



FD GLOBAL
L I M I T E D

**Haringey Warehouse District, Seven –
Sisters Road, London, United Kingdom
Pedestrian Wind Comfort and Safety**

For

Dakota

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Executive Summary

An experience based desk study has been carried out by FD Global Limited (FDG) to provide an assessment of the pedestrian level wind environment for the proposed Warehouse District medium rise development project in Haringey, London, United Kingdom. The study has considered the wind regime for existing and proposed site conditions and incorporates the generic wind climate at the site, based on long-term wind statistics and likely ground level wind flow patterns for the various wind sectors that dominate pedestrian comfort and safety.

The main conclusions and recommendations of the wind assessment are summarised as follows:

- The assessment has shown that the likely impact of the proposed development in all areas of the public realm is such that the wind microclimate is likely to remain as being suitable for the planned pedestrian uses and no specific wind mitigation measures are required in this regard
- The assessment has also shown that the ground level wind microclimate in the proposed site conditions is likely to remain safe for all users and no specific wind mitigation measures are required in this regard

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1. Overview

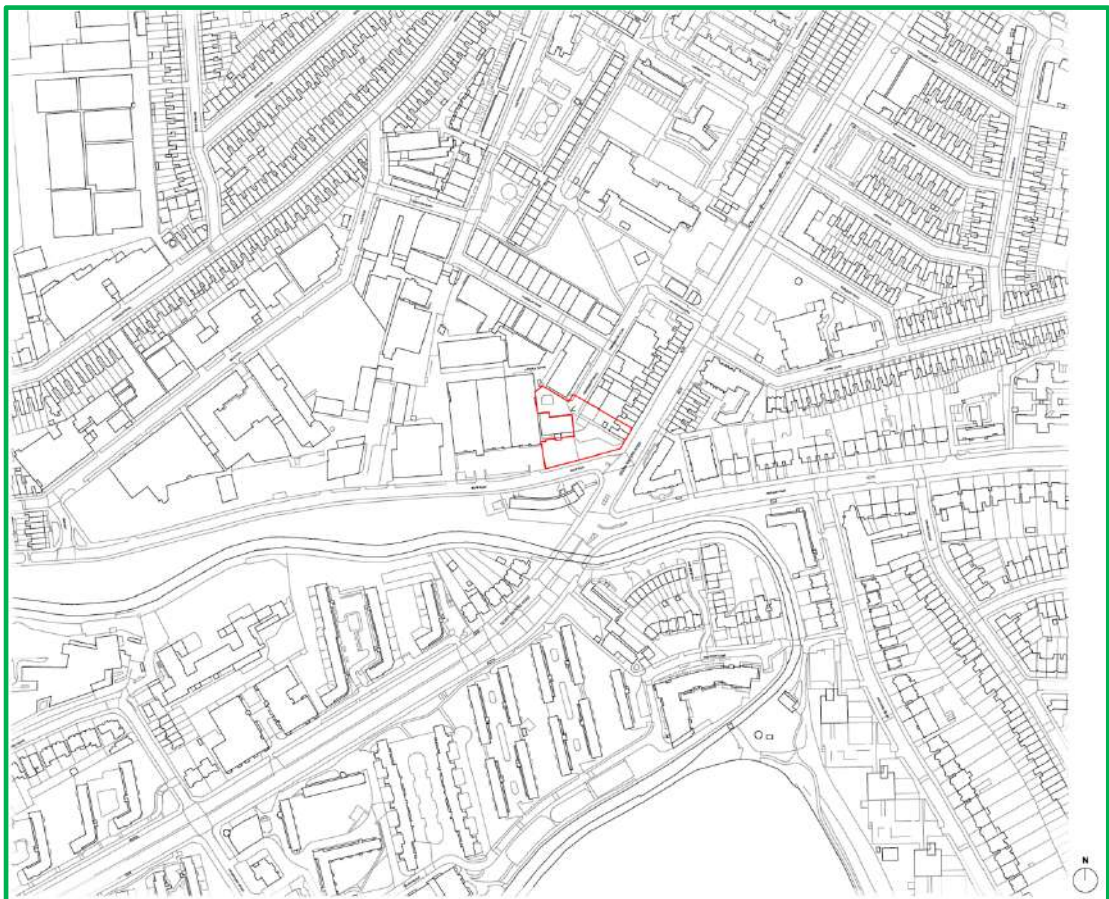
The present report summarises the key processes and findings of an experience based desk top assessment of pedestrian wind comfort and safety carried out by FD Global Limited (FDG) for the proposed Haringey Warehouse District development on Seven Sisters Road in Haringey, London, United Kingdom.

The desk studies provide an experience based assessment of potential wind impacts on the public realm and in key areas of sensitive pedestrian uses within the development and the surrounding areas for the proposed site conditions.

2. The Existing Site Description

2.1. Site Location and Surrounding Terrain

The project site is located centrally in Haringey, London. The site location is defined below on the site location plan.



Site Location Plan

The far field terrain roughness that affects the generic wind regime at the site in terms of wind strength and gustiness for winds approaching the site from the northerly, easterly, southerly and westerly wind directions is characterised as built up urban/suburban terrain. This terrain category has been used in the assessment of the so-called background windiness for the site that defines the generic wind regime for the existing site conditions in the absence of building impacts of the proposed redevelopment.



Site Location – Far Field View and Terrain

2.2. The Buildings of the Surrounding Area

The local wind flow patterns and local wind regime at the site is affected by the surrounding near field terrain that is formed by the buildings within a nominal distance of 450m at full scale, which is shown below.



The Site and Surrounding Buildings Affecting the Wind Regime at the Site

The buildings of the surrounding area largely comprise of low to medium rise structures and open spaces.

Immediately to the south of the site there is a residential housing development that fronts onto Eade Road from the junction with Seven Sifers Road and has a height of 5 storeys. To the south west of the site along Eade Road the surrounding area consists of open park land and is free of developments within the near field environment of the site.

