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Human Habitats

58 Princes Highway, Dandenong

Wind Impact Assessment

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Executive Summary

Human Habitats commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed development at **58 Princes Highway, Dandenong**. This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed development were provided by John Anthony Garofalo in March 2023.

The findings of this study can be summarized as follows:

With proposed design:

- Wind conditions in the ground level footpath areas and access ways would be expected to be within the **walking** comfort criterion;
- Wind conditions at the main entrances would be expected to be within the **standing** comfort criterion;
- Wind conditions at the communal open space would be expected to be within the **standing** comfort criterion;
- Wind conditions at the private balconies would be expected to be within the recommended **walking** comfort criterion or better; and
- The gust wind speeds would be expected to be within the safety criterion.

As such, Vipac makes no wind control recommendations for the proposal.

As a general statement, educating occupants about wind conditions at open terrace/balcony areas during high-wind events and fixing loose, lightweight furniture on the terrace are highly recommended.

The assessments provided in this report have been made based on experience of similar situations in Melbourne and around the world. As with any opinion, it is possible that an assessment of wind effects based on experience and without experimental validation may not account for all complex flow scenarios in the vicinity.

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1 Introduction

Vipac Engineers and Scientists has been commissioned by **Human Habitats** to carry out an appraisal of the pedestrian wind effects at the ground level of the proposed development at **58 Princes Highway, Dandenong**.

Strong winds in pedestrian areas are frequently encountered in central business districts of cities around the world; including Sydney, Melbourne and Brisbane. Wind characteristics such as the mean speed, turbulence and ambient temperature determine the extent of disturbance to users of pedestrian areas. These disturbances can cause both comfort and safety problems and require careful consideration to mitigate successfully.

The proposed development is a 5-storey residential building with a maximum height of 16.77 m from the ground level. The site is bounded by Princes Hwy Service Rd to the southwest, and existing development to the other directions. A satellite image of the proposed development site and the southwest elevation of the building are shown in Figure 1 and Figure 2, respectively.

This report details the opinion of Vipac as an experienced wind engineering consultancy regarding the wind effects in ground level footpath areas adjacent to the development as proposed. No wind tunnel testing has been carried out for this development at this stage. Vipac has carried out wind tunnel studies on a large number of developments of similar shape and having similar exposure to that of the proposed development. These serve as a valid reference for the prediction of wind effects. Empirical data for typical buildings in boundary layer flows has also been used to estimate the likely wind conditions on the ground level areas of the proposed development [2] & [3].

Drawings of the proposed development were supplied to Vipac by John Anthony Garofalo in March 2023. A list of drawings supplied is provided in Appendix C of this report.



Figure 1: Aerial view of the proposed development site.

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Figure 2: Princes Hwy elevation of the proposed development.

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2 Analysis Approach

In assessing whether a proposed development is likely to generate adverse wind conditions in ground level footpath areas, Vipac has considered the following five main points:

- The exposure of the proposed development to wind;
- The regional wind climate;
- The geometry and orientation of the proposed development;
- The interaction of flows with adjacent developments; and
- The assessment criteria determined by the intended use of the areas affected by wind flows generated or augmented by the proposed development.

The pedestrian wind comfort at specific locations of ground level footpath areas may be assessed by predicting the gust and mean wind speeds with a probability of 0.1% and 20% expected at that location. The location may be deemed generally acceptable for its intended use while gust and mean wind speeds are within the threshold values noted in Section 2.5. Where Vipac predicts that a location would not meet its appropriate comfort criterion, the use of wind control devices and/or local building geometry modifications to achieve the desired comfort rating may be recommended. For complex flow scenarios or where predicted flow conditions are well in excess of the recommended criteria, Vipac recommends scale model wind tunnel testing to determine the type and scope of the wind control measures required to achieve acceptable wind conditions.

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2.1 Site Exposure

The proposed development is located on a relatively flat terrain. The site is surrounded within an approximately 1 km radius predominately by low-rise developments with some parklands in between. A satellite image showing these site surroundings is shown in Figure 3.

