CERMAK PETERKA PETERSEN

WIND ENGINEERING AND AIR QUALITY CONSULTANTS

Final Report

Qualitative Wind Assessment for:

MOOLOOLABA MIXED USE DEVELOPMENT

Mooloolaba, QLD 4557, Australia

Prepared for:

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1. INTRODUCTION

Cermak Peterka Petersen Pty. Ltd. has been engaged by DMC Projects to provide a qualitative assessment of the impact of the proposed Mooloolaba Mixed Use Development on the wind conditions in the surrounding areas.

The proposed development is located on the west corner of First Avenue and Brisbane Road, in a region of low to medium-rise development, Figure 1. The proposed development will comprise 3 medium-rise towers, reaching a maximum height of about 45 m above ground level, Figure 2, and is of similar size to most of the surrounding structures. The addition of the proposed development is expected to have some impact on the local wind conditions, and the extents are broadly discussed in this report.

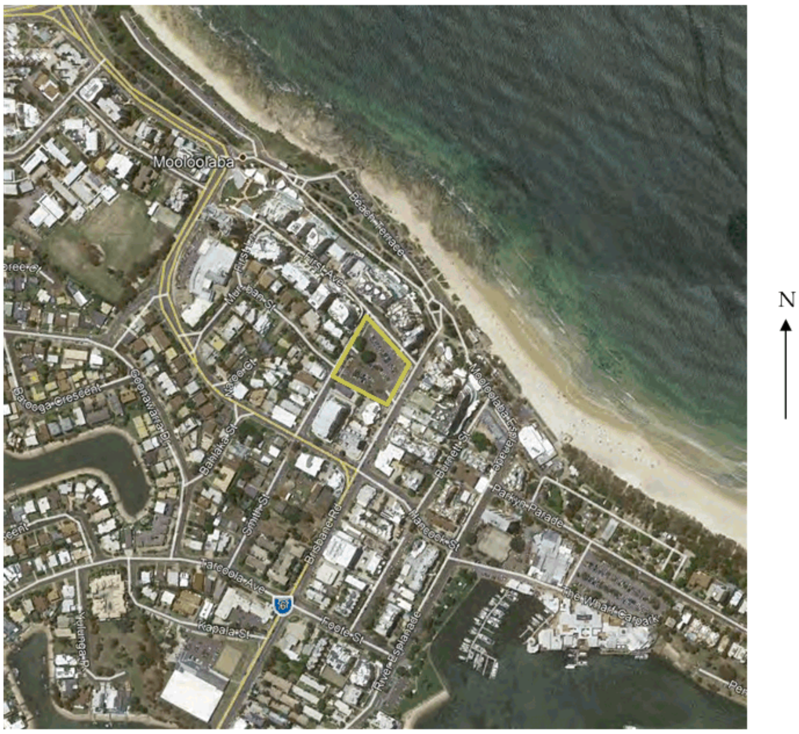

Figure 1: Aerial view of the proposed development site (Google Earth, 2017).

Figure 2: South-east elevation of the proposed development.

2. SUNSHINE COAST WIND CLIMATE

The proposed development lies approximately 10 km to the south-east of the Sunshine Coast Airport Bureau of Meteorology anemometer. To enable a qualitative assessment of the wind environment, the wind frequency and direction information measured by the Bureau of Meteorology at a standard height of 10 m at Sunshine Coast Airport from 1995 to 2015 have been used in this analysis. The wind rose for Sunshine Coast Airport is shown in Figure 3 and is considered to be representative of prevailing winds at the site. It is noted from Figure 3 that strong prevailing winds typically originate from the north-north-east and south-east quadrants. Winds from the north-east are most frequent and strong in spring and summer, and winds from the south-east tend to be summer and autumn winds. This wind assessment is focused on these prevailing strong wind directions.

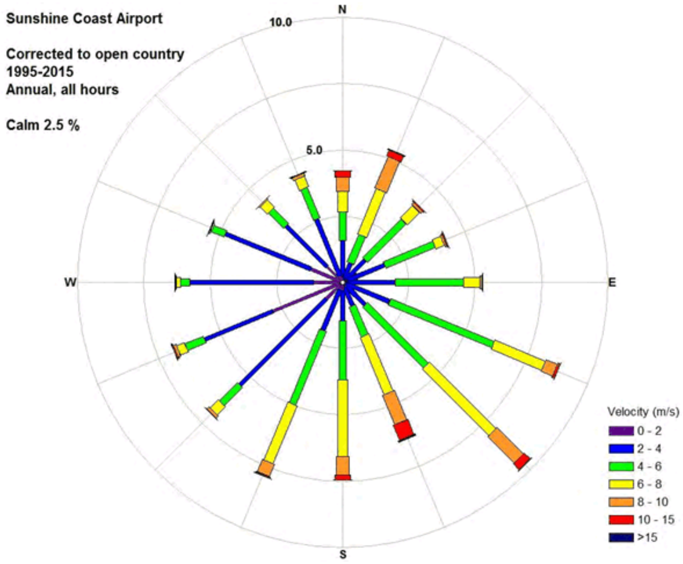

Figure 3: Wind rose for Sunshine Coast Airport.

