Informal document No. **GRSG-94-28**
(94th GRSG, 21-25 April 2008,
Agenda item 6.)

PROPOSAL FOR DRAFT AMENDMENTS TO THE 02 SERIES OF AMENDMENTS TO REGULATION No. 46

(Devices for indirect vision)

Transmitted by the expert from the European Commission (EC)

Note: The text reproduced below was prepared by the expert from the EC in order to introduce requirements for the determination of the ocular points when the driver seat has a fixed seat-back angle or when the design torso line cannot be set at 25°. The proposal comes in addition to ECE/TRANS/WP.29/2006/101 and takes into account some comments from the Netherlands in a document without an official symbol (Informal Document GRSG-91-5). The modifications to the current text of the Regulation (up to the 02 series of amendments) are marked in **bold** characters.

A. PROPOSAL

Paragraph 12.1., amend to read:

" …. as defined in Annex 8. **In the case the driver's seat cannot be adjusted for a design torso line of 25° or has a fixed seat-back angle for which the design torso line differs from 25°, the location of the ocular points in relation to the R point shall be adjusted in accordance with the provisions of Annex 11.** The straight line …. "

Insert a new Annex 11, to read:

"**Annex 11**

DETERMINATION OF THE OCULAR POINTS FOR A SEAT WITH A FIXED SEAT-BACK ANGLE

The table below indicates the corrections to be made to the coordinates of the ocular points when the seat-back angle does not allow the design torso line to be set at 25 .

Seat-back angle (in degrees)	*Horizontal coordinates*	*Vertical coordinates*
	ΔX	ΔZ

Note: This document is distributed to the Experts on General Safety only.

5°	- 217.1 mm	-38.3 mm
6°	- 206.7 mm	- 34,6 mm
7°	- 196.2 mm	- 31,1 mm
8°	- 185.7 mm	- 27,7 mm
9°	- 175.0 mm	- 24,6 mm
10°	- 164.4 mm	- 21.6 mm
11°	- 153.6 mm	- 18.8 mm
12°	- 142.8 mm	- 16.3 mm
13°	- 132.0 mm	- 13.9 mm
14°	- 121.1 mm	- 11.7 mm
15°	- 110.3 mm	- 9.6 mm
16°	- 99.3 mm	- 7.8 mm
17°	- 88.4 mm	- 6.2 mm
18°	- 77.4 mm	- 4.7 mm
19°	- 66.4 mm	- 3.5 mm
20°	- 55.3 mm	- 2.4 mm
21°	- 44.3 mm	- 1.5 mm
22°	- 33.2 mm	- 0.9 mm
23°	- 22.1 mm	- 0.4 mm
24°	- 11.1 mm	- 0.1 mm
25°	0 mm	0 mm
26°	+ 11.1 mm	- 0.1 mm
27°	+ 22.1 mm	- 0.4 mm
28°	+ 33.2 mm	- 0.9 mm
29°	+ 44.3 mm	- 1.5 mm
30°	+ 55.3 mm	- 2.4 mm
31°	+ 66.4 mm	- 3.5 mm
32°	+ 77.4 mm	- 4.7 mm
33°	+ 88.4 mm	- 6.2 mm
34°	+ 99.3 mm	- 7.8 mm
35°	+ 103.3 mm	- 9.6 mm
36°	+ 121.1 mm	- 11.7 mm
37°	+ 132.0 mm	- 13.9 mm

38°	+ 142.8 mm	- 16.3 mm
39°	+ 153.6 mm	- 18.8 mm
40°	+ 164,4 mm	- 21.6 mm

■

JUSTIFICATION

Driver's ocular points OD and OE have been defined taking into account that a design seat back angle of 25° can be achieved easily and represents the most usual driving condition. This occurs almost when the driver's seat is inclinable. As the angle of the rear-view mirrors can be adjusted easily for a wide range of driver's position, it is sufficient to place the measuring device at the location prescribed in paragraph 12.1. of Annex I. As the position of the 'R point' corresponds to the rearmost and lowest normal design driving position of each seating position in a vehicle, this would normally cover the worst case.

However, the coordinates of the ocular points has to be corrected for those seats where the seat-back is fixed and it is not possible to set it at 25°.

As there has been some confusion at the time documents ECE/TRANS/WP.29/GRSG/2006/13 and GRSG-91-5 were submitted to GRSG to address the issue of fixing appropriate corrections, it has been seen necessary to assess wether it would be useful to use the same corrections as for the V and P points defined in Regulation [125] relating to the driver's front field of vision or strive to a specific approach.

