

HammondCare



Greenwich Hospital, NSW

Pedestrian Level Winds - Wind Tunnel Testing



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Executive Summary

Vipac Engineers & Scientists Ltd (Vipac) has been commissioned by **HammondCare** to carry out a wind tunnel test to determine the likely pedestrian level wind conditions for the proposed development at **Greenwich Hospital, NSW**.

The model was constructed based on drawings supplied by **Bickerton Masters** in **February 2022**. The proposed development and surrounding buildings covering a circular area of approximately 500 m radius were modelled at a 1:400 scale. The approaching mean and turbulent flows of the Terrain Category 2 (150 to 230 azimuth degrees), Terrain Category 2.5 (110-140 and 240-250 azimuth degrees) and Terrain Category 3 (all other wind directions) Atmospheric Boundary Layer were modelled based on Australian Standard AS 1170.2-2011.

The findings of the current study are summarised as follows:

The proposed design of the development:

- Fulfils the recommended criterion for **safety** at all test locations;
- Fulfils the recommended criterion for **walking** at all footpath locations;
- Fulfils the recommended criterion for **standing** at all building entrances;
- Fulfils the recommended criterion for **sitting** at all external play / dining areas **with the recommendations**; and
- Fulfils the recommended criteria for **walking** at all outdoor communal terraces **with the recommendations**.

As a general statement, common to all new developments, educating occupants about wind conditions at high-level terraces/balconies during high-wind events and tying down loose furniture are highly recommended.

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1 Introduction

Vipac Engineers & Scientists Ltd was commissioned by **HammondCare** to carry out a wind tunnel test of the likely pedestrian level wind conditions of the proposed development at **Greenwich Hospital, NSW**.

The project is to redevelop the existing Greenwich Hospital to three mid-rise towers. The intention is to retain the Pallister building, and develop two Senior Living towers (5 and 6 storeys) as well as a 10 storey Hospital tower. The existing site plan of the proposed development is shown in Figure 1, and the north elevations of the redevelopment is shown in Figure 2. The ground level plan of the proposed development is also shown in Figure 3. The surrounding developments within a 1.8km radius are low to mid-rise developments to the north and water bays and lands in between to the south. Considering the immediate surroundings and terrain, the site of the proposed development is assumed to be within Terrain Category 2 for 150 to 230 azimuth degrees, Terrain Category 2.5 for 110-140 and 240-250 azimuth degrees, and Terrain Category 3 for all other wind directions (Figure 4).

This report details the pedestrian level wind assessment results of the tests carried out on a 1:400 scale model of the proposed development in Vipac's Boundary Layer Wind Tunnel in Melbourne, during February and March 2022. The results show the wind effects in ground level public areas adjacent to the development as proposed.

The pedestrian wind environment study of the development was conducted using Omni-directional pressure sensor techniques to predict wind velocities. The study investigated safety and comfort in ground level pedestrian access-ways, entrances and terrace areas.

Drawings of the proposed development were supplied to Vipac by **Bickerton Masters** in **February 2022**. A complete list of the drawings supplied is provided in Appendix B of this report. Figure 5 & Figure 6 show the 1:400 scale building with the surrounding models in the wind tunnel.

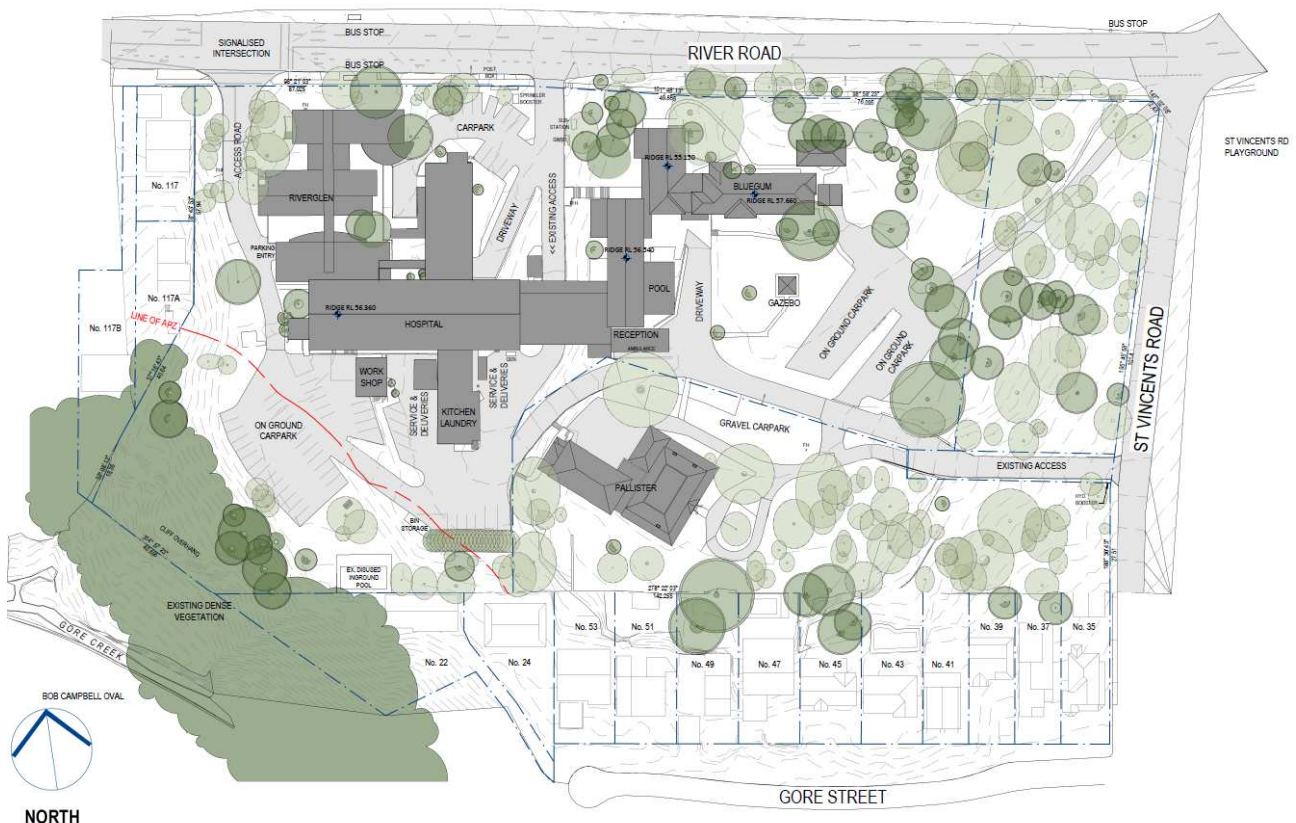


Figure 1: Existing site plan of the proposed redevelopment.

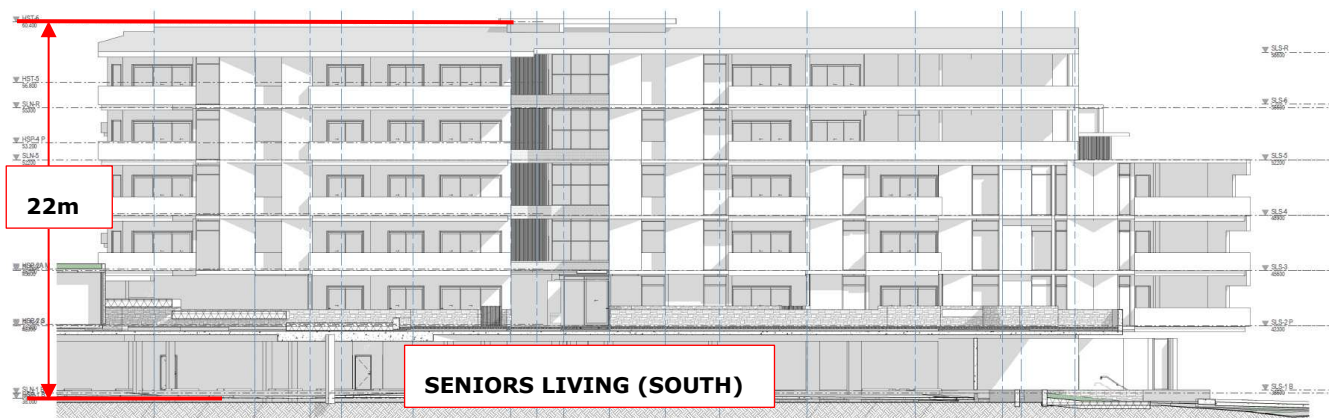
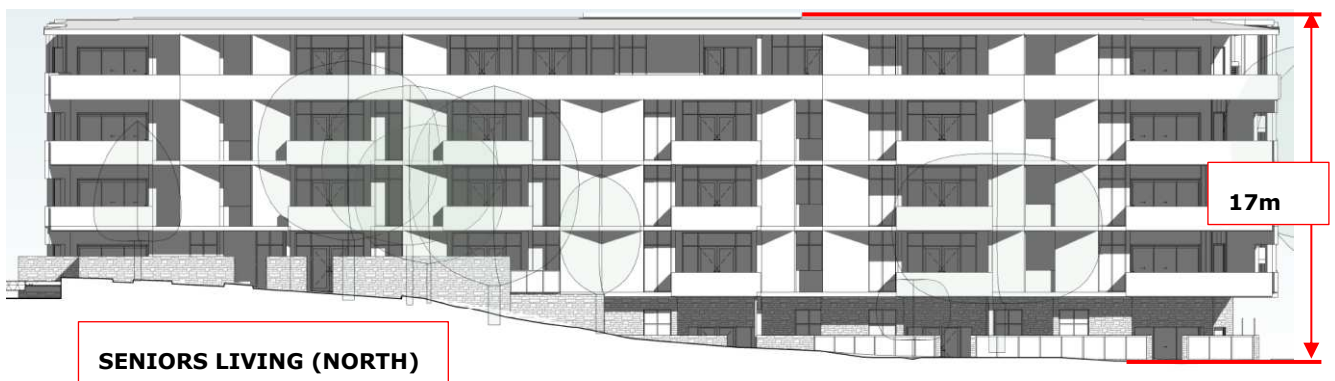
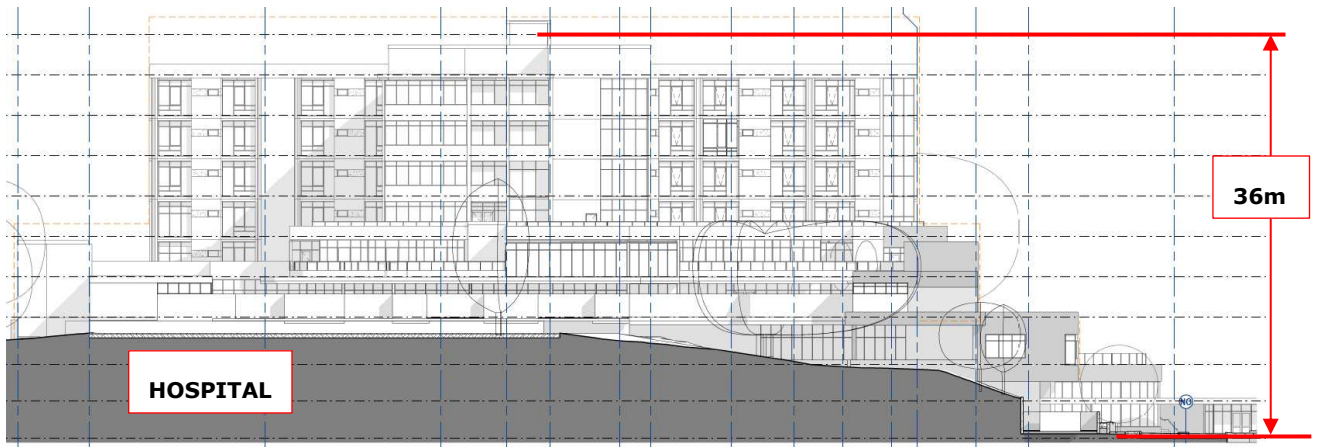


Figure 2: Northern elevations of the proposed redevelopment.



Figure 3: Ground floor plan showing the overall dimensions.

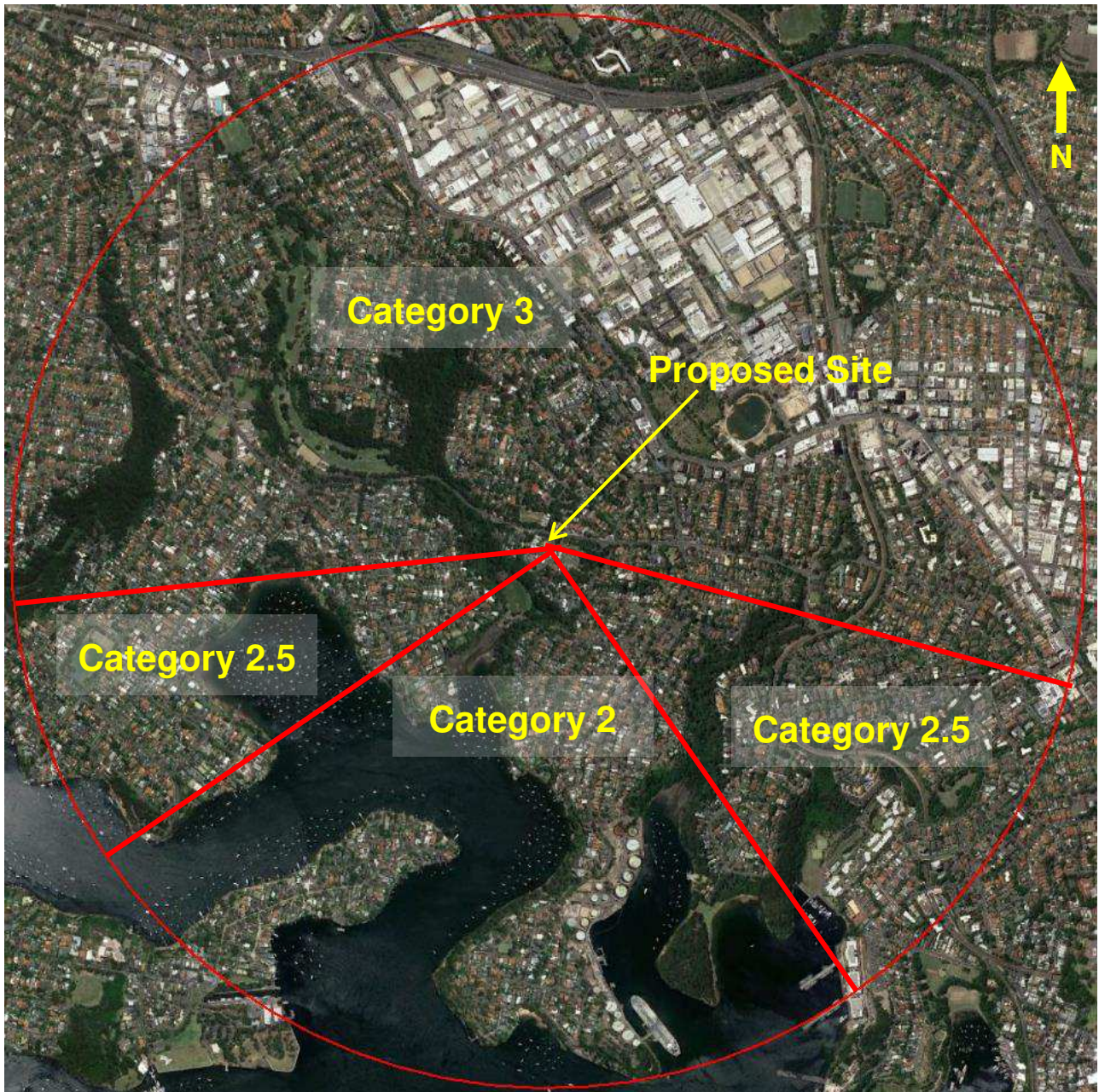


Figure 4: Assumed terrain categories for wind speed estimation.



Figure 5: Overall view from north of the 1:400 scale model of the proposed development in the wind tunnel.



Figure 6: Close-up view from the south-east of the 1:400 scale model in the wind tunnel.

1.1 Environmental Wind Effects

Atmospheric Boundary Layer

As wind flows over the earth it encounters various roughness elements and terrain such as water, forests, houses and buildings. To varying degrees, these elements reduce the mean wind speed at low elevations and increase air turbulence. The wind above these obstructions travels with unattenuated velocity, driven by atmospheric pressure gradients. The resultant increase in wind speed with height above ground is known as a wind velocity profile. When this wind profile encounters a tall building, some of the fast moving wind at upper elevations is diverted down to ground level resulting in local adverse wind effects.

The terminology used to describe the wind flow patterns around the proposed development is based on the aerodynamic mechanism, direction and nature of the wind flow.

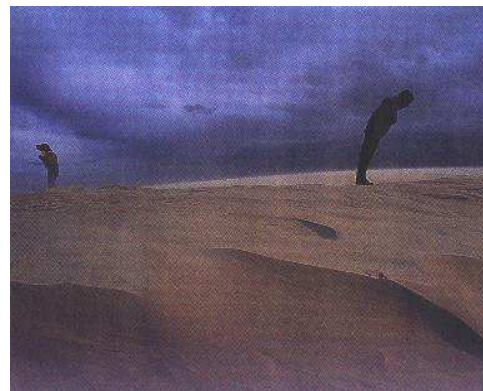
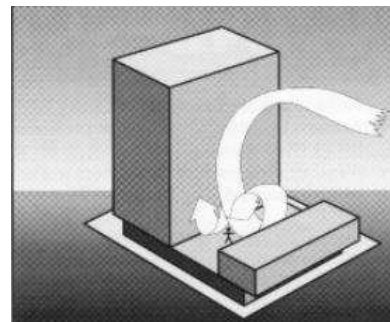
Downwash – refers to a flow of air down the exposed face of a tower. A tall tower can deflect a fast moving wind at higher elevations downwards.

Corner Accelerations – when wind flows around the corner of a building it tends to accelerate in a similar manner to airflow over the top of an aeroplane wing.

Flow separation – when wind flowing along a surface suddenly detaches from that surface and the resultant energy dissipation produces increased turbulence in the flow. Flow separation at a building corner or at a solid screen can result in gusty conditions.

Flow channelling – the well-known “street canyon” effect occurs when a large volume of air is funnelled through a constricted pathway. To maintain flow continuity the wind must speed up as it passes through the constriction. Examples of this might occur between two towers, in a narrowing street or under a bridge.

Direct Exposure – a location with little upstream shielding for a wind direction of interest. The location will be exposed to the unabated mean wind and gust velocity. Piers and open water frontage may have such exposure.



2 Regional Wind Climate

The mean and gust wind speeds have been recorded in the Sydney area for over 30 years. These data have been analysed and the directional probability distribution of wind speeds have been determined. The directional distribution of hourly mean wind speed at the gradient height once per year (i.e. 1 year return period) and with a probability of occurring 5% of the time are shown in Figure 7. The wind data at this free stream height is common to all Sydney sites and may be used as a reference to assess ground level wind conditions at the development site.

**Hourly Mean Wind Speeds (m/s), once per year and 0.5% of the time,
at 500 m height, Cat 2, Sydney**

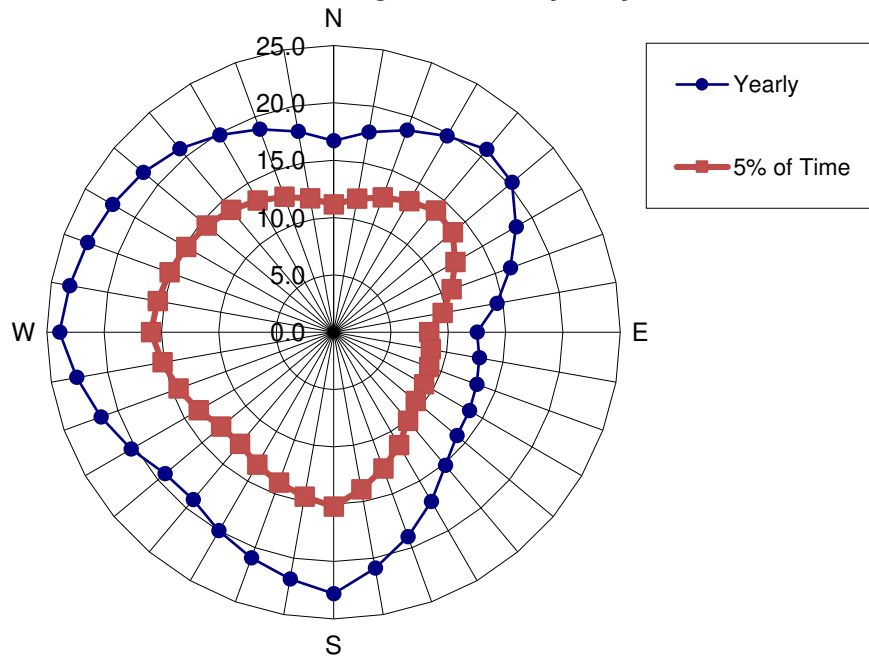


Figure 7: Directional Distribution of Mean Hourly Wind Velocities (m/s) of Annual Return Period and 5% of time at the gradient height for Sydney.

3 Assessment Criteria

The wind comfort criteria from the Central Sydney Planning Strategy has been applied to this study. The document recommends the following wind safety and comfort criteria (Table 1):

Table 1: Wind Criteria summarized from Central Sydney Planning Strategy

Measurements	Result on Perceived Pedestrian Comfort
Peak wind speed (0.5 second gust) once per year, ≤24m/sec for any direction*.	Accepted international criterion for human safety to avoid a healthy pedestrian losing balance
Hourly mean wind speed*, 5% of the time exceedance, ≤8m/sec , for any directions.	Acceptable for walking (steady steps for most pedestrians)
Hourly mean wind speed, 5% of the time exceedance, ≤6m/sec , for any directions.	Acceptable for standing (wind shopping, vehicle drop off)
Hourly mean wind speed, 5% of the time exceedance. ≤4m/sec , for any directions.	Acceptable for sitting (outdoor cafes, gardens, park benches)

*Note: Hourly Mean wind speed is the maximum of mathematical mean or Gust equivalent mean (Gust divided by 1.85).

The wind speed assessment is undertaken for winds occurring between 6am and 10pm (AEST).

3.1 Applicable Criteria

The following Table 2, lists the specific recommended criteria for the various areas of the proposed development. These are shown in more detail in Figure 8 to Figure 10.

Table 2: Recommended application of the criteria.

Area	Specific Location	Recommended Criteria
Public Footpaths and Access ways	Along River Rd and St Vincents Rd, as well as the laneways at west and south	Walking
Building Entrances	Throughout the site	Standing
External Play Area / Dining Area	Level 3 Hospital	Sitting
Communal Outdoor Spaces	Up the height of all buildings	Walking
Private Terraces	Up the height of Seniors Living buildings	Walking (See discussion below)

3.1.1 Communal Terrace / Apartment Balcony Recommended Criterion Discussion

Vipac recommends as a minimum that communal terrace / balcony areas meet the criterion for walking for the following reasons:

- These are not public spaces;
- The use of these areas is optional;
- Many similar developments in Sydney and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.

However, it should be noted that meeting the walking criterion on elevated recreation areas will be no guarantee that occupants will find wind conditions in these areas acceptable at all times.

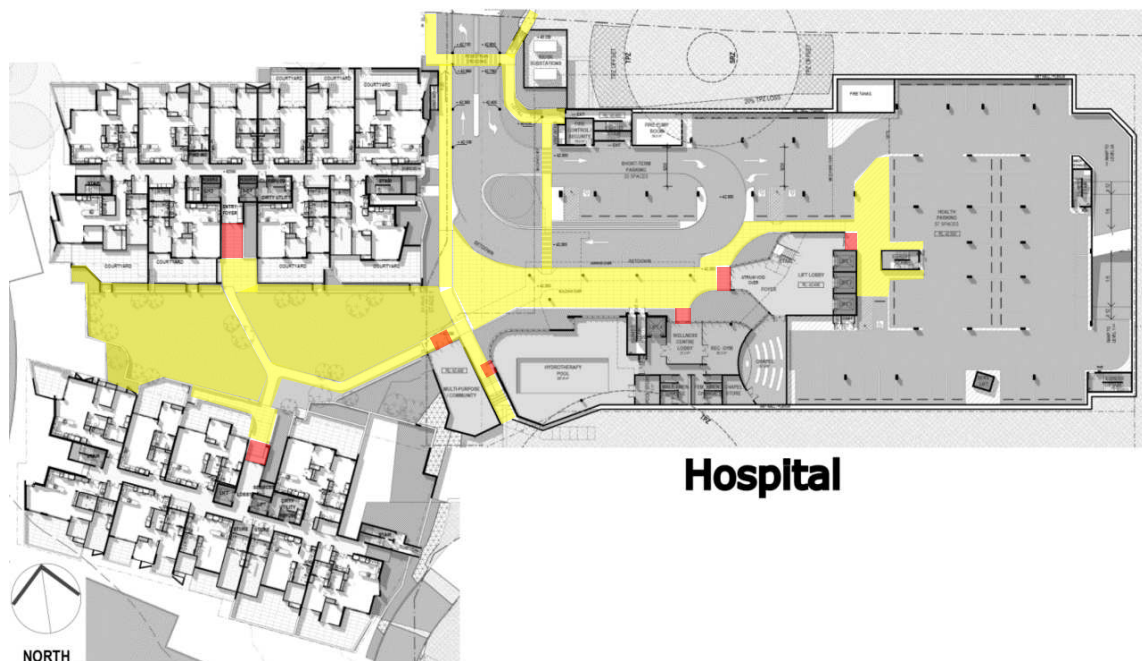


Seniors Living Level 1



Recommended to fulfil Walking

Figure 8: Level 1 plan for the proposed development with recommended comfort criteria overlaid.



Hospital

Seniors Living

Level 2

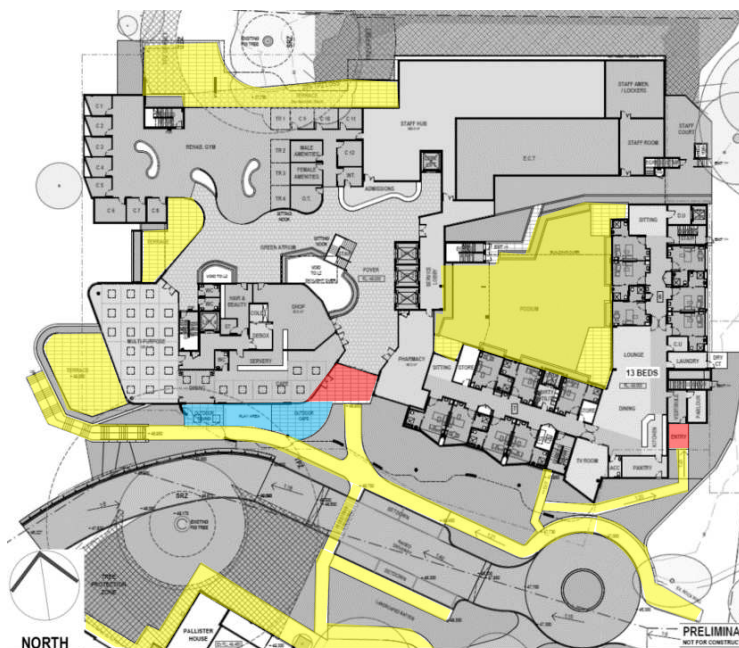


Recommended to fulfil Walking



Recommended to fulfil Standing

Figure 9: Level 2 plan for the proposed development with recommended comfort criteria overlaid.



Hospital Level 4



Recommended to fulfil Walking

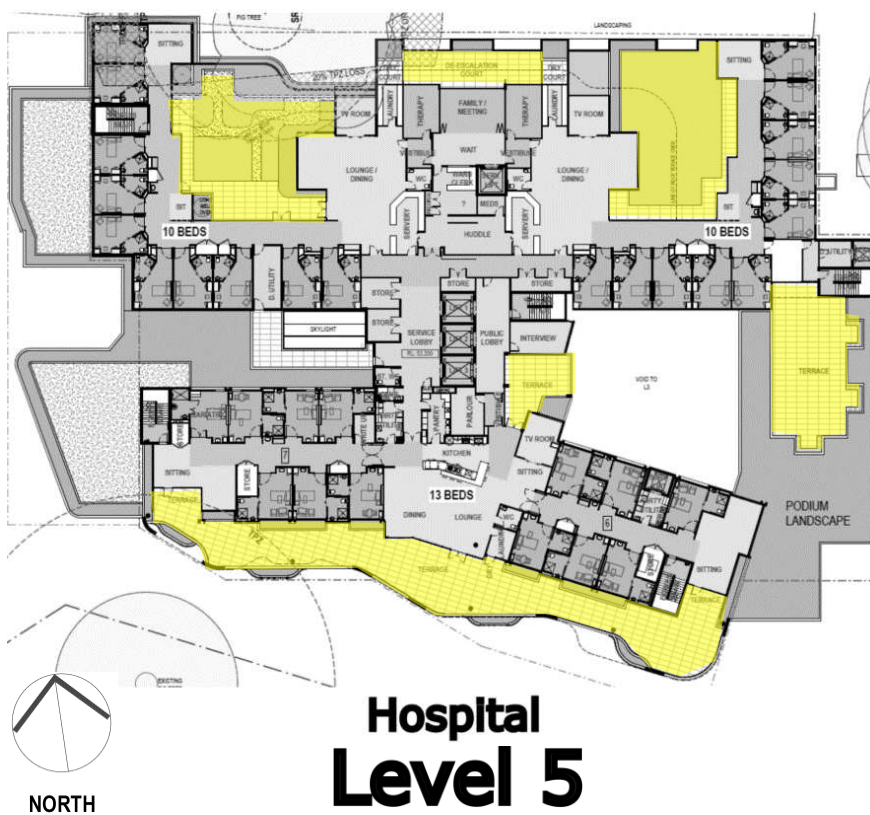


Recommended to fulfil Standing



Recommended to fulfil Sitting

Figure 10: Level 4 plan for the proposed development with recommended comfort criteria overlaid.



Hospital Level 5



Recommended to fulfil Walking

Figure 11: Level 5 plan for the proposed development with recommended comfort criteria overlaid.



Figure 12: Level 6 plan for the proposed development with recommended comfort criteria overlaid.



Figure 13: Level 7 plan for the proposed development with recommended comfort criteria overlaid.

4 Wind Tunnel Simulation

4.1 Similarity Requirements

The validity of wind tunnel testing relies on the similarity between model and full-scale parameters. This requires undistorted length scaling (i.e. geometric similarity), similarity of flow parameters (i.e. kinematic similarity) and finally similarity of pressures and forces.

Complete similarity is usually impossible to obtain because of the competing requirements of the various non-dimensional parameters, (e.g. Reynolds Number, Rosby Number and Richardson Number). Some requirements (i.e. Reynolds Number equality) can be waived for sharp edged structures immersed in a neutrally stable atmospheric boundary layer and geometric and kinematic similarity suffice. These are the requirements specified in Section C1.4, AS/NZS 1170.2 Supplement 1: 2011 [4] and are employed in this study.

4.2 Approach Wind Simulation

The wind effects tests were carried out in the 3m wide × 2m tall × 16m long Boundary Layer Wind Tunnel at Vipac Engineers and Scientists Ltd in Melbourne. The Boundary Layer Wind Tunnel is designed to simulate the flow incident on a proposed development by modelling the upstream terrain characteristic roughness. To this end, an estimate of the upstream terrain properties for the Development has been made and reproduced in the wind tunnel.

The approaching mean and turbulent flows of the Terrain Category 2 for 150-230 azimuth degrees, Terrain Category 2.5 for 110-140 and 240-250 azimuth degrees, and Terrain Category 3 for all other directions (Figure 4). The wind tunnel calibration velocity and turbulence intensity profiles for the approaching mean and turbulent flows of the Terrain Category 2, 2.5 and 3 are shown in Figure 14, Figure 15 and Figure 16 respectively. These represent the wind velocity and turbulence intensity profiles approaching the model of the development. Closer to the ground the wind moves more slowly but with increased turbulence. The simulated approach is indicative of full-scale planetary boundary layer velocity and turbulence intensity profiles.

Velocity correction factors are used to adjust the measured wind speed to ensure that the ratio of mean roof-height to reference height wind speed in the wind tunnel matches expected full-scale values.

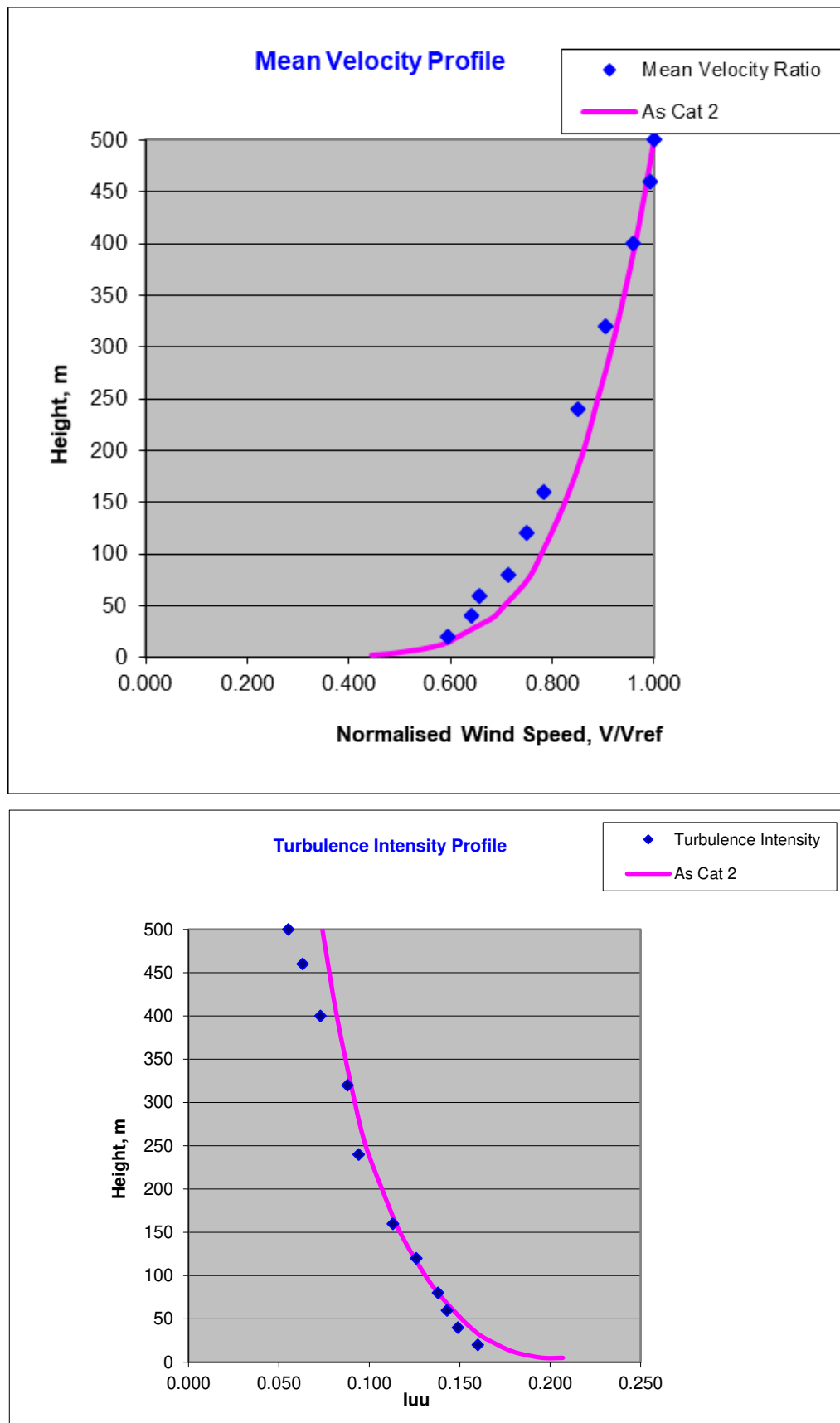


Figure 14: Mean Velocity and Turbulence Intensity Profiles for Terrain Category 2 (1:400 scale).

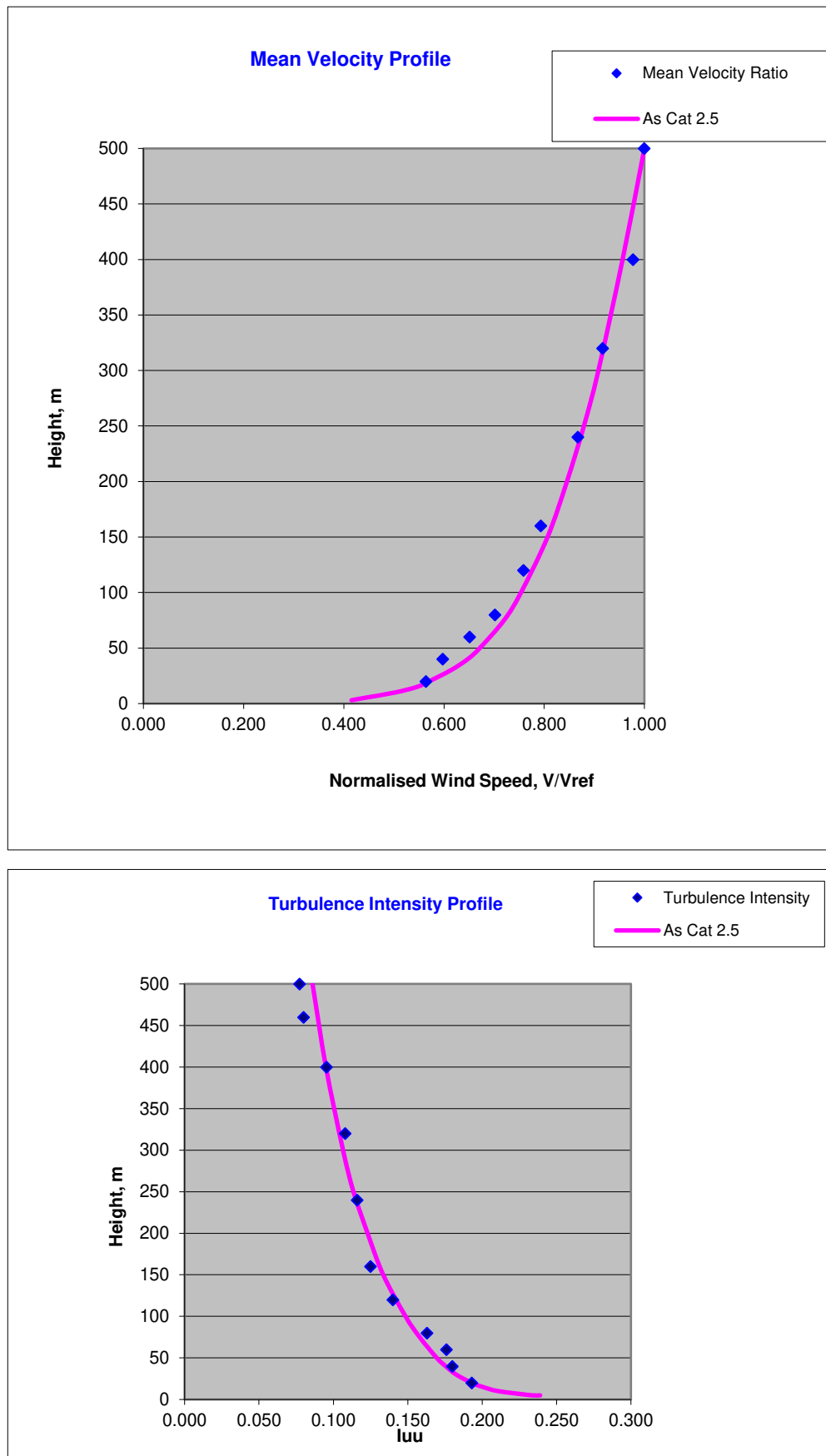


Figure 15: Mean Velocity and Turbulence Intensity Profiles for Terrain Category 2.5 (1:400 scale).

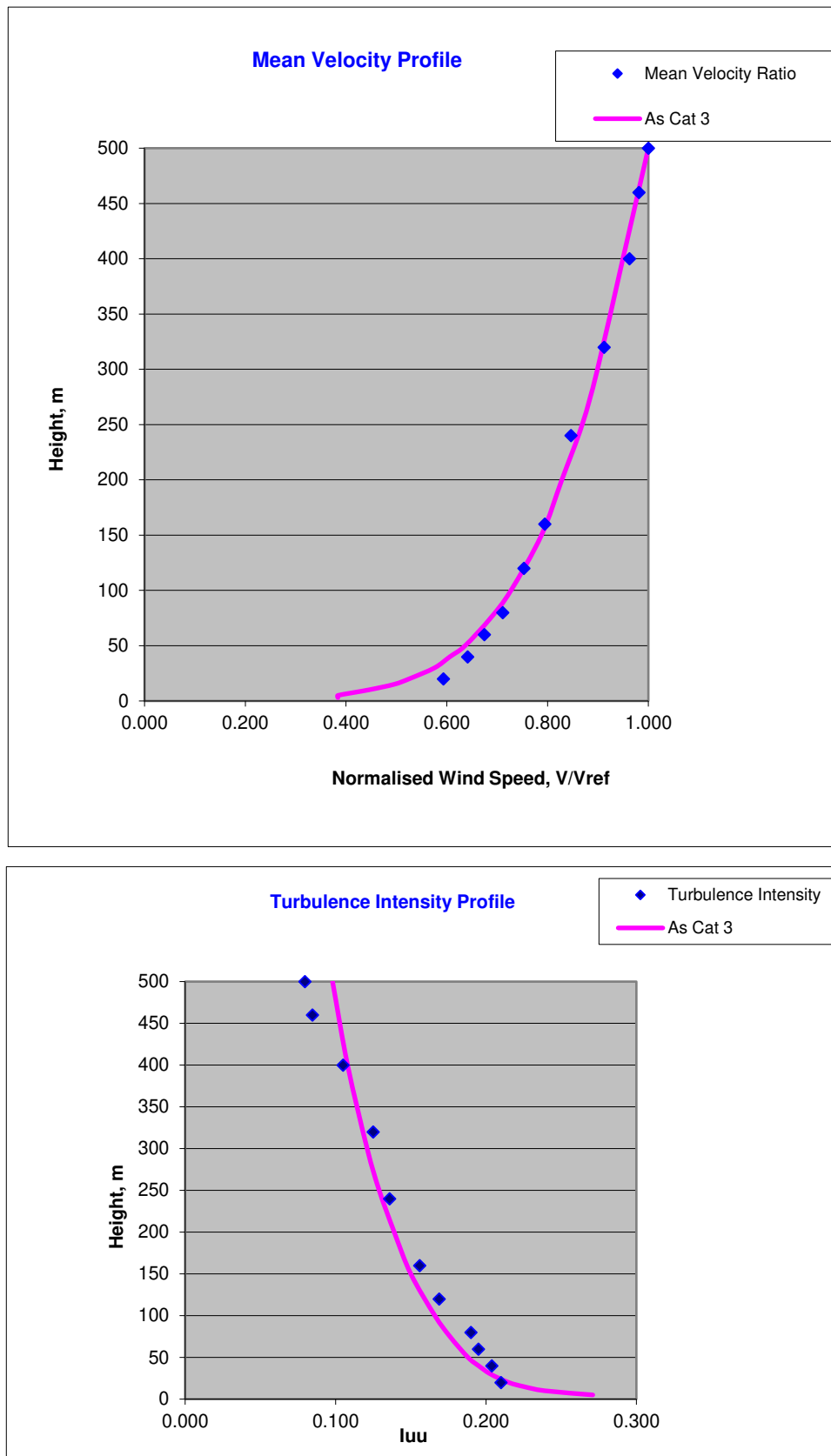


Figure 16: Mean Velocity and Turbulence Intensity Profiles for Terrain Category 3 (1:400 scale).

5 Test Procedure

The pedestrian wind environment in the adjacent footpath areas along River Rd and St Vincents Rd, as well as the laneways to the west and south, were assessed using Omni-directional pressure sensor measurements [4].

Velocity measurements were made using Irwin sensors (Omni-directional pressure sensors) installed at different locations at the adjacent ground level footpath areas and podium level of the proposed development. The test was conducted without any landscaping. The distribution of Irwin sensors has allowed the determination of the variation in velocity sufficient to capture the changes in velocity distribution that can typically occur over such areas. The resolution of measurement locations is in accordance with that prescribed in the Wind Tunnel Testing Quality Assurance Manual of the Australasian Wind Engineering Society.

PVC tubes with 1.3 mm internal diameter linked the Irwin sensors to pressure transducer device using a tuned arrangement to prevent harmonic fluctuations.

Velocity measurements were obtained at 10° wind azimuth increments starting from 0° (north) for a full 360° circle. The sampling time is determined based on the similarity criteria and corresponds to a total time of one hour in full scale. Statistical analysis was carried out on the signals for the mean and standard deviation. All velocity coefficients derived from the wind tunnel were converted to velocities by integrating the data with the regional wind climate and corresponding to design wind speeds with a probability of one per year exceedance for safety criterion assessment and 5% of the time for comfort criterion assessment.

A total of **70** sensors were used in order to provide a quantitative measure of the ground level wind speeds at various locations around the footpaths, building entrances and the selected rooftop terraces. The sensor locations are shown in Figure 17 to Figure 24.

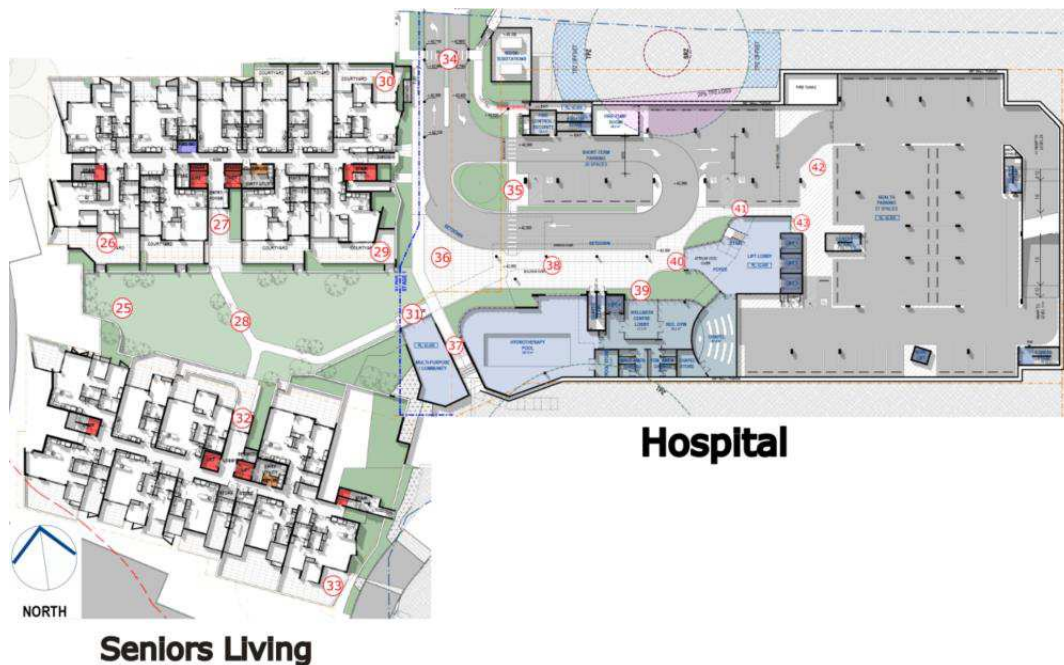


Figure 17: Sensor locations and numbers in the surrounding area.



Seniors Living Level 1

Figure 18: Sensor locations and numbers on Level 1.

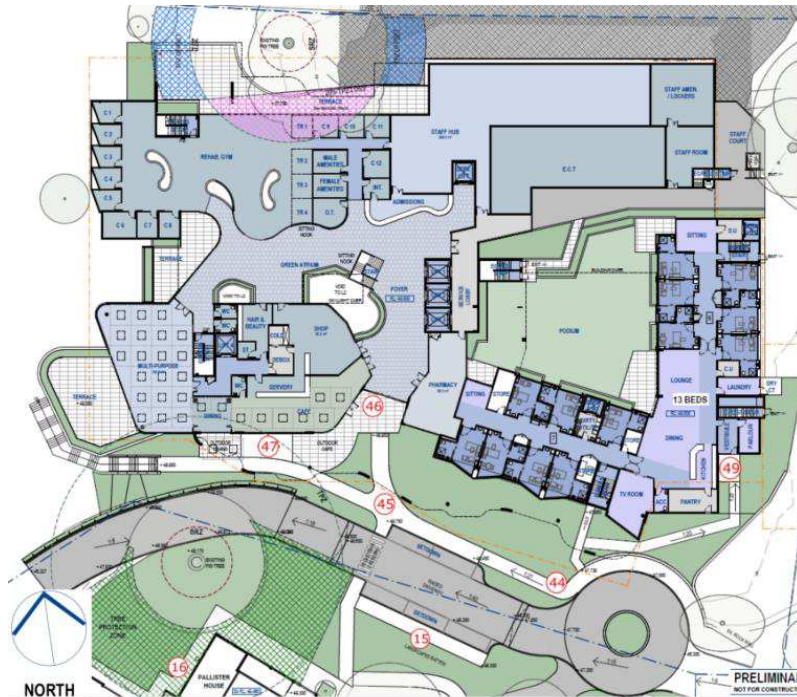


Seniors Living

Hospital

Level 2

Figure 19: Sensor locations and numbers on Level 2.



Hospital Level 4

Figure 20: Sensor locations and numbers on Level 4 (ground).



Hospital Level 4

Figure 21: Sensor locations and numbers on Level 4 (terraces).

