

# 12. Wind Microclimate Assessment

## Introduction

- 12.1. This Chapter of the ES has been prepared by BuroHappold and assesses the likely wind microclimate impacts of the proposals upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce, or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.
- 12.2. This Chapter is accompanied by one technical appendix, a [Committed Developments] (Appendix 2).
- 12.3. The author of this chapter has seven years of experience in analyzing wind pedestrian comfort CFD and wind tunnel studies for EIA developments, ES, planning and design advice purposes in more than twenty projects.

## Legislative and Policy Context

### National Planning Policy

- 12.4. There are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment.
- 12.5. The UK wide National Planning Policy Framework (NPPF) came into force in March 2012, and was updated in February 2019. There are no national planning policies directly relating to wind microclimate issues; however, the benefits of a high quality built environment are emphasised in the NPPF. An example of this is presented in paragraph 127: "...using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit...".
- 12.6. The impact of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned usage are described by the Lawson Comfort Criteria (LCC), which are recognised by Local Planning Authorities (LPAs) as a suitable benchmark for wind assessments. LCC has been applied in the wind assessment of the Proposed Development.

### Regional Planning Policy

- 12.7. There is no specific national or regional legislation or policy 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

- 12.8. Several local authorities provide planning guidance for tall buildings, recommending that a microclimate assessment be performed. The definition of tall buildings within these documents varies, but typically includes any buildings which are significantly higher than their neighbours. Reference on how the Manchester City Council (MCC) aims to avoid potential adverse effects of tall buildings can be found in Manchester's Local Development Framework, Core Strategy Development Plan Document, July 2012.
- 12.9. Policy EN2 states that "Tall buildings are defined as buildings which are substantially taller than their neighbourhoods and/or which significantly change the skyline", and "By their very size tall buildings can have a significant impact on the local environment and its micro-climate. 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".
- 12.10. Furthermore, Objective 6 (Environment) states in paragraph 12.6 that development in Manchester will be expected to follow seven design principles, including "Quality of the public realm: a place with attractive, and successful outdoor areas".

- 12.11. This report considers the above as part of the assessments carried out, by considering the massing impact on the local conditions that may be experienced by users of the external areas around and within the site. Due to its size, location and nearby building heights the Proposed Development is not considered a tall building. However, the SRF masterplan includes tall buildings. The wind microclimate assessment has been undertaken to ensure that all areas of the proposed public realm are comfortable and safe for pedestrians to use, particularly given the Proposed Development's proximity to several tall buildings outside the red line.

## Assessment Methodology and Significance Criteria

### Methodology

- 12.12. The wind study includes a direct comparison between the baseline conditions and those created by the Proposed Development for the wind occurrences based on the Wind statistical data translated to the site. The Chapter describes the quantitative assessment of the likely wind environment, and the qualitative judgements that are made in order to identify areas of potential concern. This analysis included an assessment of the relative forms, layouts and massing of the existing Site and the Proposed Development, as well as landscaping and topography.
- 12.13. Impacts of the likely wind conditions are judged based on the Computational Fluid Dynamics (CFD) modelling results and BuroHappold's extensive experience of wind assessments, full-scale testing, CFD and wind tunnel modelling of similar developments.
- 12.14. The assessment is supported by CFD modelling of the full range of wind speeds and directions for the two configurations (which have been agreed with the Local Planning Authority through the EIA Scoping Process), as follows:

### Tested scenarios

- 12.15. Two scenarios have been tested within this assessment. These scenarios are as follows:

#### Current Baseline Scenario 1: Existing site in existing surroundings

- Existing Site: current All Saints Library Building
- Existing Surroundings: surroundings buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain

#### Proposed Scenario 2: Proposed development in existing surroundings

- Proposed Development: new library building with outdoor terraces
- Existing Surroundings: surroundings buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain.

12.16. The figure below includes the application redline boundaries of the cases listed above.



Figure 0-1 MMU Library Red Line Boundary

- 12.17. Wind microclimate comfort strongly depends on an individual's activity and so has therefore been defined separately for each activity in terms of an average (mean) wind speed exceeded for a certain percentage of the year.
- 12.18. The pedestrian comfort criteria have been developed around the Beaufort scale (Lawson 2001), extending its applicability to environments in and around buildings.
- 12.19. 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.

## Design criteria (standards)

### Lawson Comfort Assessment

- 12.20. The Lawson assessment has included a direct comparison between the baseline conditions (existing) and the Proposed Development. A quantitative assessment of the likely wind environment has been carried out, with any areas of potential concern identified.
- 12.21. A comfort map was created to illustrate the assessment results. This map includes a direct correlation between the calculated wind speeds by the CFD simulations and the wind frequency data near the Site for the last 10 years. It provides a complete picture of the likely wind conditions related to certain activities, indicating when suitable conditions can be achieved for carrying out such activities or if distress is likely to be experienced. The maps cover the whole Site on a plane 1.5 m above ground level, where wind speeds are measured.
- 12.22. The thresholds used to determine the effect for a given activity are specified for Unacceptable, Tolerable, and Acceptable. An example of the thresholds is given in Table 0—1 for "Perceived response to wind for a pedestrian" (as per the Lawson Criteria) which would be Unacceptable. The definitions for these thresholds are summarised below:
- Unacceptable, unpleasant conditions for the given activity, which should not normally be allowed to occur;
  - Tolerable, conditions that would be describe as 'windy' but which would be tolerated for the given activity; and
  - Acceptable, conditions that will elicit no adverse comment about wind conditions.

- 12.23. It is considered that effects that breach the “Unacceptable” threshold could be significant and it is these effects that are considered further within this assessment, in terms of the activity occurring in the area identified, and requirement for mitigation. The Lawson criteria (Lawson 2001) are used to assess the wind speeds for different activities. The criteria that have been used to assess the unacceptable threshold for different activities as well as the distress criteria are listed in Table 0—1.

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

| Lawson Comfort Criteria Classification | Use of Space                        | Maximum acceptable combination of wind speed and occurrence |       |                      |
|----------------------------------------|-------------------------------------|-------------------------------------------------------------|-------|----------------------|
|                                        |                                     | Beaufort Scale                                              | (m/s) | Allowable occurrence |
| <b>Safety (Distress)</b>               | General public                      | B7                                                          | 15    | 0.025%               |
| <b>Uncomfortable</b>                   | General public                      | B6                                                          | 14.1  | 0.01%                |
| <b>10</b>                              | Pedestrian Business Walking         | B5                                                          | 10.95 | 6%                   |
| <b>9</b>                               | Pedestrian Walking around Buildings | B5                                                          | 10.95 | 2%                   |
| <b>8, 7</b>                            | Pedestrian Walk through             | B4                                                          | 8.25  | 4%                   |
| <b>6</b>                               | Entrances/ Standing                 | B3                                                          | 5.6   | 6%                   |
| <b>5</b>                               | Sitting                             | B3                                                          | 5.6   | 3%                   |

Table 0—2 The Beaufort scale for wind on land

| Beaufort Force | Hourly-average wind speed (m/s) | Description of wind | Noticeable wind effect                                       |
|----------------|---------------------------------|---------------------|--------------------------------------------------------------|
| <b>B0</b>      | < 0.45                          | Calm                | Smoke rises vertically                                       |
| <b>B1</b>      | 0.45 - 1.55                     | Light air           | Direction shown by smoke drift but not by vanes              |
| <b>B2</b>      | 1.55 - 3.35                     | Gentle breeze       | Wind felt on face; leaves rustle; wind vane moves            |
| <b>B3</b>      | 3.35 - 5.60                     | Light breeze        | Leaves & twigs in motion; wind extends a flag                |
| <b>B4</b>      | 5.60 - 8.25                     | Moderate breeze     | Raises dust and loose paper; small branches move             |
| <b>B5</b>      | 8.25 – 10.95                    | Fresh breeze        | Small trees, in leaf, sway                                   |
| <b>B6</b>      | 10.95 - 14.10                   | Strong breeze       | Large branches begin to move; telephone wires whistle        |
| <b>B7</b>      | 14.10 - 17.20                   | Near gale           | Whole trees in motion                                        |
| <b>B8</b>      | 17.20 - 20.80                   | Gale                | Twigs break off; personal progress impeded                   |
| <b>B9</b>      | 20.80 - 24.35                   | Strong gale         | Slight structural damage; chimney pots removed               |
| <b>B10</b>     | 24.35 - 28.40                   | Storm               | Trees uprooted; considerable structural damage               |
| <b>B11</b>     | 28.40 - 32.40                   | Violent storm       | Damage is widespread; unusual in the U.K                     |
| <b>B12</b>     | > 32.40                         | Hurricane           | Countryside is devastated; only occurs in tropical countries |

