



WIND MICROCLIMATE ASSESSMENT REPORT

New Victoria, Manchester

26 September 2023

GIA No: 19923

PROJECT DATA:

Client **Chroma Consulting**
Project Title **New Victoria, Manchester**
Project Number **19923**

REPORT DATA:

Report Title **Wind Microclimate Assessment**
GIA Department **Wind Microclimate**
Dated **26 September 2023**
Prepared by **JW**
Checked by **CH**

Revisions	No:	Date:	Notes:	Signed:

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1 INTRODUCTION

This report outlines the results of a wind microclimate analysis for the proposed office development (Phase 2) at New Victoria in Manchester, UK.

1.1 SUMMARY

Wind microclimate conditions for the proposed Phase 2 office development at New Victoria, Manchester were assessed using high resolution Computational Fluid Dynamics (CFD).

There are no wind safety exceedances around the site and surrounding area.

Conditions were found to be suitable for all thoroughfares, principal entrances (proposed and existing off-site), bus stops, station platforms, proposed roof terraces and ground floor amenity spaces.

Conditions around the proposed Phase 2 office development will be suitable for all intended uses, and no additional wind mitigation measures will be required.

1.2 BACKGROUND

Planning Permission was originally granted in September 2016 (111777/FO/2016/C1) for a phased development known as New Victoria. Phase 1 comprises a residential development and is now complete. Phase 2 proposed an office development. The original application for the redevelopment was supported by a Wind Assessment that recommended wind mitigation across both phases of development.

The mitigation measures associated with phase 1 have been implemented.

Planning Permission was subsequently granted in October 2022 (134092/FO/2022) for Phase 2 for a revised office development. This was supported by a qualitative wind assessment based on the findings of the 2016 Wind Assessment. There is a planning condition attached to this permission that requires a new wind assessment to be undertaken prior to operation of the building.

A further planning application is currently being considered by the LPA (137792/FO/2023) and a similar wind condition is expected to be attached to any subsequent planning permission. Therefore the applicant has commissioned a new CFD wind assessment to be undertaken to fully understand the wind mitigation required for the office development.

GIA has undertaken this CFD assessment which concludes that wind comfort levels are suitable for all thoroughfare and principal entrances with the introduction of the proposed office development, therefore no additional wind mitigation is required.

1.3 GUIDANCE

Planning Practice Guidance

The Planning Practice Guidance (2021) identifies the potential for tall and large buildings to affect wind microclimate. The National Design Guide (2021) states in Paragraph 71 that:

“Proposals for tall buildings (and other buildings with a significantly larger scale or bulk than their surroundings) require special consideration. This includes their [...] environmental impacts, such as [...] wind. These need to be resolved satisfactorily”

Greater Manchester Joint Development Plan

The Greater Manchester Combined Authority Joint Development Plan, ‘Places for Everyone’ is currently under preparation.

Draft Policy JP-P-1 ‘Sustainable Places’ states that “all development [...] should be consistent with: [...] comfortable and inviting, with indoor and outdoor environments: [...] addressing microclimate issues such as sunlight, indoor air quality, overheating, shade, wind and shelter”.

Manchester Core Strategy (2012 – 2027)

Policy EN2 – Tall Buildings – States that, by their very size, tall buildings can have a significant impact on the local environment and its microclimate. It is therefore expected that this impact be modelled and that submissions for tall buildings also include appropriate measures to create an attractive, pedestrian friendly local environment.

2 METHOD

To identify the likely effect of the proposed development on the pedestrian level wind environment, a 3D CFD model of the development and surrounding site was created. This section describes the methodology for the creation of this model and the inputs used.

2.1 ASSESSMENT METHODOLOGY

The assessment was performed using GIA's high-resolution Computational Fluid Dynamics (CFD) modelling.

CFD is a digital modelling technique, which simulates the effect of wind for the built environment. The air is divided into hundreds of millions of "cells", within which the equations of motion are solved. GIA uses cloud computing from Amazon Web Services (AWS) to run the simulations, to ensure vast scalability and appropriate resource availability for any project.

A full description of the test methodology is included in Appendix 01.

On-site and local wind speeds were combined with wind statistics from 30 years of data recorded at Manchester International Airport for variations in terrain between the airport and the site, to obtain annual and seasonal frequency and magnitude of wind speeds across the model. This allows the 'grading' of the pedestrian level winds according to the Lawson Comfort Criteria, which are explained later in this report.

The mean correction factors between the site and the airport are shown in Table 1.

The wind microclimate effects are assessed annually, for the winter months (December, January and February) and for the summer months (June, July, August). Winter conditions are reported as this is the season when the strongest winds are expected, summer conditions are reported as this is the season when pedestrian usage of outdoor spaces is expected to be highest.

2.2 ESTABLISHING MICROCLIMATE CONDITIONS

Microclimate conditions were established using a high resolution CFD model, extending 400m radius from the Site.

A model of the development was included within the CFD model and tested to determine the conditions at and around the Site. The model used is shown in Figure 1 and Figure 2 .

The model was run at full scale from 18 wind angles, spaced using 10° or 30° increments such that no sector contributes more than 10% of the annual wind. The wind angles which were run are indicated in Appendix 01.

Wind speeds were measured at 1.5m above any surfaces expected to be used for pedestrian activity.

2.3 LIMITATIONS AND ASSUMPTIONS

The accuracy of the results is dependent upon the accuracy of the CAD used to construct the model.

There is an inherent assumption that on-site wind speeds will scale linearly with the measured wind speeds at the airport.

There is an inherent assumption that the wind speed statistics for the past 30 years will remain applicable for the foreseeable future.

