ENVIRONMENTAL WIND SPEED MEASUREMENTS ON A WIND TUNNEL MODEL OF DOONSIDE PRECINCT, RICHMOND

By

S. Chi

&

M. Eaddy

SUMMARY

Wind tunnel tests have been conducted on a 1/400 scale model of the Doonside Precinct 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 freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Melbourne region as a function of wind direction.

For the Proposed Configuration, the wind conditions along Doonside Street at all Test Locations have been shown to satisfy the walking comfort criterion, with many Test Locations meeting the sitting or standing comfort criteria. The wind conditions at the main entrance on Doonside Street have been shown to achieve the sitting comfort criterion.

For the Proposed Configuration, the wind conditions along Burnley Street at all Test Locations have been shown to satisfy the walking comfort criterion, with many Test Locations meeting the sitting or standing comfort criteria.

For the Proposed Configuration, the wind conditions in the surrounding streetscapes have been shown to pass the Standard D32 pedestrian safety criterion. The wind conditions on the outdoor areas have been shown to satisfy the standing comfort criterion, with many satisfying the sitting criterion and pass the Standard D32 pedestrian safety criterion.

The wind conditions for the Existing Configuration for all Test Locations are presented and most have been shown to satisfy the walking comfort criterion and the Standard D32 pedestrian safety criterion. The wind conditions at Test Locations 17, 18 and 54 for the Existing Configuration fail the Standard D32 safety criterion but are improved by the proposed development to satisfy this criterion.

MEL CONSULTANTS

Report 162-20-WT-ENV-02

March 2022

DOONSIDE PRECINCT DEVELOPMENT, RICHMOND
ENVIRONMENTAL WIND TUNNEL MODELLING

MEL CONSULTANTS REPORT NO: **162-20-WT-ENV-02**

PREPARED FOR:
Vicinity Centres PM Pty Ltd
Level 3, Chadstone Tower One
1341 Dandenong Road
Chadstone VIC 3148
c/- Case Meallin

Contact: Campbell Williams
Ph: +61 3 8823 9823

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

Contact: M. Eaddy
Ph: +61 3 8516 9680

PREPARED BY:

S. Chi
Engineer

Date: 22 March 2022

REVIEWED BY:

M. Eaddy
Managing Director

Date: 25 March 2022

RELEASED BY:

M. Eaddy
Managing Director

Date: 25 March 2022

REVISION HISTORY

Revision No:	Date Issued	Reason/Comment
0	7 January 2021	Initial Issue
1	21 April 2021	Project Name Change
2	25 March 2022	Redesign

DISTRIBUTION

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CONTENTS

1. INTRODUCTION

The Doonside Precinct Development will be a mixed used development built up to a height of approximately 58m (16 levels) on Doonside Street, Richmond, south of the Victoria Gardens Shopping Centre. The masterplan development will include several buildings with interlocking towers and create new pedestrian connections between Doonside Street, Burnley Street, and the Victoria Gardens Shopping Centre shown in Figure 1.

Figure 1: Doonside Precinct, Development Location

Vicinity Centres PM Pty Ltd, has commissioned a wind tunnel model study to quantify and assess the pedestrian wind effects of the Proposed Development on the surrounding streetscapes and terraces within the development. These tests were carried out in the MEL Consultants wind tunnel during March 2022.

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. The Yarra Planning Scheme defines wind safety and comfort criteria in Clause 58.04-4 (Standard D32) and these criteria are defined as follows:

Unsafe wind conditions means the hourly maximum 3 second gust which exceeds 20 metres/second from any wind direction considering at least 16 wind directions with the corresponding probability of exceedance percentage.

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)

It is noted that Standard D32 criteria is the same as BADS pedestrian comfort criterion.

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.

The Standard D32 comfort criteria guidelines do 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 the research paper by 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 Melbourne. 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 Doonside Precinct Development will have a main entrance on Doonside Street. The laneways of the Doonside Precinct connect to the surrounding streetscapes at locations along Burnley and Doonside Streets. There is an open outdoor seating area and a pool located on Level 1 of the Proposed development.

The target wind conditions for these pedestrian accessible areas are recommended to be the following:

- Pedestrian Transit Areas — Walking Criterion
- Main Building Entrances — Standing Criterion
- Outdoor seating areas — Sitting 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 the walking criterion, then the Proposed Development should not have any adverse wind effects in these areas.

The wind conditions on the open outdoor seating area have been recommended to satisfy the sitting criterion as these spaces could be considered elective when external conditions would be perceived as acceptable for the desired activity. Users of these outdoor areas will need to be educated on the wind effects and loose objects should not be left unattended in outdoor areas.

3. MODEL AND EXPERIMENTAL TECHNIQUES

A 1/400 scale model of the Doonside Precinct, Development was constructed from the CAD model provided by Cox Architecture, received on the 9th February, 2022.

The 1/400 scale model of the Doonside Precinct, Richmond Development 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 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 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 4a and 4b. The Test Locations in the surrounding streetscapes, and at various floor levels of the buildings are shown in Figures 5a and 5b.

4. DISCUSSION OF RESULTS

Velocity measurements were made at various locations around the Doonside Precinct, Development for different wind directions at 22.5° intervals. As discussed in Section 2, the Standard D32 Guidelines 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 comfort conditions the exceedances will be presented in tabular form in Tables 1 –7 and colour coded; green for below 20% exceedance, orange for above 20% exceedance and for pedestrian safety conditions, green or red for pass/fail respectively.

The Existing Configuration is defined as the buildings that currently exist on the site, which is partially cleared and surrounded by hoardings (included in the existing configuration study). The Proposed Configuration for the Doonside Precinct, Development was as defined by a 3D CAD model provided by Cox Architecture, received on the 9th February, 2022. To assess the wind conditions the percentage exceedances will be presented in tabular form in Tables 1 to 7. 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.

4.1 Summaries of Discussion

To assist with the assessment of the wind conditions, summaries of the wind comfort criteria satisfied and the pass/fail of the safety criterion based on the Standard D32 Guidelines at the Test Locations have been presented using a colour code system in the following figures:

- Existing Configuration – Ground Level Figure 6
- Proposed Configuration – Ground Level Figure 7a
- Proposed Configuration – Upper-Level Figure 7b

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

4.2 Doonside Street

The wind conditions for the Proposed Configuration along Doonside Street (Test Locations 1 to 6, 8 to 12, 17 to 24 and 50) have been shown to satisfy the walking comfort criterion with many Test Locations passing the standing or sitting comfort criteria.

The wind conditions for the Existing Configuration at Test Locations 17 and 18 fails the Standard D32 pedestrian safety criterion. However, the Proposed Development has shown to improve the wind comfort criterion to satisfy the standing criterion and pass the Standard D32 pedestrian safety criterion.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 1. All Test Locations for Proposed configuration have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 1: Pedestrian Wind Comfort and Safety – Doonside Street

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
1	Existing	23%	12%	6%	Pass
	Proposed	43%	27%	15%	Pass
2	Existing	22%	11%	5%	Pass
	Proposed	22%	10%	5%	Pass
3	Proposed	30%	16%	8%	Pass
4	Existing	16%	7%	2%	Pass
	Proposed	9%	3%	1%	Pass
5	Existing	32%	17%	8%	Pass
	Proposed	9%	3%	1%	Pass
6	Existing	43%	28%	17%	Pass
	Proposed	32%	17%	8%	Pass
8	Existing	38%	22%	12%	Pass
	Proposed	14%	5%	2%	Pass
9	Proposed	21%	11%	5%	Pass
10	Proposed	30%	16%	8%	Pass
11	Existing	27%	14%	6%	Pass
	Proposed	29%	15%	7%	Pass
12	Existing	43%	28%	18%	Pass
	Proposed	37%	22%	11%	Pass
17	Existing	44%	29%	19%	FAIL
	Proposed	29%	14%	6%	Pass
18	Existing	46%	33%	23%	FAIL
	Proposed	33%	20%	10%	Pass
19	Existing	35%	22%	14%	Pass
	Proposed	37%	21%	11%	Pass
20	Existing	27%	13%	5%	Pass
	Proposed	18%	7%	3%	Pass
21	Existing	23%	10%	3%	Pass
	Proposed	17%	6%	2%	Pass
22	Existing	36%	21%	10%	Pass
	Proposed	10%	3%	1%	Pass
23	Existing	22%	11%	5%	Pass
	Proposed	17%	6%	2%	Pass
24	Existing	40%	25%	15%	Pass
	Proposed	33%	17%	8%	Pass
50	Existing	19%	8%	2%	Pass
	Proposed	16%	6%	2%	Pass

4.3 David Street

The wind conditions for the Proposed Configuration along David Street (Test Locations 3a and 13 to 16) have been shown to satisfy the standing comfort criterion with Test Location 13 passing the sitting comfort criterion.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 2. All Test Locations have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 2: Pedestrian Wind Comfort and Safety – David Street

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
3a	Proposed	28%	18%	12%	Pass
13	Proposed	17%	8%	3%	Pass
14	Existing	30%	15%	7%	Pass
	Proposed	26%	19%	13%	Pass
15	Existing	26%	14%	7%	Pass
	Proposed	25%	15%	9%	Pass
16	Existing	21%	10%	4%	Pass
	Proposed	35%	20%	11%	Pass

4.4 Burnley Street

The wind conditions for the Proposed Configuration along Burnley Street (Test Locations 25 to 38) have been shown to satisfy the walking comfort criterion with many Test Locations satisfying the standing or sitting comfort criteria.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 3. All Test Locations have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 3: Pedestrian Wind Comfort and Safety – Burnley Street

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
25	Existing	44%	27%	16%	Pass
	Proposed	20%	9%	4%	Pass
26	Existing	46%	31%	20%	Pass
	Proposed	35%	20%	9%	Pass
27	Proposed	34%	19%	9%	Pass
28	Existing	24%	13%	8%	Pass
	Proposed	40%	25%	14%	Pass
29	Existing	15%	6%	2%	Pass
	Proposed	25%	11%	4%	Pass
30	Existing	22%	9%	3%	Pass
	Proposed	26%	13%	6%	Pass
31	Existing	22%	9%	3%	Pass
	Proposed	17%	6%	2%	Pass
32	Existing	23%	9%	3%	Pass
	Proposed	26%	13%	6%	Pass
33	Existing	15%	6%	2%	Pass
	Proposed	14%	6%	2%	Pass
34	Existing	17%	9%	4%	Pass
	Proposed	36%	22%	12%	Pass
35	Existing	17%	7%	3%	Pass
	Proposed	20%	8%	3%	Pass
36	Existing	13%	6%	2%	Pass
	Proposed	37%	21%	11%	Pass
37	Existing	18%	8%	3%	Pass
	Proposed	38%	22%	11%	Pass
38	Proposed	40%	24%	13%	Pass

4.5 Laneway

The wind conditions for the Proposed Configuration along the Laneway (Test Locations 7 and 39 to 47) have been shown to satisfy the walking comfort criterion with many Test Locations achieving the standing or sitting comfort criteria.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 4. All Test Locations have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 4: Pedestrian Wind Comfort and Safety – Laneway

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
7	Proposed	23%	10%	4%	Pass
39	Proposed	22%	10%	4%	Pass
40a	Proposed	18%	7%	3%	Pass
40	Proposed	34%	18%	10%	Pass
41	Existing	10%	3%	1%	Pass
	Proposed	40%	25%	14%	Pass
41a	Proposed	21%	8%	3%	Pass
42	Proposed	14%	6%	2%	Pass
43	Existing	22%	12%	6%	Pass
	Proposed	18%	8%	2%	Pass
45	Proposed	15%	4%	1%	Pass
46	Proposed	16%	9%	5%	Pass
47	Existing	6%	1%	1%	Pass
	Proposed	11%	4%	1%	Pass
47a	Proposed	16%	8%	3%	Pass

4.6 South Entrance

The wind conditions for the Proposed Configuration at the south entrance (Test Locations 48 and 49) have been shown to satisfy the sitting comfort criterion.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 5. All Test Locations have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 5: Pedestrian Wind Comfort and Safety – South Entrance

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
48	Existing	40%	24%	14%	Pass
	Proposed	9%	3%	1%	Pass
49	Proposed	2%	1%	1%	Pass

4.7 Podium Outdoor Recreational Areas

The wind conditions for the Proposed Configuration on the Podium Outdoor Recreational Areas (Test Locations 51 to 53 and 55 to 56) have been shown to satisfy the standing comfort criterion with some Test Locations 51 to 53 and 56 satisfying the sitting criterion. Test Location 55 is located at the location of the propose swimming pool.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 6. All Test Locations have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 6: Pedestrian Wind Comfort and Safety – Podium Outdoor Recreational Area

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
51	Proposed	15%	5%	1%	Pass
52	Proposed	19%	7%	2%	Pass
53	Proposed	18%	7%	3%	Pass
55	Proposed	27%	16%	9%	Pass
56	Proposed	9%	3%	1%	Pass

4.8 Existing Roof Carpark

The wind conditions for the Proposed Configuration on the Roof Carpark (Test Location 54) have been shown to satisfy the walking comfort criterion.