- 12.24. 12.26 Uncomfortable conditions are experienced at wind speeds above Beaufort B6. Additional mitigation for these areas will be of benefit and will improve comfort conditions. Wind speeds above Beaufort B7 indicate that conditions are not suitable for pedestrian activities to be carried out safely, and therefore mitigation will be required in these cases in order to bring conditions to within safe limits.

### Receptor Sensitivity

- 12.25. 12.27 Sensitive receptors in respect of wind microclimate are the pedestrians using the site and the occupants of the Proposed Development and surrounding buildings. Their sensitivity and the magnitude of any change will determine the significance of impact. Sensitivity to wind is dependent upon the activity undertaken, in line with the LCC, as presented in Table 0—3.

Table 0—3 Urban pedestrian activities for sensitivity evaluation, in order of increasing sensitivity

| Receptor Sensitivity | Activity                                         |
|----------------------|--------------------------------------------------|
| <b>Negligible</b>    | Areas with non-pedestrian activities             |
| <b>Low</b>           | Pedestrian walkthrough, roads and carparks       |
| <b>Moderate</b>      | Entrance doors, pedestrian standing, walkthrough |
| <b>High</b>          | Sitting, entrance doors                          |

### Effect Significance

- 12.26. The impact on sensitive receptors (i.e. pedestrians) is split into the categories below.
- 12.27. A major impact is one that impacts the safety of the receptors, i.e. that breaches the safety criteria described in Table 12—1, and is considered to be of major significance for the purposes of this assessment. These types of impacts will require detailed and careful mitigation.
- 12.28. Moderate and minor impacts are not considered to cause significant effects. However, in order to reduce the impacts further and improve the comfort of receptors, mitigation measures to reduce the effects from moderate (uncomfortable) to minor (tolerable/negligible) have been specified as appropriate.
- 12.29. The assessment of significance refers to the LCC as set out in Table 0—1. To determine the significance of the impact of the Proposed Development on the wind environment, comparison can be made with the conditions on the existing site. However, because the pedestrian use of a site can change markedly pre- and post-development, it is considered that assessment based upon the suitability of the site for the desired pedestrian use is the most informative and relevant.
- 12.30. The criteria used to assess the nature of the wind impacts are as follows:
- Adverse – detrimental or negative impacts to an environmental resource or receptor compared with the baseline or the intended use of the site; or
  - Beneficial – advantageous or positive impact to an environmental resource or receptor compared with the baseline or the intended use of the site.

Table 0—4 Significance Criteria

| Significance    | Description                                                                                                                                                                                                   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Major</b>    | Any impact that affects safety (or distress)                                                                                                                                                                  |
| <b>Moderate</b> | Any impact affecting pedestrian comfort where conditions change from suitable for existing activities to unsuitable for proposed activities is to be considered moderate, and vice versa for positive impacts |
| <b>Minor</b>    | Conditions that are marginal with respect to the criteria or criteria are met during key seasons only                                                                                                         |

| Significance | Description                                                          |
|--------------|----------------------------------------------------------------------|
| Negligible   | No or minimal impact on conditions that are likely to be experienced |

## Limitations and Assumptions

- 12.31. This section defines the different aspects of this type of study the CFD approach follow and the assumptions and limitation of the study. Consideration is given to the characteristics of the local area to facilitate assessment. A wind frequency analysis of the site is carried out and from this analysis all wind directions are analysed. The results of this assessment are then available to assist the overall design process.

## Computational Fluid Dynamics (CFD) Modelling Assumptions

### Approach

- 12.32. The physical layout of the site as described was analysed using a 3D CFD model. CFD modelling involves the solution of the fundamental equations of fluid motion using numerical techniques. The region of interest is divided into numerous small volumes, or cells, and equations are solved within each cell. Values of the variables that are solved in the model are determined in each cell and so a comprehensive assessment of velocity variation within the calculation domain is obtained. To improve the resolution of the results, the computational cell size has been reduced in the areas of most interest. This ensures that large gradients of velocity at street level are modelled accurately.

### Model Extents and Detail

- 12.33. The drawings and models are described in detail within this section. For buildings outside the development boundary, a 3D context model was acquired from Zmapping, this has been simplified and updated to match footprints and building heights from aerial survey data. The proposed buildings have been modelled accordingly to the information provided and mentioned in the baseline Section. These buildings have been merged with the Zmapping information and simplified accordingly for CFD modelling purposes.
- 12.34. The CFD model is contained within one single domain. This domain includes the Proposed Development and the surrounding buildings and features, around which the wind environment is analysed. Surrounding buildings and terrain were included in the model up to a radius of 400m from the centre of the domain. A total simulation domain of radius 800m was modelled. This distance is appropriate as it explicitly contains all buildings and structures surrounding the Proposed Development that are likely to affect the wind flows around it.
- 12.35. The typical edge length of the computational cells in this domain is approximately 1 to 3m, with greater cell sizes at points further from the development buildings. A refined layer of cells exists adjacent to the ground, to allow for an accurate prediction of pedestrian level wind speeds. The total number of computational cells is approximately 9 million for this study. Roughness has been applied in the outer region beyond the modelled buildings, to account for the presence of buildings and terrain features.

## Atmospheric Boundary Layer

- 12.36. The upwind boundaries of the CFD model were prescribed with an atmospheric velocity and turbulence profile corresponding to natural winds. The atmospheric velocity profile was modelled using a log-law, based on communications with ANSYS (i.e. the developers of the CFX CFD software used). This log-law is also described in reference [3].
- 12.37. The downwind and upper boundaries were represented as pressure opening boundaries. These are representative of the atmosphere surrounding the proposed development. They allow air to be entrained into the model domain or air to flow out of the domain.
- 12.38. For each wind direction, a single, steady-state RANS (Reynolds Averaged Navier-Stokes) calculation was undertaken using the commercial ANSYS CFX software. Turbulence was modelled using an SST model, with a production limiter used to ensure realistic flow predictions close to stagnation points. This method allows for the assessment of mean wind speeds for the development.

## Wind Data Analysis

- 12.39. For analysis of wind behaviour, it is necessary to know the relevant wind data for the case. Velocity fluctuation and directional variance are hard to measure accurately.
- 12.40. Both the wind speed frequency and its direction are required for this assessment. This data is commonly presented in the form of wind speed and wind frequency distribution diagrams (wind roses). Data is usually provided for average hourly wind speeds at 10m above ground level. This data is monitored and recorded from meteorological stations all over England and reported by the Met Office.
- 12.41. Good quality, long-term weather data is available from Manchester Airport. The wind data from Manchester Airport was translated to meteorological standard terrain (open country) and then to the proposed site. The method used was the method set out in "The Designer's guide to wind loading of building structures, Part 1" (1985), N.J. Cook. This allows for the sheltering effect of neighbouring terrain but does not allow for channelling of wind, for instance due to rivers and valleys. This effect is not expected to dominate conditions here. The resultant wind rose is included in the figures supporting this report.

