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Commission Regulation (EC) No 631/2009 of 22 July 2009 laying down detailed rules for the implementation of Annex I to Regulation (EC) No 78/2009 of the European Parliament and of the Council on the type-approval of motor vehicles with regard to the protection of pedestrians and other vulnerable road users, amending Directive 2007/46/EC and repealing Directives 2003/102/EC and 2005/66/EC

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ANNEX

PART I

GENERAL REQUIREMENTS AND DEFINITIONS

1. General

When performing measurements on a vehicle as described in this Part, the vehicle shall be positioned in its normal ride attitude.

If the vehicle is fitted with a badge, mascot or other structure which would bend back or retract under an applied load of maximum 100 N, then such a load shall be applied before and/or while these measurements are taken.

Any vehicle component which could change shape or position, other than suspension components or active devices to protect pedestrians, shall be set to their stowed position.

2. Definitions

For the purposes of this Annex the following definitions shall apply:

- 2.1. 'Bonnet leading edge height' for any section of a vehicle means the vertical distance between the ground and the bonnet leading edge reference line at that point;
- 2.2. 'Bonnet Leading Edge Reference Line' means the geometric trace of the points of contact between a straight edge 1 000 mm long and the front surface of the bonnet, when the straight edge, held parallel to the vertical longitudinal plane of the car and inclined rearwards by 50° from the vertical and with the lower end 600 mm above the ground, is traversed across and in contact with the bonnet leading edge (see Figure 16).

For vehicles having the bonnet top surface inclined at 50°, so that the straight edge makes a continuous contact or multiple contacts rather than a point contact, determine the reference line with the straight edge inclined rearwards at an angle of 40° from the vertical.

For vehicles of such shape that the bottom end of the straight edge makes first contact with the vehicle then that contact is taken to be the bonnet leading edge reference line, at that lateral position.

For vehicles of such shape that the top end of the straight edge makes first contact with the vehicle then the geometric trace of 1 000 mm wrap around distance, will be used as bonnet leading edge reference line at that lateral position.

The top edge of the bumper shall also be regarded as the bonnet leading edge if it is contacted by the straight edge during this procedure;

- 2.3. 'Bonnet rear reference line' means the geometric trace of the most rearward points of contact between a 165 mm sphere and the frontal upper surface, when the sphere is traversed across the frontal upper surface, while maintaining contact with the windscreen (see Figure 1). The wiper blades and arms are removed during this process;

If the bonnet rear reference line is located at a wrap around distance of more than 2 100 mm, the bonnet rear reference line is defined by the geometric trace of the 2 100 mm wrap around distance. Where the bonnet rear reference line and side reference lines do not intersect, the bonnet rear reference line shall be modified according to the procedure set out in point 2.17;

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- 2.4. 'Bumper lead' for any longitudinal section of a vehicle means the horizontal distance measured in any vehicle vertical longitudinal plane between the upper bumper reference line and the bonnet leading edge reference line;
- 2.5. 'Centre of the knee' means the point about which the knee effectively bends;
- 2.6. 'Corner of bumper' means the vehicle's point of contact with a vertical plane which makes an angle of 60° with the vertical longitudinal plane of the vehicle and is tangential to the outer surface of the bumper (see Figure 2);
- 2.7. 'Corner of frontal protection system' means the frontal protection system's point of contact with a vertical plane, which makes an angle of 60° with the vertical longitudinal plane of the vehicle and is tangential to the outer surface of the frontal protection system (see Figure 3);
- 2.8. 'Corner of frontal protection system leading edge' means the frontal protection system's point of contact with a vertical plane which makes an angle of 45° with the vertical longitudinal plane of the vehicle and is tangential to the outer surface of the frontal protection system. The bottom edge of the plane shall be at a height of 600 mm, or 200 mm below the highest part of the frontal protection system, whichever is the higher;
- 2.9. 'Corner reference point' means the intersection of the bonnet leading edge reference line and of the side reference line (see Figure 4);
- 2.10. 'Essential outer front end dimensions' means solid points in space on the test frame, representing all points of the actual intended vehicle type where the frontal protection system would be liable to impact on the vehicle during testing;
- 2.11. 'Femur' means all components or parts of components (including flesh, skin covering, damper, instrumentation and brackets, pulleys, etc. attached to the impactor for the purpose of launching it) above the level of the centre of the knee;
- 2.12. 'Frontal protection system lead' for any point on a frontal protection system means the horizontal distance between the upper frontal protection system reference line and the position of the point being considered on the frontal protection system. This distance shall be measured, at any point, on a vertical plane parallel to the vertical longitudinal plane of the vehicle;
- 2.13. 'Frontal protection system leading edge' means the uppermost outer structure of the frontal protection system and excludes the vehicle bonnet and wings, the upper and side members of the headlight surround and any other attachments such as grills protecting only lights;
- 2.14. 'Frontal protection system leading edge height' for any vertical longitudinal section of the frontal protection system means the vertical distance between the ground reference level and the frontal protection system leading edge reference line at that section, with the vehicle positioned in its normal ride attitude;
- 2.15. 'Frontal protection system leading edge reference line' means the geometric trace of the points of contact between a straight edge 1 000 mm long and the front surface of the frontal protection system, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined rearwards by 50° and with the lower end 600 mm above the ground, is traversed across and in contact with the frontal protection system leading edge. For frontal protection systems having a top surface inclined at essentially 50°, so that the straight edge makes a continuous contact or

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multiple contacts rather than a point contact, the reference line is determined with the straight edge inclined rearwards at an angle of 40°. For frontal protection systems of such shape that the bottom end of the straight edge makes first contact, then that contact is taken to be the frontal protection system leading edge reference line, at that lateral position. For frontal protection systems of such shape that the top end of the straight edge makes first contact, then the geometric trace of 1 000 mm wrap around distance will be used as the frontal protection system leading edge reference line at that lateral position. The top edge of the frontal protection system shall also be regarded as the frontal protection system leading edge for the purposes of this Regulation, if it is touched by the straight edge during this procedure (see Figure 5);

- 2.16. ‘Impact point’ means the point on the vehicle where initial contact by the test impactor occurs. The proximity of this point to the target point is dependent upon both the angle of travel by the test impactor and the contour of the vehicle surface (see point B in Figure 6);
- 2.17. ‘Intersection of bonnet rear reference line and side reference line’. 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 100 mm. 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.