The goal of this proposal for a new Annex XI is to clarify the situation and to propose simplified corrections which are necessary to the coordinates, in accordance with the method used to check the rearward fields of vision.

It is proposed to alter the position of the ocular points used to assess the mirror fields of view depending on the actual vehicle seat back angle where it is not possible to achieve a seat back angle of 25°. This would allow the field of view test to be carried out under conditions which are representative of the actual position of the driver's eyes in a vehicle.

ADDITIONAL EXPLANATIONS

1. legislation relating to the front forward field of vision

UN/ECE Regulation [125] and Directive 77/649/EEC are relating to the driver's field of vision. The concept of these two pieces of legislation is based on the locations of 95th percentile 'eyellipses' (contraction of the words 'eye' and 'ellipse', describing the elliptical shape of the driver's eye range) which constitute the subject matter of Standard ISO 4513-1978 [1].

In a study involving drivers, an 'eyellipse locator line has been developed to position the 'eyellipse' in the driver work space for seat back angles ranging from 5 to 40°. The six 'eyellipse' templates included in Standard ISO 4513 represent specific driving seat track travel lengths ranging from 102 mm to 165 mm.

For the purpose of regulating the driver's field of vision, specific points have been defined which take into account the extreme positions of one of the specific 'eyellipses' (The 'V points'). Therefore a complex correction system has been set up which applies to those points as mentioned in Standard ISO. Also P points has been defined to position the driver's eye when the head rotates in order to measure the obstruction angles created by the 'A pillar'.

V points

'V points' are two points used for the determination of the front forward field of vision. Coordinates are in relation to the driver's seat 'R point', as indicated by XYZ coordinates from the three-dimensional reference system centred on R point as shown in table I.

(Table I indicates the basic coordinates for a design seat-back angle of 25º)

V points	X	Y	Z
V_1	68 mm	5 mm	665 mm
V_2	68 mm	5 mm	589 mm

TABLE I

P points

'P points' are two points about which the driver's head rotates when he views objects on a horizontal plane at eye level. They are used for positioning the 'E points' (the driver's ocular points) which in turn are used for the determination of the obstruction angles

[1] Method for establishment of eyellipses for driver's eye location. This standard has been updated in 2003.

created by the 'A pillars'. The Coordinates of the 'P points' are in relation to the 'R point' as indicated by the XYZ coordinates from the three-dimensional reference system centred on the driver's seat 'R point', are shown in Table II.

'Pm point' is the point of intersection between the straight line P1 - P2 and the longitudinal vertical plane passing through the 'R point'.

(Table II indicates the basic coordinates for a design seat-back angle of 25º).

P points	X	Y	Z
P_1	35 mm	- 20 mm	627 mm
P_2	63 mm	47 mm	627 mm
P_m	43.36 mm	0	627 mm

TABLE II

'P points' are subject to further corrections to be made to the X coordinate when the horizontal seat-adjustment range exceeds 108 mm.

Further corrections are to be made to the X and Z coordinates of each 'P point' and each 'V point' when the design seatback angle is not 25º. These corrections are included in Table III and IV. For the sake of simplification, they are not reproduced in this paper.

2. Legislation on rearward and lateral field of vision

UN/ECE Regulation 46 and Directive 2003/97/EC are relating to the field of vision provided by interior and exterior rear-view mirrors. By contrast to the provisions recalled in Section 1, the rearward and lateral fields of vision are determined in a simplified way. A measuring device (two powerful light sources) is placed at the location prescribed in paragraph 12.1. of Annex I, i.e. 635 mm above the driver's seat 'R point'. As the location of the 'R point' corresponds to the rearmost and lowest normal design driving position of each seating position in a vehicle, this normally covers the worst case.

Two ocular points are defined, as explained below.

'O points'

'O points (driver's ocular points - OD and OE)' are two points used for the determination of the rear and lateral fields of vision. They are situated 65 mm apart and 635 mm vertically above R point of the driver's seat. The straight line joining OD and OE runs perpendicular to the vertical longitudinal plane of the vehicle while the centre of the segment joining the two ocular points is in a vertical longitudinal plane passing trough 'R point'.

While the coordinates of the 'O points' are not specified in the legislation, one can easily calculate them with respect to a three dimensional reference system centred on the driver's seat 'R point'.

O points	X	Y	Z
O_D	0 mm	32.5 mm	635 mm
O_E	0 mm	- 32.5 mm	635 mm

3. Proposal

Up to now, it has been proposed either :

a) to copy the corrections used for the coordinates of 'V points' in Regulation 46 when the seat back is fixed and does not match the 25° or

b) to copy the same corrections but to apply them in all cases when the design angle of 25° has not been used.

