LANG WALKER AO MEDICAL RESEARCH BUILDING - MACARTHUR

CAMPBELLTOWN, NSW

PEDESTRIAN WIND ASSESSMENT

PROJECT # 2104691

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SUBMITTED TO

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1. INTRODUCTION

RWDI Australia Pty Ltd (RWDI) was retained by BVN to assess the pedestrian wind conditions for the Proposed Development of the Lang Walker AO Medical Research Building - Macarthur in Campbelltown, NSW (Image 1). This qualitative assessment is based on the following:

- A review of the regional long-term meteorological data from Bankstown Airport
- SSDA design drawings received by RWDI on 14 October 2021;
- Wind-tunnel studies undertaken by RWDI for similar projects in the Sydney area;
- Our engineering judgment, experience and expert knowledge of wind flows around buildings[1-3]; and,
- Use of software developed by RWDI (Windestimator[2]) for estimating the potential wind conditions around generalized building forms.

This qualitative approach provides a screening-level estimation of potential wind conditions. Conceptual wind control measures to improve wind comfort are recommended where necessary.

Note that other wind issues, such as those related to door operability, wind entry, cladding and structural wind loads, air quality, etc., are not considered in the scope of this assessment.

Image 1: Aerial View of the Existing Site and Surroundings (Credit: Nearmap)

1. 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.
2. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", ASCE Structure Congress 2004, Nashville, Tennessee.
3. 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. SITE & BUILDING INFORMATION

The proposed development is located within the Campbelltown Hospital Campus, between Building D and Macarthur Clinical School. The existing site is a helipad. The land is raised ground sloping down from the west to east. The Proposed Development comprises five stories with an overall height of approximately 12 m (which is similar to the neighbouring buildings) and will be connected to its neighbours by elevated walkways.

The Proposed Development is surrounded by open spaces to the west and northwest (Marsden Park) and car park to the southeast. Pedestrian areas of interest in this assessment include the main entrances and footpaths around the buildings as. shown Image 3.

