ENGINEERING DRAWING LECTURE 6

Fundemental Views . Point, Line and Plane

Fundemental Views:Point, Line and Plane:

- **The projecting of a point or line from one view**

To another Is vitally important to the solution of descriptive geometry problem. .

- **If a point in space is located on a line in one view,**

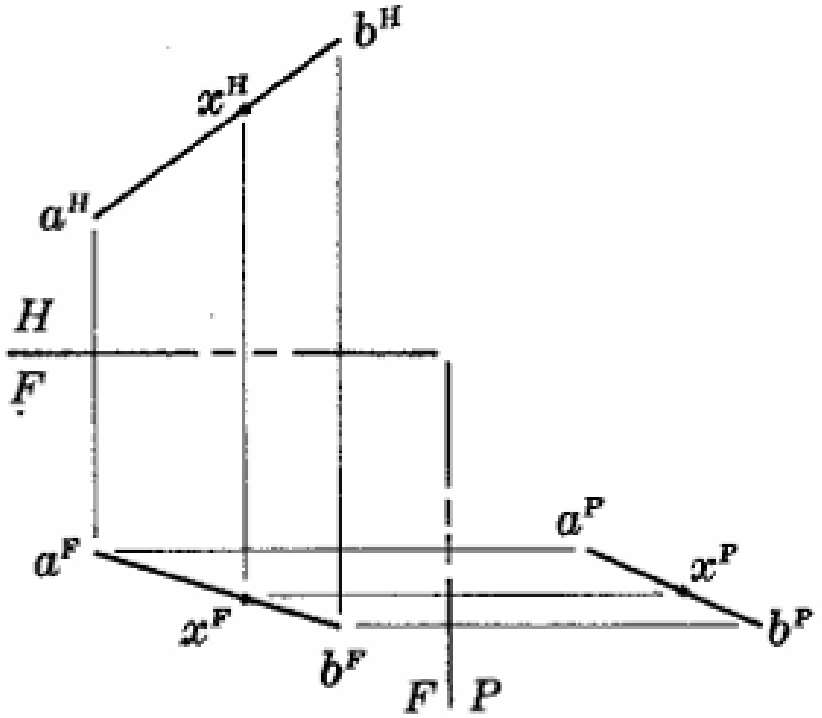
it must appear on that line in every view of the line.

- **If we have an oblique line in space, which contains point X in one view, as shown in Fig.**

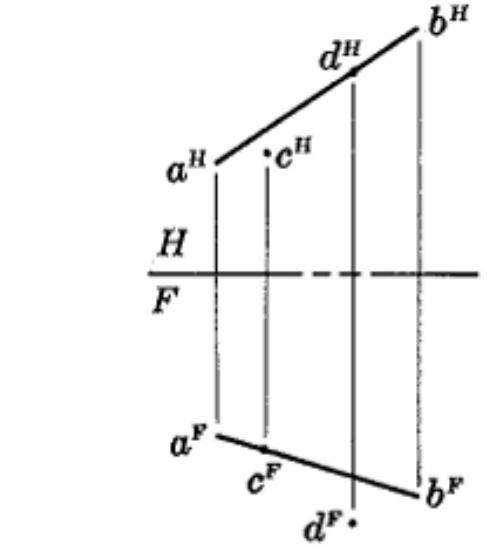
the point is located in the other two principal views

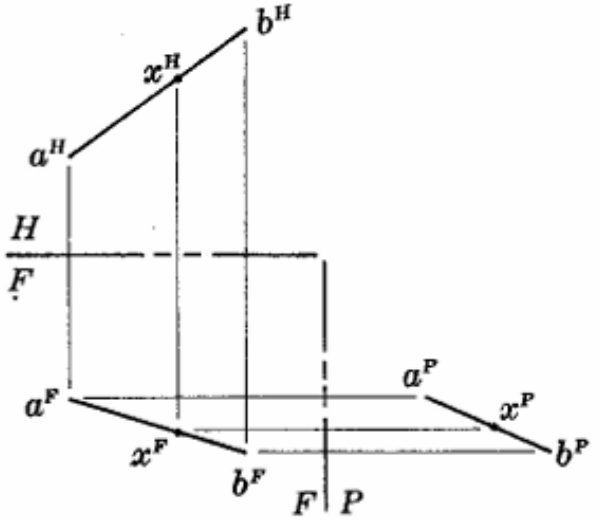
would be found by simple projection from one view

to another .



- In the Fig. -, the point C in the front view appears to be on the line AB,
- But we notice in the plan view that point C is actually located in front of the line. ,
- Likewise point D in the plan view appears to be located on the line AB
- The elevation of point D is lower than any point on the line.
- Therefore, apoint which appears to be located on a line in one view may not be on the line at all .
- But may lie Infront of the line, behind it, above it, or below it.





To PROJECT a POINT on a LINE from ONE VIEW to ANOTHER VIEW

when the LINE is PARALLEL to a PRINCIPAL PLANE

- **Analysis: Project the point at 90° to the folding line between the two views.**

Example 1: Frontal Line (Fig. 2-3). Line AB is given in both the horizontal and frontal projection planes
Point X is located online AB in the plan view.

