

Framing Common Roofscapes

Bobtail (Stub Ends)

Bobtail or stub-end trusses are used where the supporting wall position on one or both sides is set in from the normal heel position. (see section 3.9, bearing details). This commonly occurs where recesses occur in the outside wall line of a building or where walls are built up to tile level to provide a firebreak compartment within the building.

The horizontal 'A' dimension (figure 32), known as the cut-back, is therefore conveniently used to specify the shape for duo-pitch trusses, while double bobtailed trusses and bobtailed mono-pitched trusses are often more conveniently specified by a vertical 'A' dimension, known as the End Height.

Figure 31

EFFECT OF BOBTAIL ON ROOF LINE

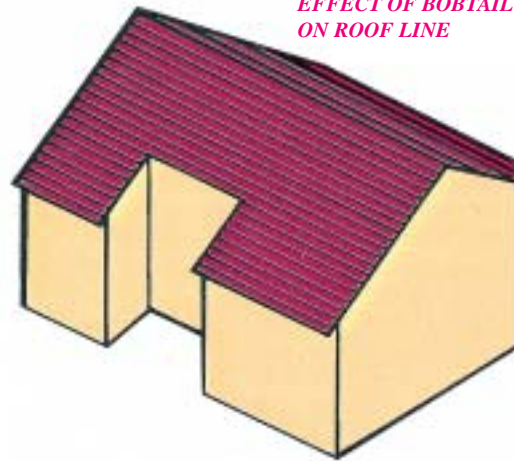


Figure 32

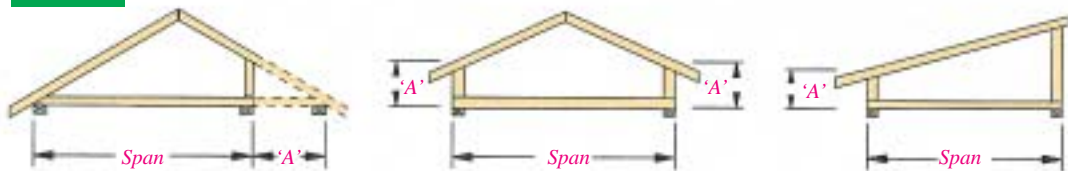


Figure 33 shows typical end details when the outer leaf is of masonry. Arrangement 33b is best confined to timber frame construction as separate columns of masonry between trusses could be unstable. There should be sufficient depth of masonry on figure 33a to anchor the roof down against wind uplift. If the end verticals are to be tile clad, one of the arrangements in figures 33c or d is suitable. In figure 33c a specially wide timber is used as the end vertical

of the trusses so that the tile battens clear the outer leaf of the wall; the inside of the end vertical member of the truss must not be located to the right of the centre-line of the wallplate. In some cases this arrangement is impractical owing to the large width required for the end vertical. In many cases the diagonal in the cantilevered part (figure 33d) can be omitted if there is little load from the cladding.

Figure 33a

MASONRY OUTER LEAF

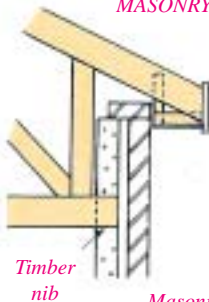
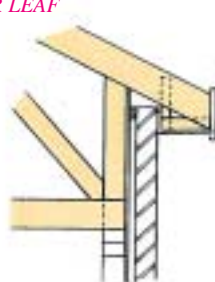


Figure 33b

Masonry inner leaf



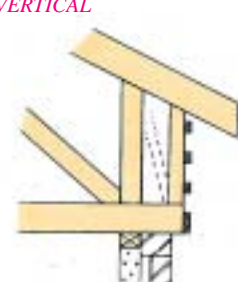
Timber frame

Figure 33c

TILE CLAD END VERTICAL



Figure 33d



Bobtailed trusses must never be formed through on-site modifications of standard truss types with which they align, following the basic rule that a trussed

rafter should never be cut, notched, drilled or otherwise modified without first checking with the Trussed Rafter Designer.

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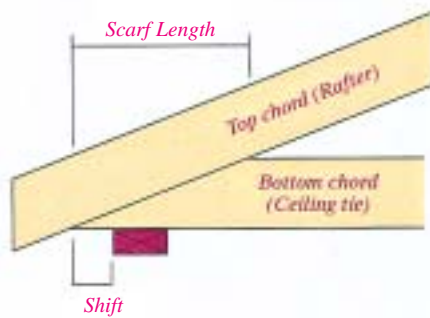
Cantilevered Trusses

The reaction from the bearing is the greatest load (although upwards) to which a truss is subjected, and in order to control excessive bending in the supported chord, it is important, except in the smallest trusses, to locate a joint at each bearing. The normal eaves joint (figure 34a) accomplishes this if the bearing shift is less than one-third of the scarf length or is less than 50mm.

