

Toriview

New Victoria Office, Manchester

Wind assessment review and desk study

Reference:

Issue | 10 June 2022



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Job number

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Document Verification

Project title New Victoria Office, Manchester
Document title Wind assessment review and desk study
Job number
Document ref
File reference

Revision	Date	Filename			
Draft 1	10 May 2022	Description			
		Prepared by	Checked by	Approved by	
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Signature					
Issue	10 June 2022	Filename			
		Description			
		Prepared by	Checked by	Approved by	
		Name	Olivia Ewing		
Signature					
		Filename			
		Description			
		Prepared by	Checked by	Approved by	
		Name			
Signature					

Issue Document Verification with Document



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Drawings

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Pictures

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Photographs

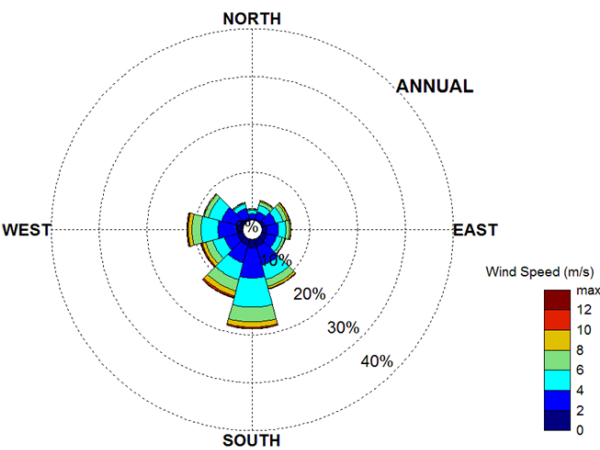
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Attachments

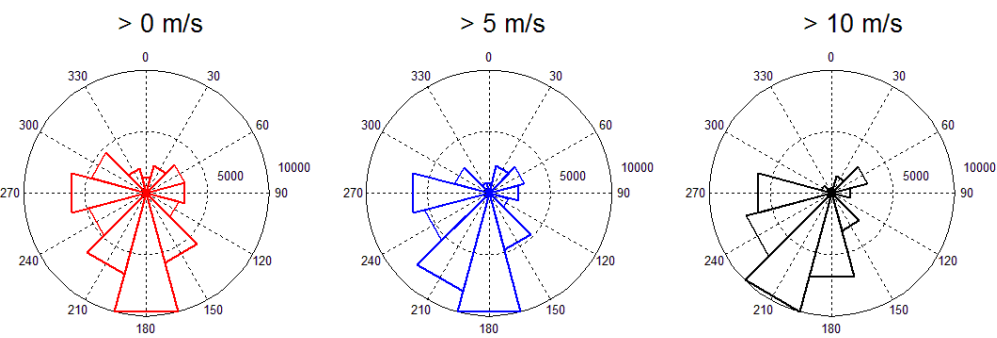
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1. Executive summary

In 2016, Muse Developments Ltd was granted permission for ‘two residential buildings of a maximum 21 and 26 storeys’ and ‘one office building of maximum eight storeys’ [ref. 111777/FO/2016/C1] (The 2016 Scheme). Wind tunnel testing was carried out and showed two areas around the office building that required mitigation to achieve safe wind conditions. Mitigation solutions were suggested, and the findings were reported in the ES Chapter 9: Wind Microclimate, submitted 2016 (including details of the wind tunnel workshops, and suggested mitigation measures).

Toriview is now seeking a new planning approval for the office site alone, with a new proposed office building design (New Victoria Office). The New Victoria Office massing and footprint are similar to the 2016 scheme, with a few additional floors (see comparisons in Section 4).

The updates to the massing height and orientation of the New Victoria Office are expected to produce similar conditions to those around the 2016 Scheme, meaning local mitigation will be needed to achieve safe conditions at two locations.

It is therefore recommended that the New Victoria Office is tested, prior to commencing above ground works. The wind analysis will be undertaken to confirm the wind conditions around the New Victoria Office scheme and validate any detailed mitigation measures, required to reduce wind speeds to acceptable levels. The testing will include the residential schemes to the north and updated surroundings from the 2016 Scheme. It should be noted that some of the mitigation may be required outside of the New Victoria Office site red line boundary, which would need to be delivered by a third party.

2. Introduction

This report documents the findings of an experience-based qualitative environmental wind desk study undertaken for the New Victoria Office Development in Manchester (the Development). The assessment is based on a review of:

- (i) Architectural drawings provided by the design team provided in May 2022;
- (ii) The wind climate obtained from Manchester airport (appended in appendix A).
- (iii) Previous wind tunnel test data available for the project from 2015; and
- (iv) The ES environmental wind chapter submitted in 2016 as part of the application ref. 111777/FO/2016/C1

The review is based Arup’s previous experience of windiness issues for developments of similar scale and wind exposure. The assessment provides a description of the likely wind conditions within and around the 2016 Proposed Office and Residential towers (2016 Scheme) and the most recent proposed scheme for the office only (New Victoria Office). The results are assessed and presented in accordance with the Lawson LDDC criteria for pedestrian wind comfort and safety (details included in Appendix A).

3. Review of previous design (2016 Scheme)

Two environmental wind tunnel workshops were organised by Arup and held at RWDI's wind tunnel in Milton Keynes on November 3 and 10, 2015. The scenarios tested included:

- 1) Existing Baseline;
- 2) Proposed 2016 Scheme (both office and residential blocks) at completion in existing surroundings;
- 3) Proposed 2016 Scheme (residential blocks only, without the office) at completion in existing surroundings; and
- 4) Proposed 2016 Scheme (both office and residential blocks) at completion in cumulative surroundings.

Possible mitigation solutions were tested for Configurations 2, 3 and 4 and can be seen in the 2016 ES Chapter 9: Wind Microclimate.

3.1 2016 Scheme without mitigation

The results around the 2016 baseline and 2016 Scheme before the introduction of wind mitigation are shown in Figure 1 - Figure 3.

