

Loading and Load Cases

It is important that all truss loadings are specified before quotation to ensure correct design. Unless

otherwise advised, trusses will normally be assumed to be for normal domestic use.

Loadings for Domestic Use

The great majority of trusses fall into this category. The relevant document, BS 5268-3 describes the minimum loadings which should be taken into account.

The following data provides a useful guide to typical loading factors in roof design:

TOP CHORD (Rafter)

Tiles

Weight to be as laid. Nearly all commonly used interlocking concrete tiles are within 0.575kN/m^2 , which is regarded as the standard loading. It is important that the actual tile weight to be used is notified to the Trussed Rafter Designer. This loading is specified as a long term loading on slope; i.e. applied along the length of the sloping rafter.

Felt, Battens, Self Weight

The allowance usually made for felt, battens and self weight of trusses is 0.11kN/m^2 .

As are the tiles, this is regarded as a long term loading slope.

Wind

Except in the case of vertical and near vertical chords, wind loading is not often a critical criterion in the design of fully triangulated trusses.

All trusses should be designed for wind loading in accordance with BS 6399: Part 2 code of practice for wind loads. Wind load data should be provided by the Building Designer to the Trussed Rafter Designer.

Wind loading is treated as a very short term loading, applied at right angles to the relevant members.

Snow

Designs for snow loadings are in accordance with BS 6399: Part 3: Actual design loads are dependant upon several factors, such as building location, altitude and roof plane geometry. The loadings imposed by snow are regarded as medium term loadings, on slope. Where appropriate, snow drifting should be considered.

Man Load on Rafter

This is specified as $0.75 \times 0.9\text{kN}$ in any position. Test have shown that, in normal circumstances, tiles and battens provide sufficient transverse load distribution for this loading not to be a critical criterion in design. However it can dictate the design of a long overhang. This loading is treated as short term loading.

BOTTOM CHORD (Ceiling Tie)

Plasterboard, Self Weight etc

The standard ceiling construction of one layer of 12.5mm plasterboard and skim coat is taken as giving a load of 0.25kN/m^2 (including truss self weight).

This load is treated as a long term loading on slope (although generally bottom chords will have no slope).

Light Storage

For normal domestic applications, the specified allowance for storage over the length of the bottom chord (ceiling tie) is given as 0.25kN/m^2 (on slope). For anything other than this condition, the Building Designer should inform the Trussed Rafter Designer of the required storage loads to be used.

This load, as for the ceiling construction load, is treated as a long term loading on slope.

Man Load on Ceiling Tie

To allow for loadings imposed by a person working in the roof void, an allowance of $0.75 \times 0.9\text{kN}$ at any location on the bottom chord, either in the bays or at the node points (joints) should be made. This loading is treated as short term loading.

Loading and Load Cases

Loadings - Water Tank

Water tanks in trussed rafter roofs should be supported by a system of bearers and cross-bearers in such a fashion that the loadings imposed on the trusses are transferred to a position as close as possible to the node points (joints) of the trusses. The standard 230 litre water tank is usually supported over three individual trusses, or 300 litre tank over four trusses. The long term loading from this arrangement is taken as 0.9kN/truss (0.45kN per node).

Loadings - Agricultural Buildings

Loadings for agricultural buildings are described in BS 5502 and are based on weight of the actual materials in the fabric of the building. Snow and wind loading criteria depend on occupancy classification determining the acceptability of collapse and expected life of the building.

Compliance with BS 5502 has been a condition of obtaining certain capital grants and an up-to-date briefing on the matter should be obtained before specification.

Purlins

Trussed rafters are generally used in conjunction with tiling battens fixed to the upper edge of the top chords and this provides an excellent method of out-of-plane restraint to the top chords. If tiling battens are not to be used, it is vital to specify the maximum purlin spacing to be used for two reasons:

- 1.To allow the Trussed Rafter Designer to apply the loads in the correct way.
- 2.To allow the Trussed Rafter Designer to apply correct top chord restraints.

The Trussed Rafter Designer will require this information in order to obtain a correct design.

Load Duration (load cases)

The load-carrying characteristics of timber are such that it can sustain heavier loading for a short time than it can for a long time.

This effect is used in establishing the allowable structural properties of a particular timber grade (or Strength Class).

Trussed rafters and other structural timber components are then designed taking into account the differing durations of the various loadings which they are required to carry.

The main loadings encountered in dealing with trussed rafters (see earlier in this section) are:

1.Roof Coverings:

Tiles, slates etc. are considered as long terms loads, as they will be present throughout the life of the building.

2.Ceiling Construction:

Plasterboard etc at ceiling level is, like the roof covering, considered as long term.

3.Ceiling Storage:

The allowance for storage in the roof void at ceiling level is also treated as an ever-present, long term load.

4.Water Tanks:

As these will also be present throughout the building's life loads applied by water tanks are treated as long term loads.

5.Snow Loadings:

The design allowances for loadings due to snow on the roof are treated as medium term loads, i.e. these loads will not be present at all times, but will affect the roof structure only for a period of weeks or months at a time.

6.Man Load on Rafter and Ceiling:

Where this is applicable, this load is treated as a short term load, ie this load will be present within the structure for a period of minutes or hours only.