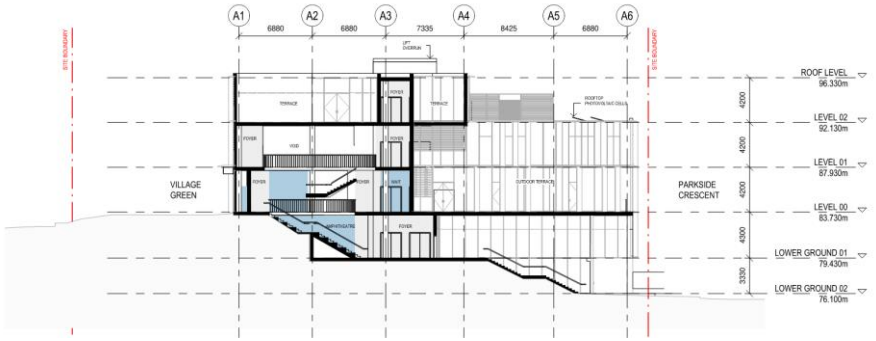


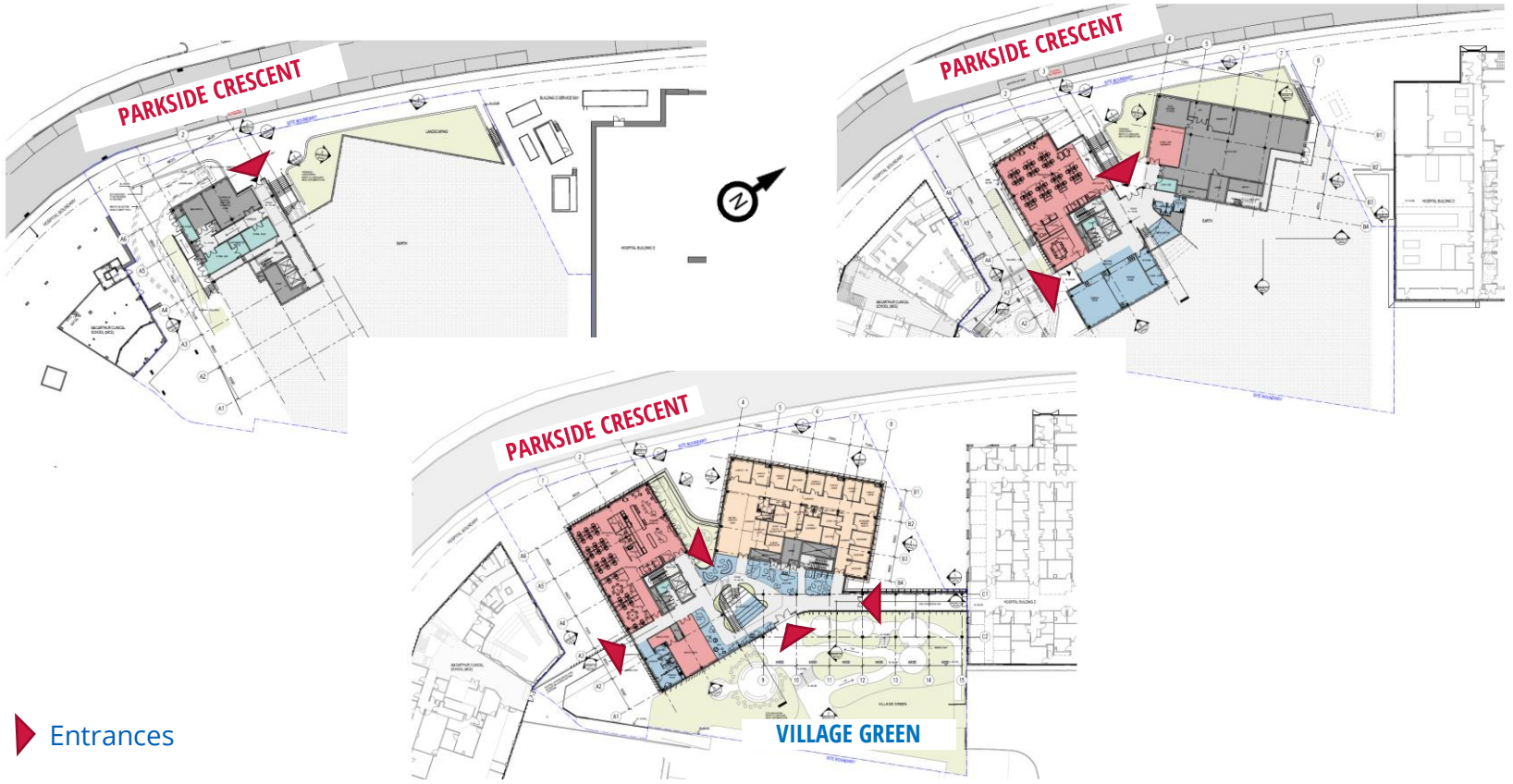
Image 2B: North-South section view of the proposed development

