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Ethos Urban

170 Foster Road, Mount Waverley

Wind Impact Statement

30N-23-0115-TNT-53745-1

20 April 2023

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Rev. 00	Original issue		
Rev. 01	Minor Amendments	20 Apr 23	E. Yuen

Executive Summary

Ethos Urban commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed development at **170 Foster Road, Mount Waverley.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed development were provided by **Concept Y** in **April 2022**.

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; and
- Wind conditions would be expected to fulfil safety criterion.

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. A wind tunnel test can be conducted in the detail design stage to quantify the wind conditions and determine the proper wind control measures wherever necessary.

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1 Introduction

Vipac Engineers and Scientists has been commissioned by **Ethos Urban** to carry out an appraisal of the pedestrian wind effects at the ground level of the proposed development at **170 Foster Road, Mount Waverley.**

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 3-storey warehouse with 2 buildings – Building 1 and Building 2 both with a roof height of 34.7m from ground level. The site is bounded by Forster Road to the west, a Shared Private Road to the north and existing developments in the remaining directions. The locality plan of the proposed development site and various elevations of the buildings are shown in Figure 1, Figure 2 and Figure 3 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 **Concept Y** in **April 2022**. A list of drawings supplied is provided in Appendix C of this report.

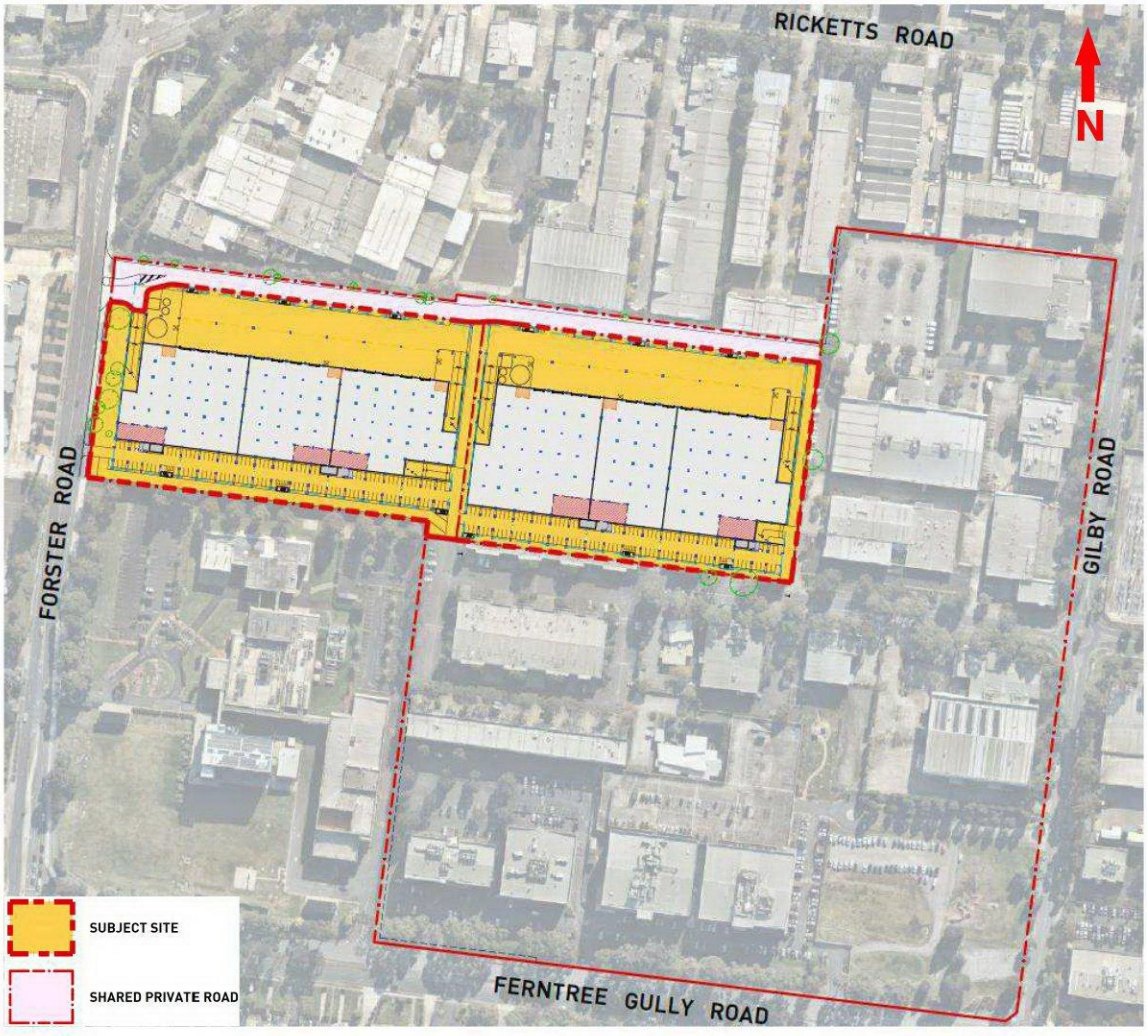


Figure 1: Locality plan of the proposed development site.

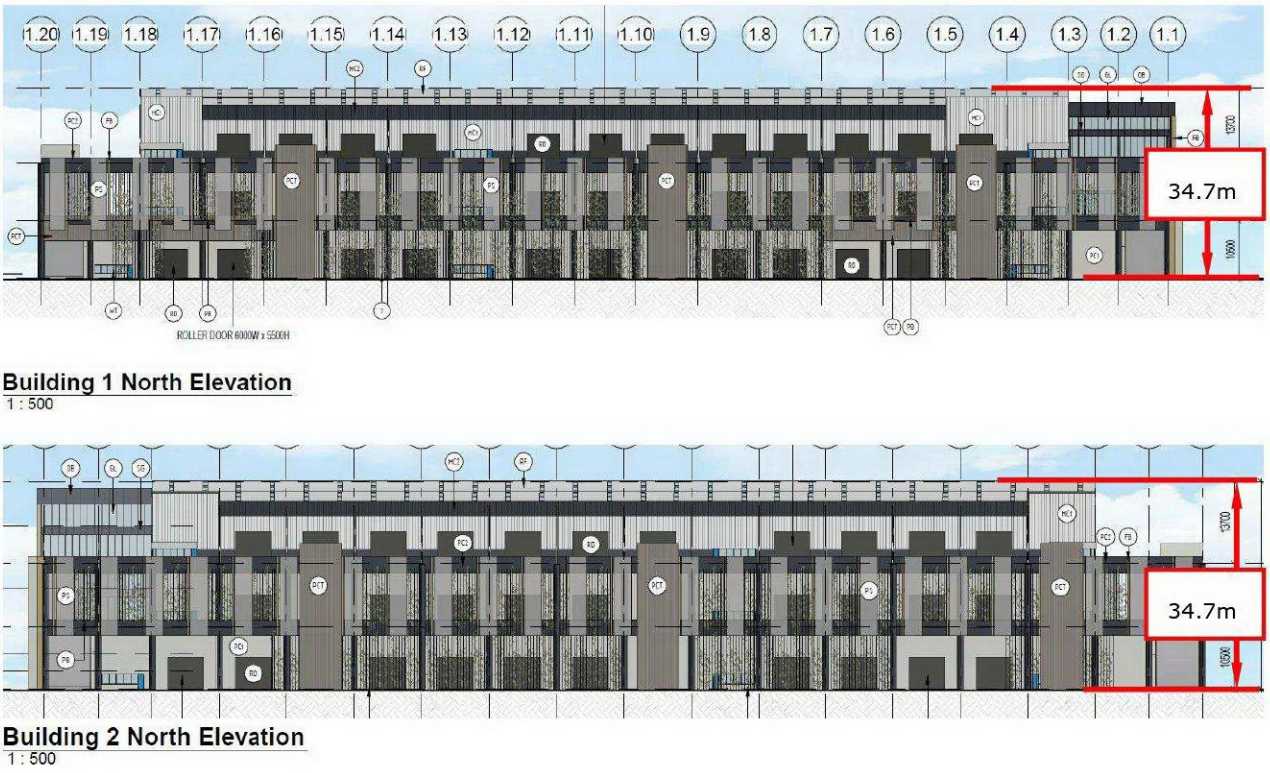


Figure 2: Northern elevation of Building 1 (top) and Building 2 (bottom) of the proposed development.