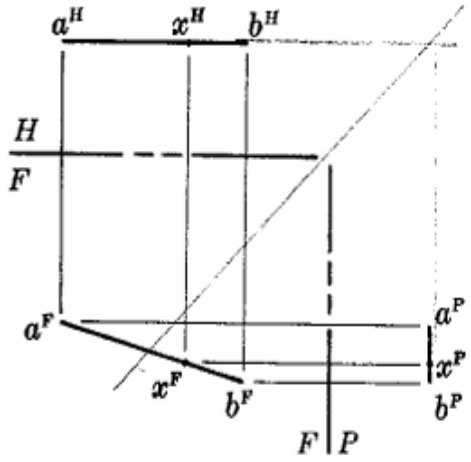


Fig. 2-3

To locate its position in the frontal plane

simply project at 90° to the H-F folding line and obtain xF • Folding line –FP

is placed perpendicular to the H-F line . Points A,B, and X in the profile view will be the same distance away from the plan viewto the frontal plane in both the horizontal and profile projection planes

Example 2: Level Line (Fig. 2-4 below). Line AB is given in both the horizontal and frontal projection planes.

Point X is located online AB in the front view. To obtain its position in the plan view of line AB

project perpendicular to the H-F folding line to obtain xH• Place folding line·H-P perpendicular

to the H-F line and project points A, B, and X from the plan view to the profile view. The distance these

points will appear from the horizontal plane will be the same in both the front and profile views. The line

will appear parallel to the horizontal plane in both the frontal and profile projection planes.

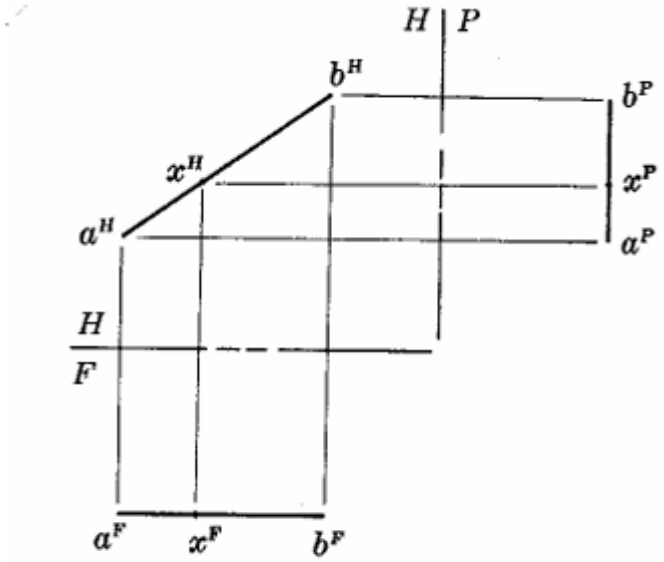


Fig. 2-4

Example 3: Profile Line (Fig. 2-5). Line AB is given in both the horizontal and frontal projection planes. Point x is located online AB in the front view.

It is impossible to project it directly to the plan view Therefore, a new view must be drawn and the point x would then be projected to the line AB in this new view, then point x can be located on line AB in the horizontal view.

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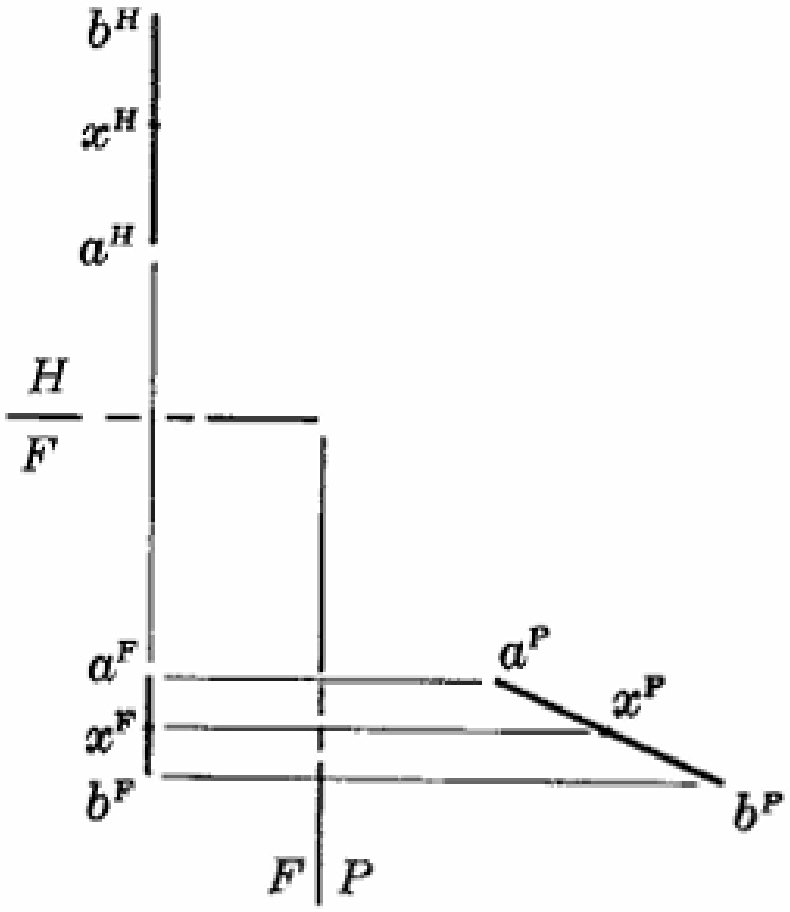


