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Vipac Engineers & Scientists

Lutkas Pty Ltd c/o The Opat Group

203-205 Normanby Road, Melbourne

Wind Impact Statement - Site 6

30N-18-0279-TRP-6763431-1

4 July 2019

Report Title: Wind Impact Statement - Site 6 **Job Title: 203-205 Normanby Road, Melbourne**	
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EXECUTIVE SUMMARY

Lutkas Pty Ltd c/o The Opat Group commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed development at **203-205 Normanby Road, Melbourne .** This appraisal is based on Vipac's experience as a wind-engineering consultancy, and assessed in accordance to Clause 43.02 – Schedule 30 of the Port Phillip Planning Scheme.

Drawings of the proposed development were provided by **Hayball** in **April 2019**. The findings of this study can be summarized as follows:

- With the proposed design, the ground level footpaths would be expected to have wind levels within the walking comfort criterion;
- With the proposed design, the wind conditions near the building entrance areas would be expected to be within the recommended standing criterion.
- With the proposed design, the Level 5 outdoor amenity area would be expected to be within the recommended walking criterion.

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. We recommend wind tunnel testing be undertaken to verify these predictions and determine the optimised wind control treatments, if required.

TABLE OF CONTENTS

1 INTRODUCTION

Lutkas Pty Ltd c/o The Opat Group commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed development at **203-205 Normanby Road, Melbourne.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

The proposed development is bounded by Normanby Road to the North, Woodgate Street to the south, and existing developments to the East and West (see Figure 1). The proposed development is a 35 storey building incorporating a 5 level podium (see Figure 2). The surrounding developments, within a 3 km radius, are a mixture of suburban dwellings, midrise offices and residential complexes.

This report details the opinion of Vipac as an experienced wind engineering consultancy regarding the wind effects in ground level public areas and access-ways 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 for this development. Empirical data for typical buildings in boundary layer flows has also been used to estimate likely ground level wind conditions adjacent to the proposed development [2] & [3].

Drawings of the proposed development were provided by **Hayball** in **April 2019** as listed in Appendix C of this report.

Figure 1: Aerial view of the proposed development site at 203-205 Normanby Road, Melbourne.

