



TECHNICAL REPORT

J1050

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DESCRIBING THE DRIVER'S FIELD OF VIEW—SAE J1050

SAE Recommended Practice

Report of Human Factors Engineering Committee and Automotive Safety Committee approved September 1973.

1. Purpose and Scope—This SAE Recommended Practice establishes a uniform method for describing the driver's direct and indirect fields of view using the SAE J941c eyellipse. These fields of view relate to both the interior and exterior of the vehicle and are applicable to all motor vehicles.

2. General—The terms monocular, binocular, and ambinocular are defined in this recommended practice relative to motor vehicle components as opposed to traditional human physical limitations.

The traditional definition of monocular, binocular, and ambinocular as illustrated in Fig. 1 limits the field of view to the physical restrictions of the human eye and head and combines the peripheral field of view with the monocular, binocular, and ambinocular direct fields of view.

This recommended practice, however, defines the terms monocular, binocular and ambinocular as illustrated in Fig. 2 to a view which can be seen by the driver directly, as opposed to peripherally. The fields of view in Fig. 2 are represented by sight lines down which the driver sees or could see by turning his eyes. The field can also be extended laterally by the driver turning his head¹. The peripheral field of view has been separated from the other terms and is expressed as a temporal monocular view only.

3. Definitions

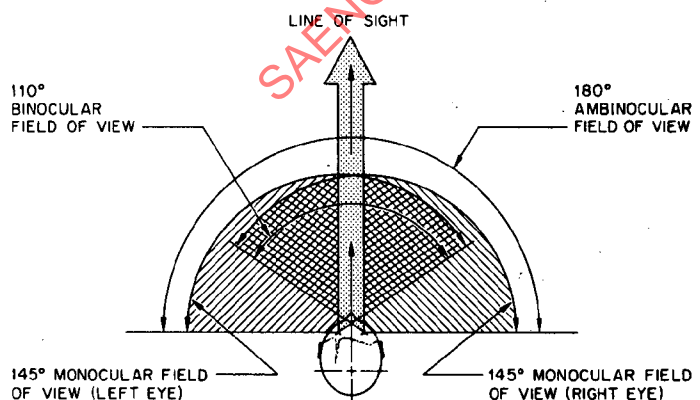
3.1 Eyellipse—A statistical representation of the driver's eyes located in a motor vehicle as defined in SAE J941c. The eyellipse templates are the contours formed by an infinite number of sight lines drawn from the object in the driver's field of view tangent to the eyellipse, and each sight line divides the eye positions so that (P) percent of the eyes are on one side of the plane and (100-P) percent are on the other.

3.2 Vision—The ability of the driver to see: ocular perception.

3.3 Field of View—The area within sight lines emanating from tangents on the eyellipse contours.

3.4 Direct Field of View—The view seen by the driver directly.

⁽¹⁾Reference: W. A. Devlin and R. N. Roe, "The Eyellipse and Considerations in the Driver's Forward Field of View," Paper 680105 presented at SAE Automotive Engineering Congress, Detroit, January 1968.



W. A. DEVLIN AND R. N. ROE, "THE EYELIPSE AND CONSIDERATIONS IN THE DRIVER'S FORWARD FIELD OF VIEW," PAPER 680105 PRESENTED AT SAE AUTOMOTIVE ENGINEERING CONGRESS, DETROIT, JANUARY 1968.

FIG. 1—DRIVER'S HORIZONTAL FIELD OF VIEW WITH NO EYE OR HEAD ROTATION (REF: SP-253, DESIGN ASPECTS FOR REAR VISION IN MOTOR VEHICLES. NEW YORK: SAE, 1964).

3.5 Indirect Field of View—The view seen by the driver through mirrors.

3.6 Monocular View—The field of view that can be seen by one eye at a time (Figs. 1 and 2).

3.7 Binocular View—The total field of view that can be seen by both eyes simultaneously (Figs. 1 and 2).

3.8 Ambinocular View—The total field of view that can be seen by either eye separately. It is not limited to the binocular field but includes, in addition, monocular field visible to the right eye but not to the left eye, and vice versa (Figs. 1 and 2).

3.9 Peripheral View—This monocular field of view extends from a direct sight line from either eye toward the temporal side to form an included angle of no more than 90 deg with the direct sight line. The vertex of the angle is at the eyepoint. (The peripheral view to the nasal side is omitted in this definition because the view overlaps the temporal peripheral view of the opposite eye and is considered redundant.)

3.10 Binocular Obscuration—An obstruction within the driver's binocular field of view which produces a volume behind the obstruction which cannot be seen by either eye simultaneously. Objects having an as-viewed width which is equal to or less than the effective interpupillary distances is not considered an obstruction when viewing objects in the exterior environment (Fig. 2).

