

ENVIRONMENTAL WIND SPEED MEASUREMENTS ON A WIND TUNNEL MODEL OF THE 50 PHILLIP STREET DEVELOPMENT, SYDNEY

By
M. Hapsari, S. Powell,
&
M. Eaddy

SUMMARY

A wind tunnel study has been conducted on a 1/400 scale model of the proposed 50 Phillip Street Development. The model of the Development within surrounding buildings, was tested in a simulated upstream boundary layer of the natural wind to determine likely environmental wind conditions. These wind conditions have been related to the Sydney Design Control Plan 2012 (Sydney DCP), including the proposed amendments to the methodology of assessment for wind conditions proposed by Council in the Sydney DCP Amendment 2020. The wind conditions have been assessed with respect to the Safety standard as well as the Walking, Standing and Sitting comfort standards.

It has been shown that for the Proposed Configuration, the wind conditions on the streetscapes and parkland surrounding 50 Phillip Street Development have been shown to satisfy the standing criterion or better for most Test Locations, except for Test Locations 12, 13 and 16 that have been shown to satisfy the walking criterion.

The wind conditions for the Existing Conditions at all Test Locations around the Development have been presented for comparison and show that the Proposed Configuration would not have significant impact on these wind conditions.

The wind conditions for the Proposed Configuration on the rooftop terrace of the adjacent The Astor Apartments have been shown to satisfy the standing criterion for all Test Locations and this is unchanged compared to the Existing Configuration.

The wind conditions at all measured Test Locations have been shown to satisfy the Safety standard.



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**50 PHILLIP STREET DEVELOPMENT, SYDNEY
ENVIRONMENTAL WIND TUNNEL MODELLING**

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PREPARED FOR:

Built
Level 7
343 George Street
Sydney NSW 2000

PREPARED BY:

MEL Consultants Pty Ltd
22 Cleeland Road
Oakleigh South VIC 3167

Contact: Aston Weber

Ph: +61 433 047 310

Contact: Jim Kostas

Ph: +61 3 8516 9680

PREPARED BY:



M. Hapsari
Engineer

Date: 1 December 2020

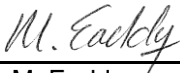
REVIEWED BY:



J. Kostas
Director

Date: 1 December 2020

RELEASED BY:



M. Eaddy
Managing Director

Date: 1 December 2020

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1. INTRODUCTION

This report supports a Stage 1 State Significant Development (SSD) Development Application (DA) for the redevelopment of a new mixed use hotel and branded residential building at 50-52 Phillip Street, Sydney. The Staged SSD DA proposes a concept proposal or Stage 1 DA for the retention and refurbishment of the heritage building on the site, demolition of other existing buildings on the site and construction of a new mixed use building. The Stage 1 SSD DA specifically seeks consent for land uses, a maximum gross floor area, a maximum building envelope, pedestrian and vehicle access and circulation arrangements, and associated car parking provision.

Built is seeking to transform the current site to deliver a new and modern mixed use development which contributes to overcoming a shortage of hotel accommodation in Sydney, and positively contributes to the character and vibrancy of Sydney's Central Business District (CBD). As part of the redevelopment project, the existing heritage listed building on the site will be retained and refurbished for hotel purposes.

As the proposal is for the development of a predominately tourist related purpose, being a hotel, that has a capital investment value in excess of \$100 million, it is SSD as prescribed in Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

1.1 Site Description

The site is located in Central Sydney, along the eastern edge of Sydney's core Central Business District (CBD). The immediate surrounds of the site in the eastern edge of the Sydney CBD present a mix of commercial, residential, and tourism uses. The prevailing built form in the vicinity of the site includes a range of building typologies and heights, as well as several significant state-listed heritage buildings, such as the Chief Secretary's Building immediately to the north of the site.

The site itself is located at 50-52 Phillip Street, Sydney and has a total area of approximately 1,726m², with frontages to Phillip Street and Phillip Lane. Two commercial buildings sharing a built-to-boundary condition currently occupy the site. The heritage-

listed sandstone building in the northern portion of the site is six generous storeys in height and contains commercial office space. The building located on the southern portion of the site is 12 storeys in height, and contains a ground level café/bar use, with commercial office space above.

Phillip Lane, which forms part of the 50 Phillip Street lot, connects through the site from Phillip Street at the northern boundary of the site. Phillip Lane is not proposed to be altered from its current form as an access point to the remainder of Phillip Lane at the rear of the site.

An aerial image of the site is provided at Figure 1 and a photograph of the existing buildings fronting Phillip Street is provided at Figure 2.



Figure 1 Aerial photograph of the Site. Source: Nearmaps (edits by Ethos Urban)

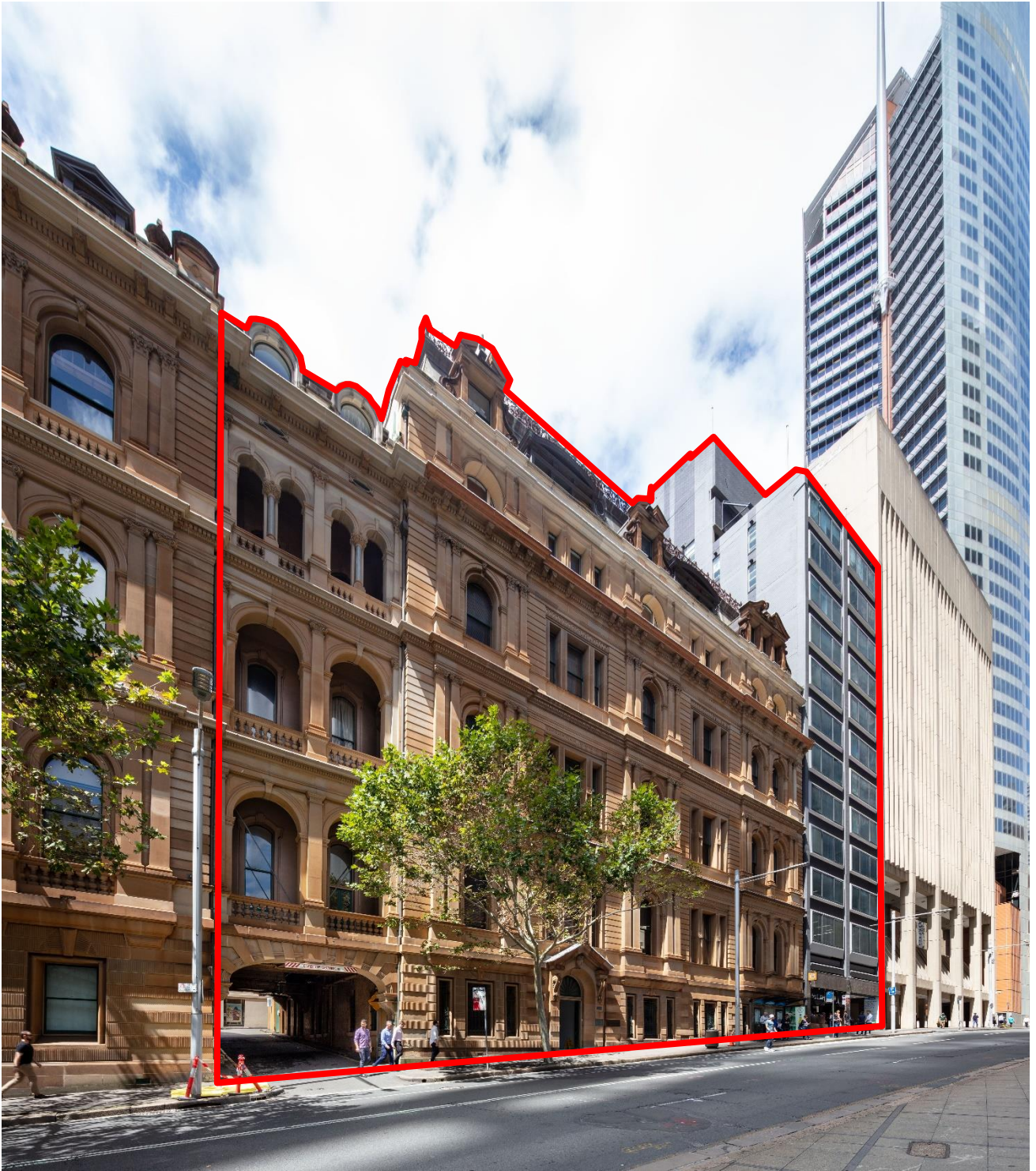


Figure 2 Existing buildings fronting Phillip Street. Source: Built

1.2 Background

1.2.1 Built Unsolicited Proposal

On 15 October 2019, the NSW Government published details of the Built Unsolicited Proposal for the leasehold purchase of 50 Phillip Street, Sydney to allow for the proposed hotel redevelopment. The Built proposal has progressed to Stage 2 of the Unsolicited Proposal process, and has been deemed unique as Built owns the adjacent property (52 Phillip Street, Sydney) to the Government owned 50 Phillip Street, Sydney. As there are no other privately owned properties immediately contiguous to 50 Phillip Street, Built possesses unique property ownership that enables it to amalgamate 50 and 52 Phillip Street, and take full advantage of the unused developable air space.

The proposed redevelopment project will combine both private and Government land, breathing new life into an underutilised heritage-listed NSW Government owned building and Built's aging privately-held commercial office building.

Built is well recognised for work in the refurbishment and restoration of iconic heritage properties across Australia. As such, a foremost principle of the project is to ensure that the integrity of the heritage listed Government building is not compromised. Rather, the heritage qualities of the building will be celebrated and revitalised for the people of NSW. The Chief Secretary's Building which fronts Bridge Street will not be leased as part of this redevelopment project, and it is intended to remain in Government ownership and control.

1.2.2 Project Vision

The vision for the redevelopment is to revitalise the lower end of Sydney's financial services district by delivering a new luxury mixed use hotel with a portion of branded residential apartments. The proposal will provide an important and much needed asset to the people of NSW and visitors. Sydney will have, as part of the amalgamation of the properties, its finest luxury hotel with associated retail areas providing ground floor public activation accessible to the general public and hotel guests alike.

Overall, the project will provide the following key public benefits:

- Job creation and benefits to the tourism industry from construction and operation of a new 5/6 star hotel in Central Sydney.
- Contribution to the NSW State's economic activity and Gross State Product, including the generation of construction phase revenue for the Government in the form of payroll tax, stamp duty and GST payments.
- Rejuvenation and adaptive reuse of a Government owned heritage building.
- Regeneration, enhancement and activation of the surrounding public domain, particularly upgrades to Phillip Lane.
- Creation of a heritage-tourism precinct with a new hotel as the centrepiece.
- A portion of branded residential apartments to support the deliver of the hotel and provide a variety of uses to contribute to the liveability of Central Sydney.
- The potential to deliver a capital return to Government to fund future Government investment in services and infrastructure.

1.2.3 Project Description

This SSD DA seeks consent for a concept proposal for a new landmark mixed use building with approximately 331 new hotel rooms and 23 branded residential apartments in Sydney's CBD. The Stage 1 SSD DA Concept Proposal will establish a maximum building envelope, land uses, a maximum total quantity of floor space, pedestrian, vehicle circulation, and drop-off arrangements and associated car parking provision.

Specifically, the Stage 1 SSD DA seeks concept approval for:

- In-principle site preparation works, including termination/relocation of site services and infrastructure, demolition of the existing buildings/structure on the site, excluding the existing heritage-listed building;
- A new 47 storey mixed use building envelope containing:
- lower level café/bar uses and associated servicing and back-of-house facilities;
- a new basement containing waste rooms, loading space, and car parking spaces;
- hotel uses on levels 1 to 35; and
- residential uses on levels 36 to 47.

- Retention of the existing heritage-listed building on the site, and refurbishment of this building for hotel purposes.
- A new driveway crossing over Phillip Street at the southern end of the site.
- Maintenance and retention of the existing vehicular access over Phillip Lane.

Development consent is not sought for any detailed component of development. A future separate Stage 2 SSD DA will be lodged for the detailed design and construction of the development, following the completion of a competitive design process.

A further detailed description of the proposal is contained in the supporting Environmental Impact Statement prepared for the SSD DA by Ethos Urban.

A wind tunnel model study was commissioned by Built to undertake measurements of environmental wind conditions around the proposed development and, if necessary, to develop wind amelioration features to achieve conditions satisfying the recommended environmental wind criteria. These tests were carried out in the MEL Consultants 400kW Boundary Layer Wind Tunnel during August 2020.

2. ENVIRONMENTAL WIND CRITERIA

The advancement of wind tunnel testing techniques, using large boundary layer flows to simulate the natural wind, has facilitated the prediction of wind speeds likely to be induced around a development. To assess whether the predicted wind conditions are likely to be acceptable or not, some form of criteria are required. The Sydney Design Control Plan 2012 (Sydney DCP), including the proposed amendments to the methodology of assessment for wind conditions proposed by Council in the Sydney DCP Amendment 2020 has defined wind comfort standards for the assessment of the wind conditions in Sydney City. The definition of the standards is as follows:

Wind Safety Standard is an annual hourly maximum peak 0.5 second gust wind speed measured between 6am and 10pm Eastern Standard Time of 24 meters per second.

