- Details of peak intrusion measurement location and photograph

3.7 Virtual testing and sled

See the Euro NCAP VTC Simulation and Assessment Protocol for details.

4 POSTTEST ASSESSMENT & INSPECTION

4.1 After test

Immediately after the test, 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.

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.

Refer to the Euro NCAP Post Crash protocol for further details of all posttest assessments and provide all required information in a Post crash report.

4.1.1 Dummy removal

Before dummy removal, refer to the Post Crash protocol for seat belt buckle unlatching.

Do not move the driver or passenger seats, try to remove the dummies. If the dummies cannot be removed with the seats in their original positions, recline the seat back and try again. Note any entrapment of the dummies. If the dummies can still not be removed, try to slide the seats rewards on their runners. If the dummies can still not be moved, the seats may be cut out of the car.

4.1.2 Rollover

Rollover requirements	
Triggering of HPD	The vehicle manufacturer must provide evidence showing that the vehicle can both sense rollover and that the side curtain HPD is deployed as a result. Functionality of rollover triggering shall be demonstrated with a full scale rollover test which may be selected by the OEM.
HPD inflation	During the HPD measurements detailed in Section 4.1.3, the laboratory will check that the deployed curtain airbag remains inflated and maintains sufficient pressure to provide head impact protection. Functionality of rollover countermeasures may also be demonstrated with one of the following: HPD internal pressure retention of 50% for a minimum of 6 seconds – C-NCAP Appendix J.3. Data must include pressure vs time output. Compliance with FMVSS 226.

Both of the above requirement must be met in order to receive rewards for rollover protection, no partial rewards will be given. Where the HPD attracts the incorrect airbag deployment modifier in either the AE-MDB or pole impact tests, no rewards will be given for rollover protection.

Vehicles with asymmetric curtain HPDs will be required to demonstrate protection on both side of the vehicle in order to gain rollover rewards.

4.1.3 Side head protection airbag evaluation (HPD)

HPD requirements	
Coverage area	Vehicles equipped with side impact, head protection devices (HPD) curtain, seat mounted or any other, will have the inflated energy absorbing areas evaluated by means of a geometric assessment. The HPD must provide protection for a range of occupant sizes in both the front and the rear seat rows on both sides of the vehicle. If the vehicle is equipped with movable rear seats the seat shall be set to the most rearward position. If there is a third row of fixed seats, these will be included in the assessment unless they are per manufacturers' recommendation not suitable for adult occupation (handbook). The coverage area is detailed in Section 4.1.3.1.
Symmetrical protection	Where the airbags differ between the left and right hand sides of the vehicle, the airbags on both sides of the vehicle will be evaluated and the assessment will be based upon worst performing side. All areas of the airbag, both front and rear, will be evaluated and the assessment will be based upon the worst performing part of any of the airbags.
Exclusions	The head protecting airbags should cover all glazed areas within the defined zone up to the edge of door daylight opening (FMVSS201) where it meets the roofline, B-pillar, C-pillar and door waistline. Seams in the airbag will not be penalised provided that the un-inflated area is no wider than 15mm. Any other areas where the airbag layers are connected will not be penalised provided that the surrounding areas are inflated, and any un-inflated areas are no larger than 50mm in diameter or equivalent area or the sum of the major and minor axes of individual areas does not exceed 100mm. In the case that the un-inflated area would be larger than described above, the OEM shall provide data to demonstrate sufficient energy absorption is guaranteed. Where a vehicle is fitted with a third row of seats where the full seat assembly can be moved/stowed into the floor, the third row (only) will be excluded from the assessment. Seats with only folding seatbacks are NOT exempt.

All of the above requirements must be met in order to gain any rewards for HPD protection, no partial rewards are given.

Where a vehicle does not offer sufficient protection, a penalty of -2 points, -1 for front and -1 for rear rows, shall be applied to the overall pole impact score. Any vehicle that does not provide a head protection device covering the front and rear seat positions on both sides of the vehicle will also attract this modifier.

