

24 September 2013  
Lend Lease Project Management & Construction (Australia) Pty. Ltd.  
Level 4, 30 The Bond  
30 Hickson Road  
Millers Point  
NSW 2000

CPP Project 6029

Attn: Mr. William Walker

Subject: Wind Engineering – Building C3, Barangaroo South

Ref: (1) CPP report, Barangaroo Masterplan, dated November 2010

(2) CPP report, Barangaroo Building C3, dated October 2011

Dear Mr. Walker,

Please find herein comments regarding the impact of the architectural changes to the Barangaroo South development on the pedestrian level wind conditions. The drawings prepared for this Planning Application No. MP11\_0044 S75W Mod 2 dated 13 September 2013 have been reviewed and assessed from an environmental wind perspective at ground level. The only relevant geometric changes are the re-orientation of Globe Street, with the corresponding change in plan form of Buildings R11, R2, R3, C1, C3, and C8, Figure 1, and the removal of mid-rise building C7, Figure 2. The heights of the amended buildings are similar.



Figure 1: Ground plan of existing Mod 4 (L) and proposed Mod 6 (R) configurations

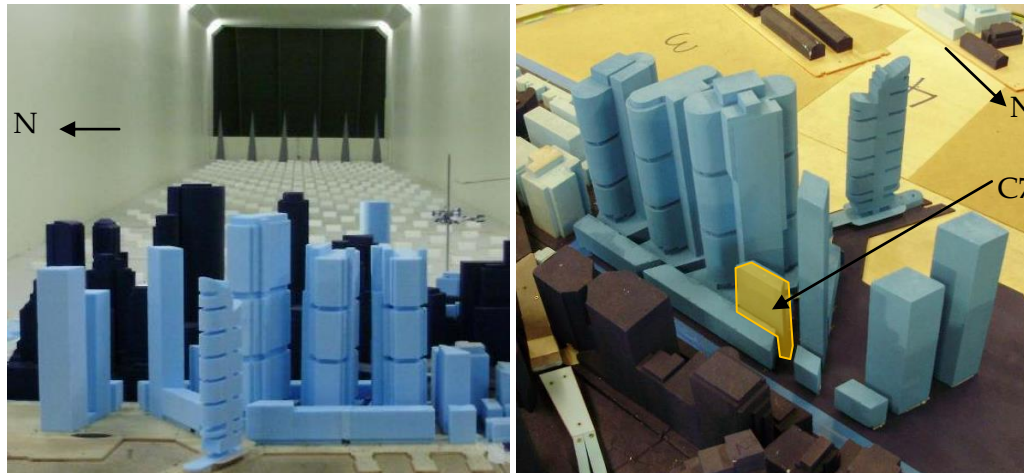


Figure 2: Photograph of the existing Mod 4 configuration (L) and existing Mod 4 configuration with revised tower geometry (R) wind tunnel models

The directional wind flow pattern around the site is complex. The classification of wind conditions at various locations around the site in the Mod 4 configuration is summarised in Figure 3, with directional results presented in Figure 4 and Figure 5. Classification of the comfort and distress criteria is determined by the integration of the measured wind speed with the local wind climate. The wind conditions between the two wind tunnel tested Mod 4 configurations are generally slight with any differences due to the precise measurement location, the proximity of the results to a step in the criterion level as well as the change in geometry of the towers.

From a comfort criterion perspective the wind conditions around the site all met the pedestrian walking criterion, Figure 3, except around the base of the hotel protruding into the harbour. From a pedestrian level wind comfort perspective, the most important change from the Mod 4 to Mod 6 geometry is the increase in size of the Building C3 podium, marked in red in Figure 3. This increase in size is expected to improve wind conditions to the north of Building C3 and along Shelley Lane and Globe Street, by redirecting downwash from reaching ground level. The forming of a regular street grid pattern, particularly opening Globe Street to the west, will increase the ground level wind speed and the channelling of wind. Winds from the west will be channelled along Globe Street to the north of Building C3 causing windy conditions across Hickson Road. The rising topography to the east of the site and the lack of a continuation of the flow path across Hickson Road will ameliorate this condition and wind conditions are expected to remain suitable for pedestrian walking hence acceptable for the intended use of the space.

From a pedestrian distress perspective, apart from in the vicinity of the exposed hotel, there were five locations around the site that were classified as acceptable for 'able-bodied' pedestrians only; to the north-west of Building 4 (Location 8, Figure 3(T)), on Globe Street to the north of Building C3 (Location 38, Figure 3(T), and Locations 14 and 15, Figure 3(B)), and on Shelley Lane to the east of Building C3 (Locations 7 and 8, Figure 3(B)). Exceedances were marginal, with a twice per annum mean wind speed about 15.5 m/s compared with the criterion level of 15 m/s, Figure 5, except Locations 8

and 38 with the sharp-edged towers, and Location 7 with the curved towers, which had a wind speed between 17.6 and 18.4 m/s.