Figure 3: West elevation of Building 1 (top) and east elevation of Building 2 (bottom) of the proposed development.

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.

2.1 Site Exposure

The proposed development is located on a relatively flat terrain. The site is surrounded within an approximately 2km radius predominately by low to mid-rise developments. A satellite image showing these site surroundings is shown in Figure 4.

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 4).

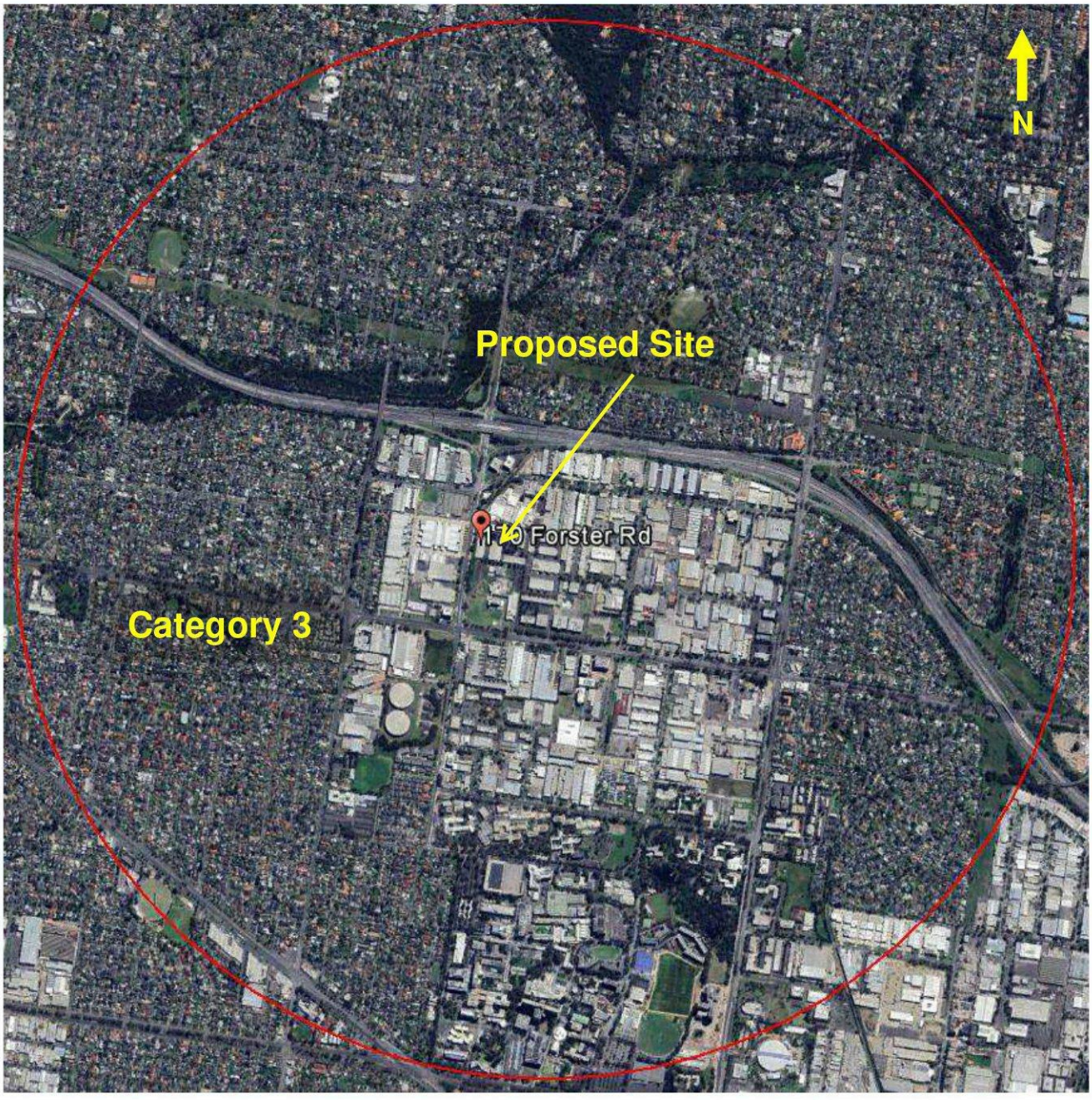


Figure 4: Assumed terrain categories for wind speed estimation.

