WIND AND MICROCLIMATE ANALYSIS REPORT

Ringers Road

Produced by XCO2 for Ringers Road Properties Ltd.

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EXECUTIVE SUMMARY

This report assesses the likely effects of the Ringers Road development on the local wind conditions. The analysis used Computational Fluid Dynamic (CFD) modelling to predict what effect the proposed development will have on wind conditions and relates the findings to industry standards on pedestrian comfort. The results are based on the local weather data details which are provided within this report.

PROPOSED DEVELOPMENT

The site is located between Ringers Road and Ethelbert Road in Bromley and includes the demolition of existing buildings and construction of a mixed-use development comprising residential units, ancillary residents' facilities (including co-working space) and commercial floor space (Use Class E) across two blocks, along with associated hard and soft landscaping, amenity spaces, cycle and refuse storage.

The microclimate analysis for the proposed development at Ringers Road incorporates the assessment of 52 receptor locations within the proposed scenario and the cumulative scenario, identified to be of interest in relation to the impact of the development. These receptors include a mix of doorway entrances, amenity spaces, main pedestrian routes as well as roads and car parks.

ENTRANCES

The wind conditions around the entrances to the existing and proposed properties are predicted to be suitable for their intended use and no adverse impacts have been identified.

AMENITY SPACES

Wind conditions assessed at the proposed and cumulative amenity spaces were mostly found to be suitable at ground level. One receptor was found to experience a minor adverse effect in an open park space. In reality, this will be mitigated due to planting surrounding the park which were not modelled in this assessment as a worst-case approach.

Elevated locations such as balconies experience adverse impacts relative to their intended, it is often unavoidable and anticipated in higher floors where there is higher wind exposure to have higher wind speeds.

MAIN PEDESTRIAN ROUTES

The wind conditions along the footpaths in close proximity to the proposed development are predicted to be suitable for their intended use and there have been no adverse impacts predicted.

ROAD/CAR PARKS

The wind conditions of the existing road/car park areas are predicted to be suitable for their intended use and there are no adverse impacts anticipated.

CUMULATIVE ASSESSMENT

A cumulative assessment was also carried out which included proposed developments within close proximity to the site that have received planning consent. This includes the proposed developments:

- S2 Estates (19/04588/FULL)
- Countryside Scheme (18/02181/FULL)
- Purelake Scheme (13/03345/FULL1)

The cumulative assessment included the potential buildings in order to take a worst-case approach in

relation to wind for the proposed scheme at Ringers Road.

The cumulative assessment indicates conditions slightly more beneficial to that in the proposed scenario.

CONCLUSION

The results of the wind assessment for the Ringers Road development indicates that no significant adverse effects are anticipated on the neighbouring areas in either the proposed or cumulative scenarios as a direct effect of the development scheme.

INTRODUCTION

This report considers the potential effect on pedestrian comfort with respect to wind. The analysis used Computational Fluid Dynamic (CFD) modelling to predict what effect the new building will have on wind conditions and relates the findings to industry standards on pedestrian comfort. The full results are presented at the end of this document.

OVERVIEW

This report outlines:

- The planning policy context in relation to the wind microclimate;
- The method used to assess the wind conditions;
- An analysis of the proposed case, i.e. the effect that the proposed development is likely to have on wind conditions at the site and in surrounding areas; and,
- An analysis of any consented schemes effect on local wind conditions with the proposed development in place.

Figure 1: Overview of the 3D model of the proposed development (blue) with the surrounding context (pink) and future developments (green).

SITE

The proposed site is located between Ringers Road and Ethelbert Road in the London Borough of Bromley. To the north across Ethelbert Road as well as to the immediate west is low rise residential properties. Churchhouse gardens is to the northwest of the development. Industrial/commercial buildings are to the east and south of the development, including a 5 storey TK Maxx to the immediate east of the site. Bromley south station and subsequent railway lines are approximately 500m to the south.