Sunshine Coast is relatively windy, with an average wind speed at 10 m reference height of approximately 4.5 m/s (8 kt, 14.5 kph), and five percent of the time the mean wind speed is in excess of approximately 9 m/s (16 kt, 29 kph). Converting the five percent of the time wind speed to pedestrian level would result in about 7 m/s using a category 2 terrain profile as contained within AS/NZS 1170.2:2011. 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.

3. 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.

The Sunshine Coast City Council has no specific wind assessment criteria. This study is based upon the criteria of Lawson (1990), which are described in Table 1 for both pedestrian comfort and distress/safety. The benefits of these from a comfort perspective is that the 5% of the time event is appropriate in terms of perception from the general public. The limiting criteria are defined for both a mean and gust equivalent mean (GEM) wind speed. 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 (max. 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/Safety (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 an hourly 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.

4. WIND FLOW MECHANISMS

When the wind hits a large isolated building, the wind is accelerated down and around the windward corners, Figure 4; this flow mechanism is called *downwash* and causes the windiest conditions at ground level on the windward corners and sides of the building. In Figure 4, 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 5 shows the wind at mid and upper levels on a building being 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.

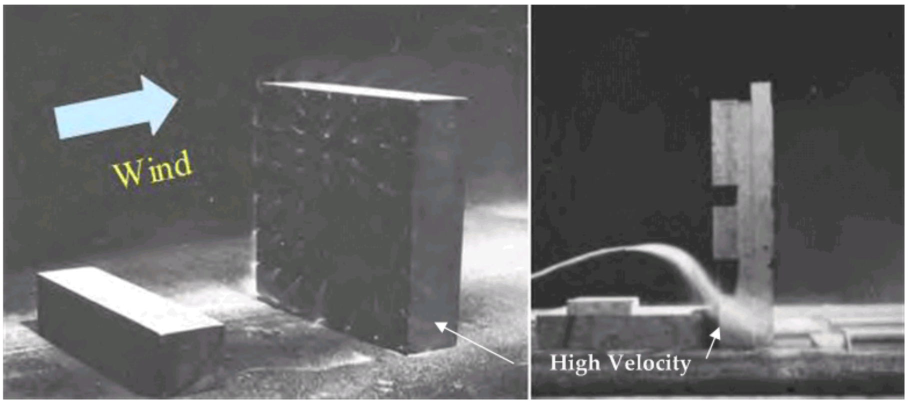

Figure 4: Flow visualisation around a tall building.

Figure 5: Visualisation through corner balconies (left) and channelling between buildings (right).

5. ENVIRONMENTAL WIND ASSESSMENT

The development site is surrounded in most directions by low to medium-rise buildings, with the Coral Sea beyond to the north-east. Topography surrounding the site is relatively flat from a wind perspective and is unlikely to significantly affect the wind climate at the site.

The subject site is situated at the north end of the block bounded by Smith Street, First Avenue, and Brisbane Road, Figure 1. The proposed mixed-use development comprises 3 towers with a common podium, Figure 2, with the ground floor and podium plans shown in Figure 6 and Figure 7, respectively. The retirement residences, hotel, and residential tower levels start from the 5th level and rise to a maximum height of 13 storeys.