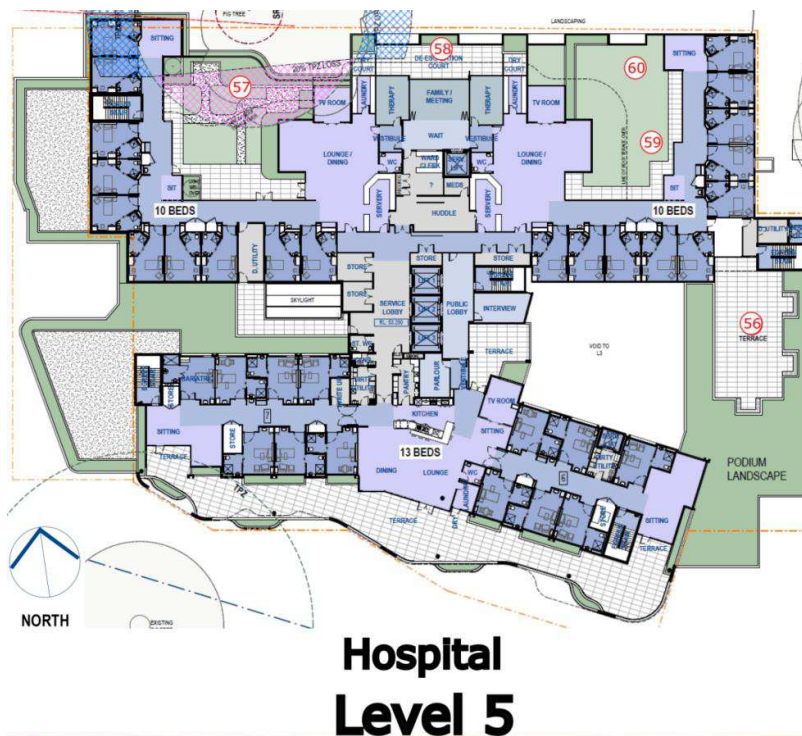


Figure 22: Sensor locations and numbers on Level 5.

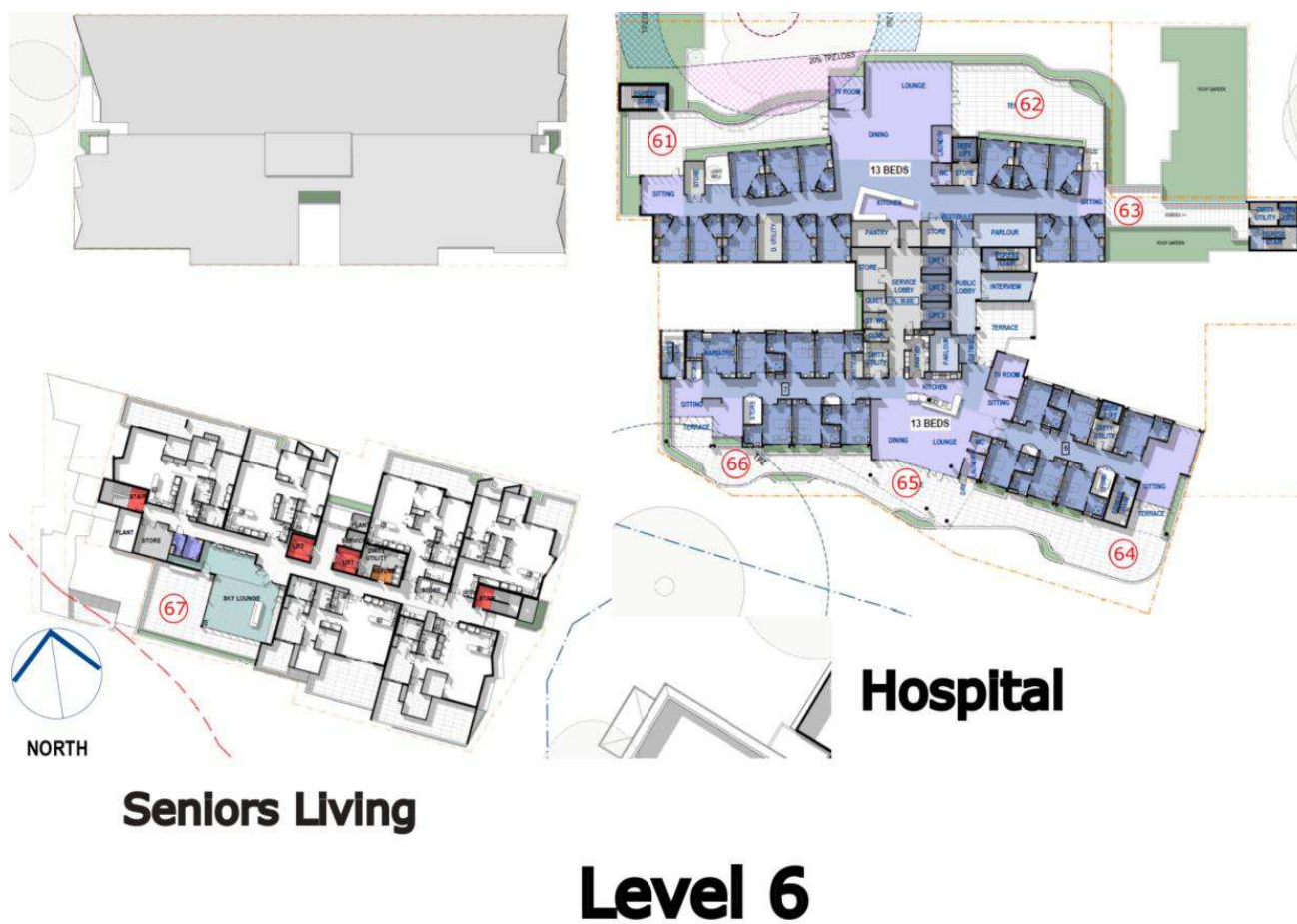
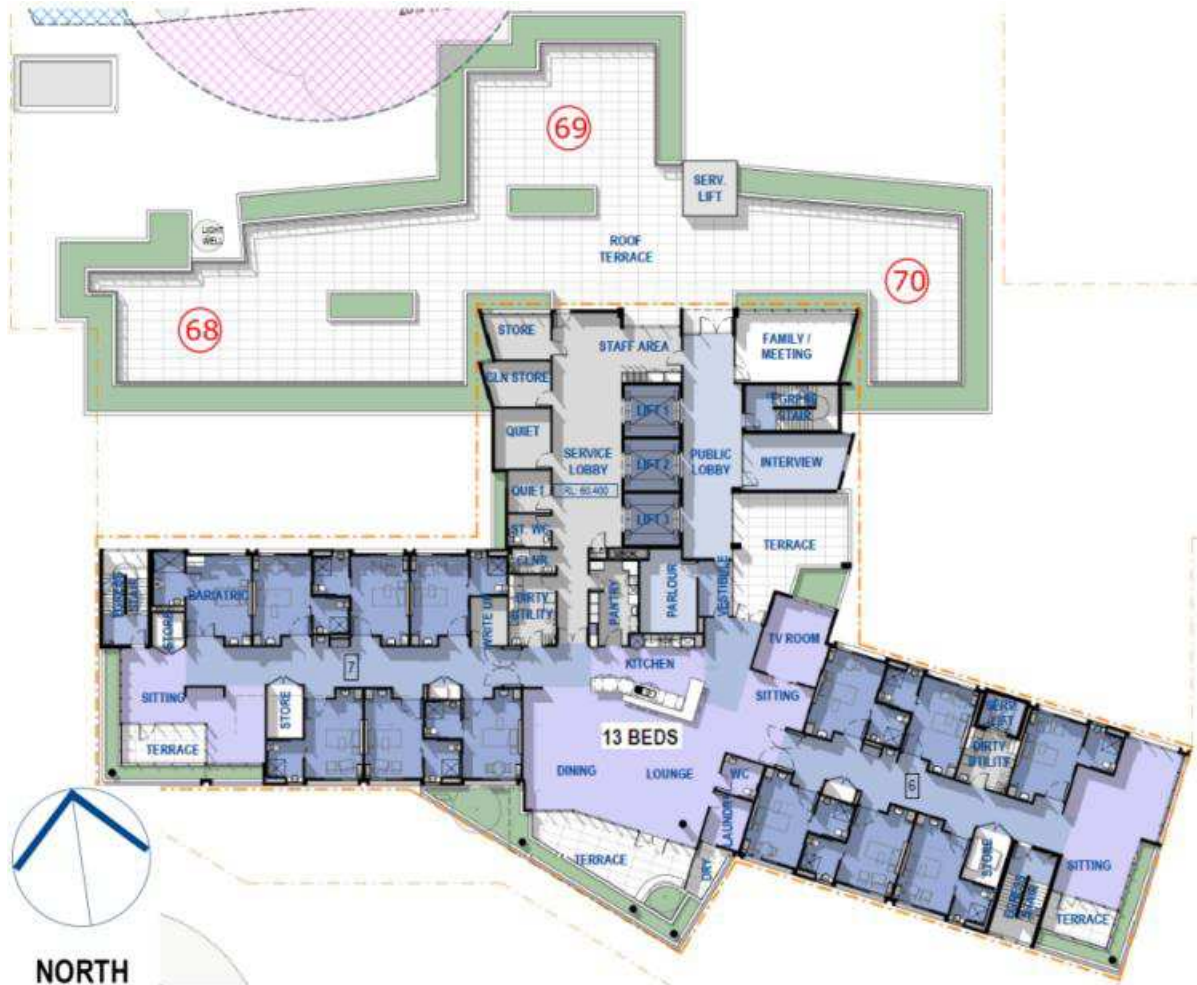


Figure 23: Sensor locations and numbers on Level 6.



Hospital Level 7

Figure 24: Sensor locations and numbers on Level 7.

6 Results and Discussion

The pedestrian wind environment in the footpath area, building entrance areas and communal terrace area were assessed using omnidirectional pressure sensor tests.

- **Configuration 1:** test with the proposed development and existing surrounding developments (Figure 25); and
- **Podium-Only:** a reference configuration of existing conditions (with podium only for the proposed development) (Figure 26).

The tests were conducted without any landscaping at the ground level.



Figure 25: Overall view of the proposed development model in the wind tunnel (Configuration 1).



Figure 26: Overall view of the proposed development model in the wind tunnel (podium-only conditions).

The results of omnidirectional pressure sensor tests are presented as polar plots for the gust and hourly mean wind speeds and are shown in Appendix B of this report. Figure 27 and Figure 28 show the examples of these plots respectively. In Figure 27, the red circle represents the gust velocities for the safety criterion and the sets of symbols with lines represent the test predicted gust velocity for the 36 directions. In Figure 28, the colour circles represent the mean velocities for the different comfort criteria and the sets of symbols with lines represent the test predicted hourly mean velocities (GEM considered) for the 36 directions. The title of the plot also indicates the sensor number and the required criterion for this location.

Figure 27 and Figure 28 showed that at Location 1 measured wind speeds were within both the safety criterion and recommended walking criterion respectively for two configurations.

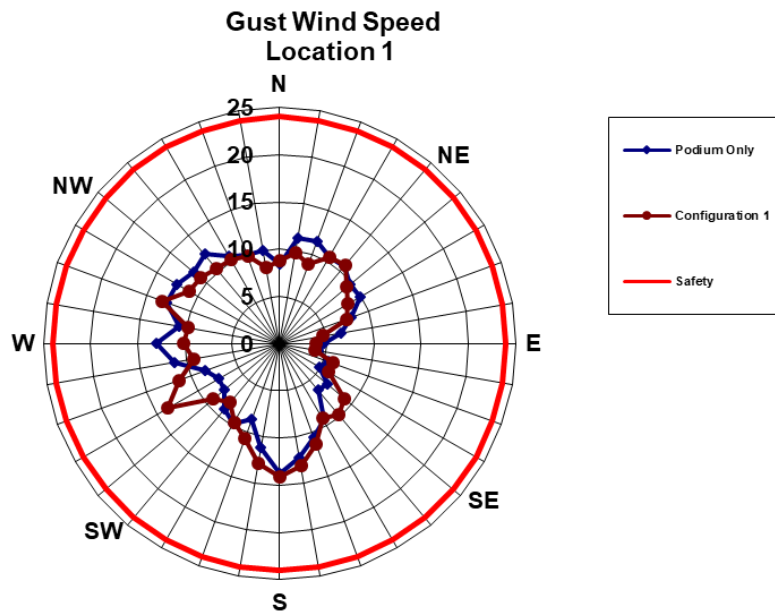


Figure 27: Polar plot of the gust wind speeds compared to the safety criterion (Location 1).

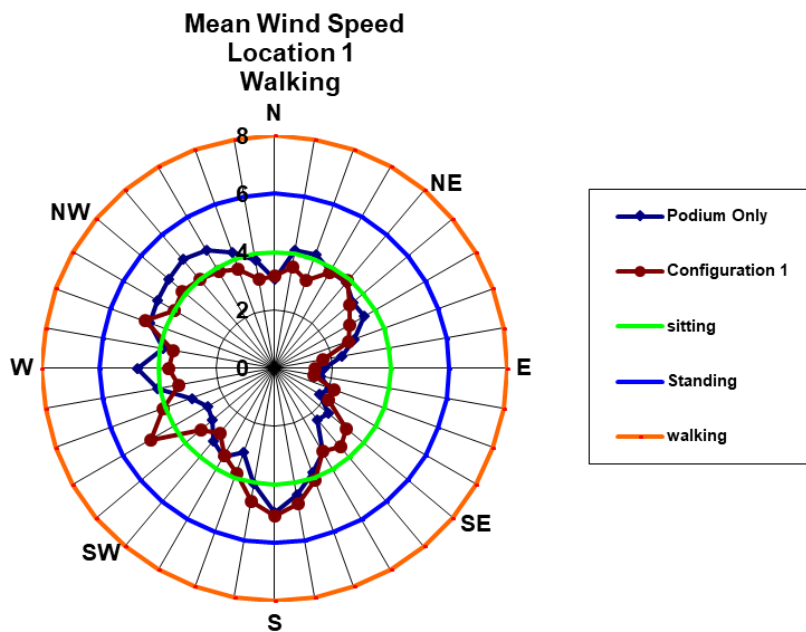


Figure 28: Polar plot of the hourly mean wind speeds compared to the comfort criterion (Location 1).

Based on the tests conducted, the following points were observed:

6.1 Safety Criterion Test

All tested locations measured gust wind speeds within the safety criterion for the proposed development for Configuration 1. As such, no recommendation for wind amelioration was provided.

6.2 Comfort Criteria

6.2.1 Public Footpaths and Accessways

All pedestrian pathways immediately surrounding the proposed development measured GEM wind speeds within the recommended walking comfort criterion for Configuration 1, with most locations reaching wind speeds within the more stringent standing or sitting comfort criteria. As such, no recommendation for wind amelioration was provided.

6.2.2 Building Entrances

All main building entrances into the proposed development, represented by Locations 27, 31, 32, 37, 39, 40, 43 and 46 measured wind speeds within the recommended standing comfort criterion for the tested configuration. Most locations measured wind speeds within the more stringent sitting comfort criterion. As such, no recommendation for wind amelioration was provided.

6.2.3 External Play / Dining Areas

The external play / dining areas for the proposed development, represented by Location 47, measured wind speeds exceeding the recommended sitting comfort criterion from most directions, with the north west recording wind speeds exceeding the least stringent walking comfort criterion. As such, 1.5m high solid wind screens are recommended at strategic locations to ameliorate wind conditions (Figure 29).

6.2.4 Outdoor Communal Terraces

All outdoor communal terraces (represented by Locations 50 to 70) were tested with 1.0m high solid balustrades along the perimeter.

Most outdoor communal terraces measured wind speeds within the recommended walking comfort criterion, with most locations measuring wind speeds within the more stringent standing or sitting comfort criteria. Location 66, however, measured wind speeds exceeding the recommended walking comfort criterion from the south. As such, the planter proposed at the south western corner of Level 6 is recommended to be raised to 1.5-1.8m (Figure 30).

Due to the small size of the terraces in the upper levels and proposed balustrades, wind speeds are expected to be well within the recommended walking comfort criterion, and hence were not tested.

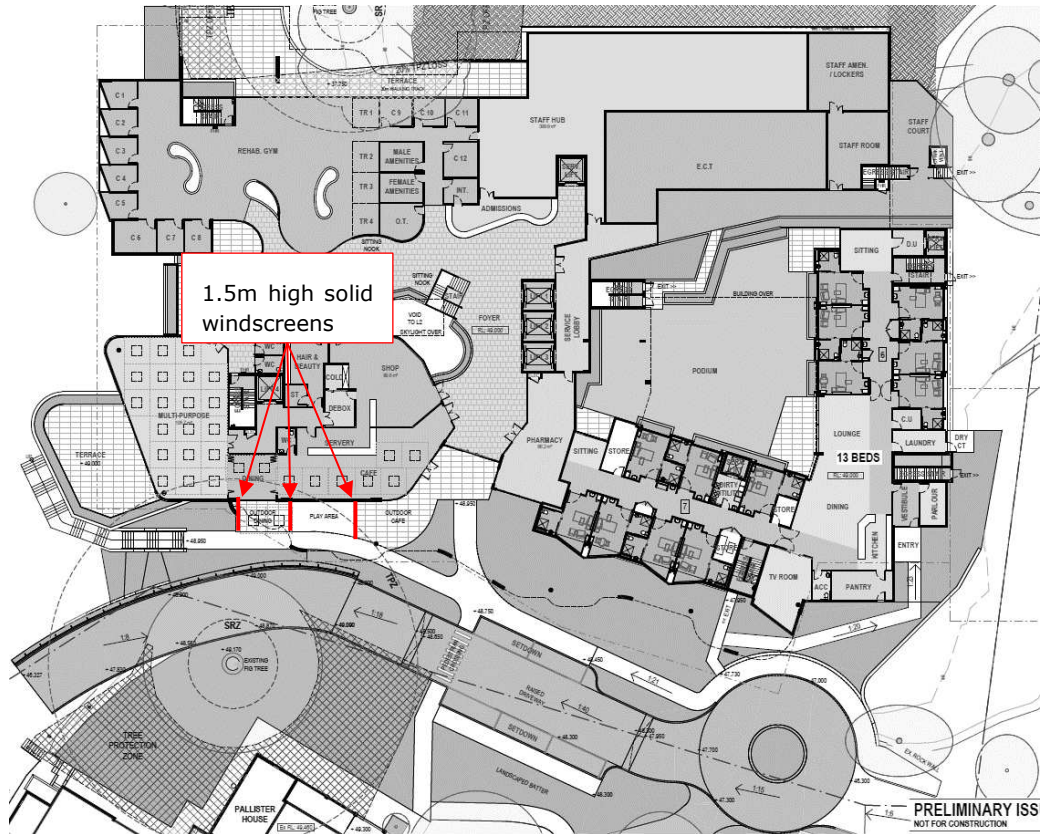


Figure 29: Level 3 plan (hospital) with wind control measure overlaid.



Figure 30: Level 5 plan (hospital) with wind control measure overlaid.

7 Additional Testing

Additional wind tunnel testing was performed on 21st March 2022 to include the Stage 4 Respite Building within the proposed development, with drawings supplied by **Bickerton Masters** in **March 2022**. All parameters remain unchanged from the original run of testing in February 2022. A close-up view of the scaled development, the recommended wind criteria and additional sensor locations and numbers are shown in Figure 31 to Figure 33 respectively.



Figure 31: Close-up view of the 1:400 scale model in the wind tunnel.

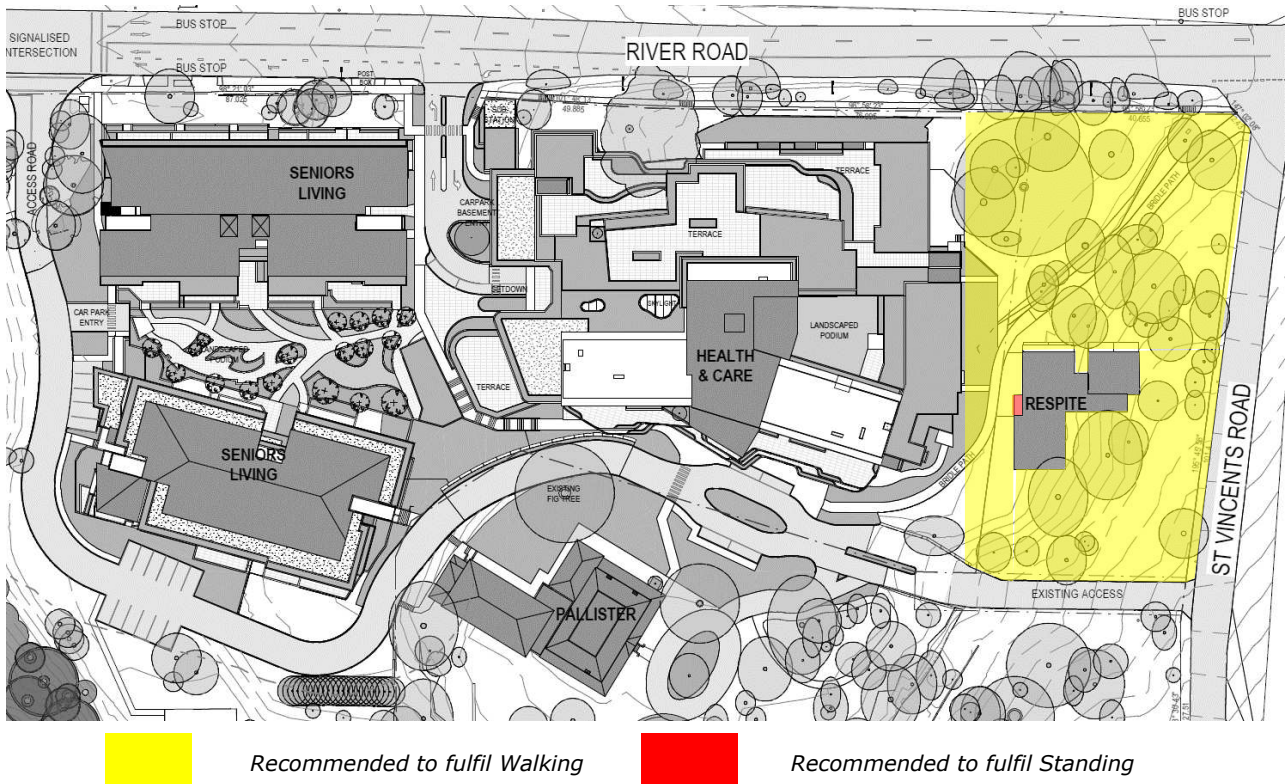


Figure 32: Site plan for the proposed development with recommended comfort criteria overlaid around the Respite Building.

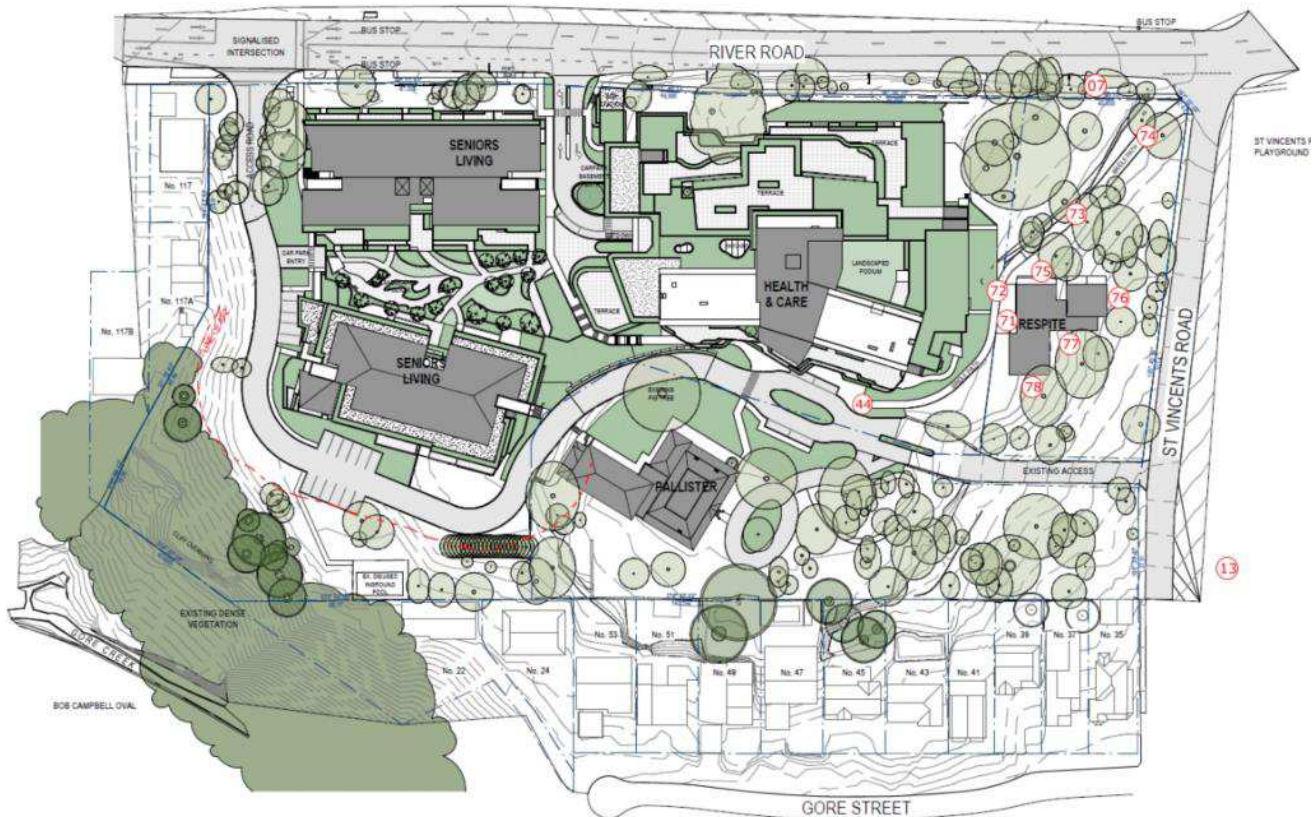


Figure 33: Sensor numbers and locations around the Respite Building for additional testing.

Based on the tests conducted, the following points were observed:

- i. All tested locations measured gust wind speeds within the safety criterion for Configuration 1. As such, no recommendation for wind amelioration was provided;
- ii. All pedestrian pathways immediately surrounding the Respite Building (represented by Locations 72-78) measured GEM wind speeds within the recommended walking comfort criterion for Configuration 1, with most locations reaching wind speeds within the more stringent standing or sitting comfort criteria. As such, no recommendation for wind amelioration was provided.
- iii. The main building entrance into the Respite Building, represented by Location 71, measured wind speeds within the recommended standing comfort criterion for the tested configuration. As such, no recommendation for wind amelioration was provided.
- iv. Locations 7, 13 and 44 were tested again for comparison of wind speed results with and without the Respite Building. Results have shown that wind speeds achieved between the February 2022 and March 2022 testing are very similar (refer to Appendix D for comparison). Hence it can be concluded that the wind speeds recorded at all locations during February 2022 testing are still valid.

8 Conclusion

HammondCare commissioned Vipac Engineers and Scientists Ltd to carry out wind tunnel tests of the likely pedestrian level wind conditions of the proposed development at **Greenwich Hospital, NSW**.

Wind conditions in these areas have been assessed based on wind safety and comfort criteria from the Central Sydney Planning Strategy. The findings of the wind tunnel assessment are summarised below:

The proposed design of the development:

- Fulfils the recommended criterion for **safety** at all test locations;
- Fulfils the recommended criterion for **walking** at all footpath locations;
- Fulfils the recommended criterion for **standing** at all building entrances;
- Fulfils the recommended criterion for **sitting** at all external play / dining areas **with the recommendations**; and
- Fulfils the recommended criteria for **walking** at all outdoor communal terraces **with the recommendations**.

As a general statement, common to all new developments, educating occupants about wind conditions at high-level terraces/balconies during high-wind events and tying down loose furniture are highly recommended.

This Report has been Prepared

For

HammondCare

By

VIPAC ENGINEERS & SCIENTISTS LTD.

Appendix A References

- [1] Australian/New Zealand Standard 1170.2:2002, Wind actions
- [2] Melbourne, W. H., "Criteria for Environmental Wind Conditions", Jour. Industrial Aerodynamics, Vol. 3, 241-249, 1978
- [3] Simiu E, Scanlan R, "Wind Effects on Structures". Wiley-Interscience
- [4] Aynsley R., Melbourne W., Vickery B., Architectural Aerodynamics Applied Science Publishers

Appendix B Drawing List

Name

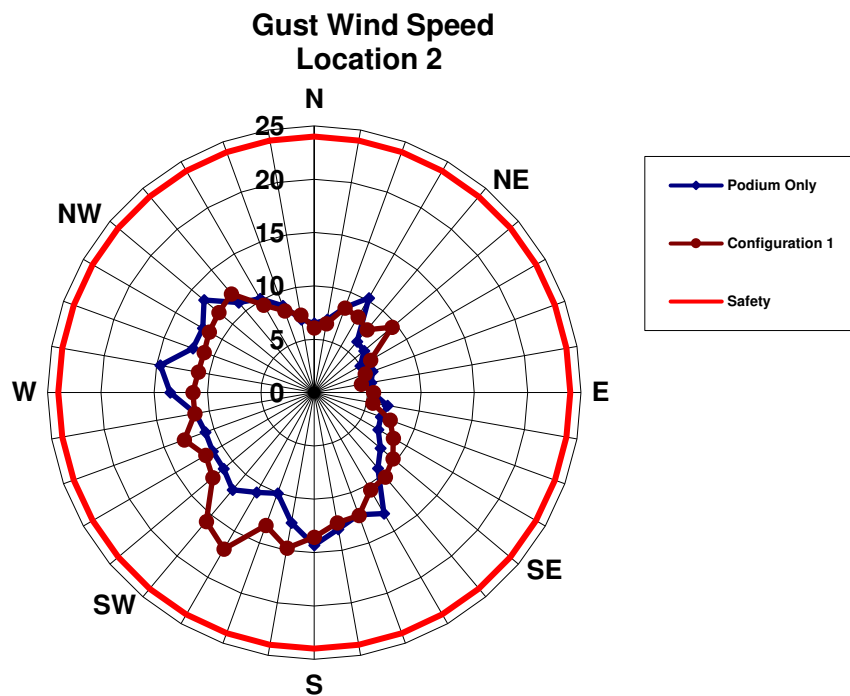
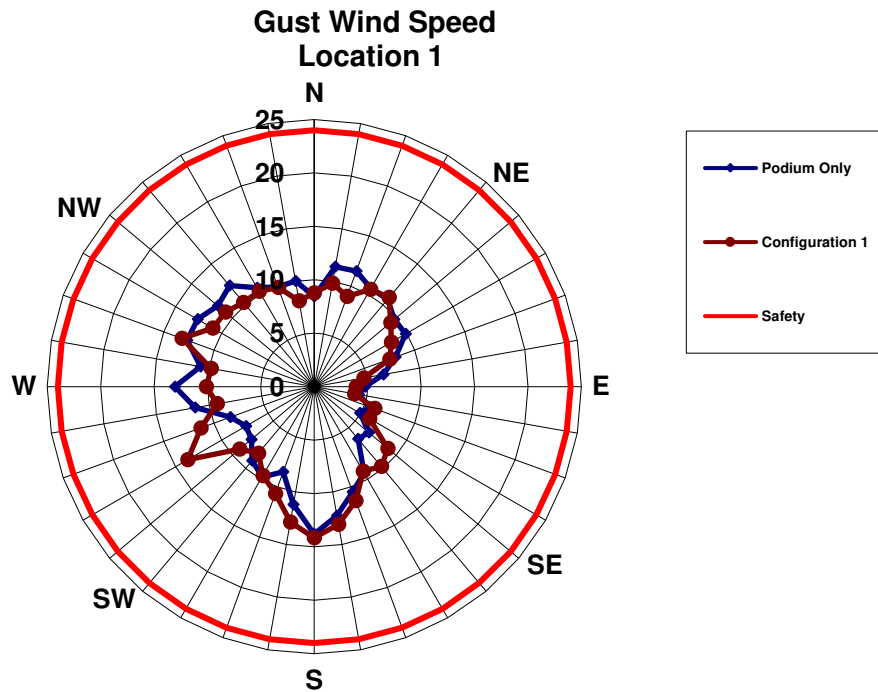
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 DD-HST-0103_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 3 (WELLNESS)_P9.pdf
 DD-HST-0104_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 4 (PODIUM)_P8.pdf
 DD-HST-0105_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 5_P7.pdf
 DD-HST-0106_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 6_P7.pdf
 DD-HST-0107_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 7_P7.pdf
 DD-HST-0108_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 8_P7.pdf
 DD-HST-0109_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 9_P7.pdf
 DD-HST-0110_HEALTH & CARE - OVERALL FLOOR PLAN - LEVEL 10 - ROOF_P7.pdf
 DD-HST-0500_EXTERNAL ELEVATIONS - SHEET 1 - OVERALL_P2.pdf
 DD-HST-0501_EXTERNAL ELEVATIONS - SHEET 2 - OVERALL_P2.pdf
 DD-HST-0502_EXTERNAL ELEVATIONS - SHEET 3_P2.pdf
 DD-HST-0503_EXTERNAL ELEVATIONS - SHEET 4_P2.pdf
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 DD-HST-0505_EXTERNAL ELEVATIONS - SHEET 6_P2.pdf
 DD-HST-0506_EXTERNAL ELEVATIONS - SHEET 7_P2.pdf
 DD-HST-0507_EXTERNAL ELEVATIONS - SHEET 8_P2.pdf
 DD-HST-0600_BUILDING SECTIONS - SHEET 1_P2.pdf
 DD-HST-0601_BUILDING SECTIONS - SHEET 2_P2.pdf
 DD-HST-0602_BUILDING SECTIONS - SHEET 3_P2.pdf
 DD-SL-0100_SENIORS LIVING - OVERALL PLAN- LEVEL 1 (BASEMENT)_P2.pdf
 DD-SL-0101_SENIORS LIVING - OVERALL PLAN- LEVEL 2 (PODIUM)_P2.pdf
 DD-SL-0102_SENIORS LIVING - OVERALL PLAN- LEVEL 3_P2.pdf
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 DD-SLN-0200_SENIORS LIVING NORTH - GENERAL ARRANGEMENT PLAN - LEVEL 1 (BASEMENT)_P3.pdf
 DD-SLN-0201_SENIORS LIVING NORTH - GENERAL ARRANGEMENT PLAN - LEVEL 2 (PODIUM)_P3.pdf
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 DD-SLN-0501_SENIORS LIVING NORTH - EXTERNAL ELEVATIONS - SHEET 2_P1.pdf
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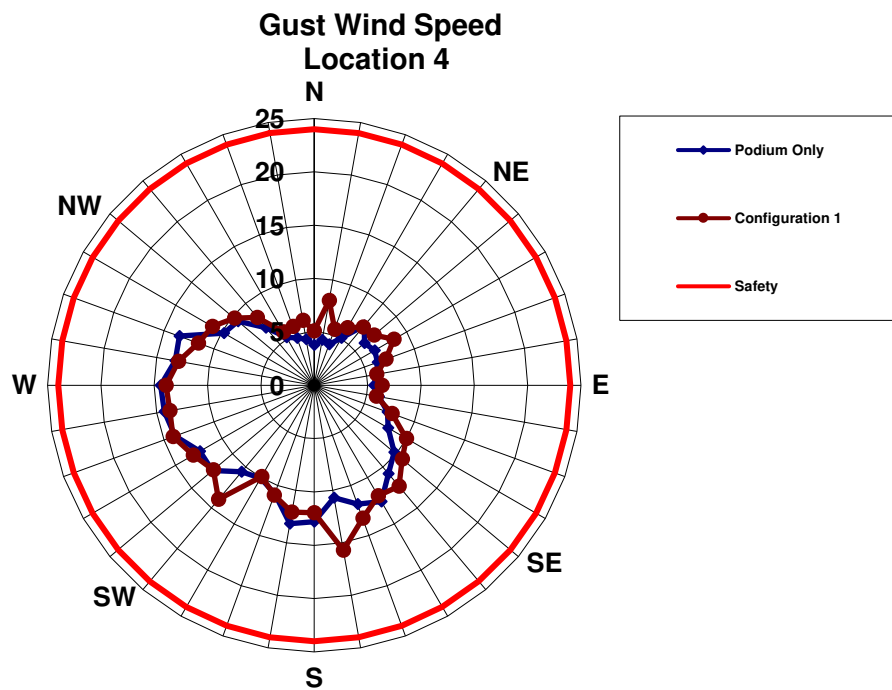
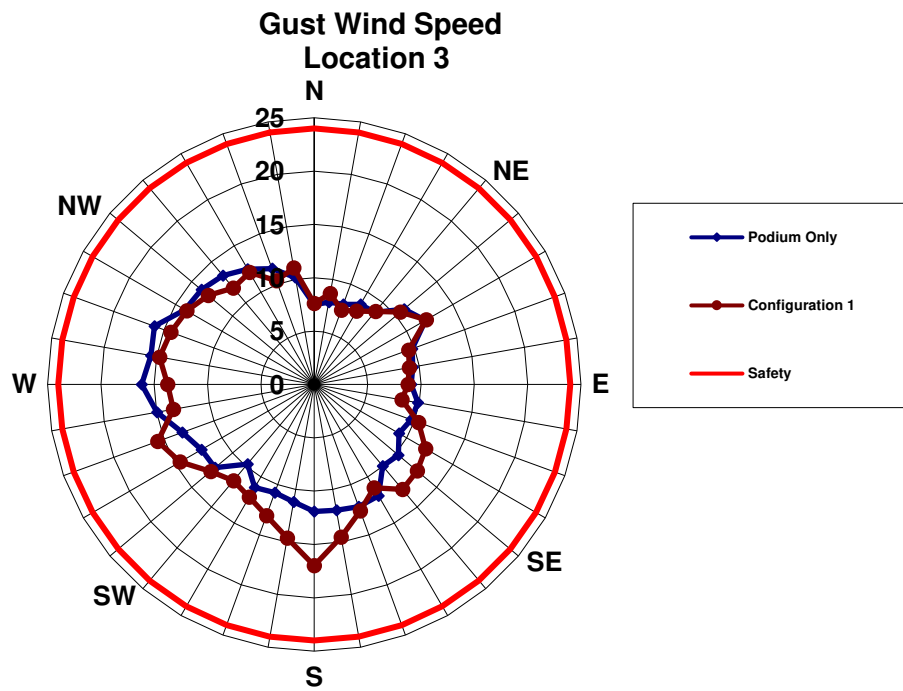
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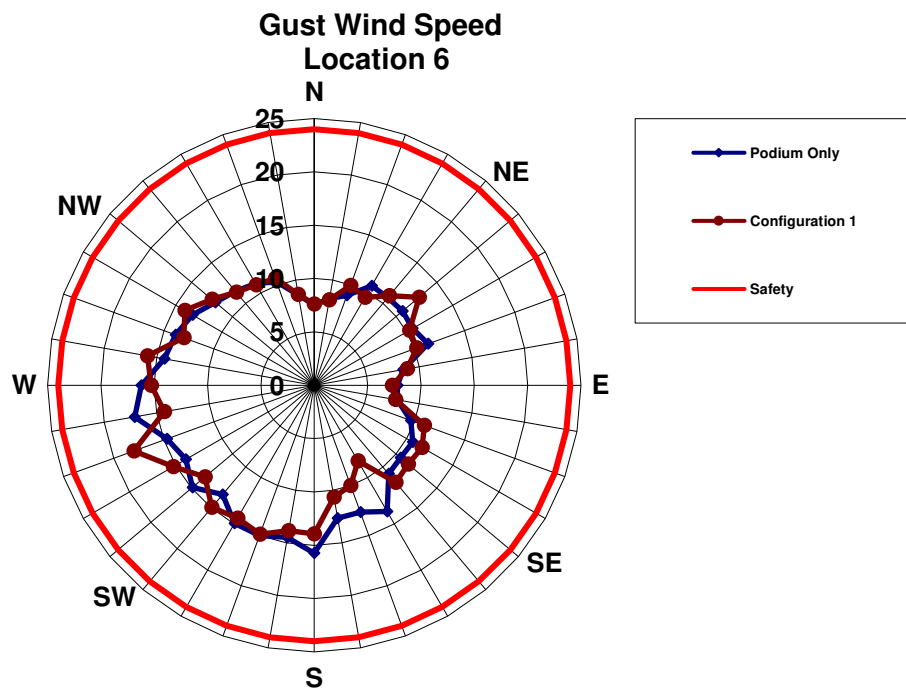
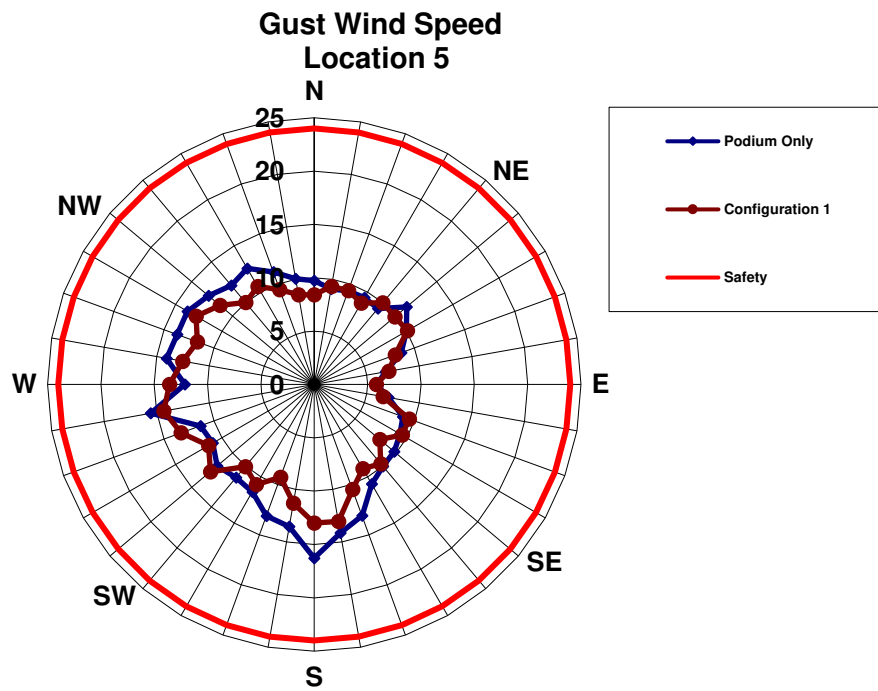
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DD-SLS-0205_SENIORS LIVING SOUTH - GENERAL ARRANGEMENT PLAN - LEVEL 6_P3.pdf
DD-SLS-0206_SENIORS LIVING SOUTH - ROOF PLAN_P2.pdf
DD-SLS-0500_SENIORS LIVING SOUTH - EXTERNAL ELEVATIONS - SHEET 1_P1.pdf
DD-SLS-0501_SENIORS LIVING SOUTH - EXTERNAL ELEVATIONS - SHEET 2_P1.pdf
DD-SLS-0502_SENIORS LIVING SOUTH - EXTERNAL ELEVATIONS - SHEET 3_P1.pdf
DD-SLS-0503_SENIORS LIVING SOUTH - EXTERNAL ELEVATIONS - SHEET 4_P1.pdf
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SLS-AR-GREENWICH_ARCHITECTURE SENIORS LIVING SOUTH FILE_E.rvt
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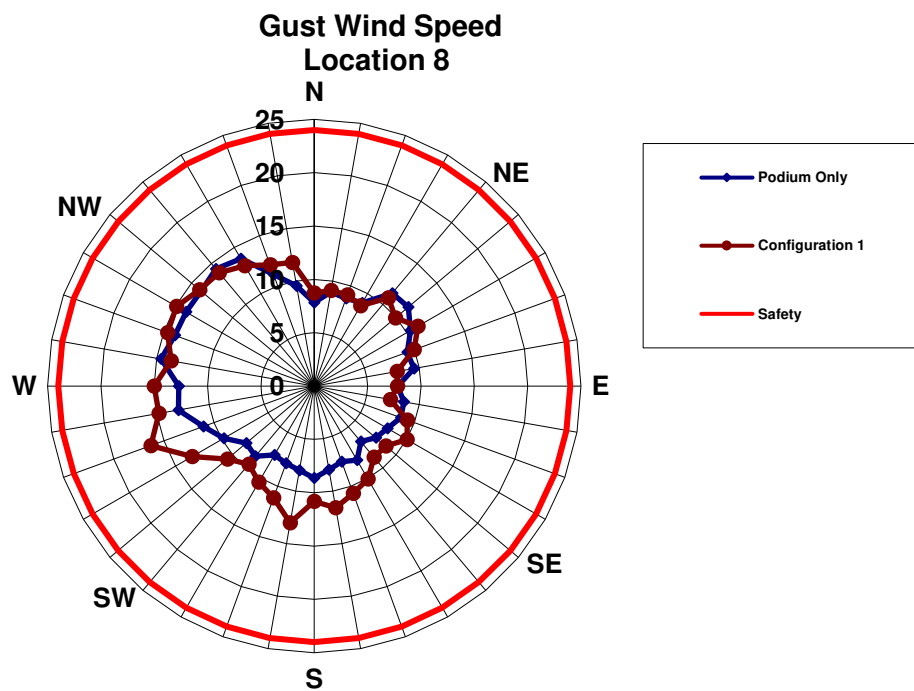
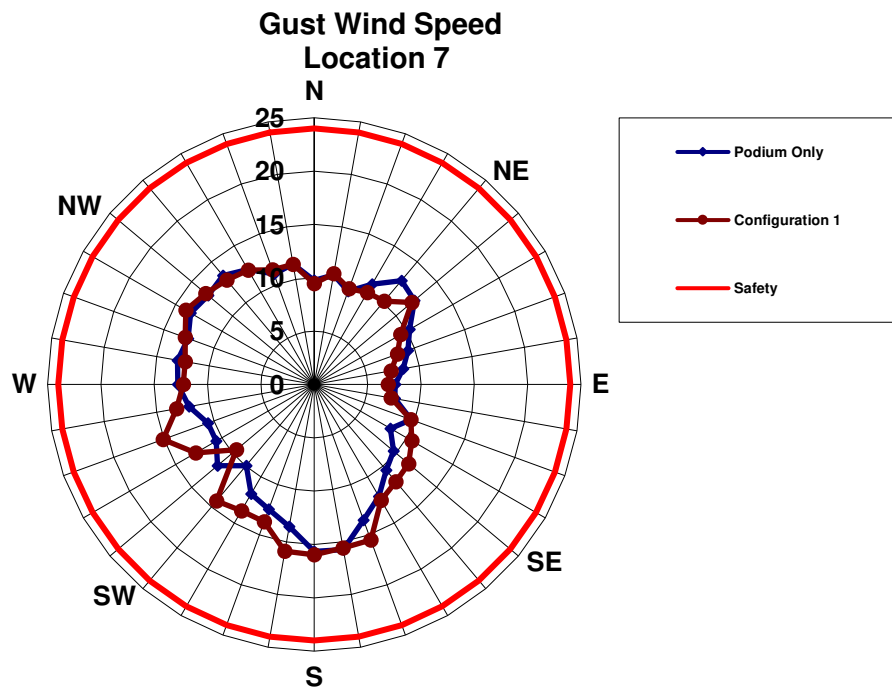
Appendix C Omnidirectional Polar Plots