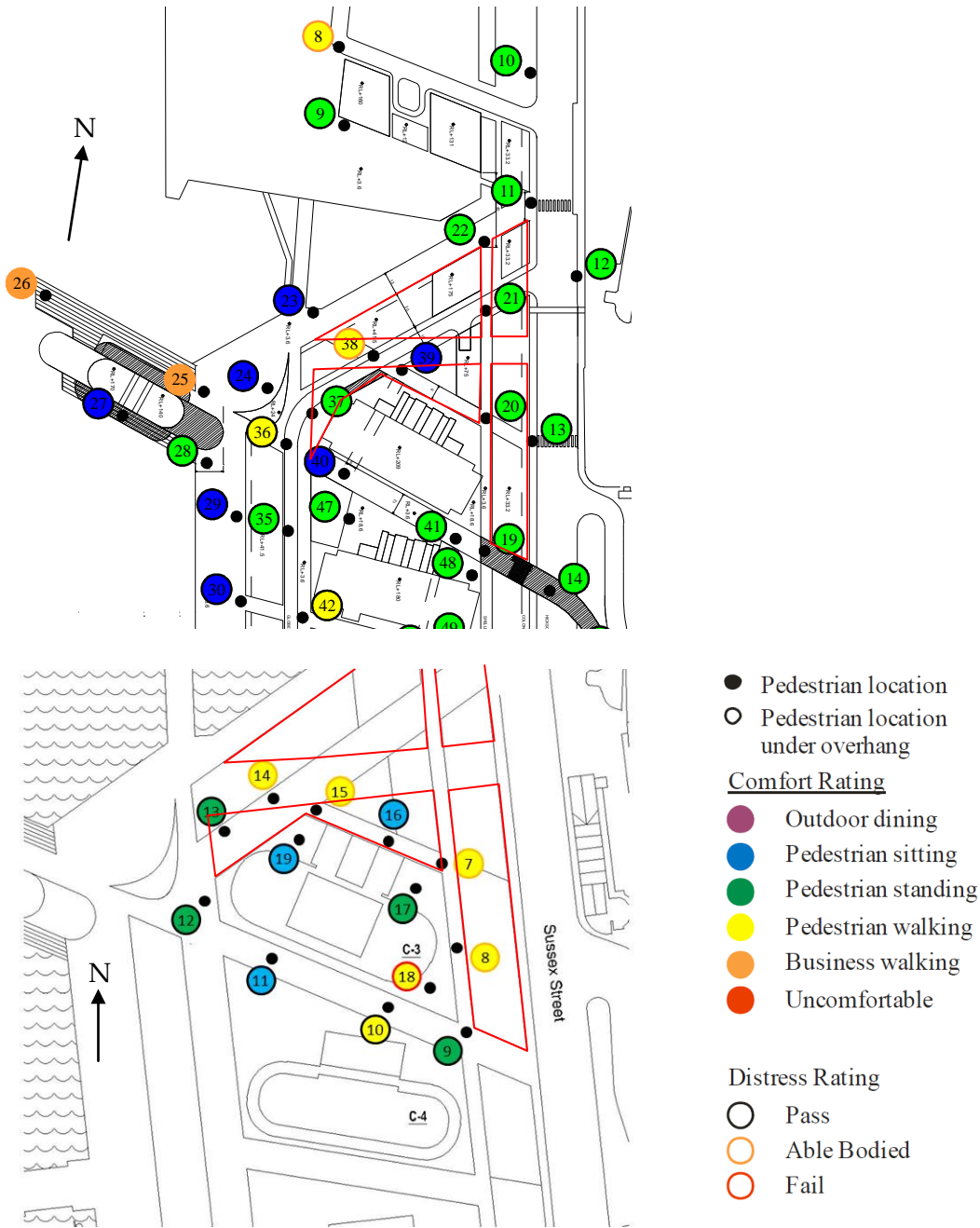


Figure 3: Wind climate results for the Mod 4 configuration (T) and curved towers and realignment of Globe Street(B)

It is evident from Figure 4 that the locations are impacted by winds from the south-west and to a lesser extent from the north-east. The wind conditions at Location 8 are governed by downwash from Building R4 and the proposed changes to the buildings to the south will have negligible impact on the wind climate in this area being governed by the geometry and orientation of Building R4. Winds conditions at Location 38 are expected to improve with the increase in Building C3 podium size by redirecting

downwash away from reaching ground level for critical winds from the south-south-west.

