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Vipac Engineers & Scientists

Piedimonte Developments Pty Ltd

27-45 Best Street, Fitzroy

Wind Impact Statement

30N-19-0099-TRP-6761546-1

24 May 2019

Report Title: Wind Impact Statement **Job Title: 27-45 Best Street, Fitzroy**	
DOCUMENT NO: 30N-19-0099-TRP-6761546-1 **PREPARED FOR:** Piedimonte Developments Pty Ltd 27-49A Best Street, North Fitzroy **CONTACT:** Darren Woolf **Tel:** +61 417 312 266 **Fax:**	**REPORT CODE:** TRP **PREPARED BY:** Vipac Engineers and Scientists Limited 279 Normanby Rd, Port Melbourne, VIC 3207, Australia **Tel:** +61 3 9647 9700 **Fax**: +61 3 9646 4370

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KEYWORDS:

EXECUTIVE SUMMARY

Piedimonte Developments Pty Ltd commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the publically accessible areas adjacent to the proposed development at **27-45 Best Street, Fitzroy.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed development were provided by **Jackson Clements Burrows Architects** in **May 2019**. The findings of this study can be summarized as follows:

- With the proposed design, the ground level footpaths and pedestrian access ways would be expected to have wind levels within the walking comfort criterion;
- With the proposed design, the wind conditions near the residential lobbies and retail store entrance areas would be expected to be within the recommended standing comfort criterion.
- With the proposed design, the alfresco dining areas on the first floor would be expected to be within the recommended sitting criterion.
- With the proposed design **and recommended 1.5m balustrade height**, the wind conditions at high level terraces 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 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 detailed experimental validation may not account for all complex flow scenarios in the vicinity.

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1 INTRODUCTION

Piedimonte Developments Pty Ltd commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the publically accessible areas adjacent to the proposed development at **27-45 Best Street, Fitzroy.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

The proposed development is bounded by Scotchmer Street to the North, Best Street to the East, Egremont Street to the west, and existing development to the south (see Figure 1). The proposed development comprises of two residential buildings (7 and 5 stories) with a commercial podium (see Figure 2). The surrounding developments, within a 2km radius, are a mixture of suburban dwellings, mid-rise residential developments, park lands and light industrial areas

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 **Jackson Clements Burrows Architects** in **May 2019** as listed in Appendix C of this report.