The proposed development includes the demolition of existing buildings and construction of a mixed-use development comprising residential units, ancillary residents' facilities (including co-working space) and commercial floor space (Use Class E) across two blocks, along with associated hard and soft landscaping, amenity spaces, cycle and refuse storage. The scheme will be purely residential with the provision of 108 residential units.

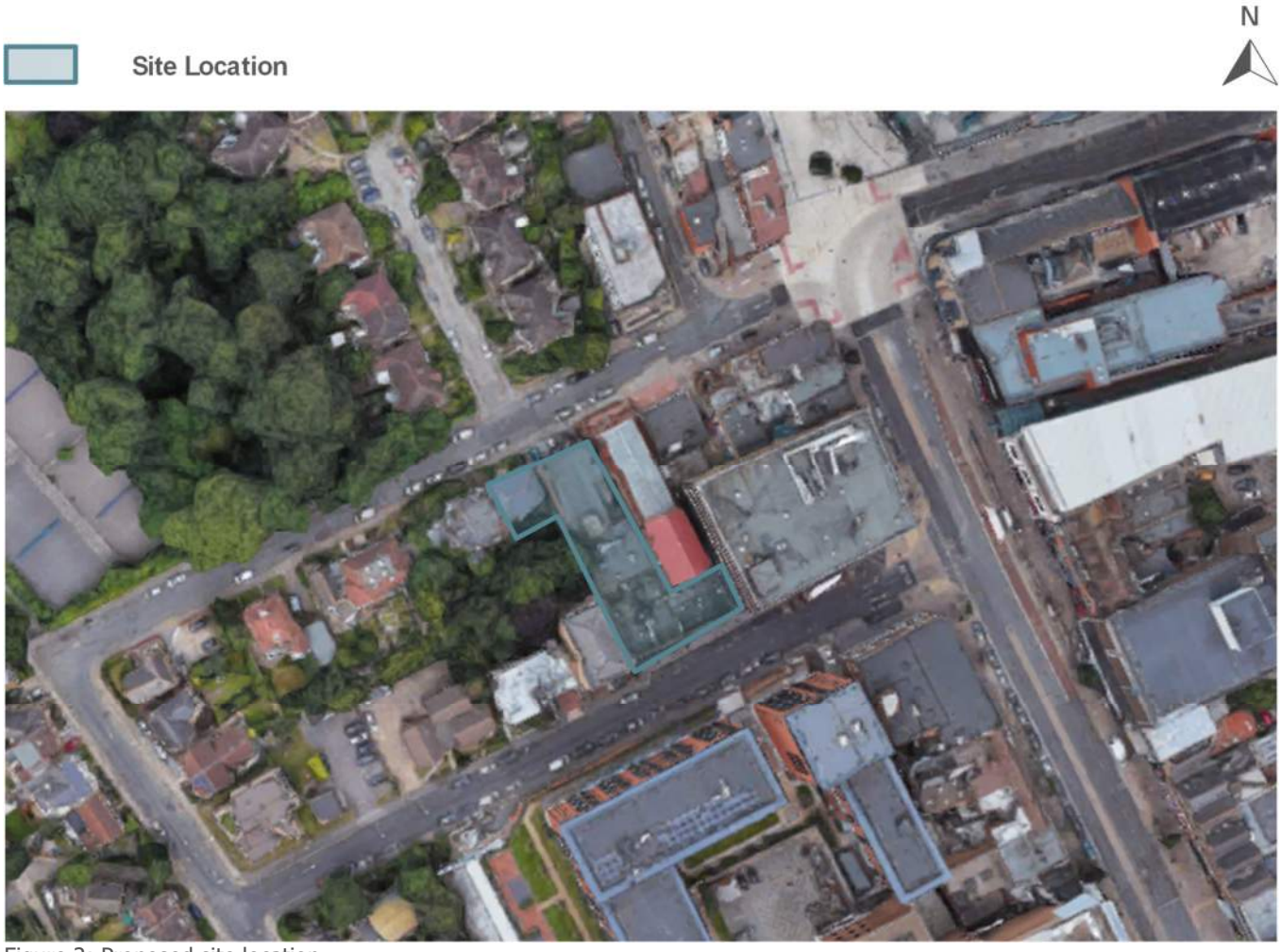
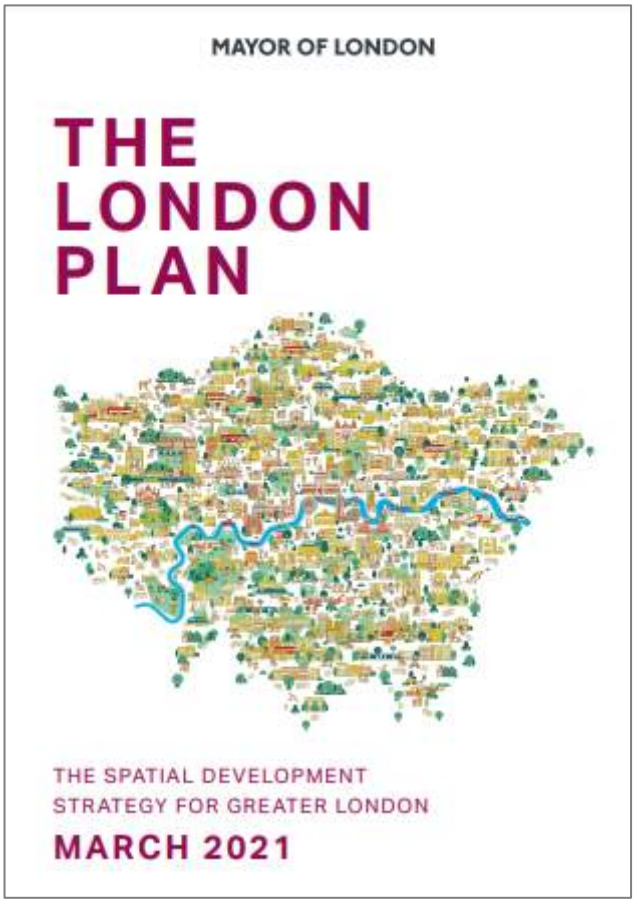