7.Wind Loadings:

Always considered for design, the loadings due to wind are treated as very short term loads. These loads will be present on the structure for a period of minutes or seconds only.

The above loadings cover the most usual types of load carried by trussed rafters.

Other loads may be present within the roof in special circumstances These may include air conditioning equipment, patient hoists, climbing ropes etc and must be allowed for in the design, in the appropriate load case.

Loading and Load Cases

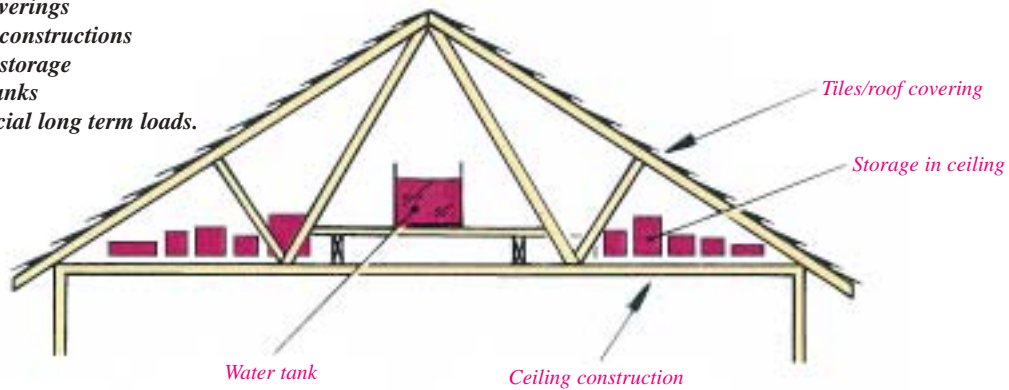
The load cases which normally dictate the results are:-

1. Long Term

Designing for the effect of all long term loads (all loads which will be present throughout the life of the building) i.e.:

- Roof coverings
- Ceiling constructions
- Ceiling storage
- Water tanks
- any special long term loads.

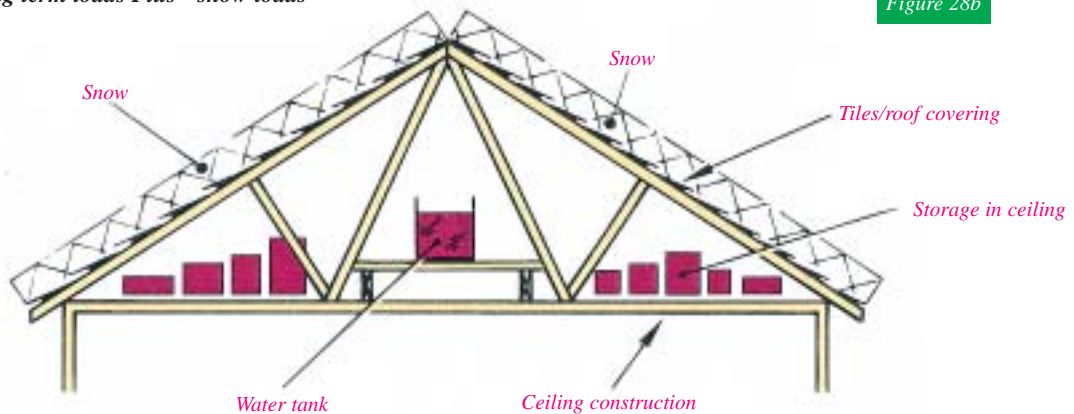
Figure 28a



2. Medium Term

Taking into account loads which will be present for a period of weeks or months on the building i.e. - *All the long term loads Plus - snow loads*

Figure 28b



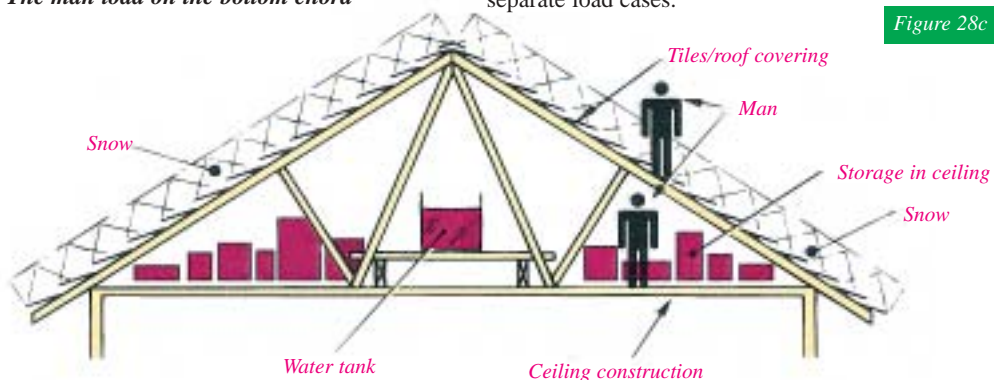
3. Short Term

For loads which may occur for minutes or hours during the buildings life i.e.:

- All the long term loads
- Plus - Snow loads
- Plus - The man load on the bottom chord

It will be seen that this load case will, in fact, be a multiple load case as the man load must be checked at every bottom chord bay and node position. Note the man load on top and bottom chords are in separate load cases.

Figure 28c



Full details of load cases see BS 5268-3