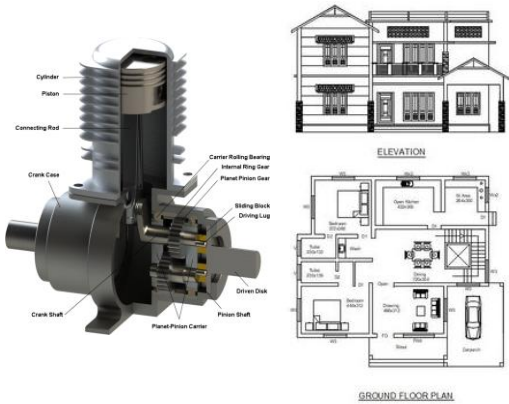


Engineering Graphics & Drawing

1. Freehand sketching
2. Orthographic projections
3. Projections of points & lines
4. Projections of planar features
5. Projections of solids
6. Sections of solids
7. Intersection of surfaces
8. Development of surfaces
9. Isometric views of solids
10. 3D CAD / Solid modelling

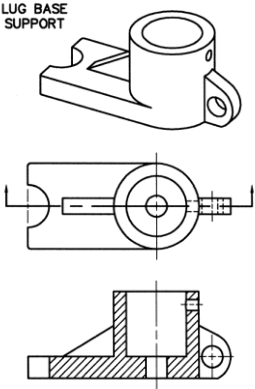
Ref: <https://www.istockphoto.com/search/2/image?mediatype=illustration&phrase=car+cross+section>



Motivation

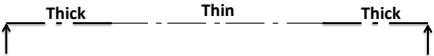
- Few hidden features – shown using dotted lines in projected views
- Too many hidden features – difficult to visualize the object
- Solution – show cross-sectional view(s) of the object
- By virtually cutting the object by a section plane, and removing the portion of object between observer & plane
- Typical Problems
 - To draw sectional views of solid & true shape of the section given inclination of cutting plane
 - To determine inclination of cutting plane given true shape of section

Ref: <https://link.springer.com/article/10.1007/s12008-018-0508-2/figures/3>



Nomenclature

Section plane – Imaginary plane cutting the solid.

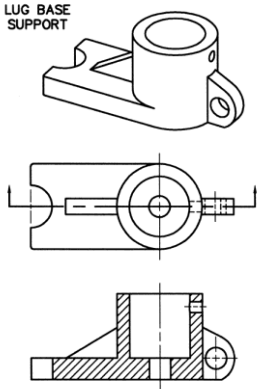


View Direction – Direction of viewing for drawing the section view

Section – Surface obtained by virtually cutting object by cutting plane. Indicated by thin section lines uniformly spaced at 45°.

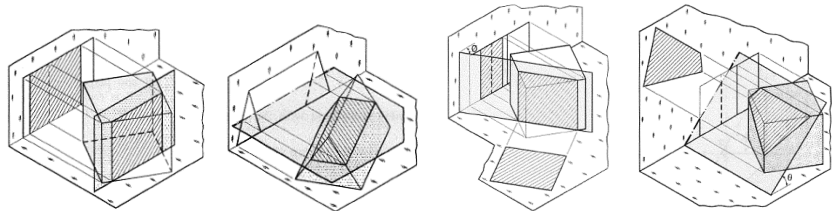


Section view – Projection of section along with remaining part of object.



Section Planes

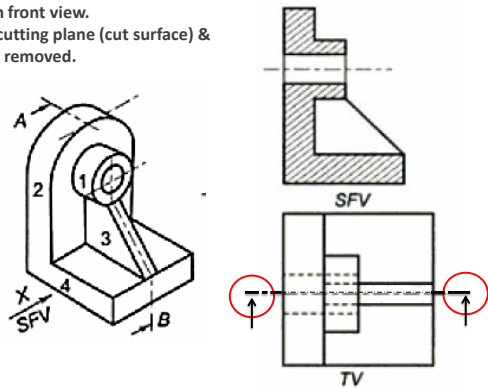
- Perpendicular to H.P. & parallel to V.P.
- Perpendicular to V.P. & parallel to H.P.
- Perpendicular to H.P. & inclined to V.P.
- Perpendicular to V.P. & inclined to H.P.



