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Wind Impact & Wind Tunneling Emulation

Assessment Report

For Proposed Building at

No. 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale

In accordance with AS 1170.2 (Wind Actions)

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DOCUMENT CONTROL

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1.0 CONSULTING BRIEF

ANA Civil P/L was commissioned to investigate the annual gust speed at the proposed development at No. 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale.

The following table developed by Penwarden (1975) is a modified version of the Beaufort Scale and describes the effects of various wind intensities on people. Note that the applicability column related to wind conditions occurring frequently (approximately once per week on average). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1- Effects of Various Wind Speeds

Type of Winds	**Beaufort Number**	**Mean Wind Speed (m/s)**	**Effects**
Calm, light air	1	0 - 1.5	Calm, no noticeable wind
Light breeze	2	1.6 - 3.3	Wind felt on face
Gentle breeze	3	3.4 - 5.4	Hair is disturbed, Clothing flaps
Moderate breeze	4	5.5 - 7.9	Raises dust, dry soil and loose paper - Hair disarranged
Fresh breeze	5	8.0 – 10.7	Force of wind felt on body
Strong breeze	6	10.8 – 13.8	Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.
Near gale	7	13.9 – 17.1	Inconvenience felt when walking.
Gale	8	17.2 -20.7	Generally impedes progress, Great difficulty with balance.
Strong gale	9	20.8 – 24.4	People blown over by ***gusts***.

This report is to demonstrate that the proposed development satisfies the following standard local government wind criteria:

Table 2 – Gust Wind Speed Criteria

Type of Criteria	Limiting Gust Wind Speed Occurring Once Per Year	Activity
Safety	24 m/s	Knockdown in Isolated Areas
	23 m/s	Knockdown in Public Access & Open Areas
Comfort	16 m/s	Comfortable Walking in Pedestrian Walkways
	13 m/s	Standing, Waiting, Window Shopping
	10 m/s	Dining in Outdoor Restaurant

For the purpose of this report we will separate the applicable criteria into the following sections:

- In pedestrian walkways (e.g. pedestrian street footpath and open hallways) the limiting gust speed will not exceed 16m per second.
- In open space (e.g. outdoor seating areas, roof terraces and ground floor communal areas) including public and private the limiting gust speed will not exceed 10m per second.

This report is to assess the limiting gust speeds in open areas, pedestrian walkways, public and private open spaces. Calculations are determined as per AS 1170.2 (Wind Actions).

2.0 DESCRIPTION OF PROPOSED BUILDING AND ENVIRONMENTS

The proposed building is situated on Princes Hwy in the suburb of Sydney (Figure 1- Site Location).

The architectural plans are by Axel Richter Architect – Project No. E24M01 Rev.A dated 16/09/2024.

The proposed development is a twelve (12) storey building used for commercial & residential purposes. There is also one (1) level of basement parking. The building extends from approx. RL 12.08m AHD in the basement to RL 55.08 AHD on the roof.

3.0 TYPES OF WINDS & WIND TUNNELING EMULATION

The impact of wind flowing past buildings has well known general impacts at ground level. These types of wind actions shown in wind tunneling emulation figures 12, 13 & 14 include the following:

1. Downwash Winds

Downwash winds (D) are the winds which impact on the face of a building and are then deflected downwards to ground level in a vertical direction. Taller buildings can deflect a fast-moving wind at higher elevations downwards. Refer to Figure 12 – Downwash and Shearflow Winds and Figure 13 – Additional Wind Types.

2. Shearflow Winds

Shearflow winds (S) are the winds that speed up as they pass by the building edges
Refer to Figure 12 – Downwash and Shearflow Winds and Figure 13 – Additional Wind Types.

3. Canyon Effect Winds

Canyon Effect winds (C) result when there are rows of parallel buildings (especially taller ones) where the gaps in between line up with prevailing wind directions. Figure 13 – Additional Wind Types.