Image 2A: East-West section view of the proposed development

2. SITE & BUILDING INFORMATION

a) Lower Ground 02

b) Lower Ground 01



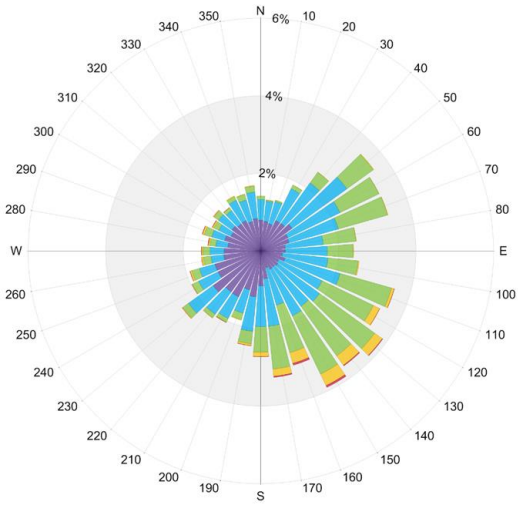
c) Ground Level

Image 3: Entrance Locations

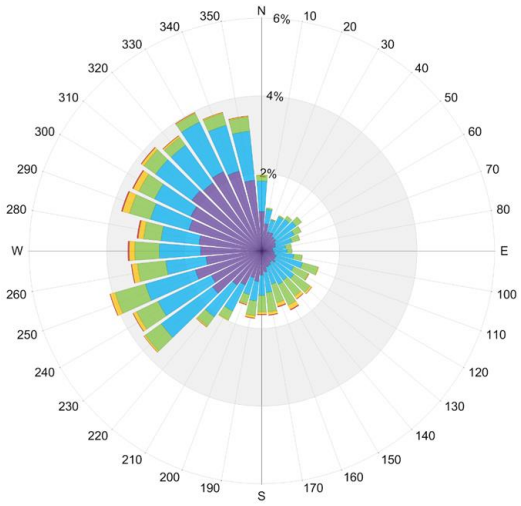
3. METEOROLOGICAL DATA

Wind statistics at Bankstown Airport, between 1998 and 2018 were analyzed and Image 4 graphically depicts the distributions of wind frequency and directionality for the two seasons, Summer (November through April) and Winter (May through October). Winds from the northeast and southeast to southerly direction are predominant during the Summer period. During the Winter, winds typically occur from a range of angles from west-southwest to north-northwest as indicated by the wind roses below. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 2.4 % and 2.1 % of the time during the summer and winter seasons, respectively and occur more often in summer than in the winter months.

The data from this meteorological station is generally calmer than that measured at Sydney International Airport which is expected as Bankstown Airport is located away from the coast. Therefore, wind speeds are typically lower due to the sheltering provided by the upwind terrain and distance away from prevailing coastal breeze that Sydney Airport is predominantly exposed to. We consider the wind data from Bankstown to be sufficiently representative of the environment at the site of the proposed development to be useful in the current assessment.



Summer (November to April)



Winter (May to October)

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	16.2	20.1
1-10	30.9	36.6
11-20	30.6	28.4
21-30	19.8	12.8
31-40	2.2	1.9
>40	0.2	0.2

Image 4: Directional distribution of winds approaching Bankstown Airport (1998 to 2018)

4. RWDI PEDESTRIAN WIND CRITERIA

The RWDI pedestrian wind criteria are used to assess pedestrian comfort in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities, building designers and the city planning community. The criterion recommended by the Australasian Wind Engineering Society (AWES) has been used to assess safety. The criteria are as follows:

4.1 Safety Criterion

Pedestrian safety is associated with excessive gusts that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (**83 km/h**) occur more than **0.1%** of the time or 9 hours per year, the wind conditions are considered severe.

4.2 Pedestrian Comfort Criteria

Wind comfort can be categorized by typical pedestrian activities:

Sitting (≤ 10 km/h): Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away.

Standing (≤ 14 km/h): Gentle breezes suitable for main building entrances and bus stops.

Strolling (≤ 17 km/h): Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park.

Walking (≤ 20 km/h): Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.

Uncomfortable: The comfort category for walking is not met.

Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated mean wind speeds are expected for at least **80% of the time**. Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

Note that these wind speeds are assessed at the pedestrian height (i.e., 1.5 m above grade or the concerned floor level), typically lower than those recorded in the airport (10 m height and open terrain).

These criteria for wind forces represent average wind tolerance. They are somewhat subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

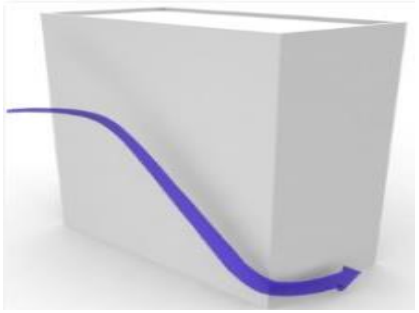
For the current development, wind speeds comfortable for walking or strolling are appropriate for footpaths; lower wind speeds comfortable for standing are required for building entrances and bus-stops where pedestrians may linger, and calm wind speeds suitable for sitting are desired in areas where passive activities are anticipated, such as the outdoor dining and amenity terraces.

5. RESULTS AND DISCUSSION

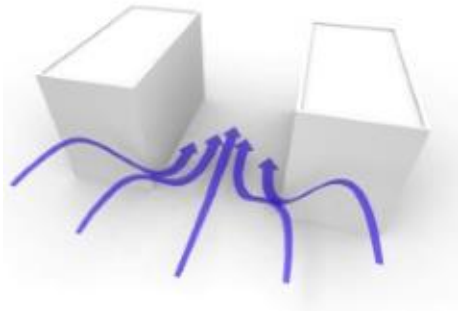
5.1 Background

Predicting wind speeds and frequencies of occurrence is complicated. It involves the assessment of building geometry, orientation, position and height of surrounding buildings, upwind terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind tunnel model studies on pedestrian wind conditions around buildings, yielding a broad knowledge base.