Ref: Engineering drawing by N.D.Bhatt, Chapter 14 – Sections of solids

Section Views

- Draw top view & section front view.
- Part of object between cutting plane (cut surface) & viewer is assumed to be removed.

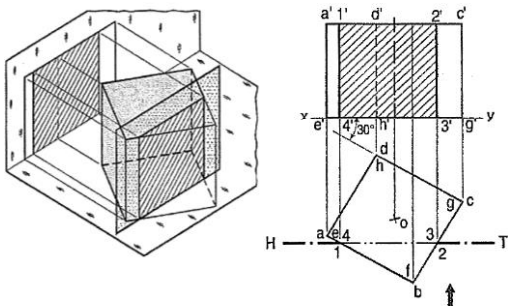


Ref: Engineering Drawing, Shah and Rana

Sections of Prisms

Section plane parallel to V.P.

- **Problem:** Cube of 35 mm long resting on H.P. on one of its faces with vertical face inclined at 30° to V.P. Section plane parallel to V.P. & 9 mm from cube axis (further from V.P.). Draw sectional F.V. & T.V.



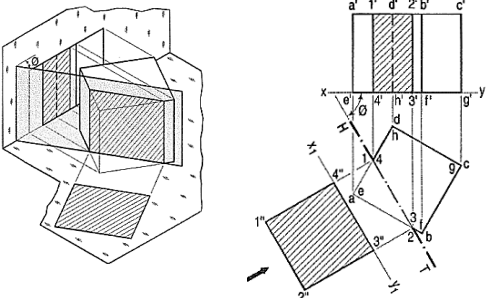
Ref: Engineering drawing by N.D.Bhatt, Chapter 14 – Sections of solids

1. Section plane transparent.
2. Cut-portion of cube removed.
3. All edges of cube are cut, hence, section is figure with four sides.
4. Section plane || V.P. & ⊥ H.P.
5. Section seen as line in T.V. coincides with section plane H.T.
6. Figure 1' 2' 3' 4' in F.V. is the true shape of section.
7. Part views – dark but thin lines, cut-portion – fainter lines.

Sections of Prisms

Section plane perpendicular to H.P. & inclined to V.P.

- **Problem:** Cube in same position as Problem1 is cut by section plane, inclined at 60° to ⊥ V.P. to H.P., so face makes 60° angle with V.P. is cut in two equal halves. Draw sectional F.V., T.V. & true shape of section.

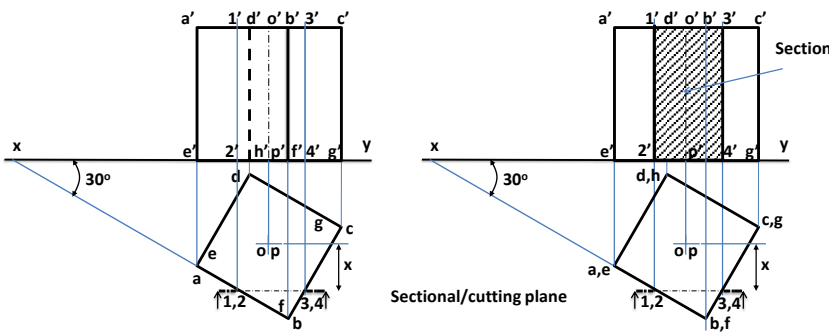


Ref: Engineering drawing by N.D.Bhatt, Chapter 14 – Sections of solids

1. Section seen as line in T.V. coinciding with section plane H.T.
2. F.V. of section (1' 2' 3' 4') does not reveal its true shape (since section plane is inclined to V.P.)
3. Only vertical lines show true lengths, while true lengths of horizontal lines are seen in T.V.
4. **True shape** of section seen when it is projected on auxiliary vertical plane, parallel to section plane.

Sections of Prisms

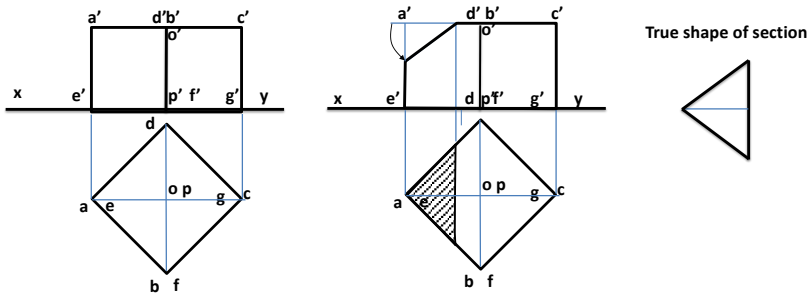
- **Problem:** Square prism resting on H.P. & one of faces at 30° with V.P.
- Cut by section plane parallel to V.P. & 'x' mm from cube axis. Draw sectional F.V. and T.V.



