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Ergonomics - Motor Vehicle Drivers' Eye Locations

人类功效学 车辆驾驶员眼睛位置

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Ergonomics - Motor Vehicle Drivers' Eye Locations

1 Scope

This Standard provides eye locations and eyellipse positioning procedure for Chinese motor vehicle drivers.

This Standard is applicable to visual field design for Class M1 motor vehicles whose seat stroke is more than 133 mm.

2 Normative References

The following documents are indispensable to the application of this Standard. In terms of references with a specified date, only versions with a specified date are applicable to this Standard. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this Standard.

GB/T 15089-2001 Classification of Power-driven Vehicles and Trailers

GB/T 29120-2012 Procedure for H-point and R-point Determination

3 Terms and Definitions

Terms and definitions defined in GB/T 15089-2001 and GB/T 29120-2012 are applicable to this Standard.

3.1 Eyellipse

Eyellipse refers to the statistical representation of drivers' eyes in spatially relative internal vehicle reference point locations (please refer to Figure 1).

In vertical view (Z plane) and rear view (X plane), eyellipse X-axis is parallel to vehicle axis.

4.3.2 β angle of lateral view direction

Please refer to Formula (1) for eyellipse axis inclination in the lateral view direction:

$$\beta = 11.0^{\circ} \quad \cdots\cdots(1)$$

4.4 Eyellipse Central Location

Eyellipse central location shall be calculated in accordance with Formula (2) ~ Formula (5). Please refer to Figure 3 for the geometric relationships of various parameters.

$$Xc = L1 + 628 + 0.587(L6) - 0.176(H30) - 12.5t \quad \cdots\cdots(2)$$

$$Ycl = W20 - \text{Chinese body's average interpupillary distance}/2 \quad \cdots\cdots(3)$$

$$Ycr = W20 + \text{Chinese body's average interpupillary distance}/2 \quad \cdots\cdots(4)$$

$$Zc = H8 + 623 + H30 \quad \cdots\cdots(5)$$

Where,

Xc---along X direction, the distance between X-axis datum line and eyellipse central location, expressed in (mm);

L1---X coordinate of acceleration pedal reference point;

L6---the distance from steering wheel's central point to acceleration pedal reference point in X direction, expressed in (mm);

H30---the distance from SgRP to acceleration pedal heel point in Z direction, expressed in (mm);

t---variable value (set as 1 when there is clutch pedal; set as 0 when there is no clutch pedal);

Ycl, Ycr---along Y direction, the distance between the left - right eyellipse center and eyellipse central point, expressed in (mm);

W20---Y coordinate value of SgRP;

Zc---along Z direction, the distance between SgRP and eyellipse central point, expressed in (mm);

H8---Z coordinate value of heel point.

NOTE 1: Chinese body's average interpupillary distance shall take relevant national

W20---Y coordinate value of SgRP;

H8---coordinate value of heel point in Z axis direction;

H30---distance from SgRP to heel point in Z axis direction, expressed in (mm);

t---variable value (set as 1 when there is clutch pedal; set as 0 when there is no clutch pedal).

B.3.2 Seat vertical adjustability

In terms of seats whose height is adjustable, in Formula (2) ~ Formula (5) in this Standard, H30 (SgRP) should take half of the vertical adjustable range. Generally speaking, SgRP height should be 20 mm ~ 25 mm above the lowest H-point. If the adjustment stroke in the vertical direction is more than 40 mm, H-point should be designed at 20 mm above the lowest position. If the adjustment stroke in the vertical direction is less than 40 mm, H-point should be designed in the middle of the height adjustment stroke.

B.4 Eyellipse Axis Length

B.4.1 X-axis length

In terms of X-axis length, axis length refers to the actual distance, instead of the horizontal distance in X direction. Figure B.1 and Figure B.2 provide the process of axis length calculation in the lateral view.