## Direction Frequency

- 12.42. Figure 0-2 and Figure 0-3 show the annual and seasonal directional velocity distribution for the proposed site, once the wind has been translated from Manchester Airport. This shows the direction the wind is blowing from, with long bars representing frequent winds and wider bars representing stronger winds.
- 12.43. The wind speed for the site can be established for both comfort and safety analysis based on a frequency of occurrence as indicated in Table 0—1.
- 12.44. As can be seen from Figure 0-2 and Figure 0-3, the prevailing wind across Manchester is from the south and southwest, with some lesser contribution from all other directions. During the spring and winter there are some contributions from the northeast.
- 12.45. Wind speeds are generally highest in the winter with the seasonal pattern showing a very similar range of wind directions for winter, spring and autumn. Summer has southerly and westerly prevailing winds with the highest speeds from the south and southwest.

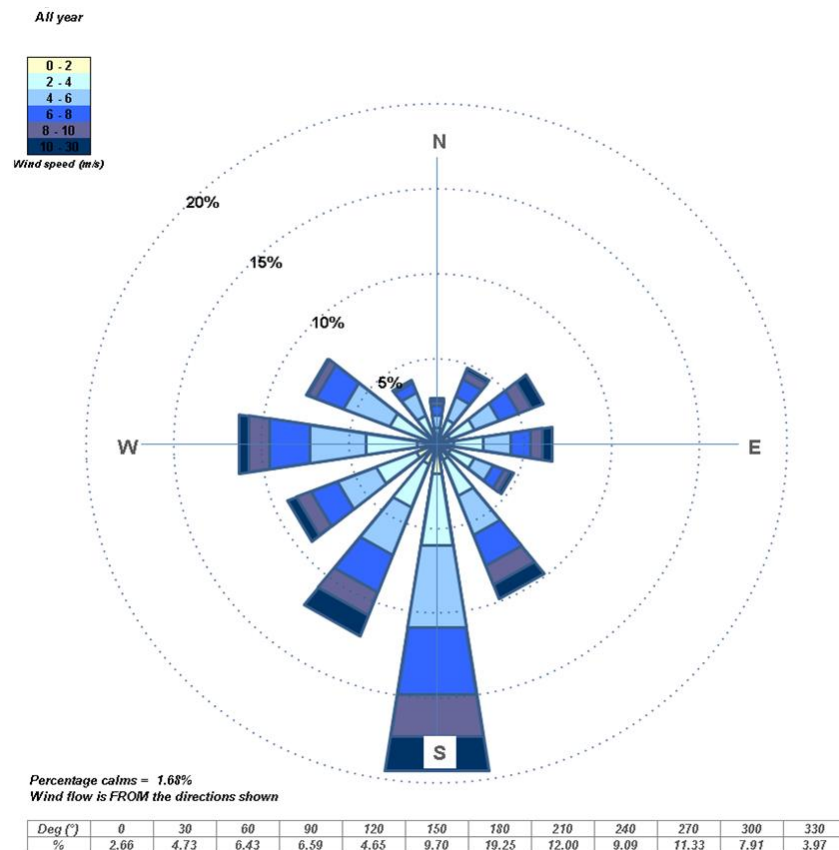
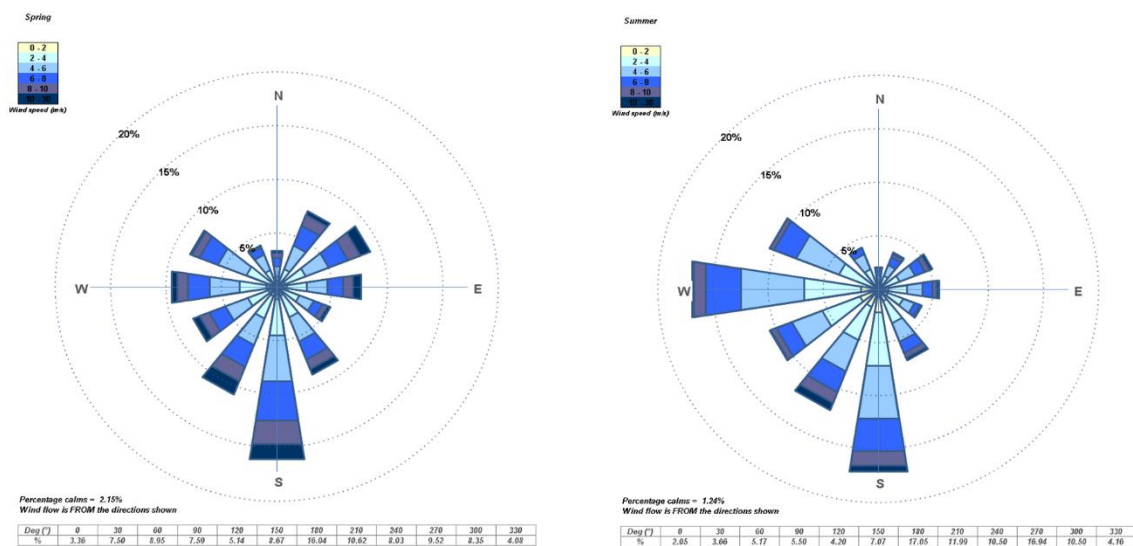


Figure 0-2 Annual wind rose for the development site



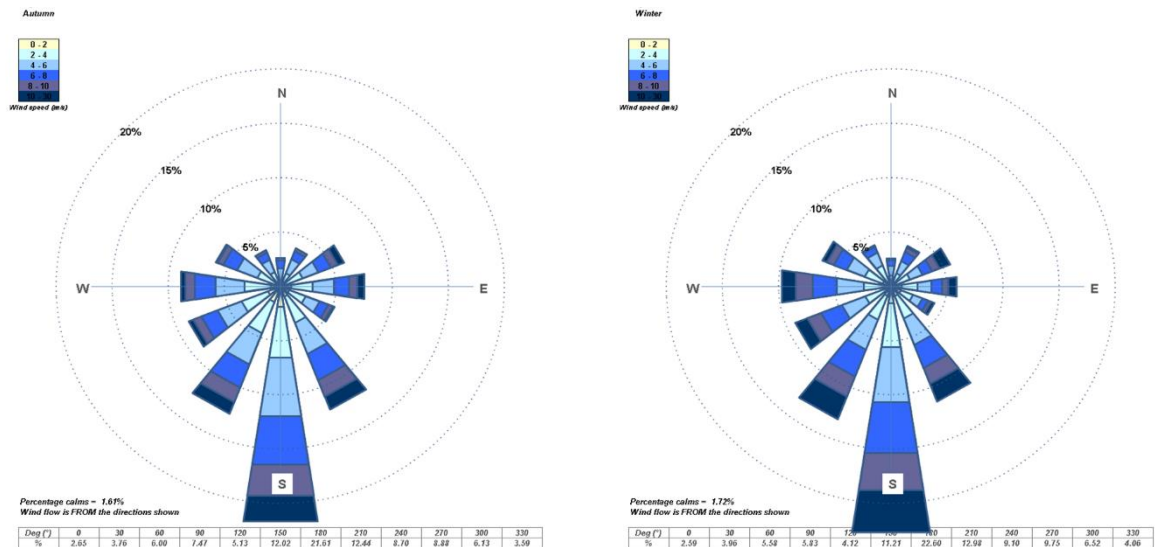


Figure 0-3 Seasonal wind roses for the development site

## Limitations

- 12.46. Future surrounding buildings are based on information available and current planning Permissions, as summarised in Appendix 2. If these buildings are amended in the future, the effects could alter for the cumulative scenario. However, any future changes will need to be subject to an appropriate wind assessment as part of any amendment planning application for each relevant scheme.

## Baseline Conditions Geometry

- 12.47. The site location is shown in Figure -0-1 and images of the modelled geometry in the CFD model are shown in Figure 0-3 (Configuration 1) and Figure 0-1 (Configuration 2).
- 12.48. The site is bound to the east by Oxford Road, to the north by the Mancunian Way, Manchester Metropolitan University's Faculty of Business and Law to the west, and All Saints Park to the south.

