ENVIRONMENTAL WIND SPEED MEASUREMENTS ON A ON A WINDTUNNEL MODEL OF THE 11 BEACH STREET DEVELOPMENT, FRANKSTON

by

G.Oree

and

J. Kostas

SUMMARY

Wind tunnel tests have been conducted on a 1/400 scale model of the updated design of the proposed 11 Beach Street development, Frankston. The model of the Development within surrounding buildings was tested in a simulated upstream boundary layer of the natural wind to determine the likely environmental wind conditions. These wind conditions have been related to the freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Frankston region as a function of wind direction.

A wind assessment of an earlier design (June 2023) was tested in MEL Consultants' wind tunnel and subsequent built form modifications were developed in conjunction with the architects so that the wind comfort criteria and thus amenity of public and private spaces in and around the development were achieved. These mitigation strategies, which included venting a level midway up the tower and taller balustrade heights of 1.8m on the west side of balconies facing the beach, have been incorporated into the latest design (8th August 2023) provided by Caleb Smith Architect. The measurement of the wind impacts of the design, and comparison against the relevant planning criteria, were the subject of this current wind tunnel study. No further wind mitigation strategies or modifications to the 11 Beach Street development design have been recommended for the updated design which is referred to as the Proposed Configuration in this report.

The wind conditions for all Test Locations in the streetscapes surrounding the Development have been shown to pass the walking comfort criterion as a minimum as well as the pedestrian safety standard for the Proposed Configuration. The wind conditions at

the main entrance (Test Location 7), along Beach Street, were shown to satisfy the recommended standing comfort criterion for building entrances. The Existing Configuration wind conditions have been included for comparison.

The wind conditions for the Proposed Configuration on the upper level balconies and rooftop terraces have been shown to pass the walking comfort criterion with wind conditions at a number of locations also achieving the standing comfort criterion or better. The wind conditions on these terraces and outdoor areas have been shown to pass the safety criterion.

Commentary has been provided on the effects of the building modifications, as a result of feedback from the OVGA, on the measured wind comfort and safety criteria, noting that the Level 13 communal rooftop terrace now no longer exists. It has been concluded that the design changes are not significant with respect to exterior built form and the wind comfort and safety criteria measured on this report would still be applicable to the most recent (May 2024) design.

Additional wind tunnel testing would not be expected to be required for the revised scheme.

11 BEACH STREET, FRANKSTON
ENVIRONMENTAL WIND TUNNEL MODELLING

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PREPARED FOR:
CAAMCo
Level 1, 5 Main Street
Mornington VIC 3931

Contact: Nghia Pham
Ph: +61 422 268 866

PREPARED BY:
MEL Consultants Pty Ltd
22 Cleeland Road
Oakleigh South VIC 3167

Contact: J. Kostas
Ph: +61 3 8516 9687

PREPARED BY:

G. Oree
Engineer Date: 15 August 2023

REVIEWED BY:

J. Kostas
Director Date: 18 August 2023

RELEASED BY:

J. Kostas
Director Date: 18 August 2023

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1	2 May 2024	Updated scheme comments
2	6 June 2024	Additional comments on terraces/balconies

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1. INTRODUCTION

A wind assessment of an earlier design (June 2023) was tested in MEL Consultants' wind tunnel and subsequent built form modifications were developed in conjunction with the architects so that the wind comfort criteria and thus amenity of public and private spaces in and around the development were achieved. These mitigation strategies, which included venting a level midway of the tower and taller balustrade height of 1.8m on the west side of balconies facing the beach, have been incorporated into the latest design (8th August 2023) provided by Caleb Smith Architect.

A wind tunnel model study was commissioned by CAAMCo to investigate the environmental wind effects of the updated design of proposed development and, if necessary, to develop wind amelioration features to achieve appropriate environmental wind criteria. These tests were carried out in the MEL Consultants 400kW Boundary Layer Wind Tunnel during August 2023.

Commentary has been provided on the wind conditions for a revised architectural scheme dated 6th May 2024, as a result of feedback from the OVGA and is provided in Section 5 within this report.

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 forms of criteria are required. The Frankston Planning Scheme Clause 58.04-4 (Standard D32) defines the wind comfort and safety criteria. This scheme can be considered for the proposed 11 Beach Street Development as we are investigating the potential wind impacts of the proposed building due to its built-in form rather than its usage. The definition of the criteria is as follows:

Unsafe wind conditions means the annual maximum 3 second gust wind speed exceeding 20 metres per second with a probability of exceedance of 0.1% considering at least 16 wind directions.

Comfortable wind conditions means a mean wind speed from all wind directions combined with probability of exceedance less than 20% of the time, equal to or less than:

- 3 metres/second for **sitting areas**
    - Sitting criterion: generally acceptable for stationary, long exposure activities such as dining at outdoor restaurants or theatres.
- 4 metres/second for **standing areas**
    - Standing criterion: generally acceptable for stationary short exposure activities such as window shopping, standing or sitting in plazas.
- 5 metres/second for **walking areas**
    - Walking criterion: generally acceptable for walking in urban and suburban areas.

Mean wind speed means the maximum of:

- Hourly mean wind speed, or
- Gust equivalent mean wind speed (3 second gust wind speed divided by 1.85)

The above comfort criteria are pass/fail criteria which assess the integrated probability of all wind directions to determine whether a location passes or fails the threshold criterion.

The safety criterion is a pass/fail criterion based upon exceedance of the wind speed for any one wind direction. For completeness, this report will provide data for each Test Location as a function of wind direction in Appendix A.

Clause 58.04-4 (Standard D32) does not provide any methodology or worked example as how to obtain the 'from all wind directions combined'. Therefore, to obtain the probability for all wind directions combined we will apply the methodology described in Melbourne (1978) to determine the probability for all wind directions. The guidelines use 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 Melbourne City. The probability data used have been corrected for the approach terrain at the location of the automatic weather station and referenced to 10m in Terrain Category 2. This is the standard reference height of AS/NZS1170.2:2021.

2.1 Suggested Pedestrian Comfort Criteria

The 11 Beach Street development will have the main entrance along Beach Street. Moreover, the development will also have many private apartment balconies throughout the tower and rooftop terraces on Level 13.

The following wind criteria are suggested for the surrounding streetscapes:

- Pedestrian transit areas — Walking Criterion
- Building/Tenancy entrances — Standing Criterion
- Terraces/Balconies — Walking Criterion

The activation of the public realm external to the site would depend on the existing wind conditions in the streetscapes that are often beyond the control of the proposed development. For cases where the existing wind conditions in the public realm external to the site are on or above the walking criterion, then the proposed development should not have any adverse wind effects in these areas.

The wind conditions on private outdoor areas have been recommended to satisfy the walking criterion as these spaces could be considered elective when external conditions

would be perceived as acceptable for the desired activity. Users of these terraces will need to be educated on the wind effects and loose objects should not be left unattended in outdoor areas. However, if outdoor terraces are intended to be used as breakout spaces for commercial offices, then standing and sitting criteria may be appropriate due to an expectation of higher utilisation, although this is now not relevant for the May 2024 scheme, as discussed in Section 5.

3. MODEL AND EXPERIMENTAL TECHNIQUES

A 1/400 scale model of 11 Beach Street, Frankston Development was constructed from digital information provided by Caleb Smith Architect, received on 8th August 2023.

The 1/400 scale model of 11 Beach Street, Frankston, and surrounding buildings were 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 proposed natural wind models for the two approach terrain categories were as follows:

Terrain Category 1: 225° to 337.5° (water approach)
Terrain Category 3: 0° to 202.5° (suburban approach)

The wind tunnel natural wind model properties for the two Terrain Categories are given in Figure 1. The surrounding wind tunnel model of all significant buildings, out to a minimum radius of 400m, 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. In these tests, measurements in the development areas are inside separated regions and peak velocity squared ratios were required to make conclusions about likely wind conditions. In summary, 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

$$\left|\frac{\hat{V}_{local}}{\bar{V}_{300m}}\right|^2$$

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 model as tested in the wind tunnel are shown in Figures 2 and 3.

4. DISCUSSION OF RESULTS

Velocity measurements were made at various locations around the 11 Beach St development for different wind directions at 22.5° intervals. As discussed in Section 2, the Clause 58.04-4 (Standard D32) wind comfort criteria are pass/fail criteria based on an assessment of the probability for all wind directions combined. The wind comfort criteria for sitting, standing and walking are given in percentage for which a given mean wind speed is exceeded. A test location will satisfy the sitting, standing and walking criteria if the percentage for which a given mean wind speed is exceeded is below 20%. Therefore, to assess the wind conditions the exceedances will be presented in tabular form in Tables 1 to 8 and colour coded; green for below 20% exceedance, orange for 20% and above exceedance and green or red for satisfying/failing the safety criterion respectively. For completeness these data are also provided in Appendix A as a function of wind direction and compared with the pedestrian criteria for gust wind speeds.

The Proposed Configuration, is as outlined in the digital information provided by Caleb Smith Architect and received up to 8th August 2023. The Existing Configuration is defined as single storey residential building that currently exists on the site. However, this study did not include or rely on existing street trees for wind mitigation. The Test Locations in the surrounding streetscapes and on the upper-level balconies/terraces are shown in Figures 4a to 4e.

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

4.1 Summary of Discussion

To assist with the assessment of the wind conditions, summaries of the highest wind criteria achieved based on Clause 58.04-4 (Standard D32) at the Test Locations have been presented in the following figures for the following configurations:

- Existing Configuration (Ground Level) Figure 5
- Proposed Configuration (Ground & Upper Levels) Figure 6a-6e

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

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

4.2 Beach Street

The wind conditions for the Proposed Configuration along Beach Street (Test Locations 1-12) have been shown to pass the walking comfort criterion. The wind conditions at the main entrance (Test Location 7) have been shown to satisfy the standing comfort criterion, suitable for building entrances. The criteria achieved at these Test Locations have been presented in Table 1 as well as the data for the Existing Configuration.

The wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figures A2 to A4). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 1: Pedestrian Wind Comfort and Safety – Beach Street

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
1	Proposed	40.7%	23.5%	19.8%	Pass
	Existing	44.4%	26.5%	13.7%	Pass
2	Proposed	45.0%	26.9%	13.5%	Pass
	Existing	38.2%	21.1%	11.2%	Pass
3	Proposed	31.6%	14.7%	6.3%	Pass
	Existing	22.6%	11.5%	5.1%	Pass
4	Proposed	47.0%	29.2%	16.1%	Pass
	Existing	32.2%	17.6%	9.4%	Pass
5	Proposed	37.1%	19.4%	9.0%	Pass
	Existing	27.5%	14.9%	7.2%	Pass
6	Proposed	41.3%	28.1%	17.4%	Pass
	Existing	38.2%	22.8%	11.8%	Pass
7	Proposed	30.6%	18.0%	10.3%	Pass
	Existing	34.3%	18.5%	9.4%	Pass
8	Proposed	35.4%	22.7%	14.2%	Pass
	Existing	35.2%	19.6%	10.9%	Pass
9	Proposed	37.8%	21.1%	10.5%	Pass
	Existing	36.5%	21.8%	11.6%	Pass
10	Proposed	28.5%	16.1%	8.4%	Pass
	Existing	20.5%	7.8%	2.2%	Pass
11	Proposed	40.9%	25.9%	15.8%	Pass
	Existing	27.0%	15.2%	7.7%	Pass
12	Proposed	36.6%	23.6%	12.8%	Pass
	Existing	27.8%	13.7%	5.8%	Pass

4.3 Olsen Street & Nepean Highway

The wind conditions for the Proposed Configuration along Olsen Street (Test Locations 13 and 14) and Nepean Highway (Test Location 23) have been shown to satisfy the standing comfort criterion. The overall wind criteria satisfied at these locales are similar to the Existing Configuration indicating that the Proposed 11 Beach Street Development would have no significance influence along Olsen Street and Nepean Highway. The criteria achieved at these Test Locations have been presented in Table 2 as well as the data for the Existing Configuration.

The wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figure A5). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 2: Pedestrian Wind Comfort and Safety – Olsen Street & Nepean Highway

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
13	Proposed	34.9%	18.6%	8.8%	Pass
	Existing	30.1%	15.4%	6.2%	Pass
14	Proposed	21.9%	11.2%	5.0%	Pass
	Existing	20.6%	9.6%	3.5%	Pass
23	Proposed	31.2%	17.8%	8.4%	Pass
	Existing	29.9%	17.6%	8.7%	Pass

4.4 Evelyn Street

The wind conditions for the Proposed Configuration along Evelyn Street (Test Locations 15-22) have all been shown to satisfy the walking comfort criterion. A general increase in wind conditions relative to the Existing Configuration were observed and can be attributed to wind flow deflecting off the east corners of the tower and being induced towards ground level along Evelyn Street. Flow visualisation has shown that the vented level located approximately midway up the tower, helped in reducing the wind flow impact of the tower and as such all Test Locations along Evelyn Street to pass the walking comfort and safety criteria. The criteria achieved at these Test Locations have been presented in Table 3 as well as the data for the Existing Configuration.

The wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figures A6 and A7). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 3: Pedestrian Wind Comfort and Safety – Evelyn Street

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
15	Proposed	45.2%	30.0%	19.6%	Pass
	Existing	39.6%	22.8%	11.1%	Pass
16	Proposed	41.2%	27.1%	16.3%	Pass
	Existing	41.1%	24.5%	12.6%	Pass
17	Proposed	45.2%	30.5%	19.9%	Pass
	Existing	25.9%	12.8%	5.4%	Pass
18	Proposed	49.2%	32.4%	19.8%	Pass
	Existing	35.7%	19.3%	9.3%	Pass
19	Proposed	51.2%	33.9%	19.9%	Pass
	Existing	31.1%	13.1%	4.6%	Pass
20	Proposed	47.6%	30.5%	18.1%	Pass
	Existing	37.7%	20.3%	9.2%	Pass
21	Proposed	47.1%	29.6%	15.4%	Pass
	Existing	41.5%	22.4%	9.9%	Pass
22	Proposed	49.8%	32.1%	16.8%	Pass
	Existing	41.5%	22.9%	10.8%	Pass

4.5 Laneway (west side of the development) & Neighbouring Premises

The wind conditions for the Proposed Configuration along the laneway on the west side of the development (Test Locations 24 and 25) and in the Neighbouring Private Premises (Test Locations 26-31) have been shown to pass the walking comfort, with Test Location 25 also passing the sitting comfort criterion as a result of the shielding effect provided by the proposed 11 Beach Street Development. The criteria achieved at these Test Locations have been presented in Table 4 as well as the data for the Existing Configuration.

The wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figures A8 and A9). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 4: Pedestrian Wind Comfort and Safety – Laneway (west side of the development) & Neighbouring Private Premises

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
24	Proposed	30.4%	13.1%	5.1%	Pass
	Existing	25.9%	9.2%	2.7%	Pass
25	Proposed	17.7%	6.6%	2.6%	Pass
	Existing	21.2%	10.6%	4.3%	Pass
26	Proposed	30.6%	17.1%	8.4%	Pass
	Existing	21.4%	8.4%	3.2%	Pass
27	Proposed	30.0%	18.0%	8.6%	Pass
	Existing	28.6%	16.5%	7.7%	Pass
28	Proposed	50.4%	31.9%	17.2%	Pass
	Existing	39.3%	19.9%	9.0%	Pass
29	Proposed	46.9%	27.7%	13.3%	Pass
	Existing	42.0%	23.8%	12.3%	Pass
30	Proposed	40.8%	24.5%	12.3%	Pass
	Existing	32.4%	15.0%	6.1%	Pass
31	Proposed	24.6%	11.4%	4.9%	Pass
	Existing	15.4%	3.5%	0.6%	Pass

4.6 Adjacent to East & West sides of development

The wind conditions for the Proposed Configuration for Test Locations adjacent to the East and West sides of the development (Test Locations 32-36) have been shown to pass the walking comfort as a minimum. The increased in wind conditions at Test Locations 32 and 34 can be attributed to downwash effect and flow acceleration at ground level around the northeast and northwest corners of the development. The criteria achieved at these Test Locations have been presented in Table 5 as well as the data for selected Test Locations for the Existing Configuration.

The wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figures A10 and A11). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 5: Pedestrian Wind Comfort and Safety – Adjacent to East & west sides of development

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
32	Proposed	47.2%	27.5%	16.0%	Pass
	Existing	33.1%	15.0%	6.9%	Pass
33	Proposed	21.9%	11.4%	5.8%	Pass
	Existing	32.1%	17.6%	8.0%	Pass
34	Proposed	32.8%	18.8%	10.1%	Pass
	Existing	15.4%	4.7%	1.1%	Pass
35	Proposed	19.4%	7.5%	2.9%	Pass
	Existing	8.2%	1.6%	0.3%	Pass
36	Proposed	29.2%	13.7%	6.0%	Pass
	Existing	21.7%	10.9%	4.8%	Pass

4.7 Balconies at Level 3, 5 and 10 & Rooftop Terraces

The balcony wind conditions for the Proposed Configuration were tested at Level 3 (Test Locations P2-P50, Balconies at Level 5 (Test Locations B1-B4) Balconies at Level 10 (Test Locations B5-B8) and Rooftop Terraces at Level 13† (Test Locations T1-T4).

†refer to Section 5 for wind conditions on updated scheme which now does not include level 13 communal terrace.

We note Planning Practice Note (PPN) 93 which stipulates that "*Private open spaces do not require assessment against the comfortable wind criteria as a private resident can chose to retreat indoors during uncomfortable wind conditions while a pedestrian or person using a public area may not have this option*". Assessment of the balconies in this instance has been undertaken to confirm that the balconies achieve at minimum the wind safety criteria. Results on the wind comfort criteria are provided for information.

The results of the tests show that the wind conditions on all the measured balconies pass the wind safety criteria. The wind comfort criteria has also been evaluated to determine the level of comfort for the occupants of the balcony. Wind mitigation measures have been incorporated into the testing, including the min. 1.8m high balustrades to the side of the balconies, which resulted in improved amenity for occupants. The criteria achieved at these Test Locations have been summarised in Tables 6 & 7.

It is noted that the central north and south facing balconies on all levels will be expected to achieve the sitting criterion as they are well shielded. The corner balconies are subject to greater wind exposure and as such were chosen for measurements at levels 3, 5, 10 and 13†, as noted above.

†refer to Section 5 for wind conditions on updated scheme which now does not include level 13 communal terrace.

The balconies at the level 3 podium top were shown to achieve results ranging from sitting, to standing, to walking criteria depending on the orientation. The test results did not include any of the proposed landscaping vegetation. Per Clause 58.04-4 Standard D32, the effect of trees and landscaping can be considered in relation to on-site sitting areas which would result in an improvement to the wind comfort levels for these balconies.

The balconies at level 5 achieved the sitting criteria (Test locations B1-B4). These test results are expected to be similar for the balconies at levels 4 and levels 6-8 which are also expected to achieve the sitting criterion.

The balconies at level 10 present wind conditions slightly (0.7% to 1.4%) above the sitting criterion (Test Locations B5-B8) and the wind conditions for similarly located balconies on levels 9, 11 & 12 are expected to be similar.

For the rooftop terrace, the results achieve walking criteria and it is recommended to introduce of a minimum 1.8m high wind screen to the terrace area to improve wind comfort for users.

We highlight that wind conditions within the surrounding context at street level are frequently above sitting criterion due to the coastal location and exposure to the bay. The mitigation strategies adopted for the balconies result in wind comfort criteria generally better than the prevailing norm at street level.

In relation to the results in Tables 6 & 7, the wind conditions as a function of wind direction based on the gust criteria developed for Frankston are presented in Appendix A (Figures A12 to A15). It is noted that at each Test Location the directional specific wind conditions may be higher than those of the tabulated results for certain incident wind directions.

Table 6: Pedestrian Wind Comfort and Safety – Balconies at Level 3, 5 and 10

	Test Location	Configuration	Wind Comfort Criteria			
			Sitting	Standing	Walking	Safety
Level 3	**P2**	Proposed	18.6%	9.9%	5.2%	Pass
	P3	Proposed	20.6%	10.4%	4.9%	Pass
	P4	Proposed	36.9%	25.0%	15.1%	Pass
	P5	Proposed	25.3%	16.5%	10.5%	Pass
applicable to L4, L5 – L8	**B1**	Proposed	13.9%	7.8%	4.5%	Pass
	B2	Proposed	16.5%	9.8%	6.1%	Pass
	B3	Proposed	18.8%	11.0%	6.2%	Pass
	B4	Proposed	15.4%	8.2%	3.4%	Pass
applicable to L10, L9, L11 & L12	**B5**	Proposed	15.8%	9.0%	4.6%	Pass
	B6	Proposed	20.7%	10.8%	5.3%	Pass
	B7	Proposed	20.5%	13.7%	8.6%	Pass
	B8	Proposed	21.4%	11.0%	5.5%	Pass

Table 7: Pedestrian Wind Comfort and Safety – Rooftop Terraces†

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
T1	Proposed	34.8%	20.1%	10.2%	Pass
T2	Proposed	33.8%	14.9%	6.4%	Pass
T3	Proposed	26.1%	10.6%	4.2%	Pass
T4	Proposed	44.4%	30.1%	18.9%	Pass

†refer to Section 5 for wind conditions on updated scheme which now does not include level 13 communal terrace.

5. WIND CONSIDERATIONS EFFECTS OF MAY 2024 SCHEME

Design changes to the development subsequent to the scheme tested in the wind tunnel have arisen from discussion with the OVGA. The modifications are as follows,

1. Podium office has been replaced with residential apartments with full width terrace facing north and south (3/4 width of building).
2. The mid-level venting remains unchanged, likewise overall height/setbacks.
3. Level 13 communal area and terrace has been moved down to level 1 on the north and as such any references to this terrace in the original report are no longer relevant. There is now a single apartment at level 13 with a smaller terrace facing south.
4. There is now a large communal terrace at Level 1 facing north

and have been implemented in the most recent set of plans, dated 6th May 2024.

It is noted that some measurement Test Locations would now no longer be relevant for the updated scheme, such as those associated with the former Level 13 communal rooftop terrace (Test Locations T1 and T2). The wind conditions within the new communal terrace at Level 1 would be expected to achieve the walking comfort criterion towards the east and west ends and achieve the standing comfort or better at the centre of the terrace. Similarly for the conditions on the residential terrace now at Level 2. The privacy screening presently shown in the plans would provide a beneficial mitigation effect on both these terrace levels. Furthermore the proposed landscaping on the communal terrace would provide added wind mitigation benefit to this area.

The implications of these changes to the building design with respect to the wind effects at both ground and elevated areas is not expected to be significant, and as such the wind conditions and comfort and safety criteria achieved within this report for the prior scheme (as detailed in drawings dated 8th August 2023) would remain relatively unaffected and also be applicable to the new May 2024 scheme, upon consideration of the above points of note.

Additional wind tunnel testing would not be expected to be required for the revised scheme.

6. CONCLUSIONS

Wind tunnel tests have been conducted on a 1/400 scale model of the updated design of the proposed 11 Beach Street development, Frankston. The model of the Development within surrounding buildings was tested in a simulated upstream boundary layer of the natural wind to determine the likely environmental wind conditions. These wind conditions have been related to the freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Frankston region as a function of wind direction.

A wind assessment of an earlier design (June 2023) was tested in MEL Consultants' wind tunnel and subsequent built form modifications were developed in conjunction with the architects so that the wind comfort criteria and thus amenity of public and private spaces in and around the development were achieved. These mitigation strategies, which included venting a level midway up the tower and taller balustrade heights of 1.8m on the west side of balconies facing the beach, have been incorporated into the latest design (8th August 2023) provided by Caleb Smith Architect. The measurement of the wind impacts of the design, and comparison against the relevant planning criteria, were the subject of this current wind tunnel study. No further wind mitigation strategies or modifications to the 11 Beach Street development design have been recommended for the updated design which is referred to as the Proposed Configuration in this report.

The wind conditions for all Test Locations in the streetscapes surrounding the Development have been shown to pass the walking comfort criterion as a minimum as well as the pedestrian safety standard for the Proposed Configuration. The wind conditions at the main entrance (Test Location 7), along Beach Street, were shown to satisfy the recommended standing comfort criterion for building entrances. The Existing Configuration wind conditions have been included for comparison.

The wind conditions for the Proposed Configuration on the upper level balconies and rooftop terraces have been shown to pass the walking comfort criterion with wind conditions at a number of locations also achieving the standing comfort criterion or better. The wind conditions on these terraces and outdoor areas have been shown to pass the safety criterion.

Commentary has been provided on the effects of the building modifications, as a result of feedback from the OVGA, on the measured wind comfort and safety criteria, noting that the Level 13 communal rooftop terrace now no longer exists. It has been concluded that the design changes are not significant with respect to exterior built form and the wind comfort and safety criteria measured on this report would still be applicable to the most recent (May 2024) design.

Additional wind tunnel testing would not be expected to be required for the revised scheme.

