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Technical Bulletin

Proposed Pedestrian Grid Procedure - Data Collection

Version 1.0

November 2010

TB 010

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Background

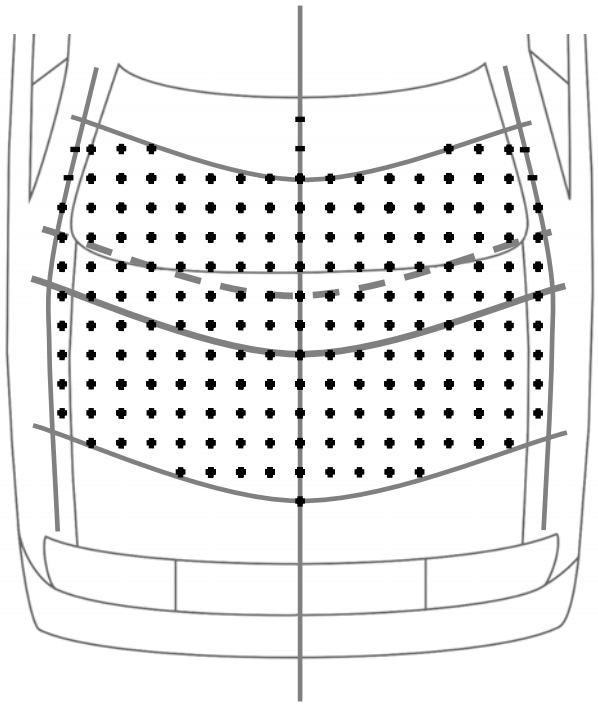
Currently, the Euro NCAP working group on pedestrian protection is developing a new method for assessing the protection offered to pedestrians. This method is based upon the application of a grid to the upper surface, where the individual grid points are evaluated rather than selected ‘worst case’ test locations. Any new method developed by the group must at least be of equal stringency to that of the current procedure. The new pedestrian procedure will be introduced in 2013 at the earliest.

In order to facilitate the development of a grid procedure, the working group needs to evaluate the suitability of data upon which an assessment can be based. Therefore, starting as of 2011 vehicle assessments, the Euro NCAP board has agreed that the work of the group can be ‘piggy backed’ onto official tests using the current procedure. Additionally, vehicle manufacturers have been asked to support this work by supplying in-house data.

A sufficient amount of data will be required to enable a successful trail of the grid procedure in the coming period. The reliance will be on test laboratories and vehicle manufacturers to undertake the required actions to support the development of the procedure.

Grid marking

All vehicles assessed will have the grid markings applied to the upper surface of the vehicle along with the current zone markings. Both marking procedures will be applied as part of the normal pedestrian testing programme. The marking out procedure is detailed in the draft Pedestrian testing protocol update (see Appendix). Vehicle manufacturers will be asked to supply details of their own grid marking to the test vehicle. This may be in the form of CAE or physical markings and should be supplied when returning the equipment matrix, a comparison between the two will then be made by the assigned laboratory. A small number of grid points must be measured using a 3D arm (all centreline points and four random points on/near SRL).



Manufacturer Predicted data

Euro NCAP has requested that industry supply 'predicted' data during pedestrian assessments. A further request for data will be made in the vehicle equipment matrix that is provided by the Secretariat. The vehicle manufacturer should inform the Secretariat whether or not they are willing to supply predicted data when returning the completed equipment matrix. Euro NCAP would like to encourage vehicle manufacturers to supply as much data as possible, ideally covering all of the worst case/shifted points and the two legform impactors. However, there is no minimum requirement for the supply of data.

Headform data:
The data may be generated by the use of CAE and/or in house physical testing provided that it is made clear how the data was generated. Euro NCAP asks that HIC values are provided to enable a more robust assessment of the accuracy of CAE models. However, where this is not the case, the data must be based on the proposed 5 colour bands covering HIC650-1700:

Green	HIC < 650
Yellow	650 < HIC < 1000
Orange	1000 < HIC < 1350
Brown	1350 < HIC < 1700
Red	1700 < HIC

Euro NCAP would like to stress that ANY data supplied by the vehicle manufacturer will not be used to influence the selection of worst case test locations, nor used in any other way in the vehicle assessment. To this end, the worst case test points will be chosen prior to the submission of predicted data. The selected worst case locations will then be frozen and not subject to future scrutiny, for example during the post test inspection. However, the vehicle manufacturer must submit their predicted data to the Secretariat prior to the commencement of testing. This is to ensure that data is a real prediction.

Legform and Upper legform data:
Data is needed for all of the impactors used by Euro NCAP, including upper legform and legform. Consideration will be given to applying a fixed grid philosophy to the bonnet leading edge and bumper as well as the upper surface of the vehicle. Initially, a comparison should be made between the results of worst case test locations and predicted data to the bumper and BLE. Euro NCAP requests that vehicle manufactures who have predicted data to these areas supply this information to aid development of the proposed procedure.

Headform Point Shifting

In order to maximise the amount of usable data, the Euro NCAP board agreed that the worst case test locations may be 'shifted' to a nearby grid point if appropriate. The first step will be for the test laboratory to choose worst case test locations, as normal, and guidance to help establish the appropriateness of shifting a point is given below.