Figure 2: Proposed site location.

PLANNING POLICY CONTEXT

The proposed Ringers Road development has been designed to comply with the requirements set out in the London Plan, the Sustainable Design and Construction SPG as well as the London Borough of Bromley Local Plan.

REGIONAL POLICY - THE LONDON PLAN, 2021



The planning guidance contained within the London Plan places great importance on the creation and maintenance of a high-quality environment for London. The policies in this section relate to wind and microclimate.

POLICY D9 TALL BUILDINGS

Definition

Based on local context, Development Plans should define what is considered a tall building for specific localities, the height of which will vary between and within different parts of London but should not be less than 6 storeys or 18 metres measured from ground to the floor level of the uppermost storey.

Locations

1) Boroughs should determine if there are locations where tall buildings may be an appropriate form of development, subject to meeting the other requirements of the Plan. This process should include engagement with neighbouring boroughs that may be affected by tall building developments in identified locations.
2) Any such locations and appropriate tall building heights should be identified on maps in Development Plans.
3) Tall buildings should only be developed in locations that are identified as suitable in Development Plans.

Impacts

Development proposals should address the following impacts:

Visual impacts

a) the views of buildings from different distances:

- long-range views – these require attention to be paid to the design of the top of the

building. It should make a positive contribution to the existing and emerging skyline and not adversely affect local or strategic views
- mid-range views from the surrounding neighbourhood – particular attention should be paid to the form and proportions of the building. It should make a positive contribution to the local townscape in terms of legibility, proportions and materiality
- immediate views from the surrounding streets – attention should be paid to the base of the building. It should have a direct relationship with the street, maintaining the pedestrian scale, character and vitality of the street. Where the edges of the site are adjacent to buildings of significantly lower height or parks and other open spaces there should be an appropriate transition in scale between the tall building and its surrounding context to protect amenity or privacy.

b) whether part of a group or stand-alone, tall buildings should reinforce the spatial hierarchy of the local and wider context and aid legibility and wayfinding
c) architectural quality and materials should be of an exemplary standard to ensure that the appearance and architectural integrity of the building is maintained through its lifespan
d) proposals should take account of, and avoid harm to, the significance of London's heritage assets and their settings. Proposals resulting in harm will require clear and convincing justification, demonstrating that alternatives have been explored and that there are clear public benefits that outweigh that harm. The buildings should positively contribute to the character of the area
e) buildings in the setting of a World Heritage Site must preserve, and not harm, the Outstanding Universal Value of the World Heritage Site, and the ability to appreciate it
f) buildings near the River Thames, particularly in the Thames Policy Area, should protect and enhance the open quality of the river and the riverside public realm, including views, and not contribute to a canyon effect along the riverg)
g) buildings should not cause adverse reflected glare
h) buildings should be designed to minimise light pollution from internal and external lighting

Functional impact

a) the internal and external design, including construction detailing, the building's materials and its emergency exit routes must ensure the safety of all occupants
b) buildings should be serviced, maintained and managed in a manner that will preserve their safety and quality, and not cause disturbance or inconvenience to surrounding public realm. Servicing, maintenance and building management arrangements should be considered at the start of the design process
c) entrances, access routes, and ground floor uses should be designed and placed to allow for peak time use and to ensure there is no unacceptable overcrowding or isolation in the surrounding areas
d) it must be demonstrated that the capacity of the area and its transport network is capable of accommodating the quantum of development in terms of access to facilities, services, walking and cycling networks, and public transport for people living or working in the building
e) jobs, services, facilities and economic activity that will be provided by the development and the regeneration potential this might provide should inform the design so it maximises the benefits these could bring to the area, and maximises the role of the development as a catalyst for further change in the area
f) buildings, including their construction, should not interfere with aviation, navigation or telecommunication, and should avoid a significant detrimental effect on solar energy generation on adjoining buildings

Environmental impact

a) wind, daylight, sunlight penetration and temperature conditions 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

b) air movement affected by the building(s) should support the effective dispersion of pollutants, but not adversely affect street-level conditions
c) noise created by air movements around the building(s), servicing machinery, or building uses, should not detract from the comfort and enjoyment of open spaces around the building

Cumulative impacts

a) 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.

Public access

Free to enter publicly-accessible areas should be incorporated into tall buildings where appropriate, particularly more prominent tall buildings where they should normally be located at the top of the building to afford wider views across London.