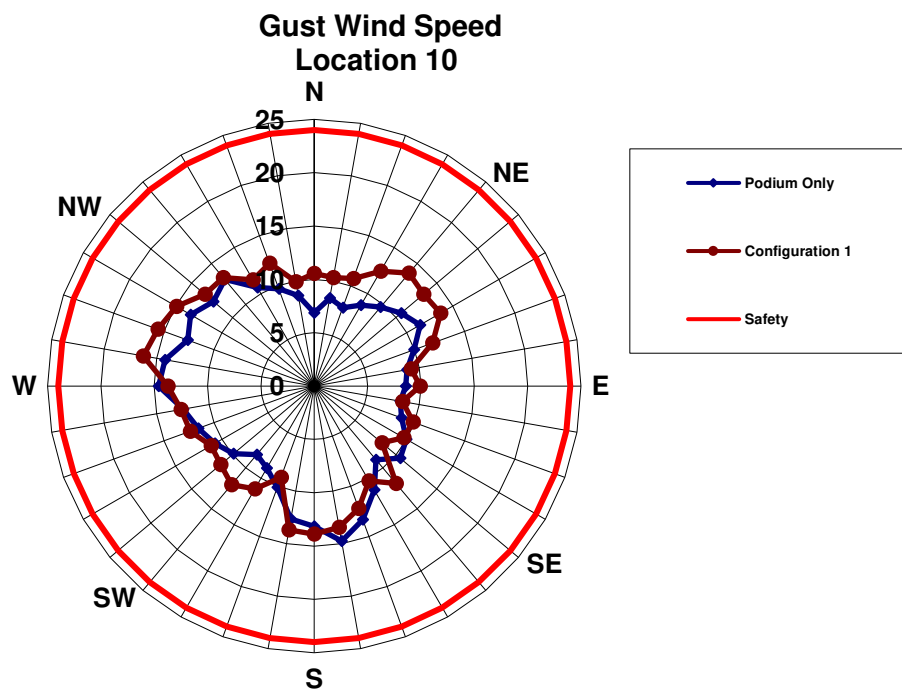
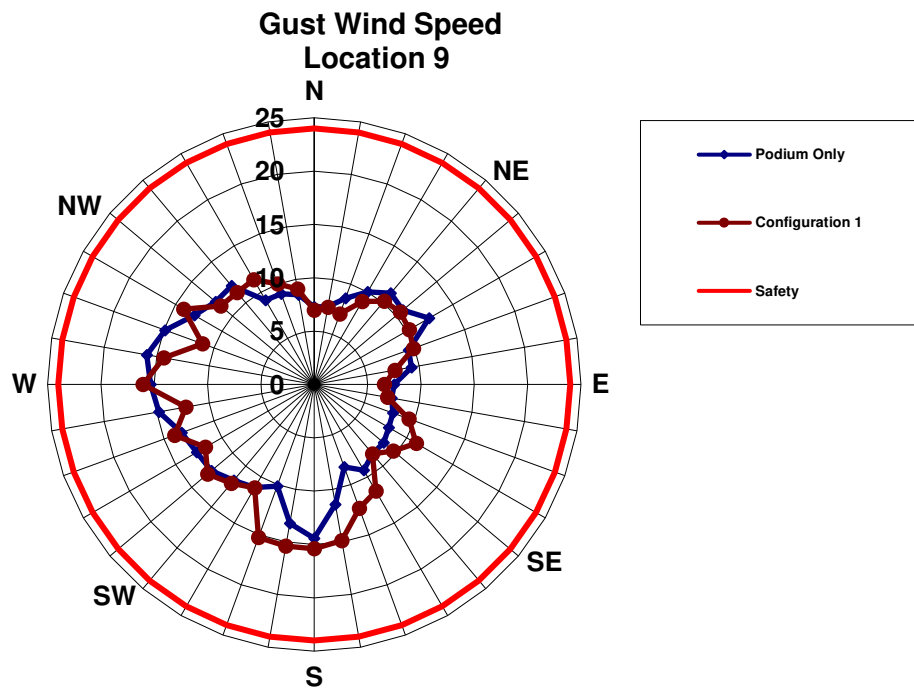
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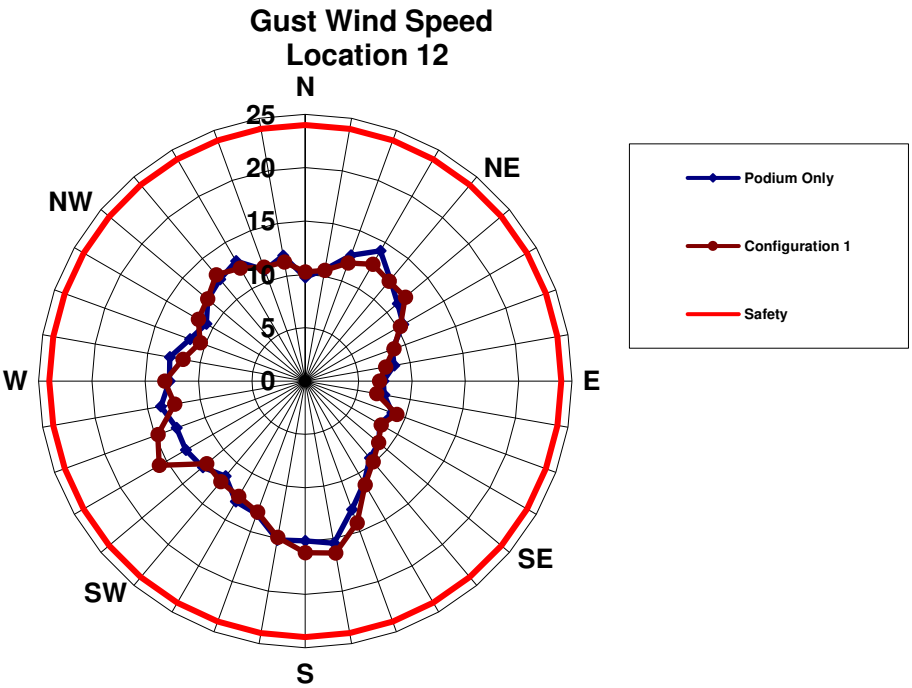
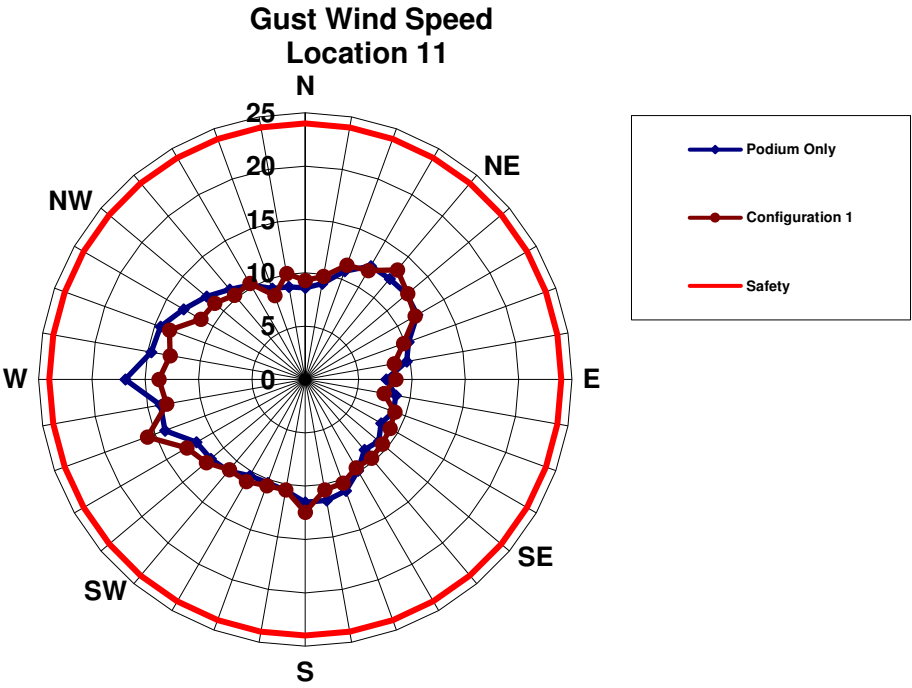


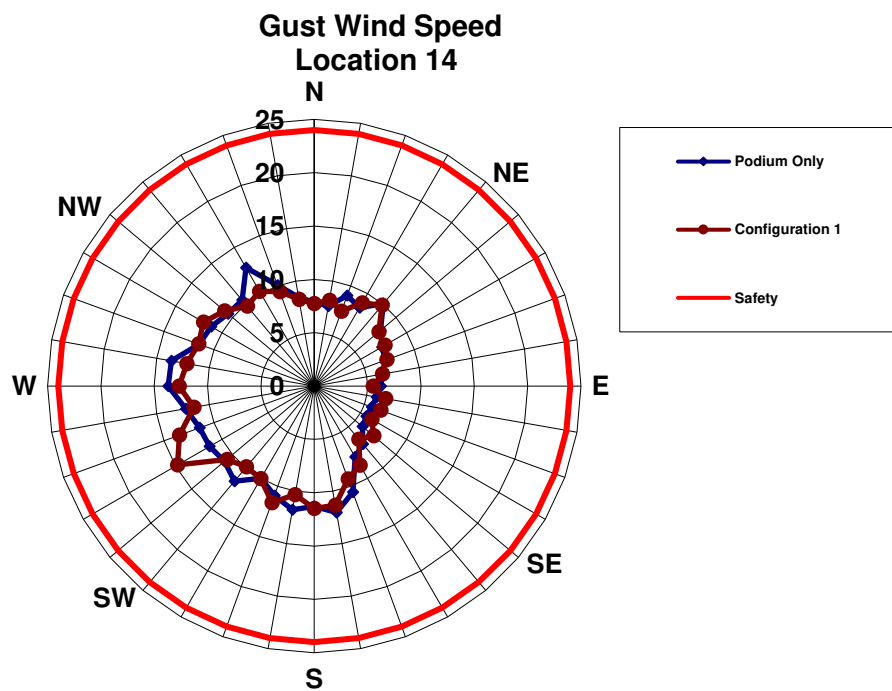
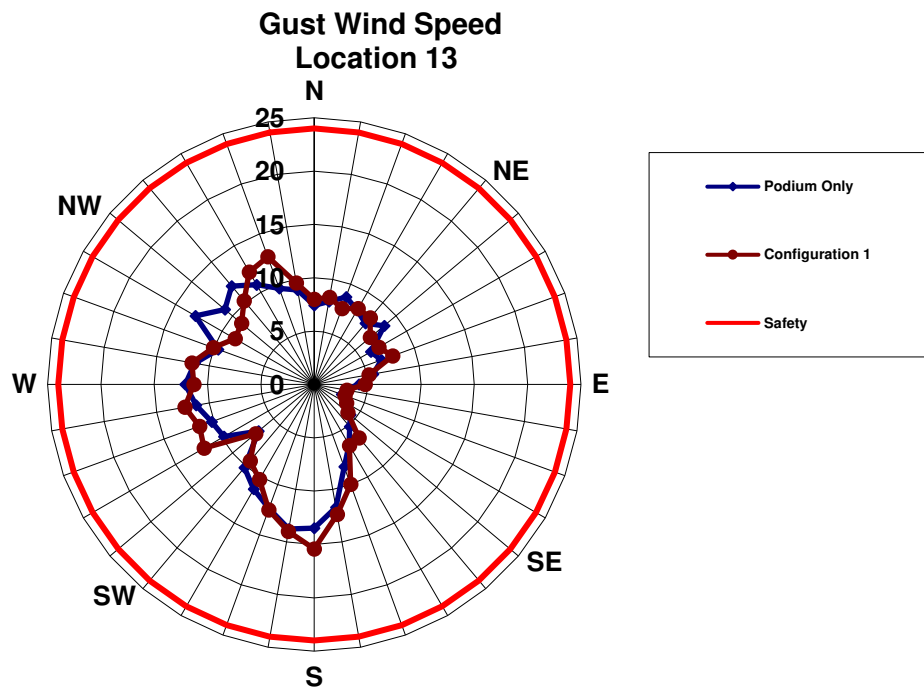


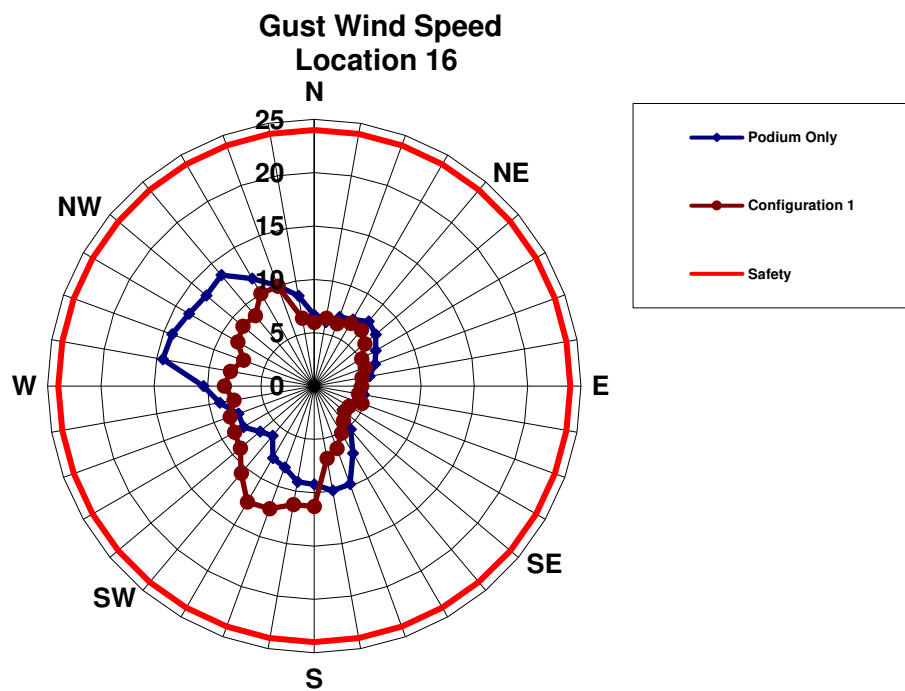
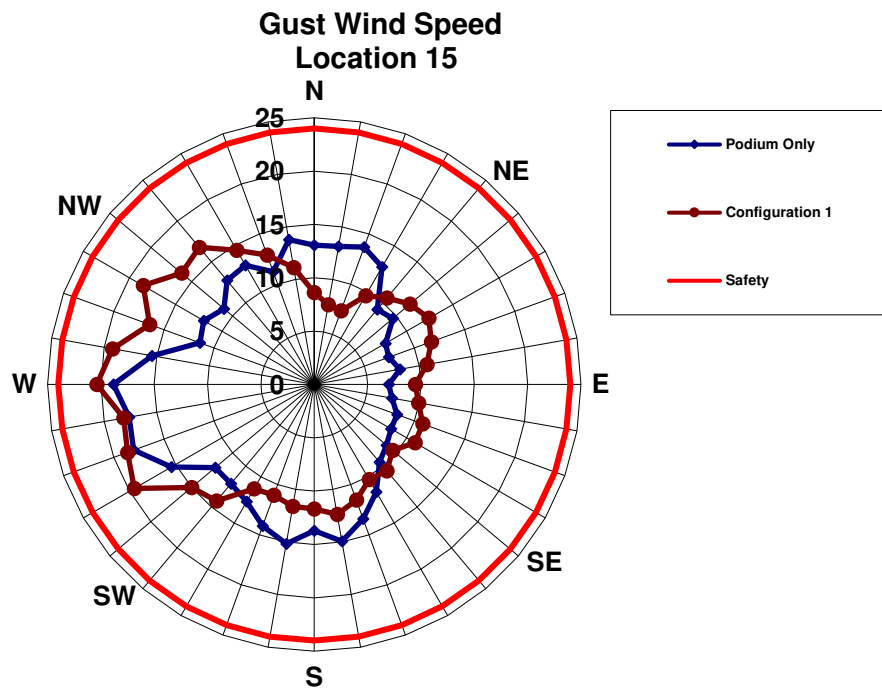


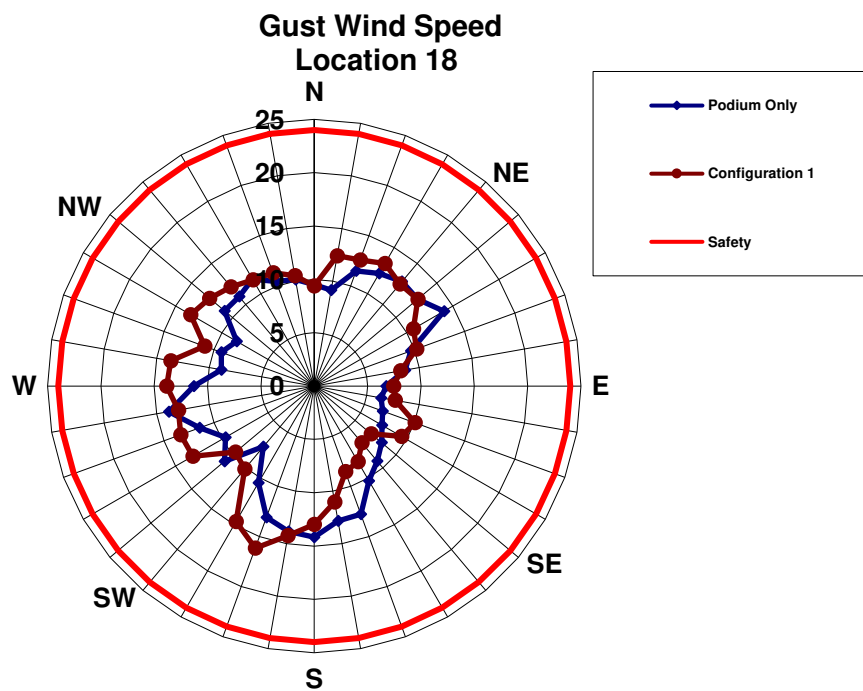
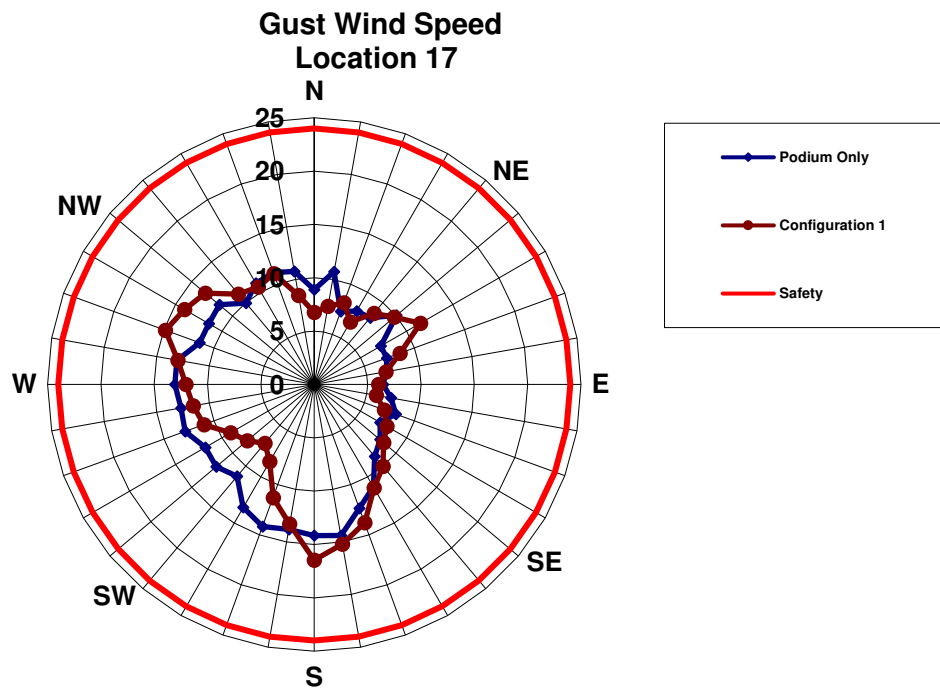


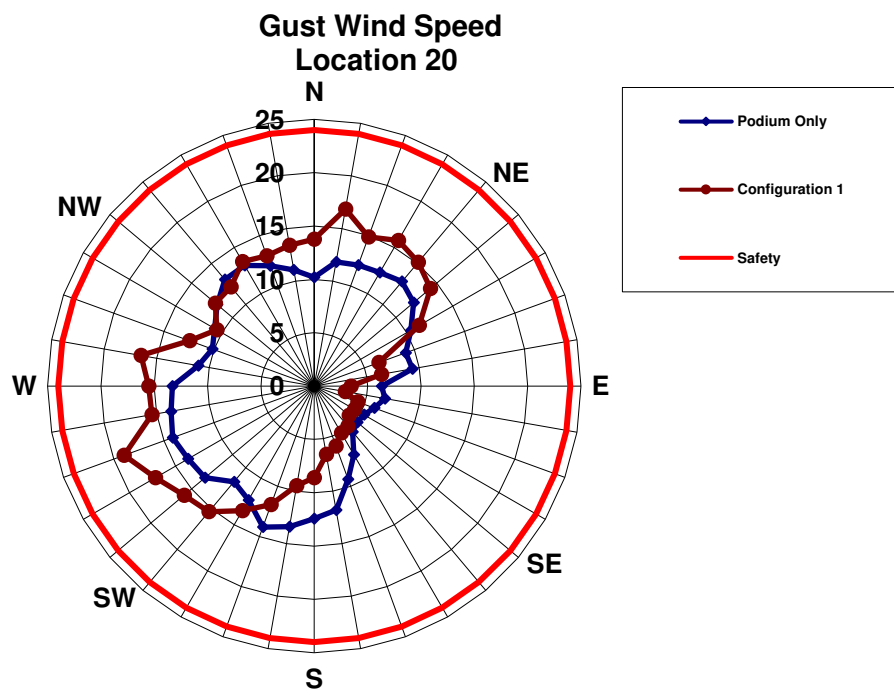
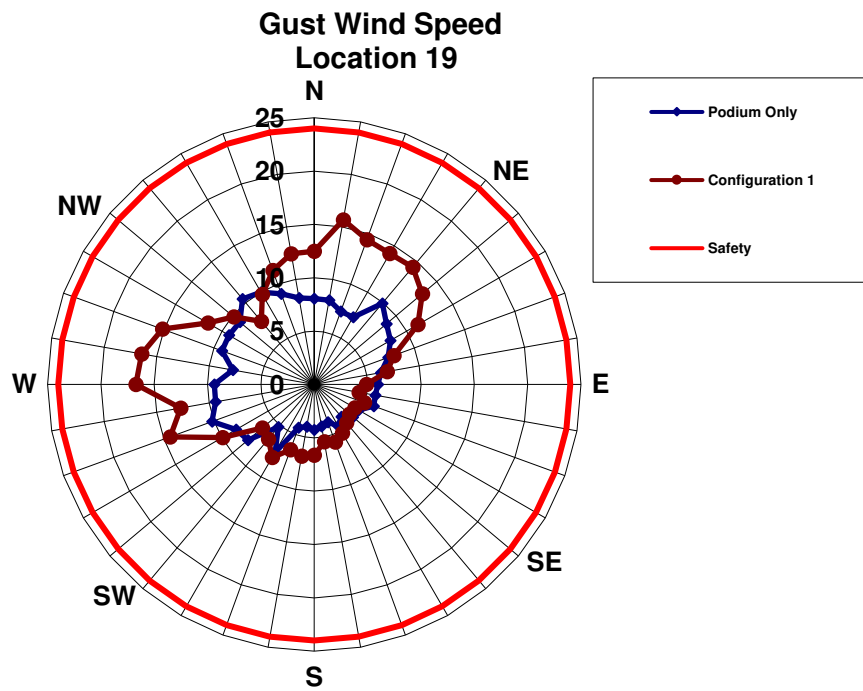


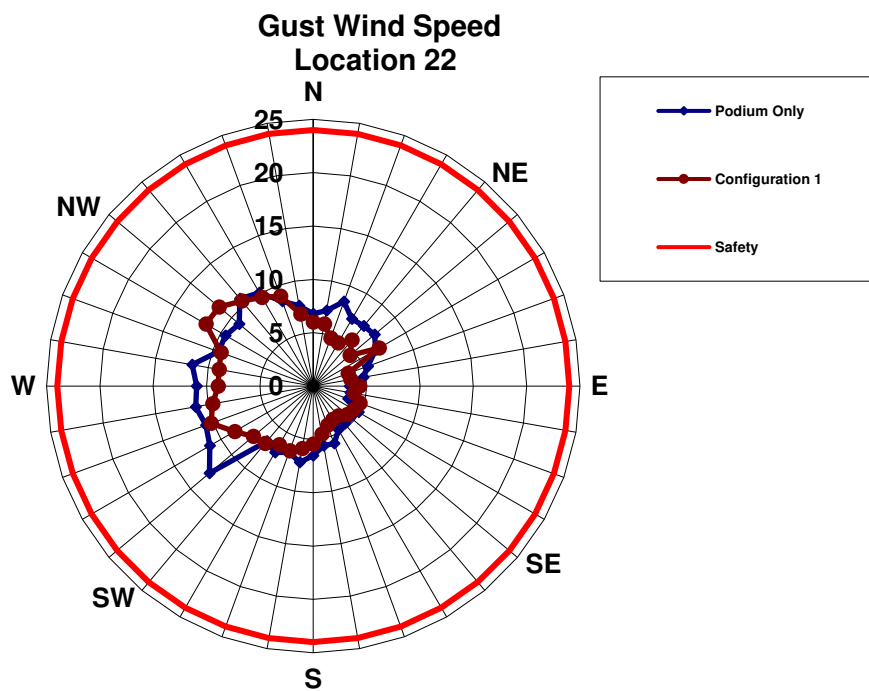
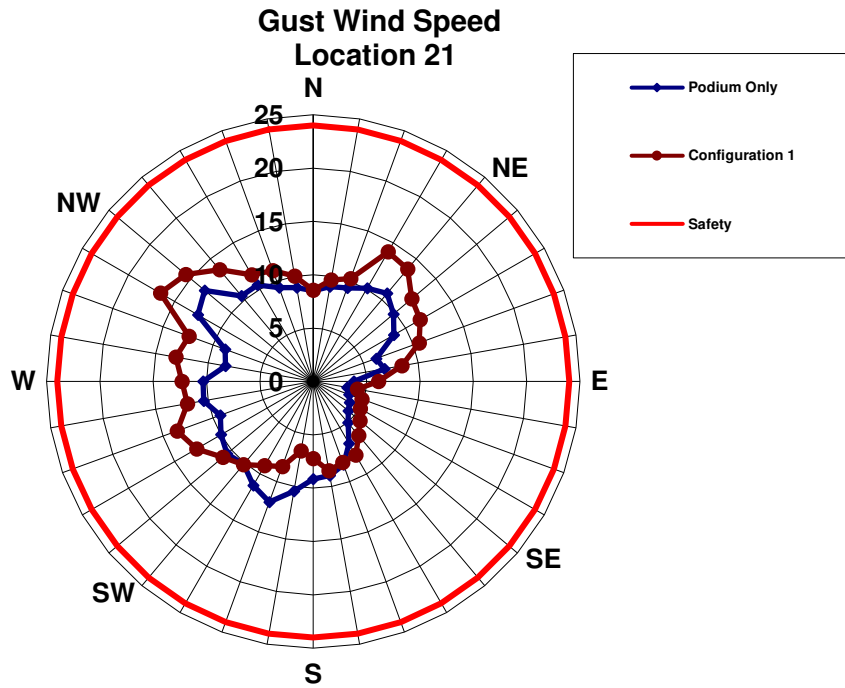


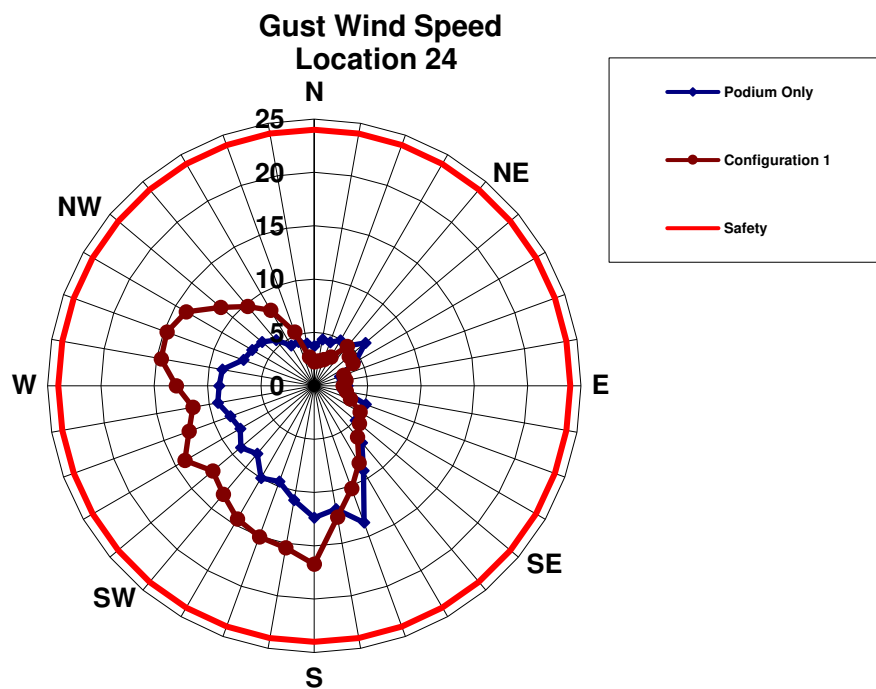
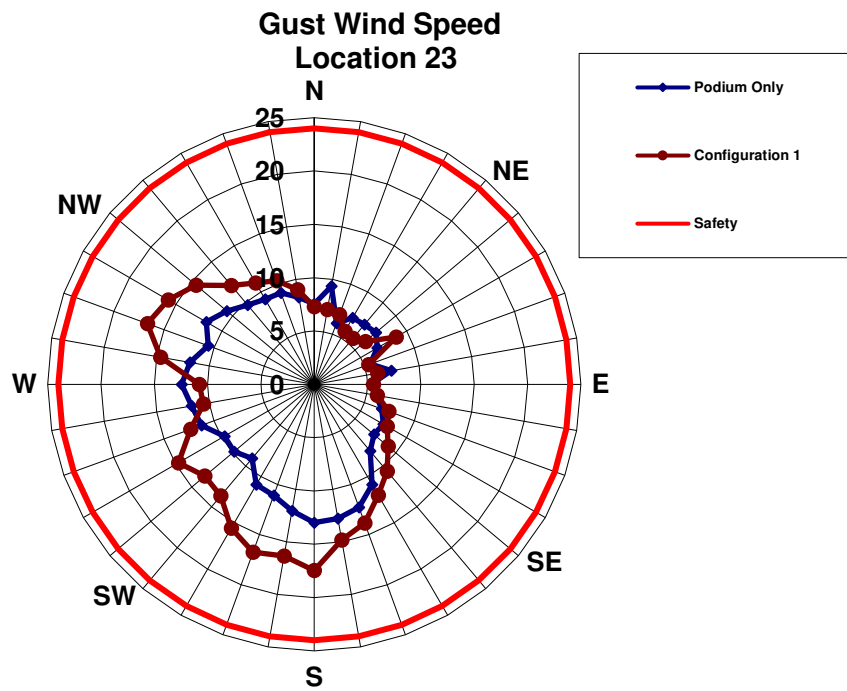


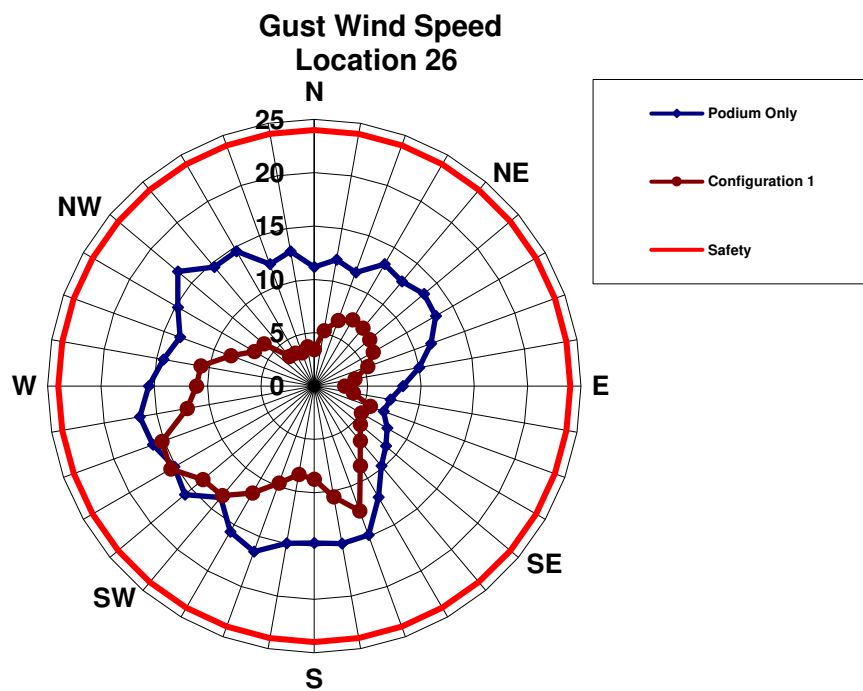
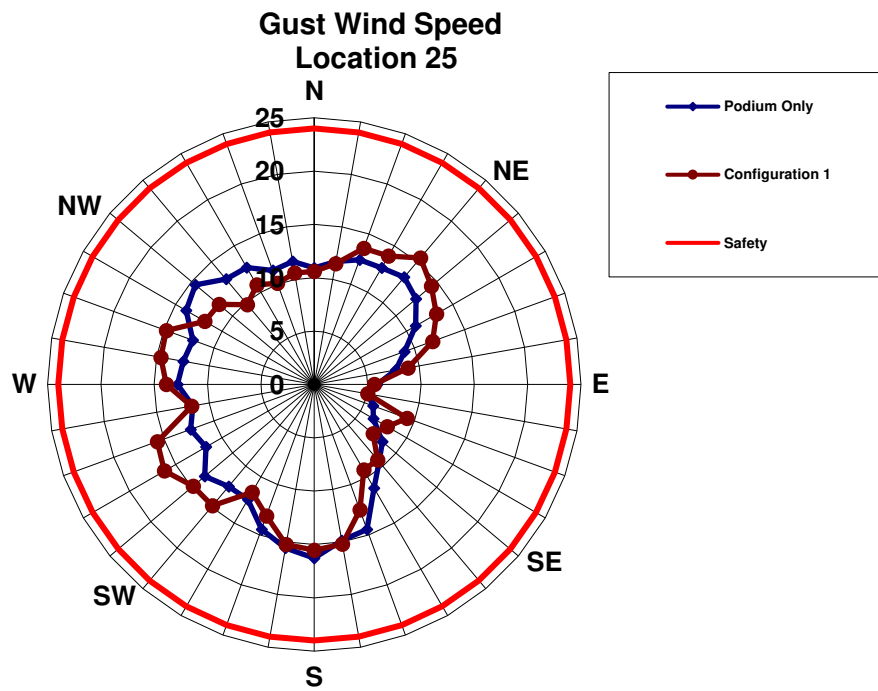


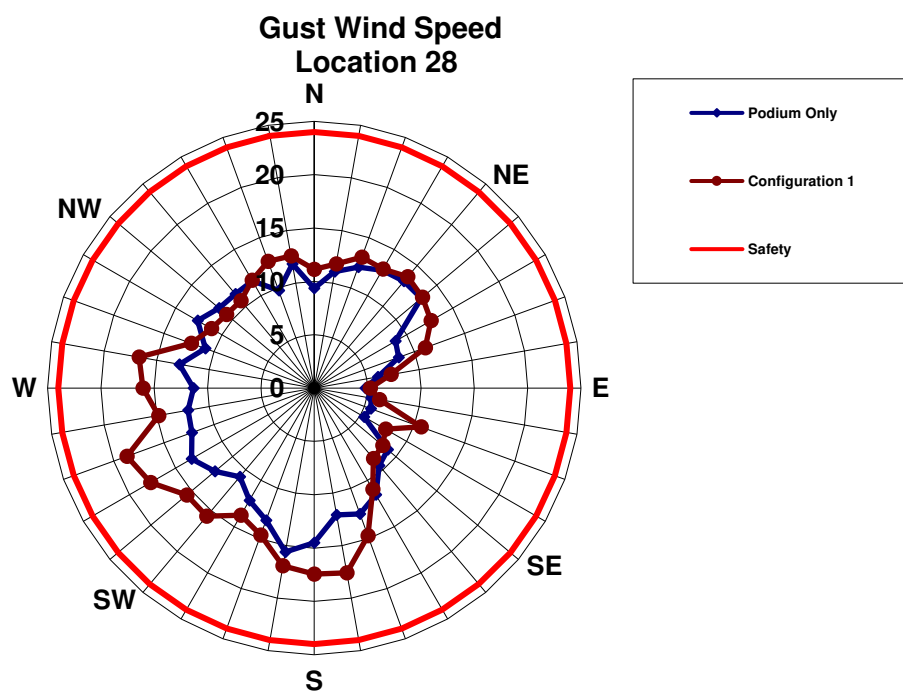
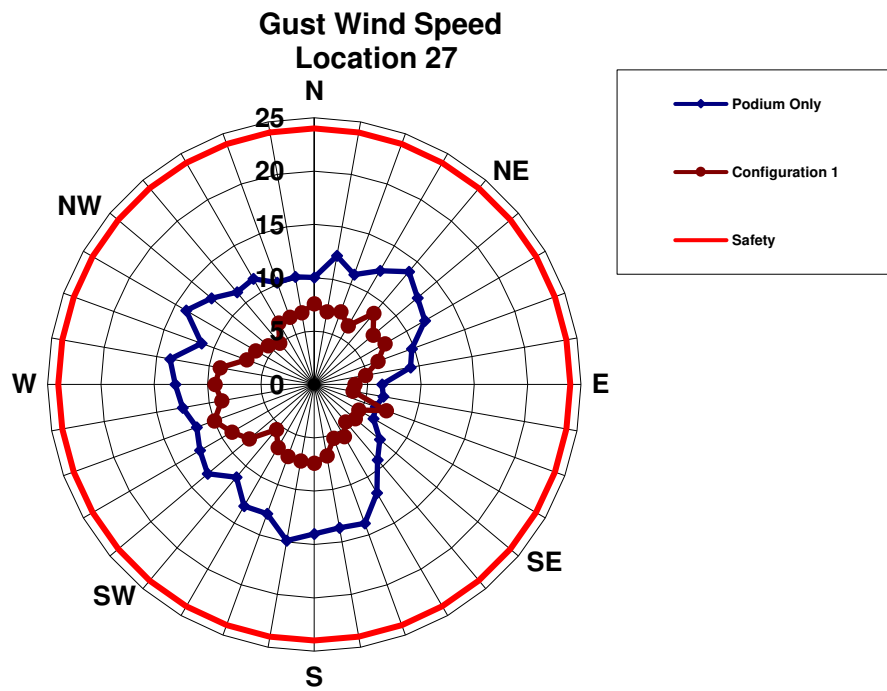


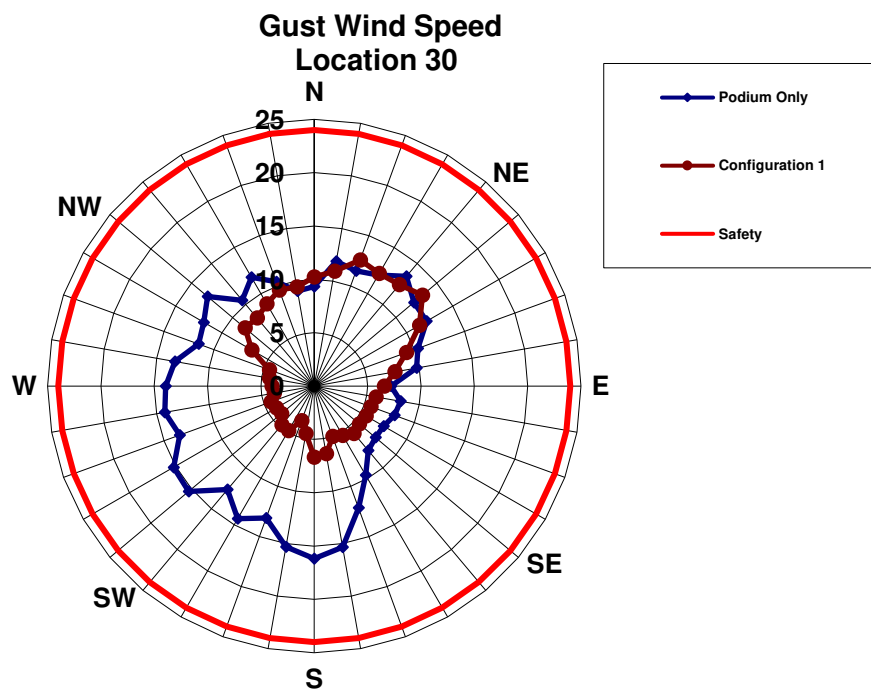
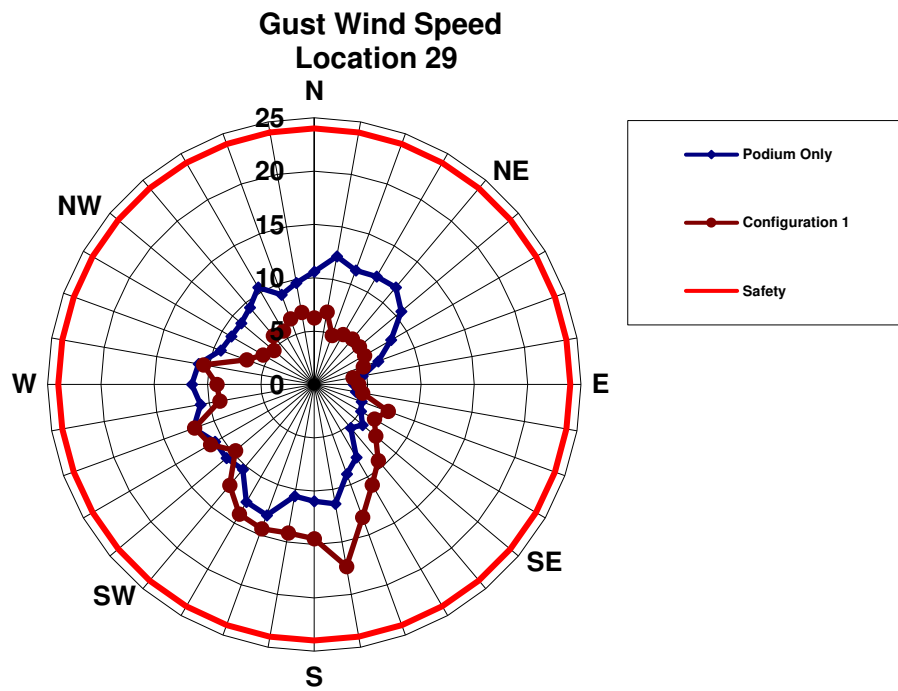


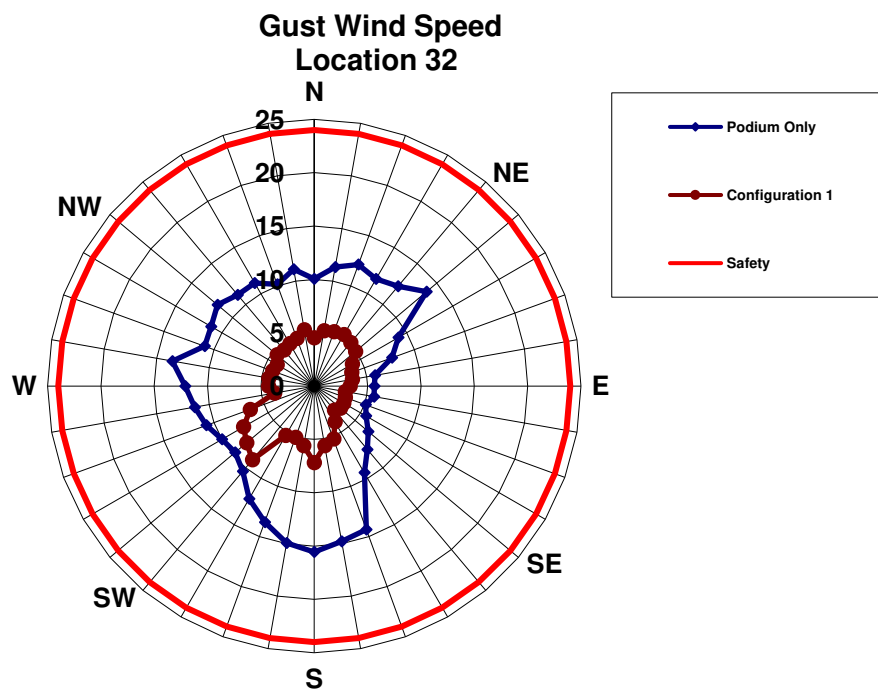
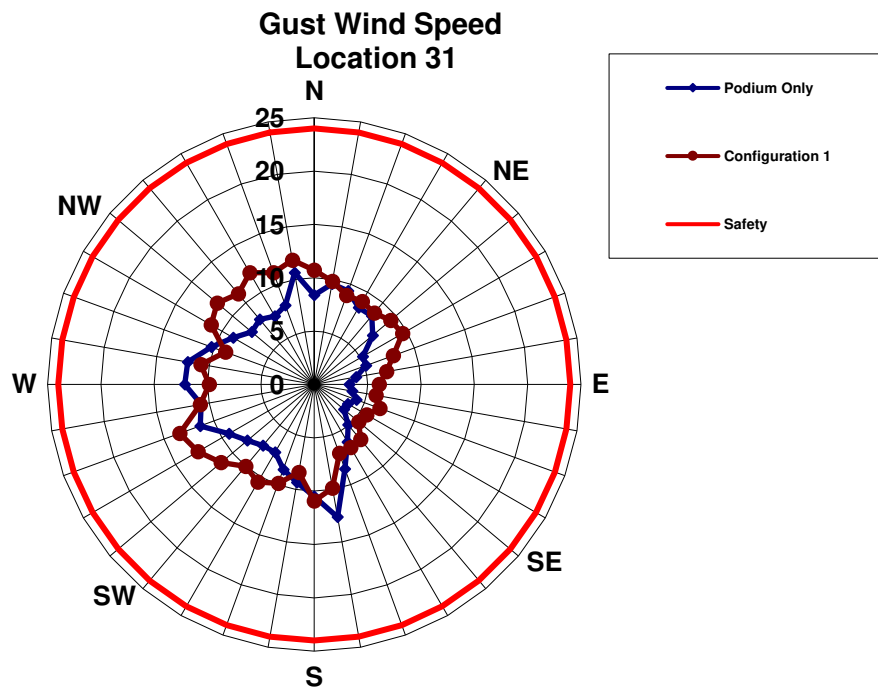


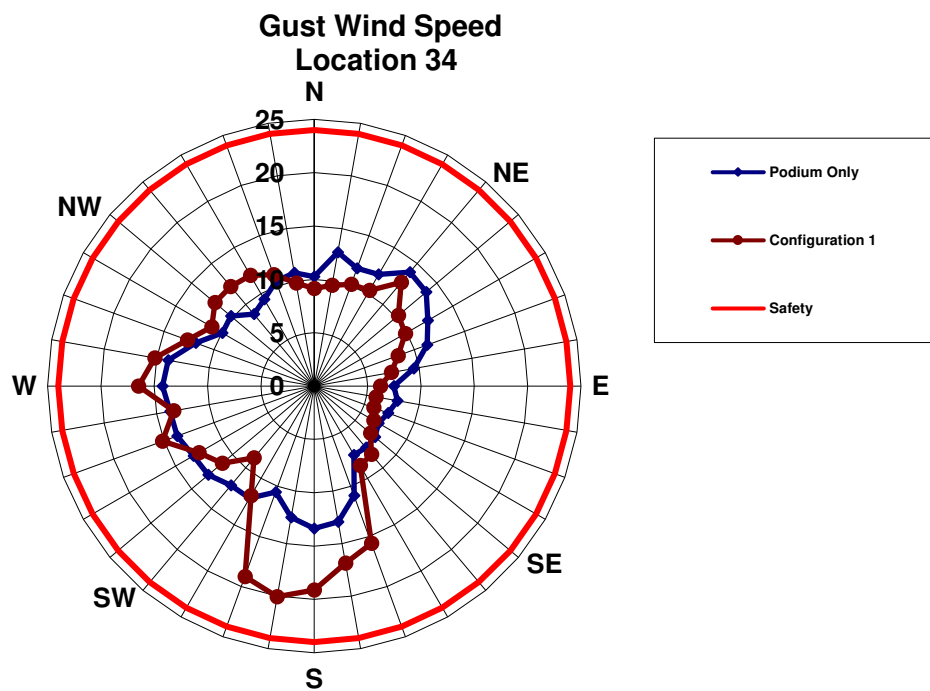
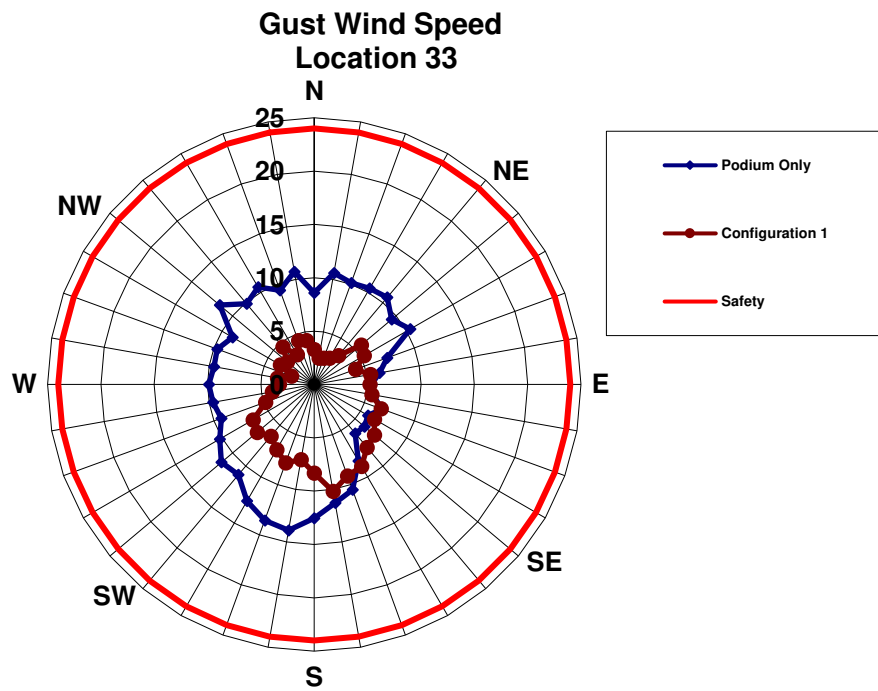


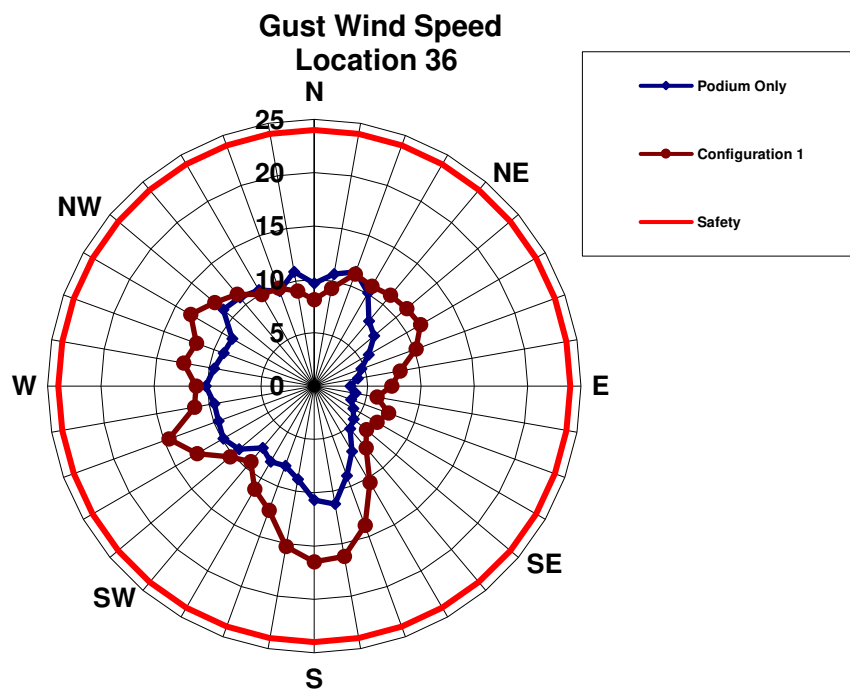
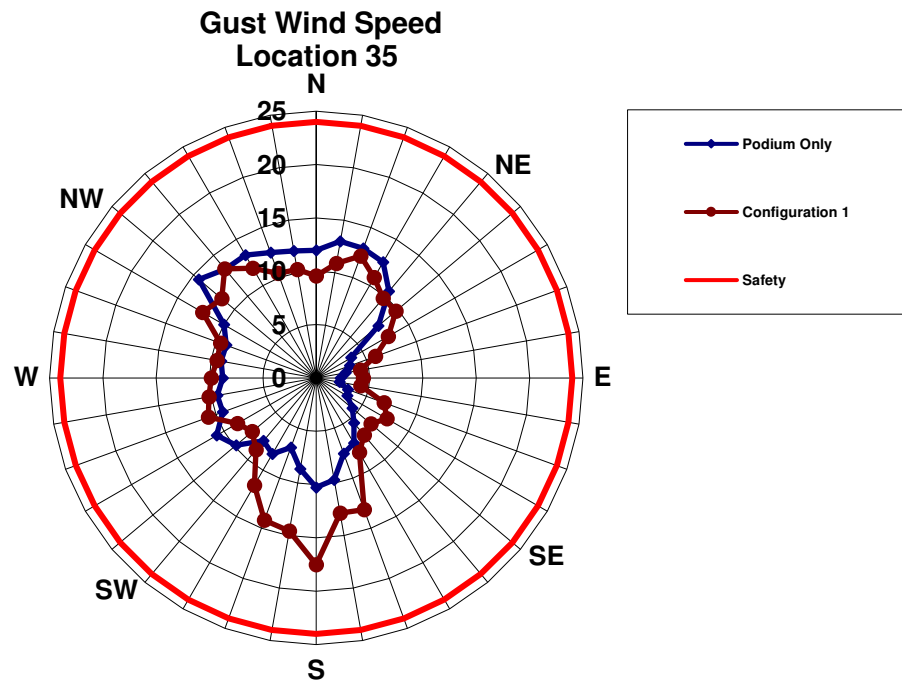


