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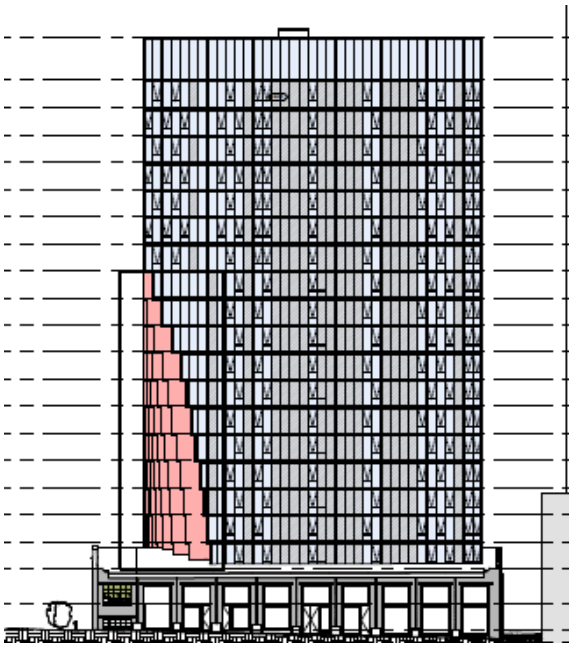
Vipac Engineers & Scientists

Fusion Project Management Pty Ltd

108 Jeffcott St, West Melbourne

Wind Impact Assessment



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Report Title:	Wind Impact Assessment
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REVISION HISTORY:

Rev. #	*Comments / Details of change(s) made*	*Date*	*Revised by:*
Rev. 00	Original issue	04/09/2020	Z. Xu
Rev. 01	Drawings updated	04/12/2020	Z. Xu
Rev. 02	Incorporating comments	18/01/2021	S. Lamande
Rev. 03	Drawings updated	22/01/2021	Z. Xu

EXECUTIVE SUMMARY

Fusion Project Management Pty Ltd commissioned Vipac Engineers and Scientists Pty Ltd to investigate the pedestrian wind environment in and adjacent to the proposed development at **108 Jeffcott St, West Melbourne** for planning approval purposes. This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Updated drawings of the proposed development were supplied by CHT Architects in January 2021, as described in Appendix C of this report.

The findings of this study can be summarised as follows:

With the proposed design**;**

- The development will be expected to generate wind conditions in the ground level footpath areas on or within the walking comfort criterion.
- The development will be expected to generate wind conditions in building entrance areas on or within the recommended standing comfort criterion, and in the seating areas within the sitting comfort criterion.
- The development will be expected to generate wind conditions in the Level 1 terraces and rooftop deck within the recommended walking comfort criterion.

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

The recommendations and assessments provided in this report have been made based on empirical data and experience of similar situations in Melbourne and around the world.

Vipac recommends that wind tunnel testing be undertaken to verify these predictions and determine the optimum wind control measures wherever necessary.

TABLE OF CONTENTS

1 INTRODUCTION

Vipac Engineers and Scientists has been commissioned by **Fusion Project Management Pty Ltd** to carry out an appraisal of the pedestrian wind effects for the adjacent public ground level areas of the proposed development at **108 Jeffcott St, West Melbourne**.

Strong winds in pedestrian areas are frequently encountered in central business districts of cities around the world; including Melbourne, Sydney 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 building is a 19-storey residential building. The roof height of the development is approximately 66.7 m above street level. The site is bounded by Jeffcott St to the south, McDougall Lane to the east and north and existing buildings to the west.

The ground floor plans of the proposed development are shown in Figure 1 and the west elevation is shown in Figure 2.

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 CHT Architects in December 2020, Updated drawings of the proposed development were supplied in January 2021. A list of drawings supplied is provided in Appendix C of this report.