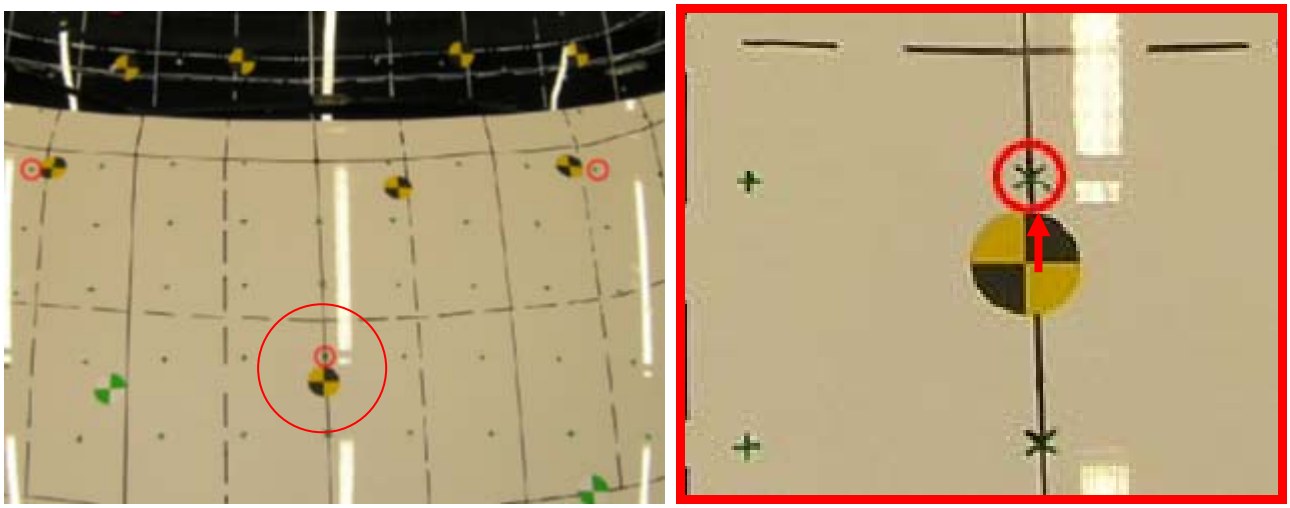
However, it must be stressed that it is not essential that any or all worst case points are shifted. The overriding principle is that all vehicles are to be assessed in a way that is representative of the current protocol to ensure vehicles are treated fairly. Points should only be shifted to a grid point expected to give very similar results.

The vehicle manufacturer will inform Euro NCAP if they are willing to provide any predicted data via the equipment matrix. If NO data is to be provided, then shifting will not take place for any points and the normal procedure will be followed. Only the individual points that the manufacturer agrees to supply data for are eligible to be shifted. If the manufacturer agrees to provide predicted data on worst case points instead of grid points, then shifting will not take place and normal procedure will be followed. ALL predicted data must be provided before testing begins, but after all test points (Euro NCAP & manufacturer) have been selected.

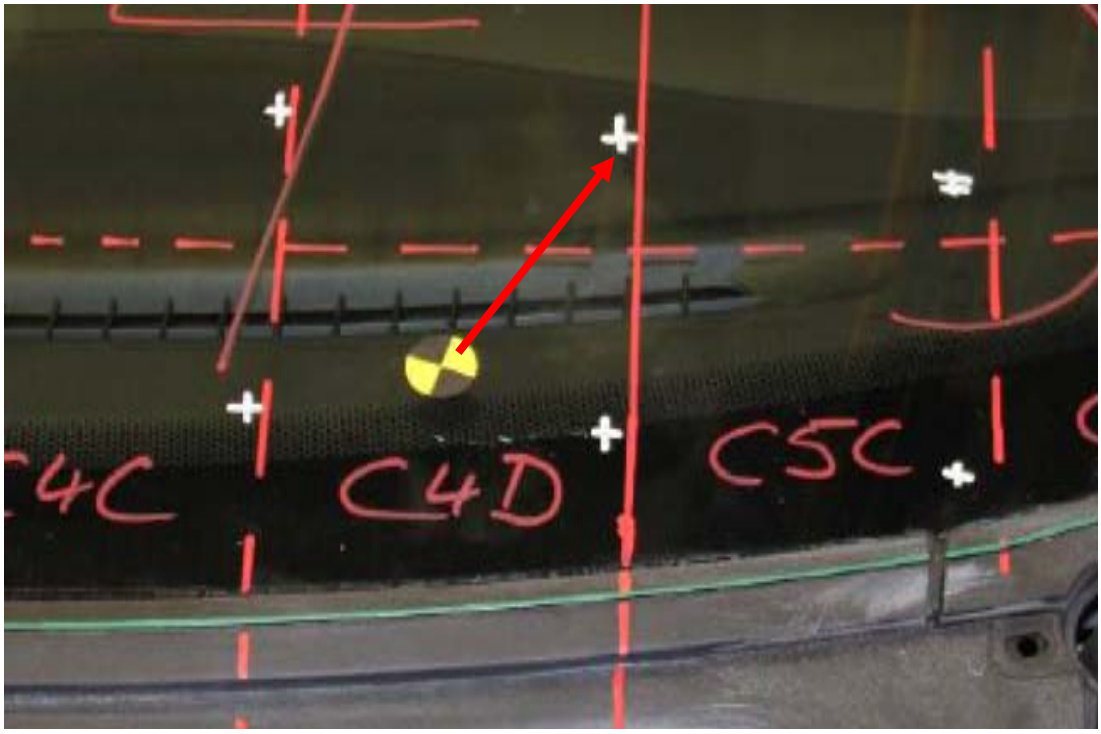
1. The laboratory shall mark both the grid AND current zones for ALL test vehicles. This will be the case even if no predicted data is to be provided. A small number of grid points must be measured using the 3D arm (all centreline points and four random points on/near SRL).
2. The laboratory will choose worst case points as normal (including spacing requirements).
3. The vehicle manufacturer may nominate additional test zones for assessment as normal. The laboratory will then select the worst case points in those nominated zones as normal. Where appropriate, worst case points may be shifted to grid points, but the point must remain within the quarters nominated by the vehicle manufacturer. If an appropriate grid point cannot be found, then no shift will be made and the worst case location will be tested as normal.
4. Where appropriate, worst case points are to be shifted to the closest or most appropriate grid point. The point must remain within the same zone (A1, A2 etc) as the original worst case points. If an appropriate grid point cannot be found, then no shift will be made and the worst case location will be tested.
5. Points must not be shifted from a clearly worst case structures e.g. wing edge, A-pillar, wipers/spindles to a grid point/structure that is deemed less injurious.
6. The spacing requirement between test points (165mm) will only apply to worst case points (i.e. between two worst case points as well as between one worst case point and a test point on the grid).

7. The spacing requirement to the Side Reference Lines (82.5mm, except A-Pillar) will apply to all points.
8. All point nominations and shifting must be completed prior to testing.
9. Once all points have been identified the vehicle manufacturer must provide predicted colour or HIC data to the Secretariat before testing begins.
10. The predicted data must either be HIC values or based on 5 colour bands covering HIC650-1700 and must also indicate whether it is CAE derived or physical test data.
11. Where there are any doubts about shifting a test point e.g. proximity to SRL, spacing issues, lack of grid points in a quarter, then the default position will be to not shift the point. The worst case point will be tested as per the normal procedure.