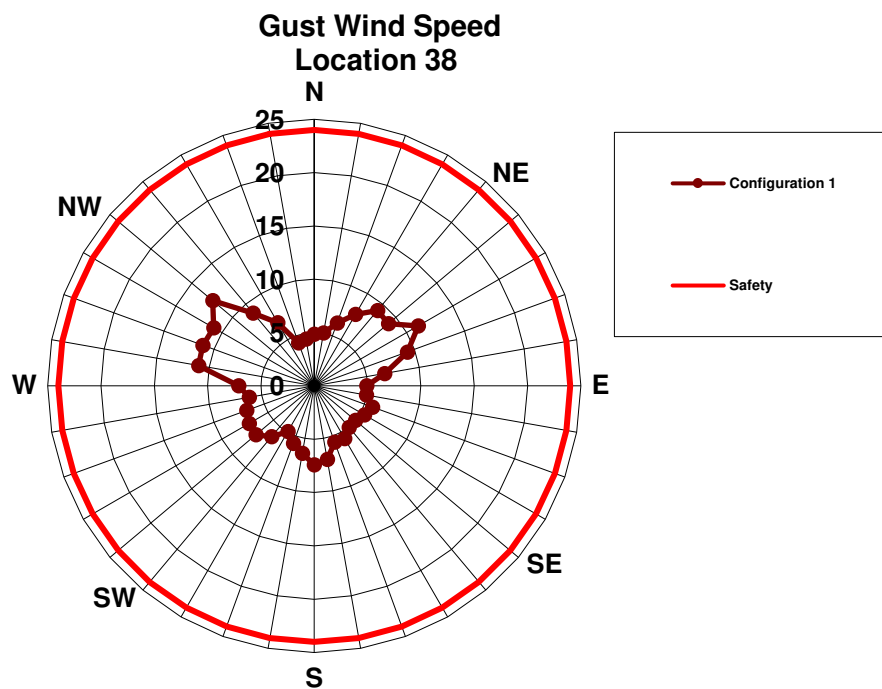
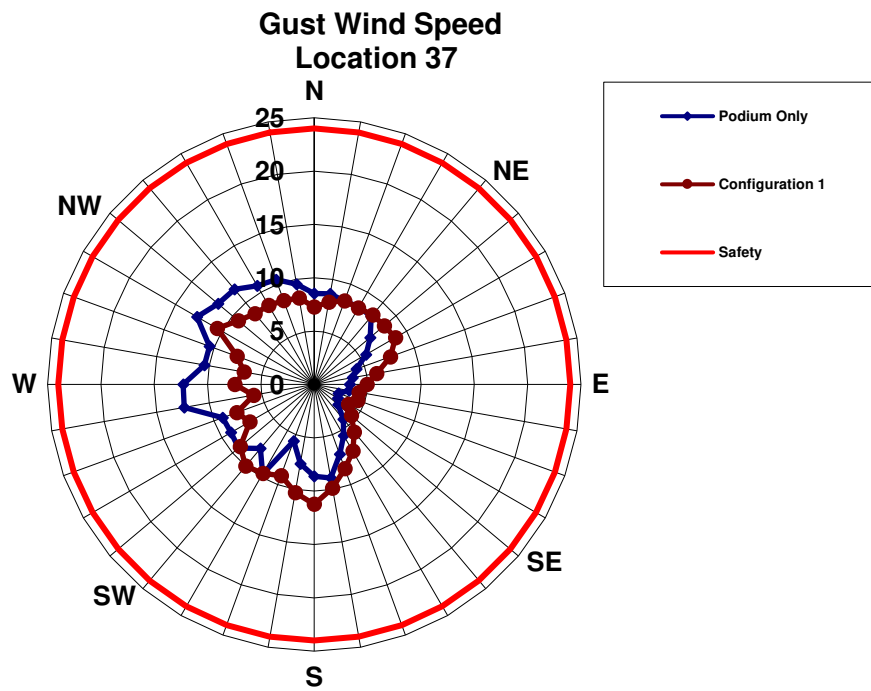


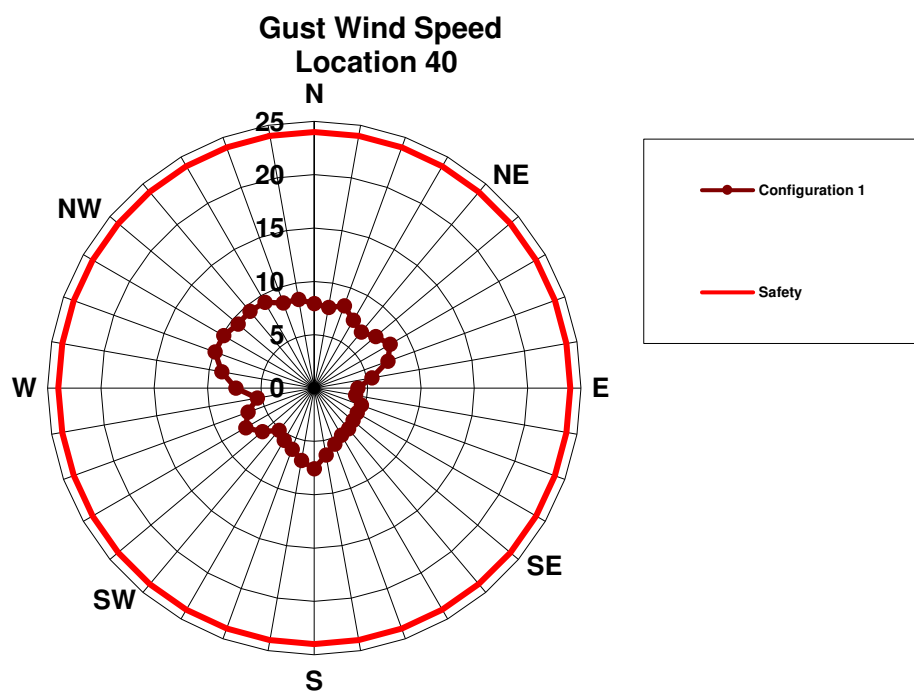
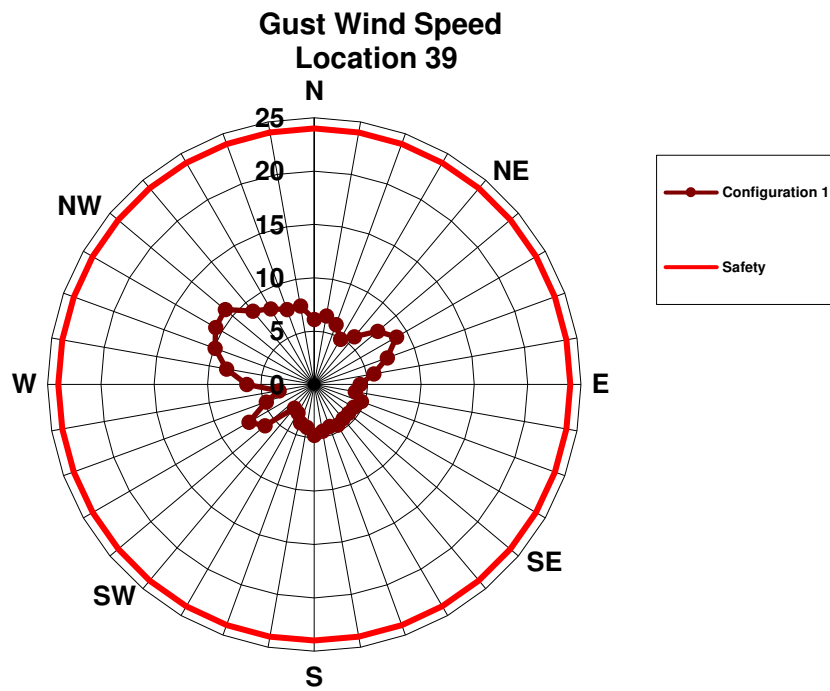


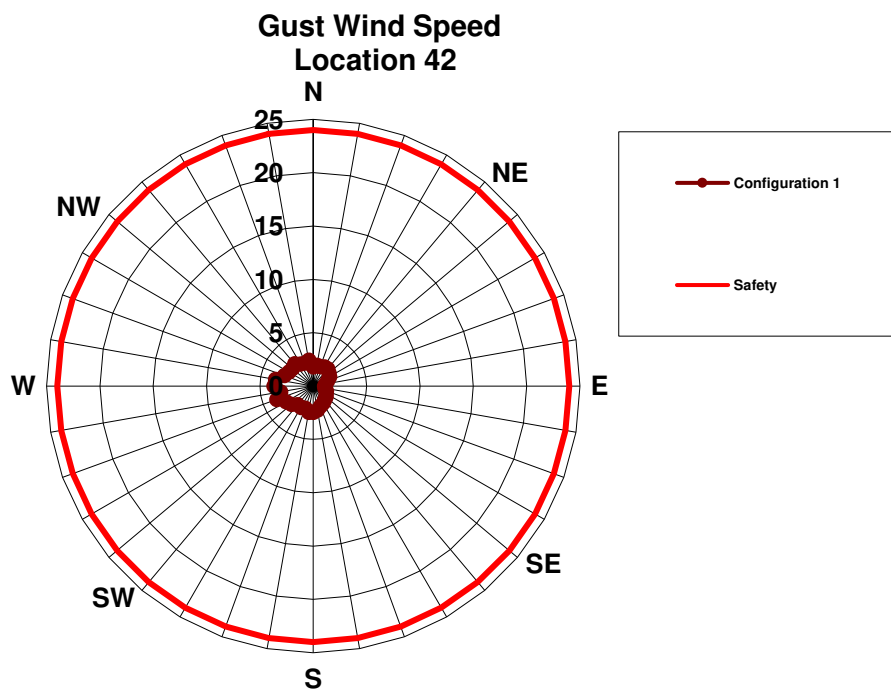
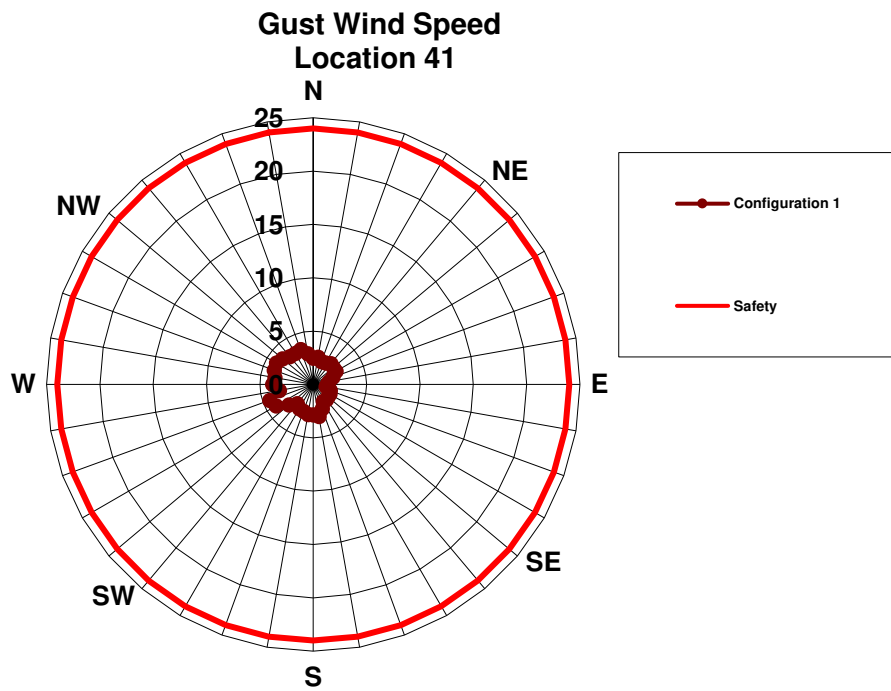


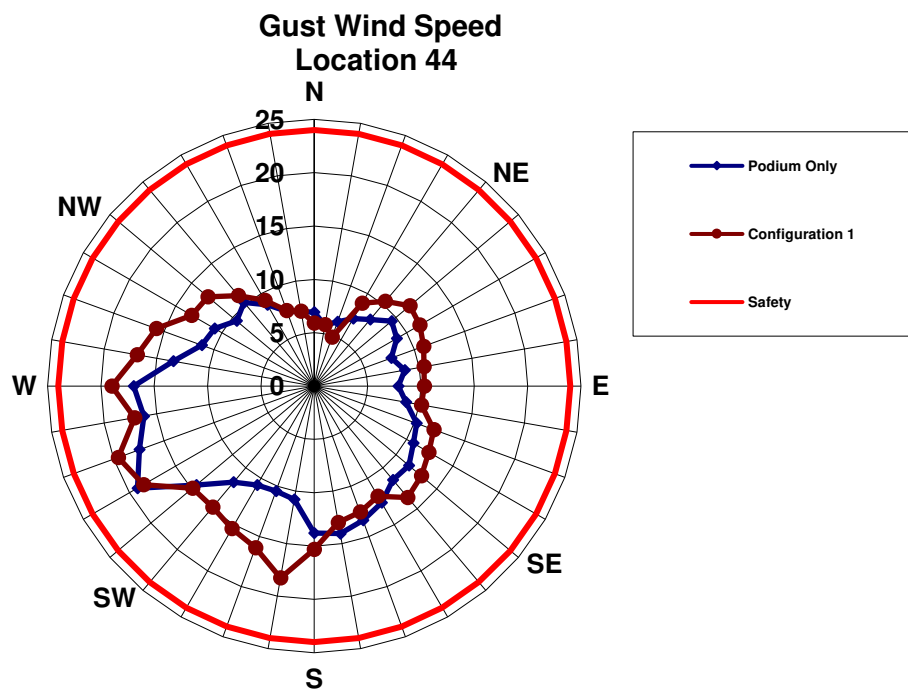
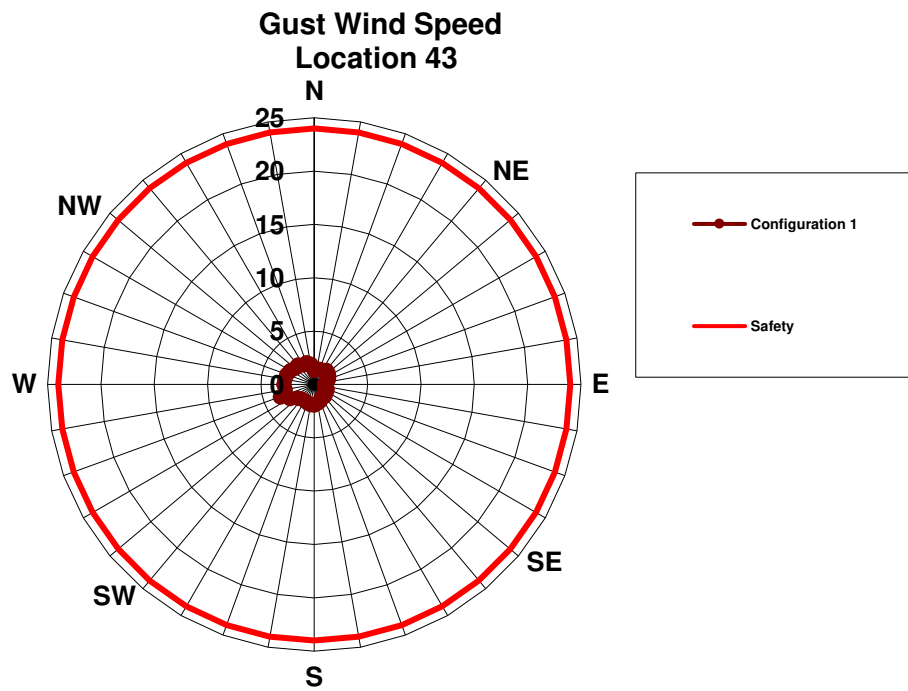


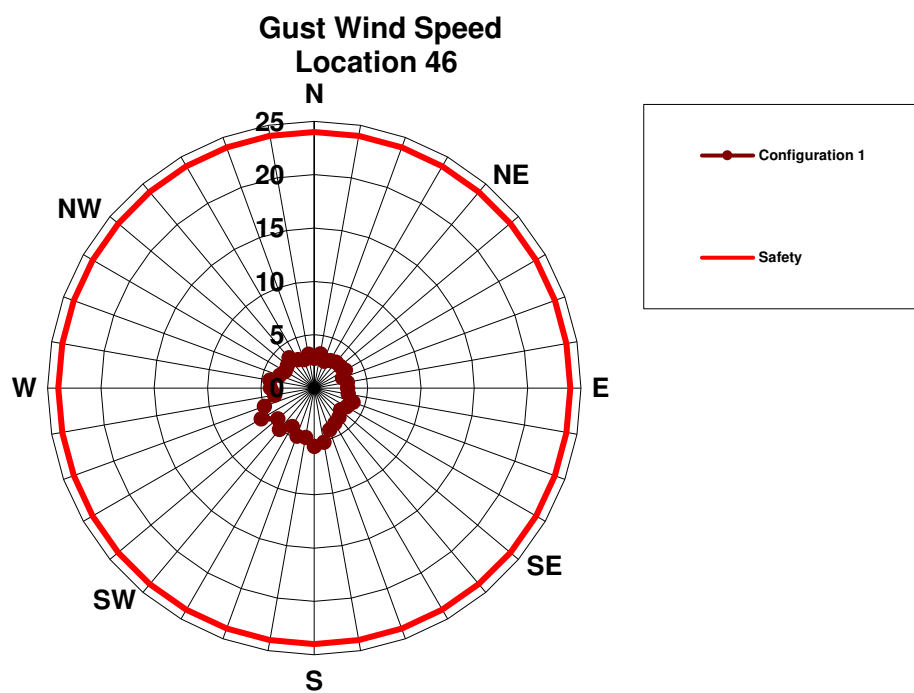
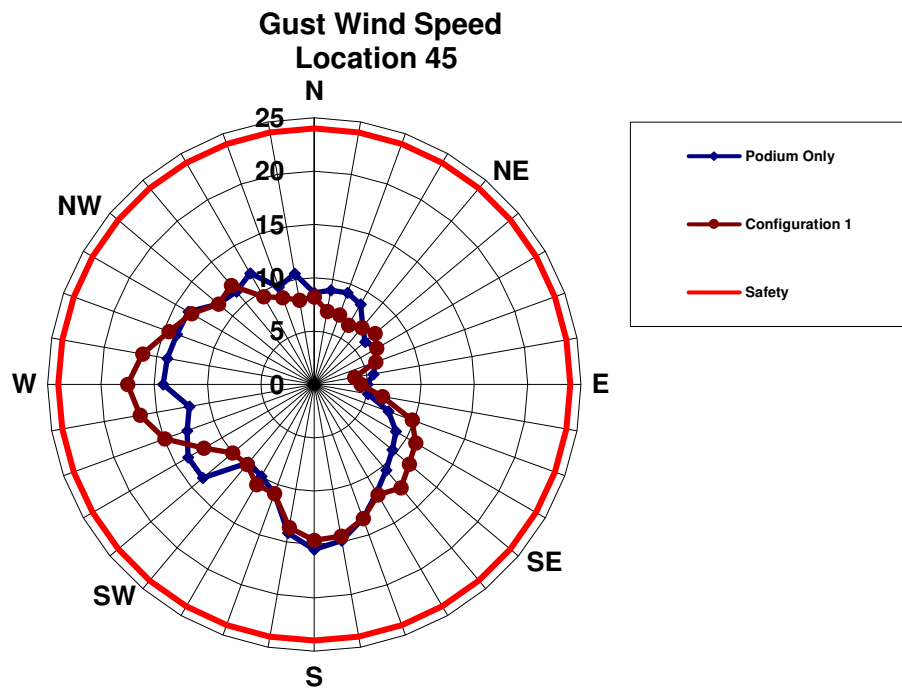


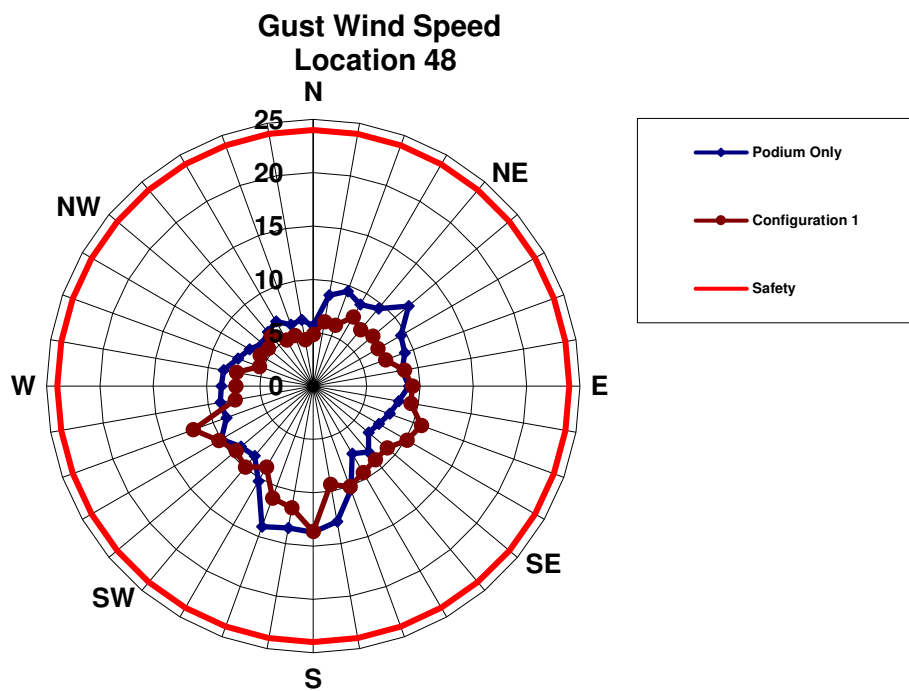
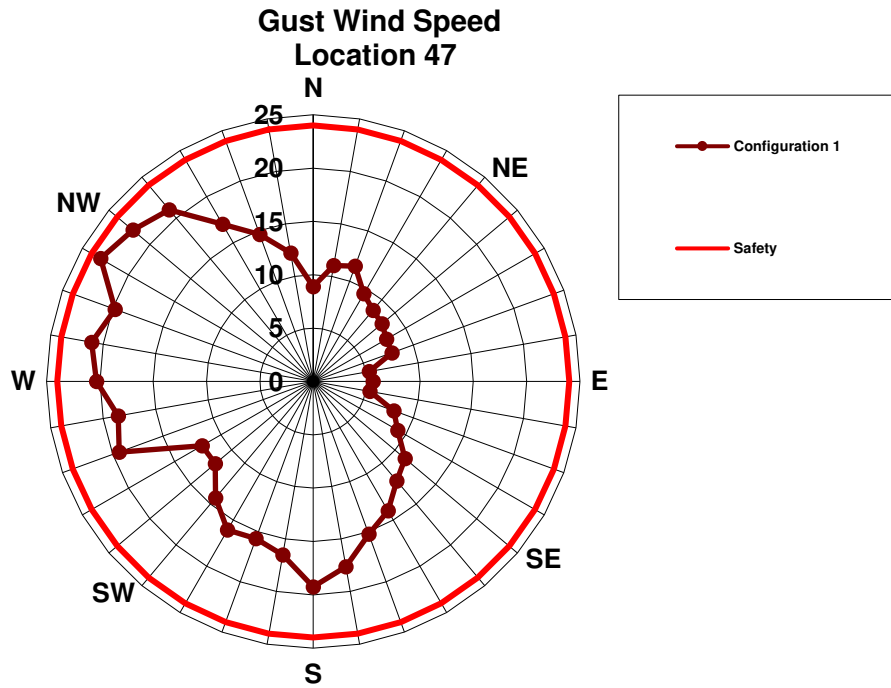


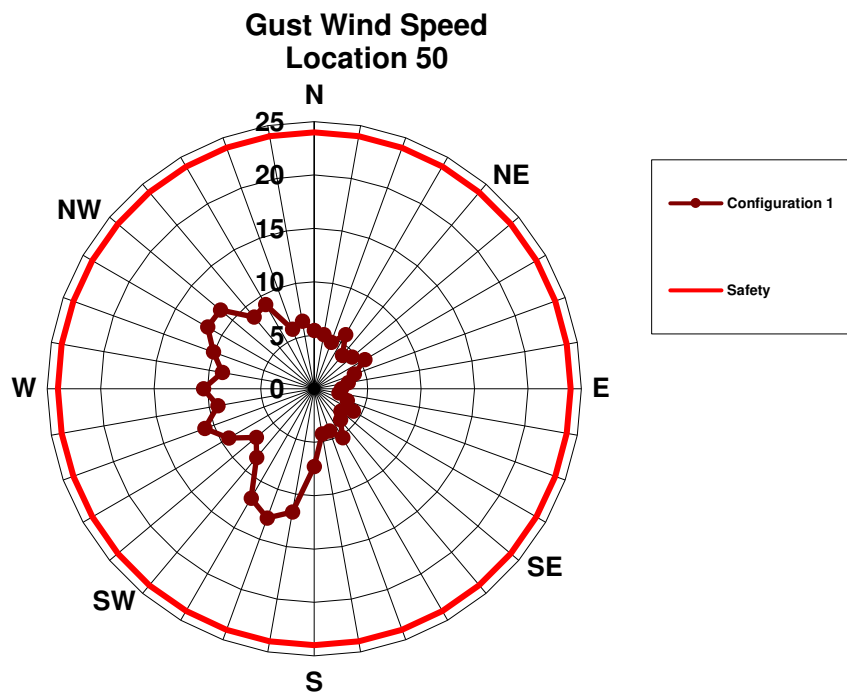
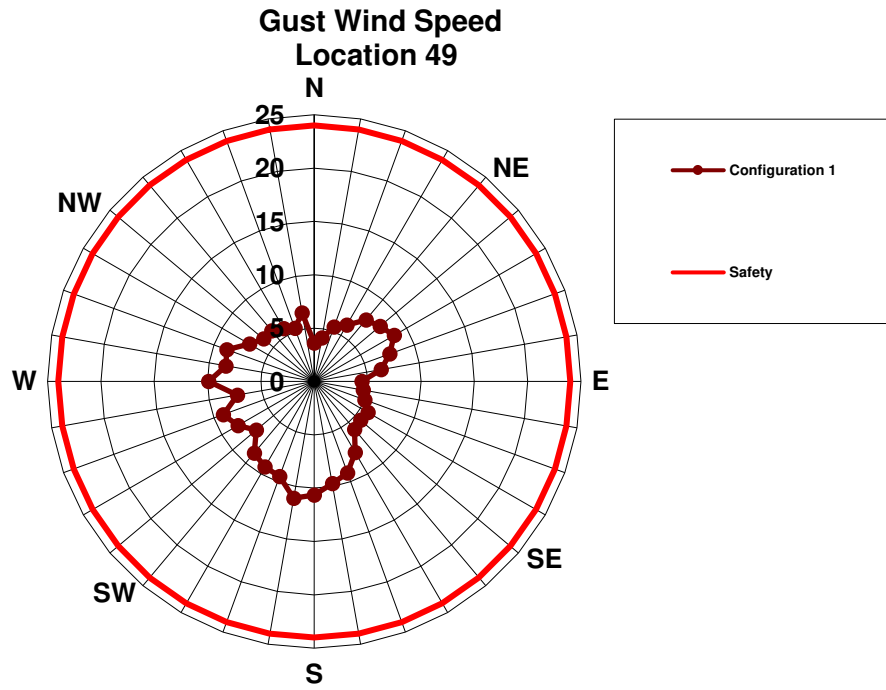


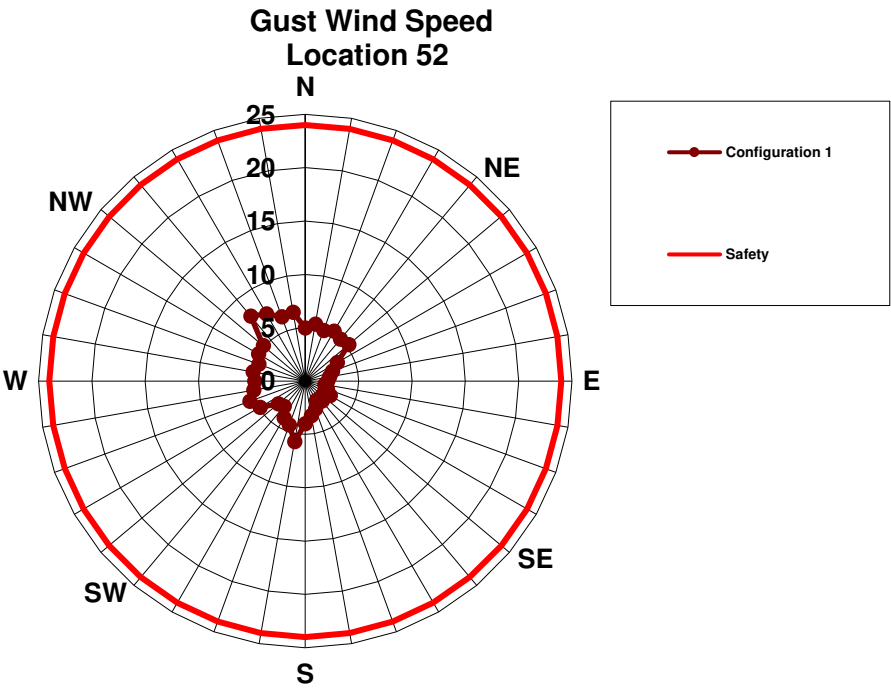
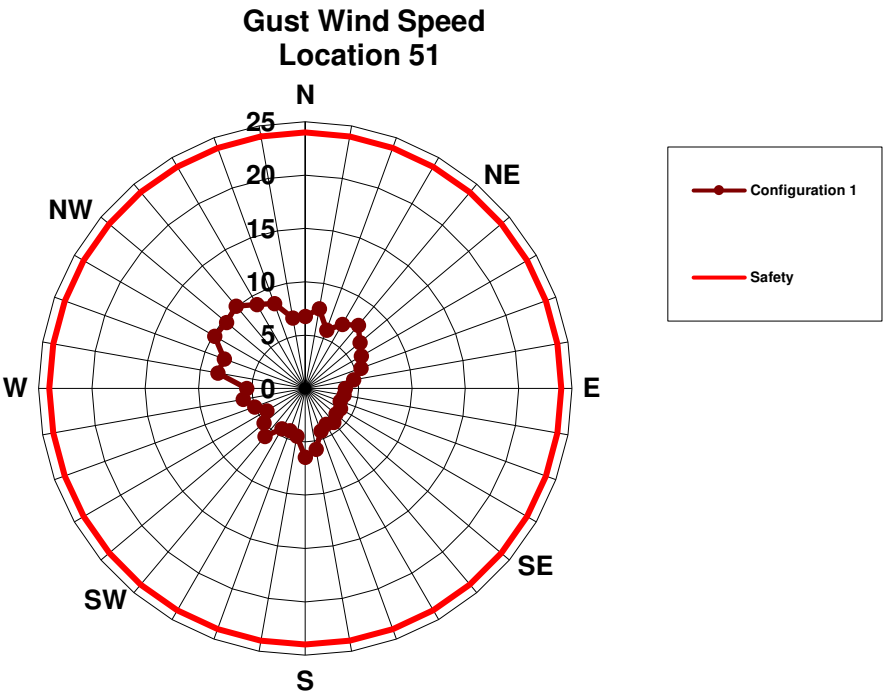


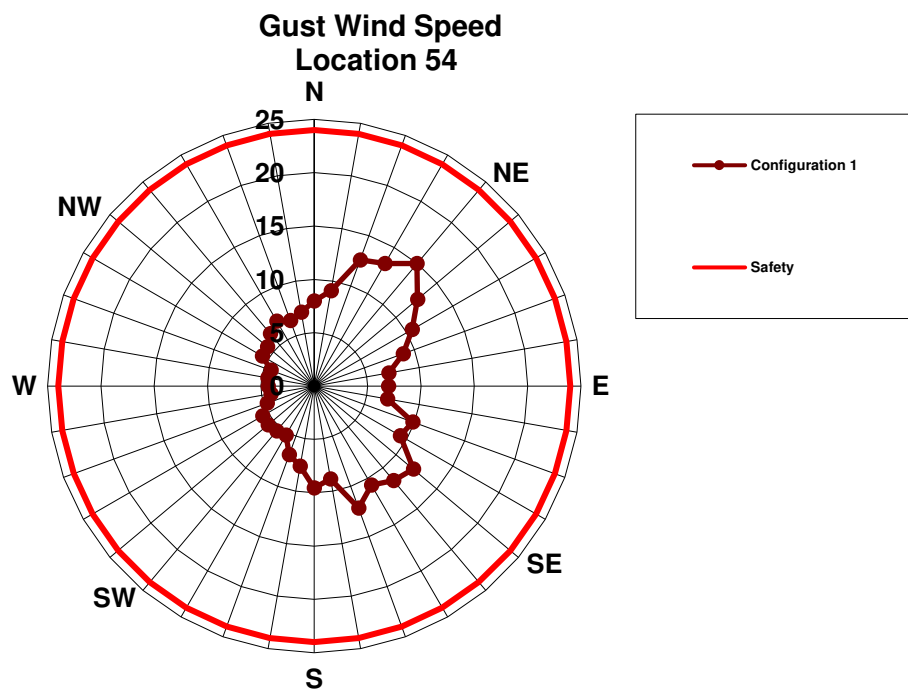
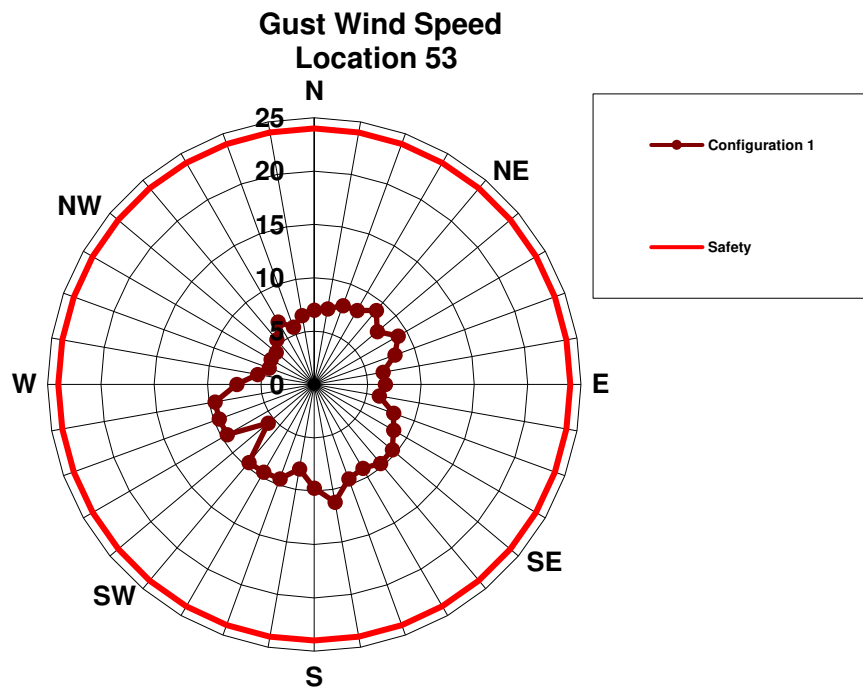


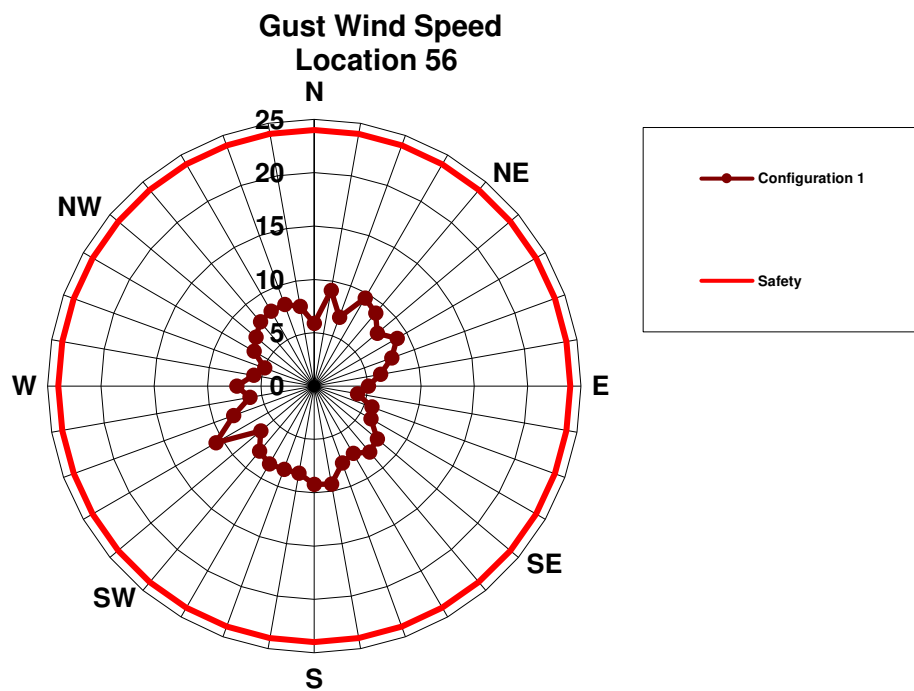
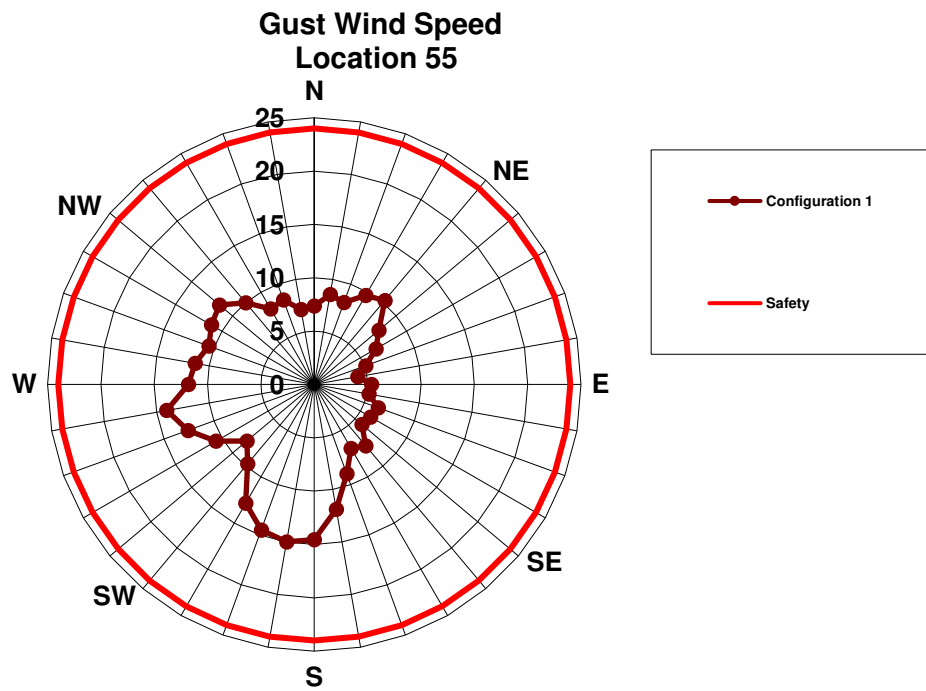


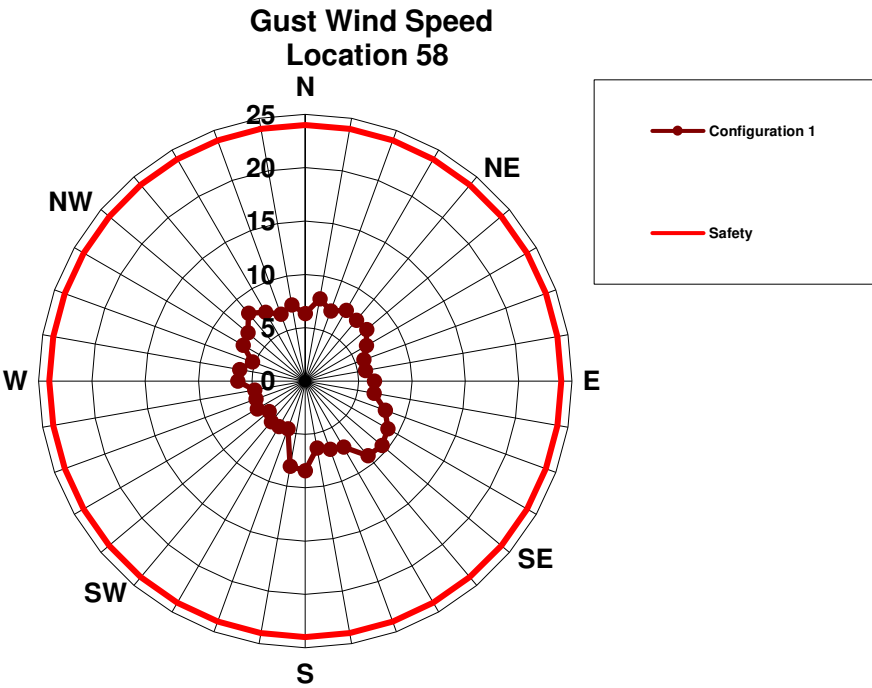
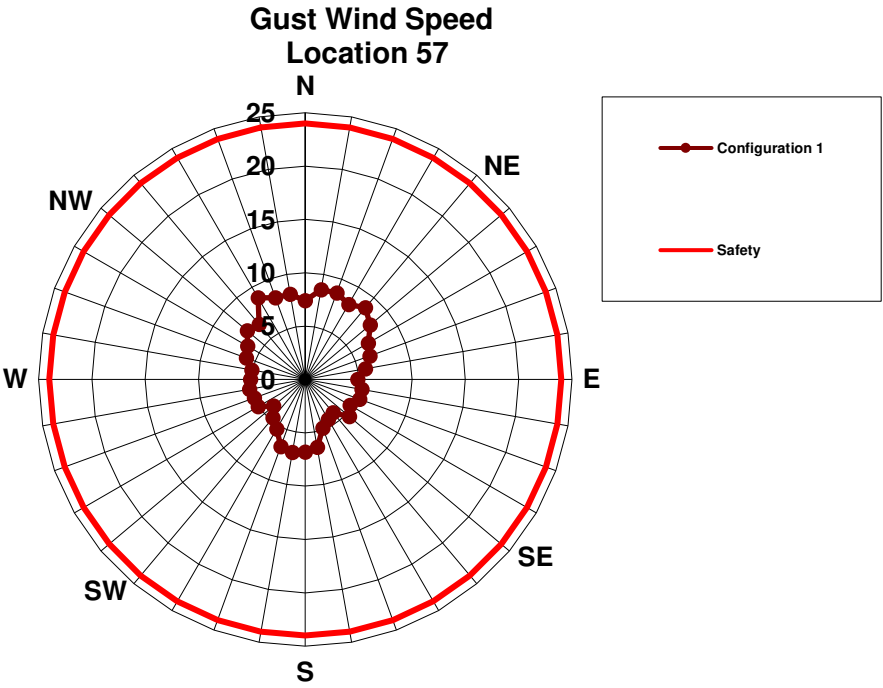


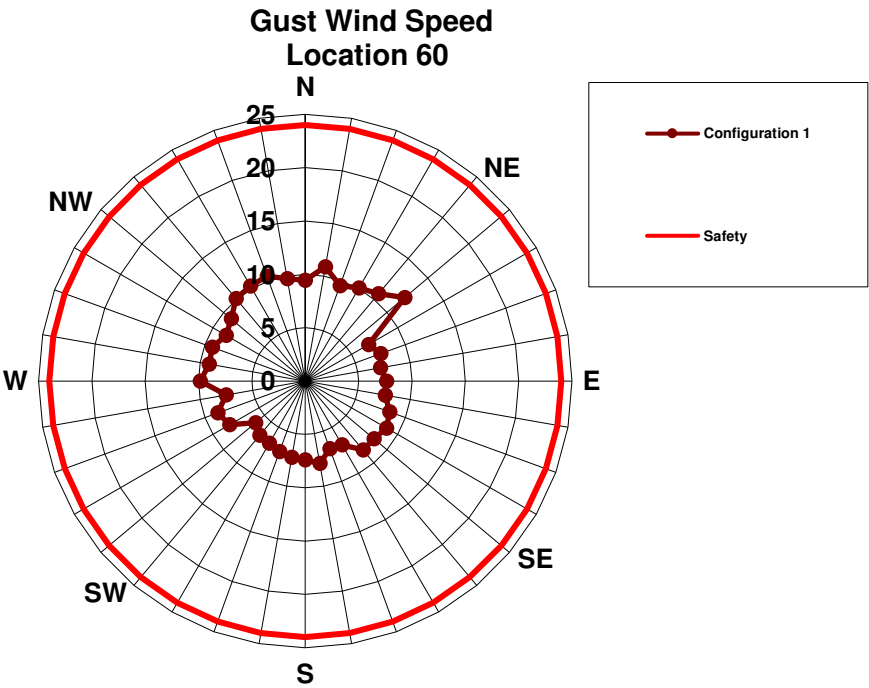
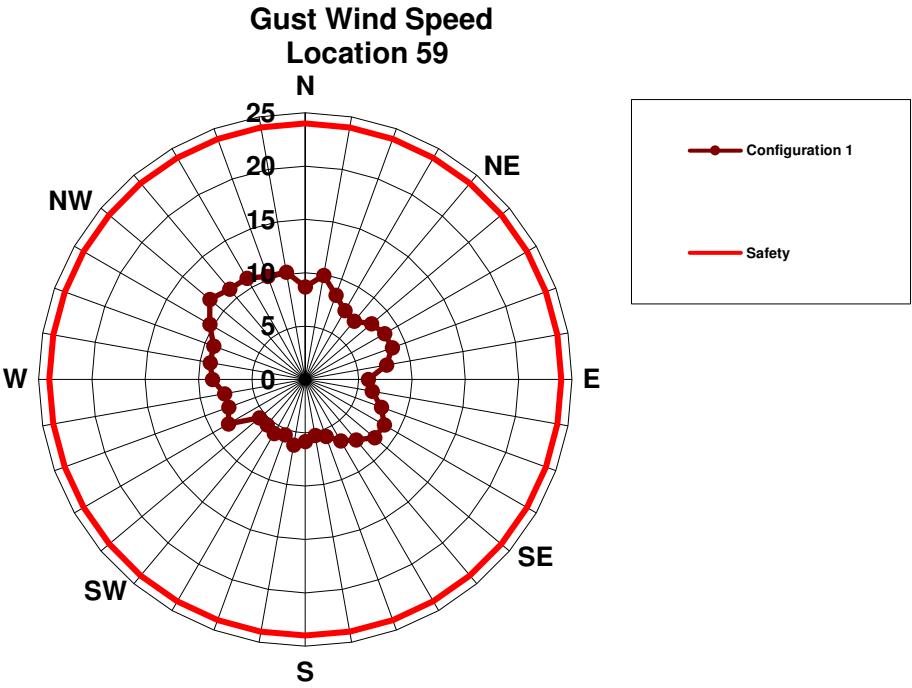


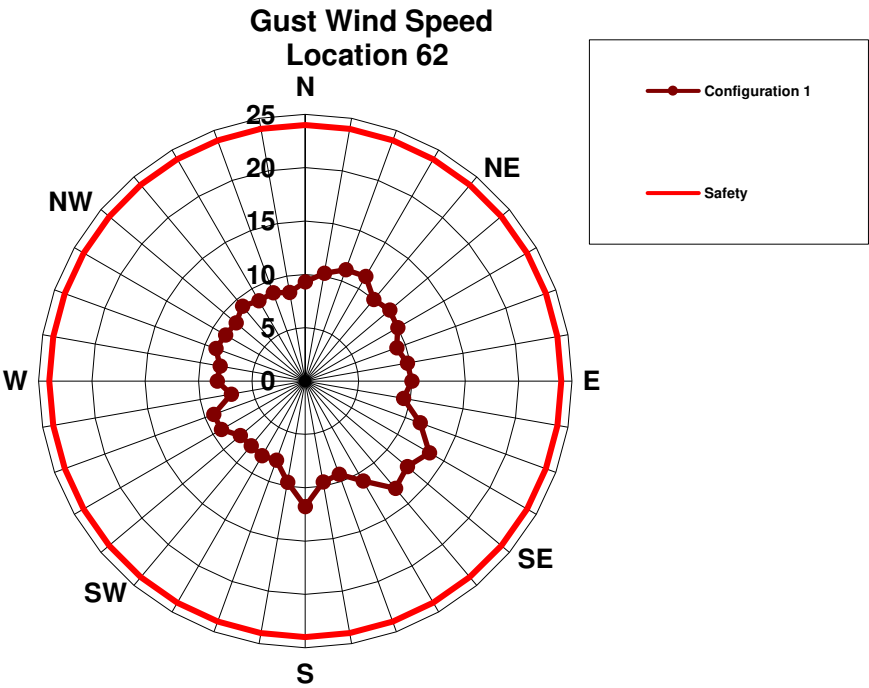
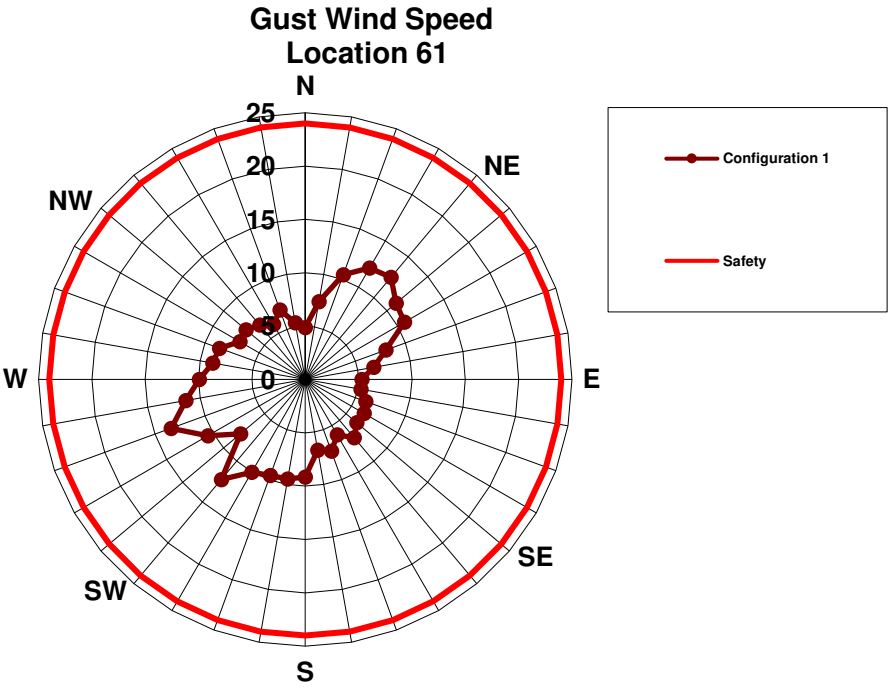


