Appendix: Wind Microclimate

Annex 1: Legislative and Planning Policy Context
Annex 2: Wind Microclimate Technical Report

Appendix: Wind Microclimate

Annex 1: Legislation and Planning Policy Context

Annex 2: Wind Microclimate Technical Report

Legislation and Planning Policy Context

National Legislation

1.1 There is no legislation direction relating to wind microclimate issues relevant to the Proposed Development.

National Planning Policy

National Planning Policy Framework (2021)

1.2 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. It states that the purpose of the planning system is to contribute to the achievement of sustainable development; and that the planning system must meet interdependent overarching objectives summarised as: an economic objective, a social objective and an environmental objective.

1.3 There are no policies or statements that are directly related to the wind microclimate, although the promotion of high-quality built environments was emphasised in the NPPF. For instance, paragraph 8 describes environmental objectives for sustainable development:

c) "[…] to protect and enhance our natural, built and historic environment […] and mitigating and adapting to climate change".

1.4 Additionally, paragraph 130 states the following:

"f) 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".

National Planning Practice Guidance (2021)

1.5 The NPPG[1] was published in November 2016 to support the NPPF and was updated in 2021. There is no guidance within the PPG related to tall buildings and wind microclimate issues.

Regional Planning Policy

The London Plan 2021 – The Spatial Development Strategy for Greater London

1.6 The London Plan 2021[2] is the Spatial Development Strategy for Greater London. It places importance on the creation and maintenance of a high-quality environment for London.

1.7 Policy D3 Optimising site capacity through the design-led approach (Para 3.3.8), states that:

"Buildings […] massing, scale and layout […] should complement the existing streetscape and surrounding area. Particular attention should be paid to the design of the parts of a building or public realm that people most frequently see or interact with in terms of its legibility, use, detailing, materials and location of entrances. Creating a comfortable pedestrian environment with regard to levels of […] wind".

1.8 Policy D8 Public realm, Development Plans and development proposals should, states that:

"Consideration should also be given to the local microclimate created by buildings, and the impact of service entrances and facades on the public realm."

"Ensure that appropriate shade, shelter, seating […] with other microclimatic considerations, including temperature and wind, taken into account in order to encourage people to spend time in a place."

1.9 Policy D9 Tall buildings: Environmental impact, states that:

"Wind […] around the building(s) and neighbourhood must be carefully considered and not compromise comfort and the enjoyment of open spaces, including water spaces, around the building";

"Air movement affected by the building(s) should […] not adversely affect street-level conditions".

1.10 Policy D9 Tall buildings: Cumulative impacts, states that:

"The cumulative visual, functional and environmental impacts of proposed, consented and planned tall buildings in an area must be considered when assessing tall building proposals and when developing plans for an area. Mitigation measures should be identified and designed into the building as integral features from the outset to avoid retro-fitting."

Shaping Neighbourhoods: Play and Informal Recreation SPG (2012)

1.11 Section 4.48 (under Step B5: What types of play space should be provided and how should existing play provision be improved?) of this SPG[3] references wind microclimate:

"Playable spaces should be properly integrated into new development and the existing context […] If […] windy spaces are utilised; they should be made worthy through innovative design."

Local Planning Policy

Southwark Core Strategy (2011)

1.12 The Southwark Core Strategy was adopted in 2011[4] "to ensure developments create attractive and distinctive places" and "provide guidance for the height and scale of developments" within the borough. The following paragraph of Section 5 is of relevance to assessment of the wind microclimate:

1.13 Section 5.112 states that:

"*The height and scale of development is an important consideration in creating attractive and distinctive places. English Heritage and CABE have produced guidance on tall buildings, which has been endorsed by the Government. This advises that in the right place tall buildings can make positive contributions to places […] However they need to be well designed so that they do not […] create wind tunnels"*.

New Southwark Plan Submission Version – Proposed Modifications for Examination 2019 to 2033

1.14 The new Southwark Plan[5] is being developed "To improve and protect all the different areas within Southwark borough" and "sets out to guide any new developments".

1.15 Policy P12, Design quality, states that:

"Development must provide:

1.3. […] a comfortable microclimate […];

1.10. A positive pedestrian experience".

1.16 Policy P12, Reasons, states that:

"Sustainable design must reduce […] creation of adverse local climatic conditions (e.g. wind shear)."

1.17 Policy P14, Tall Buildings, states that:

"The design of tall buildings will be required to:

2.7. Avoid harmful and uncomfortable environmental impacts including wind shear […];

2.9. Have a positive relationship with the public realm […] and create a positive pedestrian experience".

1.18 Policy P14, Reasons, states that:

"However, tall buildings can […] harm the setting of historic buildings and cause unpleasant environmental effects, especially on the location's micro-climate."