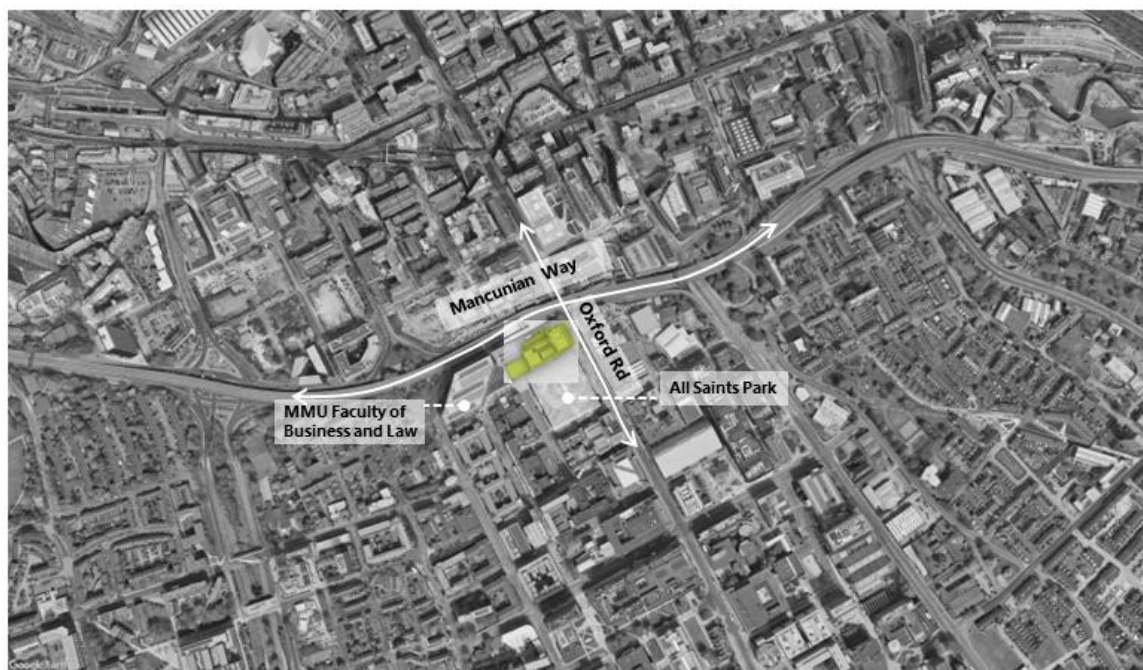


Figure -0-1 Site location

- 12.49. The existing site comprises the All Saints Library Building, a seven storey brick building, currently used as a library facility for students and staff of Manchester Metropolitan University.

- 12.50. The existing immediate surroundings comprise low rise buildings of approximately 2 to 3 storeys in height to the east, on the opposite side of Oxford Road. To the south, All Saints Park provides public realm, surrounded by Manchester Metropolitan University Buildings, and St Augustine's Church. To the west, there are further University buildings, and student accommodation. To the north, Mancunian Way runs east to west, and to the north of that, the Manchester Metropolitan University John R Dalton Building and Circle Square.



Figure 0-2 Site location and surrounding buildings

- 12.51. A quantitative assessment of the likely wind environment has been performed via CFD simulations, based on Revit model provided by the design team labelled: 1044B-HBA-ZZ-ZZ-M3-A-001\_P06.rvt and the surrounding buildings generated by Zmapping provider.
- 12.52. This section studies the comfort and safety of pedestrians in the baseline condition, i.e. the existing site within existing surroundings. The modelled geometry for the baseline scenario is shown below in Figure 0-3 Modelled Baseline geometry, existing site in existing surroundings, which includes the following:
- Existing Site: current All Saints Library Building
  - Existing Surroundings: surroundings buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain

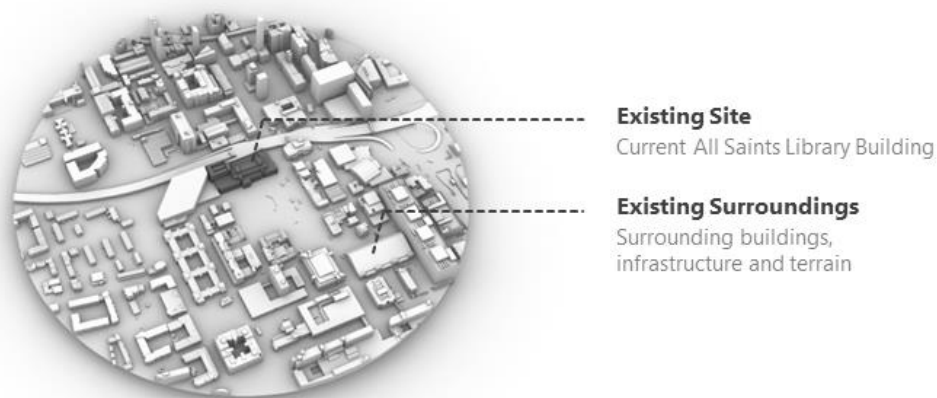
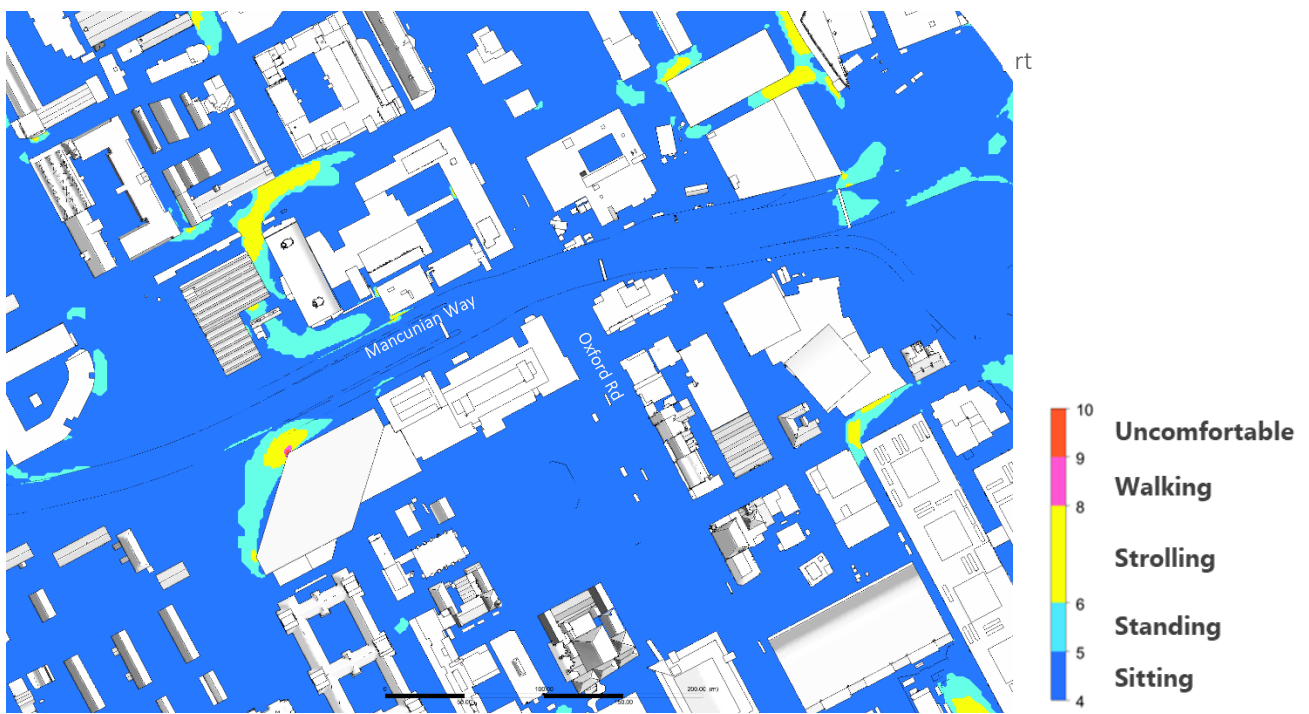
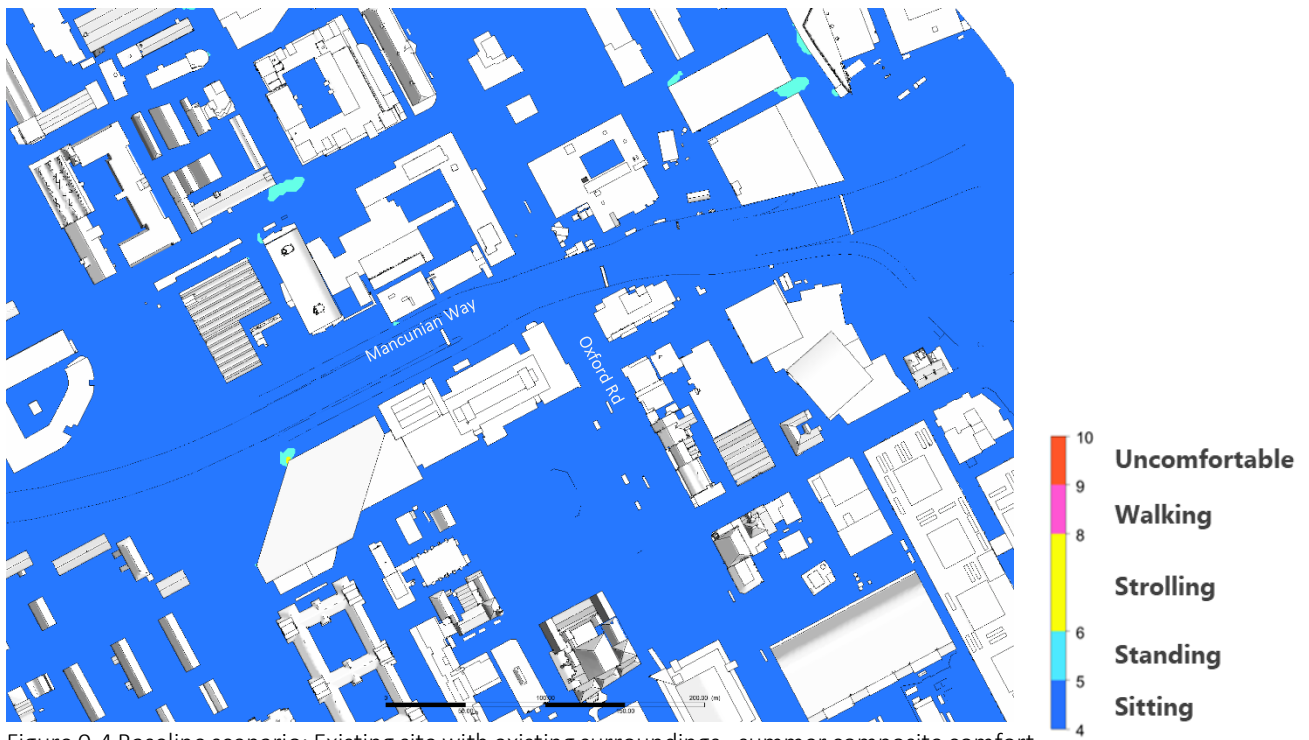


