79 CAMDEN ROAD
& 86-100 ST PANCRAS WAY

pedestrian level wind microclimate assessment desk study

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by RWDI

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W. Pearce

OBJECTIVE

The objective of this study was to review the architectural drawings of the 79 Camden Road Development in the London Borough of Camden, and to make a desk-based assessment of the expected environmental wind conditions at street level. The assessment is based on extensive experience of similar urban developments and wind flow around buildings. Results are presented in terms of the well-known Lawson Comfort Criteria.

1. Summary

This is an assessment of the likely wind conditions around the Proposed Development at 79 Camden Road in north London. It outlines the overall methodology and the use of the Lawson Comfort Criteria to describe the expected on-site wind conditions. The assessment is based upon analysis of meteorological conditions for London, adjusted to the Site, and a review of the scheme drawings in the context of the meteorological data.

The Site description is used mainly to identify building massing and features that are pertinent to the wind microclimate on site. The expected main flow interactions around the site are then described and quantified in terms of the familiar Lawson Comfort Criteria used for around thirty years throughout the UK in assessments of this kind.

Results from the assessment show that the wind microclimate around the Development is largely compatible with the intended pedestrian use of the Site. Terraces on the 4th, 5th and 6th floors would benefit from the mitigation measures described in section 7 of this report.

2. Site Description

2.1 Site Location & Surroundings

The Site is in the London Borough of Camden. It is bounded by St Pancras Way to the south-southwest, Camden Road to the southeast, Rochester Place to the northeast and 102 St Pancras Way to the northwest.

The Ordnance Survey Landranger reference for the Site is TQ291843 and it is currently occupied by a low rise commercial development. Camden Road and the general surroundings consist mainly of low-rise commercial and residential buildings. Figure 1 shows an aerial view of the Site and surroundings and the approximate Site location.

2.2 The Proposed Development

The Proposed Development is of residential use and ranges in height from three to seven storeys.

Entrances are predominantly located along St Pancras Way and Rochester Place. The Development also provides several private balconies and terraces and two communal gardens on the 4th, 5th and 6th floors. Amenity space is provided at ground level in the form of two courtyards.

3. Meteorological Data

Knowledge of the prevailing wind direction focuses attention on the likely impact of these winds on the Site except where the proposed building massing/layout indicates that winds from other directions are likely to be important.

3.1 General Meteorological Data

Joint frequency tables of wind speed, divided into ranges of the Beaufort Scale, and direction on an annual basis for 30° sectors around the compass were obtained for London and are presented in Figure 2 for Meteorological standard conditions of open-countryside terrain. The presentation of results in this report is for annual and seasonal data defined as spring (March, April, and May),

summer (June, July and August), autumn (September, October, November) and winter (December, January, February).

Analysis of the meteorological data indicates the expected peak from the south-westerly direction which is prevalent throughout the year and the secondary north-easterly during the spring and summer months.

3.2 Terrain Roughness

Another consideration is the terrain roughness in each wind direction because wide, open spaces permit the wind to blow down to ground level generating conditions similar to those of open countryside even within a built-up area. An assessment of the terrain roughness for the Site was conducted using the BREVe3 software[1].

Table 1 presents the 'mean factors' for the Site where the mean factor represents the ratio of wind speed on site, at the stated reference height, as a fraction of the wind speed in open, flat countryside at a height of 2m and 10m. The mean factors for the site at 10m ranged from 0.41 to 0.57 and the higher mean factors, which would denote higher wind speeds, are attributed to the open space found to the southeast of the Site. The lower mean factors are typical for an urban Site.

4. Comfort Criteria

The wind microclimate assessment uses a set of criteria (after Lawson) to benchmark the predicted wind conditions. The Comfort Criteria are defined in Table 2 and the Beaufort Land Scale, to which the Comfort Criteria refer, is presented in Table 3.

The Criteria (see Appendix A for more information) set out six pedestrian activities and reflect the fact that less active pursuits require calmer wind conditions. In ascending order of activity level, the six categories are:

- sitting,
- standing,
- entering/leaving a building[2],
- leisure walking (strolling),
- business walking (purposeful walking) and,
- roadway/car-park use.

