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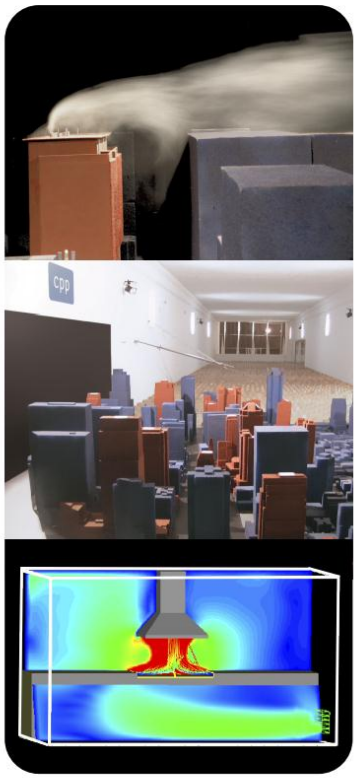
WIND ENGINEERING AND AIR QUALITY CONSULTANTS

FINAL REPORT



Wind Assessment for:

NSW NETBALL CENTRAL

Sydney Olympic Park, NSW, Australia

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Introduction

Cermak Peterka Petersen Pty. Ltd. has been engaged by Netball NSW to provide an opinion based assessment of the impact of the proposed Netball Central development at Sydney Olympic Park on the pedestrian level local wind environment.

The site is located at the south-west end of Olympic Boulevard, Sydney Olympic Park, Figure 1, and is surrounded by isolated similar sized buildings. To the north and north-west of the site is a mix of grandstands, warehouses, and buildings associated with the facilities of Sydney Olympic Park. Bicentennial Park and suburban zones are located to the east, and light industrial and suburban zones to the south-west. Topography surrounding the site slopes gently upwards to the north and west.

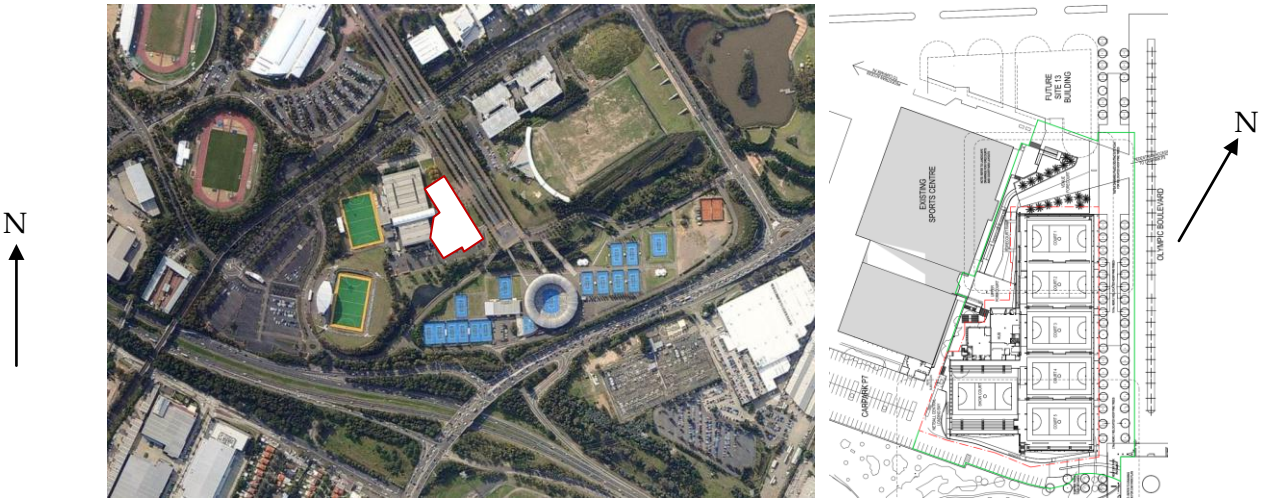

Figure 1 Location of the proposed development (Near Map 2012) and site plan

Environmental Wind Speed Criteria

It is generally accepted that wind speed and the rate of change of wind velocity are the primary parameters that should be used in the assessment of how wind affects pedestrians. Local wind effects can be assessed with respect to a number of environmental wind speed criteria established by various researchers. Despite the apparent differences in numerical values and assumptions made in their development, it has been found that when these are compared on a probabilistic basis, there is remarkably good agreement.

Auburn City Council has no specific wind assessment criteria. The wind assessment criteria used in this study are based upon the research of Lawson (1990), which are described in Table 1 for both pedestrian comfort and distress. The benefits of these criteria over many in the field are that they use both a mean and gust equivalent mean (GEM) wind speed to assess the suitability of specific locations. The criteria based on the mean wind speeds define when the steady component of the wind causes discomfort, whereas the GEM wind speeds define when the wind gusts cause discomfort.