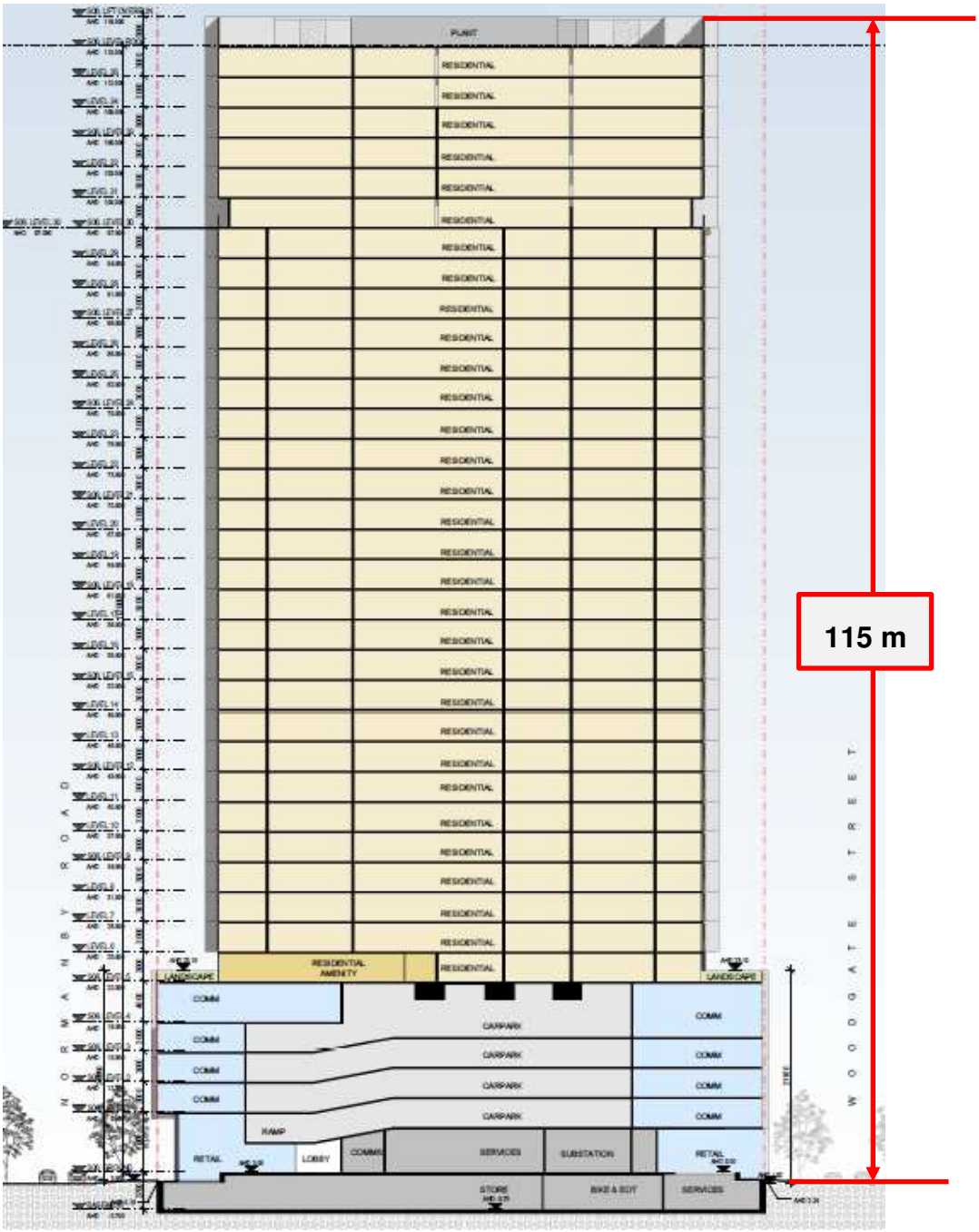


Figure 2: Section A-A of the proposed development with its approximate height in meters

2 ANALYSIS APPROACH

When considering whether a proposed development is likely to generate adverse wind conditions in adjacent ground level areas, Vipac considers 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;
- The assessment criteria, determined by the intended use of the public areas affected by wind flows generated or augmented by the proposed development.

The pedestrian wind comfort at specific locations around a site may be assessed by predicting the worst annual 3-second wind gust expected at that location. The location may be deemed generally acceptable for its intended use if the annual 3-second gust is within the threshold values noted in Section 2.5. For cases where Vipac predicts that a location would not meet its appropriate comfort criterion we may recommend the use of wind control devices and/or local building geometry modifications to achieve the desired comfort rating. 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 predominantly surrounded within a 3 km radius by a mix of suburban dwellings, industrial areas as well as residential and office developments. There are a number of future buildings proposed in the area of a similar height to the proposed development. Considering the immediate surroundings and terrain, the site of the propose development is assumed to be within Terrain Category 3 for the azimuth degrees of 0-70, Terrain Category 2.5 from 160-220 azimuth degrees and Terrain Category 3 all other wind directions [1] (see Figure 3).