Fig. 2-5

To LOCATE a POINT in a PLANE:

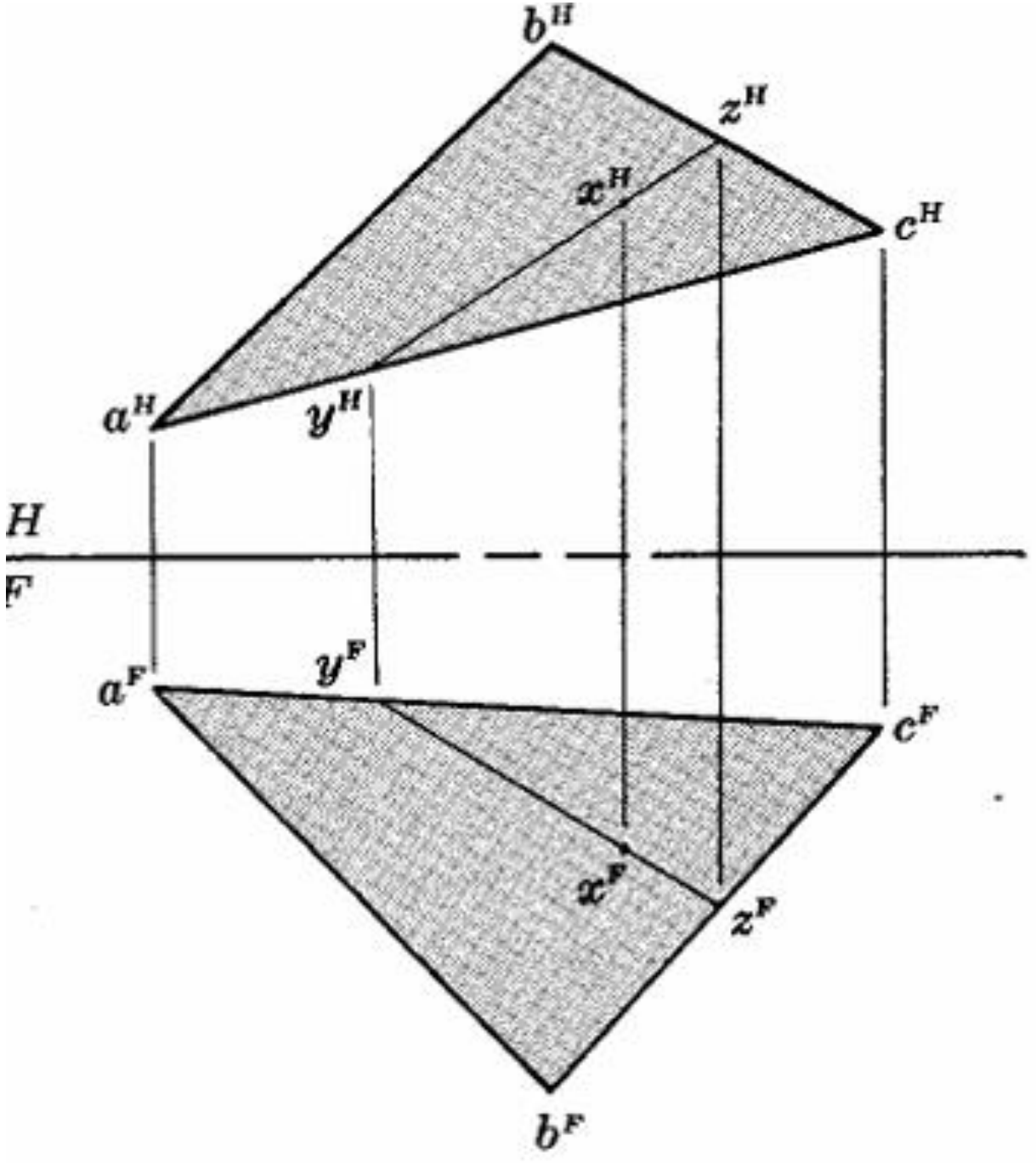
Analysis: Choose line which can be drawn through a point on the plane.

The various views of the given point must lie on the corresponding views of the chosen line passing through the point.

Example: The given data reveals plane ABC containing the point X in the plan view. See Fig. Draw a line, YZ, through the point X on the plan view of the plane. Locate the line in the

Front elevation view by simple orthographic projection. Be sure that the points Y and Z are located on lines AC and BC respectively.

