

68-80 O'CONNELL STREET
CADDENS, NSW



PEDESTRIAN WIND ASSESSMENT

PROJECT # 2509747

14 MAY 2025

SUBMITTED TO

Caddens Estate Pty Ltd

SUBMITTED BY

RWDI Australia Pty Ltd.

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DOCUMENT CONTROL



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QUALITY ASSURANCE

RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and Licence No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering, air quality and wind engineering; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

1. INTRODUCTION



RWDI Australia Pty Ltd (RWDI) was retained to undertake a pedestrian wind assessment for a mixed-use development at 68-80 O’Connell Street, Caddens within the Penrith Local Government Area (LGA). The western portion of the site currently comprises an existing commercial shopping centre development and associated carpark, commonly known as ‘Caddens Corner’. The eastern portion of the site is a cleared vacant lot. The site is bounded by Corr Road to the North, O’Connell Street to the south and west and empty lots to the east. The site is approximately 2.2km from Werrington Station and 1.8km from Kingswood Station. The location of the site within its broader existing surrounding context is shown in Image 1.

The site is surrounded by low density residential areas of Caddens, Claremont Meadows, Werrington and Kingswood. The area is interspersed with a variety of uses, including Western Sydney University (WSU), TAFE NSW and sporting fields. The proposed development comprises 4 shop top housing buildings ranging in height from 5 to 7 storeys at the western end of the site with ground floor commercial, retail and medical uses. At the eastern end of the site, eleven residential buildings are proposed ranging from 5 to 6 storeys with basement carparking, landscaping and communal open spaces including a ‘public square’.

This desk-based report provides a review of the potential wind conditions around the site and offers conceptual wind control measures and design advice suitable for early design of the development. The key outdoor pedestrian accessible areas of interest associated with the development include the pedestrian footpaths around the site, the entrances to the development, and the amenity spaces on ground and upper levels.



Image 1: Project Site and Existing Surrounding Context

2. METHODOLOGY



Predicting wind speeds and occurrence frequencies around a building is a complex process, encompassing an assessment of factors such as building geometry, orientation, surrounding building heights and positions, terrain upstream, and the local wind climate. RWDI has amassed extensive expertise through conducting numerous wind tunnel studies and Computational Fluid Dynamics (CFD) assessments specifically focused on pedestrian wind conditions around buildings. This wealth of experience, complemented by comprehensive literature, facilitates a reliable and efficient desktop estimation of pedestrian wind conditions for concept designs without the need for wind-tunnel testing or detailed CFD studies.

Note that this approach delivers a preliminary assessment of potential wind conditions around the site. It offers a conceptual framework for wind control measures aimed at enhancing wind comfort, if and where necessary. To further validate and refine the predicted conditions discussed in this report or to fine-tune the suggested wind control measures, physical scale model tests in a boundary layer wind tunnel or CFD simulations will be required. These detailed studies offer a quantitative validation and enable a more detailed assessment, ensuring the accuracy and effectiveness of proposed wind control strategies.

Therefore, RWDI's assessment is based on the following:

- A review of the regional long-term meteorological data;
- Drawings and information received by RWDI in May 2025.
- Wind-tunnel studies, CFD simulations, and desktop assessments undertaken by the microclimate team for projects in the region;
- RWDI's engineering judgement, experience, and expert knowledge of wind flows around buildings^{1,2}; and,
- Assessment against a suitable criteria for pedestrian wind comfort and safety.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, building air quality, noise, vibration, etc. are not part of the scope of this assessment.

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1. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.
 2. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

3. METEOROLOGICAL DATA



The inland location of the site is expected to reduce exposure to prevailing sea breezes that is a characteristic prominent in coastal areas around Sydney. Therefore, meteorological data from Penrith Lakes Automatic Weather Station (AWS), approximately 7 km to the northwest of the project site, were used as a reference for wind conditions in the area. The data was analysed for the period of 1998 to 2018, covering both the summer (Nov - Apr) and winter (May - Oct) seasons. Image 2 illustrates the directional distribution of wind frequencies and speeds at the Penrith Lakes AWS. The records indicate that winds from the southwest sector and north are common during both the seasons. Seasonal winds from the west and northwest directions are also common in winters. Comparison with wind data from Richmond RAAF Base shows similar directionality of winds.