Figure 0-3 Modelled Baseline geometry, existing site in existing surroundings.

## Wind conditions Baseline

- 12.53. The wind conditions have been analysed for the whole year, as well as for the summer and winter season. The latter are presented and discussed below.
- 12.54. The summer comfort map for the existing site is shown in Figure 0-4 Wind speeds are shown to be suitable for pedestrian sitting across the whole site. Sitting areas identified at All Saints Park show suitable sitting conditions.
- 12.55. In the summer season (Figure 0-4), a small area immediately adjacent to the northwest corner of the MMU Business School shows conditions that are more suited for sitting, with exception of the northwest corner of the Business School Building that shows suitable conditions for strolling activities.
- 12.56. Conditions are more exposed during the winter season, as expected. However, as can be seen from the winter comfort map in Figure 0-6, the conditions on the Site itself are in the comfortable range for sitting during the winter as well.
- 12.57. Thoroughfares areas around neighbouring buildings show windier conditions during the winter (windiest season)(Figure 0-6). However, they maintain acceptable conditions for the planned activity. The MMU Business School shows standing conditions along most of the north(western) facades and strolling conditions locally at the northwestern corner. Directly adjacent to the corner, conditions are expected to be windy, however within acceptable conditions for the planned Walking category. Furthermore, opposite of the Mancunian Way, an area of Standing conditions can be seen to the south and west of the MMU Faculty of Science and Engineering, while Strolling conditions prevail around its northwestern corner.
- 12.58. Bus stops around Oxford Road and Higher Cambridge St show conditions below (more comfortable than) the planned criteria, sitting in winter. All cross roads and entrances of around the Business school Building show suitable conditions with a category ranging from sitting and standing.



## Identification and Evaluation of Significant Effects

- 12.59. This section studies the comfort and safety of pedestrians in the proposed scenario with existing surroundings. The modelled geometry for this scenario is shown in Figure 0-1. This includes:
- Proposed Development: new library building with outdoor terraces
  - Existing Surroundings: surrounding buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain
- 12.60. The wind conditions have been analysed for the whole year, as well as for the summer and winter season. These are presented and discussed below.

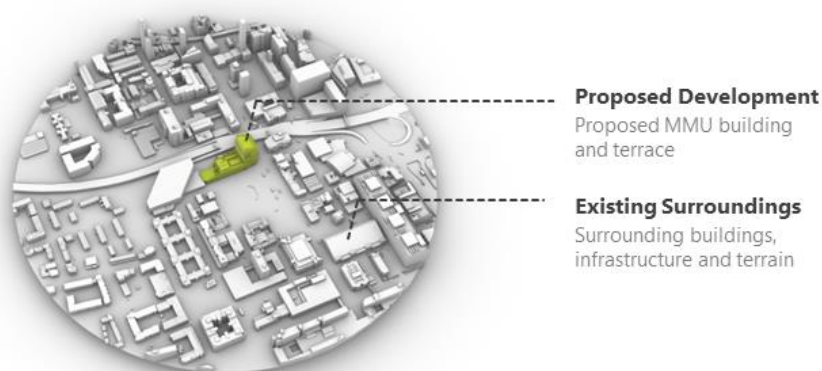


Figure 0-1 Modelled Proposed geometry, proposed site in existing surroundings

### Relevant Aspects of the Scheme

- 12.61. For neighbouring buildings and thoroughfares, the likely pedestrian activity will be strolling and business walking. The wind conditions at the All Saints Park will also be assessed against the Sitting and Standing comfort criteria. For the Proposed Development, information regarding the intended usage of different areas and indicative building plots is taken from the design information provided by the design team. This includes the building entrances (see Figure 0-2), primary pedestrian thoroughfares along the site (marked in Figure 0-4) and additional areas where outdoor activities are likely to take place, such as the terraces (see Figure 0-3).
- 12.62. The Southern entrance is the Main Entrance to the Proposed building (including for visitors / general public). As this entrance also lies at the intersection of the All Saints Park, a lot of pedestrian activity is expected here. This will be mainly Strolling, as well as Sitting in the park itself. Locally at the Main Entrance, Standing will also be a common pedestrian activity. The New East Entrance will also feature Standing and Strolling / Walking activity along Oxford Rd, and around the MMU Business School. Some smaller amounts of Standing and Walking activity will take place at the North-West entrance and Mancunian Way.
- 12.63. The Proposed Building also includes some elevated terraces, which are highlighted in Figure 0-3. The intended usage for these is Sitting and Standing.