When the residential towers are introduced without the office block, the results show an increase in wind speeds compared to the baseline. Some locations close to the residential towers exceed the safety criteria (indicated with a red ring around the impacted receptor) and are unacceptable for pedestrian use without mitigation. However, it is noted that none of the safety exceedances in this scenario occur next to the office site. (see Figure 2)

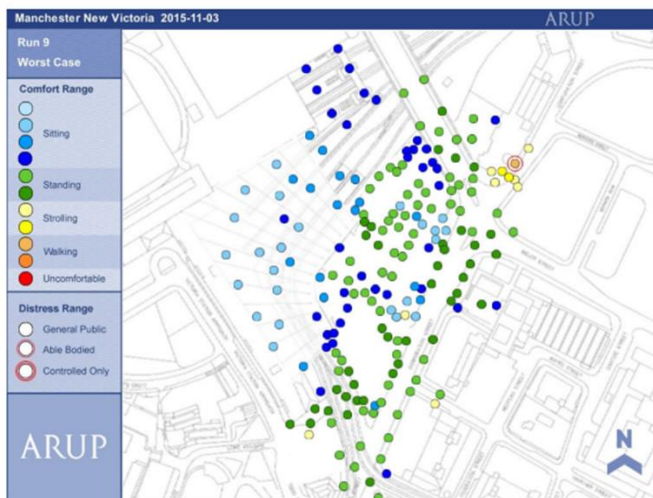


Figure 10.5: Worst season wind conditions for the baseline configuration (Site with existing surroundings).

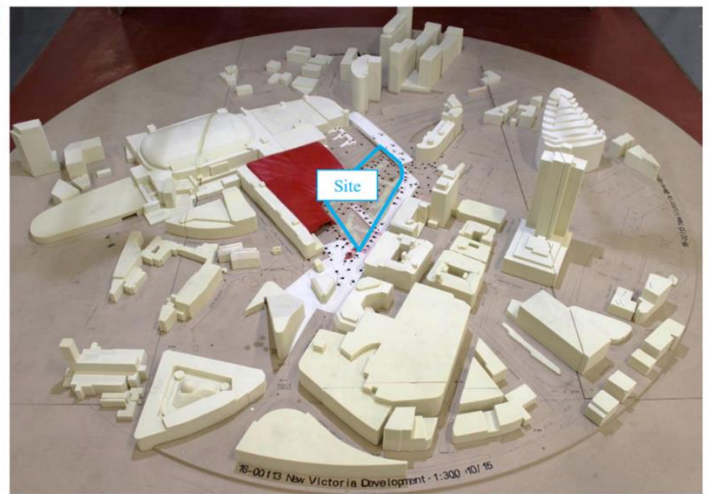


Figure 10.4: Baseline model of the Site with existing surroundings (view from the South)

Figure 1 – Conditions in the worst case around the existing baseline configuration as tested in 2016

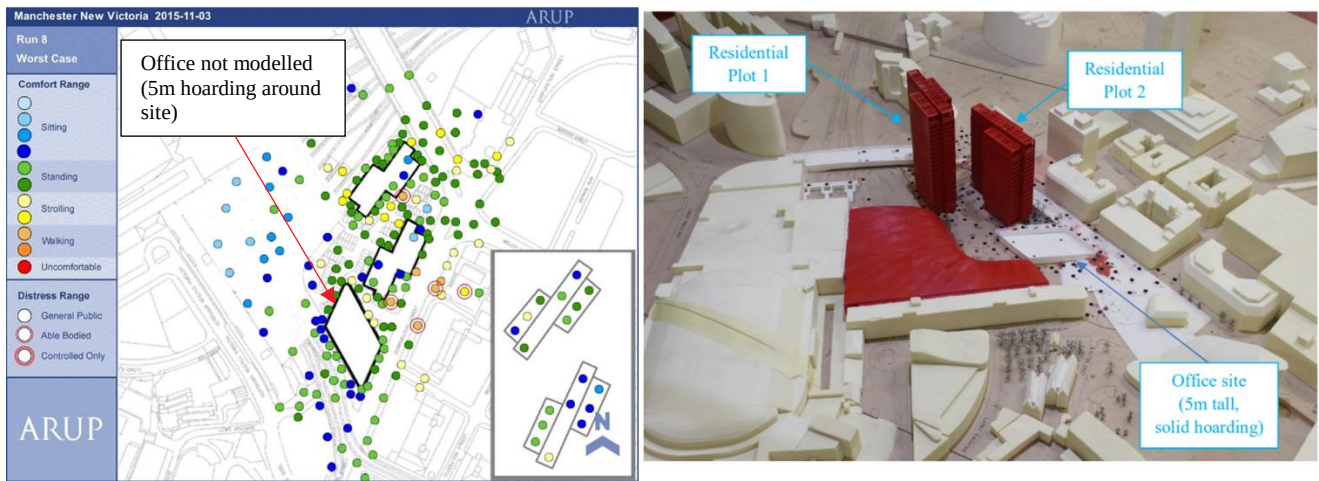


Figure 2 – Conditions in the worst case around the 2016 Development without the office or mitigation

When the office block is introduced alongside the residential blocks (Figure 3), two areas around the office show increased wind speeds that are unsafe and unacceptable without mitigation:

- 1) At the very southern corner where a main entrance was expected to be located (**southern corner/main entrance**). Conditions in this area are exposed to direct west and south-west winds that area accelerated around the acute angle created by the southern corner of the office.
- 2) At the narrowest point within the passage between the office and the residential towers (**norther passage**). Conditions in this area are mainly created by west and north-west winds being channelled between the office and the residential tower.

The two locations above therefore require mitigation to achieve safe wind conditions. Details of the previously suggested mitigation are detailed in the 2016 ES Chapter 9: Wind Microclimate. The mitigation recorded in the 2016 ES demonstrates one possible option for a local mitigation solution that include both hard and soft landscaping. The final mitigation can be achieved in numerous ways and will need to integrate with the updated design.