Wind Comfort Standard is an hourly mean wind speed for each wind direction, with probability of exceedance less than 5% per annum (averaged over all wind directions) measured between 6am and 10pm Eastern Standard Time (equivalent to 292 hours per annum), of equal to or less than:

- 4 metres/second for sitting areas
- 6 metres/second for standing areas
- 8 metres/second for walking areas

Mean wind speed means the maximum of:

- Hourly mean wind speed, or
- Gust equivalent mean wind speed (gust wind speed divided by 1.85)

It is noted that the above Safety standard is assessed for each wind direction while the above Comfort standards are pass/fail criteria as they only assess the summation of probabilities of exceedance across all wind directions to determine whether a location passes or fails the threshold criterion. There may be cases that the Test Locations pass the all directions combined criterion but still fail the same criterion when applied correctly for a particular wind direction. For completeness, this report will provide data for each Test Location as a function of wind direction in Appendix A.

The Sydney DCP uses the definition of mean wind speed as based on the hourly wind speed so the probabilities will be determined from the hourly wind data for an applicable automatic weather station for the City of Sydney. The probability data used have been corrected for the approach terrain at the location of the automatic weather station (in this case Sydney Airport) and referenced to 10m in Terrain Category 2. This is the standard reference height of AS/NZS1270.2:2011.

3. MODEL AND EXPERIMENTAL TECHNIQUES

A 1/400 scale model of the 50 Phillip Street Development was constructed from digital information provided by FJMT and dated 13th July, 2020.

The scale model of the development and surrounding buildings was tested in a model of the natural wind generated by flow over roughness elements augmented by vorticity generators at the beginning of the wind tunnel working section. The surrounding buildings include all built and under construction buildings in the immediate vicinity. The basic natural wind model was for flow over suburban terrain, the characteristics of which are given in Figure 3. The surrounding wind tunnel model of all significant buildings, out to a minimum radius of 300m, modified the approach wind model for the presence of the surrounding buildings.

The techniques used to investigate the environmental wind conditions and the method of determining the local criteria are given in detail in Reference 2. Hot-wire anemometry was used to measure the local wind speeds at various locations around the proposed building. The signals from the hot-wire anemometers were recorded by a data acquisition system for 30 seconds for each wind direction studied. Previous investigations by MEL Consultants have found this time period to be sufficient to achieve piecewise stationarity, i.e. the signal statistics become independent of the sample period. The data acquisition system uses a high accuracy digital low pass filter to filter the recorded data to give an effective full scale 3 second peak gust wind speed. MEL Consultants acknowledge that hot-wire anemometers would measure erroneous mean values in high turbulence wind environments such as the urban setting of the Sydney CBD. Therefore, MEL Consultants will only use the gust wind speed measured by the hot-wire anemometer for the analysis of the environmental wind conditions. To obtain the GEM (hourly mean) for the assessment against the wind criteria the gust wind speed will be divided by 1.85. Wind tunnel velocity measurements were made for an equivalent 1 hour period in full scale and filtered to provide an equivalent full scale 3 second gust wind speed. Photographs of the models as tested in the wind tunnel are shown for each of the configurations in Figures 4 and 5.

4. DISCUSSION OF RESULTS

Velocity measurements were made at various locations around the 50 Phillip Street Development for different wind directions at 22.5° intervals for the following model configurations:

- Existing Configuration
- Proposed Configuration

The Existing Configuration is defined as the buildings that currently exist on the site. The Proposed Configuration for the proposed 50 Phillip Street Development was constructed from digital information provided by FJMT and dated 13th July, 2020. The Test Locations examined for this study are shown in Figures 6a and 6b.

Velocity measurements were made at various locations around the 50 Phillip Street for different wind directions at 22.5° intervals. As discussed in Section 2, the Sydney DCP 2012, including the proposed amendments to the methodology of assessment for wind conditions proposed by Council in the Sydney DCP Amendment 2020, the wind comfort criteria are pass/fail criteria based on an assessment of the summation of probabilities for all wind directions combined. Therefore, to assess the wind conditions the exceedances will be presented in tabular form in Tables 1 – 5. For completeness these data are also provided in Appendix A as a function of wind direction and compared with the pedestrian criteria based on gust wind speeds.

The following sections detail the results for the various areas tested.

4.1 Summaries of Results

A summary of the highest wind conditions at each Test Location for all wind directions in the surrounding streetscapes have been summarised using a colour code system in the following figures:

Existing Configuration – Ground Level	Figure 7a
Proposed Configuration – Ground Level	Figure 7b
Existing Configuration – Rooftop	Figure 7c
Proposed Configuration – Rooftop	Figure 7d

Different colours have been used to represent the wind criteria achieved at the respective Test Locations.

4.2 Phillip Street

The wind conditions for the Proposed Configuration along Phillip Street (Test Locations 1-15) have been shown to pass the sitting comfort criterion for Test Location 7, and the standing comfort criterion for Test Locations 1-6, 8-11, 14, and 15. Test Locations 12 and 13 have been shown to pass the walking criteria. Comparing the wind conditions of the Proposed Configuration with those of the Existing Configuration show that the wind criteria achieved are similar for both configurations, with some improvements in the wind conditions for the Proposed Configuration at a number of locations due to the shielding effects of the tower

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 1.

The wind conditions are a function of wind direction based on the gust criteria for Sydney are presented in Appendix A. It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for all wind directions.

Table 1: Pedestrian Wind Comfort and Safety – Phillip Street

Test Location	Configuration	Wind Comfort Standard				Safety	wind speed (m/s)
		Sitting	Standing	Walking			
1	Existing	11.0%	2.5%	0.4%	Pass	5.53	
	Proposed	7.7%	1.0%	0.1%	Pass	4.85	
2	Existing	13.9%	3.7%	1.0%	Pass	6.28	
	Proposed	13.5%	3.3%	0.8%	Pass	6.36	
3	Existing	10.4%	2.2%	0.4%	Pass	5.75	
	Proposed	5.1%	0.8%	0.1%	Pass	4.77	
4	Existing	9.4%	2.1%	0.5%	Pass	5.66	
	Proposed	9.7%	2.5%	0.7%	Pass	5.90	
5	Existing	6.6%	1.5%	0.3%	Pass	5.00	
	Proposed	6.2%	1.3%	0.3%	Pass	5.03	
6	Existing	10.4%	2.2%	0.4%	Pass	5.78	
	Proposed	6.9%	1.3%	0.2%	Pass	5.08	
7	Existing	2.4%	0.2%	0.0%	Pass	3.86	
	Proposed	2.9%	0.3%	0.0%	Pass	3.86	
8	Existing	9.6%	1.8%	0.2%	Pass	5.53	
	Proposed	8.3%	1.7%	0.2%	Pass	5.25	
9	Existing	6.2%	0.7%	0.1%	Pass	4.82	
	Proposed	5.3%	0.7%	0.1%	Pass	4.75	
10	Existing	13.6%	3.3%	0.6%	Pass	6.36	
	Proposed	10.8%	2.7%	0.6%	Pass	5.90	
11	Existing	12.4%	3.5%	0.8%	Pass	5.93	
	Proposed	12.2%	3.3%	0.6%	Pass	5.97	
12	Existing	18.2%	6.3%	1.8%	Pass	7.27	
	Proposed	18.6%	6.5%	1.9%	Pass	7.26	
13	Existing	16.7%	5.2%	1.2%	Pass	7.01	
	Proposed	17.2%	5.4%	1.3%	Pass	7.15	
14	Existing	15.7%	4.7%	1.3%	Pass	6.73	
	Proposed	16.3%	4.8%	1.2%	Pass	6.80	
15	Existing	8.9%	1.6%	0.3%	Pass	5.49	
	Proposed	10.2%	2.0%	0.3%	Pass	5.72	
All Phillip Street	Existing					average	5.80
	Proposed						5.66

Note: Orange – Fail Criterion (≥5%)

Green – Pass Criterion (<5%)

4.3 Bridge Street

The wind conditions for the Proposed Configuration along Bridge Street (Test Locations 16-21) have been shown to pass the walking comfort criterion for Test Location 16, and the standing comfort criterion for Test Locations 17-21. Comparing the wind conditions of the Proposed Configuration with those of the Existing Configuration show that the wind criteria achieved are similar for both configurations, suggesting the Proposed Tower would have little significant impact on the existing wind conditions. These criteria achieved have been presented in Table 2 as well as the data for the Existing Configuration.

The wind conditions are a function of wind direction based on the gust criteria for Sydney are presented in Appendix A. It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for all wind directions.

Table 2: Pedestrian Wind Comfort and Safety – Bridge Street

Test Location	Configuration	Wind Comfort Standard				Safety	wind speed (m/s)
		Sitting	Standing	Walking			
16	Existing	17.0%	5.8%	1.9%	Pass	7.04	
	Proposed	17.7%	6.2%	1.9%	Pass	7.15	
17	Existing	9.5%	2.0%	0.3%	Pass	5.41	
	Proposed	8.4%	1.6%	0.2%	Pass	5.17	
18	Existing	14.3%	4.3%	1.1%	Pass	6.48	
	Proposed	14.3%	4.3%	1.1%	Pass	6.50	
19	Existing	8.3%	1.5%	0.2%	Pass	5.24	
	Proposed	8.3%	1.5%	0.2%	Pass	5.25	
20	Existing	9.5%	1.9%	0.4%	Pass	5.65	
	Proposed	10.4%	2.0%	0.4%	Pass	5.80	
21	Existing	12.5%	3.0%	0.5%	Pass	5.99	
	Proposed	13.8%	3.4%	0.6%	Pass	6.20	
All Bridge St	Existing					average	5.98
	Proposed						6.01

Note: Orange – Fail Criterion (≥5%)

Green – Pass Criterion (<5%)

4.4 Macquarie Street and Royal Botanical Gardens

The wind conditions for the Proposed Configuration along Macquarie Street (Test Locations 22-27) have been shown to pass the standing comfort criterion for all Test Locations. Comparing the wind conditions of the Proposed Configuration with those of the Existing Configuration show that the wind criteria achieved are similar for both configurations, suggesting the Proposed Tower would have little significant impact on the existing wind conditions. These criteria achieved have been presented in Table 3 as well as the data for the Existing Configuration.

The wind conditions in the Royal Botanical Gardens (Test Locations 28-30) have been shown to pass the standing criterion and this criterion is unchanged compared to the Existing Configuration as shown in Table 3. These data have shown wind speeds at Test Location 28 reduced, Test Location 29 increase, and Test Location 30 is unchanged. Averaging the Proposed and Existing Configurations wind speeds for these three Test Locations gives 5.92 ms^{-1} and 5.92 ms^{-1} respectively, i.e. no change. It is also noted that the trees of the Royal Botanical Gardens were not considered for wind mitigation in this study since they would be outside the control of the Proposed Development, but would be expected to provide wind mitigation of the wind conditions.

The wind conditions are a function of wind direction based on the gust criteria for Sydney are presented in Appendix A. It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for all wind directions.

Table 3: Pedestrian Wind Comfort and Safety – Macquarie Street & Royal Botanic Garden

Test Location	Configuration	Wind Comfort Standard				Safety	wind speed (m/s)
		Sitting	Standing	Walking			
22	Existing	7.8%	1.6%	0.2%	Pass	4.68	
	Proposed	8.0%	1.7%	0.3%	Pass	4.78	
23	Existing	11.9%	3.3%	0.7%	Pass	5.56	
	Proposed	12.7%	3.4%	0.8%	Pass	5.88	
24	Existing	10.2%	2.6%	0.5%	Pass	4.93	
	Proposed	10.4%	2.6%	0.4%	Pass	5.21	
25	Existing	9.2%	1.8%	0.3%	Pass	5.02	
	Proposed	7.7%	1.4%	0.2%	Pass	4.68	
26	Existing	6.8%	1.3%	0.2%	Pass	4.49	
	Proposed	9.0%	1.9%	0.3%	Pass	4.95	
27	Existing	7.6%	1.6%	0.2%	Pass	4.67	
	Proposed	8.0%	1.7%	0.2%	Pass	4.77	
28	Existing	12.0%	2.6%	0.4%	Pass	5.74	
	Proposed	10.9%	2.1%	0.3%	Pass	5.59	
29	Existing	12.7%	2.9%	0.5%	Pass	5.92	
	Proposed	13.3%	3.0%	0.5%	Pass	6.01	
30	Existing	13.9%	3.6%	0.7%	Pass	6.10	
	Proposed	13.7%	3.3%	0.6%	Pass	6.10	
All Macquarie St	Existing					average	5.23
	Proposed						5.34

Note: Orange – Fail Criterion ($\geq 5\%$)

Green – Pass Criterion ($< 5\%$)

4.5 Phillip Lane and Gov. Phillip Tower Courtyard

The wind conditions for the Proposed Configuration along Phillip Lane and in Governor Phillip Tower Courtyard (Test Locations 31-37) have been shown to pass the sitting comfort criterion for most Test Locations, with the exception of Test Location 32 and 34 which have been shown to pass the standing criterion. As such the effects of the Proposed Tower were shown to have little significant impact on the existing wind conditions. These criteria achieved have been presented in Table 4 as well as the data for the Existing Configuration.

The wind conditions are a function of wind direction based on the gust criteria for Sydney are presented in Appendix A. It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for all wind directions.