Overall, the wind climate from Penrith Lakes AWS indicates much calmer conditions compared to those observed at Sydney International Airport. This is consistent with observations from other inland locations such as Camden Airport and Bankstown Airport. These inland sites commonly exhibit lower wind speeds due to the shielding by upwind terrain which contributes to an overall calmer wind environment compared to coastal areas.

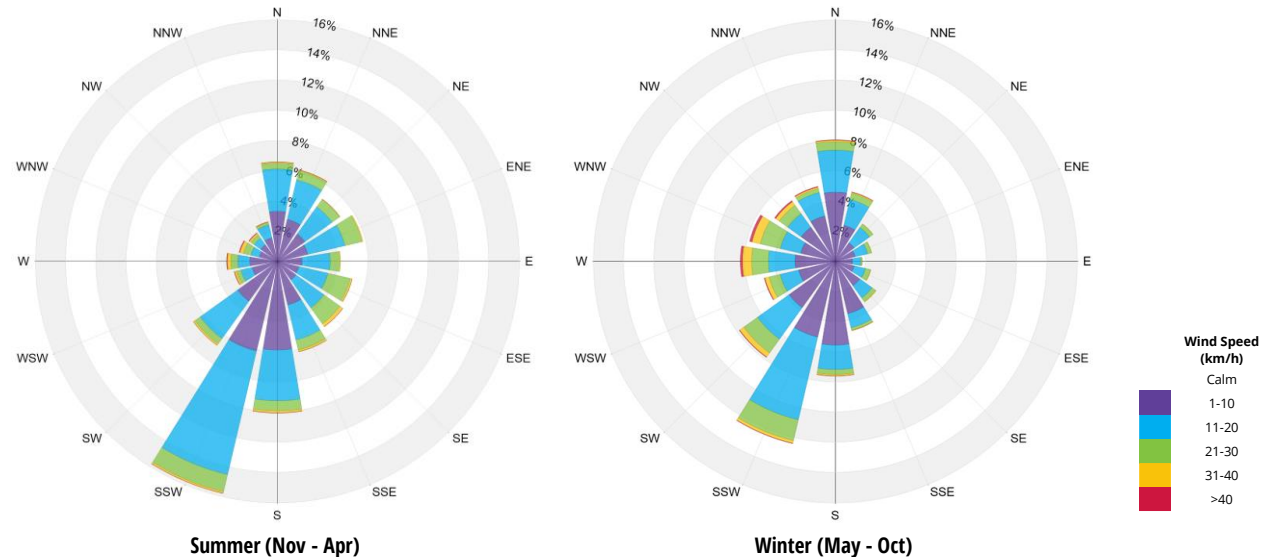


Image 2: Directional Distribution of Winds Approaching Penrith Lakes AWS
Recorded from 1998-2018

4. PEDESTRIAN WIND CRITERIA



4.1 Pedestrian Wind Safety Criterion

Pedestrian wind safety is associated with excessive gusts that can adversely affect a person's balance and footing. The *Australasian Wind Engineering Society Guidelines for Pedestrian Wind Effects Criteria* (2024) recommends assessing wind safety using a threshold of 3-second gusts exceeding 83 km/h for more than 0.1% (or 9 hours) per year. Wind conditions surpassing this limit are considered severe and likely to impact pedestrian stability. This has been assessed qualitatively in the current report.

4.2 Pedestrian Wind Comfort Criteria

Pedestrian wind comfort is assessed using the criteria developed by Soligo et al.^{1,2} which are illustrated in Image 4. These criteria, established at RWDI through extensive research and consulting since 1974, are based on gust-equivalent mean wind speeds. Wind comfort levels are categorised according to the typical/intended pedestrian activity such that higher the activity level, higher the wind speed tolerable while engaged in the activity. Wind conditions are assessed at a typical pedestrian chest height and are considered suitable for the intended use of the space if the associated winds for the category are expected for at least 80% of the time. Wind control measures are

recommended for areas where the occurrence frequencies of wind speeds are expected to exceed the threshold values for specific pedestrian activities.

