



PEDESTRIAN WIND ENVIRONMENT STATEMENT

BRANDON PARK MIXED-USE, FERNTREE GULLY RD,
WHEELERS HILL

WF976-01F02(REV1)- WS REPORT

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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of Brandon Park Mixed-Use, Ferntree Gully Rd, located in Wheelers Hill, on the local wind environment at the critical outdoor areas within and around the subject site. The effect of wind activity has been examined for the three predominant wind directions for the region, namely the northerly, southerly, and westerly winds. The analysis of the wind effects relating to the proposed development have been carried out in the context of the local wind climate, building morphology and land topography.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the latest architectural drawings. No wind tunnel testing has been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection of the architectural drawings provided (received 5 November 2021). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this assessment indicate that the development has incorporated several design features and wind mitigating strategies and is expected to be suitable for the intended use for the majority of the outdoor trafficable areas. However, there are some areas that are likely to be exposed to stronger winds. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

- Ground level trafficable areas:
 - Retention of the building set-back from Brandon Park Drive.
 - Retention of existing tree planting along Brandon Park Drive
 - Retention of proposed tree planting along Brandon Park Drive and Ferntree Gully Road.
 - Retention of the proposed awning over the medical centre entrances.
- Common Open Spaces (Level 2 and 4 of the Mixed-use Building):
 - Retention of recessed design for the Common Outdoor Area and Landscaped Area
- Common Open Spaces (Level 6 and Level 7 of the Residential Building):
 - Retention of proposed densely foliating evergreen tree planting throughout the Tenant Amenities and Landscaped areas.
 - Increasing the impermeable parapet/balustrade height of the Tenant Amenities and Landscaped areas to 2m.
- Private Balconies and Courtyards (Mixed-use Building – Eastern Aspect):
 - Inclusion of full-height porous/impermeable end screens

- Private Balconies and Courtyards (Residential Building):
 - Inclusion of full-height porous/impermeable end screens.
 - Limit corner balcony extents to only one aspect of the apartment.

With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety. Nonetheless, wind tunnel testing is recommended to be undertaken at a more detailed design to quantitatively assess the wind conditions and to optimise the size and extent of the treatments required.

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INTRODUCTION

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development has been carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is located on the corner of Ferntree Gully Road and Brandon Park Drive, and is bounded Brandon Park Shopping Centre to the south and west. The buildings surrounding the subject development are predominately low-rise residential and commercial buildings, with a few mid-rise commercial and apartment buildings to the north and east.

A survey of the land topography indicates a gradual slope downwards towards the south, however, there are no major elevation changes in the area immediately surrounding the site.

An aerial image of the subject site and the local surroundings is shown in Figure 1, with the frequency and magnitude of the prevailing winds superimposed for each wind direction.

The existing site consists of 1-2 storey commercial buildings. The proposed mixed-use development is 7 storeys high. The proposed residential development is 9 storeys high.

The critical outdoor trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are listed as follows:

- Ground Level areas and pedestrian footpath.
- Communal Open Spaces.
 - Communal Outdoor Area (Mixed-use building – Level 2)
 - Landscaped Area (Mixed-use building – Level 4)
 - Tenant Amenities Area (Residential building – Level 6)
 - Landscaped Area (Residential building – Level 7)
- Private balconies and terraces.

Legend

- Line thickness represents the magnitude of the regional wind from that direction
- Line length represents the frequency that the regional wind occurs for that direction



Figure 1: Aerial Image of the Site Location and Prevailing Wind Directions

3 REGIONAL WIND

The Melbourne region is governed by three principal wind directions that can potentially affect the subject development. These winds prevail from the north, south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological station located at Melbourne Airport by the Bureau of Meteorology (recorded from 1970 to 2009). The data has been corrected to represent winds over standard open terrain at a height of 10m above ground level. The results of this analysis are presented in Figure 2 in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also shown in Figure 2.