The template shall be marked up with four points ‘A’ through ‘D’, as shown in Figure 7, 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 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 20 mm, until all the above criteria are met.

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;

- 2.18. ‘Lower bumper height’ means, at any transverse position, the vertical distance between the ground and the lower bumper reference line, with the vehicle positioned in its normal ride attitude;
- 2.19. ‘Lower bumper reference line’ means a line which identifies the lower limit to significant points of pedestrian contact with the bumper. The line is the geometric trace of the lower most points of contact between a straight edge 700 mm long and the bumper, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined forwards by 25°, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the bumper (see Figure 9);

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- 2.20. 'Lower frontal protection system height' means, at any transverse position, the vertical distance between the ground and the lower frontal protection system reference line, with the vehicle positioned in its normal ride attitude;
- 2.21. 'Lower frontal protection system reference line' means a line which identifies the lower limit to significant points of pedestrian contact with the frontal protection system. The line is the geometric trace of the lowermost points of contact between a straight edge 700 mm long and the frontal protection system, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined forwards by 25°, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the frontal protection system (see Figure 10);
- 2.22. 'Rear windscreen reference line' means as the geometric trace of the most forward points of contact between a sphere and the windscreen, when a sphere of diameter 165 mm is traversed across the windscreen top frame, including any trim, while maintaining contact with the windscreen (see Figure 11);
- 2.23. 'Side reference line' means the geometric trace of the highest points of contact between a straight edge 700 mm long and the side of a vehicle, when the straight edge, held parallel to a transverse vertical plane of the vehicle and inclined inwards by 45° is traversed down the side and maintains contact with the sides of the frontal upper surface (see Figure 12);
- 2.24. 'Target point' means the intersection of the projection of the headform longitudinal axis with the front surface of the vehicle (see point A in Figure 6);
- 2.25. 'Third of the bonnet leading edge' means the geometric trace between the corner reference points, measured with a flexible tape following the outer contour of the leading edge, divided in three equal parts;
- 2.26. 'Third of the bonnet top' means the geometric trace of the area between the side reference lines, measured with a flexible tape following the outer contour of the bonnet top on any transverse section, divided in three equal parts;
- 2.27. 'Third of the frontal protection system' means the geometric trace between the corners of the frontal protection system, measured with a flexible tape following the outer horizontal contour of the frontal protection system, divided into three equal parts;
- 2.28. 'Third of the frontal protection system leading edge' means the geometric trace between the corners of the frontal protection system upper leading edge measured with a flexible tape following the horizontal outer contour of the frontal protection system, divided into three equal parts;
- 2.29. 'Third of the bumper' means the geometric trace between the corners of the bumper, measured with a flexible tape following the outer contour of the bumper, divided into three equal parts;
- 2.30. 'Tibia' means all components or parts of components (including flesh, skin covering, instrumentation and brackets, pulleys, etc. attached to the impactor for the purpose of launching it) below the level of the centre of the knee. Note that the tibia, as defined, includes allowances for the mass etc. of the foot;
- 2.31. 'Upper bumper reference line' means a line which identifies the upper limit to significant points of pedestrian contact with the bumper.

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For vehicles with an identifiable bumper structure it is defined as the geometric trace of the uppermost points of contact between a straight edge and the bumper, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined rearwards by 20° to the vertical, is traversed across the front of the vehicle, while maintaining contact with the surface of the bumper (see Figure 13).

For vehicles with no identifiable bumper structure it is defined as the geometric trace of the uppermost points of contact between a straight edge 700 mm long and the bumper, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined rearwards by 20° to the vertical, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the bumper (see Figure 13).

Where necessary the straight edge shall be shortened to avoid any contact with structures above the bumper;

- 2.32. 'Upper frontal protection system height' means, at any transverse position, the vertical distance between the ground and the upper frontal protection system reference line, with the vehicle positioned in its normal ride attitude;
- 2.33. 'Upper frontal protection system reference line' means a line which identifies the upper limit to significant points of pedestrian contact with the frontal protection system. The line is the geometric trace of the upper most points of contact between a straight edge 700 mm long and the frontal protection system, when the straight edge, held parallel to the vertical longitudinal plane of the vehicle and inclined rearwards by 20°, is traversed across the front of the vehicle, while maintaining contact with the ground and with the surface of the frontal protection system (see Figure 14).

Where necessary the straight edge shall be shortened to avoid any contact with structures above the frontal protection system;

- 2.34. 'Vehicle type' means a category of vehicles which, forward of the A-pillars, do not differ in any of the following aspects in so far as the changes may be considered to have a negative effect on the results of the impact tests set out in Regulation (EC) No 78/2009:
- (a) the structure;
 - (b) the main dimensions;
 - (c) the materials of the outer surfaces of the vehicle;
 - (d) the component arrangement (external or internal);
 - (e) the method of fixing a frontal protection system, where one is fitted.

For purposes of consideration of frontal protection systems to be approved as separate technical units, any reference to vehicle may be interpreted to refer to the frame on which the system is mounted for testing and which is intended to represent the front end outer dimensions of the particular vehicle for which the system is being approved;

- 2.35. 'Wrap Around Distance' means the geometric trace described on the frontal upper surface or the frontal protection system by one end of a flexible tape, when it is held in a vertical longitudinal plane of the vehicle and traversed across the frontal upper surface or frontal protection system. The tape is held taut throughout the operation with one end in contact with ground reference level, vertically below the front face of the bumper or frontal protection system and the other end is held in contact with the

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frontal upper surface or frontal protection system (see Figure 15, for example). The vehicle is positioned in the normal ride attitude.