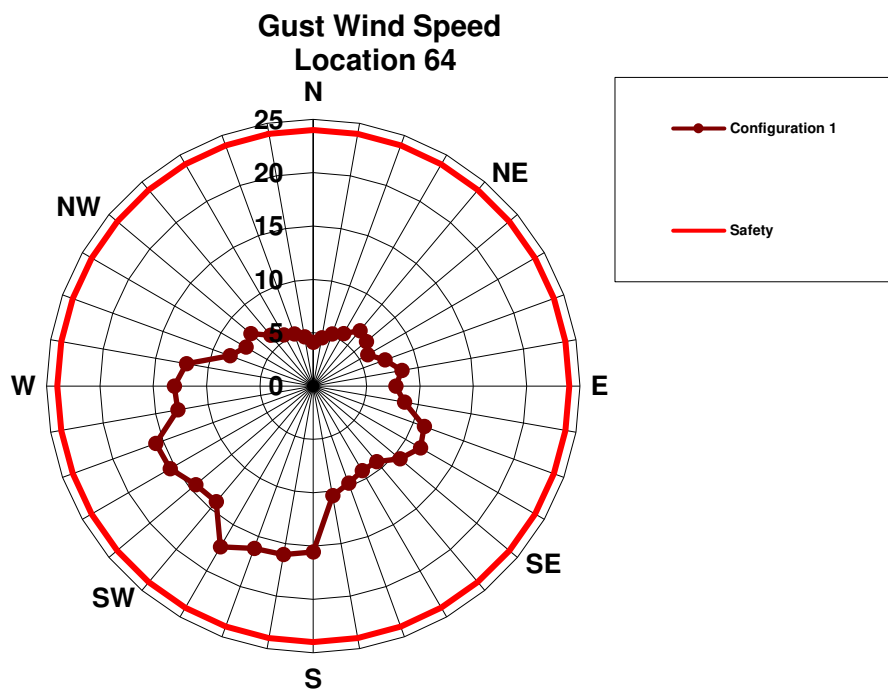
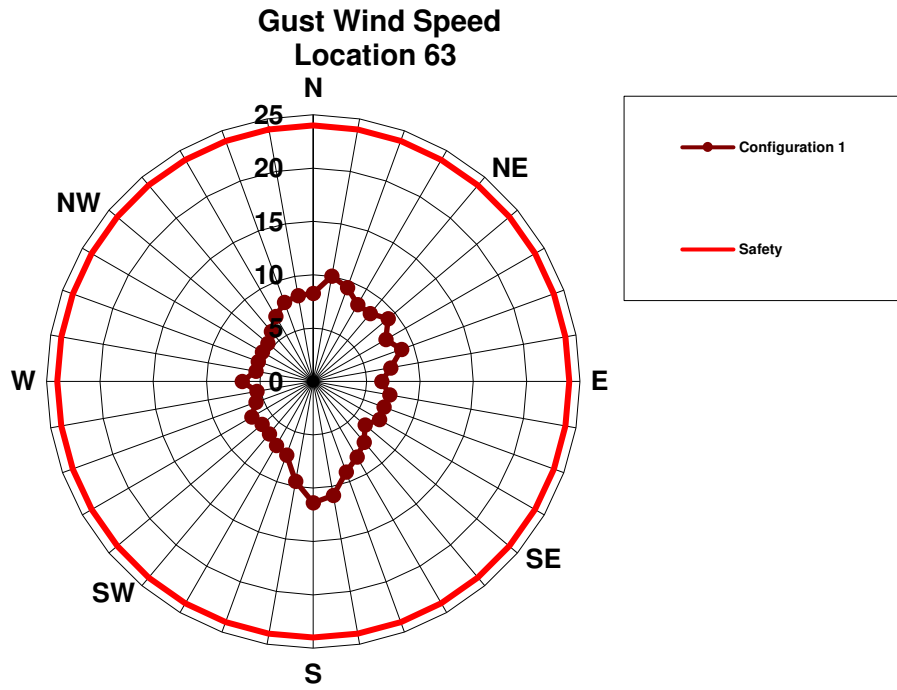


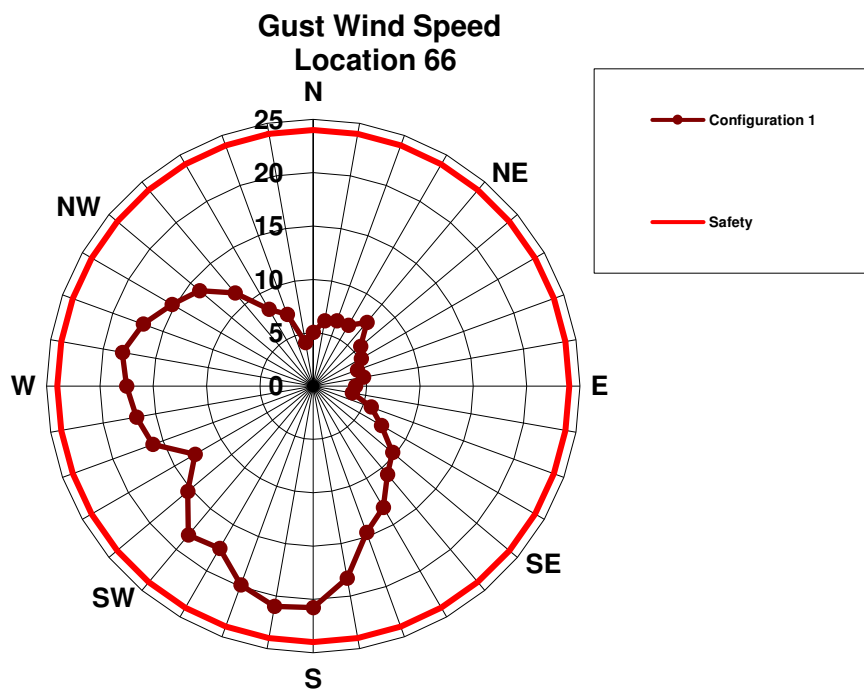
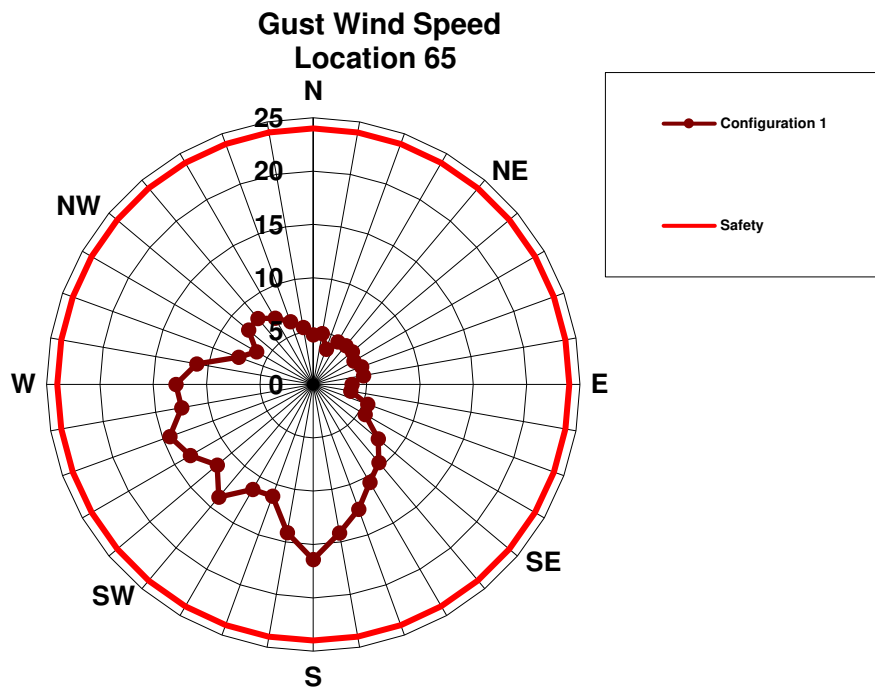


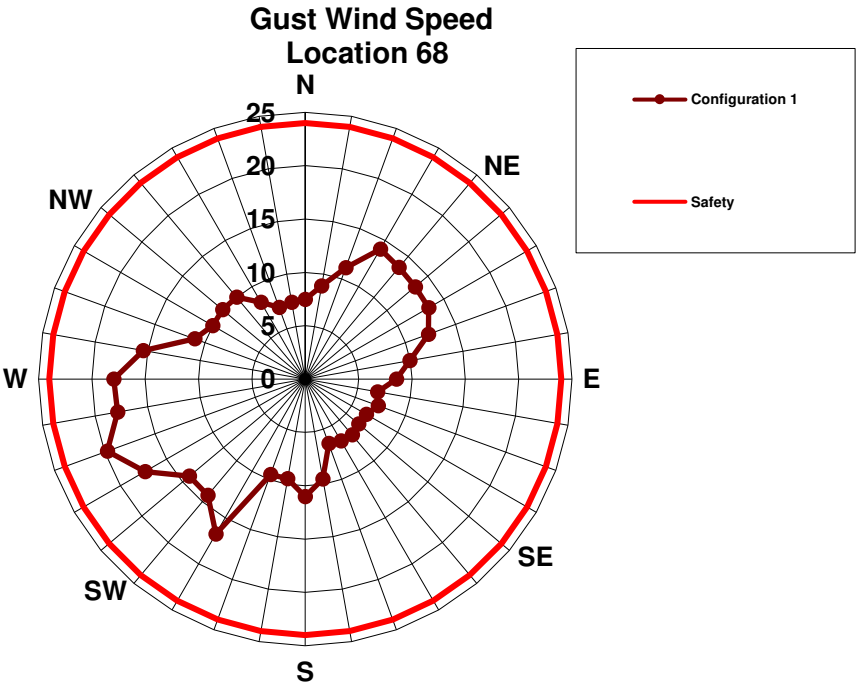
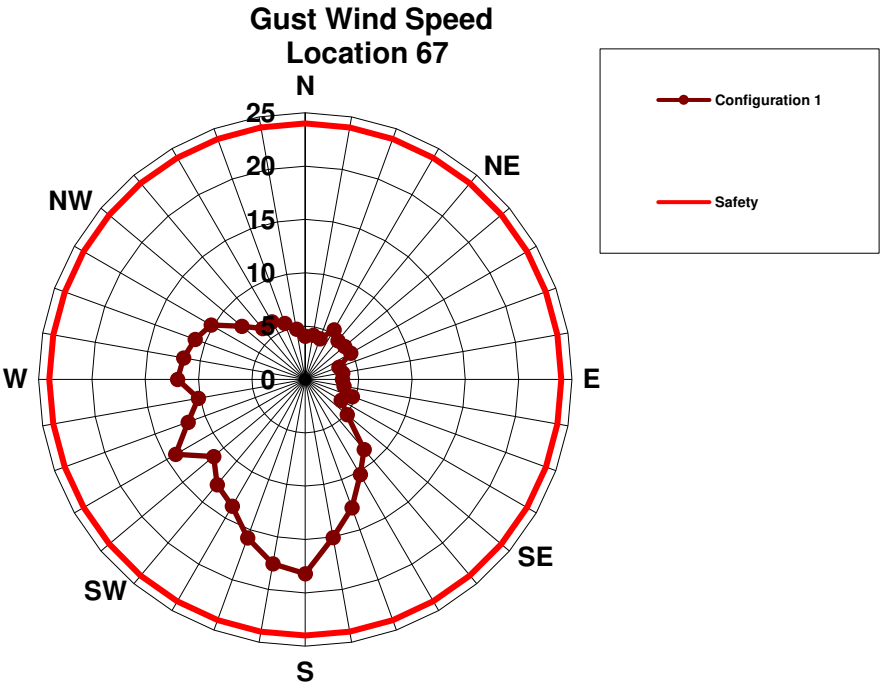


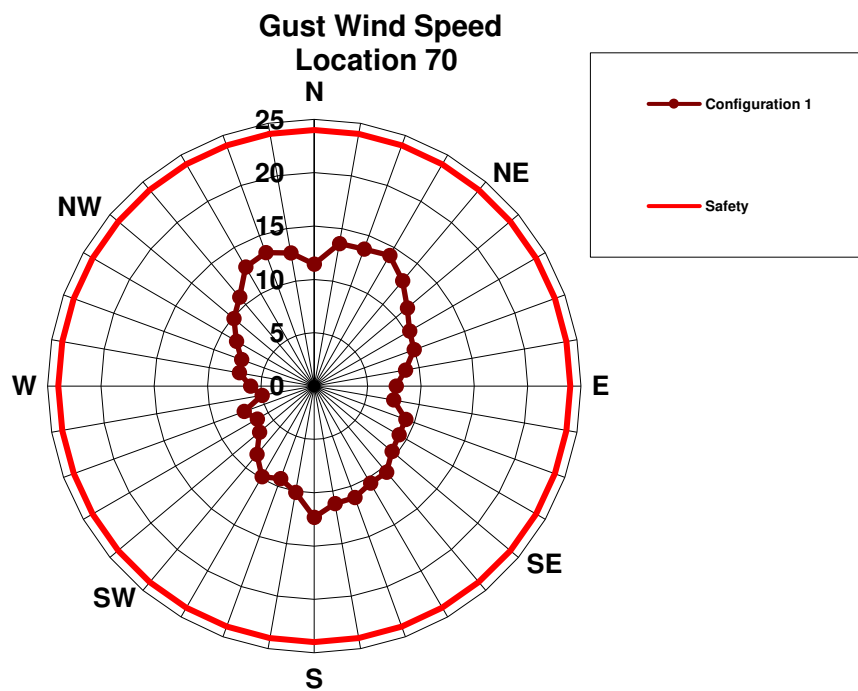
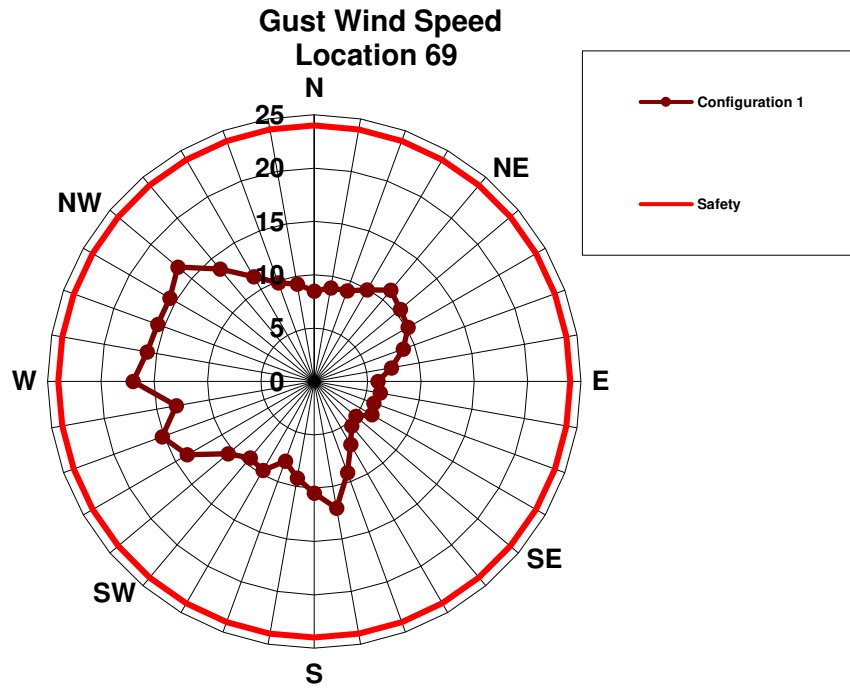


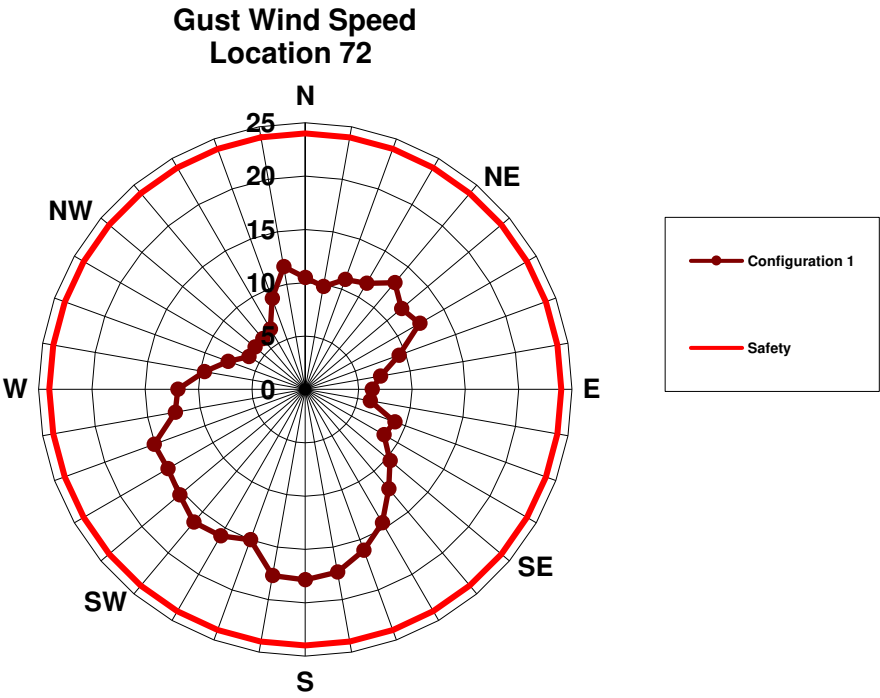
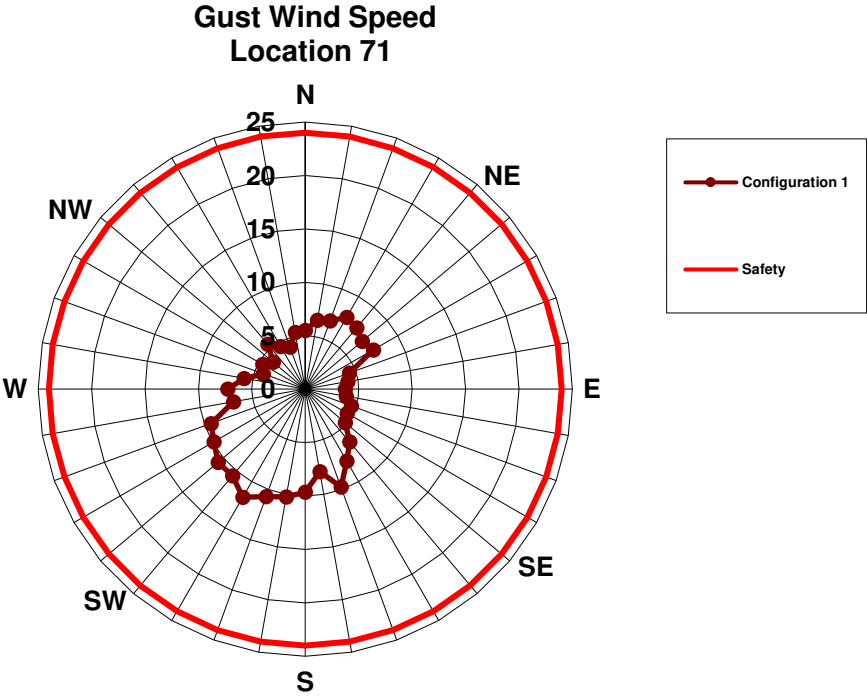


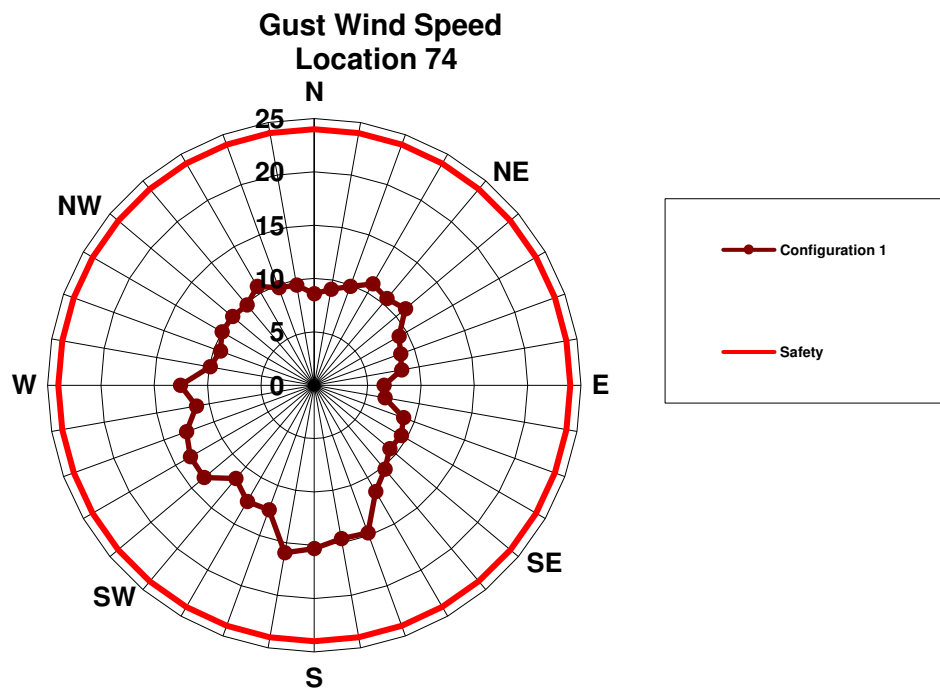
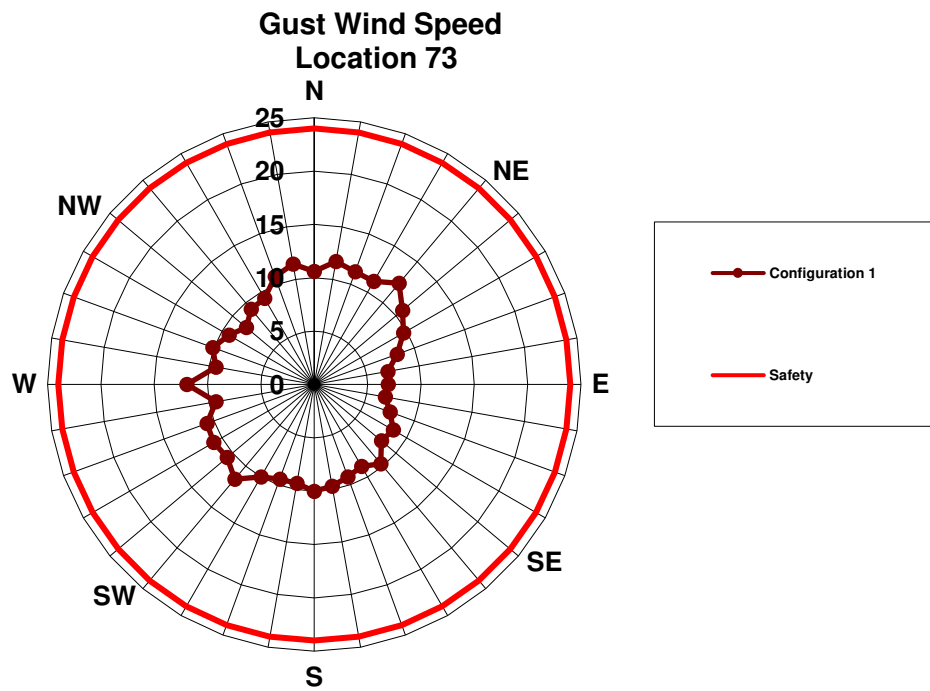


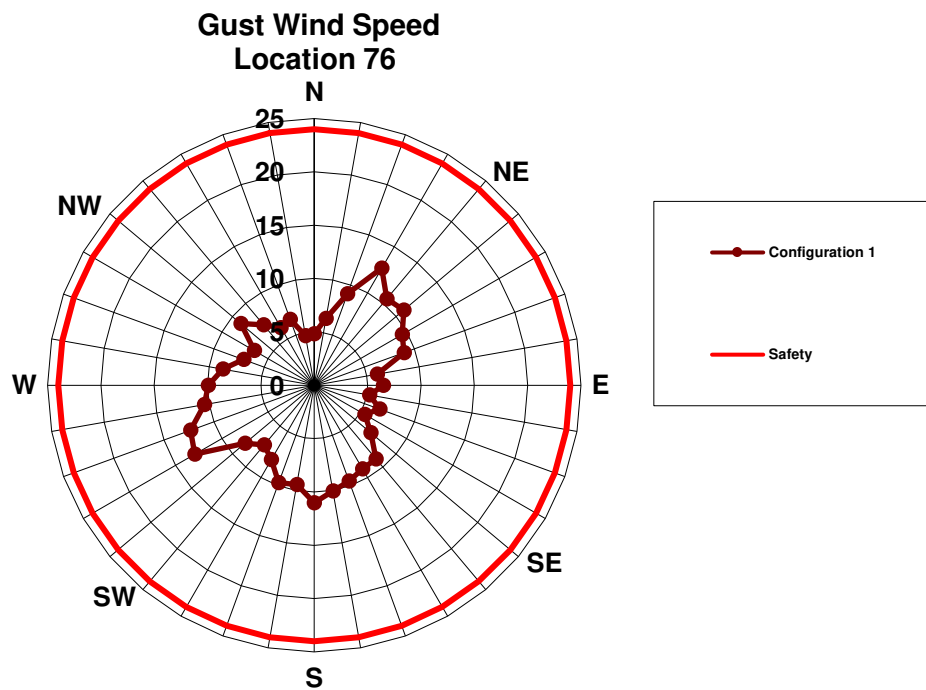
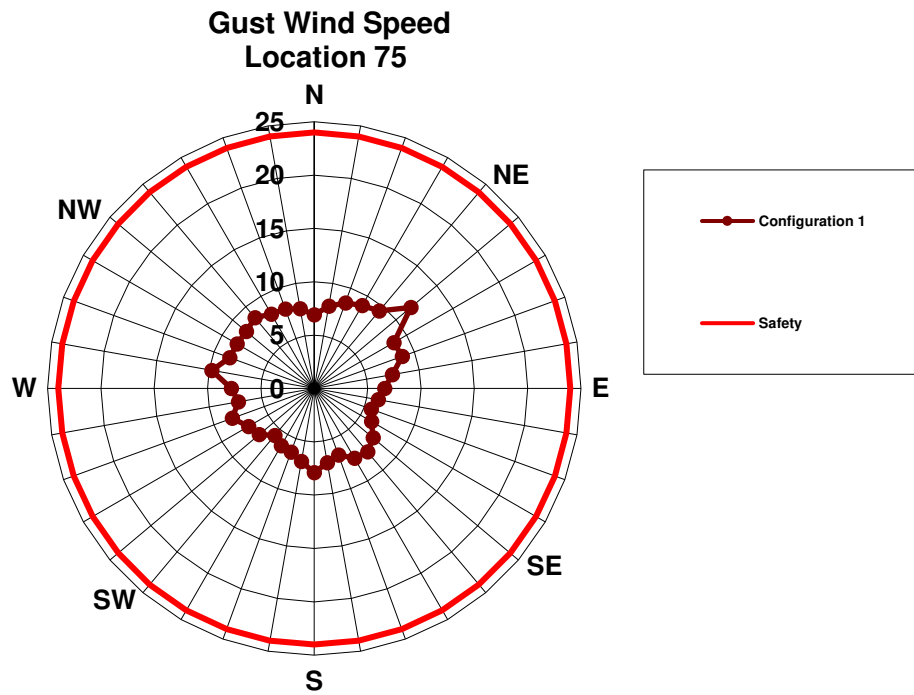


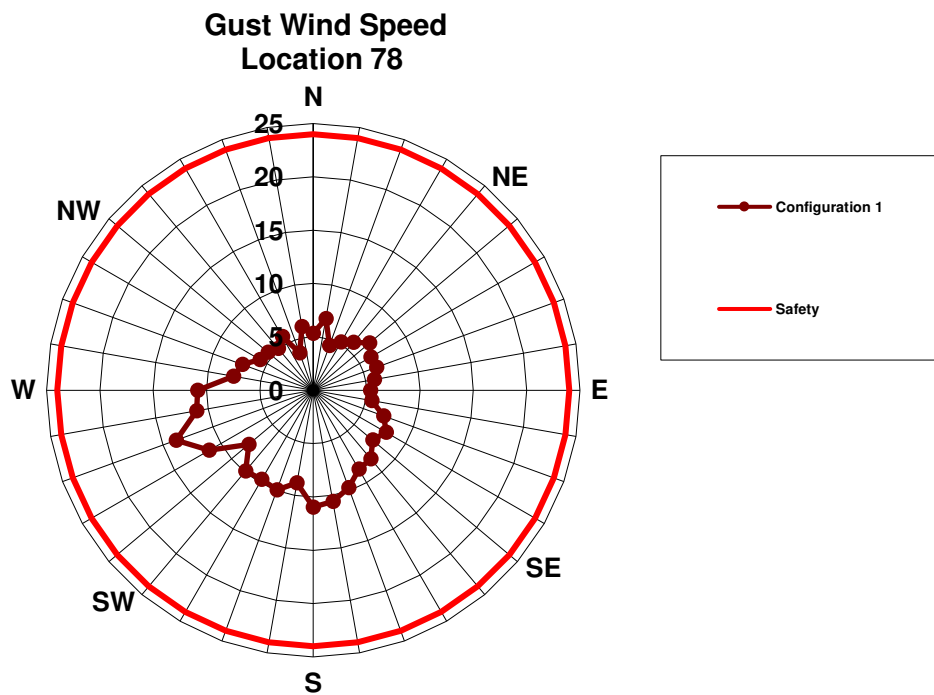
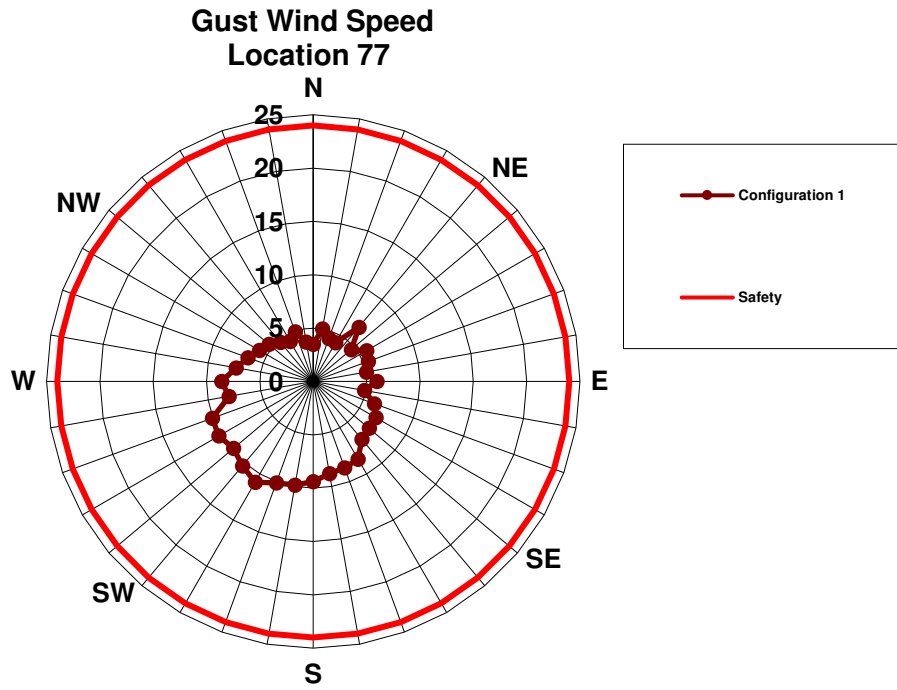




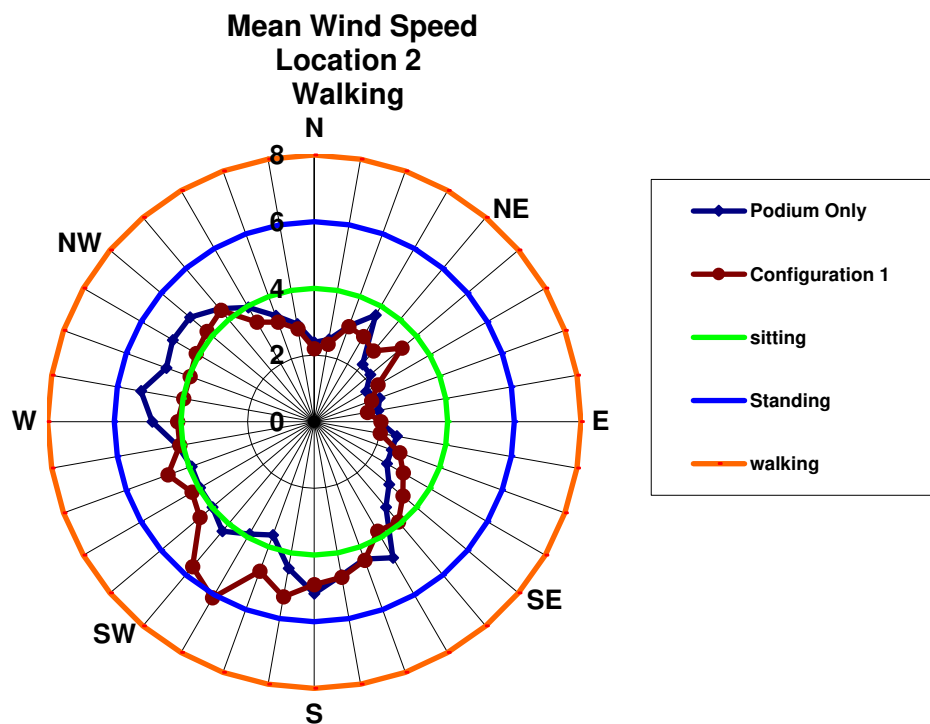
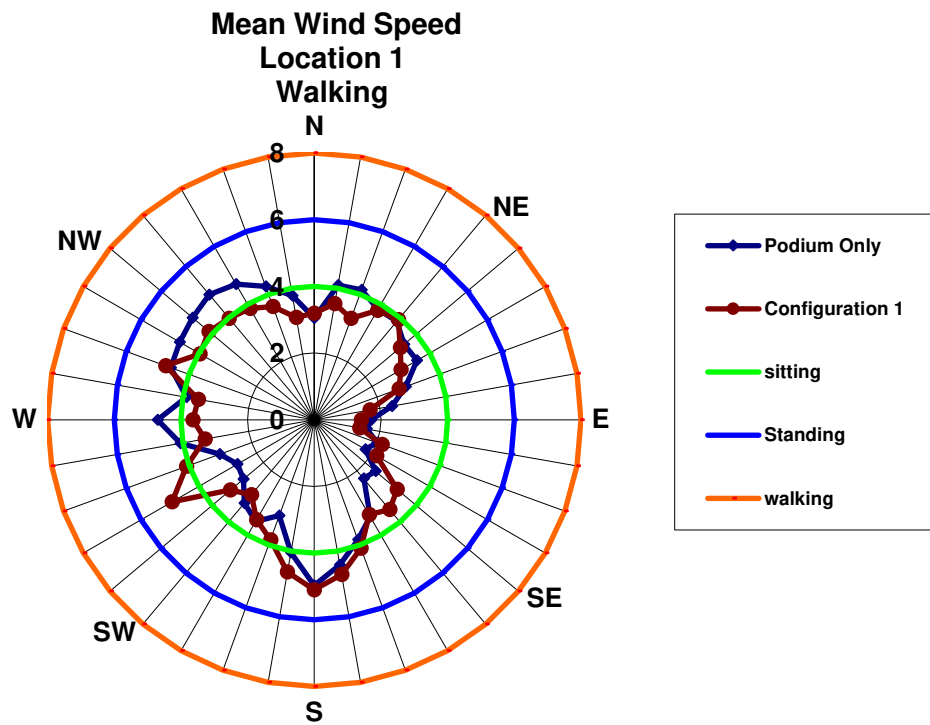


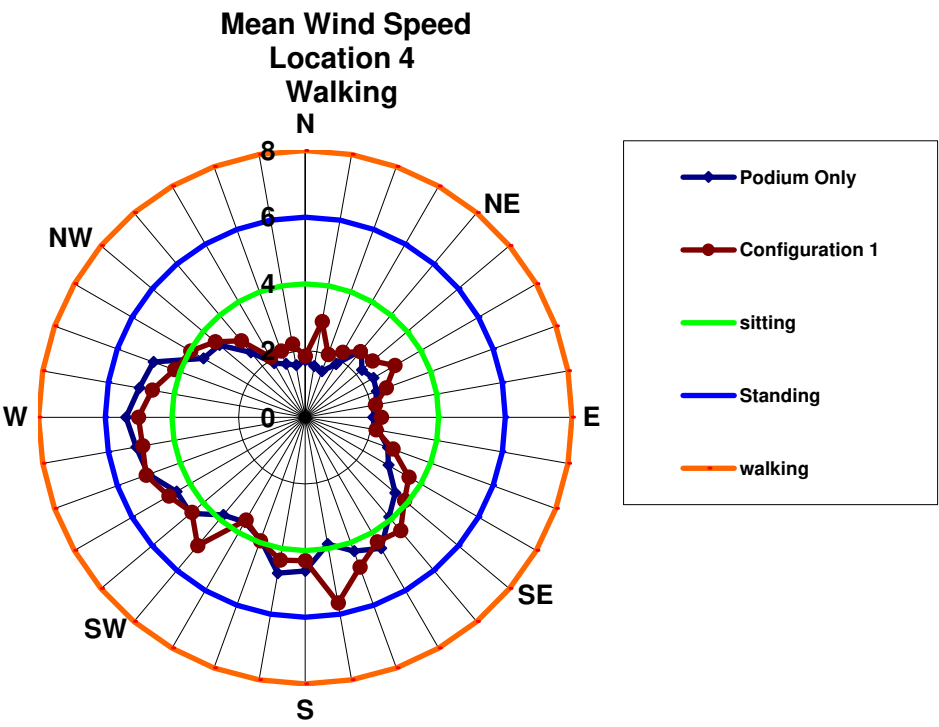
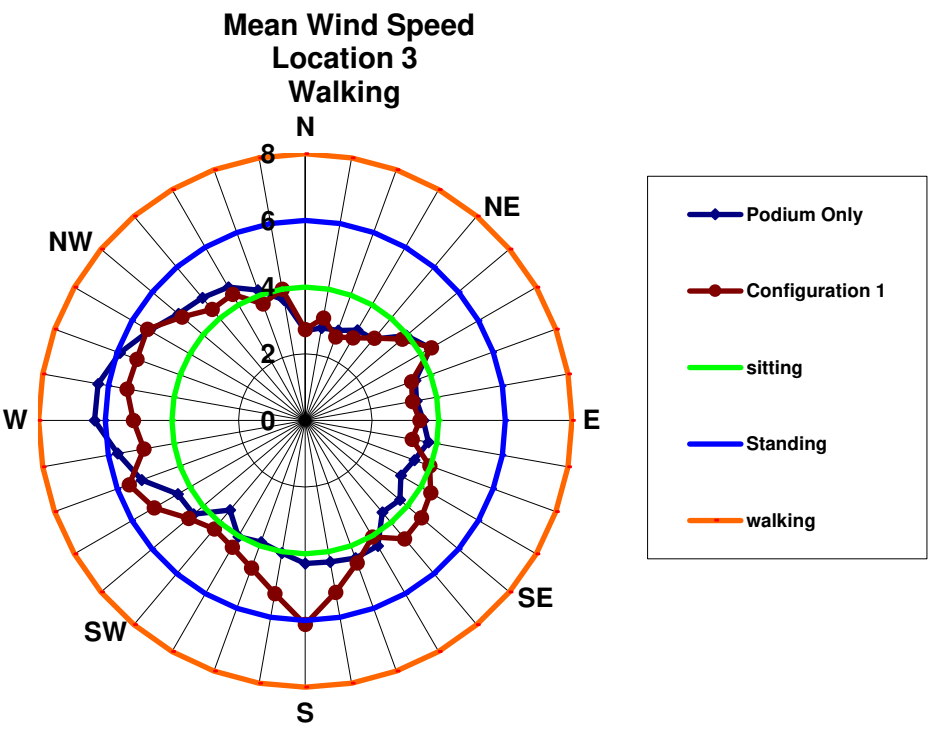


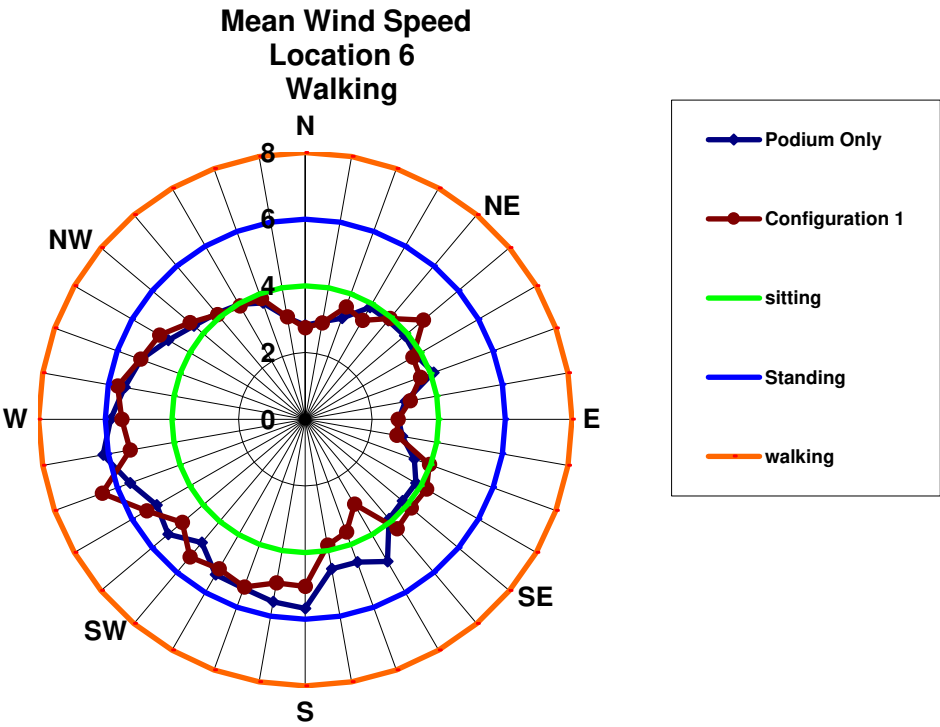
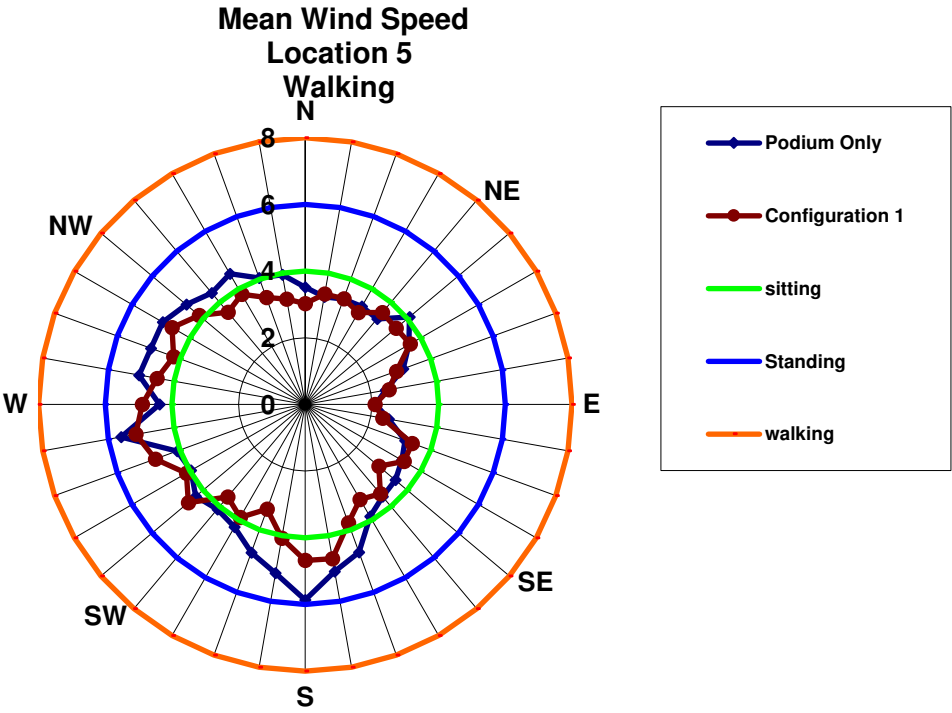


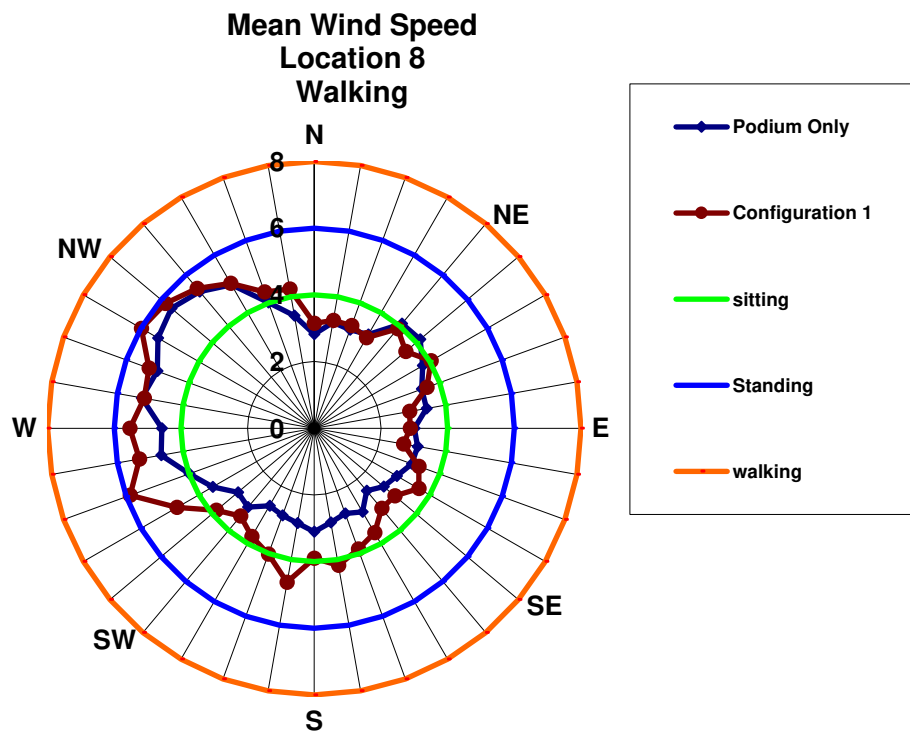
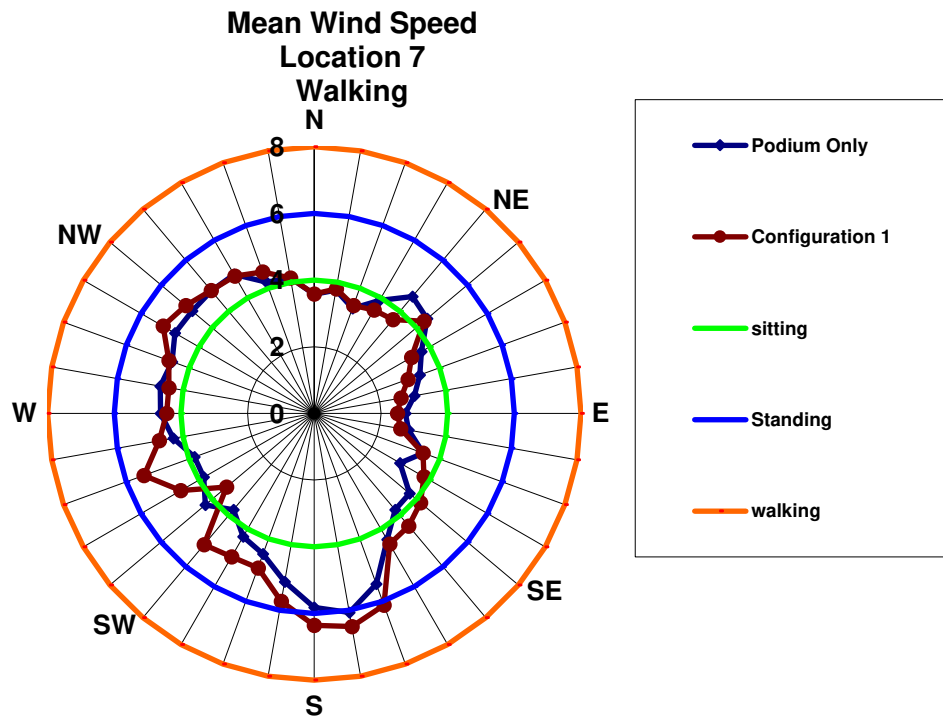


