

## Introduction

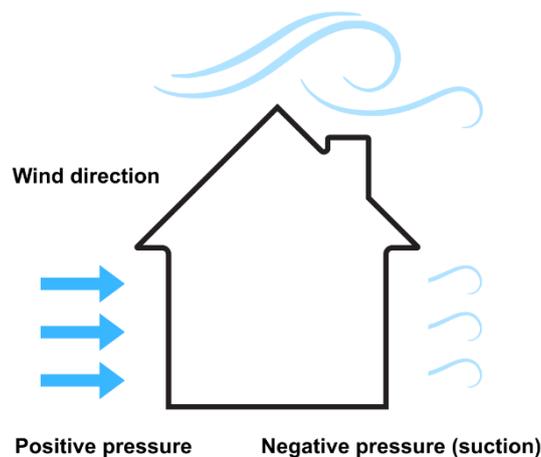
Wind loads on buildings are a crucial design element for all external components of a building envelope, whether for a simplistic residential house or larger commercial facades. They represent the effect of wind actions on buildings and structures and are used by building practitioners to assess the viability of materials proposed for construction. In glazing applications, these pressures, both positive and negative, can induce stresses, deflections, and edge reactions that influence both the safety and serviceability of glass, and therefore are an important part of glass selection for installers and window manufacturers to demonstrate compliance to the glazing standard AS 1288-2021.

Viridian Glass provides performance data and technical guidance to ensure that glass selection meets the structural requirements of **AS 1288-2021, *Glass in Buildings - Selection and Installation***. This standard contains a dedicated chapter (**Section 4**) which sets out a deemed to comply methodology for determining a minimum glass thickness to withstand the Ultimate Limit State (ULS) design wind pressures and to comply with the deflection requirements under Serviceability Limit State (SLS) actions.

This paper provides guidance on how wind loads affect glass, outlines key design parameters, and aims to provide general guidance on wind load requirements for glass in both residential and commercial buildings.

## Why Wind Loads Matter

Building façades are subjected to elements of extreme weather, including varying wind pressures associated with high wind speeds. As wind impacts with a structure, it exerts high levels of positive pressure onto the windward elements as it flows around the building. On the opposite side and over the roof, this creates negative pressure, or suction forces, commonly at higher levels, whilst corners of the structure are also subject to higher negative pressures as wind accelerates around and past the building.



**Figure 1.** Airflow over a House

The calculated strength of varying glass types such as annealed, heat strengthened, toughened, laminates, insulated glass units (IGUs), and combinations of these are addressed elsewhere. However, their ability to withstand the design load conditions is vital. The correct specification of glass type, glass thickness, panel size, and support conditions are essential to:

- Prevent glass breakage or excessive deflection.
- Maintain occupant comfort and façade airtightness.
- Support compliance with the NCC structural performance criteria.

## How Wind Loads Are Determined

The main loading standard for structural design in Australia is outlined in AS/NZS 1170, which is a complex guide of 4 volumes, referenced by engineers and broken into sections.

- **AS/NZS 1170-0** Sets out the general principles of structural design actions.
- **AS/NZS 1170-1** Covers permanent loads (self-weight of materials and structure), imposed loads (occupancy use on flooring, barriers, roofs and other actions) and other conditional loads imposed through liquid, ground water, soil mechanics and earth pressure.
- **AS/NZS 1170-3** Covers snow actions.
- **AS/NZS 1170-4** Covers earthquake actions.

**AS/NZS 1170-2 covers wind actions.** This complex and detailed outline includes calculation guidance on determining (a) site wind speeds, (b) design wind speed from the site wind speeds, (c) design wind pressures and distributed forces and (d) wind actions. It is recommended that only qualified engineers use this to determine wind loads on structures. Regionally, most of the Australian continent is divided into Region A, whilst northern and coastal areas are defined into higher wind (Zone B) and cyclonic zones C & D.

## AS 4055 – Wind Loads for Housing

The complexity of the factors within AS 1170-2 are needed for larger complex structures, however for smaller stand-alone residential Housing (Class 1 buildings) a simplified version of AS 1170-2 has been developed and published as its own wind load guide as AS 4055-2021 - Wind Loads for Housing.

AS 4055 specifies site wind speed classes for determining design wind speeds and wind loads for NCC Class 1 and Class 10 buildings within the geometric limits provided. These limits include a maximum building height of 8.5m, maximum building width 16m, and a maximum building length not exceeding 5 times the width. Other limitations on roof pitch and maximum eave dimensions also apply. Where the construction does not fit within these parameters, wind loads will need to be determined using the more complex methods in AS 1170-2.