[1] Department for Communities and Local Government, 2021. Revised National Planning Policy Framework. London. HMSO.
[2] Greater London Authority, (2021), The London Plan, Spatial Development Strategy for Greater London, Greater London Authority, London
[3] Mayor of London (2012), Shaping Neighbourhoods; Play and Informal Recreation SPG (September 2012)
[4] London Borough of Southwark, (2011). Core strategy. London. LBS
[5] London Borough of Southwark, (2020). New Southwark Plan Submission Version. London. LBS

Other Relevant Policy, Standards and Guidance

1.19 The Historic England Advice Note 4: Tall Buildings (2015)[6] recommends that the following should be addressed in relation to tall buildings in Section 4.7: “Planning applications for tall buildings are likely to require an environmental impact assessment (EIA), which would be expected to address matters in respect of both the proposed building and its cumulative impact, including: […] e. Other relevant environmental issues, particularly sustainability and environmental performance, eg the street level wind environment.”

[6] CABE (2015); Guidance on Tall Buildings

Appendix: Wind Microclimate

Annex 1: Legislation and Planning Policy Context

Annex 2: Wind Microclimate Technical Report

VINEGAR YARD

LONDON, UK

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT
RWDI #2100866
DECEMBER 4TH, 2020

SUBMITTED TO

Lucy turner
Consultant
Lucy.Turner@triumenv.co.uk

Trium Environmental Consulting LLP
7 Bemondsey Street
London
SE1 2DD
T: +44 (0)20 3887 7118

SUBMITTED BY

Edoardo Nicolini
Project Engineer
Edoardo.Nicolini@rwdi.com

Krishan Jayyaratnam
Engineering Team Leader
Krishan.Jayyaratnam@rwdi.com

Stefan Astley
Senior Project Manager
Stefan.Astley@rwdi.com

RWDI
Unit 1 Tilers Road
Milton Keynes
MK11 3LH
T: +44 (0)1908 776970

TABLE OF CONTENTS

VERSION HISTORY

RWDI Project #2100866	Vinegar Yard London, UK	
Report	**Releases**	**Dated**
Reports	Rev A	4th December, 2020
Project Team	Edoardo Nicolini	Project Engineer
	Krishan Jayyaratnam	Engineering Team Leader
	Stefan Astley	Senior Project Manager

1 INTRODUCTION

RWDI was retained by Trium Environmental Consulting LLP to conduct a pedestrian level wind microclimate (PLW) assessment for the proposed Vinegar Yard development (hereafter referred to as the 'Proposed Development') in the London, UK. This report presents the methodology employed by RWDI.

Wind tunnel tests were conducted on a 1:300 scale model of the Proposed Development. The investigation quantifies the wind conditions within and around the Site through comparison of the measured wind velocity and frequency of occurrence with the Lawson Comfort Criteria. Meteorological data for London, UK has been combined, analysed and adjusted to the Site conditions by modelling the effect of upstream terrain roughness on the wind velocities approaching the Site.

Throughout all the test configurations, measurements were taken at up to 168 locations for 36 wind directions, in 10° increments. The measurements covered locations along the building façades, at corners, near main entrances, around outdoor seating areas and amenity spaces, on pedestrian routes within and around the Site. The measurements were taken along the ground level as well as on terraces, roofs and balconies. The analyses were conducted on seasonal basis, however, the report focuses primarily on the windiest season (typically winter) and the summer season results, when pedestrian activity generally requires calmer conditions.

The following list details the configurations tested in the wind tunnel:

- Configuration 1: The Existing Site with Existing Surrounding Buildings (the Baseline Condition);
- Configuration 2: Proposed Development with Existing Surrounding Buildings;
- Configuration 3: Proposed Development with Existing Surrounding Buildings and Capital House;
- Configuration 4: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme;
- Configuration 5: Proposed Development with Cumulative Surrounding Buildings, Capital House, The Edge, and Sellar Scheme; and
- Configuration 6: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme, with developed Mitigation and Proposed Landscaping.

2 METHODOLOGY AND ASSESSMENT CRITERIA

Wind tunnel testing is a well-established and robust technique to assess the pedestrian wind microclimate of the Proposed Development. It provides the means to quantify the wind conditions at the Site and for the measurements to be classified in accordance with the Lawson Comfort Criteria (outlined in Sections 2.5 and 2.7). Wind tunnel investigations were conducted using a 1:300 scale model of the Proposed Development with existing surrounding buildings and terrain covering a radius of 360m centred on the Site.