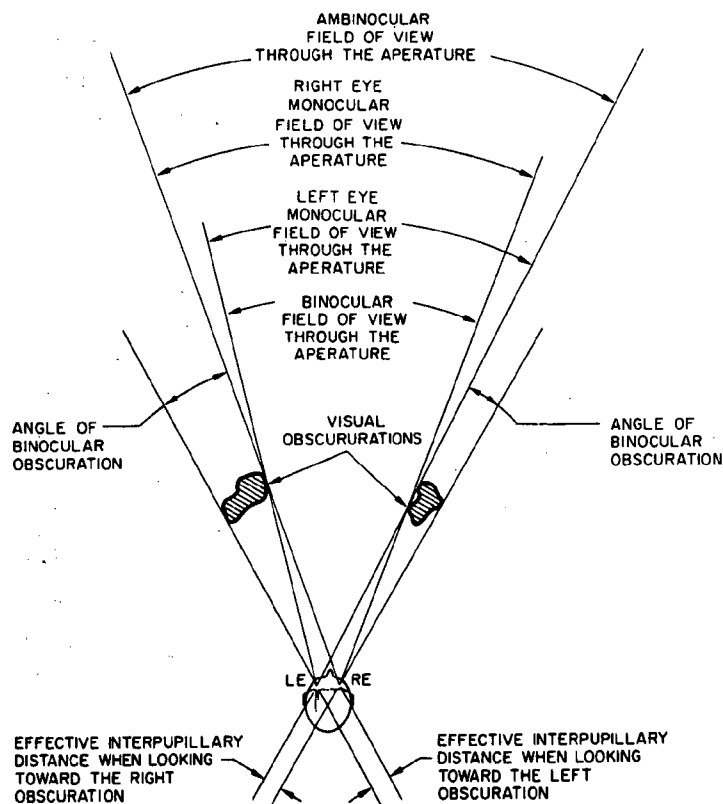
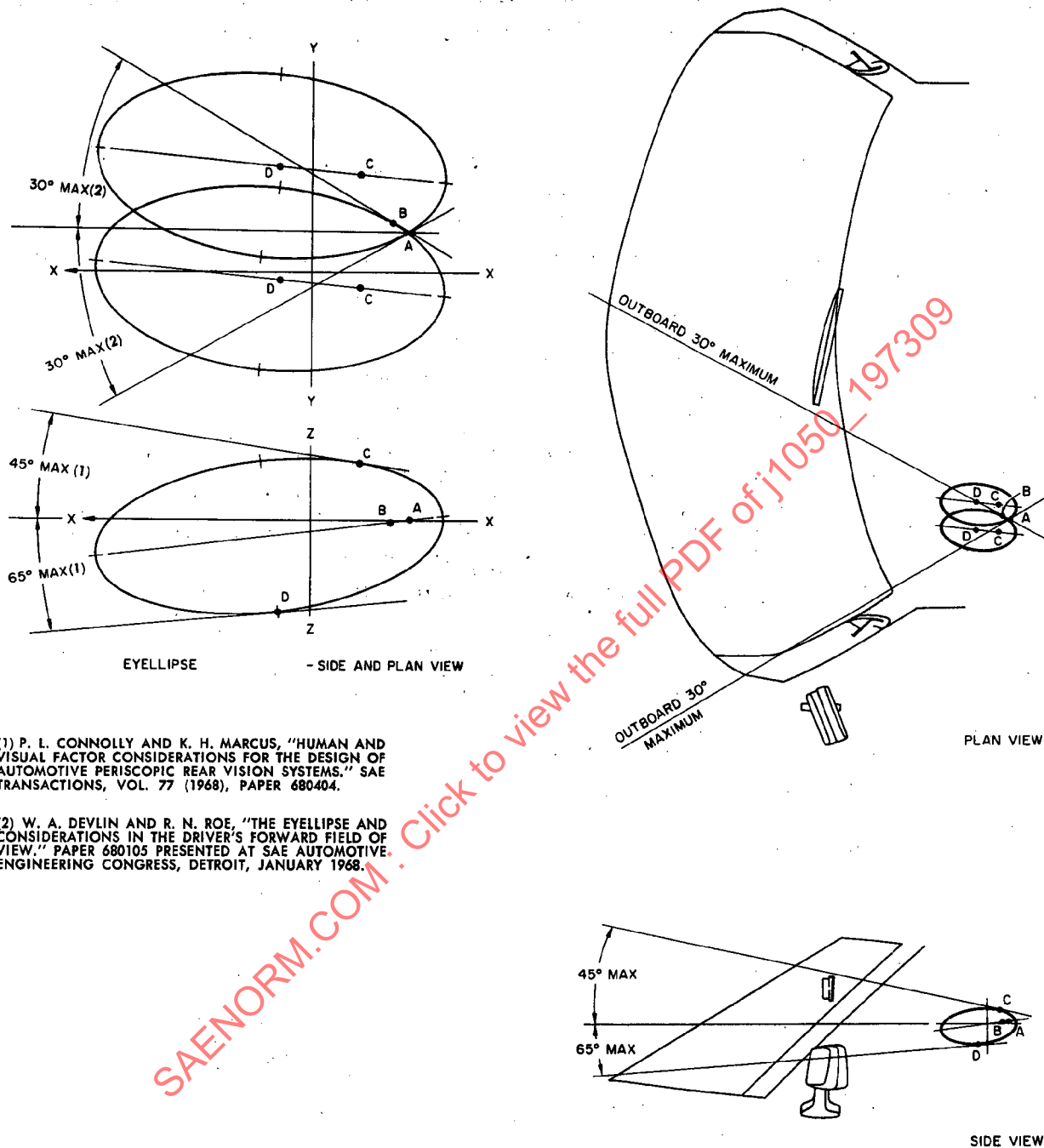


FIG. 2—DRIVER'S HORIZONTAL FIELD VIEW AS LIMITED BY OBSTRUCTIONS



(1) P. L. CONNOLLY AND K. H. MARCUS, "HUMAN AND VISUAL FACTOR CONSIDERATIONS FOR THE DESIGN OF AUTOMOTIVE PERISCPIC REAR VISION SYSTEMS," SAE TRANSACTIONS, VOL. 77 (1968), PAPER 680404.

(2) W. A. DEVLIN AND R. N. ROE, "THE EYELLIPSE AND CONSIDERATIONS IN THE DRIVER'S FORWARD FIELD OF VIEW," PAPER 680105 PRESENTED AT SAE AUTOMOTIVE ENGINEERING CONGRESS, DETROIT, JANUARY 1968.

