Engineering News

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AREA COVERED BY A HORN BEAM

A Problem in Geometrical Projection

Coverage on Level Ground

The cross-section of the horn beam is assumed approximately rectangular, as for a multicell or sectoral horn. In Figure 1, H is the horn; HA is the plane that represents the lower limit of the beam. The center line of the beam limit strikes the ground at A. In Figure 2, draw the published horizontal horn angle L_1HL_2. Now in Figure 1, draw horizontal line HB equal in length to HA. Drop a line from B intersecting HL_1 at P_1 and HL_2 at P_2. Also drop a line from A. Project to the left from P_1 to intersect vertical from A at X_1 and from P_2 to intersect at X_2. X_1 and X_2 are the corners of the area on the ground covered by sound. The points where the upper beam limit plane strikes the ground are found in the same manner. Now note that angle L_1HL_2 is the horn angle as viewed looking downward if the horn is tilted so that the beam limit plane is horizontal (HB). Angle X_1HX_2 is the same angle as viewed from above when the beam limit plane is tilted down as along HA. The latter angle appears greater by an amount that depends only upon the angle of tilt of the beam limit plane.

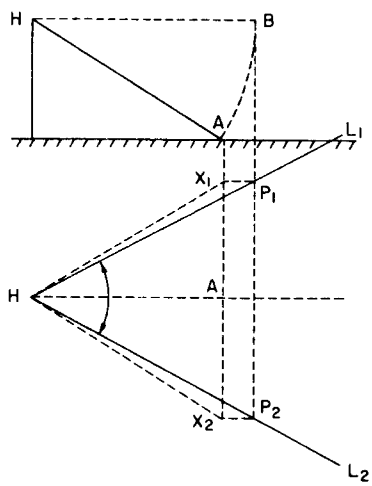

FIG 1
ELEVATION

FIG 2
PLAN

Stadium or Bowl Coverage

Figure 4 is the plan view of a section of a stadium seating area. Draw radii 1-1', 2-2', 3-3', etc., as many as necessary. These start from ground level at 1, 2, 3, etc., and reach the top row at 1', 2', 3', etc.

Project 1, 2, 3, upward to the ground line in Figure 3, and 1', 2', 3', etc., to the upper level in Figure 3. Join 1-1', 2-2', etc., in Figure 3. We now have corresponding radii as seen in plan in Figure 4 and as seen in elevation in Figure 3.

The lower beam limit is shown in Figure 3 as HA. If we sighted along the plane represented as HA (as we do in Figure 3), we would find the plane intersecting the radii at 1" (A), 2", 3", etc. These points in Figure 4 can now be located by dropping verticals down to intersect the radii in Figure 4. These should be connected by a curve which represents the intersection of the lower beam limit plane with the curved and sloping seating area.

Not all of this curve, however, is covered with sound, as we have still to locate the limits of the width (horizontal) angle. This is done for slope HA by the procedure described for Figures 1 and 2. The portion of curve 1", 2", 3", etc., which lies within the angle X_1HX_2 is the extent of the intersection of the beam limit plane with the seating area. A similar curve is found in the same manner for the upper limit plane of the beam. The extremities of the two curves may be joined by straight lines to establish the four boundaries of the coverage area.

Of course, the location of the lower beam limit plane shown in the figures is for purposes of the example only, and not a desirable one as it would leave front rows uncovered. The assumption that the beam cross-section is a neat rectangle is also naive but convenient for visualization.

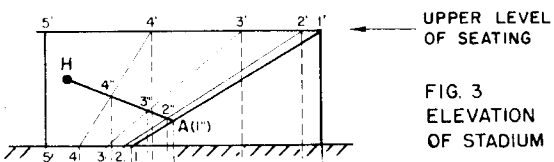

FIG. 3
ELEVATION
OF STADIUM

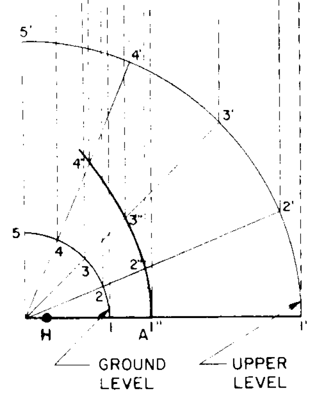

FIG. 4
PLAN OF
STADIUM