The basic methodology for quantifying the pedestrian level environment is outlined below:

1. Measure the wind speeds at pedestrian level in the wind tunnel relative to a reference wind speed;
2. Adjust standard meteorological data to account for conditions at the Site;
3. Combine these to obtain the expected frequency and magnitude of wind velocities at pedestrian level; and
4. Compare the results with the Criteria to 'grade' conditions around the Site.

2.1 Simulation of Atmospheric Winds

The wind is turbulent, or gusty, and this turbulence varies depending upon the Site. It is necessary to reflect these differences in the wind tunnel test. In addition, the atmospheric boundary layer is a shear flow which means that the mean wind speed increases with height.

Modelling these effects is achieved by a combination of spires and floor roughness elements to create a naturally grown boundary layer that is representative of urban or open country conditions, as appropriate. The detailed proximity model around the Site is used to fine-tune the flow and create similar conditions to those expected at full scale (as shown in **Error! Reference source not found.**).

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT
VINEGAR YARD

RWDI #2100866
December 4th, 2020

Figure 1: Image of Proposed Development with Existing Surrounding Buildings Capital House, The Edge, and Sellar Scheme (View in the wind tunnel from south)

2.2 Measurement Technique

Wind speed measurements were made using Irwin probes. For pedestrian comfort studies, both the mean wind speed and the peak wind speed are measured at each location at a scaled height of 1.5m above ground level. The typical equivalent full-scale time period for measuring the mean wind speed is around 90 minutes, whereas the peak wind speed is taken as the wind speed exceeded for 1% of the time.

Wind speeds at each location were measured for 36 wind directions in 10° intervals, with 0° representing a wind blowing from the north and 90° a wind blowing from the east.

2.3 Scaling

The length scale of the model was 1:300 and the velocity scale was approximately 1:2 for strong winds. Consequently, the time scale for the tests was 1:150, or in other words 1 second in the wind tunnel is equivalent to 150 seconds at full scale. The sampling frequency for the data acquisition equipment is therefore adjusted for the time scale.

2.4 Meteorological Data

Approximately thirty years' worth of data were obtained from London Heathrow Airport and London City Airport. The combined meteorological data were categorised by season as demonstrated in Figure 1 as wind roses. The radial axis indicates the percentage hours per season that the wind speed exceeds each velocity range. The seasons are defined as spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February).

The meteorological data obtained for London indicates that the prevailing wind throughout the year is from the south-west (i.e. 210 to 240 degrees on the compass). This is typical for many areas of southern England. There is a secondary peak from the north-east during the late spring and early summer. The winds from the north-east are not as strong as the prevailing winds from the south-west.

The combination of meteorological data and velocity ratios permits the percentage of time that wind speeds are exceeded on the Site to be evaluated. The locations can then be assessed using 'comfort criteria', as described below.