FIG. 3—AMBINOCULAR DIRECT FIELD OF VIEW WITH EYE MOVEMENT ONLY

3.11 Effective Interpupilar Width—The minimum width between parallel sight lines, one from each eye. The width when using the SAE J941c eyellipse is 2.54 in (64.5 mm) when looking directly forward. This width decreases with increased eye turn (Fig. 2).

4. Driver's Field of View—The following methods of describing the driver's field of view are predicated on the proper location and use of the SAE J941c eyellipse within a specific motor vehicle.

4.1 Driver's ambinocular direct field of view (viewed through apertures): with eye movement only (paragraph 5) and with eye and head movement (paragraph 6).

4.2 Driver's ambinocular indirect field of view through an inside rearview mirror (paragraph 7).

4.3 Driver's binocular obstruction viewed directly or indirectly (must be totally within his binocular field of view): directly, left A-pillar (paragraph 8); directly, inside rearview mirror (paragraph 9); indirectly, through inside rear view mirror (paragraph 11).

4.4 Driver's monocular obstruction viewed indirectly (not totally within his binocular field of view): indirectly, through inside rear view mirror (paragraph 10).

4.5 Driver's peripheral field of view, right side (paragraph 12).

5. Ambinocular Direct Field of View with Eye Movement Only

5.1 Procedure—See Fig. 3.

5.1.1 PLAN VIEW

(a) Draw a vertical plane in the plan view tangent to the left edge

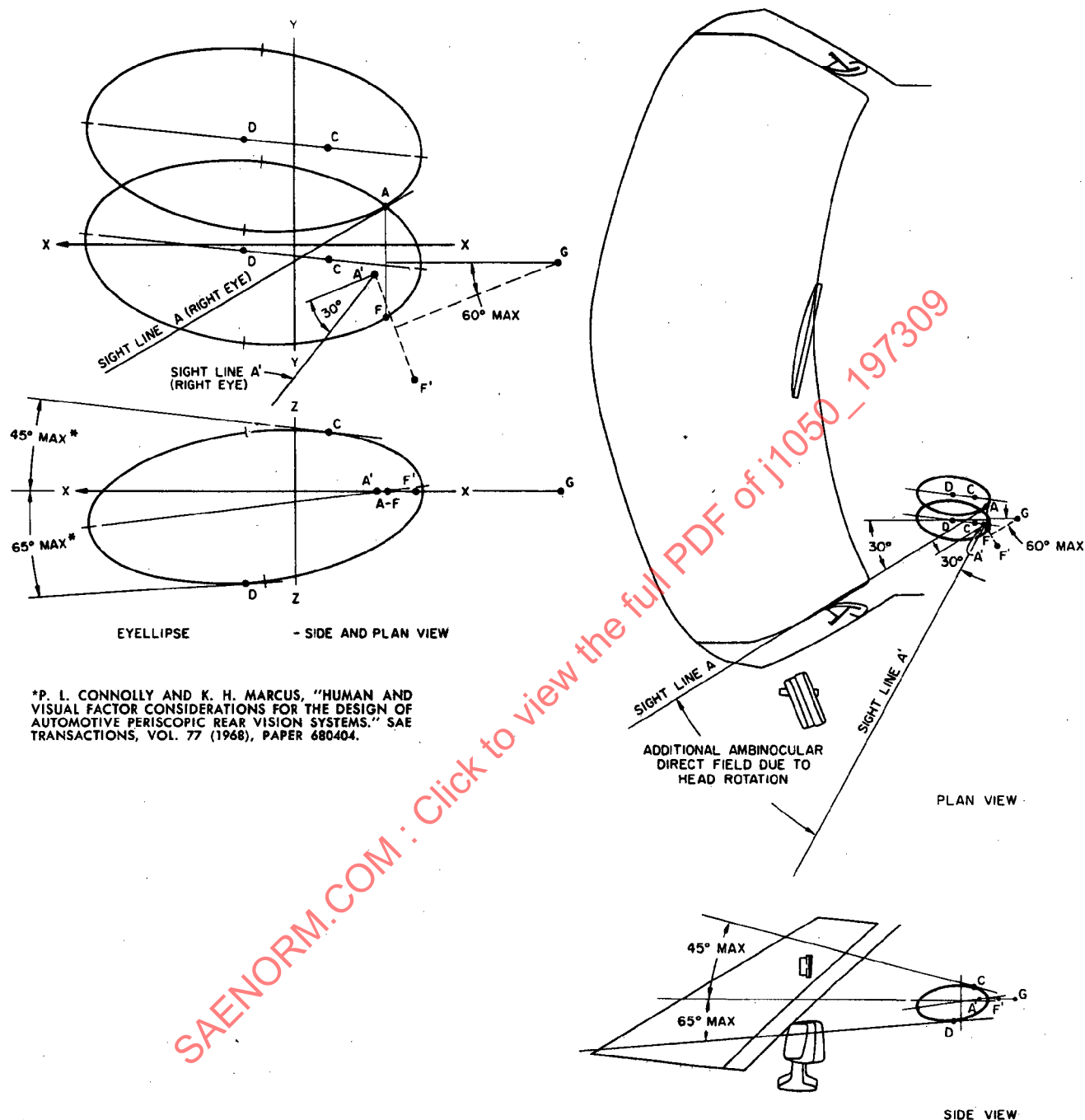


FIG. 4—AMBINOCULAR DIRECT FIELD OF VIEW WITH EYE AND HEAD MOVEMENT TO LEFT

of the right ellipse from directly forward to a maximum of 30 deg to the left. (Point A is the tangent point.) This represents maximum angular eye movement without head turn.

(b) Draw a vertical plane in the plan view tangent to the right edge of the left ellipse from directly forward to a maximum of 30 deg to the right. (Point B is the tangent point.) This represents maximum angular eye movement without head turn.