Table 01: Site Wind Correction Factors

DIRECTION (°N)	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
Corr. Factor	1.47	1.45	1.45	1.42	1.34	1.30	1.30	1.30	1.32	1.30	1.43	1.41



Fig. 01: 3D View of proposed Development



Fig. 02: Proposed Development with Existing Surrounds

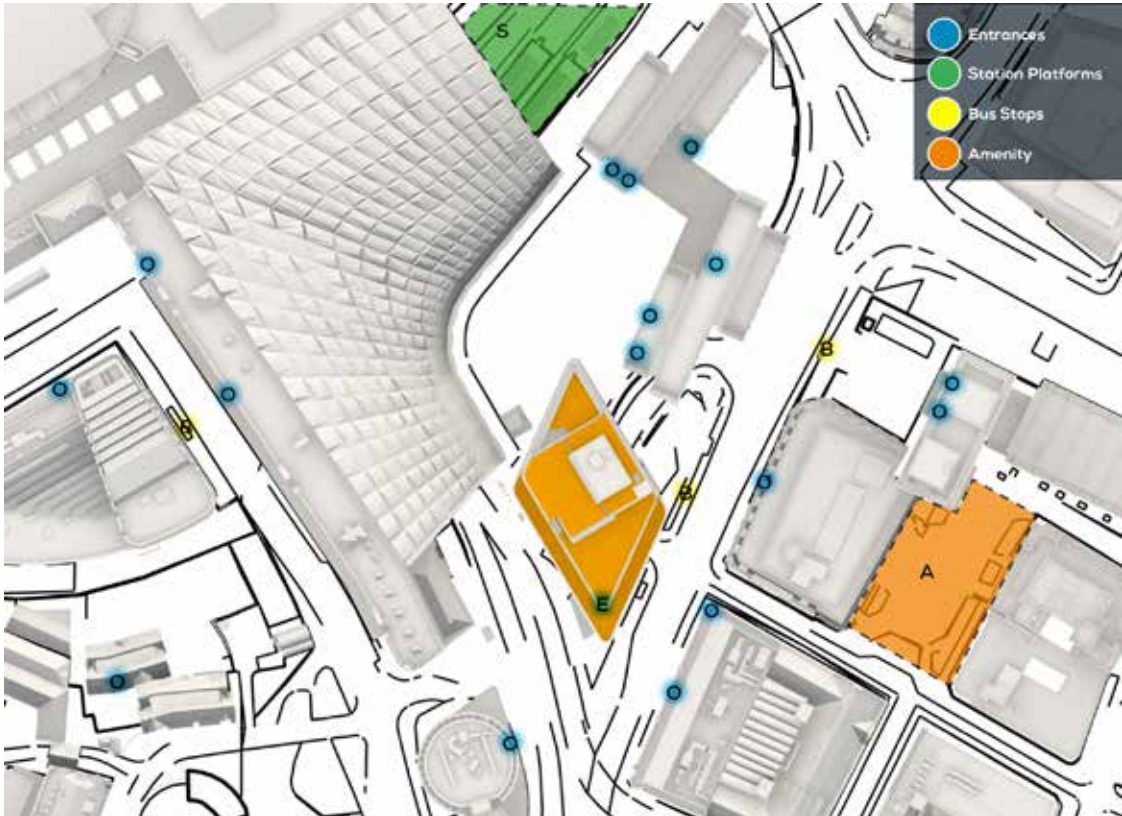


Fig. 03: Sensitive Wind Receptors

2.4 LAWSON COMFORT AND SAFETY CRITERIA

The assessment was performed using the London Docklands Development Corporation (LDDC) variant of the Lawson Comfort Criteria. The Lawson Criteria are well-established in the UK for quantifying wind conditions in relation to build developments and, although not a UK 'standard', the criteria are recognised by local authorities as a suitable benchmark for wind assessments. The Lawson Criteria have been adopted for this assessment.

The assessment was graded against the Lawson Comfort and Safety Criteria.

Table 2 and Table 3 show the banding of the various categories within the Lawson Comfort and Safety criteria.

Comfort categories are based on the level of wind speed exceedance for 5% of each season, and safety categories are based on the level of wind speed exceedance for ~2 hours per year.

Table 02: Lawson Comfort Criteria (LDDC variant)

KEY	COMFORT CATEGORY	MEAN WIND SPEED (5% EXCEEDANCE)	DESCRIPTION
	Sitting	4 m/s	Acceptable for outdoor sitting use (e.g. cafés, benches, balconies and terraces)
	Standing	6 m/s	Acceptable for main building entrances, pick-up / drop-off points and bus stops
	Walking (leisure)	8 m/s	Acceptable for strolling
	Walking (business)	10 m/s	Acceptable for external pavements, walking purposefully without lingering
	Uncomfortable	>10 m/s	Not comfortable for regular pedestrian access

Table 03: Lawson Safety Criteria (LDDC variant)

KEY	SAFETY CATEGORY	MEAN WIND SPEED (0.025% EXCEEDANCE)	DESCRIPTION
	No Safety Exceedance	<15 m/s	
	S15 (Distress)	>15 m/s	Unsafe for frail individuals, or cyclists
	S20 (Safety)	>20m/s	Wind conditions considered unsafe for all users

2.5 TARGET CONDITIONS

For a mixed-use urban area within which the Site is located, the desired wind microclimate would typically need to have areas acceptable for sitting, standing (including at entrances of buildings) and walking use. A description of the comfort categories to classify wind conditions in accordance with is given below.

Any areas which show up as either unsafe (annually) or uncomfortable (for winter) will require mitigation, unless they are in locations where pedestrian access can be controlled in the event of strong winds. This applies to all thoroughfares (for pedestrians) and roads (for cyclists) around the Development.

The areas immediately outside any building entrances should be suitable for standing use during winter to provide a “buffer” between the still conditions in interior spaces and the general thoroughfare. The principal entrances to the proposed development are marked “E” on all results figures, and principal off-site entrances are marked “O”.

There are existing bus stops on Victoria Station approach and Corporation Street, as well as a proposed bus stop at the south east corner of the development (all marked “B” in results figures). These are targeted to be suitable for standing.

There is existing ground level amenity (marked “A” on results figures) in Sadler’s Yard. This is targeted to be suitable for a mixture of sitting and standing in summer.

