Gang-Nail Guide Lines No.18

ARE ALL HOUSES BUILDABLE?

I would love to have the following conversation with some house designers:

Designer:	*I know this roof is a bit tricky but why is your price so high for the trusses?*
TR:	*Sorry, you're going to need a crane for this one.*
Designer:	*A few hours of crane hire wouldn't blow the price out that far!*
TR:	*No you misunderstand - you'll need to buy a crane to hold that roof up!*

by Tim Rossiter
Chief Engineer,
Gang-Nail Australia Limited

Of course we need to be more diplomatic than that, after all they are our clients. However, there are a few issues, which should be addressed by the designer, that would help everyone in the long term.

One of the problems that needs to be addressed is that some fundamental principles of roof geometry need to be recognised, so that a plan that is drawn, can in fact be built.

There are many occasions where the old practice of building a cardboard model of a roof would assist designers to sort out these problems.

Many of the problems with the geometry of the roof would be overcome by a simple check of each elevation to ensure that there are no inconsistencies with each other or the roof plan.

Discrepancies in the structure's drawings means the fabricator must guess what the designer has intended. Sometimes the estimator guesses assuming that it will be sorted out later when they get the job.

This has obvious ramifications for the accuracy of the quote and leaves the fabricator vulnerable, should he make the wrong assumption and fail to clarify the situation before manufacturing the roof.

Now for the principles of roof geometry:

Continued over page

Diagram 1.

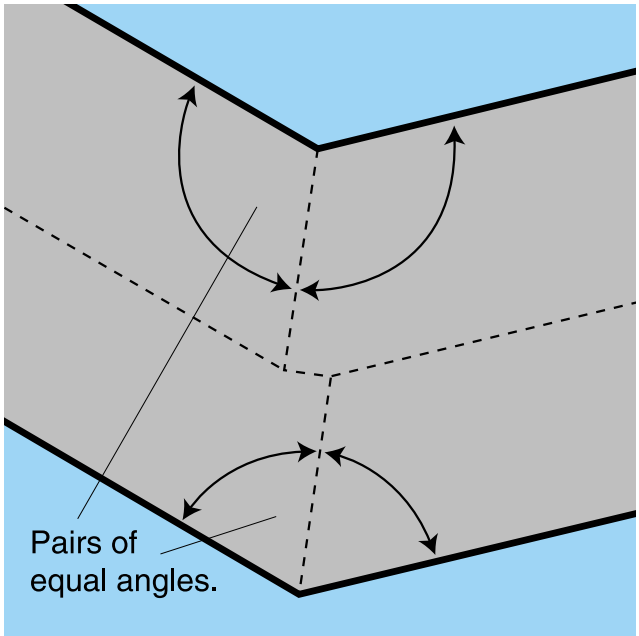
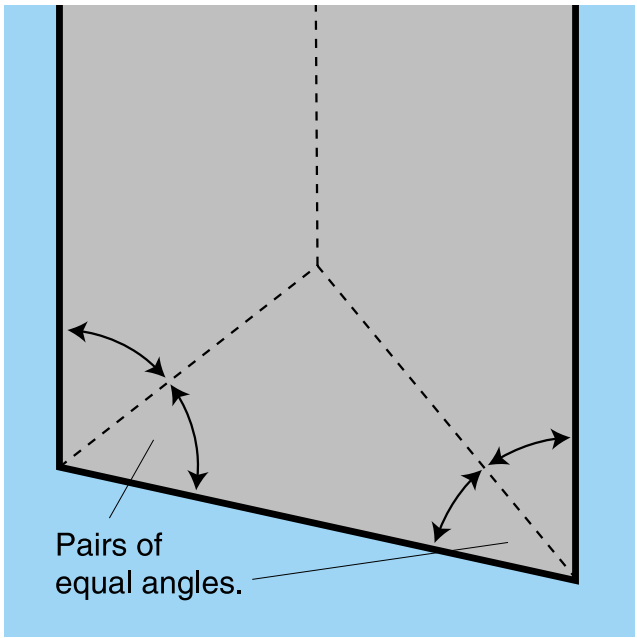


Diagram 2.



1. Hip and valley lines.

When two roof slopes meet they form either a hip line or a valley line. Often the location of these lines on the plan causes confusion particularly when the pitching lines are not at 90 degrees to each other.