Sections of Prisms

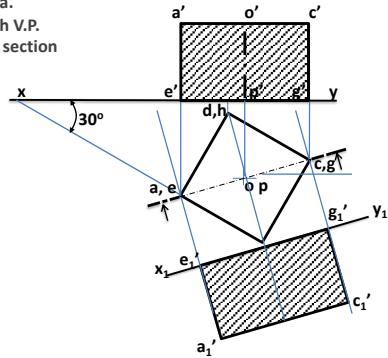
Axis Perpendicular to H.P.

- Problem: Square prism (base 1.6", axis 1.3") on H.P. and all edges of its base equally inclined to V.P.
- Cut by a section plane, \perp to V.P., inclined to H.P. such that true shape of section is isosceles triangle with 1.5" base & 1" height. Draw sectional T.V. & F.V.



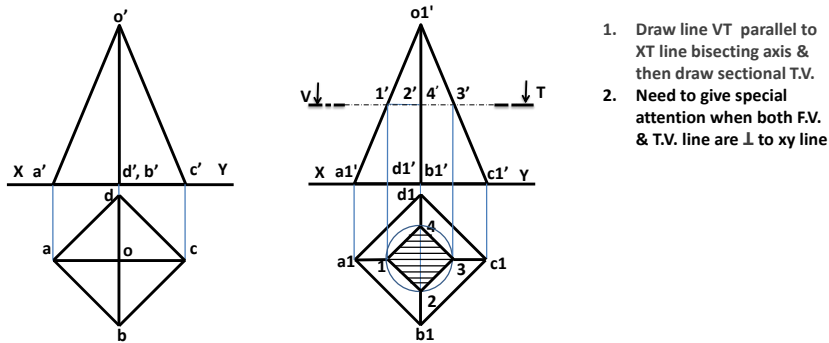
Sections of Prisms

- Problem: Square prism resting on H.P. & one of faces at angle of 30° with V.P.
- Cut by section plane \perp to H.P. & inclined to V.P.
- Section is rectangle with largest area.
- Find inclination of cutting plane with V.P.
- Draw sectional F.V. & true shape of section



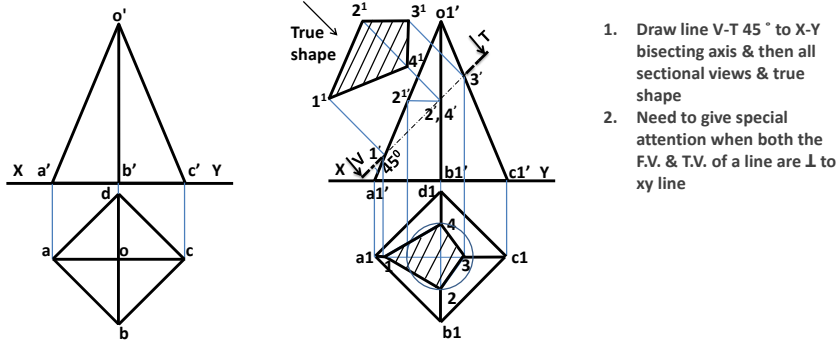
Sections of Pyramids

- Problem: Square pyramid (base 40 mm, axis 65 mm) on H.P. & all base edges equally inclined to V.P.
- Cut by section plane, parallel to H.P. & bisecting axis. Draw its sectional T.V.