Table 4: Pedestrian Wind Comfort and Safety – Phillip Lane and Governor Phillip Tower

Test Location	Configuration	Wind Comfort Standard				Safety	wind speed (m/s)
		Sitting	Standing	Walking			
31	Existing	5.2%	0.6%	0.1%	Pass	4.45	
	Proposed	4.2%	0.5%	0.1%	Pass	4.17	
32	Existing	7.3%	1.3%	0.2%	Pass	4.93	
	Proposed	5.6%	1.0%	0.1%	Pass	4.40	
33	Existing	3.9%	0.6%	0.1%	Pass	4.08	
	Proposed	3.5%	0.5%	0.1%	Pass	4.14	
34	Existing	5.1%	0.6%	0.1%	Pass	4.55	
	Proposed	5.4%	0.7%	0.1%	Pass	4.43	
35	Existing	1.4%	0.1%	0.0%	Pass	3.16	
	Proposed	0.7%	0.0%	0.0%	Pass	2.66	
36	Existing	1.1%	0.0%	0.0%	Pass	2.96	
	Proposed	1.2%	0.1%	0.0%	Pass	3.00	
37	Existing	3.6%	0.4%	0.0%	Pass	3.97	
	Proposed	4.1%	0.4%	0.1%	Pass	4.31	
All Phillip Lane & Governor Phillip Tower	Existing						4.02
	Proposed					average	3.87

Note: Orange – Fail Criterion (≥5%)

Green – Pass Criterion (<5%)

4.6 The Astor Apartments Rooftop Terrace

The wind conditions for the Proposed Configuration on The Astor Apartments Rooftop Terrace (Test Locations R1-R4) have been shown to pass the standing comfort criterion for all Test Locations. Comparing the wind conditions of the Proposed Configuration with those of the Existing Configuration show that the wind criteria achieved are similar for both configurations, with improvements in the wind conditions for the Proposed Configuration due to the shielding effects of the tower

The wind conditions are a function of wind direction based on the gust criteria for Sydney are presented in Appendix A. It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for all wind directions.

Table 5: Pedestrian Wind Comfort and Safety – The Astor Apartments Rooftop Terrace

Test Location	Configuration	Wind Comfort Standard				Safety	wind speed (m/s)
		Sitting	Standing	Walking			
R1	Existing	14.0%	4.6%	1.3%	Pass	6.52	
	Proposed	11.2%	2.8%	0.5%	Pass	5.91	
R2	Existing	10.6%	2.8%	0.8%	Pass	5.96	
	Proposed	9.8%	3.0%	0.8%	Pass	5.81	
R3	Existing	15.9%	4.4%	1.1%	Pass	6.49	
	Proposed	14.6%	3.7%	0.9%	Pass	6.29	
R4	Existing	5.3%	0.8%	0.1%	Pass	4.58	
	Proposed	4.6%	0.7%	0.1%	Pass	4.36	
All The Astor Rooftop Terrace	Existing					average	5.91
	Proposed						5.61

Note: Orange – Fail Criterion ($\geq 5\%$)

Green – Pass Criterion ($< 5\%$)

5. CONCLUSIONS

A wind tunnel study has been conducted on a 1/400 scale model of the proposed 50 Phillip Street Development. The model of the Development within surrounding buildings, was tested in a simulated upstream boundary layer of the natural wind to determine likely environmental wind conditions. These wind conditions have been related to the Sydney Design Control Plan 2012 (Sydney DCP), including the proposed amendments to the methodology of assessment for wind conditions proposed by Council in the Sydney DCP Amendment 2020. The wind conditions have been assessed with respect to the Safety standard as well as the Walking, Standing and Sitting comfort standards.

It has been shown that for the Proposed Configuration, the wind conditions on the streetscapes and parkland surrounding 50 Phillip Street Development have been shown to satisfy the standing criterion or better for most Test Locations, except for Test Locations 12, 13 and 16 that have been shown to satisfy the walking criterion.

The wind conditions for the Existing Conditions at all Test Locations around the Development have been presented for comparison and show that the Proposed Configuration would not have significant impact on these wind conditions.

The wind conditions for the Proposed Configuration on the rooftop terrace of the adjacent The Astor Apartments have been shown to satisfy the standing criterion for all Test Locations and this is unchanged compared to the Existing Configuration.

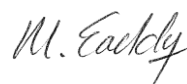
The wind conditions at all measured Test Locations have been shown to satisfy the Safety standard.

Prepared By:



M. Hapsari

Authorised By:



M. Eaddy



December 2020

REFERENCES

1. W. H. Melbourne, Criteria for environmental wind conditions, Journal of Industrial Aerodynamics, Volume 3, 1978, pp. 241-249
2. W. H. Melbourne, Wind environment studies in Australia, Journal of Industrial Aerodynamics, Volume 3, 1978, pp. 201-214

FIGURES

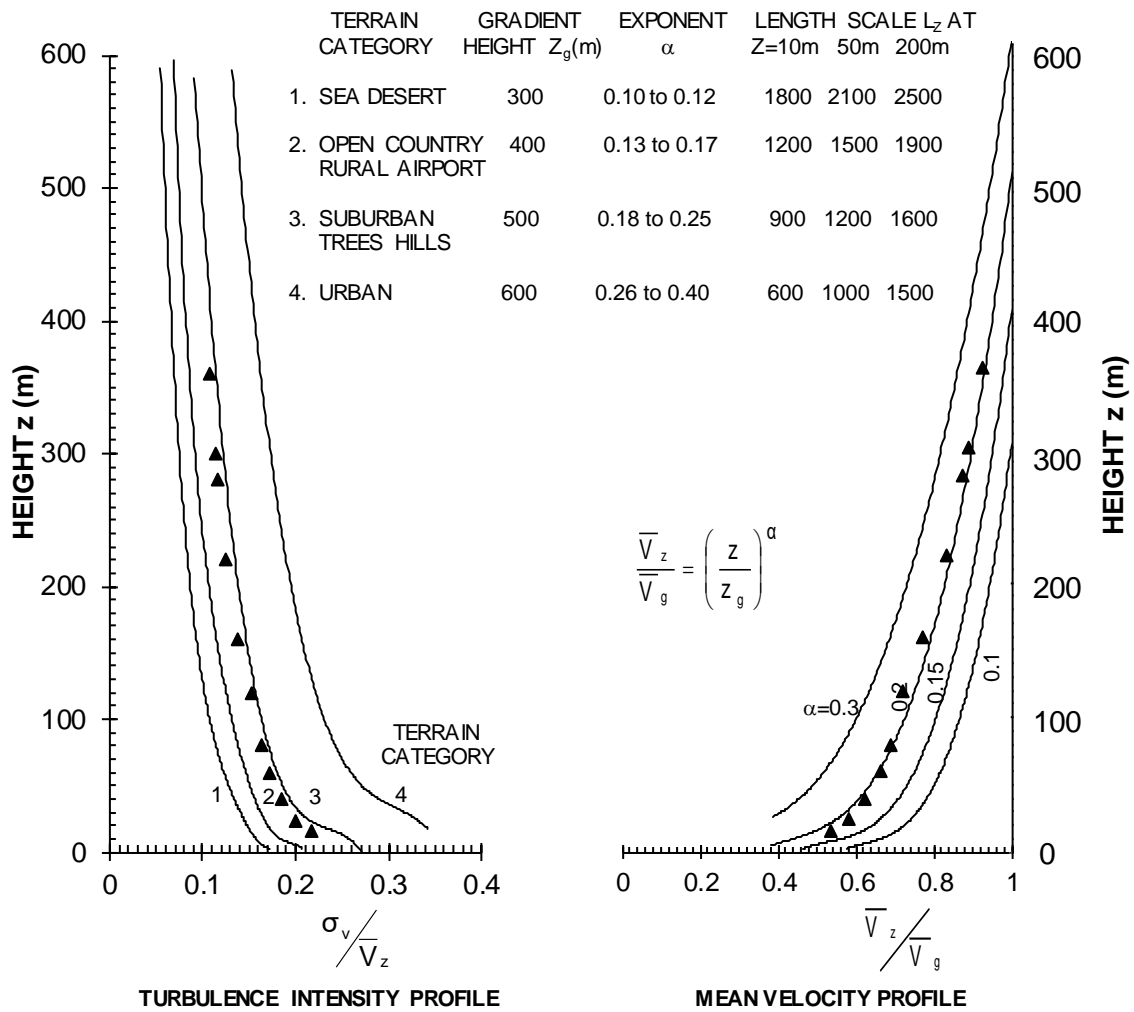


Figure 3 - 1/400 scale TC3 boundary layer turbulence intensity and mean velocity profiles in the MEL Consultants Boundary Layer Wind Tunnel 4.8m x 2.2m working section, scaled to full scale dimensions.



Figure 4 – View from the southeast of the 1/400 scale Proposed Configuration model of the 50 Phillip Street Development in the wind tunnel.



Figure 5 – Close-up view from the east of the 1/400 scale Proposed Configuration model of the 50 Phillip Street Development in the wind tunnel.

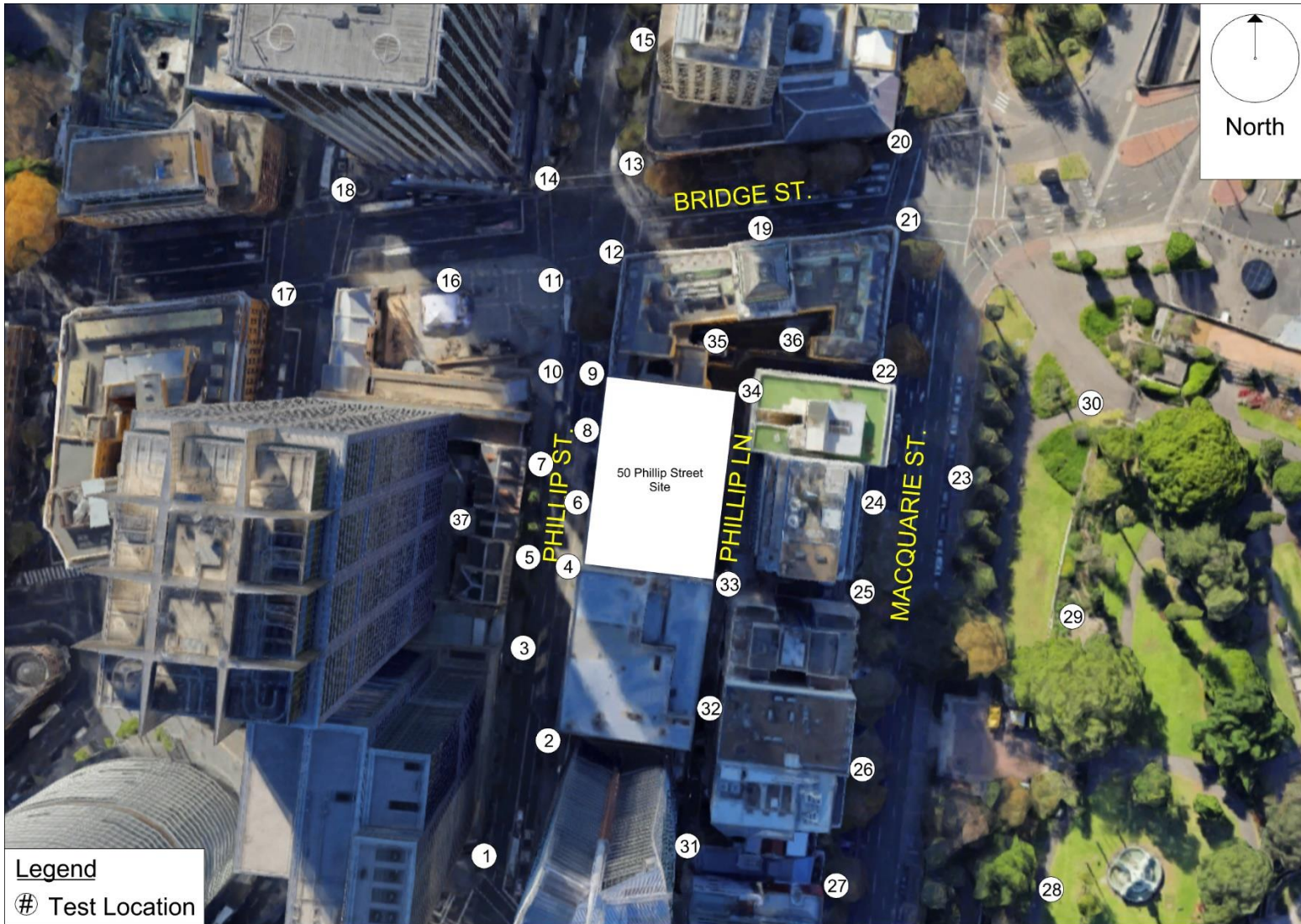


Figure 6a - Ground Level Test Locations for the 50 Phillip Street Development.