However, it seems necessary to re-address the issue for the following reasons :

1. the measurement method in 2003/97/EC requires the use of luminous sources located at the ocular points of the driver which are set in an horizontal plane distant from the 'R point' by 635 mm, **irrespective of which torso angle it might be** but assuming that it is set at 25° from the design point of view. In principle, given the requirements and the measurement method, no corrections are actually needed in most of the cases;

2. corrections should apply only when the seat back is fixed and where the design position of 25° is not existing (or where the seat back is adjustable but a seat back angle of 25° cannot be achieved however the seat is adjusted)

3. correction values as proposed in table under Point 2 have been calculated on the basis of a definition of ocular points which differ significantly from the one referred to in 2003/97/EC. In fact, such corrections, as currently in table under Point 2, apply to "eyellipse" location points used in Directive 77/649/EEC.

The conclusion is that a new Annex XI should be drafted to introduce appropriate corrections of relevance only for rear-view mirrors legislation.

For the purpose of calculation, it is assumed that the location of the ocular points set up at 635 mm above the R point corresponds to a seat back angle inclined by 25° and that the height of the eyes with respect to the body does not change if the seat back is moved from 5 to 40° (which implies in turn that the position of the head does not change). Therefore, it can be assumed that the ocular points will run a circular travel around the R point when the seat back moves from 5 to 40°. This is a simplification because the movement of seat back would not follow the same law as the dummy (e.g. hybrid III dummy or 3 D-H machine).

Coordinates of the various positions of the O points can be calculated from the equation

$$X^2 + Z^2 = 635^2$$

and the variations ΔX ΔZ, deduced by using simple trigonometric functions.

When testing the field of vision in the case of a fixed sat back angle which is different from 25°, the light sources have to be positioned in accordance with the adaptations calculated by the method described here above (see diagrams for details).