There is proposed amenity in the form of roof terraces on the proposed development. These are targeted to be suitable for a mixture of sitting and standing in summer.

The locations of key sensitive receptors are shown in Figure 4.

2.6 TEST SCENARIOS

The purpose of these tests was to assess conditions for the Phase 2 office development.

The following scenario was tested:

- Proposed Development with Existing Surrounds.

It should be noted that the existing surrounds includes the neighbouring Phase 1 development in full, as well as the mitigation measures which have already been implemented as part of the Phase 1 development

3 RESULTS

3.1 CONDITIONS FOR PROPOSED DEVELOPMENT WITH EXISTING SURROUNDS

Annual safety at ground level is shown in Figure 4. Annual safety at terrace level is shown in Figure 5.

Winter comfort at ground level is shown in Figure 6. Winter comfort at terrace level is shown in Figure 7.

Summer comfort at ground level is shown in Figure 8. Summer comfort at terrace level is shown in Figure 9..

There are no safety or distress exceedances within the study area (either at ground or terrace level).

Winter conditions range between suitable for sitting, standing and leisure walking. Summer conditions range between suitable for sitting and standing..

Conditions for the entrance to the proposed development (marked "E" in results figures) are suitable for standing in all seasons. This is suitable for the intended use.

All principal off-site entrances (marked "O" in results figures) are suitable for either sitting or standing in all seasons. This is suitable for the intended use.

Conditions for the bus stops (marked "B" in results figures) are suitable for standing in winter and sitting or standing in summer. This is suitable for the intended use.

Conditions for the Sadler's Yard amenity (marked "A" in results figures) are suitable for a mixture of sitting and standing in all seasons, with the majority suitable for sitting in summer. This is suitable for the intended use.

Conditions for the proposed roof terraces are suitable for a mix of sitting, standing and leisure walking in winter, and for a mix of sitting and standing in summer (with the majority suitable for sitting). This is suitable for the intended use.

