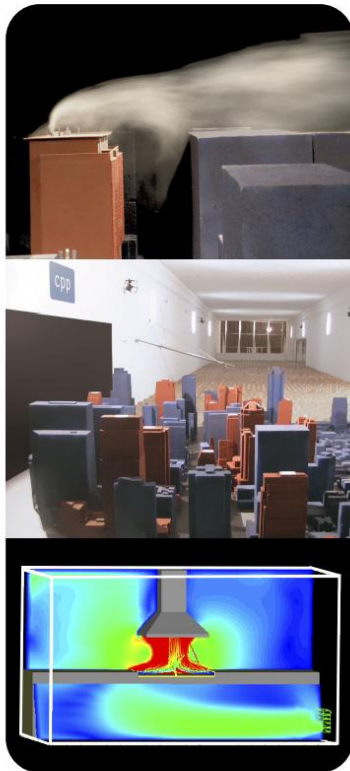




CERMAK  
PETERKA  
PETERSEN

WIND ENGINEERING AND AIR QUALITY CONSULTANTS

## FINAL REPORT



Wind Assessment for:

### **BLACKTOWN HOSPITAL – STAGE I**

Blacktown, Australia

Health Infrastructure

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**TABLE OF CONTENTS**

Introduction.....2  
 Bankstown Wind Climate .....2  
 Environmental Wind Speed Criteria .....3  
 Wind Flow Mechanisms .....4  
 Environmental Wind Assessment .....5  
 Conclusions .....7  
 References.....8

**TABLE OF FIGURES**

Figure 1: Location of the proposed development and aerial view from the west (Near Map, 2011).....2  
 Figure 2: Wind rose for Bankstown Airport corrected to open country terrain.....3  
 Figure 3: Flow visualisation around a tall building .....5  
 Figure 4: Site plan of the proposed development.....6  
 Figure 5: South and west elevations of the proposed building .....6  
 Figure 6: Level 3 and Level 5 floor plans of the proposed development.....7

**TABLE OF TABLES**

Table 1: Pedestrian comfort criteria for various activities.....4

## Introduction

Cermak Peterka Petersen Pty. Ltd. has been engaged by Health Infrastructure to provide an opinion based assessment of the impact of the proposed Blacktown Hospital Stage 1, Blacktown on the pedestrian level local wind environment in and around the proposed development.

The site is located to the south-east of the Blacktown on the east of the block bounded by Blacktown Road, Bungarrabee Road, and Panorama Parade. The site is surrounded by low-rise residential buildings, Figure 1. The site is on the car-park to the immediate south of the existing hospital building. From a wind engineering perspective, topography surrounding the site is essentially flat.



Figure 1: Location of the proposed development and aerial view from the west (Near Map, 2011)

## Bankstown Wind Climate

The proposed development lies approximately 17 km to the north-west of Bankstown Airport Bureau of Meteorology anemometer. The wind rose for Bankstown airport is shown in Figure 2. The Bureau of Meteorology anemometer at Homebush Bay is closer to the site, but is known to be directionally influenced by surrounding buildings, topography, and landscaping hence the readings are unreliable for

pedestrian level wind comfort analysis. The prevailing strong winds at Bankstown come from the south-east and west quadrants.

Winds from the south-east, which tend to be cold, are often caused by frontal systems that can last several days and occur throughout the year. Winds from the west tend to be 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 prevailing wind directions associated with rain are from the south and west quadrants.

This wind assessment is focused on these prevailing wind directions.