Considering the immediate surroundings and terrain, for the purposes of this study, the site of the proposed development is assumed to be within Terrain Category 3 for all wind directions (Figure 3).

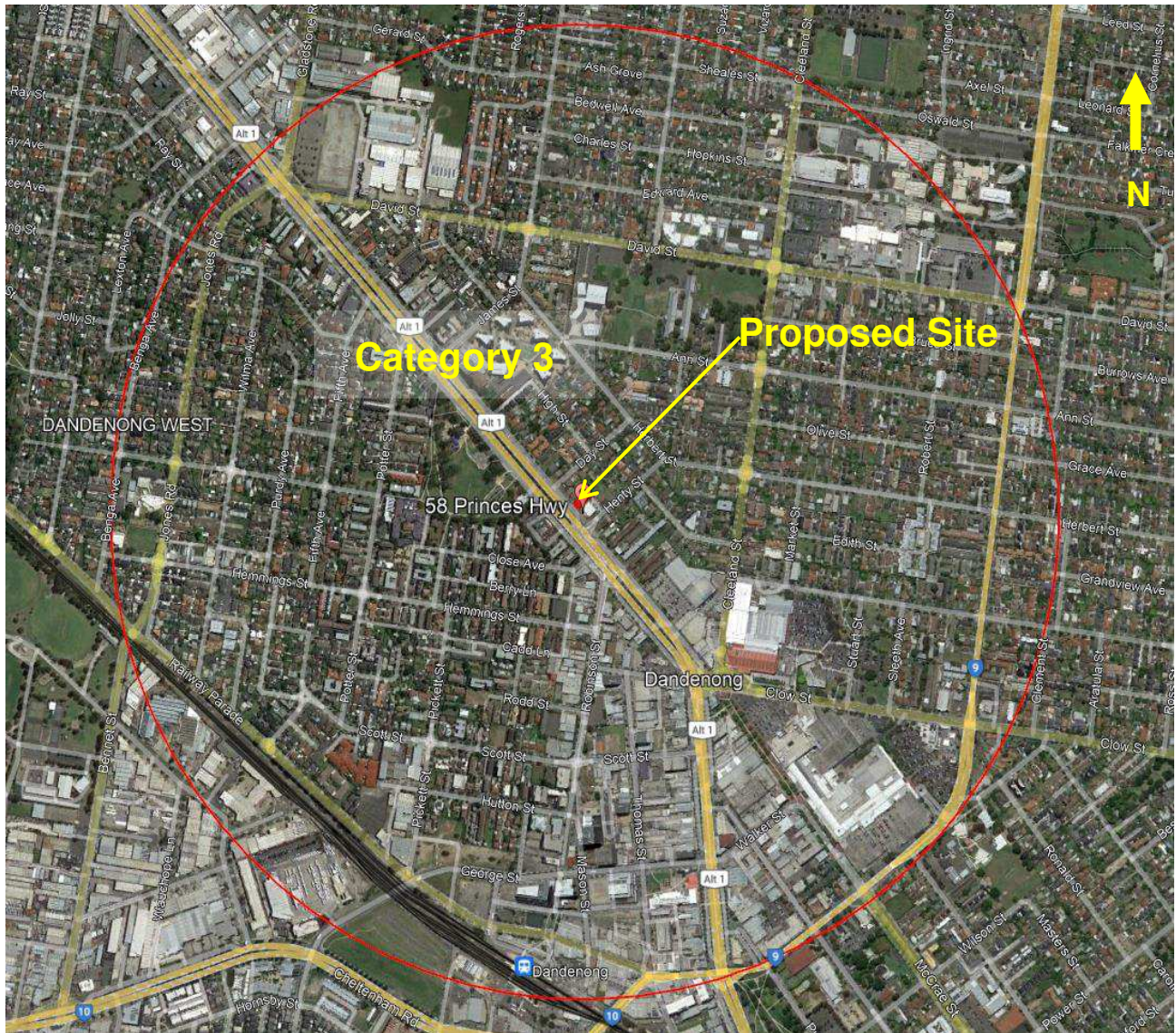


Figure 3: Assumed terrain categories for wind speed estimation.