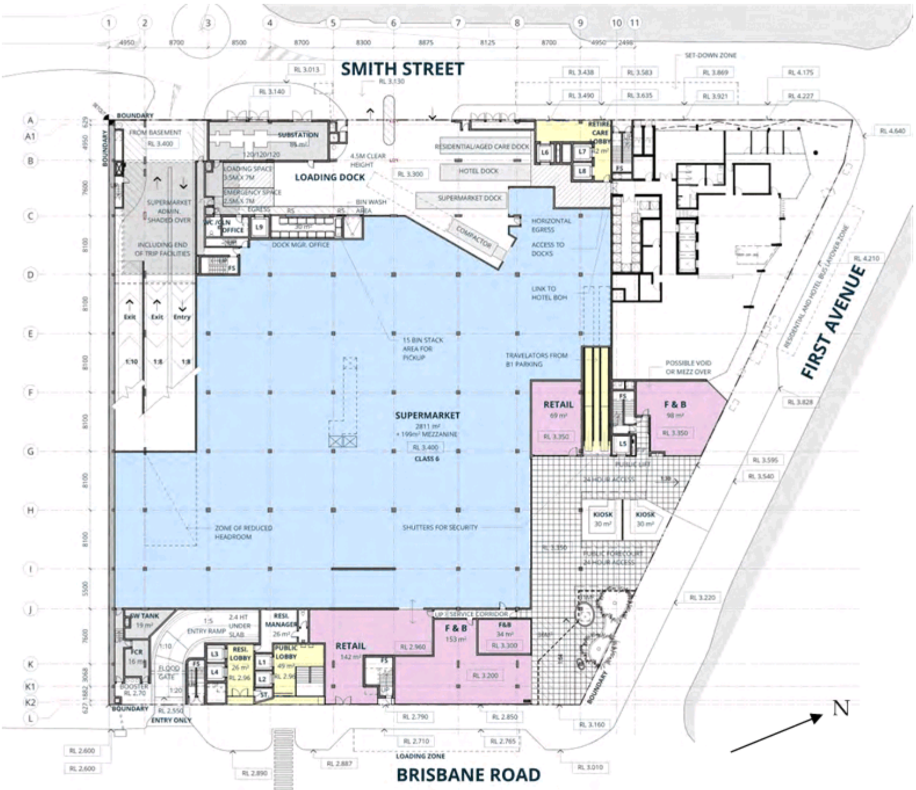

Figure 6: Ground floor of the proposed development.

Figure 7: Plan view of the podium rooftop of the proposed development.

Winds from the north-east

Winds from the north-east quadrant will approach from the Coral Sea. The proposed development is relatively shielded from winds from the north-east by several similar-sized structures located to the north-east of the proposed development. High level flow reaching the upper levels of the north-east façade of the Hotel Tower would be expected to be drawn toward ground level by the low pressure region in the wake of the neighbouring upstream towers, with this downwash flow accelerating around the north-west corner of the Hotel Tower and discharging along Smith Street. The placement of an awning at Level 1 along the north-east and north-west edges of the proposed development, Figure 8, is considered beneficial from a wind perspective, as this horizontal element will assist in deflecting any downwash from the north-east façade of the Hotel Tower away from ground-level. Some flow would also be expected to be channelled between the Retirement and Residential Towers, though the proposed planting between these towers, Figure 7. would assist in keeping this flow elevated.

The alignment of Brisbane Road with prevailing winds from the north-east will encourage channelling flow along this road, the inclusion of the proposed development would be expected to contribute slightly to this mechanism. If the space along Brisbane Road is to be activated for café-style seating, then local vertical screening could be implemented on windier days to create localised areas of calm.

Figure 8: Plan view of Level 1 of the proposed development

Winds from the south-east

Winds from the south-east quadrant will pass over the Mooloolah River and over the medium-rise developments of Mooloolaba. The proposed development receives some shielding from winds from the south-east by several similar-sized structures located to the south-east of the proposed development. Incoming flow will impinge on the broad face of the Residential Tower generating downwash, this flow would be expected to accelerate around the north-east corner of the tower and discharge over the main pool deck. Provision of a solid, or porous, canopy above the pool deck near the north-east corner of Residential Tower would be suggested to assist in improving wind conditions in the vicinity of the main pool deck. The inclusion of the Level 1 awning along the south-east edge of the proposed development, Figure 8, is considered beneficial from a wind perspective, as this awning would assist in deflecting downwash from the upper levels of the south-east façade of the Residential Tower away from ground-level.

Summary

Wind conditions within the proposed development site are expected to remain similar to the existing wind conditions. From a pedestrian comfort perspective, the wind environment around the proposed development site is likely to be classified as acceptable for pedestrian standing or walking from a Lawson comfort perspective. These pedestrian comfort levels would be suitable for public accessways, and for stationary short-term exposure activities. All locations would be expected to satisfy the Lawson distress criterion.

General Comments

Private balconies are located throughout the development. Wind conditions within the balconies are expected to be mostly calm provided they are recessed within the façade. Balconies located on building corners or protruding from the façade are typically more exposed and can experience strong cross flows. For such exposed balconies, it would be recommended to include vertical fins and/or screens, to allow calm areas to exist for a larger portion of time. Over time, residents tend to learn to determine the usability of their balconies based on the seasonal weather conditions.

6. CONCLUSIONS

Cermak Peterka Petersen Pty. Ltd. has provided a qualitative assessment of the impact of the proposed Mooloolaba Mixed Use Development on the local wind environment in and around the development site. Being similar in size to most surrounding structures, there is less potential for the proposed development to generate significant downwash. Wind conditions around the development are expected to be classified as acceptable for pedestrian standing or walking from a Lawson comfort perspective and pass the distress criterion. Local amelioration would likely be necessary for areas intended for long-term stationary or outdoor dining activities.

Wind tunnel testing would be required to quantify the advice provided herein, and for specific local amelioration.

7. REFERENCES

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