Immediately, to the west of the site along Eade Road there is an existing 5 storey office building that is set back from Eade Road and a number of industrial warehouse units that are nominally 4 storeys in height that are set back from Eade Road. Further to the west there are a number of industrial units that front onto Eade Road.

To the immediate north and the north east of the site the surrounding buildings consist of densely clustered warehouses and industrial units nominally 2 – 4 storeys in height.

A perspective view of the existing site is given below viewed from south west and from north east.



The Site – Viewed From South West



The Site – Viewed From North East

2.3. The Existing Site

The existing site plan is show below that defines the site boundary.



The Existing Site – Ground Floor Plan

In the existing site conditions the site in the main consists of an open car park and an area of greenery along Eade Road and on the corner with Seven Sisters Road. On Seven Sisters Road the existing site includes an end of terrace 3 storey residential development that has a retail unit at ground level along Seven Sisters Road.

Within the site boundary there is a thoroughfare that connects Seven Sisters Road to Tewkesbury Road to the north of the site via mezzanine stairs that progressively cascade down from Seven Sisters.

At the north edge of the site boundary the existing site conditions comprise of an open square that connects to Catwalk Place.

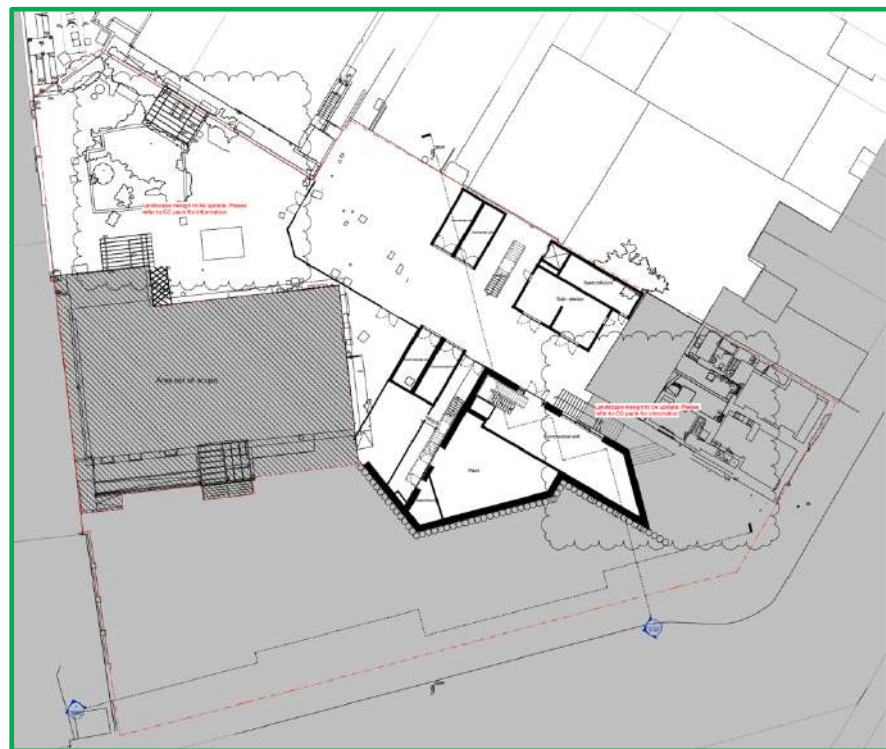
3. The Proposed Site Description

The proposed development is shown in the following figures in section, in plan and in isometric view. The footprint of the proposed development and its' positioning relative to the adjacent buildings in the proposed site conditions is also shown on the site layout plan.

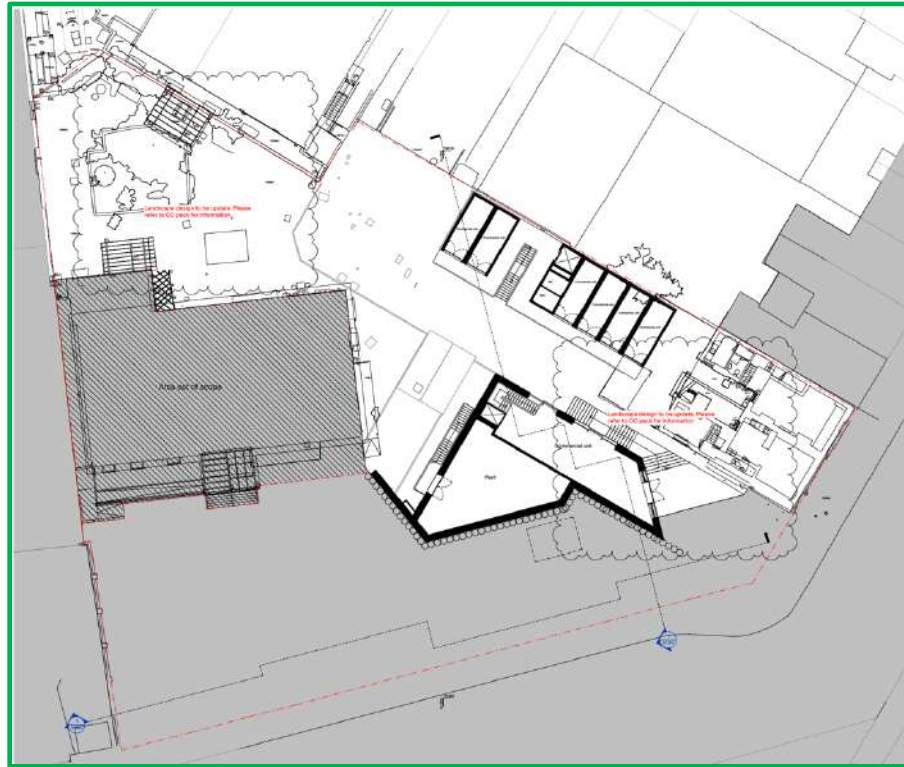
In the main, the proposed development consists of two building blocks that extend along Seven Sisters Road and Eade Road with a nominal east west long alignment axis. The smaller of the two building blocks is on the west side of the site and reaches a height of 4 storeys while the taller building extends up to 8 storeys.