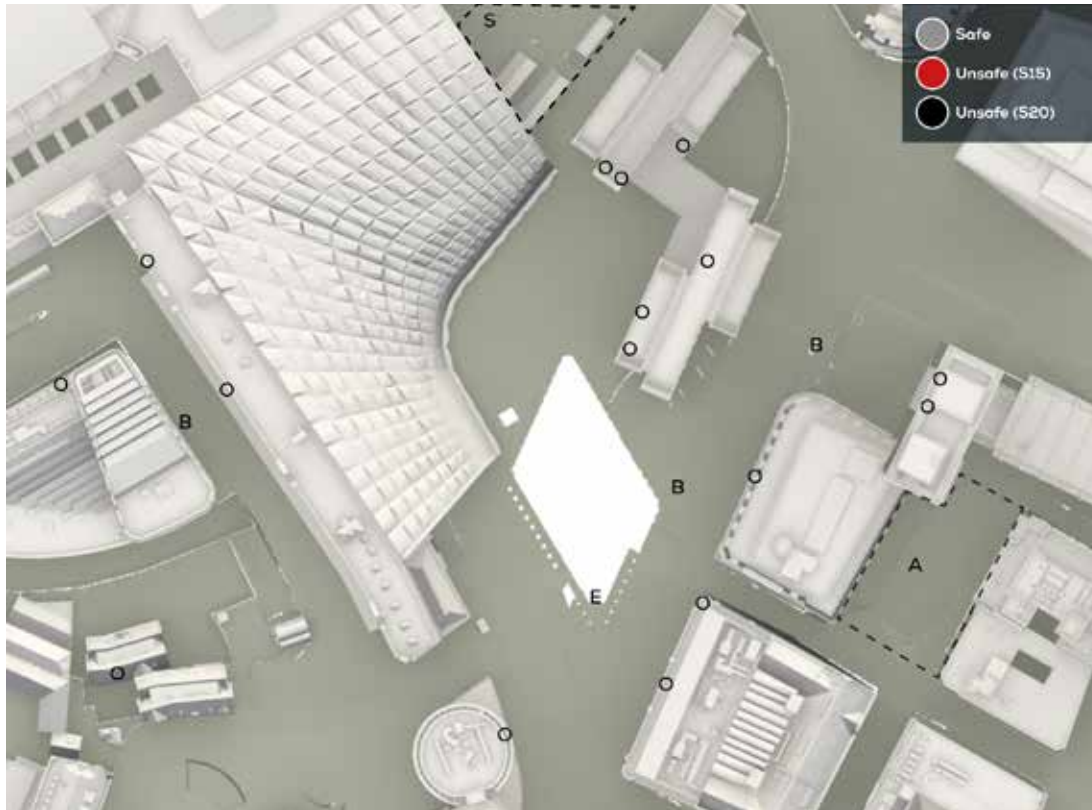


Fig. 04: Annual Safety at Ground Level

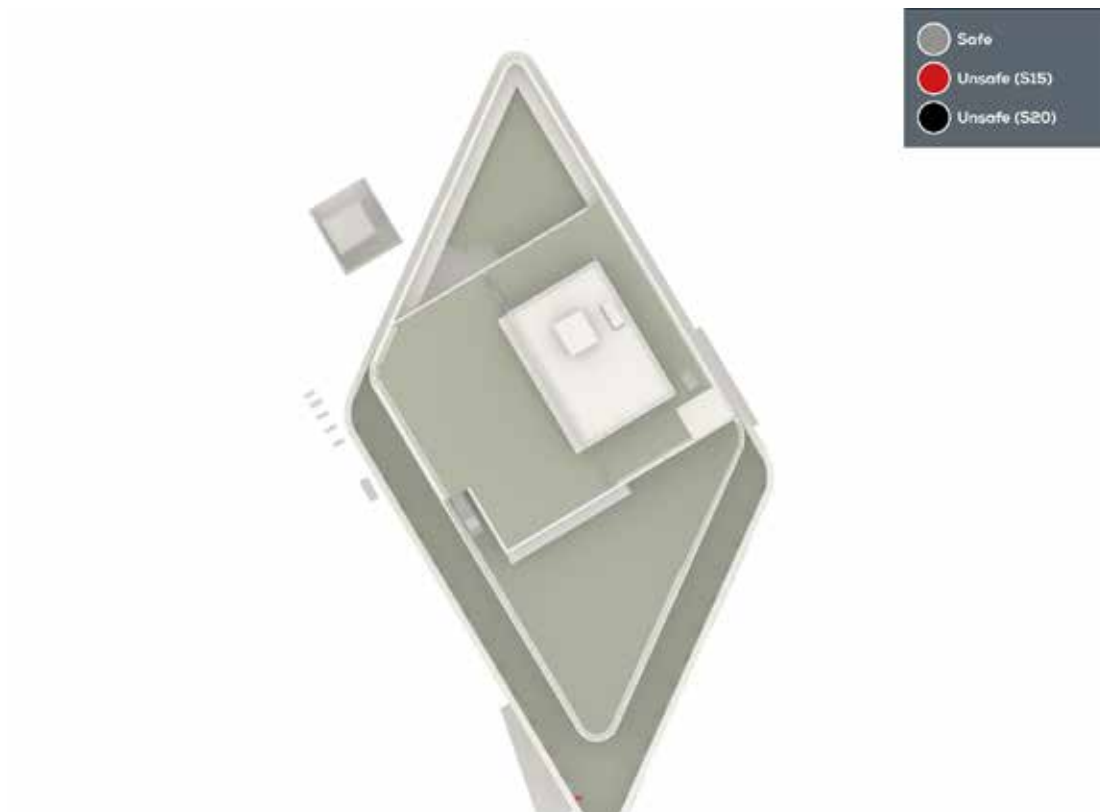


Fig. 05: Annual Safety at Terrace Level

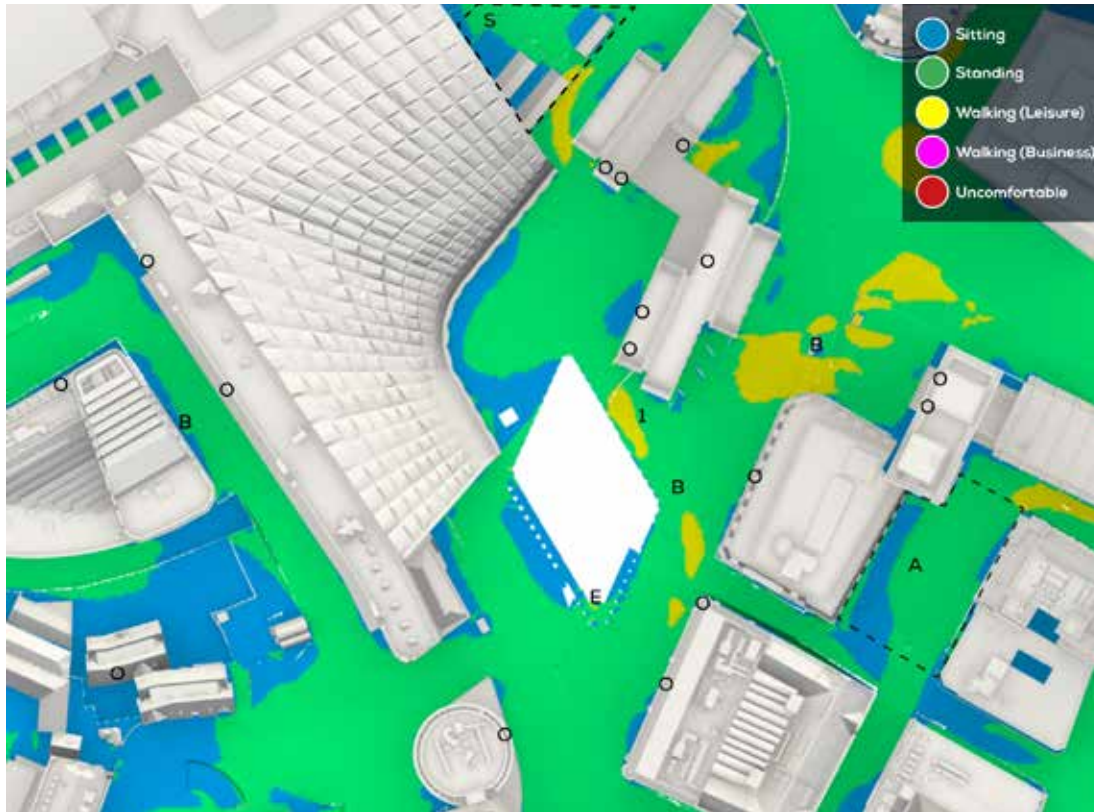


Fig. 06: Winter Comfort at Ground Level

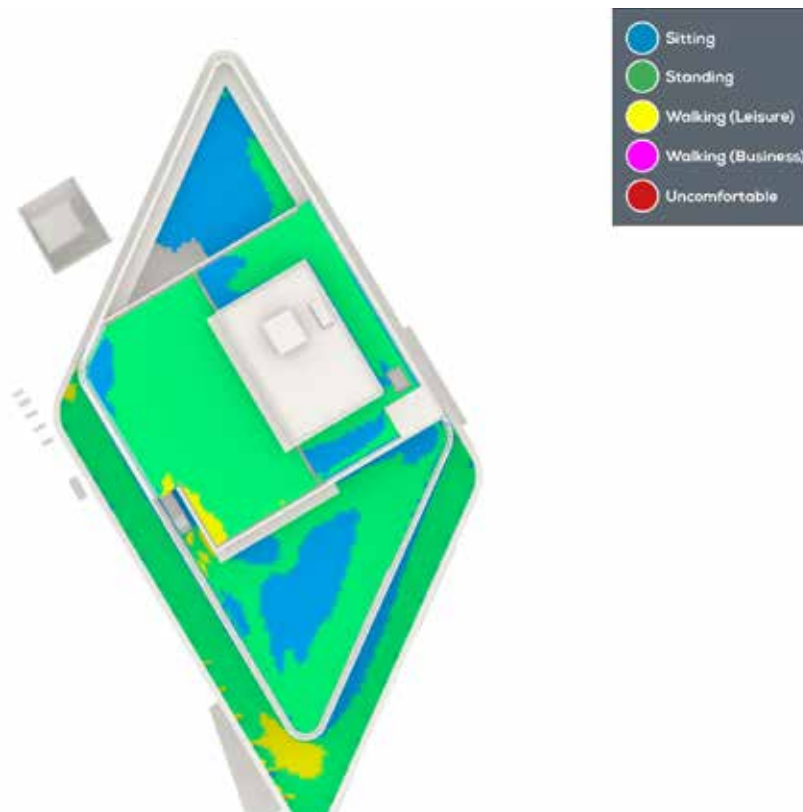


Fig. 07: Winter Comfort at Terrace Level