This procedure shall be followed, using appropriate measuring tape lengths, to describe wrap around distances of 900 mm (WAD900), 1 000 mm (WAD1000), 1 700 mm (WAD1700) and 2 100 mm (WAD2100).

Figure 1

Determination of bonnet rear reference line

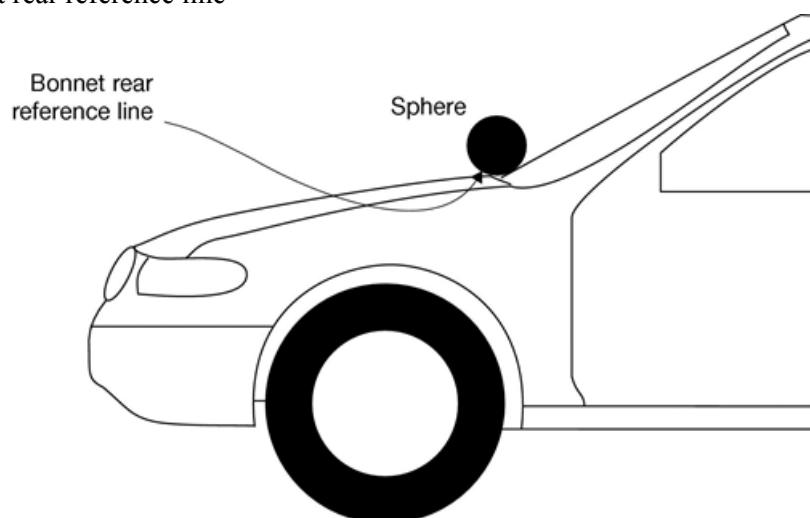


Figure 2

Determination of corner of bumper

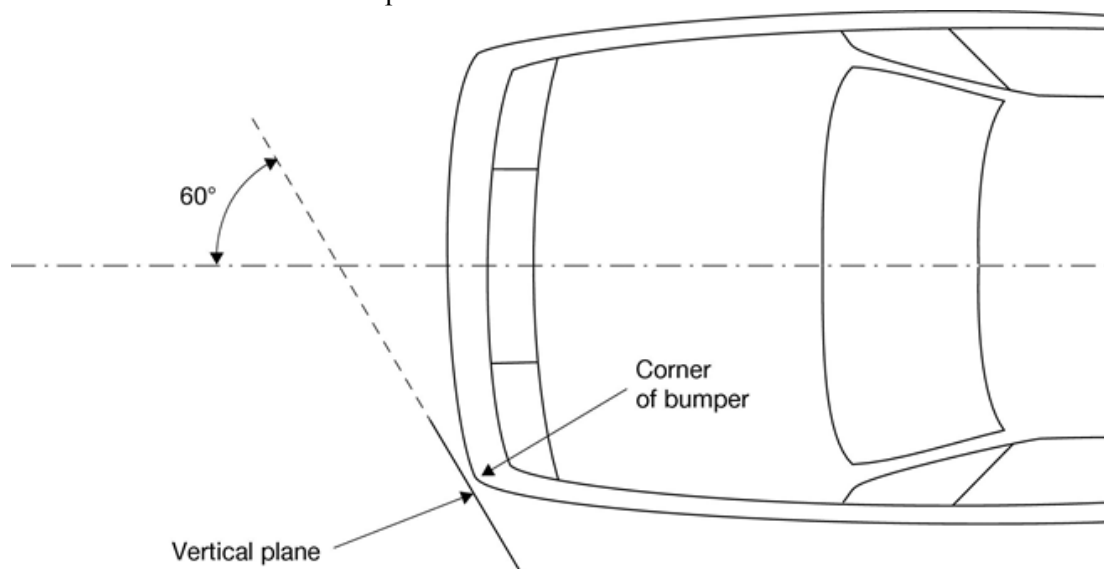


Figure 3

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Determination of Corner of Frontal Protection System

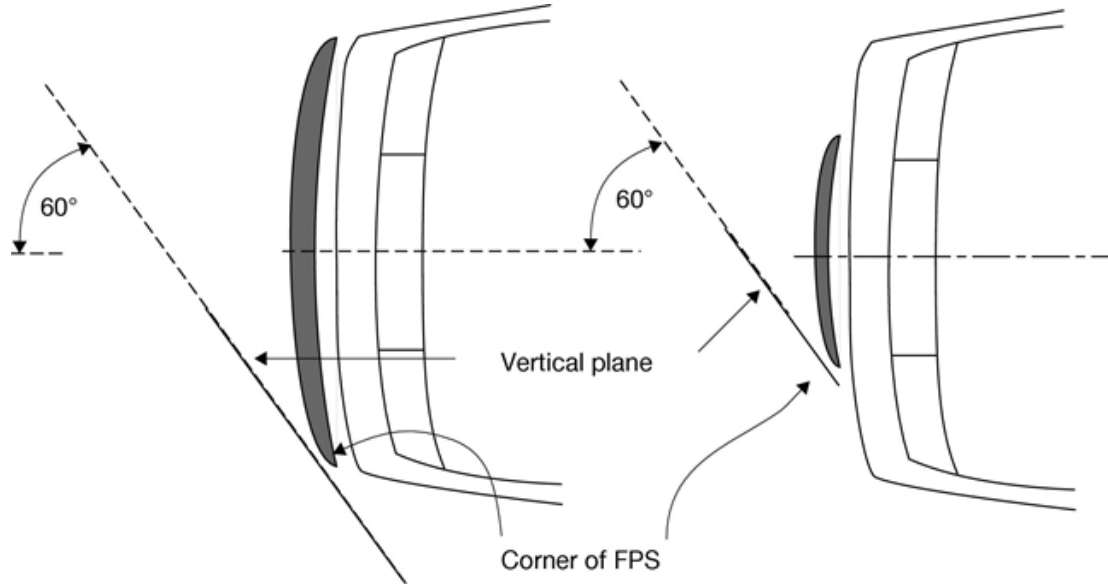


Figure 4

Determination of corner reference point; intersection of the bonnet leading edge reference line and the side reference line