Example 1.
Below shows an example of where a worst case point may be shifted to an appropriate grid point. Underlying structures are the same and the results are not expected to change as a result of the shift.



Example 2.
Below shows an example of where the worst case point may NOT be shifted to the grid point further up the windscreen.


C4C
C4D
C5C

APPENDIX
Proposed grid marking procedure, as at November 2010, based on the Euro NCAP Pedestrian Testing Protocol V5.1, January 2010.

2.7 Marking the Bonnet Rear Reference Line
The Bonnet rear reference line is defined as the geometric trace of the most rearward points of contact between a 165mm sphere and the frontal upper surface, when the sphere is traversed across the frontal upper surface, while maintaining contact with the windscreen.

2.7.1 Remove the wiper blades and arms.

2.7.2 Place a 165mm sphere at the vehicle centreline on the frontal upper surface so that the rearmost point of contact is with the moveable bonnet top.

2.7.3 Mark the most forward point of contact between the sphere and the vehicle's frontal upper surface. Repeat this at suitable increments moving outboard until the sphere contacts the side reference line on both sides of the vehicle. See Figure 2.6

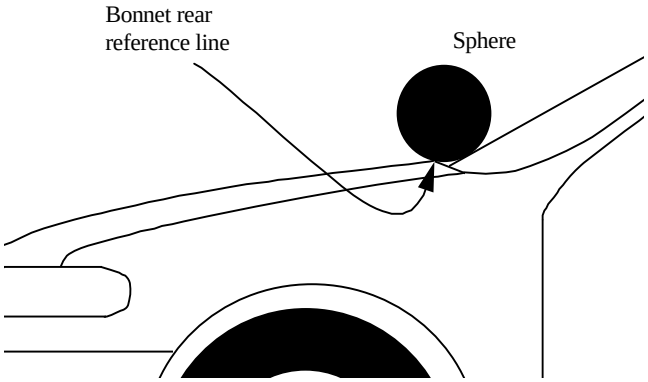


Figure 2.6
Bonnet rear reference line

2.7.4 Where there is a gap in the rear bonnet reference line, for example at the transition between the windscreen and A-pillar, a straight line shall be drawn between the last two points of contact. See Figure 2.7.

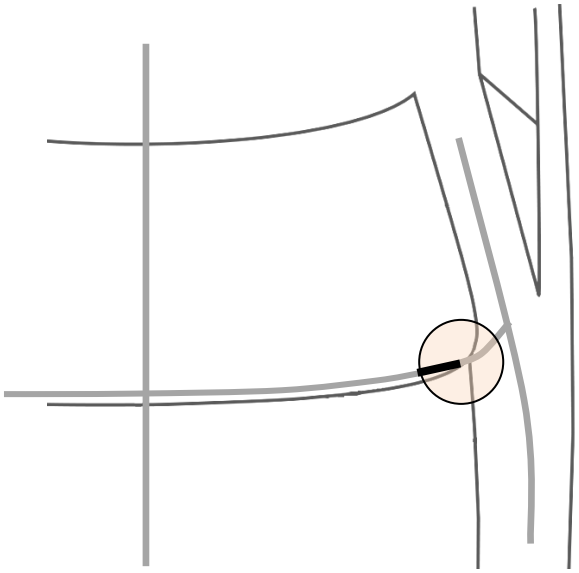


Figure 2.7
Gap in bonnet rear reference line

2.7.5 If the bonnet rear reference line is located at a wrap around distance of more than 2100mm, the bonnet rear reference line is defined by the geometric trace of the 2100mm wrap around distance.

2.7.6 Where the bonnet rear reference line and side reference line do not intersect, the bonnet rear reference line is extended and/or modified using a semi-circular template, of radius 100mm. The template shall be made of a thin flexible sheet material that easily bends to a single curvature in any direction. The template shall, if possible, resist double or complex curvature where this could result in wrinkling. The recommended material is a foam backed thin plastic sheet to allow the template to 'grip' the surface of the vehicle.

2.7.7 The template shall be marked up with four points 'A' through 'D', as shown in Figure 2.8, while the template is on a flat surface. The template shall be placed on the vehicle with Corners 'A' and 'B' coincident with the side reference line. Ensuring these two corners remain coincident with the side reference line, the template shall be slid progressively rearwards until the arc of the template makes first contact with the bonnet rear reference line. Throughout the process, the template shall be curved to follow, as closely as possible, the outer contour of the vehicle's bonnet top, without wrinkling or folding of the template. If the contact between the template and bonnet rear reference line is tangential and the point of tangency lies outside the arc scribed by points 'C' and 'D', then the bonnet rear reference line is extended and/or modified to follow the circumferential arc of the template to meet the side reference line, as shown in Figure 2.9.

2.7.8 If the template cannot make simultaneous contact with the side reference line at points 'A' and 'B' and tangentially with the bonnet rear reference line, or the point at which the bonnet rear reference line and template touch lies within the arc scribed by points 'C' and 'D', then additional templates shall be used where the radii are increased progressively in increments of 20mm, until all the above criteria are met.

2.7.9 Once defined, the modified bonnet rear reference line is assumed in all subsequent paragraphs and the original ends of the line are no longer used;