Table 1: Pedestrian comfort criteria for various activities

Comfort (maximum wind speed exceeded 5% of the time)	
<2 m/s	Outdoor dining
2 - 4 m/s	Pedestrian sitting (considered to be of long duration)
4 - 6 m/s	Pedestrian standing (or sitting for a short time or exposure)
6 - 8 m/s	Pedestrian walking
8 - 10 m/s	Business walking (objective walking from A to B or for cycling)
> 10 m/s	Uncomfortable
Distress (maximum wind speed exceeded 0.022% of the time, twice per annum)	
<15 m/s	General access area
15 - 20 m/s	Acceptable only where able bodied people would be expected; no frail people or cyclists expected
>20 m/s	Unacceptable

The wind speed is either a mean wind speed or a gust equivalent mean (GEM) wind speed. The GEM wind speed is equal to the 3 s gust wind speed divided by 1.85.

Local Wind Climate

The Bureau of Meteorology anemometer at Homebush is known to produce directionally biased wind measurements, due to its proximity to surrounding developments. Therefore an analysis of meteorological data from Bankstown Airport has been conducted to assess the local wind climate and is considered to be representative of Sydney Olympic Park wind environment.

The proposed development lies approximately 10.5 km to the north-west of Bankstown Airport Bureau of Meteorology anemometer. The wind rose for the airport is presented in Figure 2 and is considered to be representative of prevailing winds at the site. It is evident that wind speed distribution is reasonably constant with prevailing winds from the south and west. Winds from the south occur throughout the year and tend to be cold, generally associated with frontal systems that can last several days. Winds from the west are the strongest of the year and are associated with large weather patterns and thunderstorm activity. These winds occur throughout the year and can be cold or warm depending on the inland conditions. The summer north-east sea breezes prevalent in coastal Sydney have dissipated this far inland at the site.

Sydney is relatively windy, with an average wind speed at 10 m reference height of approximately 3 m/s (6 kt, 11 kph), and five percent of the time the mean wind speed is in excess of approximately 9 m/s (17 kt, 32 kph). Converting the five percent of the time wind speed to typical pedestrian level chest height would result in about 6.5 m/s. Comparing this with the comfort criteria of Table 1 indicates that the locale would be acceptable for pedestrian walking; hence any recreational outdoor activity requires significant shielding from prevailing wind directions.

This wind assessment is focused on these prevailing wind directions.

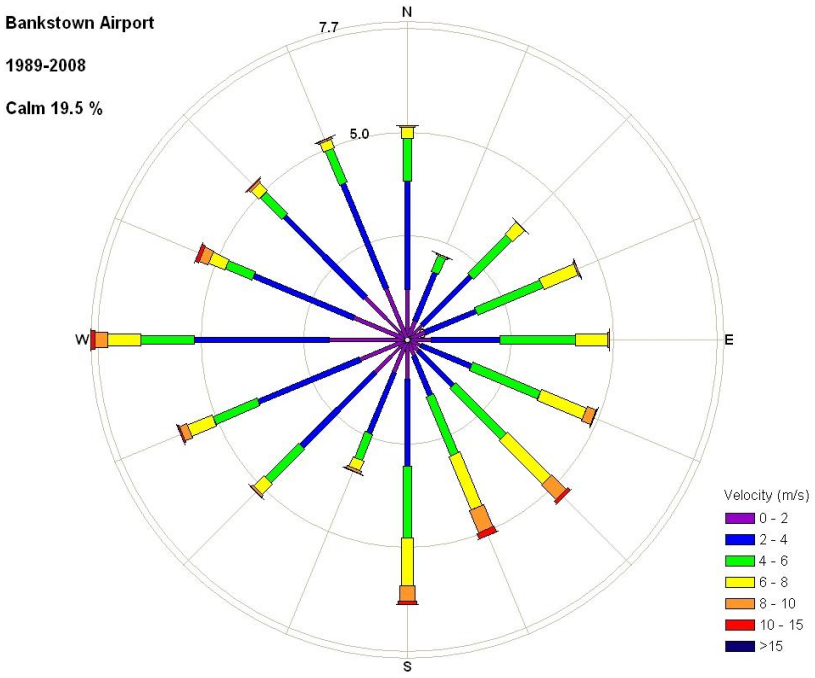

Figure 2: Wind rose for Bankstown Airport

Wind Flow Mechanisms

When the wind hits an isolated building, the wind is accelerated down and around the windward corners, Figure 3; this flow mechanism is called downwash and causes the windiest conditions at ground level on the windward and sides of the building. In Figure 3 smoke is being released into the wind flow to allow the wind speed, turbulence, and direction to be visualised. The image on the left shows smoke being released across the windward face, and the image on the right shows smoke being released into the flow at about third height in the centre of the face.

