

Buro Happold

Wind Assessment

Burley Place

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1 Introduction

1.1 Introduction

A qualitative assessment of wind effects has been performed for the Burley Place Student Accommodation site developed by Burley Place Ltd. The assessment is based on a desk study and is experience-based. The new development is not expected to change conditions on site significantly. Some areas are expected to result in wind corner accelerations and façade downwash, however these effects are not considered to be significant.

The development will bring new pedestrian activities into the site in areas such as the public sitting areas and roof gardens; landscape is likely to ensure that these external areas are suitable for their intended uses, i.e. sitting or standing.

The study was performed at stage C of the design and considered the heights and massing of the proposed buildings.

1.1.1 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 effects and suitability of these spaces for planned usage are described by and compared against the industry standard Lawson criteria, which are recognised by planning authorities as a suitable benchmark for wind assessments.

1.1.2 Regional Planning Policy

There are no Regional 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 effects and suitability of these spaces for planned usage are described by and compared against the industry standard Lawson criteria, which are recognised by planning authorities as a suitable benchmark for wind assessments.

1.1.3 Local Planning Policy

The Leeds City Council has written the Tall Building Design Guide (TBDG), that is a Supplementary Planning Document (SPD) and part of the Leeds Local Development Framework. This document states in Chapter 5 the studies that need to be carried out for tall buildings. With respect to the guide the building that form the proposed Sovereign Square site development (proposed development) is not likely to be considered a tall building; the TBDG applies the criteria below to buildings which are substantially taller than their neighbours and/or which significantly change the skyline. Consideration has been given to the document given that the propose development provides a structures of similar height to its immediate surroundings, there are no know tall structures in the immediate surroundings.

Chapter 5 states:

“It is essential that those involved with proposed tall buildings should conduct appropriate risk assessments and wind quantitative analysis (appropriate wind tunnel and/or CFD modelling) – especially the effects of down draughts and wind at the base of tall buildings or group of tall buildings. Assessments will also be required for areas beyond red line boundaries so that the developers and designers can demonstrate that their designs and measures will not produce harmful effects on pedestrians, vehicles and cyclists next to and away from the proposed tall building. In addition to standard assessments of likely comfort levels for persons sitting or walking in the vicinity of new tall buildings, it is important that extreme turbulence of high wind events can be modelled to assess the likely impacts on users at ground level, including high sided vehicles...”

The inclusion of mitigation measures is also mentioned in this chapter:

“..... The study also needs to demonstrate that appropriate mitigation measures have been applied to improve conditions in areas where the comfort and/or safety criteria have not been met.....”.

1.2 Design criteria (standards)

Locations within a development can be assessed for comfort and safety. Both are related to the pedestrian, the former relates to the activity, and the latter to the level of distress experienced. The criteria used for comparison are those of T.V. Lawson. These criteria have categories for discomfort, based on the larger of a mean or gust equivalent mean wind speed exceeded 5% of the time, and distress (for safety assessment), based on occasional wind speeds. The gust equivalent mean is the peak gust wind speed divided by 1.85. The can be used in the detailed stage of the development by using quantitative analysis by means of Computational Fluid Dynamics (CFD) and/or Wind Tunnel studies. These criteria have been widely accepted for these types of studies and are comparable with international guidance. The criteria have been developed around the Beaufort scale, extending its applicability to environments in and around buildings. The comfort and safety scales are indicated in Table 1- 1 and Table 1-2 respectively.