Since line YZ passes through point X in the plan view, project point X down to the frontelevation view and its location will be on the line YZ in the front view.



Practically every problem which must be solved graphically

will involve certain basic or fundamental views.

From the understanding of four basic views is derived the solutions of the more difficult space problems involving points, lines, and planes.

The four fundamental views are:

1. **The true length of a straight line**
2. **The straight line appearing as a point**
3. **The plane appearing as an edge**
4. **The plane appearing in its true size and shape**

The TRUE LENGTH of a STRAIGHT LINE:

Analysis: Any line in space which is parallel to an image plane will be projected on that plane in its true length. Similarly, if a line is parallel to a folding line (reference line) in one view, it will appear in its true length in the related view on the other side of the folding line.

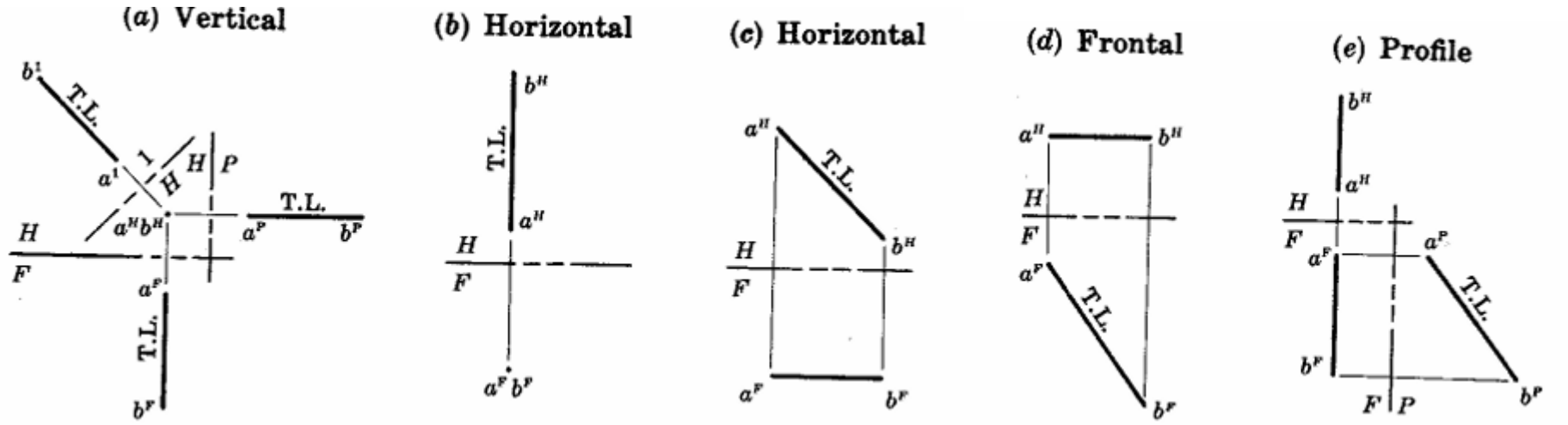
Examples: In Fig. we have several examples of lines which appear in their true length in the three principal views.

At (a) the line is vertical and therefore appears in its true length in any

elevation view.

At (b) and (c) we have shown level lines which appear as true length in the plan view.

At (d) is shown a frontal line which reveals its true length in the front view. And finally, at (e) is illustrated a profile line which shows its true length in the profile view.



- **In the case of an oblique line which does not appear in its true length in any of the principal views,**
- **A new view is drawn by placing an image plane**

parallel to the line as shown in one of the given views.

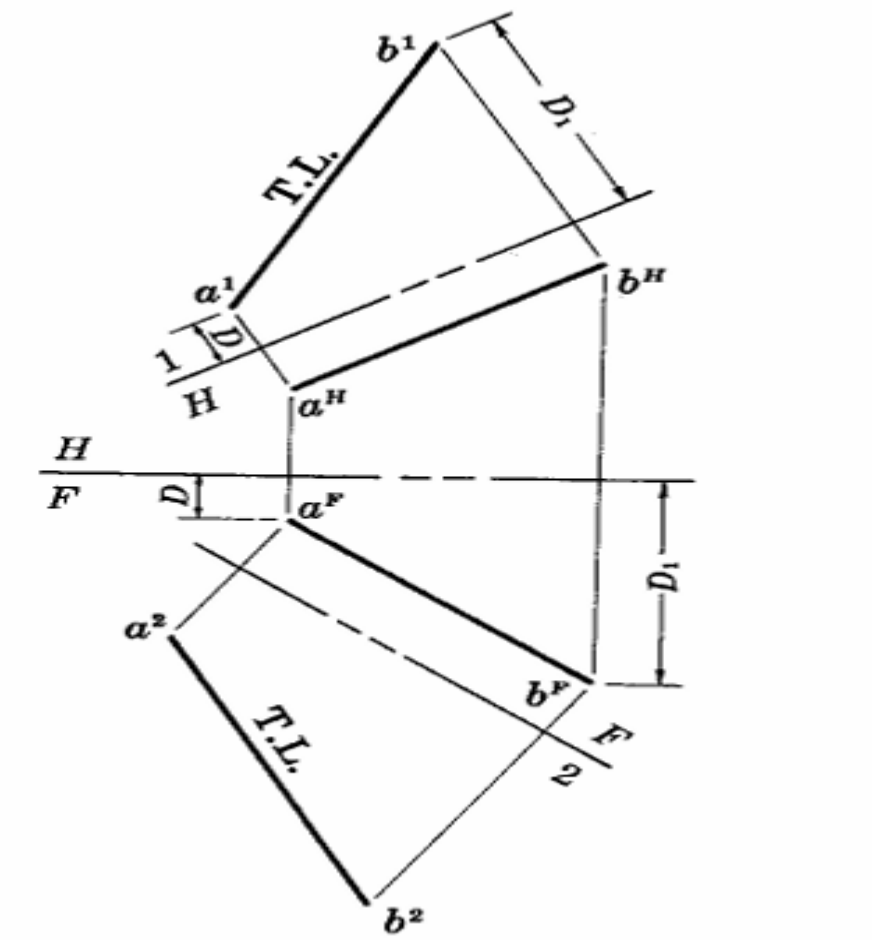
for example, the line AB is given in both