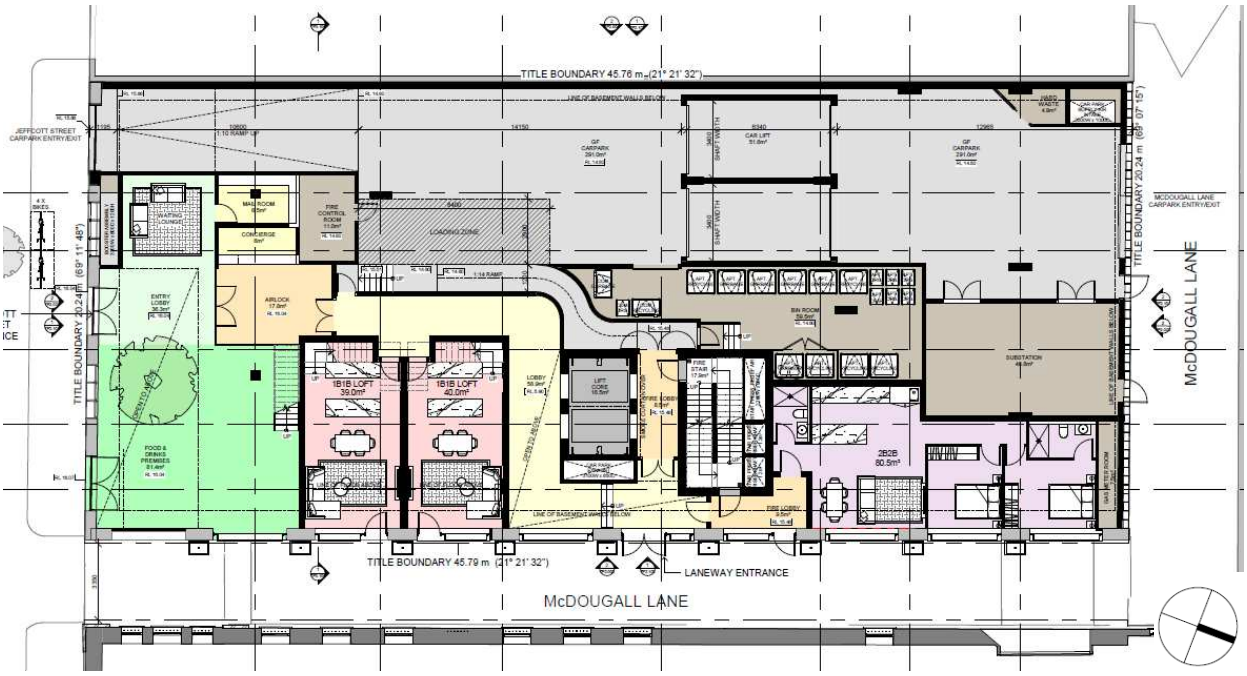


Figure 1: Ground floor plan of the proposed development

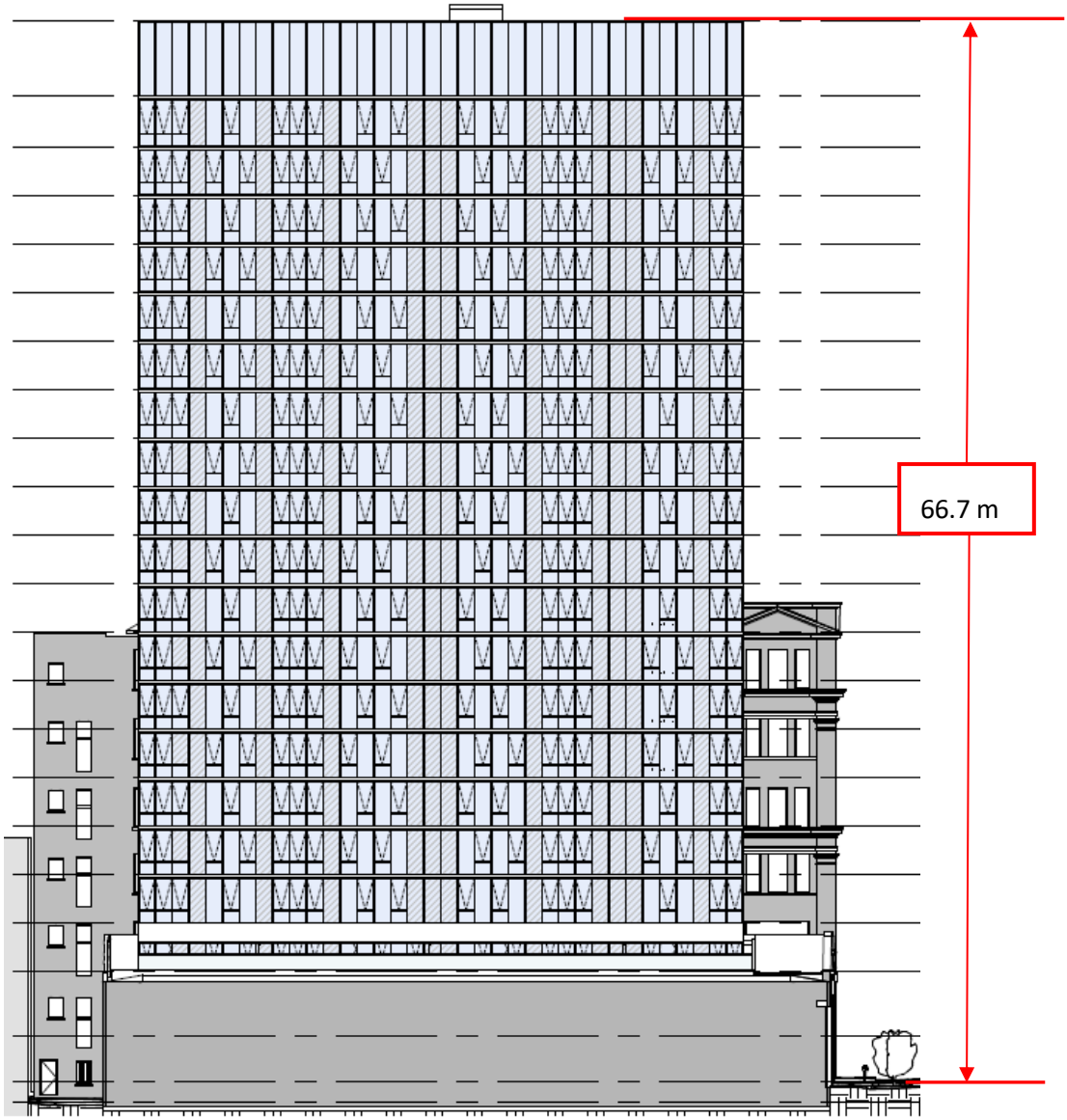


Figure 2: West Elevation of the proposed development

2 ANALYSIS APPROACH

In assessing whether a proposed development is likely to generate adverse wind conditions in ground level footpath areas, Vipac has considered 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 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 worst annual 3-second wind gust and mean velocity expected at that location. The location may be deemed generally acceptable for its intended use if the annual 3-second gust and mean velocity are within the threshold values noted in Section 2.5. Where Vipac predicts that a location may 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. Considering the points listed above in regards to the proposed development, it is Vipac's opinion that a desktop study provides sufficient prediction of the wind effects in the adjacent public pathways.

2.1 SITE EXPOSURE

The proposed development is located on terrain that slopes down to the west, surrounded within a 3.5 km radius by the high rise buildings of the Melbourne CBD from E to SE; and suburban housing, low rise retail and industrial surroundings for other directions. 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 3.5 for E through SE; and Terrain Category 3 for all other directions (Figure 3).