- 12.64. The remaining surrounding areas to the buildings which are not mentioned above are intended as circulations and would require conditions suitable for pedestrian walkthrough and are identified as thoroughfares.

The image below summarises the assumed entrance usage considered for students during the peak period, as agreed with MMU and H\B on 24.05.2023.

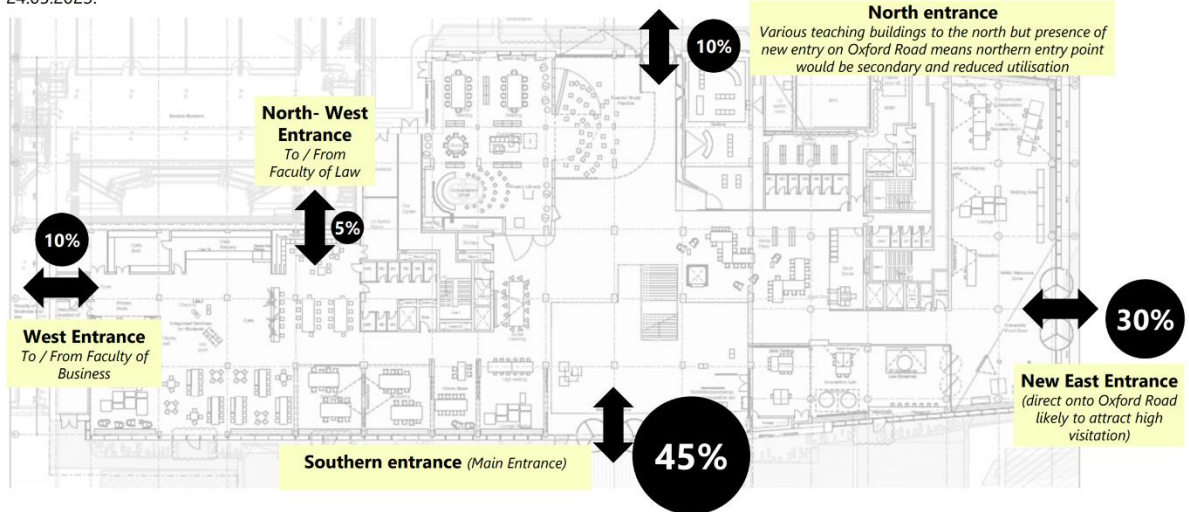


Figure 0-2 Entrance locations (MMU Library, People Flow Study - Final Report, 01/08/2023)

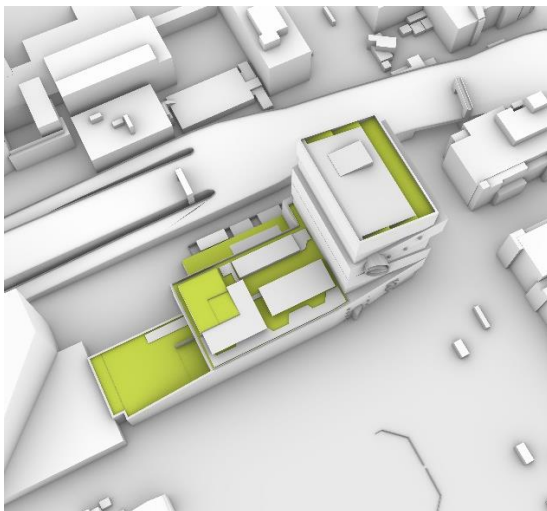


Figure 0-3 Terraces on Proposed Building (highlighted in green)

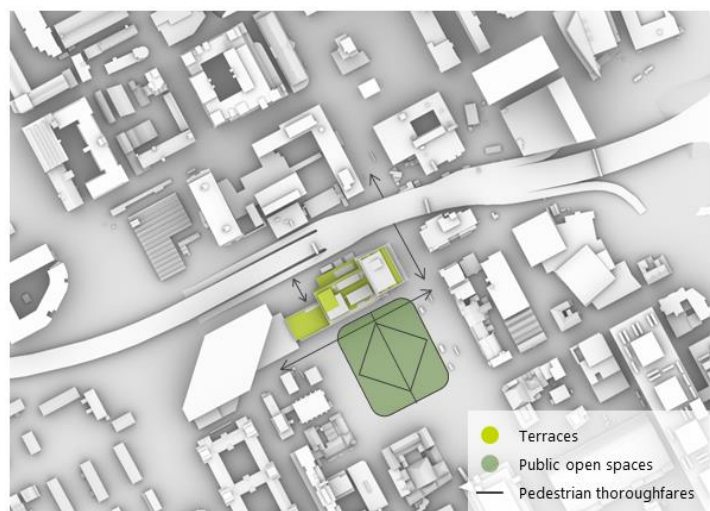


Figure 0-4 Pedestrian Thoroughfares and Public Spaces

## Potential Effects of the Development and Their Significance (Within the Site Boundary)

Table 5 Impact significance matrix

| Receptor                                             | Sensitivity     | Description of effect                                                       | Magnitude of change/impact | Effect significance                                                             |
|------------------------------------------------------|-----------------|-----------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------|
| Seating areas, public open spaces, terraces          | Moderate - High | Negligible                                                                  | Negligible                 | Negligible                                                                      |
| Standing areas, entrances, bus stops, standing areas | Moderate        | Slightly windier winter conditions nearby New East and North-West Entrance  | Negligible                 | Negligible (conditions remain comfortable for intended use)                     |
|                                                      |                 | Negligible at other entrances / bus stops                                   | Negligible                 | Negligible                                                                      |
| Thoroughfares                                        | Low             | Negligible for summer conditions                                            | Negligible                 | Negligible                                                                      |
|                                                      |                 | Wind acceleration at eastern corner of Proposed Building in winter scenario | Minor adverse              | Minor adverse (conditions remain in comfortable ranges for standing to walking) |
|                                                      |                 | Wind acceleration to the north of Proposed Building (on Mancunian Way)      | Minor adverse              | Minor adverse (conditions remain in comfortable ranges for standing to walking) |
| Safety exceedances                                   | High            | No exceedance of safety criteria                                            | Negligible                 | Negligible                                                                      |

## Wind Effects on Pedestrian Comfort

### Thoroughfares

- 12.65. The summer comfort map for the Proposed scenario (Proposed Development in existing surroundings) is shown in Figure 0-6. The summer wind conditions of the Proposed scenario do not show any major differences from the Baseline conditions on the site - mostly within sitting category - with exception of the northwest corner of the Business School Building that shows suitable conditions for strolling activities.
- 12.66. Conditions are more exposed during winter, as expected. The winter comfort map for the Proposed Development in the existing surroundings is shown in Figure 0-7. The thoroughfares along the southeastern façade and across the All Saints Park still show suitable conditions; one or two categories below the planned activity, walking. Towards the east corner of the Proposed Building on Oxford Rd, wind corner acceleration is shown, however, conditions show suitable for standing and strolling.
- 12.67. In a similar way, the thoroughfare along the northeastern façade (on Oxford Rd) does show a clear impact due to the southeastern building corner of the Proposed Development. However, the conditions remain within the comfortable ranges from sitting to strolling.
- 12.68. The west area of the Business School Building shows suitable conditions for standing to strolling, with exception of the west corner, a small area of acceleration similar to the baseline suitable for walking.

### Entrances and Bus stops

- 12.69. The summer wind conditions at all the building entrances (see marked in Figure 0-2) are within the comfortable range for the intended use. The summer scenario does not show any impact on the assessed entrances due to the construction of the Proposed Development.
- 12.70. Windier conditions are found during winter (shown in Figure 0-7) nearby the New East and North-West Entrance, but the entrances remain within the comfortable range for their intended Standing use.
- 12.71. Bus stops are suitable for the planned activity from sitting to standing conditions.