4.1.3.1 Side head protection device evaluation

Using the location of the H-point as measured in Section 2.3 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:

4.1.3.2 5th female Head CoG:

$X_{CoG,5th}$ = H-point(X) + 126 - seat travel 5th-50th
$Z_{CoG,5th}$ = H-point(Z) + 594

4.1.3.3 95th male Head CoG:

$X_{CoG,95th}$ = H-point(X) + 147 + seat travel 50^{th}-95^{th}
$Z_{CoG,95th}$ = H-point(Z) + 693

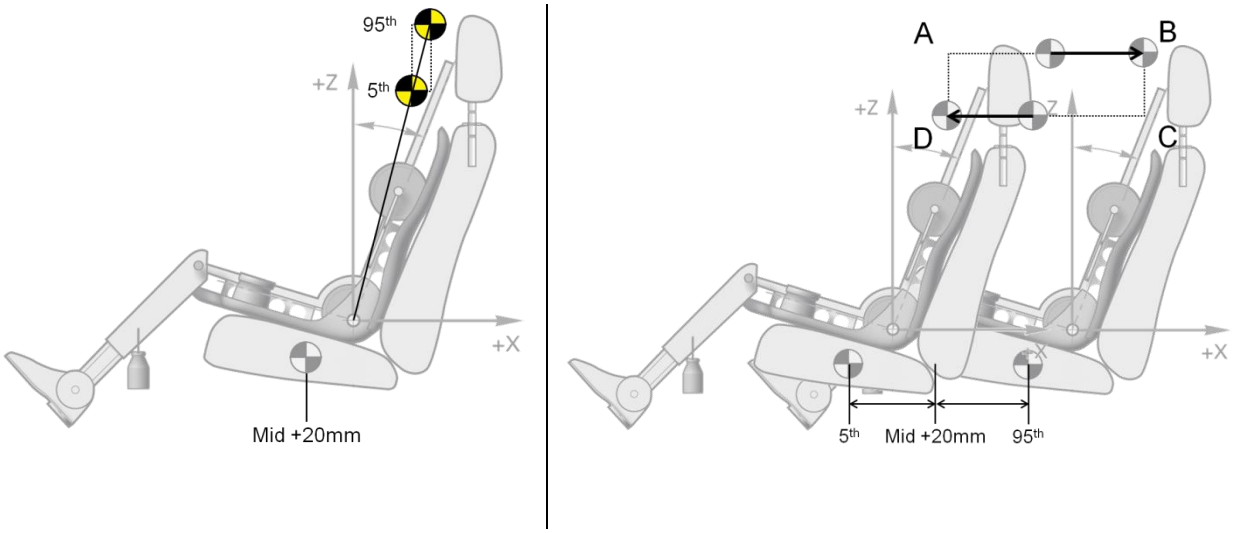


Figure 11: HPD zone front seat row

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	$X_{CoG,5th}$	$Z_{CoG,5th}$

The seat travel for the 5th and 95th positions will be required from the vehicle manufacturer in Technical Bulletin TB 018 but verified by the laboratory. Where differences exist, the worst case seat positions shall be used.

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, see Figure 12:

4.1.3.4 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

4.1.3.5 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

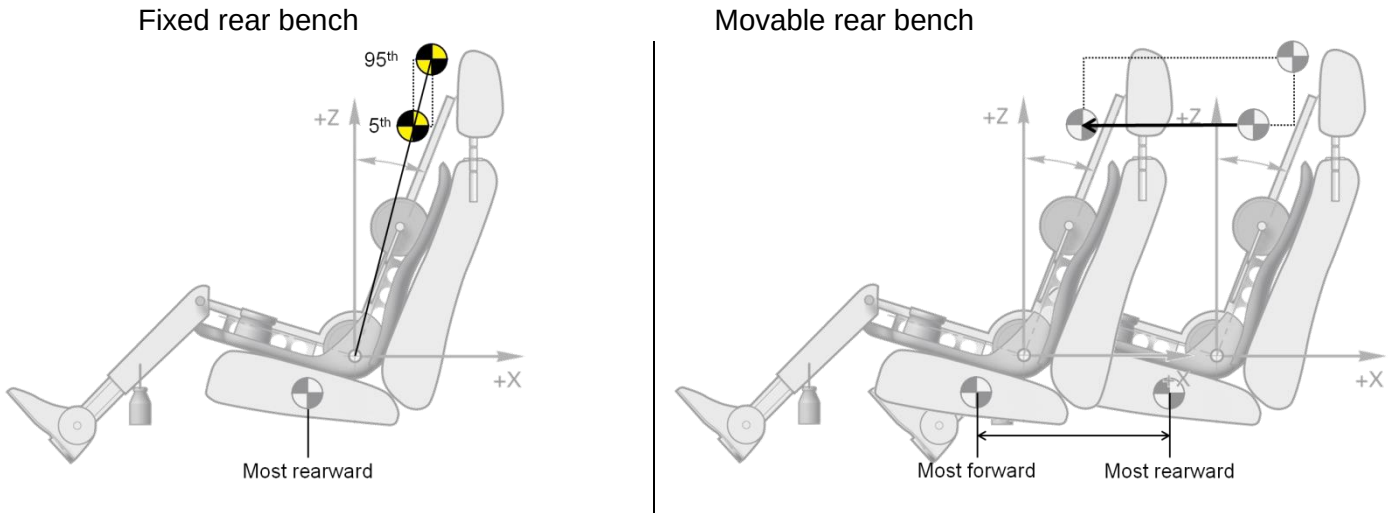


Figure 12: HPD zone rear seat row(s)

The side curtain 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. The zone shall be constructed parallel and perpendicular to the ground reference level, see Figure 13.

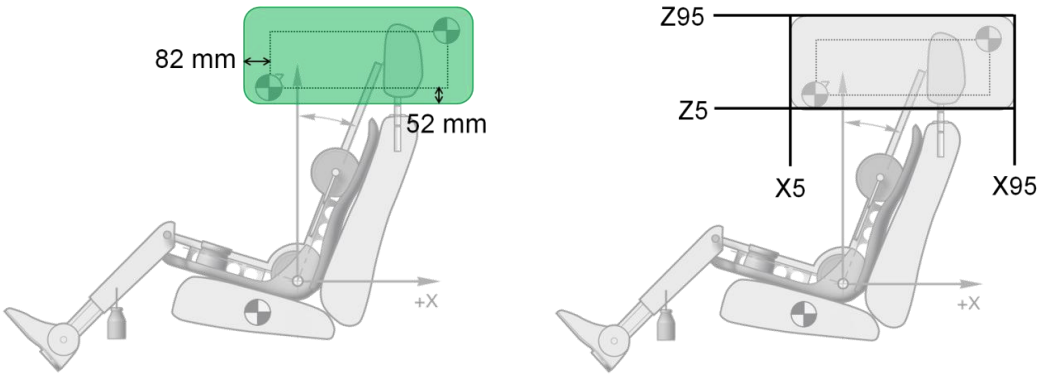


Figure 13: HPD assessment zone

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.

Inflate the airbag to the pressure recommended by the OEM.

Project the assessment zone onto the inflated airbag for front and rear seating positions using the measurements marked/recorded above.

Seat mounted head protection devices

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.

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

Evaluate coverage area of the airbag(s), record and check the dimensions of any joined, stitched or seamed areas, see Figure 14.