The predominant winds tend to move around exposed building corners, causing a localised increase in wind activity due to Corner Acceleration and Channeling (**Images 5a and 5b**). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and *uncomfortable* conditions.



a) Corner Acceleration

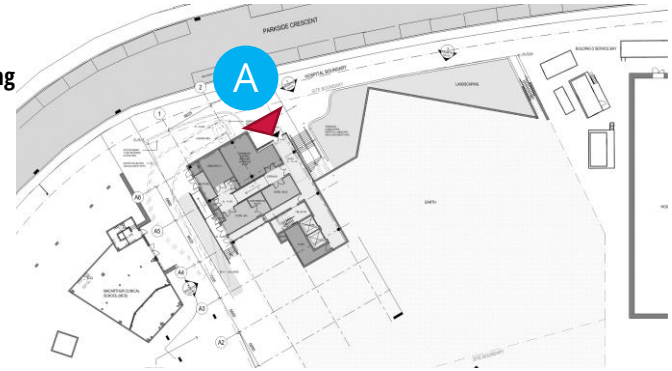


b) Channeling Effect

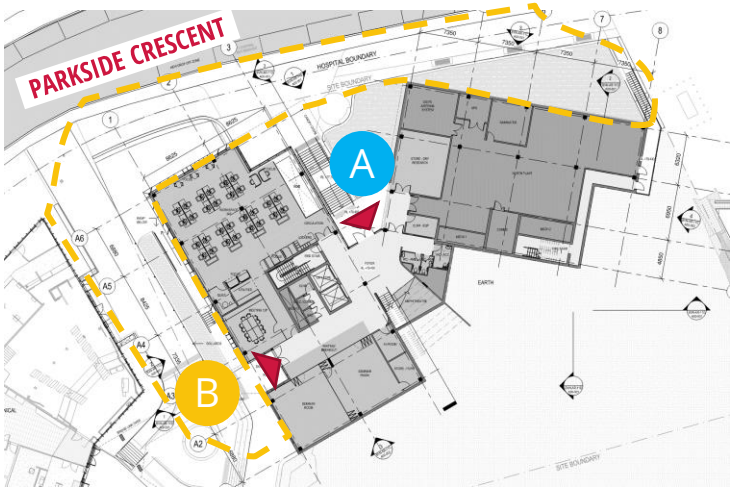
Image 5: General wind flow around buildings

5. RESULTS AND DISCUSSION

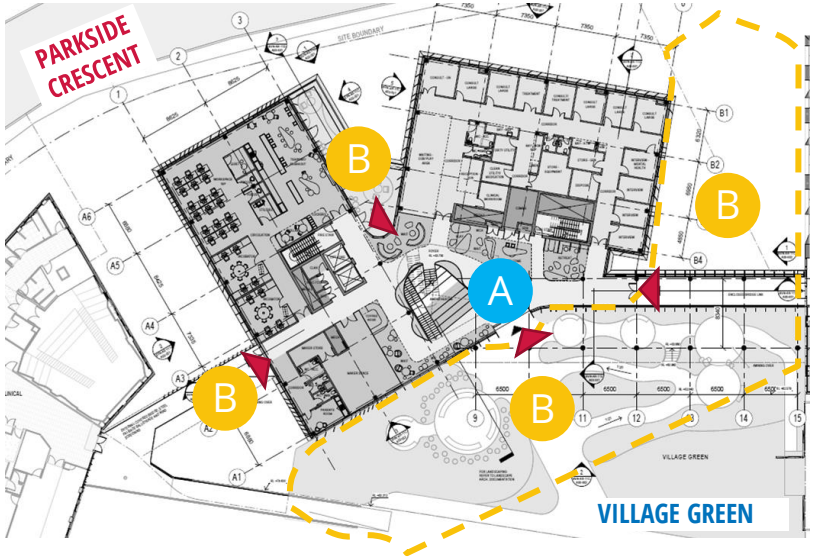
Image 5: Wind conditions around the proposed building



a) Lower Ground Level 02



b) Lower Ground Level 01



c) Ground Level

Entrances

A — Generally calm. Well-sheltered areas suitable for any use, including entrances.

B — Moderately windy. Likely to be suitable for strolling use. Potentially windy for entrances, which would benefit from localised mitigation if they are not already recessed.