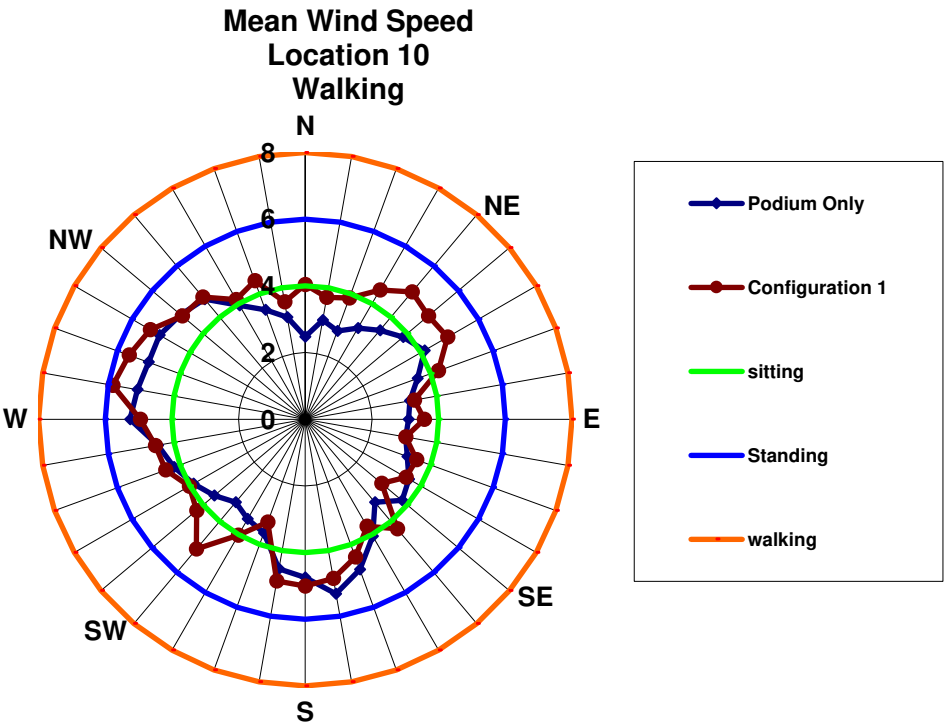
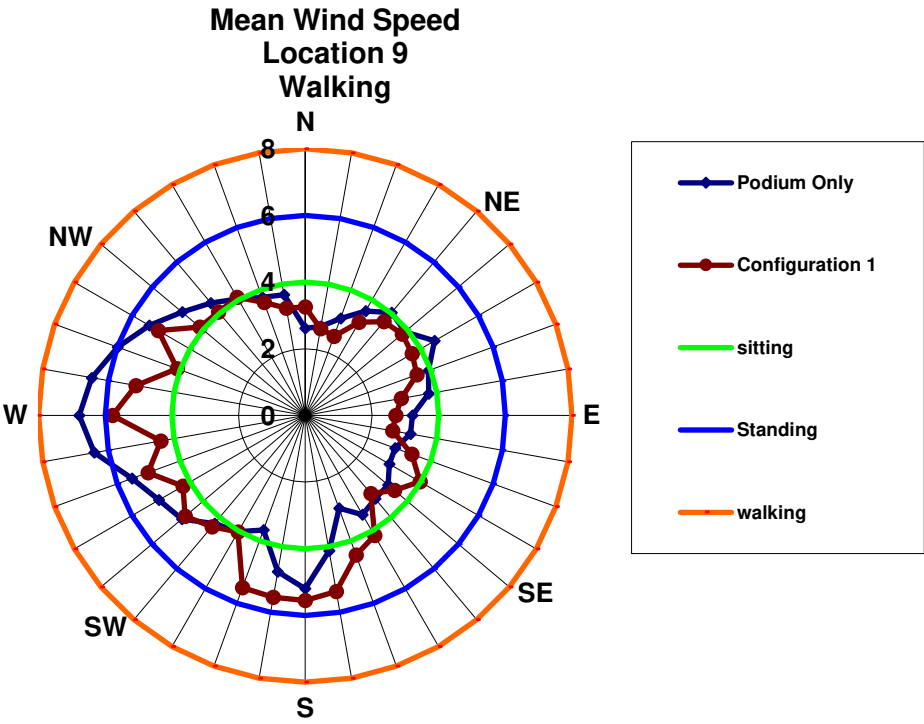
C.2 Mean Wind Speeds (Comfort Criteria)

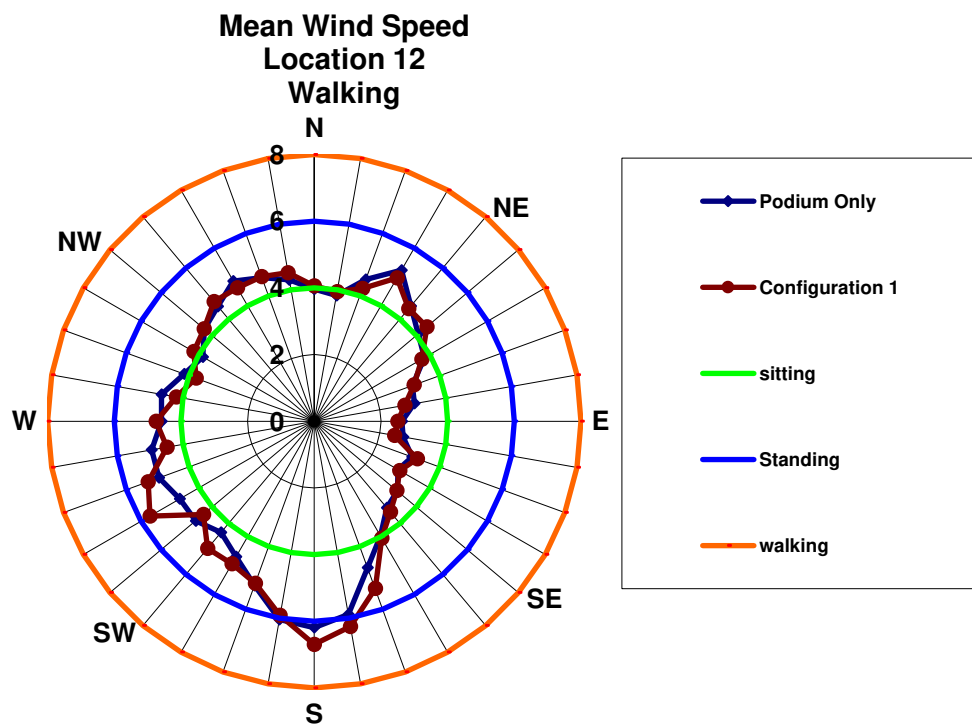
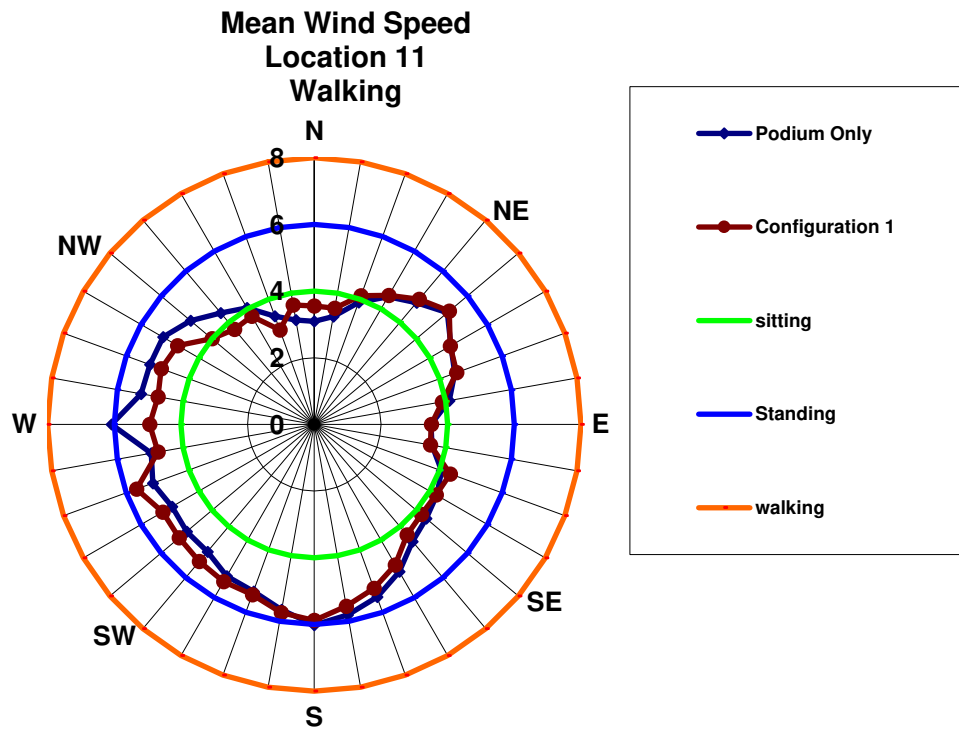


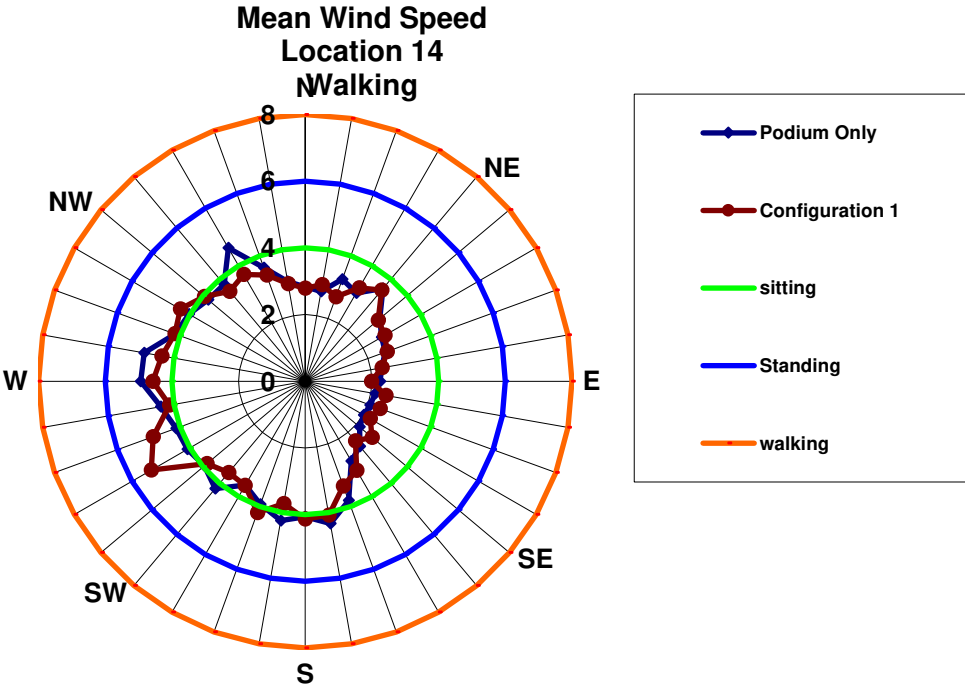
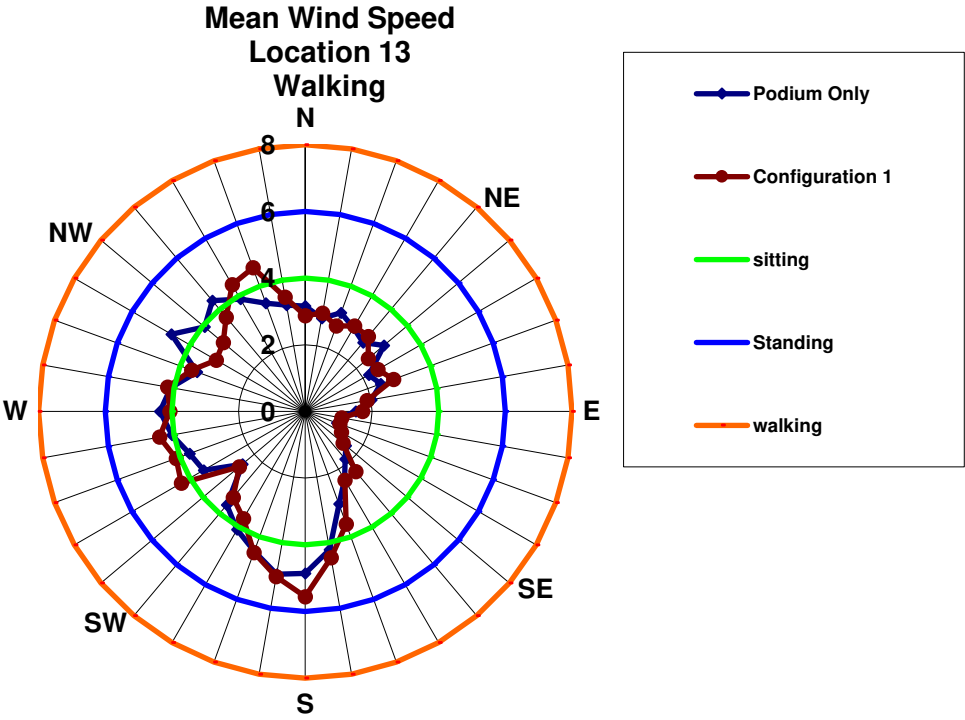


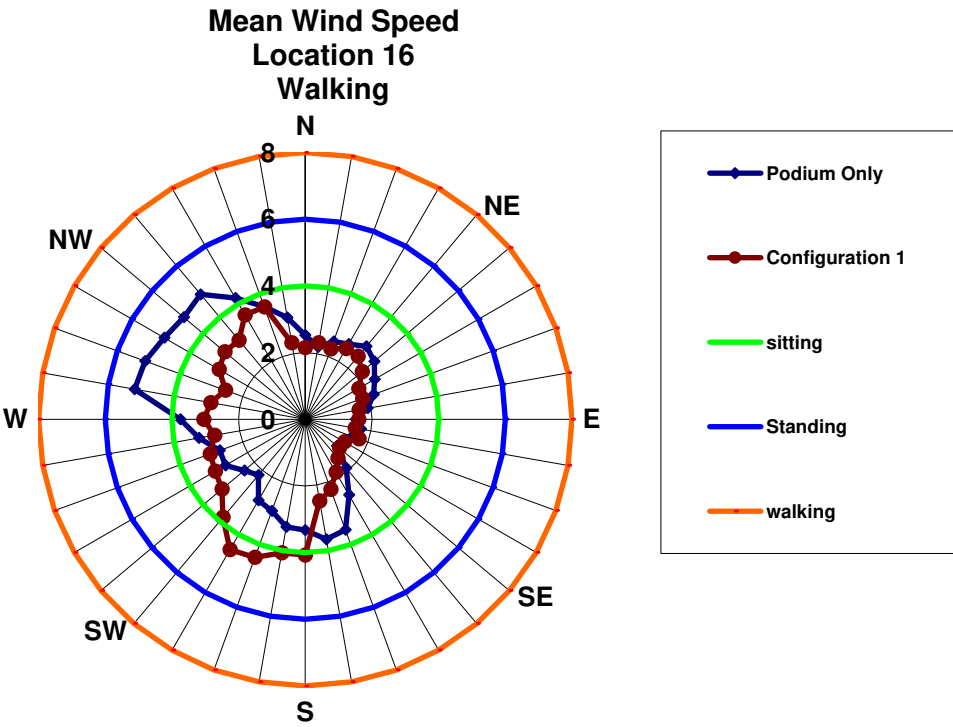
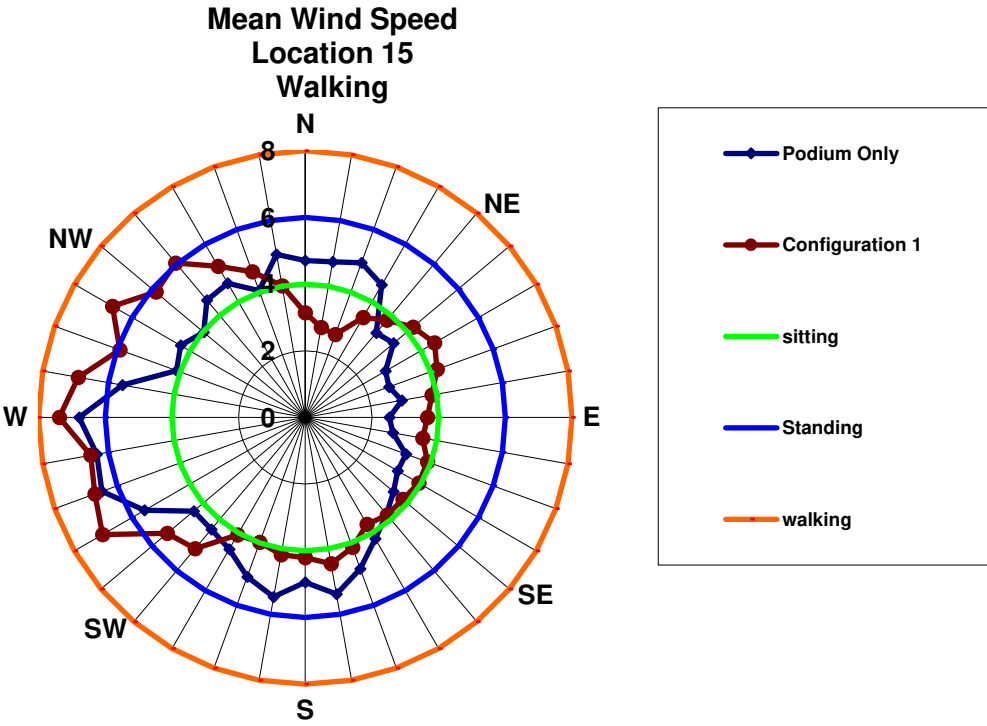


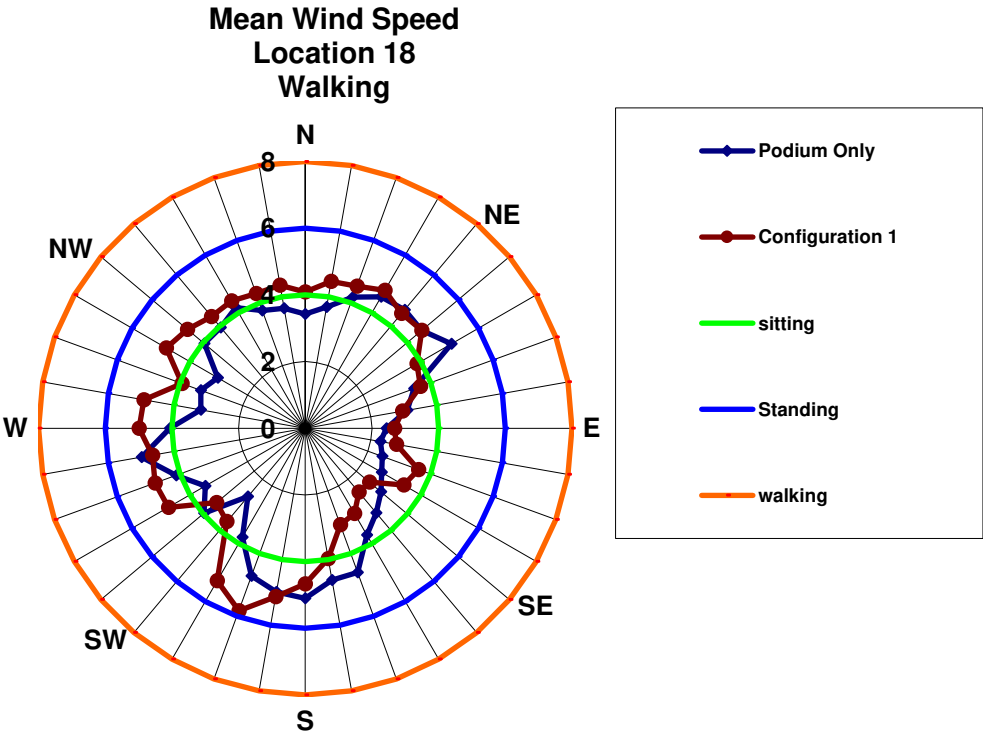
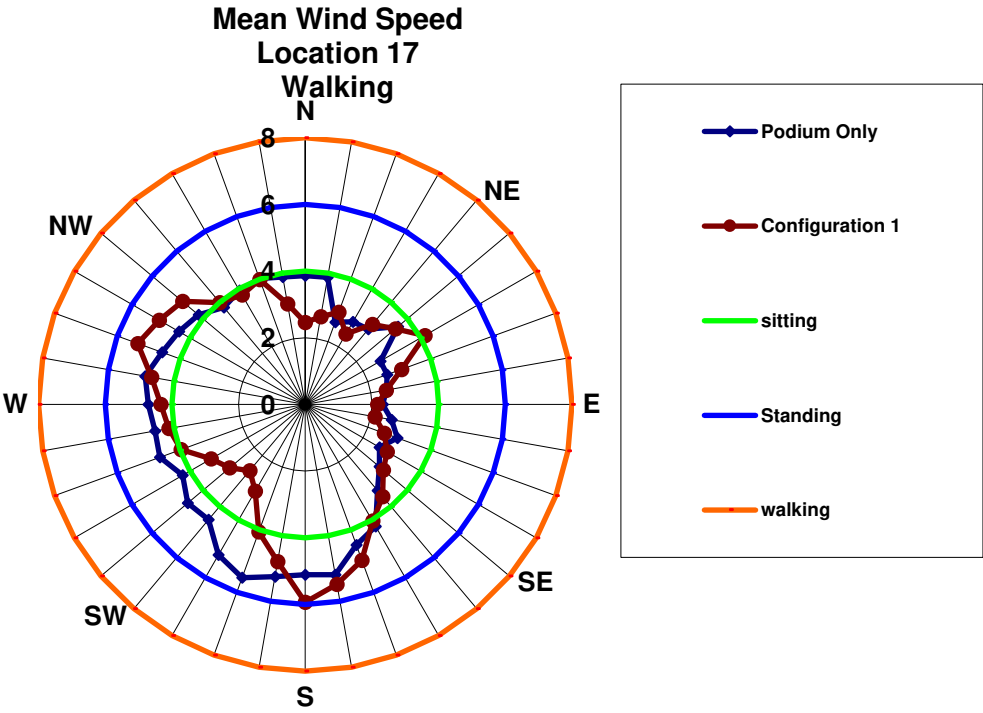


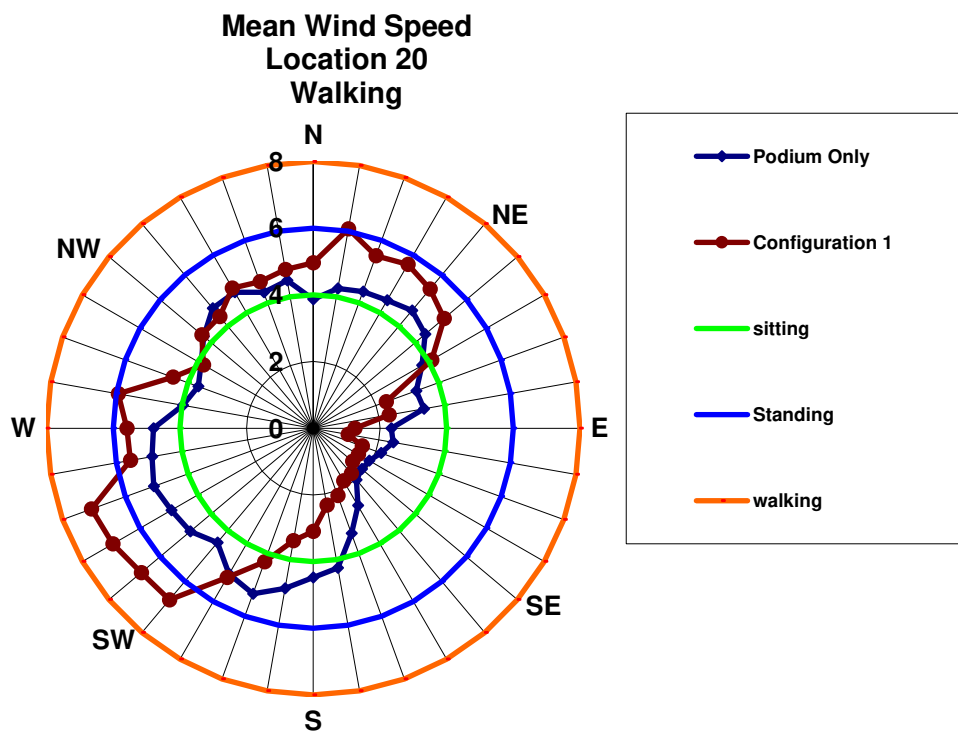
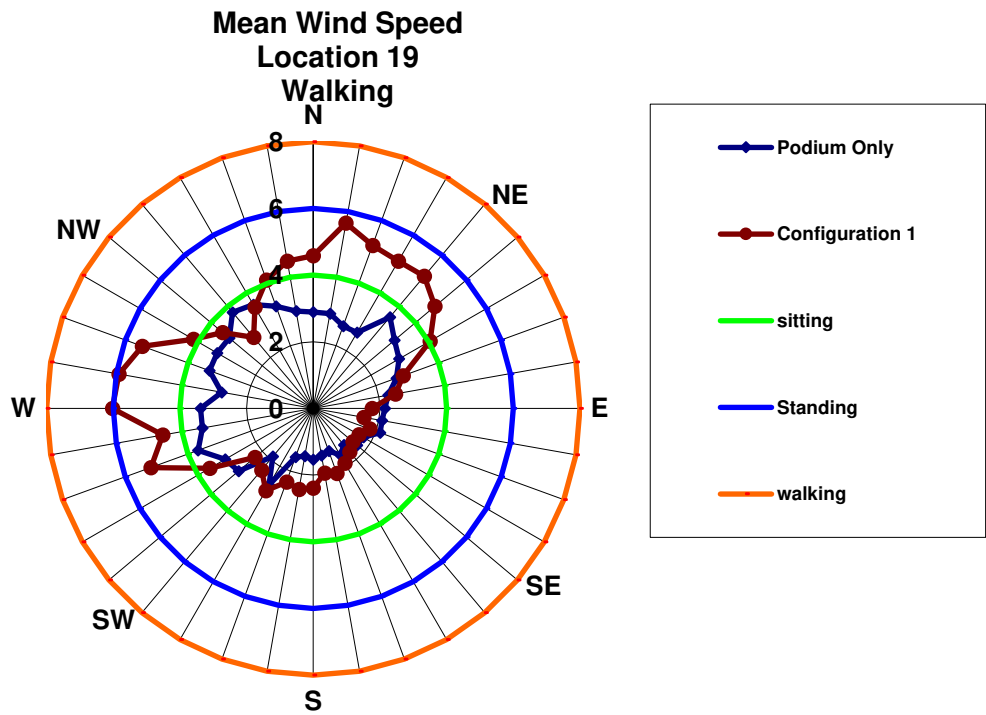


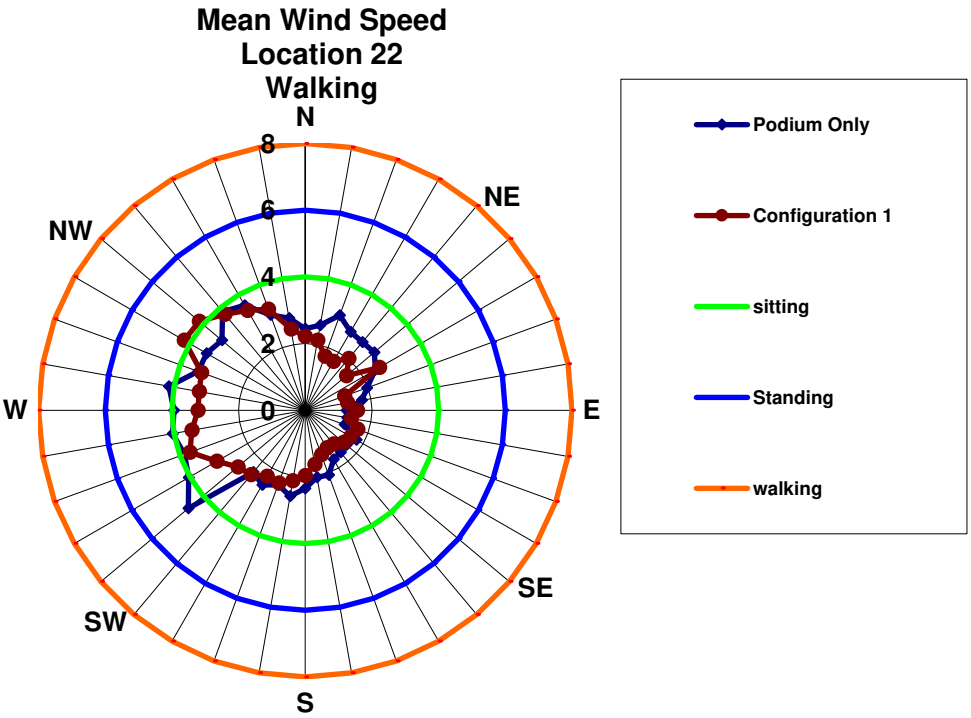
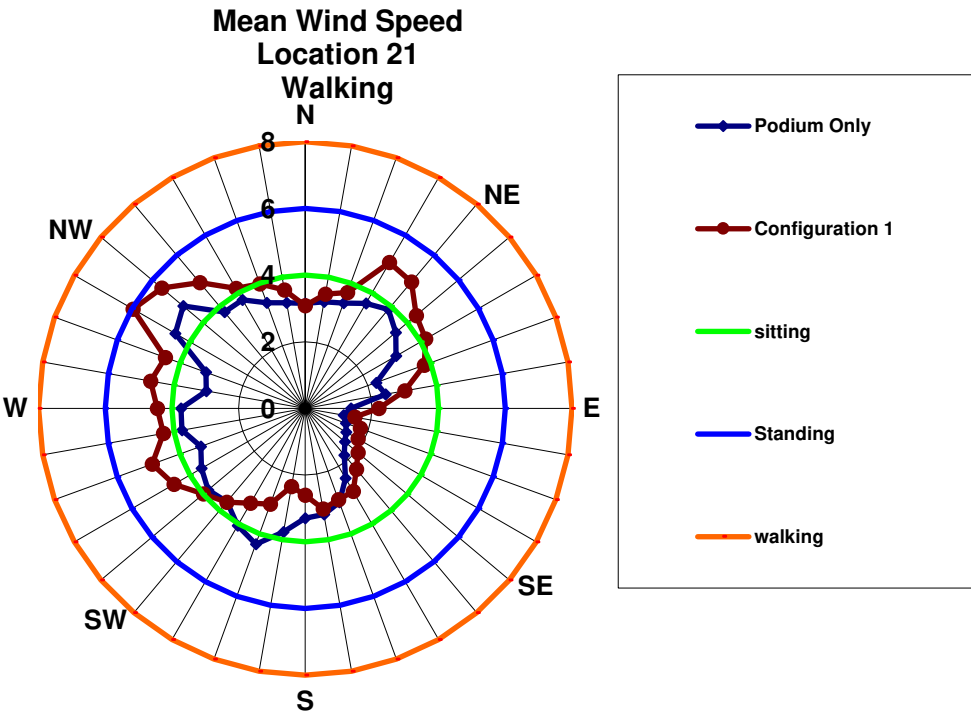


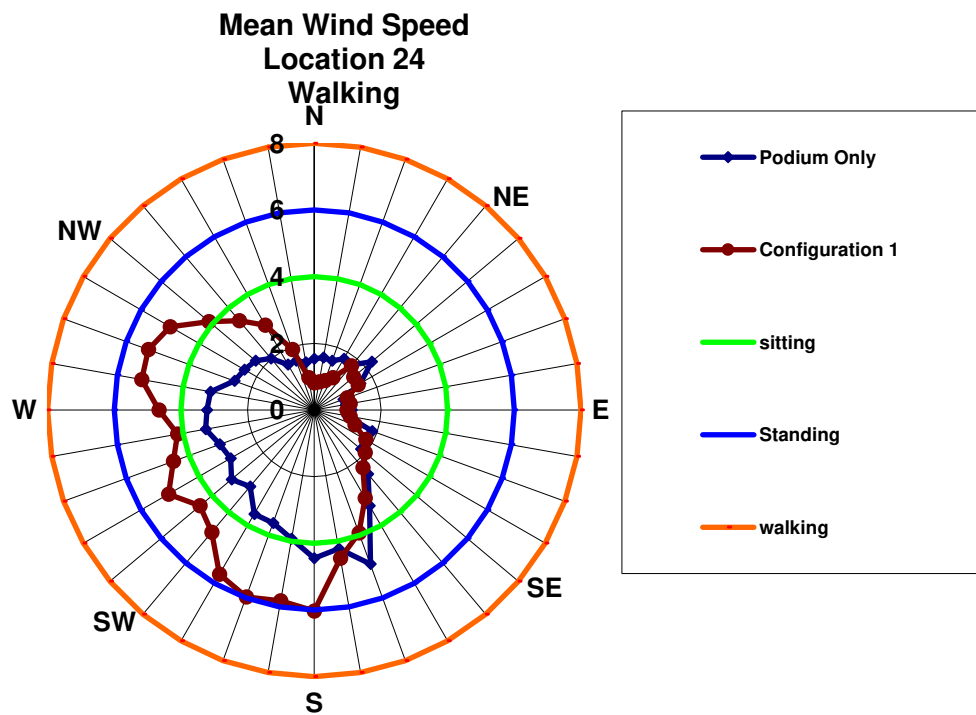
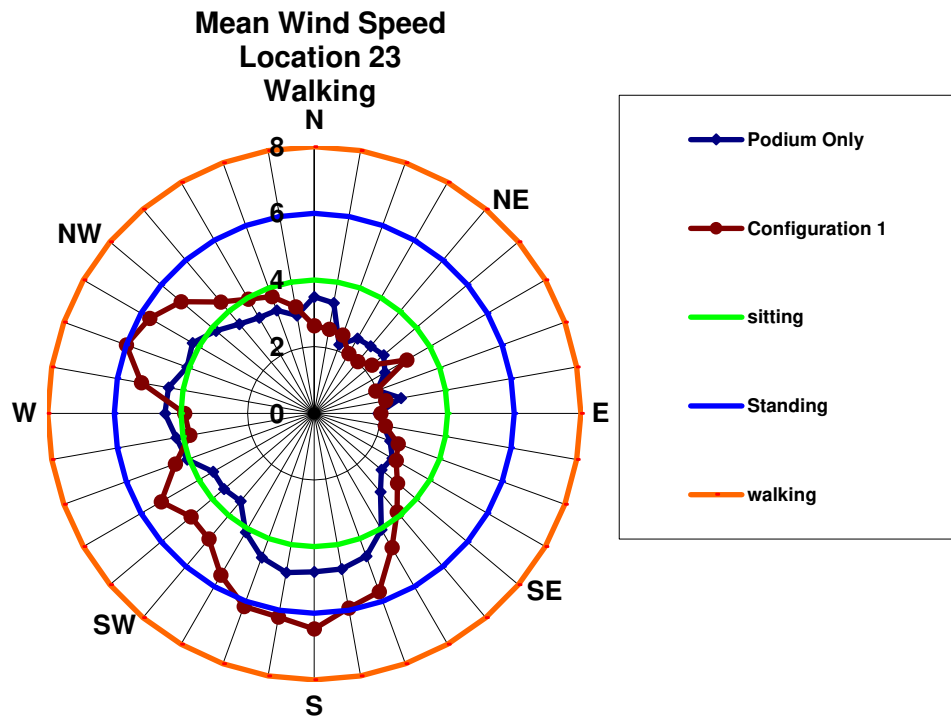


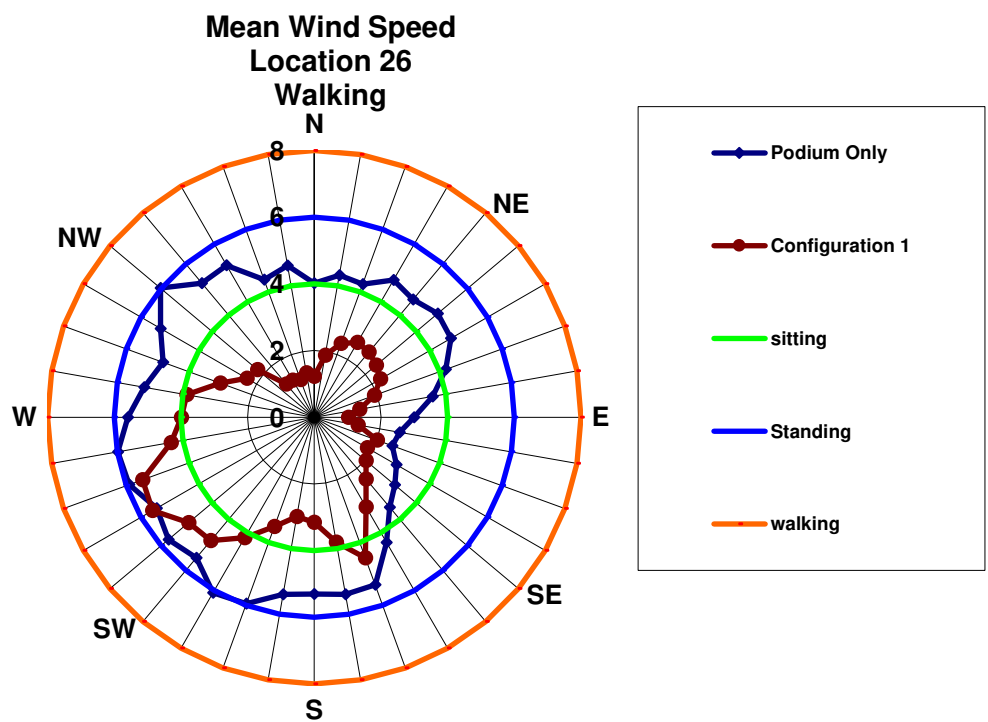
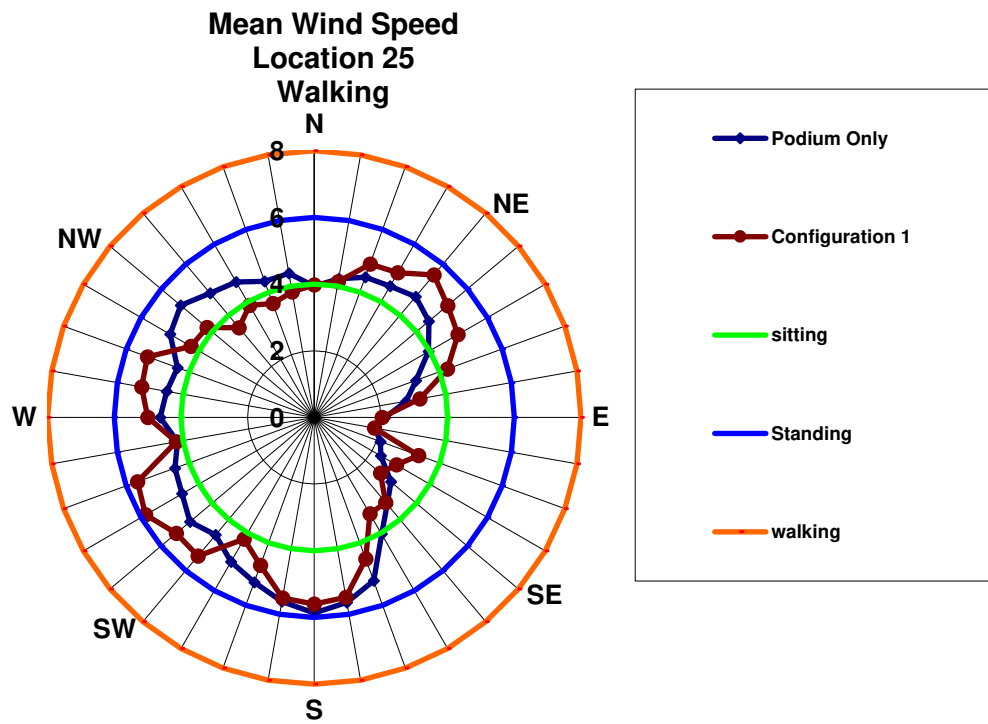


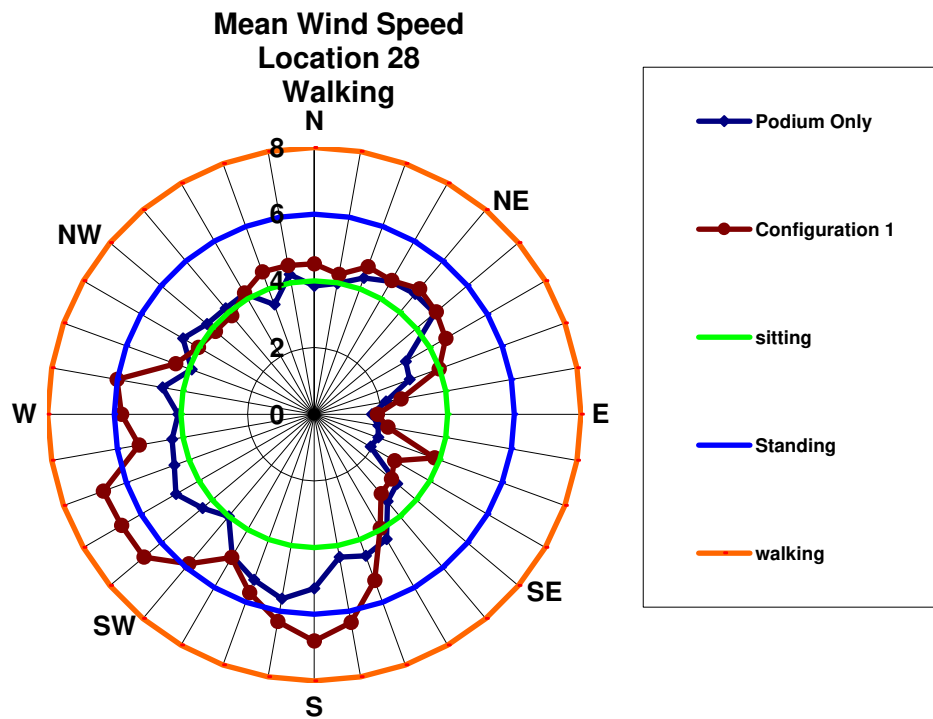
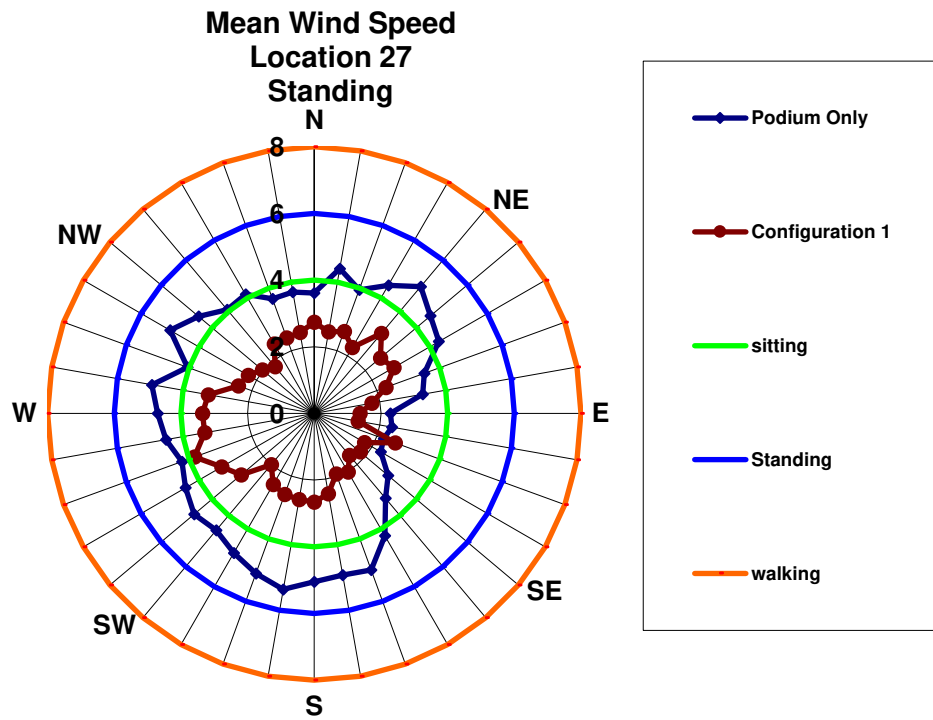


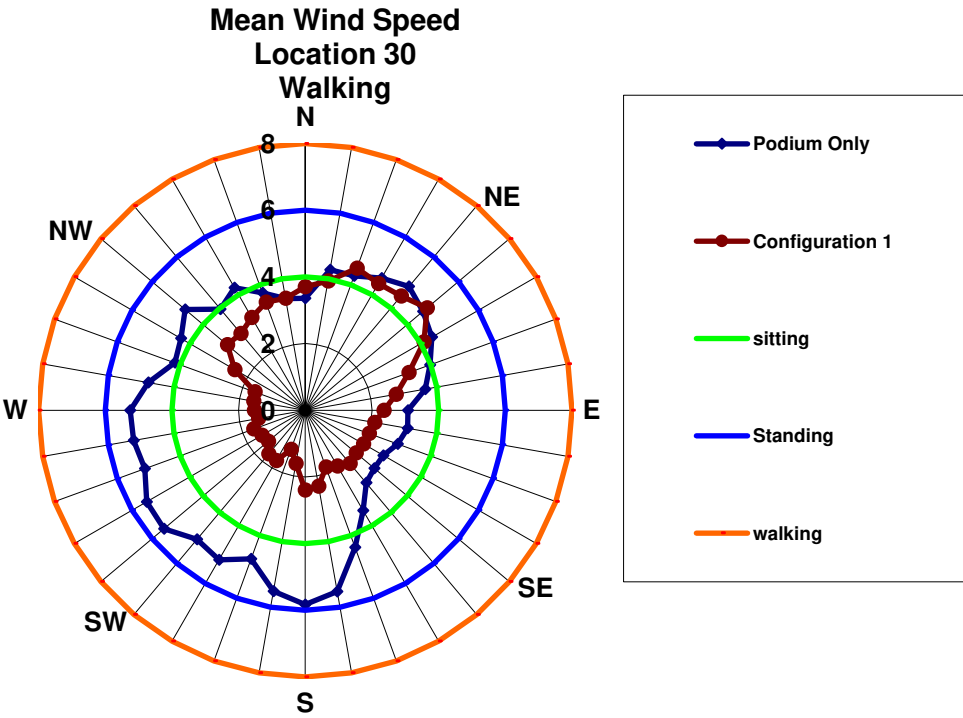
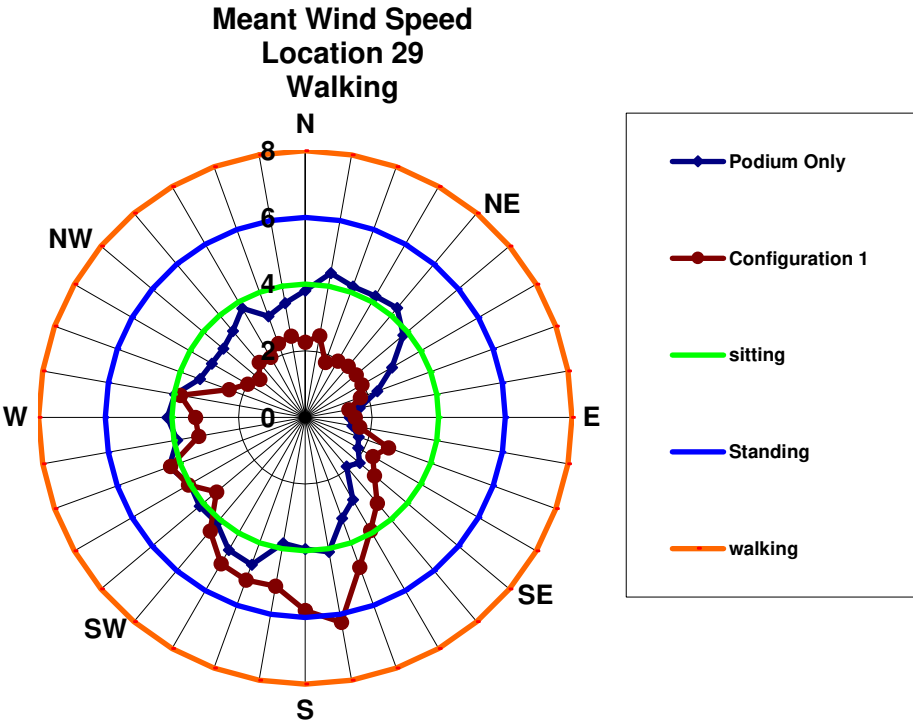


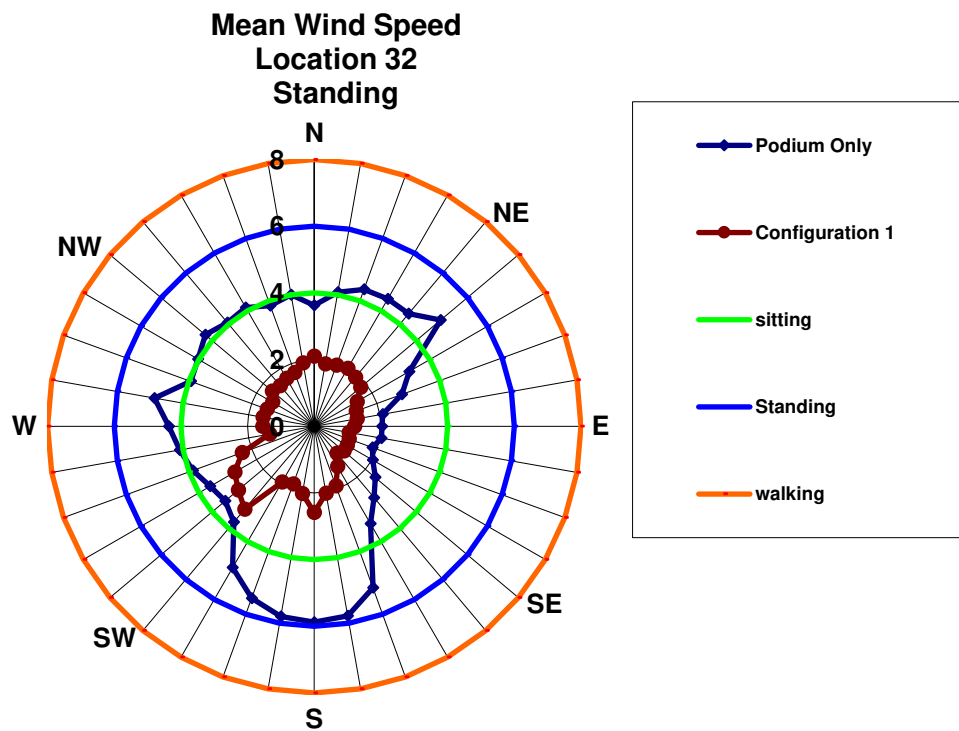
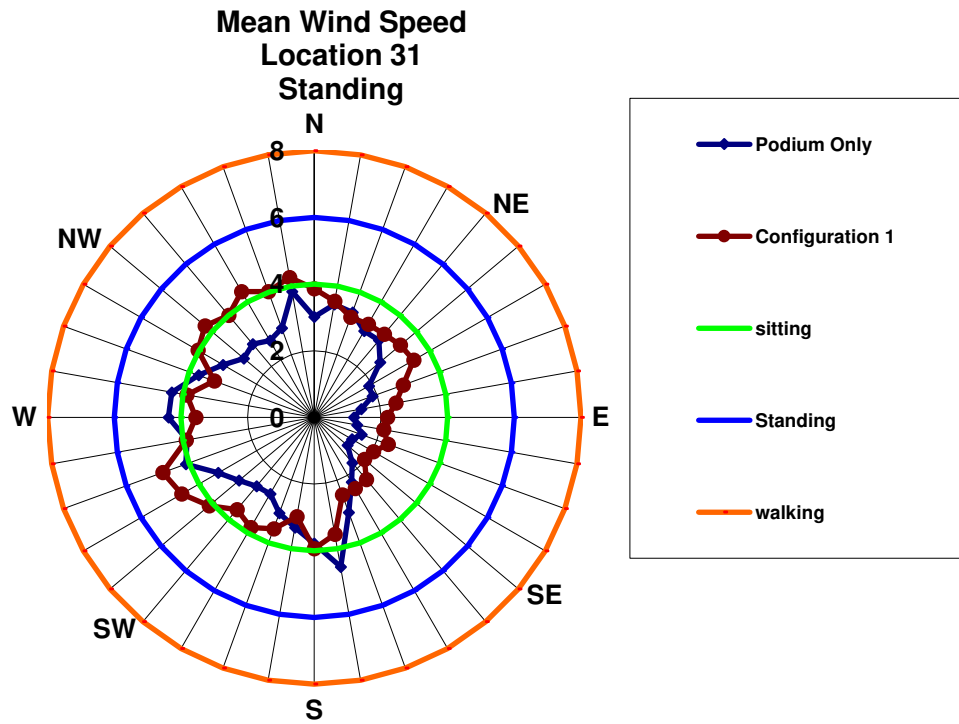