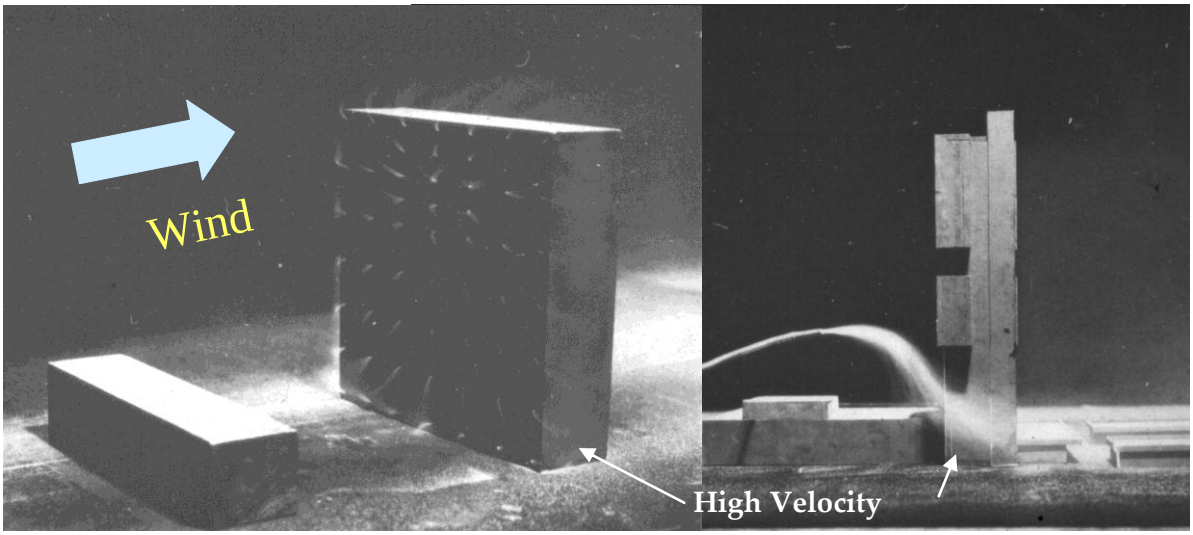

Figure 3: Flow visualisation around a tall building

Techniques to mitigate the effects of downwash winds on pedestrians include the provision of horizontal elements, the most effective being a podium to divert the flow

away from pavements and building entrances. Awnings along street frontages perform a similar function and generally, the larger the horizontal element the more effective it will be in diverting the flow.

Channelling occurs when the wind is accelerated between two buildings or along straight streets with buildings on either side.

Environmental Wind Assessment

The proposed development consists of a single building approximately 130 m long, between 40 and 80 m wide, and rising about 15 m above ground level, Figure 4 and Figure 5.

