

Fallowfield Campus Redevelopment Project

Desktop Wind Assessment

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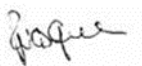
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Glossary

Term	Definition
CFD	Computational Fluid Dynamics
LCC	Lawson Comfort Criteria
LPA	Local Planning Authority
MCC	Manchester City Council

Executive Summary

This report has been prepared to consider wind effects and microclimate on and around the Fallowfield Campus Redevelopment Project, taking into consideration the maximum development proposed heights and the existing baseline condition. It considers the effect of topography, building shape and climate on wind conditions around the site.

This study will support the outline planning application for the development. The study will determine if further assessment is recommended during the detailed design (reserved matters) stage in order to mitigate any undesirable conditions on site. The likely effects caused by the new development on surrounding areas and within the site are highlighted and described. The conclusions of the study are summarised below:

- The baseline condition and the new development have been studied.
- Regarding wind effects, the introduction of the proposed development is likely to maintain the areas of shelter over the existing site currently being provided by the existing campus buildings.
- Depending on the final massing and orientation of the buildings, wind façade downwash, funnelling and corner wind effects may be present.
- The buildings are taller than the surrounding buildings and some façade downwash is expected to occur.
- The retention of trees on site aligns with best practices regarding wind within the site as these are mature and offer shelter to the site.
- Due to the height of the buildings that comprise the proposed development (no more than 14 storeys) and the nature of the residual effects once landscape is put in place, further studies are required once more detailed design of the proposed building is advanced. Further quantitative studies could be required at later design stages to determine the direct effect on local wind speeds and determine if mitigation measures are required to achieve comfortable and safe conditions on site.

This report is not an impact assessment, rather it provides an early analysis of how the proposed development may alter the surrounding wind microclimate.

Introduction

This Report provides an overview of the external wind conditions around the proposed development, in relation to pedestrian comfort and safety. The study covers the outline massing as presented in the outline massing model parameter plan of the entire proposed development (see Figure 0—1) and the wind flow around the outline massing and its context. A qualitative assessment has been performed based on the latest design scheme, and qualitative judgments have been made in order to identify areas of potential concern. This is a robust assessment based on the significant experience of the consultant engineer.

International Policy and Guidance

There is no specific international legislation or policy guidance for the assessment of the impact that a new development has on the comfort and safety of the local wind microclimate. However, local planning guidance in a number of cities around the world, including London, Leeds and Bristol (England), Wellington (New Zealand) and Chicago (USA) recommends that where new developments are significantly taller than neighbouring areas, the effect of the development on local microclimate should be assessed.

National Planning Policy

There are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment. The impact of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned usage are described by Lawson Comfort Criteria (LCC) (Lawson 2001), which are recognised by Local Planning Authorities (LPAs) as a suitable benchmark for wind assessments. The London Docklands Development Corporation's (LDDC) version of the Lawson Criteria, henceforth referred to as the 'LDDC Lawson Criteria' will be used as the criteria for this study.

There is no specific national or regional legislation, policy or guidance for the assessment of the local wind microclimate impact that a new development has on the comfort and safety of users.

Local Planning Policy

Manchester City Council Core Strategy (2012)

A number of local authorities provide planning guidance for tall buildings, recommending that a wind microclimate assessment be performed. Manchester City Council's (MCC) adopted Core Strategy (July 2012) contains guidance in its Policy EN2, advice on tall buildings which is applicable for buildings considered to be significantly higher than their neighbours. Policy EN2 states that a tall building can have a significant effect on the local environment and microclimate. Policy EN2 concludes that it is expected this effect should be modelled and that the application of tall buildings should include measures to create an attractive pedestrian-friendly local environment.

Wind Impact Analysis

Assessment methodology

Wind engineering uses skills in meteorology, aerodynamics, comfort assessment and urban design. Professional judgement has been applied to this desktop-based assessment; however, it is recommended that at the detailed design (reserved matters) stage (which is not being assessed during this report), quantitative studies are undertaken in order to ensure that the public spaces around the proposed buildings will be suitable for their intended activities throughout the year. Consideration is given to the characteristics of the local area and a wind frequency analysis of the site is carried out. From this analysis, appropriate wind directions are selected and analysed. The results of this baseline assessment are then used to assist the overall design process.

In this assessment of the concept design, analysis is made through qualitative evaluation of the above elements. Reference is made to known urban wind phenomena including façade downwash for tall buildings, funnelling between buildings, wake effects, skimming flow and courtyard effects.

Assessment of significance

The criteria used in this study is the LDDC Lawson Criteria (see Table 0—1). Like most criteria used in assessments of pedestrian wind conditions, they relate to a threshold wind speed and a threshold frequency for the suitability of an activity.