The wind conditions for the Existing Configuration at Test Locations 54 does not satisfy the walking comfort criterion and fails the Standard D32 pedestrian safety criterion. However, the Proposed Development has shown to improve the wind comfort criterion to satisfy the walking comfort criterion and pass the Standard D32 pedestrian safety criterion.

The criteria achieved for both the Existing and Proposed Configurations have been presented in Table 7. All Test Locations for Proposed configuration have been shown to pass the Standard D32 pedestrian safety criterion.

The wind conditions as a function of wind direction based on the gust criteria for Melbourne are 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.

Table 7: Pedestrian Wind Comfort and Safety – Existing Roof Carpark

Test Location	Configuration	Wind Comfort Criteria			
		Sitting	Standing	Walking	Safety
54	Existing	55%	40%	28%	FAIL
	Proposed	39%	26%	16%	Pass

5. CONCLUSIONS

Wind tunnel tests have been conducted on a 1/400 scale model of the Doonside Precinct 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 freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Melbourne region as a function of wind direction.

For the Proposed Configuration, the wind conditions along Doonside Street at all Test Locations have been shown to satisfy the walking comfort criterion, with many Test Locations meeting the sitting or standing comfort criteria. The wind conditions at the main entrance on Doonside Street have been shown to achieve the sitting comfort criterion.

For the Proposed Configuration, the wind conditions along Burnley Street at all Test Locations have been shown to satisfy the walking comfort criterion, with many Test Locations meeting the sitting or standing comfort criteria.

For the Proposed Configuration, the wind conditions in the surrounding streetscapes have been shown to pass the Standard D32 pedestrian safety criterion. The wind conditions on the outdoor areas have been shown to satisfy the standing comfort criterion, with many satisfying the sitting criterion and pass the Standard D32 pedestrian safety criterion.

The wind conditions for the Existing Configuration for all Test Locations are presented and most have been shown to satisfy the walking comfort criterion and the Standard D32 pedestrian safety criterion. The wind conditions at Test Locations 17, 18 and 54 for the Existing Configuration fail the Standard D32 safety criterion but are improved by the proposed development to satisfy this criterion.

M. Eaddy

M. Eaddy

MEL CONSULTANTS

March 2022

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

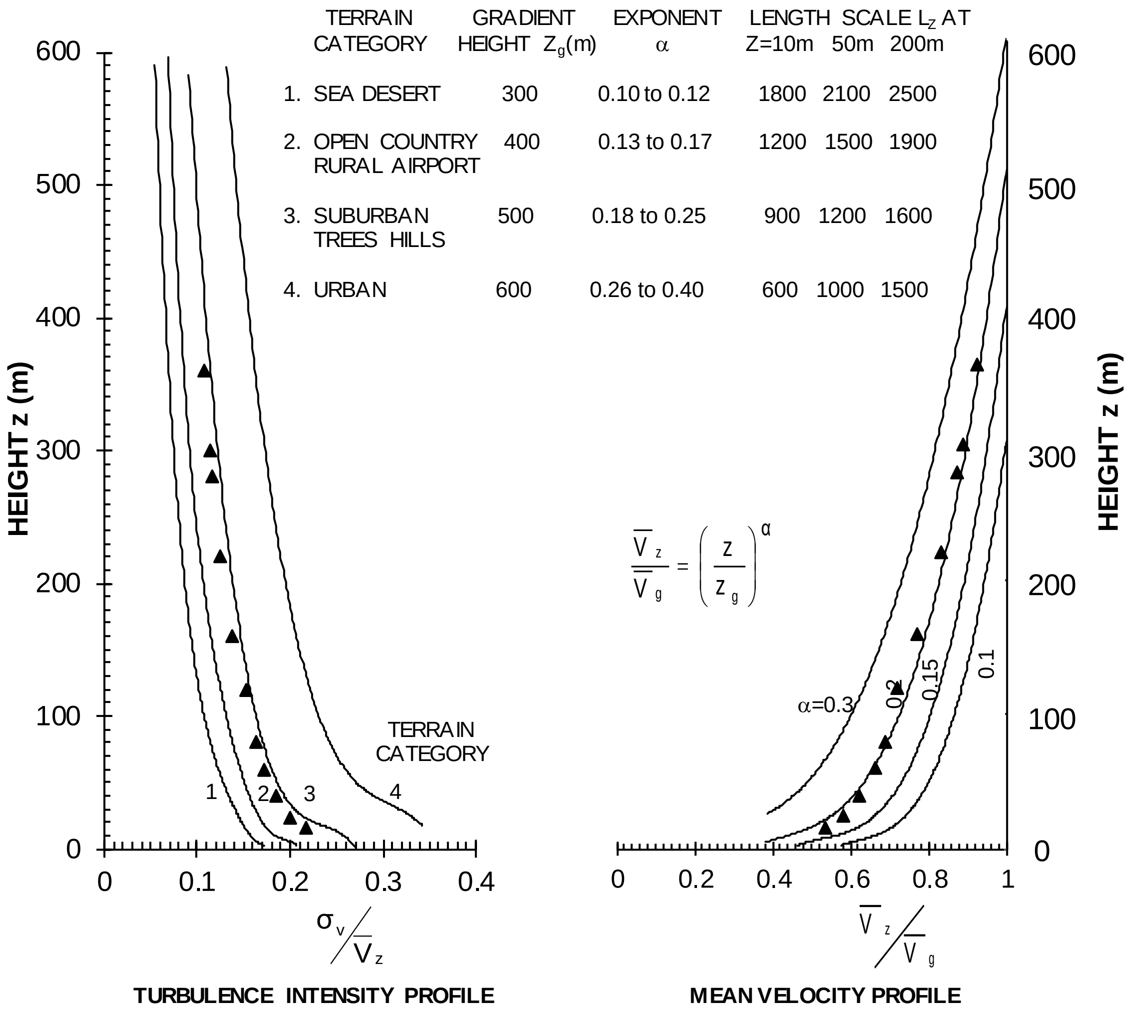


Figure 3 - 1/400 scale TC3 boundary layer turbulence intensity and mean velocity profiles in the MEL Consultants Boundary Layer Wind Tunnel 4.8m x 2.2m working section, scaled to full scale dimensions.

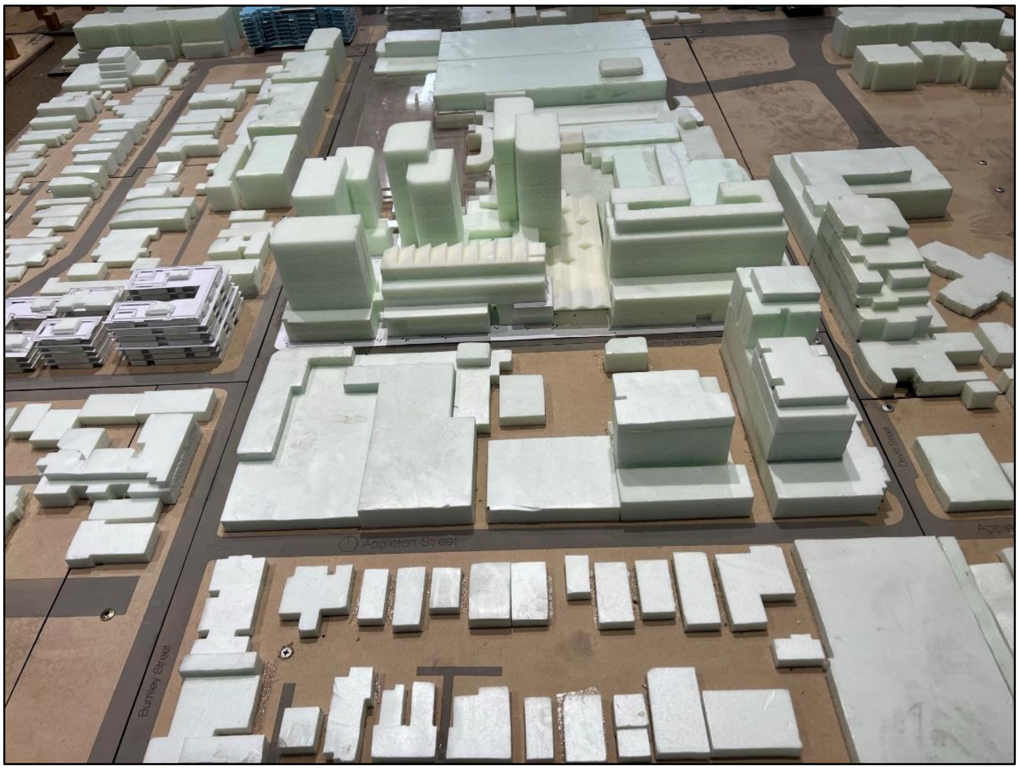


Figure 4a – View from the South of the 1/400 Proposed scale model of the Doonside Precinct, Richmond Development in the wind tunnel.

Figure 4b – Close-up view from the Southwest of the 1/400 Proposed scale model of the Doonside Precinct, Richmond Development in the wind tunnel.

Figure 5a - Ground Level Test Locations around the Doonside Precinct, Richmond Development.

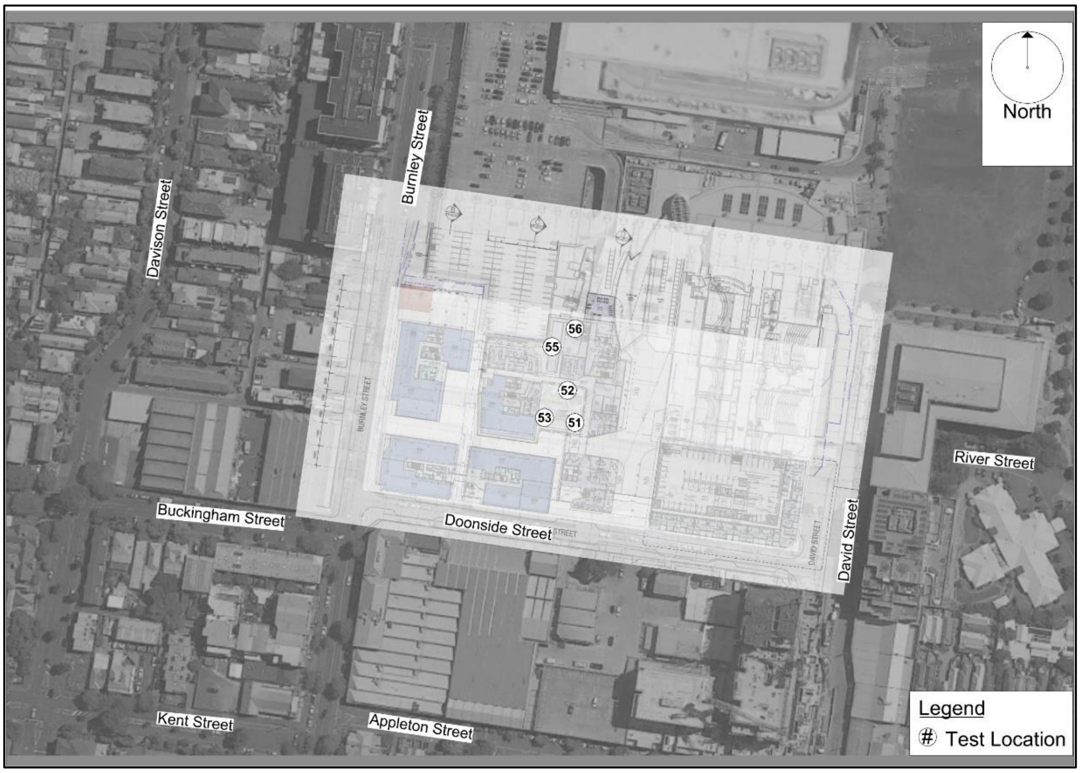


Figure 5b - Proposed Upper-Level Test Locations around the Doonside Precinct, Richmond Development.