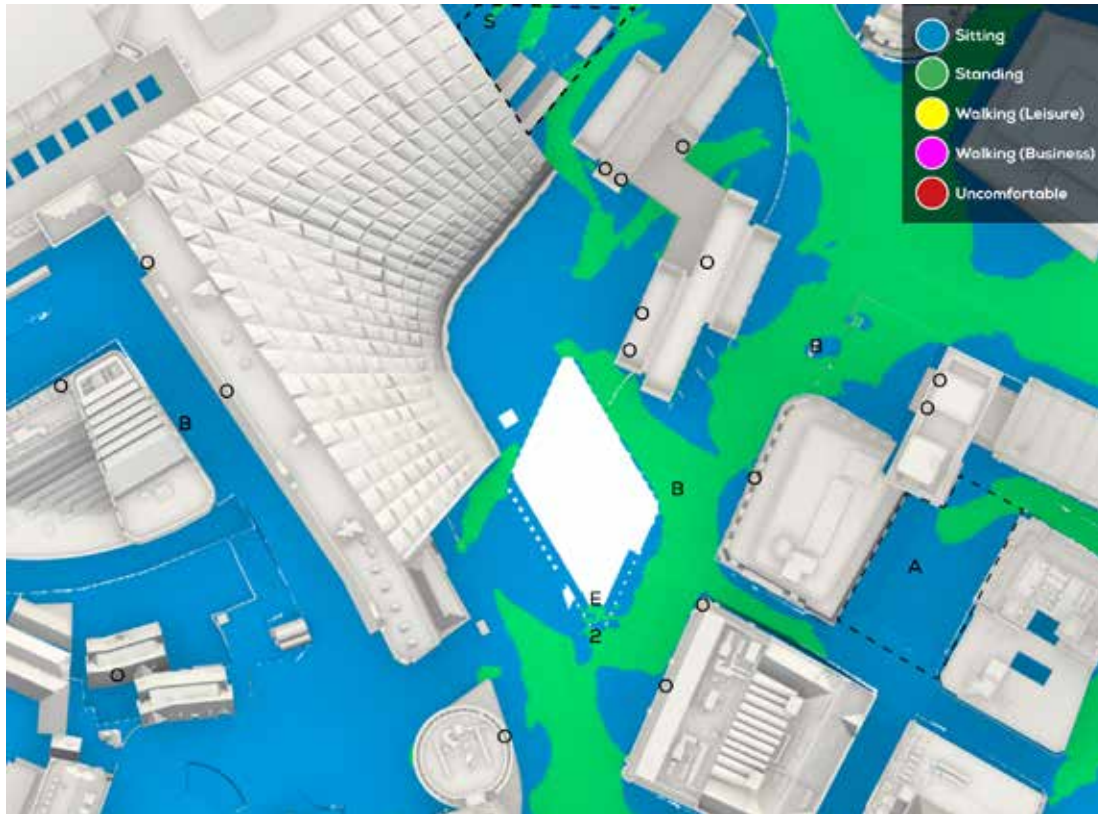


Fig. 08: Summer Comfort at Ground Level

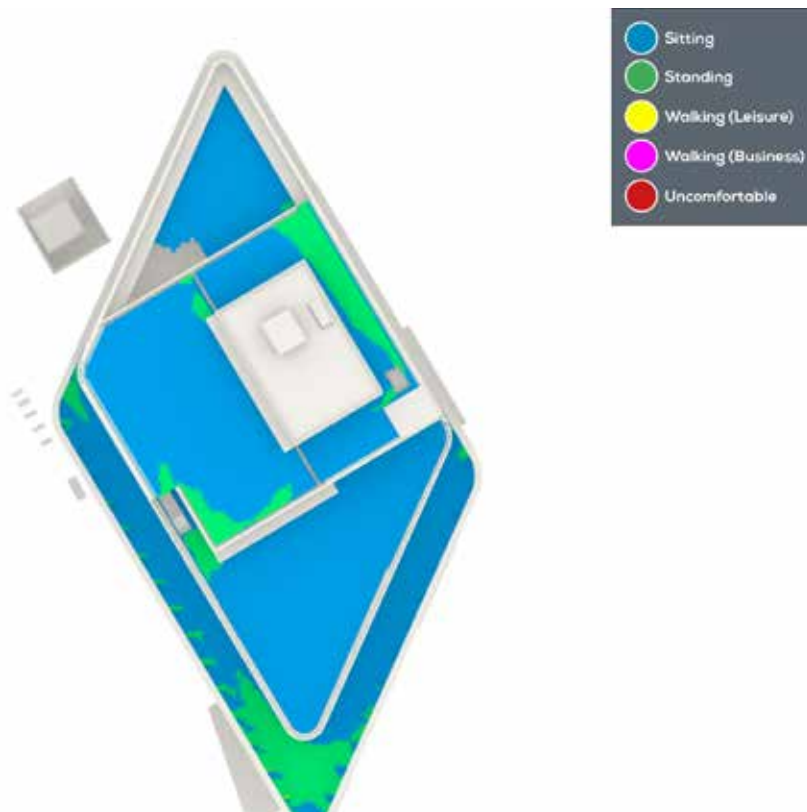


Fig. 09: Summer Comfort at Terrace Level

4 CONCLUSIONS

Wind microclimate conditions for the proposed Phase 2 office development at New Victoria, Manchester were assessed using high resolution Computational Fluid Dynamics (CFD).