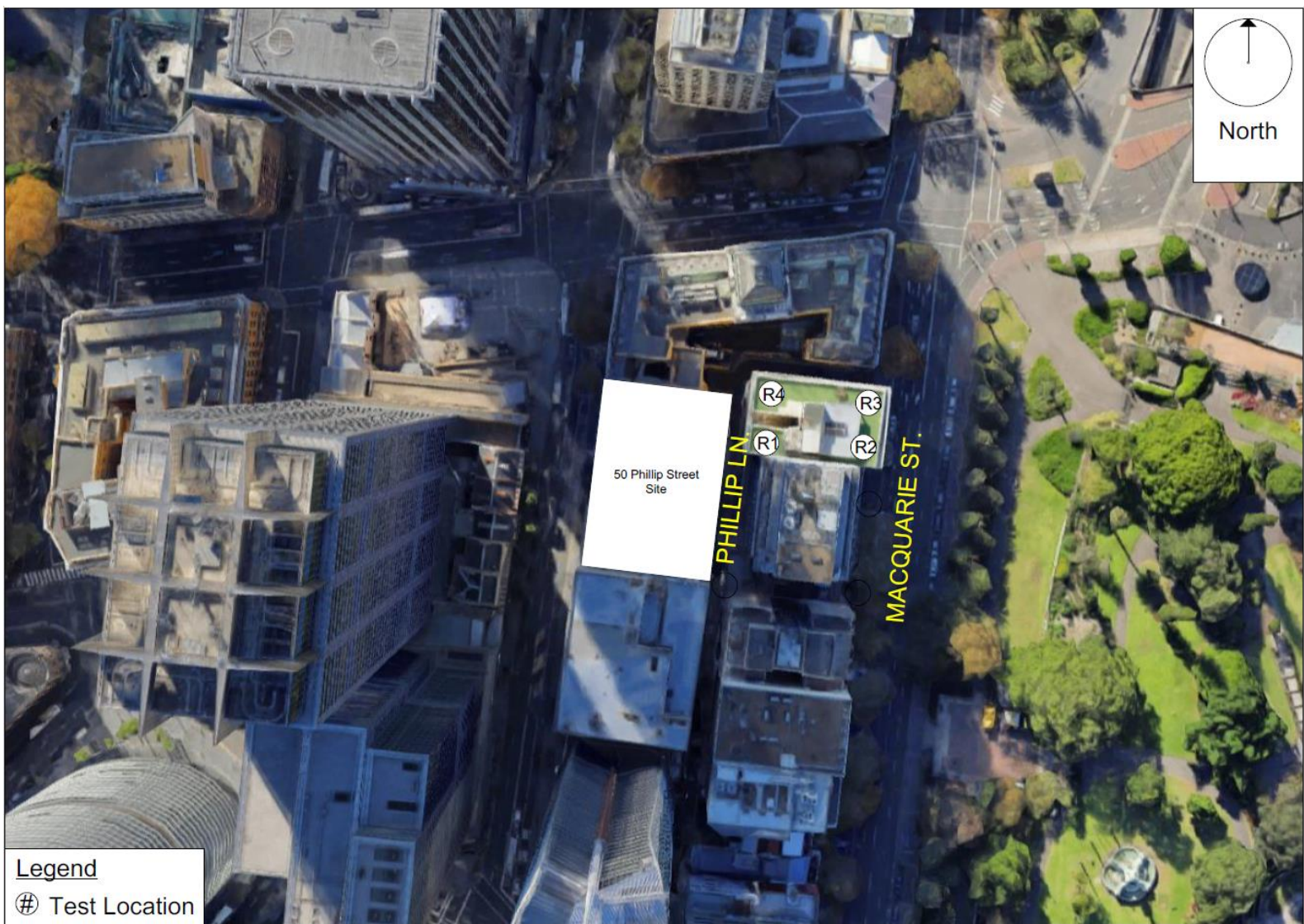


Figure 6b - Rooftop Test Locations for the 50 Phillip Street Development.

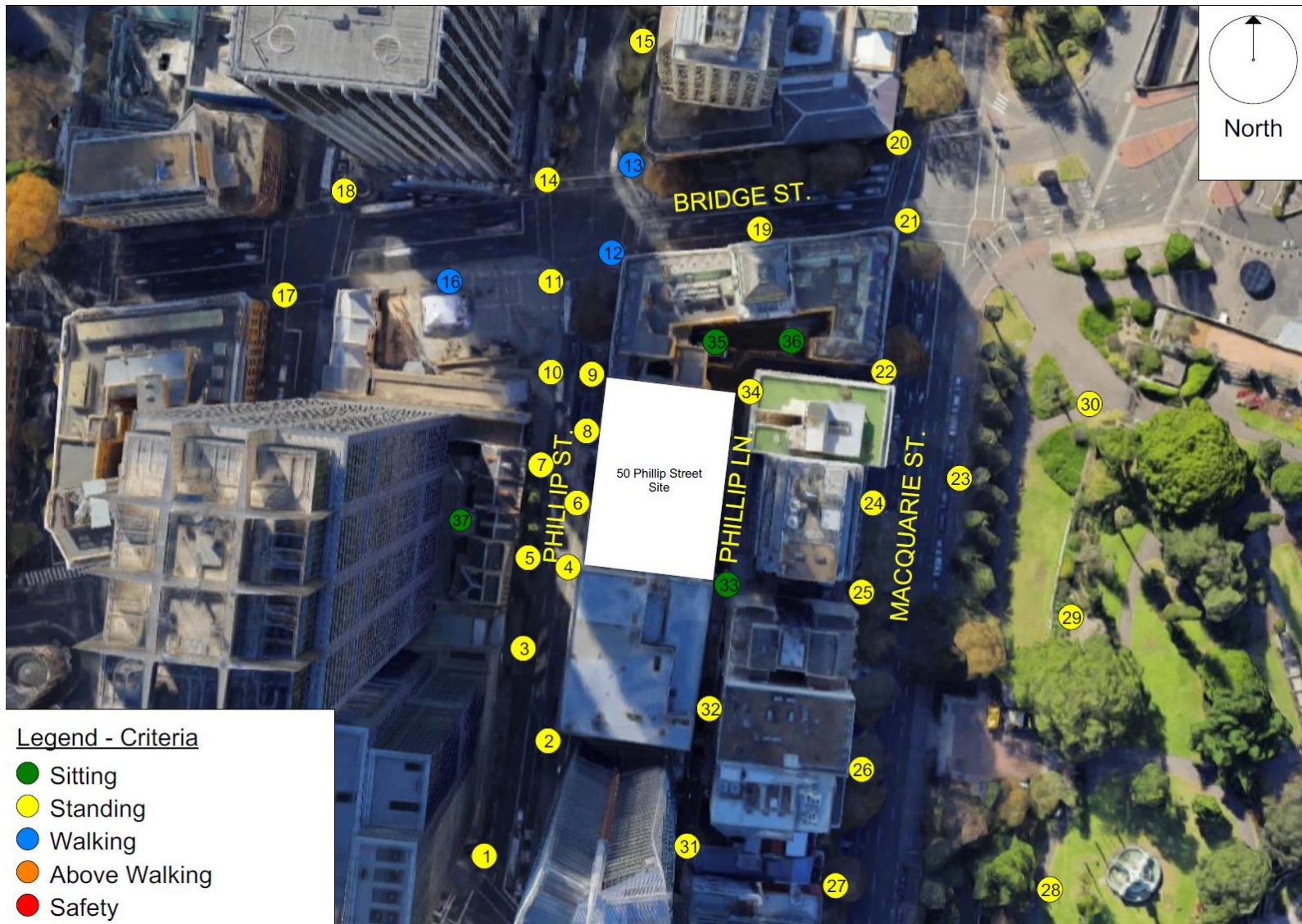


Figure 7a - Summary of Ground Level wind conditions for the Existing Configuration for 360° of wind direction.

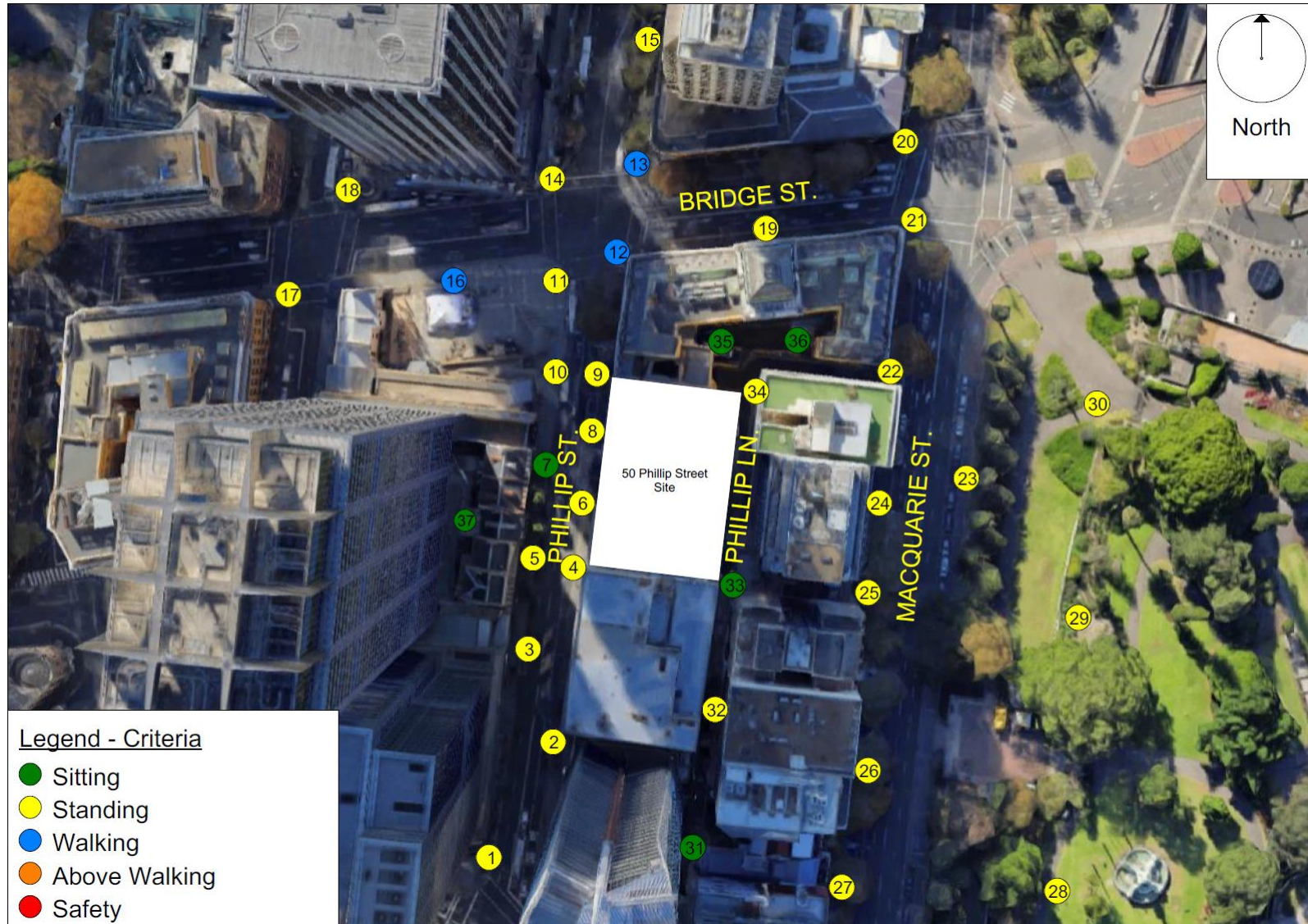


Figure 7b - Summary of Ground Level wind conditions for the Proposed Configuration for 360° of wind direction

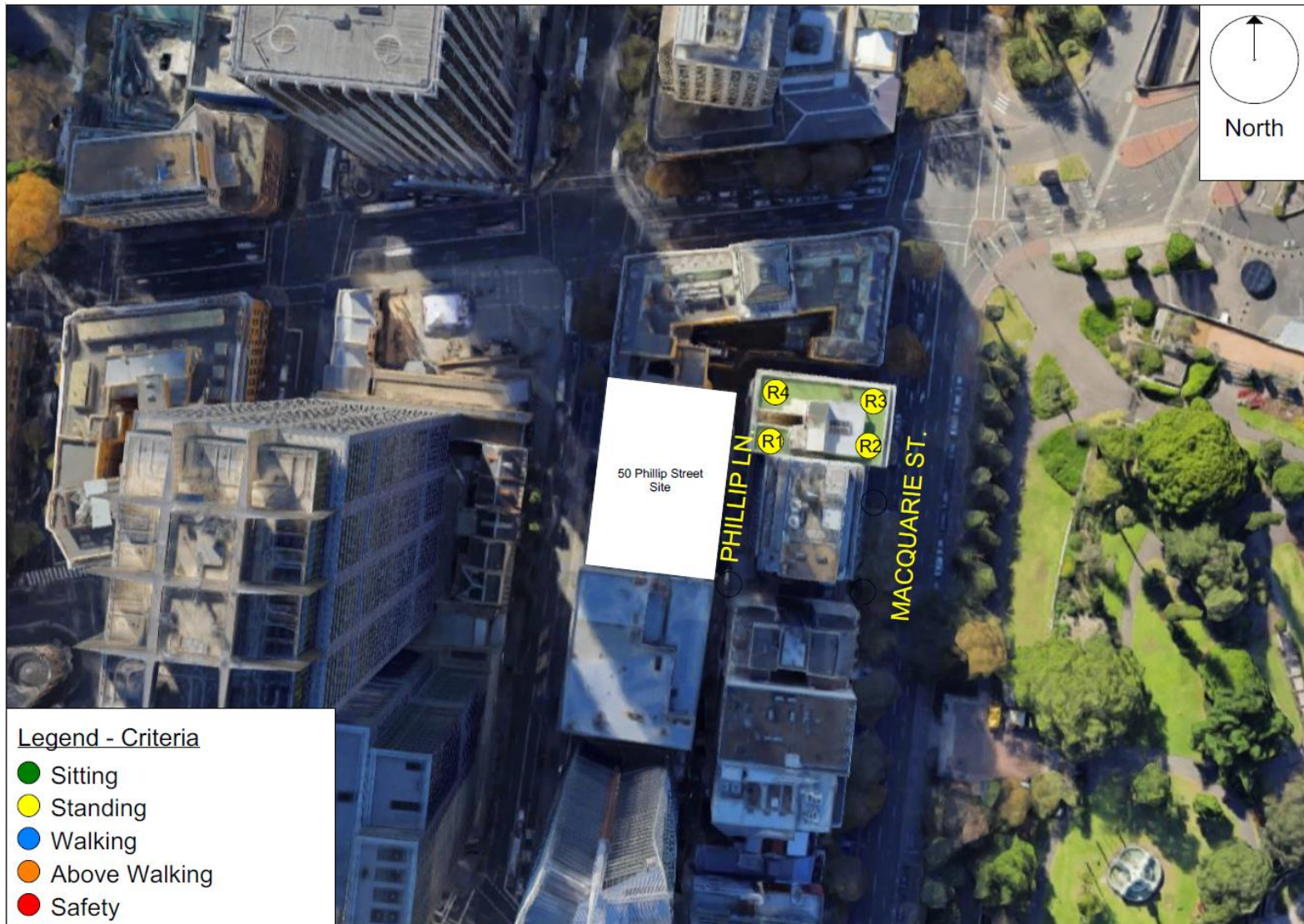


Figure 7c - Summary of Rooftop wind conditions for the Existing Configuration for 360° of wind direction

