FTMA TECH Talk

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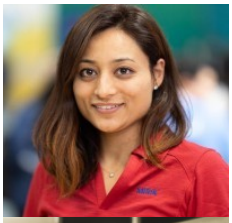

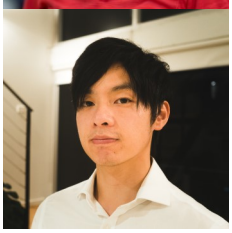

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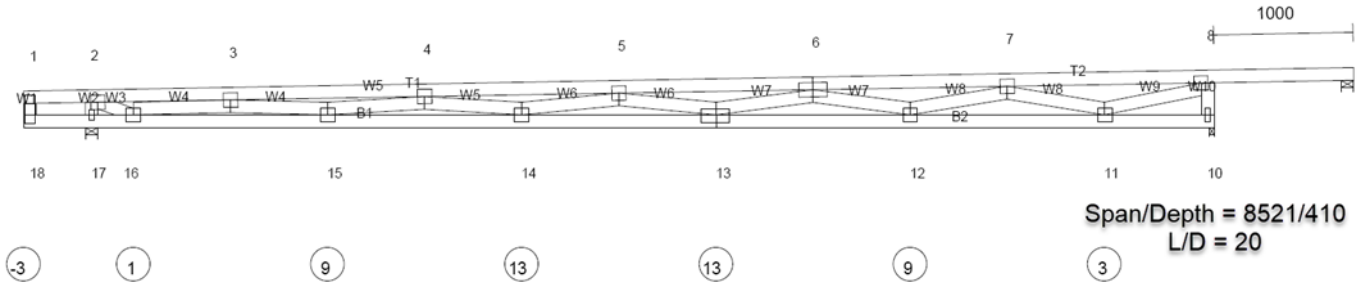
ARE YOUR TRUSSES SHALLOW?

Land sizes are getting smaller, and the demand for energy efficient homes with maximised space and cheaper costs is on the rise. Open plans and higher ceilings are now the norm but building heights for Class 1 structures in NCC still remains at 8.5m max. These design constraints have increased popularity for large spanning trusses with low pitches and short heel depths – or "shallow trusses".

In-spite of their growing popularity, an often-overlooked aspect of these trusses are their slenderness and their ability to perform across the intended design span in real life.

From the experience of our design support team in recent times, it is evident that the manufacture of shallow trusses to any reasonable camber is hard given their geometric limitations and space constraint with real-life material. Examples of the difference between design and reality are shown below.

Trusses shown in Figure 1 were identified to have deflected excessively on site, resulting in the roof plane showing an obvious dip mid-span. Though these shallow trusses were correctly designed and manufactured with camber, the ability of their webs to maintain camber was highly compromised due to its shallowness.



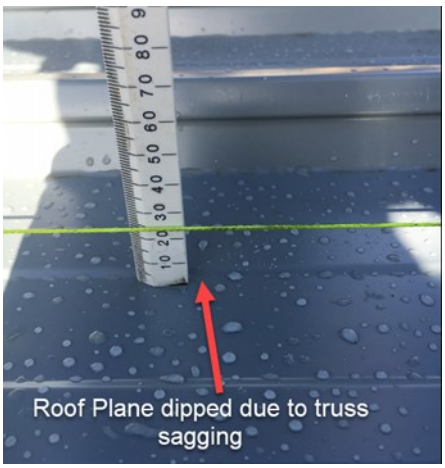
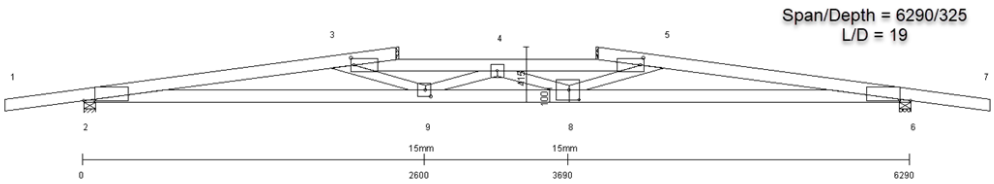


Figure 1: Illustrates the Designed Vs Installed performance



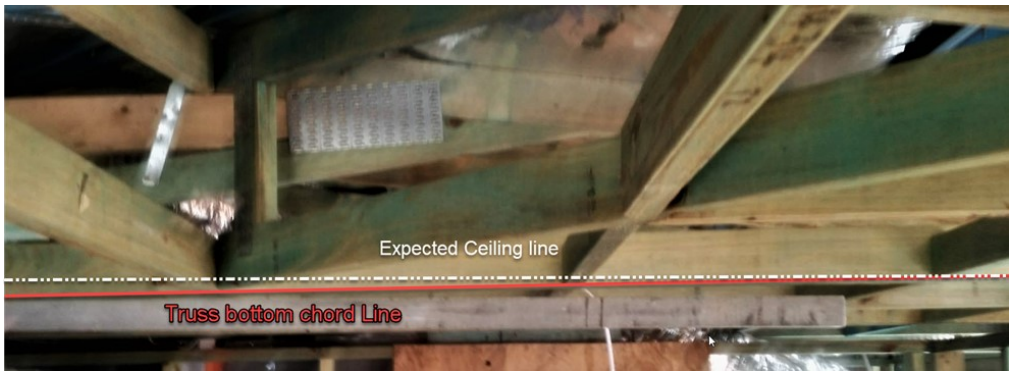


Figure 2: Illustrates Girder Truss Designed Vs Installed performance

Web triangulation plays a vital role in these low pitch trusses. The Girder Truss shown in Figure 2 has only two web joints that is supposedly holding 15mm camber – an impossible feat with shallow web angles and low truss depths.

How to manage shallow trusses?

As a rule of thumb, trusses with a span-to-depth ratio in the range of 10 to 15 generally exhibit reliable stiffness and structural performance. Trusses with a span-to-depth ratio beyond 15 - like those shown above - may have unpredictable behaviour which can result in higher deflection than predicted.

Truss design software can now assess the shallowness of a truss and raise WARNINGS where necessary. This check is done to identify trusses with excessive span-to-depth ratios and help detailers to predict the reliability and serviceability performance of shallow trusses.

Some of the ways to tackle shallow trusses are:

- Increasing the truss depth, and/or adding internal support bearings to increase the D/L ratio.
- Increasing chord grades/sizes, and/or reducing truss spacing will improve truss design and its ability to resist deflection.
- Use shorter panel lengths by increasing number of webs – this will make the diagonal webs steeper as well as more effective to hold camber.
- Where possible, improve the alignment of analog member with physical member to achieve a more accurate truss deflection.
- Increase heel depth/ plumb depth if pitch cannot be changed
- Introduce structural ties between trusses at mid or third spans to mitigate potential differential deflections.

As the common adage goes: "*Prevention is better than cure*" – which is true for the Frame and Truss industry, where valuable time and money is wasted fixing trusses on site and giving unwanted inconveniences to the supplier, the builder, and ultimately – the customer.

Finally, being aware of the implications of shallow trusses and catering for this early in the design and production phase will ensure the timely and successful completion of a project, giving an extra peace of mind to all parties involved.