J.Kostas

MEL CONSULTANTS

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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

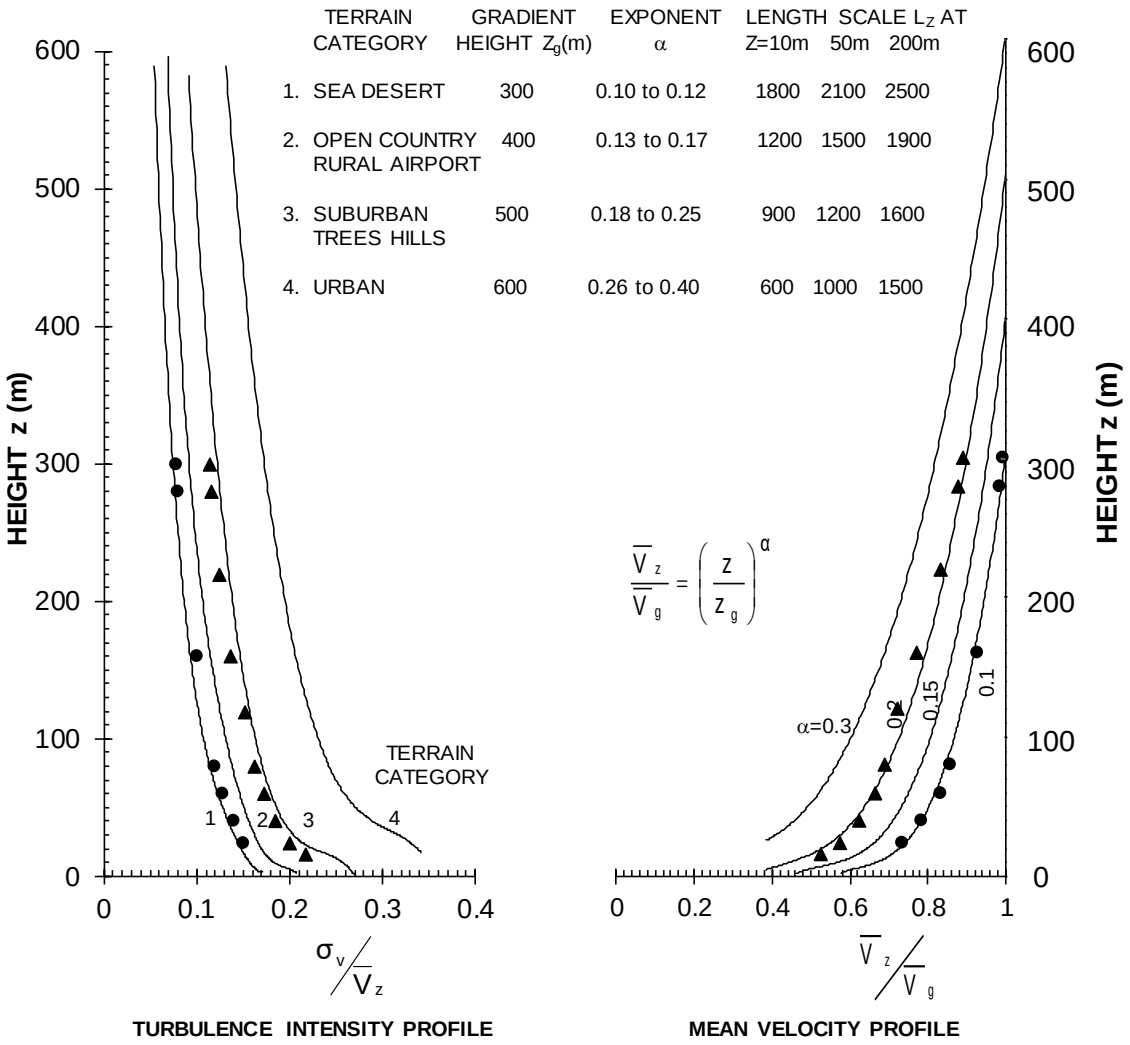


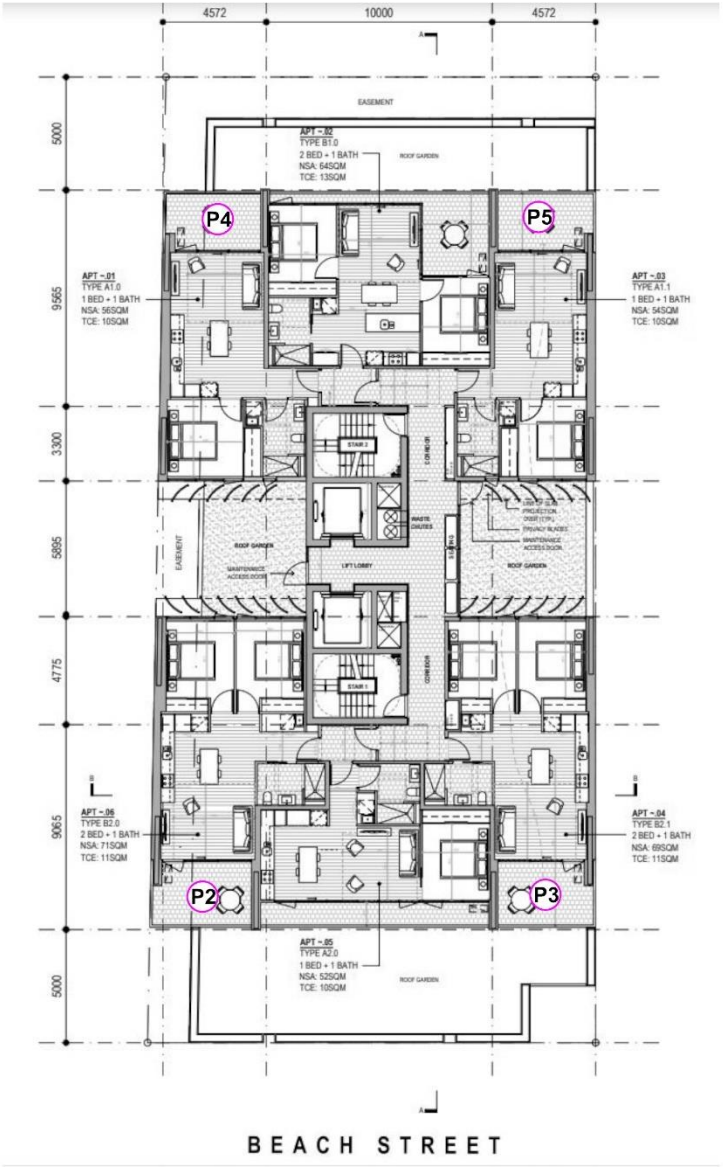
Figure 1 - 1/400 scale TC3 boundary layer turbulence intensity and mean velocity profiles in the MEL Consultants Boundary Layer Wind Tunnel 4.8m x 2.2m working section, scaled to full scale dimensions.

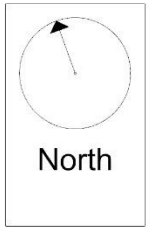
Figure 2 – View from the Northwest of the 1/400 scale proposed 11 Beach Street Development in the wind tunnel

1

Figure 3 – View from the Northeast of the 1/400 scale proposed 11 Beach Street Development in the wind tunnel

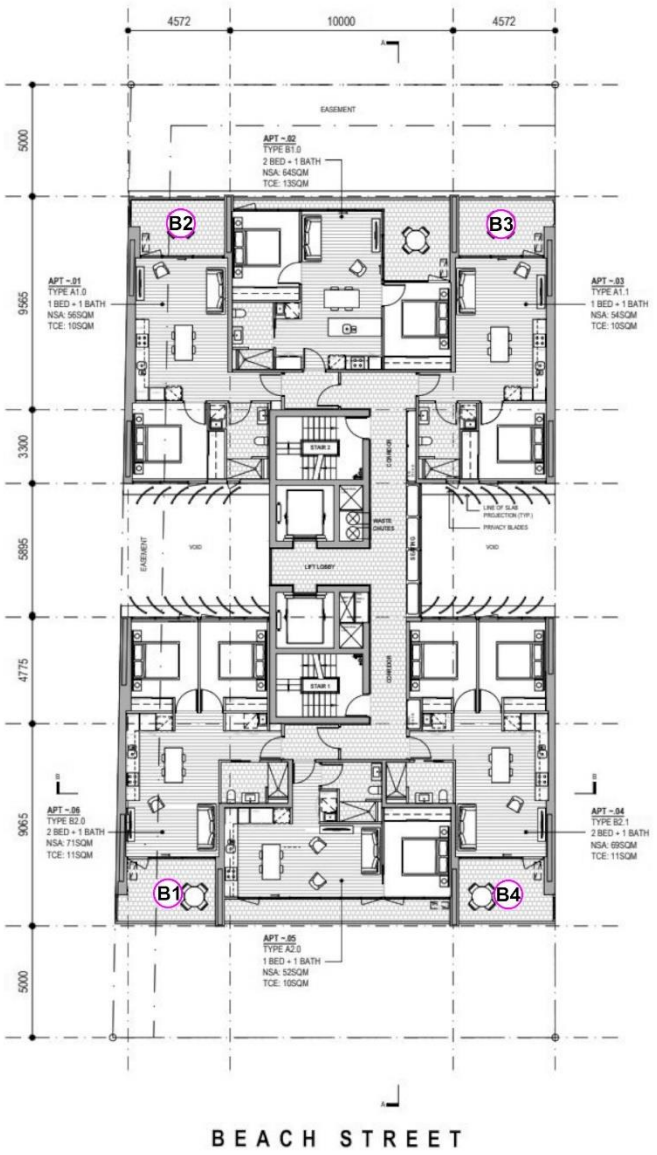
Figure 4a - Test Locations in the surrounding streetscapes for the proposed 11 Beach Street, Frankston Development.

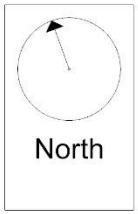




Legend
Test Location

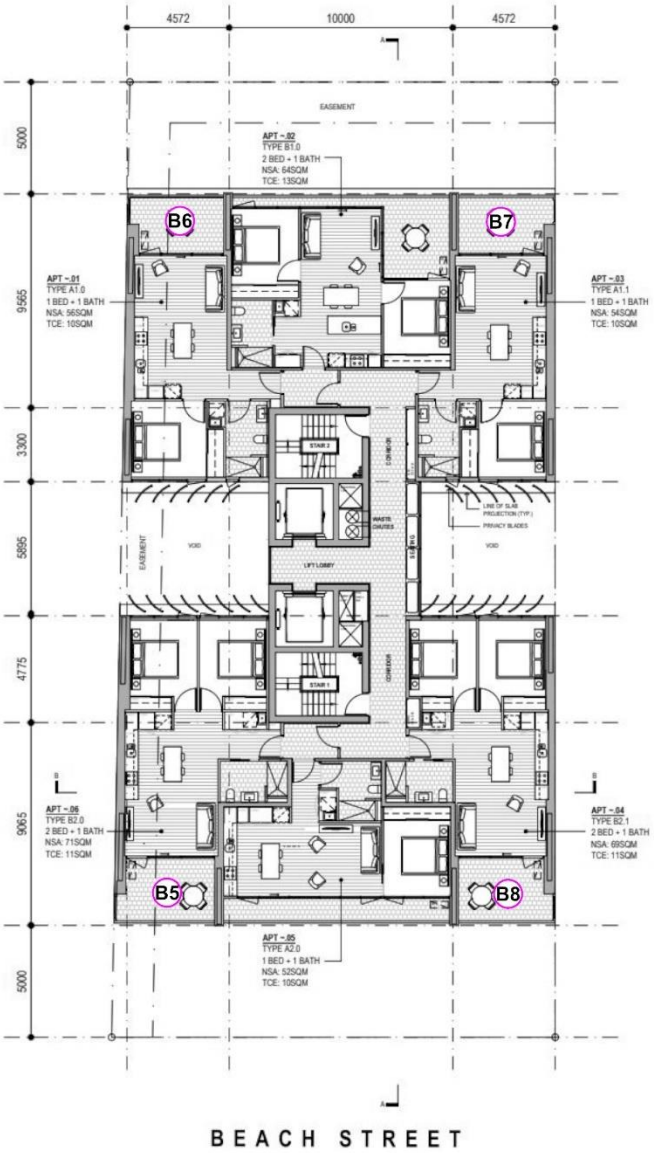
Figure 4b - Test Locations on Level 3 for the proposed 11 Beach Street, Frankston Development.

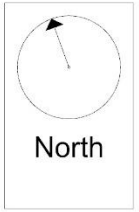




Legend
Test Location

Figure 4c - Test Locations on Level 5 for the proposed 11 Beach Street, Frankston Development.





Legend
Test Location

Figure 4d - Test Locations on Level 10 for the proposed 11 Beach Street, Frankston Development.