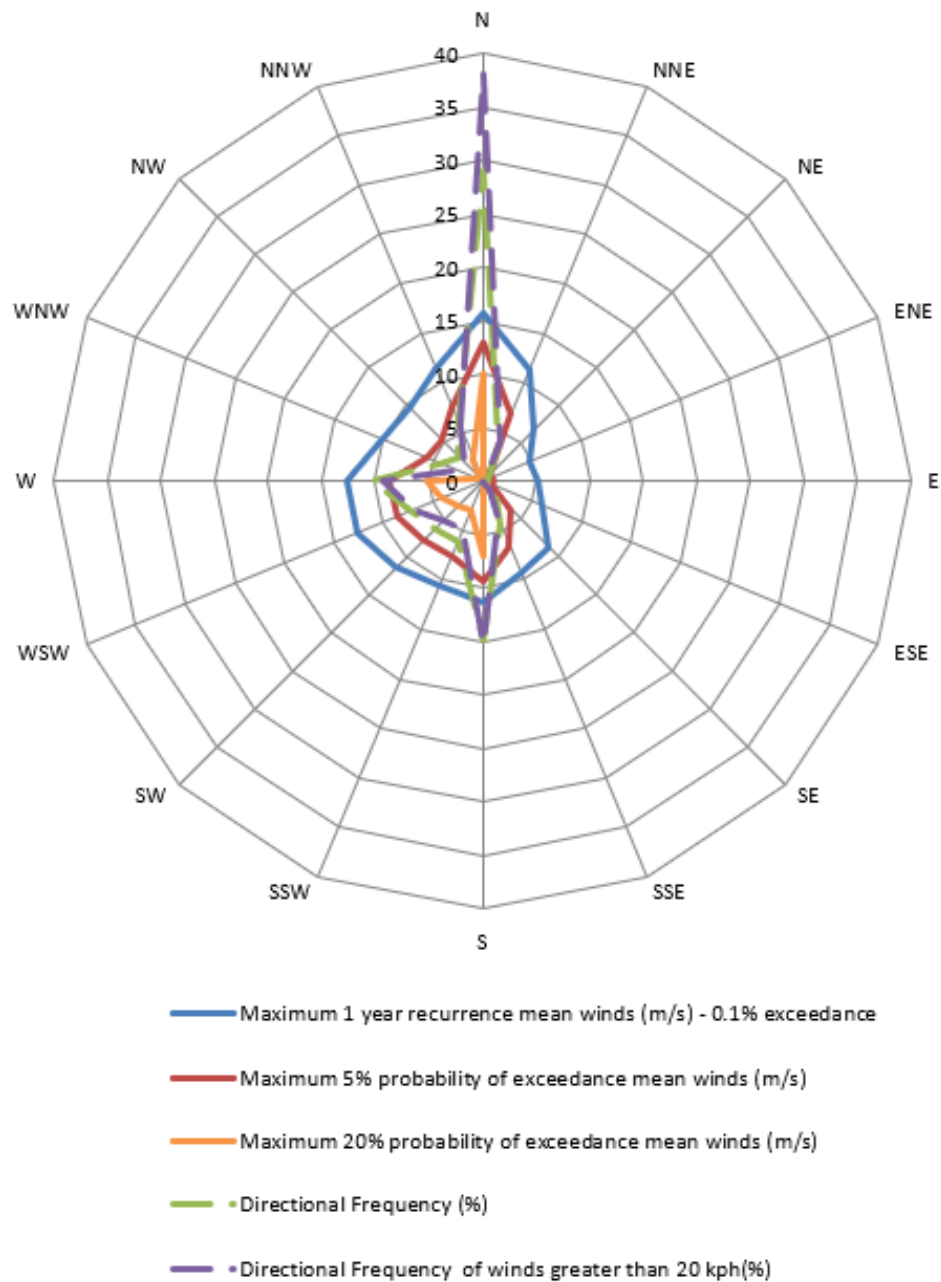


Figure 2: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Melbourne Region

4 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking, or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

It should be noted that wind speeds affecting this particular development can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

RESULTS AND DISCUSSION

The expected wind conditions affecting the development are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report. A glossary of the different wind effects described in this report included in Appendix A.

