

TECHNICAL INFORMATION NOTE NO 22

Building Regulation 2000 Part A (Structure)

Designing and Constructing Simple Pitched Roofs

SH/A/7

Principles:

Whatever the roof type, it is designed to give the people and the inside of the property the best protection possible from the weather.

Roof design is quite a complex subject and involves many calculations regarding the strength of the materials used.

A roof has to withstand very high wind speeds and snow loading; and each roof is designed to carry the weight of the covering, e.g. tiles or slates.

Traditional framed roofs are constructed on site using sawn timber, typically with all joints simply cut and nailed together, forming the rafters and ceiling joists into 'triangles'.

They have both advantages and disadvantages:

Advantages:

- ❑ It creates a strong roof structure with a mostly open loft space.
- ❑ Often joists are strong enough for light storage.
- ❑ Complex or bespoke roof designs can be accommodated.

Disadvantages:

- ❑ They can use more timber than a prefabricated trussed rafter design.
- ❑ May take longer to assemble on site.
- ❑ Needs more skilled labour to erect.
- ❑ May require a central spine load-bearing wall to span any great depth of building.

Roof Design:

Timber sizes:

Generally the minimum size of roof timbers can be obtained from the tables within the *TRADA Span Tables (2nd edition)*, although larger timbers can be used. Sizes will vary depending on the roof pitch, the weight of the roof covering, imposed loads, the span of the roof members, member centres, and whether intermediate supporting walls can be used to prop members, etc.

The pitches and spans given in the following diagrams are those where the roof type has been shown to be structurally and economically viable.

Design types:

Couple roof

The simplest form of pitched roof consists of rafters bearing against each other at the ridge board (Fig 1). The walls have to resist the full load and horizontal thrust at the eaves.

Except for the very smallest spans, modern lightweight cavity wall construction is unlikely to be adequate and this form of roof is therefore little used today.

For flatter pitches or larger spans the walls would be heavier, thicker or buttressed.

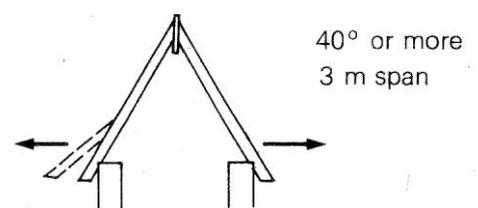


Figure 1

Collar / raised tie roof

Adding a collar to the roof it is possible to relieve the walls of thrust, but only partially (Fig 2) – the lower the collar is to the eaves the greater will be the relief or effect.

However, the collar imposes a severe bending moment on the rafter; the higher the collar the greater the bending moment.

Rafter sizes may have to be dramatically increased to handle the stresses, for example, a small roof tied at the supporting wall-plate level requiring 38mm x 100mm rafters will require 50mm x 150mm rafters when a collar is located at mid height. This is doubling the amount of timber in the rafters and the increase can be greater when the roof is larger.

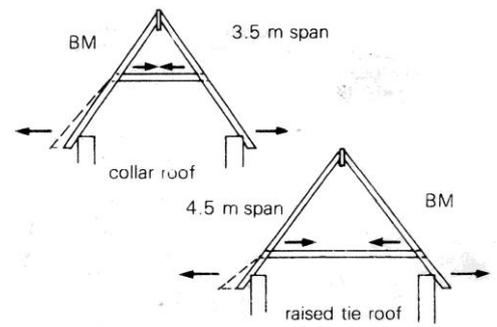


Figure 2

Close couple roof

Structurally the most efficient solution is to use ceiling joists to tie the rafter feet together thereby relieving the walls of horizontal thrust (Fig 3).

Binders are normally added when the span exceeds about 2.5m to prevent the ceiling joists having to be increased to an uneconomical size. Binder sizes can be obtained from the tables within the.

The ceiling joist is in tension and relieves the wall or all horizontal thrust. This three-member form of roof can be used for spans up to approximately 5.5m.

Rafter sizes can be calculated or, depending upon the roof dead load, be ascertained from tables within the *TRADA Span Tables (2nd edition)*.

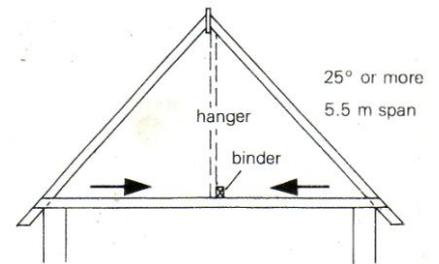


Figure 3

Rafter support

In cut-roof construction the common rafters traditionally are bird-mouthed over the wall plate at eaves level (Fig 4) and fixed to a ridge board at the apex of the roof.

Accurate cutting and assembly are vital to ensure stability of the structure, bird-mouth seating over the wall plate should be cut to a depth not exceeding one third of the rafter depth.

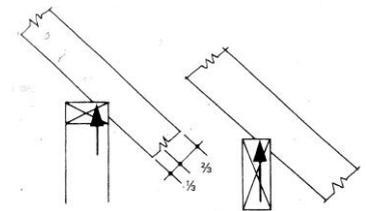


Figure 4

Purlin roof

For roofs with span in excess of 6.0m, additional support for the rafters will be necessary to keep them to an economic size. This can be achieved by fixing one or more purlins to the underside of the rafter's midway, or at equal centres, through their length. Purlin sizes can be obtained from the tables within the *TRADA Span Tables (2nd edition)*.

Good Building Practice

Traditional cut roofs are fabricated on site where they are fixed to the wall plate. Wall plates should be fixed to the supporting walls. Rafters and ceiling joists are normally placed at 400mm or 450mm centres along the wall plate.

The overall stability of the roof and prevention of roof spread is vital.

This can be achieved by forming the roof members into triangles and by connecting the roof members to each other and to ridges, wall plates and purlin satisfactorily

The use of birds-mouth joints etc. helps. In some cases, bolted connections of structural timbers may be necessary to ensure total stability of the roof construction.

The installation of a roof-light or other large opening in the roof may require the rafters doubling up both sides of the trimmed opening.

The Local Authority endeavour to give the best advice but no responsibility is accepted for its completeness or applicability. The recommendations contained in this guidance note are supplied in good faith but without liability and their use shall be entirely at the risk of the user.