If the shift is greater than the allowed a stress check is required on the short cantilever. Unfortunately, there is often insufficient space for an additional web so it is usually necessary to increase the bottom chord (figure 34c) or alternatively, to incorporate a relief rafter (figure 34d) or a heel wedge. Both of these options can add to the final costs of the trusses and therefore it is best to avoid cantilevering the trusses in this range.

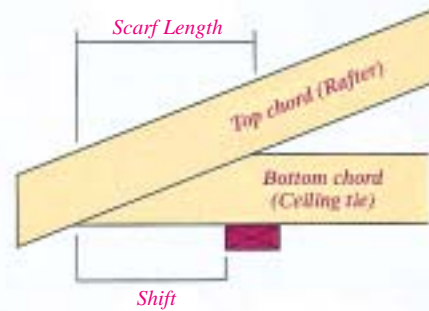
Figure 34a

Standard truss



Check bottom chord

Figure 34b



If the shift is greater than two scarf lengths, then an ordinary standard cantilever truss is employed. (fig.35)

position of the joint on a non-cantilevered standard truss type, so that it is over a bearing.

Note that the chord sizes are not normally greater than the corresponding non-cantilevered standard truss and the cost is very little more. The MiTek system offers many standard cantilevered truss types. Many other variations are possible by adjusting the

Finally, if required a non-standard cantilever truss of almost any triangulated configuration can be designed and fabricated. Note that a brace may sometimes be needed on the bottom chord, which is untypically in compression.

Figure 34c



Figure 34d

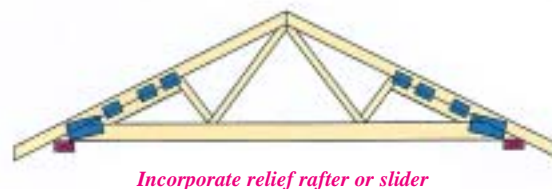
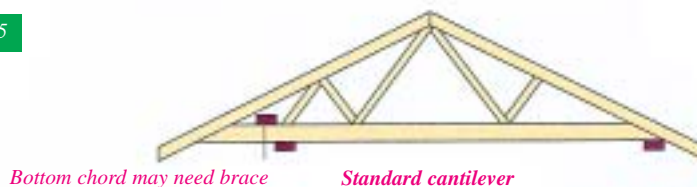


Figure 35



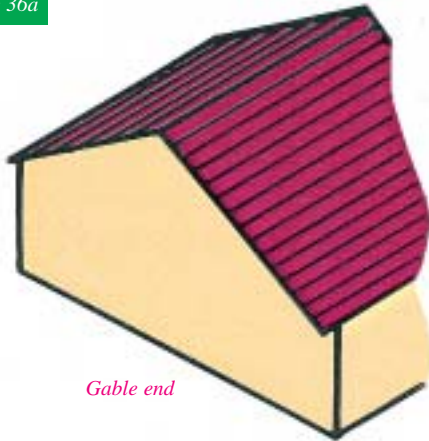
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Typical Roof Features - Hipped Ends

The most common end shapes are the Gable End, which allows the simplest roof framing and uses most support wall surface; the Hipped End which offers a simple wall solution at the expense of a more

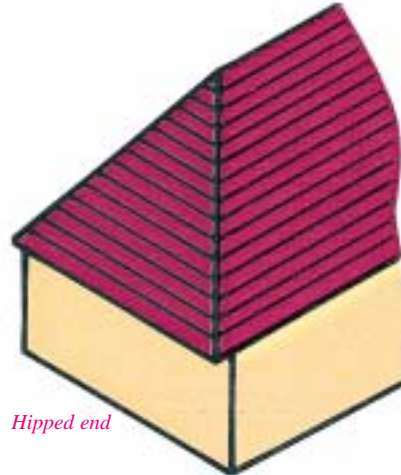
complex roof structure, and the Dutch Hip and Gable Hip, which are compromises between a gable and hip, easily formed using trussed rafters.