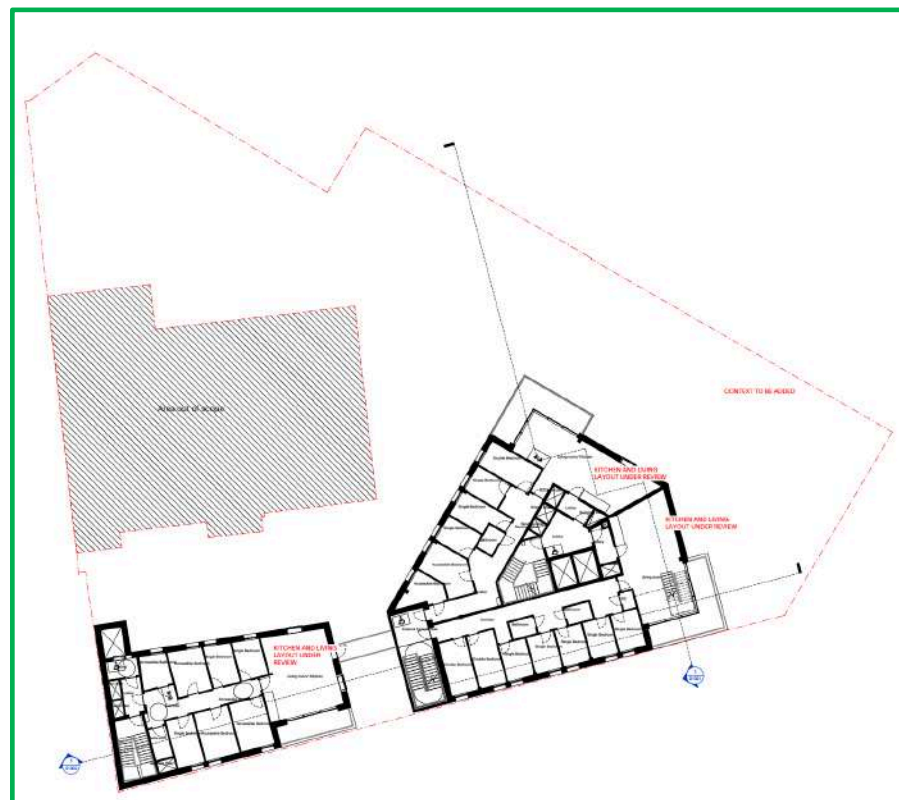
Proposed Site Layout – Ground Floor Plan Along Seven Sisters Road



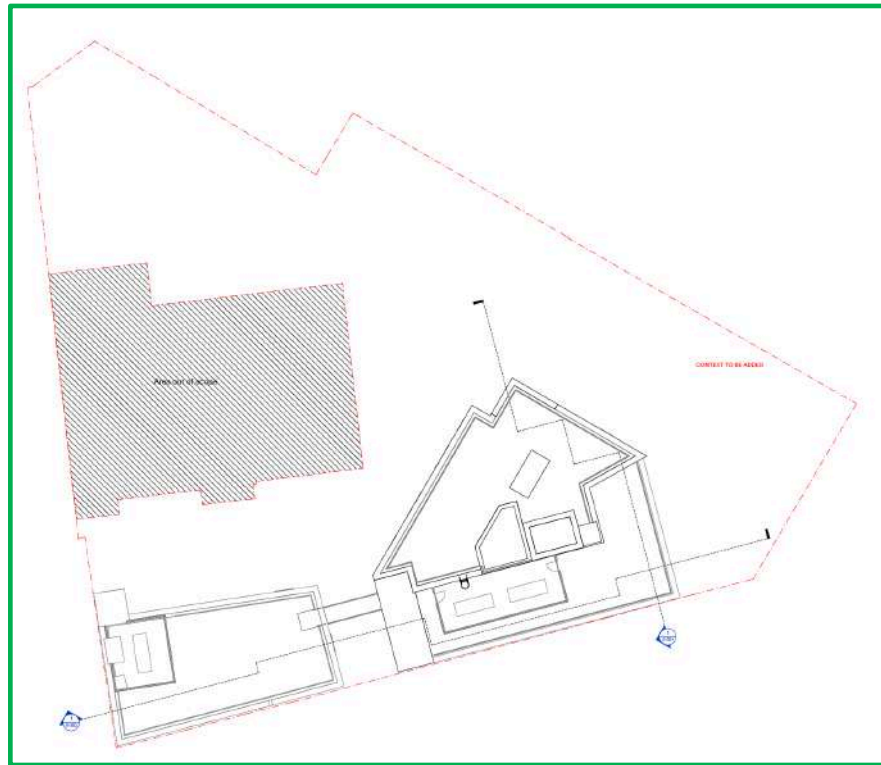
Proposed Site Layout – Ground Floor Plan Along Tewkesbury Road