There are no wind safety exceedances around the site and surrounding area.

Conditions were found to be suitable for all thoroughfares, principal entrances (proposed and existing off-site), bus stops, station platforms, proposed roof terraces and ground floor amenity spaces.

Conditions around the proposed Phase 2 office development will be suitable for all intended uses, and no additional wind mitigation measures will be required.

APPENDIX 01

DETAILED METHODOLOGY

CFD METHODOLOGY

The CFD was performed using OpenFOAM.

Meshed using a hybrid mesh of hexahedral, polyhedral, tetrahedral and prismatic elements:

- On site building edge length: 0.05m – 0.25m
- Surrounding context edge length: 0.25m – 1m

Prismatic cells were used in the boundary layer region, with 4 layers of cells growing with an expansion ratio of 1.15 and aspect ratios between 0.1 and 0.4.

The total mesh size was 125 million cells. Mesh detail is shown in Figure 10 and Figure 11.

Buildings within 400m of the site were included.

The domain was 5000mx5000m, with a blockage ratio of 0.5%

The blockage ratio uses a “test section” of 600mx200m (within which detail is captured).

Run using the SST turbulence model with high Re wall functions to ensure mesh suitability.

The simulations were steady state and isothermal.

2nd order discretisation schemes were used.

Convergence was measured as the residuals of the continuity, x-velocity, y-velocity, z-velocity, k and omega equations all falling by at least 2 orders of magnitude, and by measured static pressure on the site buildings varying by less than 1% over the final 100 iterations.

The wind speed is corrected into a “gust-equivalent” mean. The gust-equivalent mean is calculated using an empirical relationship between the gust and mean ratios recorded at over 13,000 data points from wind tunnel tests. This method is found to give a significant correlation improvement over the more traditional methods based on the CFD turbulent kinetic energy field.

WIND CLIMATE METHODOLOGY

The simulations were performed from 18 wind directions, spaced such that no single direction contributed more than 10% of the annual winds.

The directions simulated were 0°, 30°, 60°, 90°, 120°, 150°, 170°, 180°, 190°, 200°, 210°, 220°, 240°, 260°, 270°, 280°, 300°, 330°.

Seasonal wind roses for Manchester International Airport are shown in Figure 12.

Target wind profiles for the site, from each wind direction, were generated using sectoral analysis of the terrain surrounding the site and the local weather stations with ESDU 2010 Item 01008 ‘Computer program for wind speeds and turbulent properties: flat or hilly sites in terrain with roughness changes’. The target wind profiles, compared to the wind speeds measured from the CFD model are shown in Figure 13.