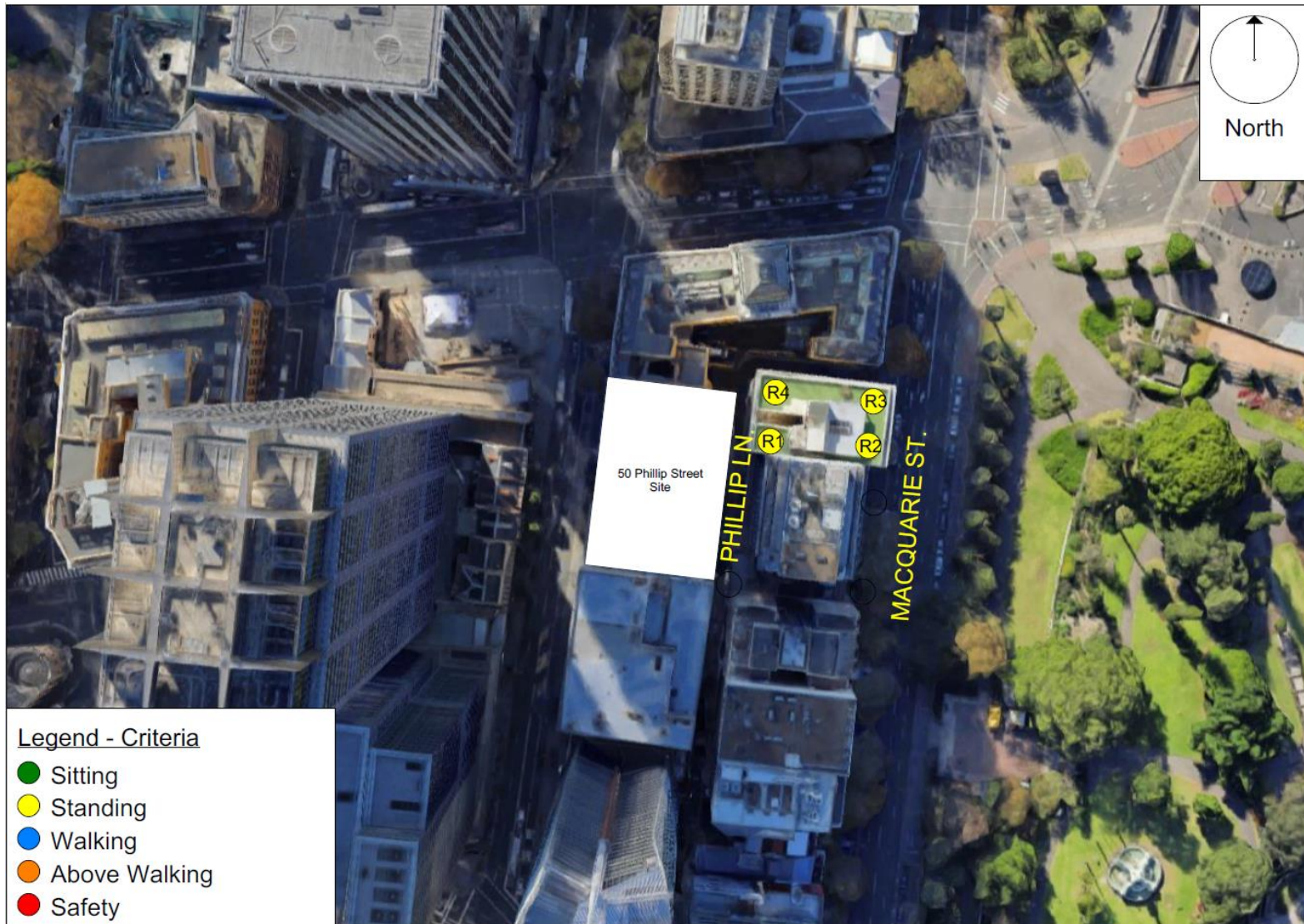


Figure 7d - Summary of Rooftop wind conditions for the Proposed Configuration for 360° of wind direction

Appendix A1

Measurements were made of the peak gust wind velocity with a hot wire anemometer at various stations and expressed as a squared ratio with the mean wind velocity at a scaled reference height of 300m. This gives the peak velocity squared ratio

$$\left(\hat{V}_{local} / \bar{V}_{300m}\right)^2$$

as shown in Figure A1.

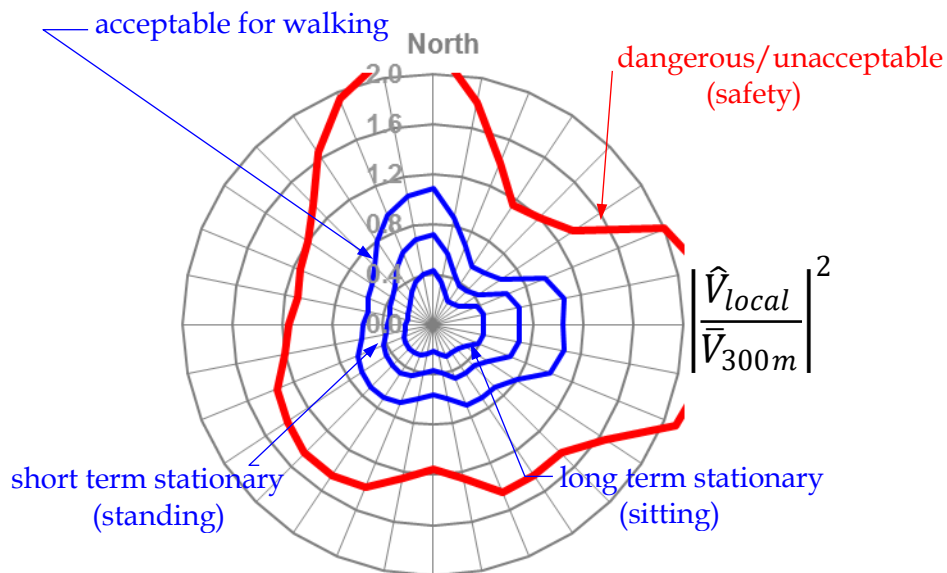
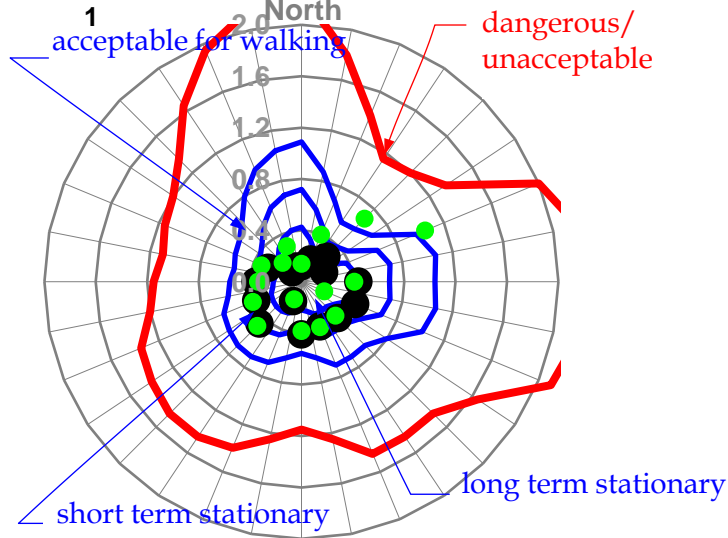
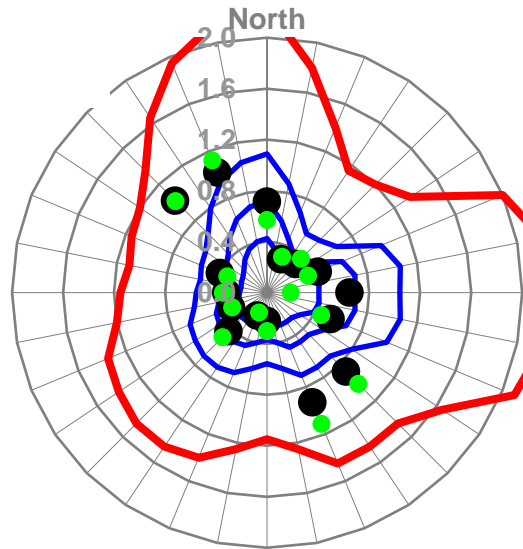


Figure A1 - Environmental wind criteria for Sydney as a function of wind direction expressed in terms of peak velocity pressure ratio.