It should be noted that these criteria for wind forces represent average wind tolerance and can be subjective with regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. also impacting and individual's perception of the wind climate. For a full assessment of comfort, a thermal comfort study is required.

<p>Sitting ≤ 10 km/h</p>		<p>Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away</p>
<p>Standing ≤ 14 km/h</p>		<p>Gentle breezes suitable for main building entrances, bus stops and locations where pedestrians may linger such as communal terraces</p>
<p>Strolling ≤ 17 km/h</p>		<p>Moderate winds that would be appropriate for strolling along a downtown street, plaza or park and where the objective is not to linger</p>
<p>Walking ≤ 20 km/h</p>		<p>High Winds that can be tolerated if one's objective is to walk, run or cycle without lingering - Also suitable for certain sporting activities</p>
<p>Uncomfortable > 20 km/h</p>		<p>None of comfort categories above are met - Represents conditions that might be dangerous to the elderly and children and are of a considerable discomfort to others</p>

Image 4: RWDI Pedestrian Wind Comfort Criteria

1. M.J. Soligo, P.A. Irwin, and C.J. Williams (1993). "Pedestrian Comfort Including Wind and Thermal Effects," Third Asia-Pacific Symposium on Wind Engineering, Hong Kong.
2. M.J. Soligo, P.A. Irwin, C.J. Williams, and G.D. Schuyler (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," Journal of Wind Engineering and Industrial Aerodynamics, vol. 77&78, pp. 753-766.

5. RESULTS AND DISCUSSION



5.1 General Wind Flow around Buildings

In the discussion of wind conditions on and around the proposed development, reference may be made to the following generalised wind flows (see Image 4). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable or potentially unsafe conditions. Design details such as setting back a tower from the edges of a podium for a prevailing wind direction, deep canopies close to ground level, wind screens / tall trees with dense landscaping, etc. can help reduce high wind activity. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

Conversely, in areas where higher wind velocities are desired, design measures can be implemented to enhance wind flow. For instance, channels aligned with prevailing wind directions can be integrated into the design to promote increased wind infiltration in regions prone to stagnant conditions. Such measures are particularly beneficial in areas with generally milder climates and high humidity levels, such as those closer to the equator.