The wind conditions in an area for sitting need to be calmer than a location that people (i.e. staff, students and visitors) merely walk past and this is reflected in the Comfort Criteria. The threshold condition for sitting is based on a wind speed of Beaufort Force 3 (B3) being exceeded no more than 1% of the time (where Beaufort Force 3 is a 'Light Breeze').

The Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season. The criteria address the force of the wind on a person, or activity, they do not take account of thermal factors.

[2] Note that the standing and entrance classifications have the same benchmark wind condition and so get lumped together in the discussion that follows.

Previous experience has shown that the business walking and roadway classifications are associated with relatively strong winds, in excess of Beaufort Force 7 or 8, during the windiest season which, if they occurred, would usually require mitigation in an urban development.

5. Baseline Conditions

Often a new development dramatically alters the pedestrian activity on site and consequently a comparison of the original wind conditions with those on the developed site can be misleading. For example, wind conditions which remain suitable for leisure walking after development imply that there is no change in the microclimate but mitigation would be required if on the new development the location of interest is outside a main entrance. Assessment in terms of the desired pedestrian activity on or around a Site takes into consideration any change of use and this is where the comfort criteria are particularly helpful.

5.1 'Background' Windiness of the Site

Analysis of the meteorological data adjusted for the terrain roughness approaching the site provides an indication of the 'background' windiness for the Site. This analysis concluded that the existing conditions, at 2m above ground, on site are likely to be tolerable for standing/entrance use during the windiest season. The implication of this result is that, after development, if the site has a number of areas where the conditions are tolerable for (say) leisure walking, then these would be perceived as 'windy' relative to general conditions in the area.

5.2 On Site Baseline Conditions

5.2.1 Pedestrian Comfort

As the Site is currently occupied by low rise buildings, which are a similar height to the surrounding buildings, it is unlikely that any significant impacts will be generated.

The wind conditions around the existing Site are therefore classified as suitable for standing during the windiest season. It is likely that leisure walking conditions would occur in the vicinity of west-facing corners of the buildings during the windiest season.

5.2.2 Strong Winds

Strong winds, in excess of Beaufort Force 6, are not expected to occur at the existing Site.

6. Wind Conditions Around the Proposed Development

6.1 'Target' Wind Conditions

For a residential development in an urban area the target wind microclimate would typically be suitable for leisure walking on main thoroughfares and standing/entrance use at entrances, bus-stops and taxi ranks throughout the year.

Where there are roof terraces or public amenity areas, these should target sitting conditions during the summer months when these areas are expected to be used more frequently by residents.

6.2 Pedestrian Comfort

The expected comfort levels, for the windiest season (i.e. winter), at ground level within and around the Site are shown in Figure 3, conditions at terrace levels during the summer season are shown in Figure 4, 5 and 6. The windier zones, suitable for leisure walking, are shown in yellow, whereas the calmer zones, suitable for standing/entrance use are indicated in blue. The windier zones are restricted to building corners and along the service road which links St Pancras Way with Rochester Place, where funnelling occurs between the two buildings. The expected wind microclimate is discussed below.

6.2.1 Thoroughfares

Conditions at thoroughfares across the Development range from leisure walking to sitting throughout the year. Windier zones are expected between the Development and 102 St Pancras Way and at the building corners, however other areas within and around the Development are suitable for standing or sitting throughout the year which is calmer than required for a pedestrian thoroughfare.

6.2.2 Entrances

Entrances to the Development are located along St Pancras Way, Rochester Place and Camden Road. All of the entrances to the Development have a wind microclimate that is suitable for their intended use, throughout the year. This is primarily due to the amount of shelter provided by the surrounding buildings which range in height from approximately 3-6 storeys. The height of the surrounding buildings (9m-18m) and the width of the surrounding streets (approximately 26m or less) affect the way the wind behaves, resulting in calmer conditions at ground level. This is due to the surrounding buildings providing shelter 3 to 5 building lengths down wind.