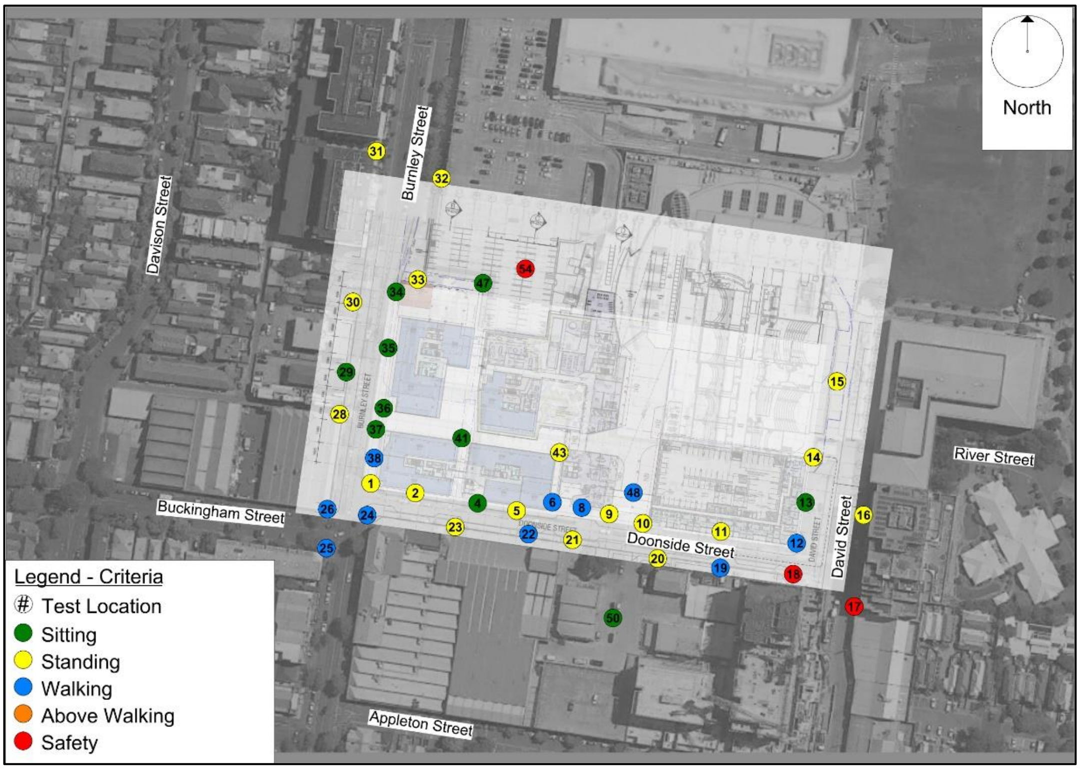


Figure 6 - Summary of wind conditions in and around the Doonside Precinct, Richmond Development for 360° of wind direction in the Existing Configuration.

Figure 7a - Summary of wind conditions in and around the Doonside Precinct, Richmond Development for 360° of wind direction in the Proposed Configuration.

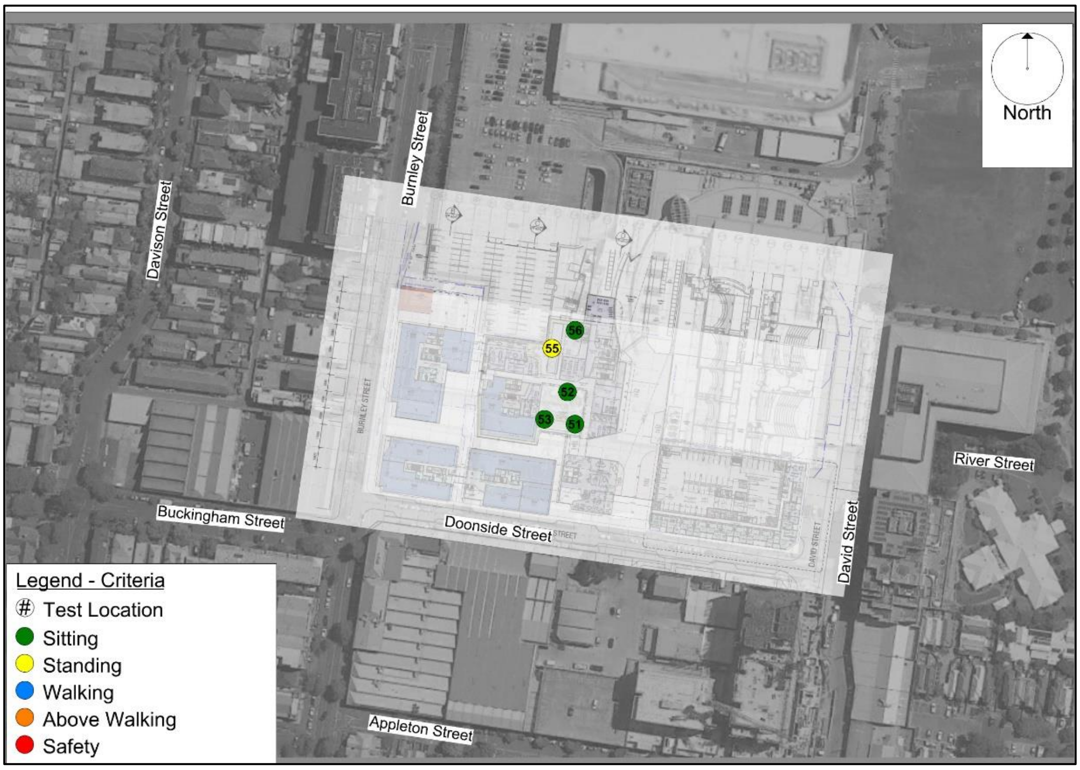
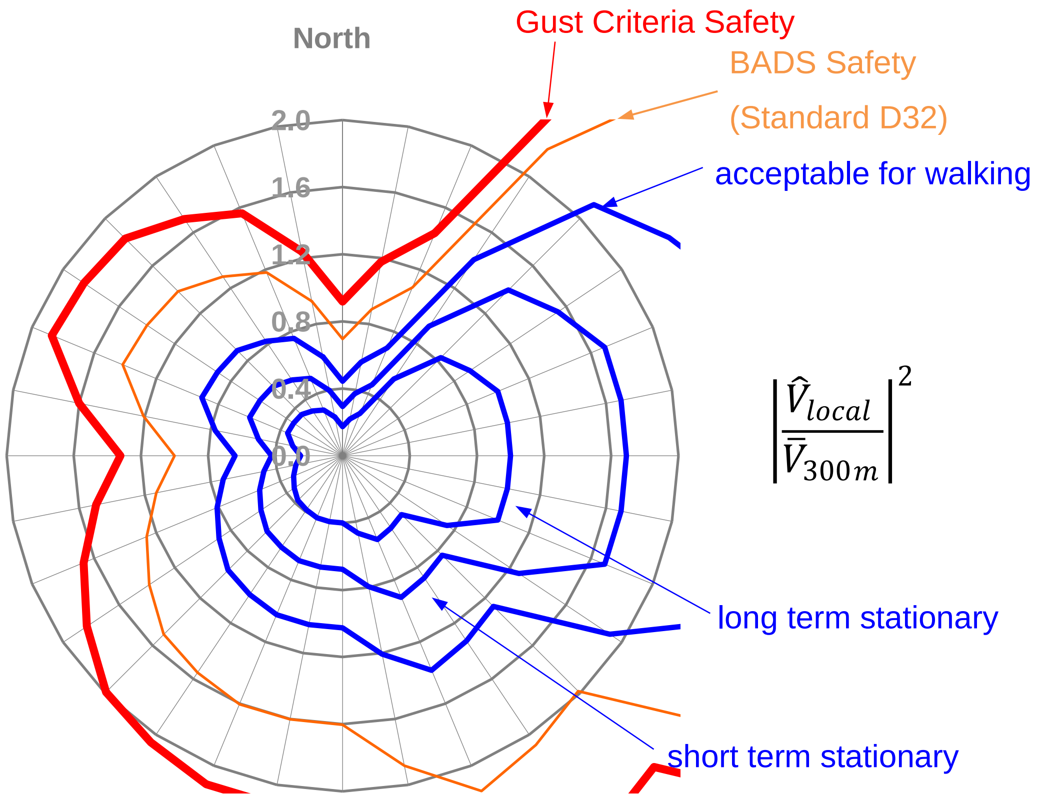
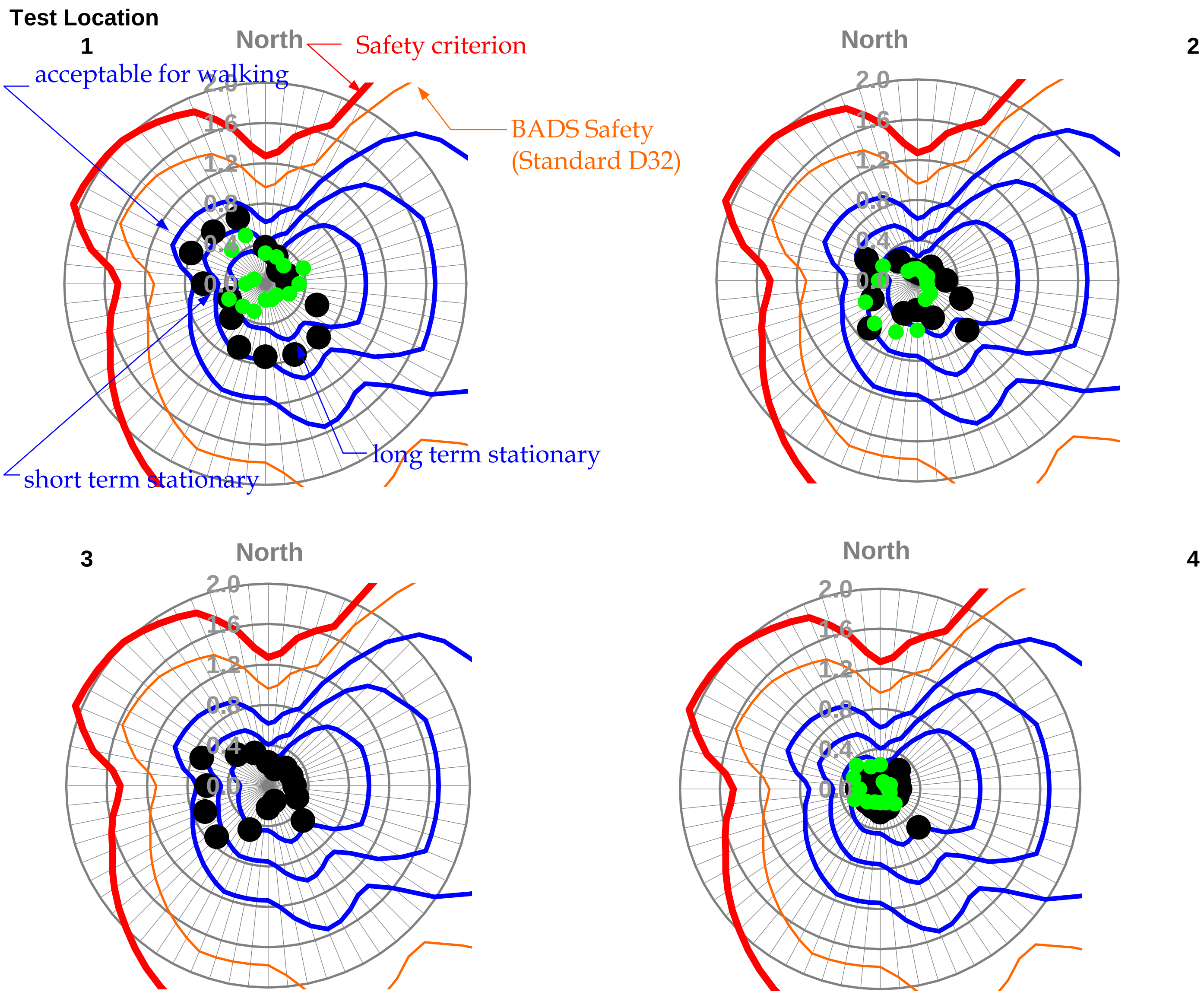


Figure 7b - Summary of wind conditions for Level 1 of the Doonside Precinct, Richmond Development for 360° of wind direction in the Proposed Configuration.