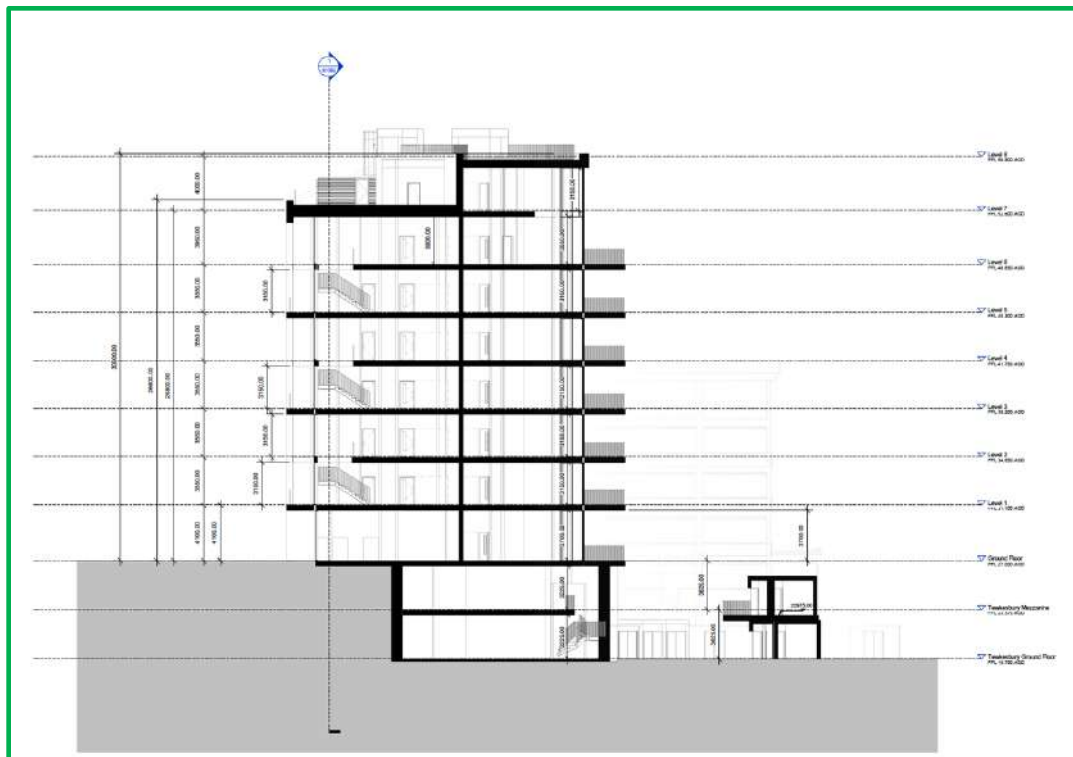
Proposed Site Layout – Mezzanine Floor Plan Along Tewkesbury Road



The Proposed Development – Level 3 Floor Plans



The Proposed Development – Roof Plans



The Proposed Development – Short Section (Seven Sisters Road to Tewkesbury Road)



The Proposed Development – Long Section (Along Seven Sisters Road / Eade Road)



The Proposed Development – Isometric View From Eade Road



The Proposed Development – Isometric View From Seven Sisters Road



The Proposed Development (Tewkesbury Yard) – Artist View From Tewkesbury Road

3.1. Public Realm and Sensitive Receptors

The public realm at ground level around the site in the proposed site conditions and the associated sensitive receptors that have been considered in the present assessment are as follows:

- The pedestrian thoroughfares along Eade Road
- The building entrances and open areas of adjacent developments along Eade Road
- The pedestrian thoroughfares along Seven Sister Road
- The building entrances and open areas of adjacent developments along Seven Sisters Road
- The access routes to the proposed buildings
- The open areas within the site that are intended for outdoor recreational uses
- The building entrances to the proposed buildings

The receptors have been classified in terms of the pedestrian activities that are understood to be prevalent. This classification forms the basis for defining minimum target comfort levels for the wind microclimate assessment for the proposed site conditions and the significance of possible wind impacts.

4. Wind Comfort Assessment Methodology

The local site wind regime around buildings is governed by the background windiness, the aerodynamics of the development itself and aerodynamic proximity effects from the surrounding buildings, which can cause wind funnelling, downdraft and/or wind shielding effects. All of these factors vary respectively with approach wind direction and need to be accounted for wind sector by wind sector. Aerodynamic proximity effects from nearby buildings largely relate to building wakes emanating from a particular building that convect downwind, aligned with the incident wind direction. For bluff cross-sectional shapes such as buildings, the downwind building wake in which the wind speed is substantially reduced compared to that of the incident wind, typically persist downwind for some distance from the site that can be a multiple of the key building dimensions. The effect becomes amplified in cases of building clusters where individual building wakes can merge to form a much larger region of decelerated wind flow.

The predictive assessment of pedestrian wind comfort in the built environment requires consideration of the generic wind regime at the site in terms of the wind strength and the wind turbulence which determines the gustiness. In addition, local ground level wind flow patterns that are likely to occur in the proposed site conditions between the target development being assessed and the surrounding buildings, need to be assessed for prevailing and non-prevailing wind directions. Lastly, the frequency of occurrence of key wind events predicted for the proposed site conditions needs to be assessed based on long term wind statistics for the site.

Combining the three components of the wind assessment allows exceedance of wind speed bands that relate to accepted UK industry standard comfort and safety criteria to be predicted and, therefore, the suitability of the pedestrian wind environment for its' planned uses in key areas to be assessed. A comprehensive environmental wind assessment needs to consider not only user comfort, but – in cases where severe local wind force is predicted – also user safety.

Accepted UK industry standard for the assessment of the local wind flow patterns comprises either numerical modelling (Computational Fluid Dynamics), physical modelling (Boundary Layer Wind Tunnel Testing) or experience based application of desk study models by suitably qualified experts.

Quantitative numerical or physical modelling of wind flow patterns are beyond the scope of the present assessment, which instead draws on FDG's long standing experience in the assessment of unsteady atmospheric wind action in the built environment and in turn is based on estimated ground level wind speed-up factors for key wind sectors.

4.1. Overview of Potential Wind Impact Drivers

From the above it can be seen that for a given site location that fixes the generic wind climate and the generic wind regime at the site the other determinist component for local wind microclimate is aerodynamic effects caused by the building arrangement itself.

For tall buildings there are a number of recognised potential adverse aerodynamic / wind flow impacts and impact driving building features on which they depend that are tabulated below, and which can also be referred to in the Building Research Establishment (BRE) guidance note Digest 520 'Wind Microclimate Around Buildings' dated May 2011.

