# Hip Rafters – on the "diamond"

*Joe Thompson,*

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*Joe@sussexoak.co.uk.*

## 1. Introduction.

In Southern England between the thirteenth and eighteenth centuries there were four ways to orientate a "square section" or "pre-Georgian" hip rafter. These rafters were nearly always oak and tapering in section towards the ridge and often slightly bowed along their length.

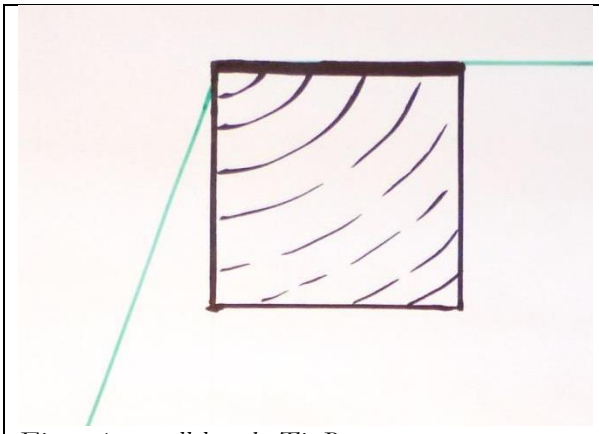

*Figure 1; parallel to the Tie Beam*

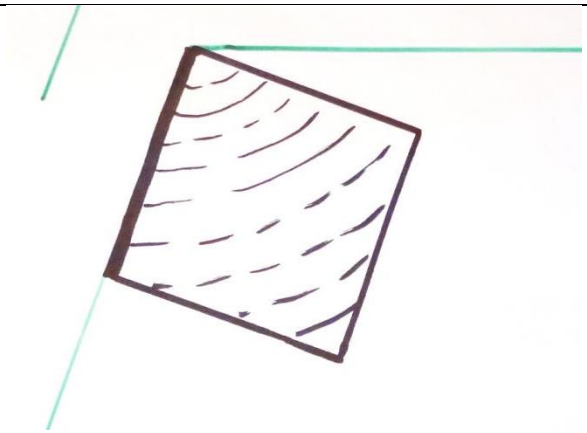

*Figure 2; parallel to the Wall Plate*

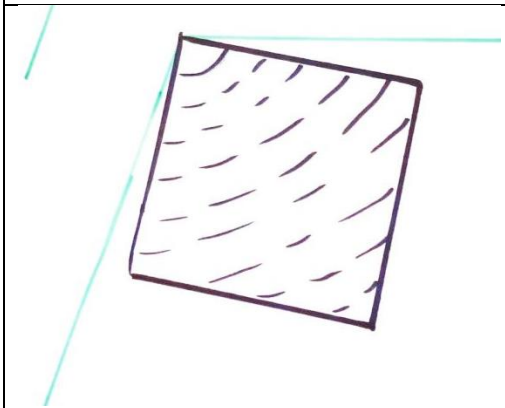

*Figure 3; on the "diamond". Not parallel to either the Wall Plate or the Tie Beam*

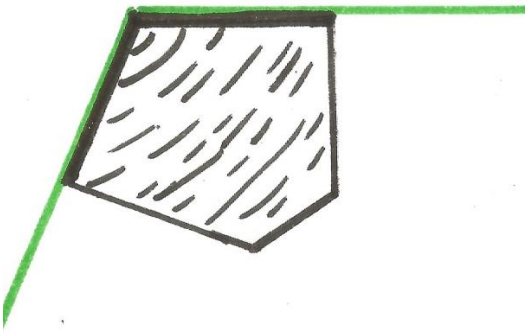

*Figure 4; Backed hip, parallel to both the Wall Plate and to the Tie Beam.*

The two most common versions are "parallel to the Tie Beam" and "parallel to the Wall Plate", these occur throughout the period. In both methods, one set of jack rafters has a splayed abutting joint and one set has a crutch joint.

Research that I have carried out in Sussex, Surrey and Kent has shown that during the sixteenth century a new variant was introduced; on the "diamond". This has been found in both houses and barns. It occurs only rarely and has not yet been found in any seventeenth century building, (but I suggest that it probably will). The upside and the downside of this variation is that crutch or compound birdsmouth joints are

required on both sets of jack rafters. This is perceived as being more time consuming to line out and to cut. However the crutch joint is a strong and secure joint that only relies on a nail to keep it in place temporarily, before the laths (battens) are fixed. In this sense it could be perceived as being better than a joint that relies on the shear strength of a nail to hold it in place. Two examples of hip rafters on the diamond are shown below.

*Figure 5; C16 Barn from Sussex.*

*Figure 6; C16 alteration to a house from Kent.*

*Figure 7; the crutch joint or compound birdsmouth joint on the jack rafter fixed to a "parallel to wall plate" or "parallel to tie beam" hip rafter.*


*Figure 8; the splay joint on the jack rafter fixed to a "parallel to wall plate" or "parallel to tie beam" hip rafter.*

Recently some examples in softwood have been found in Bergen, Norway, dating from the eighteenth century (pers com from Axel Weller).

During the eighteenth century (possibly the late seventeenth century) the backed hip rafter was introduced, again this was a rare variation. This did not require crutch joints but instead used simple splay cut abutments on both sets of jack rafters.