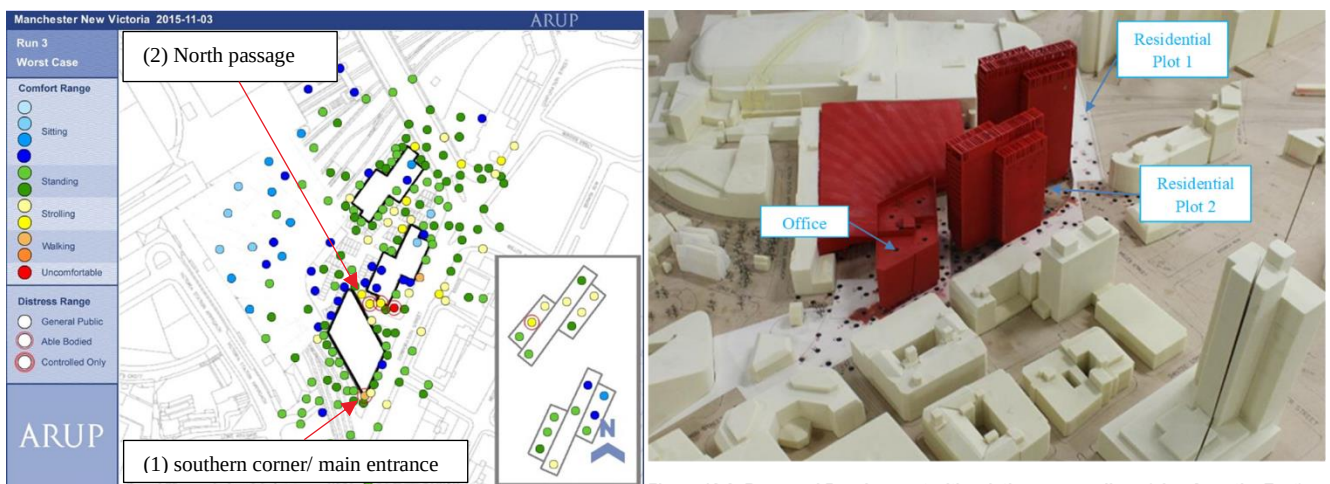


Figure 10.6: Proposed Development with existing surroundings (view from the East).

Figure 3 – Conditions in the worst case around the 2016 Development with the office but no mitigation

4. Current design (New Victoria Office)

4.1 Changes from the 2016 Scheme to the New Victoria Office (2022)

A visual comparison of the massing and layout for the New Victoria Office compared to the 2016 scheme is shown in the Figure 4 - Figure 5.

The New Victoria Office occupies roughly the same footprint as the 2016 design (see Figure 11), has the same orientation and the main entrances are in similar locations. Listed below are some changes that have the potential to influence the wind conditions:

- The overall building height has increased from the 2016 design (~6-7m increase in overall height) (see Figure 4 and Figure 5),
- The façade details have changed including small rounding of the building corners (see Figure 5),
- Details of the colonnade at ground-level have changed (see Figure 5 and Figure 6),
- The use of the external spaces between the office and the residential buildings has changed from mixed vehicular traffic and pedestrian access to just vehicular and partial cycle access (see Figure 7),
- The proposed landscaping at ground-level around the office has changed (see Figure 7), and
- A roof terrace is now proposed with a semi-permeable facade at roof level and proposed soft landscaping (see Figure 8 - Figure 10).

There are also new additions to the adjacent built environment outside the site boundary, which includes 4 Angle Square immediately to the north-east of the site and Hotel Indigo to the south-west.

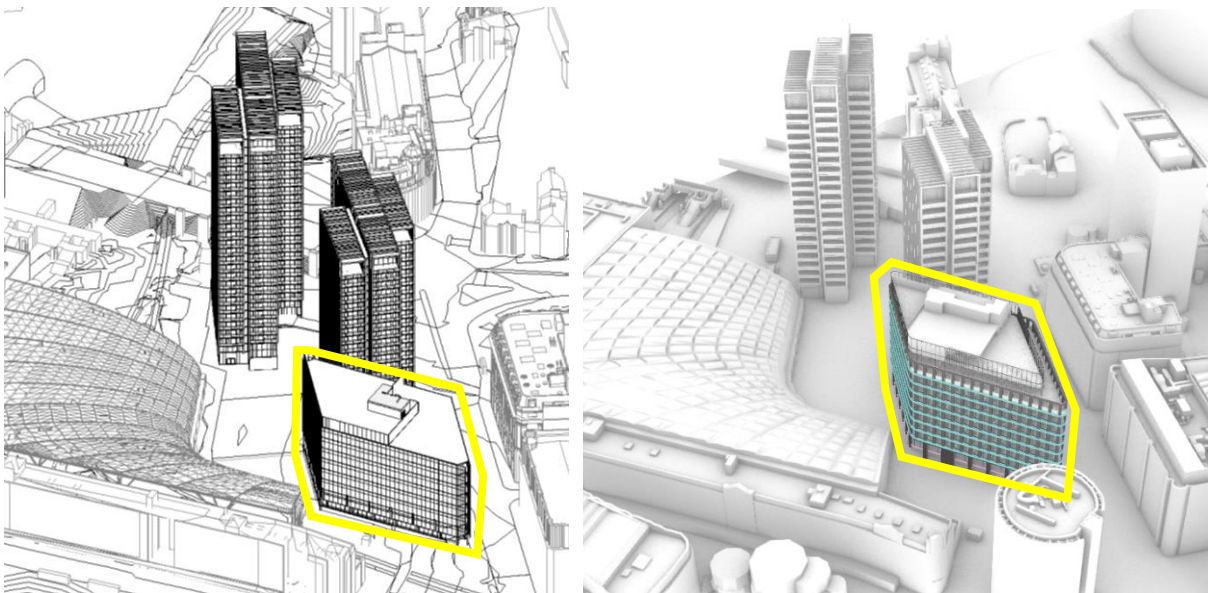


Figure 4 – (left) 3D view of the 2016 scheme viewed from the south-west and (right) view of the New Victoria Office viewed from the south-west

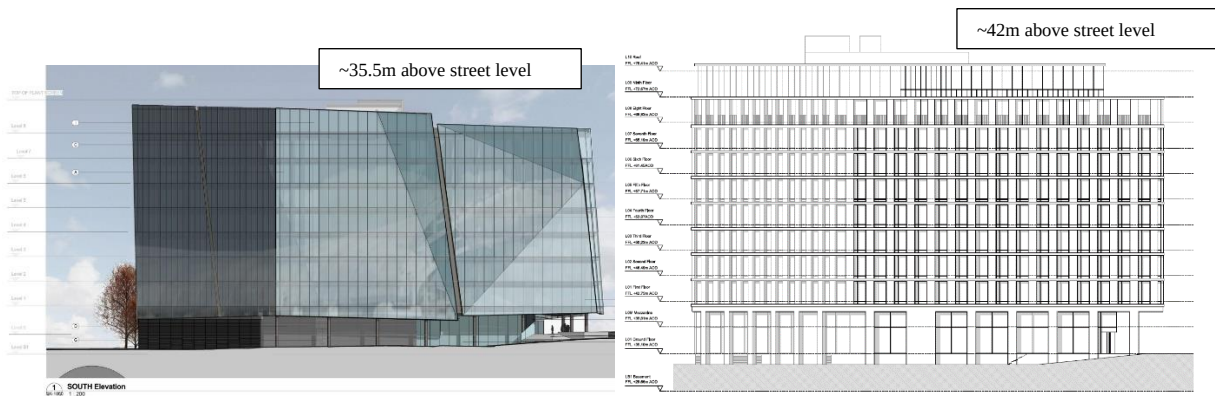


Figure 5 – (left) southern elevation of the 2016 office building reaching ~70 and (right) southern elevation of the New Victoria Office