4. Venturi Effect Winds

Venturi Effect winds (V) result when windflow is forced to pass between two converging buildings or groups of buildings with a resulting increase in flow. Figure 13 – Additional Wind Types.

5. Undercroft Effect

Undercroft Effect is a well-known adverse building-wind characteristic as depicted in the generic building wind effect diagrams shown in Figure 14. The wind is induced towards the negative pressure area within the undercroft, creating concentrated adverse windflow through undercrofts. Refer to Figure 14 – Wind Effects Past and Through A Building.

4.0 EXISTING & FUTURE WIND EFFECTS ON SITE.

The strongest and most frequent dominant winds in the region are the southerly, westerly winds and north-easterly winds. West quadrant winds are the strongest winds all year round, whilst the South and South easterly winds provide the strongest gusts in summer.

There is low-level shielding from surrounding dwellings and established vegetation in the vicinity of the site. There is also some shielding from the existing medium rise development around the site.

Wind flow approaching from the northerly and southerly wind direction would be over medium-rise developments and commercial buildings of similar height to the proposed development. Wind flow approaching from the easterly and westerly wind directions will be over buildings of lower height than the proposed development.

Existing street level wind conditions in the vicinity of the site are likely to be less that the 16m/sec pedestrian walkway criteria due to the westerly, north-westerly and south-westerly winds due to the abundance of low-level shielding from surrounding upstream buildings and structures.

The future wind environment should remain at their present levels provided the recommendations in this report are adhered to.

5.0 WIND LOAD CALCULATIONS.

This study is prepared in accordance with AS 1170.2 (Structural Design Actions: Wind Actions) Sections 1, 2 3, & 4.

In Section 2.2 of AS 1170.2 (Wind Actions) the site wind speeds ($V_{sit,\beta}$) defined for 8 cardinal directions (β) at a reference high (z) above ground shall be a follows:

$$V_{sit,\beta} = V_R M_d (M_{z,cat} M_s M_t)$$

Where:

V_R = regional gust wind speed in meters per second for annual probability of exceedance and it is defined as $67—41\ R^{-0.1}$ for Sydney area.

M_d = wind directional multipliers for the 8 cardinal directions (β) as given in Section 3 table 3.2 of AS 1170.2 (Wind Actions). We assess the winds in all applicable directions.

$M_{z,cat}$ = terrain/height multiplier, as given in Section 4 of AS 1170.2 (Wind Actions). In this case we believe the terrain to be Terrain Category 3 which is terrain with numerous closely spaced obstructions having heights generally 3-10m.

M_s = shielding multiplier, as given in Section 4 of AS 1170.2 (Wind Actions) for Flat topography.

M_t = topographic multiplier, as given in Section 4 of AS 1170.2 (Wind Actions).

5.1 Annual Limiting Gust Wind Speed in Open Areas

The most critical annual limiting gust wind speeds are expected in the following open areas:

- Communal outdoor on level 1
- Level 1-11 Balconies.

These open areas will be affected by westerly, and easterly winds and subsequently the Annual Limiting Gust Wind Speed may exceed the Open Area outdoor sitting criteria of 10m/s.

We highly recommend some wind mitigation measures that for the affected open areas:

- All Balcony/terrace balustrades – preferably of masonry/concrete construction with no openings; or glass supported on edge of slab or recessed into concrete balcony with no gaps between edge of slab and bottom of glass rail;

- Pergolas, canopies and awnings over open areas; and

- Landscaping such as dense shrubs and trees.

5.2 Annual Limiting Gust Wind Speed in Pedestrian Walkways

The most critical annual limiting gust wind speeds are expected in Princes Hwy and where pedestrians will experience northernly (not critical) and north easterly winds that will not exceed the pedestrian walkway criteria of 16m/s. The walkway will be shielded by upstream buildings, the proposed building itself and proposed landscaping.

5.3 Wind Load on Façade

Wind load on the different façade orientations are presented in figures 16 to figure 19 of this report. Wind load presented is ultimate wind pressure 1:500 year and used to calculate glazing specification.