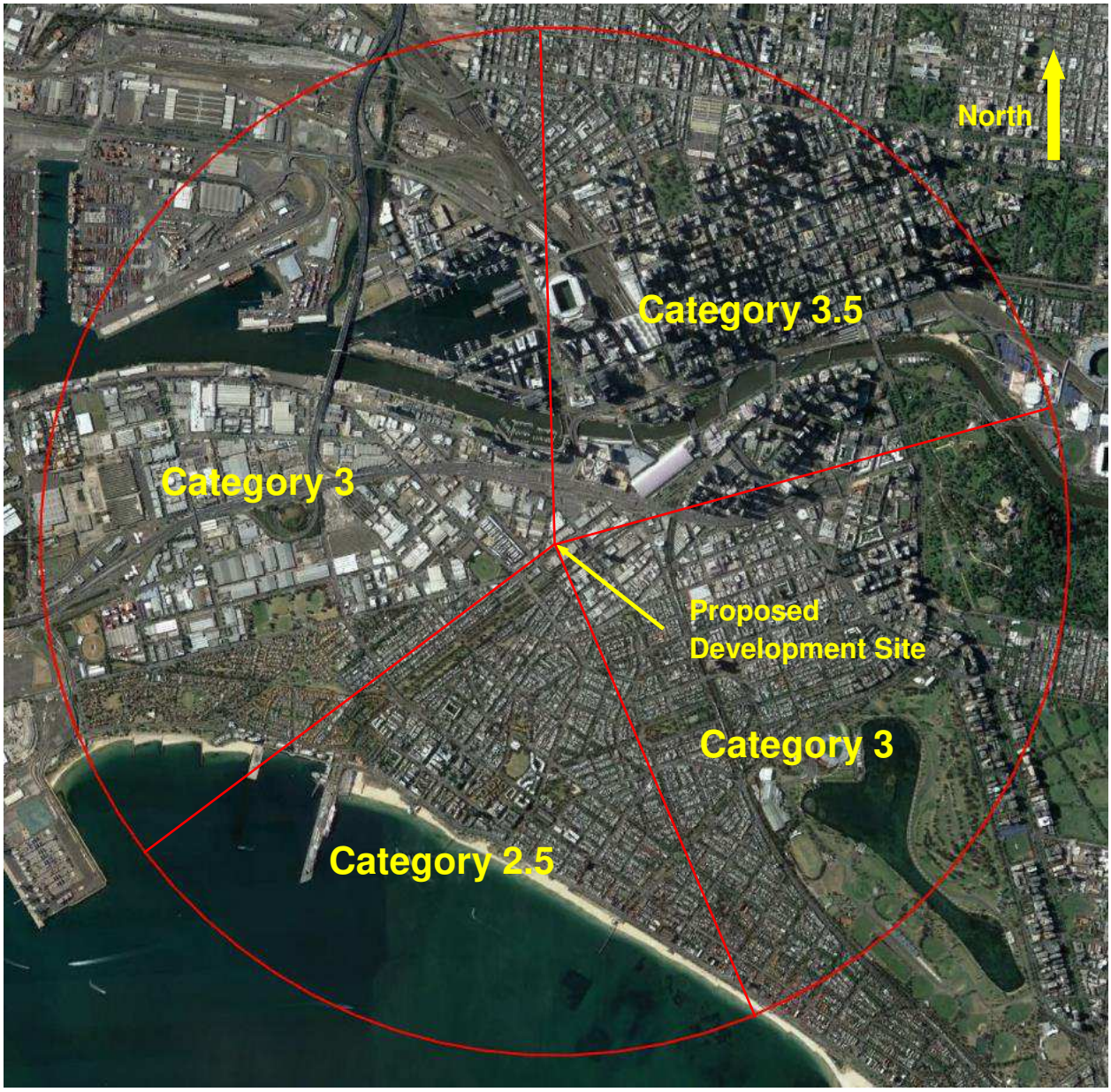


Figure 3: Assumed terrain categories for wind speed estimation.

2.2 REGIONAL WIND CLIMATE

The mean and gust wind speeds have been recorded in the Melbourne area for 30 years. These data have been analysed and the directional probability distribution of wind speeds have been determined. The directional distribution of hourly mean wind speed for 36 wind directions at the gradient height (≈500m), with a probability of occurring once per year (i.e. 1 year return period) is shown in Figure 4. The wind data at this free stream height are common to all Melbourne city sites and may be used as a reference to assess ground level wind conditions at the site. Figure 4 indicates that the stronger winds can be expected from the northerly, southerly, and westerly directions.

