

Capital City College Group
The College of Haringey, Enfield and North
East London

Tottenham Campus Microclimate Analysis

February 2024



Notice

This report was produced by AtkinsRealis for Capital City College Group (CCCG) for the specific purpose of report on The College of Haringey, Enfield and North East London, Tottenham Site. This report may not be used by any person other than the Client without AtkinsRealis express permission. In any event, AtkinsRealis accepts no liability for any costs, liabilities or losses arising as a result of the use or reliance upon the contents of this report by any person other than the Client.

JOB NUMBER: 5219901 | DOCUMENT REF: The College of Haringey, Enfield and North East London, Tottenham Campus - Design and Access Statement

Revision	Status	Originated	Checked	Reviewed	Authorised	Date
P1	Issued for Planning	AB	AS	JR	JR	07/02/2024





01

Introduction & Methodology

01.01 Microclimate Introduction

Microclimate analysis in urban environments is performed to understand and mitigate adverse effects of local weather in neighbourhoods, public spaces and across cities. Data driven simulations and analysis inform sustainable urban design to help create comfortable and successful places that people can and want to use. Understanding the relationship between buildings, the surrounding context and the micro-climate is central to the development and design of successful places that support human wellbeing, comfort, and enjoyment.

Urban microclimate analysis has a multi-fold purpose:

- Identifies levels of comfort (or discomfort) for the users.
- Helps maximising use of public spaces.
- Informs the design of such spaces by providing evidence data to guide design solutions, i.e., provide more shade from sun, shelter from wind, etc., and helping mitigate Urban Heat Island (UHI) effects.
- Helps in creating urban fabrics that are more resilient to climate change, induced events, i.e., protects more from heatwaves, etc.
- Potentially, helps in reducing building energy demand using more climate sympathetic massing arrangements and, by consequence, can help reducing demand on primary resources.

The level of adaptation is influenced by physical, physiological, and psychological human responses, which differ from one person to another. The mitigation of the UHI could contribute to an improvement of the outdoor quality of spaces, and hence, the indoor quality of spaces. An overall improvement in urban geometry, materials and greenery could modify the thermal comfort conditions in the urban space, which will lead to reduction of cooling loads during the warm period, and in turn less heat released in the environment.



The College of Haringey, Tottenham site Ownership Boundary Line

01.02 Methodology: Solar Radiation & Sunlight Hours

A 3D model for the proposed development has been prepared to undertake shading analysis. The model has been prepared using Rhino and assessed in Grasshopper for the shading analysis. The chosen areas are representative of a variety of boundary conditions, building orientations and space typologies. Simulations of sunlight hours, wind speed, wind comfort and thermal comfort were conducted. The methodology is outlined in the following sections.

Solar radiation and sunlight hour calculations are assessed using simulation software for the four key periods. Sunlight hour calculations are based on the sun's daily position on the equinox and the summer solstice. Solar radiation calculations were performed at a monthly resolution.