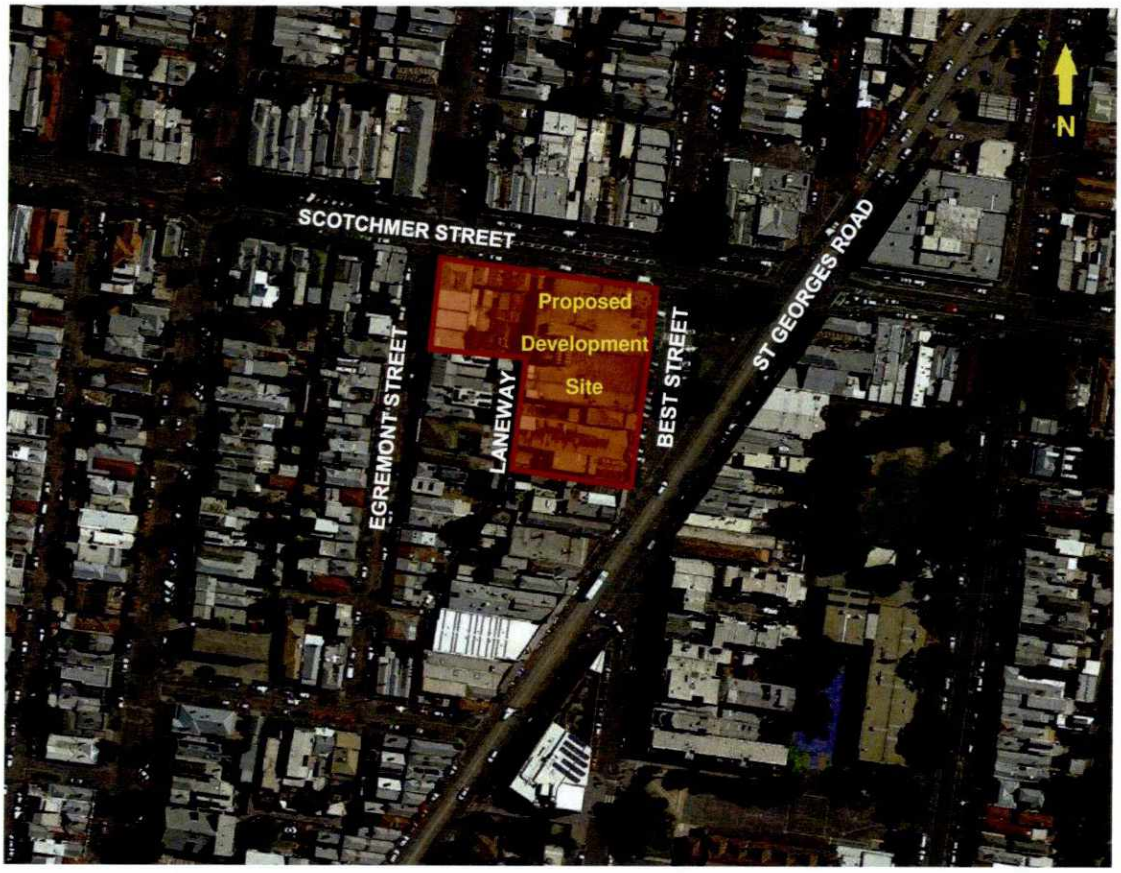


Figure 1: Aerial view of the proposed development site at 27-45 Best Street, Fitzroy.

Figure 2: North Elevations 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.

2.1 SITE EXPOSURE

The proposed development is predominantly surrounded within a 2 km radius by a mix of suburban dwellings, midrise office, parklands and light industrial warehouses. Considering the immediate surroundings and terrain, the site of the proposed development is assumed to be within Terrain Category 3 for all wind directions [1] (see Figure 3).

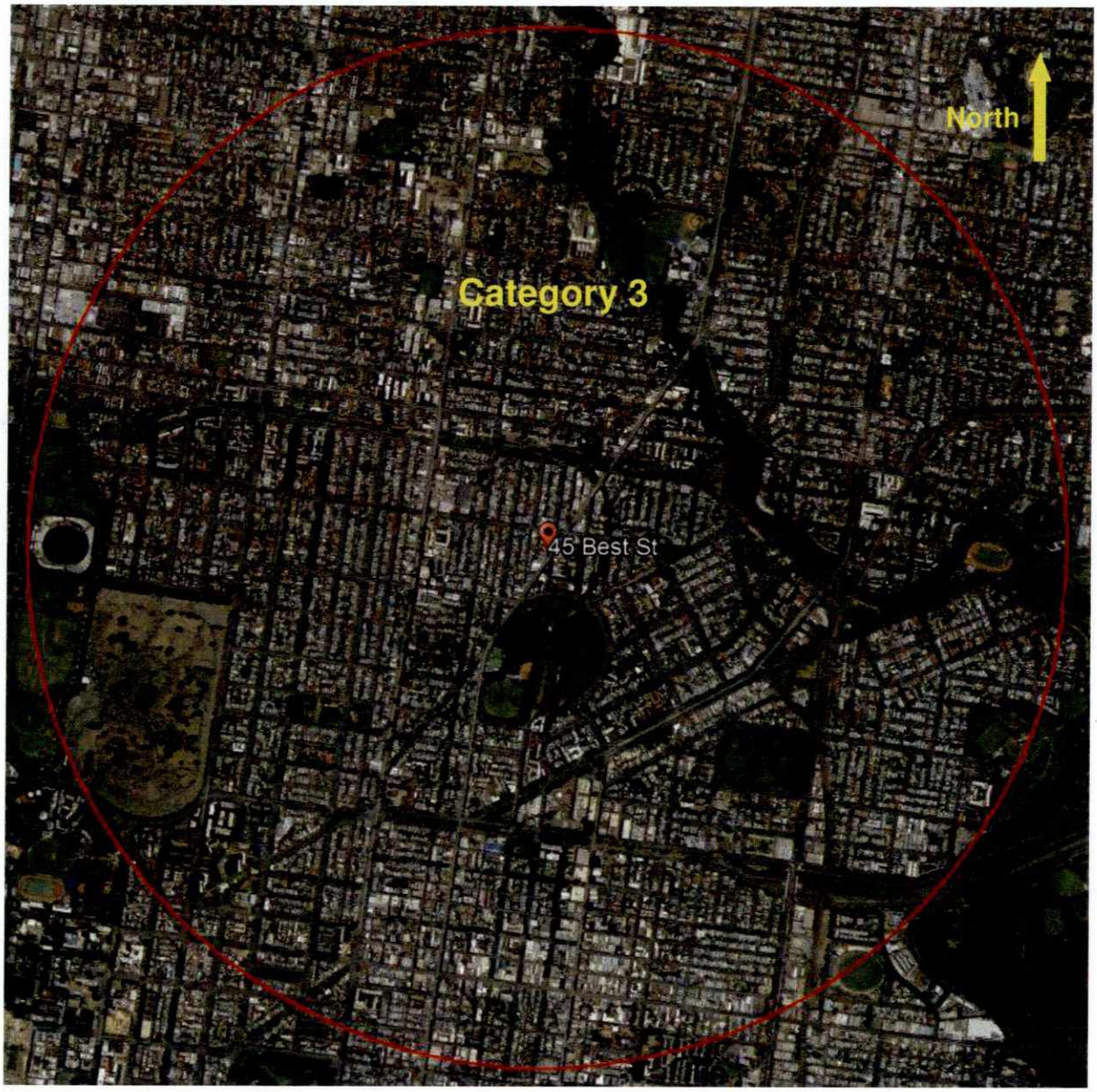


Figure 3: Assumed terrain categories for wind speed estimation.