Wind microclimate comfort strongly depends on an individual's activity; therefore it has been defined separately for each activity in terms of an average (mean) wind speed exceeded for a certain percentage of the year.

The pedestrian LDDC Lawson Criteria has been developed around the Beaufort Scale extending its applicability to environments in and around buildings.

The assessment has been undertaken to investigate the likely pedestrian conditions in and around the proposed development when it is subject to wind from different directions. An assessment of the appropriateness of different parts of the site for their intended use has also been made.

The LDDC Lawson Criteria determines which 'comfort category' an area falls into based on a threshold value. If wind speeds in an area exceed the comfort category speeds 5% of the time the area falls within that respective category. Given activities are then set for these velocity thresholds. These activity categories represent what activity would be comfortable to do given the wind environment and are: 'Sitting', 'Standing', 'Pedestrian Walking/Strolling' and 'Pedestrian Walking Through'. There is a fifth category which would indicate doing any activity in the area would be uncomfortable. If conditions for a certain area are above the criteria set for the activity above for any particular area, mitigation is likely to be required.

Regarding safety – an area is determined as unsafe if the wind speeds in this area exceeds 15m/s 0.02% of the time approximately 1.9hrs per year.

The LDDC Lawson Criteria used to assess the comfort and safety can be found in Table 0—1 and Table 0—2.

The wind frequency exceedance threshold for each criterion is 5% (about two and a half weeks per year) as explained above. It is also useful to assess frequency on a seasonal basis. For example, an outdoor seating area may require wind conditions suitable for sitting or standing in summer, but not in winter when the seating is unlikely to be used due to

other factors, e.g. ambient temperature and precipitation. For season-specific results, the criteria are based on 5% of hours across the months in that season.

Table 0—1 LDDC Lawson 2001 Comfort Criteria thresholds for levels of wind speed

Comfort Scales	
Wind Speed - not to be exceeded more than 5% of the time (m/s)	Tolerable Activity
0-4	Sitting
4-6	Standing
6-8	Pedestrian walking
8-10	Pedestrian walk through
> 10	Uncomfortable

Additionally, criteria for safety have been defined based on 0.022% wind speed exceedance (~1.9 hours) per year. These are areas where someone could find walking difficult or even lose their footing. The criterion is reproduced in Table 0—2.

Table 0—2 Threshold for wind safety exceedance

Safety rating	Threshold mean-hourly wind speed exceeded once per annum (0.025%)	Description
S15 - Unsuitable for the general public	> 15 m/s	Presents a safety risk for pedestrians, especially to more vulnerable members of the public.
S20 - Unsuitable for able-bodied	> 20 m/s	Presents a safety risk for all pedestrians.

Baseline conditions

Site details

The site is located in the south of the Manchester, approximately 3.6km from the city centre. Fallowfield Campus is a residential campus for the University of Manchester, and the proposed use of the site will remain student accommodation. To the east of the site lie more University of Manchester campus buildings and to the northeast is Manchester grammar school. To the east and south there is largely residential buildings. The site runs parallel to the A6010 and north of the A34 leading to Manchester city centre.

The site's topology shows very little change in height, and it is considered to be a flat site.

The existing site is currently UoM student accommodation and university-related land use. Oak House and Woolton Hall are still in use as student accommodation (Owens Park is now closed). The student accommodation currently on site is generally 4 storeys in height, with one tower in the north of the site more than 18 storeys (Owens Park tower). All these buildings will be demolished to make way for the proposed development, including the Limes building which will be demolished and relocated elsewhere (under a future planning application).

Wind Conditions

The prevailing wind across Manchester is from the south and southwest, with some lesser contribution from all other directions. During the winter there are some contributions from the northeast. In spring contributions from northeast become relevant. Good quality long-term weather data is available from Manchester Airport, this is the closest weather station 8 miles southwest of the site therefore translation to the site is not necessary and the data is suitable for direct application.

Wind speeds are generally highest in the winter and spring and the seasonal pattern shows a very similar range of directions for winter, spring, and autumn. Summer has southerly and westerly prevailing winds with the largest speeds from the south.

The predicted site annual wind rose is shown in Figure 0—1. This shows the direction the wind is blowing from, with long bars representing frequent winds and wider bars representing stronger winds.