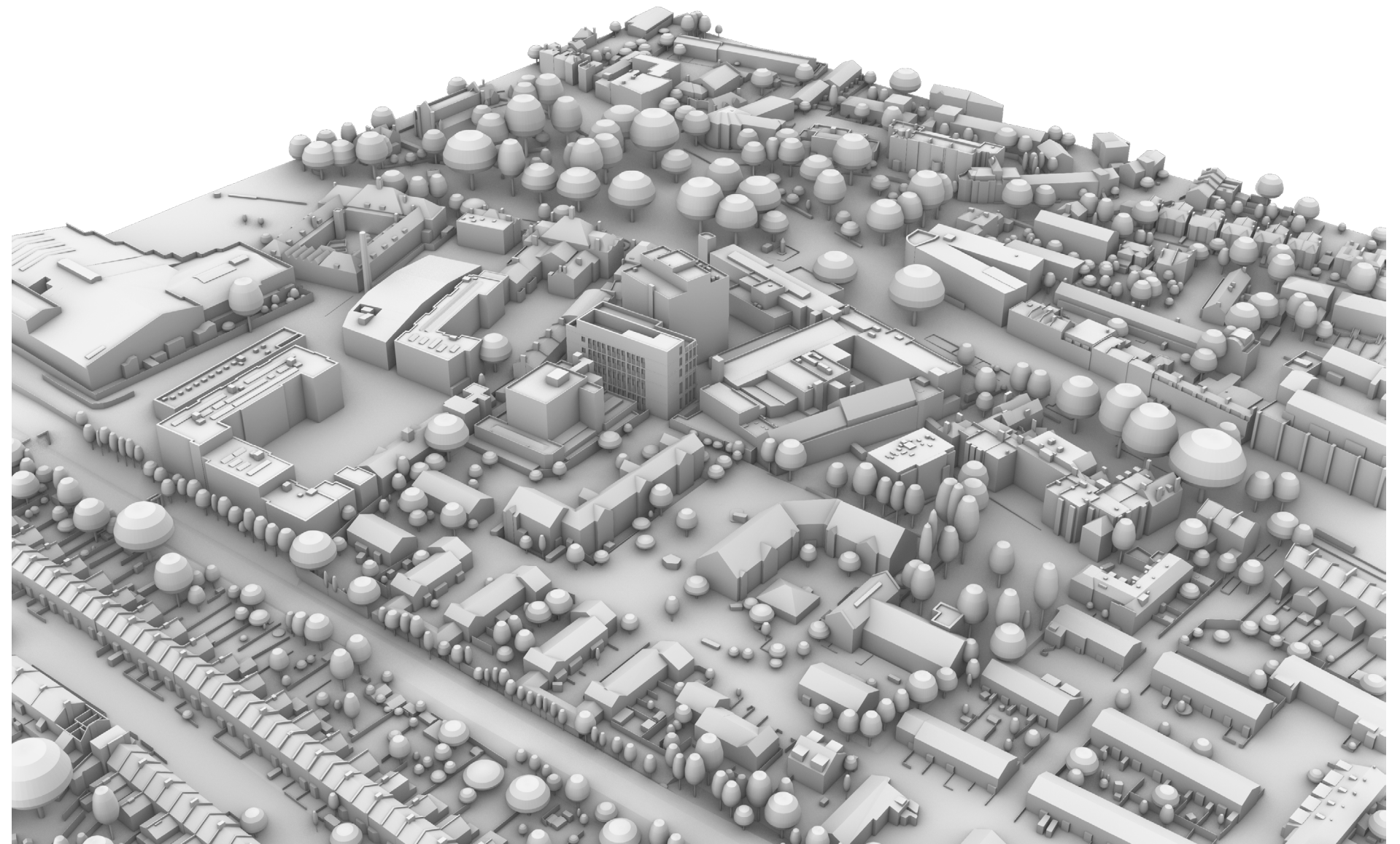
Simulations were carried out on the proposed scenario for the following periods:

- Equinox: the time at which the sun crosses the celestial equator when day and night are of equal length (22nd September and 20th March).
- Summer Solstice: when the sun reaches its highest position in the sky and the day with the longest period of daylight (21st June).
- Winter Solstice: when the sun reaches its lowest position in the sky and the day with the shorter period of daylight (22nd December).
- Summer period : the month of June between 8 am and 4pm
- Winter period : the month of December between 8 am and 4pm
- Spring period : the month of March between 8 am and 4pm

The surface area identified for analysis is divided using a 1 metre grid, aligned to the human scale. The identified surfaces is prepared and assessed in relation to the local sun angles as extracted from the available local weather file.

Solar radiation is measured in units of power, watts per square meter (Kwh/ m2). The shading assessment identifies areas that are protected from direct solar radiation.

As for the sunlight hour assesment it is represented as the number of hours a particular point receives direct sunlight.



An image representing the model used for the assessments

01.03 Methodology: Wind Computational Fluid Dynamics

Wind conditions for the proposal have been determined by assessing the available local weather data within the Simscale platform. The weather data do not reproduce all local weather effects, such as thunderstorms and local winds, which are out of the scope of this current assessment. The weather data set used for this assessment included 16 different wind directions. This number has been deemed to be appropriate for the purposes of this study as this approach is typically used in developments of this size and complexity. Therefore, simulations are expected to provide minimal or no variation in the results if performed using additional wind directions.

Wind can create both positive and negative comfort conditions, as it can enhance thermal comfort during extreme / high temperatures, while it can also decrease pedestrian comfort if it is too strong. However, the level of comfort is dependent on the types of activities performed, for example, higher wind speeds are generally tolerated for active spaces, such as walkways, cycle lanes, etc., while lower ones are comfortable for spaces allocated for sitting and resting.

The wind analysis presented in this report has been carried out using Computational Fluid Dynamics (CFD), and the Simscale platform has been used to perform the simulations.

Transient simulations have been conducted using LBM (Lattice Boltzmann Method) and the k-w Shear Stress Transport (SST) turbulence model.

Geometry

A 3D model for the proposed development has been prepared using Rhino and imported into the Simscale platform for the analysis. For the purpose of the modelling, the geometry of the

surrounding buildings are simplified, to reflect the massing and height of the building envelopes, excluding terraces, windows, and other facades elements however the proposed building envelope and façade details were included. Landscaping elements of the wider site have been included. The trees have been considered in the assessment and in the findings of the pedestrian comfort. Where they are set with porous properties to reflect the tree porosity.

Assessment Criteria

Comfort

Wind comfort, and the criterion used to evaluate this perception, is based upon numerical concepts to capture how people feel in different wind conditions, at varying activity levels. To test and determine the level of pedestrian wind comfort in an urban area, many standards exist to aid assessment of predicted comfort conditions for the built environment.