Figure 36a



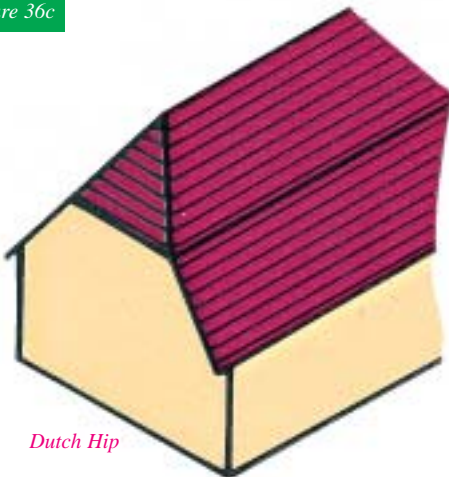
Gable end

Figure 36b



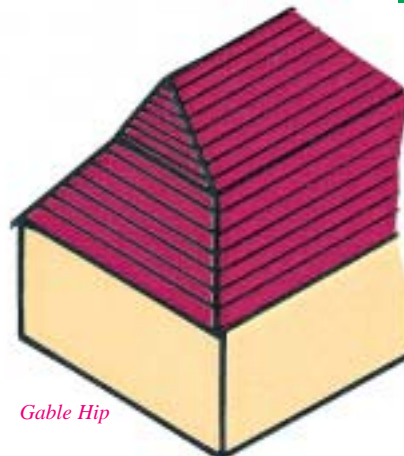
Hipped end

Figure 36c



Dutch Hip

Figure 36d



Gable Hip

Figure 37a



Action of hip end

Figure 37b



Traditional hipped end

Most traditional hipped ends behave like an inverted conical basket and, under load, the tendency for its rim (the wall plate) to spread is resisted by friction (lateral force on the wall), tension in the rim (tension and bending in the wall plate) and tension in the weft (the tiling battens). In the long term the results are sagging hip boards and rafters, bulging walls and characteristic horizontal cracks in the masonry at the inside corners of the dwellings roughly 300-600mm below ceiling level.

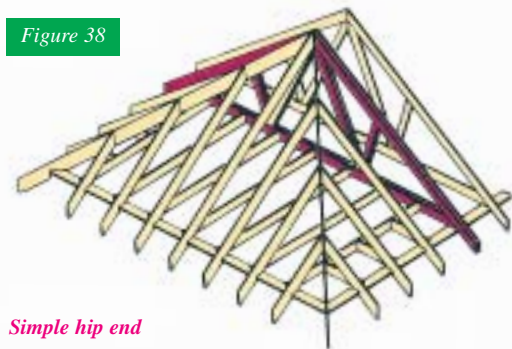
However, hipped end systems develop by MiTek do not depend on tension in battens, or a massive wallplate and horizontal resistance from the walls. With suitable bracing, the trussed rafter hip roof provides the walls with the stability required by Building Regulations.

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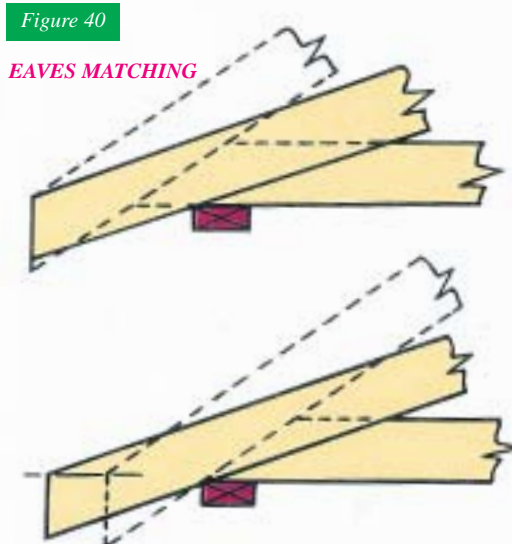
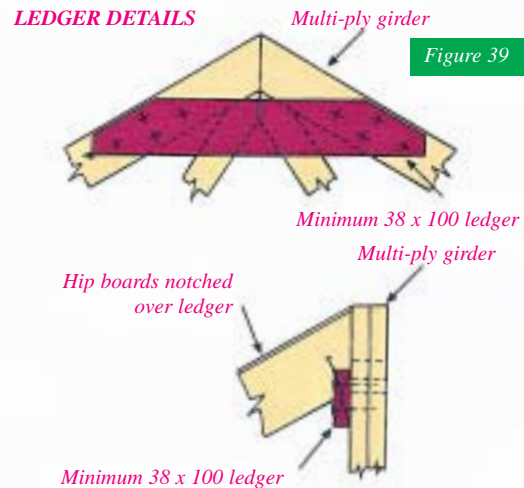
Hipped Ends

The simplest form of hipped end consists of a multi-ply girder of standard trusses securely nailed or bolted together, which support loose rafters and ceiling joists, as in figure 38.