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 5. 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.

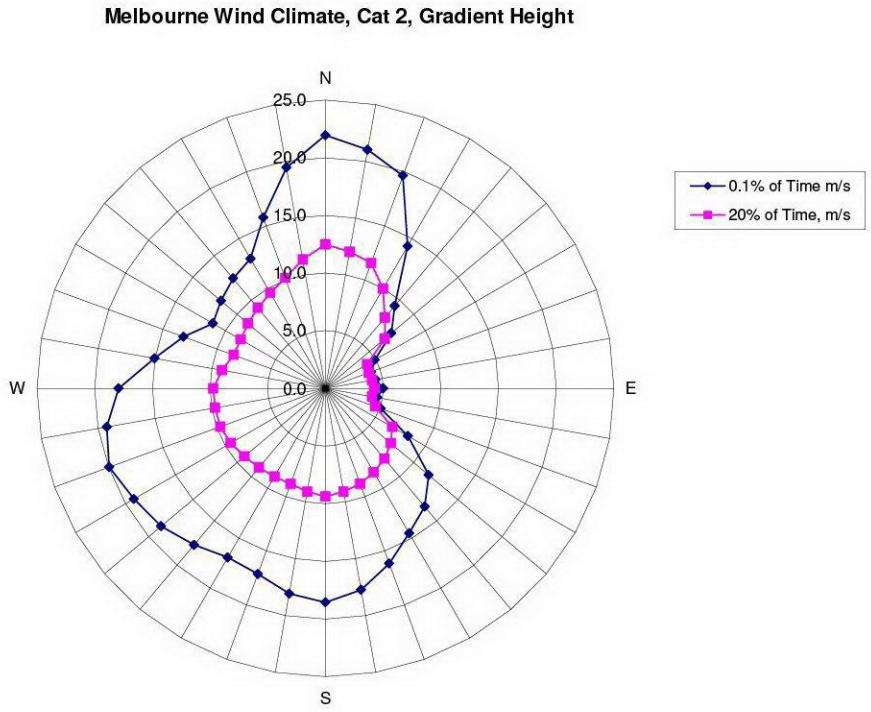


Figure 5: Directional Distribution of Mean Hourly Wind Velocities (m/s) for 0.1% and 20% exceeded at Gradient Height for Melbourne.

2.3 Building Geometry and Orientation

The proposed development is a warehouse with two buildings, 3 storeys each. The overall plan-form dimensions are approximately 113m x 206m for Building 1 and 128m x 194m as shown in Figure 6.