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2.2 Regional Wind Climate

The mean and gust wind speeds have been recorded in the Melbourne area for over 30 years. This data has been analysed and the directional probability distribution of wind speeds has been determined. The directional distribution of hourly mean wind speed at the gradient height, with a probability of 0.1% of time and 20% of time exceeded are shown in Figure 4. The wind data at this free stream height is common to all Melbourne city sites and may be used as a reference to assess ground level wind conditions at the site.

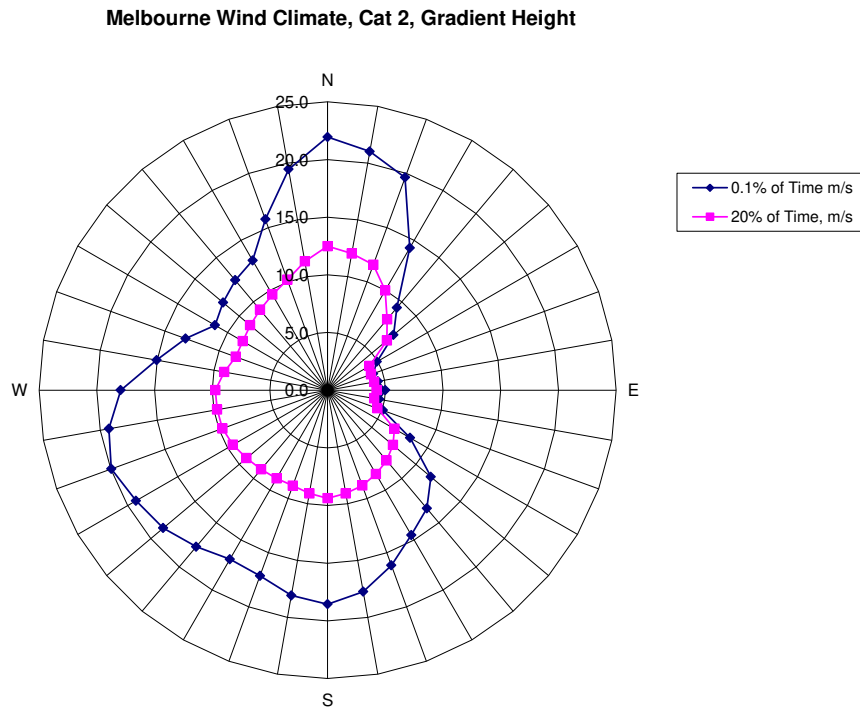


Figure 4: Directional Distribution of Mean Hourly Wind Velocities (m/s) for 0.1% and 20% exceeded at Gradient Height for Melbourne.

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2.3 Building Geometry and Orientation

The proposed development is a 5-storey residential building. The overall plan-form dimensions are approximately 15 m x 46 m as shown in Figure 5. The main entrance is located on Princes Hwy. The development incorporates 3-5 m setback from Princes Hwy Street boundary.