After this period the hip rafter changed to a "deep" board section with the angles for the cuts being given by templets. The angles for the templets usually being generated by the iron square or occasionally by taking off a drawing.

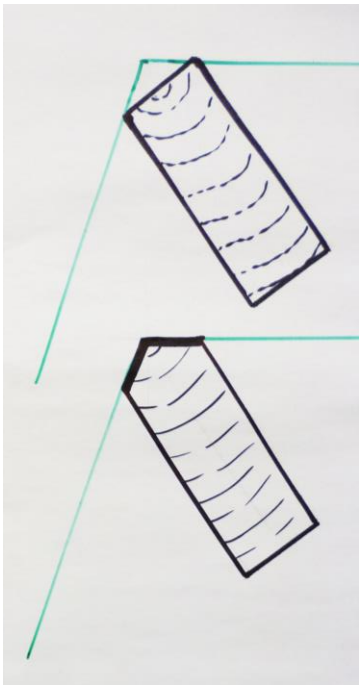

*Figure 9; showing the cross section of the hip rafters used from the late eighteenth century onwards. Sometimes backed but often not.*

## 2. Carpentry techniques used to frame these hip roofs.

My thoughts are that these Southern English hip roofs were generally framed by laying the timbers out over the wall plates and tie beams and scribing them together. The pitch of the roof tended to conform to a limited number of standard pitches, mainly referring to the ratio between the span and the rafter length and then latterly in the eighteenth century between the span and the rise of the roof. E.g. ¾ pitch or 1/3rd pitch

There is no evidence yet found that the Continental practice (Trait) of drawing the roof out on the ground and then laying the timbers out over these lines was widely practiced (only a few buildings have been found with scratched or snapped coloured centre lines). There are however numerous instances during this period of roofs being framed by using a "jig" or a "pattern pair", demonstrating that the technique of laying the timbers out full size and scribing directly was a common technique.

Laying out the hip rafters either, "parallel to the tie beam" or "parallel to the wall plate" presents few problems (see section 3 below). The hip rafter is first laid out parallel to either the tie beam or to the wall plate and one cut is lined out at top and bottom. Then the hip rafter is laid out on the other timber and twisted, so that the first cut line is now at 90º to its first layout. The second cut is now lined out at top and bottom.

The hip on the "diamond" could, in theory, be laid out as above but with an additional stage of adjusting by "eye", by halving the twist that the "parallel to the tie beam" or "parallel to the wall plate" method produces. Note that this approach has not yet been tried.

The shape of the eighteenth century backed hip would probably have been generated from a templet. The bevels or angles for the templet would have been produced by lining out the backing for the hip rafter, on a scale drawing, or by using the iron square.

## 3. Layout showing a hip rafter *(parallel to the tie beam*) being lined out.

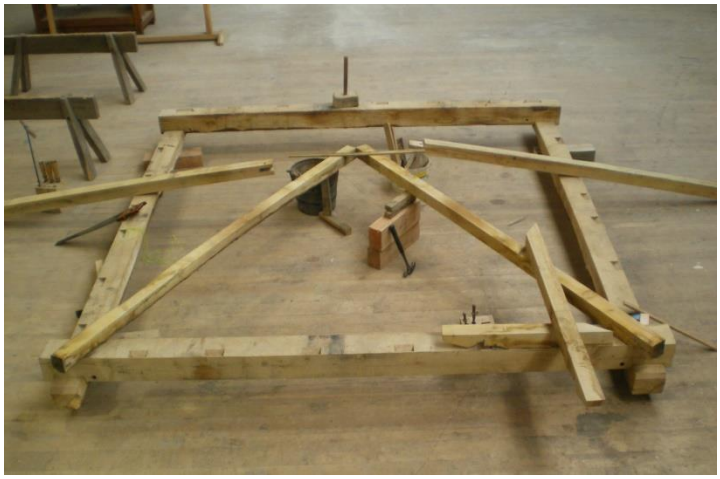

*Figure 10; hip rafters laid out parallel to the tie beam.*

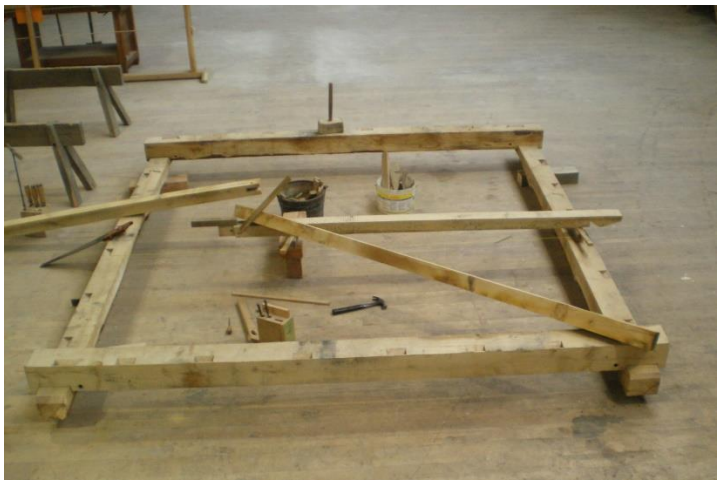

*Figure 11; hip rafter laid out on the wall plate, twisted to the required angle, based on 90º to the first layout*

*Figure 12; showing the hip rafters cut to the scribed lines and reared up.*