(c) The angle between the two planes is the ambinocular field of view of a driver facing straight ahead with no head movement but with eye movement allowed from looking straight ahead to a maximum of 30 deg outboard.

5.1.2 SIDE VIEW

(a) Draw a plane seen as a line in the side view tangent to the top

of the eyellipse inclined to a desired angle or to a target with a maximum up angle of 45 deg above the horizon. (Point C is the tangent point.)

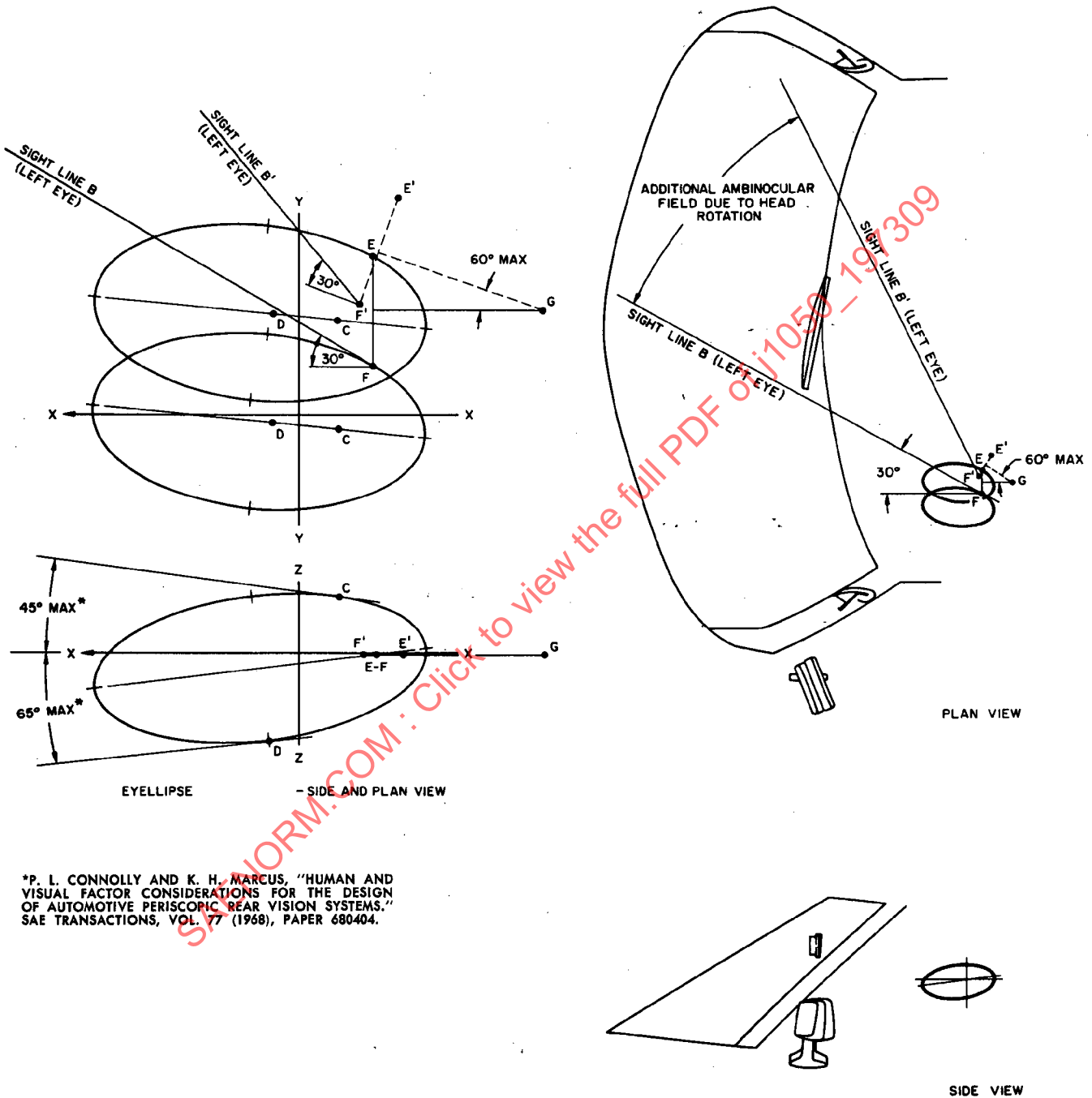
(b) Draw a plane seen as a line in the side view tangent to the bottom of the eyellipse declined to a desired angle or to a target with a maximum down angle of 65 deg below the horizon. (Point D is the tangent point.)

6. Additional Ambinocular Direct Field of View with Eye and Head Movement—(Head turn to the left is shown in Fig. 4, head turn to the right is shown in Fig. 5.)

6.1 Procedure

6.1.1 PLAN VIEW

(a) Using the procedure previously discussed for describing am-



*P. L. CONNOLLY AND K. H. MARCUS, "HUMAN AND VISUAL FACTOR CONSIDERATIONS FOR THE DESIGN OF AUTOMOTIVE PERISCOPIC REAR VISION SYSTEMS," SAE TRANSACTIONS, VOL. 77 (1968), PAPER 680404.