2.7.10 Replace the wiper arms and blades.

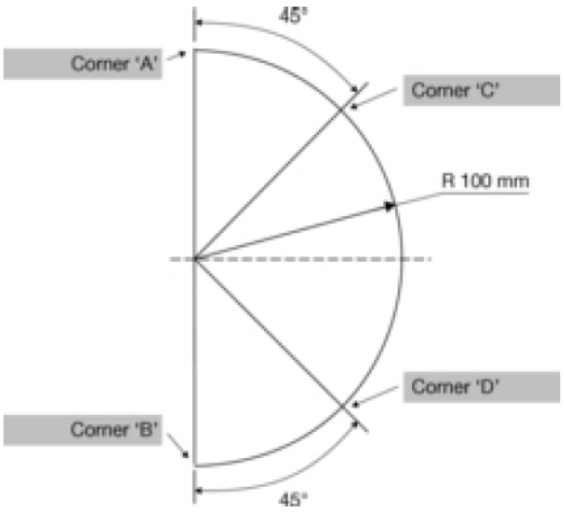


Figure 2.8

Rear bonnet reference line template

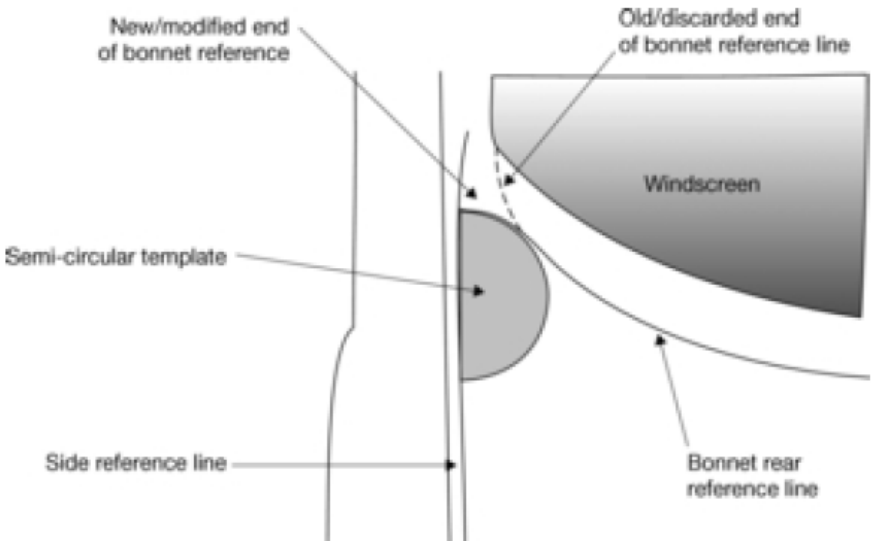


Figure 2.9
Extension of rear bonnet reference line

2.8 Marking Wrap Around Distances

The test area is defined as the outer structure that includes the upper surface of all outer structures. It includes, but is not limited to, the bonnet, wings, windscreen scuttle, wiper arms/spindles, windscreen frame, A-pillars and roof. It is bounded by the geometric trace of the 1000mm wrap around line in the front, as defined in section 2.7, the Bonnet Side Reference Lines, as defined in section 2.5, and the 2100mm wrap around line. The moveable bonnet top is defined as all structures connected to the bonnet that move with the whole assembly when opened. All other areas, such as the plastic scuttle, wipers and parts that do not move when opening the bonnet are considered to be the windscreen base area. The rear edge of the bonnet is the most rearward point of the moveable bonnet top when it is closed.

2.8.1 Begin at the vehicle centreline.

2.8.2 Place the end of a flexible tape measure or graduated wire on the floor vertically below the front edge of the bumper.

2.8.3 Wrap the tape (or wire) over the bumper, bonnet windscreen and roof ensuring that it is maintained in a vertical longitudinal (X, Z) plane and that its end is still in contact with the ground. The tape should be held taut throughout the operation, vertically below the front face of the bumper, see Figure 2.6.

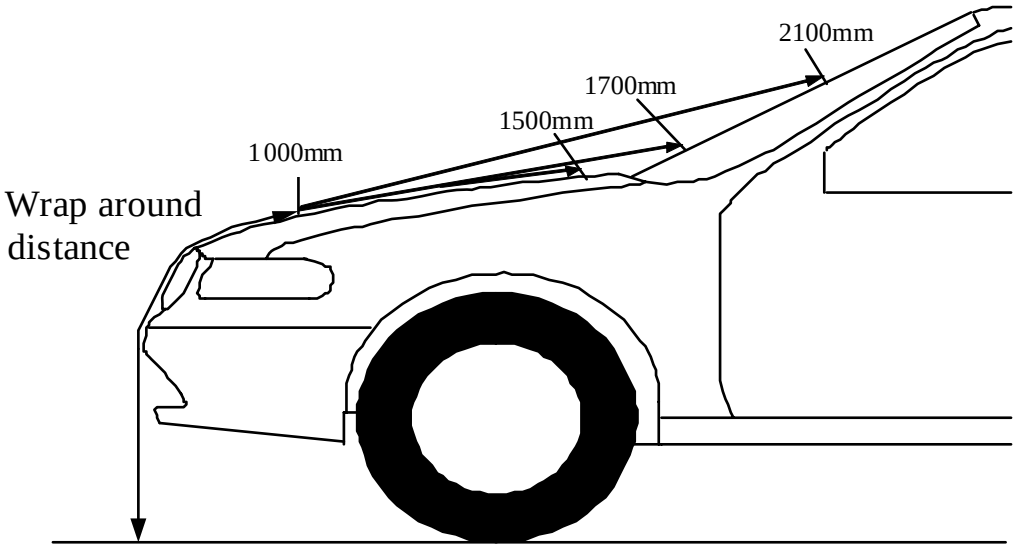


Figure 2.6
Determination of wrap around lines

2.8.4 Mark on the bonnet top, windscreen, A-pillars and/or roof the Wrap Around Lines of 1000mm, 1500mm, 1700mm and 2100mm. These are the geometric traces described on the outer surface of the vehicle by the end of flexible tape or wire 1000, 1500, 1700 or 2100mm long, when it is held in a vertical fore/aft plane of the car and traversed across the front of the bonnet and bumper.

2.8.5 Where any of the WAD's lie below the outer contour of the vehicle, for example in the gap behind the bonnet, using the tape (or wire) approximate the outer contour of the vehicle horizontally rearward from the last point of contact and project the WAD vertically down onto the underlying structure.

2.8.6 Reposition the end of the tape on the ground no further than 100mm laterally outboard starting at the vehicle centreline up to the Corner of Bumper. The tape should be stretched over the A-pillars where necessary.

2.8.7 Repeat steps 2.8.2 to 2.8.6 until the width of the vehicle has been marked up to the Side Reference Lines.

2.8.8 Join the points marked on the bonnet to form lines at wrap around distances of 1000mm, 1500mm, 1700mm and 2100mm. Points located between 1000 and 1500mm WAD will be assessed using the child/small adult headform. Points between 1700 and 2100 mm WAD will be assessed with the adult headform, see Figure 2.7.

2.8.9 Where the bonnet rear reference line is between 1500mm-1700mm WAD, points forward of the line will be assessed using the child/small adult impactor. Points rearward of the bonnet rear reference line between 1500mm-1700mm WAD will use the adult impactor.