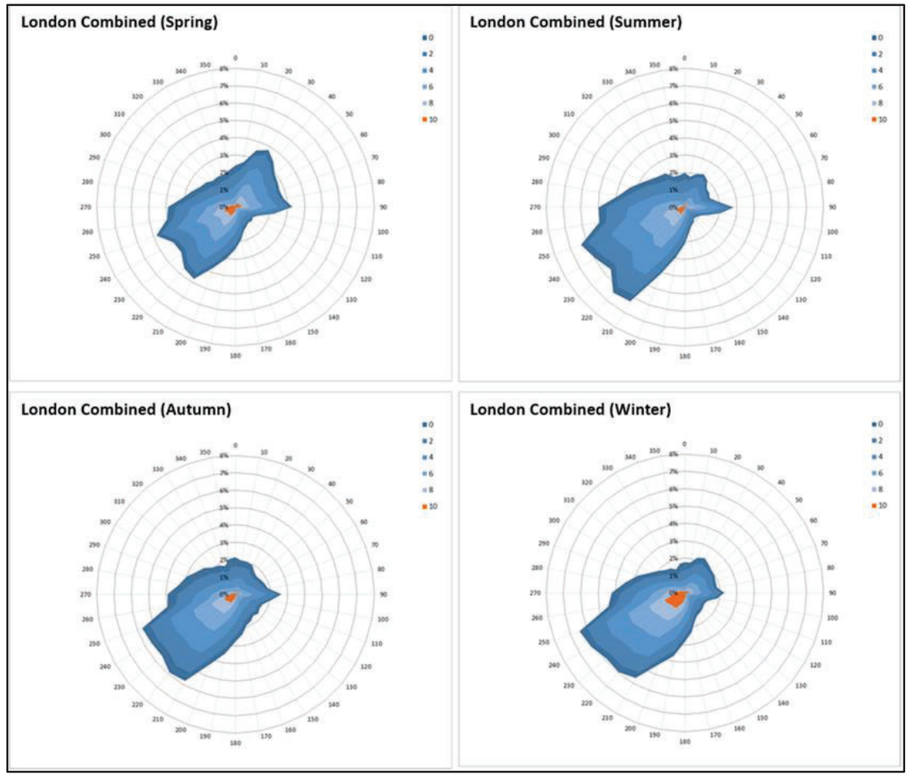

Figure 1: Seasonal Wind Rose for London (combined data for Heathrow and London City Airports over a period of 30 years

2.5 Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the measurements can be compared. This report uses the Lawson Comfort Criteria, which have been established for over thirty years. The Criteria, which seek to define the reaction of an average pedestrian to the wind, are described in Table 1. If the measured wind conditions exceed the threshold for more than 5% of the time, then they 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 sets out four pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The four categories are sitting, standing, strolling and walking, in ascending order of activity level, with a fifth category for conditions that are uncomfortable for all uses. 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 strolling and walking is that in the strolling scenario pedestrians are more likely to take on a leisurely pace, with the intention of taking time to move through an area, whereas in the walking scenario pedestrians are intending to move through the area quickly and are therefore expected to be more tolerant of stronger winds.

The Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season. Thermal comfort is discussed with reference to acceptable wind environments but not evaluated as part of the assessment.

The coloured key in Table 1 corresponds to the presentation of wind tunnel test results described within the 'Baseline conditions' and 'Potential effects' sections of this chapter.

Table 1: Lawson Comfort Criteria

Key	Comfort Category	Threshold	Description
	Sitting	0-4 m/s	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods
	Standing	4-6 m/s	Gentle breezes acceptable for main building entrances, pick-up/drop-off points and bus stops
	Strolling	6-8 m/s	Moderate breezes that would be appropriate for strolling along a city/town street, plaza or park
	Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
	Uncomfortable	> 10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

2.6 Desired Pedestrian Activity around the Proposed Development

The wind conditions are compared with the intended pedestrian use. With respect to the site itself, sensitive receptors include the following locations (where present on the Proposed Development), with the required wind conditions specified for each use:

- Strolling during the windiest season on pedestrian thoroughfares;
- Standing conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year;
- Standing conditions at private balconies where seating is not designated during the summer season; and
- Sitting conditions at outdoor seating during the summer season when these areas are more likely to be frequently used by pedestrians.

The walking and uncomfortable classifications are usually avoided because of their association with occasional strong winds, unless they are on a minor pedestrian route or a route where pedestrian access could be controlled in the event of strong winds.

At back of house entrances, maintenance entrances or fire escapes, strolling wind conditions would be tolerable.

In some circumstances, for a mixed-use amenity space such as an outdoor gym area or play space, a mix of sitting and standing wind conditions would be deemed acceptable; however, if any seating was situated within this space, they would have to be restricted to areas having sitting wind conditions.

For a large terrace space, a mix of standing and sitting wind conditions is acceptable provided that any desired seating areas are situated in areas having sitting wind conditions.

Achieving a sitting classification in the summer usually means that the same location would be acceptable for standing in the windiest season because winds are stronger at this time. This is considered an acceptable occurrence for the majority of external amenity spaces because other factors such as air temperature and precipitation influence people's perceptions about the 'need' to use seating in the middle of winter.

Table and 3 summarise the expected usage of each probe location in Configuration 1 (baseline scenario) as well as in Configurations 2-6 with the Proposed Development in place.

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT
VINEGAR YARD

RWDI #2100866
December 4th, 2020

Table 2: Expected Receptor Usage in Configuration 1.

Receptor (and associated target wind conditions)	Measurement Locations
Pedestrian Thoroughfares (Windiest)	On-Site: 29, 57, 67-69, 74, 76,79-82, 84, 86, 88-99, 101-103, 105, 106, 109-117, 119, 121, 123, 124, 130, 131, 134, 151, and 152 Off-Site: 6-10, 13, 15, 16, 18, 32, 37, 46, 47, 49-55, 59, 62-65, 71, 73, 87, 120, 121, 157, 147, 148, and 150
Crossings (Windiest)	On-Site: N/A Off-Site: 2, 28, 33, and 34
Entrances (Windiest)	On-Site: N/A Off-Site: 1, 12, 35, 44, and 45
Roadway (Windiest)	On-Site: N/A Off-Site: 5, 11, 14, 17, 19, 20-25, 27, 30, 31, 36, 38, 39, 41, 43, 56, 58, 60, 66, 77, 83, 85, 107, 118, 122, and 150
Ground Floor Amenity (Summer)	On-Site: N/A Off-Site: 48

Table 3: Expected Receptor Usage in Configurations 2-6.

