

Geometrical Projection

An object having three dimensions may be shown on a single plane by means of **Projection**. The projection of a point on a plane is a point. The project of a line on a plane is generally a line. The plane upon which points or lines are projected is the **plane of projection**. The **direction of projection** is the direction in which a point is projected into the plane of projection. The direction of projection is perpendicular to the plane of projection in **Normal projection**.

Normal Projection is illustrated in Figure 1. Points and lines have been projected into the horizontal plane represented by the upper surface of the blocks. In figure **1-A**, point **B** is the projection of point **A**; line **EF** is the projection of line **CD**. In figure **1-B**, line **GI** is the projection of the **GH** into this plane.

The line of intersection of two planes is the trace of plane upon the other. The trace of one plane of projection upon a second plane of two planes called a **folding line**. In normal projection the angle between two planes having a common folding line always 90°.

To represent a plane (map) and a section on one plane (paper), it is required to rotate the section into the plane of the map around the folding line as an axis. In the following problems it is best to consider the section as lying below the folding line; the section will then be rotated upward into the horizontal plane. In figure (1-C), point B is the projection of point A into horizontal plane; point C is the projection of point A into vertical plane represented by side of the block. Figure (1-D) shows the projection after the vertical plane has been rotated into the plane of the paper about the folding line (F.L) as an axis.

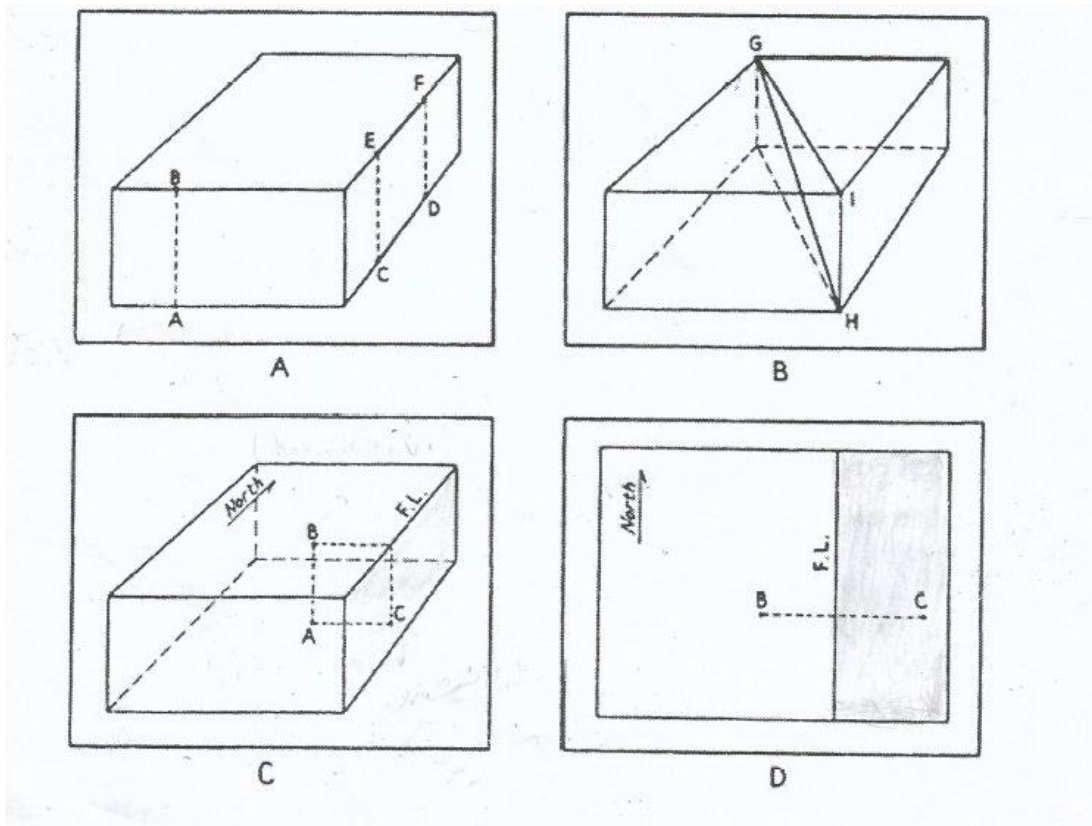


Figure. (1): Normal projection of points and planes on horizontal and vertical planes.