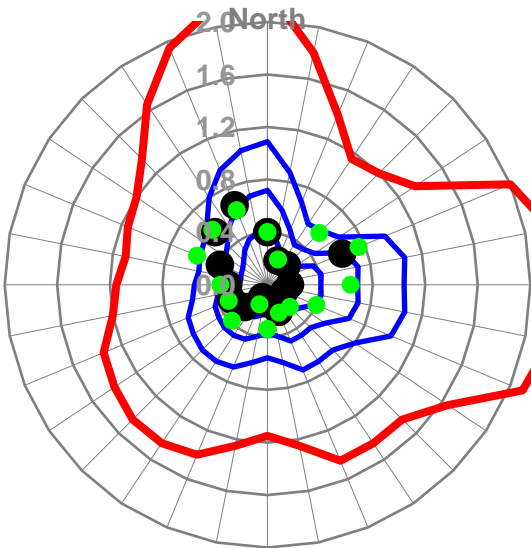
Test Location



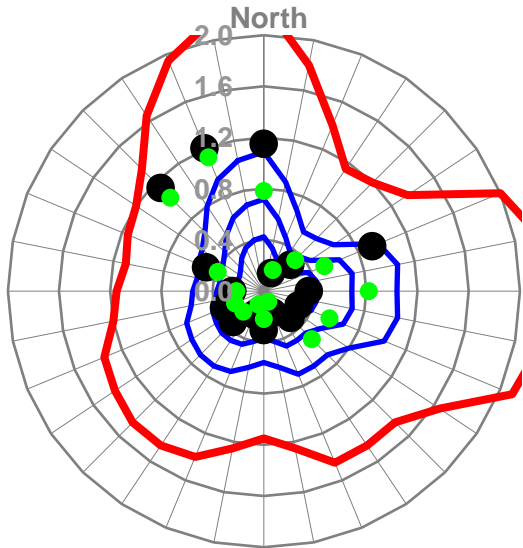
2



3



4



Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

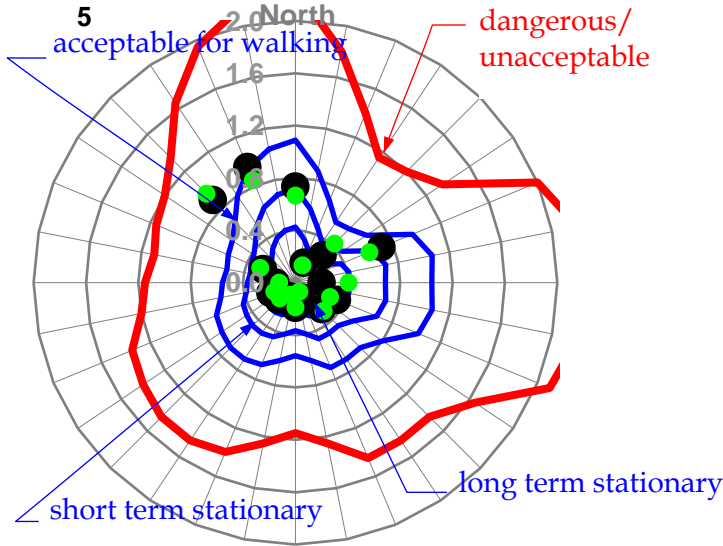
Proposed Configuration

Existing Configuration

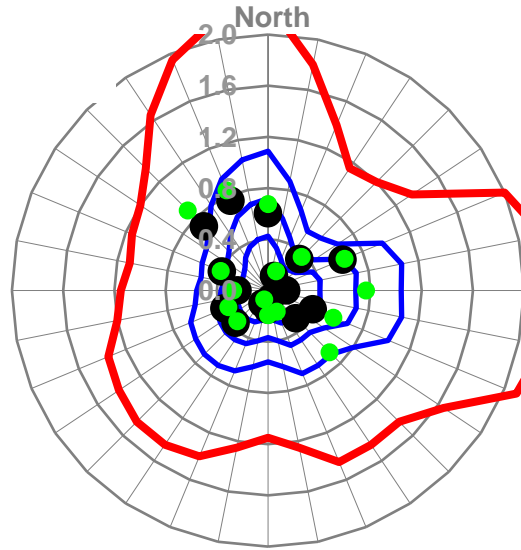


Appendix A2 - Phillip Street

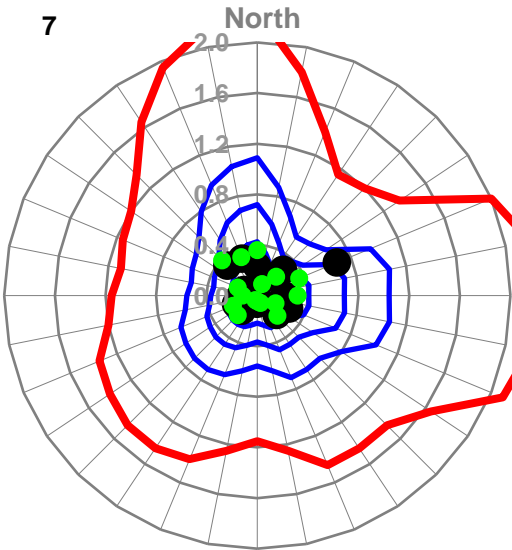
Test Location



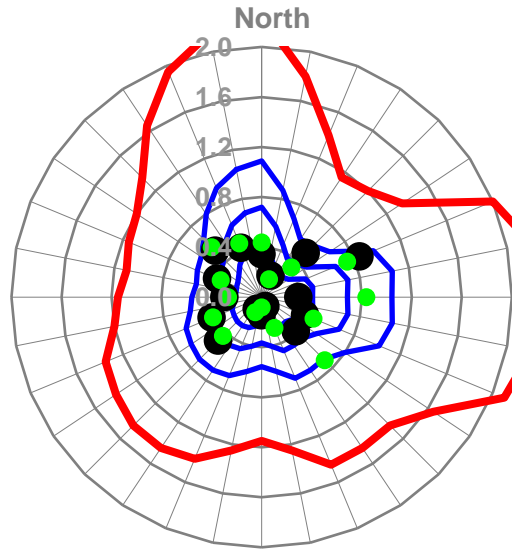
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7



8

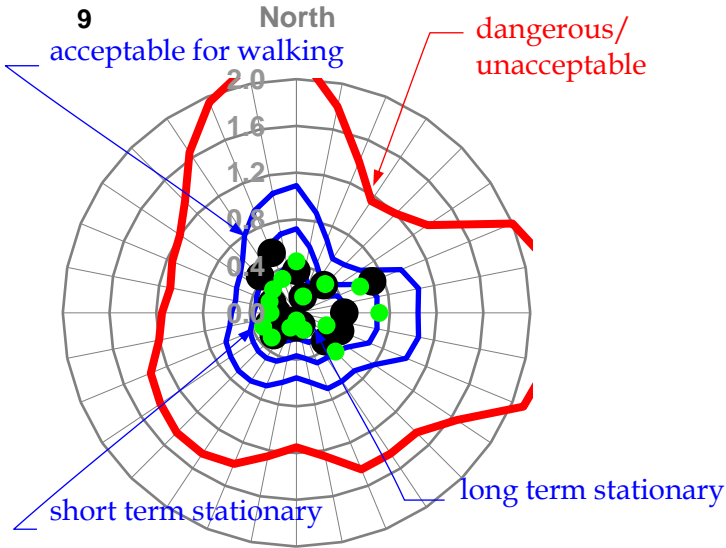


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

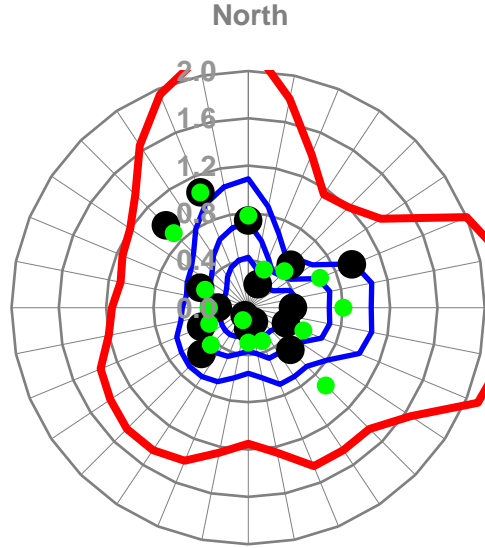
Proposed Configuration	●
Existing Configuration	●

Appendix A3 - Phillip Street [CONTINUED]

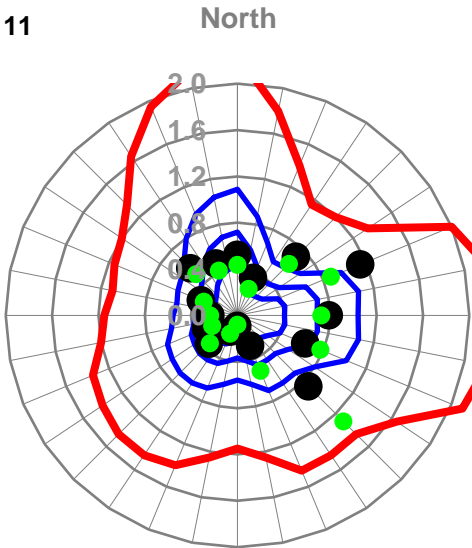
Test Location
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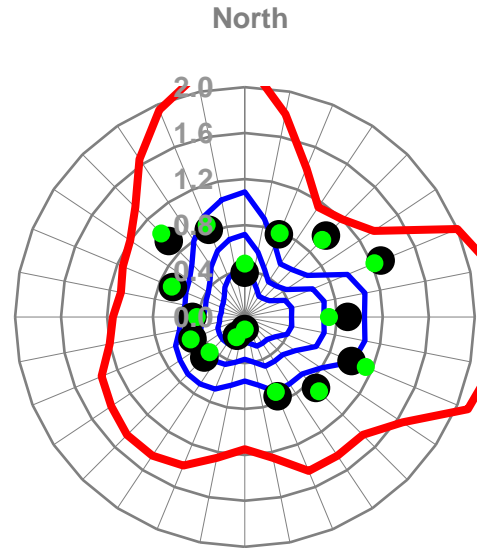
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11



12



Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

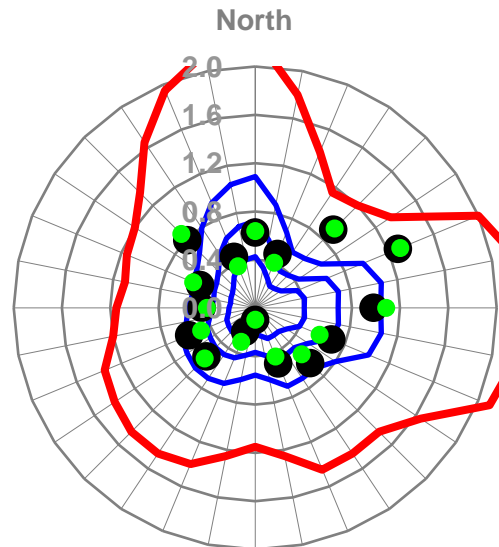
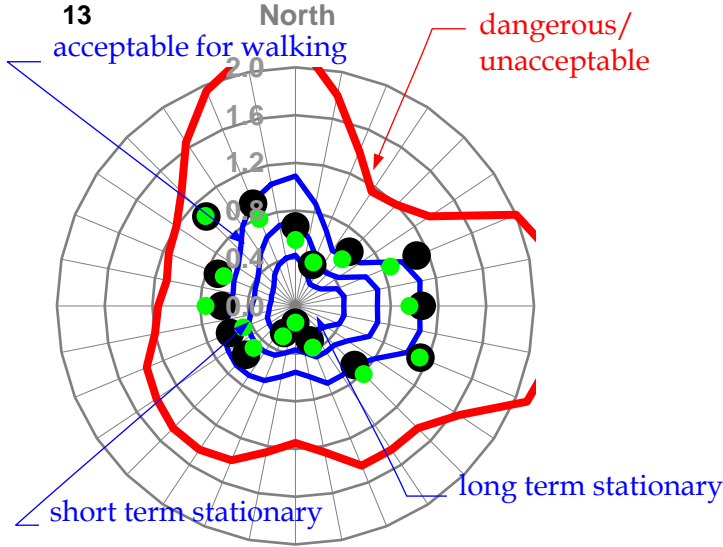
Proposed Configuration	●
Existing Configuration	●

Appendix A4 - Phillip Street [CONTINUED]

Test Location

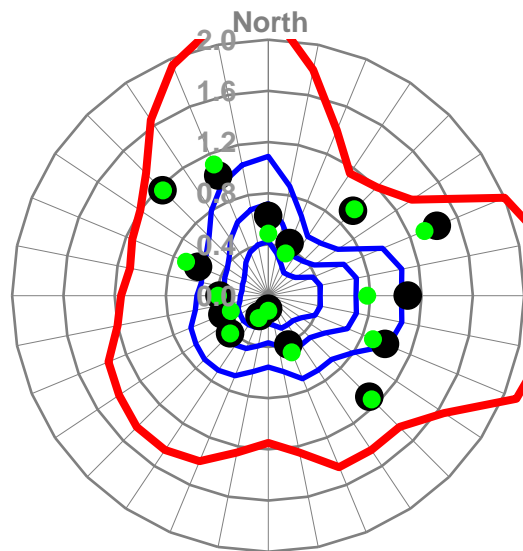
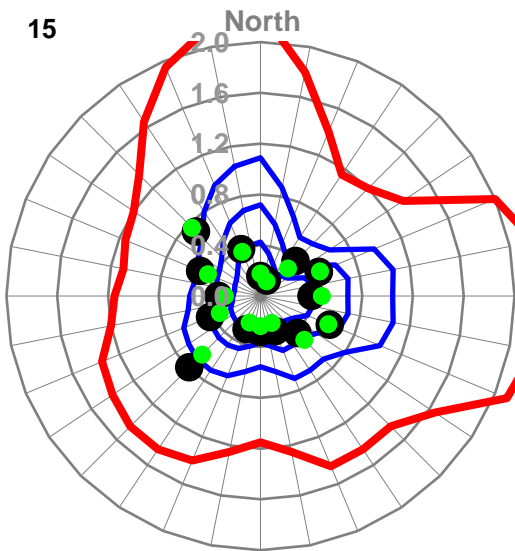
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14



15

16

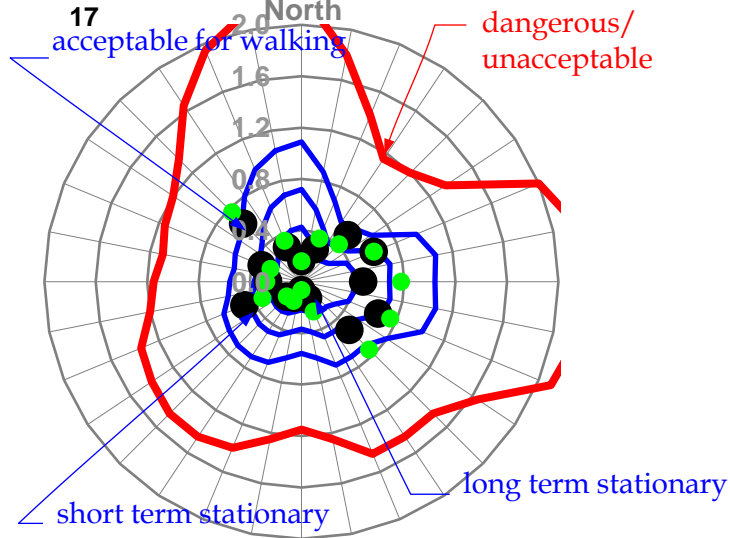


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

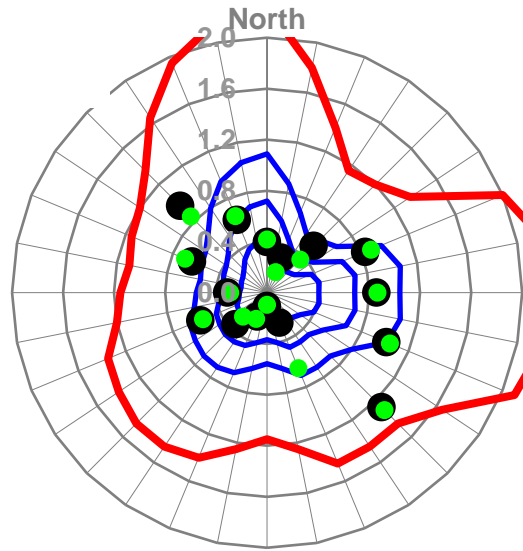
Proposed Configuration	●
Existing Configuration	●