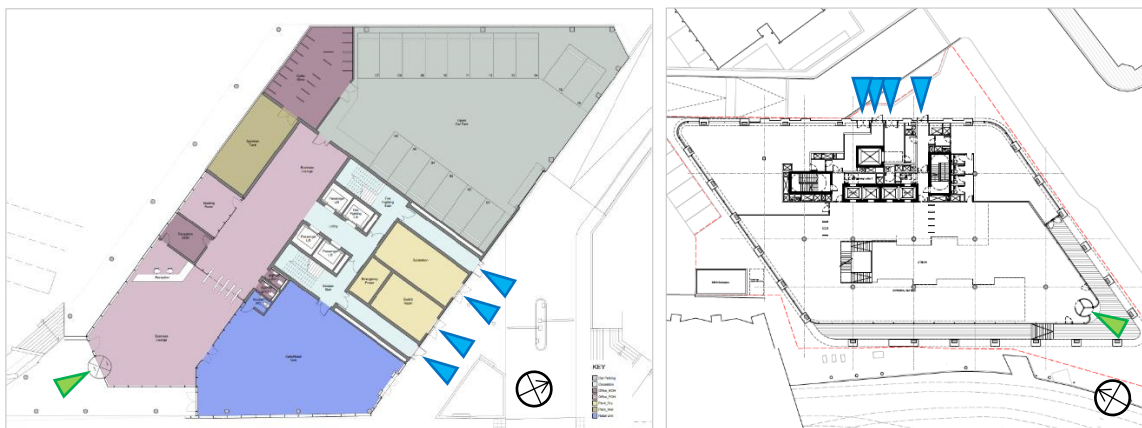


Figure 6 – (left) ground floor plan of the office scheme in 2016 and (right) ground floor plan of the New Victoria Office. The main entrance is indicated with a green arrow and secondary entrances are indicated with blue arrows.

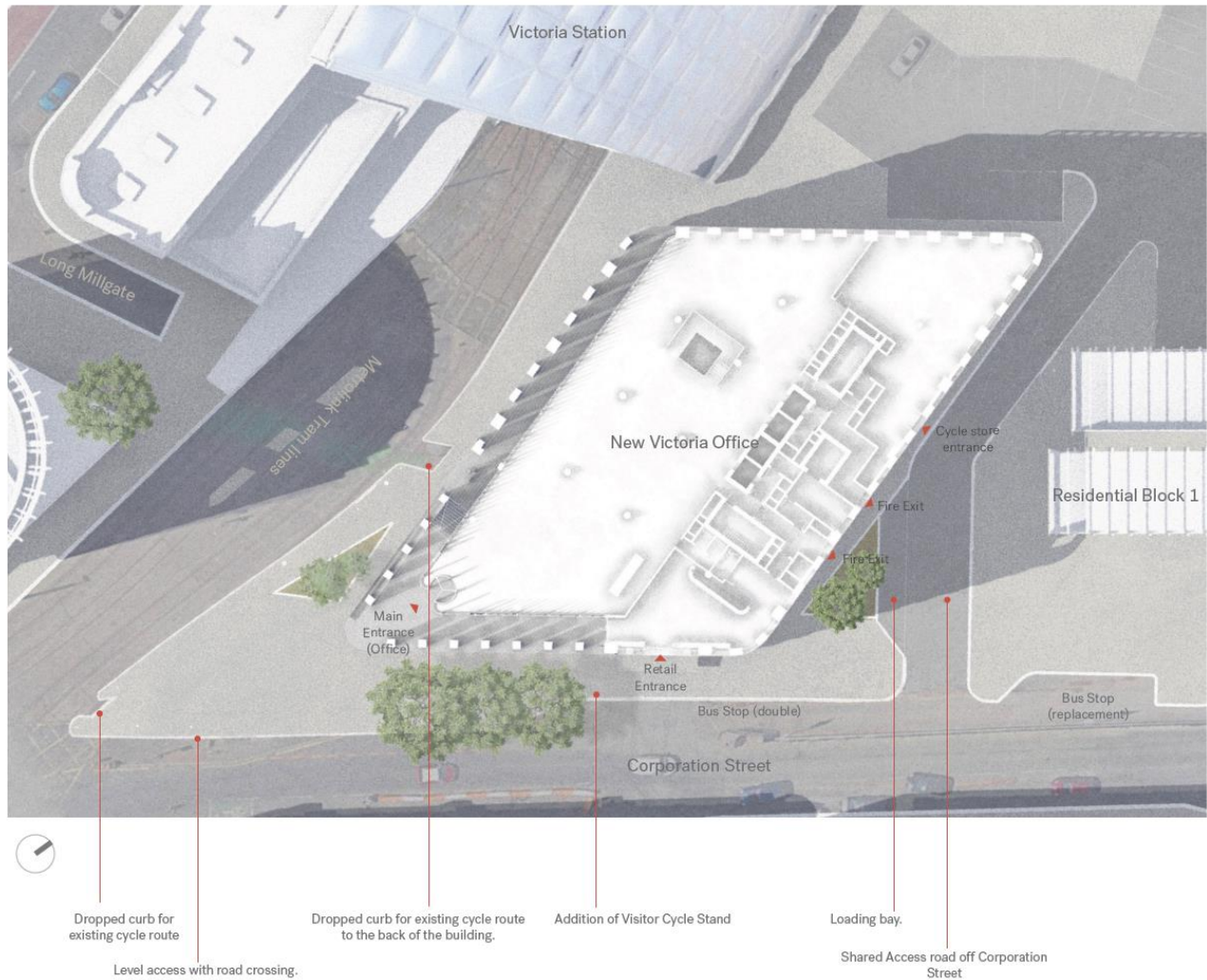


Figure 7 – View of the proposed development at ground-level around the New Victoria Office, showing access and entrance locations as well as landscaping.