the plan and front elevation views. It is obvious

from observation that the line is neither parallel nor

perpendicular to any of the three principal planes;

So it is an oblique line.



- **Since a line must be parallel to an image plane**

in order to be shown in its true length,

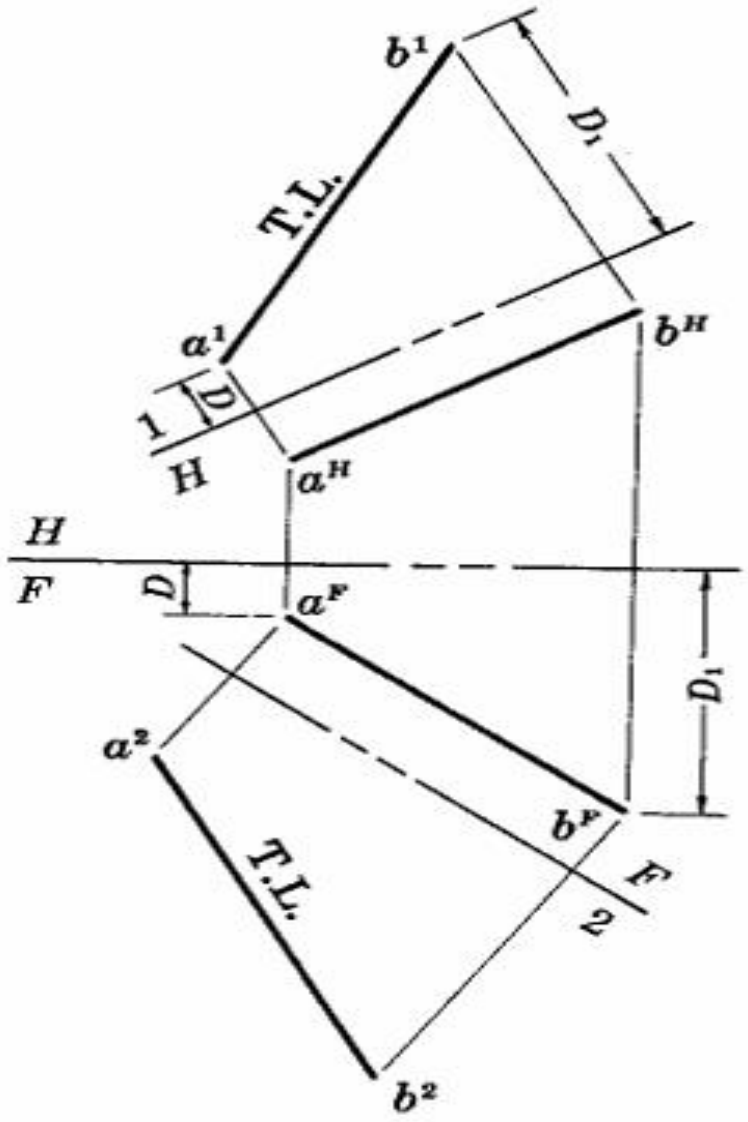
- **A new image plane is located parallel to the plan view of the line.**
- **The intersection of this auxiliary elevation image**

plane with the horizontal image plane is designated

as H-1 folding line.

This new view, being elevation view projected directly from the plan.

Will have the same elevational relationship between its points as the front view.



In Fig. 2-9(a) below we have shown an oblique line AB which represents the diagonal of an imaginary rectangular box.

If the length of the box is 2", its depth3/4", and its height is I",

the true length of the line would be equal to the square root of the sum of the squares of L, D, and H. True length of AB= $square\ root\ of L^2+ D^2$ +H² = square root of $2^2+ 3/4^2 +1^2$ =2.3585in.