Appendix A5 - Phillip Street [CONTINUED] & Bridge Street

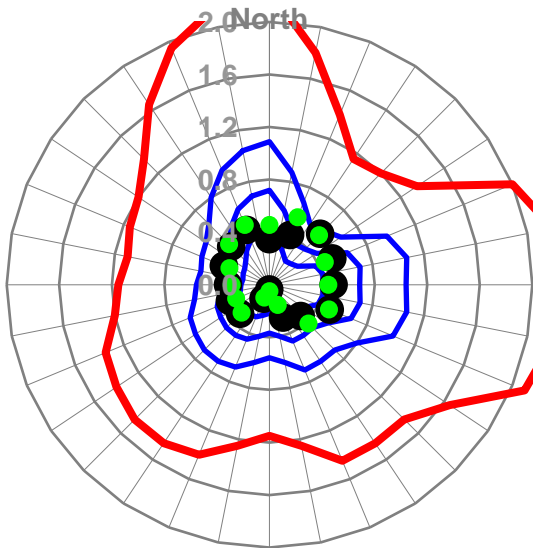
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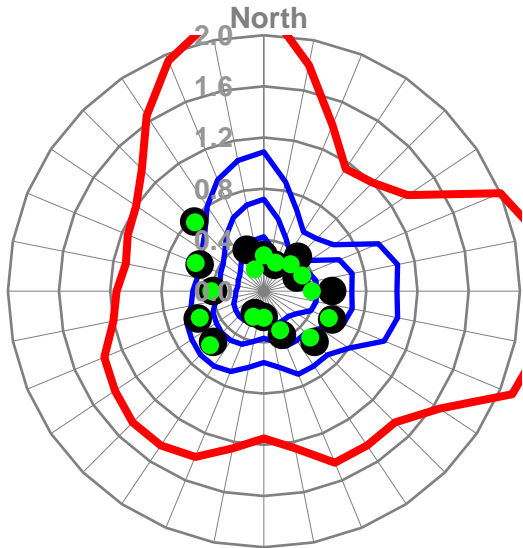
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19



20

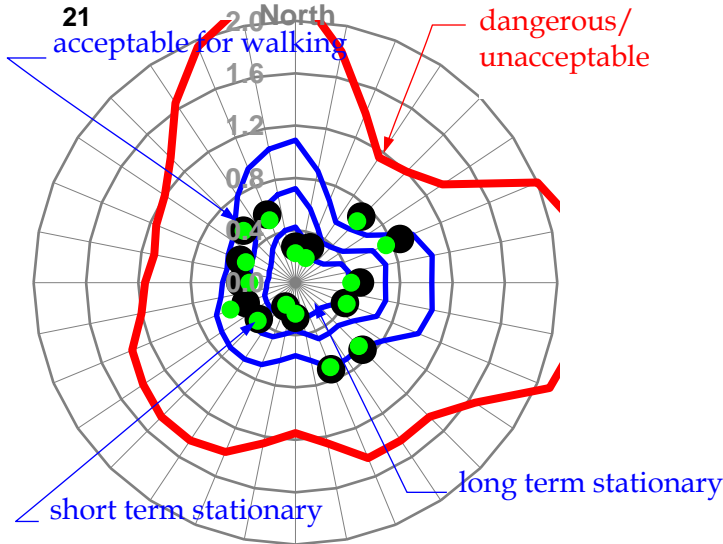


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

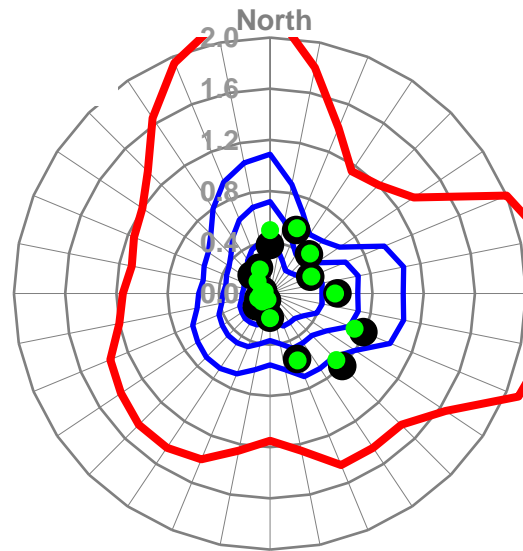
Proposed Configuration	●
Existing Configuration	●

Appendix A6 - Bridge Street [CONTINUED]

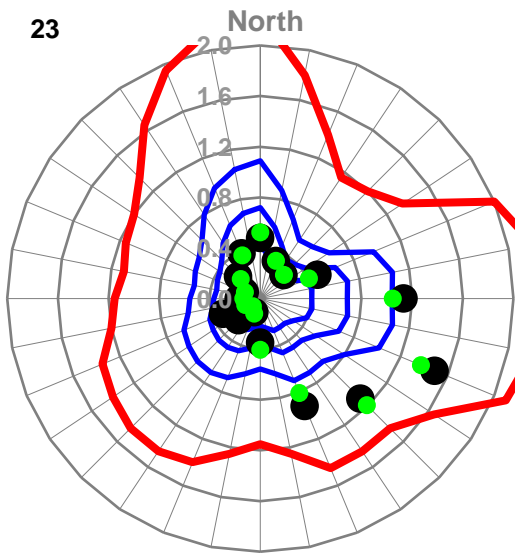
Test Location



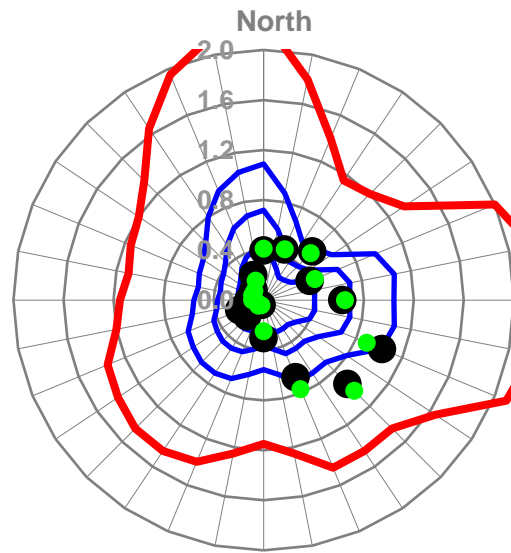
22



23



24



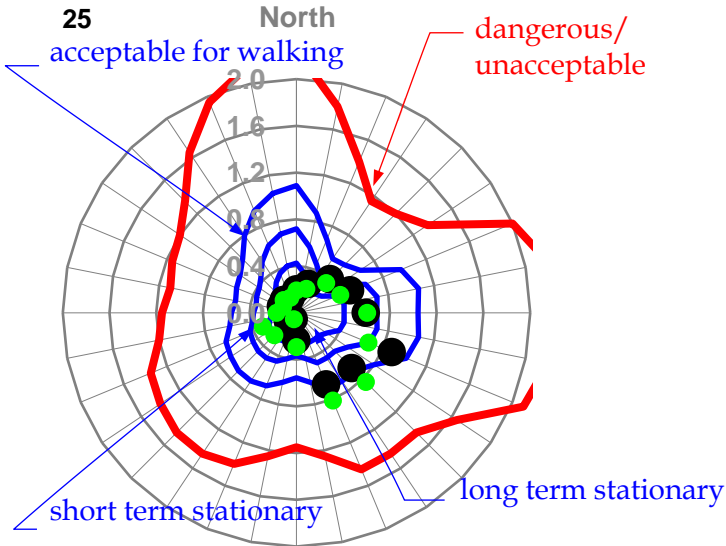
Peak velocity squared ratio $\left| \frac{\bar{V}_{local}}{\bar{V}_{300m}} \right|^2$ as a function of wind direction

Proposed Configuration	●
Existing Configuration	●

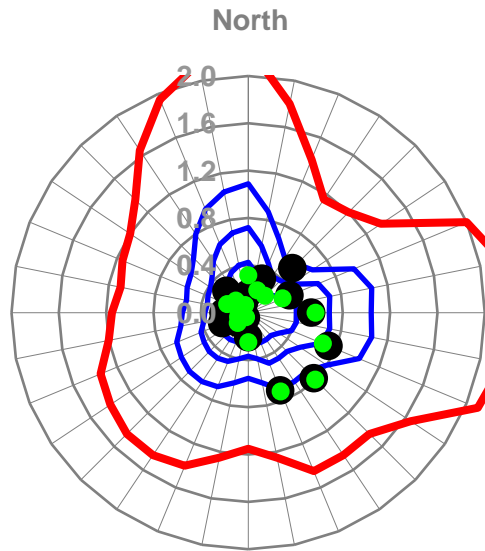
Appendix A7 - Bridge Street [CONTINUED] & Macquarie Street

Test Location

25

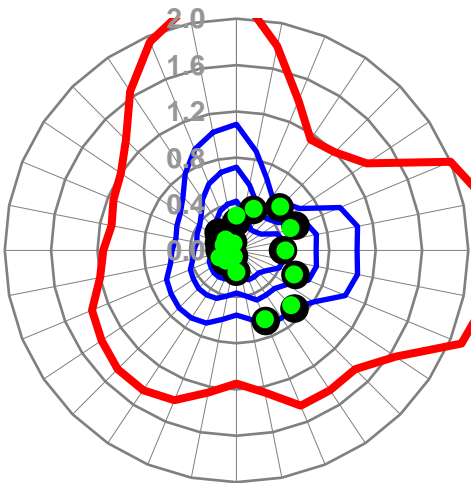


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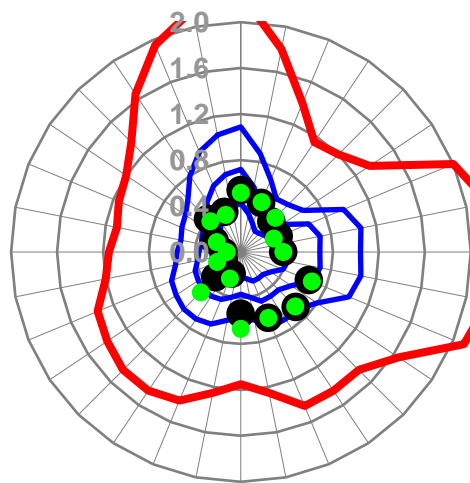


27

North



North



28

Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

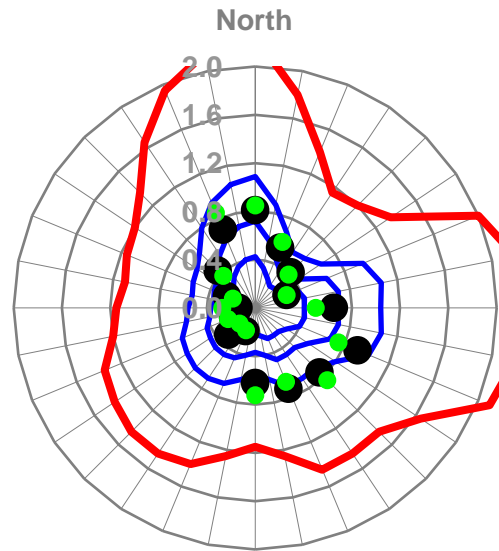
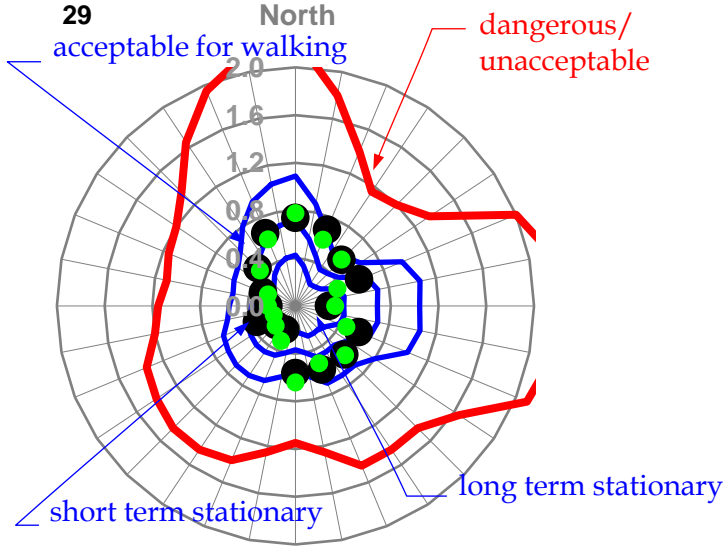
Proposed Configuration	●
Existing Configuration	●

Appendix A8 - Macquarie Street [CONTINUED] & Royal Botanic Garden

Test Location

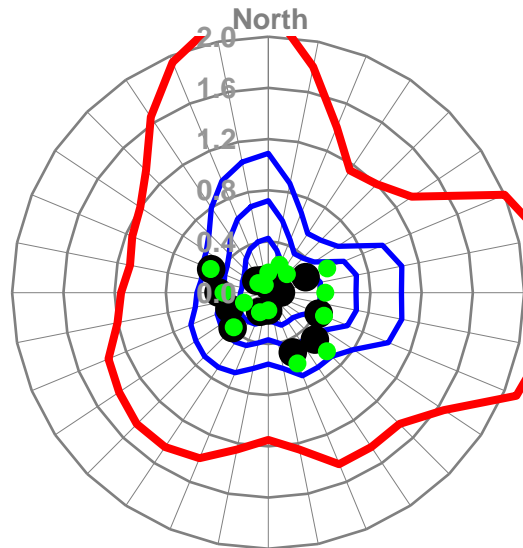
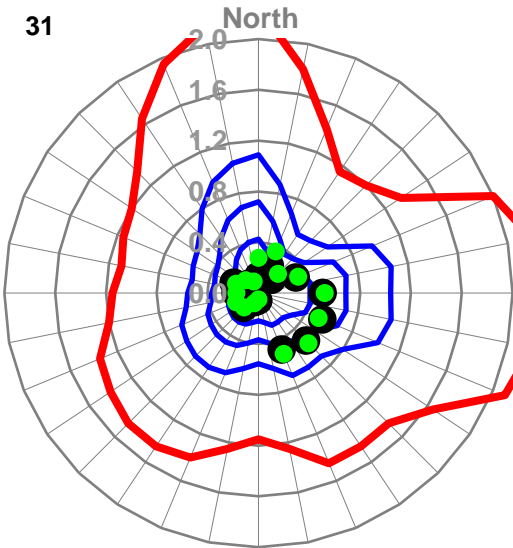
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30