6.2.3 Amenity Space

6.2.3.1 Ground Level

At ground level there are two public amenity areas located within the courtyards. Conditions within these areas are expected to be suitable for sitting during the summer season, which is the desired condition for amenity spaces. The courtyard on the eastern side of the Development is expected to be marginally calmer than the courtyard on the west side of the Development, this is primarily due to the western courtyard being more exposed to the secondary north easterly winds which blow along Rochester Mews into the courtyard, whereas the eastern courtyard is enclosed on all sides.

6.2.3.2 Private Terrace and Balconies

The private terrace and balconies have been assessed during the summer season due to the expectation that these areas will be suitable for sitting during this season.

Private balconies are located on the 4th, 5th and 6th floors and are relatively well sheltered from the prevailing winds. Therefore conditions within the majority of balconies are expected to be suitable for the desired sitting condition during the summer season.

At the 4th floor there are balconies on the north and west elevations of the building. As the balconies on the west elevation are aligned with the prevailing southwesterly winds, conditions along these balconies are expected to be suitable for standing. Conditions on the west elevations balconies are due to the southwesterly winds blowing unimpeded through this space and relatively little shelter from the adjacent building. Conditions on the north elevation are expected to be calmer and suitable for sitting conditions due to self-shelter from the prevailing winds (Refer to Figure 4).

Conditions on the 5th floor along the south and east elevations are expected to be suitable for sitting during the summer season due to shelter from the neighbouring building directly to the southwest.

The 6th floors private terrace (Block F) is expected to be suitable for a mix of sitting and standing conditions because to its exposure to southwesterly winds (see Figure 6) and would require mitigation measures to achieve conditions suitable for sitting.

6.2.3.3 Terraces

Within the communal garden on Block A and B's rooftop conditions are likely to be a mix of sitting and standing, the windier zone suitable for standing is expected to occur within the more exposed northern side of the garden where the prevailing southwesterly winds are expected the blow through the space, sitting conditions are reported at the southeastern end of the space which is sheltered by a taller section of the Development. Block E's communal garden would be suitable for standing due to winds channeling between the taller sections of the Development (refer to Figure 5).

6.2.4 Strong Winds

Strong winds, in excess of Beaufort Force 6, are not expected to occur at the Proposed Site.

7. Mitigation Measures

The assessment above assumed that no planting or landscaping was present around or within the development, in order to present a conservative (i.e. windier) scenario. In general, planting and other landscape enhancements would increase shelter within the development compared to the wind conditions described above, particularly when the trees and plants are established and in full leaf.

7.1 Mitigation at Ground Level

7.1.1 Thoroughfares

The wind conditions, during the windiest season, around the Proposed Development are expected to be suitable for a range of pedestrian activities from leisure walking through to standing. There are no recommendations for mitigation on the thoroughfares.

7.1.2 Entrances

All entrances to the Development are expected to be suitable for the intended pedestrian use throughout the year.

7.1.3 Amenity Space

7.1.3.1 Ground Level

Both the east and west courtyards are likely to be suitable for the intended sitting conditions during the summer season, therefore mitigation measures are not required.

7.1.3.2 Private Terrace and Balconies

The 4th floor private balconies on the west elevation of Block A and B are aligned with the prevailing southwesterly winds, conditions along these balconies are reported as being suitable for standing, However as these balconies are to be partitioned as part of the design, mitigation measures are not required as they are expected to be suitable for sitting conditions during the summer.

All private balconies on the 5th and 6th floors are suitable for the intended sitting use during the summer; therefore mitigation measures are not required.

Block F's large private terrace on the 6th floor is expected to be suitable for a mix of sitting and standing conditions due to its exposure to southwesterly winds. Mitigation is recommended in the form of planting throughout the space to calm conditions to those suitable for sitting.

7.1.3.3 Terraces

On the 5th floor Block E's communal garden is expected to be suitable for standing due to winds channeling between the taller sections of the Development. For Block A and B's communal garden conditions are expected to be suitable for standing in the more exposed areas, and sitting conditions in the more sheltered eastern corner. For both communal gardens mitigation is advised in the form of soft landscaping throughout the gardens to diffuse winds blowing through the space.