FIG. 5—AMBINOCULAR DIRECT FIELD OF VIEW WITH EYE AND HEAD MOVEMENT TO RIGHT

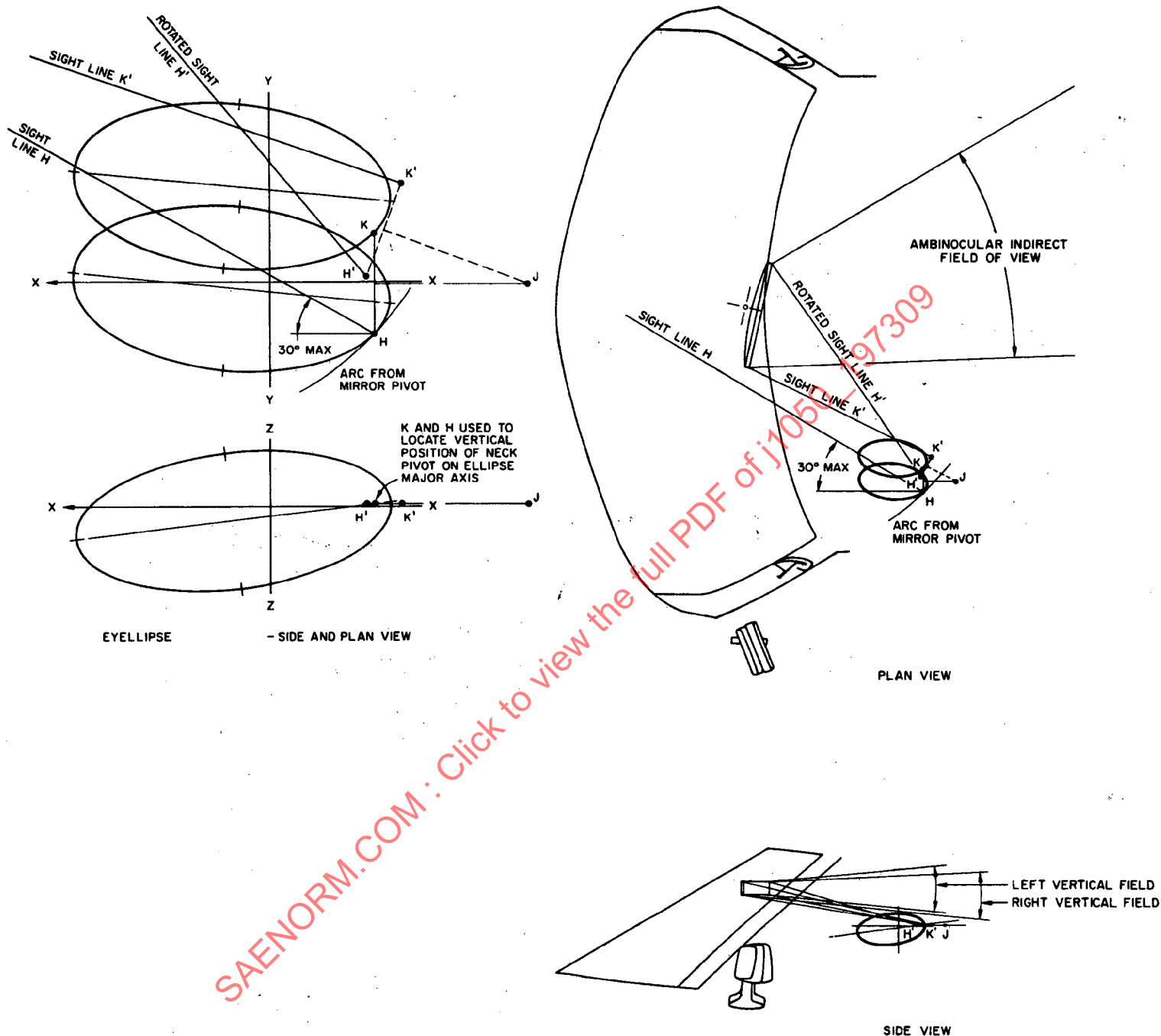


FIG. 6—AMBINOCULAR INDIRECT FIELD OF VIEW THROUGH INSIDE MIRROR

binocular direct field of view with eye movement only, establish tangent point A on the left edge of the right eyellipse for a sight line A with 30 deg eye turn to the left. Point A represents the right-hand eye point.

(b) From this tangent point A on the right eyellipse locate the equivalent left eyellipse tangent point F and then the neck pivot point G. Point F represents the left-hand eye.

(c) Using SAE J941c procedures and holding the relative position between the sight line A and neck pivot point G, rotate the sight line around the neck pivot point G to the desired angle or location A' to a maximum of 60 deg head turn angle. This new location shall be called sight line A'.

(d) The angle between sight line A and sight line A' is the additional ambinocular horizontal field of view when head turn to the left is being considered.

6.1.2 SIDE VIEW—Same as previous example with no head or eye movement.

7. Ambinocular Indirect Field of View Through an Inside Mirror

7.1 Procedure—Describes inside mirror field (Fig. 6). Fig. 7 covers sight line construction for ambinocular indirect field of view through a left outside mirror.

(a) From the mirror pivot center, swing a tangent arc, in the plan view, to the farthest point on the eyellipse. This establishes point H as being the farthest from the mirror which will represent the left