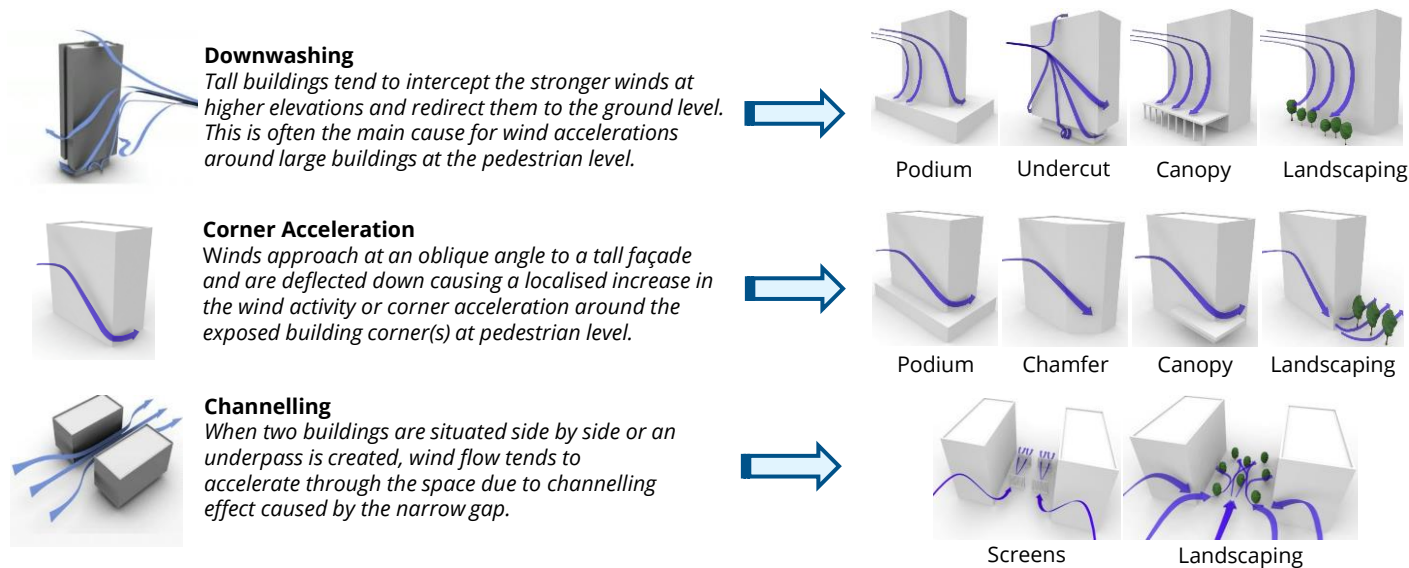


Image 4: General Wind Flow around Buildings with Examples of Common Wind Measures

5. RESULTS AND DISCUSSION



5.2 Site Exposure and Existing Site Conditions

The exposure of the site to regional prevailing winds is illustrated in Image 5 and discussed below:

1. Vacant land plots to the north provides upwind terrain that is open and flat. The prevailing winds are expected to approach the site with little obstruction.
2. The low-rise residential buildings to the southwest of the site are expected to offer minimal protection from the prevailing southerly winds, particularly for any exposed structures on-site.
3. Similar to the terrain to the south-west, the north-western upwind terrain is predominantly low-rise residential buildings with densely planted parkland immediately adjacent to the site.

Given the above exposure to the prevailing winds, the existing site is expected to be generally exposed to all prevailing wind directions. However, given the meteorological data presented in Section 3, the existing site wind conditions are expected to be calm and suitable for sitting and standing use in areas protected by vegetation or buildings to strolling use in more exposed areas.

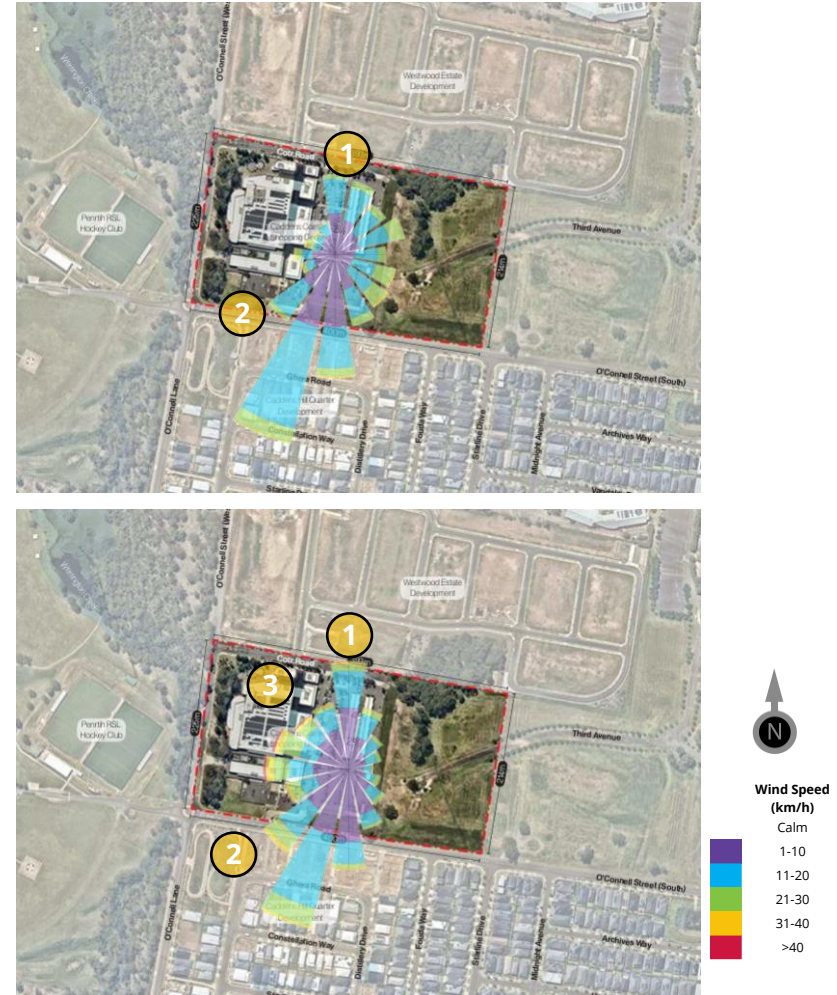


Image 5: Exposure of Site to Regional Prevailing Winds
Top: Summer | Bottom: Winter