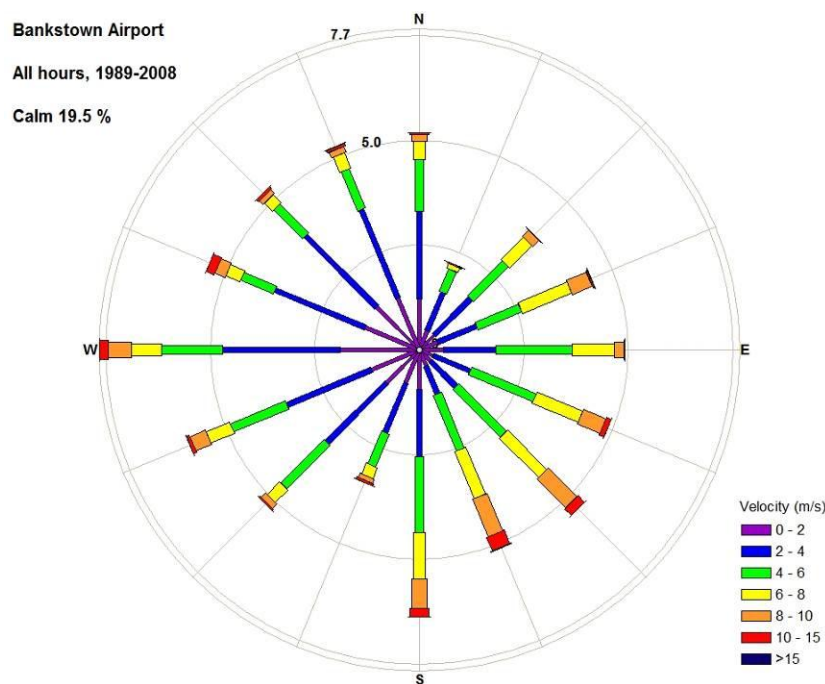


Figure 2: Wind rose for Bankstown Airport corrected to open country terrain

### 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.

Blacktown Development Control Plan 2006 has no specific wind assessment criteria. The wind assessment criteria used in this study are based upon the research of Lawson (1990), which is 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

<b>Comfort</b> (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
<b>Distress</b> (max. 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.

Bankstown is relatively mild, 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 approximately 8.5 m/s (17 kt, 31 kph). Converting the five percent of the time mean wind speed to typical pedestrian level at the site using Standards Australia (2011) would result in about 5.4 m/s (11 kt, 20 kph). Comparing this with the comfort criteria of Table 1 indicates that pre-existing winds at any Bankstown location with a similar built environment surrounding the proposed development site would be classified as acceptable for pedestrian standing. Specific building massing of the proposed development and their interaction with approaching wind flows will dictate the actual wind environment at the site and the resulting wind acceptability levels; these are explored in detail below.

### Wind Flow Mechanisms

When the wind hits a large 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.

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 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.

Figure 3 shows wind at mid and upper levels on a building is accelerated substantially around the corners of the building. When balconies are located on these corners they are likely to be breezy, and will be used less by the owner due to the regularity of stronger winds. Owners quickly become familiar with when and how to use their balconies. If the corner balconies are deep enough, articulated, or have regular partition privacy fins then local calmer conditions can exist.

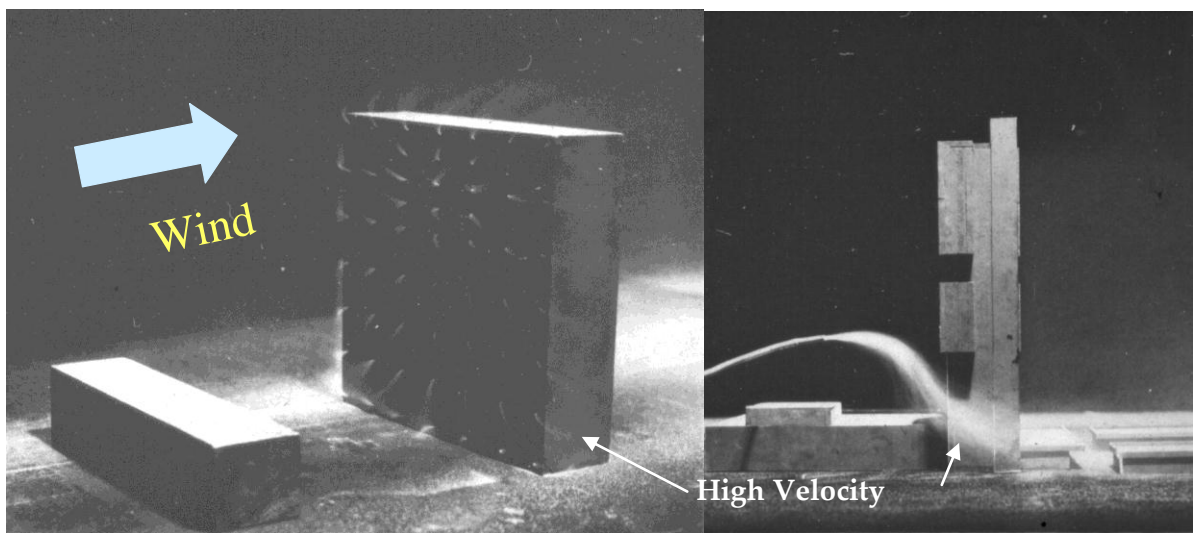


Figure 3: Flow visualisation around a tall building

### Environmental Wind Assessment

The proposed development is located to the south of the existing Blacktown Hospital Building, Figure 4. The proposed development consists of a 8-storey building with two basements rising approximately 28 m above ground level, Figure 5. Floor plans are shown in Figure 6 indicating the Level 3 ground floor and outdoor area on Level 5.

