FINAL REPORT (Rev. 0)

STRATHFIELD CENTRAL

SYDNEY, NSW

WIND ENVIRONMENT DESKTOP ASSESSMENT

RWDI PROJECT #1903394
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SUBMITTED TO

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1. INTRODUCTION

RWDI Anemos Ltd. (RWDI) was retained by Memocorp Australia to assess the pedestrian wind environment for the proposed Strathfield Central development in Sydney (Image 1). This qualitative assessment is based on the following:

- A review of regional long-term meteorological data;
- Design drawings received by RWDI on September 20, 2019;
- Wind-tunnel tests undertaken by RWDI in the Sydney area;
- Our engineering judgement and knowledge of wind flows around buildings[1-3]; and,
- Use of 3D software developed by RWDI (Windestimator[2]) for estimating the potential wind conditions around generalized building forms.

This approach provides a screening-level estimation of potential wind conditions on and around the development. Conceptual wind measures to improve wind comfort are recommended, where necessary. In order to quantify these conditions or refine any conceptual mitigation measures, physical scale-model tests in a boundary-layer wind tunnel would typically be required.

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

Image 1: Concept Massing – View from north

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. 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. 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. BUILDING AND SITE INFORMATION

Strathfield Central is located in the middle of the Strathfield CBD, with the Town Centre and Strathfield Station located to the north of the site (Image 2). The Plaza currently consists of a large single story retail shopping centre over the entire site with carparking located atop the centre. On the eastern aspect of the site is a 9 storey commercial tower, adjacent to The Boulevarde.

The proposed Strathfield Central development will consist of a common four storey podium over the entirety of the site, with public plaza space connecting Churchill Avenue and Redmyre Road on the north and south of the site. Additional retail corridors are proposed to connect The Boulevard to this area, as well as two levels of below grade retail space, with potential underground connection link back to Strathfield Station. A Transportation Hub is also located along the western boundary of the site.

Five towers are located above the common podium elements ranging in height from 13 to 38 levels above the podium. These will consist of a mix of commercial and residential apartments. The design of the tower forms are generally rectangular in plan, aligned in the north-south direction for Towers 1, 2, 4 and 5, while Tower 3 is oriented in the east-west direction (Images 3a and 3b).

Image 2: View of Existing Site and Surrounding

2. BUILDING AND SITE INFORMATION

Image 3a: Ground Floor Plan

Image 3b: View from Strathfield Station

3. METEOROLOGICAL DATA

Meteorological data recorded at Sydney Kingsford Smith International Airport, for the period from 1995 to 2018, were used as a reference for wind conditions in the area. The distributions of wind frequency and directionality for summer (November through April) and winter (May through October) seasons are shown in Image 4.

When all wind data is considered, winds are frequent from the north-northeast, northeast, south-southeast and south directions during the summer months. During the winter, winds from the west-southwest through northwest and the southerly directions. Strong winds of a mean speed greater than 30 km/h measured at the airports (at an anemometer height of 10 m) occur more often in winter than in the summer (10.6%) than in the winter (8.0%). During both seasons, strong winds from the southerly direction are predominant. Winds from these directions could potentially be the source of uncomfortable or even severe wind conditions, depending on the site exposure or development design. The analysis methods have accounted for this and all winds directions.