**Figure 2.** The building width must not exceed 16 metres, and the length must not be more than five times the width.



**Figure 3.** The height from ground level to the underside of the eaves must not exceed 6m.



**Figure 4.** The height from ground level to the highest point of the roof must not exceed 8.5m.



**Figure 5.** The eaves width must not exceed 900mm.



**Figure 6.** The roof pitch must not be greater than 35 degrees.

When using the guidance within AS 4055, it provides an overall wind classification based on wind region and site conditions to assign a “N” rating for non-cyclonic regions, or a “C” rating for cyclonic regions. These simplified classifications enable the Ultimate Limit State (ULS) and Serviceability Limit State (SLS) pressures defined by the Standard to be applied.

Within **AS 4055–2021**, the corresponding **ULS and SLS design wind pressures are defined in Section 2.2. Reference to these values should be made directly from the Standard**, and they may then be used to inform subsequent glass selection and design checks in accordance with **AS 1288**.

Within these classifications, the relevant Ultimate Limit State (ULS) and Serviceability Limit State (SLS) wind pressures, including the allowance for corner loads, are defined in the following table.

Refer to AGWA member guidance (*Wind Loads for Housing* Technical Fact Sheet) for diagrams supporting the application of AS 4055 and AS 2047 housing definitions.

| Window Rating | Serviceability Limit State (SLS)<br>Pressure, Pa |        | Ultimate Limit State (ULS)<br>Pressure, Pa |        | Water Penetration Resistance<br>(WPR) Pressure, Pa |         |
|---------------|--|--------|--|--------|--|---------|
|               | General  | Corner | General                                    | Corner | Non-Exposed  | Exposed |
| N1            | 400  | 600    | 600  | 900    | 150  | 200     |
| N2            | 400  | 600    | 900  | 1300   | 150  | 200     |
| N3            | 600  | 800    | 1400                                       | 2000   | 150  | 300     |
| N4            | 800  | 1200   | 2000                                       | 3000   | 200  | 300     |
| N5            | 1200   | 1800   | 3000                                       | 4500   | 300  | 450     |
| N6            | 1600   | 2500   | 4000                                       | 6000   | 450  | 600     |
| C1            | 600  | 800    | 1800                                       | 2700   | 150  | 300     |
| C2            | 800  | 1200   | 2700                                       | 4000   | 200  | 300     |
| C3            | 1200   | 1800   | 4000                                       | 4900   | 300  | 450     |
| C4            | 1600   | 2500   | 5300                                       | 8000   | 400  | 600     |

**Figure 7.** Housing Performance Requirements

*Reproduced from AS 4055:2012, Wind loads for housing, Standards Australia.*

The advantage of having defined Ultimate Limit State (ULS) and Serviceability Limit State (SLS) wind pressures, is that these values can be used to obtain the deemed-to-comply solutions as set out within AS 1288-2021, Section 4. While the procedures within AS 1288 can be time consuming and complex, this process is simplified when using the wind load tables provided in the supplement to AS 1288. Minimum glass thickness' for both Ultimate Limit State (ULS) and Serviceability Limit State (SLS) actions can be readily determined for all ULS pressures up to 10 kPa and SLS up to 6.2 kPa. Where wind pressures exceed these limits, further verification is required using the more detailed methods outlined in AS 1170-2.

### Known Service Characteristics

Even when correctly designed, glass subjected to high wind pressures can exhibit temporary optical distortion, such as bowing reflections or audible creaking, as framing systems flex. These behaviours are normal service responses and do not constitute defects. Whilst the SLS deflection limits are generally defined as span/60, in practice it is common to limit visible deflection to 20mm or less to manage occupant perception and visual performance.

Viridian encourages early communication between design, fabrication, and installation teams to align performance expectations and serviceability outcomes.

### Conclusion

Wind load design is fundamental to façade safety, performance and longevity. Through technical analysis, guidance and interpretation of the relevant standards, Viridian Technical Advisory Services can assist with glass solution recommendations — whether annealed, laminated, or tempered — to meet the structural demands of the design whilst maintaining architectural intent and performance requirements.

The information in this document is provided to give an outline of wind loads, their governing standards, and guidance on where compliant solutions can be sourced. Where structures fall outside the limits of AS 4055, it is recommended that wind pressures are determined by qualified engineers or consultants. Once wind pressures can be determined, the AS 1288 appendix tables may be used to undertake a conservative deemed-to-comply assessment for minimum glass thickness.

**Disclaimer:** Viridian Glass issues TechDirect™ documents to provide clarification on a range of topics and is offered as a general guide only. It is recommended the user should undertake careful evaluation and make suitable enquiries with a technical consultant.