This is the most inexpensive form of hip because no special trusses are needed other than the girder, but their use is limited to spans up to 5m.



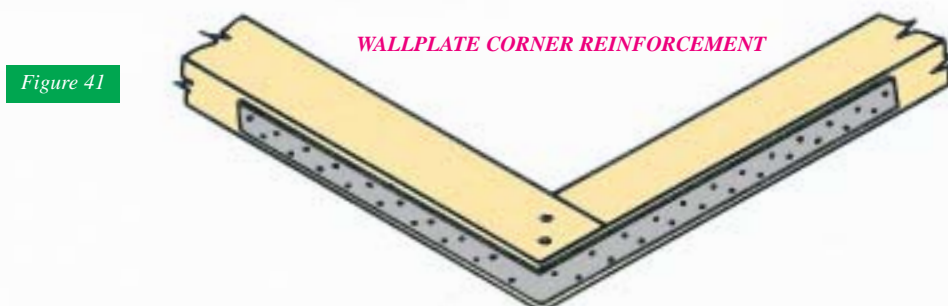
Loose rafter and ceiling joist sizes should be taken from Approved Document A to the Building Regulations. Hip boards should be supported off the girder by means of a ledger. The ceiling joists should be supported by proprietary joist hangers.



If the end pitch is different to the pitch of the main roof, the eaves details should be discussed with your trussed rafter supplier. It is advisable to ensure that the top extremities of rafter overhangs are at the same level to provide for continuous guttering. Note that whilst adjustments can be dealt with on site in loose timber construction, the mono-pitched trusses used in other hip types must be made correctly in the factory.

It should also be noted that all forms of hip construction employing a hip board exerts a horizontal thrust at the wallplate corner junction. Having taken up any horizontal movement, of course, the structure becomes stable. Movement of the wallplate can be controlled by fixing a 1200mm length of galvanised steel restraint strap around the outside. See figure 41.

MiTek trussed rafter suppliers can provide detailed advice on hipped end roof details.



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Hipped Ends - 'Stepdown'

The step-down hip system uses flat top hip trusses of progressively diminishing height from the ridge to the girder truss position. This system is rarely used as each truss is different to make. The number of step-down hip trusses is determined by the need to maintain reasonable sizes for the loose ceiling joists and hip board in the hipped corner infill areas. For these reasons, the span of mono-pitch trusses is not usually greater than 3 metres in the case of regular hips, where the hip end pitch is the same as the pitch of the main roof.

hip truss to support tiling battens. The web configuration of the various truss types shown (including the mono-pitch) are typical, but will be chosen to provide the best structural solution. Fortunately, this system is flexible in accommodating large spans and irregular hips with unequal roof pitches and employs standard, designed truss types throughout.