Wind Microclimate Impact Category	Impact Driving Tall Building Features
1. Downdraft of higher level winds	• Site exposure • Building height (relative to the surrounding buildings) • Building bluffness due to overall form in particular building cross-sectional shape • Building bluffness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)
2. Corner vortex flow (often occurs in conjunction with 1. above) and downwind horseshoe vortex formation	• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building
3. 'Trapped' vortex flow with adjacent buildings on the windward side of the building (Often occurs in conjunction with 1. above)	• Lateral distance of the building to upwind adjacent buildings / structures • Relative height between the building and that of upwind adjacent buildings / structures
4. Wind Funnelling	• Occurrence of throughways at ground level within the building between the windward and the leeward sides • Narrow passage ways formed by the building and adjacent buildings / structures

4.2. Wind Comfort / Safety Assessment Criteria

The present assessment is based on criteria that are a UK industry standard accepted formulation of the so-called Lawson criteria (the LDDC version), originally developed by Professor Tom Lawson of Bristol University, UK.

The comfort criteria are based on a 5% time exceedance of the threshold wind speeds, that relate to tolerable wind conditions for categorised types of pedestrian activity. These are tabulated below. It is conventional to apply these criteria on a seasonal basis considering summer and worst case seasonal comfort ratings.

The Lawson criteria also require an assessment of pedestrian safety with respect to wind force. The safety criteria are based on a 0.022% (once per annum) seasonal exceedance of the threshold wind speeds 15 m/s and 20 m/s that are respectively deemed to destabilise 'less able' users (e.g. the elderly, cyclists and children) and 'able-bodied' users.

Threshold Mean- hourly Wind Speed Exceeded < 5% of the Time	Comfort Rating / Activity	Qualifying Comments
0 - 4m/s	C4 - Long-term standing / sitting	Reading a newspaper and eating and drinking
4 - 6m/s	C3 - Short-term standing / sitting	Appropriate for bus stops, window shopping and building entrances
6 - 8m/s	C2 - Leisure thoroughfare / strolling	General areas of walking and sightseeing
8 - 10m/s	C1 - Pedestrian transit / thoroughfare (A-B)	Local areas around tall buildings where people are not likely to linger
> 10m/s	C0 - Uncomfortable for all uses	Uncomfortable for all pedestrian activities

Comfort Criteria

Threshold Mean- hourly Wind Speed Exceeded Once Per Annum	Safety Rating	Qualifying Comments
> 15 m/s	S2 - Unsuitable for general public	Less able and cyclists find conditions physically difficult
> 20 m/s	S1 - Unsuitable for able-bodied	Able-bodied persons find conditions difficult. Physically impossible to remain standing during gusts.

Safety Criteria

5. Assessment

5.1. Definition of Target Comfort Classifications

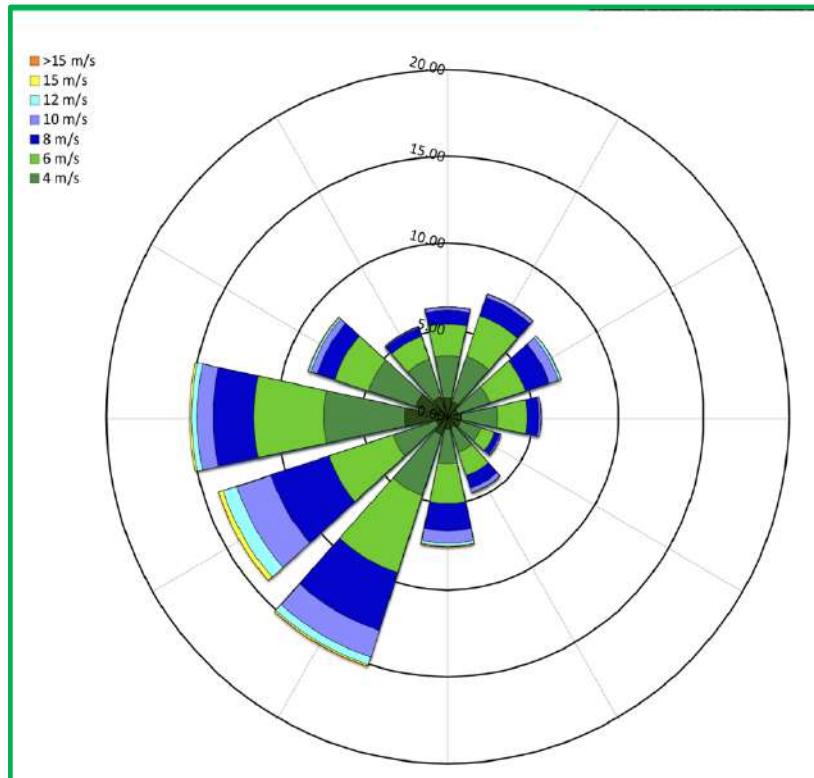
Based on FDG's understanding of the planned pedestrian uses in the proposed site conditions detailed above, the minimum target comfort rating has been defined as follows for summer and for the worst-season:

- The pedestrian thoroughfares along Eade Road (Minimum Target Comfort 'C1 - Pedestrian transit / thoroughfare (A-B)' for Summer and Worst Season)
- The building entrances and open areas of adjacent developments along Eade Road (Minimum Target Comfort 'C3 - Short-term standing / sitting' for Summer and Worst Season)
- The pedestrian thoroughfares along Seven Sister Road (Minimum Target Comfort 'C1 - Pedestrian transit / thoroughfare (A-B)' for Summer and Worst Season)
- The building entrances and open areas of adjacent developments along Seven Sisters Road (Minimum Target Comfort 'C3 - Short-term standing / sitting' for Summer and Worst Season)
- The access routes to the proposed buildings (Minimum Target Comfort 'C1 - Pedestrian transit / thoroughfare (A-B)' for Summer and Worst Season)
- The open areas within the site that are intended for outdoor recreational uses (Minimum Target Comfort 'C4 - Long-term standing / sitting' for Summer and 'C3 - Short-term standing / sitting' for the Worst Season)
- The building entrances to the proposed buildings (Minimum Target Comfort 'C3 - Short-term standing / sitting' for Summer and Worst Season)

