
UNIT 7 WOODEN AND STEEL ROOF TRUSSES

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7.1 INTRODUCTION

Trusses are provided to support roof covering. The weight of roof covering through purlins is transferred at joints along the rafters. These joint loads cause axial forces – tensile or compressive – in all the members of a truss since all the joints of a truss are assumed to be hinged. Finally all loads including self-weight are transferred to the supports through the joints at supports (Figure 7.1). The trusses may be constructed of wood or of steel. Wooden trusses may be used for smaller moderate span; whereas steel trusses may be provided for smaller to larger spans as steel is stronger than wood. Trussed roof covering is economical proposition for warehouses, assembly halls, hangers, etc.

Figure 7.1 : Loaded with Dead Load and Wind Loads

Objectives

After studying this unit, you should be able to

- describe the types of wooden and steel roof truss, and
- draw the detailed drawings of wooden and steel truss, and their components.

7.2 WOODEN ROOF TRUSSES

7.2.1 General

Most of the trusses are triangular in shape for drainage purposes. Sometimes, these may be in curved shapes for larger spans such as for warehouses, hangers, etc. Inclination of roof with horizontal plane is called *pitch* which varies from almost zero to 1/4 (i.e. rise to span) depending upon the intensity of rainfall

and/or snowfall. Roof covering supported on grid of common rafters and battens to transfer loads through purlins at the joints on rafters of a truss (Figure 7.2). The members are joined in such a way that their centre lines meet at joints.

Figure 7.2 : King Post Truss

The members are first joined by joining methods explained in Unit 5 and then the joints are further strengthened by steel straps – namely U-shaped strap, 3-way member strap, heel strap or plate strap. Various joints are shown in Figures 7.3 to 7.6.

Figure 7.3 : Joint between Principal Rafter and King Post

Figure 7.4 : Joint Showing Principal Rafter at One End and King Post at the Other End

Figure 7.5 : Showing Heel Strap

Figure 7.6 : Showing Plate Strap

7.2.2 Type of Wooden Trusses

Mainly five types of wooden trusses are in use. They are :

- (a) King post trusses,
- (b) Queen post trusses,
- (c) Combination of king post and queen post trusses, and
- (d) Bowstring trusses.

King Post Trusses

These are simplest type of trusses used to span up to about 8 m. A King Post truss consists of rafters to support purlins, main-tie to connect the lower ends of rafters to prevent supports from spreading out and a king post connecting ridge and mid-point of main-tie to check its sagging. For longer spans, struts may be connected to the rafters preventing their buckling. A typical King Post truss has been described through Figure 7.7.

Figure 7.7 : King Post Truss

Queen Post Trusses

For longer spans, if instead of one vertical king post, two posts at certain interval, called Queen Posts, are provided to strengthen the main-tie against sagging, the truss so formed is called a *Queen Post truss* (Figure 7.8). The two horizontal members enclosed between the two queen posts are called *straining members*. The lower straining member is further strengthened by providing straining sill to balance compressive force at the lower joints of struts. This type of truss may be used for spans up to 12 m.

Figure 7.8 : Queen Post Truss

Combination of King Post and Queen Post Trusses

A combination of both the above mentioned types of trusses further strengthen the truss so that it can be used for even larger spans say up to 18 m (Figures 7.9 to 7.12).

Figure 7.9: Combination of King-Post and Queen-Post Mansard Truss

Figure 7.10 : Combination of King Post and Queen-Post Howe Truss

Figure 7.11 : Mansard Trusses

Figure 7.12 : Alternative Forms of Mansard Trusses

Bowstring Trusses

As the name suggests, the upper members of this truss are curved to form a bow whereas the main-tie is straight as a string (Figure 7.13). This type of truss may be used upto say 30 m span.

Figure 7.13 : Bowstring Truss

SAQ 1



- (a) Why trussed roof is preferred to flat reinforced concrete roof?
- (b) Define pitch. How roof-covering load is transferred to support through truss?
- (c) Enumerate the most commonly used types of roof trusses.
- (d) Sketch a King Post and Queen Post trusses.

7.3 STEEL ROOF TRUSSES

7.3.1 General

Steel trusses are economical, lighter in weight, more durable, more fire-resistant and easier to fabricate in comparison to wooden trusses. Therefore, steel trusses are preferred to wooden trusses for all spans.

7.3.2 Types of Steel Trusses

Depending upon the orientation of members, most commonly used trusses may be put in the following categories :

King Post Trusses

As explained in wooden truss, this types of truss, in its simplest form, has minimum number of members and hence used for smaller spans only (Figure 7.14).


 Figure 7.14 : King Post Trusses


Queen Post Trusses

This type of truss as explained earlier has more members for load transference, to prevent buckling of compression members and to reduce sagging. Being stronger and more stable than king post truss it can be used for larger spans (Figure 7.15).

Howe Trusses

This type of truss, named after its originator, has vertical members as struts and diagonal tensile members oriented towards centre-line of the truss. By increasing the size of members and number of panels, the trusses may be made stronger and suitable for larger spans (Figure 7.16).


 Figure 7.15 : Queen Post Truss


 Figure 7.16 : Howe Truss

Fink Trusses

This type of trusses (Figure 7.17) is suitable for larger spans. For ease in erection it is assembled in two parts. These two parts are hoisted in position and then joined at ridge (joint *a* in Figure 7.17(a) and at joints *b* and *c* at the level of main tie in Figure 7.17). Fink trusses with riveted as well as welded joints have been described through Figures 7.18 and 7.19, respectively.



 Figure 7.17 : Fink Truss


 Figure 7.18 : Fink Truss (Riveted)

Figure 7.19 : Fink Truss (Welded)

Fan Trusses

Fan trusses are similar to fink type trusses so far as construction and erection are concerned. The orientation of intermediate members looks like fan-blades emanating from interior joints and joints on main-tie and the other ends meeting at rafters (Figure 7.20).

Figure 7.20 : Fan Truss

Pratt Truss

Pratt trusses are similar to Howe trusses with the difference that the diagonal members are oriented towards nearer supports (Figure 7.21).

Figure 7.21 : Pratt Trusses

SAQ 2



- Why a steel truss is preferred to wooden truss?
- Enumerate the types of steel roof trusses.
- What is the difference between Howe truss and Pratt truss?

7.4 SUMMARY

Trusses, an assemblage of triangles formed of members made of wood or rolled steel sections, are in triangular or curved shape for proper drainage of rainwater or snowfall. Trussed roofs are economic alternative to flat roofs for all spans. For columnless large coverage of space like assembly halls, warehouses, hangars, etc. trussed roofs are invariably used.

Wooden trussed roof are suitable for small to moderate spans (say upto 10 m) for areas where wood is very cheaply available – otherwise, now-a-days, only steel trusses are used.

Wooden trusses are constructed of wooden members of rectangular cross section joined together in proper form. The joints are further strengthened by steel straps.

Steel trusses are made of rolled steel sections (mostly angles) joined in proper shape by means of gusset plates and rivets or welds.

7.5 ANSWERS TO SAQs

SAQ 1

- (a) Refer Section 7.1.
- (b) Refer Sections 7.2 and 7.1.
- (c) Refer Section 7.2.2.
- (d) Refer Section 7.2.2.

SAQ 2

- (a) Refer Section 7.3.1.
- (b) Refer Section 7.3.2.
- (c) Refer Section 7.3.2.