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 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.

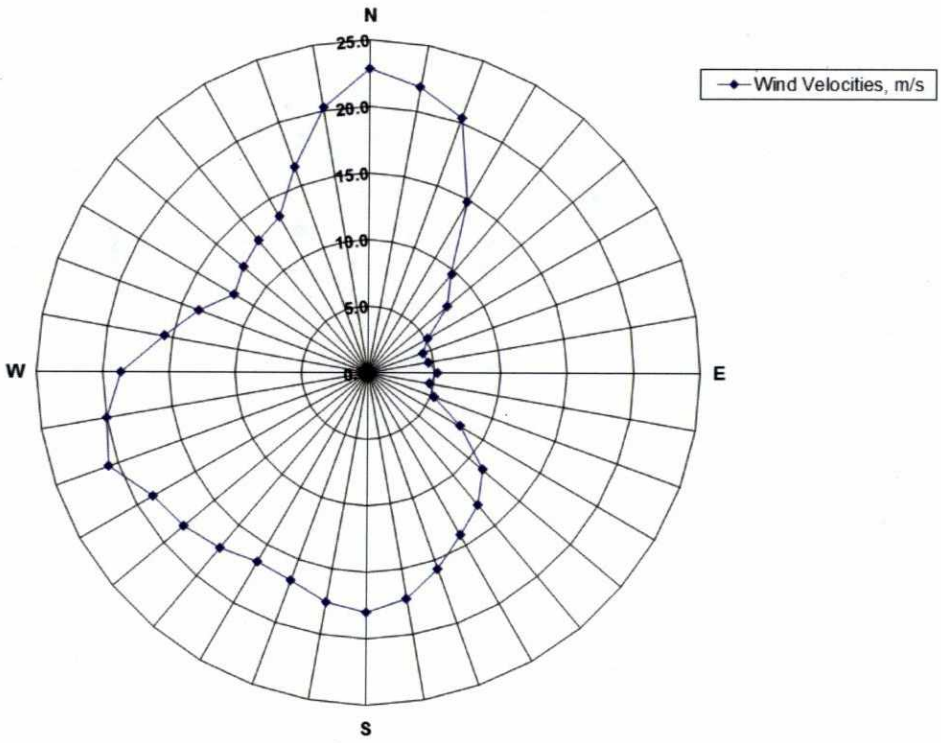


Figure 4: Directional Distribution of Annual Return Period Maximum Mean Hourly Wind Velocities (m/s) at gradient height of 500m in Melbourne.

2.3 BUILDING GEOMETRY AND ORIENTATION

The proposed development comprises of two residential buildings (7 stories and 5 stories) with retail elements in the podium. The towers have a height of approximately 25 m and 17 m. The overall plan-form dimensions are approximately 77 m x 68m with the long axis running from the west to the east (Figure 5).