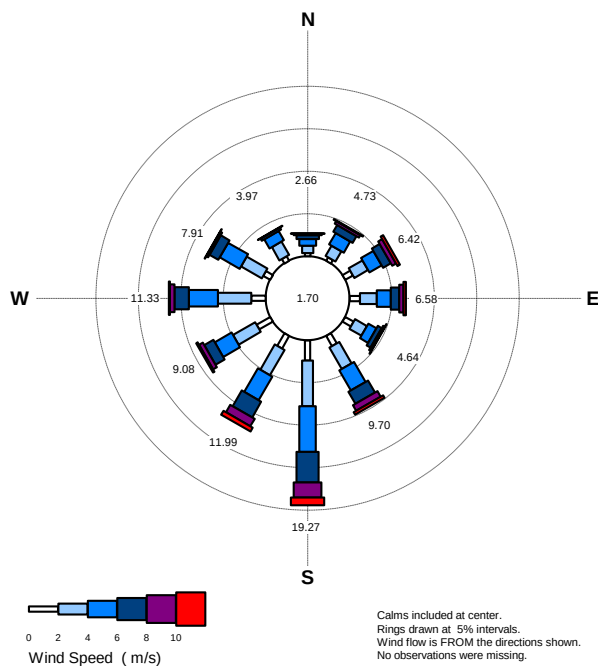


Figure 0—1 Annual wind rose for Manchester airport (nearest weather station to the site)

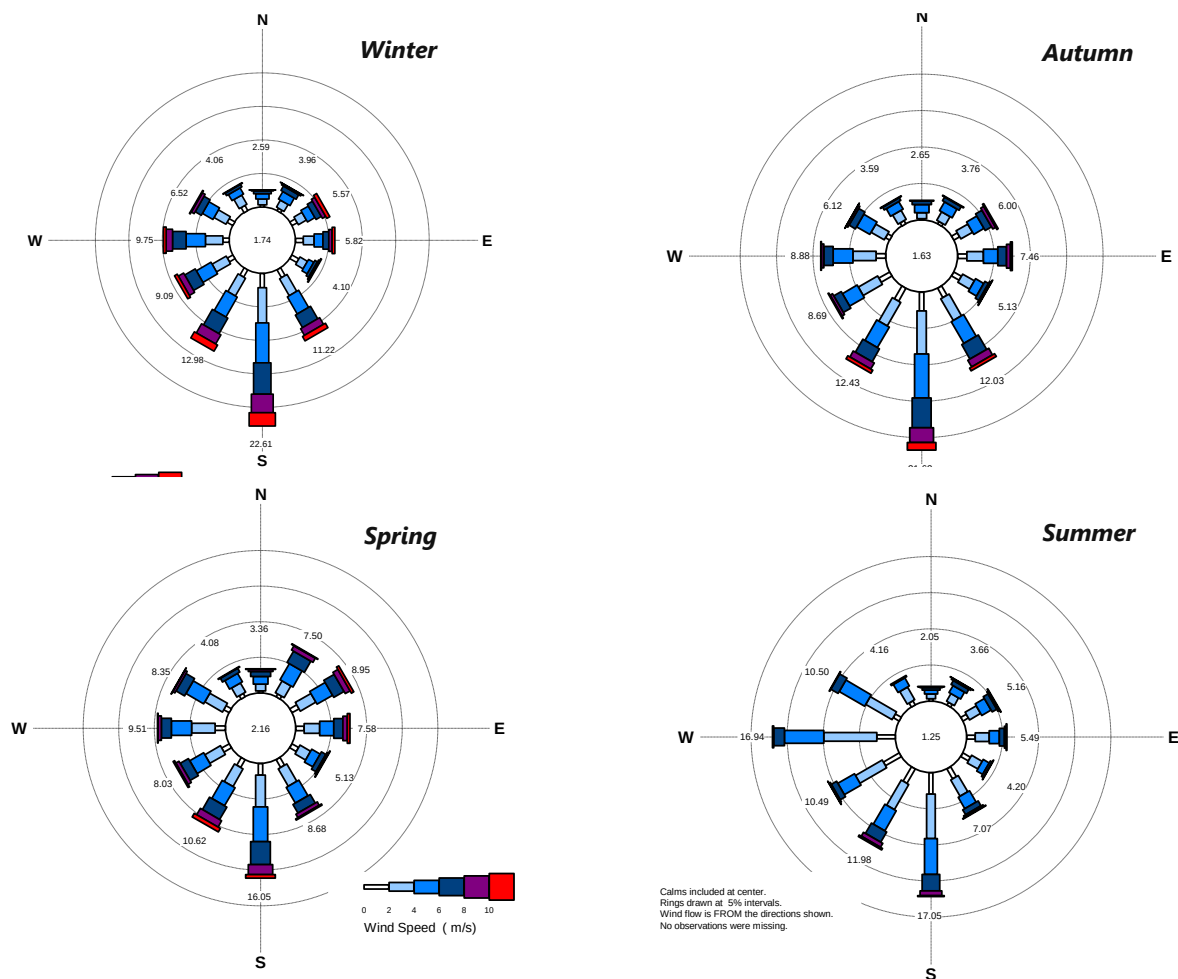


Figure 0—2 Seasonal wind roses for Manchester airport.