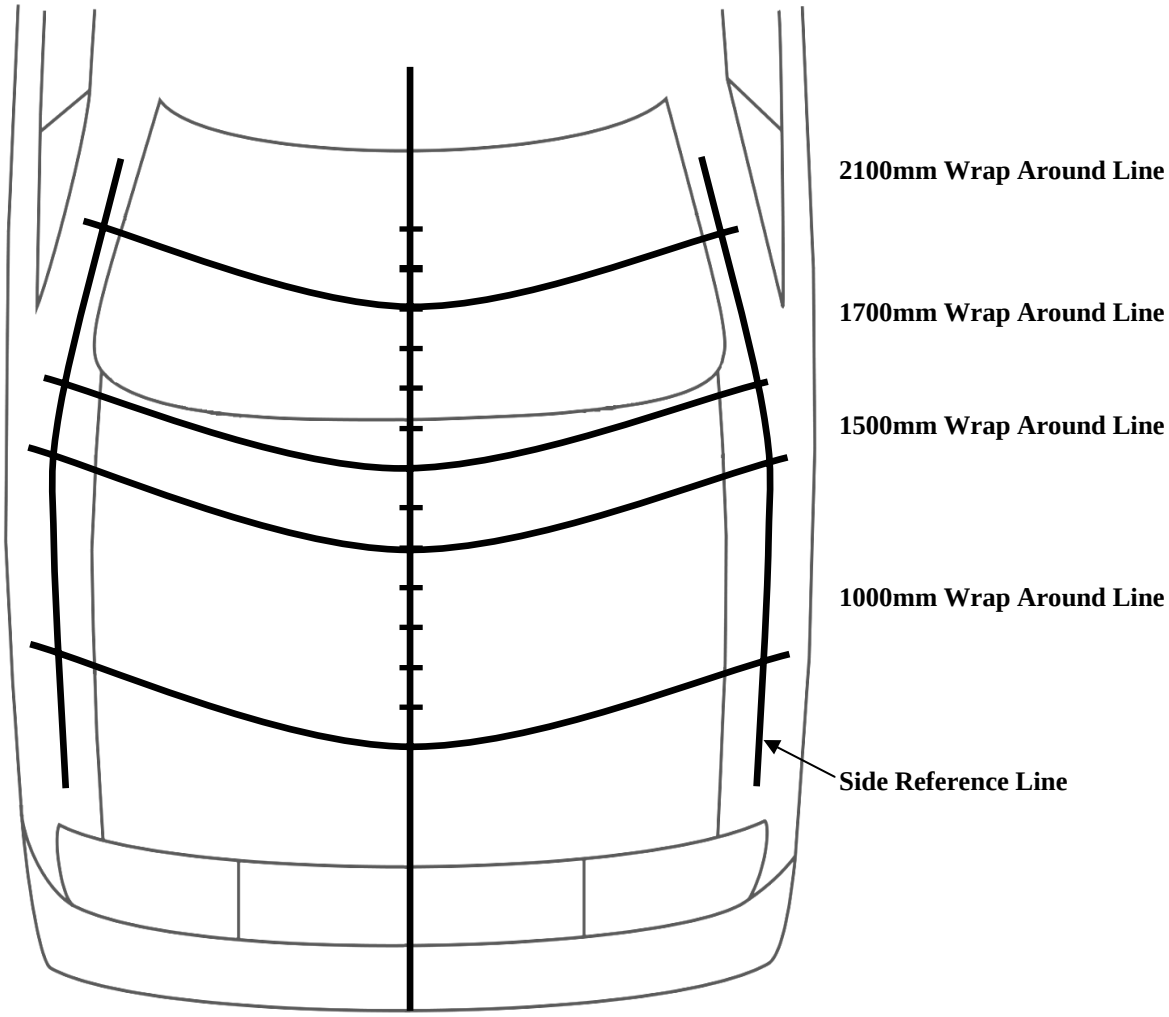


Figure 2.7
1000mm-2100mm Wrap Around Lines

2.9 Marking Headform Impact Area Grid Points

2.9.1 Mark the longitudinal centreline of the vehicle on the bonnet top, windscreen and roof.

2.9.2 Mark Wrap Around Distances (not lines) on the centreline only at 100mm intervals. Start from Wrap Around Distance 1000mm and end at Wrap Around Distance 2100mm. For vehicles with a V-shaped front end it may also be necessary to mark additional Wrap Around Distances of 2200mm, 2300mm, etc. See Figure 2.7.

2.9.3 Starting at one of the wrap around distance marks at the centreline, mark grid points every 100mm in both lateral directions up to the side reference lines. The 100mm distances are measured horizontally in a lateral vertical plane through the respective centreline mark and projected vertically onto the vehicle surface.

2.9.4 Repeat step 2.9.3 for every wrap around distance on the vehicle centreline until the entire headform impact area is marked with grid points. Depending on the shape of the vehicle, (e.g. V-shaped vehicle front end) it may be necessary to also use the wrap around distance points at 2200mm, 2300mm, etc. See

Figure 2.8a.

2.9.5 For A-pillars only, mark an additional grid point at the intersection of the lateral vertical plane and the side reference line for each wrap around distance.

