

Appendix: Wind Microclimate

Annex 1: Legislation and Planning Policy Context

Annex 2: Computational Fluid Dynamics Methodology

Annex 3: Wind Climate Methodology

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Annex 1: Legislation, Policy and Guidance

The assessment was performed using the London Docklands Development Corporation (LDDC) variant of the Lawson Comfort Criteria. The Lawson Criteria are well-established in the UK for quantifying wind conditions in relation to build developments and, although not a UK 'standard', the criteria are recognised by local authorities as a suitable benchmark for wind assessments. The LDDC variant is established as the most practically applicable variant of the Lawson criteria, and is used industry wide. The Lawson Criteria (LDDC variant) have been adopted for this assessment.

The assessment will have due regard to the provisions of the following policy and guidance.

National Planning Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was revised in February 2019 by the Department of Communities and Local Government (DCLG). The relevant paragraphs are as follows:

Paragraph 127 of the National Planning Policy Framework states that:

“Planning policies and decisions should ensure that developments:

- will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;
- are visually attractive as a result of good architecture, layout and appropriate and effective landscaping;
- are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities);
- establish or maintain a strong sense of place, using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit;
- optimise the potential of the site to accommodate and sustain an appropriate amount and mix of development (including green and other public space) and support local facilities and transport networks; and
- create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion and resilience.”

There is no specific planning policy guidance dealing with microclimate in terms of pedestrian comfort set out in the revised NPPF.

Planning Practice Guidance (2021)

The Department for Communities and Local Government (DCLG) Planning Practice Guidance (2021) identifies the potential for tall and large buildings to affect wind microclimate. The National Design Guide (2021) states in Paragraph 71 that: “Proposals for tall buildings (and other buildings with a significantly larger scale or bulk than their surroundings) require special consideration. This includes their [...] environmental impacts, such as [...] wind. These need to be resolved satisfactorily”

Local Planning Policy

Gravesham Local Plan (2014)

The Gravesham Local Plan was adopted in September 2014 by Gravesham Borough Council. Although there is no specific guidance dealing with microclimate within the Gravesham Local Plan, Policy CS19: Development and Design Principles states:

“New development will ... ensure that public realm and open spaces are well planned, appropriately detailed and maintained so they endure”

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Annex 2: Computational Fluid Dynamics Methodology

he CFD was performed using OpenFOAM.

Meshed using a hybrid mesh of hexahedral, polyhedral, tetrahedral and prismatic elements:

- On site building edge length: 0.05m - 0.25m
- Surrounding context edge length: 0.25m - 1m

Prismatic cells were used in the boundary layer region, with 4 layers of cells growing with an expansion ratio of 1.15 and aspect ratios between 0.1 and 0.4.

The total mesh size was between 109 and 159 million cells.

Buildings within 600m of the site were included.

The domain was 5000mx5000m, with a blockage ratio of 0.5%

The blockage ratio uses a “test section” of 600mx200m (within which detail is captured).

Run using the SST turbulence model with high Re wall functions to ensure mesh suitability.

The simulations were steady state and isothermal.

2nd order discretisation schemes were used.

Convergence was measured as the residuals of the continuity, x-velocity, y-velocity, z-velocity, k and omega equations all falling by at least 2 orders of magnitude, and by measured static pressure on the site buildings varying by less than 1% over the final 100 iterations.

The wind speed is corrected into a “gust-equivalent” mean. The gust-equivalent mean is calculated using an empirical relationship between the gust and mean ratios recorded at over 13,000 data points from wind tunnel tests. This method is found to give a significant correlation improvement over the more traditional methods based on the CFD turbulent kinetic energy field.