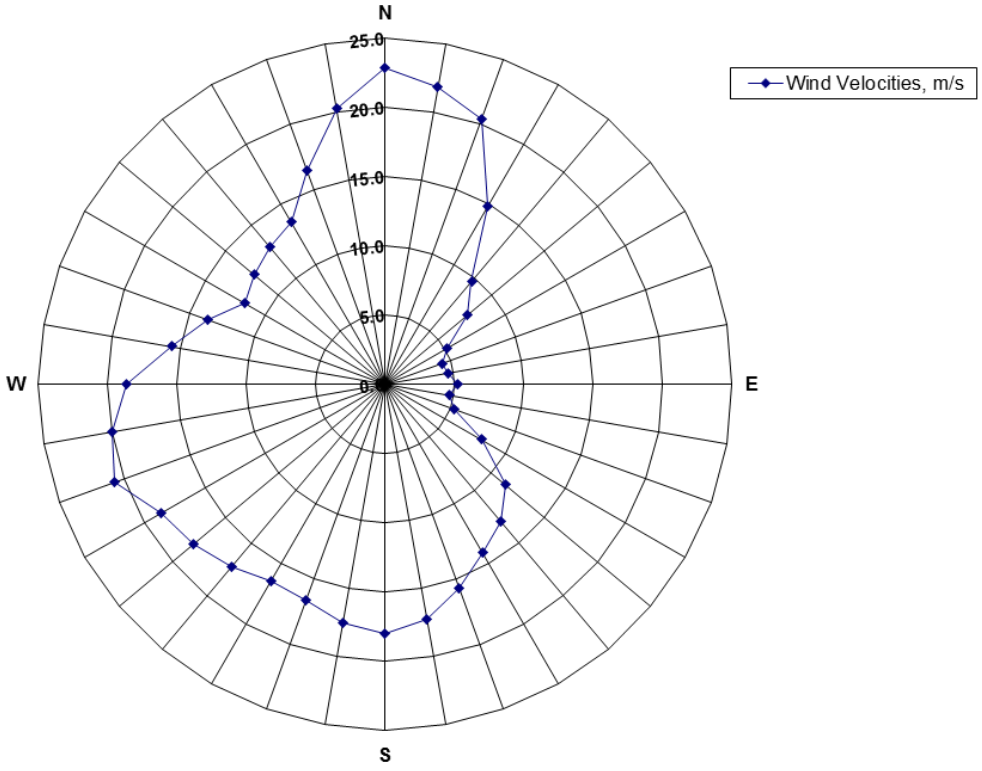


Figure 4: Directional Distribution of Annual Return Period Maximum Mean Hourly Wind Velocities (m/s) for 36 wind directions at gradient height of 500m in Melbourne.

2.3 BUILDING GEOMETRY AND ORIENTATION

The proposed development is a 35 level development incorporating a 5 storey podium. The overall plan-form dimensions are approximately 20 m x 60m (Figure 5) with the long axis running Normanby Road to Woodgate Street.

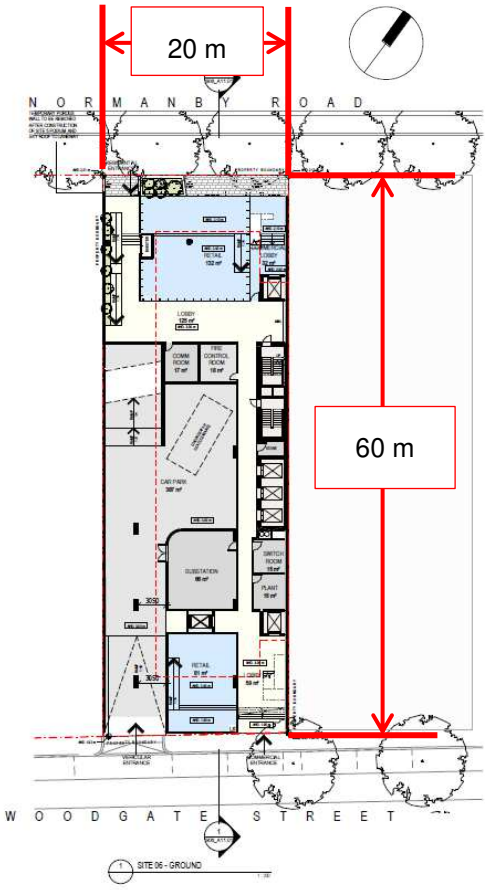


Figure 5: Site Plan of the proposed development.