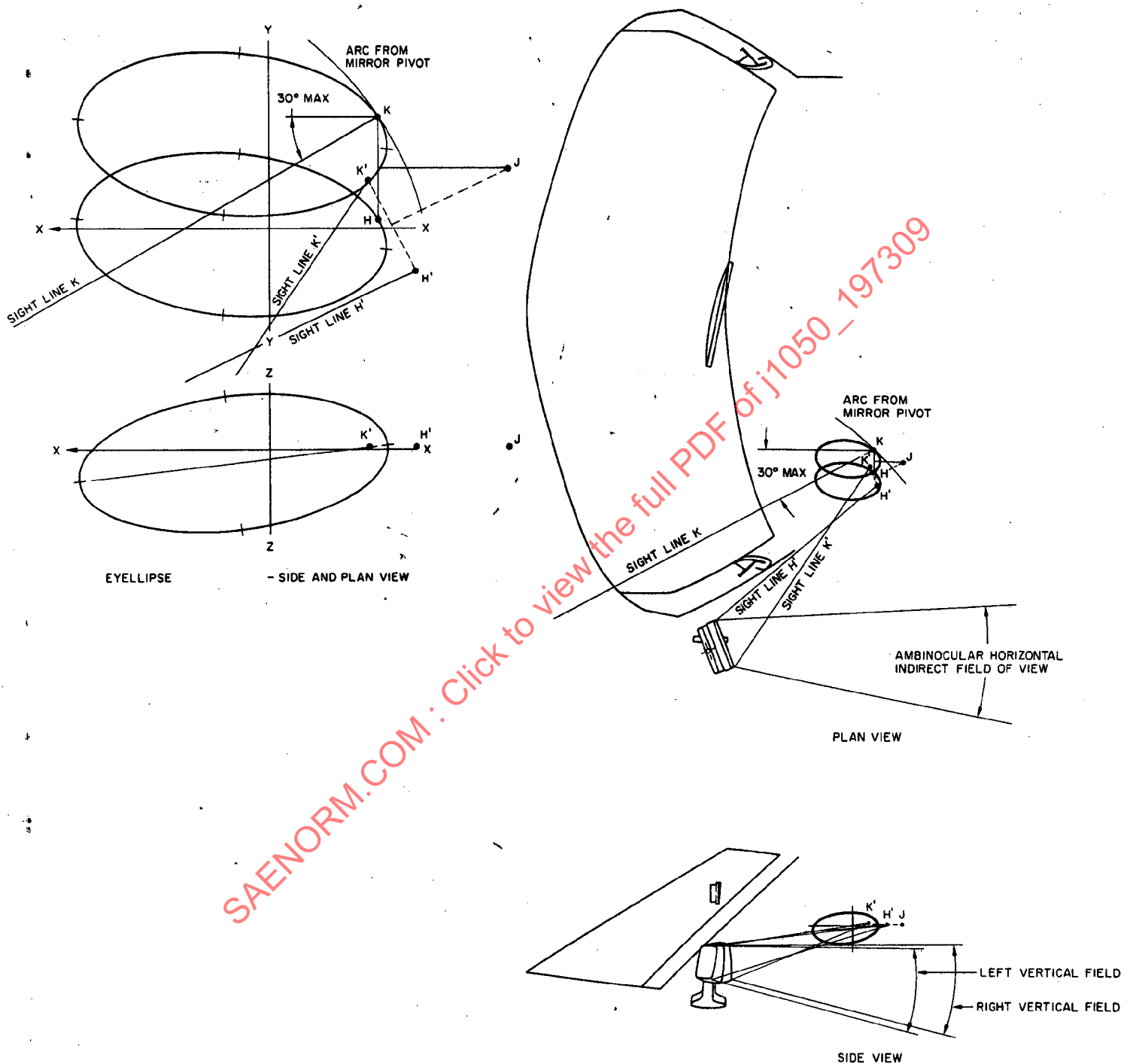


FIG. 7—AMBINOCULAR INDIRECT FIELD OF VIEW THROUGH OUTSIDE MIRROR (LEFT-HAND MIRROR SHOWN)