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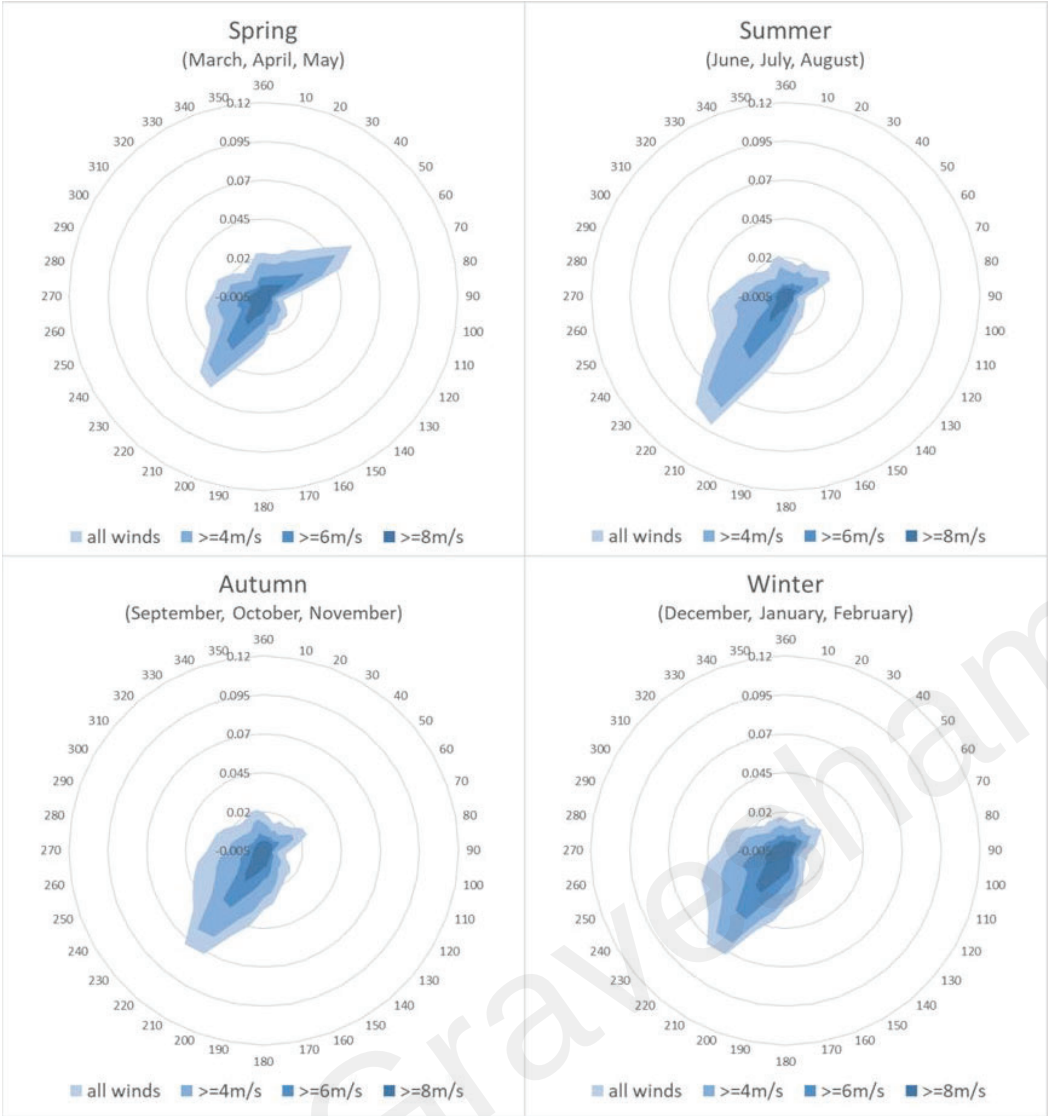
Annex 3: Wind Climate Methodology

The simulations were performed from 18 wind directions, spaced such that no single direction contributed more than 10% of the annual winds.

The directions tested were 0°,30°,60°,90°,120°,150°,180°,200°,210°,220°,230°,240°, 250°, 260°, 270°, 280°, 300°, 330°.

30 years of weather data for Biggin Hill Airport was obtained, and was used for this study. seasonal wind roses for this data are shown in Figure 1.

Figure 1 Seasonal Wind Roses for Biggin Hill (1990-2020)



Target wind profiles for the site, from each wind direction, were generated using sectoral analysis of the terrain surrounding the site with ESDU 2010 Item01008 'Computer program for wind speeds and turbulent properties: flat or hilly sites in terrain with roughness changes'. The target wind profiles, compared to the wind speeds and turbulence intensities measured from the wind tunnel are shown in Figure 2.

Figure 2 Wind Profiles for Northfleet