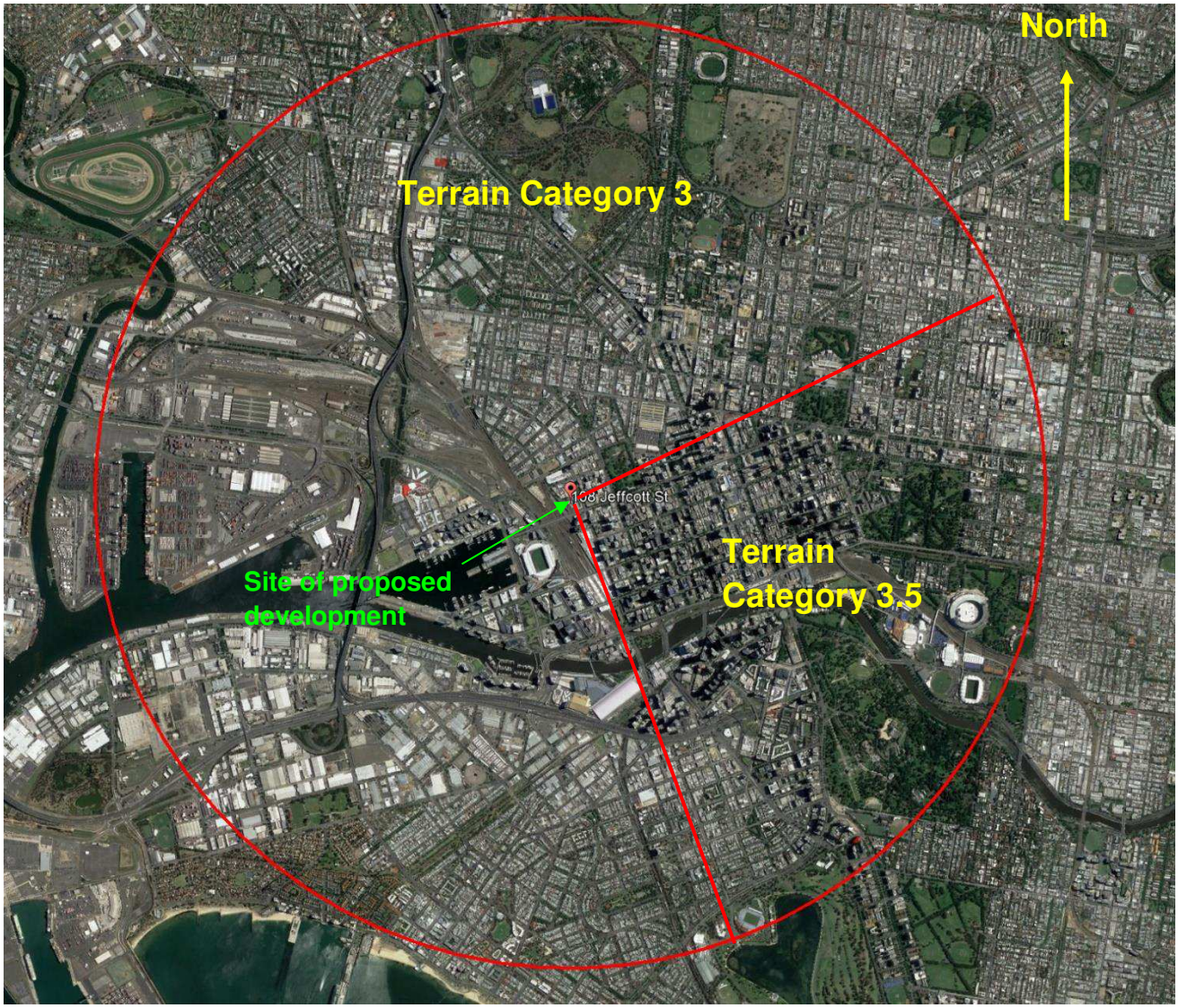


Figure 3: Assumed terrain roughness for wind speed estimation

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 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.

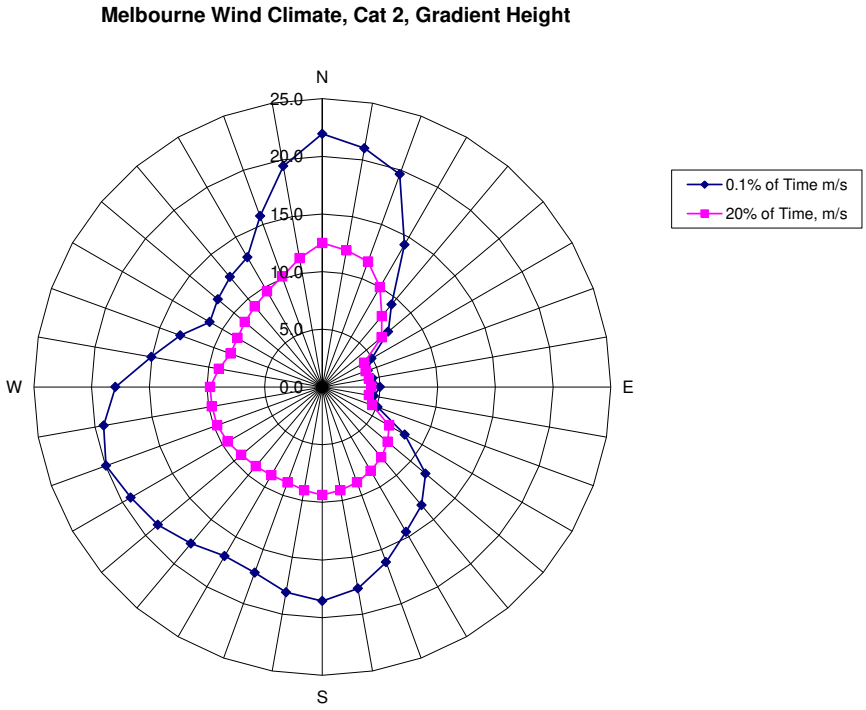


Figure 4: Directional Distribution of Mean Hourly Wind Velocities (m/s) for 0.1% and 20% exceeded at Gradient Height for Melbourne.

2.3 BUILDING GEOMETRY AND ORIENTATION

The proposed development has a rectangular plan, with the dimensions of approximately 20.2 m x 45.8 m shown in Figure 5. The long side runs perpendicular to Jeffcott Street. The proposed building is a 19 Storey residential building with retail at the ground floor. The roof height of the development is approximately 76.8 m above ground level (Figure 2).