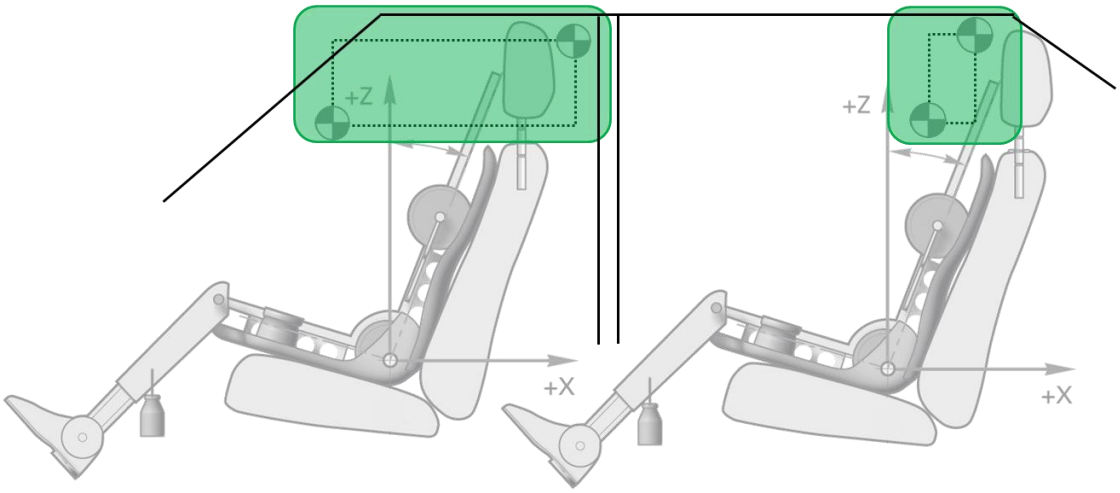


Figure 14: HPD assessment zones

4.1.4 Occupant to occupant protection

Dual occupancy test requirements	
No occupant to occupant interaction	The heads of both the driver and passenger dummies will be evaluated. Upper neck and shoulder forces for both dummies must be reported. Interaction will be determined from the high-speed film with either evidence of direct contact or where the head lower performance limits (HIC & 3ms) are exceeded. Any direct contact between the far side occupant's head and any part of the nearside occupant will be assessed regardless of whether the limits in Section 3.5 have been exceeded or not. For example, if an inflatable countermeasure allows the far side occupant's head to contact the driver, the peak resultant acceleration trace and/or the high-speed film will be used to identify head contact.
Symmetrical protection	Countermeasures must offer equivalent levels of protection in dual occupancy scenarios regardless of which side of the vehicle is impacted. Where a countermeasure is asymmetric, the OEM must provide evidence to show that it provides protection when impacted on both sides. The following methods are permitted: A full scale, dual occupancy test impacting the passenger side of the vehicle Numerical simulations. In both cases, the front row of seat shall be positioned to that of the AE-MDB test. The HCz assessment window is not applied in this case.
Robustness head coverage zone (HCZ)	A countermeasure against occupant interaction must be able to protect a range of occupant sizes in different seating positions. Regardless of which dual occupancy test is performed, the coverage zone must be demonstrated in the zone defined as follows:

	Protection must be provided in a rounded rectangular area between the passenger head CoG in the dual occupancy pole test position and forwards up to the driver pole impact test position plus an additional 82mm border front and rear (half head diameter). In the vertical direction, the zone is 120mm upwards and downwards of the CoG. See Figure 15. The following shall be noted: a) Where countermeasures utilise inflatable systems, the protection zone is measured on a flattened countermeasure using the passenger's head paint mark on the countermeasure from the dual occupancy pole impact test. This will be evaluated during the vehicle inspection. b) It may be necessary to measure the coverage area using an inflated airbag. For example, using a flattened airbag may not be suitable if the shape/orientation of the inflated area cannot be flattened. This will be evaluated during the vehicle inspection. c) In some cases, the countermeasure may offer protection in the requested zone without fully or partially covering the protection zone. In this case, the robustness of occupant to occupant interaction avoidance in the requested protection zone must be clearly demonstrated to Euro NCAP by the manufacturer. This must be done with in house, full scale test data from an equivalent occupant to occupant pole test where the passenger seat is in the same position as that of the driver. A different test set-up may be necessary to show that the systems works for different statures within the protection zone, e.g. a higher or lower seat position.

All of the above requirements must be met in order to gain any rewards for O2O protection, no partial rewards are given.