For this assessment, the wind speed criteria for pedestrian comfort that are considered are listed as follows:

- Walking Criterion (5m/s with a 20% probability of exceedance)
for general circulation and pedestrian thoroughfares, e.g. footpaths, private balconies/terraces, through-site links etc.
- Standing Criterion (4m/s with a 20% probability of exceedance)
for stationary activities generally less than an hour, e.g. waiting areas, communal terraces, main entries, café seating etc.
- Sitting Criterion (3m/s with a 20% probability of exceedance)
for stationary activities longer than an hour, e.g. outdoor cinemas, outdoor fine dining etc.

Although this assessment is qualitative in nature, the abovementioned criteria for pedestrian comfort are considered when assessing the wind environment impacts. However, all areas are also assessed with consideration to a pedestrian safety criterion of 20m/s for the annual maximum gust.

5.1 Ground Level Areas

The pedestrian footpath along Ferntree Gully Road, located to the north of the site, is subject to the northerly and westerly prevailing winds. Northerly winds have the potential to downwash off the proposed development, adversely impacting the wind conditions of the footpath. Additionally, the westerly winds are expected to side-stream along the northern aspect of the proposed building, also adversely impacting the wind conditions of the footpath. To ameliorate the wind's effect on pedestrian comfort, incorporating densely foliating evergreen tree planting along the northern aspect of the site is recommended. The entrance to the resident lobby of the residential building is expected to be protected from the prevailing winds due to its recessed design. The proposed air locks are also expected to mitigate the winds through the carpark affecting the residential lobby.

The pedestrian footpath along Brandon Park Drive, located to the east of the site, is subject to the northerly and southerly prevailing winds. Both the northerly and southerly winds have the potential to side-stream along the eastern aspect of the proposed buildings, adversely affecting the wind conditions of the footpath. The southerly winds are also expected to downwash off the southern aspect and side stream to the east reattaching at Brandon Park Drive. The proposed stepped façade is expected to provide less of a downwash surface and reduce the amount of downwash impacting Brandon Park Drive. The building set-back from the footpath is expected to reduce the severity of the prevailing winds. Retention of the existing densely foliating evergreen trees is also expected to help mitigate the effects of the prevailing winds.

Proposed airlocks at the entrances to the commercial and serviced apartments lobbies of the mixed-use building are expected to inhibit the wind entry from the prevailing winds. The Medical Centre entrances of the mixed-use building, located to the east of the site, are subject to the northerly and southerly prevailing winds. Both the northerly and southerly winds have the potential to side-stream along the eastern aspect of the proposed building, adversely affecting the wind conditions of the entrances. Southerly winds also have the potential to downwash onto the entrances. The proposed awning over the Medical Centre entrances is expected to hinder the prevailing winds impact on the area. Retention of the existing densely foliating evergreen trees is also expected to help mitigate the effects of the prevailing winds.

Treatments Legend



-  Retain existing densely foliating evergreen tree planting
-  Retain proposed densely foliating evergreen tree planting



Figure 3: Recommended Treatment for the Ground Level (Residential Building)

Treatments Legend

- ▬ Retain proposed awning
- Retain existing densely foliating evergreen tree planting



Figure 4: Recommended Treatment for the Ground Level (Mixed-Use Building)

5.2 Communal Open Space

The Common Outdoor Area is located on level 2 of the mixed-use building, on the eastern side of the proposed development. Due to the recessed design, prevailing northerly and southerly winds are not expected to severely impact the area. The proposed building provides shielding from the north, west, and south, while the existing densely foliating evergreen trees provide shielding from the east.

The Outdoor Landscaped Area is located on level 4 of the mixed-use building, on the eastern side of the proposed development. Similarly, prevailing northerly and southerly winds are not expected to severely impact the area due to its recessed design.

The Outdoor Tenant Amenities Area is located on level 6 of the residential building, on the north-eastern corner of the proposed development. Both the northerly and southerly prevailing winds have the potential to directly impact the area and accelerate around the eastern façade corners. Incorporating densely foliating evergreen landscaping throughout the area has the potential to lessen the impact of prevailing winds. Increasing the impermeable parapet/balustrade height to 2m also has the potential to hinder the impact of the prevailing winds.