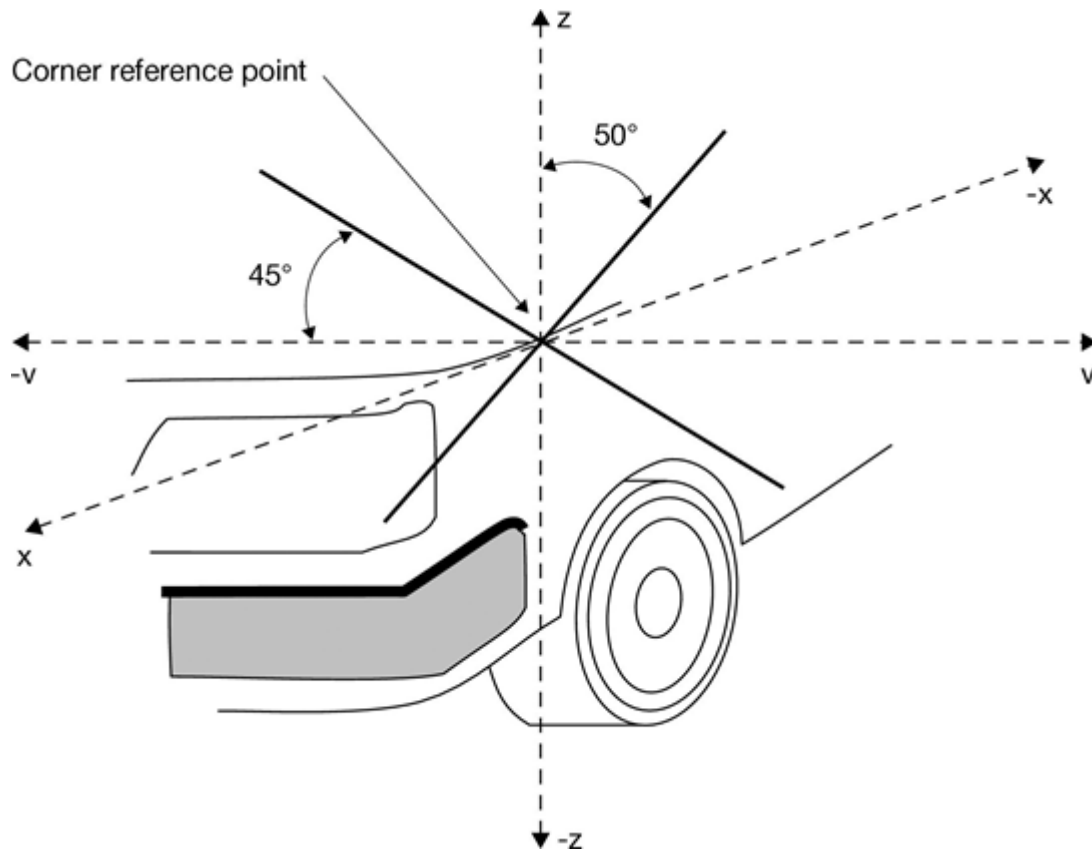


Figure 5

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Determination of Frontal Protection System Leading Edge Reference Line