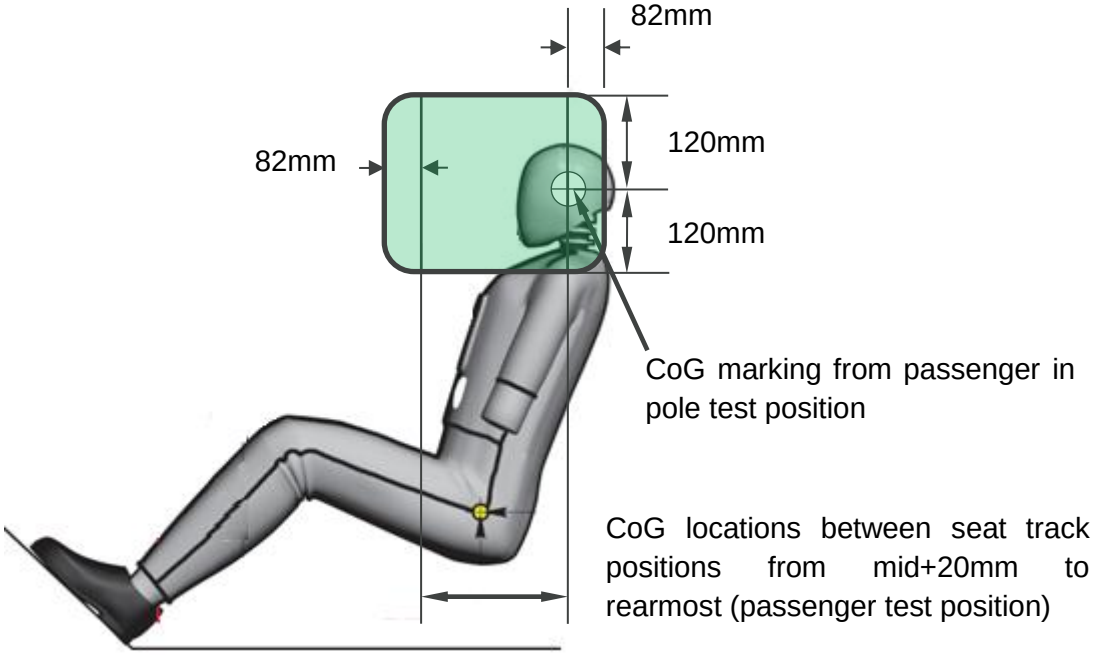


Figure 15: Far side protection zone

4.2 Inspection

After the test, Euro NCAP will perform a vehicle inspection where scoring modifiers can be applied. The inspection manual describes the inspection procedure and the criteria applied.

4.2.1 AE-MDB & Pole modifiers

Front Occupant	Modifiers	Criterion	Modifier score
Head & neck	Direct contact with pole	Inspection	capping
	DAMAGE	DAMAGE ≥ [0.47]	-1
	Incorrect airbag deployment	Inspection	-0.5
Chest	Shoulder load	≥ 3.0kN	-2.5
	Viscous Criterion	≥ 1.0m/s	-2.5
	Incorrect airbag deployment	Inspection	-0.5
Abdomen	Viscous Criterion	≥ 1.0m/s	-2.5
	Incorrect airbag deployment	Inspection	-0.5
Pelvis	Incorrect airbag deployment	Inspection	-0.5

Rear occupants	Modifiers	Criterion	Modifier score
Q10 Head	Curtain airbag bottoming out	Inspection	-0.25
Q6 & Q10	Ejection	Inspection	-2.5
Q6 & Q10	CRS to vehicle attachment	Inspection	-2.5

Test penalties	Modifiers	Criterion	Modifier score
HPD – applied to pole impact test score only	Curtain airbag measurement	Zone measurement	-1 per row
Rollover – applied to pole impact test score only	Curtain airbag inflation or no rollover sensing	Inspection	-2.0
Restraint failure	Non-deployment	Inspection	-0.5
Door opening		Inspection	-0.5
Door detachment	Structural detachment	Inspection	-2.5

4.2.2 Far side occupant modifiers

Front Occupant	Modifiers	Criterion	Modifier score
Pelvis	$F_{pubic\ symphysis}$	2.8kN	-2
	$F_{y\ lumbar}$	2.0kN	-2
	$F_{z\ lumbar}$	3.5kN	-2
	$M_{y\ lumbar}$	120Nm	-2

4.3 Scoring and visualisation

The scores for each occupant and body region are calculated individually.