The Outdoor Landscaped Area is located on level 7 of the residential building, on the north-eastern corner of the proposed development. Both the northerly and southerly prevailing winds have the potential to directly impact the area and accelerate around the eastern façade corners. Incorporating densely foliating evergreen landscaping throughout the area has the potential to lessen the impact of prevailing winds. Increasing the impermeable parapet/balustrade height to 2m also has the potential to hinder the impact of the prevailing winds.

Treatments Legend

- 2m high impermeable parapet/balustrade
- Retain proposed densely foliating evergreen tree planting

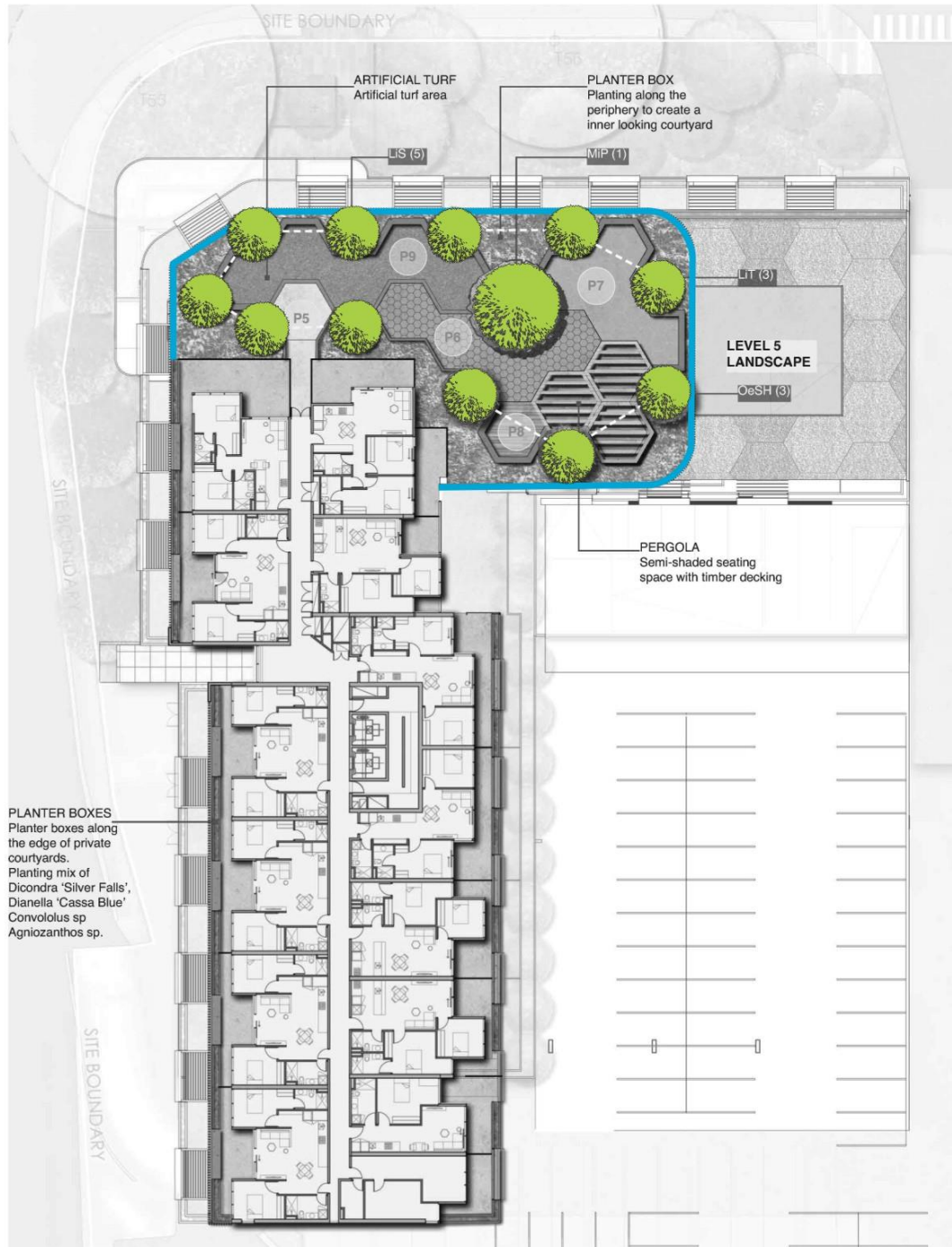


Figure 5: Recommended Treatment for the Tenant Amenities Area (Residential Building Level 6)