Table 1—1 Comfort Scales

Comfort Scales		
Wind Speed Category	Wind Speed Range (m/s)	Tolerable Activity
A	0 - 4	Pedestrian sitting for extended periods, in the vicinity of entrance doors
B	4 – 6	Pedestrian standing i.e. standing/sitting for a short time
C	6 – 8	Pedestrian walking i.e. strolling
D	8 – 10	Business walking (walk through – i.e. walking from A to B), Includes cyclists

Table 1—2 Safety Criteria

Criteria	Frequency of wind speeds occurrences	Mean wind speed	Activity
Comfort	<5%	9.09 m/s	All pedestrian Activities
Safety	<0.1%	15.0 m/s	All pedestrian Activities

For every study, different pedestrian walking areas can be identified, for example:

- Roads
- Pedestrian areas around buildings
- Pedestrians walk through
- Pedestrians standing
- Seating areas

Comfort will strongly depend on the individual activity. For that reason, the table is defined separately for each activity in terms of an average or gust wind speed exceeded for no more than 5% of the time.

For safety, the scale is defined for no more than 0.1% of the time. This corresponds to 9 hourly occurrences within a year for a value of the mean wind speed not exceeding 15m/s.

1.3 Identification of potential issues

To identify any changes in the microclimate, the development, immediate surrounding environment and building structures need to be studied. This is a subsection of a larger region, which represents the broader urban environment. The elements of this type of study that will affect the wind environment are:

- Building form, shape, height, location and orientation
- Surrounding areas and local terrain topography (photographs)
- Local wind climate
- Landscape (trees, fences, hedges)
- Effects of the proposed development on the surrounding pedestrian areas
- Construction stages of the buildings that form the scheme and surrounding developments.

The assessments made are based on an assessment of the site wind conditions, coupled with an experience-based assessment of likely wind conditions. As such, the assessment is qualitative.

In line with common UK practice in Wind Engineering, the method used relates to the Lawson method (2001).

1.3.1 Baseline studies

Baseline conditions have been assessed using the same criteria as the new development, as described below. The assessment is based on historical wind records and an analysis of the surrounding terrain.

1.3.2 Impact magnitude

Likely wind conditions are judged based on experience of similar developments. This analysis includes an assessment of building form, layout and relative massing as well as site landscaping and topography.

1.3.3 Receptor sensitivity

The key receptors in this case are pedestrians using the site. Sensitivity to strong winds is dependent upon activity and, in line with the Lawson method, the following activity classes are used, in order of increasing sensitivity: (the assessment compares the baseline and proposed to assess the impact)

Table 1—3 Urban pedestrian activities for sensitivity evaluation in order of increasing sensitivity

Receptor sensitivity	Activity
Low	Roads and car parks
Low	People around buildings
Low / Moderate	Pedestrian walk-through
Moderate	Pedestrian standing
Moderate / High	Entrance doors
High	Sitting

1.4 Significance evaluation

Where wind impacts are identified, their significance is judged in terms of the likely effect on planned activities, in terms of the Lawson assessment method. This is a function of the receptor sensitivity and the magnitude of the impact and results in a classification as follows:

Table 1—4 Significance

Impact significance	Description
None	No change in wind conditions
Negligible	Wind conditions are likely to be suitable for the intended activity
Minor adverse	Wind conditions are likely to be tolerable for the intended activity
Moderate adverse	Wind conditions are likely to be classed uncomfortable for the intended activity but safety is unlikely to be compromised
Major adverse	Safety concerns are likely.

The criteria used to assess the magnitude of the wind impacts are as follows:

Adverse – detrimental or negative impacts to an environmental resource or receptor compared with the baseline;

Beneficial – advantageous or positive impact to an environmental resource or receptor compared with the baseline.

2 Methodology

This section defines the different aspects of this type of study. Consideration is given to the characteristics of the local area to facilitate assessment. A wind frequency analysis of the site is carried out. From this analysis wind directions are selected and analysed. The results of this assessment are then available to assist the overall design process.

A site survey has been carried out to facilitate appropriate site topography and building height of the baseline situation.

2.1 Wind data analysis and direction frequency

For analysis of wind behaviour, it is necessary to know the relevant wind data and temperature data for the case. Velocity fluctuation and directional variance are hard to measure with great accuracy.