Noggings must be fitted between the flat chords of the step-down

Figure 42

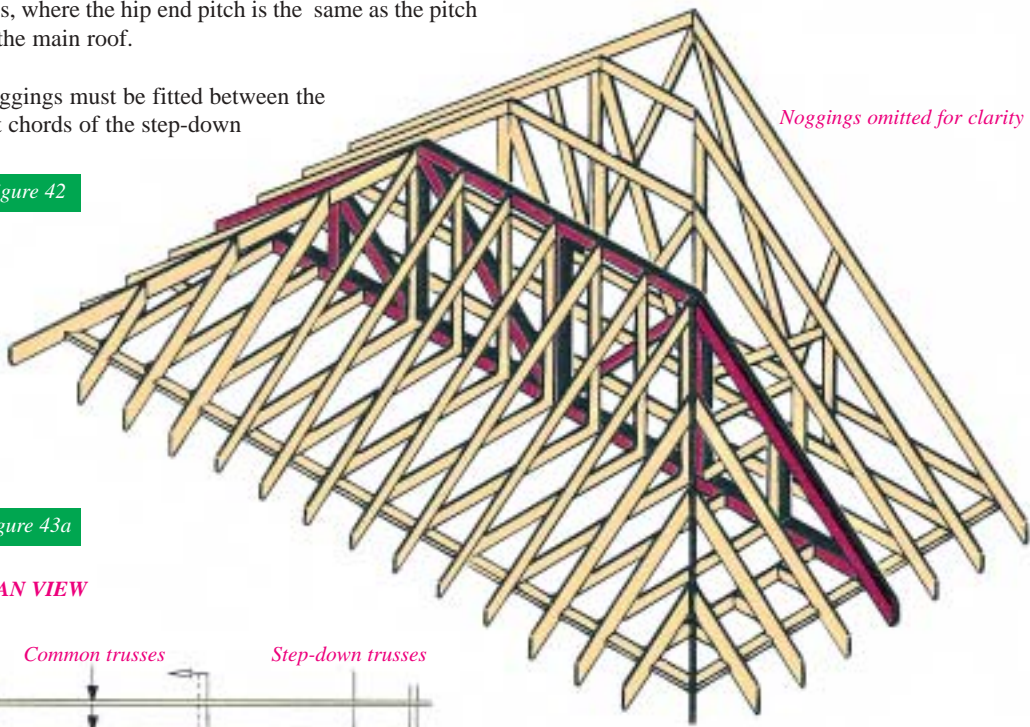


Figure 43a

PLAN VIEW

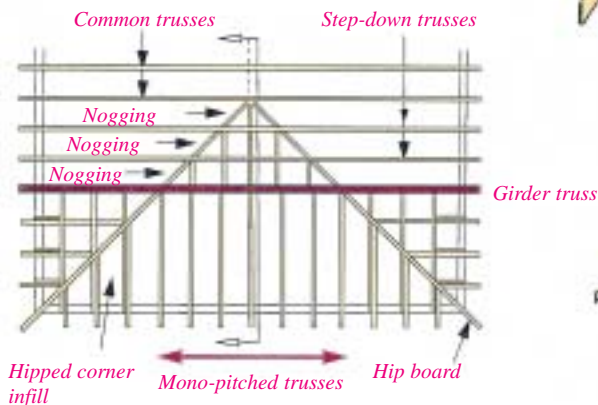


Figure 43b

SECTION

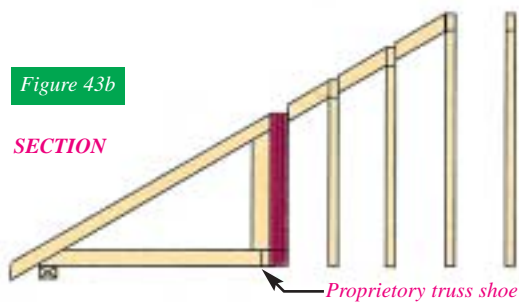
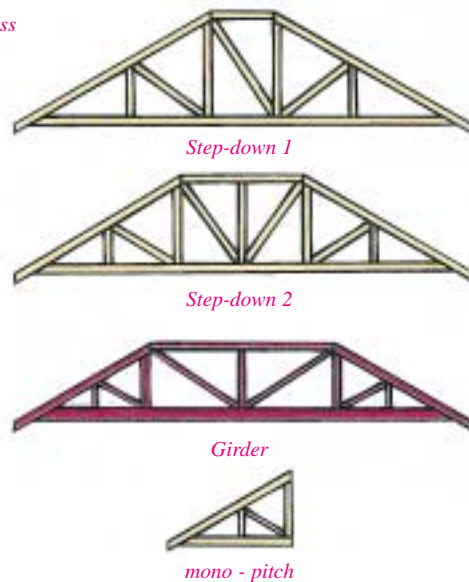


Figure 43c

TRUSS COMPONENTS



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Hipped Ends - 'Flying Rafter'

Of the many types of hip systems this one has an obvious manufacturing advantage: There is only one basic hip truss profile. All the hip trusses, including those forming the girder truss are identical; and the mono-pitch trusses supported off the girder have the same profile as the sloped part of the hip trusses, which speeds up fabrication and reduces the overall cost of the hip system.

The rafters of the mono-pitched trusses and/or hip trusses are extended and are site cut to fit against the upper hip board. Off-cuts may be required to be nailed in position to the rafters of the hip trusses. For the longer rafters props may be required to run down to the trusses underneath.

The flat parts of the top chords of the hip trusses and girder must be securely braced together to ensure stability.

The hip corner may be constructed from pre-fabricated rafter/joist components commonly called Open Jacks or all the corner can be framed with loose rafters, joists and hipboards on site. The hip board is notched over the girder truss and supported off ledgers at the apex of the hip.

This system offers the advantage of continuous rafters and thus easily constructed smooth roof slopes.

Typical spans using this construction with one primary multi-ply hip girder is 5 - 9.6 metres.

Larger spans, up to 13.2 metres, may be accommodated by the use of intermediate girders between the main girder carrying the mono-pitch trusses and the hip apex.

It is possible to construct several types of hip end using the *'Flying Rafter'* concept, or indeed, to combine the *'Step-down'* concept within the hip trusses with the *'Flying Rafters'* on the hip end mono-pitch trusses.