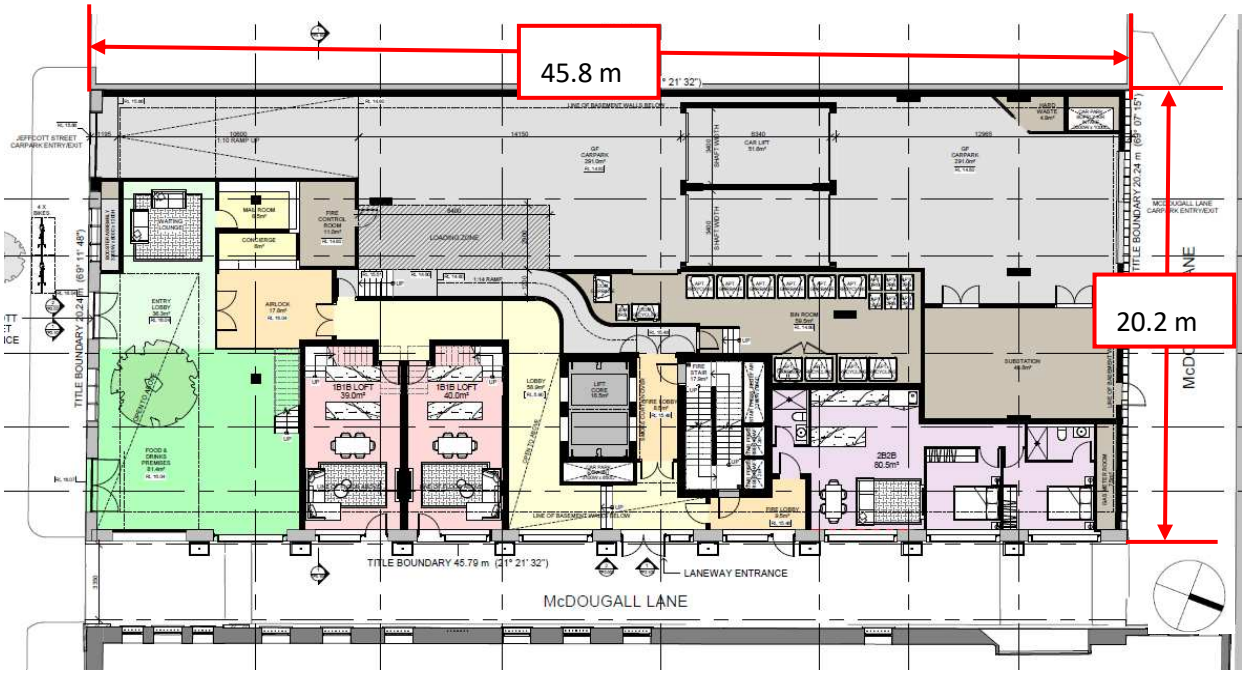


Figure 4: Ground level plan of the proposed development

2.4 FLOW INTERACTIONS WITH ADJACENT DEVELOPMENTS

The immediately adjacent developments are shown in Figure 6. There are existing 2 storey high buildings to the west of the development, with some tall developments (22F and 27F) to the north.

At the ground level, the proposed development is relatively shielded to winds approaching from all directions, except the south sector. However, the south direction is the third prevailing wind direction for Melbourne region (Figure 4).