5. RESULTS AND DISCUSSION



5.3 Proposed Site Conditions

5.3.1 Ground Level

The following is a discussion on the expected wind conditions within and around the site – refer to Image 6 for overlay and key areas:

1. Prevailing south-westerly and northerly winds are likely to flow through the communal open space between the proposed buildings T and U throughout the year. Wind conditions are expected to be suitable for strolling use and will provide an ideal location for active use such as parks and play areas.
 2. Open trafficable areas to the north of the site are expected to have low wind flows during the year as they are generally shielded by the proposed buildings to the south and west, creating calm wind conditions suitable for sitting to standing use. These areas may have reduced thermal comfort during the summer periods.
 3. Prevailing westerly and south-westerly winds have the potential to flow through the Village Quarter open area and channel through the east-west through-site link. This channelling is likely to be reduced at the western end due to the inclusion of the proposed awning along the aspects facing the Village Quarter. However, with the reduced depth of the awning between Buildings S and T, these winds have the potential to reattach on the ground plane. The increase in terrain slope towards the eastern end of the through-site link has the potential to increase these channelling winds. The wind conditions along the through-site link are expected to range from standing to strolling use.
 4. The prevailing south-westerly winds are expected to channel through the open spaces between the proposed southern buildings. Due to the expected low speeds, these areas are expected to be suitable for standing use.
 5. Existing northern trees are expected to provide shielding from the prevailing northerly winds to the central areas of the development.
 6. The Village Quarter will likely be sheltered to an extent from the westerly and south-westerly winds due to low-rise commercial buildings to the west of the site. Wind conditions are expected to be generally comfortable for standing-use activities. However, it is noted that wind conditions near Building R2 might be more suitable for active strolling use due to local wind acceleration effects.
- It is also noted that the majority of building entrances are recessed into the various building forms which is expected to create protected areas suitable for short-duration activities.