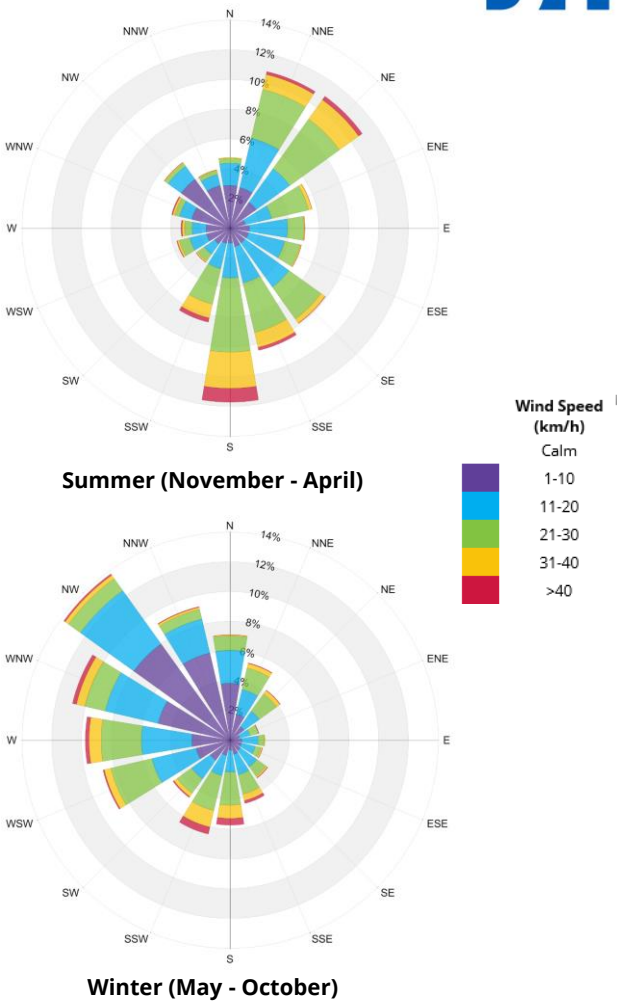


Image 4: Directional Distribution of Winds Approaching Sydney Kingsford Smith International Airport (1995-2018)

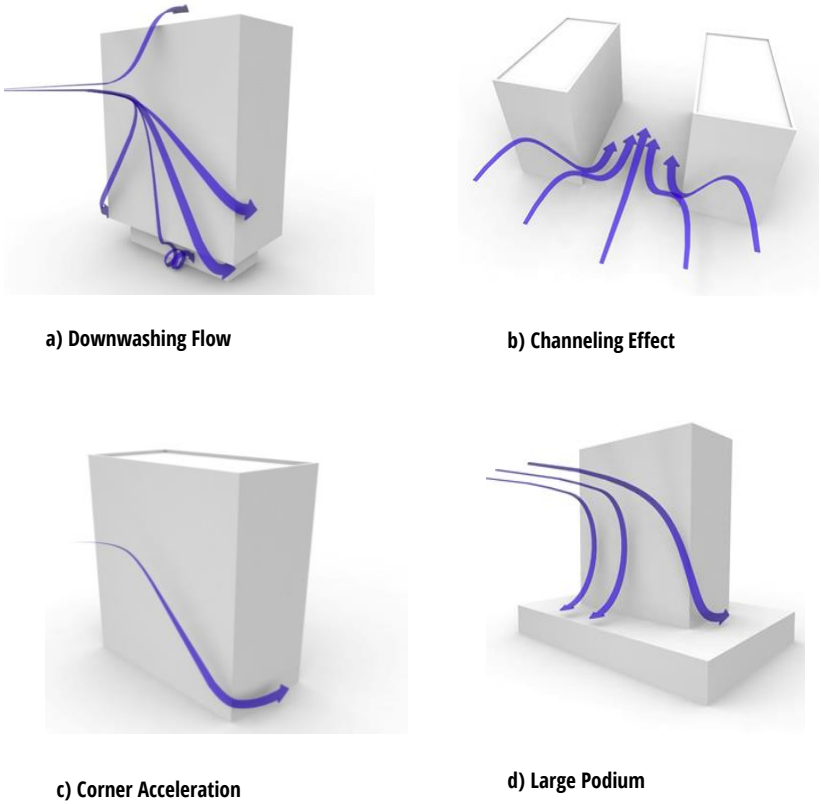
4. CONCEPTUAL WIND FLOWS

Background

Predicting wind speeds and occurrence frequencies is complicated. It involves building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies regarding pedestrian wind conditions around buildings, yielding a broad knowledge base. This knowledge has been incorporated into RWDI's proprietary software that allows, in many situations, for a qualitative, screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing.

The proposed development is taller than its immediate surroundings in all directions and as such, consideration for its interaction with the prevailing winds is of importance. Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. *Downwashing Flow* (see Image 5a) is the main cause for increased wind activity at the grade level. When two buildings are situated side by side, wind flows tend to accelerate through the space between the buildings due to the *Channelling Effect* (5b). Oblique winds also cause wind accelerations around the exposed building corners (see Image 5c). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

Important consideration has therefore been placed on this regarding the precinct massing, with the design responding to help minimize the potential for downwash effects, with more narrow towers, and reduce large horizontal surface areas.



a) Downwashing Flow

b) Channeling Effect

c) Corner Acceleration

d) Large Podium

Image 5: General Wind Flow Patterns

Existing Wind Conditions

The site is currently occupied by the existing Strathfield Plaza which currently consists of a large single story retail shopping centre over the entire site with carparking located atop. On the eastern aspect of the site is a 9 storey commercial tower, adjacent to The Boulevarde.