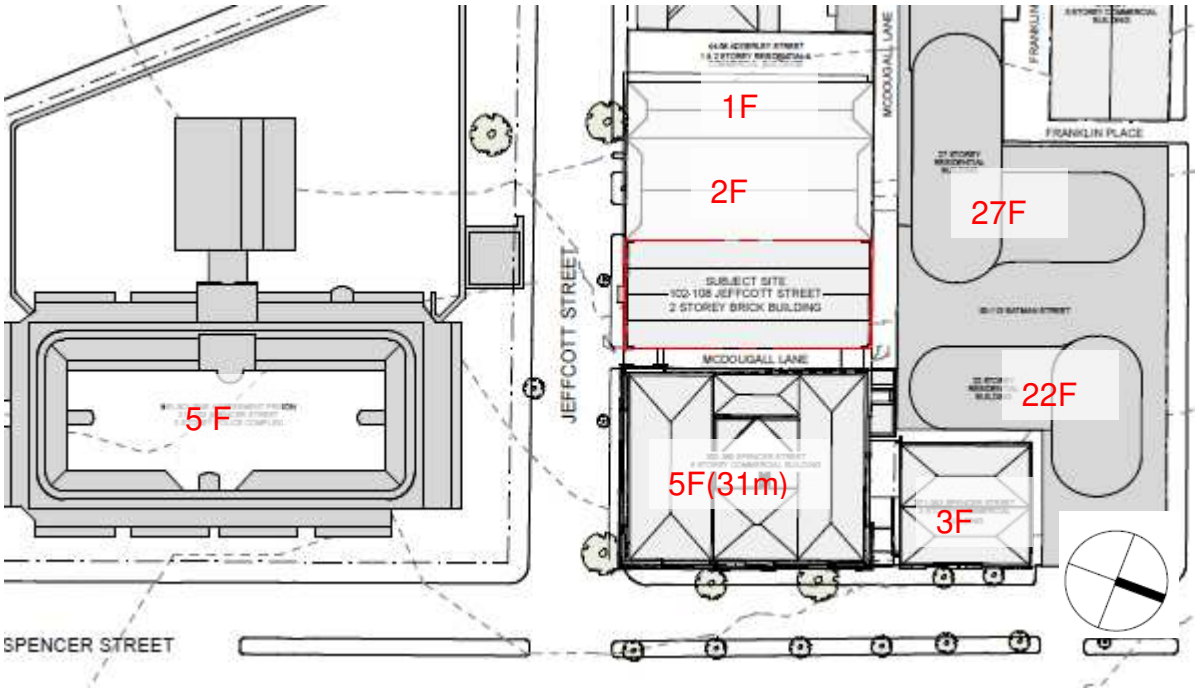


Figure 5: Immediately adjacent surroundings and their approximate number of storeys (F)

2.5 ASSESSMENT CRITERIA

The following set of wind criteria is applicable for new development in the Melbourne CBD and will be applicable for new developments in the upcoming amendments to the Better Apartments Design Standard. These criteria are listed in Table 1.

Table 1: Wind Criteria

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).

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.

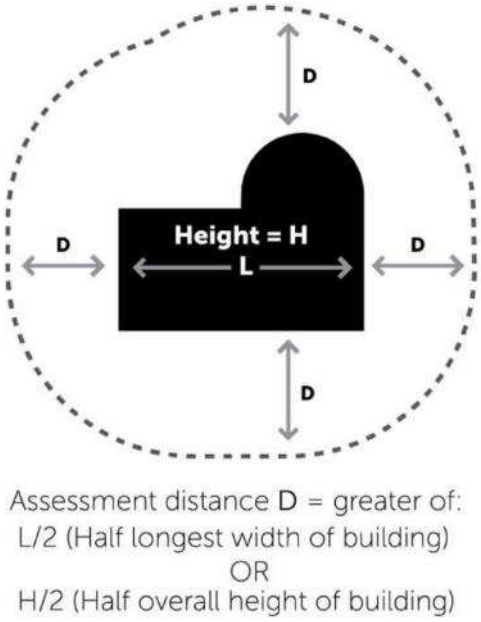


Figure 7: Assessment distance

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 (see Figure 8 to Figure 10).

Table 2: Recommended application of criteria

Area	Specific location	Recommended Criteria
Public Footpaths	Along the building frontage on Jeffcott St, Laneway and under croft	Walking
Building entrances	Entrances under croft	Standing
Seated areas	Open Yard （café seating）	Sitting
Terrace/Balcony	From Level 1 up, Roof deck	Walking (Refer to the discussion below)

Apartment Balcony/terrace Recommended Criterion Discussion

Vipac recommends as a minimum that apartment balconies, podium roof and rooftop tarrace 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.

Vipac wishes to state 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.