Once the proposed landscape plan is in place conditions within the fifth floor communal gardens are expected to be eased to those suitable for sitting throughout the area during the summer season. This is due to the inclusion of the raised planters which are 900mm tall and include ornamental shrubbery, and will line the perimeter of the communal gardens. The raised planters and shrubbery is expected to deflect and diffuse the winds which would have blown across the terrace unimpeded in their absence.

8. Concluding Remarks

In conclusion:

1. The meteorological data for the Site indicate prevailing winds from the southwest throughout the year and a secondary wind from the northeast which is most prevalent in the spring.
2. The background exposure of the Site, due to the surrounding terrain roughness, is similar in most directions, and reflects the general urban terrain around the Site. For the existing site the wind microclimate at ground level is expected to be generally suitable for standing during the windiest season.
3. For the proposed development the wind microclimate at ground level during the windiest season is classified as suitable for leisure walking or better and is compatible with the intended pedestrian use of the Site.
4. Conditions within the courtyards are expected to be suitable for sitting during the summer season.
5. Mitigation measures have been advised at terrace level in the form of soft landscaping for communal gardens on the 5th floor and the private terrace on the 6th floors which are identified as being suitable for standing conditions.

Wind Direction>>	0	30	60	90	120	150	180	210	240	270	300	330
Mean Factor at 2m	0.42	0.43	0.43	0.44	0.41	0.41	0.43	0.58	0.57	0.41	0.42	0.42
Mean Factor at 10m	0.79	0.81	0.80	0.81	0.77	0.77	0.79	0.89	0.87	0.77	0.77	0.77

Table 1: BREVe3 mean factors at 2m and 10m above ground level

Description	Threshold	Suitable Activity
Roads and Car Parks	6% > B5	open areas where pedestrians are not expected to linger
Business Walking	2% > B5	'purposeful' walking or where, in a business district, pedestrians may be more tolerant of the wind because their presence on Site is required for work
Leisure Walking	4% > B4	strolling
Pedestrian Standing	6% > B3	waiting at bus-stops, window shopping etc
Entrance Doors	6% > B3	pedestrians entering/leaving a building
Sitting	1% > B3	long-term sitting, for example, sitting outside a café

Table 2: Lawson Comfort Criteria

Beaufort Force	Hours Average Wind Speed (m/s)	Description of Wind	Noticeable Wind Effect
0	< 0.45	Calm	Smoke rises vertically.
1	0.45 – 1.55	Light Air	Direction shown by smoke drift but not by vanes.
2	1.55 – 3.35	Gentle Breeze	Wind felt on face; leaves rustle; wind vane moves.
3	3.35 – 5.60	Light Breeze	Leaves & twigs in motion; wind extends a flag.
4	5.60 – 8.25	Moderate Breeze	Raises dust and loose paper; small branches move.
5	8.25 – 10.95	Fresh Breeze	Small trees, in leaf, sway.
6	10.95 – 14.10	Strong Breeze	Large branches begin to move; telephone wires whistle.
7	14.10 – 17.20	Near Gale	Whole trees in motion.
8	17.20 – 20.80	Gale	Twigs break off; personal progress impeded.
9	20.80 – 24.35	Strong Gale	Slight structural damage; chimney pots removed.
10	24.35 – 28.40	Storm	Trees uprooted; considerable structural damage.
11	28.40 – 32.40	Violent Storm	Damage is widespread; unusual in the U.K.
12	> 32.40	Hurricane	Countryside is devastated; only occurs in tropical countries.

Table 3: Beaufort Land Scale

Figure 1: Aerial Photograph of the Existing Site (Site with red line boundary)

