

BRACING FOR TOP HAT TRUSSES



by **TIM ROSSITER**
Chief Engineer,
Gang-Nail Australia Limited

I have to confess to borrowing the idea for this article from a U.S. article about the "Permanent Bracing of Piggyback Trusses".

This is an important issue in Australia that is not often given proper attention. Top Hat trusses are used when a roof truss would be too tall if made in one piece. This can be due to a large span or a steep pitch or a combination of both. The system employed is to make up truncated trusses of a manageable height, and then a secondary truss is placed on top, see Figure 1.

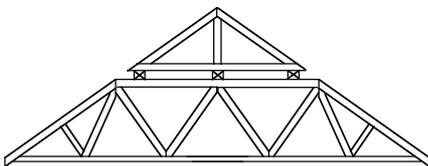


Figure 1

The general construction practice is well known - place a series of ties across the horizontal top chords of the truncated trusses and put the secondary trusses on top of those.

It is also fairly well understood that to get the correct tie down, the battens have to be connected to the horizontal top chords and the bottom chords of the top hat trusses are then attached to the ties.

The ties have another function that is even more important.

The horizontal top chord is in compression when the roof is loaded, which means that it wants to buckle sideways - the ties are meant to stop that occurring.

Now we come to the part that is NOT done properly - bracing the bracing.

If you refer back to a GN Guideline No. 11 on the use of Speedbrace, you will read a good explanation of how diagonal bracing is used to brace the roof battens that restrain the top chord of trusses.

This system requires the same treatment - at one end of these ties we need to have brace which is diagonal to stop the whole set of horizontal top chords buckling together (See Figure 2).

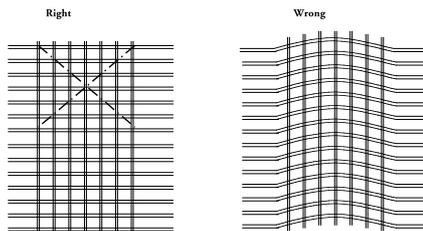


Figure 2

The lack of this bracing has caused problems in buildings with which I have been involved in Australia, and has been the cause of building collapse in the U.S. Do not forget the reason the top-hat system is being used is because the trusses are larger than normal, so the

buckling forces will be larger too.

The end bracing of these ties, or permanent braces to give them their proper name, can be done effectively in a number of ways:

- ☞ Speedbrace at approximately 45 degrees fixed as for normal roof bracing.
- ☞ Diagonal timber braces placed either under the horizontal top chords or over the top hat bottom chord, again at approximately 45 degrees.
- ☞ A diaphragm brace, which can be achieved using a product such as sheet ply or brace board.

The logic, that if top-hat trusses which are already in place without this diagonal bracing are OK because they have not as yet fallen down, is a fallacy.

The failure due to buckling of a truss can take many years after the roof is fully loaded.

So if you know of, or have supplied, a roof system using top-hat trusses that does not have the diagonal bracing correctly fitted, then go and fix it.

The diagonal bracing can easily be retrofitted using any of the systems described above.

However, if buckling has already progressed beyond normal installation tolerances (L/200 or 50mm, whichever is the lesser) additional diagonal bracing will be required.

In this case you should contact an appropriately qualified engineer.

| Category | Application of structural member | Typical type of building |
|----------------|---|---|
| H (House) | All structural elements in houses and secondary structural elements in structures other than houses. | Houses, farm buildings and other light structures whose failure does not result in significant loss of life or property. |
| C (Commercial) | Primary structural elements in structures other than houses. | Commercial and industrial buildings, multi-residential buildings, school classrooms and other institutional buildings. |
| E (Essential) | Primary structural elements in structures intended to fulfil an essential services or post disaster function. | Essential services buildings such as fire stations, hospitals, civil emergency shelters (e.g. school assembly halls), communication centres, etc. |