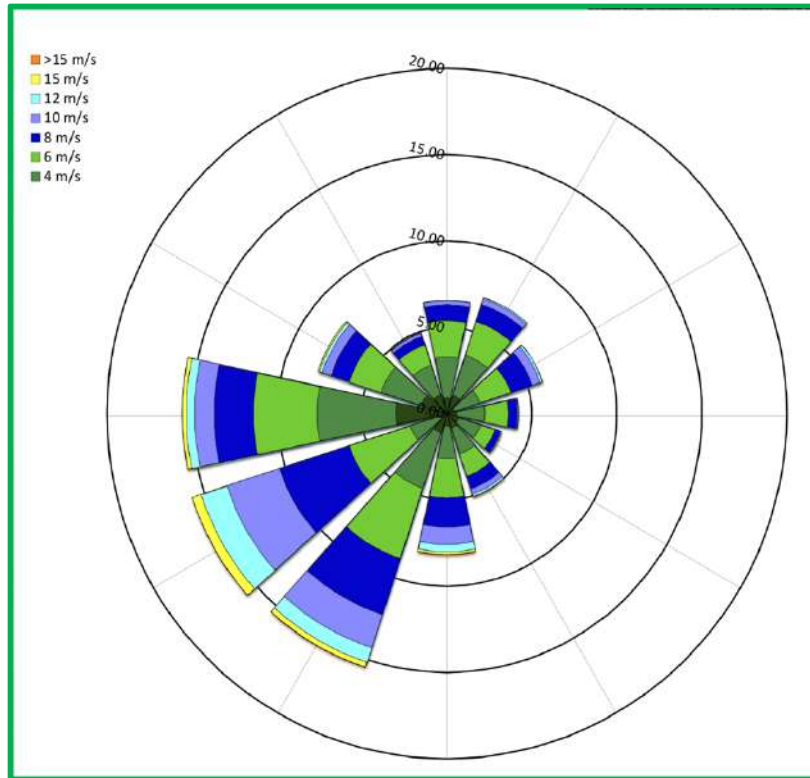
The target safety rating at all locations is 'safe for all users'.

5.2. Site Specific Wind Climate

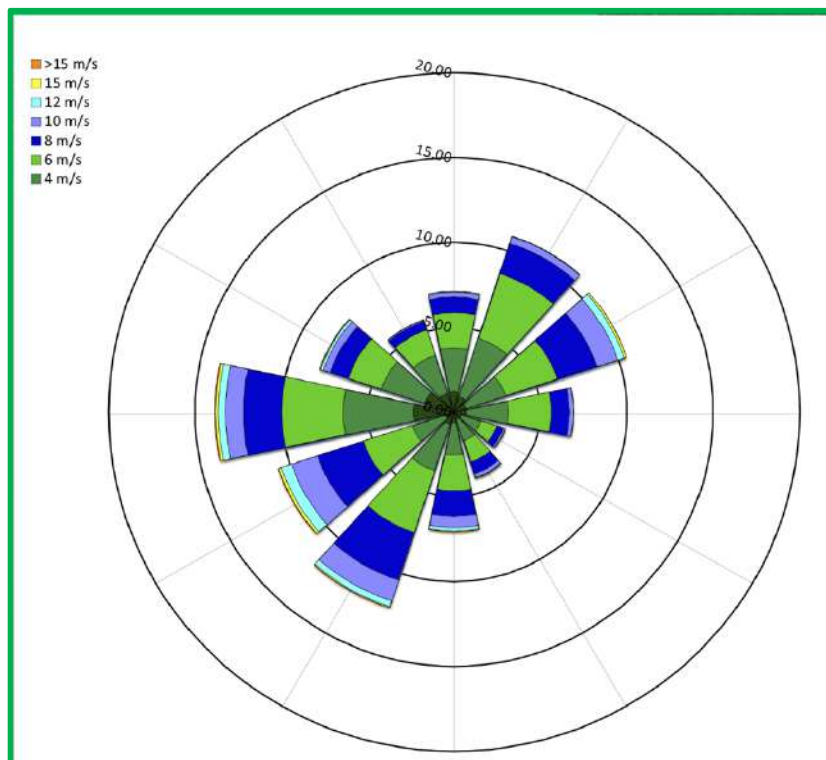
Up-to-date, long term wind statistics have been acquired and processed for London Heathrow Weather Centre using industry standard Weibull Analysis and are shown below for the different seasons of the year. This has facilitated a seasonal approach to the wind microclimate analysis. The wind statistics are shown below in wind-rose format.



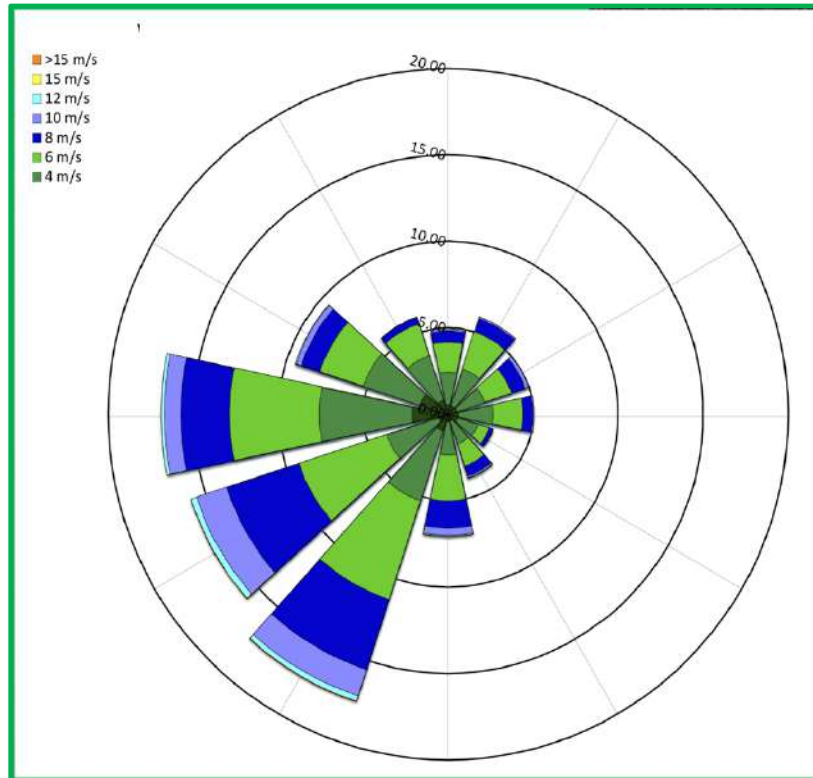
Wind Frequency Distribution by Wind Sector – Annual



