Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**
Building and Energy

Industry Bulletin 124

Warning on inappropriate wind classifications

Building and Energy has become aware through audit activities that AS 4055 has been inconsistently used in the wind loading classification of houses. This bulletin provides technical guidance on determining wind classifications for houses. It clarifies the use of Australian Standard AS 4055-2012: Wind loads for housing (AS 4055) and AS/NZS 1170.2-2011: Structural design actions; Part 2: Wind actions (AS/NZS 1170.2). Using the correct wind classifications is important to ensure that a house will be designed and constructed to comply with the applicable building standards.

Background:

Building and Energy are continuously identifying incorrect wind classifications during inspections of plans for residential houses. The main concern in such wind classifications is the use of AS 4055 when the house falls outside of the geometric limits applicable to it. Other wind classifications issues include incorrect terrain category (i.e. not accounting for presence of a large open space within 500m, such as a golf course or waterway); incorrect topographic class (not accounting for site being elevated on a hill) and inappropriate shielding applied to houses where it is not possible to have a row/rows of housing surrounding each side of the subject site within five years.

The net design uplift at the top of walls can almost double between subsequent wind classifications for houses with metal clad roofs, with an even greater increase possible for houses with tiled roofs (refer Table 4.1 of AS 4055). As a result, the tie-down requirements to resist the roofs from being lifted off, also increase substantially between consecutive wind classifications (i.e. N1, N2, N3 etc. or C1, C2, C3 etc.). A building may experience damage in a design wind event if it is constructed to the requirements of a lower wind classification.

This industry bulletin aims to address common areas of concern and improve the determination of wind classifications for houses in Western Australia. It provides simple steps to assist builders, building surveyors, design engineers and building designers to be confident in the accuracy of wind classifications when determined using AS 4055. Where the house falls outside of the scope of AS 4055, AS/NZS 1170.2 may be used by suitably qualified engineers to determine wind speeds equivalent to an AS 4055 wind classification. Information is provided on differences between these standards that builders, building surveyors and designers should be aware of.

When does AS 4055 apply?

AS 4055 provides a simplified method of assessing the wind classification for one or two storey housing only. AS 4055 -2012 considers topography, shielding and hills in all directions, but makes a single evaluation of wind classification based on the worst case for each. Class 1 and 10 structures (as per the National Construction Code which is also referred to as the Building Code of Australia) can be designed using AS 4055 if they meet the dimensional parameters set out in Clause 1.2:

- maximum external wall height under the eaves ≤ 6m;
- maximum roof height above the natural ground line ≤ 8.5m;
- maximum house width between external walls across the ridge line ≤ 16m; and
- maximum roof pitch ≤ 35°.

Where the geometric limitations in Clause 1.2 are not met, AS/NZS 1170.2 must be used to derive the applicable wind loads. AS/NZS 1170.2 is used by engineers to determine the wind pressures on any size building, and can be used for houses. Eight different wind directions must be assessed for terrain category, shielding and topography. AS/NZS 1170.2 gives design wind speeds and wind pressures for each direction applicable to the building.

Further note:

The Residential timber-framed construction standards (AS 1684) are simplified timber standards for housing, and have similar geometric limitations to AS 4055. Where these limits are not met, the AS 1720 series (Timber structures) must be used to design timber elements in the house.

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Determining wind classifications using AS 4055-2012:

1) **Determine wind region** – Use the map in Figure 2.1 of AS 4055.

   (Building and Energy recommend using the higher wind region for houses for sites within the border of two wind regions.)

   For the next steps, focus on the site. A visit to the site is recommended. You need to picture what it will look like in five years. For example, it might be on the edge of a development now, but in five years, it may be surrounded by new houses.

2) **Determine the terrain category** – Use satellite imagery to create a circle with the site at the centre and a radius of 500m. Clause 2.3 defines five terrain categories (1 is the smoothest and 3 is the roughest). Rougher terrains, that is ground with lots of obstructions like trees or buildings, can slow the wind as it passes over them. If there are different terrain categories within a 500m radius, the one with the lowest number is selected. Determine the lowest terrain category within 500m of the site. (e.g. a site within 500m of a river, lake or canal wider than 200m will typically be TC1, and within 500m of a golf course or farm land will be TC2) – refer to Section 2.3.

3) **Evaluate topographic class** – Houses near the top of hills generally experience higher wind speeds. Use contour maps (often available on local council websites and the like) to find the top and bottom of hills, ridges and escarpments and calculate their height. The topographic class is different depending on where the site is located relative to the top of the hill and the slope of the hill.

4) **Determine shielding class** – Determine shielding applicable to the house estimating likely development five years forward from the assessment date. 'Full shielding' applies to houses with two rows of houses on all four sides; 'Partial shielding' applies to houses with at least one row of housing on all four sides; 'No shielding' applies to houses where there is no house on either of the sides. Refer to Clause 2.5.

5) **Determine wind classification** – Use Table 2.2 to determine the wind classification based on the factors from above.

6) When house dimensions have been finalised, re-check whether AS 4055-2012 still applies (Section 1).

Frequently asked questions

1) AS 4055 does not apply to my building as it is outside the geometric limitations of the standard. Can I still work to an equivalent N# or C# wind classification?