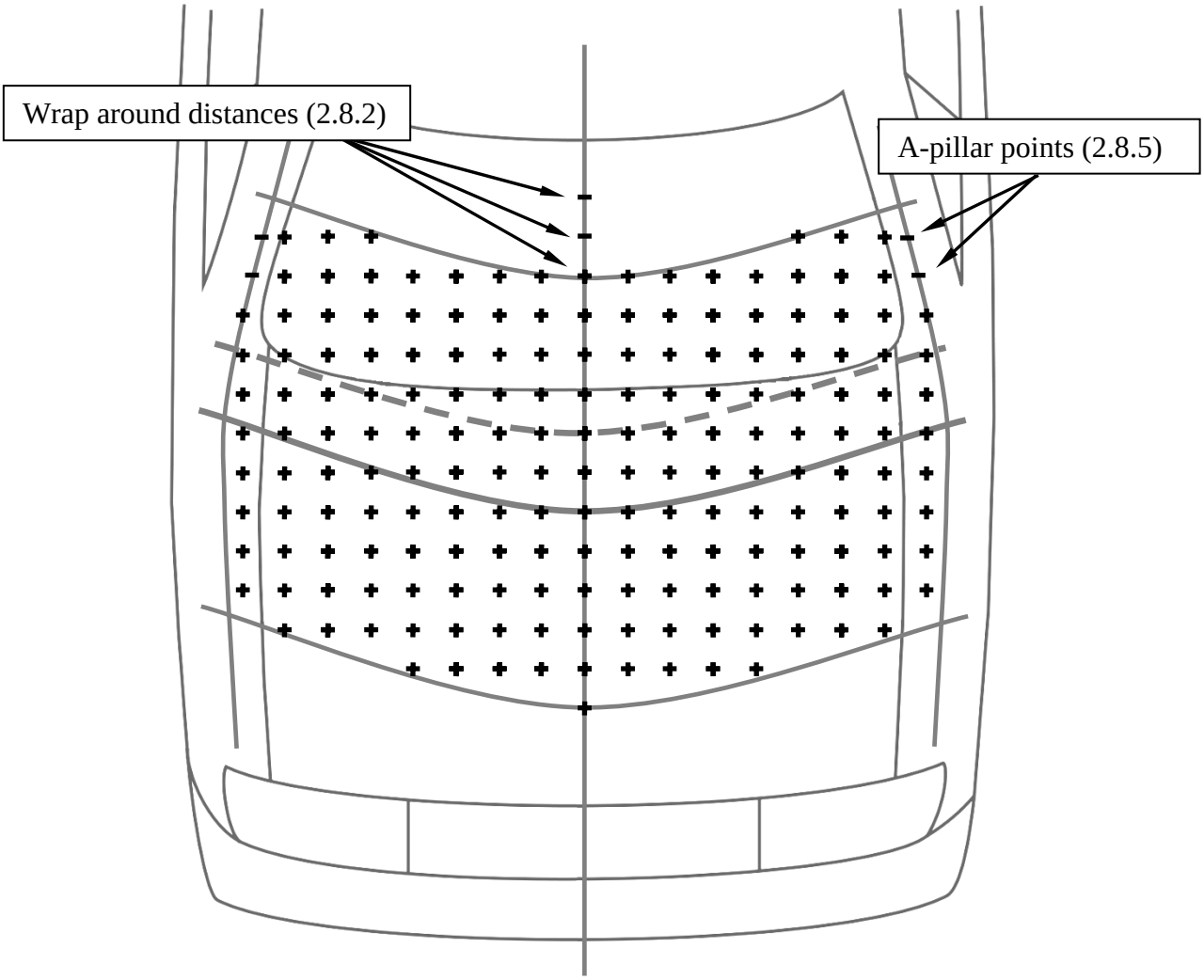


Figure 2.8a
Grid Points

2.9.6 Remove those grid points that have a distance, measured in the lateral Y axis, of less than 50mm to the side reference lines, excluding those points which are on A-pillar side reference line.

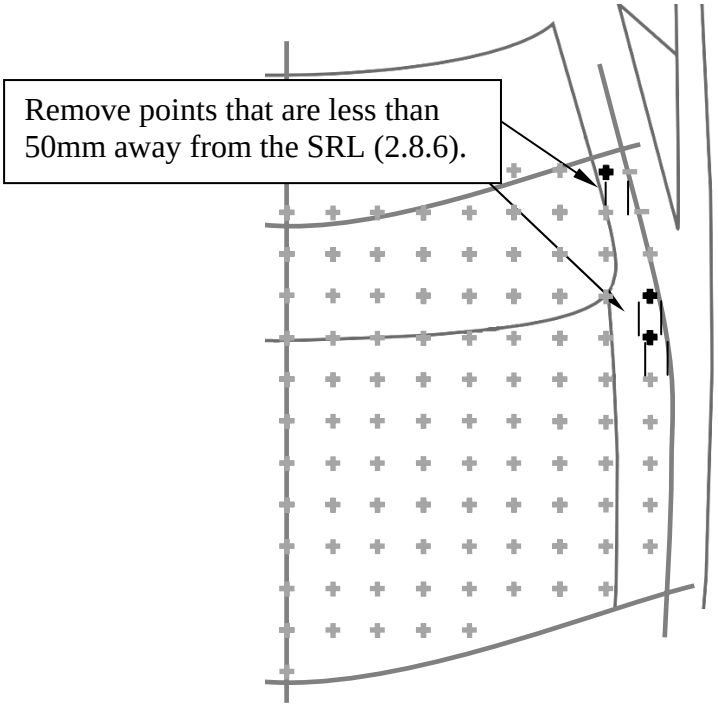


Figure 2.8b
Deleting Grid Points

2.9.7 Remove those points that are on the windscreen base/scuttle area between the rear edge of the bonnet, as defined in Section 2.8, and the rearmost contact point of a 165mm diameter sphere and the windscreen base/scuttle. The windscreen wipers should be removed before performing this operation and replaced when completed. See Figure 2.8c.

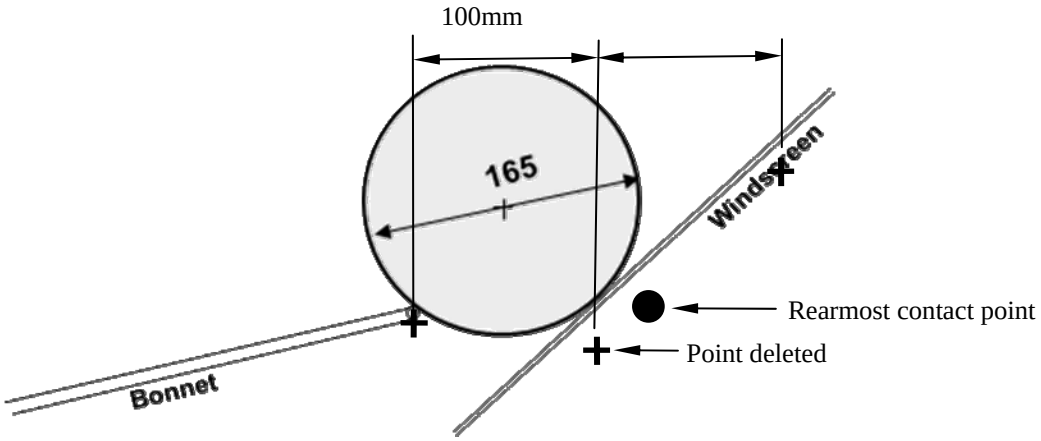


Figure 2.8c
Deleting Grid Points

2.9.8 The remaining grid points are used for the assessment of the vehicle. For impact testing, these grid points are the aiming points.