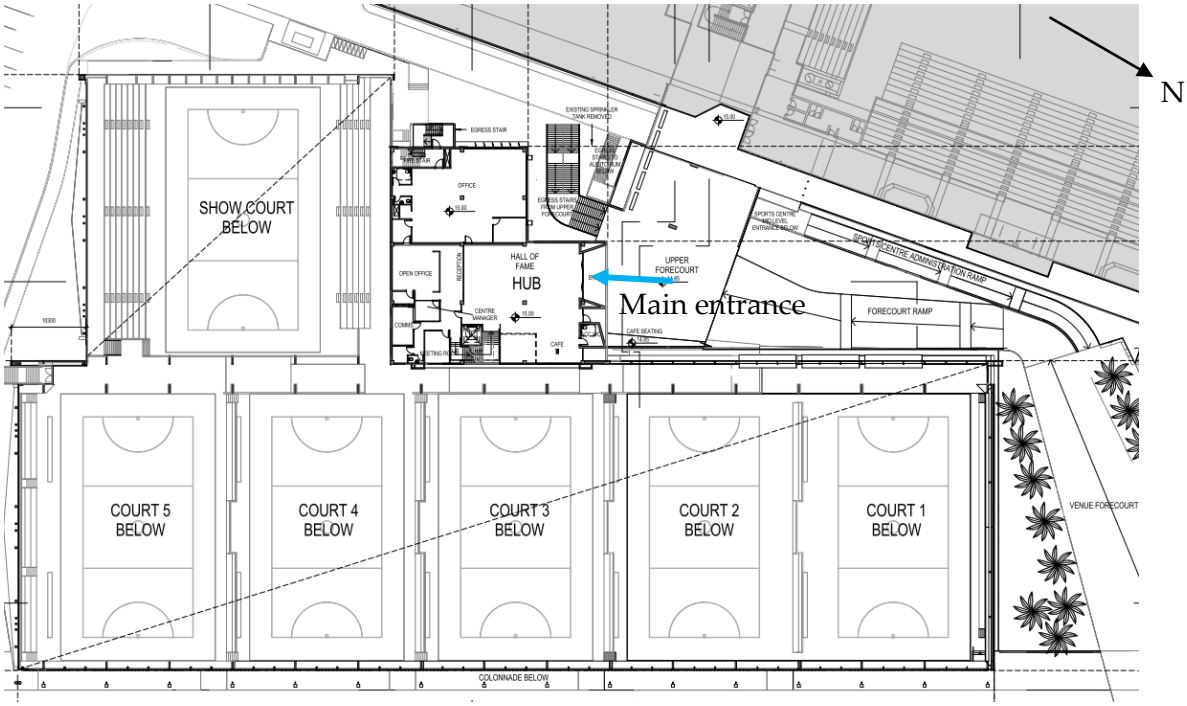

Figure 4: Level 3 floor plan

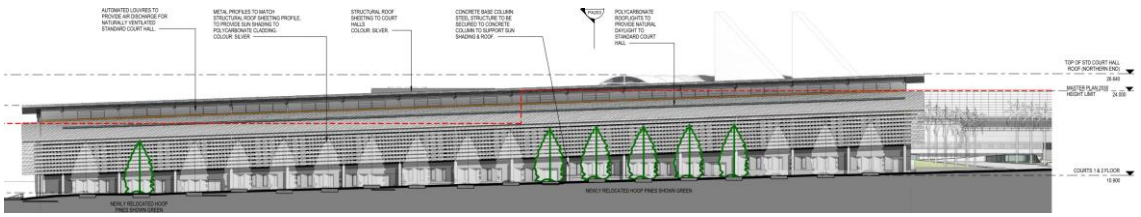

Figure 5: Olympic Boulevard elevation

There will be heavy pedestrian traffic around the development during events. The main pedestrian entrance is from the north at Level 3, Figure 4 which is well positioned being remote from the building corners where local high winds are experienced.

Existing wind conditions at the site are known to be acceptable for pedestrian walking. The inclusion of a relatively low-rise structure will not significantly affect the wind environment.

Winds from the south-east quadrant are currently accelerated along the eastern elevation of the Sports Centre. The proposed building extends further south than the existing building, therefore will offer significant shielding to the gap between the buildings. Upon completion, the wind will accelerate along the east face of the building discharging around the north-east corner of the site across the forecourt. The main access ramp adjoins the north face of the building, which will offer protection to pedestrians compared with the ramp crossing the forecourt area. The design of Building 13 to the immediate north of the site, Figure 1, will have an impact on the local flow patterns in the forecourt area. If there is a north-south through-site passageway, or gap between two taller wings of Building 13, then the wind will be encouraged to cross the forecourt creating windier conditions.

Winds from the west are currently accelerated around the Sports Centre. The proposed building is located in the lee of the existing building and therefore shielded. Wind conditions around the south-west corner are likely to be strong, but there is no pedestrian access in this area. The current geometry of Building 13 will channel the flow between the buildings and across the northern section of the forecourt.

Winds from the north-east are decelerated by the local topography, but there will be accelerated flow between the proposed building and Sports Centre. The inclusion of Building 13 will reduce this effect.

The proposed outdoor seating area to the adjacent to the west face of the proposed building is well located from a wind perspective receiving shielding from most prevailing wind directions, except wind from the north-east, which tends to occur on hot summer days bringing welcome relief to patrons.

Due to the location of the building and the surrounding buildings and landscaping, the proposed development is not expected to change the existing wind environment around the site. With reference to the Lawson criteria, wind conditions with the inclusion of the proposed development are expected to remain suitable for use as a main public accessway.

Conclusions

Cermak Peterka Petersen Pty. Ltd. has provided an opinion based assessment of the impact on the surrounding local wind environment of the proposed NSW Netball Central development, Sydney Olympic Park. Due to the relatively small height of building, the inclusion of the proposed building will have a minor influence on the local wind environment. Wind conditions at pedestrian level around the development are expected to be suitable for use as a public accessway, and most locations would be classified as suitable for pedestrian standing activities according to the Lawson comfort criterion. No exceedances of the Lawson distress conditions are expected.

References

Lawson, T.V., (1990), The determination of the wind environment of a building complex before construction, *Department of Aerospace Engineering, University of Bristol*, Report Number TVL 9025.