Receptor (and associated target wind conditions)	Measurement Locations
Pedestrian Thoroughfares (Windiest)	On-Site: 29, 57, 67-69, 74, 76,79-82, 84, 86, 88-99, 101-103, 105, 106, 109-117, 119, 121, 123, 124, 130, 131, 134, 151, and 152 Off-Site: 6-10, 13, 15, 16, 18, 32, 37, 46, 47, 49-55, 59, 62-65, 71, 73, 87, 120, 121, 157, 147, 148, and 150
Crossings (Windiest)	On-Site: N/A Off-Site: 2, 28, 33, and 34
Entrances (Windiest)	On-Site: 69, 72, 75, 100, 104, and 133 Off-Site: 1, 12, 35, 44, 45 (3, 4, 138-144 entrances to Capital House) (40, 42, 145, 146, and 149 entrances to the Sellar Scheme), 61, (135-138 entrances to the Edge)
Ground Floor Amenity (Summer)	48
Upper Level Amenity (Summer)	153-168
Roadway (Windiest)	On-Site: N/A

	Off-Site: 5, 11, 14, 17, 19, 20-25, 27, 30, 31, 36, 38, 39, 41, 43, 56, 58, 60, 66, 77, 83, 85, 107, 118, 122, and 150

2.7 Strong Winds

In addition, the criteria stipulate two strong wind threshold limits; when winds exceed 15m/s or 20m/s for more than 0.025% of the time (or 2.2 hours of the year). The lower limit, 15m/s, if exceeded may require remedial measures depending on the sensitivity of the location i.e. is it reasonable to expect an elderly or very young pedestrian to be present at the location? Wind speeds that exceed the 20m/s threshold for more than approximately 2.2 hours per year would represent a safety risk for all members of the population and would therefore require mitigation to provide an appropriate wind environment.

In the UK, strong winds are associated with areas which would be classified as walking or uncomfortable for pedestrian use. In a mixed-use, urban development scheme, walking or uncomfortable conditions would not usually form part of the 'target' wind environment and would usually require mitigation due to pedestrian comfort considerations. Mitigation applied to improve pedestrian comfort would also reduce the frequency of, or even eliminate, any strong winds. Table 4 summarises the probe locations that wind conditions exceed the safety threshold.

Table 4: Annual Exceedance of Strong Winds

Location	Strong Wind Exceedance	Main Wind Direction	Hours per Annum
Configuration 1: Existing Site with Existing Surrounding Buildings Error! Reference source not found.			
No instances of strong winds exceeding 15 m/s for more than 2.2 hours would occur in this configuration			
Configuration 2: Proposed Development with Existing Surrounding Buildings Error! Reference source not found.			
81	S15	230	9.2
107	S15	230	11.8
Configuration 3: Proposed Development with Existing Surrounding Buildings Error! Reference source not found.**and Capital House**			
3	S15	240	3.2
81	S15	220	11
107	S15	230	15.9
Configuration 4: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme			
81	S15	210	19.2
83	S15	210	5.4
85	S15	230	11.9
107	S15	230	32.4
Configuration 5: Proposed Development with Cumulative Surrounding Buildings, Capital House, The Edge, and Sellar Scheme Error! Reference source not found.			

81	S15	210	18.9
83	S15	210	5
85	S15	210	11.6
107	S15	230	31.4
Configuration 6: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme, with developed Mitigation and Proposed Landscaping			
No instances of strong winds exceeding 15 m/s for more than 2.2 hours would occur in this configuration			

APPENDICES

APPENDIX A: WIND TUNNEL PHOTOS

Figure 3: Existing Site with Existing Surrounding Buildings (Configuration 1) – View of the Model (from the south)