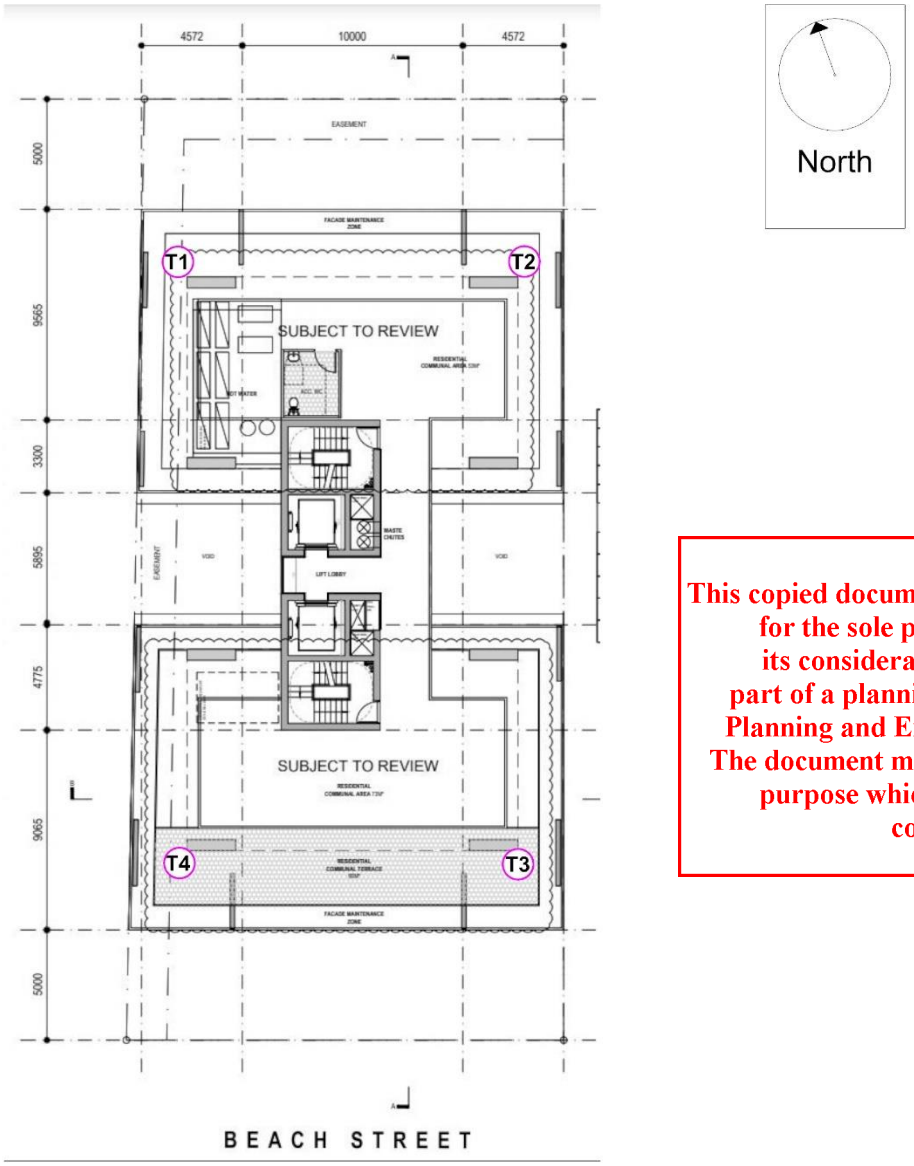
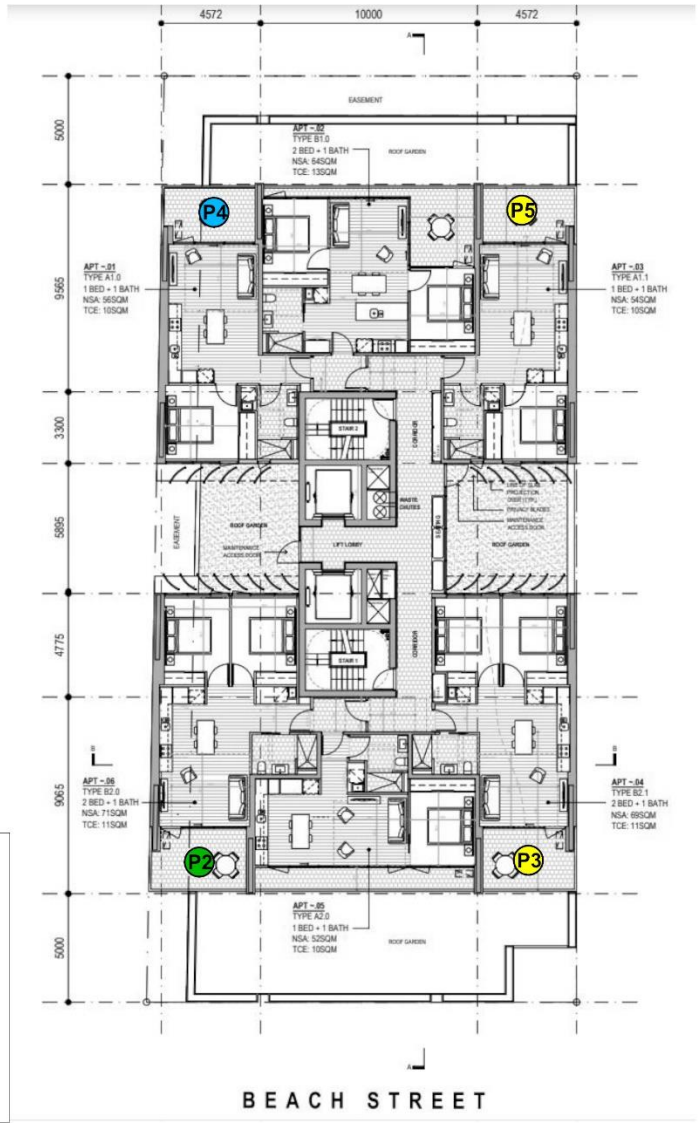
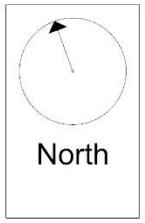


Figure 4e - Test Locations on Rooftop Terraces for the proposed 11 Beach Street, Frankston Development.

Figure 5 - Summary of wind conditions for the proposed 11 Beach Street, Frankston Development for the Existing Configuration for 360° of wind direction.

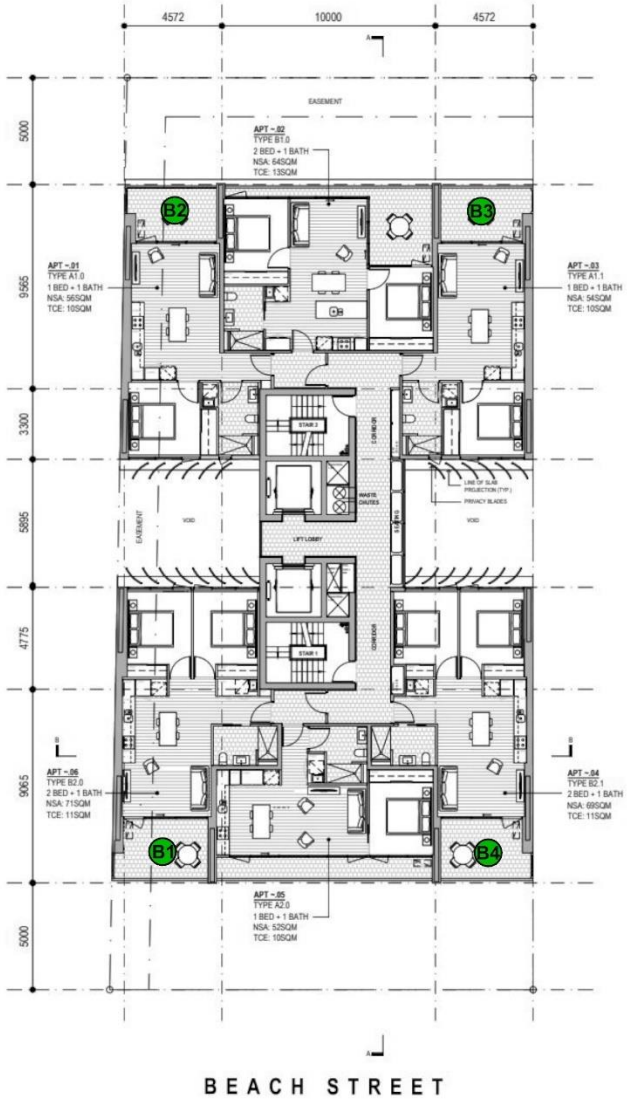
Figure 6a - Summary of wind conditions for the proposed 11 Beach Street, Frankston Development for the Proposed Configuration for 360° of wind direction.

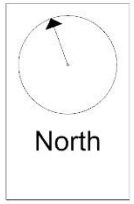




Legend - Criterion
- Sitting
- Standing
- Walking
- Above Walking
- Safety

Figure 6b - Summary of wind conditions at Test Locations on Level 3 of the proposed 11 Beach Street development for the Proposed Configuration for 360º of wind direction





Legend - Criterion
- Sitting
- Standing
- Walking
- Above Walking
- Safety

Figure 6c - Summary of wind conditions at Test Locations on Level 5 of the proposed 11 Beach Street development for the Proposed Configuration for 360º of wind direction

Figure 6d - Summary of wind conditions at Test Locations on Level 10 of the proposed 11 Beach Street development for the Proposed Configuration for 360º of wind direction

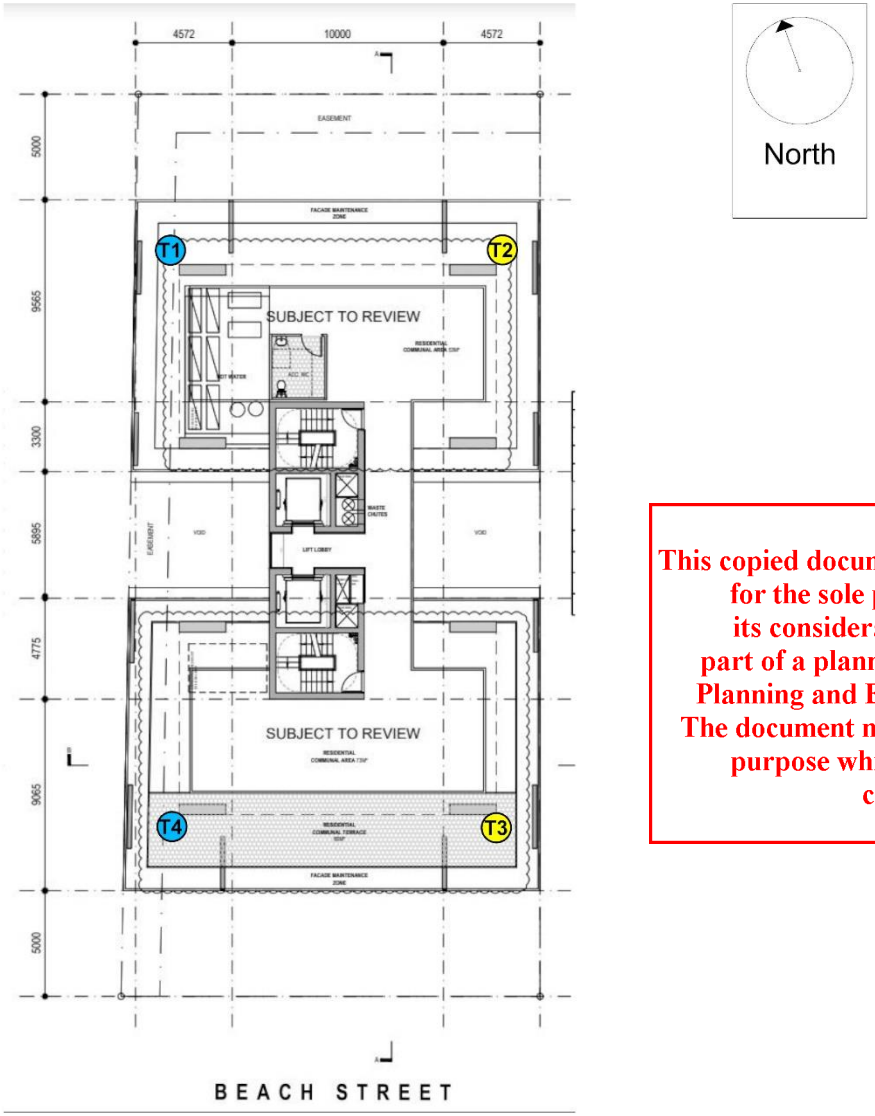
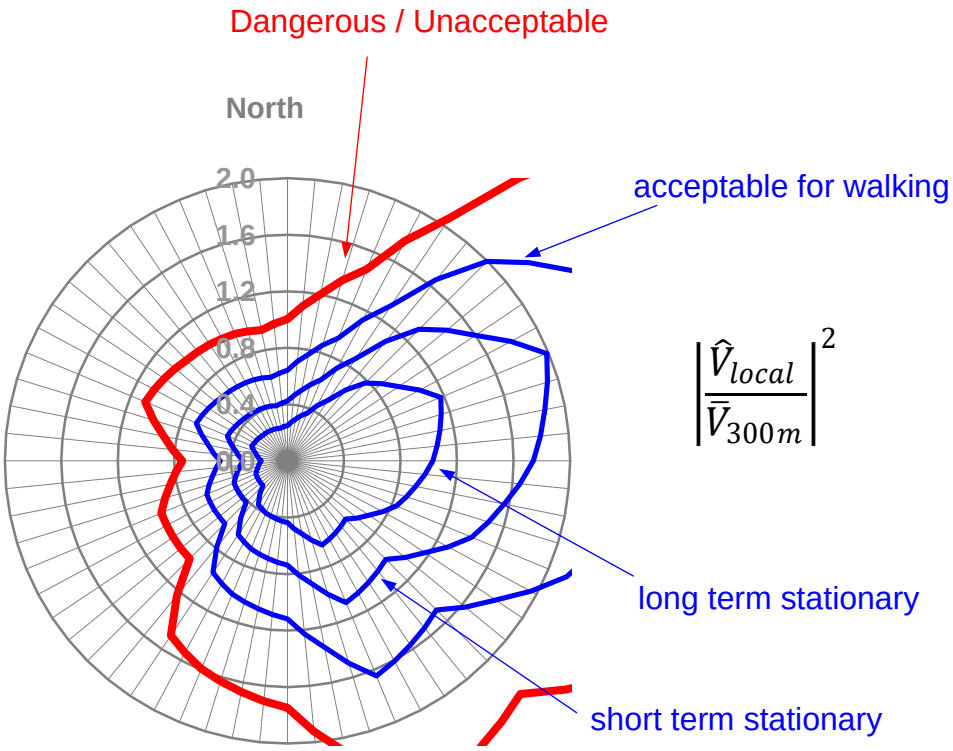