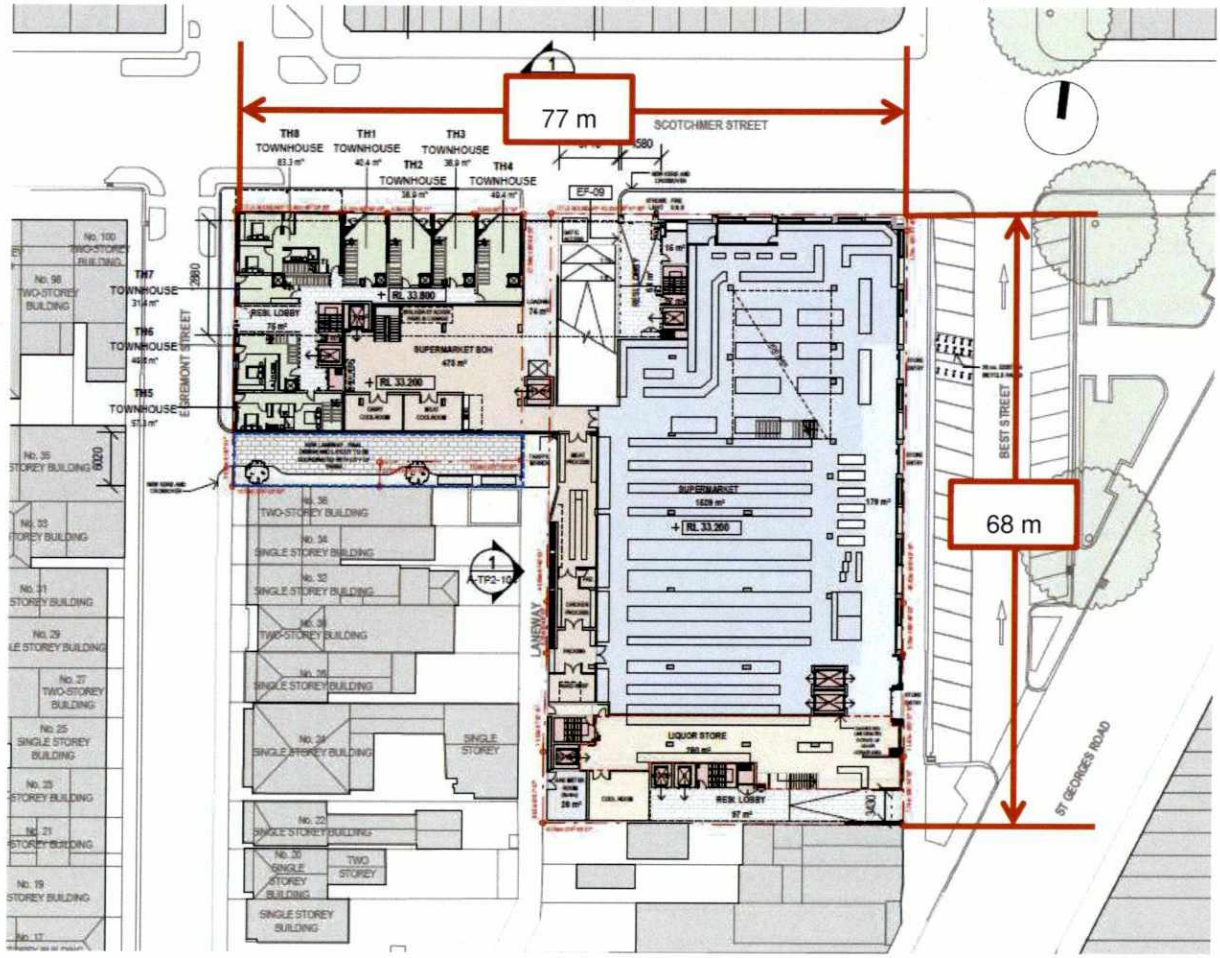


Figure 5: Ground Level Plan of the proposed development.

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. The prevailing winds are from the North and South West. The ground level areas are well sheltered by neighbouring buildings for south-westerly winds; however the ground level is relatively exposed to northerly winds channelling along St Georges Road, which are expected to possess high mean velocities.