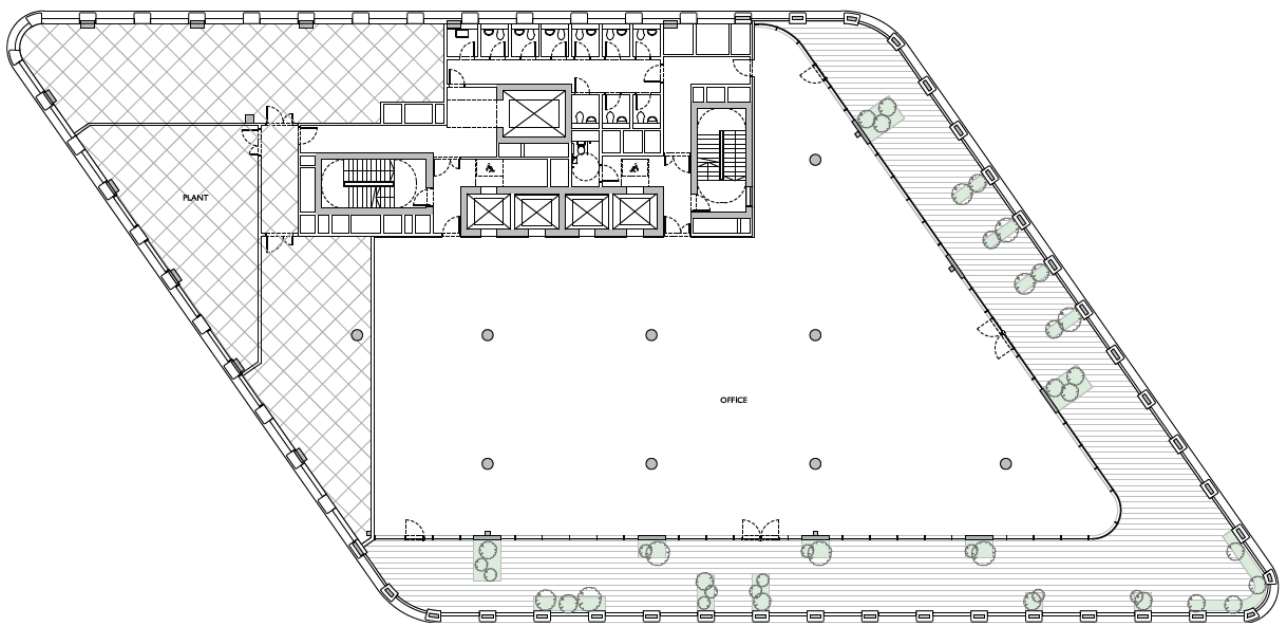


Figure 8 - Plan view of the proposed Level 8 balcony and landscaping in the New Victoria Office.

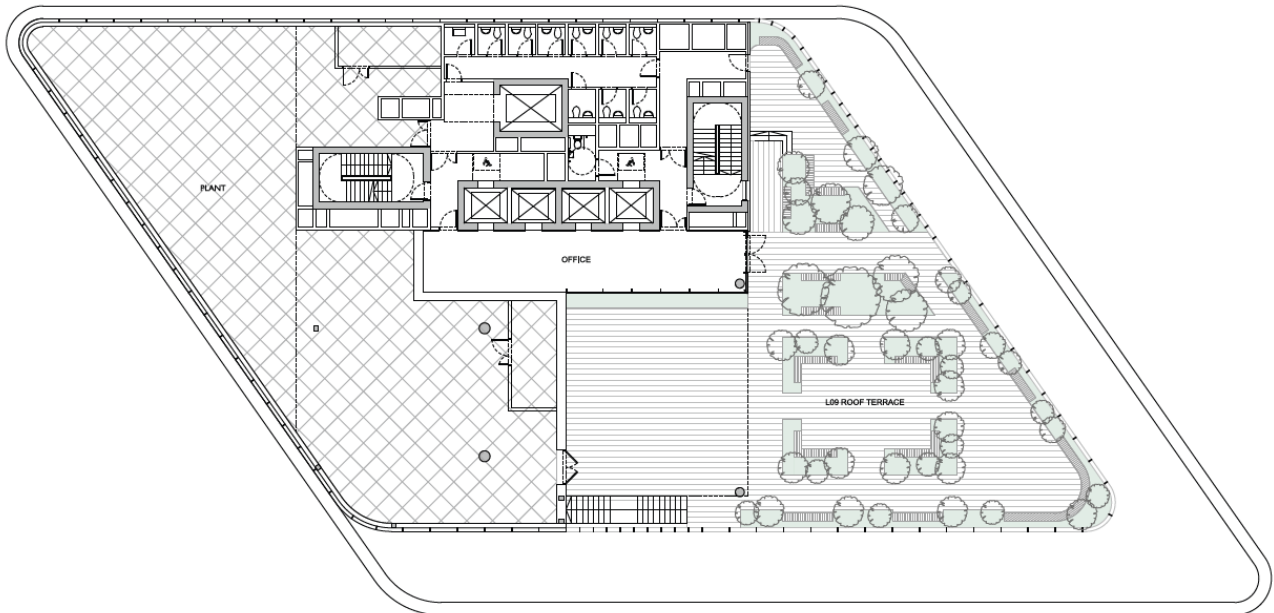


Figure 9 – Plan view of the proposed Level 9 terrace and landscaping in the New Victoria Office.