The protection provided for adults for each body region are presented visually, using coloured segments within body outlines. The colour used is based on the points awarded for that body region and rounded to three decimal places, as follows:

Colour	Performance	Criterion score
Green	Good	100%
Yellow	Adequate	66.67% ≤ score < 100%
Orange	Marginal	33.33% ≤ score < 66.67%
Brown	Weak	0% < score < 33.33%
Red	Poor	0%

APPENDIX A

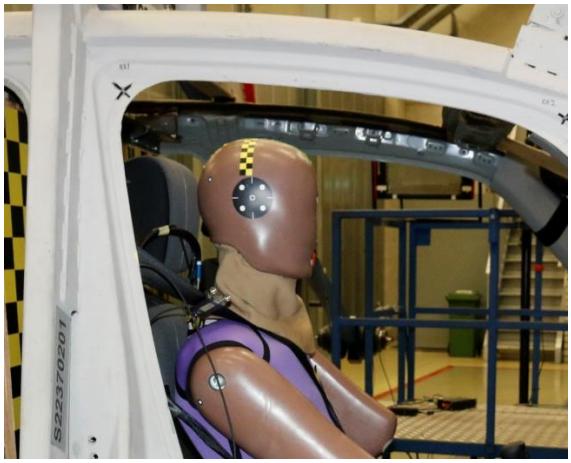
1. Far side sled test - Required channels

Location	Parameter	Axis	ISO Code
Head CoG	Angular velocities	x	1?HEAD0000WSAVX0
		y	1?HEAD0000WSAVY0
		z	1?HEAD0000WSAVZ0
	Accelerations	x	1?HEAD0000WSACX0
		y	1?HEAD0000WSACY0
		z	1?HEAD0000WSACZ0
Upper neck	Forces	x	1?NECKUP00WSFOX0
		y	1?NECKUP00WSFOY0
		z	1?NECKUP00WSFOZ0
	Moments	x	1?NECKUP00WSMOX0
		y	1?NECKUP00WSMOY0
		z	1?NECKUP00WSMOZ0
Lower neck	Forces	x	1?NECKLO00WSFOX0
		y	1?NECKLO00WSFOY0
		z	1?NECKLO00WSFOZ0
	Moments	x	1?NECKUP00WSMOX0
		y	1?NECKUP00WSMOY0
		z	1?NECKUP00WSMOY0
Spine – T4	Accelerations	x	1?THSP0400WSACX0
		y	1?THSP0400WSACY0
		z	1?THSP0400WSACZ0
Spine – T12	Accelerations	x	1?THSP1200WSACX0
		y	1?THSP1200WSACY0
		z	1?THSP1200WSACZ0
Lumbar spine	Forces	x	1?LUSP0000WSFOX0
		y	1?LUSP0000WSFOY0
		z	1?LUSP0000WSFOZ0
	Moments	x	1?LUSP0000WSMOX0
		y	1?LUSP0000WSMOY0
		z	1?LUSP0000WSMOZ0
Shoulder joint	Forces	x	1?SHLD??00WSFOX0
		y	1?SHLD??00WSFOY0
		z	1?SHLD??00WSFOZ0
Shoulder – rib	Displacement	1D	1?SHRI??00WSDC00