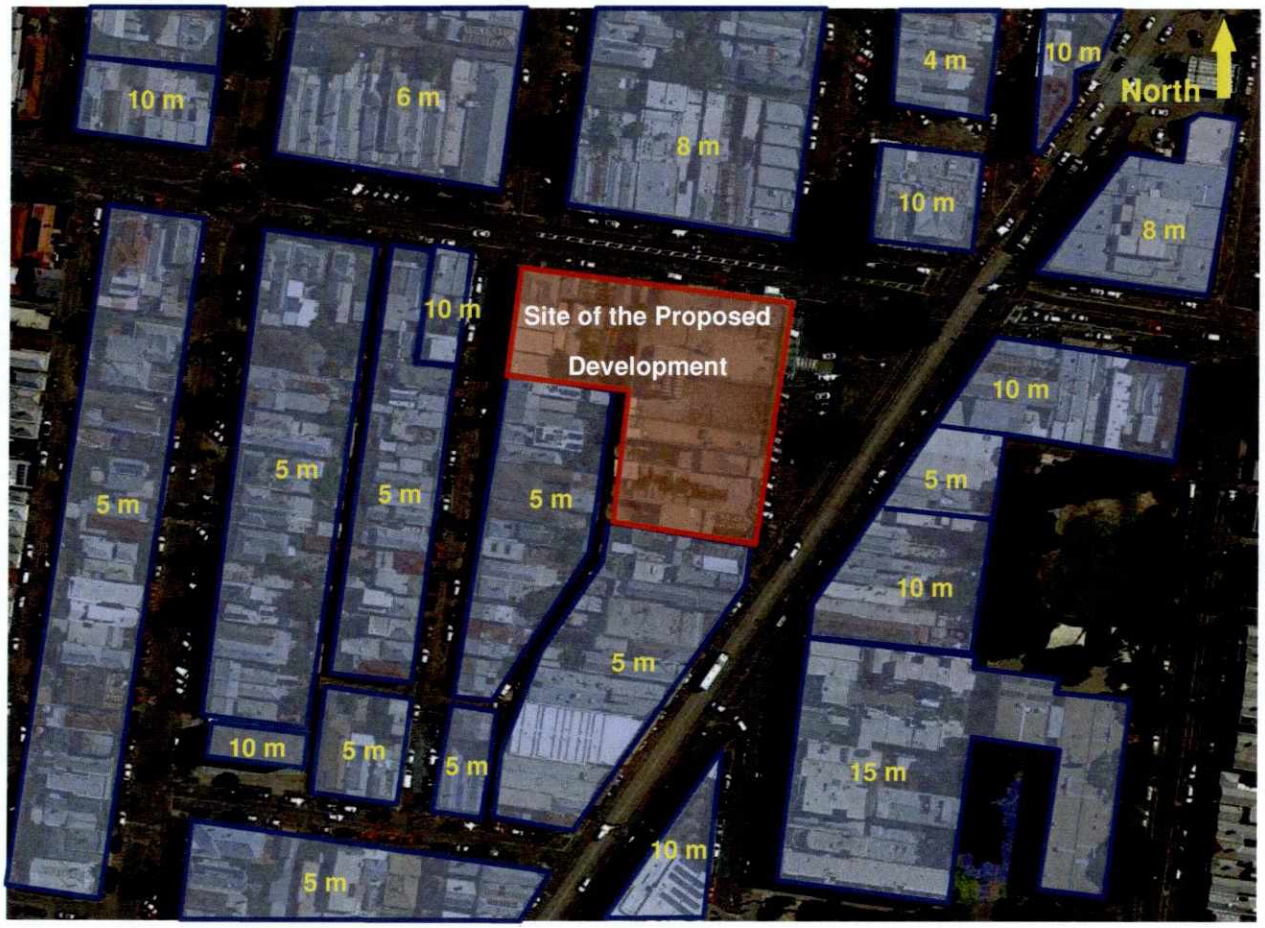


Figure 6 : Immediately adjacent buildings and their approximate buildings heights in meters (m) overlaid

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

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 5: Recommended application of criteria

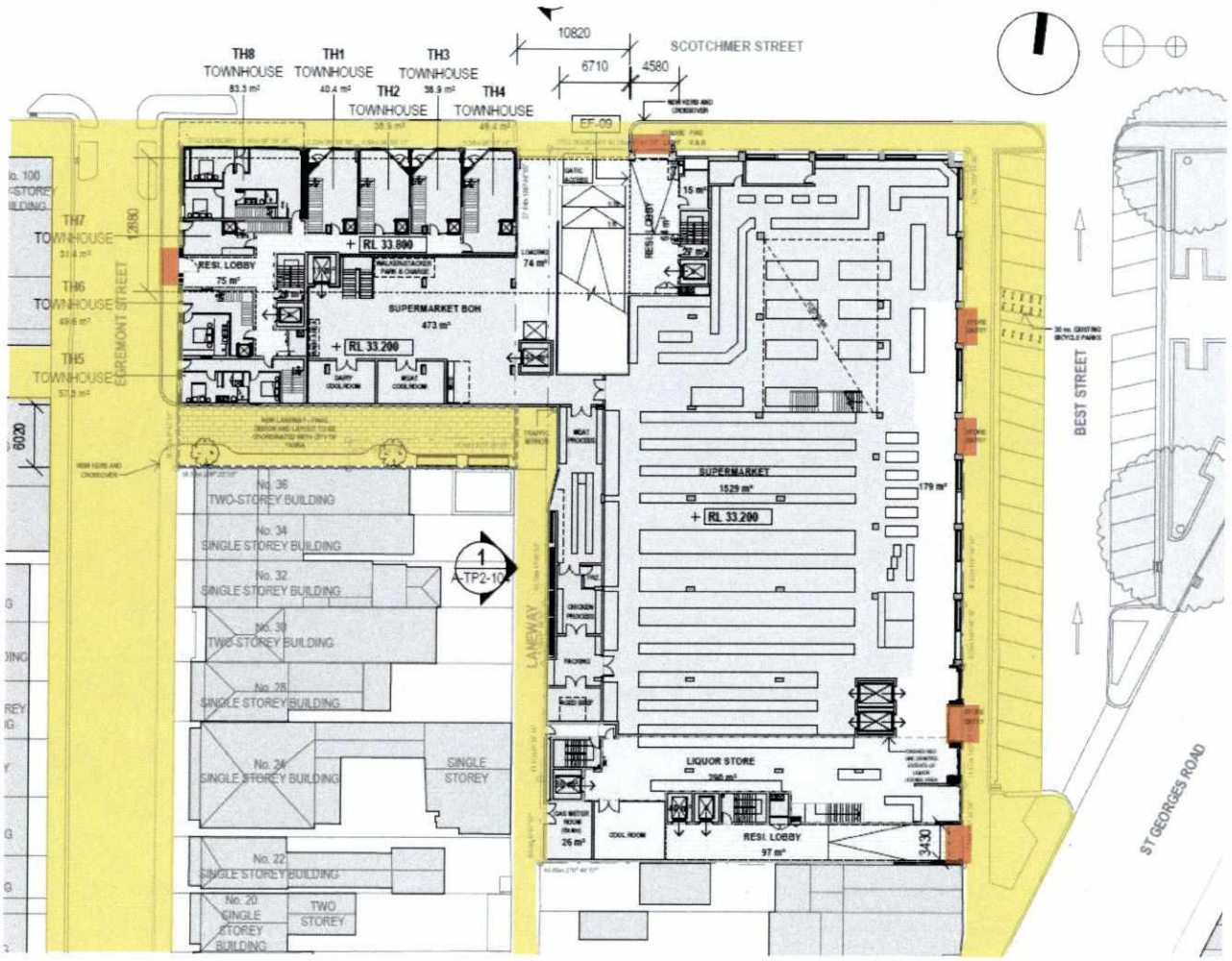
Area	Specific location	Recommended Criteria
Public Footpaths and Access ways	Along Scotchmer Street, Egremont Street, Best Street, and the pedestrian pathway ways in the surrounding area (Figure 7).	Walking
Main Building entrances	Residential Lobby at Egremont Street, Scotcher Street and Best Street, as well as the Store Entrances along Best Street (Figure 7).	Standing
Outdoor Dining Areas	On the first floor east facing balcony (Figure 8).	Sitting
Communal Terraces	Communal Terraces on the Roof Level (Figure 9).	Walking (see discussion below)