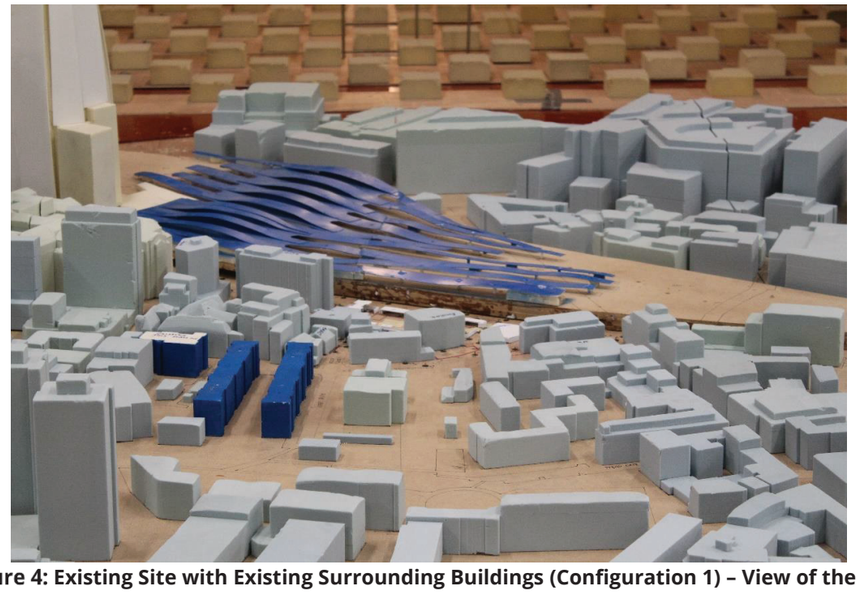

Figure 4: Existing Site with Existing Surrounding Buildings (Configuration 1) – View of the Model (from the south, close-up)

Figure 5: Proposed Development with Existing Surrounding Buildings (Configuration 2) – View of the Model (from the south)

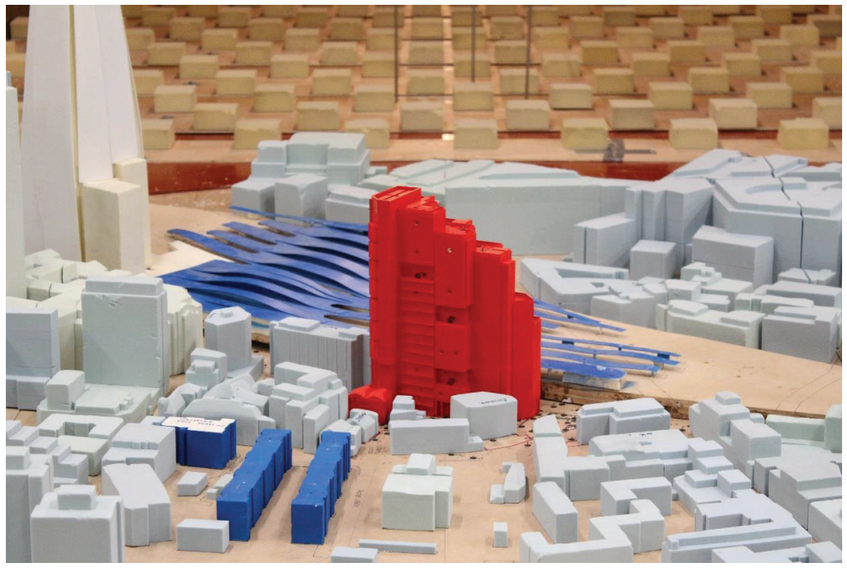

Figure 6: Proposed Development with Existing Surrounding Buildings (Configuration 2) – View of the Model (from the south, close-up)

Figure 7: Proposed Development with Existing Surrounding Buildings and Capital House (Configuration 3) – View of the Model (from the south)