Site exposure

In the baseline condition the site will be partially sheltered from winds from the south and west by trees at the perimeter of the site and the surrounding existing buildings mainly residential, approximately two to four storeys in height. Shelter is likely to extend to the north and east where there are taller buildings from 2 to 8 storeys in height.

There are a number of high-value and mature trees on the site, and it is proposed to retain as many of these as possible, avoiding key groups of trees wherever possible by adapting the building footprint or replanting, and protecting all Class A trees. This is important in terms of wind microclimate as these provide shelter and it help to improve comfort and safety conditions on site.

The shelter provided by the existing building is leading to slightly lower wind speeds from most wind directions. Looking to the north and west, the site is largely exposed to incoming wind acceleration and will remain so until proposed future development takes place. The rail track to the north is likely to offer some degree of protection to the site.

The 18-storey tower that is currently in the north of the site is likely to produce some façade downwash and likely wind acceleration around its perimeter.

There are several zones in the current campus layout that have been designated specific functions, to be utilised by their occupants in different ways. This varies from seating areas, social areas and walkways. Depending on the activity the area will be used for, a lower value of wind speed may be required in order to keep occupants comfortable. Ideally if people are to remain stationary for an extended period, wind speeds need to be lower in order to ensure comfort.

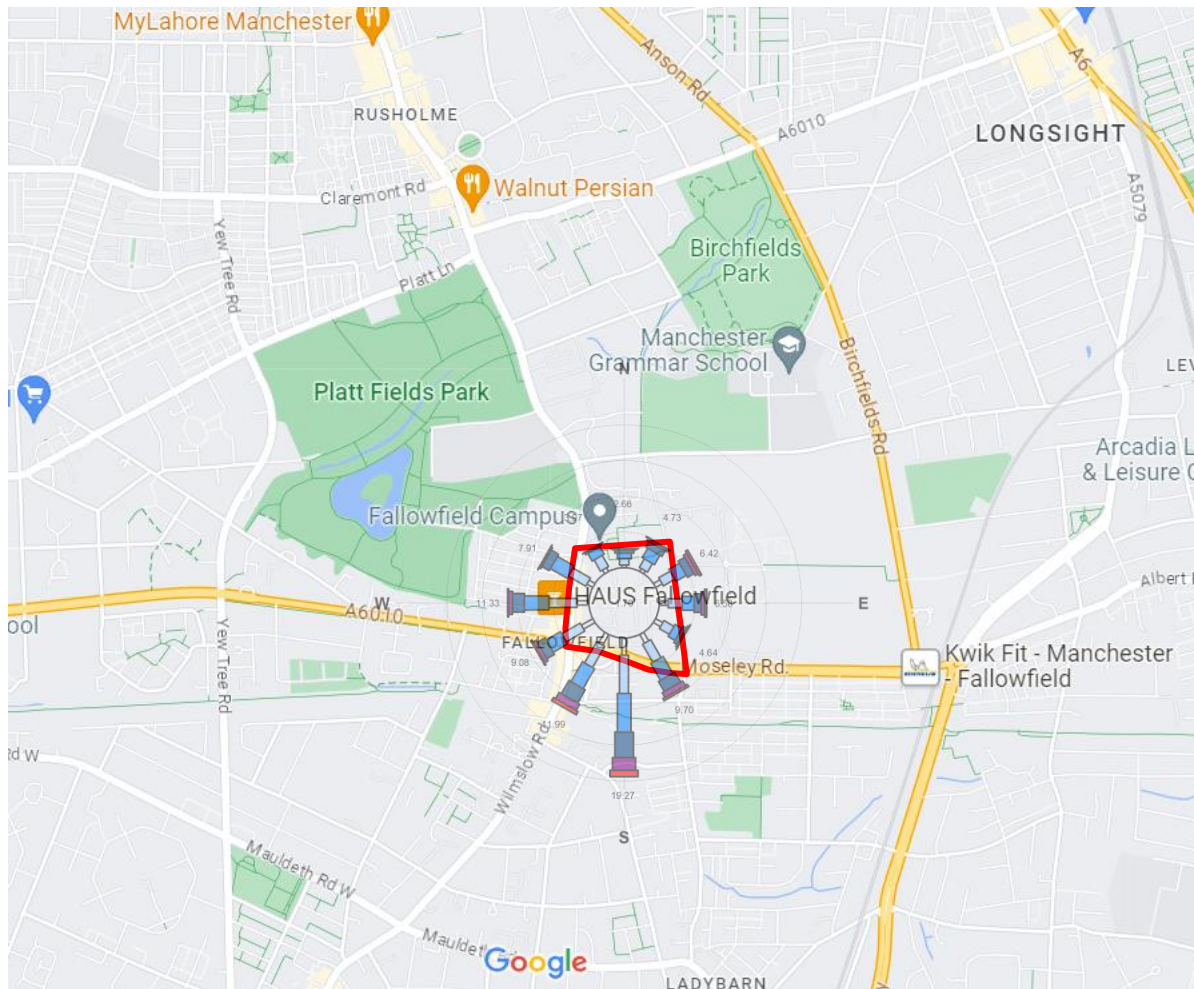


Figure 0—3 Site view from above (Manchester airport wind rose overlaid)

Although climate change is currently expected to have significant impacts on a national level, wind conditions are not likely to change sufficiently to require specific analysis. No clear pattern of increasing strength or frequency of strong winds has thus far been identified. As such it is normal practice to assume that historical wind conditions give a good indication of the likely range of future conditions.