2.10 Labelling Grid Points

2.10.1 All child/small adult headform grid points will contain the prefix ‘C’. All adult headform points will contain the prefix ‘A’.

2.10.2 The grid point will be identified by means of a row and column system. The

origin will be at the grid point on the vehicle centreline and the 1000mm WAD. This point will be marked C0,0.

2.10.3 The column on the centreline will be column 0, the adjacent column on the right of the vehicle, as shown below, will be column +1, with the other columns increasing by 1 toward the SRL, i.e. +2, +3, ….+8. The column on the left of the vehicle will be column -1 with the other columns decreasing by 1 toward the SRL, i.e. -2, -3, ….-8.

2.10.4 The rows at the origin will be row 0, the subsequent rows will be marked in increasing increments of 1 up to the rearmost row.

2.10.5 Every point will be labelled firstly by the relevant headform impactor (A or C), then by the column, then by the row. See Figure 2.9.

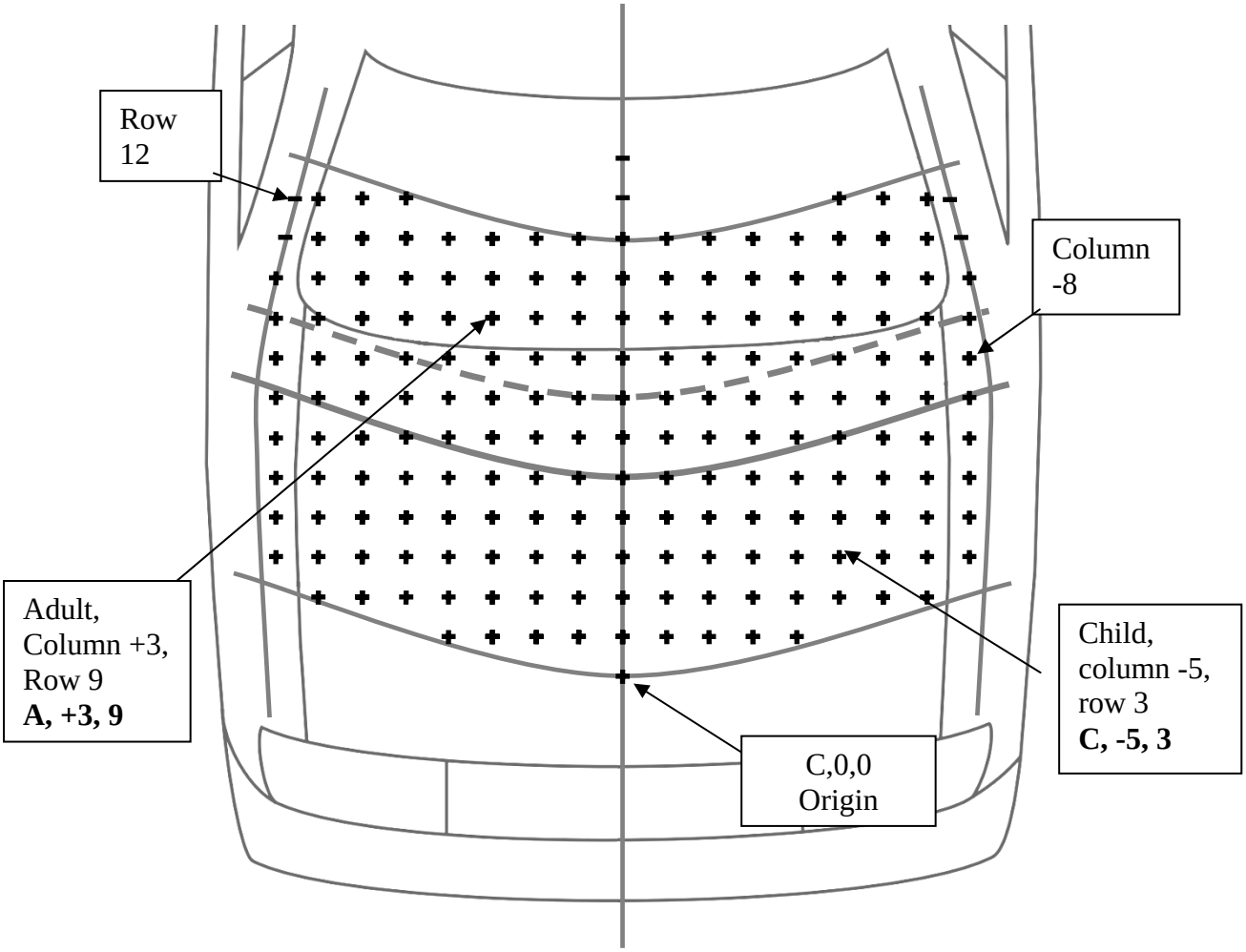


Figure 2.9
Labelling of the headform test zones

2.11 Dividing the Bonnet Leading Edge Reference Line into Sixths

2.11.1 Using a flexible tape, measure the distance between the two corner reference points, along the outer contour of the bonnet (measure directly between the corner reference points and not along the Bonnet Leading Edge Reference Line).

2.11.2 Divide the measured distance by six and project forward, parallel to the centreline of the vehicle, each point onto the bonnet leading edge. See Figure 2.11.

NOTES:

The division of the bonnet leading edge reference line has resulted in three areas (thirds) across the front of the vehicle, each consisting of two halves.

2.12 Dividing the Bumper Reference Lines into Sixths

2.12.1 Place a flexible measuring tape along the horizontal contour of the Upper Bumper Reference Line, ignoring any small discontinuities in the bumper profile, for example licence plate depressions. Using the Bumper Corners as the extreme measuring points, measure and divide the distance by six, see Figure 2.11. If the Bumper Corner is not coincidental with the Upper Bumper Reference Line, then mark a point (Inner Bumper Corner) on the Upper and Lower Bumper Reference Lines at the same lateral distance as the Bumper Corner.