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



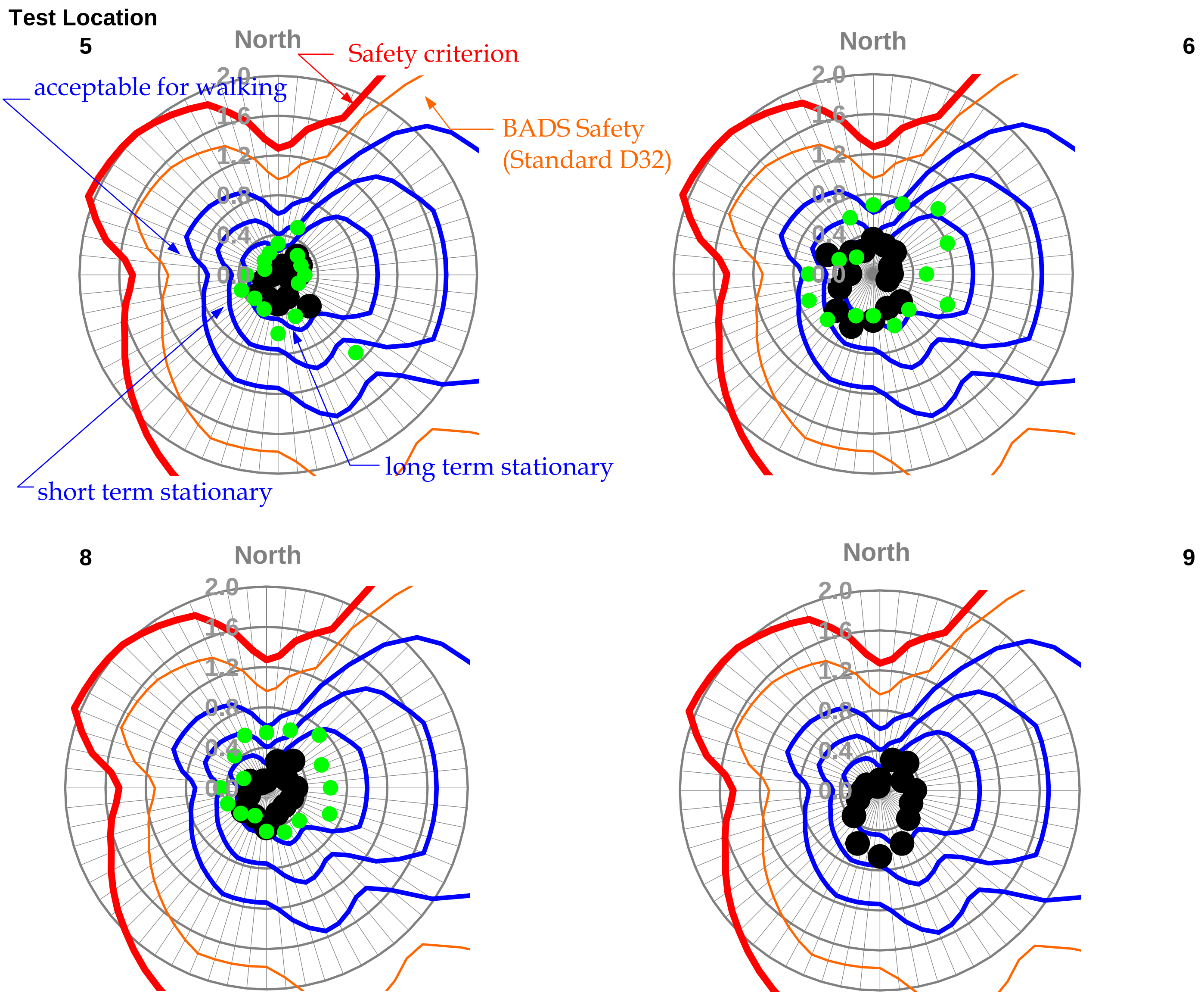
Appendix A1 - Environmental wind criteria for Melbourne as a function of wind direction based on a 3 second gust.