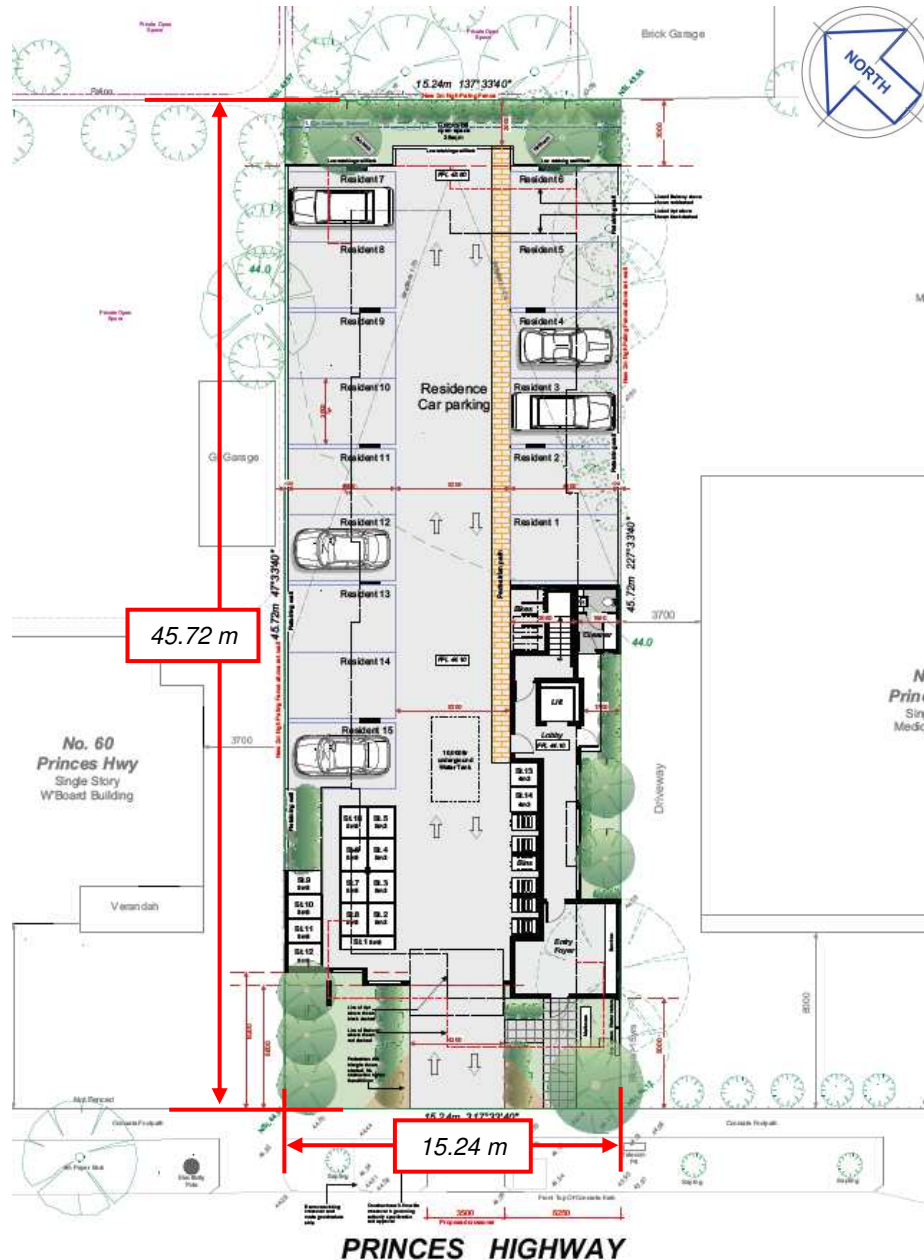


Figure 5: Ground floor plan with the overall dimensions overlaid.

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2.5 Assessment Criteria

The following wind comfort criteria detailed in Table 1 were applied in this study.

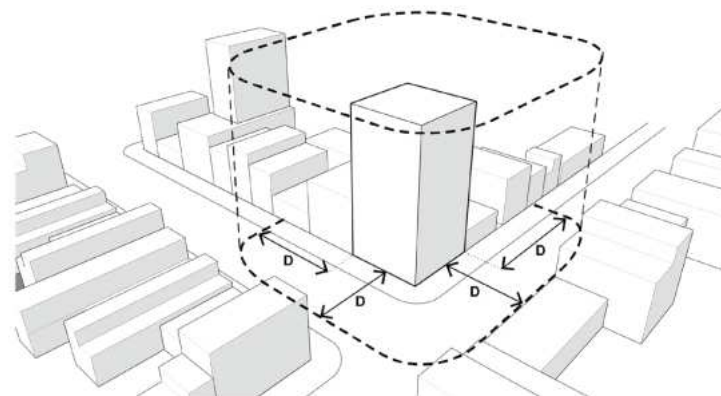
Table 1: Wind Comfort Criteria as per Clause 58.04-4