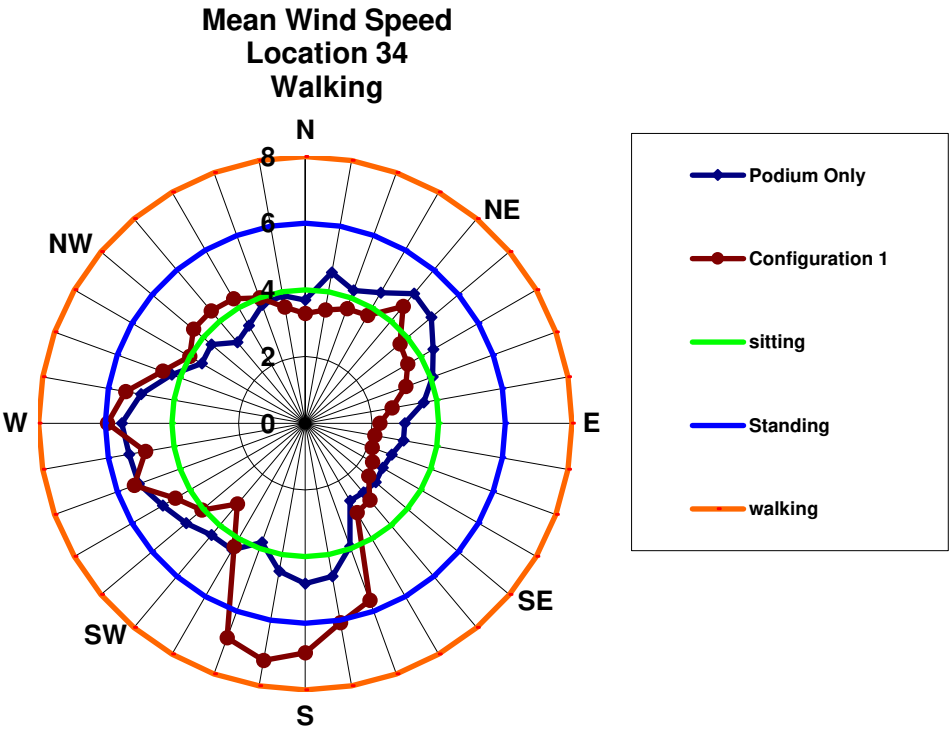
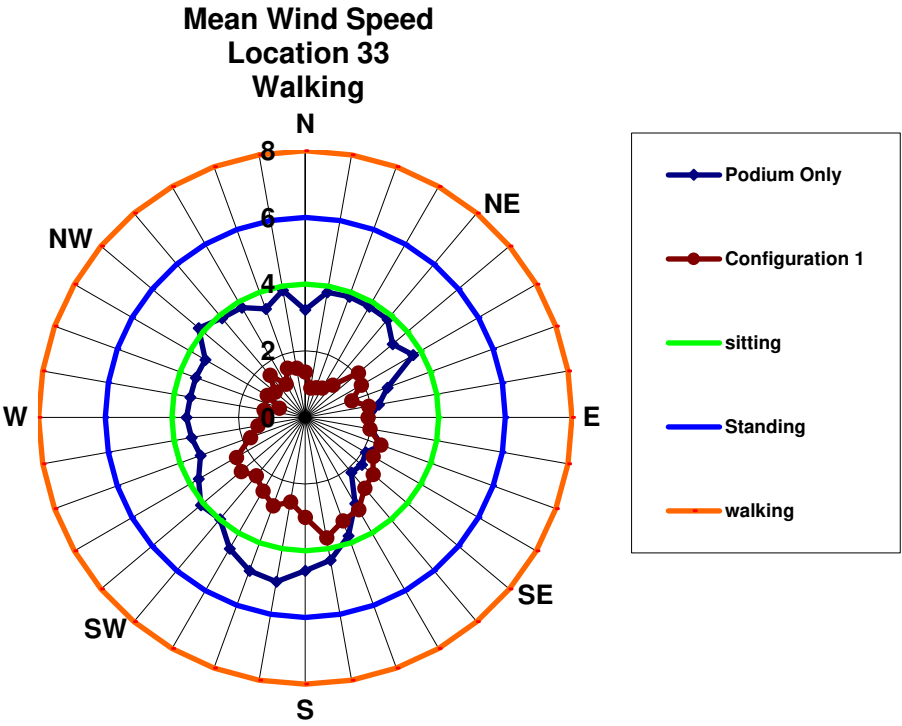


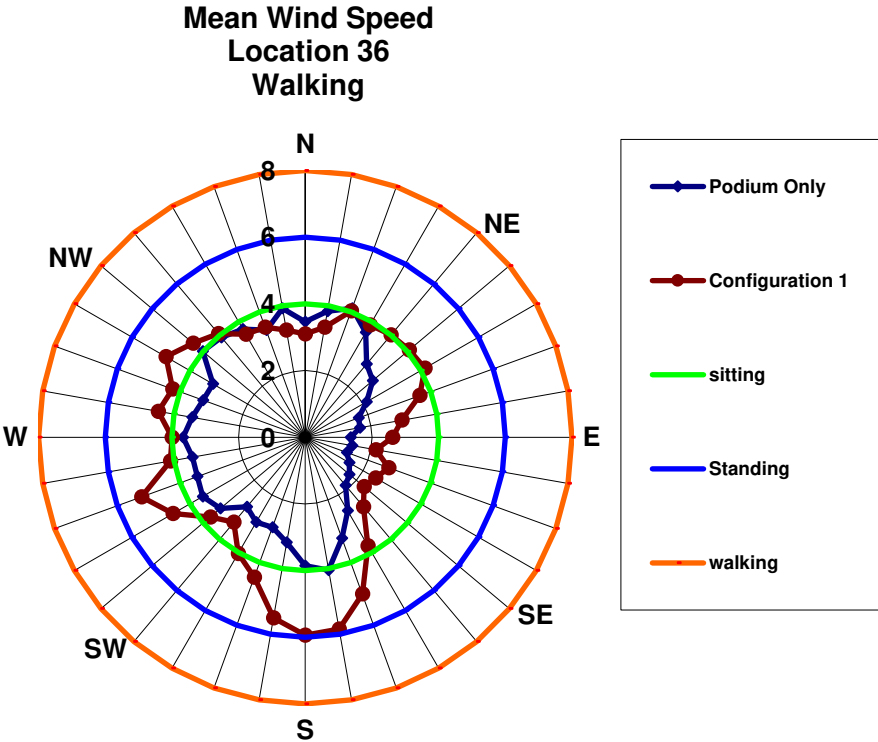
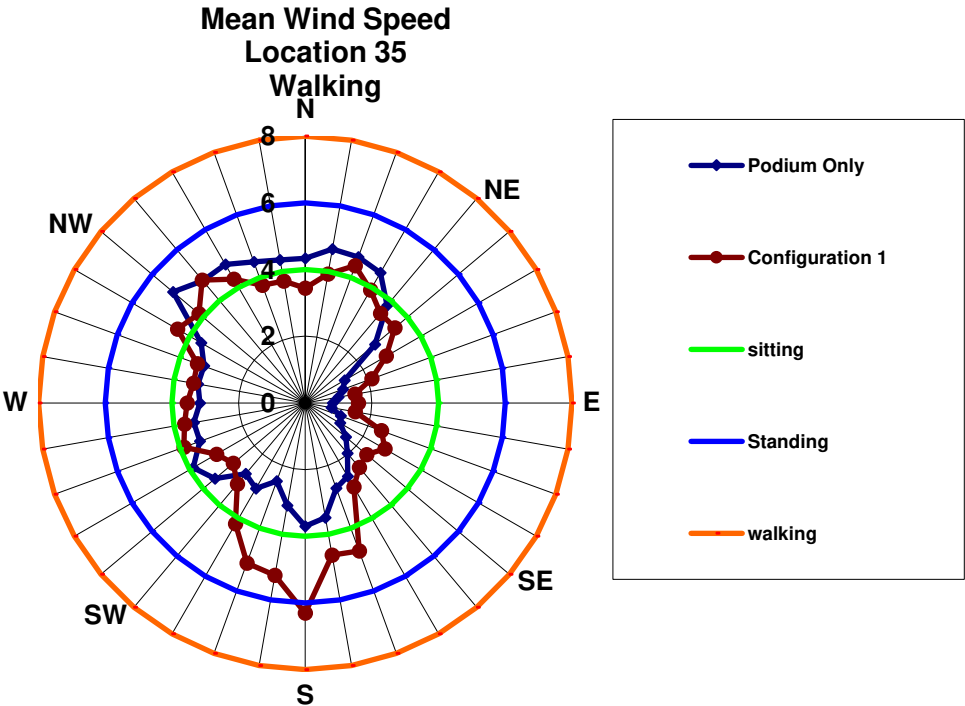


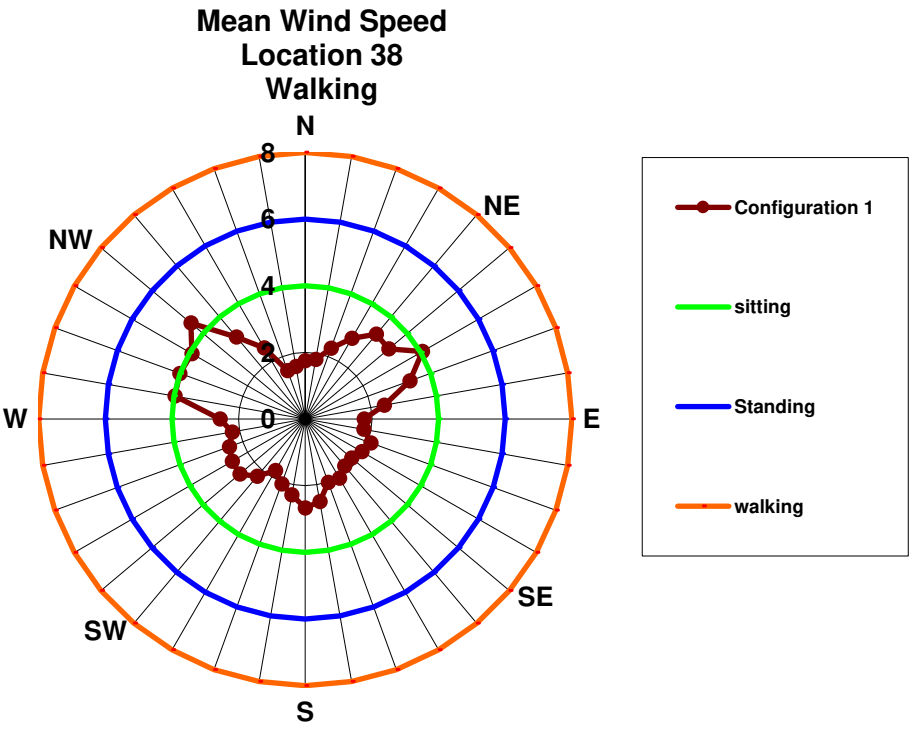
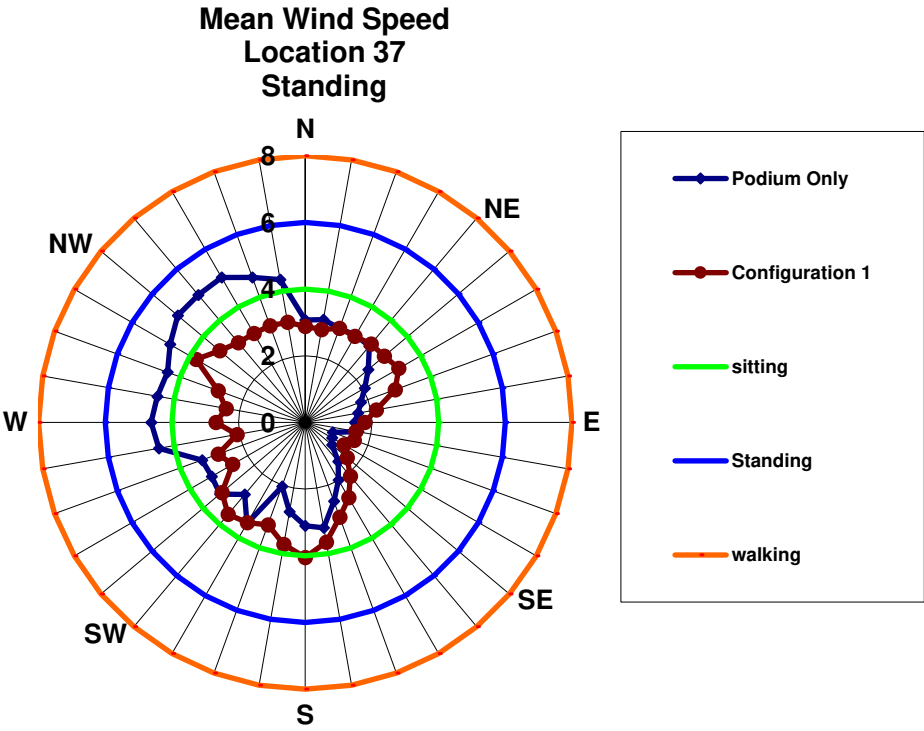


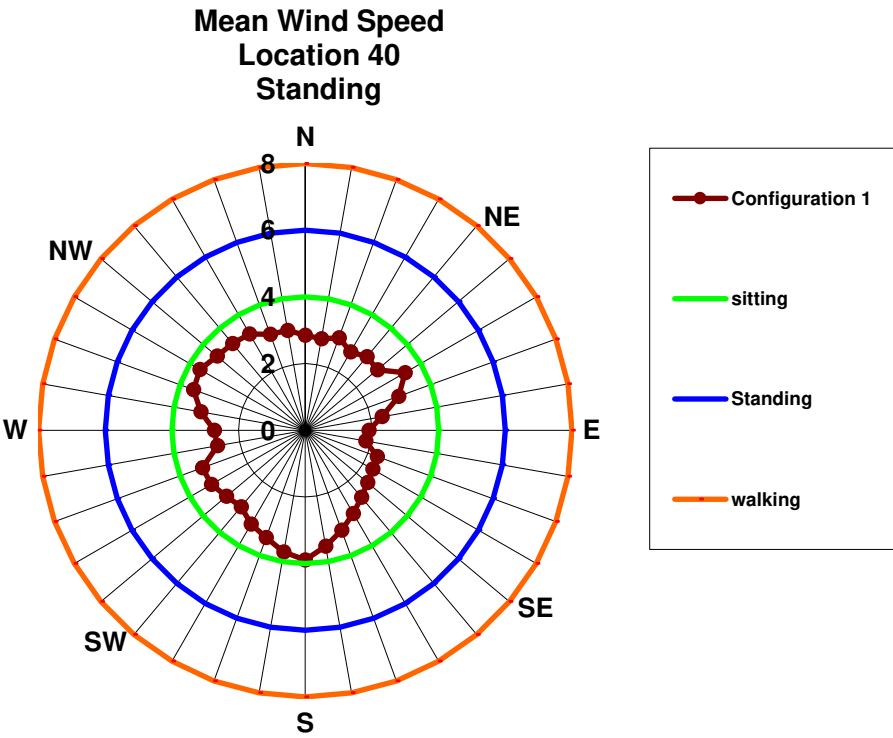
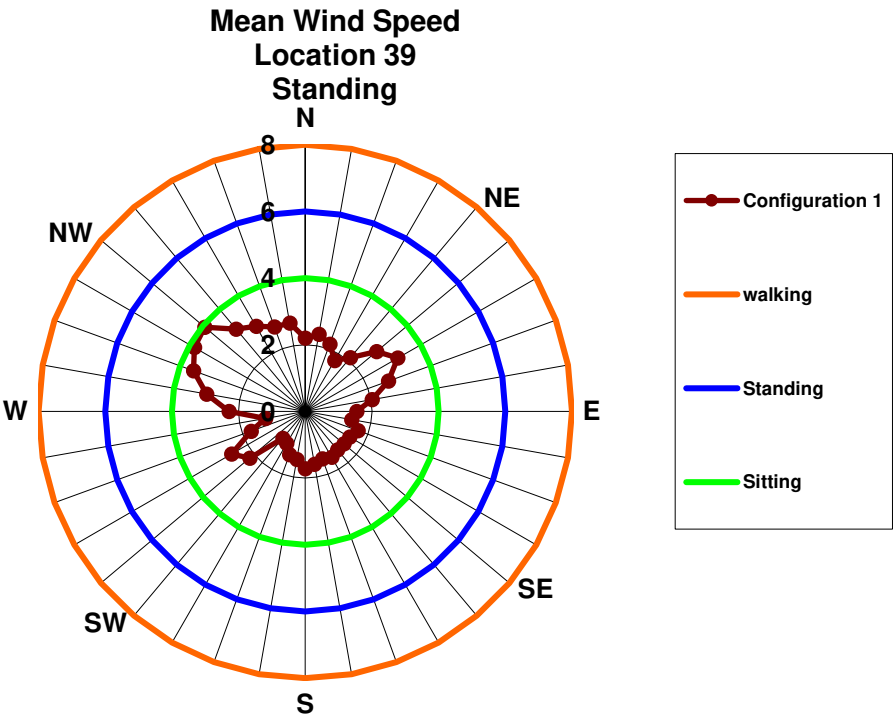


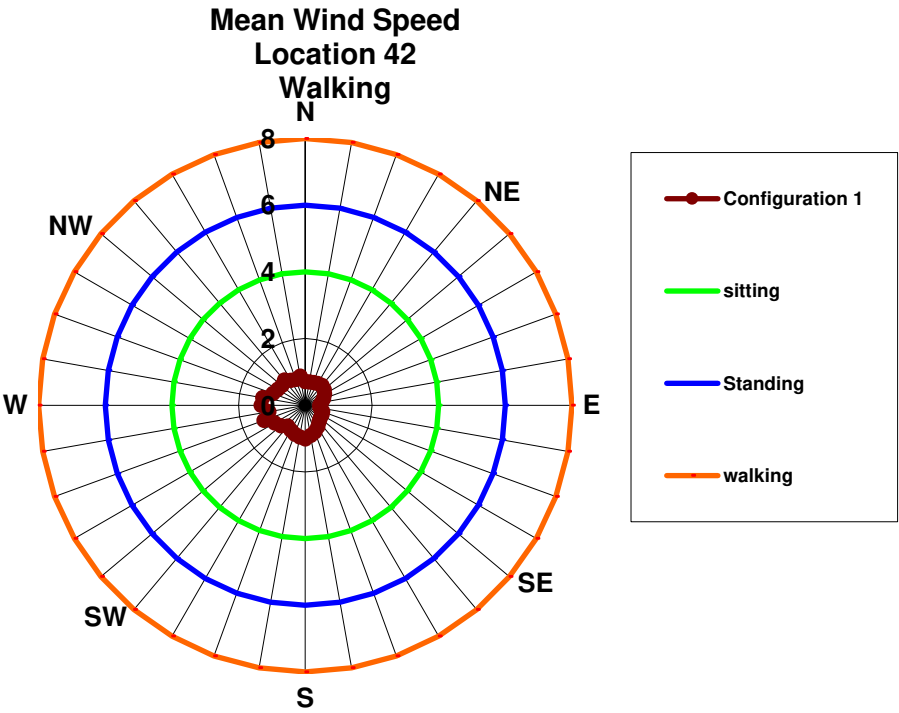
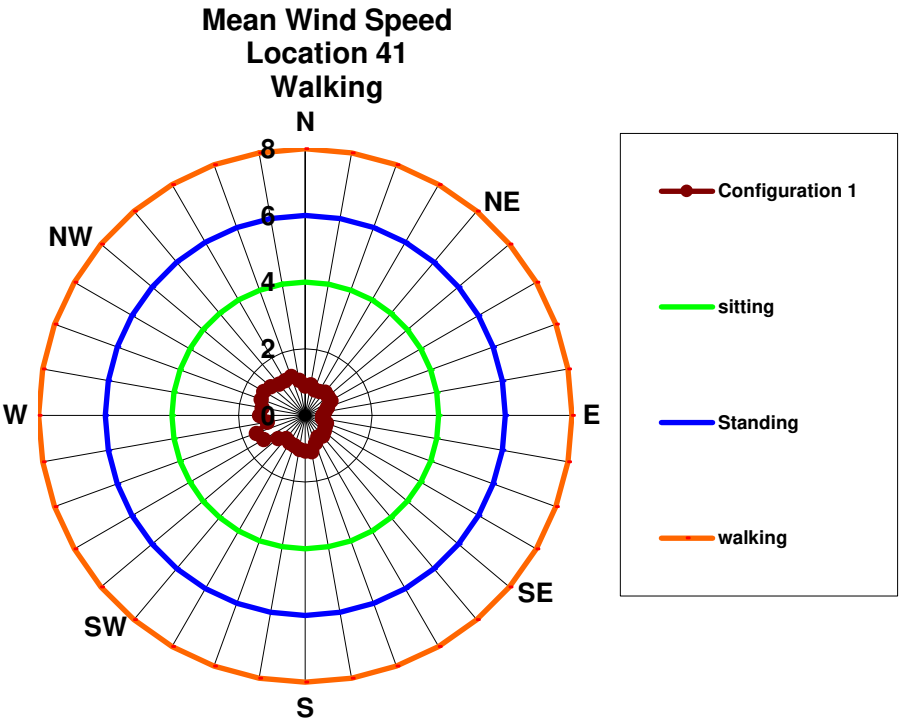


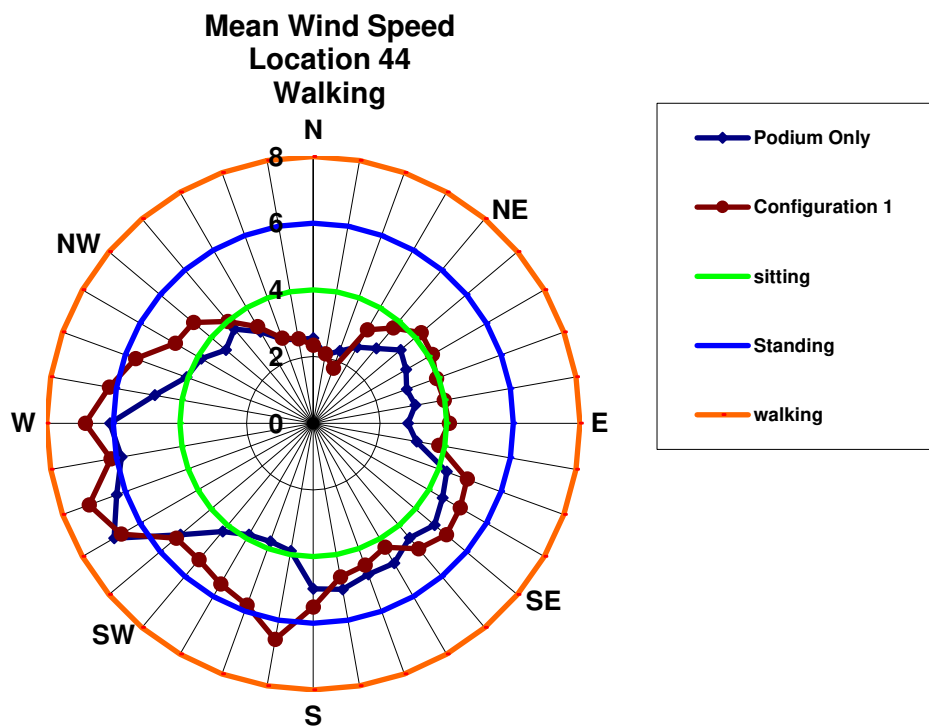
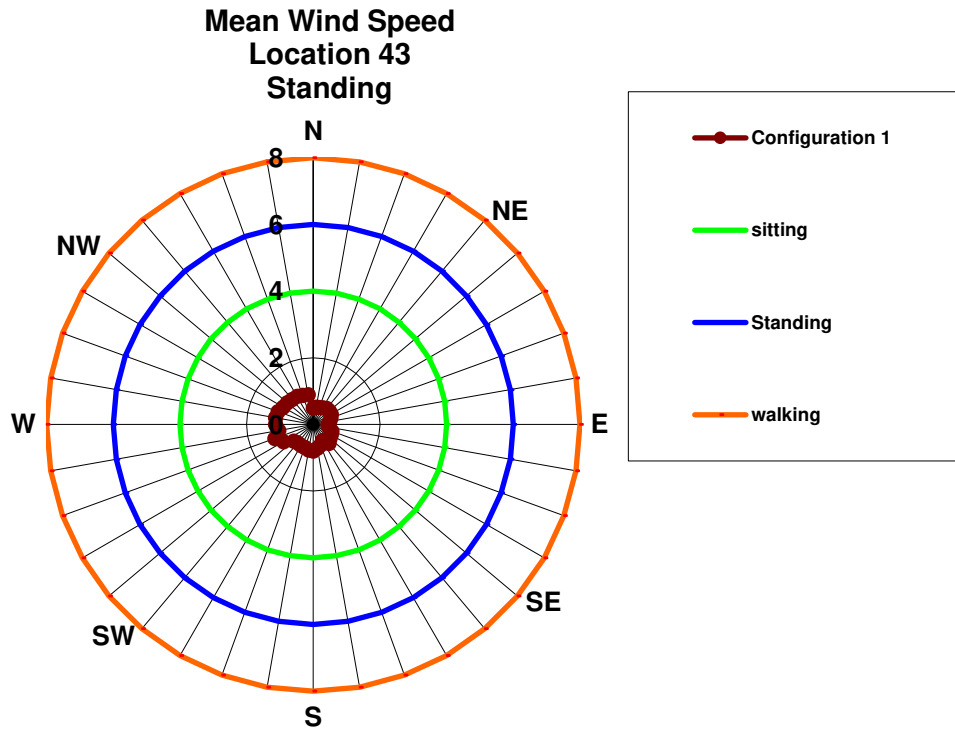


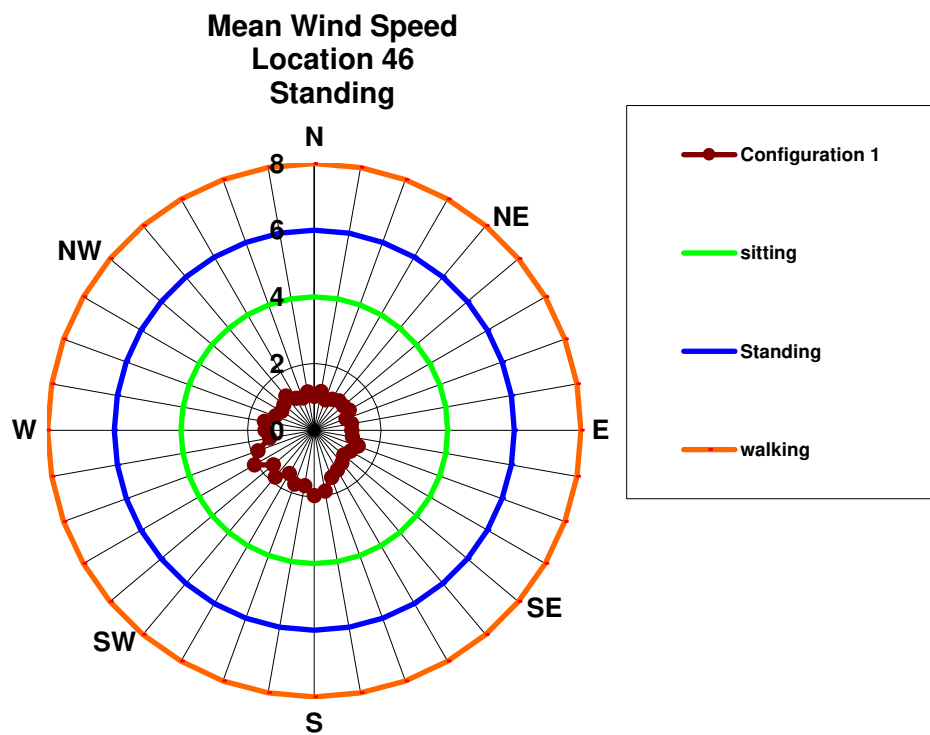
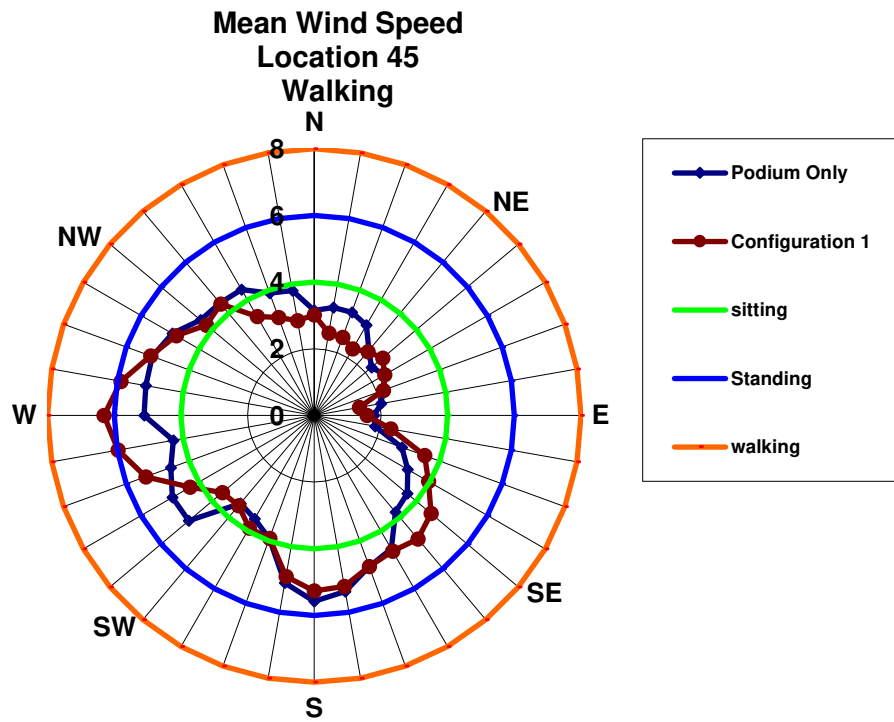


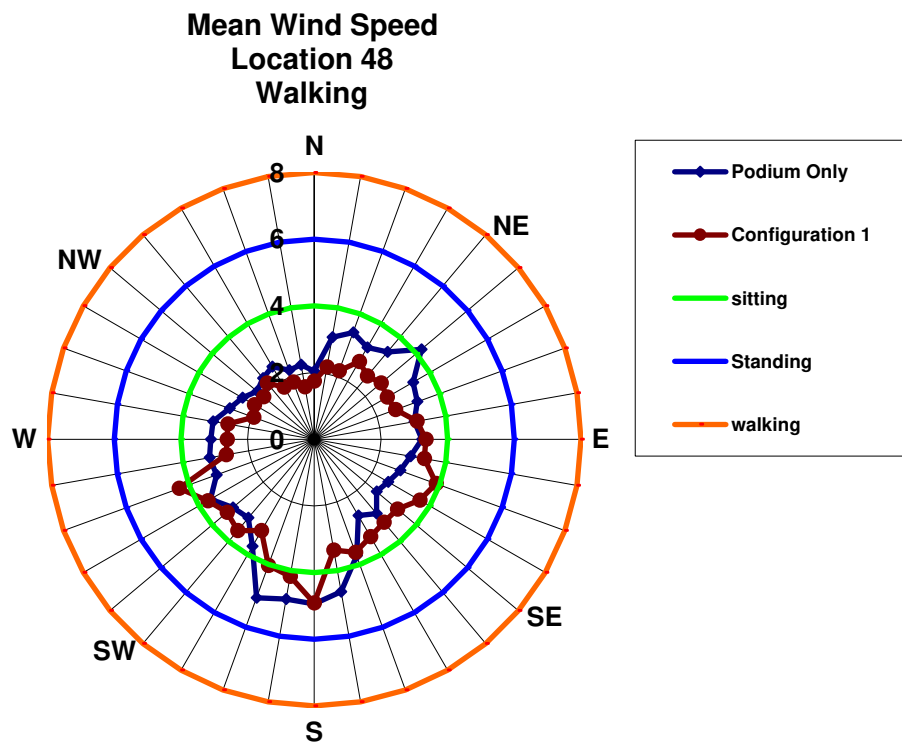
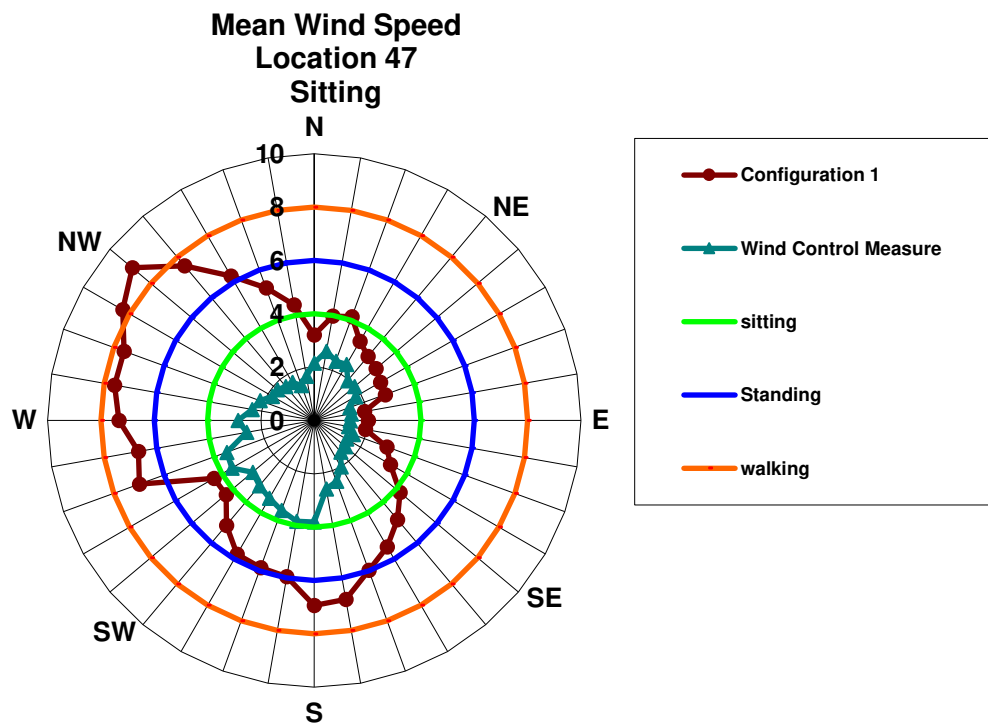


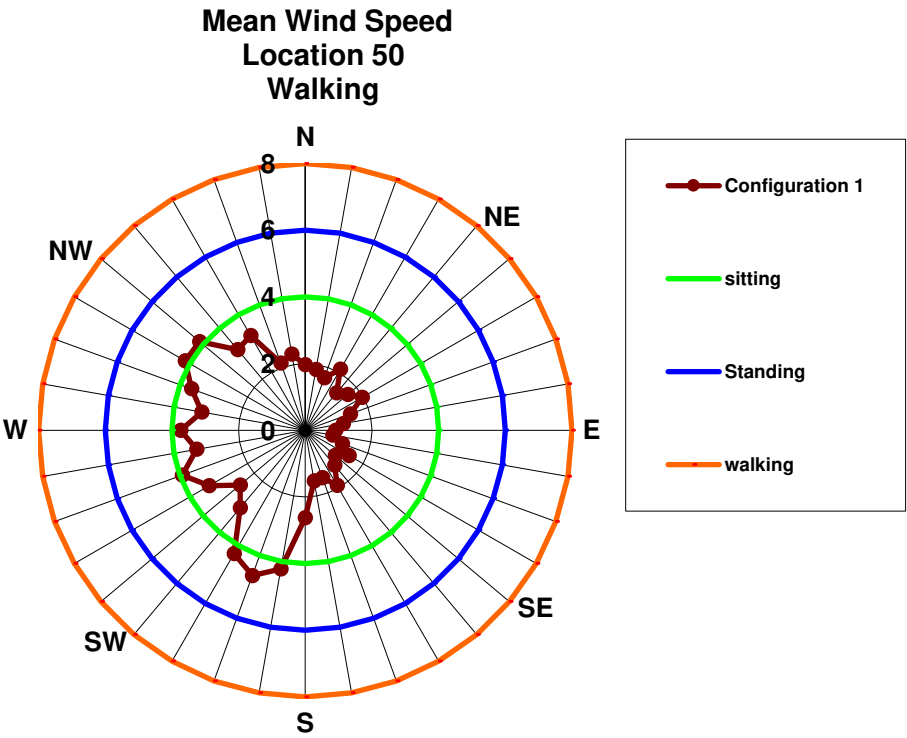
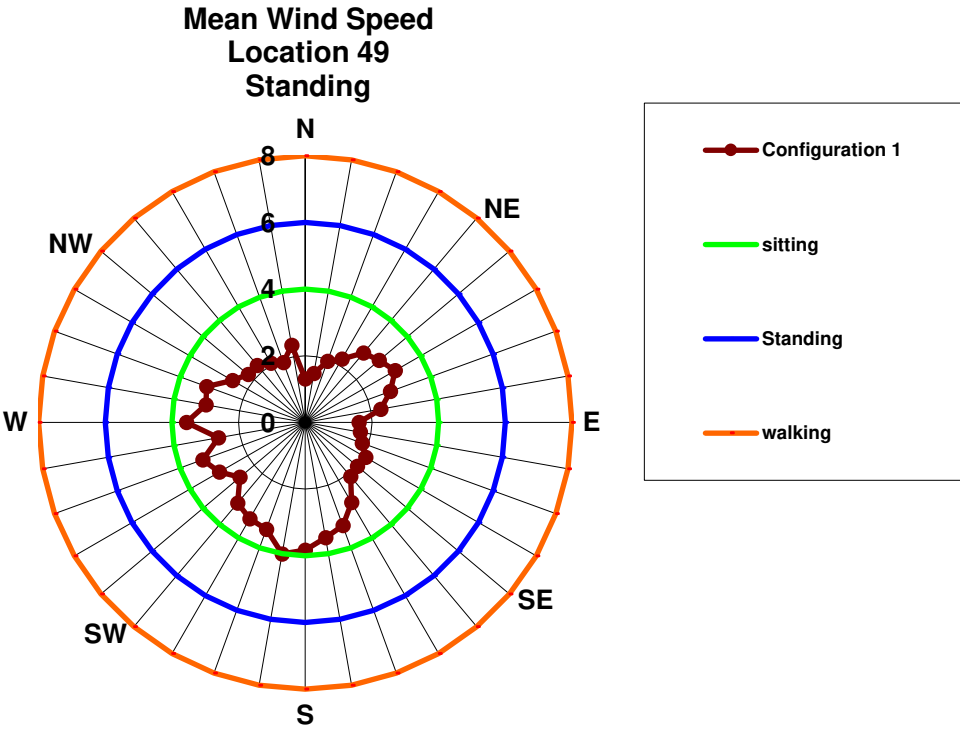


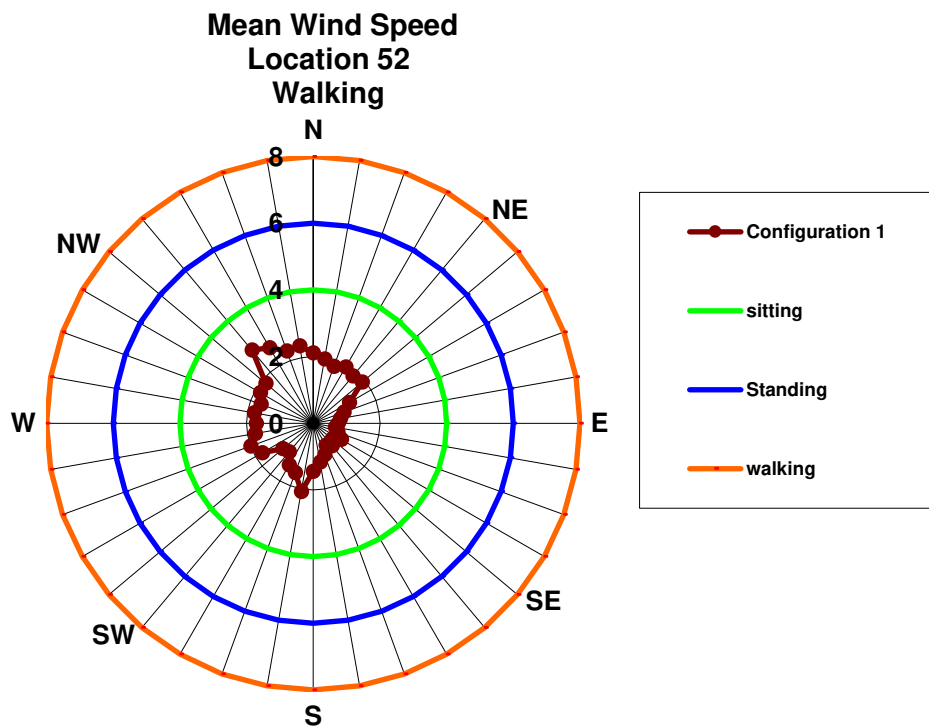
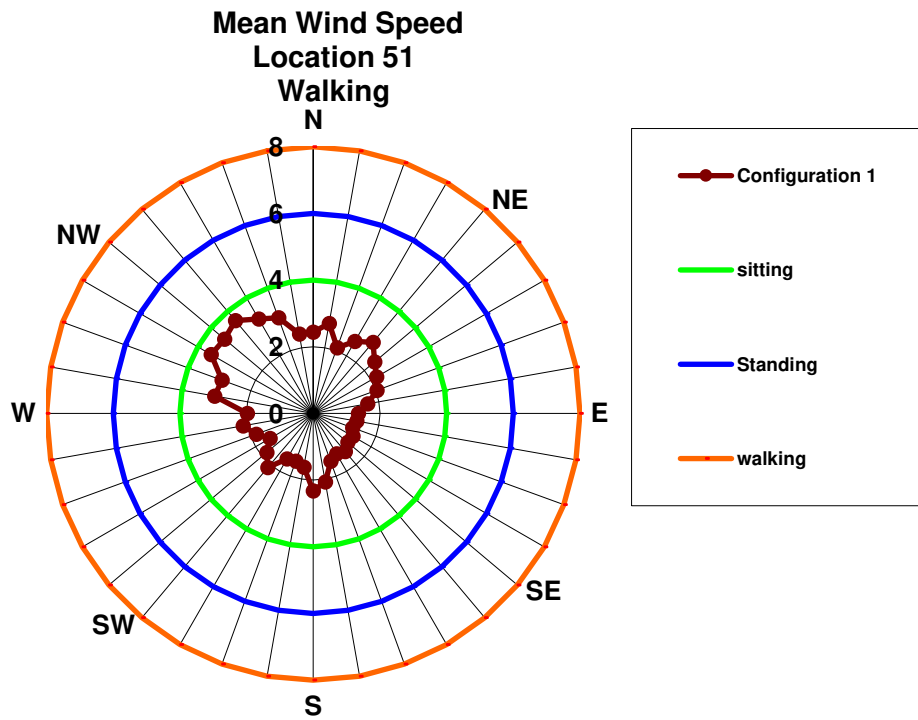


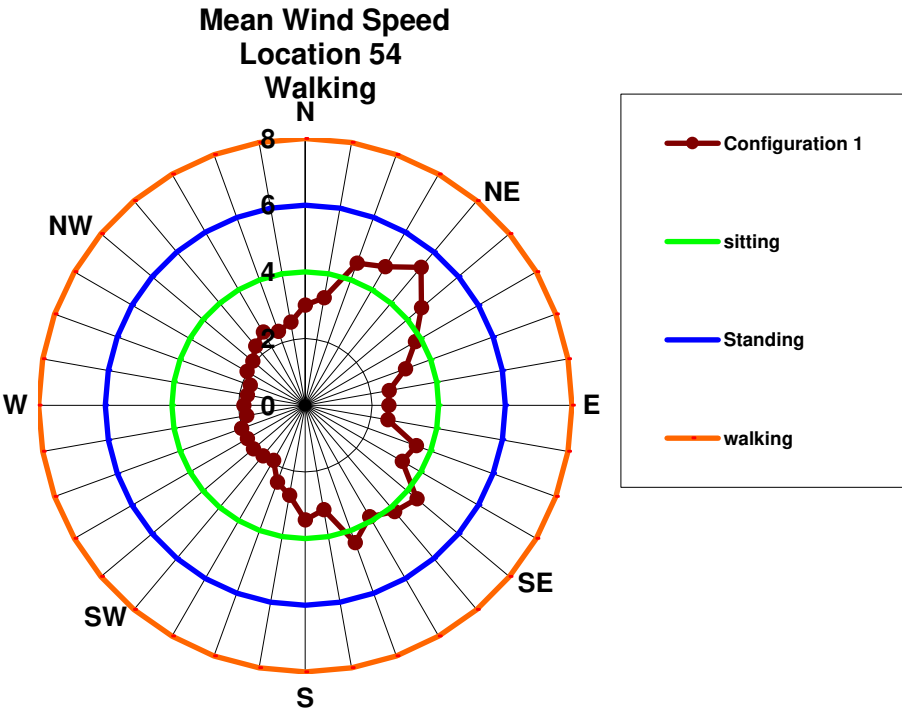
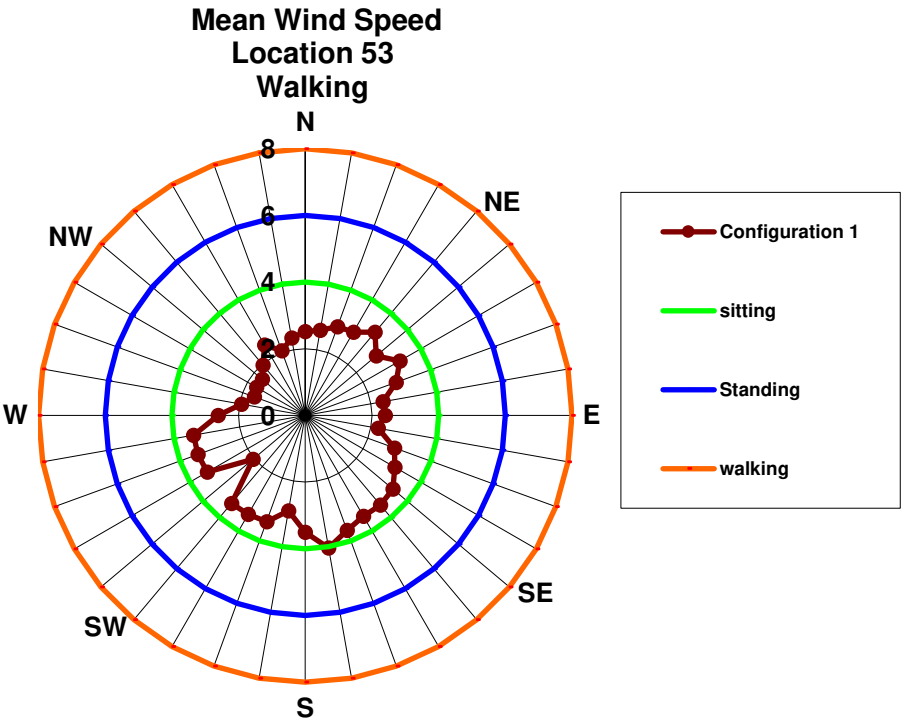