The proposed development is generally surrounded by residential buildings. In the immediate vicinity there is the 4-storey hospital building to the north, the 3-storey admin building to the south-east and a proposed multi-storey car park to the south, Figure 4. The building is relatively exposed to winds from the west and south until the car-park is constructed, Figure 4. From a wind engineering perspective, topography surrounding the site is relatively flat. Winds in such complex surrounds tend to be channelled along the streets with local effects being dictated by exposed similar sized building and local topography. Wind conditions around the Blacktown Hospital precinct are known to be acceptable for use as a main public accessway.

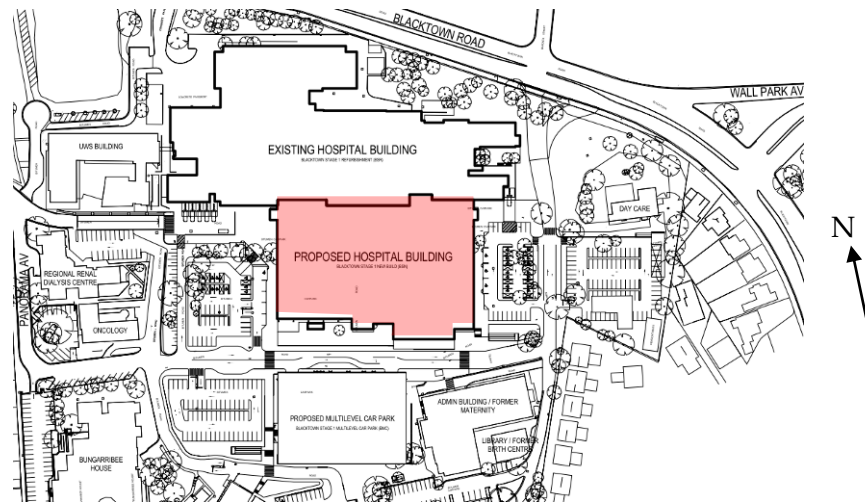


Figure 4: Site plan of the proposed development

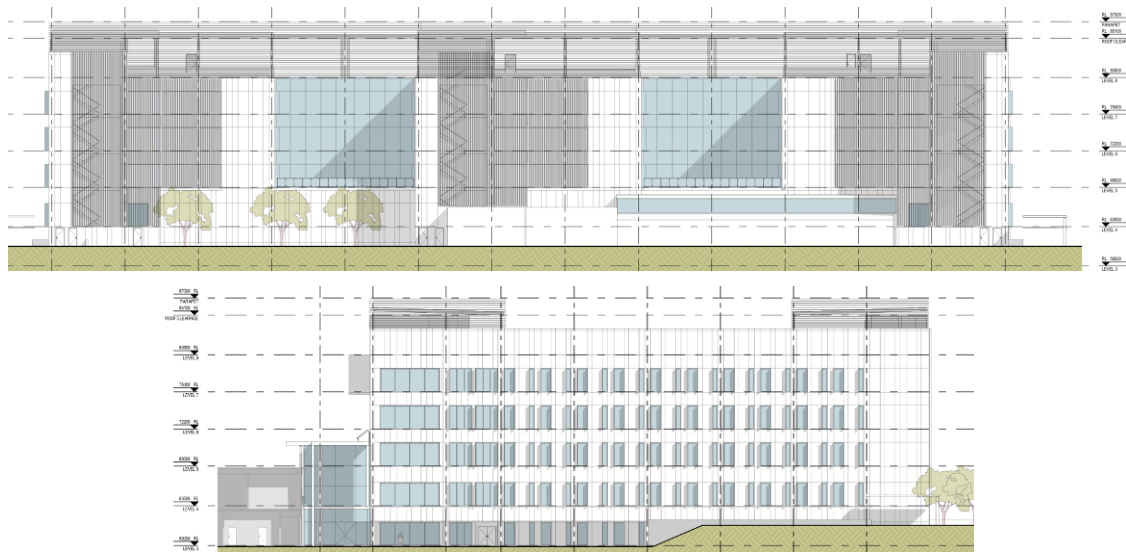


Figure 5: South and west elevations of the proposed building

In general, the wind climate for Blacktown is relatively mild and all the areas around the development are expected to be suitable for main public accessways. The strongest winds are from the south-east and west quadrants. During these events the wind will stagnate on the exposed south and west façade and accelerate down and around the windward corners creating local windier conditions. The articulation and deep terraces along the south façade on Level 5, Figure 6, will reduce the wind acceleration along the southern face, and will significantly reduce the amount of downwash reaching ground level during winds from the south quadrant. The wind conditions although slightly stronger at the southern corners are expected to remain acceptable for use as a main public accessway.

During winds from the west there will be channelling of flow between the proposed building and the existing administration building to the south of the site. The height of the structure will mean that any increase in velocity will be small. The proposed car-park will further amend the wind conditions in this area and if of an open design will improve the local wind conditions.