2.6.1 ROOFTOP AREAS RECOMMENDED CRITERION DISCUSSION

Vipac recommends as a minimum that rooftop terrace areas meet the criterion for walking since:

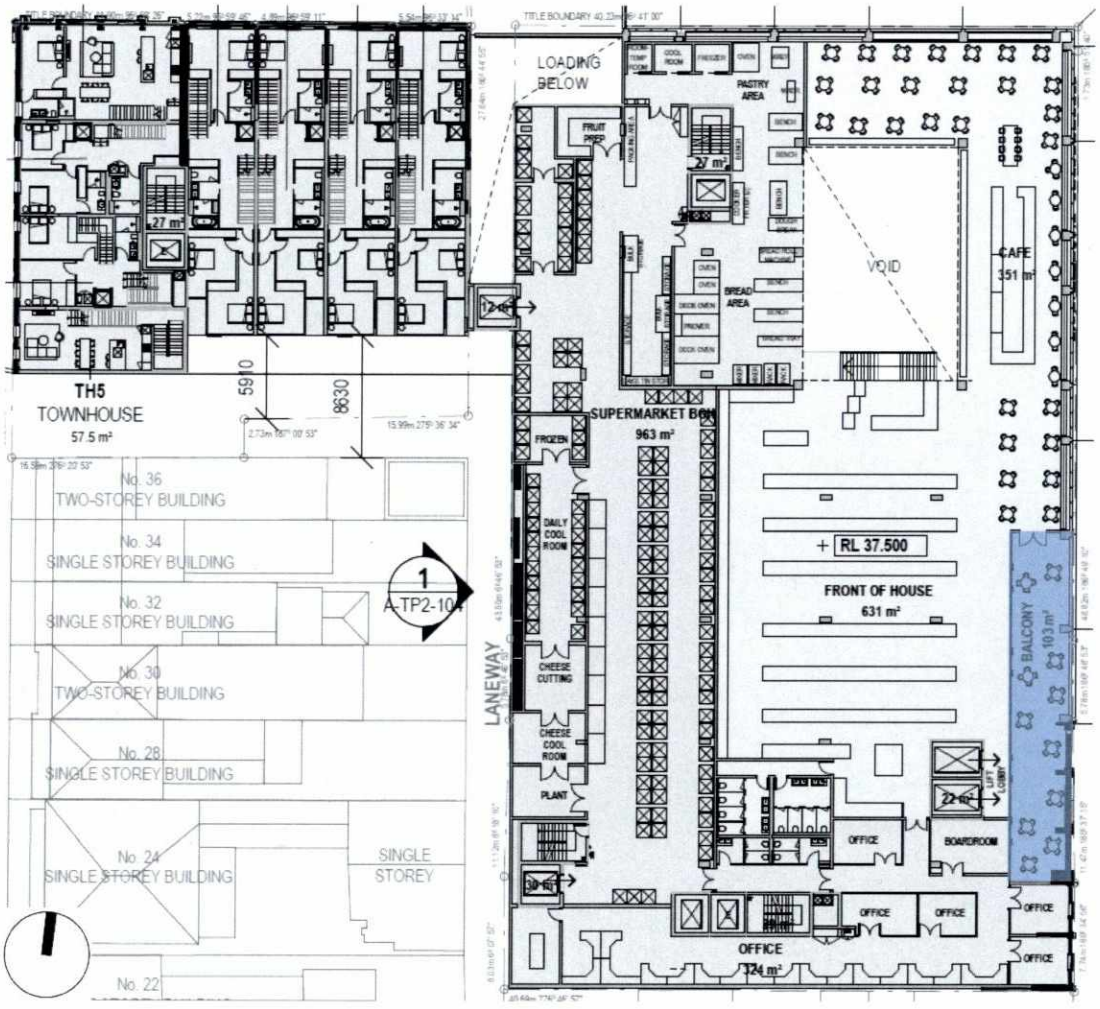
- these areas are not public spaces;
- the use of these areas is optional;
- many similar developments in Melbourne and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.

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.