Yes, AS/NZS 1170.2 can be used to calculate the maximum wind speed ($V_{sit.\beta}$), for each of the eight directions. The largest of these can be compared with the ultimate wind speed ($V_{h.u}$) in AS 4055 Tables 2.1A/B. If the house is in wind region A or B it will have an 'N' classification, otherwise it will have a 'C' classification.

The 'N' or 'C' classification is selected so that $V_{h.u}$ in AS 4055 Table 2.1 has a velocity greater than or equal to the maximum wind speed ($V_{sit.\beta}$) calculated from AS/NZS 1170.2.

Important note:

Where the house is outside the scope of AS 4055, it will also be outside the scope of AS 1684. So, even if wind speeds calculated using AS/NZS 1170.2 have been converted to a 'C' or 'N' classification, some parts of AS 1684 (Residential timber-framed construction standards) may still not apply. Other methods must therefore be used to select tie-down details. However, it still may be possible to order windows and doors by the 'N' or 'C' classification.

2) Do the geometric limits of AS 4055 apply to an existing house undergoing alterations and additions where a wind classification is required for the new construction?

Yes, the geometric limitations apply to the completed house. For instance, AS 4055 may not apply when adding an extra storey to an existing single storey house, if the combined height exceeds the geometric limits. In these cases, AS/NZS 1170.2 should be used to determine the design site wind speed. This could be used to derive a 'C' or 'N' wind classification for design of windows etc.

Likewise, AS 1684.2 limits would not apply and AS 1720.1 should be the reference standard for the design of timber framing.

3) Would the first house in a new subdivision have a higher wind classification than the houses built after it?

Wind classifications using AS 4055 are based on the likely terrain and shielding five years from the design stage. Therefore, a house can be classified according to a reasonable assumption of the surrounding build-up within five years. Local councils can provide information on approved planning schemes for areas around the site.

Note that where houses exceed the geometric limits in AS 4055, they must use AS/NZS 1170.2 to evaluate design wind speeds. AS/NZS 1170.2 refers to known future changes when assessing the terrain category and shielding around the proposed house. Therefore, for use of AS/NZS 1170.2 it is only those houses that are known to be at least as big as the subject house (i.e. already built or in construction) that can be considered in selecting shielding class.

4) If a house is built above a retaining wall, how does this affect the geometric limits in AS 4055?

Building and Energy note that:

- The maximum 8.5m height dimension in Figure 1.1 of AS 4055 -2012 indicates that this distance relates to the averaged ground level. Where retaining occurs to build up a site, the averaged ground level is often below the finished ground level for part of the house. The wind loads on the house may be higher as the house sits higher on the pad above the retaining wall. The slope of roads around the site can help identify the averaged ground level.

Responsibilities of parties with respect to evaluation of wind loads and classifications

Building and Energy expects that the registered professionals responsible for building or certifying Class 1a structures understand how wind classifications are determined using AS 4055 and **take appropriate measures when a building wind classification appears inappropriate or is absent**. In the first instance, this may involve asking your design engineer to review the classification or provide an appropriate classification.

Where the building is outside of the limits for which AS 4055 applies, suitable guidance should be provided to demonstrate that any 'N' or 'C' classification used is appropriate, and detail should be provided for any further limitations (i.e. the edge zones over which increased uplift applies may require widening).

Building surveyors must be satisfied that the technical documents (i.e. a wind classification) included in a CDC will allow completed building work to comply with all applicable building standards.

Section 19 of the *Building Act 2011* requires the **certificate of design compliance** to *"contain a statement of the building surveyor signing the certificate to the effect that if the building or incidental structure that is the subject of the application is completed in accordance with the plans and specifications that are specified in the certificate, the building (including each incidental structure associated with the building) or incidental structure will comply with each applicable standard"*.

It is the responsibility of builders to ensure the appropriate wind classification is relayed to the relative parties through the supply chain (i.e. prefabricated framing and truss suppliers, window and door suppliers) and is applied to the construction of the building.

Section 29 of the *Building Act 2011* (the Act) requires **builders** to construct the building or incidental structure in accordance with the plans and specifications listed in the applicable certificate of design compliance. Section 37 of the Act requires the builder to ensure, on completion of the building or incidental structure, that the building or incidental structure complies with each applicable building standard. Builders have a responsibility to comply with both requirements under the Act.

Building and Energy appreciates the difficulty that registered building service providers may face when they have relied on a design professional to determine an appropriate wind classification/structural design for the subject building in which they are involved, however require them to ensure that houses are built to the applicable building standards (to resist the correct wind loads).

James Cook University has published educational videos to assist the building industry including building surveyors and builders on wind classification for houses. A link to one such video is provided in the below "Additional resources".

Building and Energy has liaised with **structural engineers** regarding concerns over incorrect site wind classifications. The responsible engineers have in most cases taken action to ensure that the houses have been built/upgraded to meet applicable building standards. In instances this has been burdensome to the builder.

When incorrect determination of wind loads, wind classifications and design requirements lead to house construction failing to comply with applicable building standards, public safety is put at risk. Building and Energy may investigate building surveyors and builders for negligence in connection with carrying out a building service.

Additional resources:
https://www.jcu.edu.au/cyclone-testing-station/videos/industry

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