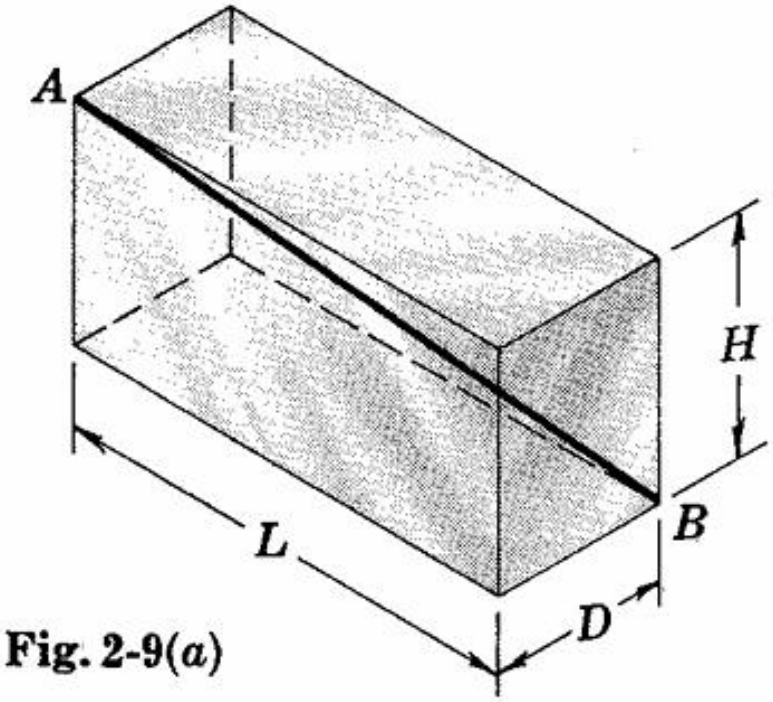


Fig. 2-9(a)

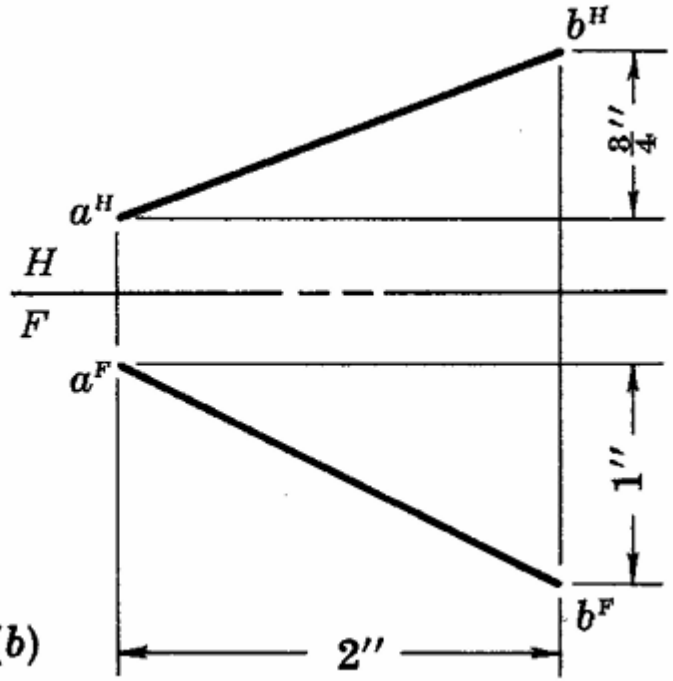
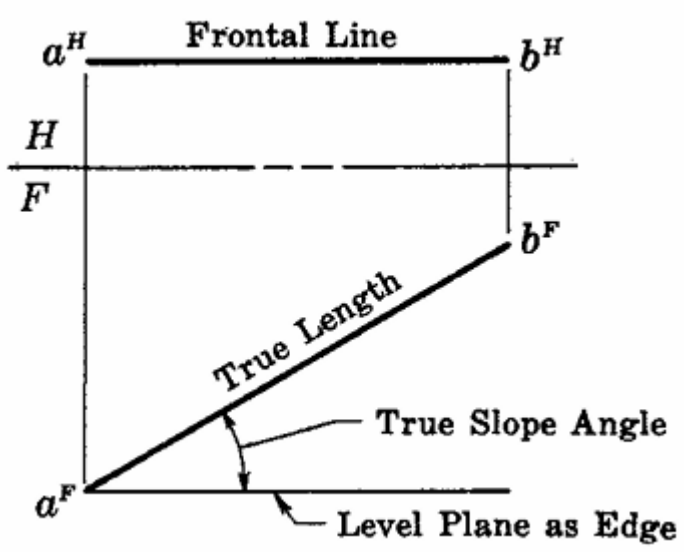


Fig. 2-9(b)

The TRUE SLOPE of a STRAIGHT LINE:

Analysis: The true slope of a line is the tan gent of the angle that the line makes with a horizontal plane. The angle between the true length of the line and a horizontal plane is called the slope angle. The slope angle of any line can be seen only in the elevation view which shows the line in its true length.