At this stage an outline planning application is being submitted therefore there is little detail regarding future public realm land uses, including seating areas. This will come forward at the detailed design (reserved matters) stage.

Assessment of impacts

Proposed development details

The outline massing of the proposed redevelopment plan comprising purpose-built student accommodation in the Fallowfield campus can be seen in Figure 5 – 1. The proposed development will provide up to 3,300 beds for prospective students. It is a combination of 3 plots K-M to the north and a larger plot to the south.

This proposed model is an outline Parameter Plan covering where the proposed buildings will be situated.

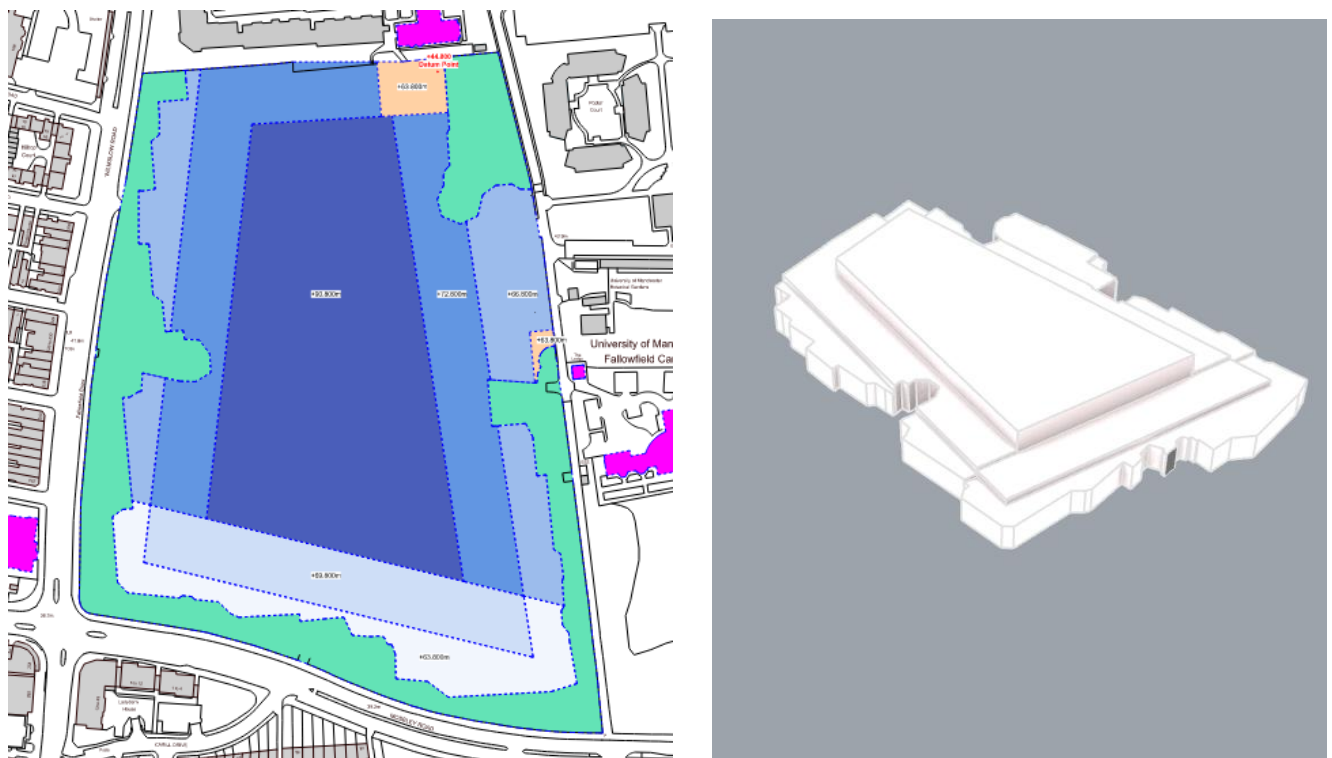


Figure 0—1 Phase 3 Outline massing (2D drawing in context and 3D model)

The prevailing winds in Manchester are from the south and southwest (see Figure 0—1 and Figure 0—2), with a moderate amount from a north-easterly direction. Therefore, these prevailing wind directions have been considered in the following sections.