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

Proposed Configuration	●
Existing Configuration	●

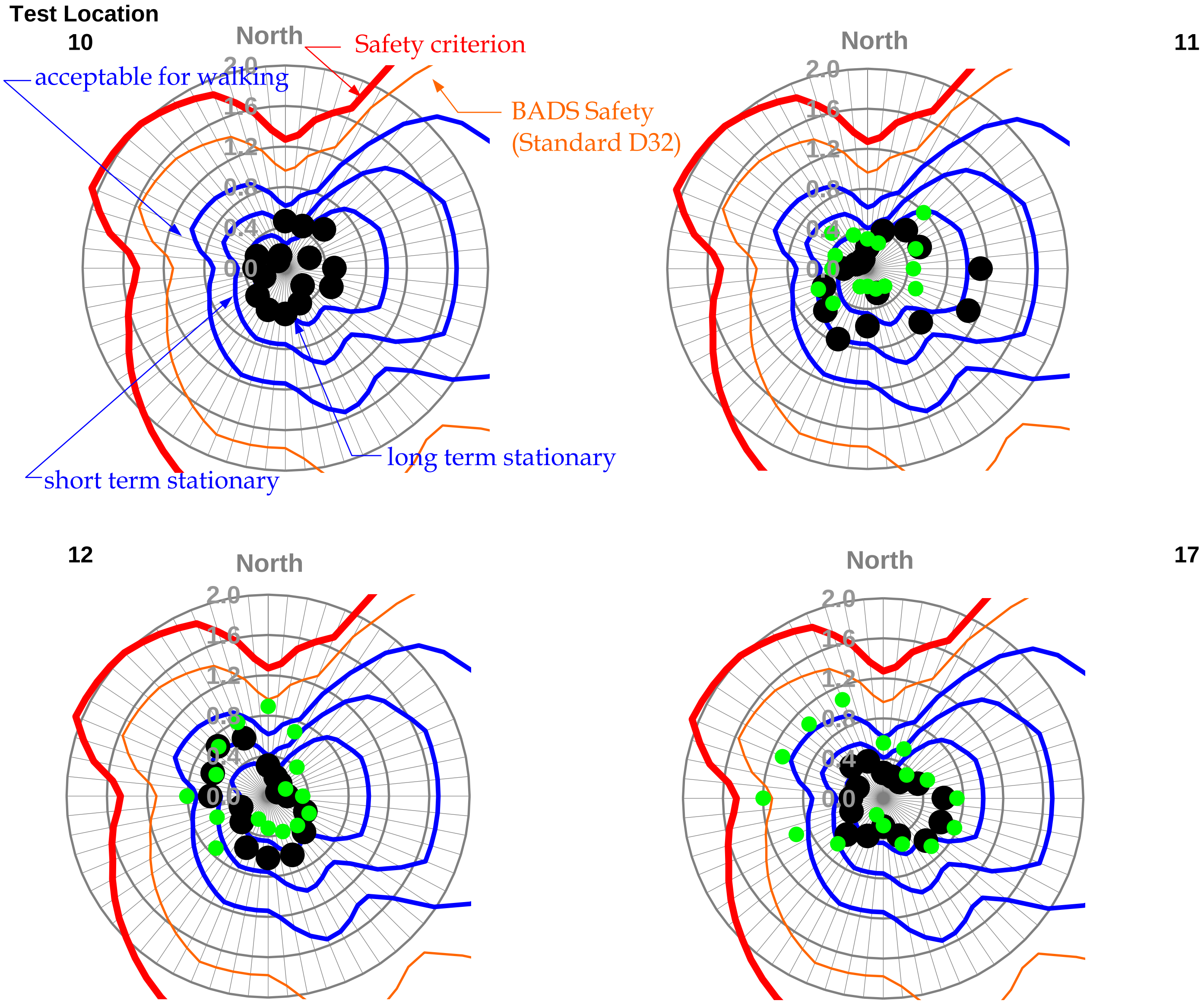
Figure A2 - Doonside Street



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

Proposed Configuration	●
Existing Configuration	●

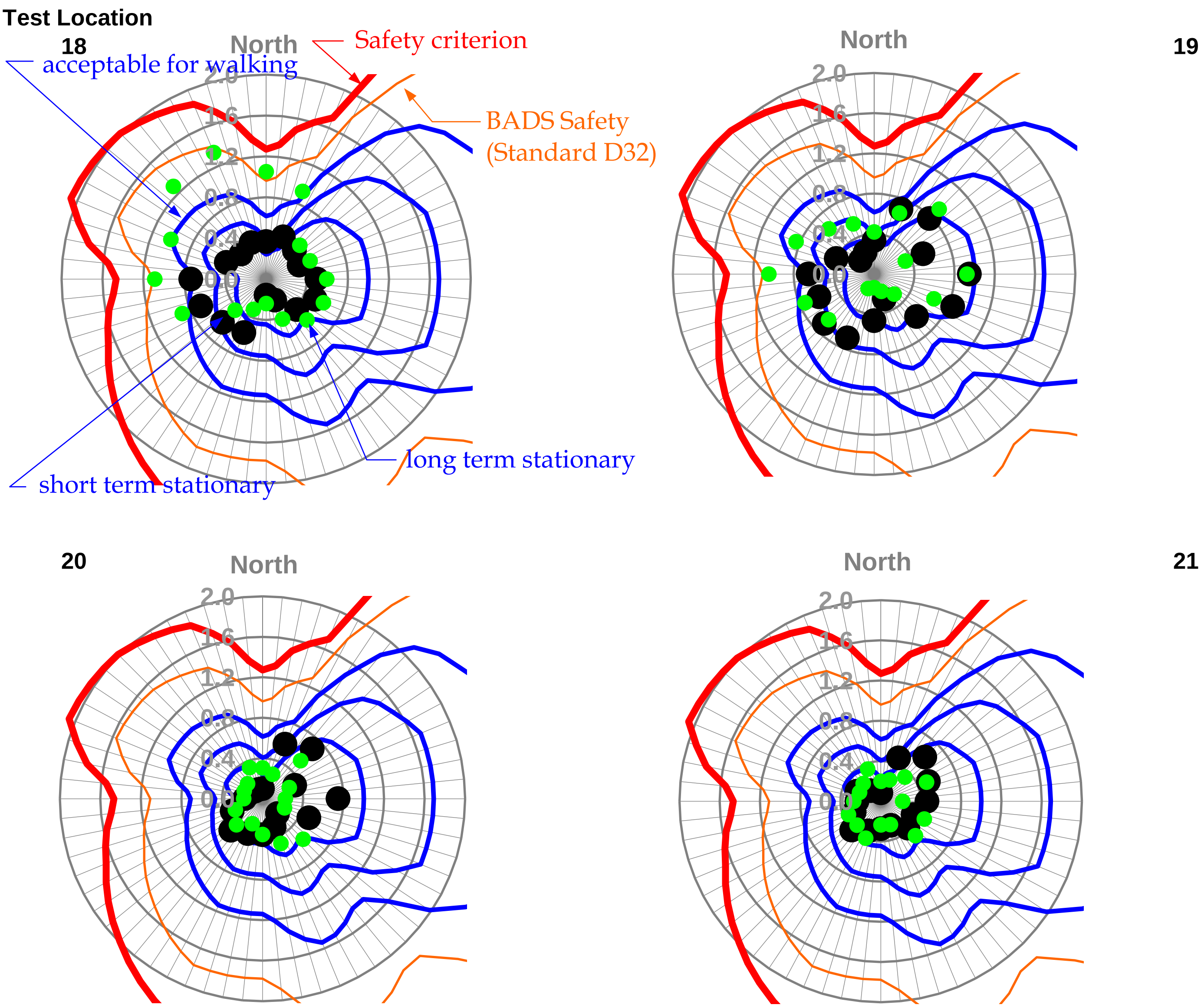
Figure A3 - Doonside Street - continued



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

Proposed Configuration
Existing Configuration

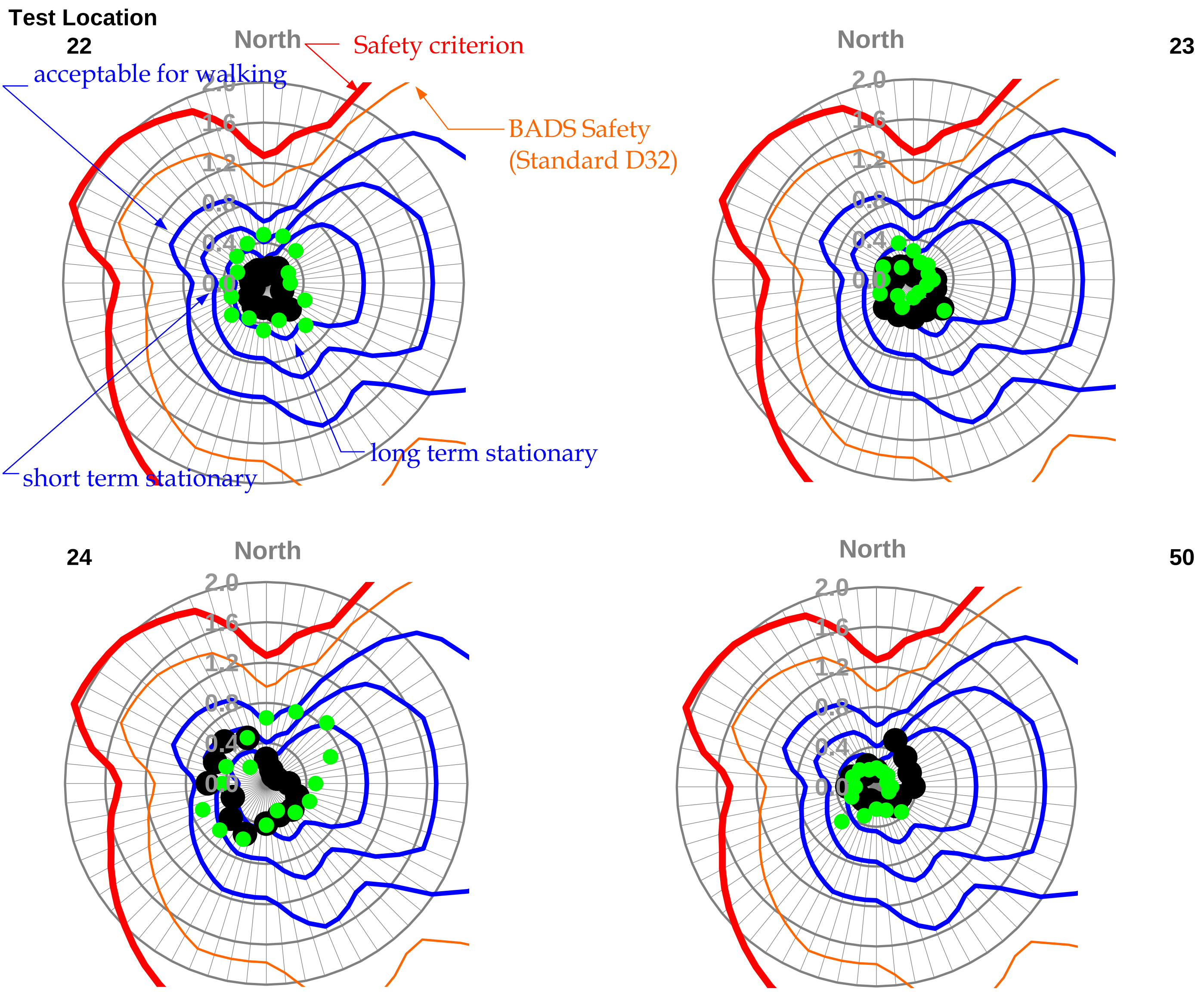
Figure A4 - Doonside Street - continued



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

Proposed Configuration	●
Existing Configuration	●

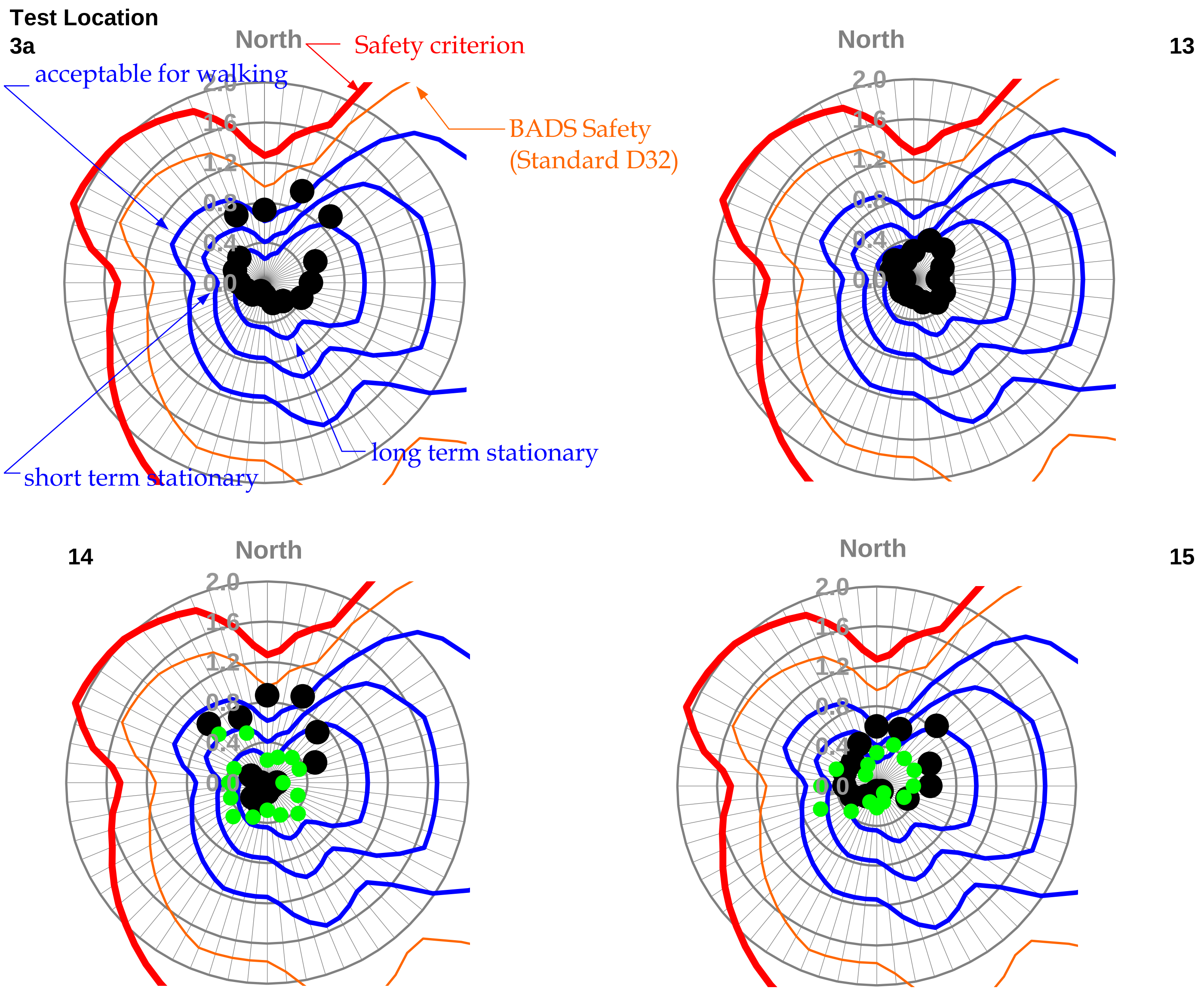
Figure A5 - Doonside Street - continued



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

Proposed Configuration
Existing Configuration

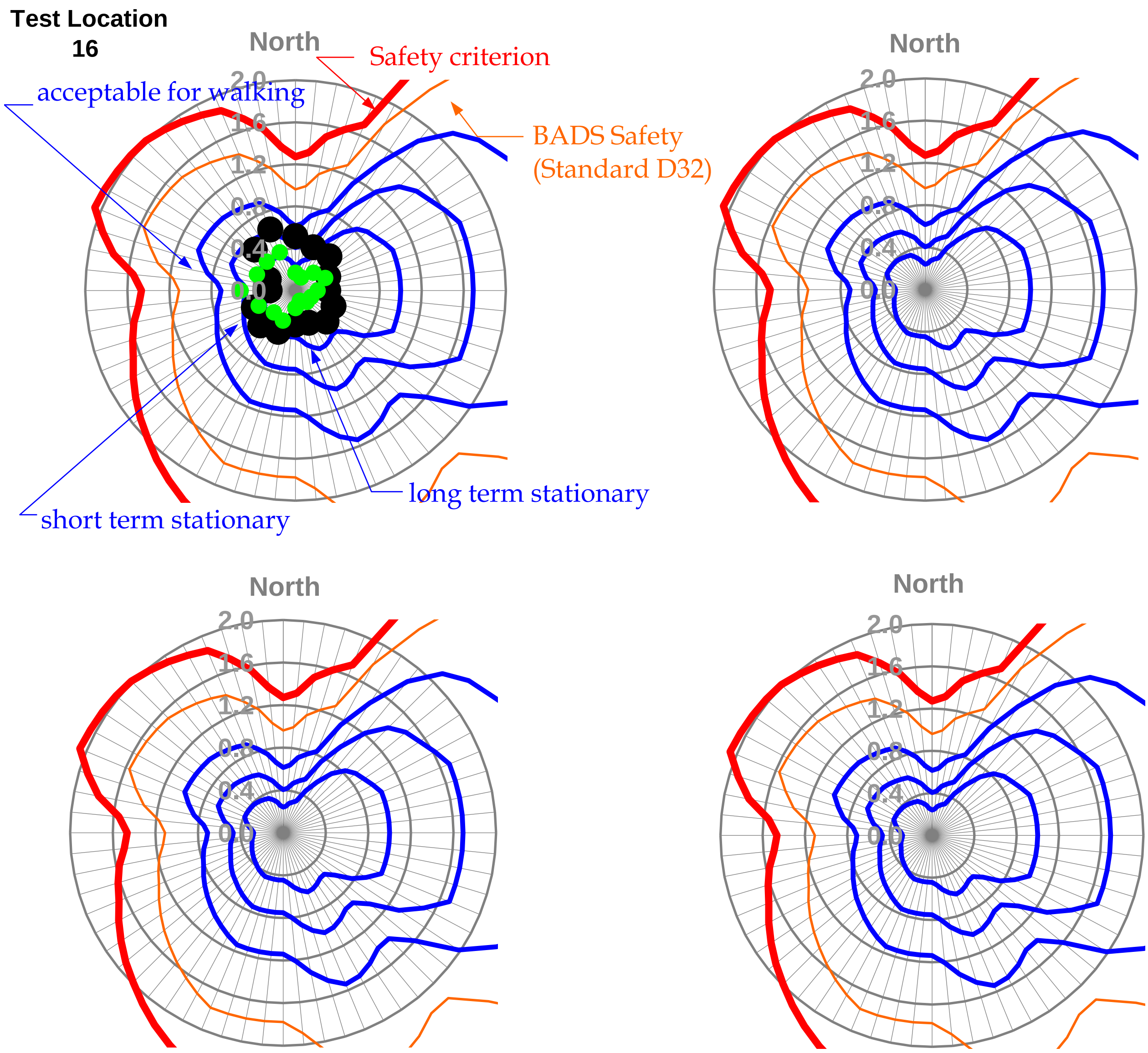