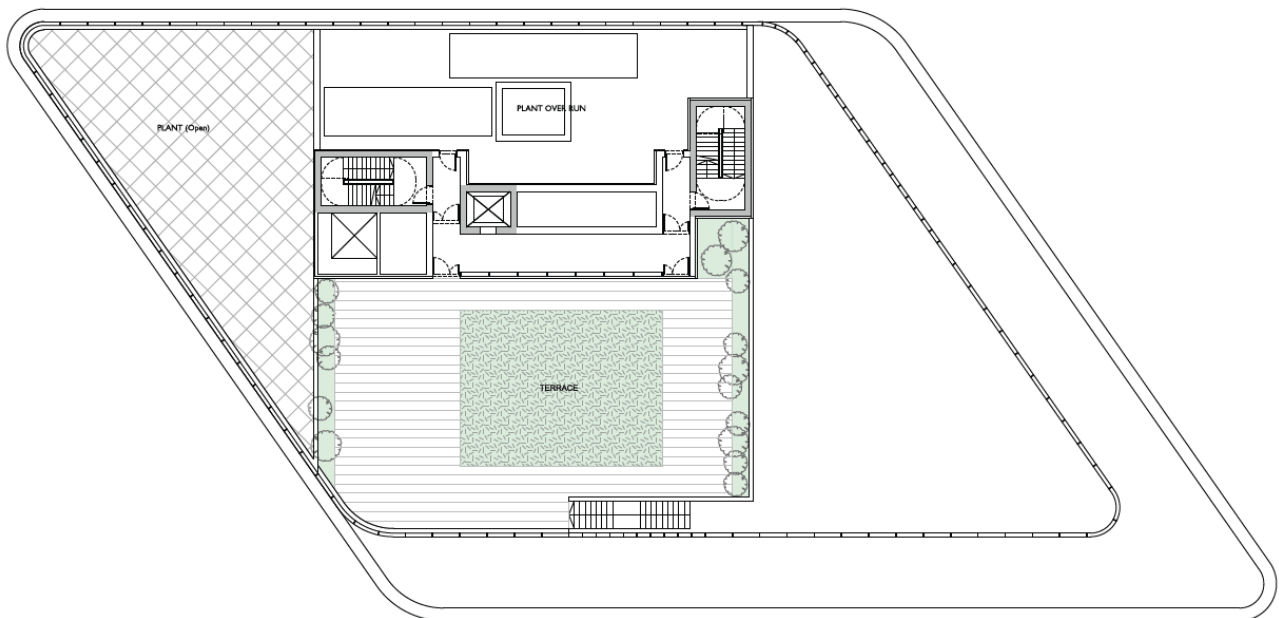


Figure 10 - Plan view of the proposed Level 10 terrace and landscaping in the New Victoria Office.

4.2 Wind Conditions around the New Victoria Office (2022)

4.2.1 Conditions at ground-level

The expected impact of the changes listed above on the surrounding wind environment have been qualitatively assessed using professional judgment.

The increased height is marginal and is not expected to significantly impact the wind conditions. The changes to façade details and colonnade are also too subtle to materially impact the wind conditions around the site.

The 2022 surroundings are expected to provide some additional sheltering to the overall wind conditions on the site although most of the sheltering is likely to occur in non-critical wind directions, such as from the north-east.

Considering the combined impact of all the changes listed above, conditions at ground-level around the New Victoria Office are expected to be similar to those around the unmitigated 2016 scheme.

Without mitigation, conditions around most of the site are expected to be in **acceptable** ‘Standing’ to ‘Strolling’ ranges in the worst-case. However, the two locations where safety exceedances were identified around in the unmitigated 2016 office scheme (see Figure 3) are also expected to occur around the New Victoria Office. Figure 11 shows the locations of expected possible exceedance around the New Victoria Office, highlighted in yellow.

The first area of possible safety exceedance is located in front of the main office entrance, at the south-east corner (labelled as No.1 in Figure 11). According to the Lawson criteria, all main entrances must achieve stringent ‘Standing’ comfort conditions and be within safe limits.

The second area of possible safety exceedances is within the passage between the office and the residential block to the north (labelled as No.2 in Figure 11). Although the use of this passage has been limited for vehicles and cyclists, the threshold target comfort conditions are ‘Business Walking’ and must be within safe limits.

Therefore, both of these locations will require additional mitigation to achieve acceptable conditions. Further discussion of mitigation options and validation are discussed in Section 5.