The wind qualitative assessment will be carried out over the outline massing proposal.

Southerly winds

Looking at the Outline massing of the Fallowfield campus there are a few features that could possibly cause wind acceleration across the site. The prevailing winds are from the south therefore it is possible that the wind will hit the south façade of the buildings, creating downwash and subsequent acceleration at occupant level (see Figure 5 – 2).

Also depending on the orientation of the proposed residential buildings there may be funnelling and as a consequence corner acceleration as the southerly winds hit the façade and divert around the corners. It will be important to consider building entrances noting these areas of acceleration. Focusing on the initial design there is also likely to be acceleration due to funnelling as many of the pedestrian routes between buildings are oriented north to south therefore the air will be 'squeezed' through these areas as it travels from the south causing acceleration, this will be reviewed during the detail design stage.

To the south of the site there is largely low- to mid-rise residential buildings, therefore the proposed development will be considerably higher than the surrounding areas. As a result, there will be some shelter at lower levels but at higher heights façade downwash is likely to occur. If this is the case, canopies above walkways and entrances would likely be beneficial as a mitigation measure. Final mitigation measures will be reviewed during the detailed design (reserved matters) stage of the project to ensure comfortable and safe conditions are achieved within the site.

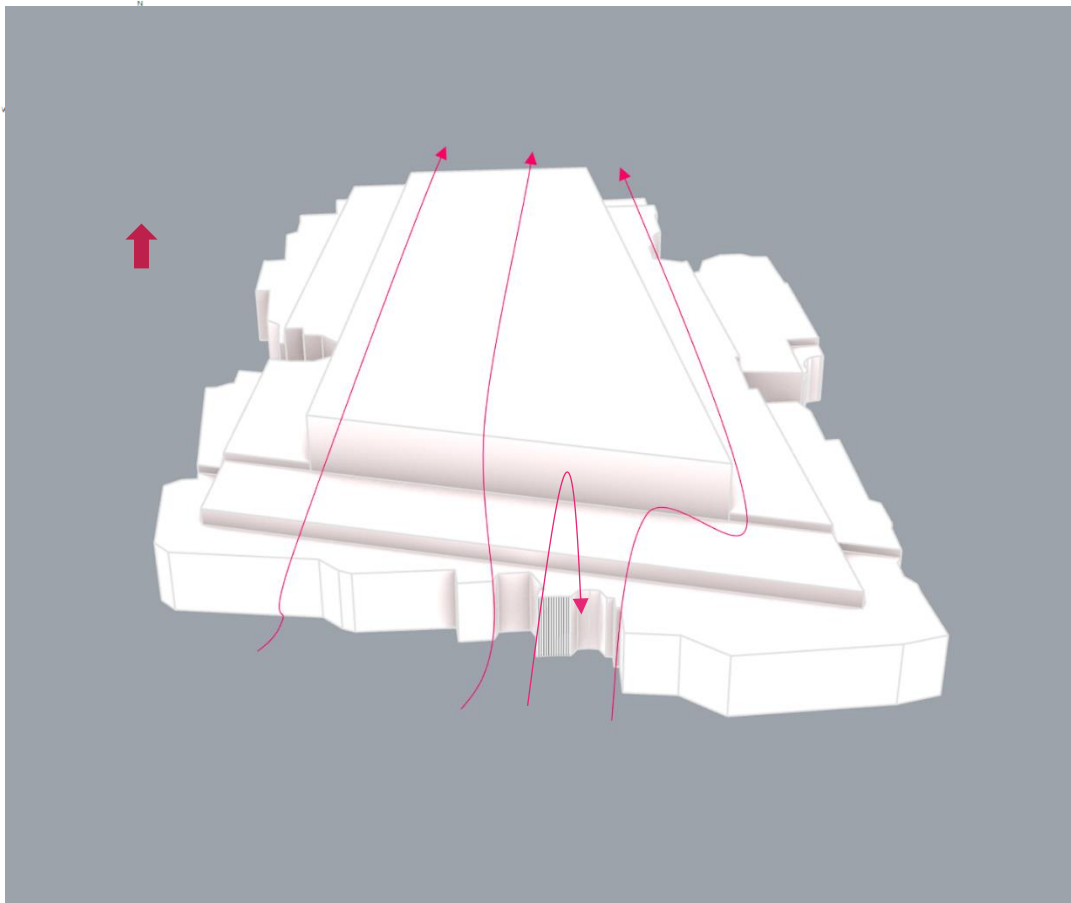


Figure 0—2 Southerly wind effects for phase 3

South-Westerly Winds

Similar effects including façade downwash and corner acceleration at pedestrian level are likely to be seen from the south westerly direction (Figure 5—3). There will most likely be areas of acceleration at the corners of the southwest buildings with less acceleration as the wind reaches the northeast of the site and starts to dissipate or is redirected.