Both wind speed frequency and its direction are required. This data is commonly presented in the form of wind speed and wind frequency distribution diagrams (wind roses).

Weather data has been obtained from the Meteorological office for Leeds City Centre. The data collected were hourly average wind speeds for the 10-year period from 1 January 1993 to 31 December 2002.

The data reflect the prevailing westerly wind that it is in line with the surrounding weather stations and it is representative of the condition on the proposed development site.

Figure 2—1 shows the annual directional velocity distribution for the site.

The wind speed for the site can be established for both comfort and safety analysis based on a frequency of occurrence of no greater than 5% and 0.1% respectively.

As can be seen from Figure 2—1 the wind in Leeds comes predominantly from the west, with the strongest winds (indicated by the widest, not the longest, lines) coming from the west or southwest.

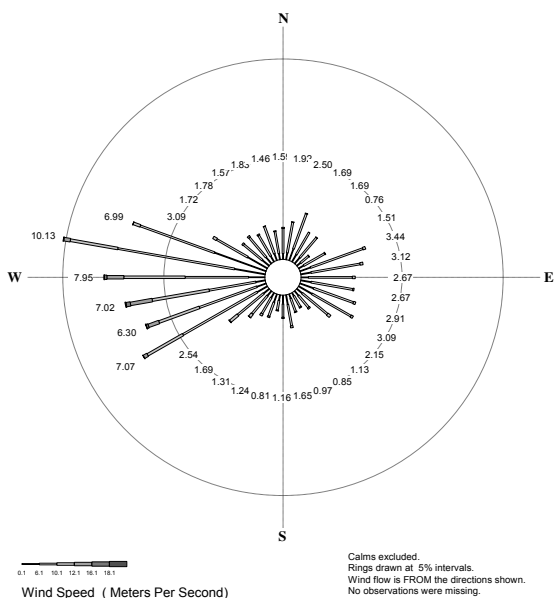


Figure 2—1 Wind Rose for Central Leeds.

3 Site location and topography

3.1 Prevailing wind

The wind climate of Leeds is dominated by westerly and south-westerly winds. From Figure 2—1 it can be shown that the prevailing wind direction for the site is strongly from the west and southwest throughout the year (around 50% of the time). There is also a moderate occurrence of wind from the northeast.

3.2 Site Location

The Burley Place development is located to the west of the Leeds City Centre. The site is bounded to the North by Park Lane street, and low buildings on the opposite side of the street, to the North west a 5 to 6 storey building is located. The Sorting office building is located to the East of the site and is around 5 stories high. A substation is located to the west, farther away some student accommodation buildings are found, on the opposite side of Burley Street the Opal one building (around 15 stories) dominates the landscape. There are several office and accommodation buildings to the south on the opposite side of Burley Street, building of around 6 stories. The site location is shown in Figure 3—1.



Figure 3—1 Burley Place site location

3.3 Terrain of the Site

The site is located on the south side of a slope, the terrain drops towards the south towards the A65. There is a level difference of around 5m between Park Lane and Burley Street.

4 Wind effects

4.1 Baseline Condition

The baseline condition (i.e. the current site) contains a building of 1 to 2 stories. The site is likely to feel sheltered from prevailing wind by the surrounding buildings. Current conditions at the site are likely to be suitable for all activities. The site is also likely to be sheltered from Northerly winds by the lower part of the slope. The baseline conditions are suitable for activities such as cycling, pedestrian walking and business walking, and no safety issues are expected to occur.

Under south-westerly winds, the site area may feel sheltered and, this is again not expected to result in significantly uncomfortable conditions for pedestrians.