2.12.2 Repeat 2.11.1 for the Lower Bumper Reference Line.

NOTES:

The division of the Upper Bumper Reference Line results in three test zones across the front of the vehicle, each consisting of two halves.

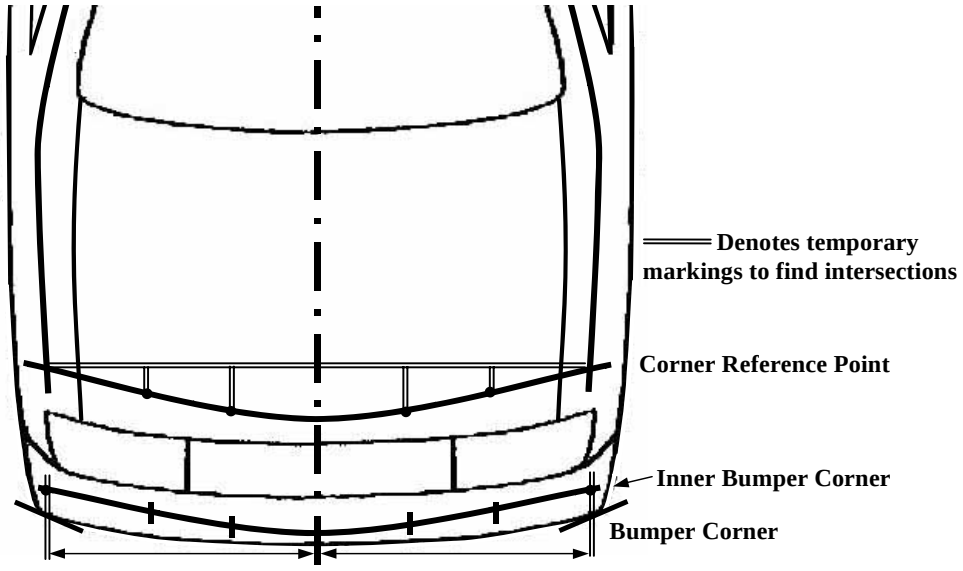


Figure 2.11

Division of the Bonnet Leading Edge and Upper Bumper Reference Lines

2.13 Bumper Lead

2.13.1 This is defined as the horizontal distance between the Bonnet Leading Edge Reference Line and the Upper Bumper Reference Line. The bumper lead may vary across the front of the car; therefore, the bumper lead must be measured separately at all selected bonnet leading edge impact points.

2.13.2 The bumper lead will be used in Section 8.

2.13.3 Position a vertical straight edge in contact with the Upper Bumper Reference Line positioned longitudinally to align with the Bonnet Leading Edge impact point chosen later in Section 3.

2.13.4 Measure the horizontal longitudinal distance from the Bonnet Leading Edge Reference Line to the vertical straight edge. This is the bumper lead at that point. Alternatively a 3D measuring arm can be used to establish this distance. Record the Bumper Lead for each impact point.

2.14 Bonnet Leading Edge Height

2.14.1 This is defined simply as the vertical height above the ground of the Bonnet Leading Edge Reference Line. This line follows the contours of the bonnet and its height may vary across the front of the car, therefore, the bonnet leading edge height must be measured separately at all selected Bonnet Leading Edge impact points, which will be chosen in Section 3.

2.14.2 The bonnet leading edge height will be used in Section 8.

2.14.3 Position a horizontal straight edge with one end in contact with the impact point on the Bonnet Leading Edge Reference Line and measure the vertical distance to the ground. Alternatively use a 3D measuring arm to measure and record the Bonnet Leading Edge height for each impact point.

2.15 Labelling the Bonnet Leading Edge and Bumper Test Zones

2.15.1 Beginning with the Bonnet Leading Edge Reference Line, move from the right hand side of the vehicle to the left hand side of the vehicle the first third (two sixths) is labelled U1. The remaining thirds are then labelled U2 and U3.

2.15.2 Each third has been divided into two, beginning with the first sixth within U1, label from the right hand side of the vehicle to the left hand side of the vehicle alphabetically i.e. A and B. Repeat this for the remaining two thirds.

2.15.3 Repeat steps 2.14.1 and 2.14.2, for the Bumper Reference Lines, replacing U with L. See Figure 2.12.

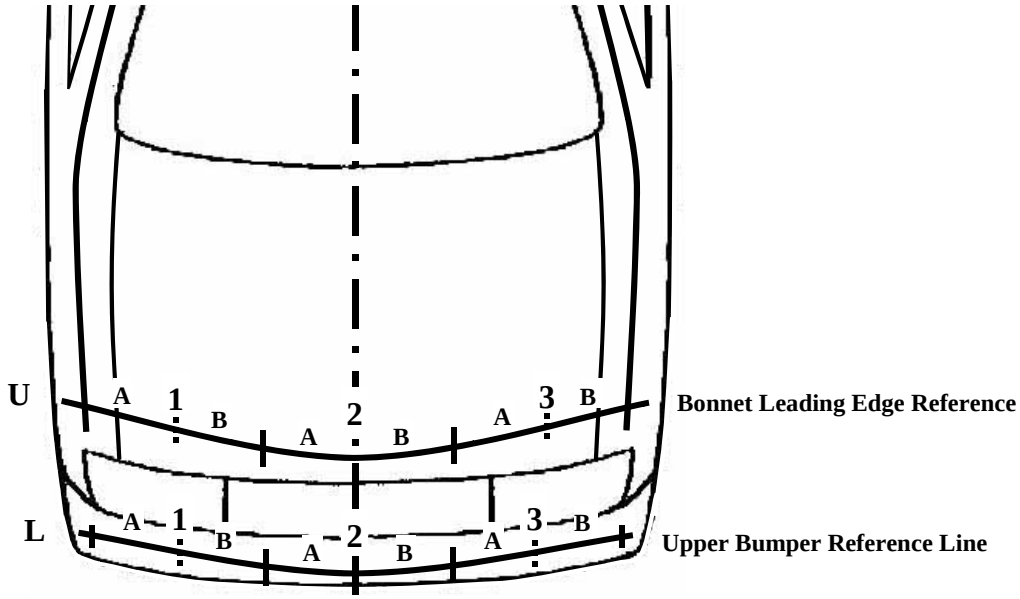


Figure 2.14

Labelling the Bonnet Leading Edge and Bumper Test Zones