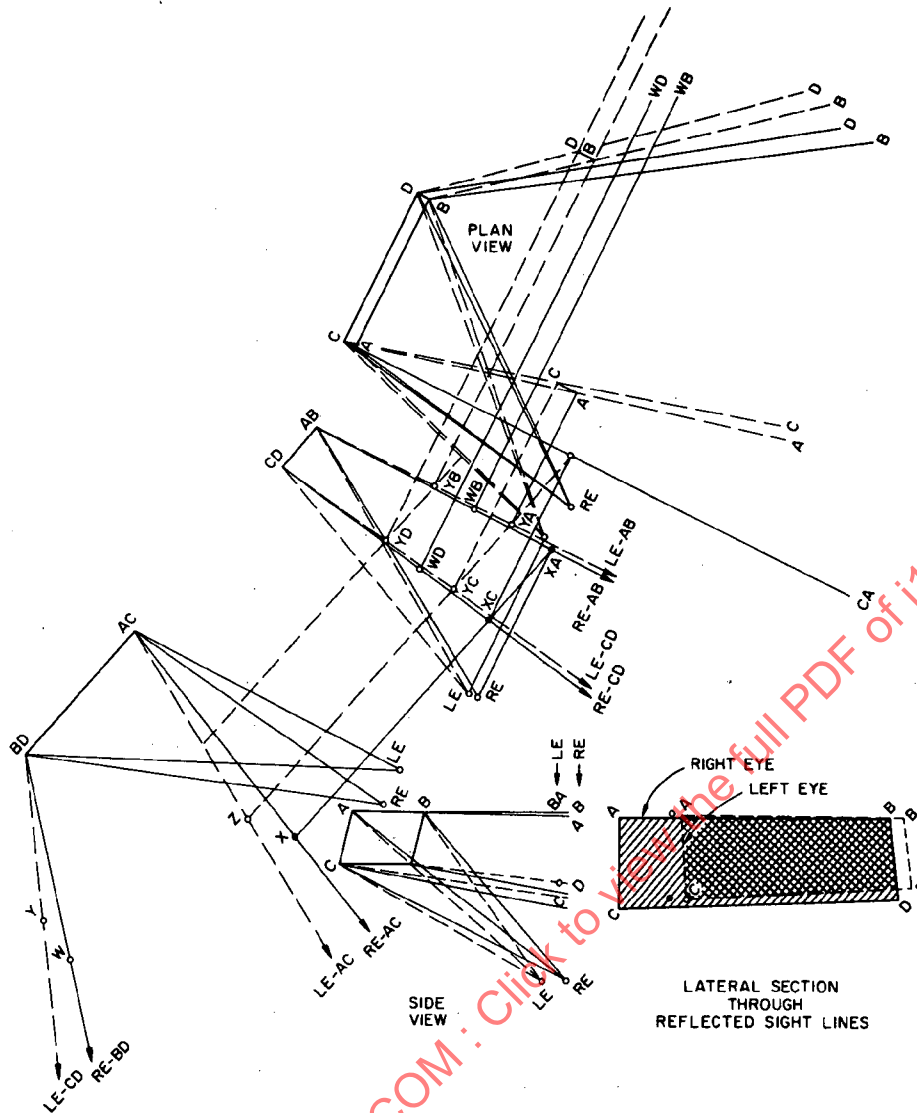


FIG. 8—SIGHT LINE CONSTRUCTION FOR AMBINOCULAR FIELD OF VIEW THROUGH THE INSIDE MIRROR

eye point before head rotation, and also provides the smallest field since point H is farthest from the mirror.

(b) Using SAE J941c, establish the right eye K and neck pivot point J. Also construct sight line H from the left eye (point H) forward and to the right a maximum of 30 deg toward the upper and lower right corners of the mirror aimed to view the desired target. If the sight line does not reach the right corners of the mirror within the 30 deg angle, head turn is required. Assuming head turn is required, rotate sight line H to the right around neck pivot point J until the new sight line H' is coincident with the upper and lower right-hand corners of the mirror. The rotated left eye location is H'. The rotated right eye location is K'.

(c) Construct four reflected sight lines as shown below:

- (1) Left eye to right upper corner of the mirror.
- (2) Left eye to right lower corner of the mirror.
- (3) Right eye to left upper corner of the mirror.
- (4) Right eye to left lower corner of the mirror.

The volume within the sight lines is the ambinoocular field of view through the mirror. For a typical lateral section through this volume, see Fig. 8.

8. Binocular Obscuration of the Left-Hand Windshield A-Pillar—See Fig. 9.

8.1 Procedure

8.1.1 PLAN VIEW

(a) Establish the closest tangent point on the left ellipse to the A-pillar by swinging an arc from the A-pillar. The point on the A-pillar

to be used is the rearmost point on the pillar at a height of the tangent on the left ellipse. The point on the pillar is designated point A, the point of tangency on the left ellipse is designated point B. Point B is the unrotated position of the left eye.

(b) Using SAE J941c procedure, locate the right eye C and the neck pivot point D.

(c) Draw sight line B from the left eye (point B) to a maximum of 30 deg to the left. If the sight line does not reach point A, head turn is required. Assuming head turn is required, then using the procedures of SAE J941c, rotate this sight line around the neck pivot point D until sight line is coincident with point A on the pillar. This is sight line B'. The rotated left and right eye points are C' and B', respectively.

(d) Draw a sight line from the rotated right eye C', horizontal and tangent to the pillar, point E, on the opposite side of the pillar from point A. This is sight line C'.

(e) If the two sight lines diverge away from the driver, the angle between the two sight lines B' and C' is the binocular angle of obscuration. If the two sight lines converge or are parallel, the angle of binocular obscurations is said to be zero.

9. Binocular Obscuration of the Inside Rear View Mirror—See Fig. 10.

9.1 Procedure

9.1.1 PLAN VIEW

(a) Establish the closest tangent point on the right ellipse to the inside mirror by swinging an arc from the mirror pivot point A. The