2.4 FLOW INTERACTIONS WITH ADJACENT DEVELOPMENTS

The buildings immediately adjacent to the proposed development site, with their approximate building heights in meters are shown in Figure 6. There are a number of high rise proposed developments in the immediate surrounding of the subject site (indicated in yellow text). Due to the height above the surrounding environment, the proposed development is particularly exposed to northerly and southerly winds.

Figure 6 : Immediately adjacent buildings and their approximate buildings heights in meters (m) overlaid

2.5 ASSESSMENT CRITERIA

With some consensus of international opinion, pedestrian wind comfort is rated according to the suitability of certain activities at a site in relation to the expected annual peak 3-second gust velocity at that location for each wind direction. Each of the major areas around the site are characterized by the annual maximum gust wind speeds. Most patrons would consider a site generally unacceptable for its intended use if it were probable that during one annual wind event, a peak 3-second gust occurs which exceeds the established comfort threshold velocity (shown in Table 1). If that threshold is exceeded once per year then it is also likely that during moderate winds, noticeably unpleasant wind conditions would result, and the windiness of the location would be considered as unacceptable.

Table 1: Recommended Wind Comfort and Safety Gust Criteria

Annual Maximum Gust Speed	**Result on Perceived Pedestrian Comfort**
>23m/s	Unsafe (frail pedestrians knocked over)
<20m/s	Acceptable for **fast walking** (waterfront or particular walking areas)
<16m/s	Acceptable for **walking** (steady steps for most pedestrians)
<13m/s	Acceptable for **standing** (window shopping, vehicle drop off, queuing)
<11m/s	Acceptable for **sitting** (outdoor cafés, gardens, park benches)

In a similar manner, a set of hourly mean velocity criteria (see Table 2) with a 0.1% probability of occurrence are also applicable to ground level areas in and adjacent to the proposed development. An area should be within both the relevant mean and gust limits in order to satisfy the particular human comfort and safety criteria in question.

Table 2: Recommended Wind Comfort and Safety Mean Criteria

Mean Speed in 0.1% of Time	**Result on Perceived Pedestrian Comfort**
>15m/s	Unsafe (frail pedestrians knocked over)
<13m/s	Acceptable for **fast walking** (waterfront or particular walking areas)
<10m/s	Acceptable for **walking** (steady steps for most pedestrians)
<7m/s	Acceptable for **standing** (window shopping, vehicle drop off, queuing)
<5m/s	Acceptable for **sitting** (outdoor cafés, gardens, park benches)

The Beaufort Scale is an empirical measure that related the wind speed to observed conditions on the land and sea. Table 3 describes the categories of the Beaufort Scale. The comparison between these observed conditions and the comfort criteria described above can be found in Table 4.

Table 3: Beaufort Scale - empirical measure relating wind speed to observed conditions on land

Beaufort Number	Descriptive Term	Wind Speed at 1.75 m height (m/s)	Specification for Estimating Speed
0	Calm	0-0.1	
1	Light Air	0.1-1.0	No noticeable wind
2	Light Breeze	1.1-2.3	Wind felt on face
3	Gentle Breeze	2.4-3.8	Hair disturbed, clothing flaps, newspapers difficult to read
4	Moderate Breeze	3.9-5.5	Raises dust and loose paper; hair disarranged
5	Fresh Breeze	5.6-7.5	Force of wind felt on body, danger of stumbling when entering a windy zone
6	Strong Breeze	7.6-9.7	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, sideways wind force about equal to forwards wind force, wind noise on ears unpleasant
7	Near Gale	9.8-12.0	Inconvenience felt when walking
8	Gale	12.1-14.5	Generally impedes progress, great difficulty with balance in gusts
9	Strong Gale	14.6-17.1	People blown over

Table 4: Comparison between Mean comfort criteria and the observed conditions

Comfort Criteria	Beaufort Scale Equivalent
Safety	9 – Strong Gale
Walking	5 – Fresh Breeze
Standing	4-5 – Moderate to Fresh Breeze
Sitting	<4 – Moderate Breeze

Port Phillip developments with a total building height over 40 meters are required, as per the Design Development Overlay (Clause 43.02 – Schedule 30) of the Port Phillip Planning Scheme, to be under specific wind criteria. The document recommends the following wind comfort criteria listed in Table 3. **This set of wind criteria were applied in this study**.