Unsafe	Comfortable
Annual maximum 3 second gust wind speed exceeding 20m/sec with a probability of exceedance of 0.1% considering at least 16 wind directions.	Hourly mean wind speed or gust equivalent mean speed from all wind directions combined with probability of exceedance less than 20% of the time, equal to or less than: 3m/sec for sitting areas (outdoor cafés) 4m/sec for standing areas (window shopping, queuing) 5m/sec for walking areas (steady steps for most pedestrians)

This criterion specifically calls for the safety criterion to be used to assess infrequent winds (e.g. peak event of $\leq 0.1\%$ of the time); and the perceived pedestrian comfort to be assessed based on frequently occurring winds (e.g. winds that occurs 80% of the time).

In Table 1, the mean wind velocity is defined as the maximum of hourly mean or gust equivalent mean ($Gust/1.85$)

This criteria specifies that safe and comfortable wind conditions must be achieved in publicly accessible areas within a distance equal to half the longest width of the building measured from all facades or half the overall height of the building, whichever is greater, as shown in Figure 7.



ASSESSMENT DISTANCE D = GREATER OF:
L/2 (HALF LONGEST WIDTH OF BUILDING) OR
H/2 (HALF OVERALL HEIGHT OF BUILDING)

Figure 7: Assessment distance.

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2.5.1 Use of Adjacent Pedestrian Occupied Areas & Recommended Comfort Criteria

The following table lists the specific areas adjacent to the proposed development and the corresponding recommended criteria.

Table 2: Recommended application of criteria

Area	Specific location	Recommended Criteria
Public Footpaths, Access ways	Along Princes Hwy, walkway to lobby (Figure 8)	Walking
Building Entrances	Main building entrances along Princes Hwy (Figure 8)	Standing
Communal Open Space	Ground level (Figure 8)	Standing
Balcony/Terraces	Up the height of the building	Walking (See discussion below)