Exercise 1 : A vein that strikes $N40^{\circ}E$ and dips $40^{\circ}NW$ intersect a vein that strikes $S30^{\circ}E$ and dip $55^{\circ}NE$. Draw the projection of the intersection of the intersection of the two vein **(a)**: on a horizontal plane, and find the attitude of the intersection, **(b)**: on a vertical plane striking north south and **(c)**: on vertical plane striking parallel to the direction of plunge of the intersection. **(d)**: Show the trace of the $N40^{\circ}E$ vein on the $S30^{\circ}E$ vein.

Exercise 2: A joint that strikes $N41^{\circ}E$ and dips $55^{\circ}NW$ intersects a vein that strikes $N64^{\circ}W$ and dips $40^{\circ}SW$. Draw the projection of the intersection **(a)** on a horizontal plane, and find the orientation of the intersection, **(b)** on a vertical plane striking parallel to the trend of intersection. **(c)** Show the trace of the joint on the vein.

Exercise 3: a vertical vein that strikes $N49^{\circ}W$ intersects a joint that strikes $N39^{\circ}E$ and dips $1^{\circ}NW$. Determine the trend and plunge of the intersection.

Exercise 4: The two limbs of a fold strike $N62^{\circ}E$ and $S46^{\circ}E$, dip $34^{\circ}NW$ and $56^{\circ}NE$, respectively. Find attitude of the hinge line of the fold.

Construction:

- A:** (1) Draw AB and CD parallel to the respective strike of the vein.
(2) Construct a folding line FF' perpendicular to AB.
(3) Using these folding lines as the horizontal, to make cross section. Draw HH' parallel to F.L. and at an arbitrary distance (h) from FF'. HH' and II' represent a level which will be called the lower reference lane (L.R.P.) F'' is the intersection FF' with AB.
(4) Draw angle FF''J and G'G''K equal to the respective dips of the two veins. F''J intersects HH' at J'.
(5) Draw J'M and K'L parallel to AB and CD. These two lines represent the horizontal projections (H.P.) of contours on the two veins at (h) distance below the plan. Point N is the (H.P.) of intersection of the veins on the L.R.P. and point O is the intersection of the two veins on the plan. Therefore line ON is the (H.P.) of the intersection of the two veins.
- B:** (1) Draw line PP'. in a North -South direction through arbitrary point .This line is the trace of a north south vertical plane (V.P.) on the plan. The (V.P.) must be rotated into the upper reference plane (U.R.P) around PP' as the axis of rotation to show the projection of intersection ON on the V.P.
(2) Project point O to O' in the north south plane.
(3) Draw a line through NN' and extend it to the right of N'. Lay off point N'' at a distance (h) from point N'. Point N'' is the intersection of the two veins in their L.R.P. projected into the north- south V.P.. Line O'N'' is the intersection of the two veins projected into the north -south (V.P.).
- C:** (1) Through some arbitrary point construct line QQ' parallel to line ON. Line QQ' is the trace on the plan (map) of a (V.P.) that strikes parallel to the direction of the plunge of the two veins. This vertical plane must be rotated into the horizontal around the (F.L.) line QQ' in order to show the projection of the intersection of the two veins upon it.
(2) Project point O into this plane to O''.
(3) From point R, lay off RR'' equal to (h). Point R'' is the intersection of the two veins with the L.R.P. projected into a V.P. that strikes parallel to the intersection of the two veins.
(4) Line O''R'' is the intersection of the two veins projected to this same plane. Angle RO''R'' is the plunge of the intersection of the two veins.
- D:** (1) To draw the trace of the N40°E on the N30°W vein, it is required to rotate the N30°W vein into the plan (map). CD the trace of the vein plan, is used as axis of rotation.
(2) Using the line G''K' as radius and the point G'' as the center, draw an arc to intersect GG' at S. Through point S draw a line SS' parallel to strike of the N30°W, now rotated into horizontal position.
(3) From point N, construct NT perpendicular SS'. N is the H.P. of a point on the L.R.P., this point on the L.R.P. falls at T when it is rotated to the surface.
(4) Line OT is the trace of the N40°E vein on the N30°W .Angle DOT, is the rake (pitch) of the trace of the N40°E vein on the N30°W vein.