MiTek
SCISSOR TRUSSES AND MITIGATION PROCESS

The purpose of this document is to provide guidance on both the design and detailing of scissor trusses, so they don't cause any surprises on site.

Scissor trusses by virtue of their geometry will perform very differently compared to a conventional truss. As the bottom chord is pitched at an angle, when a scissor truss is loaded it will result in a horizontal thrust or force that will push horizontally on a wall frame. If the thrust is not limited or mitigated, it may cause problems in the walls bowing and cracks in joints of ceiling and wall plasterboard.

There are a lot of variables that affect a scissor truss performance including geometry, roof materials, truss span, wall stiffness etc. However, MiTek have put together some recommendations for designers, detailers, and engineers to help mitigate the performance issues.

Message to the Designers:

When considering scissor trusses as part of the design at concept stage, there are a few simple recommendations that need to be followed:

- A minimum angle between the top and bottom chords of 15^0. If 15^0 cannot be achieved, Specific Engineering Design is required i.e. contact MiTek or a suitably qualified engineer.
- Avoid scissor trusses with large spans. Large spans will result in the centre of the truss to deflect more, which in turn will cause a large horizontal thrust to the external walls.
- If scissor trusses are used in large open areas, look to introduce return walls at right angles (spaced at a maximum of 6m centres) and detail good connections between the intersecting top plates.
- If return walls are not feasible consider using a centre parallel chord truss (along ridge line), with half trusses on either side. Speak to your local MiTek Truss Fabricator/Detailer for guidance.
- Prevent discontinuous top plates; for example, avoid the detail of lintels that protrude above the top plate of walls.
- Consider thicker walls (eg. 140mm) which will allow for larger and stronger top plates.
- Be aware that if return walls are only on one side, then the opposite wall will move out twice as much.
- Also, patio areas with beams and posts do not provide any restraint to top of wall.

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Message to Fabricators / Timber Structure Detailers:

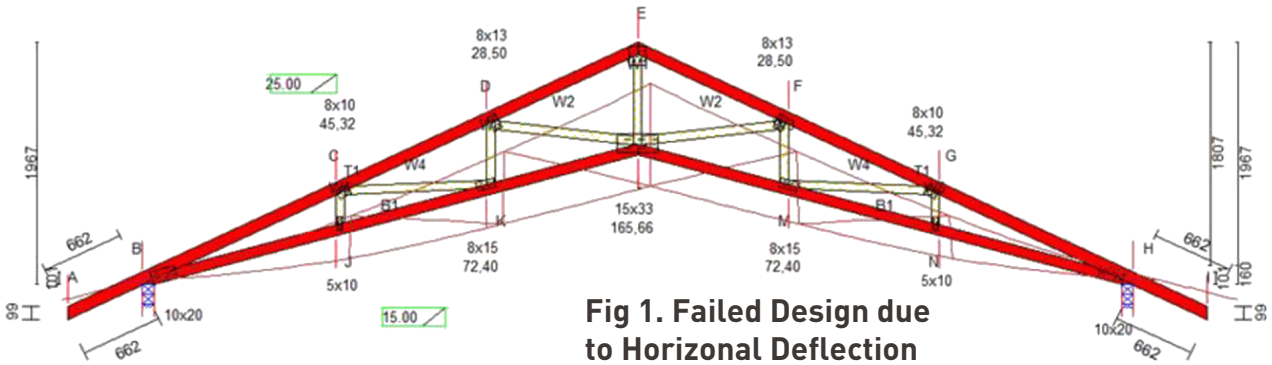

Fig 1. Failed Design due to Horizonal Deflection

If roof pitch is 45^0 a 5mm deflection at mid-span will cause each wall to move outwards by 5mm. If one wall is restrained (by other return walls), then the opposite wall will move outwards 10mm. This horizontal movement is resisted by wall top plate and ceiling packer (if any). Under NZS 3604:2011 Clause 5.4.6 "Bracing lines in any storey shall be at not more than 6m centres in each direction,..." So, if this is the case a **continuous** 6m long top plate and ceiling packer may reduce this horizontal movement and there may be no issue. However in practice, rooms with scissor trusses are usually open plan and can be 10 to 12m long.

- Check scissor trusses have a minimum of 15^0 angle between top and bottom chords.
- Design scissor truss for a maximum mid-span deflection / camber of 5mm.
- Increase number of panels so diagonal webs are about 15^0 to bottom chord.
- Double end cut diagonal webs to improve angle.
- Increase plate sizes at all joints (especially at heels and mid-span) to minimise joint slippage during handling and installation.
- Use continuous top and bottom chords.