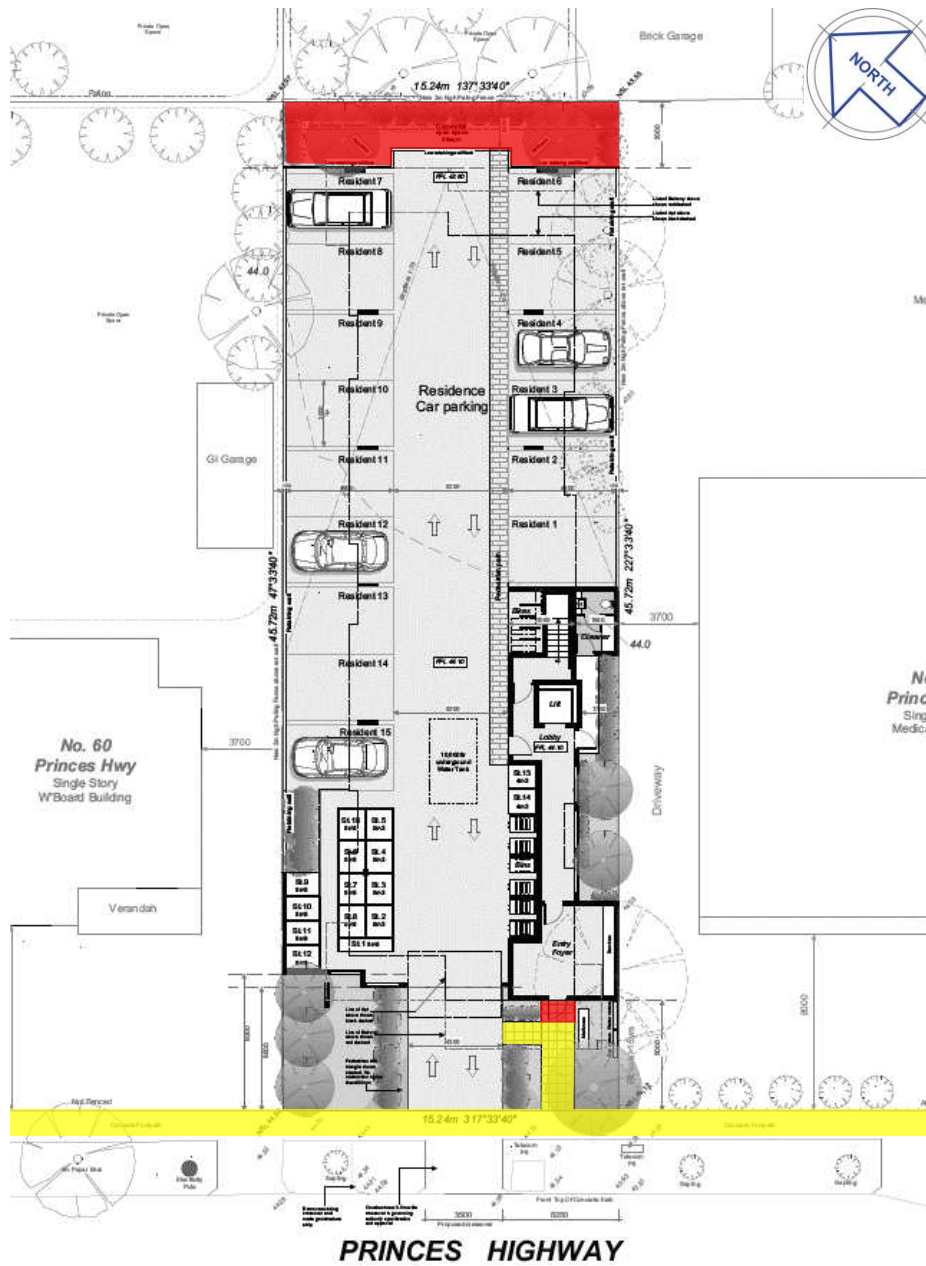
2.5.2 Terrace / Balcony Recommended Criterion Discussion

There are Private Balconies and Terraces located up the height of the development. Vipac recommends as a minimum that balcony/terrace areas meet the criterion for walking since:

- these areas are not public spaces;
- the use of these areas is optional, and only intended to be used on fair weather days with calm winds;
- many similar developments in Melbourne and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.

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Recommended to fulfil Walking
 Recommended to fulfil Standing

Figure 8: Ground floor with recommended wind criteria overlaid.

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3 Pedestrian Level Wind Effects

3.1 Discussion & Recommendations

The proposed design has a number of features that are expected to be beneficial to the pedestrian wind environment. This is inclusive but not limited to the following:

- Set back design from streetscape; and
- Landscaping at ground level.

Due to the proposed height above the surrounding areas, the proposed development is particularly exposed to adverse westerly winds. Such that high wind levels are expected along Princes Hwy and the two building corners. However, the proposed development has a setback design from Princes Hwy streetscape. These tower setbacks in combination with the landscaping are expected to be beneficial to the wind environment on the ground floor; such that the surrounding pedestrian streetscape is expected to be within the recommended walking comfort criterion.

The main entrance is located along Princes Hwy, at the southwest corner. This entry is setback from the streetscape and underneath the canopy above. It is expected to be within the recommended standing comfort criterion. The side entry at the east is expected to have wind conditions within the standing criterion as well.

The communal open space north east of site is shielded well by the 2m high paling fence, landscaping and the development itself. As such, wind speeds are expected to be within the recommended standing comfort criterion.

The private balconies are expected to have wind conditions within walking criterion or better for the proposed design.

The proposed development would be expected to have wind conditions within the safety criterion.

It should be noted that this study is based on experience only and has not utilised any experimental data for the analysis.

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4 Conclusions

An appraisal of the likely wind conditions at the pedestrian ground level and balcony areas of the proposed development at **58 Princes Highway, Dandenong** has been made.