Table 5: Wind Criteria from Clause 43.02 – Schedule 30 to the Design and Development Overlay

Measurements	Result on Perceived Pedestrian Comfort
Maximum 3 second gust exceeds **20m/sec** ≤ 0.1% of the time from all directions combined.	Accepted international criterion for human safety, to avoid a healthy pedestrian losing balance
Mean wind velocity exceeds **5m/sec** ≤ 20% of the time	Acceptable for **walking** (steady steps for most pedestrians)
Mean wind velocity exceeds **4m/sec** ≤ 20% of the time	Acceptable for **standing** (window shopping, vehicle drop off, queuing)
Mean wind velocity exceeds **3m/sec** ≤ 20% of the time	Acceptable for **sitting** (outdoor cafés, gardens, park benches)

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). The Schedule specifies that safe and comfortable wind conditions must be achieved in public accessible areas within a distance equal to half the longest width of the building above 40 m in height measured from all facades or half the total height of the building, whichever is greater, as shown Figure 7. These guidelines were applied to the subjet set as shown in Figure 8

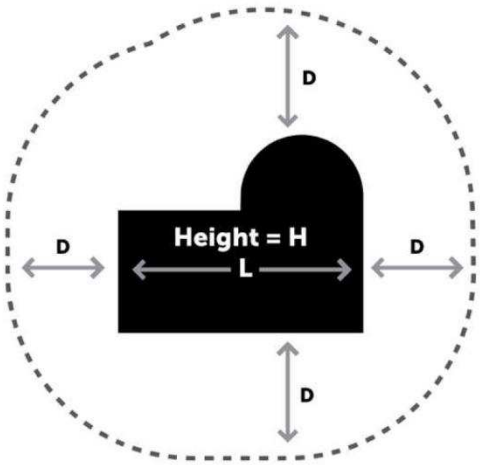


Figure 7: Assessment distance as detailed in Table 7 of Clause 43.02 - Schedule 30

2.6 USE OF ADJACENT PEDESTRIAN OCCUPIED AREAS & RECOMMENDED COMFORT CRITERIA

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

Table 6: Recommended application of criteria

Area	Specific location	Recommended Criteria
Public Footpaths and Access ways	Along Normanby Road and Woodgate Street (Figure 9).	Walking
Building entrances	Along Normanby Road and Woodgate Street (Figure 9).	Standing
Terraces/Communal outdoor amenity areas	The Communal Amenity area on Level 05 (Figure 10), and balconies throughout the proposed development.	Walking (Refer to discussion below)

2.6.1 TERRACE / BALCONY AND ROOFTOP AREAS RECOMMENDED CRITERION DISCUSSION

Terrace/balconies are located throughout the proposed development. Vipac recommends as a minimum that balcony/rooftop terrace areas meet the criterion for walking since:

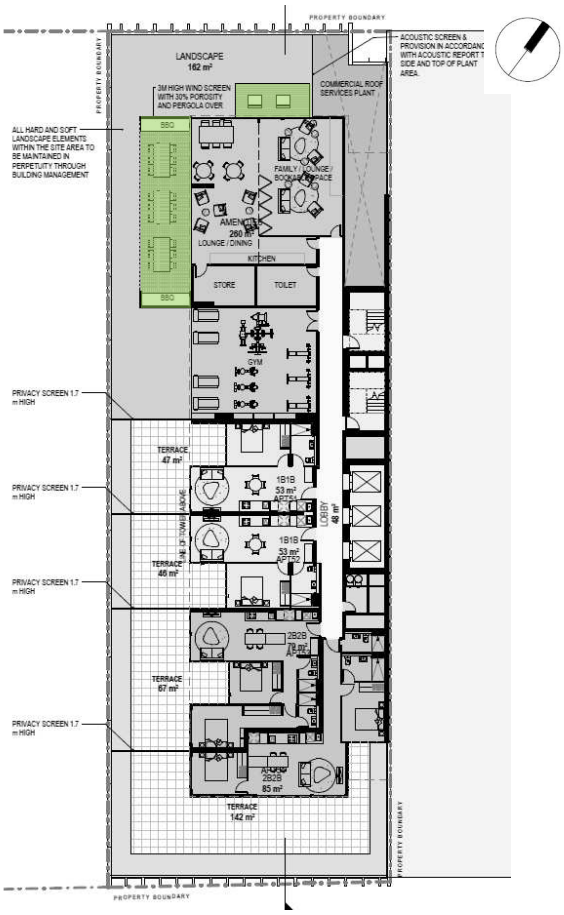
- these areas are not public spaces;
- the use of these areas is optional;
- many similar developments in Melbourne and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.

However, it should be noted that meeting the walking criterion on elevated recreation areas will be no guarantee that occupants will find wind conditions in these areas acceptable at all times.

Figure 8: Satellite view of the subject site with the public accessible areas overlaid.

Recommended to fulfil Walking *Recommended to fulfil Standing*

Figure 9: Plan view of the Ground level of the proposed development with the recommended comfort criterion overlaid



Recommended to fulfil Walking

Figure 10: Plan view of the Level 05 of the proposed development with the recommended comfort criterion overlaid

3 PEDESTRIAN LEVEL WIND EFFECTS

3.1 DISCUSSION AND RECOMMENDATIONS

Ground Floor

The proposed development stands at approximately 115 metres from street level and features a five storey high podium. The tower is set back approximately 5 metres from Normanby Road and Munro Street. This setback is expected to reduce downwash effects and corner acceleration effects. The proposed design also features a number of wind mitigation features such setback entrances and landscaping on the ground floor. Other features include vertical fins that extend to the ground floor from the podium above. With all these wind mitigation elements, the ground floor is expected to be within the recommended walking comfort criterion. As such, the pedestrian footpaths around the proposed development and the surrounding public accessible areas are expected to be within the recommended walking comfort criterion.

The entrances into the various retail spaces on the ground floor, and the lobby are setback along Woodgate Street and Normanby Road. As such, the all entrances are expected to be within the recommended standing comfort criterion.

Communal Terrace

The communal open terrace amenity area located on Level 5 and features 3m high porous wind screens and Pergola structure above. With these wind mitigation features, the wind environment is expected to be within the recommended walking comfort criterion.

4 CONCLUSIONS

An assessment of the likely wind conditions at pedestrian level of the proposed development at **203-205 Normanby Road, Melbourne** has been made.

Vipac has carefully considered the form and exposure of the proposed development, nominated criteria for various public accessible areas in relation to their function in accordance to Clause 43.02 – Schedule 30 of the Port Phillip Planning Scheme. We have also referred to past experience to produce our opinion of likely wind conditions. Based on this assessment, the following conclusions are drawn:

- With the proposed design, the ground level footpaths would be expected to have wind levels within the walking comfort criterion;
- With the proposed design, the wind conditions near the building entrance areas would be expected to be within the recommended standing criterion.
- With the proposed design, the Level 5 outdoor amenity area would be expected to be within the recommended walking criterion.

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. Considering the height and exposure of the development, we recommend wind tunnel testing be undertaken to verify the results of this assessment.

This Report has been Prepared

For

Lutkas Pty Ltd c/o The Opat Group

By

VIPAC ENGINEERS & SCIENTISTS 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 1170.2:2011

[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: DRAWING LIST

Drawings Received: April 2019

Drawing Name	Drawing Number
Site 06 – Plans	S06_A03.01
Site 06 – Plans	S06_A03.02
Site 06 – Plans	S06_A03.03
Site 06 – Plans	S06_A03.04
Site 06 – Section A-A	S06_A11.01