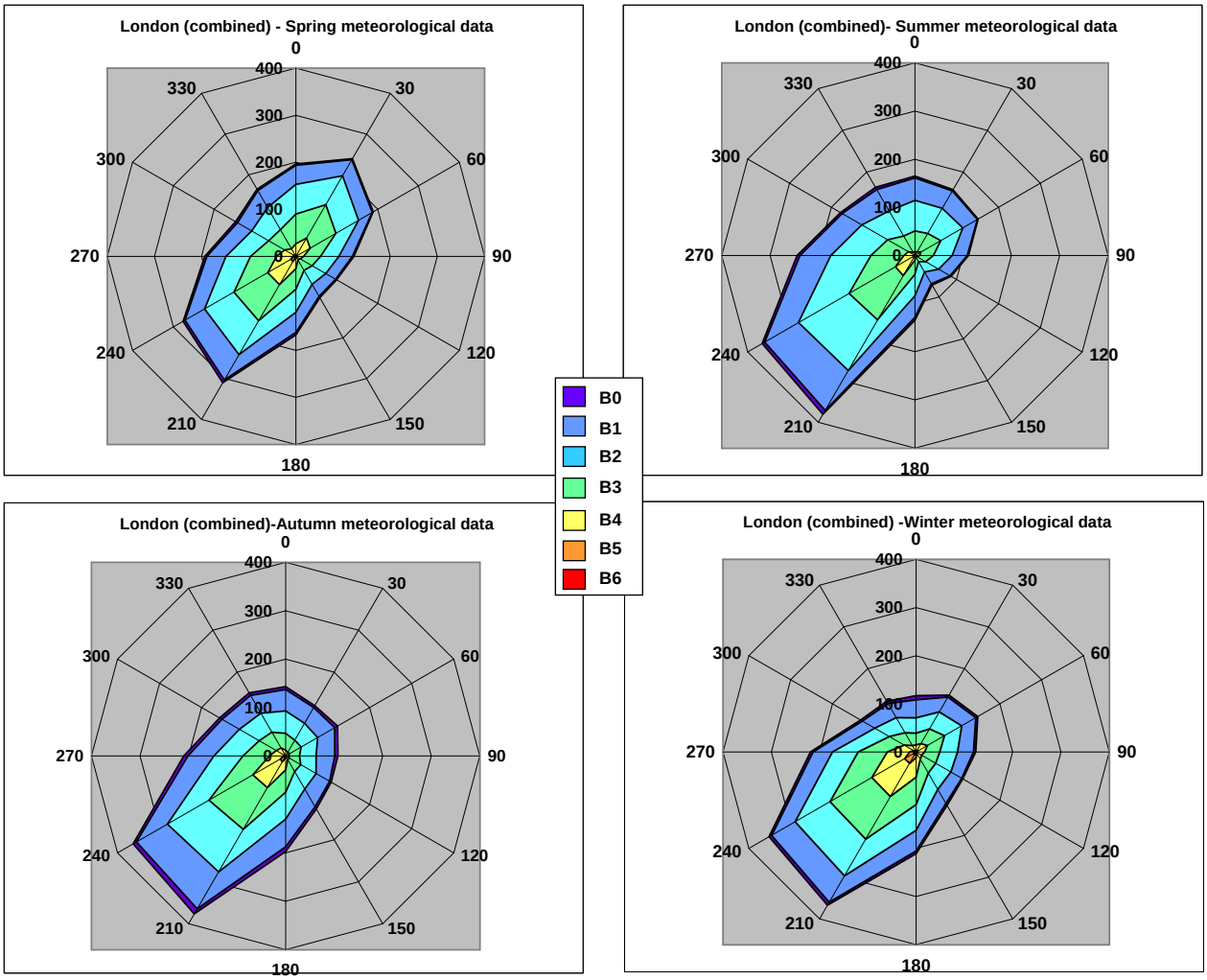

Figure 2: Seasonal wind roses for London (in Beaufort Force)
(Radial axis indicates the hours for which the stated Beaufort Range is exceeded)