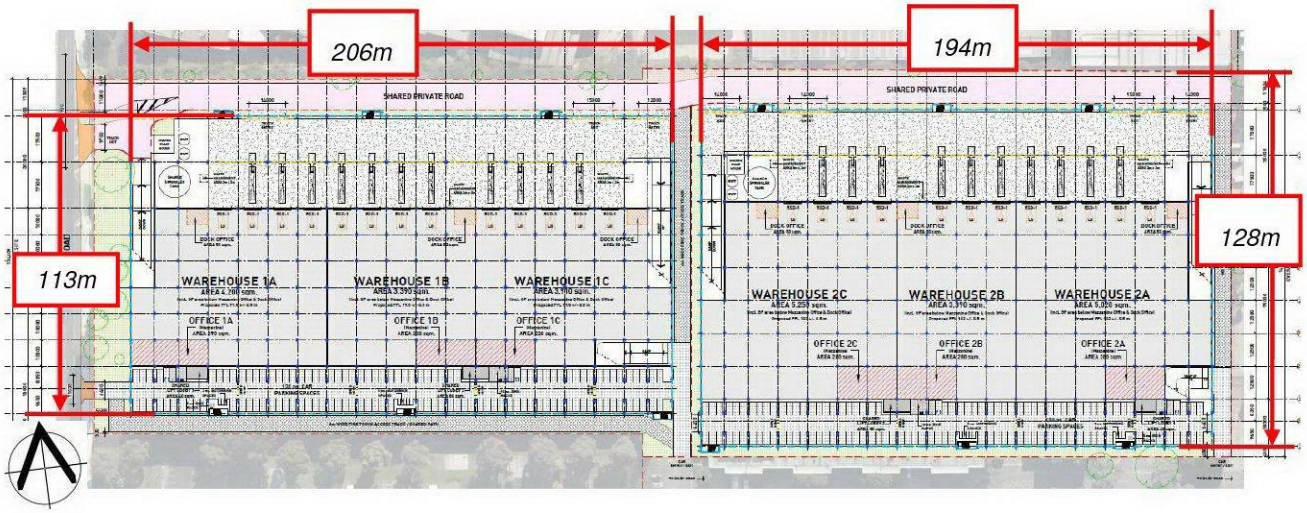


Figure 6: Ground floor plans with the plan-form dimensions overlaid.

2.4 Flow interactions with Adjacent Developments

The immediately adjacent developments are shown in Figure 7. At ground level, the site is exposed to direct winds from the northerly directions channelling along Forster Road. The development is taller than the surrounding buildings and so is exposed to winds from all directions at the upper levels.

