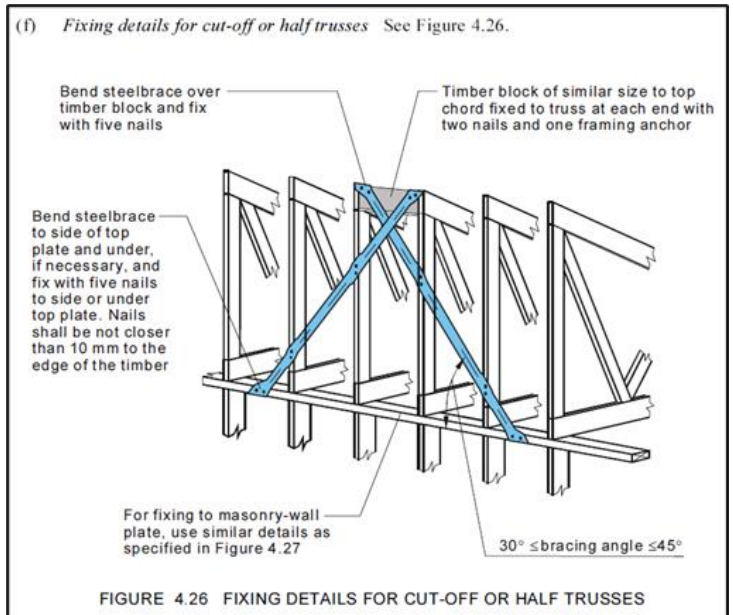




CONFUSION AND MISCONCEPTIONS WITH VERTICAL END BRACING

When it comes to the design and detailing of roof bracing, one commonly overlooked aspect is vertical end bracing or “cut-off” end bracing, even though it functions as an important link in the overall lateral bracing system on a structure. The intention of vertical end bracing is to function as a transfer mechanism to bridge the gap between the roof bracing (usually inclined with the roof pitch) and wall bracing which typically finishes at the top of the wall frame. It also helps with lateral stability of trusses or other elements with a cut-off or vertical end, by preventing torsion or “rolling over”, especially during erection and construction. It is therefore perplexing to come across situations where it is completely left off or vaguely referenced on truss layouts for installers to “figure it out”. A common example being a passing note saying “Provide vertical bracing as per AS 4440” with very little else in the way of details or vertical bracing locations. It may have been uncommon in older building designs, however modern designs incorporate mono-slope roof planes (often low-pitched), with or without box gutters, therefore bringing the requirement of vertical end bracing right to the forefront of roof bracing designs, specifications, and detailing.

One reason could be the lack of guidance or specific requirements when it comes to Australian Standards, general roof bracing training and other design literature on the topic of roof bracing for timber roof trusses. Section 4 of “AS 4440 Installation of nailplated timber roof trusses” would be considered a primary resource when it comes to roof bracing in our industry. So, hopefully it wouldn’t surprise you to know that vertical or cut-off end bracing made it into the very first 1997 edition. (Refer Extract 1) This content remained unchanged to this very day even in the latest 2004 edition apart from improvements with illustrations and diagrams.



Extract 1 – Figure 4.26 from AS 4440

Figure 4.26 would certainly be the more commonly known reference and one that I’m sure most of us would have seen in AS 4440 or other sources. Finding any more references on this topic in AS 4440 is quite limited though and it is therefore not surprising how it can be easily overlooked. But for the more astute reader, you may have come across a couple more references in this standard such as Clause 4.3.7 Steelbrace for mono-pitched roof, which calls up “... diagonal bracing in the vertical plane ...”, shown highlighted in Extract 2.

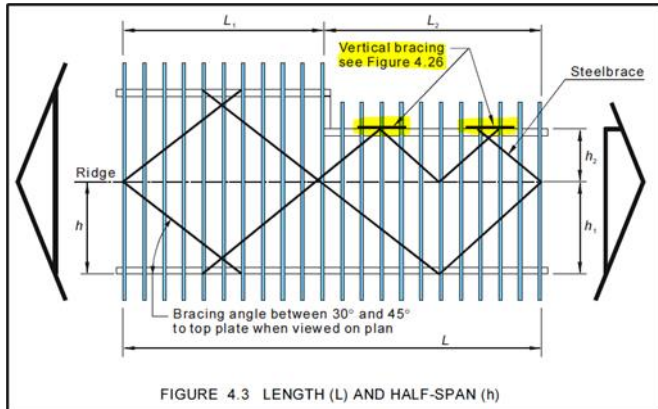
Extract 2 – Clause 4.3.7 from AS 4440

4.3.7 Steelbrace for mono-pitched roof

Where the roof consists of half trusses (mono-pitched roof), the truss span of the half truss shall be taken as the half truss-span (h), and one of the criteria from Clauses 4.3.3.2 to 4.3.3.4 shall be applied. The apex of the half truss shall be braced to the supporting structure with diagonal bracing in the vertical plane as specified for half truss fixing for apex bracing in Clause 4.3.8(g).



The only other reference, which doubles as an illustrative example on the placement or location of vertical end bracing, can be found in Figure 4.3 as shown in Extract 3. Once again, blink and you could easily miss this reference, so it's not difficult to see why there may be confusion or misconceptions on this subject.



Extract 3 – Figure 4.3 from AS 4440

Nevertheless, Figure 4.3 provides a good starting point to illustrate where vertical end bracing should be installed. Using the principles of bracing design and engineering fundamentals, we can further expand on the original intent of AS 4440 with a few rule-of-thumb guidelines where vertical bracing should ideally be located:

- At each end of a series of trusses, with the same span, or forming the same vertical plane.
- At the intersection point where roof bracing is anchored to the vertical plane formed by mono or cut-off trusses.
- Intermediately between vertical end braces, either spaced at regular centres or as needed to satisfy calculated wind force demand along cut-off end.

The best-case scenario would be to expand Section 4 of AS 4440 to capture this and many other topics such as box gutter bracing. This follows similar principles to vertical end bracing, but I digress, and it's best left for another edition!

Certifiers and building inspectors are catching on to this requirement and sometimes even requiring vertical end bracing to be applied to internal areas where they are technically not required. This is yet another good example of what confusion & misconceptions can arise when it is not clearly documented in standards or industry literature.

On site installation of vertical end bracing can be another point of contention with traditional carpenters installing a timber diagonal strut with a few skew nails each end as seen in Photo 1. When the strut is in tension, the end fixings are subject to withdrawal, and nails are very poor in this mode which is why steel brace wrapped around at the ends always provides a far superior connection.



Photo 1 – Non-complying vertical end bracing

Remember the old saying – “A chain is only as strong as the weakest link”. This analogy equally applies to a complete bracing system too, so make sure you have the knowledge and know-how when it comes to a compliant vertical end bracing design. It's always much easier to deal with at design stage than to find solutions after the fact and having to work around cladding or other obstructions!

In the interim, your nailplate supplier should be able to support you with literature, tools, guidance, and any training needs on this subject while AS 4440 catches up.

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