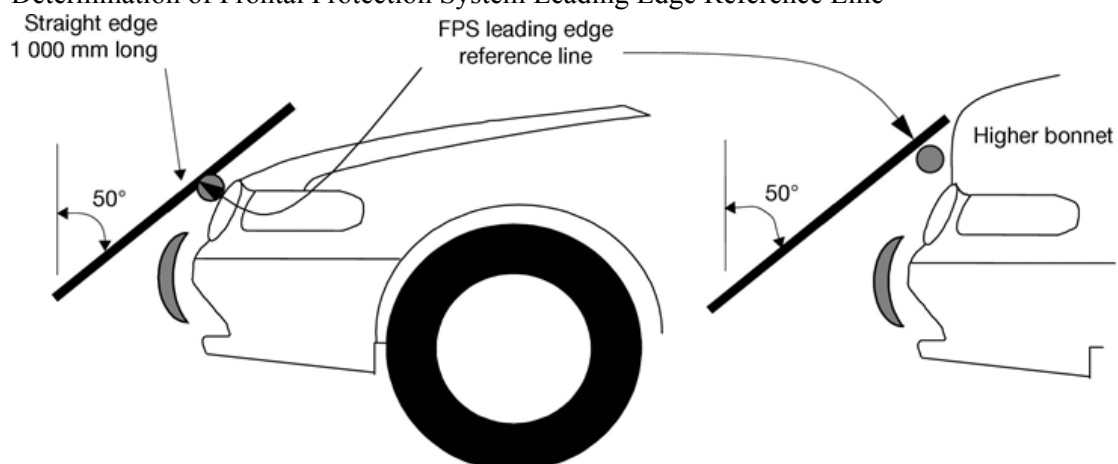


Figure 6

Impact and target points

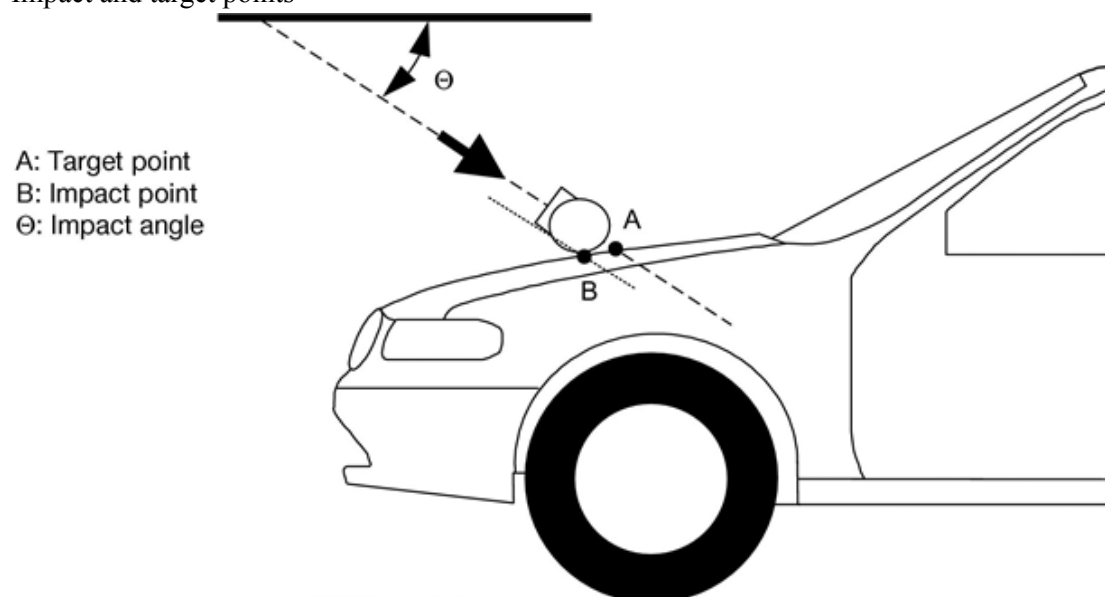


Figure 7

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Template design and markings used to join bonnet rear reference line and side reference line

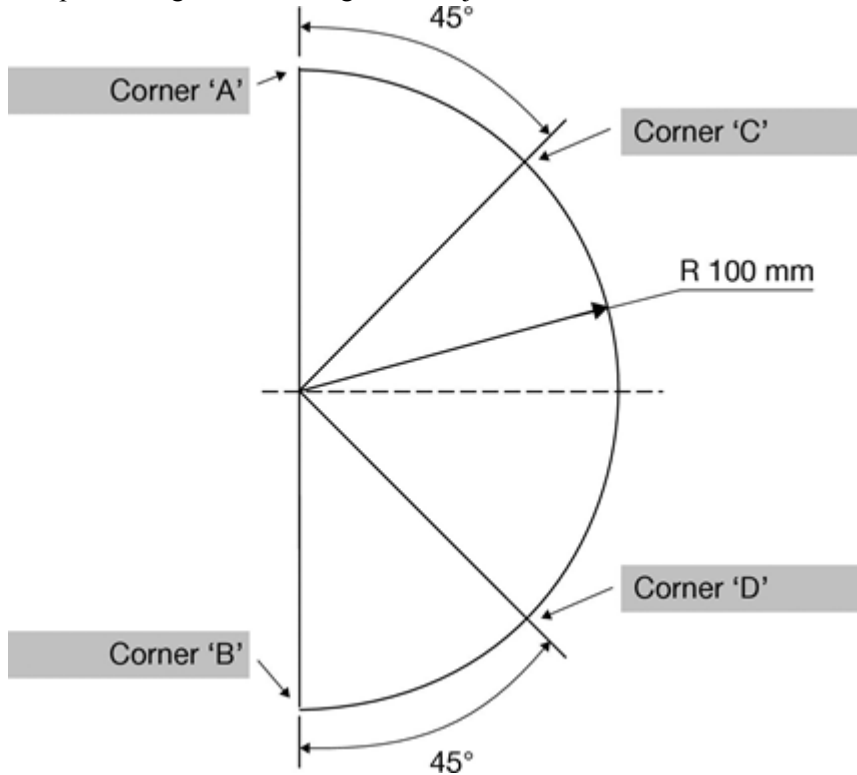
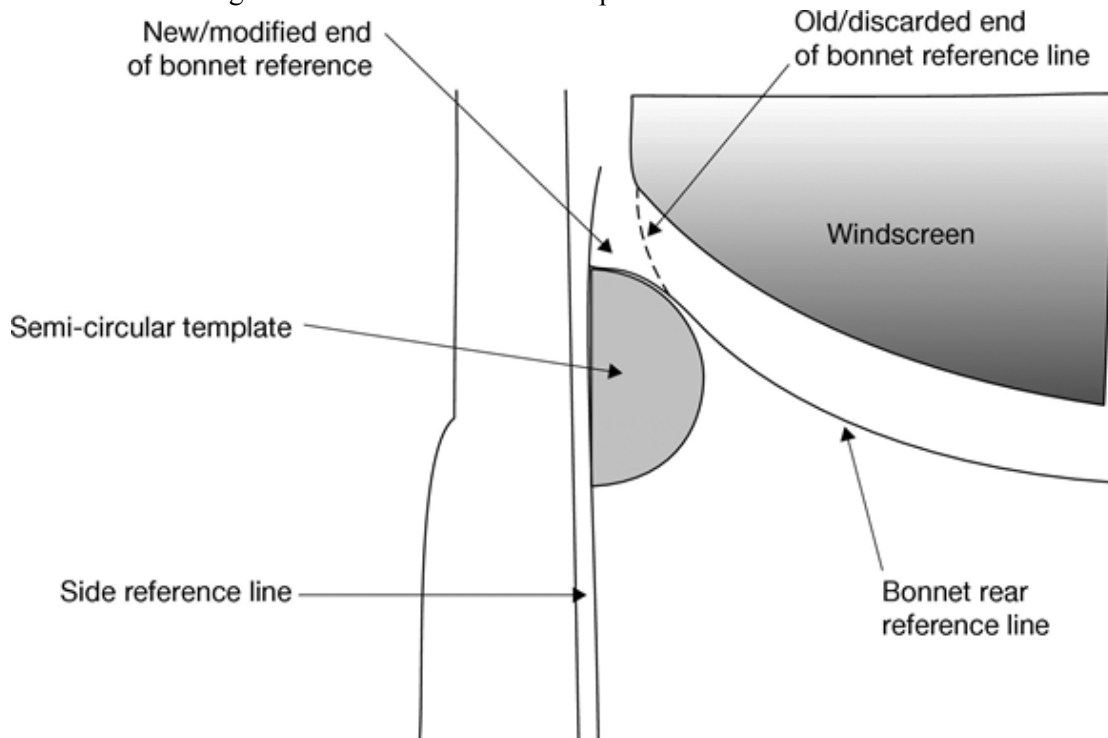