Please contact your truss supplier if you have a preference for a particular method of construction, as the MiTek design system can encompass any method.

- 1 Flat top chords require bracing
- 2 Ledger under to support hip boards
- 3 'Flying Rafters' on hip trusses (may require props to trusses below)
- 4 Girder
- 5 Infill rafters
- 6 Hipboard
- 7 Infill ceiling joists
- 8 Mono-pitch trusses

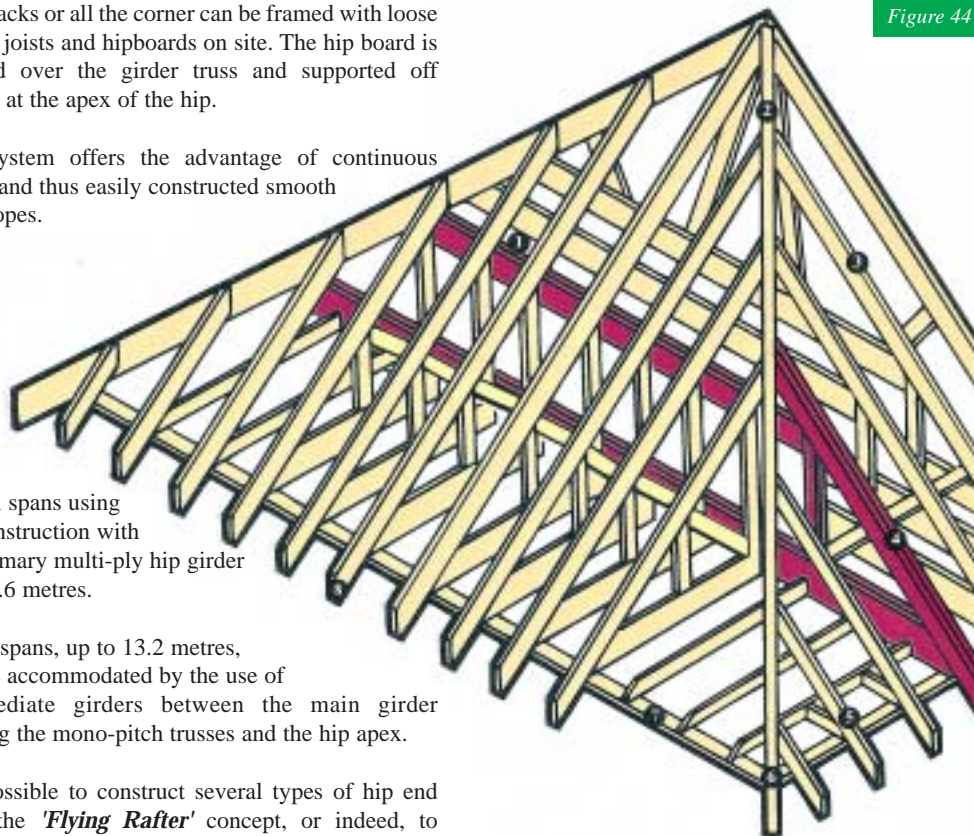


Figure 44

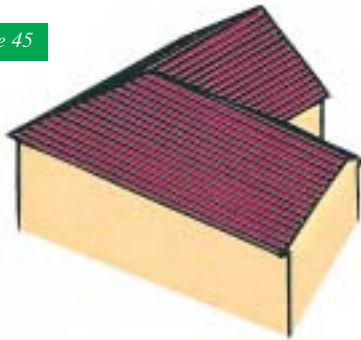
Rafters omitted for clarity

Framing Common Roofscapes

Hipped Corners

A hipped corner is formed by the intersection, at 90 degrees, of two roofs which may, or may not be the same span or pitch.

Figure 45



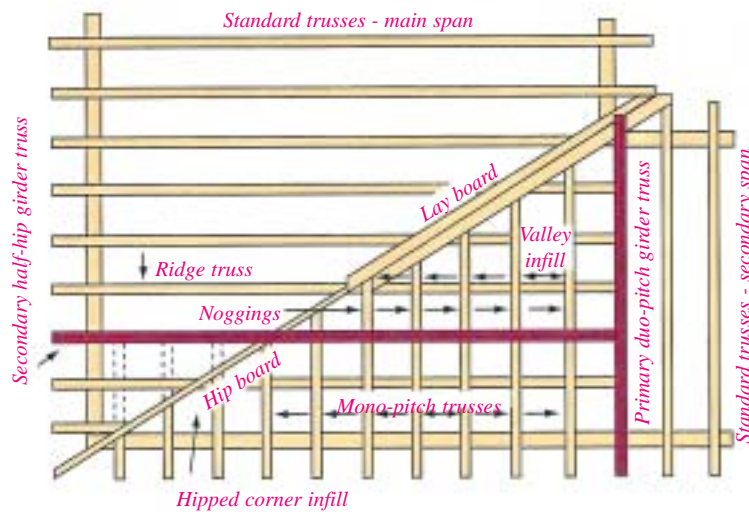
Hipped corners for mono-pitched and other roof shapes are based on the same principles described below for duo-pitched roofs.