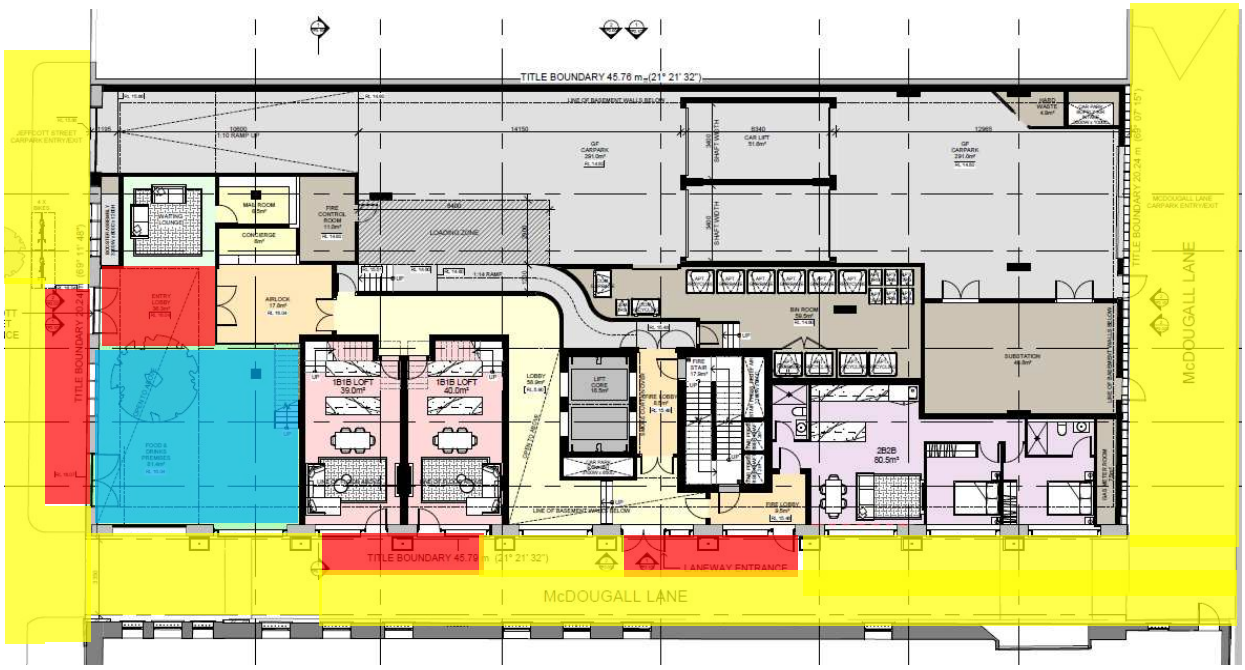


Figure 8: Ground level plan with recommended comfort criteria overlaid.

Figure 9: Level 1 private terraces with recommended comfort criteria overlaid.

Figure 10: Rooftop Deck with recommended comfort criteria overlaid.

3 PEDESTRIAN LEVEL WIND EFFECTS

3.1 DISCUSSION

Ground Floor

As the proposed building retains the existing heritage frontages and set back design from Jeffcott streetscape, the footpath on the Jeffcott Street would be expected to have wind conditions within the walking criterion. Due to the sheltering effects from the surrounding buildings, the footpath at the laneway would be expected to have wind conditions within the recommended walking criterion.

The entrances in Jeffcott Street and east laneway would be expected to fulfil the recommended standing comfort criterion.

The open courtyard at the ground floor would be expected to have sitting criterion due to the cover above.

Level 1 Terraces

The terraces at Level 1 would be expected to experience high downwash winds from west and north façades. There is a pergola with a specific roof proposed on west side which would be effective to protect these areas.

Rooftop Deck

The Rooftop Deck would be expected to have wind conditions within the recommended walking criterion with the proposed 4.7 m screen/parapet at the perimeter. These terraces would also likely fulfil more stringent criteria of standing/sitting.

Balconies General

Whilst wind conditions on the proposed apartment terraces/balconies will frequently be acceptable for outdoor recreation, during strong winds, conditions in these areas may exceed human comfort criteria. Balcony areas on similar developments in many major Australian capital cities typically experience similar elevated wind conditions. High exposure, corner acceleration flows and standing vortices would sometimes preclude these areas from use for outdoor recreation.

3.2 RECOMMENDATIONS

Vipac predicts that the pedestrian access at the ground floor and the level 1 balcony as well as rooftop terrace would be expected to have wind conditions within the recommended comfort criteria. As such, no recommendations have been made to alter the building form design regarding the pedestrian level winds.

However, it should be noted that this study is based on experience only and has not utilized any experimental data for the analysis.

Vipac recommends a scaled wind tunnel test be conducted to verify these predictions.

4 CONCLUSIONS

An appraisal of the likely wind conditions in the adjacent ground level areas of the proposed development **at 108 Jeffcott St, West Melbourne** 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, made calculations using empirical data and referred to past experience to produce our opinion of likely ground level wind conditions adjacent to the proposed development.

Vipac predicts that the pedestrian access at the ground floor and the level 1 balcony as well as rooftop terrace would be expected to have wind conditions with the recommended comfort criteria. As such, no recommendations have been made to alter the building form design regarding the pedestrian level winds.

As a general advice, educating occupants about wind conditions at open elevated terrace/balcony areas during high-wind events and tying down loose furniture on the terraces/balconies are highly recommended.

The recommendations and assessments provided in this report have been made based on empirical data and experience of similar situations in Melbourne and around the world.

Vipac recommends that wind tunnel testing be undertaken to verify these predictions and determine the optimum wind control measures wherever necessary.

This Report has been Prepared

For

Fusion Project Management Pty Ltd

By

VIPAC ENGINEERS & SCIENTISTS LTD.