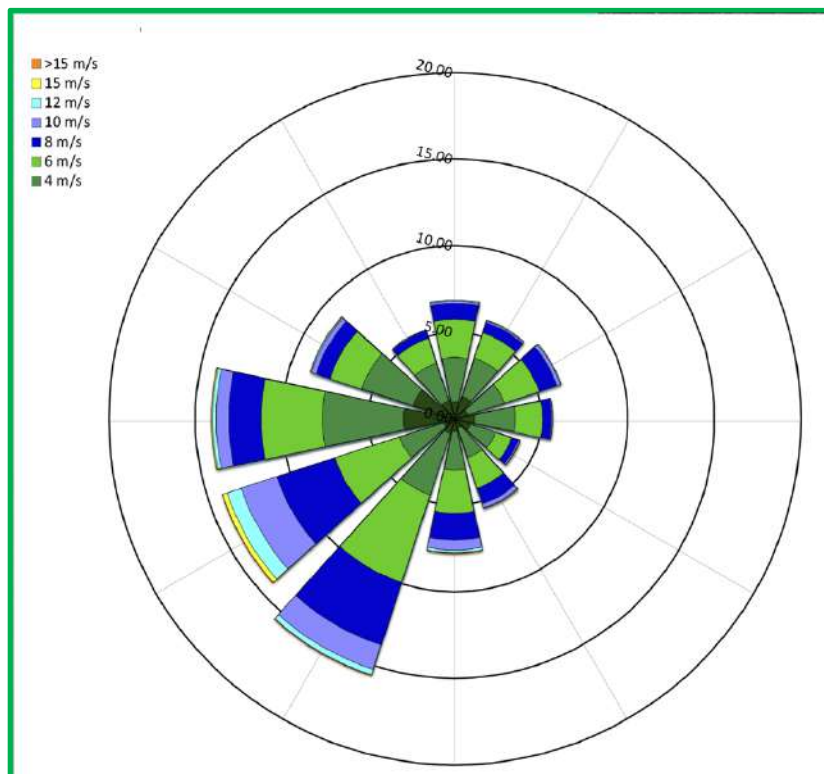
Wind Frequency Distribution by Wind Sector – Winter



Wind Frequency Distribution by Wind Sector – Spring



Wind Frequency Distribution by Wind Sector – Summer



Wind Frequency Distribution by Wind Sector - Autumn

It can be seen that the prevailing wind sectors at the site across all seasons are South West (SW), West South West (WSW), West (W). In Spring and Winter the north easterly wind sector emerges as a second frequent wind direction (30° EoN to 60° EoN).

In terms of wind comfort at the site these prevailing wind sectors are dominant in that they govern the more frequent local wind events at the site.



Prevailing Wind Sectors at The Site - Summary

5.3. Review of Wind Impact Potential of the Proposed Development

The wind microclimate assessment has incorporated experienced based wind speed-up assumptions that relate to the recognised potential wind impact drivers as per the BRE Digest 520 that is detailed above. In turn the impact potential that has been considered is given below for the various sensitive receptors in the public realm surrounding the site and within the proposed development.

5.3.1. The Pedestrian Thoroughfares Along Eade Road

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluntness due to overall form in particular building cross-sectional shape • Building bluntness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building	• Low • Low

• Lateral distance of the building to upwind adjacent buildings / structures • Relative height between the building and that of upwind adjacent buildings / structures	• Low • Low
• Occurrence of throughways at ground level within the building between the windward and the leeward sides • Narrow passageways formed by the building and adjacent buildings / structures	• Low (due to shielding from upwind adjacent structures) • Low (due to shielding from upwind adjacent structures)

5.3.2. The building entrances and open areas of adjacent developments along Eade Road

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluffness due to overall form in particular building cross-sectional shape • Building bluffness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building	• Low • Low
• Lateral distance of the building to upwind adjacent buildings / structures • Relative height between the building and that of upwind adjacent buildings / structures	• Low • Low
• Occurrence of throughways at ground level within the building between the windward and the leeward sides • Narrow passageways formed by the building and adjacent buildings / structures	• Low (due to shielding from upwind adjacent structures) • Low (due to shielding from upwind adjacent structures)

5.3.3. The pedestrian thoroughfares along Seven Sister Road

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluntness due to overall form in particular building cross-sectional shape • Building bluntness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building	• Low • Low
• Lateral distance of the building to upwind adjacent buildings / structures • Relative height between the building and that of upwind adjacent buildings / structures	• Low • Low
• Occurrence of throughways at ground level within the building between the windward and the leeward sides • Narrow passageways formed by the building and adjacent buildings / structures	• Low (due to shielding from upwind adjacent structures) • Low (due to shielding from upwind adjacent structures)

5.3.4. The building entrances and open areas of adjacent developments along Seven Sisters Road

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluntness due to overall form in particular building cross-sectional shape • Building bluntness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building	• Low • Low
• Lateral distance of the building to upwind adjacent buildings / structures	• Low • Low