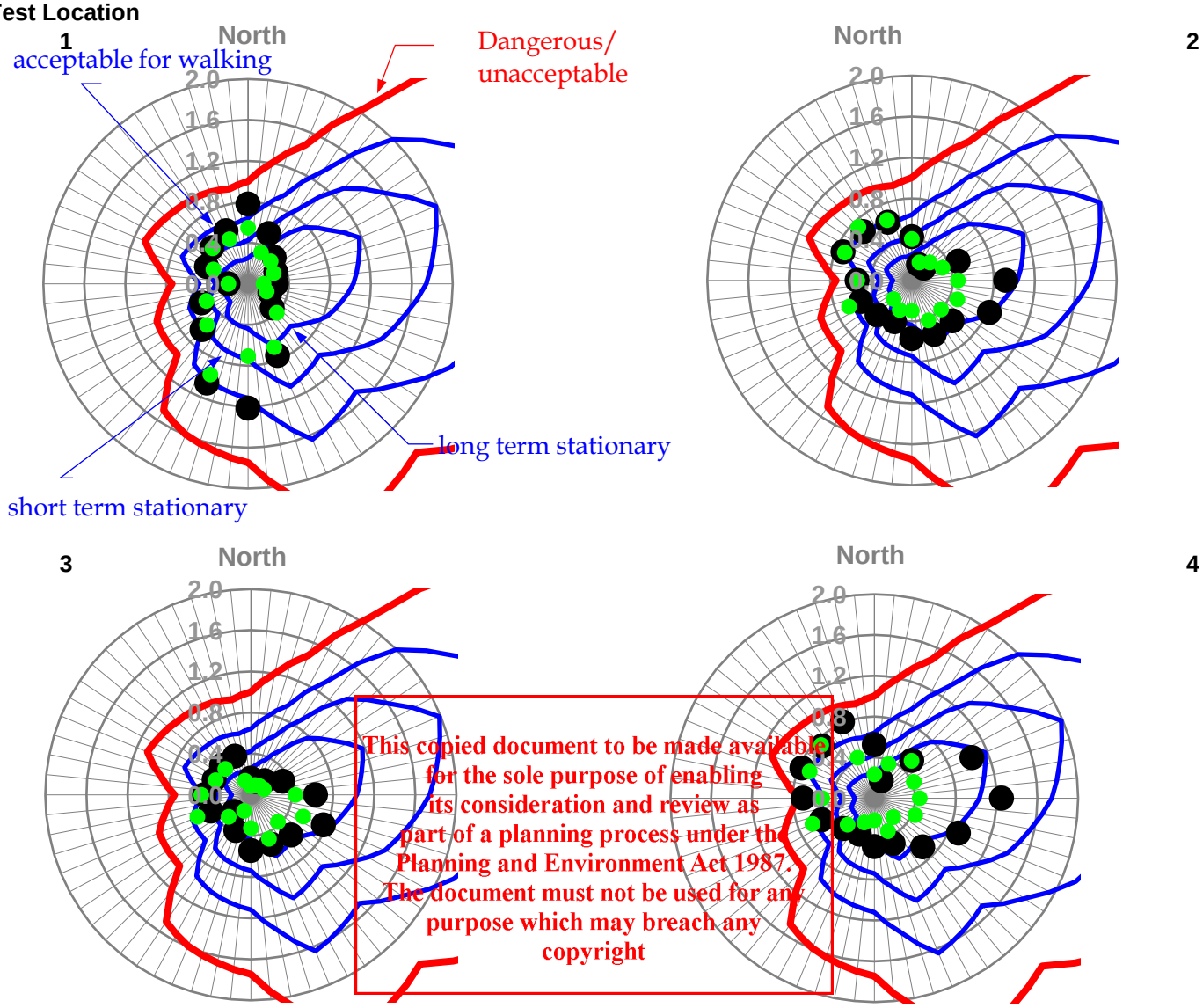
Figure 6e - Summary of wind conditions at Test Locations on Rooftop Terraces of the proposed 11 Beach Street development for the Proposed Configuration for 360º of wind direction.

APPENDIX A – 3 SECOND GUST WIND CRITERIA PLOTS AS A FUNCTION OF WIND DIRECTION



Appendix A1 - Environmental wind criteria for Frankston as a function of wind direction based on a 3 second gust.

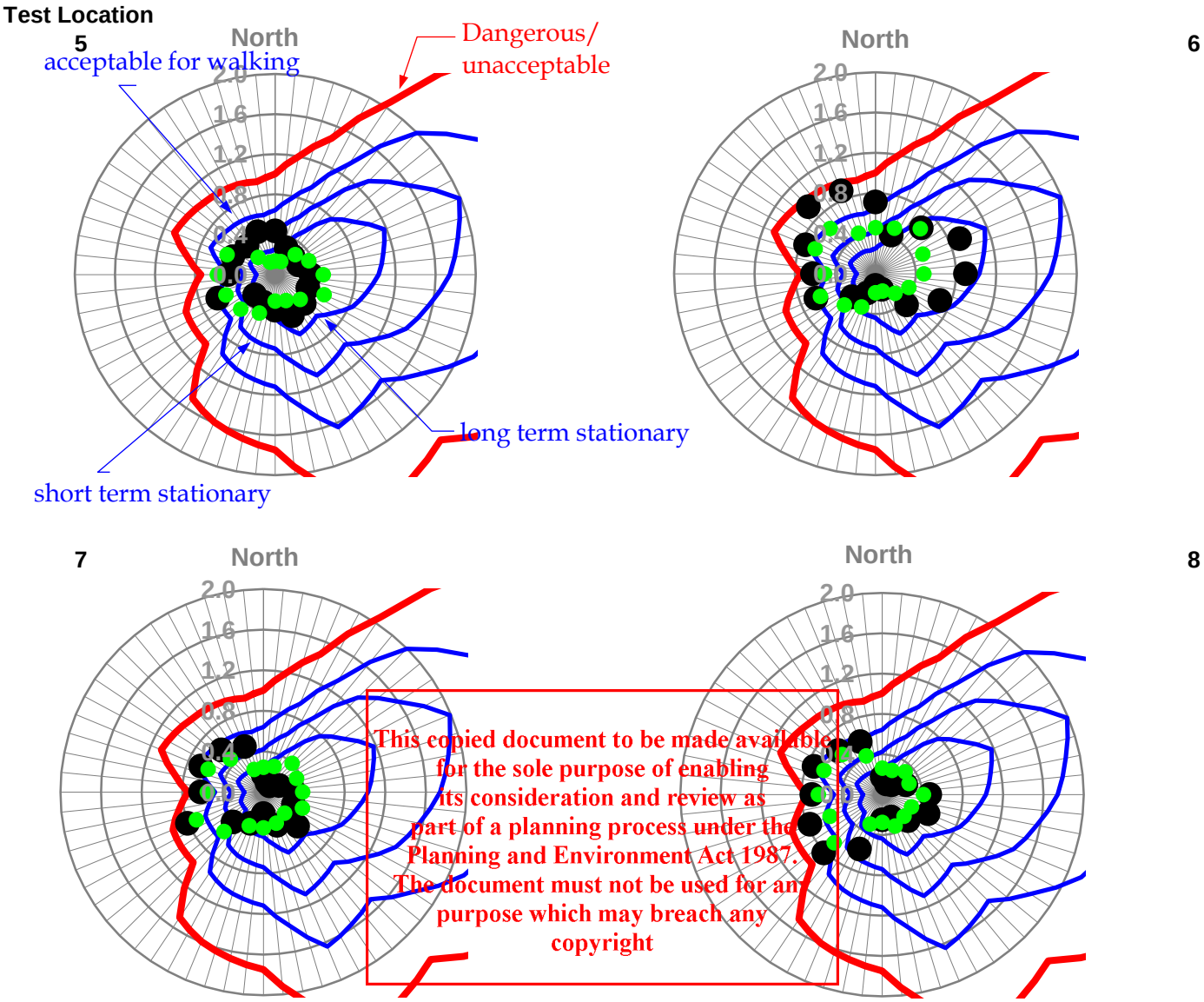
Test Location



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

Proposed Configuration
Existing Configuration

Figure A2 - Beach Street



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

Proposed Configuration
Existing Configuration

Figure A3 - Beach Street (Continued)

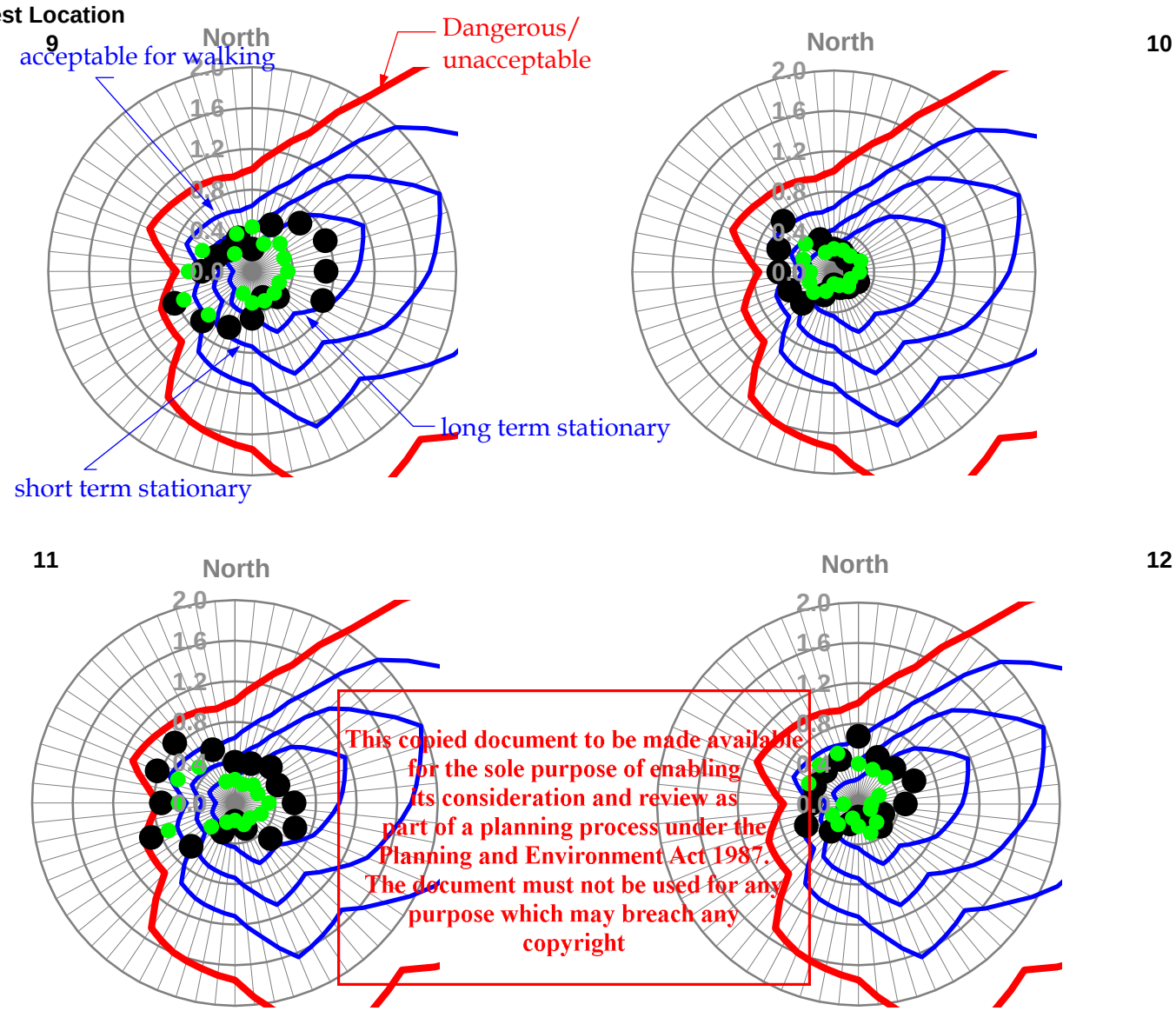


Figure A4 - Beach Street (Continued)