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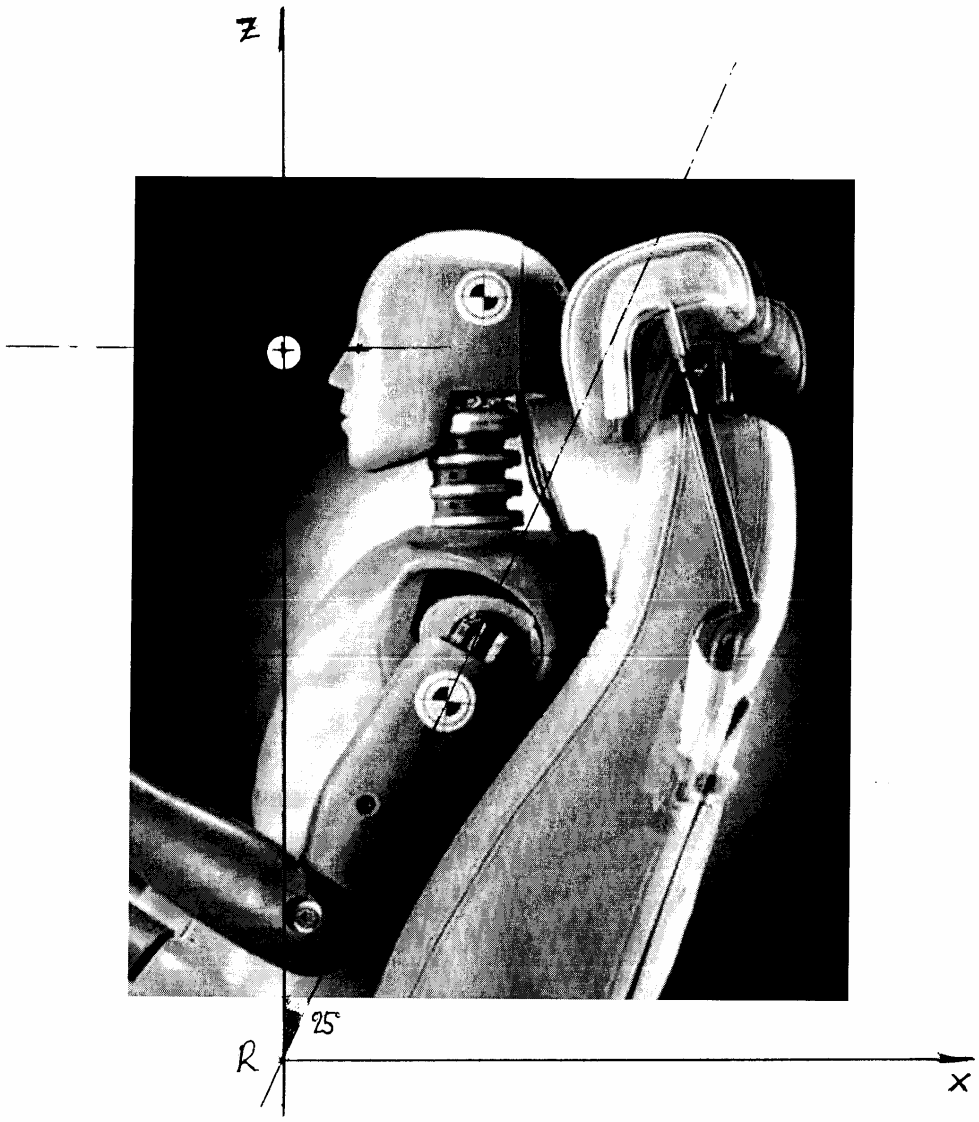
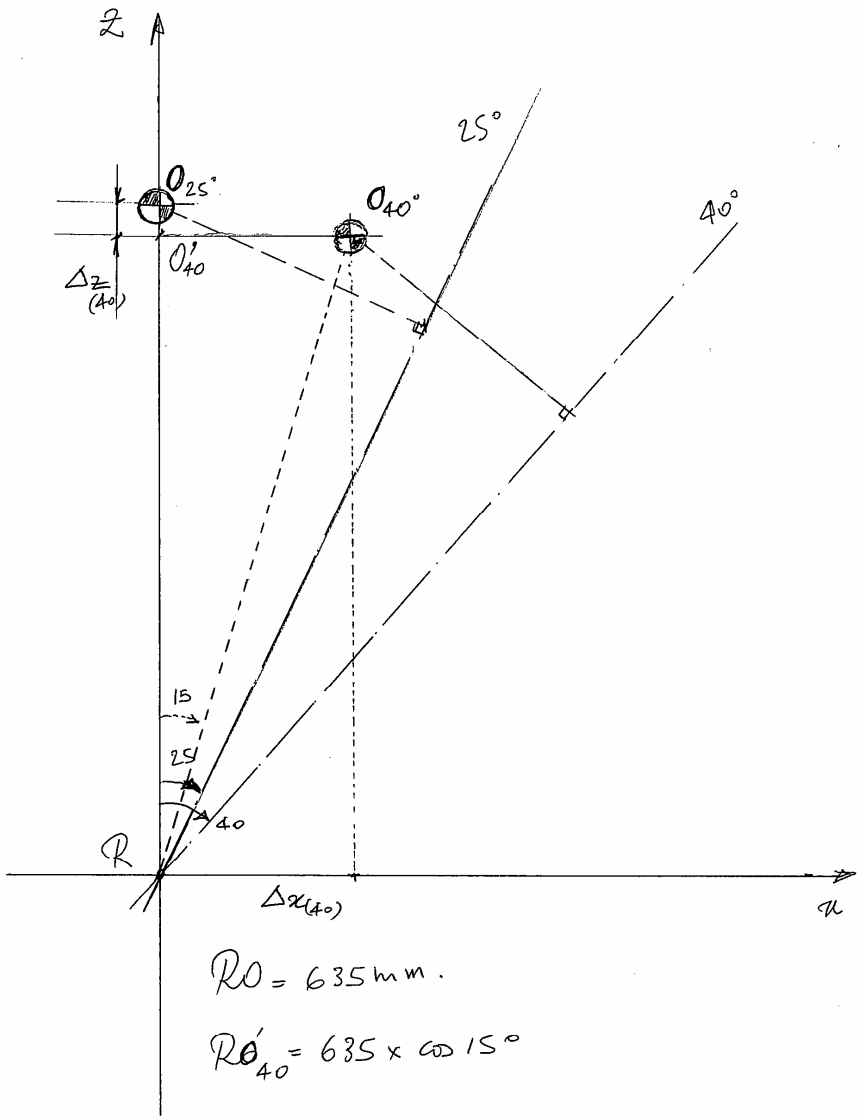

Z
25°
R
X

Principe du calcul Δz & Δx.



$R0 = 635\,mm.$

$R\theta'_{40} = 635 \times \cos 15°$

$\Rightarrow \Delta z_{(40)} = -635(1 - \cos 15) = -21{,}637.$