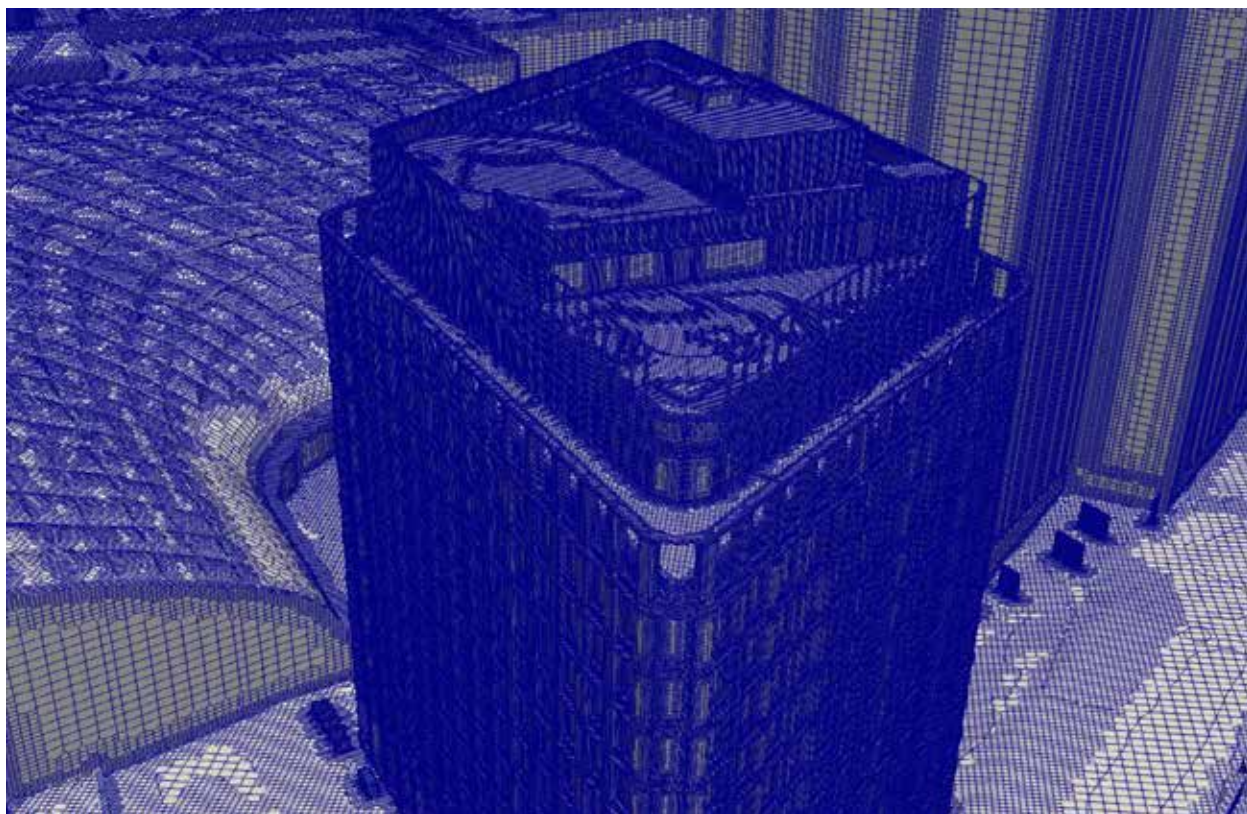


Fig. 10: Mesh Detail on Site Buildings

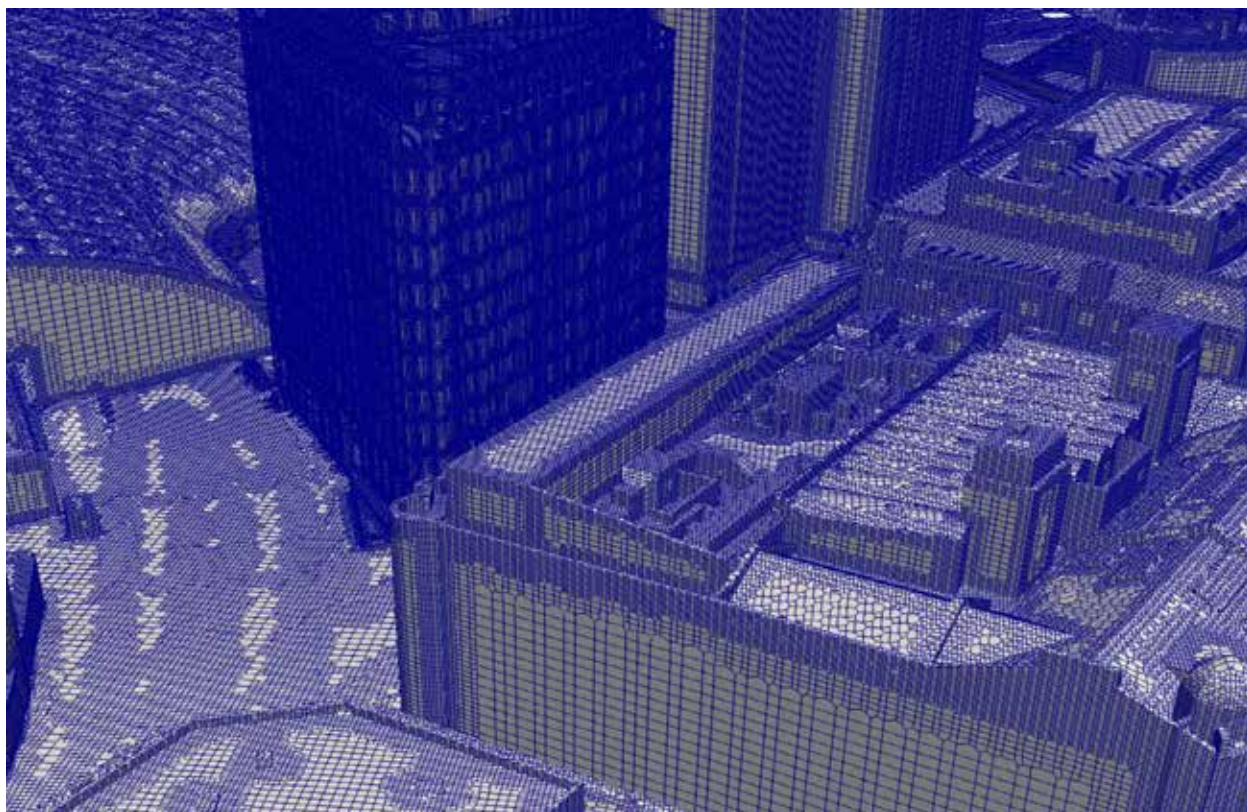


Fig. 11: Mesh Detail on Surrounds

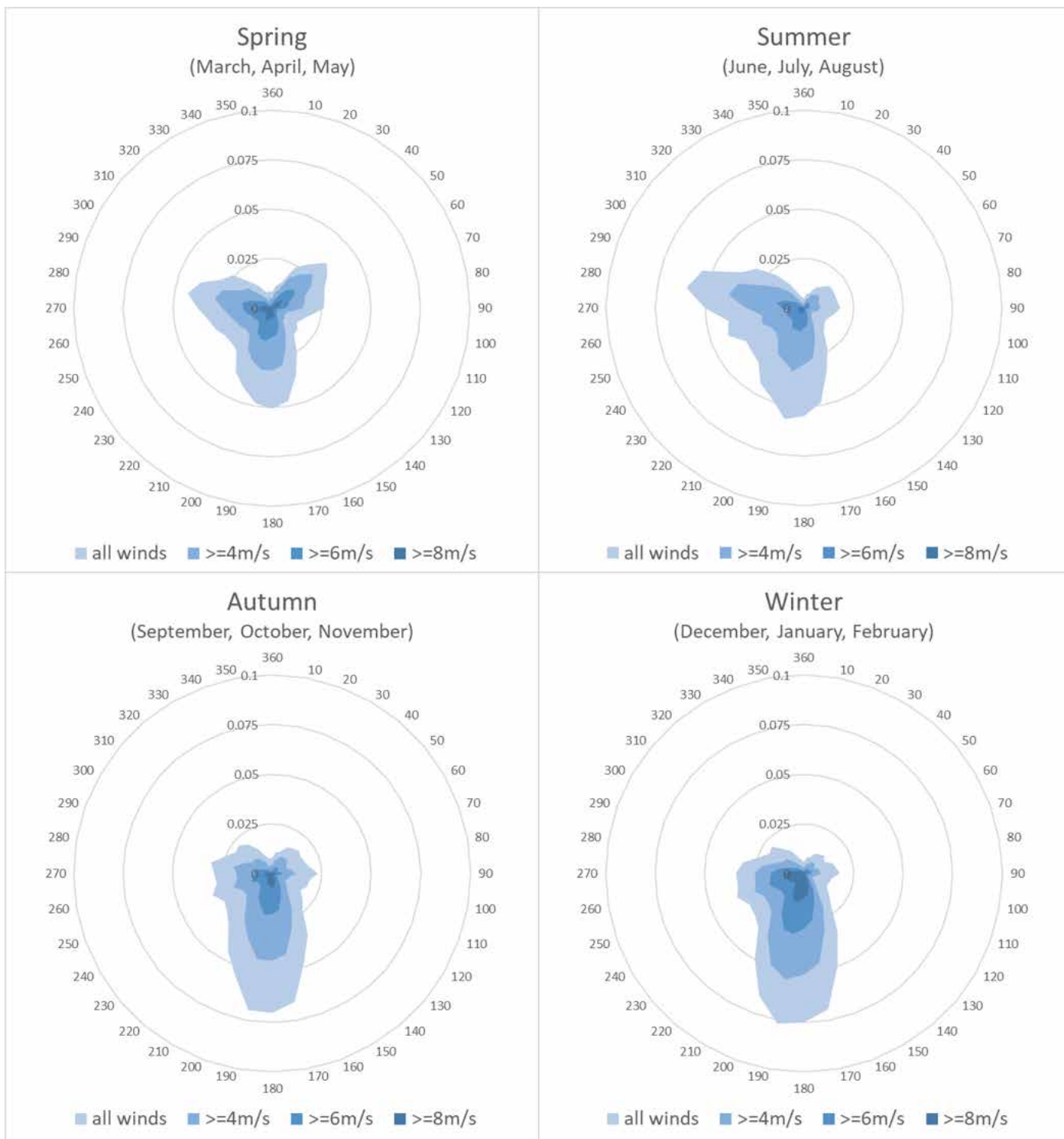


