FTMA TECH TALK

JUNE 2024 - ED.64

Sriraj Varier - Pryda Structural Engineer NZ

FLOOR TRUSS SUPPORTING BRACE WALLS

In recent years it has been seen that the market calls for houses with larger lintel openings and open plan living and kitchen. From a structural engineer's perspective this means more open spaces leaving less walls that can be used as braced walls. Also, with the current market pushing for large scale developments with town houses or multi-unit buildings having requirement for open spaces and larger openings, it gets even harder to allow for braced walls on the exterior LBW (Load bearing walls). For Example, in Figure 1 as we can see the bracing can be easily achieved for the vertical 'Y' direction, but it is necessary for us to provide an internal braced wall (supported on floor trusses) for the horizontal 'X' direction.

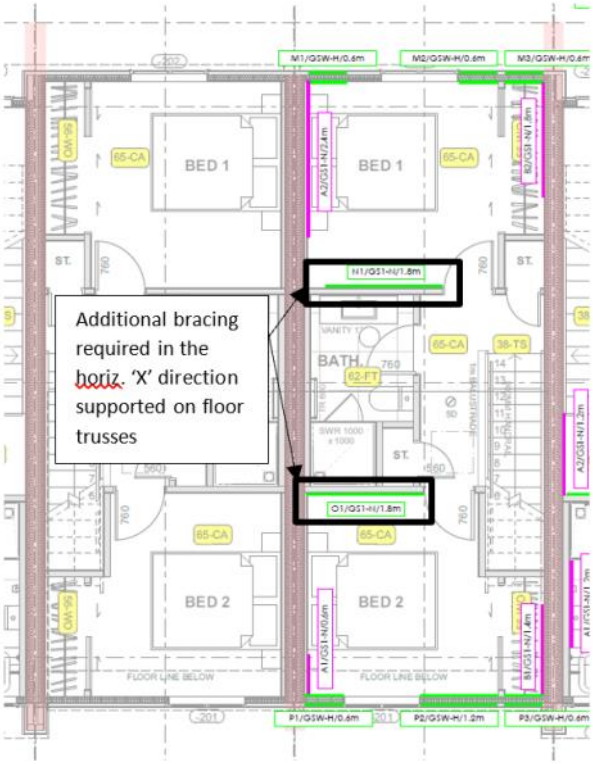

Figure 1 – rectangle and square structural Shapes

With the need for larger open spaces in the building these braced walls must be considered within the floor truss design. Thus, in cases like this it is important to design the floor trusses/floor joists to be able to cater for the reactions from the braced walls.

The action of a braced wall on floor trusses is basically the load from a stiffened wall with a rocking movement. The stiffness in the wall creates a rocking movement providing stiffness in the frame which creates stress points at the toe and heel end. This lateral load must be catered for in both wind direction and the trusses shall be designed accordingly.

Although the shear from the lateral forces is distributed along the length of the wall the overturning moment from the height of the wall shall be catered by the end connections as reaction load (heel and toe). These loads can range from a mere 1 kN to more than 20 kN depending on the specifications of the braced wall (length, height & rating).

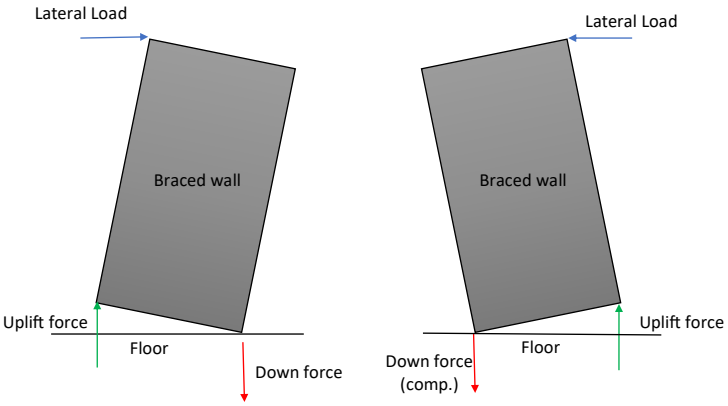

Figure 2 – Representation of reaction forces (tension & comp.)

From Figure 2 we can understand that the same point on the floor truss or floor joist shall be subjected to up or down forces depending on the lateral load direction.

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As a general practice the industry has been using double trusses or nogging in between trusses to share the point load between two trusses, which is a good practice for smaller up and down loads (typically under 4.5 kN) from the wall as shown in Figure 3 and 4. Nowadays with longer walls and effectively higher loads from the braced walls it is necessary to add the loadings to the trusses/joists and design the trusses/joists to handle the point loads.