5. RESULTS AND DISCUSSION



▲ Building Entrances

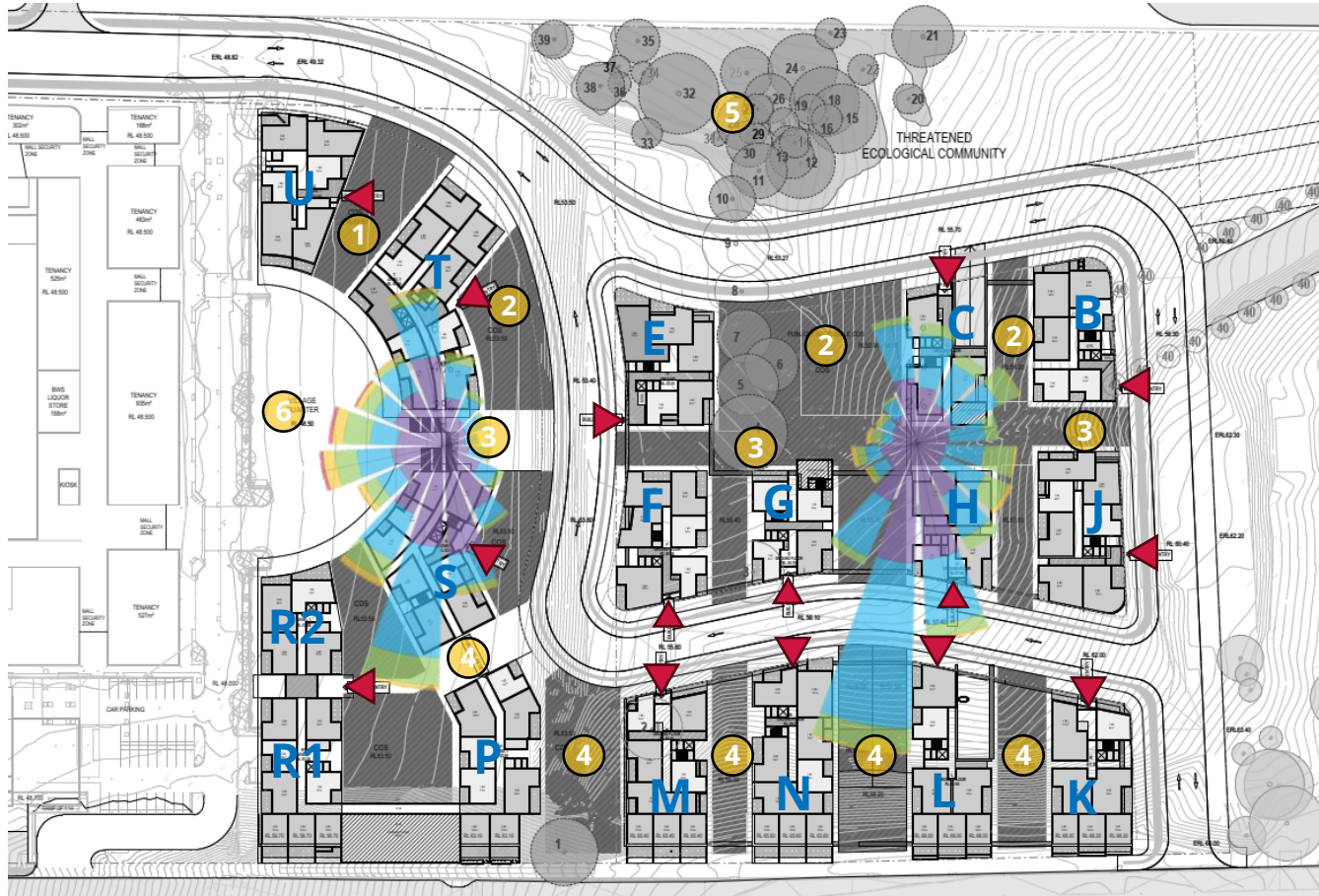


Image 6: Wind Rose Overlay and Key Areas (Ground Level)

5. RESULTS AND DISCUSSION



5.3 Proposed Site Conditions

5.3.2 Elevated Areas

- The elevated communal outdoor spaces generally benefit from partial shielding by the proposed building forms, offering protection from one of the prevailing wind directions (Image 7). However, these areas remain exposed to other prevailing wind directions which have the potential to directly impact the open areas. The wind conditions are expected to be suitable for strolling use within these spaces.
- The majority of the private balconies are recessed into the building form and/or incorporate full height blade walls along one aspect which is expected to provide protection to the balcony areas. Private corner balconies are expected to be subject to corner accelerated wind flows. However, given the calm wind climate and low-rise nature of the proposed buildings, the overall wind conditions are expected to be well within the comfort and safety limits.



Image 7: Exposure of Elevated Communal Outdoor Spaces to Prevailing Winds

5. RESULTS AND DISCUSSION



5.4 Design Advice and Recommendations

Based on the discussions provided, the following design advice and wind control measures are recommended (examples shown in Image 8):

- It is recommended to include densely foliating tree clusters with interlocking canopies throughout the ground and elevated communal open spaces to both reduce the strength of any direct or channelling winds and to provide shading for improved thermal comfort.
- It is recommended to increase the depth of the impermeable awnings between Buildings S and T. Alternatively, strategic landscaping along the awnings between Buildings S and T can also mitigate winds.
- It is recommended to consider shading structures within the communal open spaces where calmer wind conditions are expected to increase thermal comfort.
- Localised impermeable or porous screening and hedge planting can be located around areas intended for sitting and long duration uses.
- It is recommended to incorporate 1.5m high impermeable screening along the perimeter of the rooftop terraces of Buildings R, S and T to reduce direct exposure to regional winds. Localised canopies or additional hard and soft landscaping elements are also recommended to provide buffer to the winds. Any seating areas should incorporate screening to provide protection from winds expected on the rooftop.