Again, sheltering at lower levels from surrounding buildings is likely but façade downwash at higher levels will likely cause acceleration at ground level.

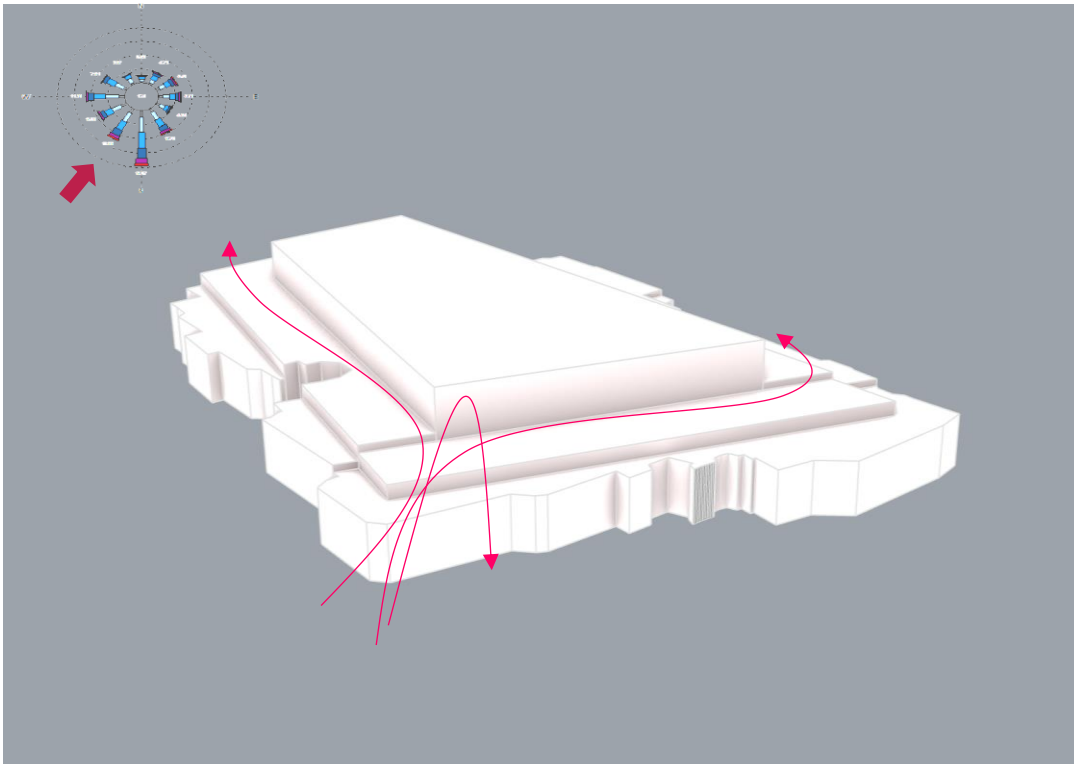


Figure 0—3 South-Westerly wind effects for phase 2

North-Easterly winds

North-easterly winds are highest in the spring and winter seasons. There are potential similar effects as in the south-westerly case – façade downwash and corner acceleration (Figure 5—4).

There is a largely open terrain directly northeast of the site due to the school playing fields and low-rise residential buildings beyond that. As a result, the high winds hitting the façade may be slightly more increased than the southwest

which appears to be more sheltered. It is likely canopies above walkways and entrances will mitigate against this, preventing high winds hitting the ground level.