Figure A6 - Doonside Street - continued



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

Proposed Configuration
Existing Configuration

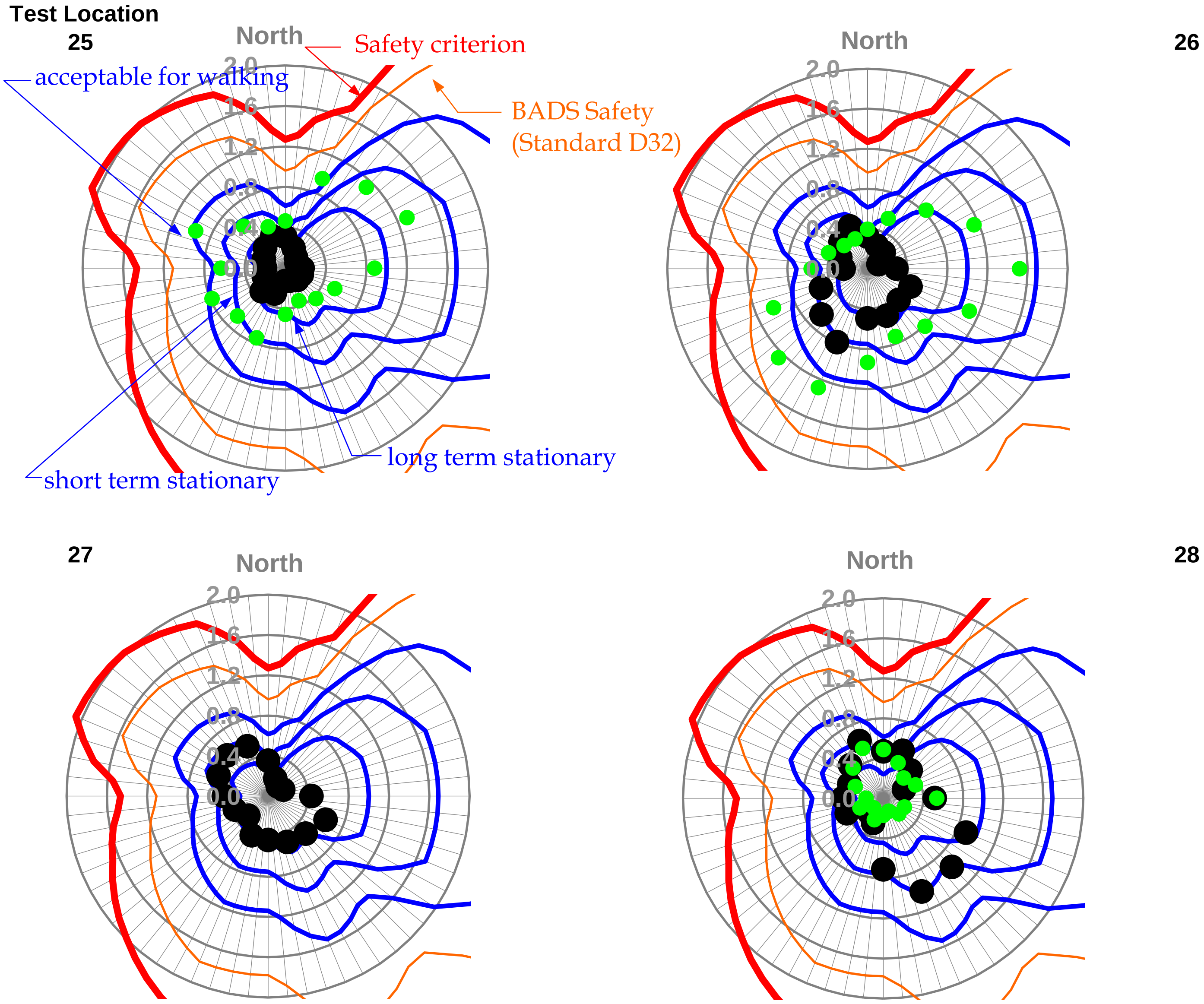
Figure A7 - David Street



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

Proposed Configuration	●
Existing Configuration	●

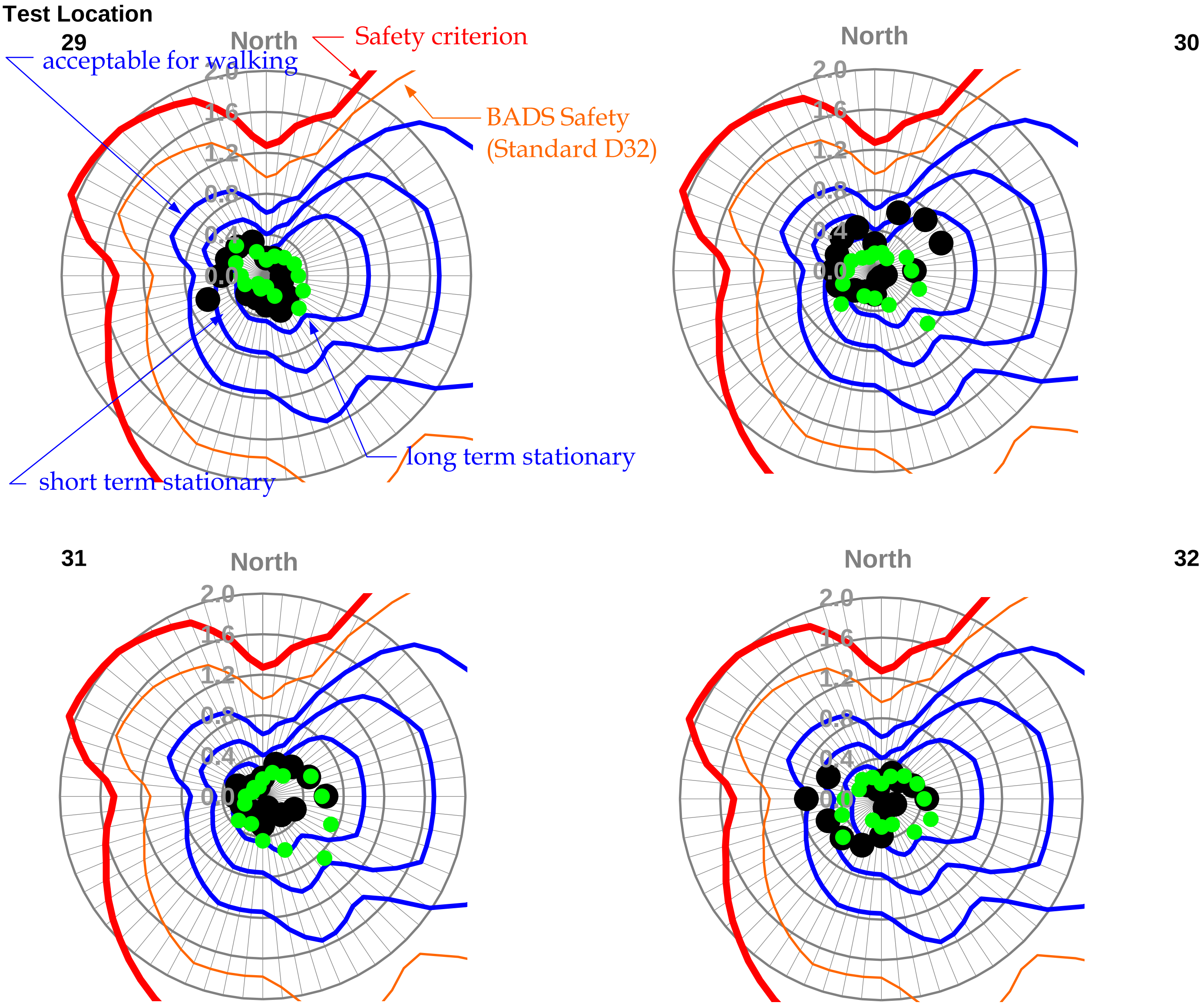
Figure A8 - David Street - Continued



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

Proposed Configuration	●
Existing Configuration	●

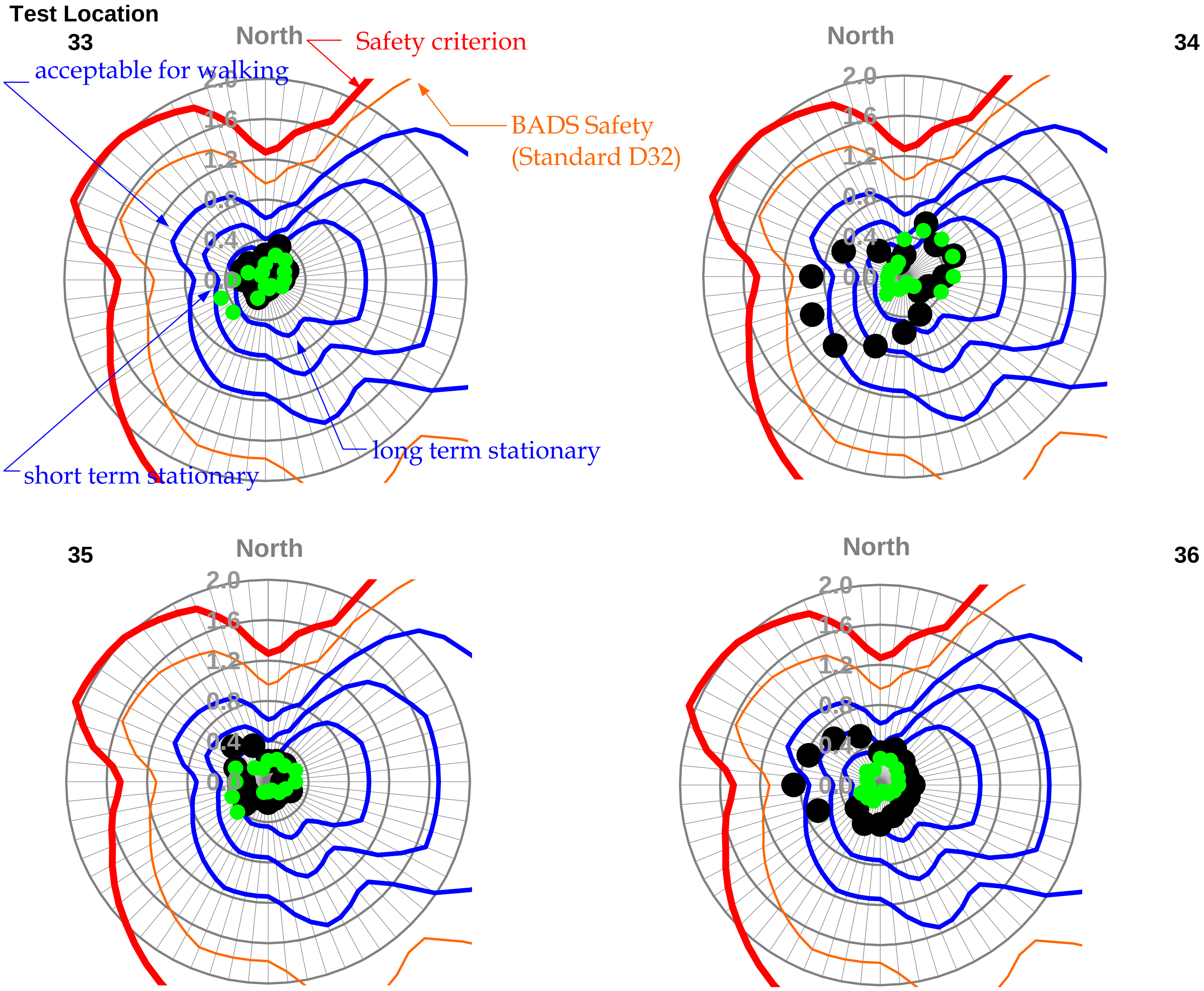
Figure A9 - Burnley Street



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

Proposed Configuration ●
Existing Configuration ●

Figure A10 - Burnley Street - continued

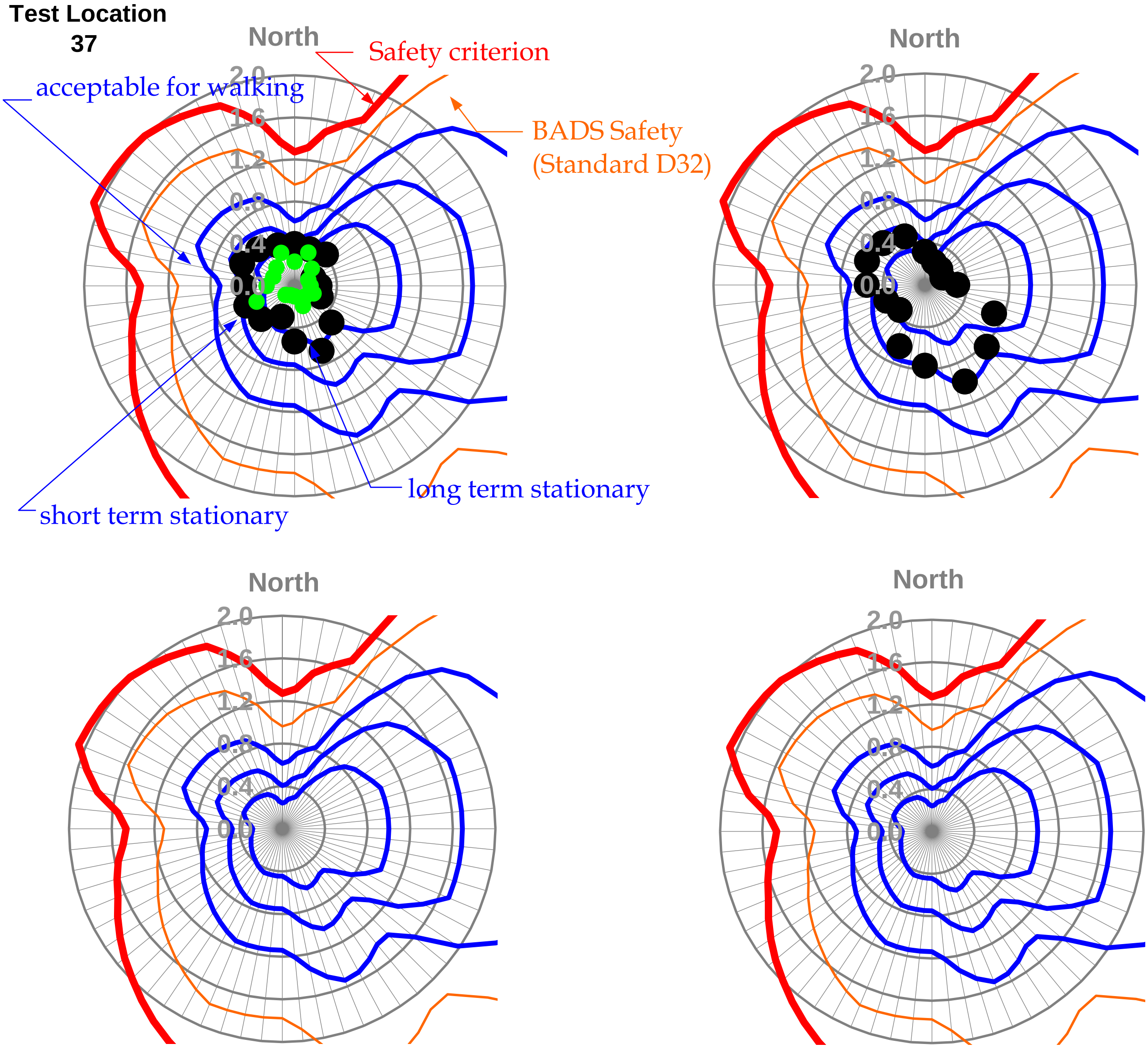


$$Peak\ velocity\ squared\ ratio \left|\frac{\hat{V}_{local}}{\bar{V}_{300m}}\right|^2 as\ a\ function\ of\ wind\ direction$$