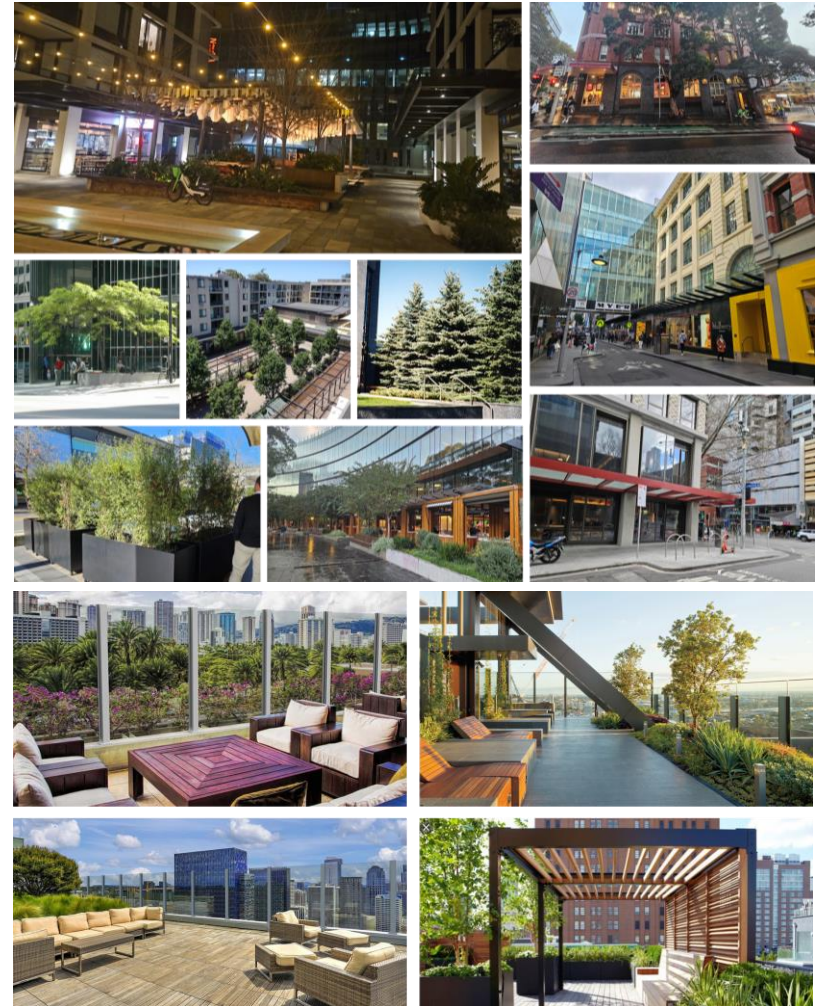


Image 8: Examples of Wind Control Measures

Landscaping, Awnings, and Rooftop Terraces

Pedestrian Wind Assessment

6. SUMMARY



Wind conditions within and around the proposed development located at 68-80 O'Connell Street, Caddens, NSW are discussed in this report. The qualitative assessment is based on the review of local wind climate and the current design of the proposed development. The impact of the surrounding buildings and the local land topography has also been considered. The assessment is based on RWDI's experience with wind tunnel testing and CFD analysis of similar buildings within the region.

Conceptual wind interactions around the proposed development are discussed in the report for the prevailing wind directions to identify key wind sensitive areas. The assessment indicates that wind conditions around the site with trafficable areas on the ground level are expected to range from strolling to standing use. No areas are expected to exceed the safety and uncomfortable criteria. Design advice has been provided in the report to further improve wind conditions within trafficable areas to better align with targeted use.

Note that this qualitative approach provides a screening-level estimation of potential wind conditions around the site and offers advice suitable for early design of buildings. To quantify and validate the predicted conditions, wind tunnel testing or computational wind simulations will be required.

7. APPLICABILITY OF ASSESSMENT



The assessment discussed in this report pertains to the proposed development in accordance with the drawings and information received on May 2025. In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

Statement of Limitations

This report entitled '*68-80 O'Connell Street Pedestrian Wind Assessment*', dated 14 May 2025, was prepared by RWDI Australia Pty Ltd ("RWDI"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during

the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilise the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provide.