The common framing consist of a SECONDARY half-hip girder truss supported by a PRIMARY duo-pitch girder truss. An internal load-bearing wall or beam support can often be used to perform the function of the primary girder truss.

The duo-pitch girder truss is specially designed for the exceptional loads it carries and includes a wider than normal vertical web to which a proprietary girder hanger can be fixed to carry the half-hip girder.

Figure 46b

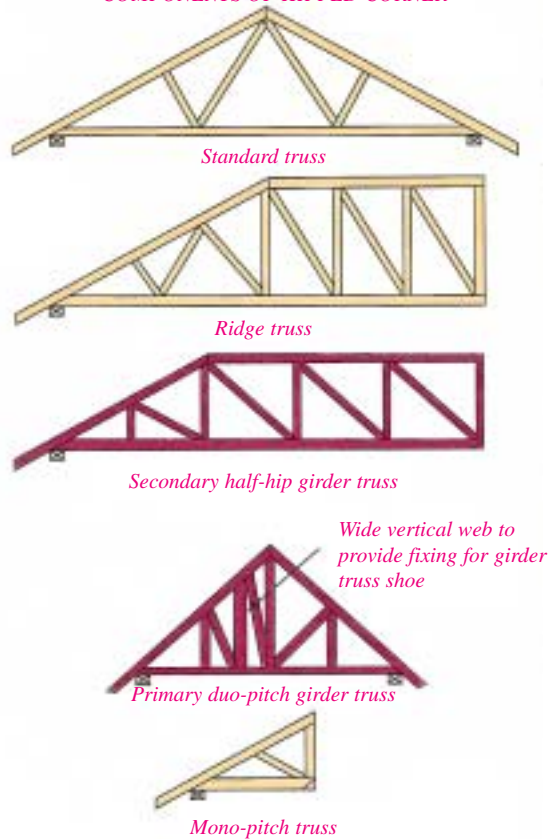
PLAN VIEW



The roof is built up in the valley area using a mono-pitched valley set so that the half-hip girder carries the mono-pitch trusses and hipped corner infill, in the same way as at a hipped end. The span of the mono-pitch trusses is not generally greater than 3 metres and more than one half-hip truss may be needed between the ridge truss and the half-hip girder.

Figure 46a

COMPONENTS OF HIPPED CORNER



The details shown correspond to the method of construction used in the Step-down hipped end, in which noggings have to be sited between trusses to support the tiling battens.

Hipped corners with a Flying Rafter can also be provided.

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'Tee' Intersections and Valley Infill

The basic junction of two roofs is known as a 'Tee' intersection, where a valley line will be formed at the point of intersection of the two sloping planes. The construction around the valley area is commonly formed by the use of either timber rafters, valleyboards and ridgeboards (not recommended) or by the use of pre-fabricated valley frames (Fig 47b).



Figure 47a

Figure 47b



It is strongly recommended that valley frames be used in junction areas, as these provide the quickest, cheapest and most structurally effective solution to the roof framing in these areas.

The use and function of the valley frames are more important than they appear. The individual components transfer the roof loadings to the top chords of the underlying standard trusses in a uniform manner. Acting with the tiling batten between each neighbouring pair of components, they provide lateral stability to the same chords.

Some variations on the basic system are shown in figure 49. Others occur from time to time and suitable layouts can be easily devised by MiTek trussed rafter suppliers.

The layboards shown in figure 48 are in short lengths and supported off battens nailed to the sides of the rafters, to lie flush with the tops of the rafters. This enables the felt and tiling battens to be carried through into the valley. The tile manufacturers advice should be sought to ensure correct tile and pitch suitability.

In many cases, the support for the main roof trusses may be provided by a multi-ply girder truss as shown in figure 48, with the incoming trusses supported in proprietary Girder Truss Shoes at each intersection.

It is common practice on site to erect the girder truss first and position the incoming trusses afterwards.