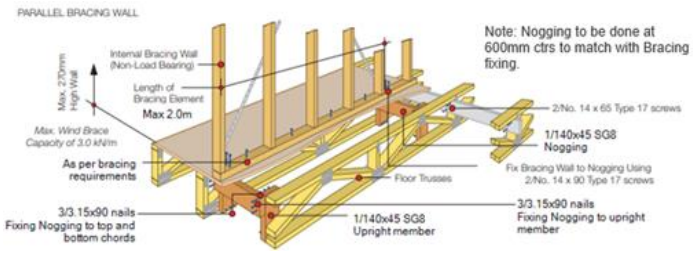

Figure 3 – Braced wall parallel to floor trusses

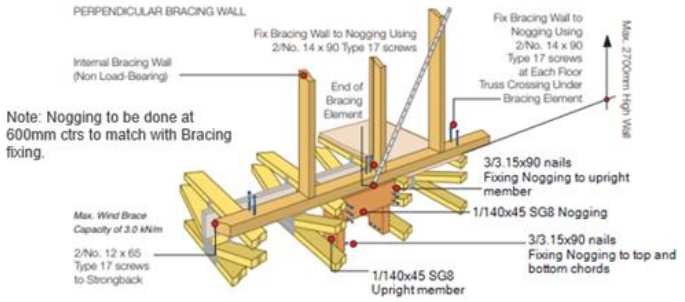

Figure 4 – Braced wall perpendicular to floor trusses

Table 1 – Load table for point load application on trusses/joists supporting braced walls

Wall height=2.4m	Uplift force at the ends of bracing wall (kN)							
	Wall length in meters (m)							
Wind BU/m	0.5	1	1.5	2	2.5	3	3.5	4
50 (2.5 kN/m)	0.8	2.0	3.3	4.5	5.8	7.0	8.3	9.5
70 (3.5 kN/m)	1.3	3.0	4.8	6.5	8.3	10.0	11.8	13.5
90 (4.5 kN/m)	1.8	4.0	6.3	8.5	10.8	13.0	15.3	17.5

As far as the NZ detailers are concerned it is a bit difficult to evaluate the loadings from a BU (Bracing units) perspective to kN or kN/m ratings. Table 1 can be used as a guide to evaluate the loads that need to be applied onto the floor truss design as wind uplift & downforce.

The application of the loads onto floor trusses can be seen in the example shown in Figure 5 below.

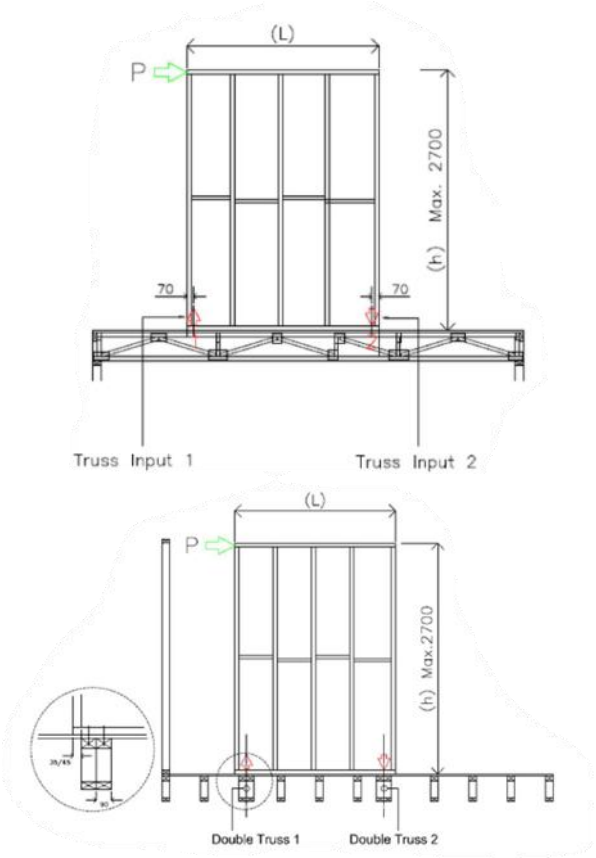

Figure 5 – Application of Point load to trusses

In Summary it is critical to evaluate the actions from the braced walls correctly and incorporated into the floor/joist design. Seek assistance from your nailplate engineer for further support.

This FTMA Tech Talk was written by Sriraj Varier, Structural Engineer NZ of our Principal Partner, Pryda.

If you have any questions for Sriraj, please don't hesitate to contact him.

Ph: +64 27 266 1120

E: svarier@prydaanz.com