The fundamental rule is:

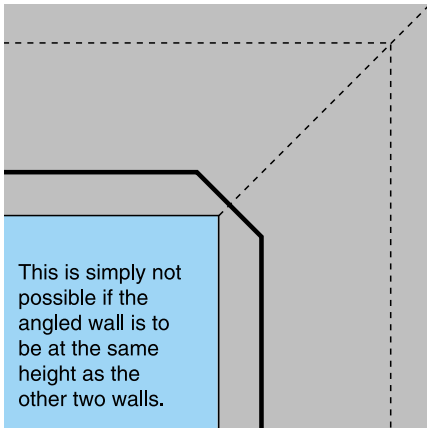
"If the roof pitches are the same, then the angle of the hip/valley must bisect the angle between the walls". (See diagrams 1 & 2)

2. Eaves lines.

With eaves lines, the principle to remember is:

"If the pitch is the same then for identical distances from the pitching line the dropoff will be the same". Alternatively if two different pitches meet then the eaves distances must also be different to match the dropoff. (See diagrams 3 & 4)

Diagram 3.

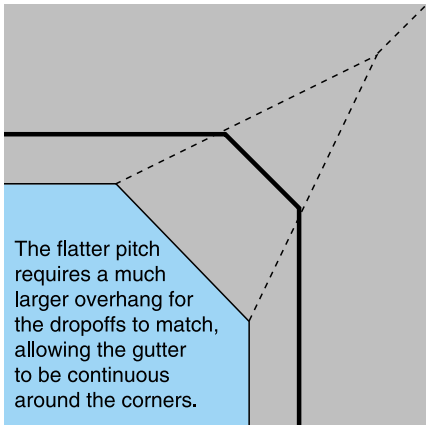


Discussions have occurred numerous times with designers who insist that what they have drawn is not only possible, but is how they expect it to be done (bring on the cardboard model).

So where does the crane come in?

Many plans stipulate the location of the supporting structure in an impractical position when compared to the roof planes. An example of this, the practice of placing a kitchen window 45 degrees to an internal corner of the house (See diagrams 3 & 4).

Diagram 4.



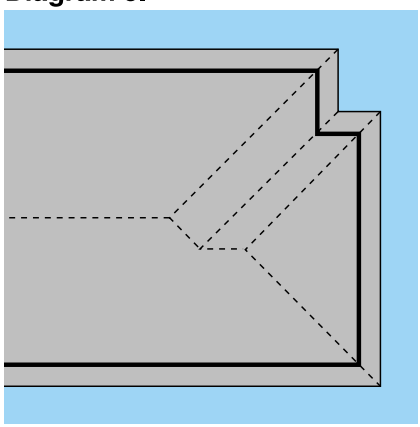
This case requires a bulkhead to take the pitching beams that are needed, to provide support for the trusses. Otherwise expensive top chord supported trusses need to be designed.

Another problem area is the use of small hip extensions on large spans that would require very low truncated trusses. (See diagram 5.) There is similar difficulty with the support of trusses where walls are offset by small amounts. (See diagram 6)

Although each of these examples can be resolved by inserting internal beams or by using jack girders it is advisable to avoid wherever possible circumstances where multiple level girder trusses are required.

That is, cases where one girder truss is required to be supported by one or two other girder trusses in turn.

Diagram 5.

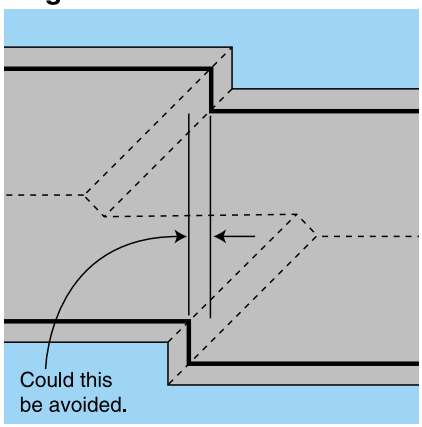


How do we fix these types of problems?

Education, I believe, is the only solution - for house designers, estimators, building authorities and detailers. House designers need to be encouraged to draw plans that are practical and feasible.

There is always room for innovation - but some rules of geometry cannot be broken. Potential issues should be brought to light when the house is first quoted.

Diagram 6.



Particularly in the case of the wall bracing, i.e. the lack of opportunity to properly brace the walls. The Council has the first opportunity to ensure a house is "braceable".

To broach these issues at the frame inspection stage will cause frustration, additional costs and time delays. The detailing is really the last chance to stop a problem being built.

Detailing of wall frames without checking that adequate bracing can be applied to the frame is still occurring. Frames should not be detailed until these issues are resolved.

The aim of all this education is to avoid the wasted time and additional cost. The bottom line - fixing a problem on paper is much cheaper than on site when a house is half built.