Relative height between the building and that of upwind adjacent buildings / structures	
- Occurrence of throughways at ground level within the building between the windward and the leeward sides - Narrow passageways formed by the building and adjacent buildings / structures	- Low (due to shielding from upwind adjacent structures) - Low (due to shielding from upwind adjacent structures)

5.3.5. The access routes to the proposed buildings

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
- Site exposure - Building height (relative to the surrounding buildings) - Building bluntness due to overall form in particular building cross-sectional shape - Building bluntness due to elevational aspect ratio - Building orientation to the prevailing (most frequent and strongest wind directions at the site)	- Low - Low - Low - Low - Low
- Sharpness of building edges at ground level - Free areas to the side of the building allowing downwind vortex convection away from the building	- Low - Low
- Lateral distance of the building to upwind adjacent buildings / structures - Relative height between the building and that of upwind adjacent buildings / structures	- Low - Low
- Occurrence of throughways at ground level within the building between the windward and the leeward sides - Narrow passageways formed by the building and adjacent buildings / structures	- Low (due to shielding from upwind adjacent structures) - Low (due to orientation relative to prevailing winds and downwards cascade of mezzanine stair ways from Seven Sisters Road to Tewkesbury Road)

5.3.6. The open areas within the site that are intended for outdoor recreational uses

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluffness due to overall form in particular building cross-sectional shape • Building bluffness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level • Free areas to the side of the building allowing downwind vortex convection away from the building	• Low • Low
• Lateral distance of the building to upwind adjacent buildings / structures • Relative height between the building and that of upwind adjacent buildings / structures	• Low • Low
• Occurrence of throughways at ground level within the building between the windward and the leeward sides • Narrow passageways formed by the building and adjacent buildings / structures	• Low (due to shielding from upwind adjacent structures) • Low (due to orientation relative to prevailing winds and downwards cascade of mezzanine stair ways from Seven Sisters Road to Tewkesbury Road)

5.3.7. The building entrances to the proposed buildings

Impact Driving Tall Building Features	Impact Potential For Prevailing Winds (Low / Medium / High)
• Site exposure • Building height (relative to the surrounding buildings) • Building bluffness due to overall form in particular building cross-sectional shape • Building bluffness due to elevational aspect ratio • Building orientation to the prevailing (most frequent and strongest wind directions at the site)	• Low • Low • Low • Low • Low
• Sharpness of building edges at ground level	• Low

Free areas to the side of the building allowing downwind vortex convection away from the building	Low
- Lateral distance of the building to upwind adjacent buildings / structures - Relative height between the building and that of upwind adjacent buildings / structures	- Low - Low
- Occurrence of throughways at ground level within the building between the windward and the leeward sides - Narrow passageways formed by the building and adjacent buildings / structures	- Low (due to shielding from upwind adjacent structures) - Low (due to shielding from upwind adjacent structures and the orientation relative to prevailing winds and downwards cascade of mezzanine stair ways from Seven Sisters Road to Tewkesbury Road)

5.4. Wind Comfort / Safety Assessment

The wind comfort and safety analysis in terms of comfort and safety ratings that have been estimated using experience based wind speed up factors that incorporate the key wind impact drivers as outlined in generic form above (i.e. downdrafts, so-called ground level corner and trapped vortex flows, canyon flows between extensively aligned rows of buildings and also shielding) and also the site specific wind climate statistics.

This has allowed worst case comfort ratings to be estimated for the various sensitive receptor zones for the existing and the proposed site conditions.

The estimated comfort ratings are detailed in tabulated form below for the worst season (winter) and for summer season. In order to objectively gauge the requirement for wind mitigation measures required to ensure that the worst case wind impacts are such that the wind microclimate is suitable for the planned uses, the predicted comfort levels are compared to the target comfort ratings that have been defined.

5.4.1. Existing Site Conditions

The wind conditions throughout the public realm for the existing site conditions has been assessed as being safe for all users. The estimated comfort ratings are tabulated below.

Sensitive Receptor	Estimated Worst Case Comfort Rating Category Within Sensitive Receptor Zone		Target Comfort Level Met (Yes / No)
	Worst Season	Summer	
The pedestrian thoroughfares along Eade Road	C2	C3	N/A
The building entrances and open areas along Eade Road	C2	C3	N/A
The pedestrian thoroughfares along Seven Sisters Road	C2	C3	N/A
The building entrances and open areas along Seven Sisters Road	C2	C3	N/A

Estimated Worst Case Comfort Rating Category

5.5. Proposed Site Conditions

The wind conditions throughout the public realm for the proposed site conditions has been assessed as being safe for all users. The estimated comfort ratings are tabulated below. It can be seen that the target comfort levels are predicted to be met throughout the public realm and all sensitive receptors. Accordingly, there is no requirement for wind mitigation measures.

Sensitive Receptor	Estimated Worst Case Comfort Rating Category Within Sensitive Receptor Zone		Target Comfort Level Met (Yes / No)
	Worst Season	Summer	
The pedestrian thoroughfares along Eade Road	C2	C3	Yes
The building entrances and open areas along Eade Road	C2	C3	Yes
The pedestrian thoroughfares along Seven Sisters Road	C2	C3	Yes
The building entrances and open areas along Seven Sisters Road	C2	C3	Yes
The access routes to the proposed buildings	C2	C3	Yes
The open areas within the site that are intended for outdoor recreational uses	C3	C4	Yes

The building entrances within the proposed development	C3	C3	Yes
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6. Conclusions and Recommendations

The main conclusions and recommendations of the wind assessment are summarised as follows:

- The assessment has shown that the likely impact of the proposed development in all areas of the public realm is such that the wind microclimate is likely to remain as being suitable for the planned pedestrian uses and no specific wind mitigation measures are required in this regard
- The assessment has also shown that the ground level wind microclimate in the proposed site conditions is likely to remain safe for all users and no specific wind mitigation measures are required in this regard