### Sitting Areas

- 12.72. summer wind conditions show sitting areas identified at All Saints Park suitable for sitting activity.

### Terraces

- 12.73. The wind conditions on the Proposed Development's external terraces are shown in Figure 0-5 for the summer conditions. Comfortable conditions for Sitting are expected across all the terraces in the summer scenario. Overall, it can be concluded that the terrace conditions are within the acceptable range for their intended use.

### Surroundings

- 12.74. The slightly windier winter conditions that were found along the northwestern façade of the MMU Business School in the Baseline scenario and around the MMU Faculty of Science and Engineering across Mancunian Way remain similar in extent and comfort classification range in the Proposed scenario.
- 12.75. Overall, the assessment shows no major impacts due to the Proposed Development on the surrounding circulation zones.

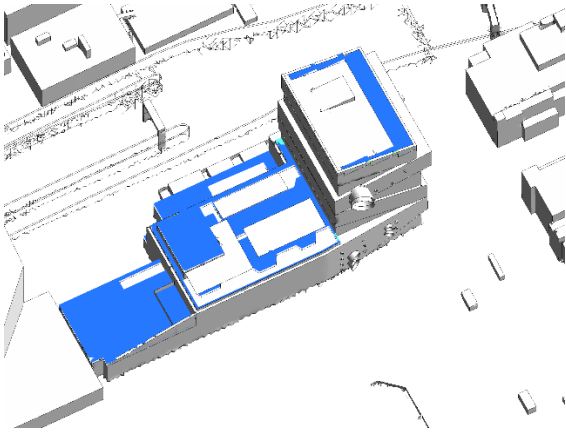


Figure 0-5 Proposed scenario: Proposed Development  
in existing surroundings - comfort on  
Terraces in summer

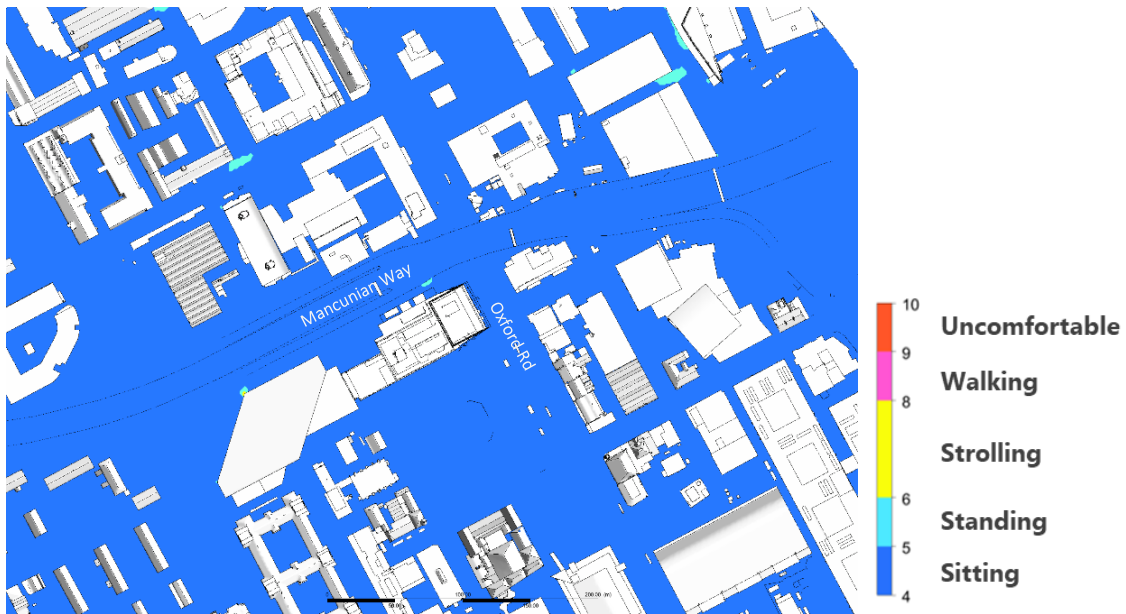


Figure 0-6 Proposed scenario: Proposed Development in existing surroundings  
- summer composite comfort map

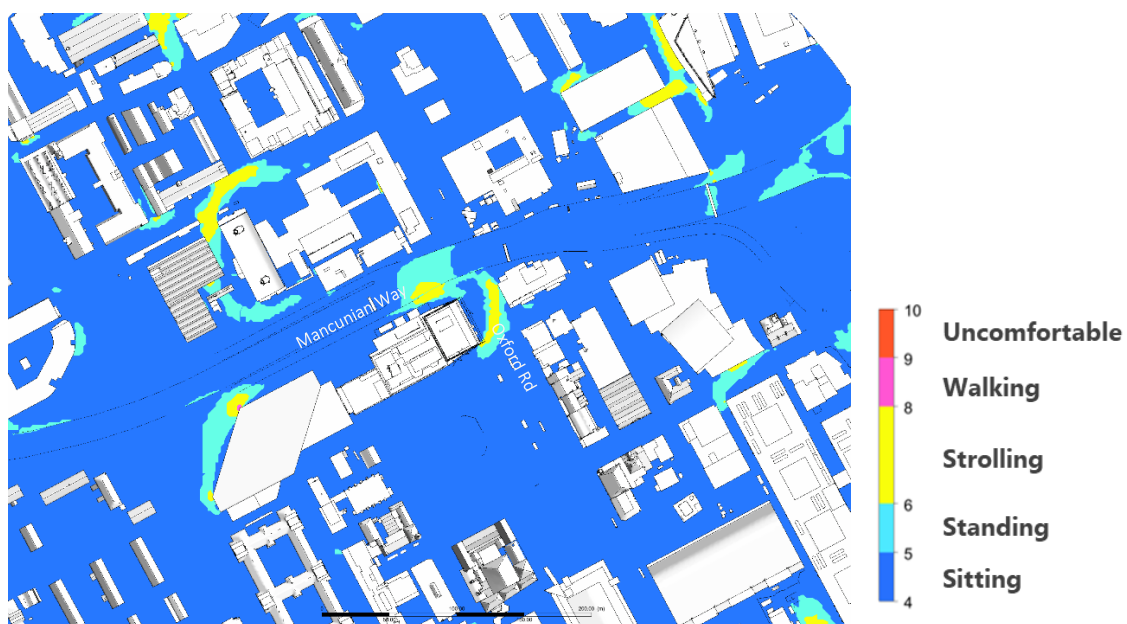


Figure 0-7 Proposed scenario: Proposed Development in existing surroundings  
- winter composite comfort map

### Wind Effects on Pedestrian Safety

12.76. Figure 0-8 shows the annual composite safety map for the Proposed scenario with existing surroundings. As can be seen, the safety criteria are not exceeded and mitigations are therefore not necessary.



Figure 0-8 Proposed Development in existing surroundings - annual composite  
safety map

## Mitigation Measures

12.77. No mitigation is required.

## Cumulative Effects

- 12.78. Considering that the only future building in the vicinity is 137 Oxford Road, and its alterations include just one additional level and a modest façade extension of approximately 3 meters, it's noteworthy that the overall structure will have a total of five stories after these changes. This adjustment is deemed to exert a minimal influence on the wind dynamics around the given plot, in the full analysis context.
- 12.79. The planned 137 Oxford Road development (LPA Planning Ref 128837/FO/2020) is positioned 100 meters southeast of the proposed development site, and its impact on the anticipated wind conditions, stemming from the introduction of the proposed development, is projected to be negligible.
- 12.80. In light of the previously mentioned points, a qualitative evaluation of the forthcoming surrounding scenario is considered appropriate and valid. An additional Cumulative Effects (Proposed Development in cumulative surroundings) scenario was therefore deemed unnecessary.
- 12.81. Based on Experience and previous assessments in Manchester, the small changes explained above on 137 Oxford Road, with the introduction of the proposed development are likely to produce the same results as the proposed development scenario due the combination of wind directions and the mild wind conditions evaluated around 137 Oxford Road suitable for sitting. These conditions are likely to remain the same due the small change of the massing of the cumulative plot.
- 12.82. In the case of the effects in proximity to the proposed development, the wind effects that are shown in the existing surroundings scenario will not be affected by 137 Oxford Road's cumulative changes, these will likely remain the same due the orientation and distance of 137 Oxford Road from the proposed building. The cumulative plot also shows a relative shelter from the easterly wind directions towards the proposed development.

