

Determining wind loads

There she blows... or does it? **By Afzal Laphir – Principal Engineer, Meyer Timber Pty Ltd**

Melbourne has seen some windy days recently, which got us thinking—it's a good time to revisit how our buildings are designed to withstand this force of nature.

In our previous edition, my colleague George explored wall bracing in medium-density housing, noting the differences between detached homes and multi-unit developments. He raised an interesting question: are the commonly used design wind speeds appropriate for high-density areas? In this article, I'd like to take that discussion further and unpack how wind loads are determined. To keep things relevant, let's focus on our suburban areas and the factors that influence the wind speeds.

DETERMINING WIND SPEEDS

Every construction site in Australia requires a wind classification. This classification is essential for determining the expected wind speeds at the site and the resulting wind loads that the building and its components—such as windows, roof trusses, and cladding—must withstand. These wind loads directly influence various aspects of the building's structural design, including timber framing, bracing, tie-downs, fixings, and glazing.

Two key Australian Standards govern wind classification and structural design for housing:

- AS 4055:2021 – Wind Loads for Housing
- AS 1170.2:2021 – Structural Design Actions, Part 2: Wind Actions

Accurate wind classification ensures that a building is designed and constructed in compliance with these standards.

AS 4055 is the primary standard used for residential buildings up to two storeys in height. It offers a simplified approach to determining wind classification by considering the most severe conditions across four key site factors: (1) Wind Region, (2) Topography, (3) Shielding, and (4) Terrain. Wind classifications range from N1 to N6 for non-cyclonic areas and C1 to C4 for cyclonic areas.

If a building design falls outside the scope of AS 4055—such as when the roof height exceeds 8.5 metres or in applications other than NCC Class 1 and 10a buildings—AS **1170.2** must be used. This standard provides a more detailed and flexible framework for calculating wind loads, particularly for more complex or taller structures.

Wind classification for a site can be

determined using various sources. An architect or building designer may make an initial assessment based on prior experience or guidance from the local council.

A structural engineer typically becomes involved only if the wind classification is not provided during the design phase or if verification is specifically requested.

Wind speeds & wind pressures

Wind Classification	Ultimate Design Wind Speed		Wind Pressure (kPa)	% increase
	m/s	km/h		
N1	34	122	0.69	-
N2	40	144	0.96	38.4%
N3	50	180	1.50	56.3%
N4	61	220	2.23	48.8%

Fig 1 – Wind Speeds & Wind Pressures

Bracing requirement (kN)

Two-storey rectangular building (12m x 20m) - 20 deg roof pitch - gable ends

Wind Classification	Upper Level		Lower Level	
	Dir A	Dir B	Dir A	Dir B
N1	17	28	39	65
N2	24	40	54	90
N3	37	60	84	140
Diff. N1 to N2	7	12	15	25
Diff. N2 to N3	13	20	30	50

Note: Dir A and Dir B are the two perpendicular wind directions.

Additional 3.0 kN/m units required over 2.7m walls (capacity = 8.1 kN)

	TOTAL				
N1 to N2	1	2	2	4	9
N2 to N3	2	3	4	7	16

Fig 2 – Comparative Bracing Requirement in N1, N2 and N3 wind classifications.

Top plate specification

Single-storey building - RLW < 5.0m; 20 deg roof pitch

Stud spacing = 600mm; Tie-down spacing = 1.2m (N1/N2), 0.6m (N3)

Wind Classification	Top Plate Specification	Tie-down Requirement
N1	90x35 MGP10	100mm screw @ 1.2m CRS
N2	90x45 MGP10	125mm screw @ 1.2m CRS
N3	90x45 MGP10	125mm screw @ 0.6m CRS

Note: Screw relates to Simpson SDWS or equivalent.

Fig 3 – Top plate specification in N1, N2 and N3 wind classifications

Wind Region	Terrain Category	Topographic classification T0		
		FS	PS	NS
A	3	N1	N1	N1
	2.5	N1	N1	N2
	2	N1	N2	N2
	1	N2	N2	N3

Note: FS, PS & NS refers to fully, partial and no shielding respectively

Fig 4 – Wind Classifications in Region A -Topographic classification T0 (extract from Table 2.2 AS 4055)

IMPACT OF WIND CLASSIFICATIONS

For this exercise, I'll focus on the three commonly used wind classifications in non-cyclonic regions: N1, N2, and N3. Figure 1 shows the percentage differences in wind loads between these classifications, which translate into design implications illustrated in Figures 2 (wall bracing) and 3 (top plate specification).