There are a number of nearby developments in the immediate context to be considered as part of the wind environment considerations (Image 6). This includes:

- *1-9 The Boulevarde* – This is located at the north-eastern corner of the block, up to 11 storeys high.
- *2-6 Pilgrim Avenue* – A proposed 10-16 storey development located to the north-north-west of the site.
- *19-25 Everton Road (U/C) and 27-33 Everton Road (Approved)* – Located to the north-east of Strathfield Station and will be 9 storeys once completed.

While the site is located in the middle of the Strathfield CBD precinct, the region is generally surrounded by low-rise built forms in all directions. The apartment buildings located to the west and north-west of the site provide shielding to the westerly winds, however are expected to direct this down Churchill Avenue and Redmyre Road to the north and south of the site.

The site is generally exposed to the prevailing southerly and northeasterly winds given the surrounding context. The existing built forms of Sandalwood Apartments and Regal Court Apartments currently direct some of the northeasterly winds south towards the site. The inclusion of the development at 1-9 The Boulevarde will also provide localised shielding, and may direct the northeasterly winds down The Boulevarde.

Consideration for the southerly winds will be of importance given the current exposure in this direction.

Image 6: Existing and Proposed Surrounding Built Forms

Future Wind Conditions

The design of the development has considered the exposure of the site noted in the previous section, to the prevailing wind directions, in particular the north-easterly and southerly winds.

As such the following considerations have been incorporated into the design in response to these aspects:

- Four of the tower forms of the development have been aligned in the north-south direction. Further, the design opted for taller and narrower rather than shorter squatter forms. This arrangement will assist in reducing the potential for downwashing of the southerly winds to the ground plane below, especially on Redmyre Road. Reducing the width of the tower forms, increasing building separation in trade-off for increased height, has a notable benefit in terms of reducing the downwash effect of the prevailing winds. This is due to the winds being able to move more easily around the towers and through the site.

- Awning elements have been included on the northern and southern aspects of the site to further help mitigate any downwashed winds, primarily from the lower levels of the development as well as provide weather protection. The space between the towers enables a flow path through the site (Image 8). This helps to reduce the expected pressure build up on the northern and southern aspects of the site which would otherwise affect the wind conditions on the pedestrian footpaths.

- The alignment of the Transport Hub in the north-south direction will also encourage suitable ventilation of vehicle exhaust for improved comfort for patrons.

Image 7: Ground Floor Plan

5. PEDESTRIAN WIND CONDITIONS

- Tower 3 which is located off The Boulevarde is aligned in the east-west direction. This positioning benefits from the shielding of the north-easterly winds provided from 1-9 The Boulevarde development to the north.
  Noting that this tower alignment can increase the impact by the southerly winds, the design has incorporated a two level high recess along the southern aspect at Level 3 to help breakup any downwashed winds from impacting the streetscape below. Furthermore, the alignment of this recess corresponds with the adjacent existing buildings to the south, which would also act as an artificial podium. The design of this tower has been aimed at responding to the surrounding built form with consideration for the wind conditions.

- As the height of the development will exceed the existing buildings to the west, the design has incorporated a significant setback and podium along this boundary. This area will capture any downwashed winds and minimize any impact to the adjacent surrounding areas. The height at which the setback occurs has been aligned with consideration for the adjacent building form to enhance this effect.

- Inclusion of landscaping within the public realm through the site will assist in breaking up any direct winds through this covered area. The design of the public landscaping can be developed in due course as the design develops.

Image 8: Wind Flows around Development

6. SUMMARY

Wind conditions on and around the proposed Strathfield Central development in Sydney are discussed in this report. Our qualitative assessment was based on the local wind climate, the current design of the proposed development, existing surrounding buildings and our experience with wind tunnel testing of similar buildings.

The proposed development has considered the prevailing wind directions that currently impact the site as well as the built form around the development. The towers have incorporated a number of key design features to respond to this aspects, aimed at limiting the impact to the surrounding areas. These features include, reducing the width of tower forms and podiums heights, setbacks of the towers from site boundaries, consideration for the adjacent built forms and heights to consider a precinct wide wind response, inclusion of recessed areas to reduce downwash and awnings along key street frontages, and the primary public plaza space.

The elevated outdoor terrace spaces will be exposed to the prevailing winds. However the development of an appropriate landscape design will be developed as part of the design process to ensure these spaces are suitable for their intended use by the occupants.

Detailed modelling will be undertaken as part of the design development process to verify the wind conditions within and around the development site, and ensure that suitable conditions are provided to the occupants and pedestrians.

Overall, the Planning Proposal is supported.

7. APPLICABILITY OF RESULTS

The assessment presented in this report are for proposed at Strathfield Central development in Strathfield, NSW was based on the architectural design drawings and documents received by RWDI on September 20, 2019.

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 pedestrian wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.