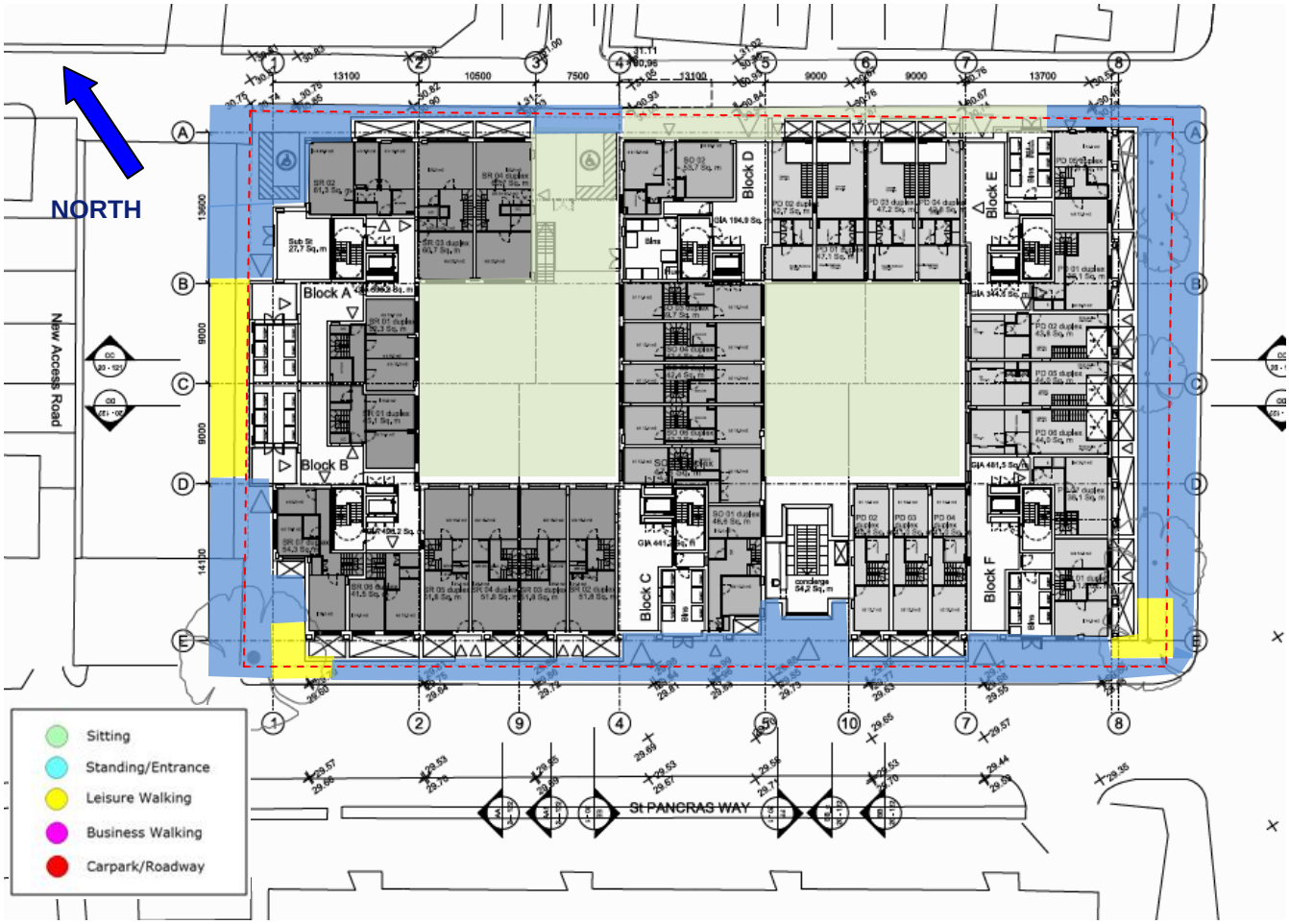

Figure 3: Ground Floor Plan Showing Expected Worst-Case (Winter Season) Comfort Levels

