TIMBER NOGGINS

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Timber portal frames

When it comes to solving a modern design problem , what's old is new again.

They say things come back around every so often. Records are back in vogue, Lego is a hit with the kids and movie re-makes are happening all the time. But there is also continual evolution at the same time, like with housing design.

Modern homes are synonymous with big open areas, taller walls and large windows, driven by the demands of the homeowner and building designer. These translate into fewer walls, increased wind loads or reduced bracing capacities and narrow wall panels respectively. It is under such adverse conditions that wall-frame manufacturers are expected to provide a compliant wall bracing design. The challenges outlined here and illustrated in Figure 1 make wall bracing more critical today than it ever has been in the past. Figure 2 shows the kind of impact that can result from inadequate bracing.

This article looks at the challenges of dealing with narrow wall panels in design. What are the available options and what limitations apply?

The Australian Standard AS 1684 (Clause 8.3.6.6) requires bracing units to be evenly distributed and initially be placed in external walls and, where possible, at the corners of the buildings. The need for narrow wall bracing units is at these corners of external walls where widths ranging from 300mm to 600mm widths are common around large or multiple openings.

AVAILABLE OPTIONS

Table 1 (above right) gives sheet-bracing options for wall widths of 450mm (minimum), with Egger's OS'Brace being an example of a readily available OSB bracing with known manufacturer's specifications (there is no generic OSB specified in AS 1684). However, at increased wall widths of 600mm, plywood becomes a viable option as specified in AS 1684 (Clause 8.3.6.5), albeit with reduced capacities. It must be noted that Engineered Wood Products Association of Australasia (EWPAA) plywood bracing manual (2010 edition) permitted plywood for wall widths as narrow as 330mm with appropriate reduction factors, but this manual has been subsequently withdrawn and is currently under review. As an alternative to sheet-bracing systems, designers may consider using wall truss bracing units supplied by the truss manufacturer.

Narrow Wall Sheet Bracing Systems (450mm nominal length)				
Type	**Reference**	**Special fixing** at each corner	**Tie-down** at each end	**JD5 Capacity** (kN)
OS'Brace Type 4a	Egger	M10x70 coach screws (50x50x3 washer)	Nominal	1.00
OS'Brace Type 4b	Egger	None	M12 rods	1.45
Hardboard Type D	Detail (n) Table 8.18 AS 1684	M10x50 coach screws (38x38x3 washer)	Nominal	1.30
Hardboard Type E	Detail (n) Table 8.18 AS 1684	None	M12 rods	2.25

Table 1 Sheet-bracing options for wall widths of minimum 450mm

The narrow wall panels, even with M12 tie-down rods at each end, give net design capacities that are too low to be effective (refer Table 1) and they are not feasible for wall widths less than 450mm. There are also difficulties with tie-down of narrow panels to the supporting substructure. In this scenario, a structural diaphragm ceiling may be used, to help transfer racking forces to internal bracing walls through cantilever action. However, these structural diaphragm ceilings become less effective in large open areas, and they can also be cumbersome to install.

TIMBER PORTAL FRAMES

Another suitable option is a timber portal frame bracing unit. Although the current practice is to consider portal frames as the last resort, there is a strong case for them to be included in the initial design, especially when faced with wall widths <600mm. Portal action can be easily achieved by combining a timber lintel with two vertical members to give design capacities as much

Characteristics of Modern Homes		Wall Bracing Design Challenges
Large open areas	→	Fewer walls for bracing
Taller walls	→	Increased wind load & Reduced capacities
Large and multiple window openings	→	Narrow wall panels

Fig 1 (above) *Conflicting challenges of owners and designers.*
Fig 2 (right) *An example of a failure due to lack of bracing.*

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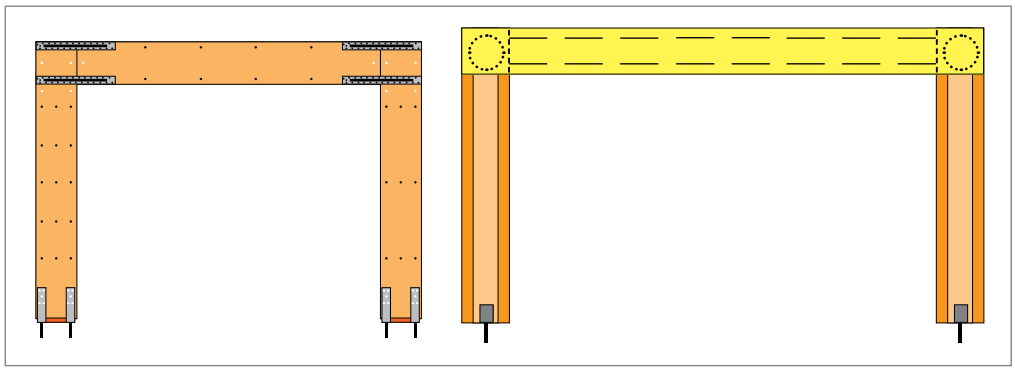

Fig 3 *Timber portal frames, with Simpson Strong-Tie (left) and an individually designed system (right).*

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as 1.5 to 2 times of two individual narrow wall bracing units. This is achieved by creating a moment connection where the column meets the lintel and can be done with as little as 240mm on one side and 90mm on the other. The designs can be a proprietary product such as the Simpson Strong-Tie Portal Frame System (available through Meyer Timber) or can be individually designed. Refer Figure 3 for examples of timber portal frames.

Sheet-bracing walls are most effective at widths of 900mm or greater to satisfy the requirements of their nominated ratings. At widths 600mm or less, their use becomes non-viable, paving the way for timber portal frames as the most suitable option. Talk to your LVL supplier to get more insight into the solutions they have available. Over time we have continually been forced to innovate in response to changing housing trends. Wall bracing in a house is a fundamental structural requirement and timber portal frames will become more prevalent as the next innovation in response to fewer walls and larger openings in houses.

Hundreds of years ago houses were built from timber post and beam construction, and the mortise and tenon joints locked the structure in place and provided bracing resistance. Timber portal frames as outlined above are essentially fulfilling the same purpose. As we said in the introduction – what's old is new again. T

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For more information on this topic, contact Afzal Laphir via email at **AfzalL@meyertimber.com.au**