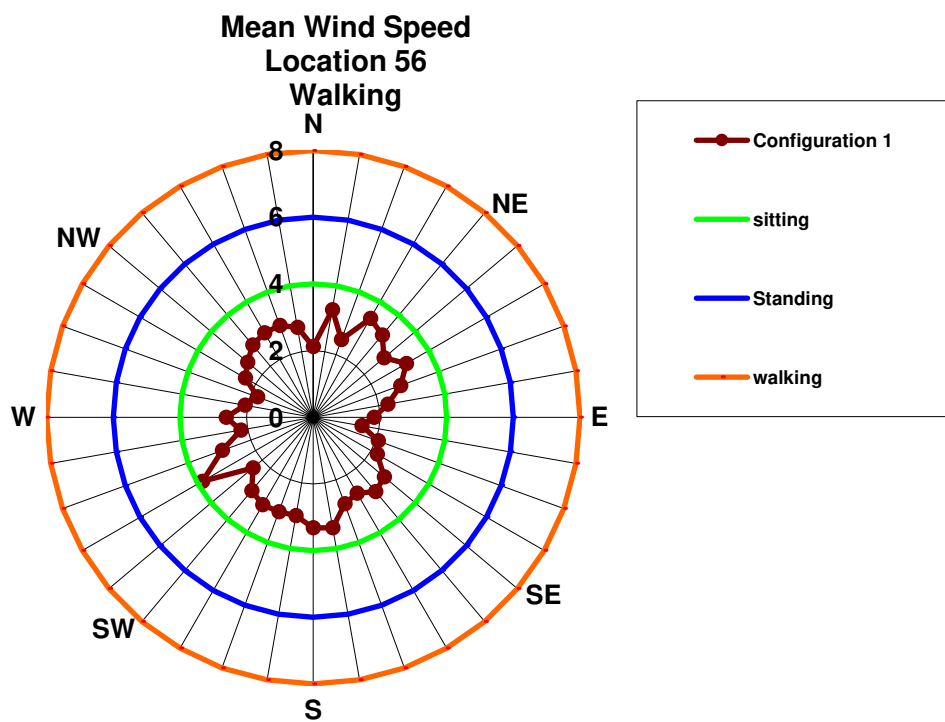
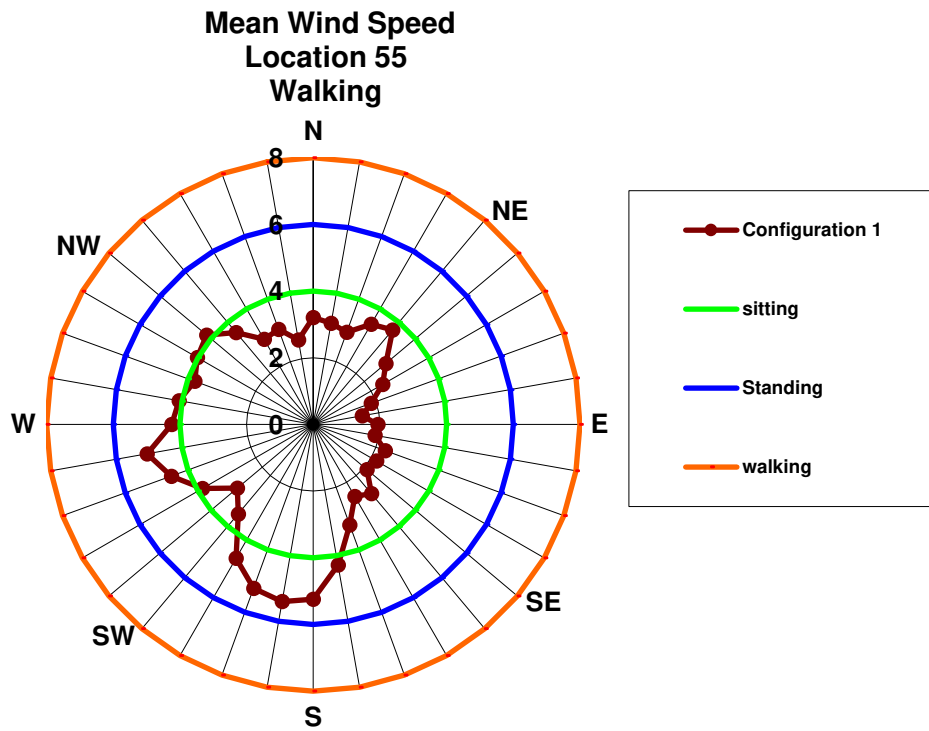


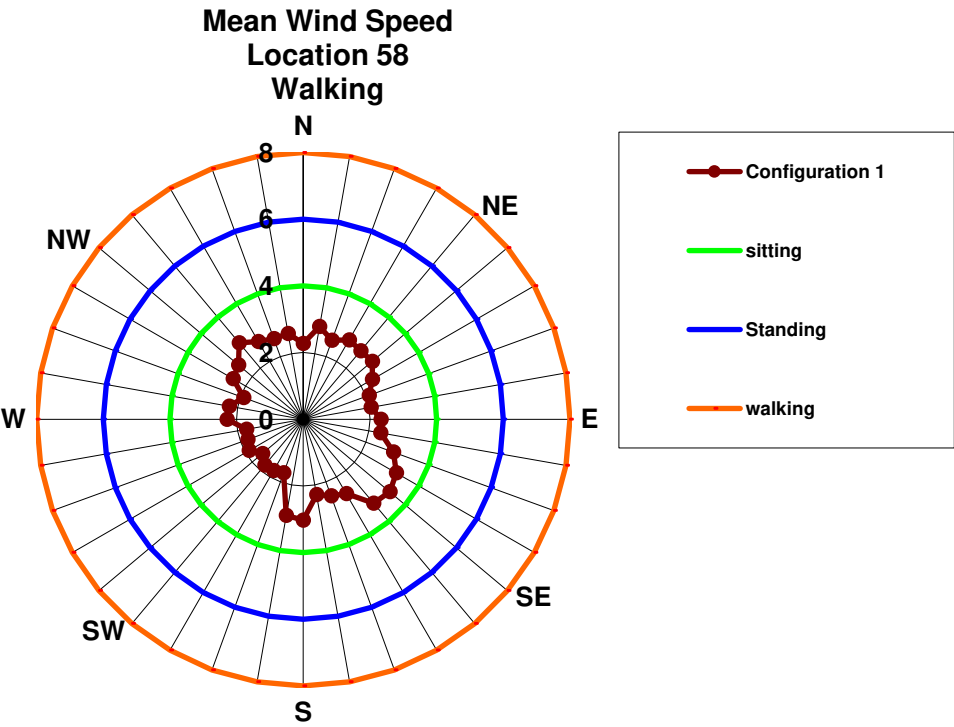
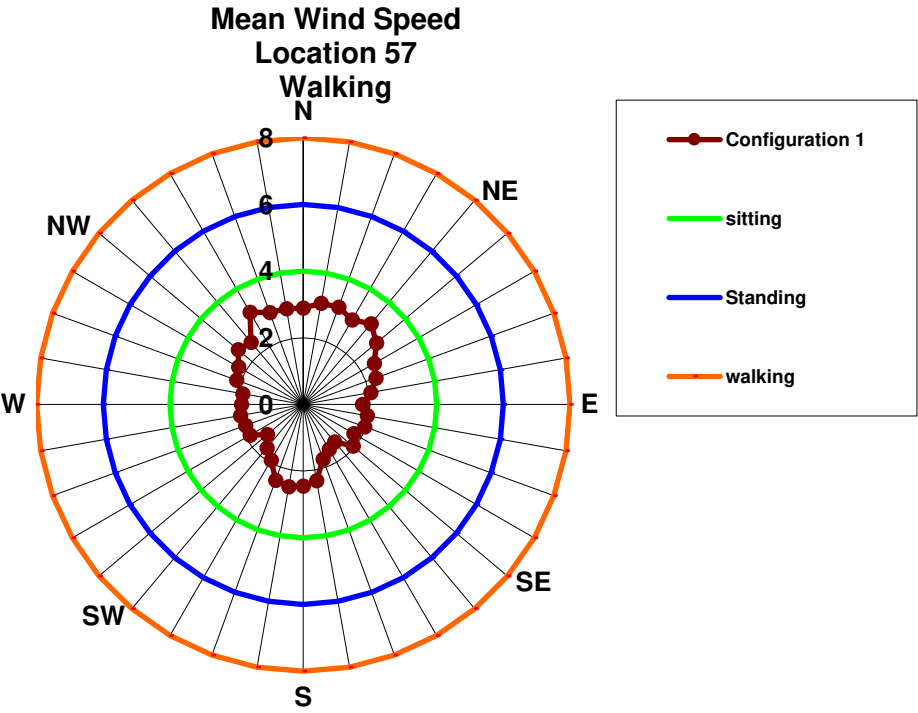


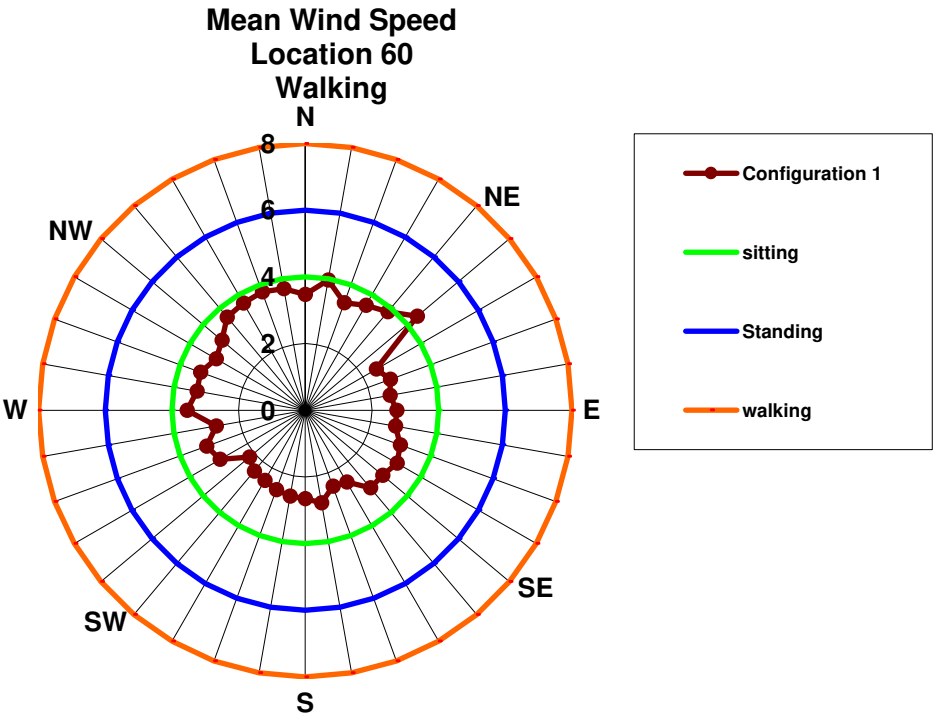
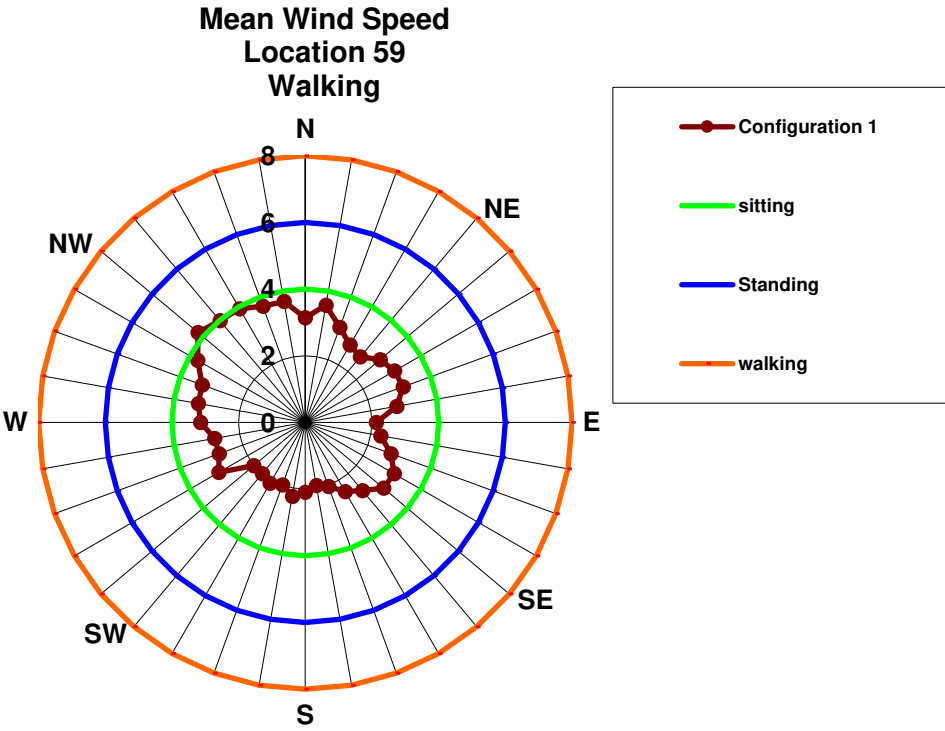


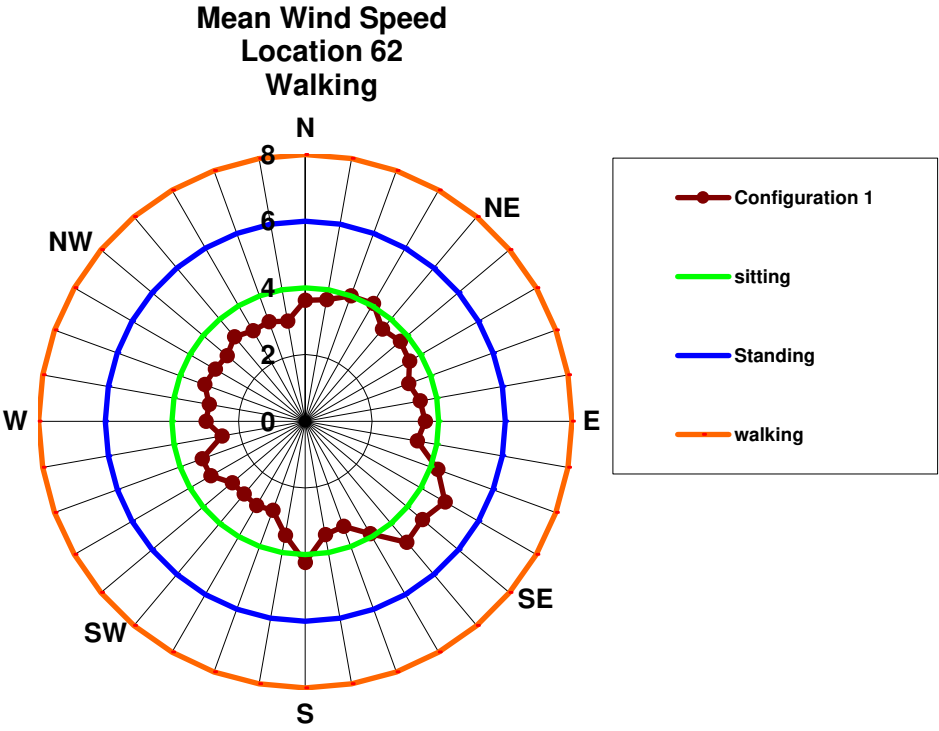
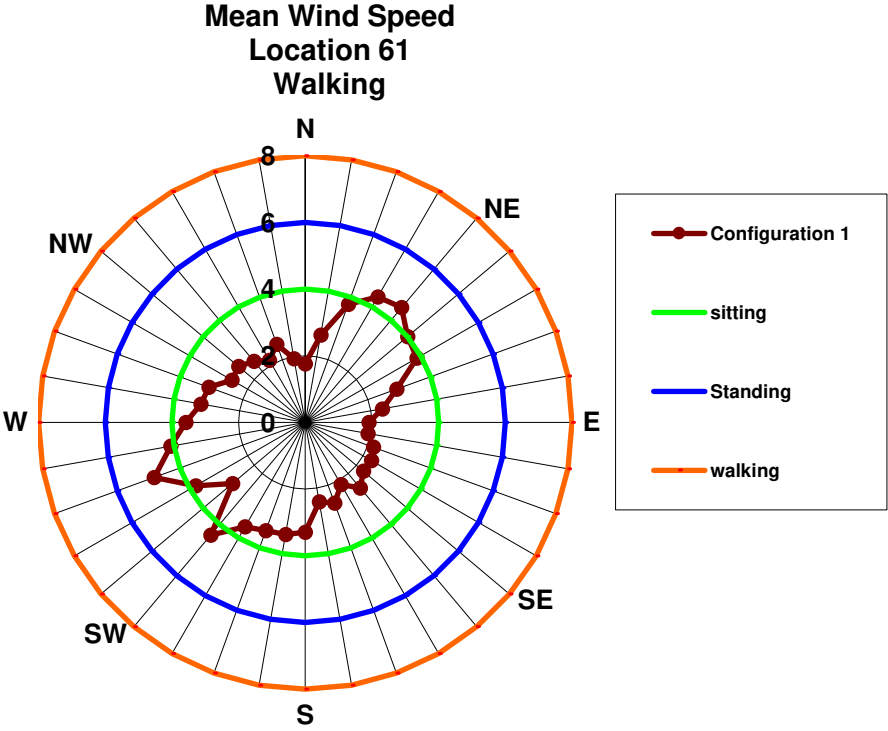


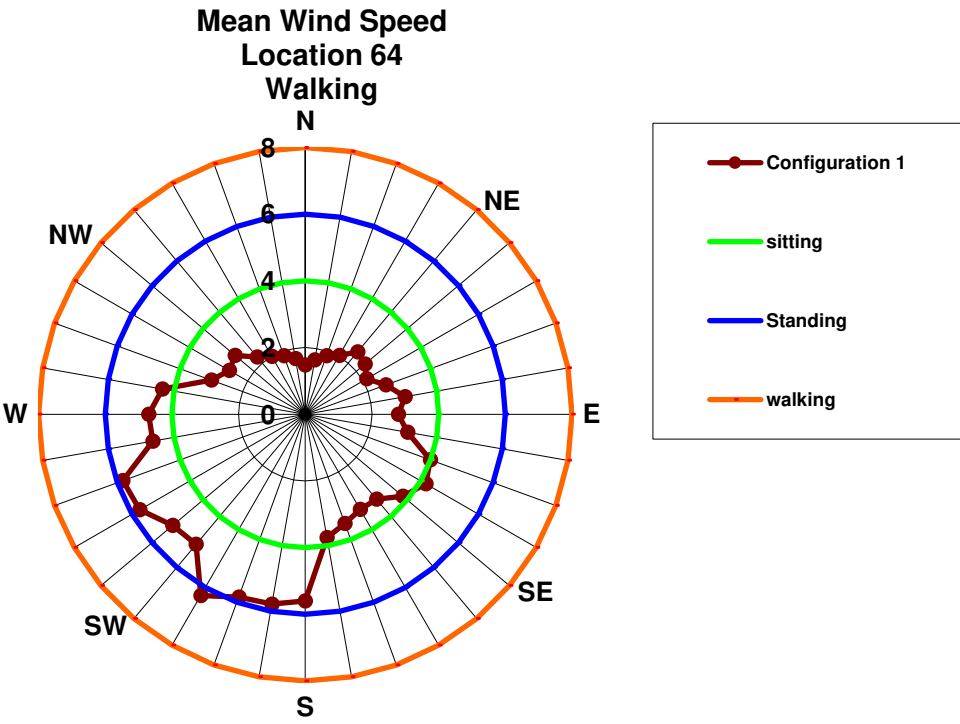
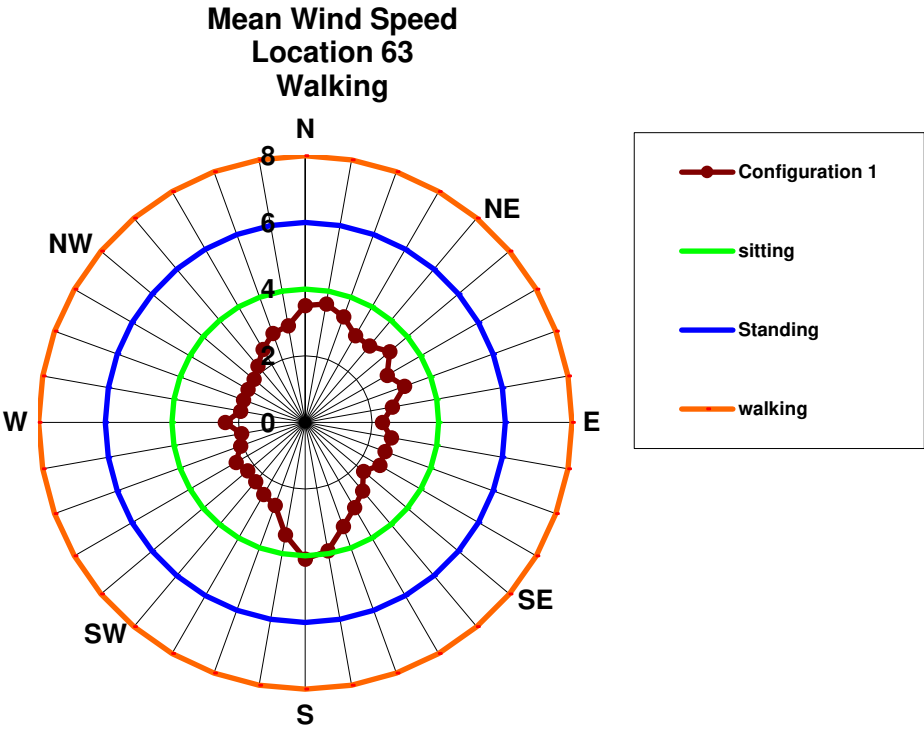


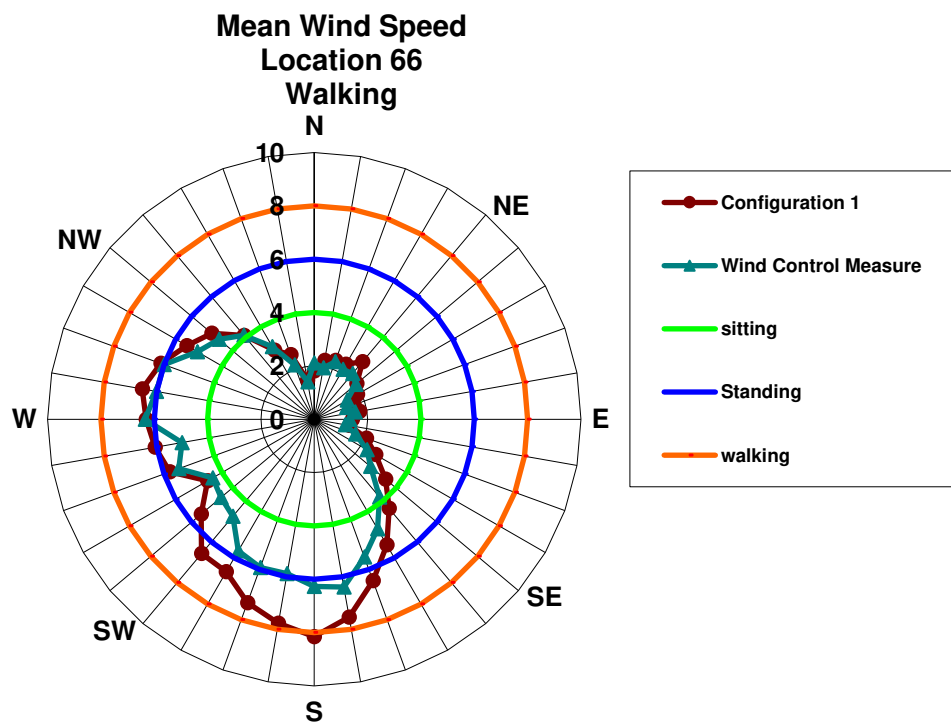
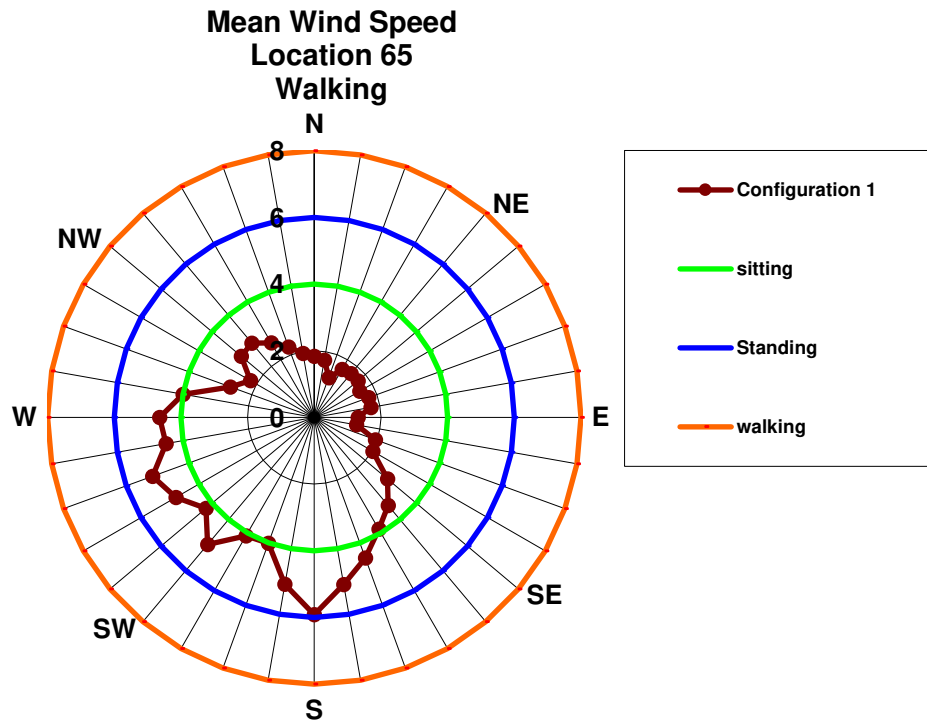


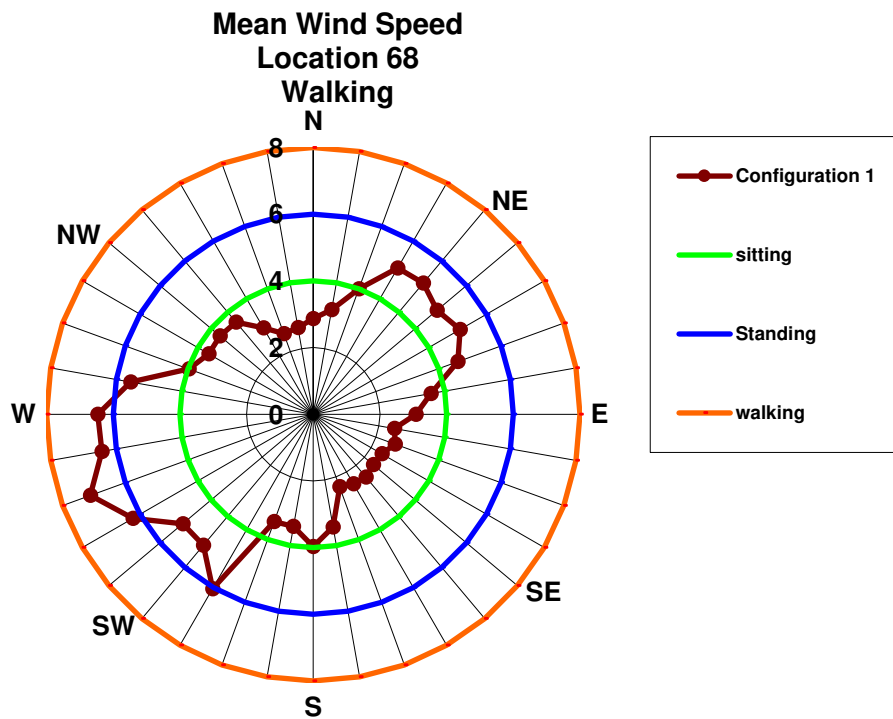
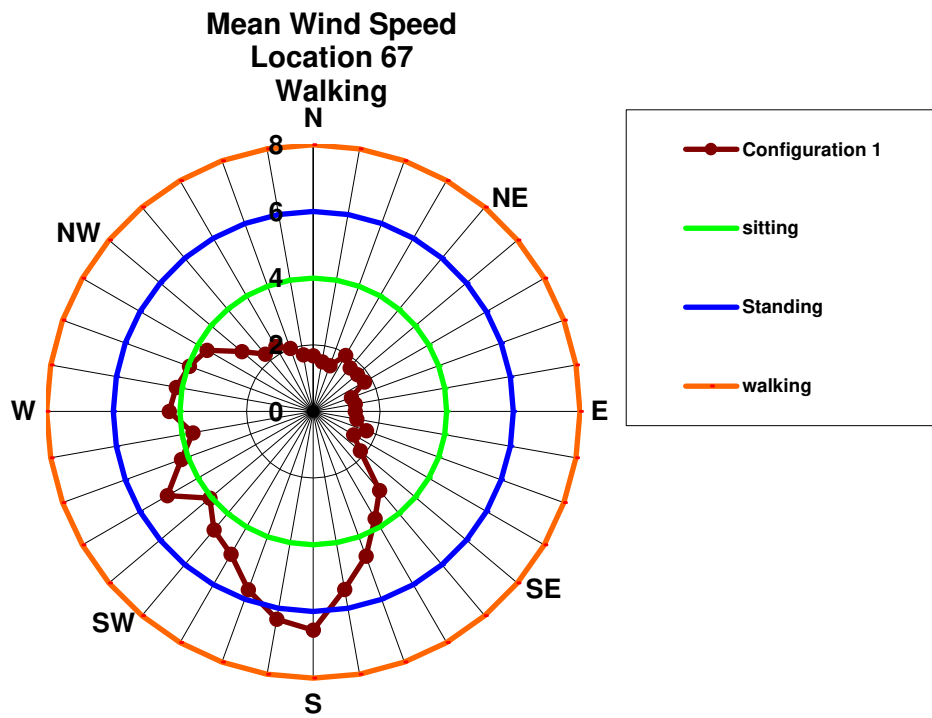


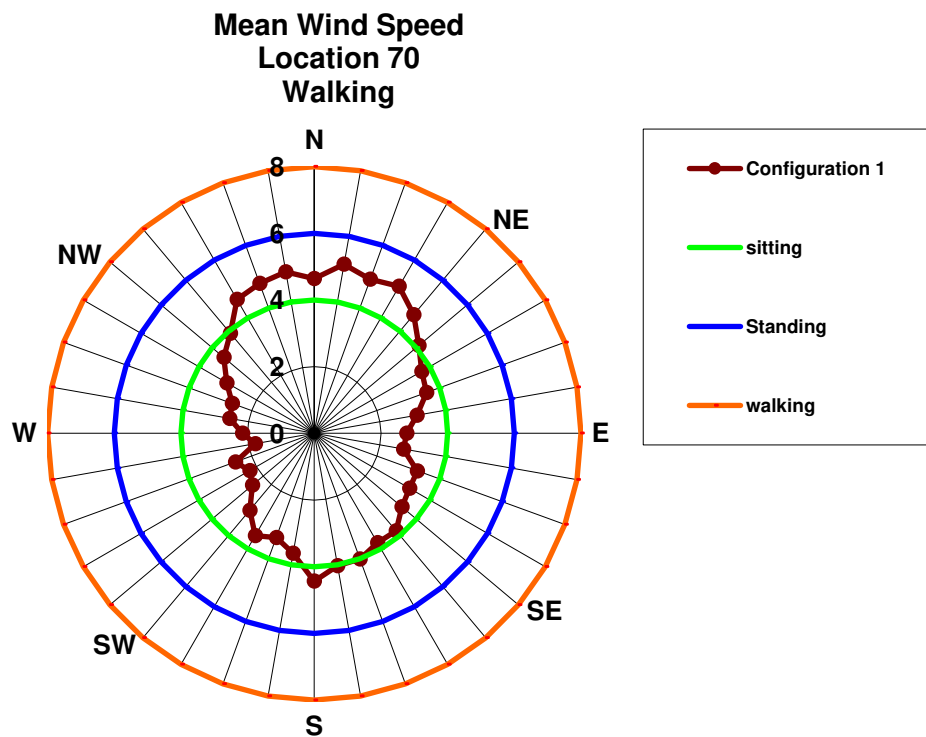
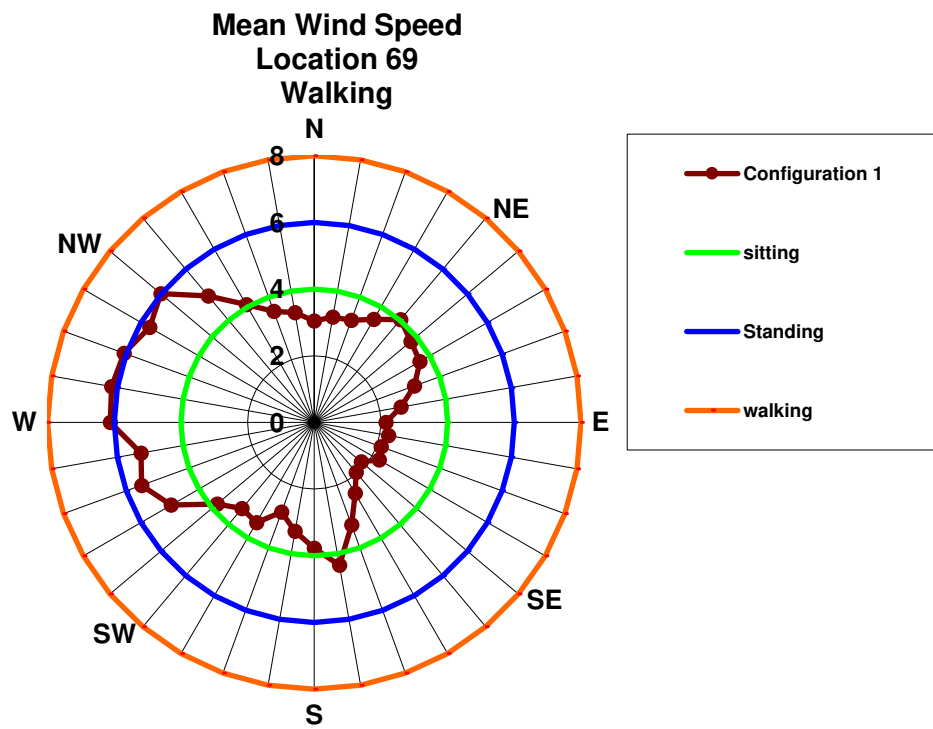


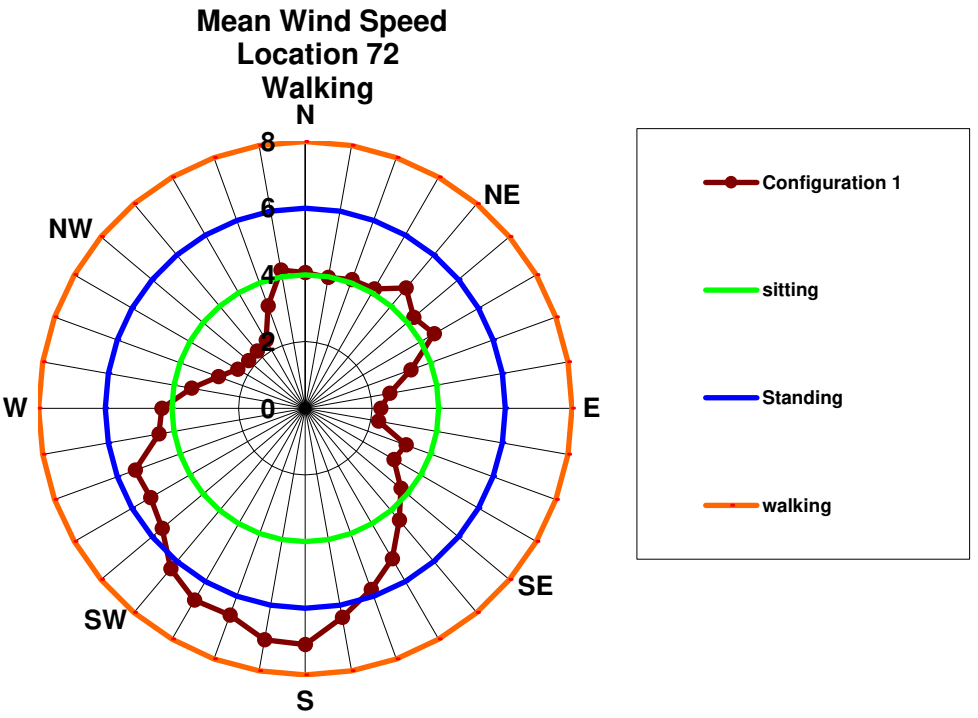
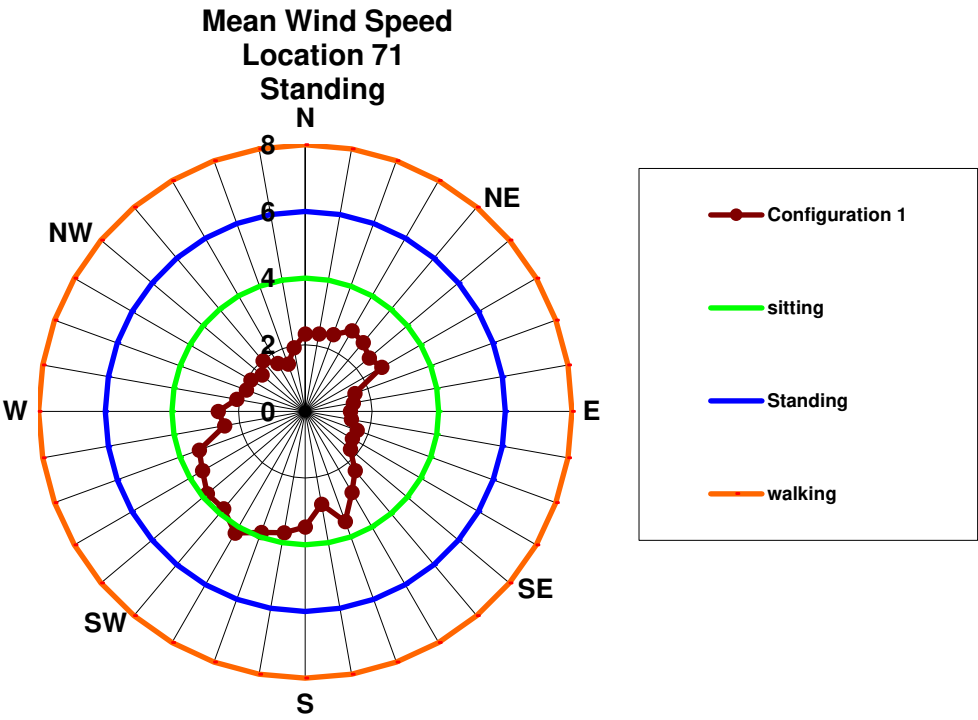


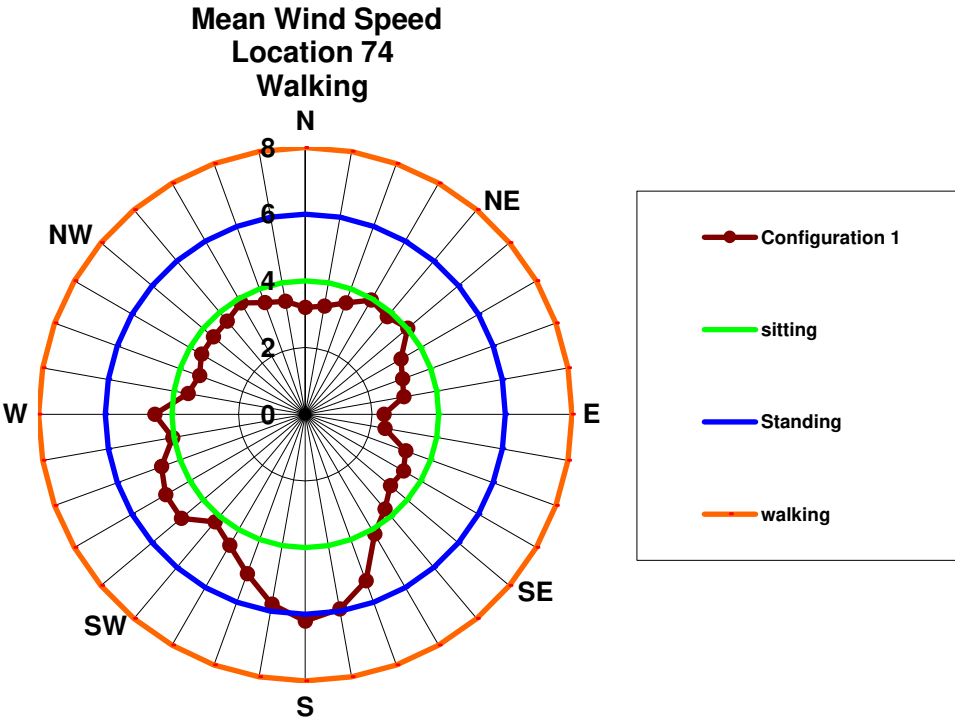
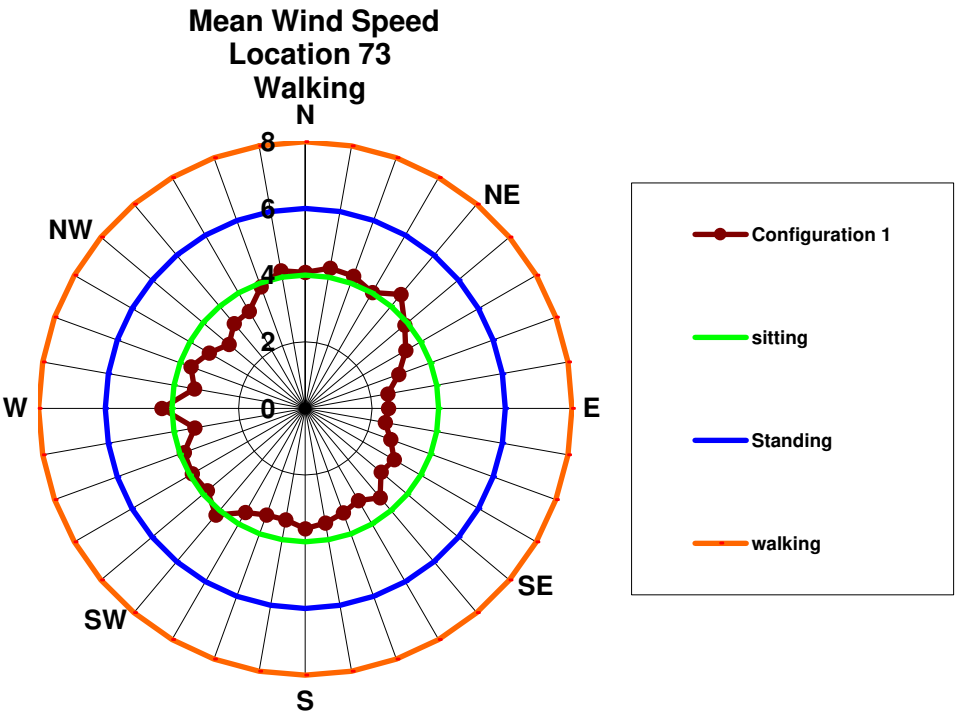


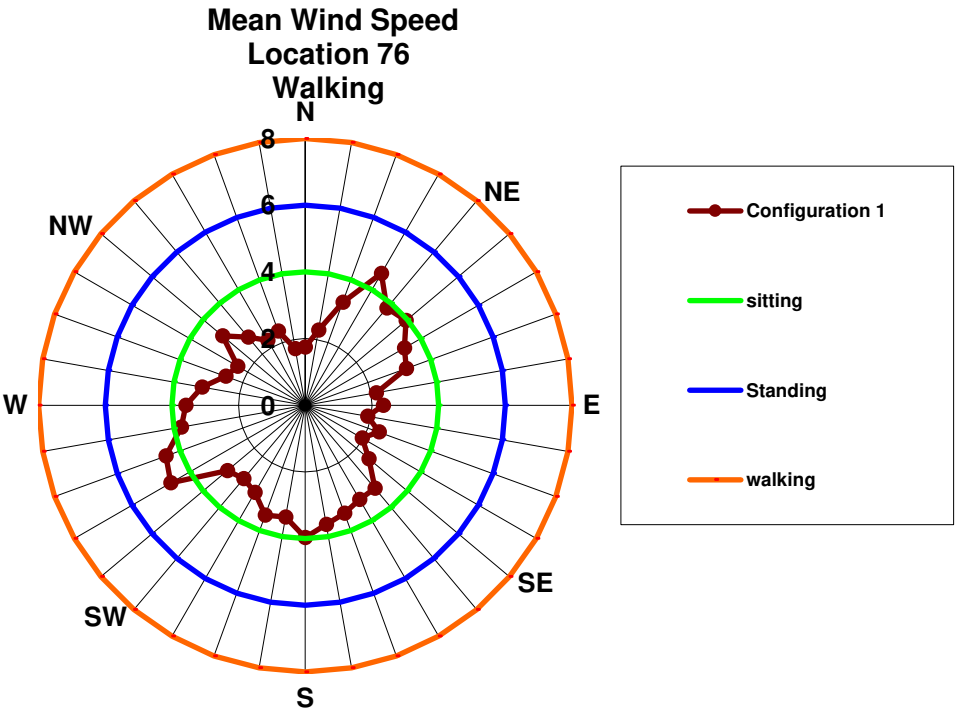
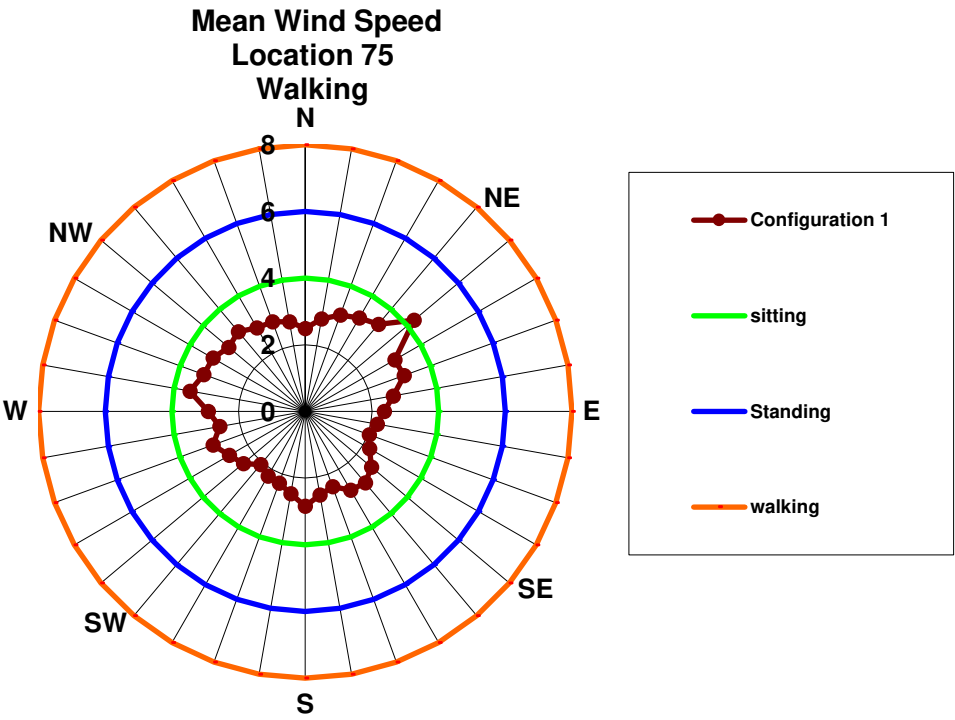


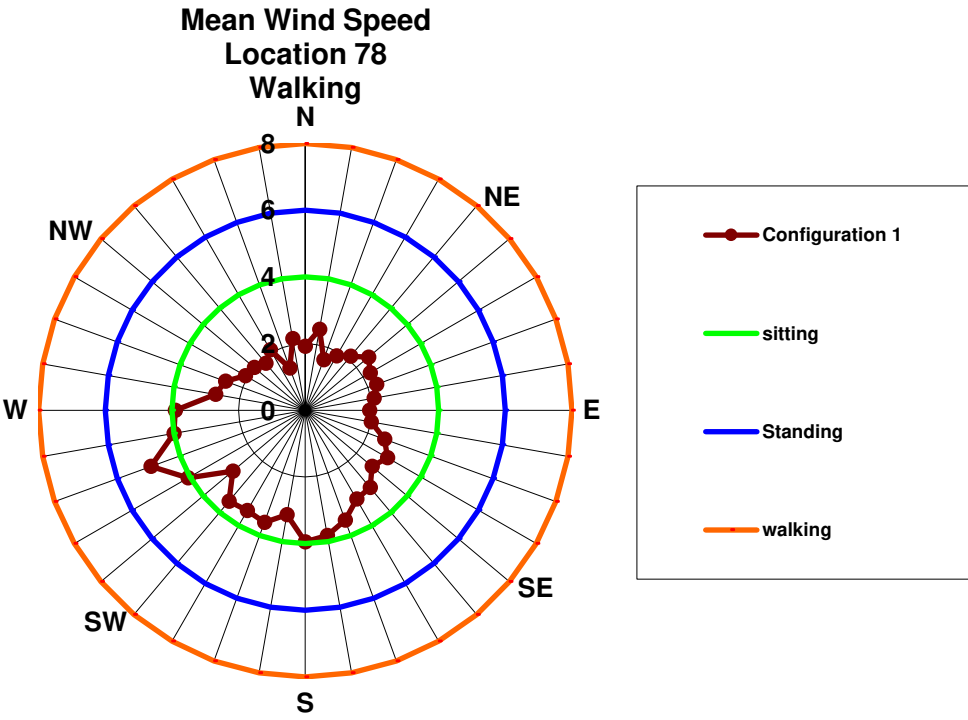
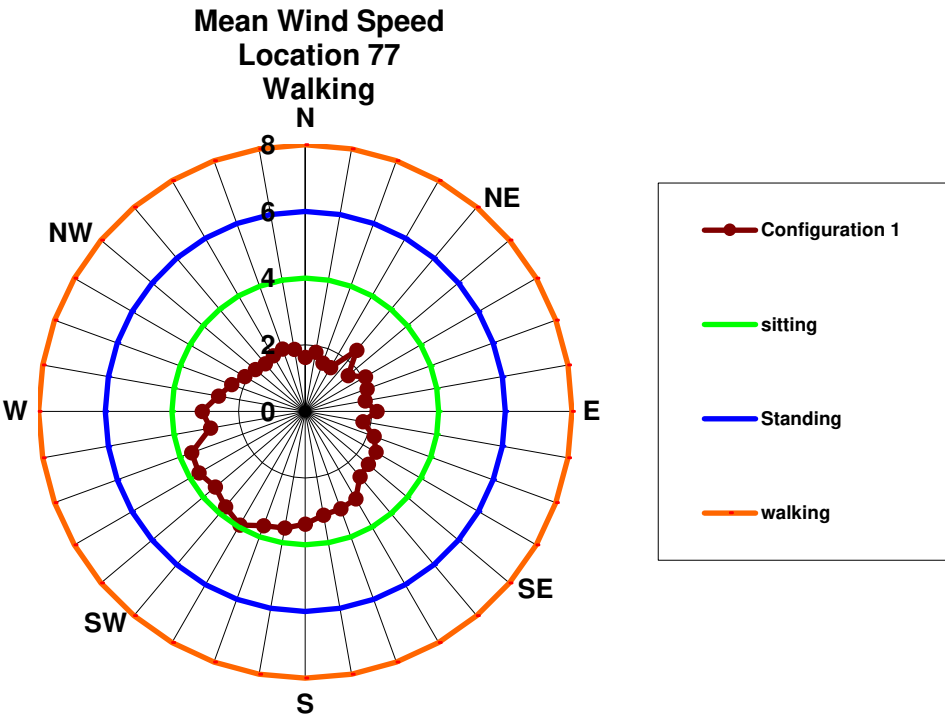












Appendix D Comparison between February 2022 and March 2022 Tests