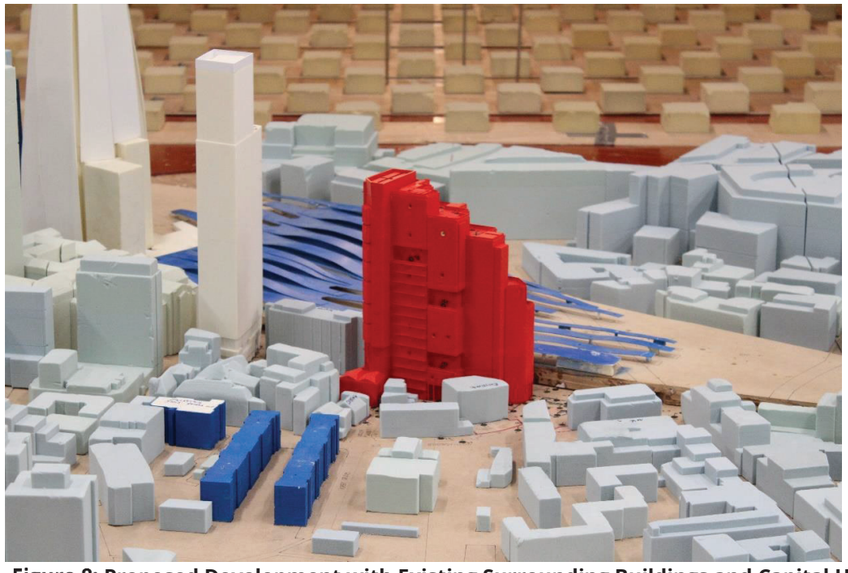

Figure 8: Proposed Development with Existing Surrounding Buildings and Capital House (Configuration 3) – View of the Model (from the south, close-up)

Figure 9: Proposed Development with Existing Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme (Configuration 4) – View of the Model (from the south)

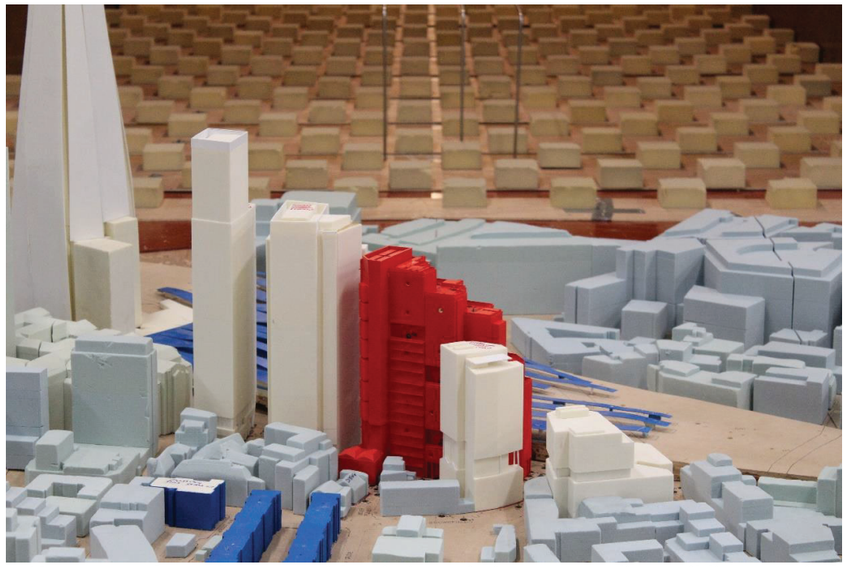

Figure 10: Proposed Development with Existing Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme (Configuration 4) – View of the Model (from the south, close-up)

Figure 11: Proposed Development with Cumulative Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme (Configuration 5) – View of the Model (from the south)

Figure 12: Proposed Development with Cumulative Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme (Configuration 5) – View of the Model (from the south, close-up)

Figure 13: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme, with developed Mitigation and Proposed Landscaping (Configuration 6) – View of the Model (from the south)

Figure 14: Proposed Development with Existing Surrounding Buildings, Capital House, The Edge, and Sellar Scheme, with developed Mitigation and Proposed Landscaping (Configuration 6) – View of the Model (from the south, close-up)

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT
VINEGAR YARD
RWDI #2100866
December 4th, 2020

APPENDIX B: MITIGATION MEASURES

Figure 15: Wind Mitigation Measures (Configuration 6)

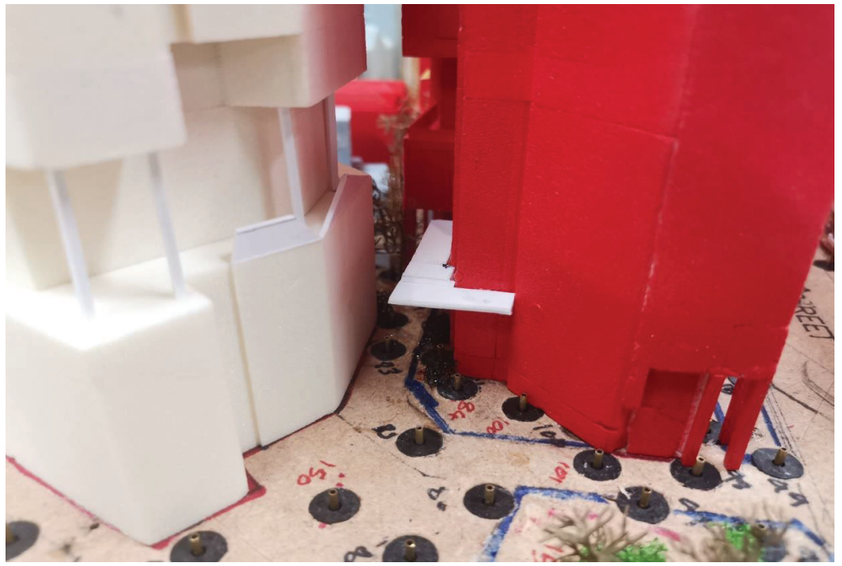

Figure 16: Wind Mitigation Measures (Configuration 6)