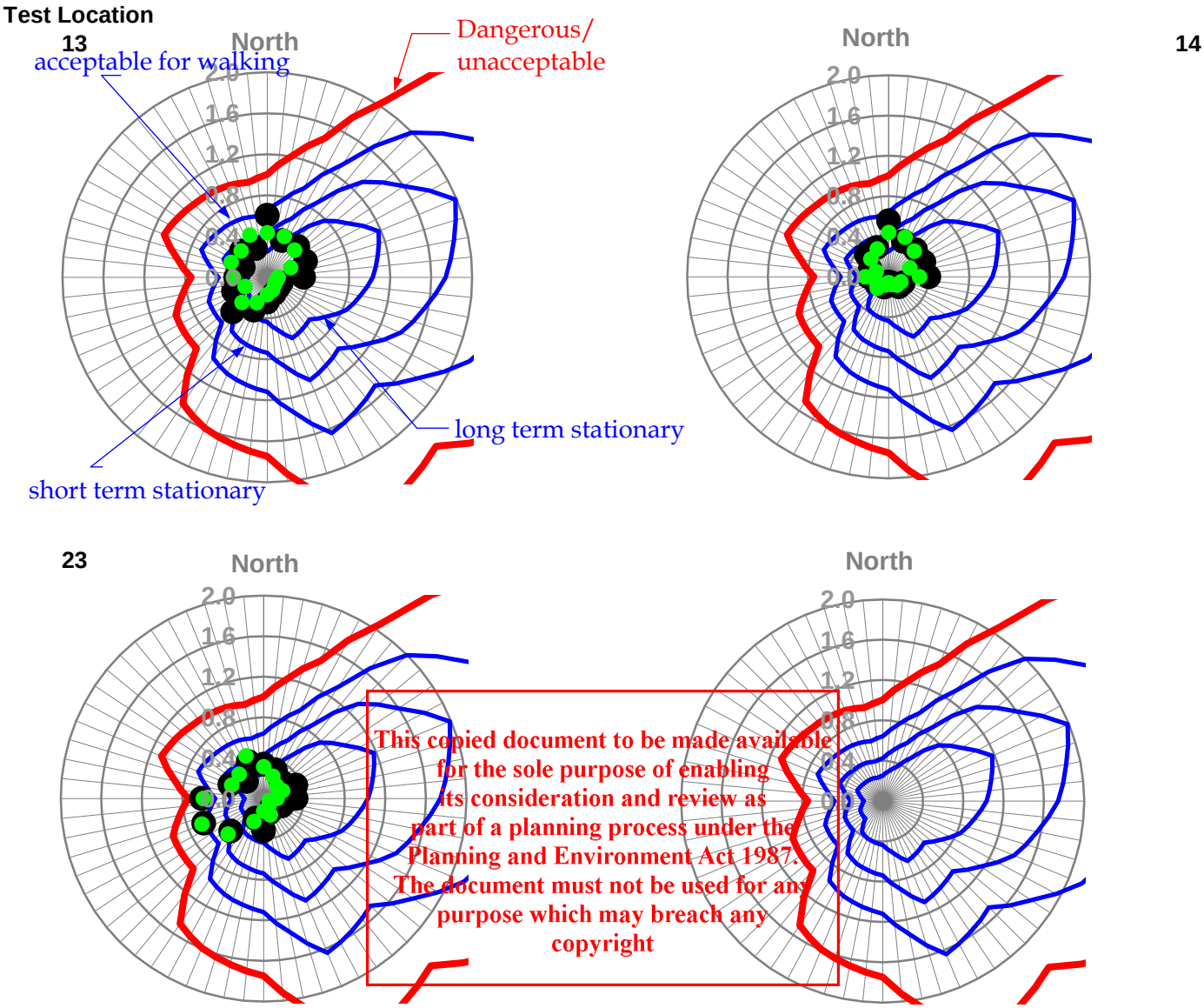
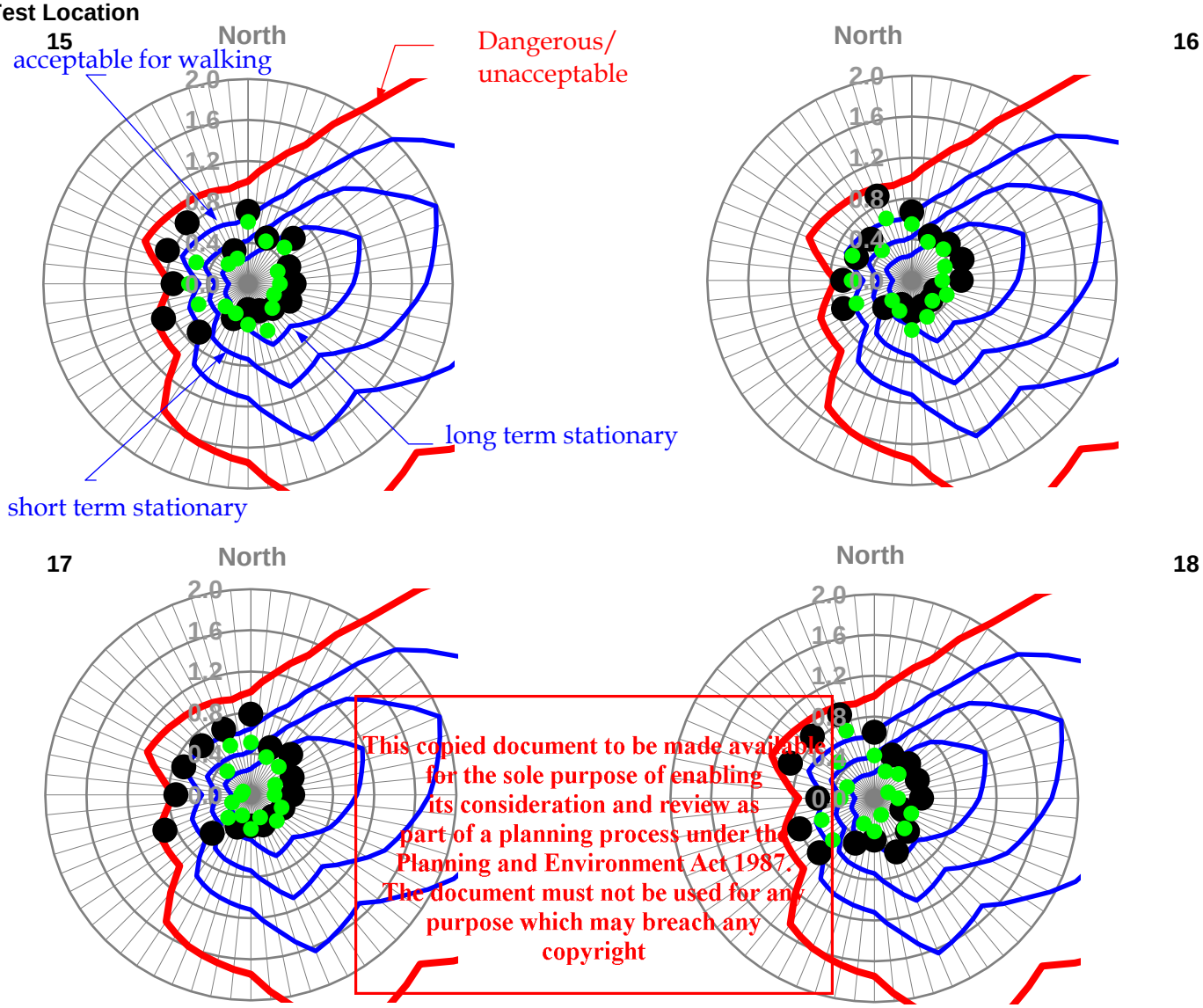