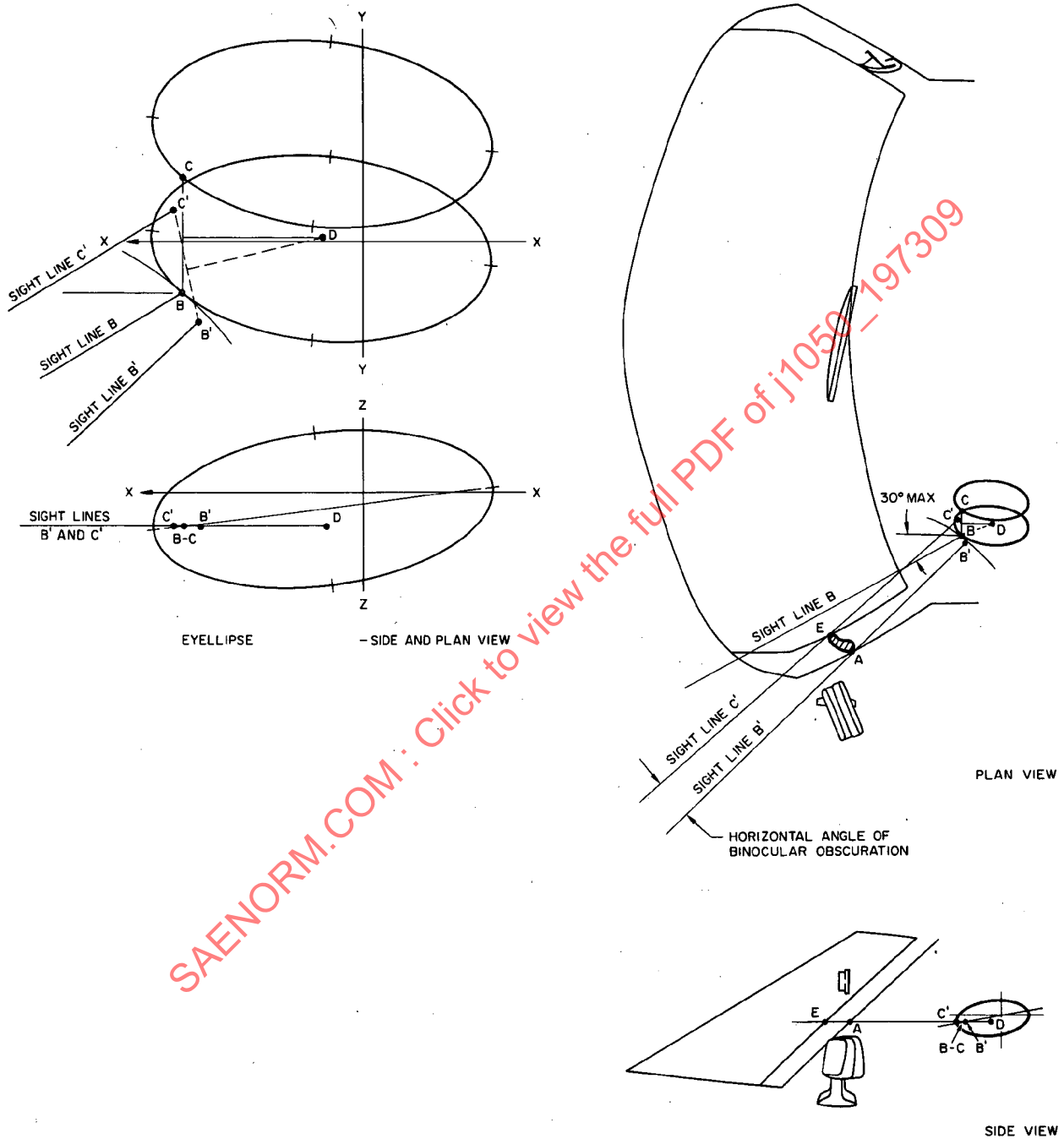


FIG. 9—BINOCULAR OBSCURATION OF WINDSHIELD PILLAR (LEFT-HAND A PILLAR SHOWN)

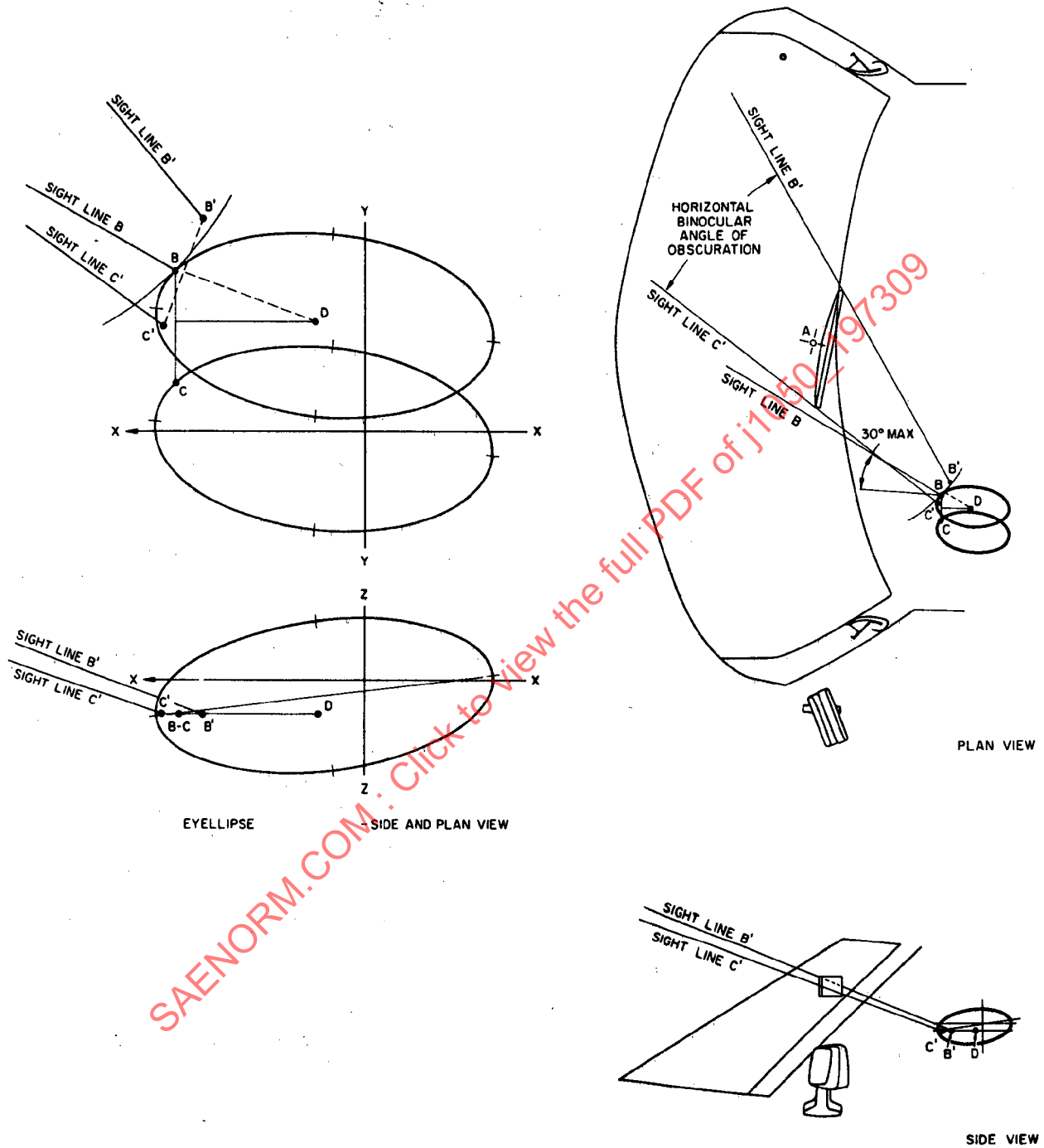


FIG. 10—BINOCULAR OBSCURATION OF INSIDE MIRROR