Figure 8

Plan view of rear corner of bonnet — extending the bonnet rear reference line to meet the side reference line along the circumferential arc of template



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Figure 9

Determination of lower bumper reference line

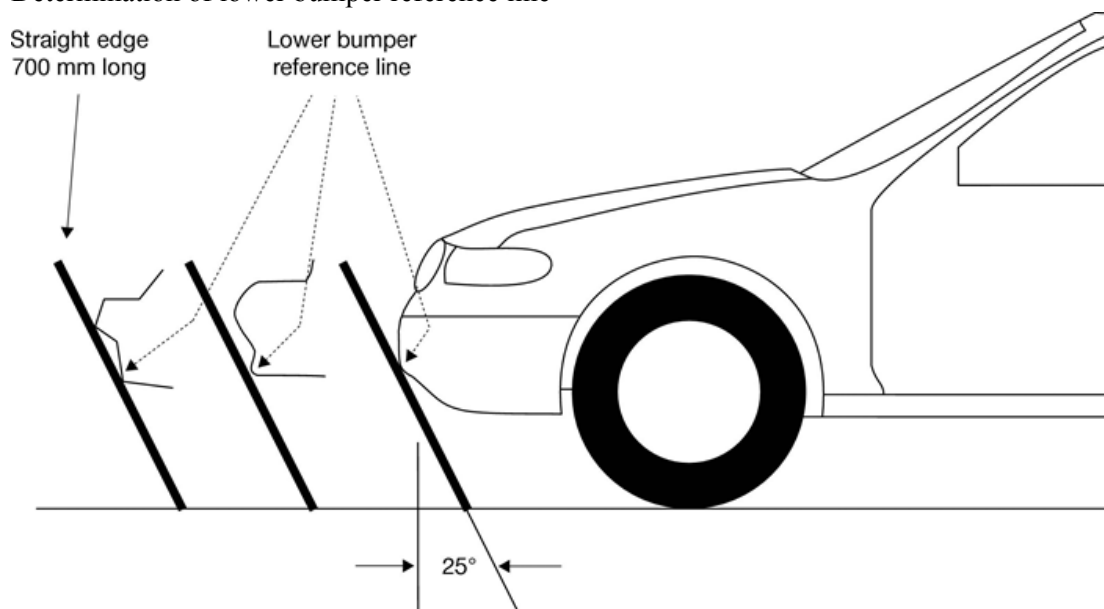


Figure 10

Determination of Lower Frontal Protection System Reference Line

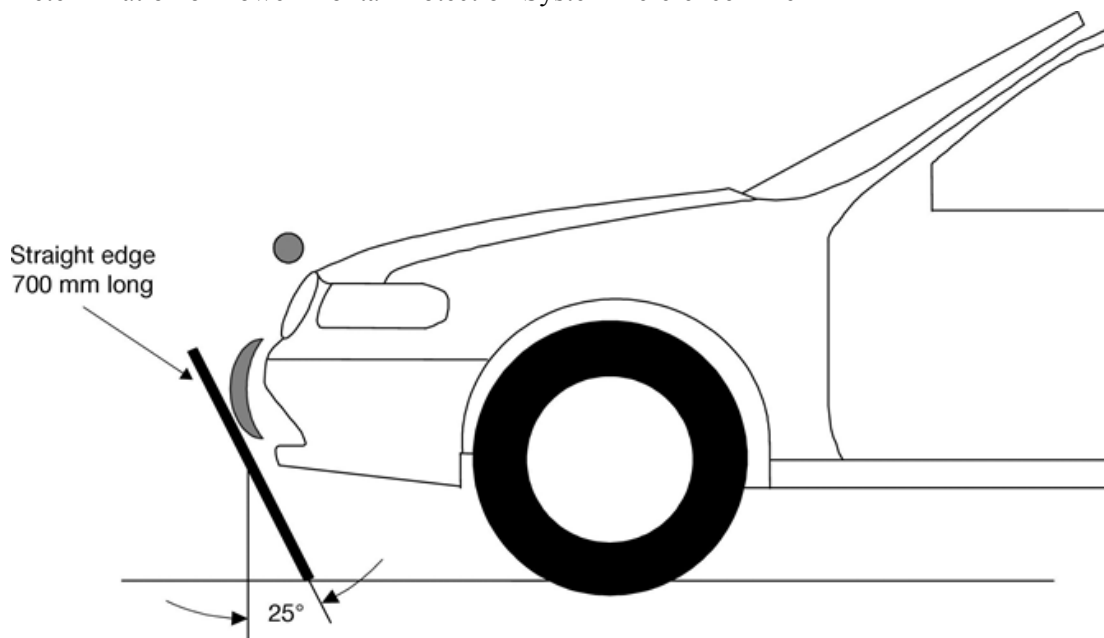


Figure 11

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Determination of rear windscreen reference line