Figure A5 - Olsen Street & Nepean Highway

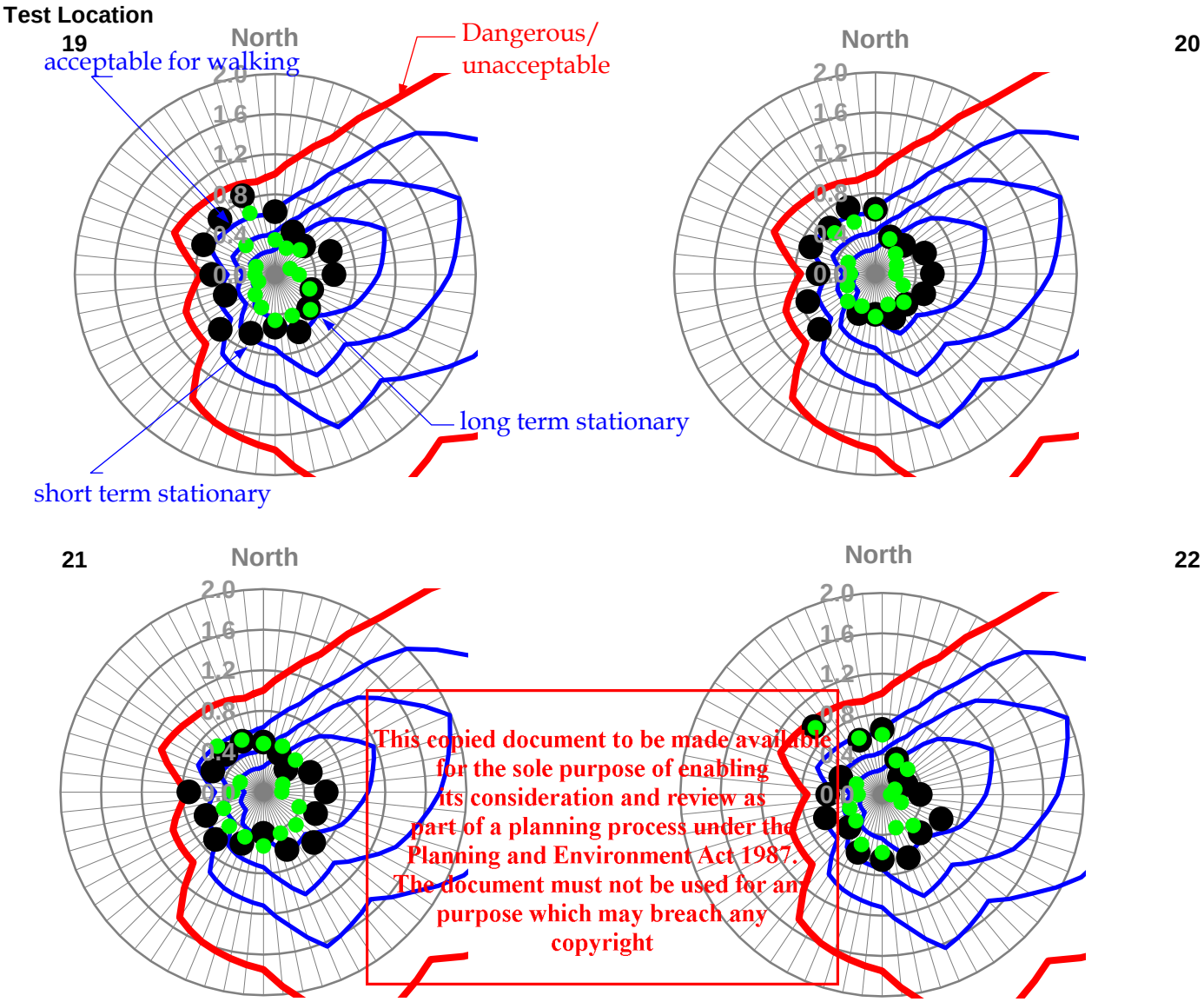
Test Location



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

Proposed Configuration
Existing Configuration

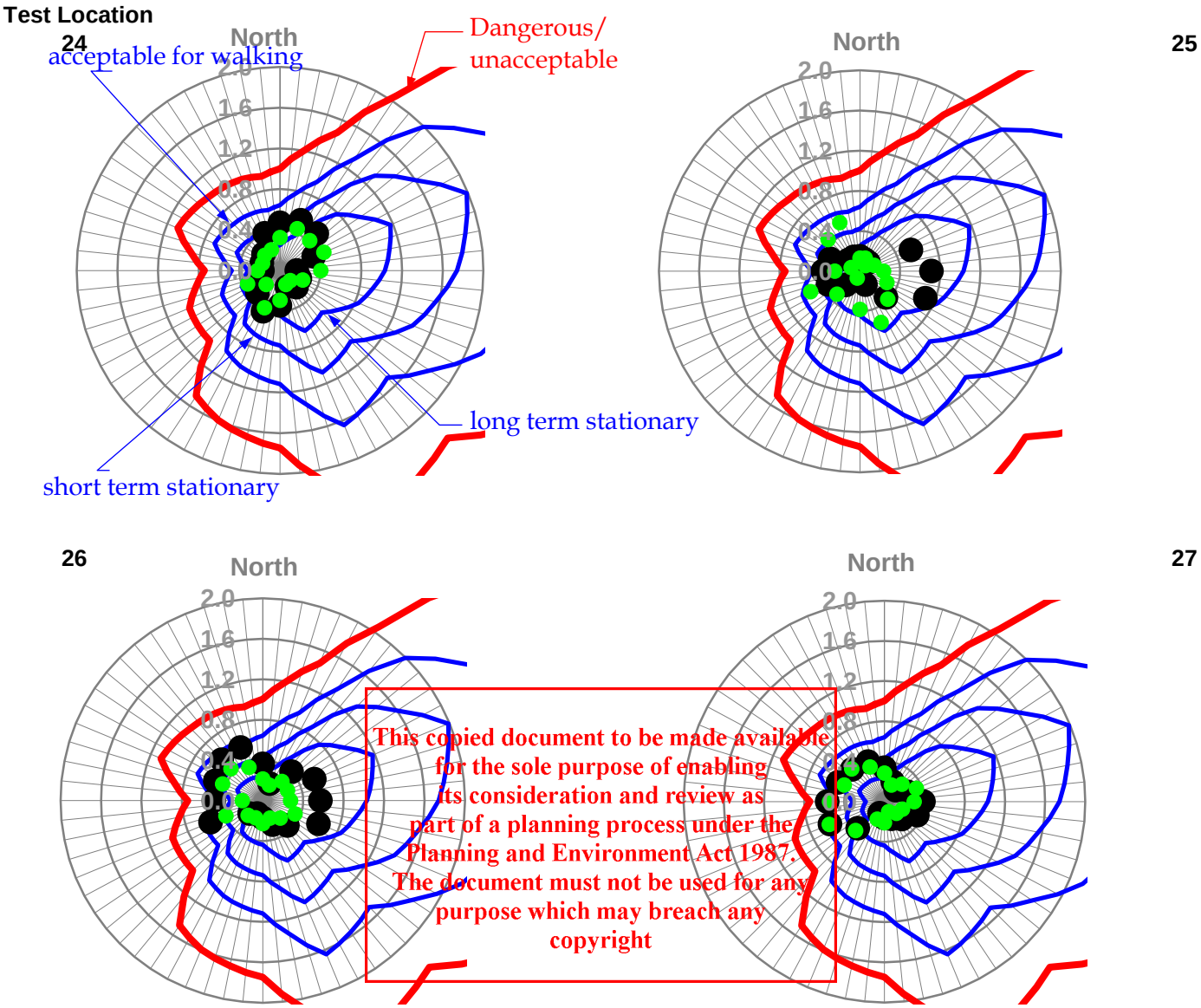
Figure A6 - Evelyn Street



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

Proposed Configuration
Existing Configuration

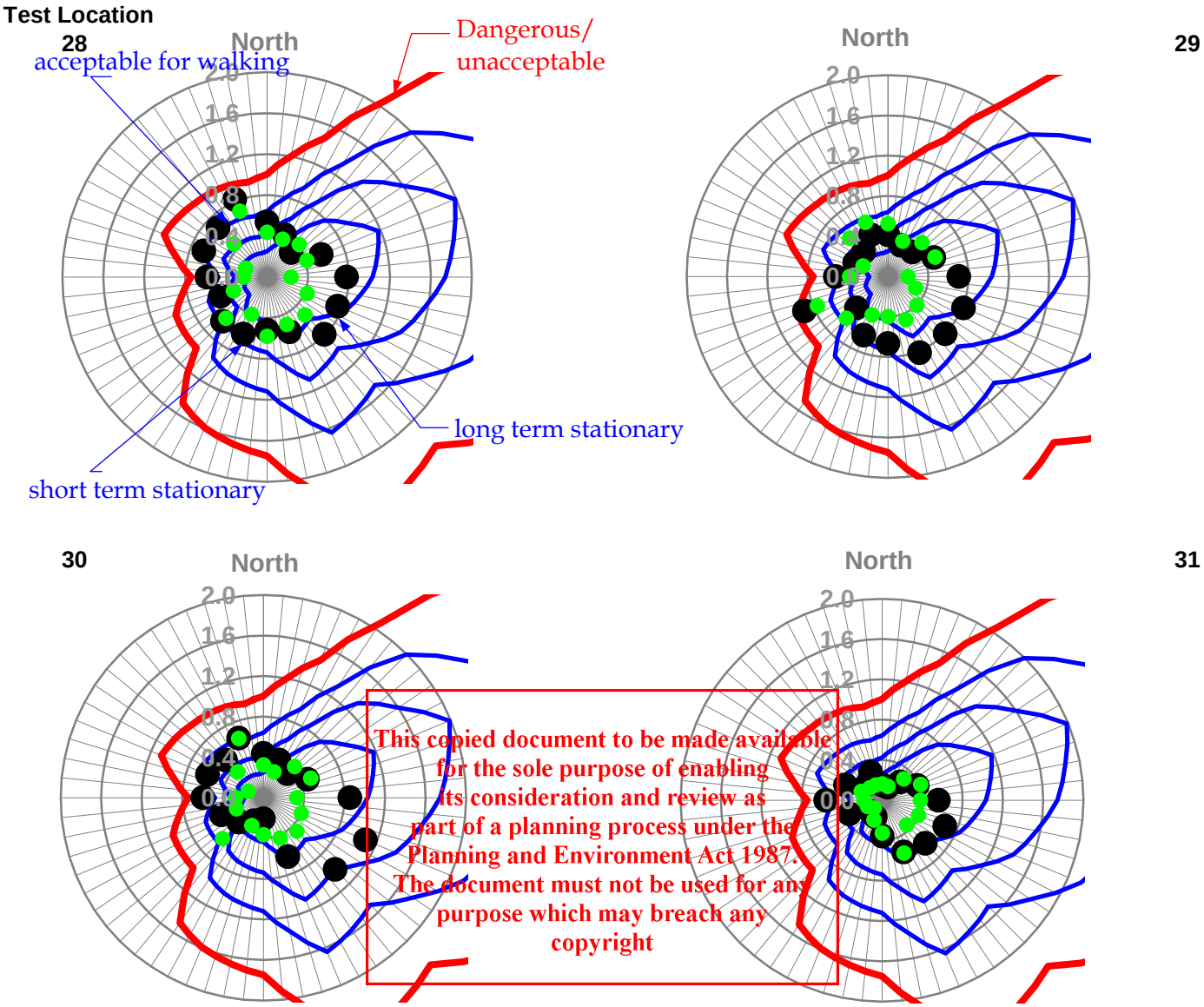
Figure A7 - Evelyn Street (Continued)



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

Proposed Configuration
Existing Configuration

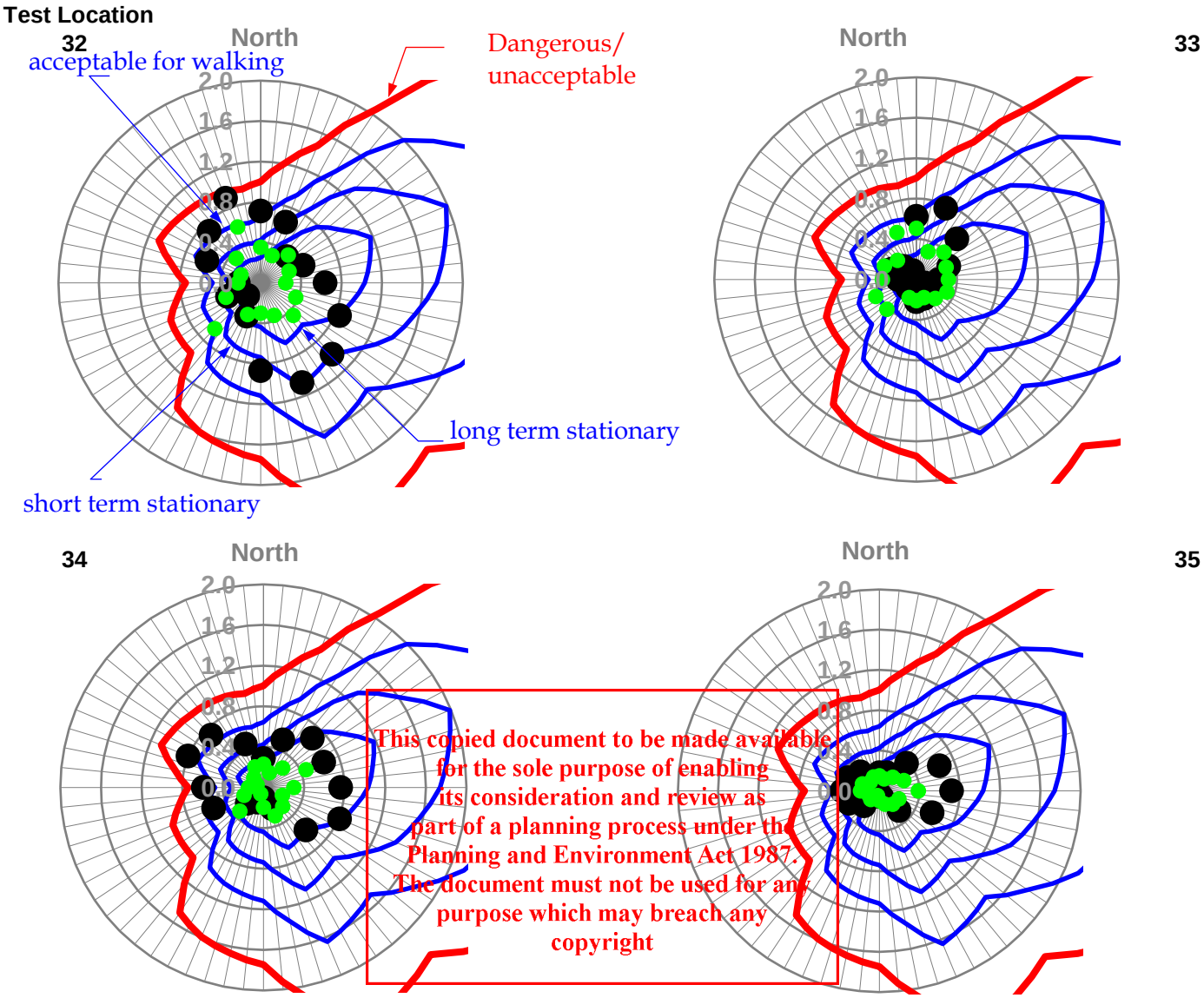
Figure A8 - Laneway (west side of development) & Neighbouring Premises



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

Proposed Configuration
Existing Configuration

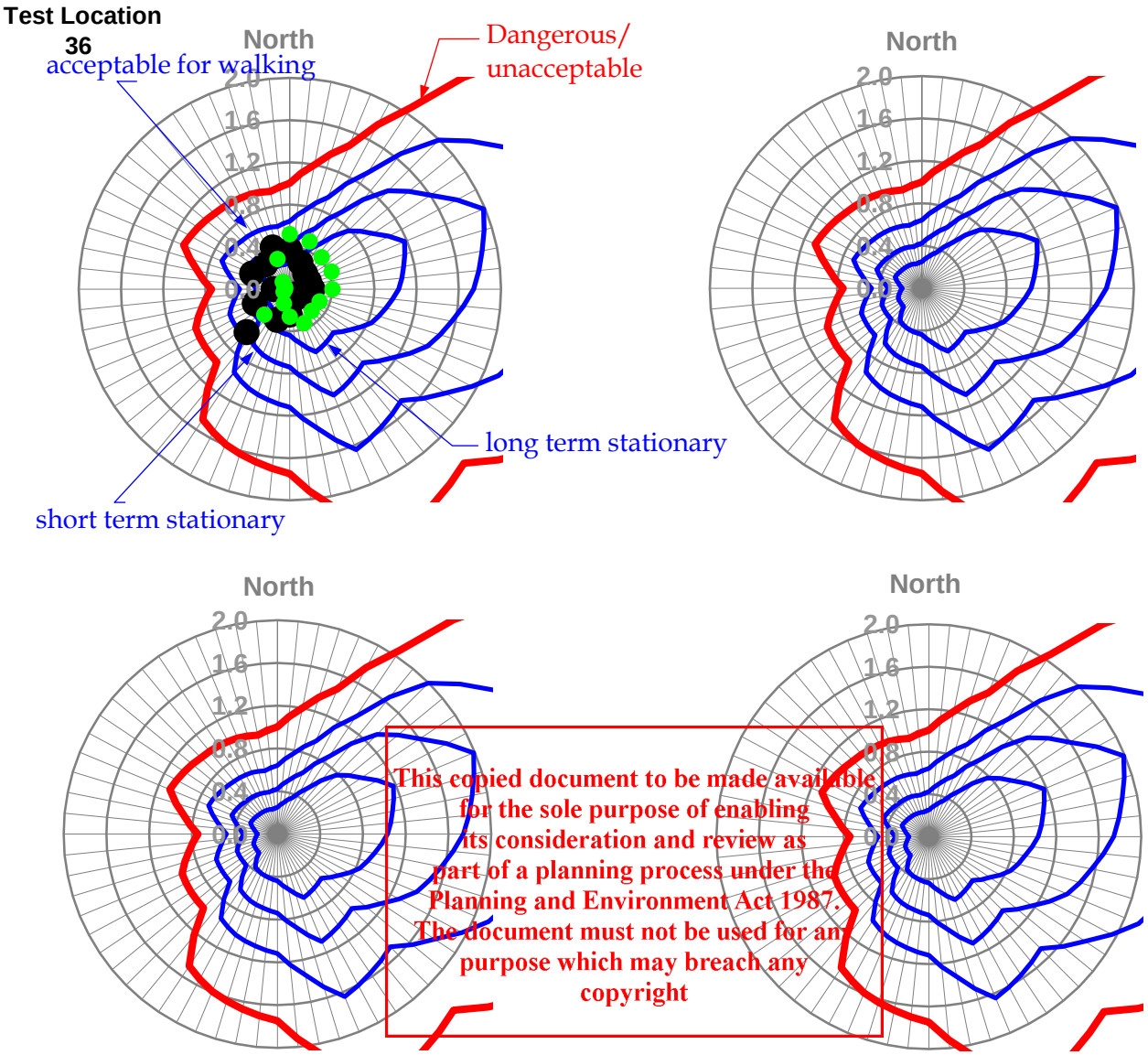
Figure A9 - Laneway (west side of development) & Neighbouring Premises (Continued)



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

Proposed Configuration
Existing Configuration

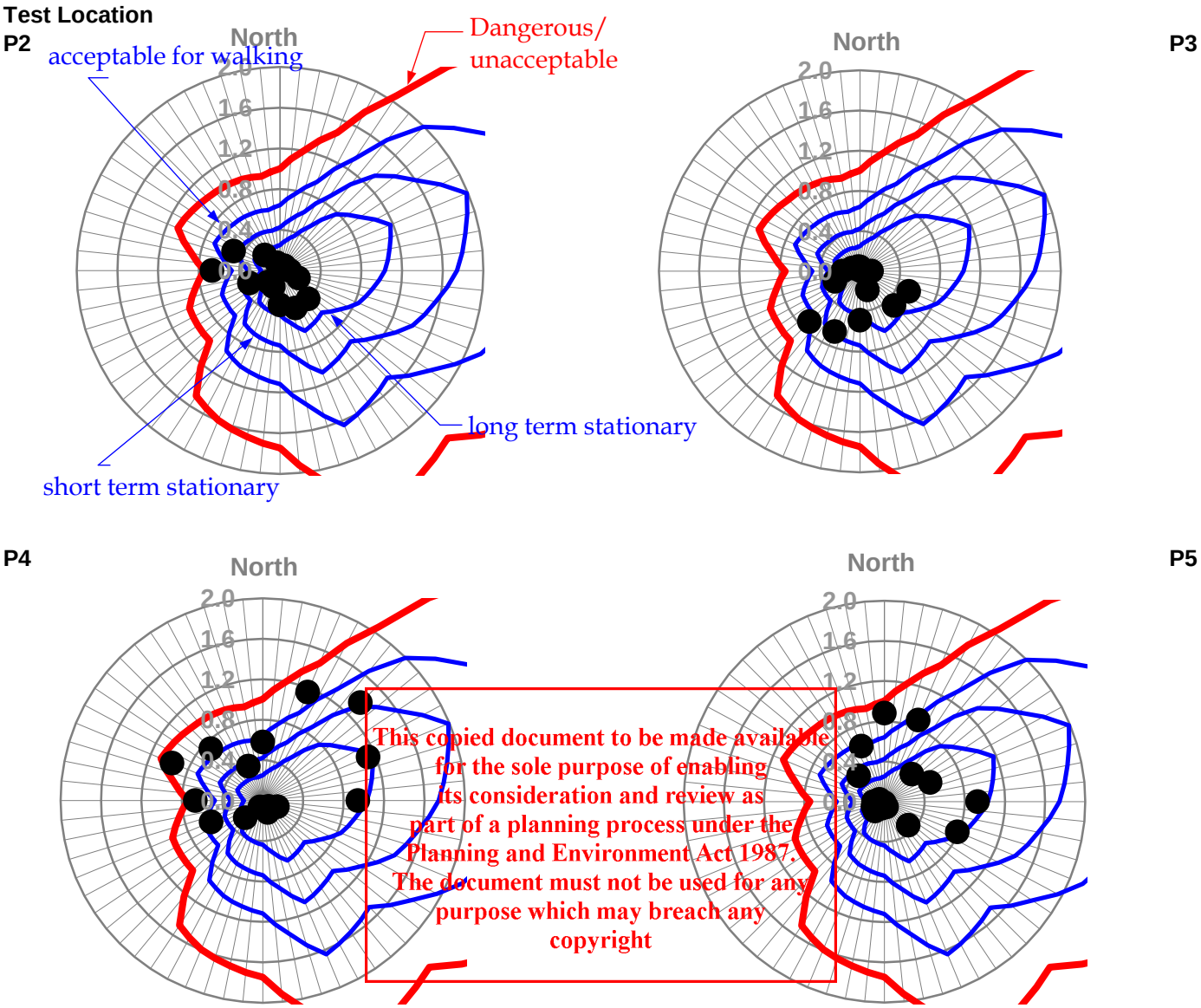
Figure A10 - Adjacent to East & West sides of development