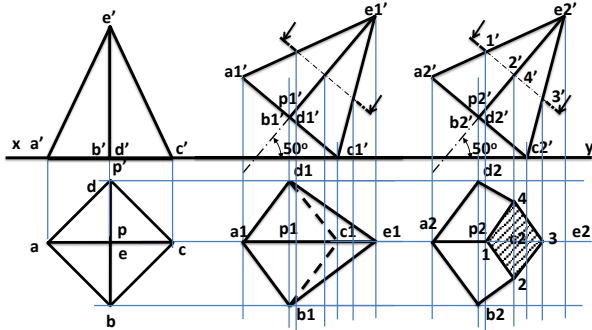
Sections of Pyramids

- Problem: Square pyramid (base 40 mm, axis 65 mm) on H.P. & all base edges equally inclined to V.P.
- Cut by section plane, \perp to V.P. inclined at 45° to H.P. & bisecting axis.
- Draw sectional T.V. & true shape of section



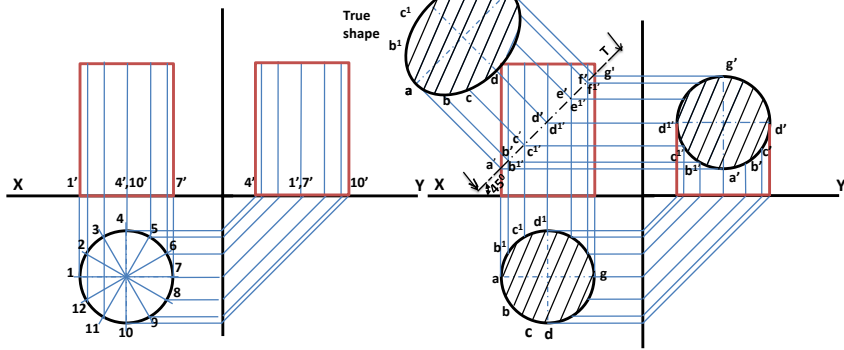
Sections of Pyramids

■ **Problem:** Square pyramid, base 25 mm & axis 50 mm long, is resting on one of corners in H.P. & its axis making 50° with H.P. & parallel to V.P. Cut by cutting plane, ⊥ to V.P., parallel to base & bisecting its axis. Draw sectional T.V.



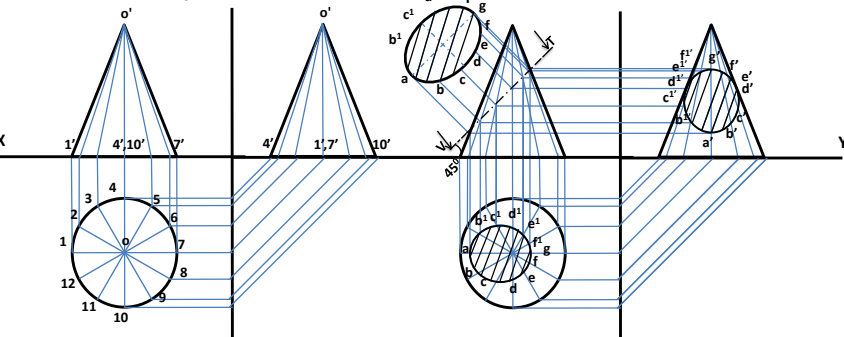
Sections of Cylinders

■ **Problem:** Cylinder of 40 mm diameter, 60 mm height & having its axis vertical, cut by section plane ⊥ to V.P., inclined at 45° to H.P. & intersecting axis 32 mm above base. Draw its F.V., sectional T.V., sectional side view & true shape of section



Sections of Cones

■ **Problem:** Cylinder of 40 mm diameter, 60 mm height & having its axis vertical, cut by section plane ⊥ to V.P., inclined at 45° to H.P. & intersecting axis 32 mm above base. Draw its F.V., sectional T.V., sectional side view & true shape of section



Points to Remember

1. If section plane is parallel to H.P. then true shape of section is seen in T.V.
2. If section plane is parallel to V.P. then true shape of section is seen in F.V.
3. True shape of section is seen on a plane parallel to section plane.
4. For prisms & cylinder – If section plane is parallel to base, section is true shape & size of base. If section plane is perpendicular to base, section is rectangle
5. For cones & pyramids – If section plane is parallel to base, section is true shape of base but of smaller size. If section plane passes through apex, then section is a triangle
6. Number of corners in true & apparent shape of a section is equal to number of edges of solid that are cut by cutting plane
7. Number of corners & edges in apparent shape & true shape are same.
8. Any pair of lines which is parallel in one view will be parallel in any other view.
9. When cutting plane cuts all generators of a cone or a cylinder, then true shape of section is an ellipse
10. When cutting plane is inclined to base of cone at an angle that is equal (greater) [less] to that made by generator with base, then true shape of section is parabola (hyperbola) [ellipse].