## Residual Effects

12.83. No mitigation is required, wind effects are maintained unchanged after mitigation.

Table 6 Summary of Receptors, Likely Significant Effects, Mitigation Measures, and Residual Effects

| Likely Significant Effect | Receptor                                             | Mitigation Measure | Means of Implementation | Post Mitigation Residual Effect – Significance and Duration (i.e. Temporary/Permanent) |
|---------------------------|------------------------------------------------------|--------------------|-------------------------|----------------------------------------------------------------------------------------|
| <b>Construction Phase</b> |                                                      |                    |                         |                                                                                        |
| Negligible                | All                                                  | None               | None                    | Negligible                                                                             |
| <b>Operational Phase</b>  |                                                      |                    |                         |                                                                                        |
| Negligible                | Seating areas, public open spaces, terraces          | None               | None                    | Negligible                                                                             |
| Negligible                | Standing areas, entrances, bus stops, standing areas | None               | None                    | Negligible                                                                             |
| Negligible                | Thoroughfares                                        | None               | None                    | Negligible                                                                             |
| Negligible                | Safety exceedances                                   | None               | None                    | Negligible                                                                             |

## Reference List

12.84. This ES Chapter has been prepared by reference to the following:

- The UK wide National Planning Policy Framework (NPPF)
- Manchester's Local Development Framework, Core Strategy Development Plan Document, July 2012.
- T. V. Lawson, Wind Effects on Buildings, Applied Science Publishers, 1980

## Non-Technical Summary

### Scope of assessment

12.85. The present Wind Microclimate Assessment entails a detailed Computational Fluid Dynamics (CFD) study for the full range of wind speeds and directions for the following two configurations:

#### Current Baseline Scenario 1: Existing site in existing surroundings

12.86. Existing Site: current All Saints Library Building

12.87. Existing Surroundings: surroundings buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain

#### Proposed Scenario 2: Proposed development in existing surroundings

12.88. Proposed Development: new library building with outdoor terraces

12.89. Existing Surroundings: surroundings buildings, including also the adjacent southeast MMU Business School, the MMU Science and Engineering Building (LPA Planning Ref. 125799/FO/2019), All Saints Park (LPA Planning Ref. 128485/FO/2020) and 3 Circle Square (LPA Planning Ref. 134288/FO/2022); as well as the adjacent All Saints Park, surrounding infrastructure and terrain.

### Description of method

12.90. The assessment has been carried out by means of Computational Fluid Dynamics modelling following a RANS (Reynolds-Averaged Navier Stokes) approach using the best practices for urban wind microclimate applications, and following BuroHappold's extensive experience of wind assessments, full-scale testing, CFD and wind tunnel modelling of similar developments. All buildings and structures surrounding the Proposed Development that are likely to affect the wind flows around it have been included explicitly in the 3D model used for the assessment.

12.91. The Lawson Comfort Criteria (LCC) have been used as the benchmark to describe the current and impact of the Proposed Development on the environmental wind conditions on the identified pedestrian spaces, as well as their subsequent suitability for their planned usage.

### Description of baseline conditions

12.92. The wind microclimate assessment has been carried out for both the annual and seasonal summer and winter conditions.

12.93. Wind speeds in the Baseline scenario are shown to be suitable for pedestrian sitting during summer across the whole site, with the exception of the northwest corner of the Business School Building which is more suited for strolling activities.

12.94. During winter, the conditions on the Site itself are in the comfortable range for sitting as well. Thoroughfares areas around neighbouring buildings show windier conditions during winter, in particular at the northwestern corner of the MMU Business School. However, they maintain acceptable conditions for their planned activity. The bus stops and entrances on the Site show suitable conditions with a category ranging from sitting to standing.

## **Environmental effects**

- 12.95. Overall, no significant adverse environmental effects were found for the Proposed scenario of the simulated Proposed Development in the existing surroundings.
- 12.96. The summer wind conditions of the Proposed scenario do not show any major differences from the Baseline conditions on the site and remain within the comfortable Sitting range. The planned elevated external terraces on the Proposed building itself also show comfortable conditions for their intended Sitting and Standing use.
- 12.97. The wind conditions around the adjacent MMU Business School as well as around the eastern corner of the Proposed Development show slight accelerations in the winter season. Standing to Strolling conditions are mostly found at these locations, although the slightlier windier conditions remain within the acceptable range for the intended thoroughfare and entrance use.
- 12.98. Looking further away in the surroundings, opposite of the Mancunian Way, an area of Standing conditions can be seen to the south and west of the MMU Faculty of Science and Engineering, while Strolling conditions prevail around its northwestern corner.

## **Mitigation proposed.**

- 12.99. In conclusion, the Proposed Development does not impose any major impact on the pedestrian comfort and safety on and around the Site. A few locations of minor adverse wind acceleration were identified, but the wind conditions are expected to remain within the comfortable range for the intended localized pedestrian activities.
- 12.100. The assessment shows that no mitigation measures are necessary, and therefore no further Mitigation scenarios were tested.

## **Residual environmental effects**

- 12.101. As no mitigations needed to be implemented in the scheme, there is no further comment on residual environmental effects.

## Note on Design Changes Since Wind Assessment in this Report

- 12.102. The design changes up to date (12<sup>th</sup> October 2023) and since the undertaking of this wind assessment are, to the best of our knowledge, limited and are not expected to alter the conclusions with regards to the wind conditions on the site as outlined in this report. Figure 0-9 shows the building massing in the Stage 3 S4 Report (Document number: 1044B-HBA-ZZ-XX-RP-A-00H111) from Hawkins Brown Architects LLP & Schmidt Hammer Lassen Architects (29 September 2023) and the CFD model used in this wind assessment respectively.

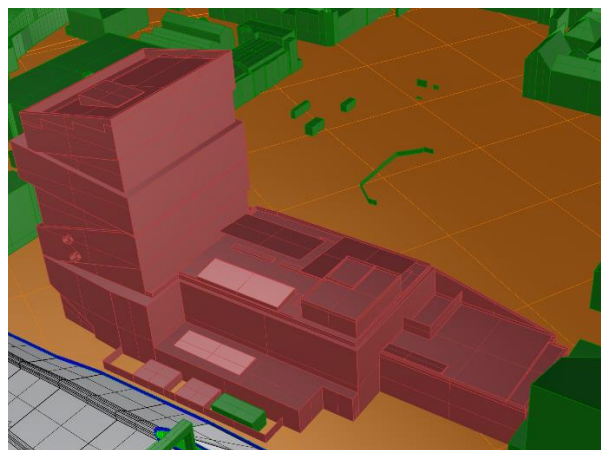
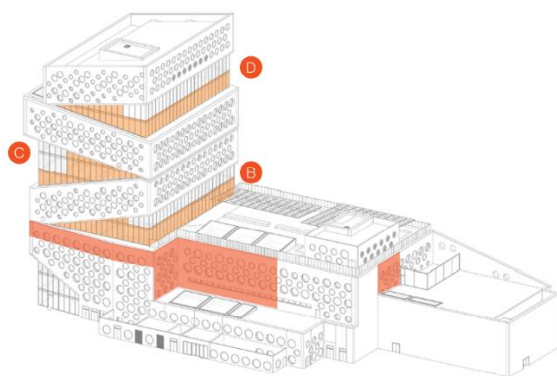


Figure 0-9 Building design to date (left) versus CFD model used in wind assessment (right)



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