5.2 Existing conditions

The existing site is a helipad and surrounded by slightly taller buildings to the north, northeast, and south and with low-lands consisting of parks and car-parking to west and southeast. The plot slopes up from the west to east. The building to the south is of similar height to the proposed development. Wind conditions on the footpaths around the site are considered comfortable for sitting and standing in the summer and winter. Strolling conditions are anticipated during the winter at the south of Parkside Crescent due to the increased exposure to the westerly winds. Wind conditions exceeding the safety criterion are not expected in the area.

5.3 Expected Conditions (Overall summary)

The proposed development will be exposed to the prevailing winds from the east and west directions which are comparatively 'open'. These winds are expected to accelerate around the building corners, resulting in increased wind activity at the north and south ends of the site. The proposed building is expected to alter the wind conditions immediately around the perimeter but will have no wind impact on other parts of the campus or in the surrounding areas.

Although the proposed development will increase wind speeds in the immediate surrounding area, several features of the building massing are favourable towards reducing the potential for severe wind impacts. These features are:

- The proposed building is only five storeys high, therefore not susceptible to strong 'down-washing' effects that taller buildings might cause.
- The recessed entrances and terrace will create local 'pockets' of shelter against the wind.

The following sections provide a discussion of the potential wind conditions around the project, taking these features into account.

5.4 Expected Conditions - Ground Level

5.4.1 Wind Safety

The noted exposure to the winds approaching from the east and west directions is expected to impact the local wind conditions. However, they are not expected to result in wind speeds which cause an exceedance of the wind safety criterion.

5.4.2 Wind Comfort at Main Entrances

The main entrances to the development are found to the south and west at the Lower Ground 01 and 02, and at the eastern front on Ground level with an entrance to the outdoor terrace on the western aspect at the same level as shown in Image 3. All entrances are recessed and, therefore, the wind conditions around them are considered appropriate for the intended use throughout the year.

5.4.3 Wind Comfort on Bridge Links and Entrances

The northern bridge link to Building D is open and exposed to the winds funneling between the northern aspect of the proposed development and Building D. However, the proposed deep awning which is also naturally ventilated and the 1.5m high fixed glazing with louvres along the length of this space will allow sufficient shelter to the area with conditions comfortable for standing. The southern bridge, similarly, would be exposed to the channeling east-west winds. However, the inclusion of louvered wind screens along the western aspect of the bridge is expected to significantly improve wind conditions in this area which will likely be suitable for standing. Due to the proposed screening measures, wind conditions at entrances to the proposed development at both bridges are also expected to experience conditions comfortable for standing, which is appropriate.

5.4.4 Wind Comfort on Terrace

The western terrace at Ground level is recessed into a sheltered area between the two wings of the building. The area is sheltered from the easterly summer winds and generally expected to be comfortable for sitting and standing which is appropriate for the intended use. Westerly winter winds are expected to funnel in before flowing up and over the building, the direct exposure to these winds is expected to result in the area being comfortable for strolling which is windier than desirable for passive use. Perimeter landscaping or screening/balustrading of 1.5 m height would improve comfort conditions by reducing exposure to these winds.

5.4.5 Wind Comfort on Footpaths

Wind conditions at the ground-level around the development, including footpaths, are predicted to be comfortable for standing or strolling throughout the year. Any landscaping intended to be placed along the thoroughfares would be beneficial in reducing the wind speeds on the footpaths, but we would not consider this to be essential for the purposes of wind mitigation.

5.4.6 Wind Comfort on Village Green

The Village Green sits to the east of the building. The entire area will be exposed to the predominant southwesterly winds, with the northern half also exposed to westerly winds flowing between the proposed development and Building D. The area is expected to be comfortable for strolling, and as such would benefit from landscaping strategy with increased density at locations intended for seating.

6. SUMMARY

RWDI was retained to provide an initial assessment of the potential pedestrian wind conditions on and around the proposed Lang Walker AO Medical Research Building - Macarthur in Campbelltown, NSW. Our assessment was based on the local wind climate, the current design of the proposed development, the existing surrounding buildings, and our experience with wind tunnel testing of similar buildings.

The proposed building forms are similar in height to the neighbours in the south directions. As a result, the wind safety criterion will be met at all outdoor locations on and around the campus. Suitable wind comfort conditions are also expected in most areas. Recommendations have been made to improve wind conditions in localised areas, where appropriate.

7. APPLICABILITY OF ASSESSMENT

The assessment discussed in this report pertain to the proposed development in accordance with the SSDA Issue drawings received 15 October 2021. 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 wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

Statement of Limitations

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 utilize 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 provided.