Vipac has carefully considered the form and exposure of the proposed development, nominated criteria for various public areas according to their function and referred to past experience to produce our opinion of likely wind conditions.

The findings of this study can be summarised as follows:

With proposed design:

- Wind conditions in the ground level footpath areas and access ways would be expected to be within the **walking** comfort criterion;
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This Report has been Prepared

For

Human Habitats

By

VIPAC ENGINEERS & SCIENTISTS PTY LTD.

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Appendix A Environmental Wind Effects

Atmospheric Boundary Layer

As wind flows over the earth it encounters various roughness elements and terrain such as water, forests, houses and buildings. To varying degrees, these elements reduce the mean wind speed at low elevations and increase air turbulence. The wind above these obstructions travels with unattenuated velocity, driven by atmospheric pressure gradients. The resultant increase in wind speed with height above ground is known as a wind velocity profile. When this wind profile encounters a tall building, some of the fast-moving wind at upper elevations is diverted down to ground level resulting in local adverse wind effects.

The terminology used to describe the wind flow patterns around the proposed development is based on the aerodynamic mechanism, direction and nature of the wind flow.

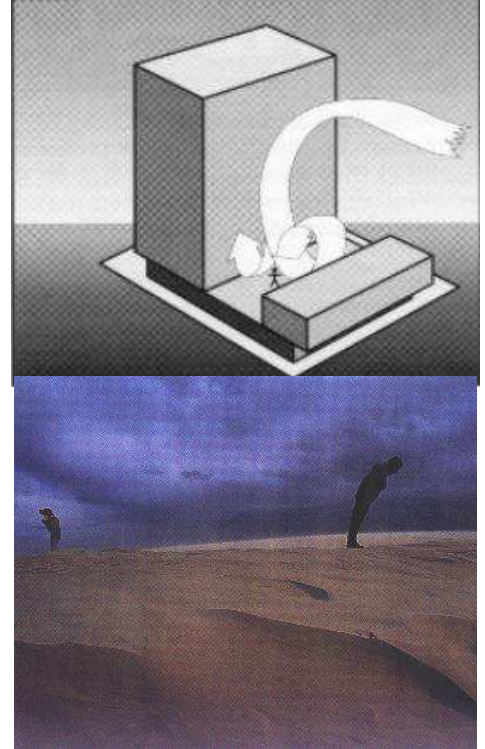
Downwash – refers to a flow of air down the exposed face of a tower. A tall tower can deflect a fast-moving wind at higher elevations downwards.

Corner Accelerations – when wind flows around the corner of a building it tends to accelerate in a similar manner to airflow over the top of an aeroplane wing.

Flow separation – when wind flowing along a surface suddenly detaches from that surface and the resultant energy dissipation produces increased turbulence in the flow. Flow separation at a building corner or at a solid screen can result in gusty conditions.

Flow channelling – the well-known “street canyon” effect occurs when a large volume of air is funnelled through a constricted pathway. To maintain flow continuity the wind must speed up as it passes through the constriction. Examples of this might occur between two towers, in a narrowing street or under a bridge.

Direct Exposure – a location with little upstream shielding for a wind direction of interest. The location will be exposed to the unabated mean wind and gust velocity. Piers and open water frontage may have such exposure.



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Appendix B References

- [1] *Structural Design Actions, Part 2: Wind Actions*, Australian/New Zealand Standard 1170.2:2021
- [2] *Wind Effects on Structures* E. Simiu, R Scanlan, Publisher: Wiley-Interscience
- [3] *Architectural Aerodynamics* R. Aynsley, W. Melbourne, B. Vickery, Publisher: Applied Science Publishers

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Appendix C Drawings List

Drawings Received: March 2023

PA TP1 Site Description Plan

PA TP2 Ground Floor Plan

PA TP3 Levels 1-3 Plan

PA TP4 Level 4 Plan

PA TP5 Shadow Diagrams

PA TP6 Streetscapes and Elevations

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