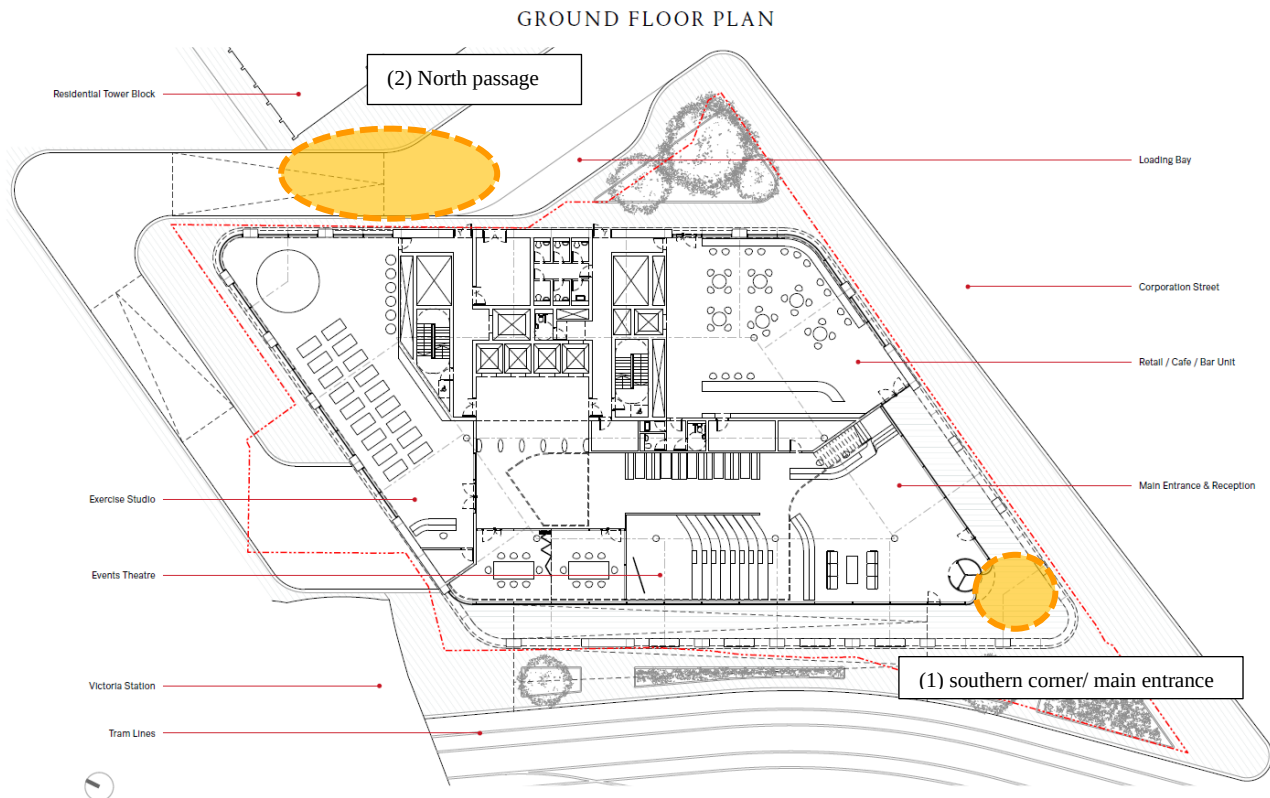


Figure 11 – Ground floor plan of the New Victoria Office showing the red-line boundary and areas expected to require wind mitigation to achieve safe conditions (highlighted in yellow).

4.2.2 Conditions on the external upper-levels

The level 8 balconies and level 9 and 10 terraces are optional spaces designed to be used by the office employees in fair weather (i.e. days with little to no precipitation, warm temperatures and good daylight).

Although the Lawson criteria are not directly applicable to such areas of temporary use, a general rule of thumb is to aim for ‘Sitting’ to ‘Standing’ conditions in the summer. Conditions in these areas have been assessed using a qualitative desk study, based on professional judgement. With the proposed landscaping in place (see Figure 8 - Figure 10), the likely wind conditions across all the external upper-levels (levels 8, 9 and 10) are expected to be within **acceptable** limits.

It should be noted that the upper-level entrances that are facing west are likely to experience high wind pressures and may be difficult to operate on windy days. These doors should be fitted with robust mechanisms to allow smooth operation under higher wind pressures to avoid injury to users and damage to the door.

5. Next Steps

It is recommended that prior to commencing above ground works, the New Victoria Office is re-assessed using wind tunnel testing or a similarly detailed methodology (to be agreed with the planning authority).

The wind analysis will be undertaken to confirm the wind conditions around the New Victoria Office scheme and validate any detailed mitigation measures required to reduce wind speeds to acceptable levels (including soft landscaping). The testing will include the residential schemes to the north and updated surroundings from the 2016 Scheme. The final look and function of the mitigation can take many forms such as those shown in Figure 12. The exact location, size, and orientation should be confirmed by a wind specialist.

It should be noted that some of the mitigation may be required outside of the New Victoria Office site red line boundary, which would need to be coordinated and delivered by a third party.

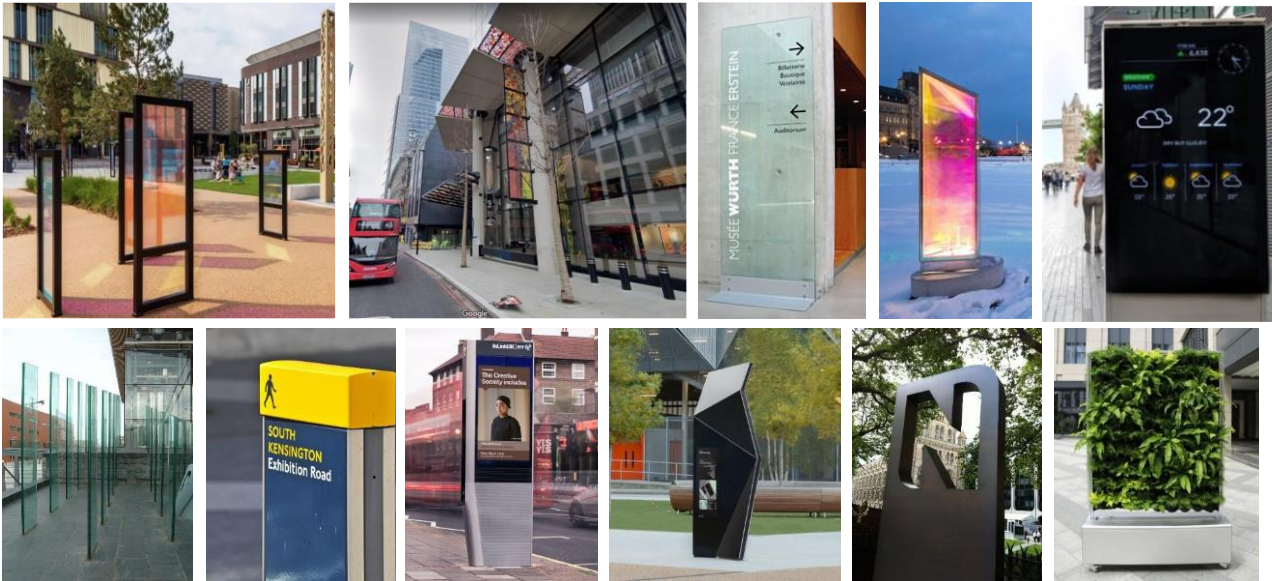


Figure 12 – images of possible mitigation design for local screens or landscaping around the southern entrance.



Figure 13 – Image capture from Google street view looking at the wind mitigation around Angle Gardens in Manchester.

6. Conclusion

An experience-based qualitative environmental wind desk study has been undertaken for the New Victoria Office Development in Manchester (New Victoria Office). The assessment was based on a review of the previous 2016 wind tunnel tests and ES Wind Microclimate chapter as well as plans and 3D models for the current scheme.

The New Victoria Office massing (including footprint, orientation, entrance location) are similar to the 2016 scheme, with a few additional floors and external terrace space (see comparisons in Section 3).

There are also new additions to the adjacent built environment outside the site boundary, which are expected to provide some additional sheltering to the overall wind conditions on site, most non-critical wind directions, such as from the north-east.

Conditions at ground-level around the New Victoria Office are expected to be similar to those around the unmitigated 2016 scheme. Conditions around most of the site are expected to be within **acceptable** 'Standing' to 'Strolling conditions but **local mitigation** will be needed to achieve **safe conditions** at two locations (see Figure 11).

With the proposed landscaping in place the expected wind conditions across all the external upper-levels (levels 8, 9 and 10) are expected to be within **acceptable** limits.