Proposed Configuration	●
Existing Configuration	●

Figure A11 - Burnley Street - continued

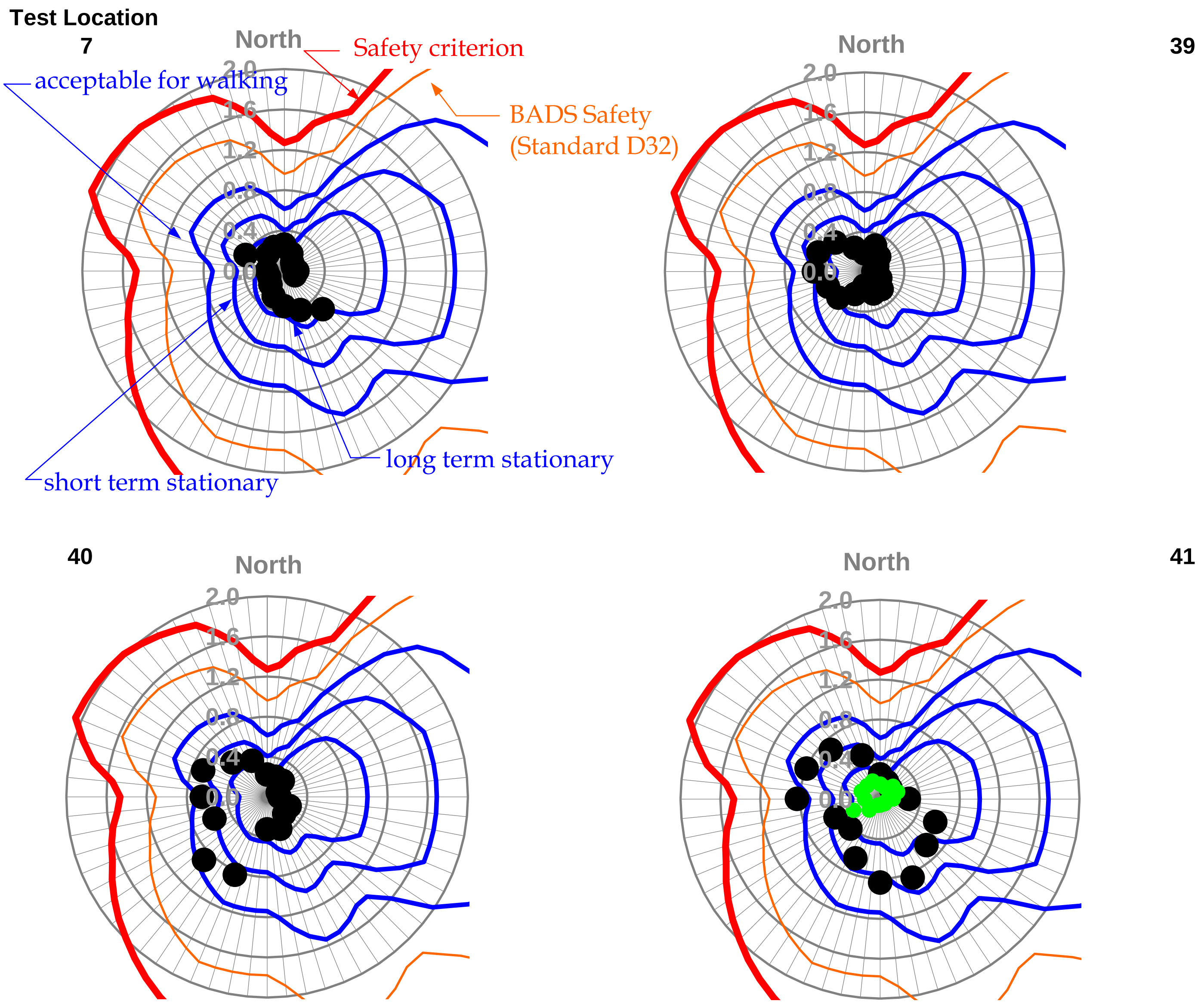
Test Location
37 **38**



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

Proposed Configuration	●
Existing Configuration	●

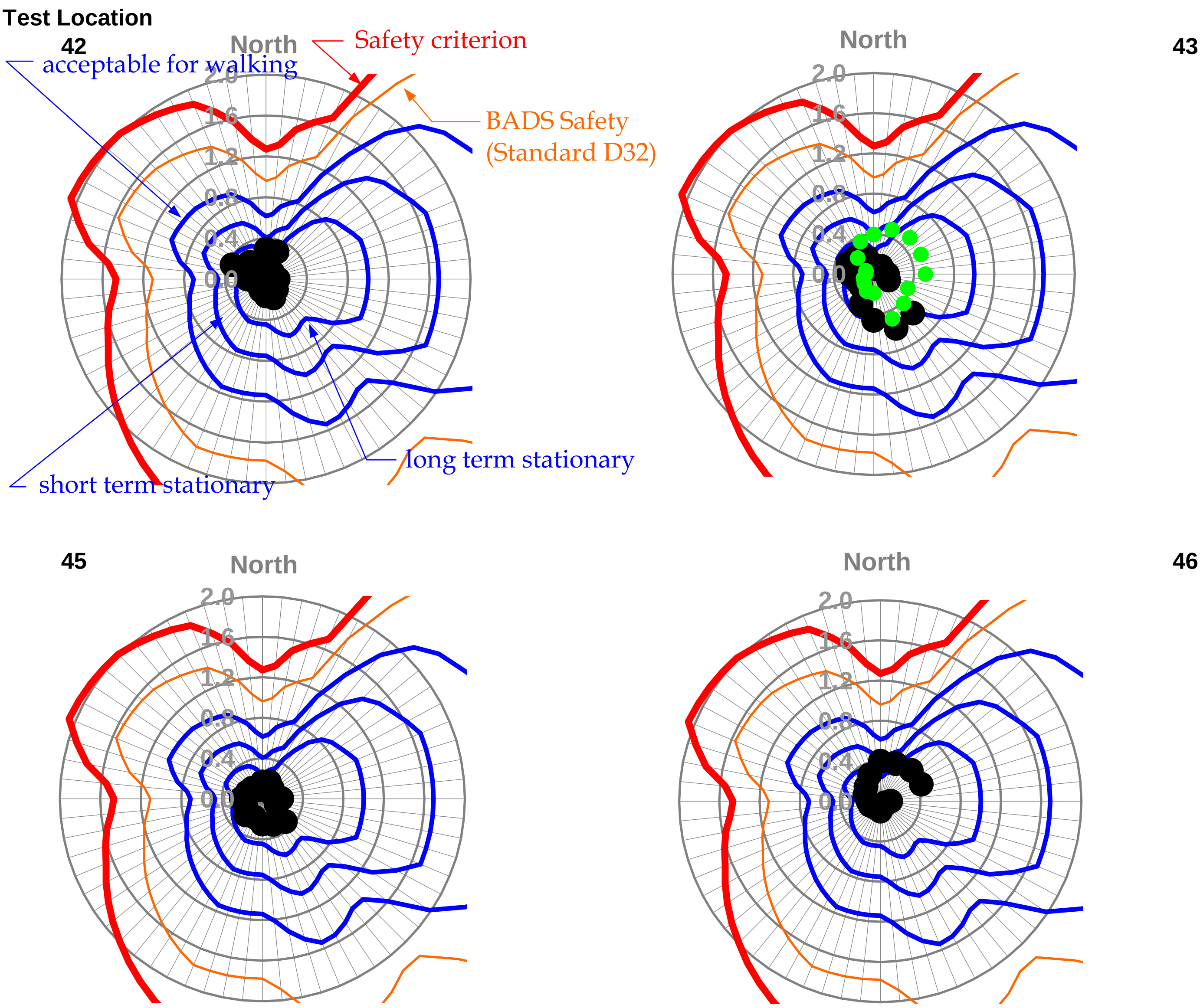
Figure A12 - Burnley Street - continued



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

Proposed Configuration ●
Existing Configuration ●

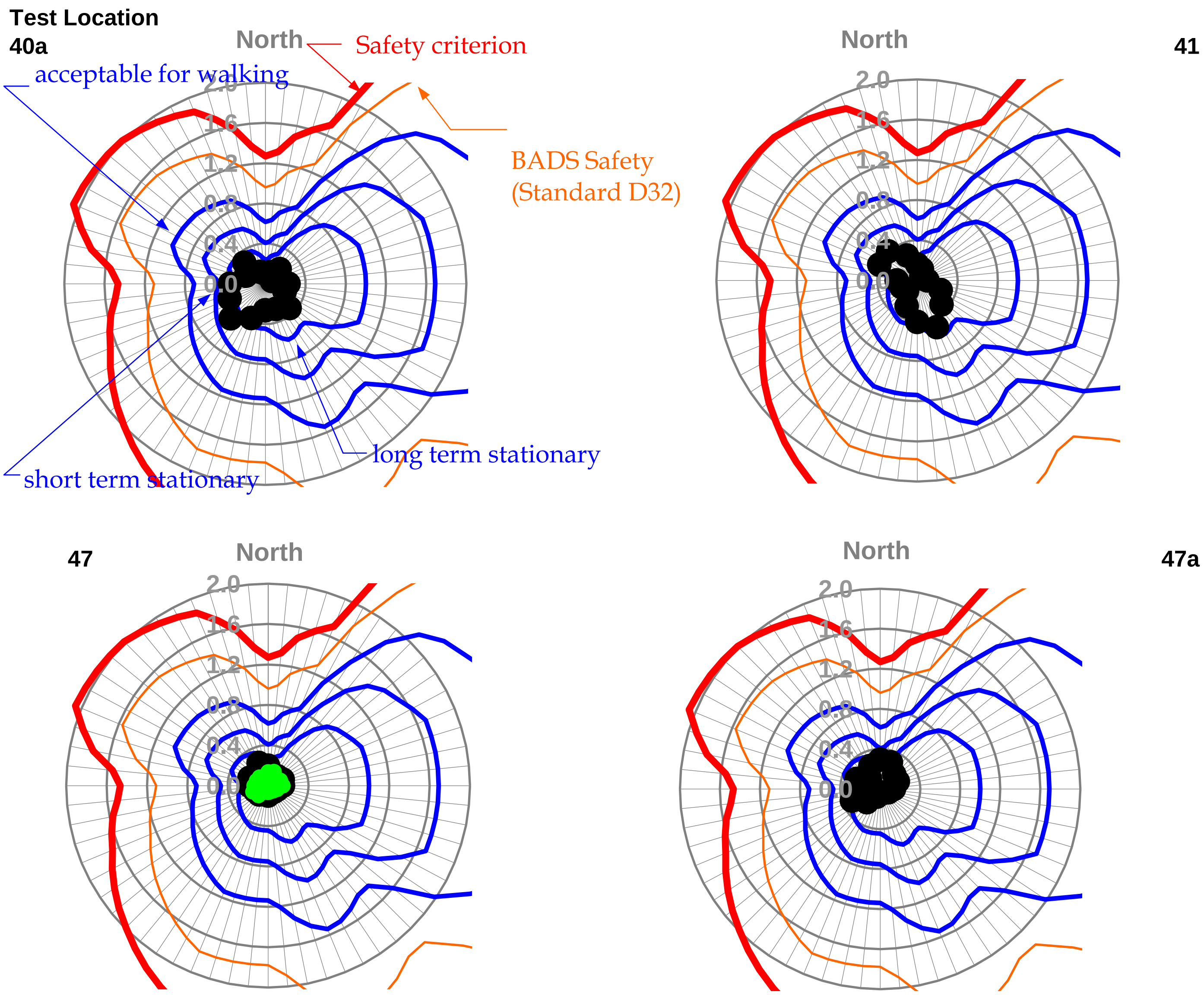
Figure A13 - Laneway



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

Proposed Configuration ●
Existing Configuration ●

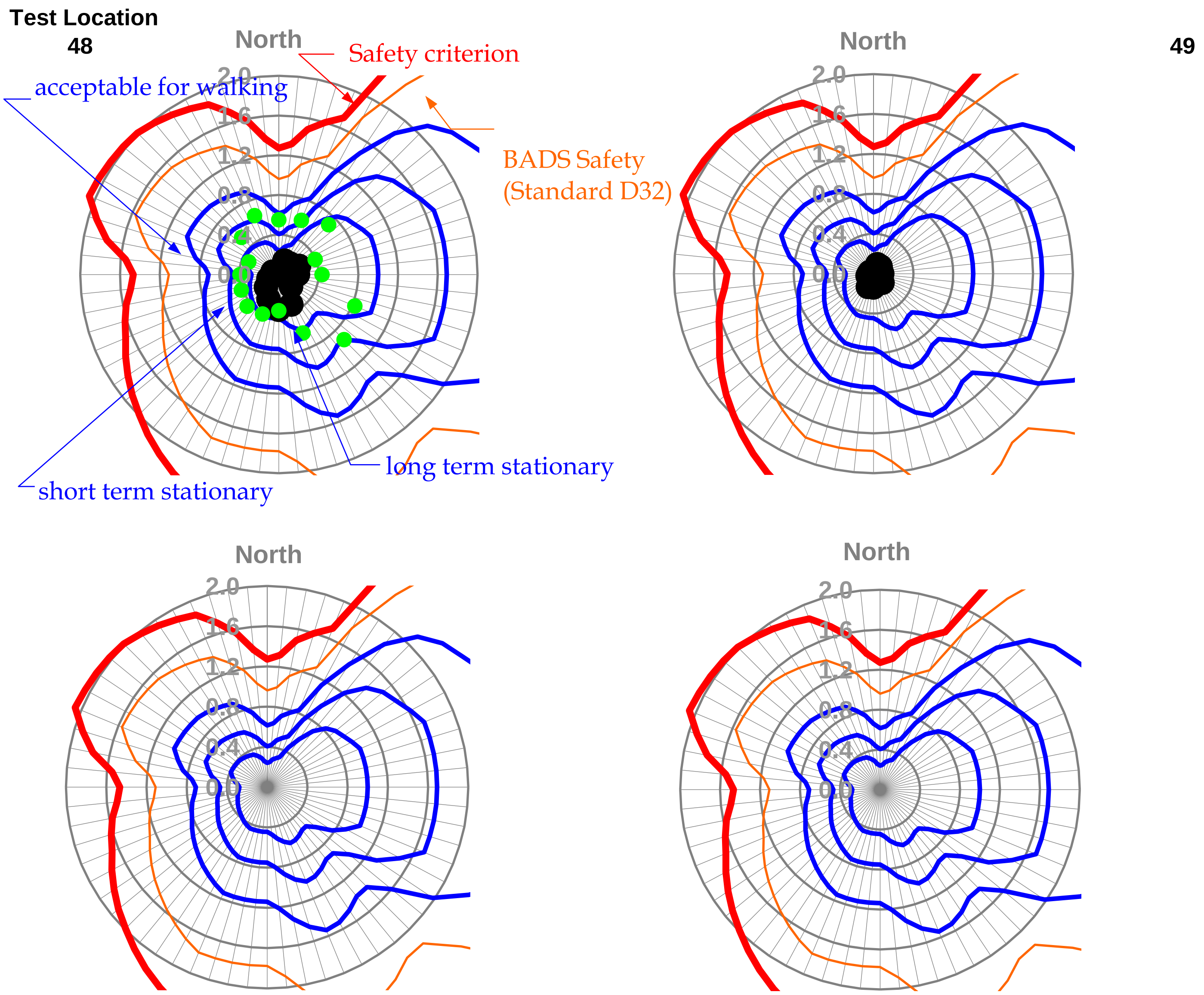