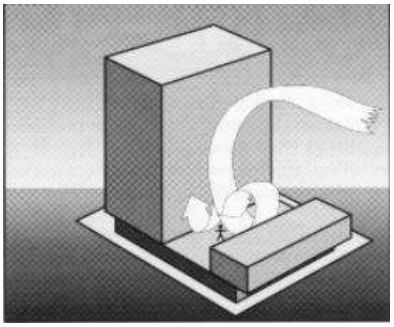
Appendix A: ENVIRONMENTAL WIND EFFECTS

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.

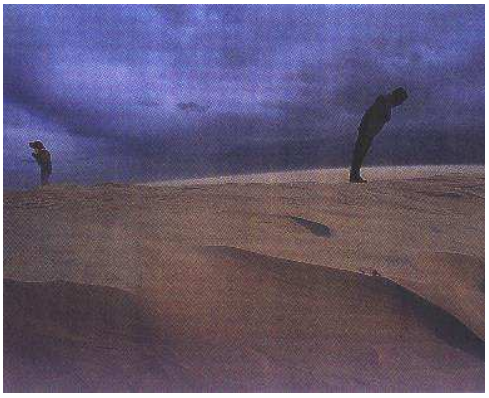


Corner Accelerations – when wind flows around the corner of a building it tends to accelerate in a similar manner to airflow over the top of an aeroplane wing.

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

Received date: 22/01/2021

TP - TOWN PLANNING SHEET LIST		
NO.	SHEET NAME	REV
TP0.000	COVER PAGE	A
TP0.001	DEVELOPMENT SUMMARY	A
TP0.002	DEVELOPMENT SUMMARY II	A
TP0.101	SITE CONDITIONS - EXISTING	A
TP0.102	STAGING DIAGRAM	A
TP1.001	EXISTING & DEMOLITION PLAN - BASEMENT 01-03	A
TP1.003	EXISTING & DEMOLITION PLAN - GROUND FLOOR	A
TP1.101	OVERALL PLAN - BASEMENT 03	A
TP1.102	OVERALL PLAN - BASEMENT 02	A
TP1.103	OVERALL PLAN - BASEMENT 01	A
TP1.104	OVERALL PLAN - GROUND	A
TP1.104A	OVERALL PLAN - MEZZANINE LEVEL	A
TP1.105	OVERALL PLAN - LEVEL 01	A
TP1.106	OVERALL PLAN - LEVEL 02	A
TP1.107	OVERALL PLAN - LEVEL 03	A
TP1.108	OVERALL PLAN - LEVEL 04	A
TP1.109	OVERALL PLAN - LEVEL 05	A
TP1.110	OVERALL PLAN - LEVEL 06	A
TP1.111	OVERALL PLAN - LEVEL 07	A
TP1.112	OVERALL PLAN - LEVEL 08	A
TP1.113	OVERALL PLAN - LEVEL 09	A
TP1.114	OVERALL PLAN - LEVEL 10	A
TP1.115	OVERALL PLAN - LEVEL 11	A
TP1.116	OVERALL PLAN - LEVEL 12	A
TP1.117	OVERALL PLAN - LEVEL 13	A
TP1.118	OVERALL PLAN - LEVEL 14	A
TP1.119	OVERALL PLAN - LEVEL 15	A
TP1.120	OVERALL PLAN - LEVEL 16	A
TP1.121	OVERALL PLAN - LEVEL 17	A
TP1.122	OVERALL PLAN - LEVEL 18	A
TP1.127	OVERALL PLAN - ROOF LEVEL	A
TP1.128	OVERALL PLAN - TOP ROOF LEVEL	A
TP2.001	HERITAGE ELEVATIONS - SOUTH	A
TP2.002	HERITAGE ELEVATIONS - NORTH	A
TP2.003	HERITAGE ELEVATIONS - EAST	A
TP2.004	HERITAGE ELEVATIONS - WEST	A
TP2.101	BUILDING ELEVATIONS	A
TP2.102	BUILDING ELEVATIONS	A
TP2.103	BUILDING ELEVATIONS	A
TP2.301	CARPARK SECTION	A
TP3.101	BUILDING SECTIONS	A
TP3.106	BUILDING SECTIONS	A
TP5.001	EXISTING SHADOW DIAGRAMS	A
TP5.002	EXISTING SHADOW DIAGRAMS	A
TP5.003	PROPOSED SHADOW DIAGRAMS	A
TP5.004	PROPOSED SHADOW DIAGRAMS	A
TP6.117	OVERALL SECTION - INDICATING VIEWS INTO PRISON COURTYARD	A
TP6.118	DETAILED SECTIONS - INDICATING VIEWS INTO PRISON COURTYARD	A