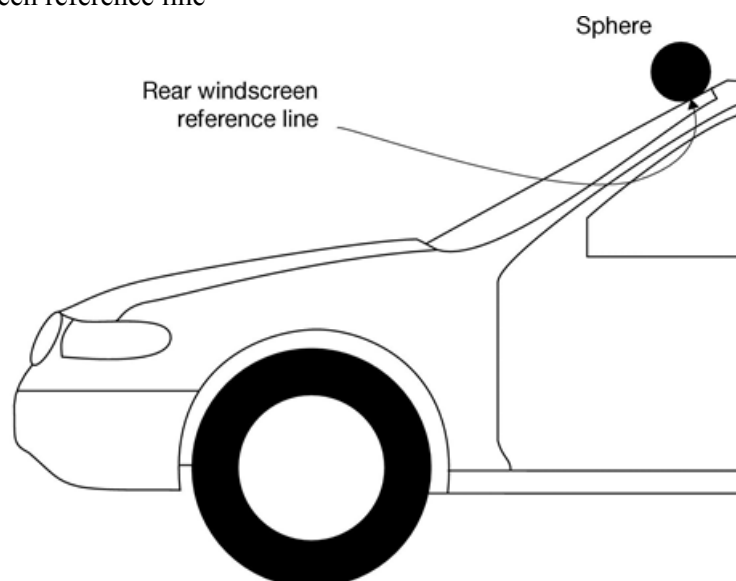


Figure 12

Determination of side reference line

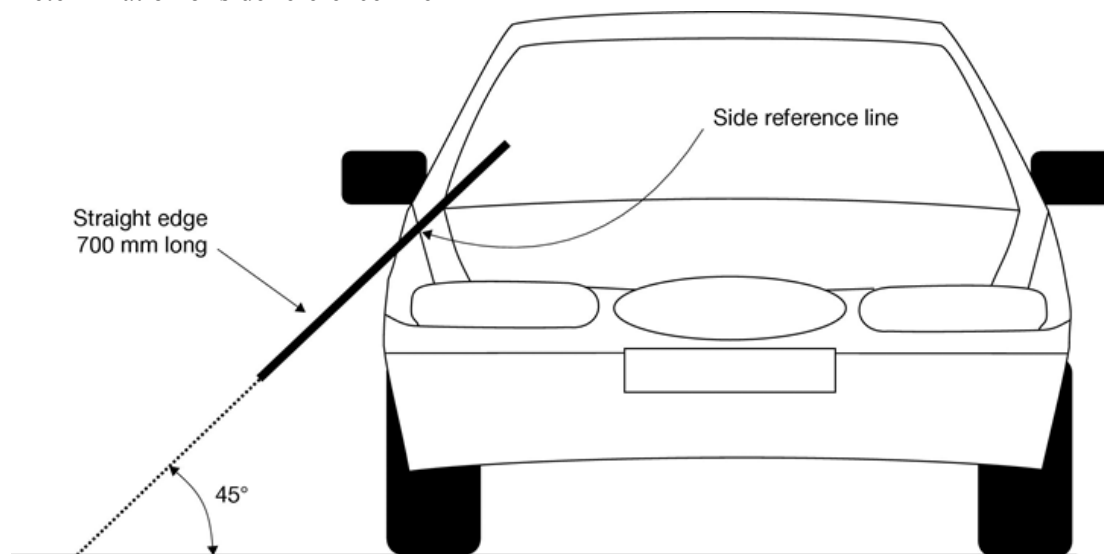


Figure 13

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Determination of upper bumper reference line