6.0 CONCLUSION

ANA Civil P/L has investigated and calculated the annual gust speed at critical sections of the proposed development at No.465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale in accordance with AS 1170.2 (Wind Actions). The proposed development is not expected to induce any significant additional wind flow on neighbouring properties.

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Figure 1 - Site Location

Source: Imagery from SIX Maps, accessed on August 2024

Figure 2 - Proposed Ground Floor Plan
Source: **Axel Richter Architect**

Figure 3 - Proposed Level 1 Floor Plan
Source: **Axel Richter Architect**

Figure 4 - Proposed Level 2 Floor Plan
Source: **Axel Richter Architect**

Figure 5 - Proposed Level 3 Floor Plan
Source: **Axel Richter Architect**

Figure 6 - Proposed Level 4 Floor Plan
Source: **Axel Richter Architect**

Figure 7 - Proposed Level 5 Floor Plan
Source: **Axel Richter Architect**

Figure 8 - Proposed Level 6 Floor Plan
Source: **Axel Richter Architect**

Figure 9 - Proposed Level 7 – 11 Floor Plan
Source: **Axel Richter Architect**

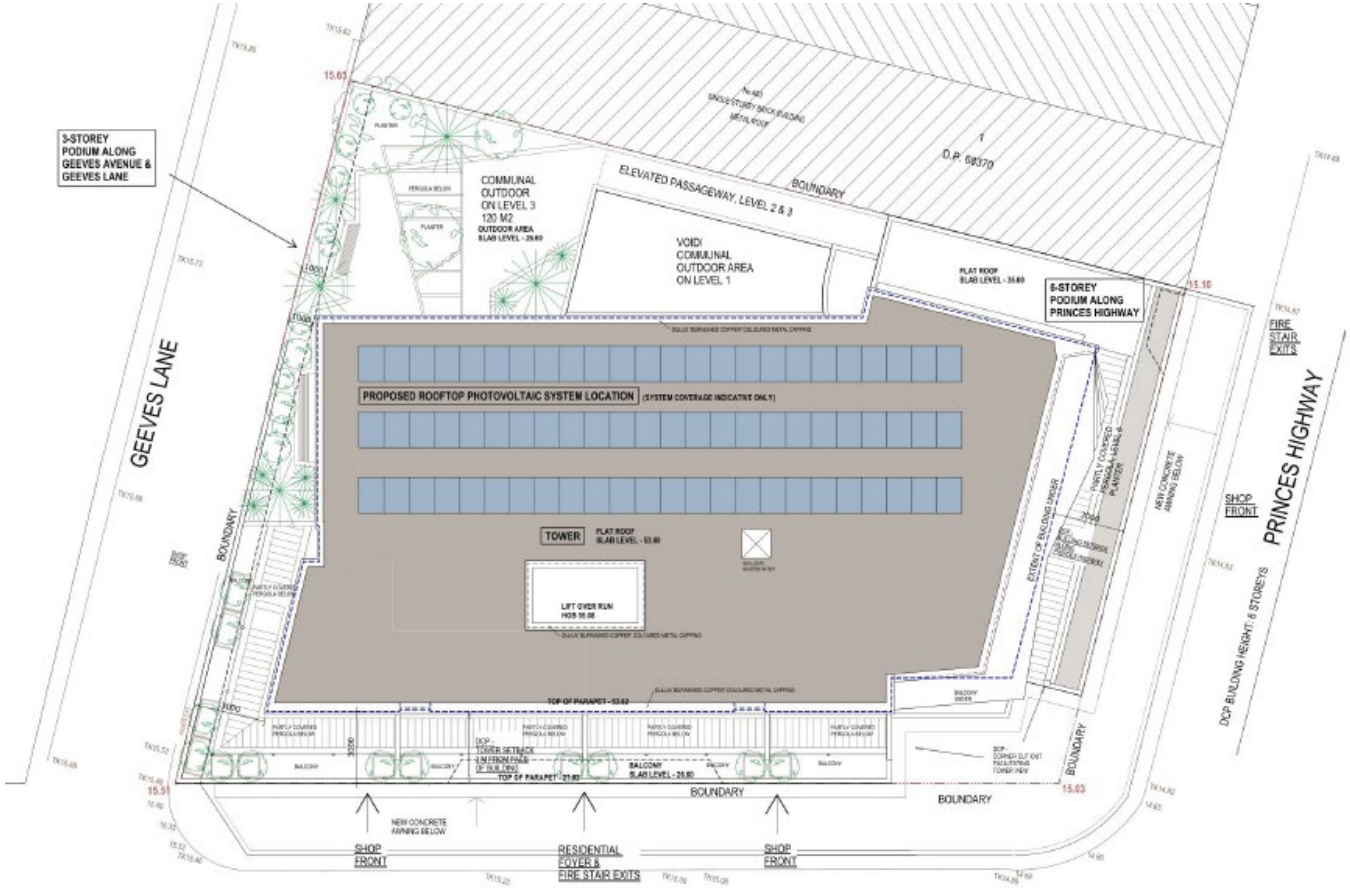


Figure 10 - Proposed Roof Level
Source: **Axel Richter Architect**

Figure 11 - Building Sections
Source: **Axel Richter Architect**

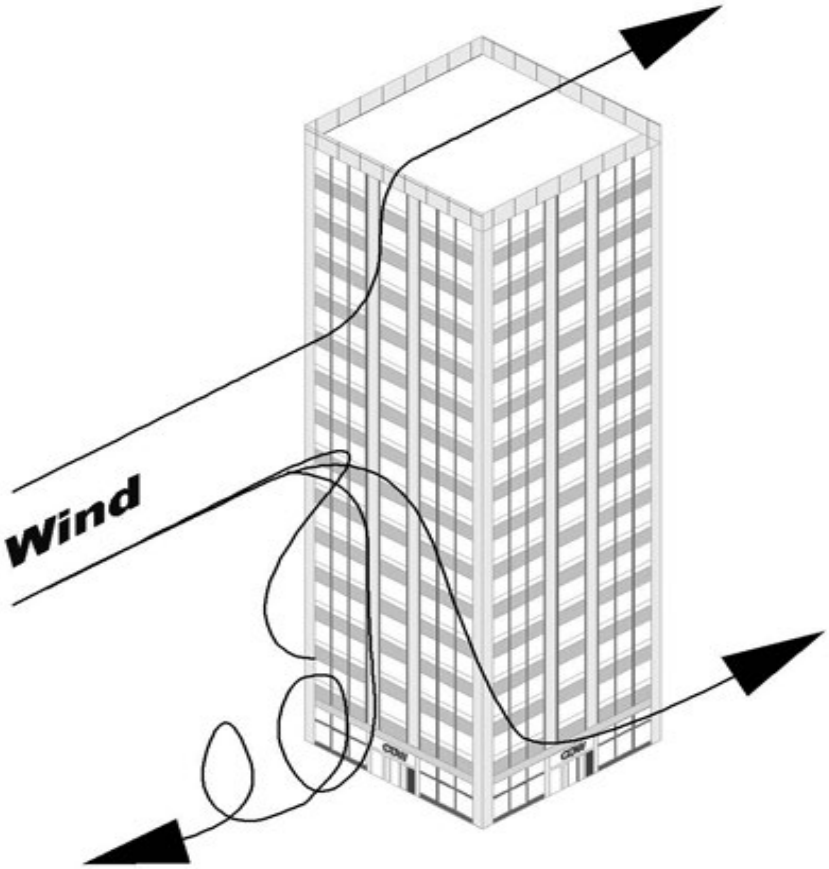
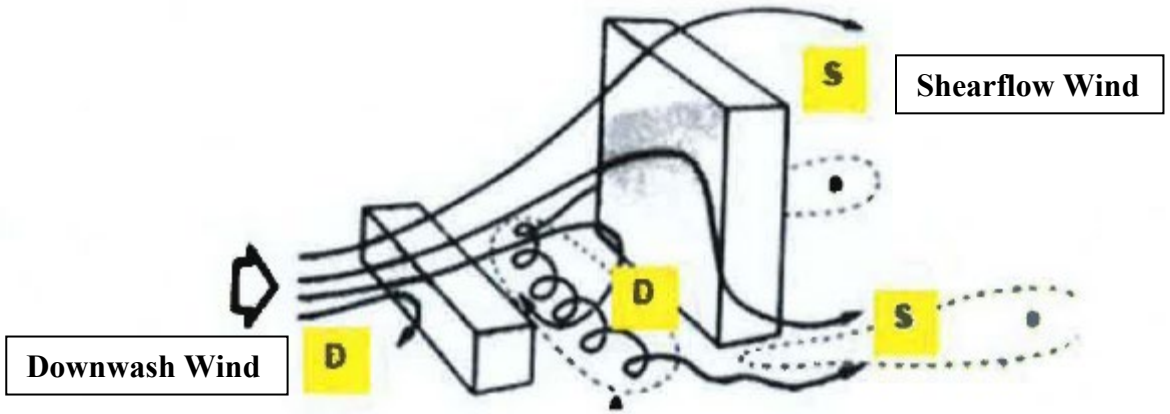
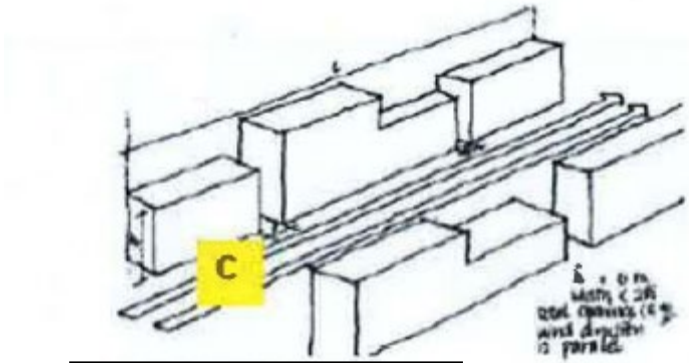