Note: Even though an inclined view may show the true length of a line, it cannot show the true slope

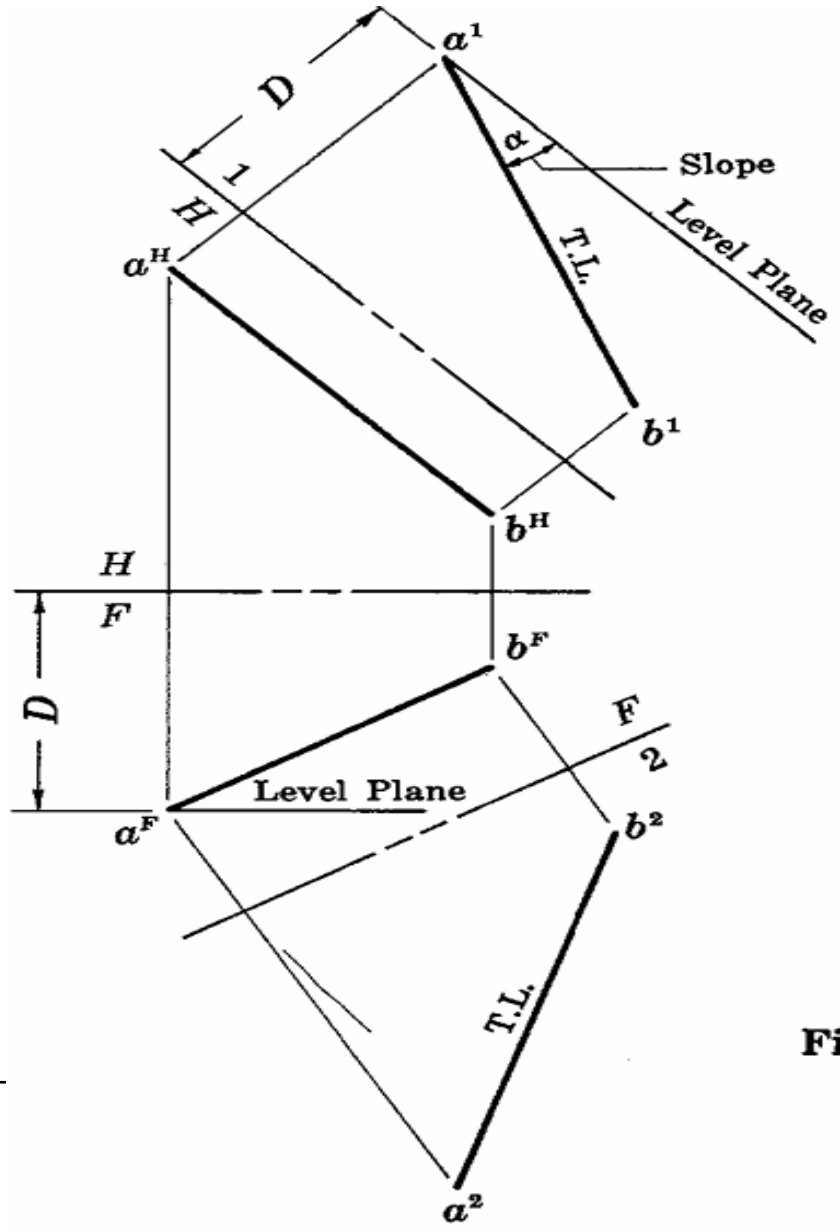
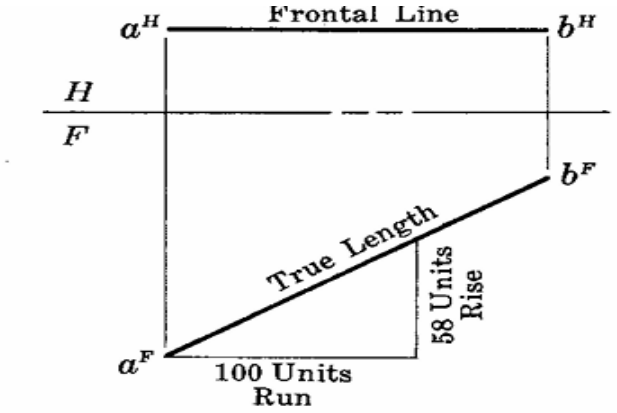


Fig. 2-1

The. angle of slope is usually expressed in de grees. However, in civil engineering the slope is expressed either as per cent grade (Fig. 2-12), or as batter (Fig. 2-13). The % grade is given by the expression vertical rise/horizontal run*100 .Perhaps the most convenient method of measuring the horizontal run is to use an engineer's scale since 10 main divisions on each of its various scales contain 100 subdivisions. Fig. 2-14 shows the method of indicating the % grade of a highway.



$$\text{Grade} = \frac{\text{Rise}}{\text{Run}} \times 100 = \frac{58}{100} \times 100 = 58\%$$