Figure A14 - Laneway - continued



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

Proposed Configuration	●
Existing Configuration	●
	■

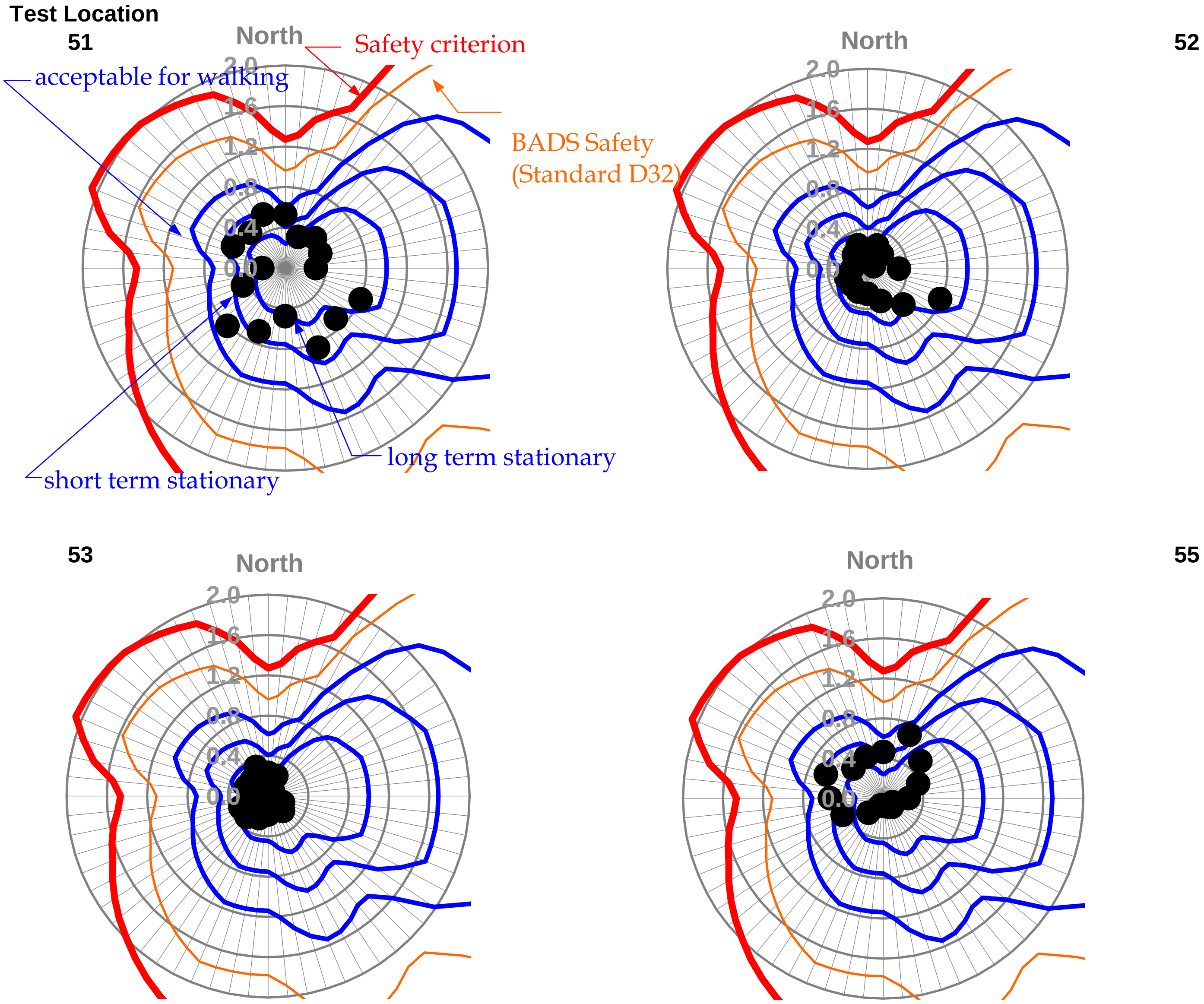
Figure A15 - Laneway - continued



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

Proposed Configuration
Existing Configuration

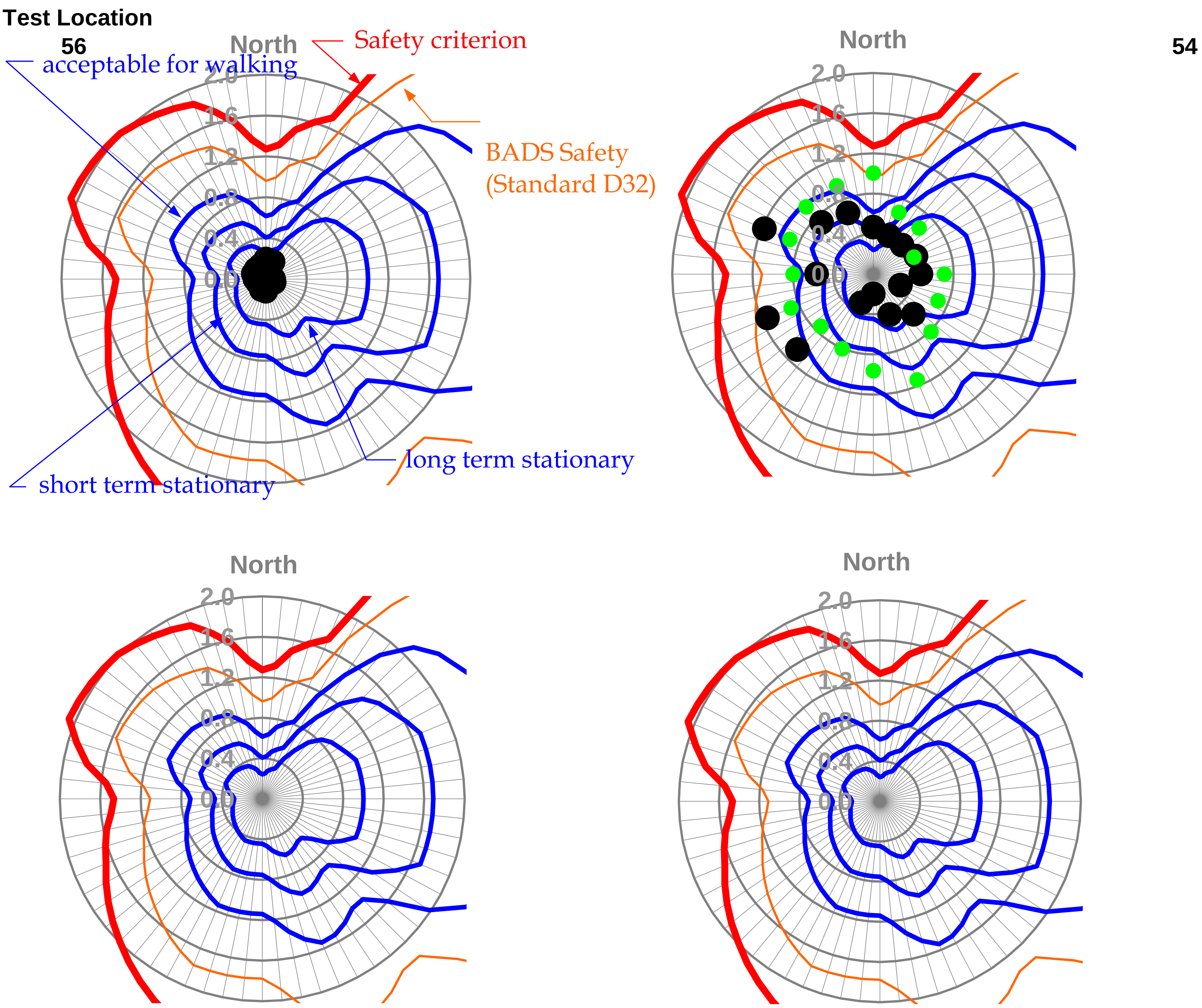
Figure A16 - South Entrance



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

Proposed Configuration ●

Figure A17 - Podium Outdoor Recreational Area



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

Proposed Configuration	●
Existing Configuration	● (green)

Figure A18 - Existing Roof Carpark