4.2 Proposed development

The effects of the proposed Burley Place development are likely to be comparable to the exiting situation. The buildings to the west and south of the site are likely to provide some degree of shelter to the proposed building. This is a result of wind being lifted up over the buildings to the west and then reach the development at high level or flow over the building, see Figure 4—1 and Figure 4—2. Some façade downwash and corner accelerations may be experienced around the west facade of the proposed development under south-westerly winds, however it is not anticipated that this acceleration will be high enough to cause pedestrians discomfort, due to the height of the proposed building and the angle to which the westerly wind approach the west facade. This is likely to be felt more on particularly windy days. When compared to the baseline, this effect can be considered to be negligible. It is predicted that conditions will be suitable for sitting, pedestrian walking and business walking. Rutland Mount is likely to experience calm conditions, the effect of the new development is likely to be negligible to moderate beneficial.

The design of the building (inset that creates the first level terrace) is likely to help reduce facade downwash at street level, most of the downwash is likely to be felt at level 2 roof level, this is helped by the building facade facing the south being sheltered from prevailing winds. When compared to the baseline, this is likely to be considered negligible for westerly winds and minor adverse to negligible for south-westerly winds.

The proposed upper external roof garden located at level 6 is likely to feel exposed during high wind events, the uses of these external areas is not recommended during these high wind events. The lower roof terrace located a level 2, should be fairly sheltered from the prevailing westerly wind by the larger buildings to the west. It is likely to be exposed to south-westerly winds, see Figure 4-2 this is likely to make the roof terrace unsuitable for sitting during high wind events, and possibly also for standing and walking. There may be facade downwash from the facade of the proposed development that is likely to be felt on the areas right east to the proposed building. The sitting areas are likely to be suitable for sitting for most of the year.

The new development is likely to be protected from north-easterly winds due to the terrain slope, some light facade downwash is expected to occur, this effect is likely to be negligible to beneficial when compare to the exiting site car park

The main entrance to the building is located on the west facade of the building, under a cantilever, this is likely to protect the main doors under south-westerly winds, which is very likely to make conditions in these areas suitable for an entrance.

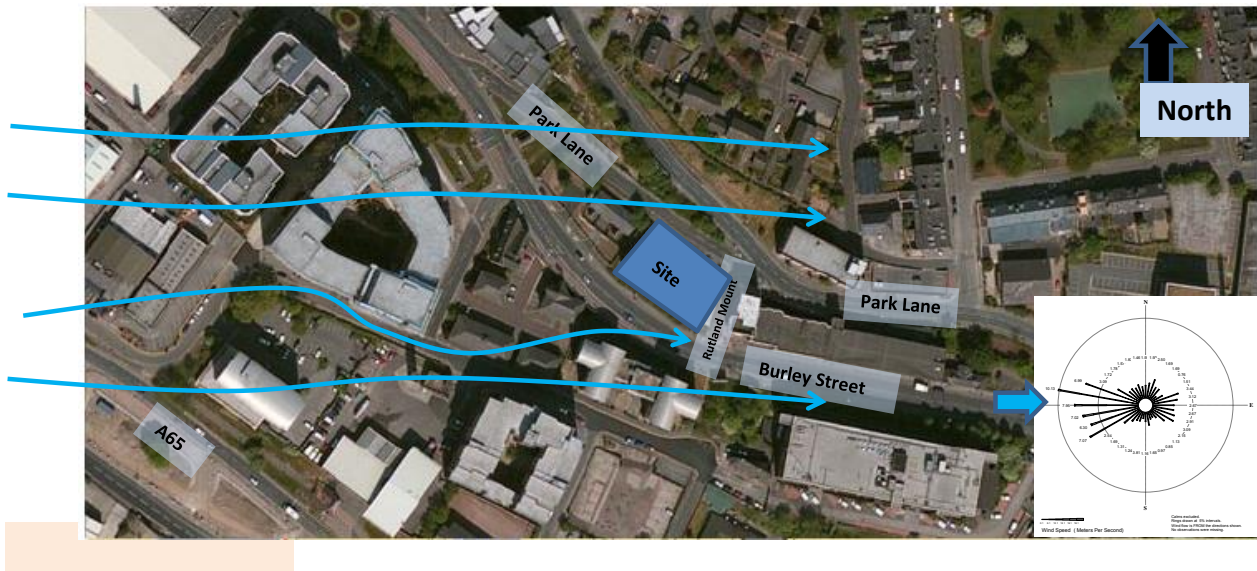


Figure 4—1 Wind effects around buildings from westerly winds.