Fig. 2-12. Per Cent Grade of a Frontal Line

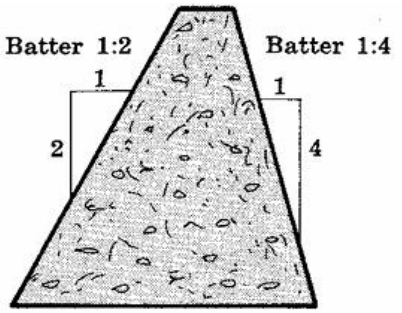


Fig. 2-13. Batter

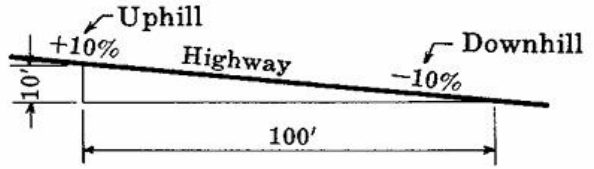


Fig. 2-14. Highway Having 10% Grade

To find the per cent grade of any oblique line, the line must be first shown true length in an

elevation view. In Fig. 2-15 below the grade calculation is made by drawing a line parallel to The H-1 folding line and setting off 100 units along this line. The rise is measured perpendicular to the H-1 line, thus establishing the 58% grade.

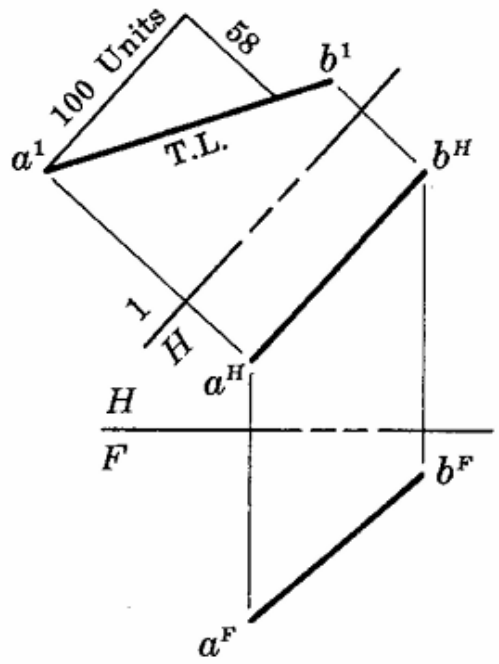


Fig. 2-15. Grade of an Oblique Line

Fig. 2-16 below illustrates the method for obtaining the grade of an oblique line from the plan and front views only. The run is measured on the plan view of the line by setting off 100 units and establishing point xH • The rise will appear in the front view as the difference in elevation between aF and xF •

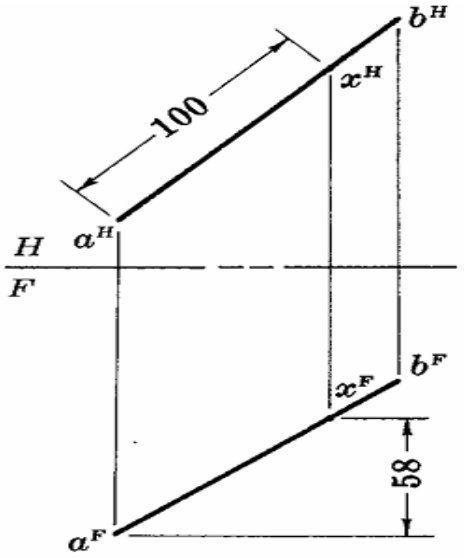


Fig. 2-16. Grade Measured from Plan and Front Views Only

The pitch of a roof in architectural drafting would be specified as shown in Fig. 2-18 above.

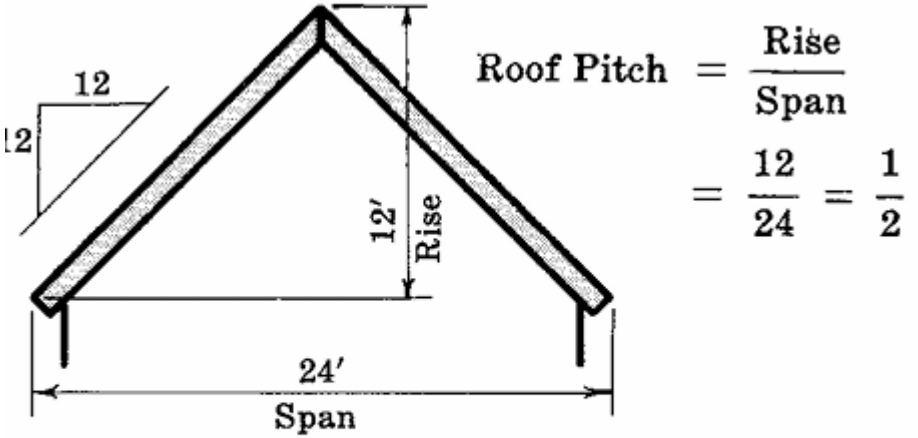


Fig. 2-18. Pitch of a Roof