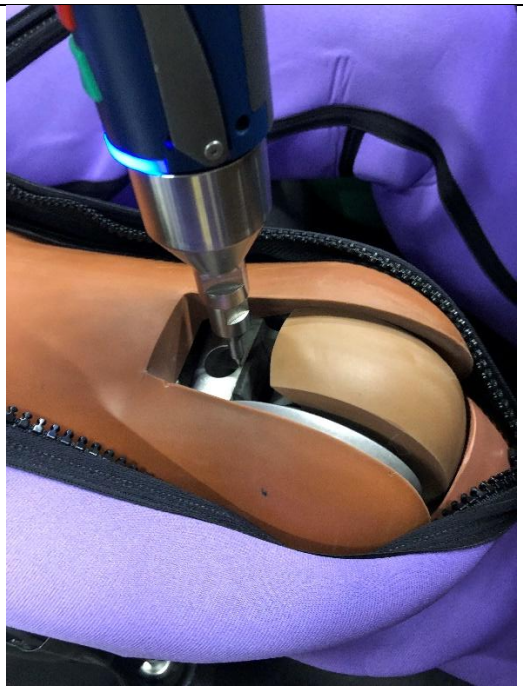
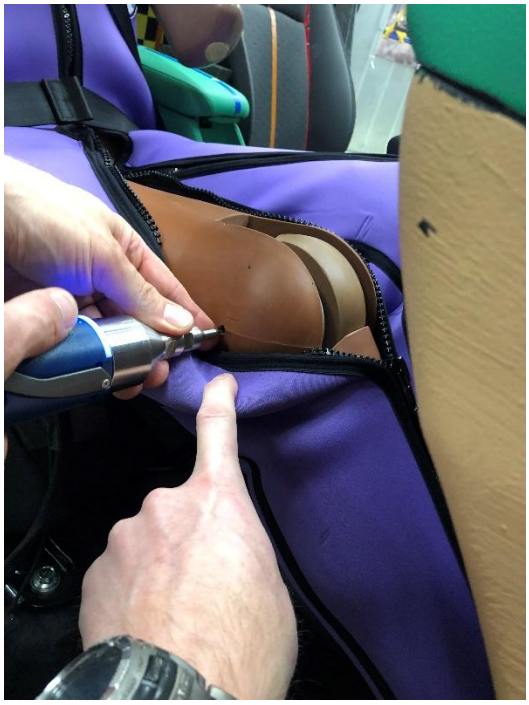
	Angular displacement		1?SHRI??00WSAN00
Thorax - Upper rib	Displacement	1D	1?TRRI??01WSDC00
	Angular displacement		1?TRRI??01WSAN00
Thorax - Mid rib	Displacement	1D	1?TRRI??02WSDC00
	Angular displacement		1?TRRI??02WSAN00
Thorax - Lower rib	Displacement	1D	1?TRRI??03WSDC00
	Angular displacement		1?TRRI??03WSAN00
Abdomen – Upper rib	Displacement	1D	1?ABRI??01WSDC00
	Angular displacement		1?ABRI??01WSAN00
Abdomen – Lower rib	Displacement	1D	1?ABRI??02WSDC00
	Angular displacement		1?ABRI??02WSAN00
Pelvis	Accelerations	x	1?PELV000000ACX0
		y	1?PELV000000ACY0
		z	1?PELV000000ACZ0
Pubic Symphysis	Force	y	1?PUBC0000WSFOY0
B-Pillar (non-struck side)	Accelerations	x	1?BPILLO0000ACX0
		y	1?BPILLO0000ACX0
		z	1?BPILLO0000ACX0
Lap Belt (B6)	Force	1D	1?SEBE0003B6FO00
Shoulder Belt (B3)	Force	1D	1?SEBE0003B3FO00
CALCULATED CHANNELS			
Shoulder – rib	Displacement corrected		1?SHRI??00WSDS00
Thorax - Upper rib	Displacement corrected		1?TRRI??01WSDS00
Thorax - Mid rib	Displacement corrected		1?TRRI??02WSDS00
Thorax - Lower rib	Displacement corrected		1?TRRI??03WSDS00
Abdomen – Upper rib	Displacement corrected		1?ABRI??01WSDS00
Abdomen – Lower rib	Displacement corrected		1?ABRI??02WSDS00
B-Pillar (non-struck side)	Calculated global velocities	x	1?BPILLO0000VEX0
		y	1?BPILLO0000VEY0
		z	1?BPILLO0000VEZ0
Total number of required channels:		63	

APPENDIX B

1. Far side sled test – Pre test dummy measurements

Description	
Head CoG, Outboard head skin marking	
Neck bracket, rearmost, outboard corner of the bracket	
Neck bracket, foremost, outboard corner of bracket	

Outboard arm, shoulder screw centre	
Outboard arm, tip of arm foam centre	
Outboard arm angle, place a straight edge alonFg the length of the arm	
Outboard femur, centreline of knee clevis	

	
Outboard knee, knee joint/bolt centre	
Outboard femur, angle, place a short length inclinometer on the femur centreline	

	
Outboard ankle, centre of bolt	
Outboard head restraint tube, most outboard part of the tube where it meets the seatback.	
Diagonal seatbelt