Fig. 12: Seasonal Wind Roses for Manchester International Airport (1990-2020)

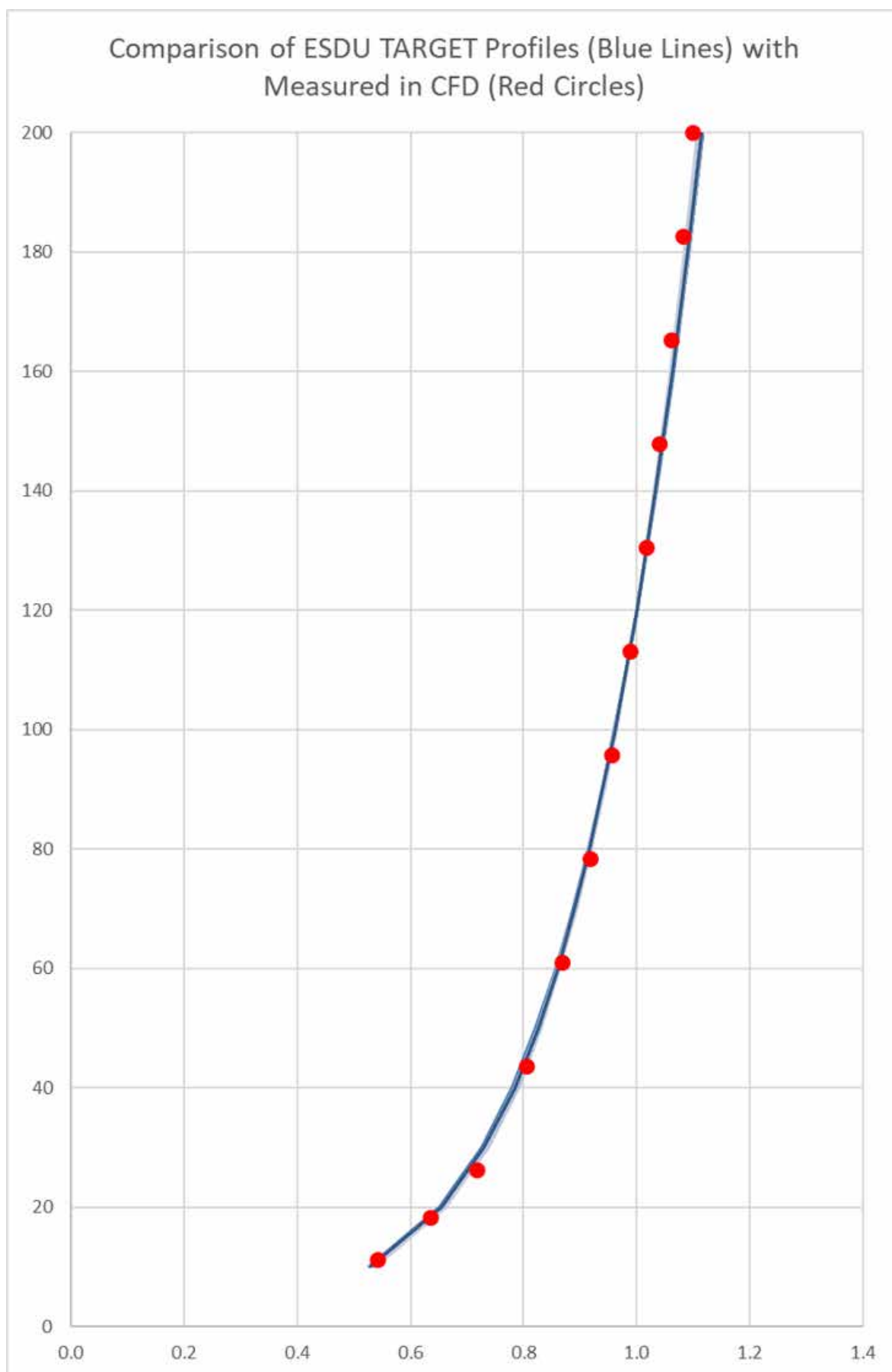


Fig. 13: Wind Profile for New Victoria

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