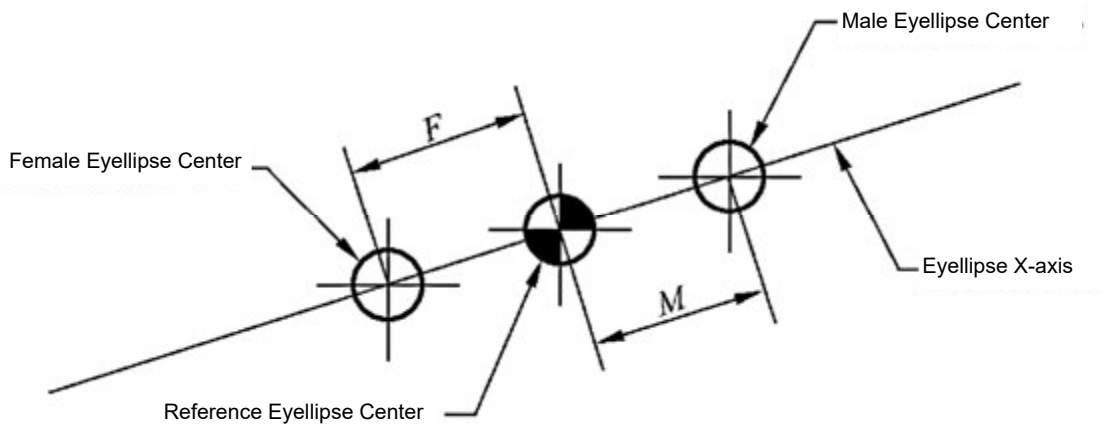

Figure B.1 -- Sketch Map of Male - Female and Reference Point in Lateral View

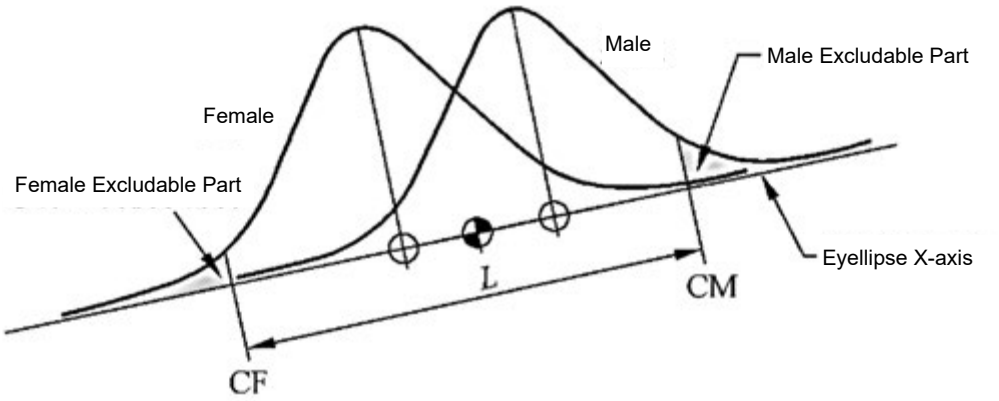

Figure B.2 -- Determination of Eye Points' Terminal Point and Length on X-axis

In the lateral view, the correlation coefficient of drivers' eye space coordinates and height is 0.473. In other words, in the lateral view, when the height difference between two drivers is 10 mm, the coordinate space point difference between them is 4.73 mm. In addition, the taller driver is located in the rear. Similarly, when the average height difference between two populations is 10 mm, in the lateral view, the eyellipse central location also has a difference of 4.73 mm. Due to the difference between the average height of male and female, their height distribution also differs in the lateral view. Therefore, in the calculation of axis length in the lateral view direction, the influence of gender needs to be taken into consideration.

Furthermore, eyellipse height shall consider population height difference. The determination of X-axis length in the lateral view includes two steps. Firstly, determine the distribution of eye points on X-axis. Then, find the upper limit point and lower limit point of the distribution; the distance between the two points shall represent the axis length. As a matter of fact, the coordinates of eye points in the lateral view comply with two-dimensional normal distribution of male and female.

In order to simplify boundary calculation, the eyellipse central point shall be taken as the origin of coordinates. In accordance with the offset of the central location, boundary distance may be calculated. Firstly, in accordance with Formula (B.5) and Formula (B.6), determine male and female eyellipse central location.

$$M = 0.473(\mathrm{SM} - \mathrm{SR}) \qquad \cdots\cdots (\mathrm{B.5})$$

$$F = 0.473(\mathrm{SF} - \mathrm{SR}) \qquad \cdots\cdots (\mathrm{B.6})$$

Where,

M, F---represent the distance of male and female eye points relative to the central location in the lateral view, expressed in (mm);

SM, SF---represent male and female average height, expressed in (mm);

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