It is evident from Figure 5 that Location 7, on Shelley Lane, was impacted by winds from the south-west and north-west quadrants. Both these wind directions induce downwash from Building C3 at this location. Winds from the south-west are channelled between Buildings C3, C4, and the hotel on the peninsula and brought to ground level by the massing of the tall buildings. Winds from the north-west are brought to ground level by the massing of Building C3. With the increase in podium size to the north of Building C3, a portion of this downwash will be redirected away from reaching ground level and will pass over the roofs of Building C1/C8. The re-direction of flow is expected to improve the wind conditions in this area.

Locations 14 and 15 marginally exceed the distress criterion and are classified as suitable for 'able bodied' pedestrians. The conditions are caused by strong winds from the south-south-west, Figure 5. These conditions are calmer than Location 38 in Figure 4 caused to a large extent by the curved ends of the towers, but the flow is still accelerated between the hotel and the Building C3 and C4. The increase in size of podium to the north-west of Building C3 and to the south of R3, is expected to improve the wind conditions in this area.

In summary, it is expected that the proposed changes to the Barangaroo South development are expected to have a beneficial impact on the local wind conditions. All ground level locations are expected to meet the 'pedestrian walking' comfort criterion. The increase in the size of the podium to the north of Building C3 is expected to improve the wind conditions at ground level from a distress perspective. This conclusion is based on previous wind tunnel test results, combined with an experienced based assessment of the impact of the minor geometric changes, and is considered not to require additional wind tunnel testing at this stage. The wind conditions around the residential towers to the north of the site are not expected to change significantly.

I hope this is of assistance, please do not hesitate to contact me on 9551 2000 if you would like to discuss any aspect of this report.

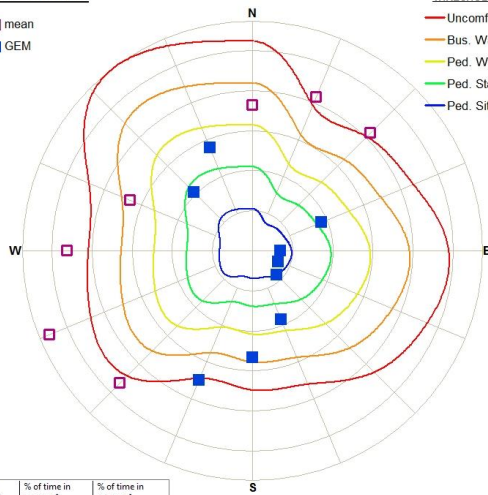
Yours sincerely,



Graeme Wood  
Director  
cc M. Glanville

**LOCATION 8**

□ mean  
■ GEM



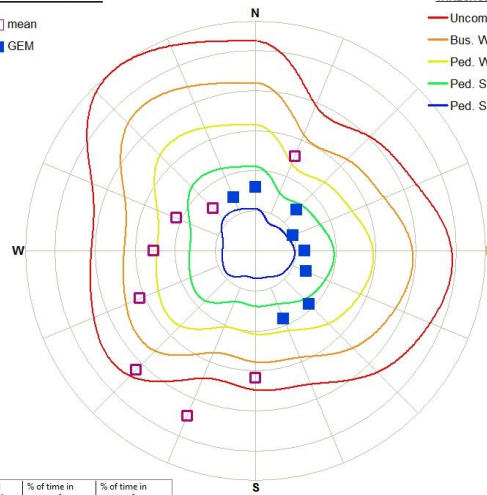
**THRESHOLD**

— Uncomfortable  
— Bus. Walking  
— Ped. Walking  
— Ped. Standing  
— Ped. Sitting

Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	52.0	55.1
4.0	27.7	29.5
6.0	14.9	13.8
8.0	7.5	5.0
10.0	3.0	1.4
8.9	5.0	Bus Walking
18.4	0.022	Able Body
7.9	Ped Walking	5.0
15.5	Able Body	0.022

**LOCATION 38**

□ mean  
■ GEM



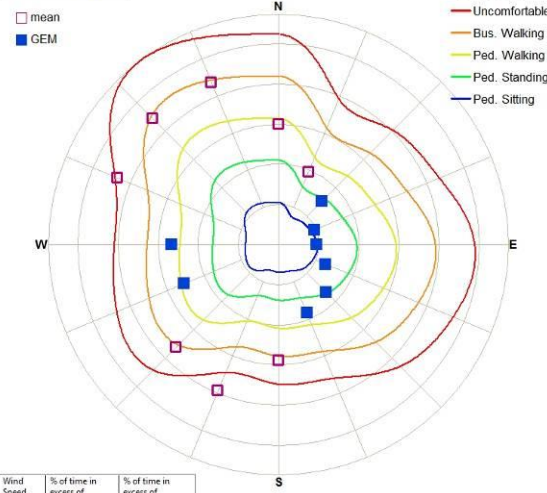
**THRESHOLD**

— Uncomfortable  
— Bus. Walking  
— Ped. Walking  
— Ped. Standing  
— Ped. Sitting

Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	42.6	44.6
4.0	19.9	18.7
6.0	9.3	7.1
8.0	3.6	2.0
10.0	1.3	0.5
7.2	5.0	Ped Walking
18.0	0.022	Able Body
6.5	Ped Walking	5.0
14.6	Pass	0.022

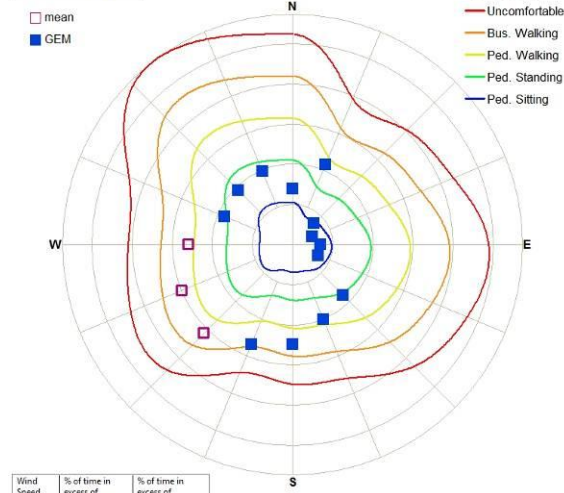
Figure 4: Directional results in the Mod 4 configuration with sharp-edged tower

**LOCATION 7.2**



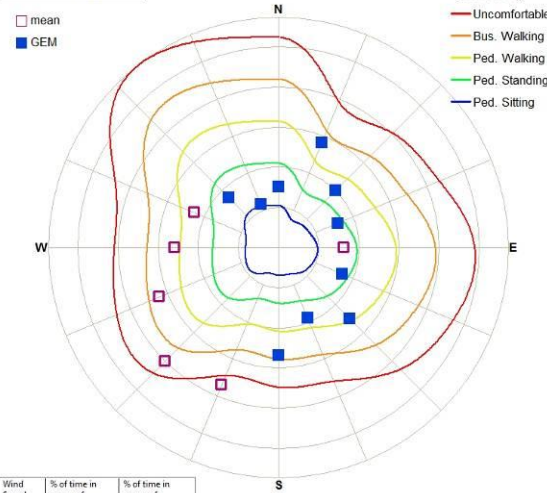
Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	51.4	52.5
4.0	22.4	20.0
6.0	8.9	6.2
8.0	3.5	1.5
10.0	1.3	0.3
7.2	<b>5.0</b>	Ped Walking
17.5	<b>0.022</b>	Able Body
6.3	Ped Walking	<b>5.0</b>
13.4	Pass	<b>0.022</b>

**LOCATION 10**



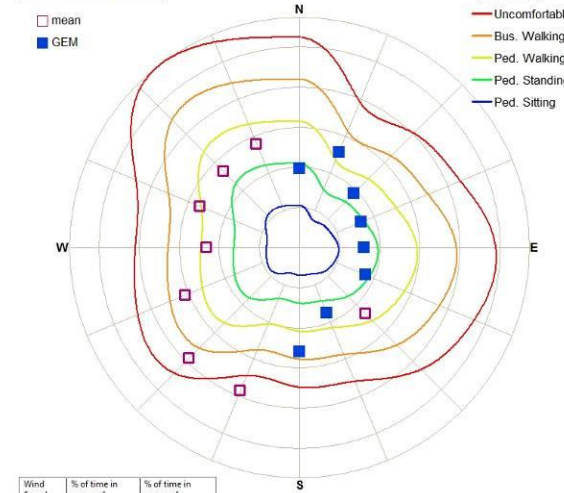
Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	33.0	40.4
4.0	13.7	16.7
6.0	3.9	4.2
8.0	0.7	0.7
10.0	0.1	0.1
5.6	<b>5.0</b>	Ped Standing
11.7	<b>0.022</b>	Pass
5.7	Ped Standing	<b>5.0</b>
11.5	Pass	<b>0.022</b>

**LOCATION 14.2**



Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	47.1	48.9
4.0	20.1	20.3
6.0	6.9	6.0
8.0	1.9	1.2
10.0	0.5	0.2
6.5	<b>5.0</b>	Ped Walking
15.2	<b>0.022</b>	Able Body
6.2	Ped Walking	<b>5.0</b>
12.7	Pass	<b>0.022</b>

**LOCATION 15.2**



Wind Speed (m/s)	% of time in excess of Mean	% of time in excess of GEM
2.0	51.0	52.2
4.0	18.2	19.7
6.0	5.7	5.8
8.0	1.8	1.3
10.0	0.6	0.3
6.1	<b>5.0</b>	Ped Walking
15.6	<b>0.022</b>	Able Body
6.2	Ped Walking	<b>5.0</b>
13.7	Pass	<b>0.022</b>

Figure 5: Directional results in the Mod 4 configuration with curved towers