For the purposes of this study, wind conditions have been evaluated against the widely used Lawson Comfort Criteria. Those criteria, named after the researcher T.V Lawson and originally published in 1978, are a series of comfort criteria categories that quantify the worst wind conditions that most pedestrians will consider acceptable in performing specific activities. Wind speeds are measured at 1.5 m above ground level.

The Lawson criteria set threshold wind speeds, and then dictate the probability of wind speeds exceeding that threshold, which is 5% of the time considered.

The most famous of the Lawson criteria, is the LDDC (London Docklands Development Corporation) method, Wind Comfort Criteria, which has been used for this current assessment and detailed in Table1 below.

Lawson LDDC Wind Comfort Criteria				
Category		Wind speed	Fulfilment value	Activity
	A	>2.5 m/s	<5%	Frequent Sitting
	B	>4 m/s	<5%	Occasional Sitting
	C	>6 m/s	<5%	Standing
	D	>8 m/s	<5%	Walking
	E	>8 m/s	>5%	Uncomfortable
	S	>15 m/s	>0.022%	Unsafe

The list below provides a guidance on the different activities and associated acceptable wind conditions:

- A/B - Sitting – Light breeze for outdoor seating areas, where reading a paper or sitting for long periods is comfortable.
- C - Standing – Gentle breeze acceptable for main building entrances, pick up / drop off points and bus stops.
- D - Strolling – Breeze that are acceptable for strolling along a city street, park, or window shopping.
- D - Business Walking / Cycling – High wind speeds that would be uncomfortable for above three categories but can be tolerated if walking with purpose to a destination or cycling.
- E - Uncomfortable – Strong winds considered a nuisance for most activities. Wind mitigation measures need to be implemented for areas with an uncomfortable rating.

01.04 Methodology: Thermal Comfort

Modelling Limitations

The analysis reported in this document uses CFD models to simulate the likely wind speeds under a variety of wind conditions, for comparison against the London Docklands Development Corporation (LDDC) Lawson comfort criteria.

CFD is widely used for this purpose, however, it is important to note that modelling results of physical phenomena have uncertainty and therefore are not intended to provide an exact representation of the real-life performance, as necessary simplifications and assumptions are made. This current Pedestrian Wind Comfort assessment considers general use patterns (i.e., sitting, standing, strolling, and walking) in accordance with the Lawson criteria and therefore some more detailed effects have not been considered at this stage:

- Specialised activities (e.g., sailing, aviation, sports, particle transport, fire safety, etc.)
- Structural effects, resonance calculations, fluid-structure interactions, and acoustic effects
- Ventilation of internal spaces, wind gusting, urban heat island effects and pollutant tracking
- Wind effects during construction phases

U.T.C.I

UTCI is a thermal comfort model for the outdoors. It is an international standard for outdoor temperature sensation (aka. “feels-like” temperature) and is one of the most common of such “feels-like” temperatures used by meteorologists. Universal Thermal Comfort Index (UTCI) takes into account the mean radiant temperature, relative humidity, and wind speed. UTCI uses these variables in a human energy balance model to give a temperature value that is indicative of the heat stress or cold stress felt by a human body in the outdoors.

Calculate Universal Thermal Climate Index (UTCI).

A 3D model for the baseline proposed development has been prepared using Rhino and assessed in Grasshopper for the thermal comfort analysis. The wind analysis results from the Simscales platform were imported into Grasshopper and assessed accordingly.

While UTCI is designed to be valid in all climates and seasons, it assumes that human subjects are walking (with a metabolic rate around 2.4 met) and that they naturally adapt their clothing with the outdoor temperature.

The parameters used to calculate UTCI include air temperature, mean radiant temperature, relative humidity, and wind speed. UTCI uses these variables in a human energy balance model to give a temperature value that is indicative of the heat stress or cold stress felt by a human body in the outdoors.

The Mean Radiant Temperature (MRT) is a result of outdoor shortwave solar shining directly onto people as well as longwave radiant exchange with the sky. This parameter is calculated using the SolarCal model of ASHRAE-55 to estimate the effects of shortwave solar and a simple sky exposure method to determine longwave radiant exchange.

The wind speeds are obtained from the CFD simulation run on Simscales platform and are then normalised using the local epw file (weather data) depending on the period of assessment (summer, spring or winter). The wind pattern and direction used is based on the prevailing wind of the specified period.

UTCI (°C) range	Stress Category
above +46	extreme heat stress
+38 to +46	very strong heat stress
+32 to +38	strong heat stress
+26 to +32	moderate heat stress
+9 to +26	no thermal stress
+9 to 0	slight cold stress
0 to -13	moderate cold stress
-13 to -27	strong cold stress
-27 to -40	very strong cold stress
below -40	extreme cold stress

Universal Thermal Climate Index categorisation