All MiTek girders are designed to resist stresses induced in the bottom chords by the supported trusses. The connector plates on girders will typically be considerably larger than those on the standard trussed rafters.

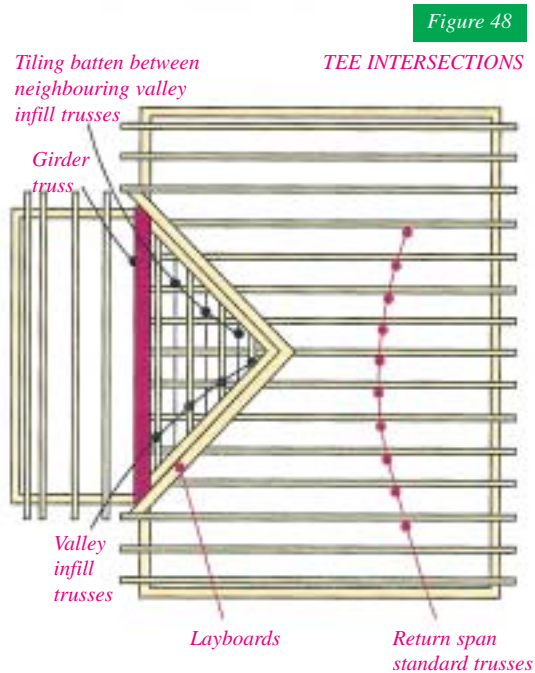


Figure 48

Figure 49



As described above, the valley construction should include intermediate tiling battens between neighbouring valley infill trusses, to provide the correct restraint for the rafters of the underlying trusses.

Figure 50



Framing Common Roofscapes

Dog Leg or Skew Corners

A dog leg or skew corner is formed by the intersection of two roofs at an angle other than 90 degrees.

It is usual for the incoming and outgoing roofs to have the same span and pitch, although it is possible to frame the roof using trussed rafters, if these differ.

The cross section may be of any of the usual shapes but is generally mono-pitched or duo-pitched.

Figure 52a

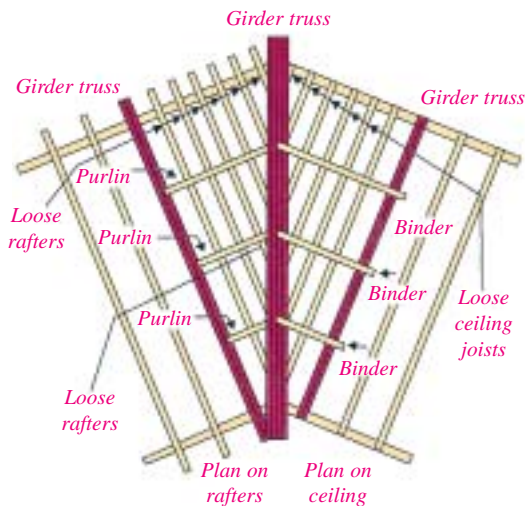
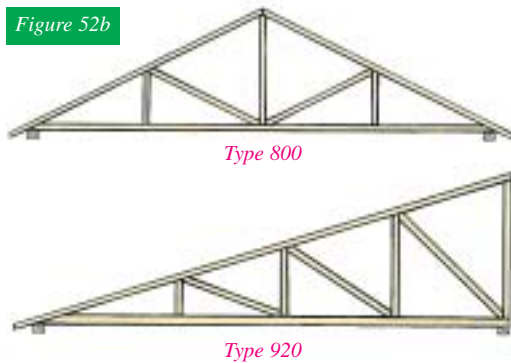


Figure 52b



The feasibility of this framing method depends on the design of the longest purlin. Although installation of loose ceiling ties from girder to girder may be simpler in carpentry requirements, it is generally preferable to adopt the layout shown (incorporating loose timber binders at ceiling level), in order to simplify plasterboarding.

The ceiling binders should be supported on the bottom chords of the girders and located against the vertical webs. A robust structural connection for example, with two proprietary angle plates should be made between binders and loose ceiling joints. The ends of the binders may need to be notched or blocked-up off the girders, to ensure that the undersides of the loose joists are level with the girders.

Figure 51

DOG LEG



The typical framing plan shown for a duo-pitch roof is characterised by the minimum number of different truss types and provides a practical solution to the problems raised in these situations but using loose infill.

The multi-ply girders used have a number of vertical webs to allow the fixing of the loose timber purlins, which support loose timber rafters.

The example shown needs a lot of site loose work. However now that there are proprietary metal hangers available to join trusses to girders at angles other than 90 degrees the whole of the corner could be framed with trussed rafters.

Figure 52c