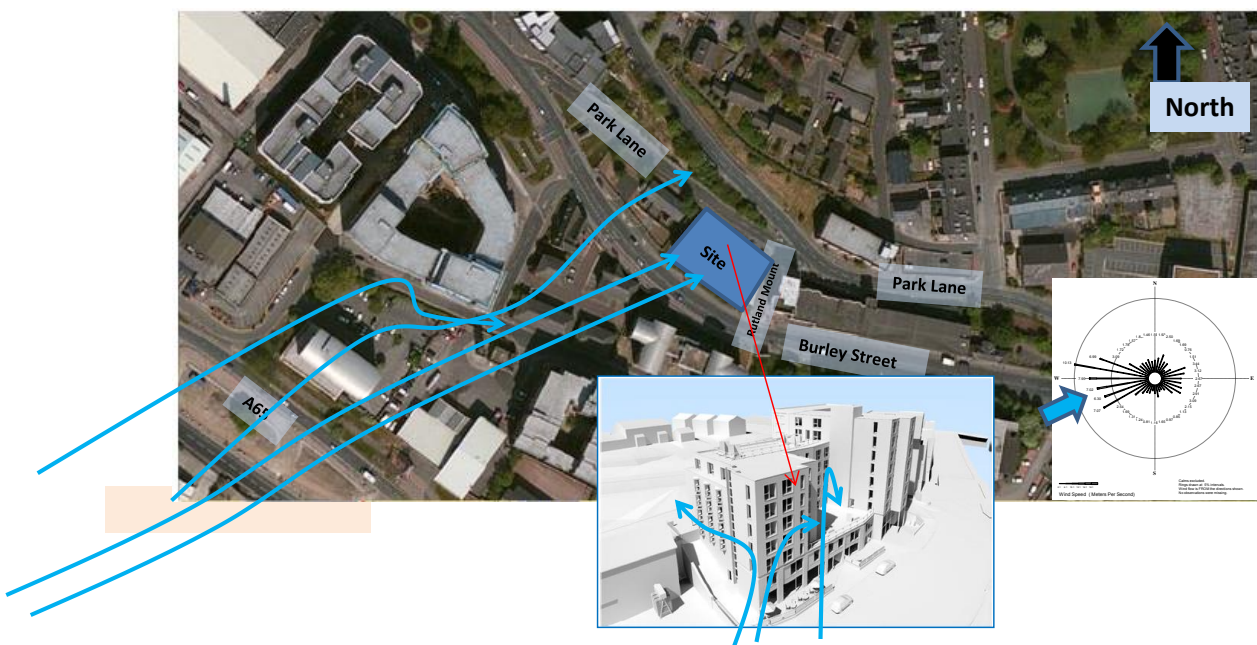


Figure 4—2 Wind effects around buildings from south-westerly winds.

The proposed development is partially sheltered from North-easterly winds by the building to the east of Swine Gate. Some facade downwash is likely to occur, this effect is likely to be negligible when compared with the baseline