Figure 17: Wind Mitigation Measures (Configuration 6)

Figure 18: Wind Mitigation Measures (Configuration 6)

Figure 19: Wind Mitigation Measures (Configuration 6)

Figure 20: Wind Mitigation Measures (Configuration 6)

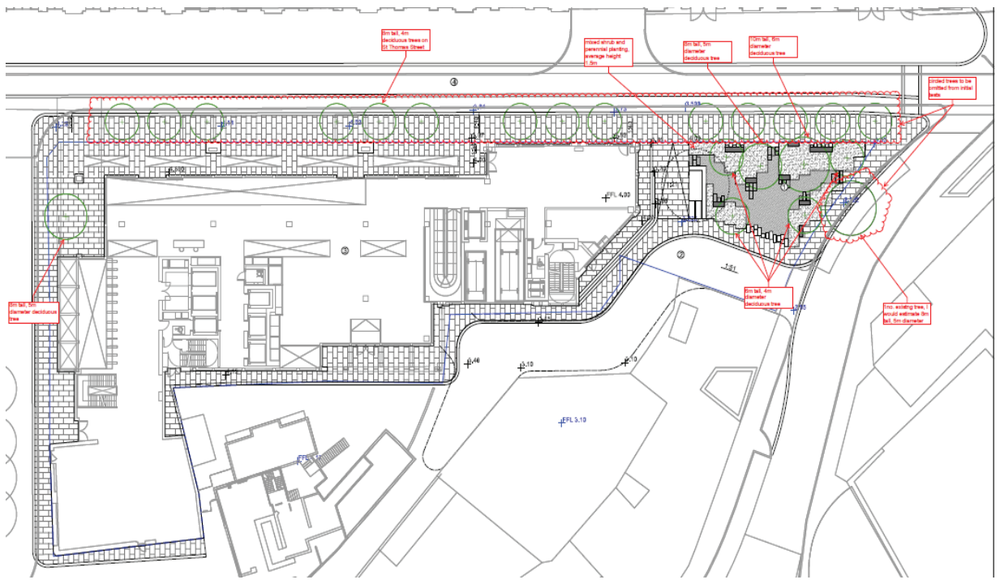

Figure 21: Proposed landscaping scheme (Configuration 6)

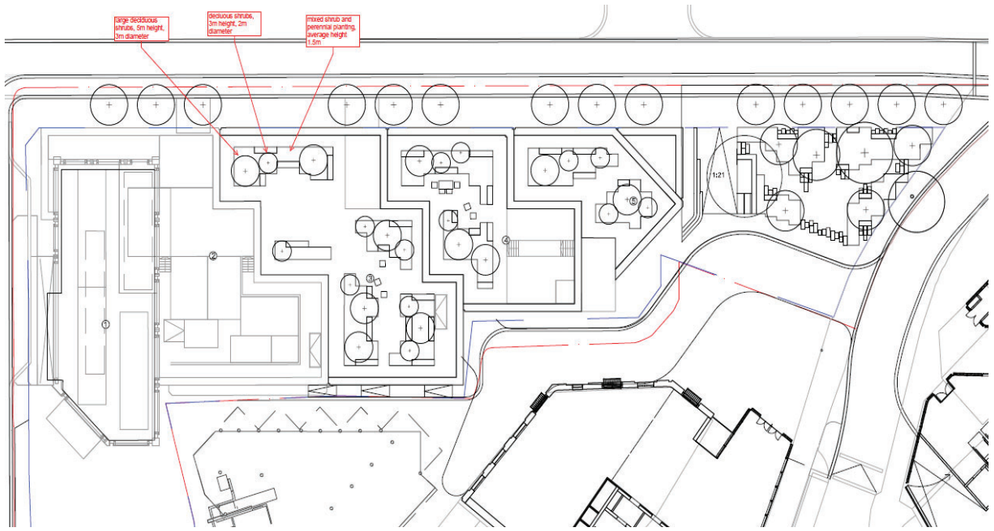

Figure 22: Proposed landscaping scheme (Configuration 6)