Treatments Legend

- 2m high impermeable parapet/balustrade
- Retain proposed densely foliageating evergreen tree planting



Figure 6: Recommended Treatment for the Landscaped Area (Residential Building Level 7)

5.3 Private Balconies and Courtyards

The eastern balconies located on levels 4, 5, and 6 of the mixed-use building are exposed to the prevailing northerly and southerly winds. Both prevailing winds have the potential to directly impact the area. To limit the effects of the prevailing winds, the following treatments are recommended:

- Inclusion of full height porous/impermeable end screens along the northern and southern aspects.
- Retain proposed intertenancy screens.

The balconies located on the eastern side of the residential building are exposed to the prevailing northerly and southerly winds. These winds are expected to directly impact the area and side-stream across the eastern façade of the building. To mitigate these effects, full length impermeable intertenancy screens and full height porous/impermeable end screens are recommended.

The balconies located on the northern side of the residential building are exposed to the prevailing westerly winds. These winds are expected to directly impact the area and side-stream across the northern façade of the building. To mitigate these effects, full length impermeable intertenancy screens and full height porous/impermeable end screens are recommended.

Corner balconies may be impacted more so due their exposure on multiple aspects. Corner acceleration is expected to be the main contributor to adverse wind conditions. Implementing full height porous/impermeable end screens and limiting balcony extents to only one aspect of their allocated apartment is expected to reduce the effects of corner acceleration.

With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses.