It is recommended that the New Victoria Office is tested, prior to commencing above ground works. The wind analysis will be undertaken to confirm the wind conditions around the New Victoria Office scheme and validate any detailed mitigation measures, required to reduce wind speeds to acceptable levels. The testing will include the residential schemes to the north and updated surroundings from the 2016 Scheme. It should be noted that some of the mitigation may be required outside of the New Victoria Office site red line boundary, which would need to be coordinated and delivered by a third party (similar to what was proposed in the mitigated 2016 scheme).

A.1 Wind Climate and Criteria

A.1.1 Wind Climate from Manchester Airport

Historical wind data (wind speed and direction) recorded at Manchester Airport during the years 2001 to 2015 were analysed and adjusted to site exposure using the ESDU method as described in the 2016 ES chapter.

Strength and directionality of the winds are fundamental aspects of the environmental wind assessment. The directionality of winds in the region of Manchester is affected by the Welsh Mountains to the south-west. While in the rest of the UK the most frequent and strongest winds are from the south-west, the most frequent winds in Manchester are slightly shifted in the direction to the south and the strongest winds are from the west. The annual wind roses shown in Figure 14 and Figure 15 illustrate the directionality and strength of the prevailing winds at Manchester Airport for all times of the day and seasons.

Other characteristics of the wind climate in Manchester are summarized below.

- The south and west winds are the most frequent and strongest in Manchester at all times of the year. These winds are relatively warm and wet. Most cases of serious annoyance due to strong winds around buildings are caused by these winds.
- Northeast winds are almost as common as the west winds during spring but are weaker. They are often associated with cold, dry conditions. These winds can be more unpleasant than their strength suggests due to the lower-than-average air temperature.
- Northwest winds are less frequent than the south and west winds. They are relatively cold.
- Finally, southeast winds are generally warm and light and are rarely associated with problematic ground level winds.

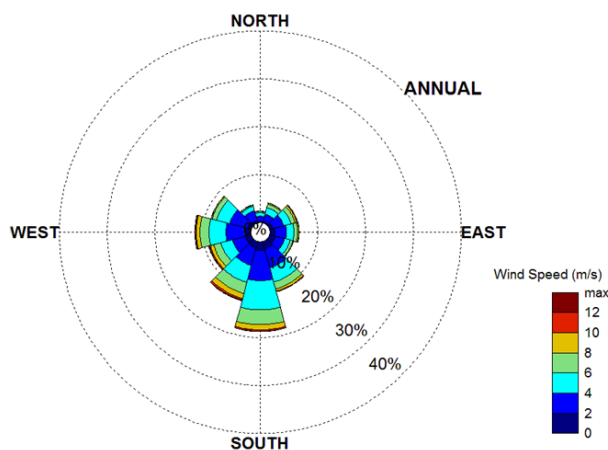


Figure 14 - Annual wind rose obtained from the wind data recorded at Manchester Airport (10m height) during the years 1991 to 2015.

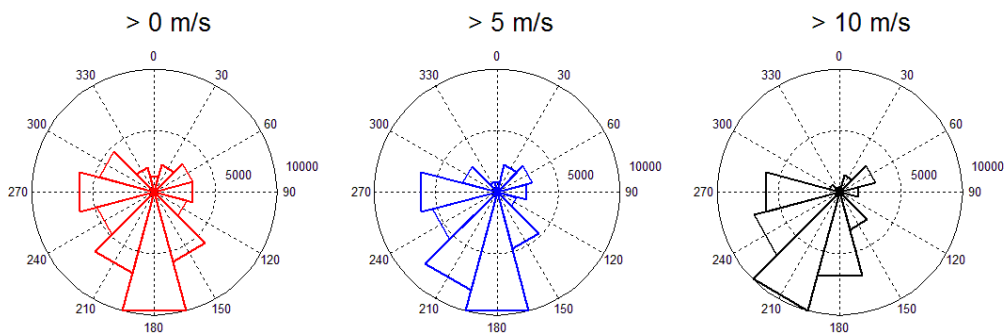


Figure 15 - Probability of exceedance of wind speeds from Manchester Airport obtained from the wind data recorded during the years 1991 to 2015.

A.1.2 LDDC Lawson Assessment Criteria

The acceptability of windiness is subjective and depends on a number of important factors, particularly the type of activity being performed.

Lawson's comfort criteria are used to describe frequent wind conditions and specify tolerable limits for various activities. The discrete categories, in order of increasing windiness, are described in Table 10.1. These conditions are limiting thresholds for comfort. For ideal conditions, it would be desirable to achieve a category better than the comfort categories described below.

The terms 'Sitting', 'Standing', 'Strolling' and business 'Walking' are used in the text to describe the comfort levels of windiness as described in Table 1. The coloured dots are used to indicate the windiness on the referenced figures, eg Figure 1, which also show the measurement locations.

Table 1 : Lawson Comfort Criteria

Comfort Criteria		Description
Long Term 'Sitting'		Reading a newspaper, eating and drinking
'Standing' or short term 'Sitting'		Bus stops, window shopping and building entrances
Walking or 'Strolling'		General areas of walking and sightseeing
Business 'Walking'		Areas where people are not expected to linger

There are also distress (or safety) criteria used to describe less frequent levels of windiness, to be exceeded less often than once a year. These are described in Table 2.

The distress limit for 'General Public Access' corresponds to an equivalent mean speed of 15 m/s and gust speed of 28 m/s. Exceeding this limit signifies a safety hazard for less able-bodied members of the public (e.g. elderly and cyclists). In such instances, the wind tunnel results would display a single red ring around the outside of the coloured dot as shown in Table 2.

There is a further limiting distress criterion above which 'Able-bodied' individuals may find themselves in difficulties at times. This corresponds to a mean speed of 20 m/s and a gust speed of 37 m/s. Aerodynamic forces beyond this limit approach the body weight and it rapidly becomes impossible to remain standing. If

these conditions are exceeded, then the wind tunnel results would display a double red ring around the outside of the dot as shown in Table 2. Such winds may also affect safety of some road vehicles.

Table 2: Lawson Distress Criteria

Distress Criteria		Description
‘General Public Access’		Above which the less able and cyclists may at times find conditions physically difficult
‘Able Bodied Access’		Above which it may become impossible at times for an able bodied person to remain standing