Message to Engineers

- Use a continuous LVL very top plate or ceiling packer where possible. Please note max. stock length of SG timber is 6m and LVL is 7.2m; longer LVL (up to 13m) is only available by special order.
- Otherwise stagger joints of top plates and strengthen with Nailon plate 320 x 150 x 2mm or a pair of Floor Joist Stiffener (FJS) for 140mm member and Rafter Splice 2mm x 80 x 400mm for 90mm member.

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- Design a horizontal beam over top plate to resist horizontal loads
- Use thicker walls, so larger top plates can be used to resist horizontal loads.
- Use stronger roof bracing eg. MultiBrace (instead of Strip Brace) to transfer the horizontal load to bracing walls at both ends.
- Consider using a parallel chord truss or beam along ridge line; this will create high point loads at each end which will need to be taken care of.

Please note that the above design and detailing recommendations will not stop scissor trusses from deflecting. They are intended to minimise the deflection of scissor trusses and horizontal movement of wall top plates to an acceptable level.

Below is an example of a scissor truss layout and prefabricated wall panels indicating joints on top plate:

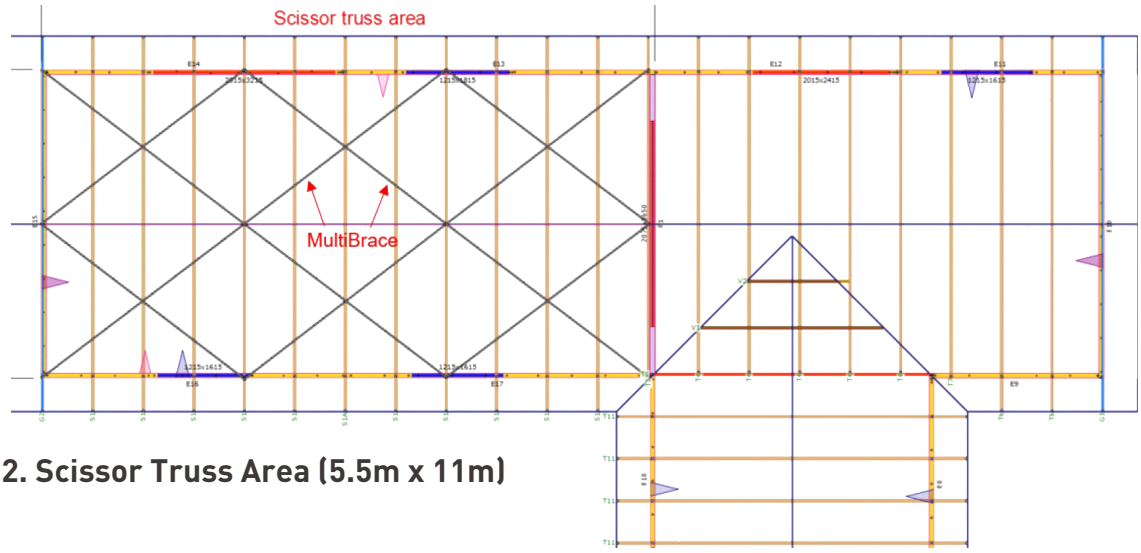

Fig 2. Scissor Truss Area (5.5m x 11m)

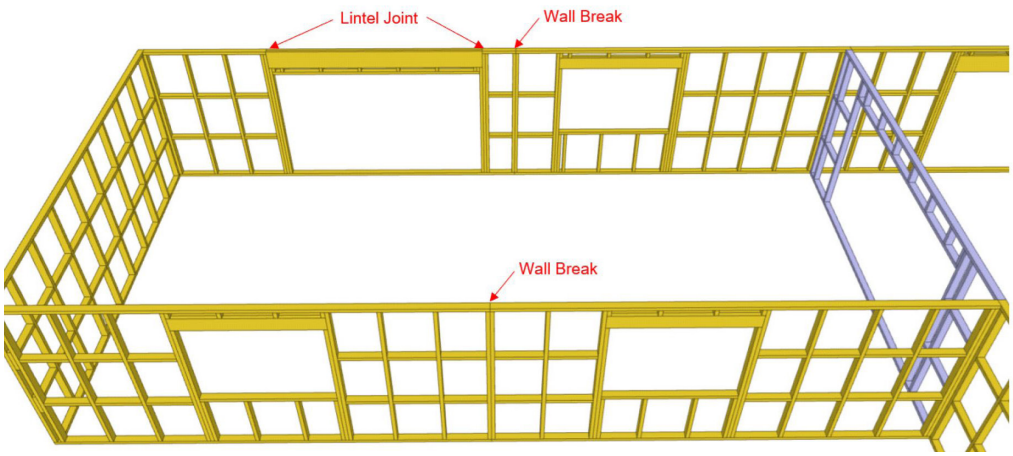

Fig 3. 3D view of Prefabricated Wall Panels indicating joints on top plate

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