Treatments Legend

■ ■ ■ Full height porous/impermeable end screens

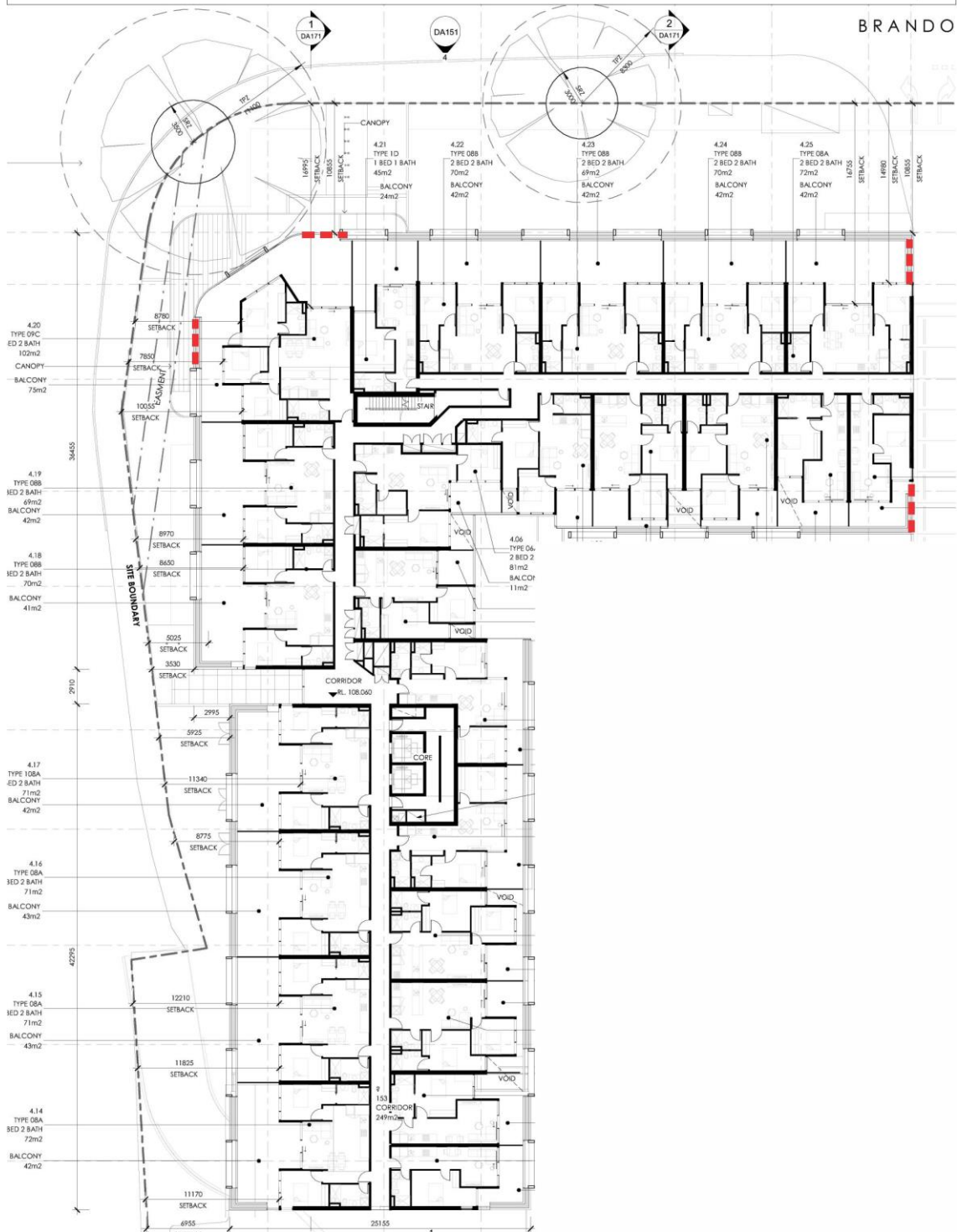


Figure 7: Recommended Treatment for Residential Building Balconies (All levels)