31

32

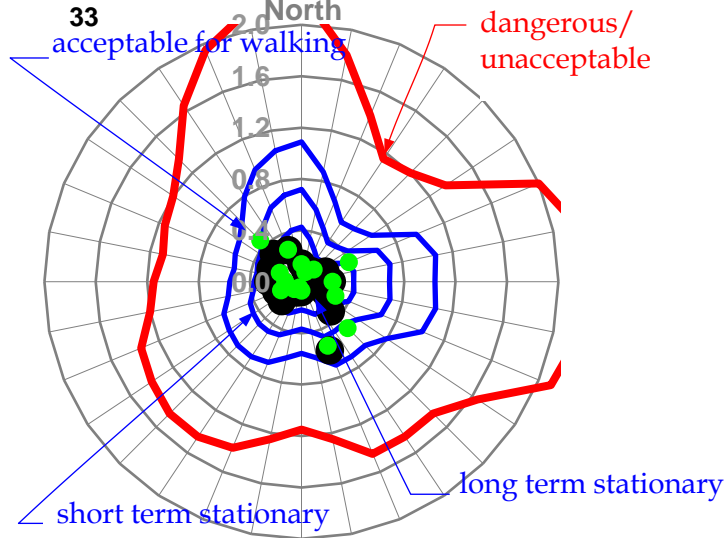


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

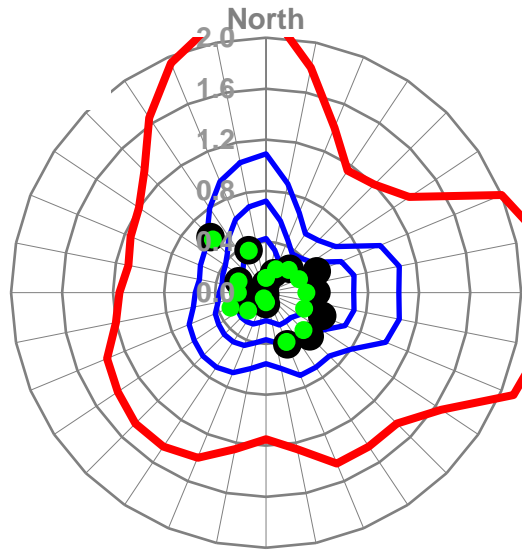
Proposed Configuration	●
Existing Configuration	●

Appendix A9 - Royal Botanic Garden [CONTINUED] & Phillip Lane

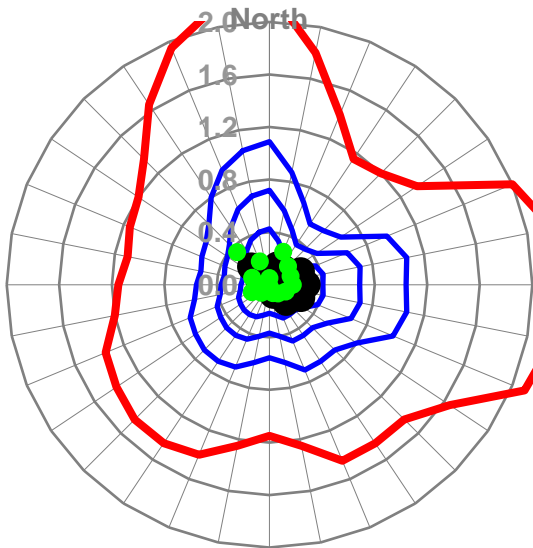
Test Location



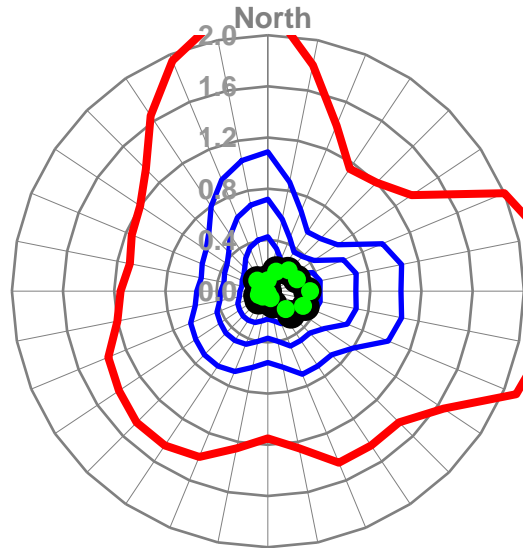
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35



36

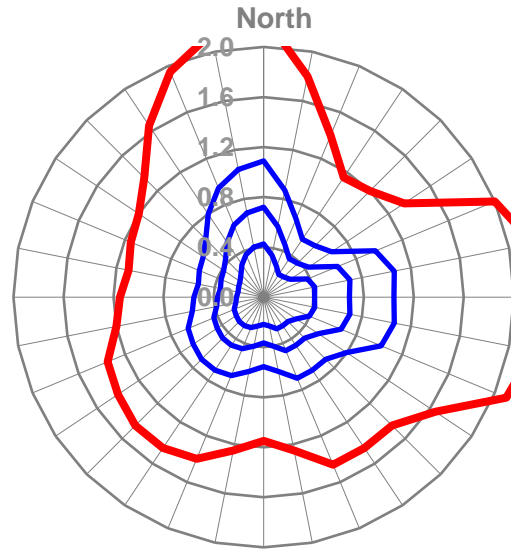
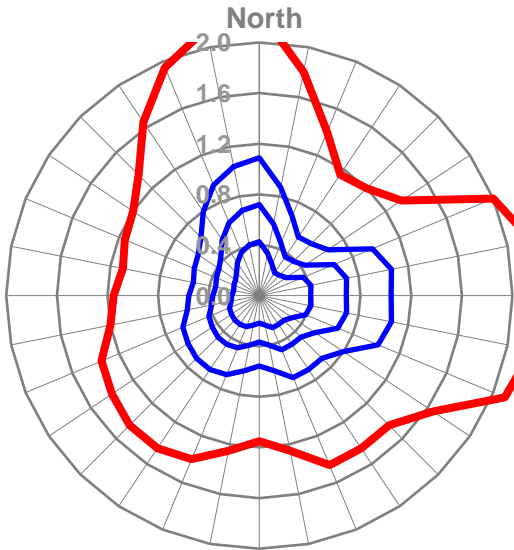
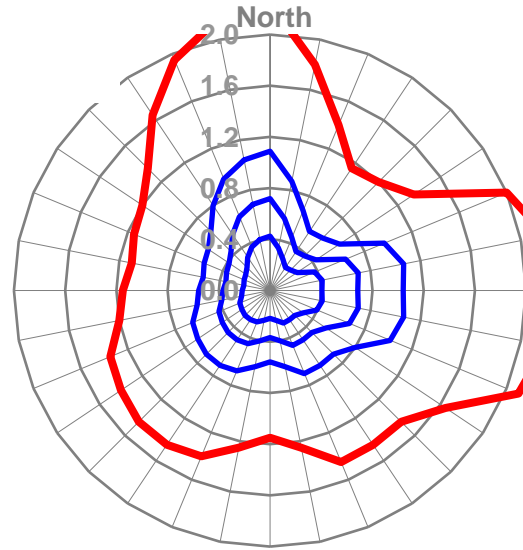
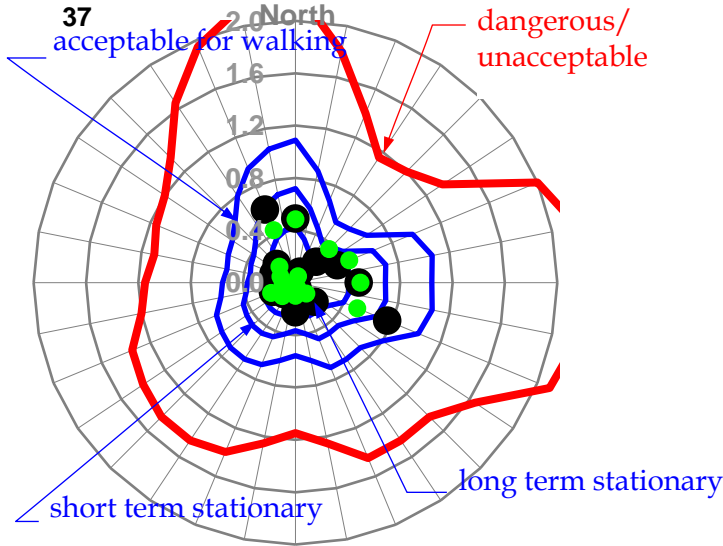


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

Proposed Configuration	●
Existing Configuration	●

Appendix A10 - Phillip Lane [CONTINUED]

Test Location

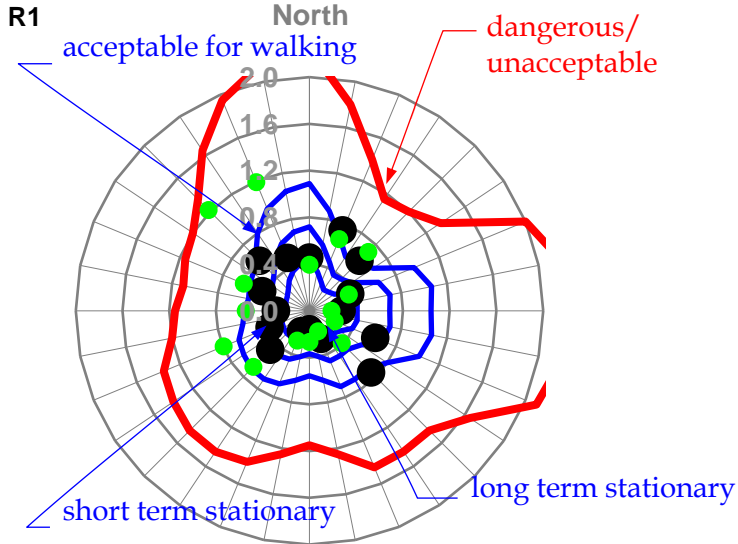


Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

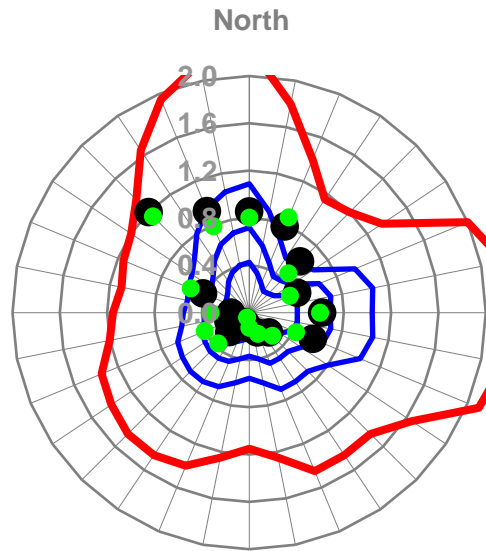
Proposed Configuration	●
Existing Configuration	●

Appendix A11 - Governor Phillip Tower

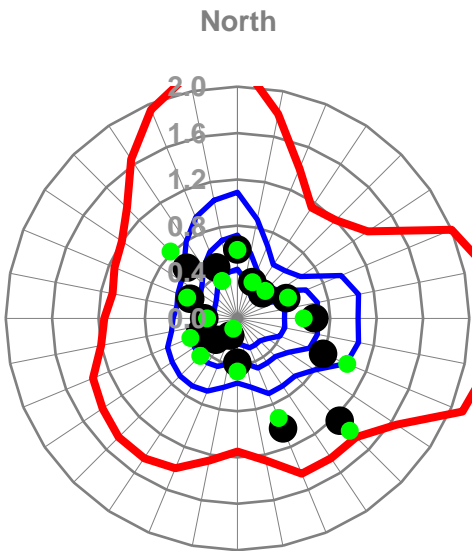
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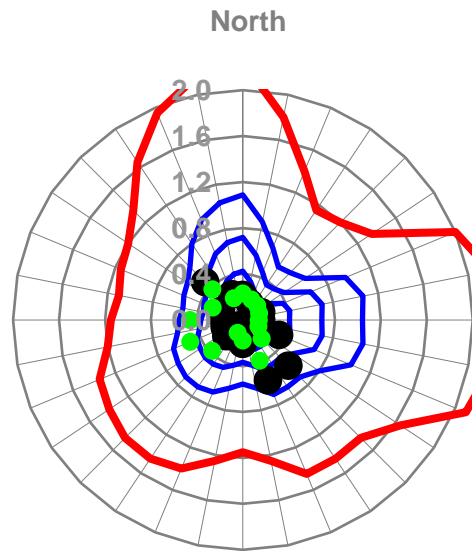
R2



R3



R4



Peak velocity squared ratio $\left| \frac{\hat{V}_{local}}{\hat{V}_{300m}} \right|^2$ as a function of wind direction

Proposed Configuration	●
Existing Configuration	●

Appendix A12 - The Astor Rooftop Terrace