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

Proposed Configuration
Existing Configuration

Figure A11 - Adjacent to East & West sides of development (Continued)

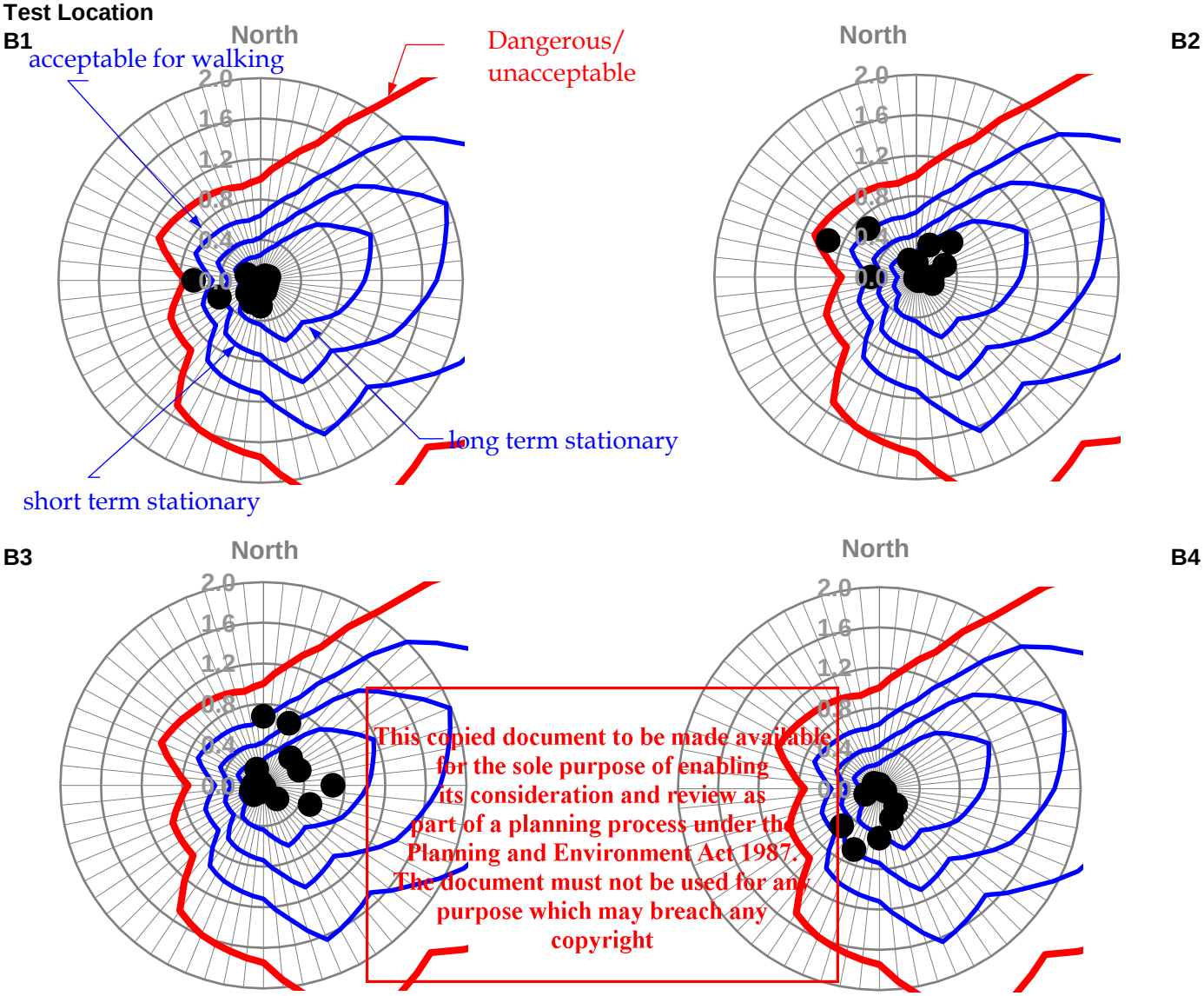


Peak velocity squared ratio $\left|\frac{\hat{V}_{local}}{\bar{V}_{300m}}\right|^2$ *as a function of wind direction*

Proposed Configuration ●

Figure A12 - Balconies at Level 3

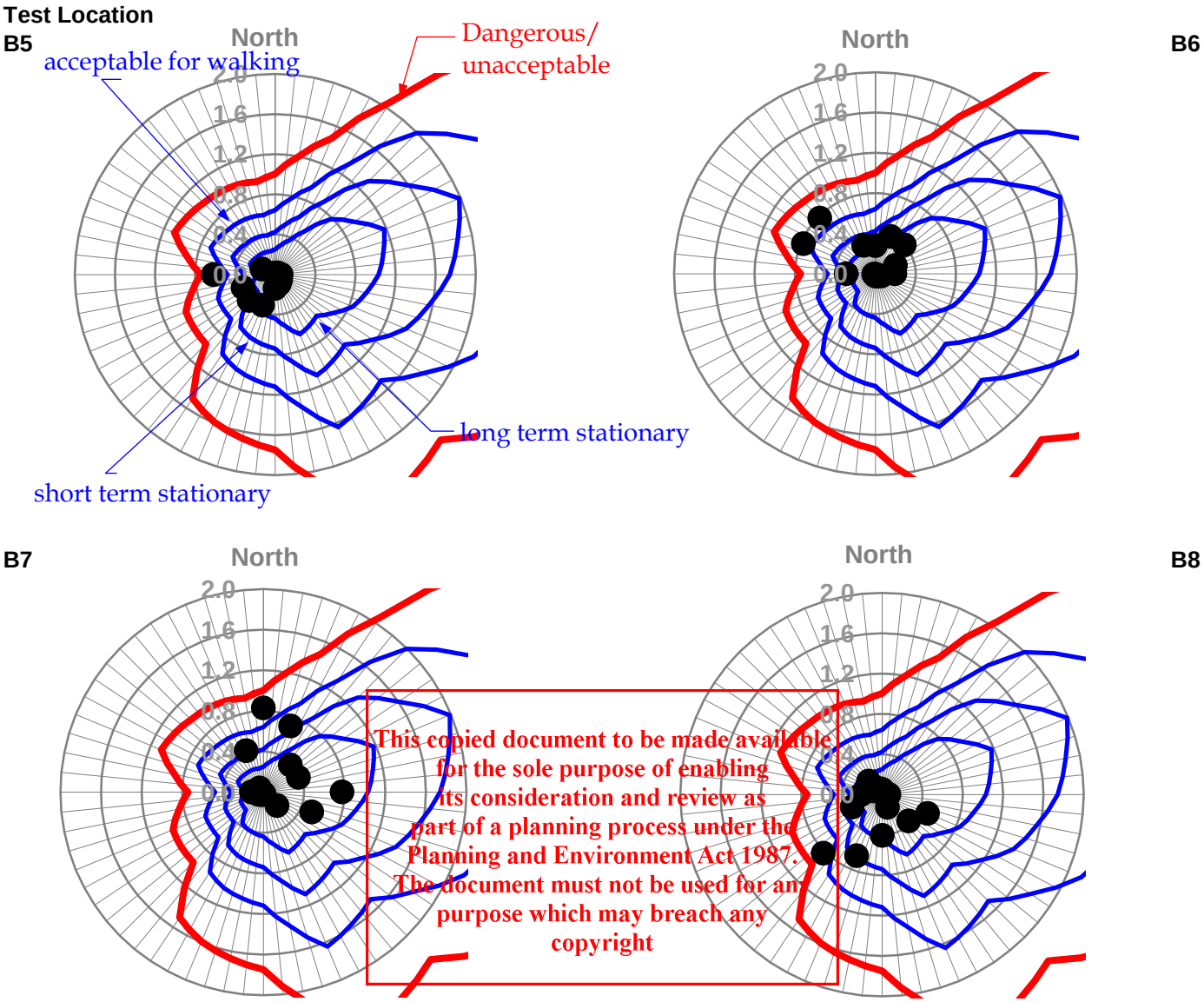
Test Location



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

Proposed Configuration ●

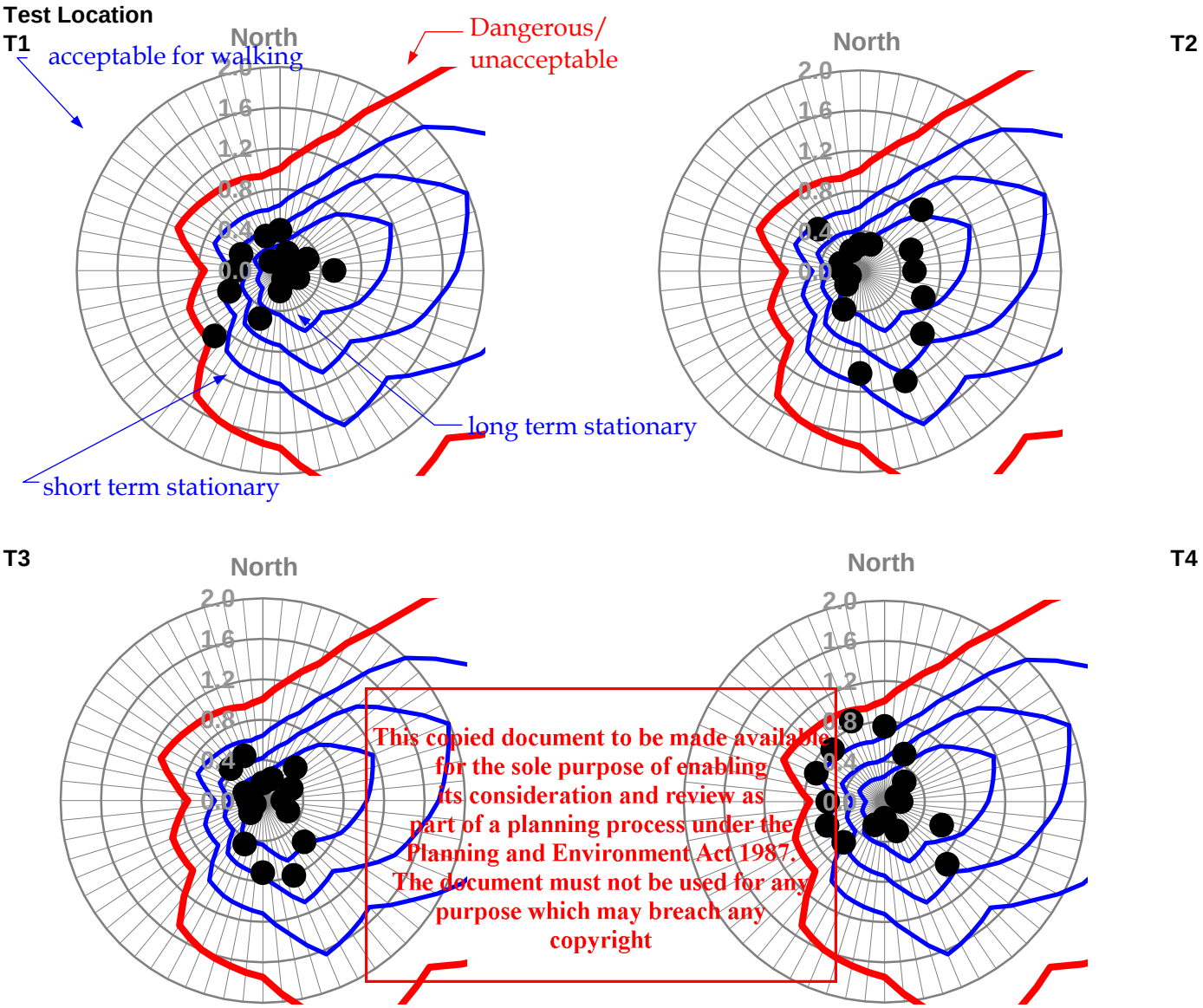
Figure A13 - Balconies at Level 5



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

Proposed Configuration

Figure A14 - Balconies at Level 10



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

Proposed Configuration

Figure A15 - Rooftop Terraces at Level 13