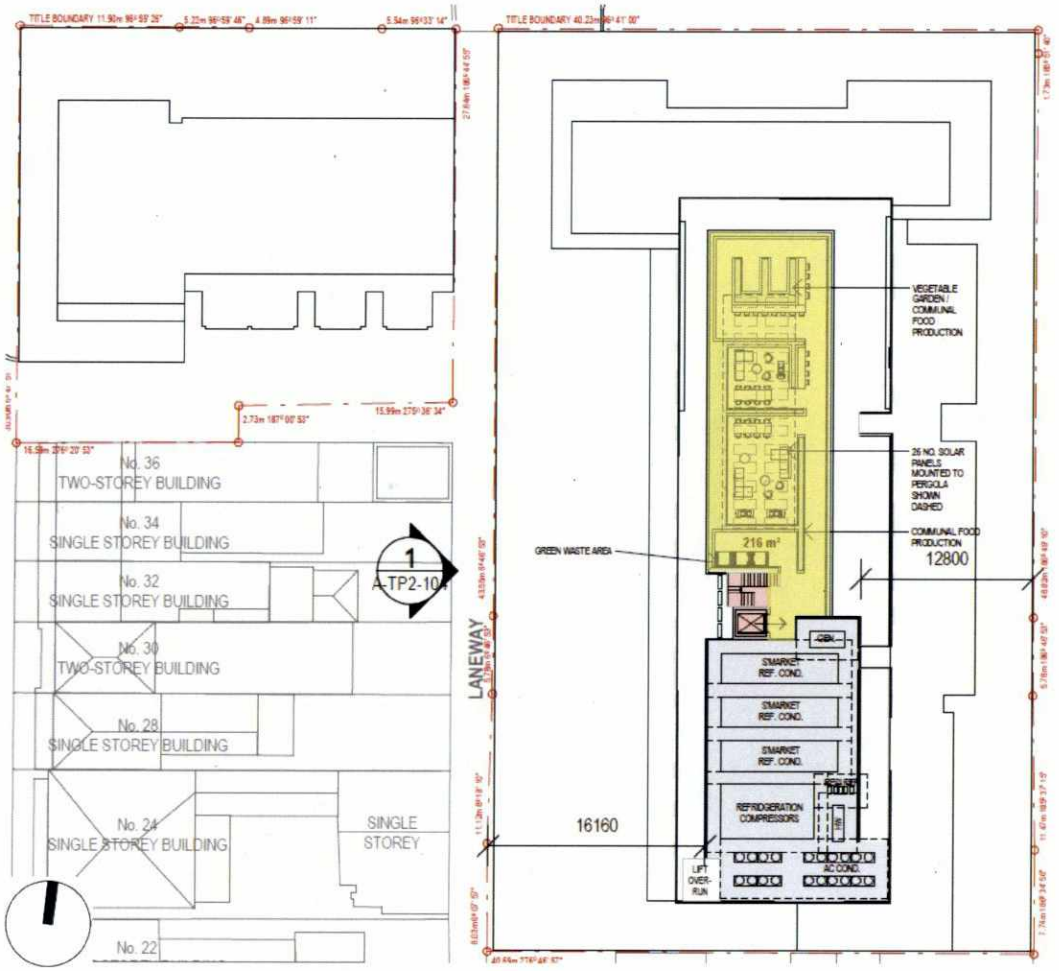
Recommended to fulfil Walking Recommended to fulfil Standing

Figure 7: Plan of the Ground level of the proposed development with the recommended comfort criterion overlaid



Recommended to fulfil Sitting

Figure 8: Plan of the Level 1 of the proposed development with the recommended comfort criterion overlaid



Recommended to fulfil Walking

Figure 9: Plan of the Roof Level 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 comprises of two residential buildings, 26 m and 17 m high respectively. Due to its orientation and its overall height above the surrounding area, the proposed development is expected to generate adverse wind conditions at the north-eastern and north-western corners on the ground floor. However, the 3.8 m setback of the eastern tower and 6.9 m setback of the western tower from Scotchmer Street, as well as the canopy around the north-eastern corner is expected to ameliorate adverse northerly winds such that these areas meet the recommended walking comfort criterion. As such, the wind conditions at public pedestrian footpaths along Best Street, Scotchmer Street, Egremont Street, the laneway and the surrounding areas are expected to be within the recommended wind comfort criterion of walking.

The retail store entrances along Best Street are under the 1.8 m deep canopies, and setback behind columns. As such, the wind levels at the retail store entrances are expected to be within the recommended standing comfort criterion.

The residential lobby on Best street is setback from the façade line above; the residential lobby along Scotcher Street is beneath a canopy; and the residential lobby on Egremont Street is shielded by the proximity of the surrounding buildings. As such, the residential lobbies are expected to be within the recommended wind comfort criterion of standing

First Level Balcony

The proposed development features an open air alfresco dining area on the east facing balcony on the first floor. This terrace is shielded by the level above, as well a 1.1 m high balustrade. This balcony is expected to be within the recommended sitting comfort criterion.