Treatments Legend

- Full height porous/impermeable end screens

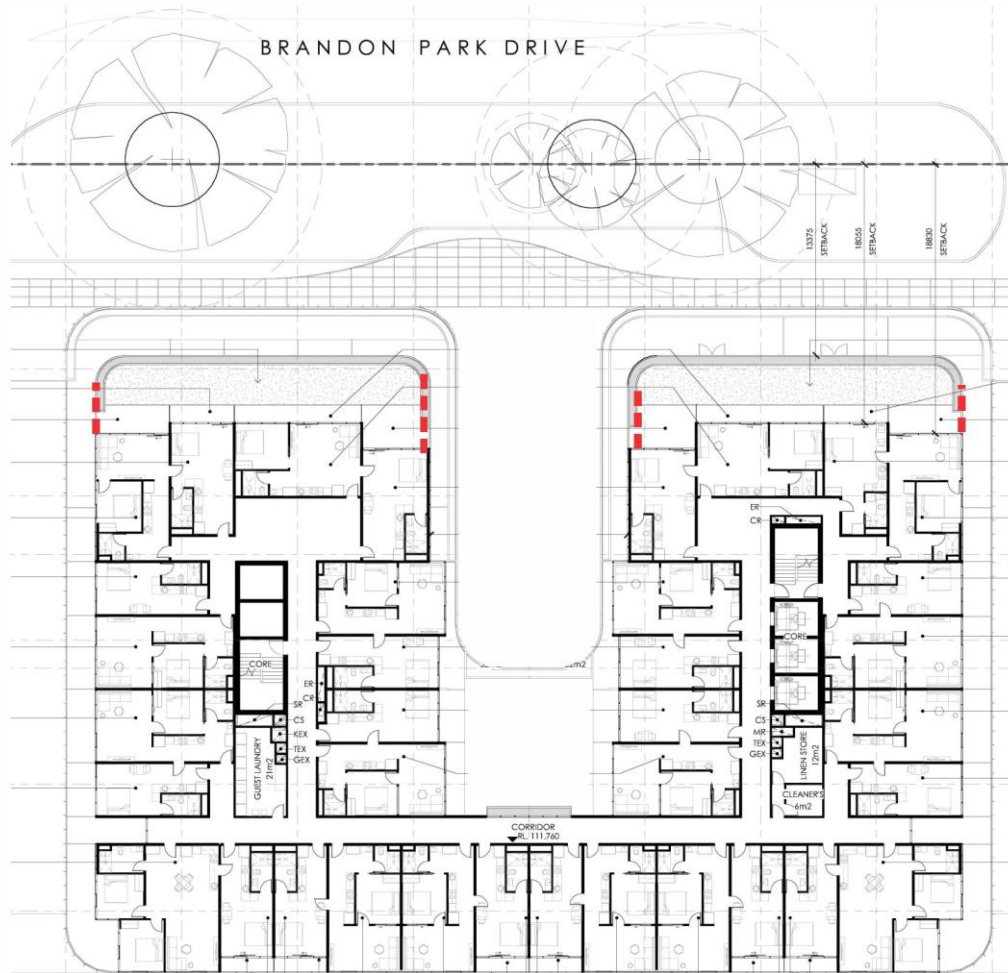


Figure 8: Recommended Treatment for Mixed-Use Building Balconies (Levels 4 and 5)