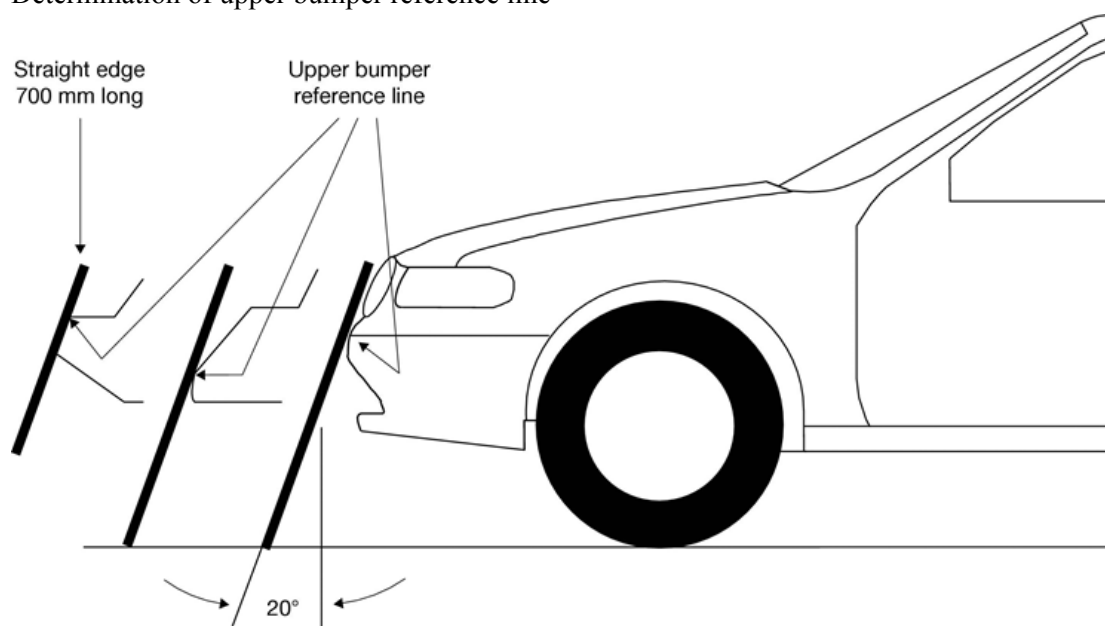


Figure 14

Determination of Upper Frontal Protection System Reference Line

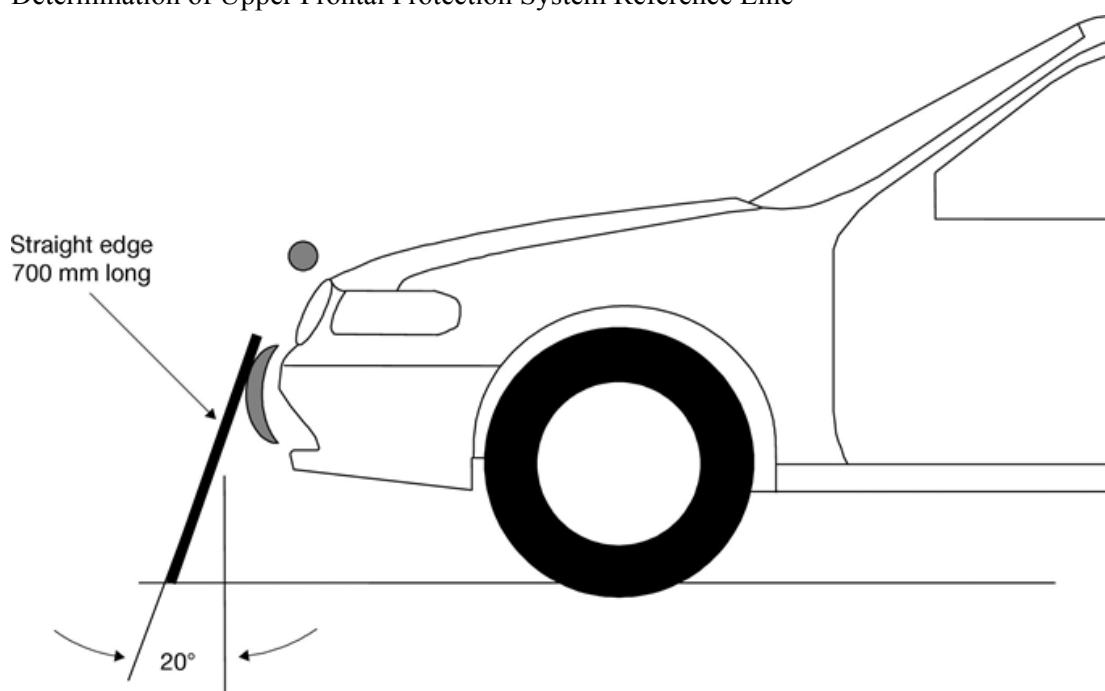


Figure 15

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Determination of Frontal Protection System wrap around distance

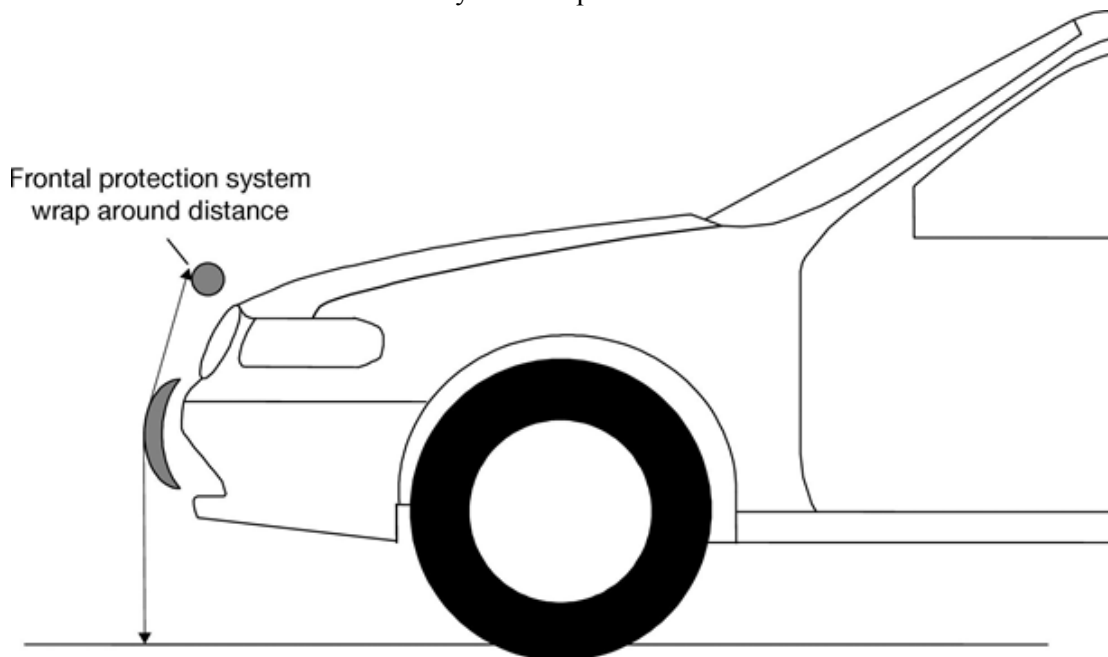
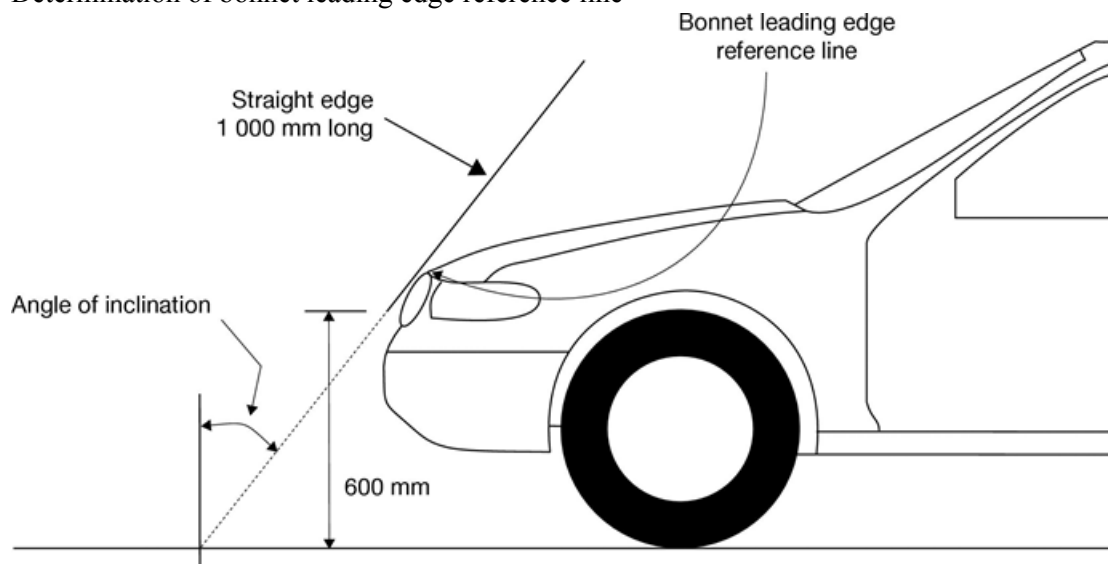


Figure 16

Determination of bonnet leading edge reference line



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Changes and effects yet to be applied to the whole legislation item and associated provisions

- Signature words omitted by [S.I. 2022/1273 reg. 54](#)