Roof Level Communal Terrace

The communal terrace is located on the roof level of the eastern residential tower and is approximately 26 m above street level. This communal terrace features a pergola above seating areas as well as a community vegetable garden. Due to its height above the surrounding area, this area is exposed to direct adverse wind conditions above the recommended walking comfort criterion. As such, 1.5 m high balustrades are recommended to shield the outdoor areas from adverse winds (Figure 10).

Balconies General

Whilst wind conditions on the proposed apartment balconies will frequently be acceptable for outdoor recreation, during moderate to 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. As a general statement, educating residents about wind conditions at high-level balconies and terraces areas during high-wind events is also recommended. Additionally, tying down loose lightweight furniture is highly recommended.

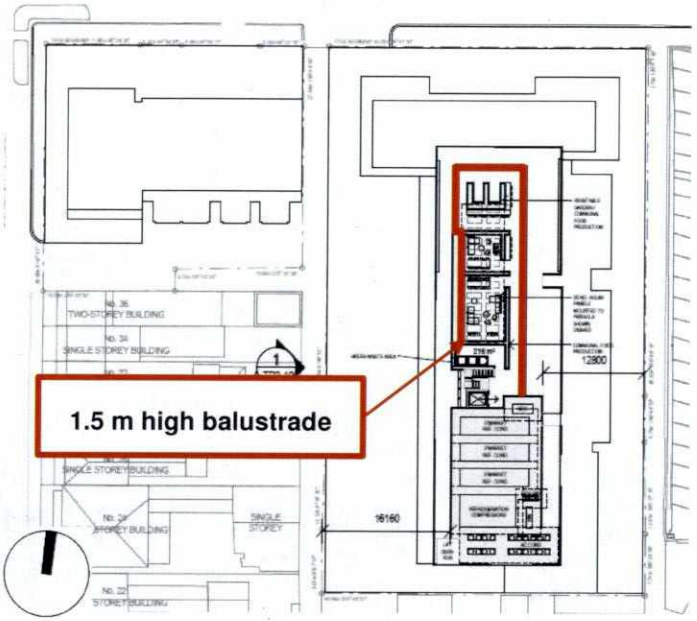


Figure 10: Plan of the Roof Level of the proposed development with the recommended wind control measures

4 CONCLUSIONS

An assessment of the likely wind conditions at pedestrian level of the proposed development of **27-45 Best Street, Fitzroy** 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. Based on this assessment, the following conclusions are drawn:

- With the proposed design, the ground level footpaths and pedestrian access ways would be expected to have wind levels within the walking comfort criterion;
- With the proposed design, the wind conditions near the residential lobbies and retail store entrance areas would be expected to be within the recommended standing comfort criterion.
- With the proposed design, the alfresco dining areas on the first floor would be expected to be within the recommended sitting criterion.
- With the proposed design **and recommended balustrade height increases**, the wind conditions at high level terraces 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 detailed experimental validation may not account for all complex flow scenarios in the vicinity.

This Report has been Prepared

For

Piedimonte Developments 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

Drawings Received: May 2019

DRAWING REGISTER

DRAWING NUMBER	DRAWING TITLE	SCALE	REV
TP SERIES			
A-TP0-001	COVER PAGE		01
A-TP0-002	SURVEY	1 : 500	01
A-TP0-101	GROUND FLOOR PLAN - EXISTING	1 : 500	01
A-TP0-102	FIRST FLOOR PLAN - EXISTING	1 : 500	01
A-TP0-103	ROOF PLAN - EXISTING	1 : 500	01
A-TP0-111	GROUND FLOOR PLAN - DEMOLITION	1 : 500	01
A-TP0-112	FIRST FLOOR PLAN - DEMOLITION	1 : 500	01
A-TP0-113	ROOF PLAN - DEMOLITION	1 : 500	01
A-TP0-201	NORTH ELEVATION - EXISTING	1 : 250	01
A-TP0-202	SOUTH ELEVATION - EXISTING	1 : 250	01
A-TP0-203	EAST ELEVATION - EXISTING	1 : 250	01
A-TP0-204	WEST ELEVATION - EXISTING	1 : 250	01
A-TP0-211	NORTH ELEVATION - DEMOLITION	1 : 250	01
A-TP0-212	SOUTH ELEVATION - DEMOLITION	1 : 250	01
A-TP0-213	EAST ELEVATION - DEMOLITION	1 : 250	01
A-TP0-214	WEST ELEVATION - DEMOLITION	1 : 250	01
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A-TP1-101	BASEMENT 02 PLAN	1 : 500	01
A-TP1-102	BASEMENT 01 PLAN	1 : 500	01
A-TP1-103	GROUND FLOOR PLAN	1 : 500	01
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DRAWING REGISTER

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A-TP3-101	SECTION BB	As indicated	01
A-TP3-102	SECTION CC	As indicated	01
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