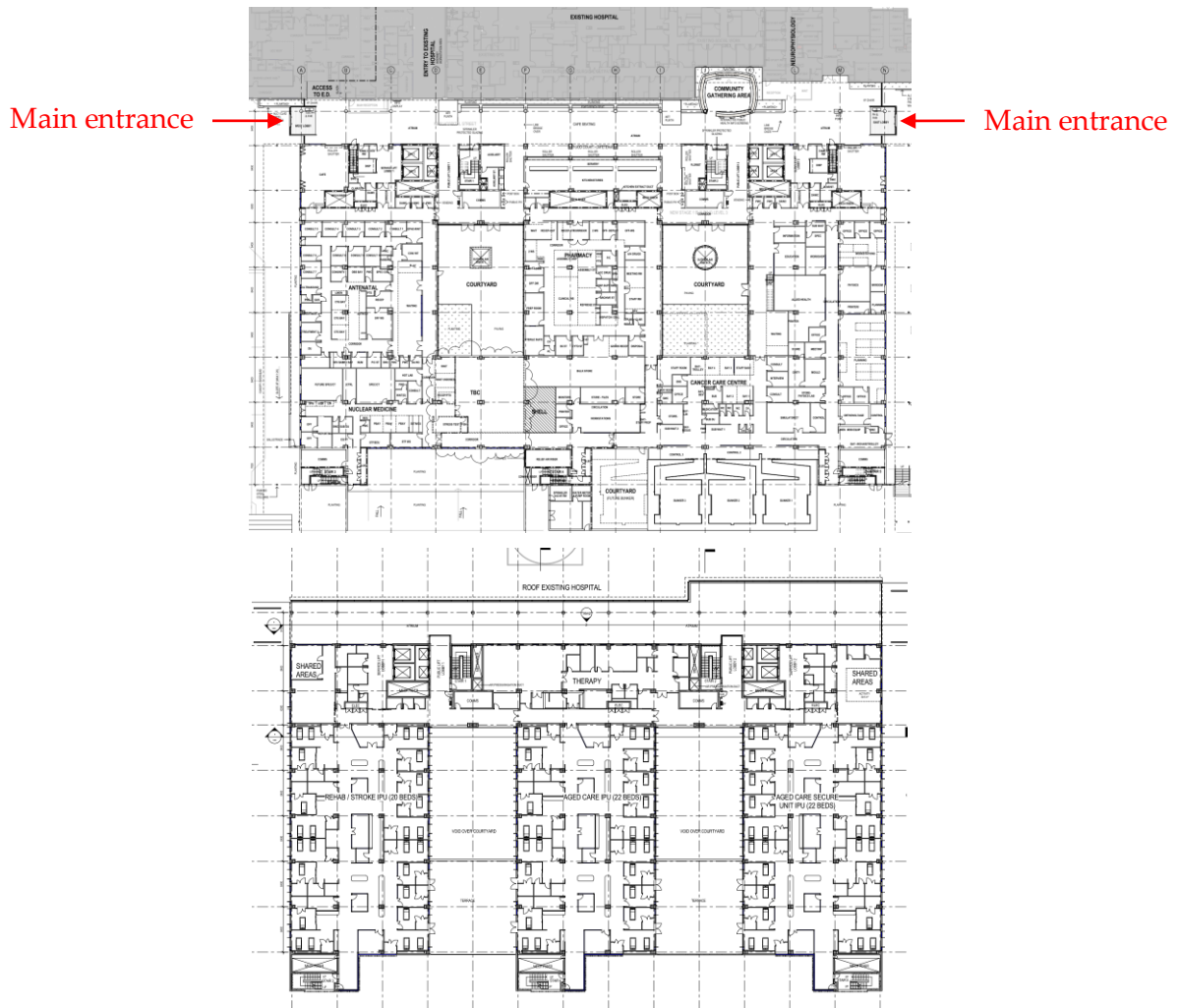


Figure 6: Level 3 and Level 5 floor plans of the proposed development

The main entrances to the building are on the east and west faces adjacent to the existing hospital building, Figure 6, which will be protected by the building massing to produce a relatively calm wind environment for pedestrian access.

Wind conditions in the courtyard and on the rooftop terraces between the wings of the building are expected to be suitable for their intended use as outdoor seating areas for the majority of time.

**Conclusions**

Cermak Peterka Petersen Pty. Ltd. has provided an opinion based assessment of the impact on the local wind environment of the proposed Stage 1 development Blacktown Hospital. The wind conditions around the site are expected to be suitable for use as a public accessway.

**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.

Standards Australia (2011), *Australian/New Zealand Standard, Structural Design Actions, Part 2: Wind Actions (AS/NZS1170 Pt.2)*.