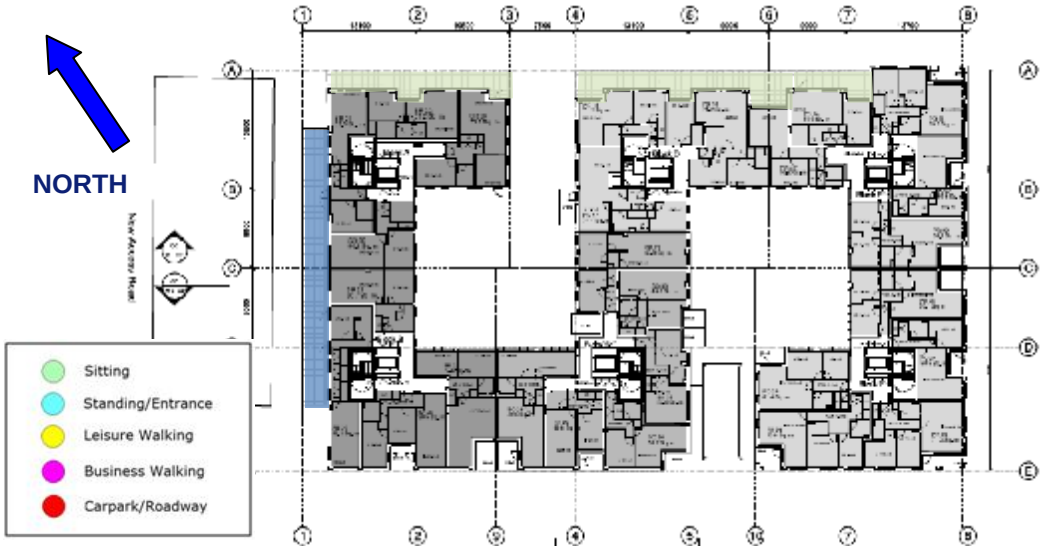

Figure 4: Fourth Floor Plan Showing Expected Summer Season Comfort Levels

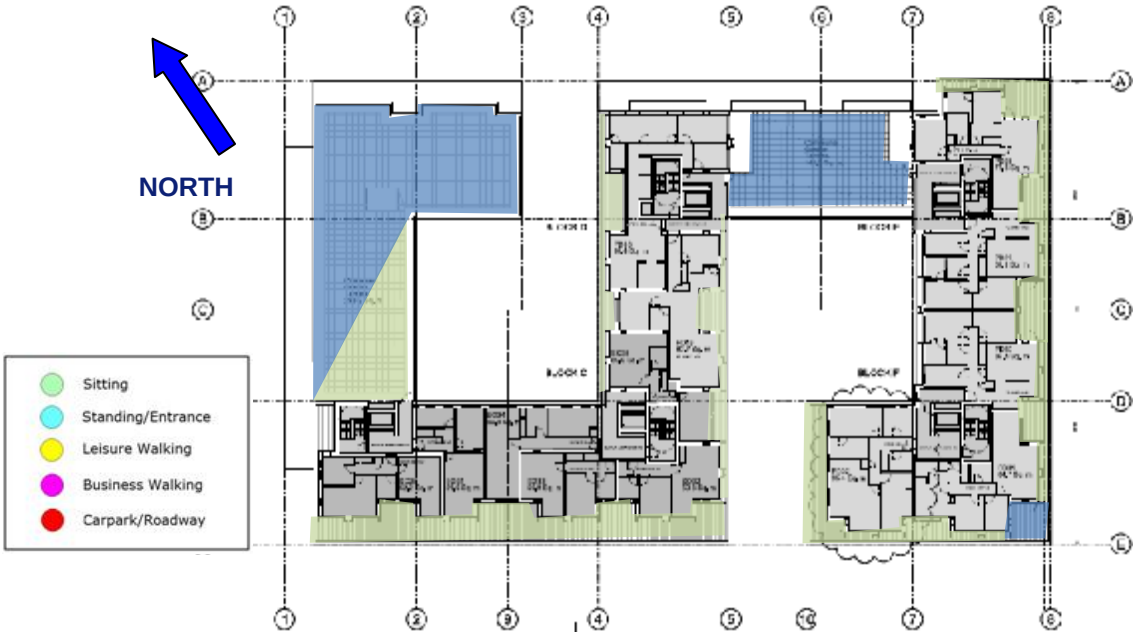

Figure 5: Fifth Floor Plan Showing Expected Summer Season Comfort Levels

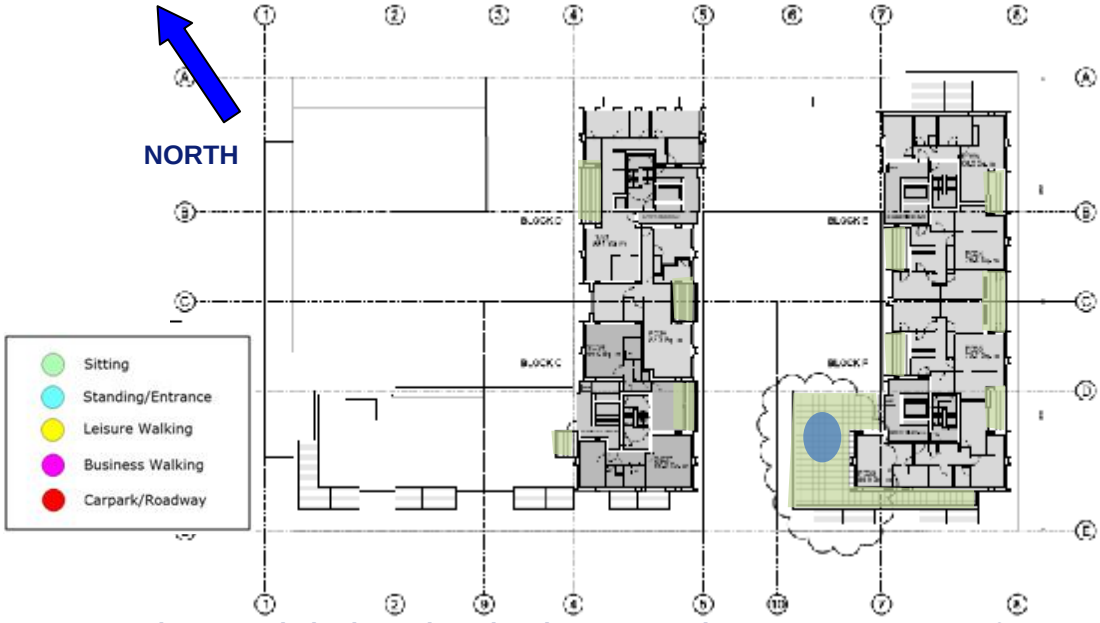

Figure 6: Sixth Floor Plan Showing Expected Summer Season Comfort Levels

Appendix A: Lawson Comfort Criteria

In order to benchmark the wind conditions the familiar Lawson Comfort Criteria are used and these are described in more detail below. The Lawson Comfort Criteria are important because they permit the wind microclimate to be assessed in absolute terms.

Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the predicted wind speeds can be compared. This report uses the Lawson Criteria[3] which have been established for some thirty years and have been widely used on building developments across the United Kingdom. Lawson defined a twelve-point scale (not shown here) to represent equal increments of pedestrian annoyance to the wind and this scale forms the basis of the comfort criteria which seek to define the reaction of an average pedestrian to the wind. The comfort criteria levels are described in Table 2 on the previously presented in this report. If predicted wind conditions exceed the threshold then conditions are unacceptable for the stated pedestrian activity and the expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.

The criteria set out six pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The six categories are sitting, standing, entering/leaving a building, leisure walking, business walking and roadway/car-park, in ascending order of activity level. In other words, the wind conditions in an area for sitting need to be calmer than a location that people merely walk past. The distinction between leisure walking and business walking is that in the business scenario, where pedestrians are on site because their livelihood depends upon it, they will be more tolerant of stronger winds. Table 3, previously presented in this report, summarises the Beaufort Land Scale and quantifies the wind speeds associated with each Beaufort Range.

The criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season.

Strong Winds

Lawson also specifies a lower limit strong wind criterion when winds exceed Beaufort Force 6. Exceedance of this threshold wind speed may indicate a need for remedial measures or a careful assessment of the expected use of that location, e.g. is it reasonable to expect vulnerable pedestrians to be present at the location on the windiest day of the year?

Experience has shown that when business walking and roadway conditions occur then the wind microclimate will be characterised by occasional strong winds during the windiest season and the potential effect of these winds should be considered as well as comfort.

[3] *Lawson T.V., "Building Aerodynamics", Imperial College Press, April 2001. [ISBN 1-86094-187-7]*