Figure 12 - Downwash and Shearflow Winds





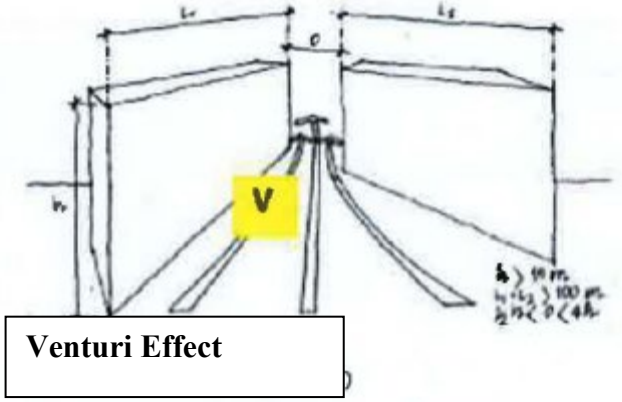


Figure 13 – Additional Wind Types

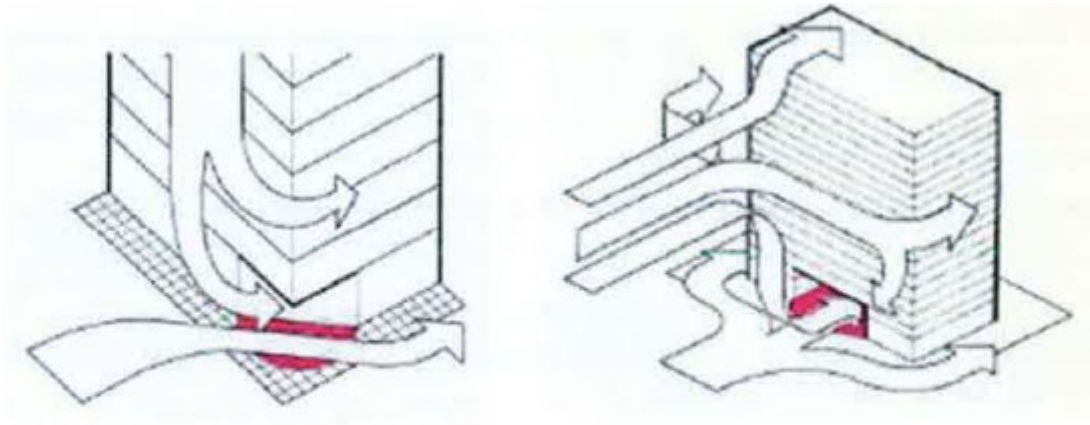
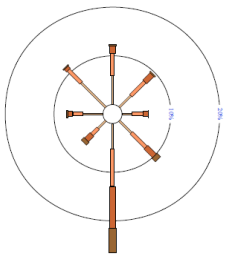
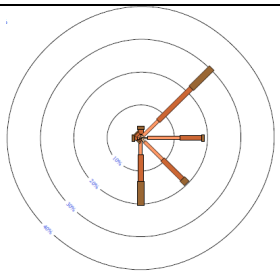
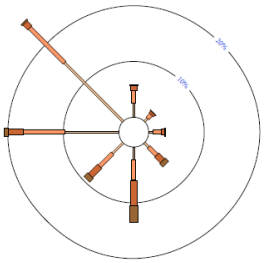
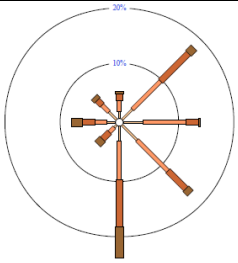
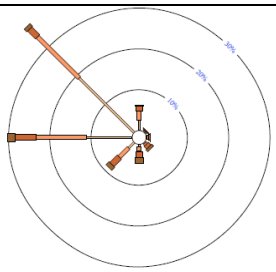
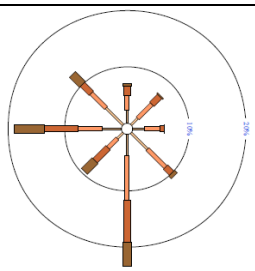
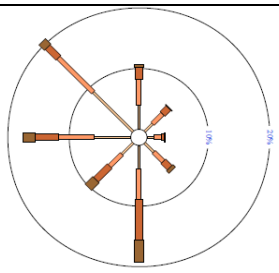
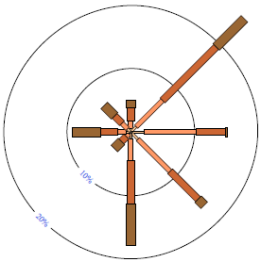
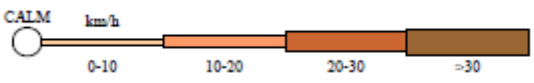


Figure 14 – Wind Effects Past & Through a Building

WIND FREQUENCY ANALYSIS (in km/h)
SYDNEY AIRPORT AMO STATION NUMBER 066037
Latitude: -33.94 ° Longitude: 151.17 °

	Morning Winds – 9am	Afternoon Winds – 3pm
Summer		
Autumn		
Winter		
Spring		



Wind directions are divided into eight compass directions. Calm has no direction.
An asterisk (*) indicates that calm is less than 1% .
An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality controlled data have been used.

Figure 15 – Sydney Wind Roses
Source: Bureau of Meteorology website accessed on April 22, 2013

Figure 16 – Ultimate Wind Load On Façade (1:500)– East West Direction

Figure 17 – Ultimate Wind Load On Façade (1:500) – North South Direction

Figure 18 – Ultimate Wind Load On Façade (1:500) –West East Direction

Figure 19 – Ultimate Wind Load On Façade (1: 500) –South North Direction