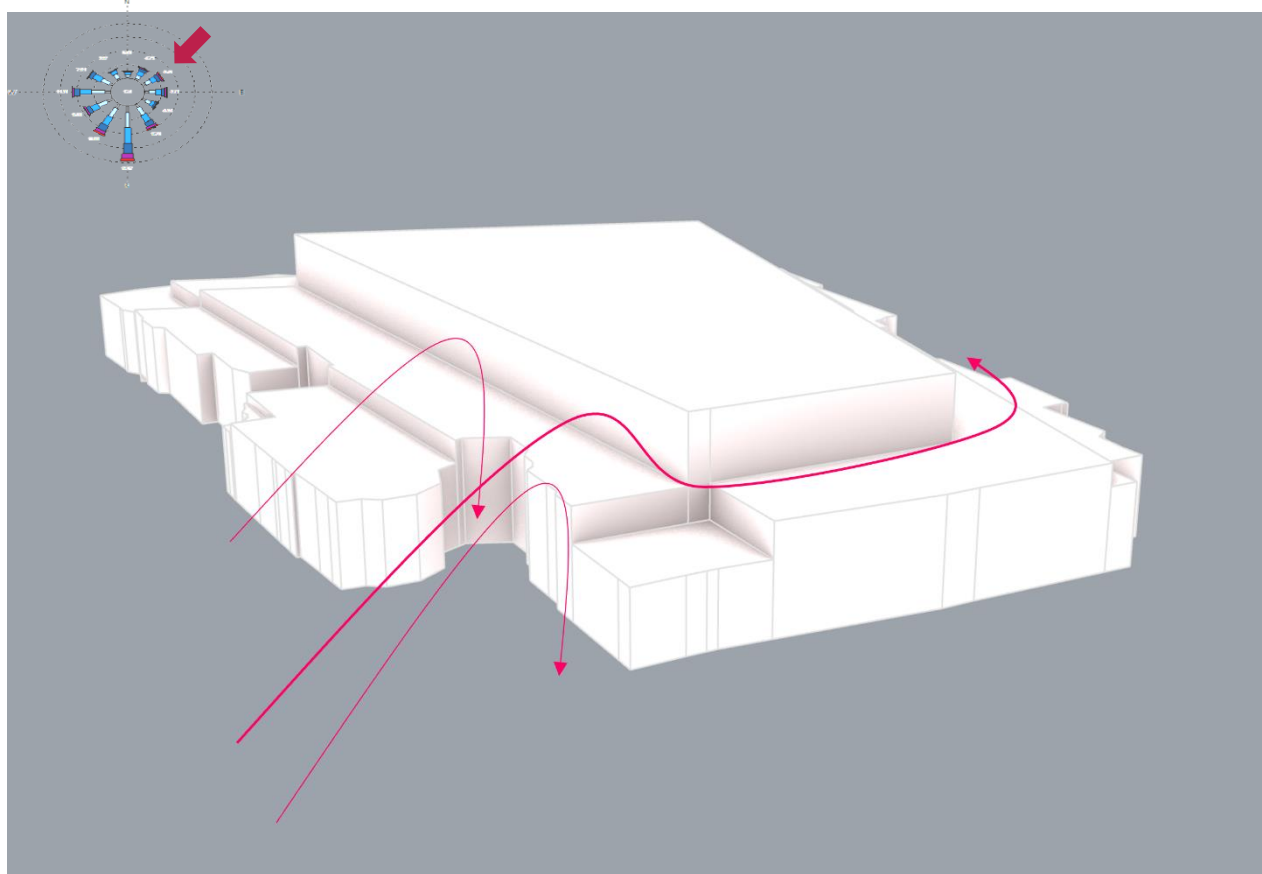


Figure 0—4 North-easterly wind effects for phase 3

Future Development impacts

Cumulative developments have been reviewed, there are no other proposed developments of significant size, therefore at this stage a cumulative assessment is not included within the assessment.

Safety

Although wind could be accelerated through areas of the site, the present desktop study has shown that wind speeds will generally fall within accepted safety limits with wind speeds not exceeding 15m/s (See Table 0—2). In considering this, it would be prudent to consider features to assist with the protection of the principal areas within the site. This could include, for example, landscaping measures around areas where wind funnelling occurs. If further detail is required, and given the uncertainty involved in making detailed predictions, further information could be obtained by the extension of the study by means of Wind Tunnel or CFD testing at the detailed design (reserved matters) stage.

Summary conclusions

This report provides an overview of the likely external wind conditions in relation to pedestrian comfort and safety for the proposed development. The study covers the development and its immediate surroundings in order to assess the impact of the wind flow on and around them.

A qualitative wind microclimate analysis was carried out for this stage of design to determine the main impacts of wind and to offer recommendations for further consideration. Most areas are expected to be suitable for activities such as pedestrian standing and walking. However, some areas, depending on final orientation and massing of the buildings, may be subject to slightly higher wind accelerations and mitigation measures will be reviewed during the detailed design (reserved matters) stage, to mitigate these effects.

The following conclusion have been derived from the above analysis.

- An analysis of conditions as they are in the baseline condition and as proposed within the outline massing of the new development have been studied.
- The main wind effects created by the introduction of the proposed development is likely to create areas of shelter over the existing open space.
- Depending on the final massing and orientation of the buildings wind façade downwash, funnelling and corner wind effects may be present.
- The proposed buildings are relatively taller than the surroundings buildings some façade downwash is expected to occur.
- It is recommended that the trees on site are retained as these are mature and offer shelter to the site.
- The maximum building height proposed is no more than 14 storeys. Once the proposals have been developed further, including landscaping plans, further studies are likely to be required. Further quantitative studies could be undertaken at later design stages to determine the direct effect on local wind speeds and determine if mitigation measures are required to achieve comfortable and safe conditions on site.

References

- i Building Aerodynamics, Imperial College Press (2001), T.V. Lawson
- ii The Designer's Guide to Wind Loading of Building Structures, Part 1, BRE (1985), N.J. Cook

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