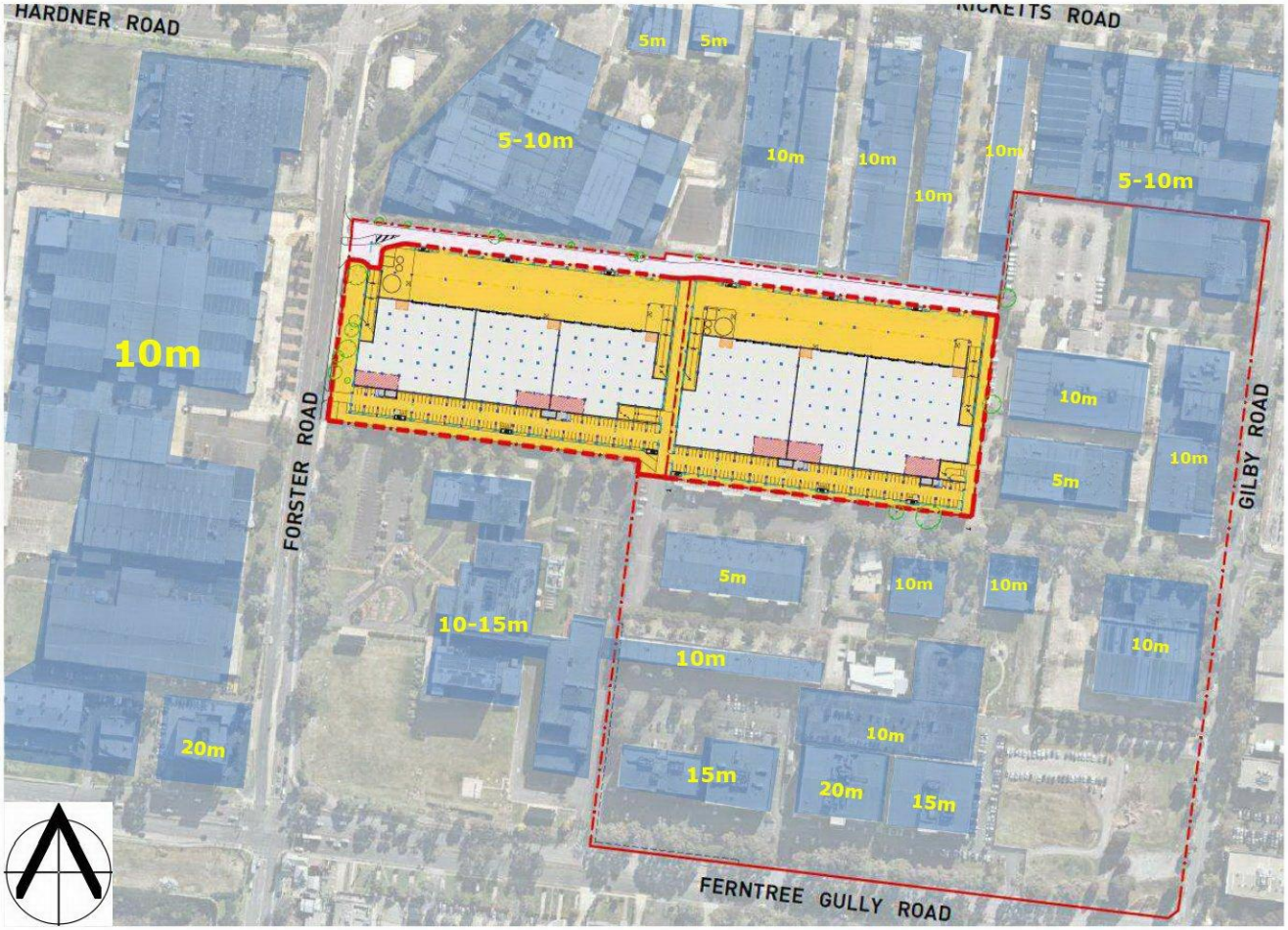


Figure 7: Immediately adjacent surroundings and their approximate height (m).

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 ≤ 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 8.

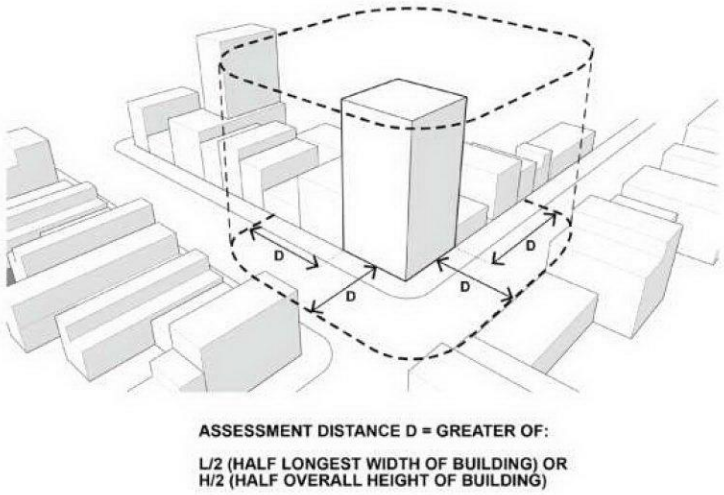


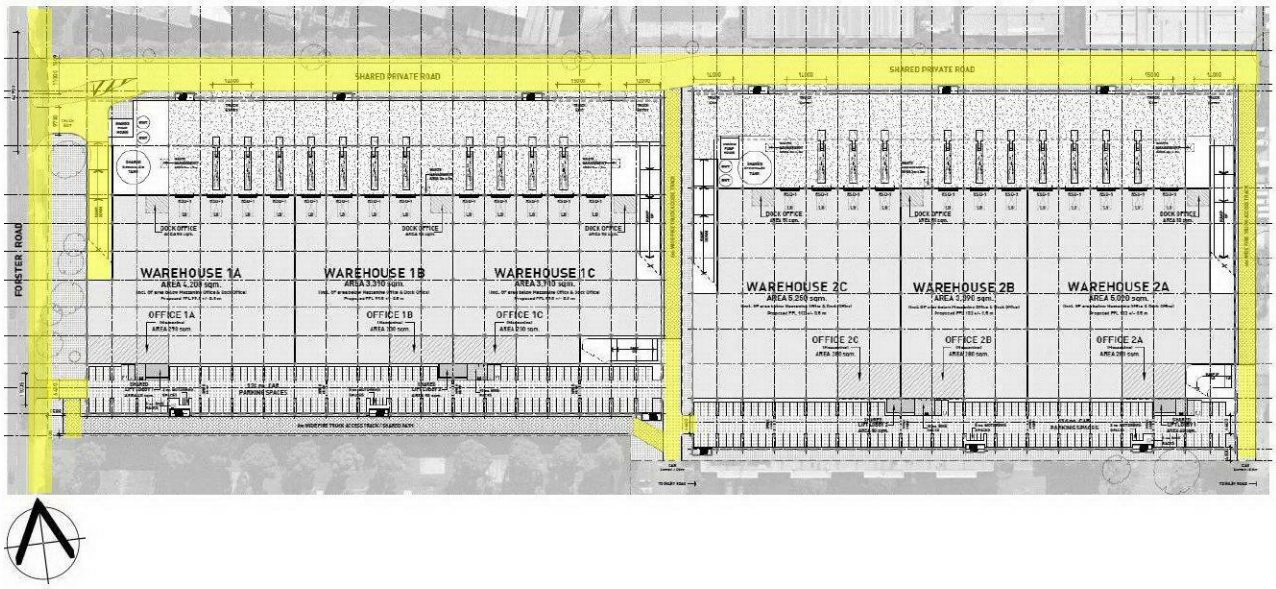
Figure 8: Assessment distance.