Treatments Legend

- ■ Full height porous/impermeable end screens

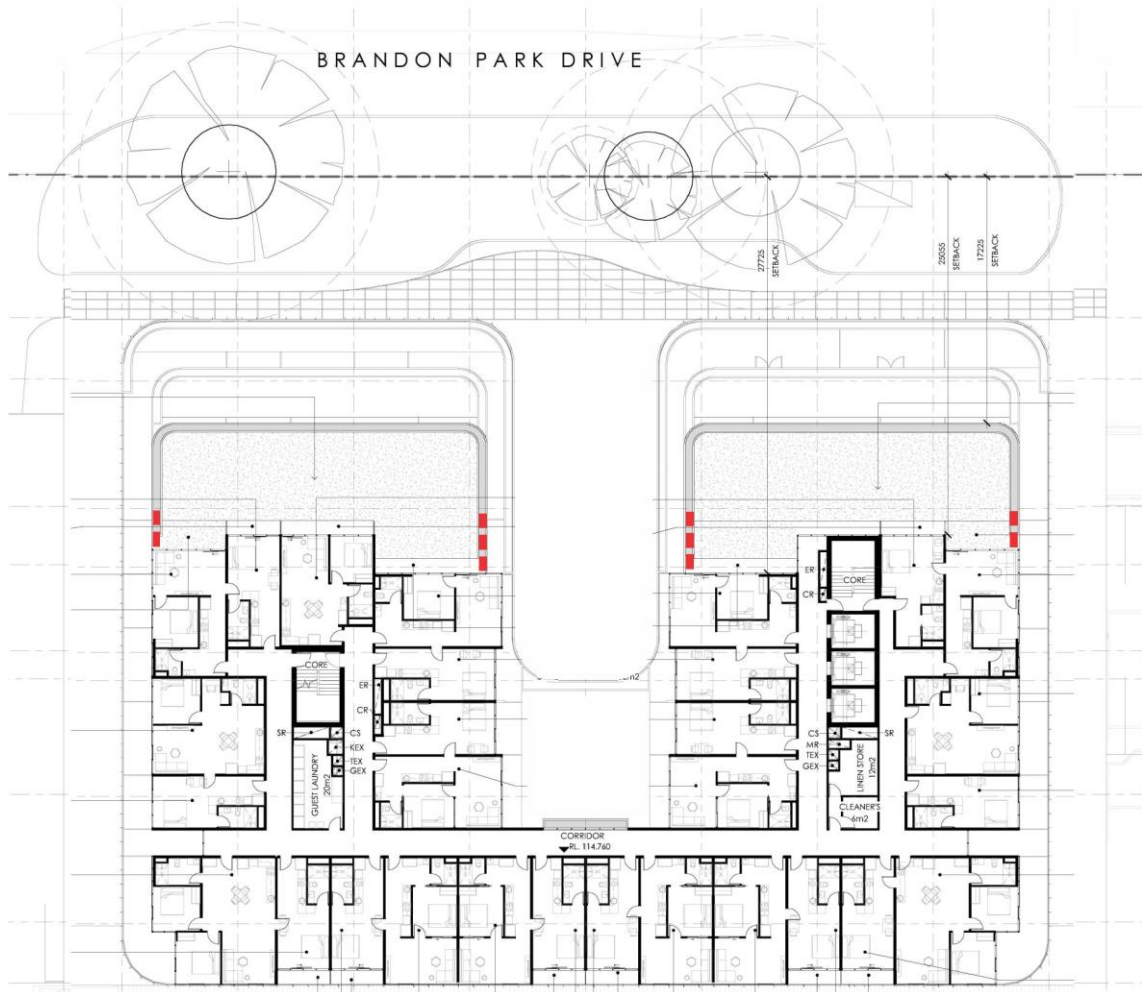


Figure 9: Recommended Treatment for the Level 6 Balconies (Mixed-Use Building)

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APPENDIX A WIND EFFECTS GLOSSARY

A.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure A.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

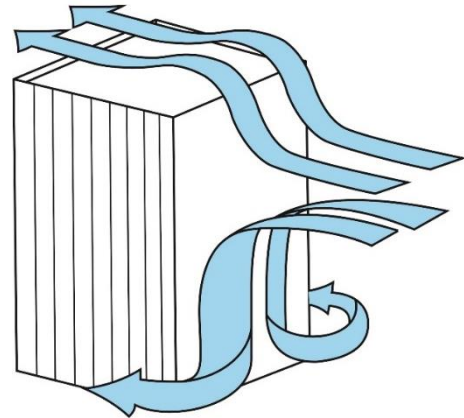


Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

A.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure A.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

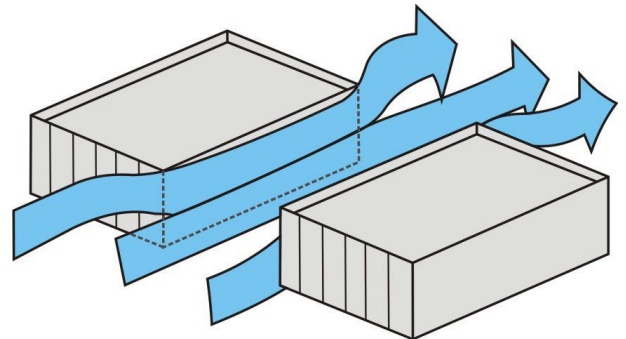


Figure A.2: Funnelling/Venturi Wind Effect

A.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure A.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

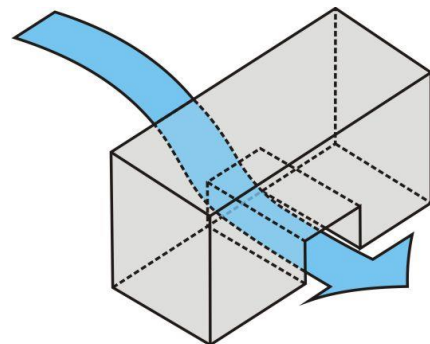


Figure A.3: Gap Wind Effect

A.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure A.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

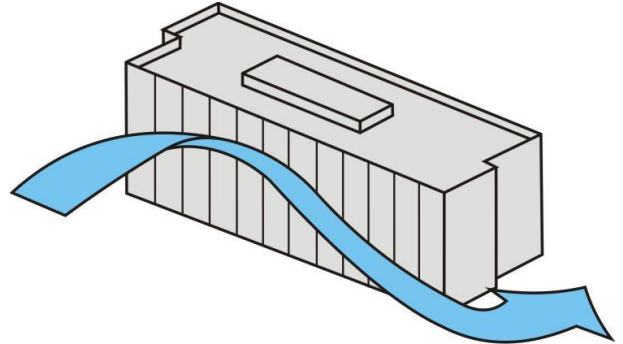


Figure A.4: Sidestream and Corner Wind Effect

A.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.