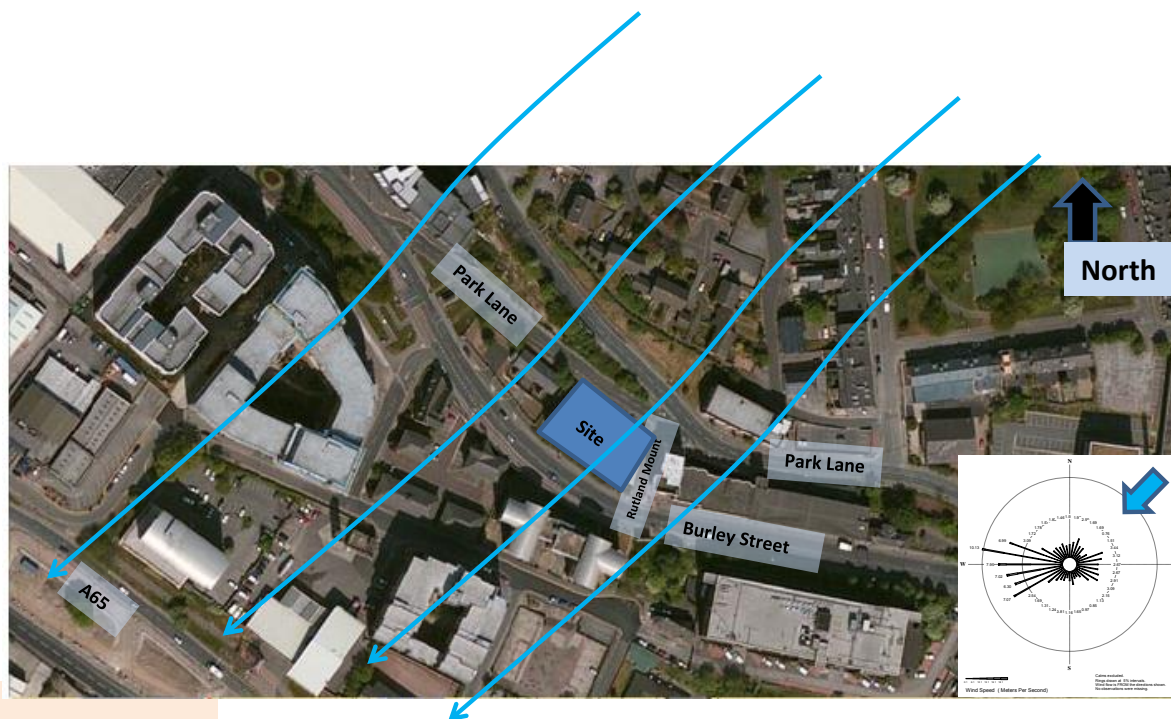


Figure 4—3 Wind effects around building north-easterly winds.

4.2.1 Comfort

The wind speeds experienced on the site will generally be within acceptable limits for all activities for large, meaning that although conditions will sometimes be windier, people will not consider them distressful.

4.2.2 Safety

Wind speeds are expected to be within safe limits. Only in extreme gales are there likely to be difficult conditions for pedestrians, however due to the moderately low height of the buildings that form the site it is unlikely that conditions will be above the safety threshold shown in Table 1—2.

5 Cumulative effects

This section of the report considers the effects of future developments on the proposed site. There are no known planned future developments.

6 Mitigation

No mitigation measures are suggested as conditions on the proposed site are expected to be suitable for pedestrian sitting, walking and business walking for most of the year and other internal areas for the intended activity. On particularly windy days however, pedestrians may feel more uncomfortable in areas where façade downwash and wind acceleration are expected to occur.

The upper roof terrace will benefit from further mitigation, mainly perimeter hedges as show at the level 2 terrace and recommendations should be given not to be used during high level wind effects.

7 Conclusions

The introduction of the new development is not likely to result in wind acceleration. Some areas have been identified as being likely to experience light façade downwash. However the wind speeds experienced on the site will generally be within acceptable for the planned activities, meaning that although conditions will sometimes be windier, people will not consider them uncomfortable and/or distressful.

Wind speeds are expected to be within safe limits all of the time (apart from the roof terraces under high wind events). Only in extreme gales will there be difficult conditions for pedestrians, however due to the moderately low height of the buildings that form the site it is unlikely that conditions will be above the safety threshold shown in Table 1—2.

When compared to the baseline, the effects of the proposed development are likely to be negligible.

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