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	Throughout site (Figure 9)	Walking
Building Entrances	Not indicated in architectural plan	Standing



Recommended to fulfil Walking

Figure 9: Ground floor with recommended wind criteria overlaid.

3 Pedestrian Level Wind Effects

3.1 Discussion & Recommendations

The public pedestrian footpath along Forster Road is located approximately 14m away from the building façade line. Due to this distance, the proposed development is not expected to have a significant impact on the wind environment on Foster Road, such that the wind conditions are expected to be within the walking comfort criterion or similar to existing wind conditions.

Within the property boundary, we note the following:

- The Shared Private Road to the north is shielded from the surrounding developments.
- The parking spaces to the south are shielded well by the building above and the existing developments; and
- the shared path to the south is not expected to be significantly affected by the proposed development.

Considering the above, the wind speeds at these locations are expected to be within the recommended walking comfort criterion.

The track between Building 1 and Building 2 are expected to experience some uncomfortable winds, however, as this is intended for Fire Truck Access, any exceedances in wind conditions are deemed to be acceptable. The other Fire Truck Access to the east, however, as this is facing the least dominant wind direction, no exceedances are expected.

All locations of the dock offices and shared lift lobbies are located away from the building corners and therefore expected to have wind conditions with the standing comfort criterion.

The wind conditions would be expected to fulfil the safety criterion throughout the site.

As such, no recommendations for wind amelioration for pedestrian comfort were deemed necessary.

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

4 Conclusions

An appraisal of the likely wind conditions at the pedestrian ground level areas of the proposed development at **170 Foster Road, Mount** Waverley 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; and
- Wind conditions would be expected to fulfil safety criterion.

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. A wind tunnel test can be conducted in the detail design stage to quantify the wind conditions and determine the proper wind control measures wherever necessary.

This Report has been Prepared

For

Ethos Urban

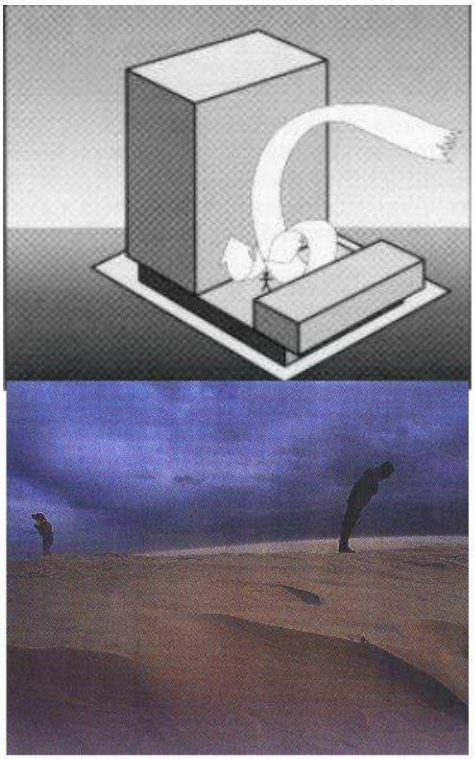
By

VIPAC ENGINEERS & SCIENTISTS PTY LTD.

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.

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

Appendix C Drawings List

Drawings received: **April 2023**

Name
2209-122-DA-011(D).pdf
2209-122-DA-013(D).pdf
2209-122-DA-201-SECTION.dwg
2209-122-DA-201(B).pdf
2209-122-DA-202(B).pdf