Using a simple example of a 12m x 20m two-storey rectangular building, Figure 2 highlights the impact of increasing wind classification. Upgrading from N1 to N2 requires an additional 9 bracing units rated at 3.0 kN/m (2.7m wide), while moving from N2 to N3 adds a further 16 units. In practice, the effect is more significant, as designers often lack the extra wall space to accommodate these 3.0 kN/m (2.7m wide) units, leading to reliance on higher-capacity bracing with more demanding tie-down requirements.

While top plate specifications are less affected, Figure 3 shows that increases in wind classification still require upgrades in both timber selection and tie-down details.

In addition to the two examples provided, the impact also extends to roof trusses, their tie-down connections, and other building elements. This highlights the importance of using the correct wind classification during the design phase. If an incorrect classification goes unnoticed, the consequences can be significant—ranging from increased costs and construction delays if the actual wind speed exceeds the design assumption, to missed cost-saving opportunities if the wind speed is lower than originally specified.

Several cost analyses have been carried out on upgrading from N2 to N3 wind classification, including evaluations by nail plate manufacturers regarding roof trusses and broader cost comparisons by builders. The increase in roof truss costs alone is relatively modest, even for sheet roofs—typically ranging from \$300 to \$500 depending on the size—and is primarily driven by the requirement for higher-capacity tie-down connectors. However, other components of the home contribute more significantly to the total cost. For example, in a recent project undertaken by a leading

builder in Victoria, upgrading a standard two-storey home from N2 to N3



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Fig 5 – Wind Regions in Australia. Source AS 4055

classification resulted in a total cost increase of up to \$5,000. This included an additional fee to the framer—approximately \$2 to \$3 per square metre—to accommodate the extra tie-down requirements.

While the differences between N2 and N3 wind classifications are more significant, using N1 instead of N2 can also lead to cost savings, as shown in Figures 2 and 3, particularly in wall bracing. These savings often go unnoticed, as builders typically do not differentiate between N1 and N2

N1 OR N2?

In Region A (which includes all of VIC, SA, TAS, and most of NSW and WA as shown in Fig 5), suburban areas and new developments are commonly classified as wind classification N2, unless located in exposed hilly terrain. This has become the default practice, even though AS 4055 suggests that N1 may often be sufficient.

Suburban terrain is typically classified as Terrain Category 3 (TC3) under AS 4055, defined as "terrain with numerous closely spaced obstructions between 3 m and 10 m high, with a minimum density equivalent to 10 house-sized obstructions per hectare—e.g., suburban housing, light industrial areas, or clusters of large trees." This corresponds to houses on blocks of up to 1000 m², typical of modern developments.

Strictly applying AS 4055 on reasonably flat land or sites situated in the lower third of a gentle hill (classified as T0 topography) and

within TC3, the appropriate default wind classification should be N1—even without shielding. See Figure 4, which references Table 2.2 of AS 4055.

Now that we understand the implications of wind classifications, it's important to approach your next project with greater awareness. Thanks to modern software systems, accurately assessing wind classifications has become significantly easier. These tools offer access to vast amounts of geospatial data for any building site in Australia, including information on terrain, wind conditions, topography, and shielding.

Some platforms even provide detailed site-specific analysis, which greatly enhances the accuracy of wind classification assessments. For sites that fall near the boundary of two classifications, it may be necessary to engage an engineer to perform a formal wind assessment. This cost can often be reduced by planning ahead and scheduling the assessment alongside the soil test.

During market downturns, all eyes turn to manufacturers to deliver the most efficient timber solutions at the lowest possible cost. One often overlooked opportunity lies in revisiting the original assumption for design wind speed—a simple check that can naturally reduce the amount of timber and bracing required. As the great Bob Dylan once said, "The answer is blowin' in the wind." **T**