SUSTAINABLE DESIGN AND CONSTRUCTION, SPG

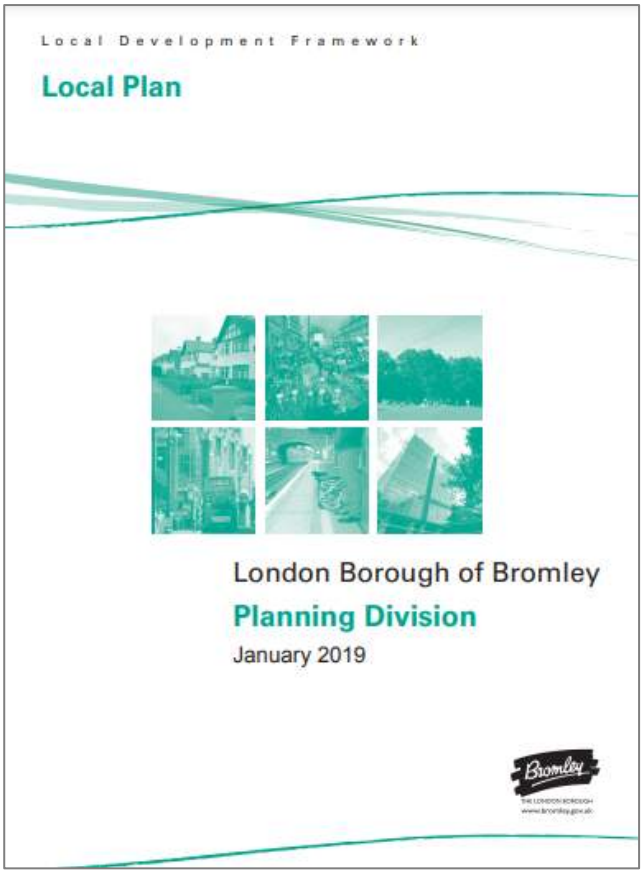
The 'Sustainable Design and Construction, Supplementary Planning Guidance' (SDC SPG, April 2014) provides additional information to support the implementation of the Mayor's London Plan. The SPG does not set out new policy, however it can be taken into account as a further material consideration and provides detailed guidance for the benefit of Local Planning Authorities, architects, developers and other professionals in the implementation of the London Plan.

SECTION 2.3.7: MICRO-CLIMATE

The section states:

"Large buildings have the ability to alter their local environment and affect the micro-climate. For example, not only can particularly tall buildings cast a long shadow effecting building several streets away, they can influence how wind travels across a site, potentially making it unpleasant at ground level or limiting the potential to naturally ventilate buildings. One way to assess the impact of a large building on the comfort of the street environment is the Lawson Comfort Criteria. This tool sets out a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speed and frequency of occurrence. It sets out a range of pedestrian activities from sitting through to crossing the road and for each activity defines a wind speed and frequency of occurrence. Where a proposed development is significantly taller that it's surrounding environment, developers should carry out an assessment of its potential impact on the conditions at ground level, and ensure the resulting design of the development provides suitable conditions for the intended uses."

LOCAL POLICY – THE LONDON BOROUGH OF BROMLEY LOCAL PLAN, 2019



POLICY 47 TALL & LARGE BUILDINGS

Proposals for tall and large buildings will be required to make a positive contribution to the townscape ensuring that their massing, scale and layout enhances the character of the surrounding area. Tall and large buildings will need to be of the highest architectural design quality and materials and be appropriate to their local location and historic context, including strategic views. Proposals for tall buildings will be required to follow the current Historic England Guidance.

POLICY 56 LOCAL GREEN SPACE

Local Green Space is green or open space which has been demonstrated to have special qualities and holds particular significance to the local community which it serves. Development which causes harm to the "special qualities" of a Local Green Space as defined within its Statement of Significance but is otherwise policy compliant will be considered inappropriate and will not be accepted except in very special circumstances

ASSESSMENT METHODOLOGY

The assessment methodology of this report is structured in the following subsections: General Approach, which provides an overview of the assessment; Assessment Criteria, which discusses the criteria used to evaluate wind conditions on site, Input Data, which details the wind data analysed and used for this study; and, Technical Approach, which details the use of CFD for the assessment.

GENERAL APPROACH

Specific locations neighbouring the site were initially identified and designated for detailed analysis. Wind speeds were predicted in these locations on and around the site for two configurations:

Configuration 1: Proposed development with the existing surrounding buildings

Configuration 2: Cumulative assessment with the proposed development in place including any future developments within close proximity which have received planning consent. As just the wind impacts in the immediate vicinity of the proposed development were analysed, only the future developments in close proximity to the proposed development were added to the cumulative scenario.

The wind speeds in the designated locations were predicted using Computational Fluid Dynamics (CFD) and the probability of exceeding set wind speed thresholds were compared against industry recognised assessment criteria for pedestrian comfort.

ASSESSMENT CRITERIA

The assessment of wind conditions requires a standard against which the measurements can be compared. Beaufort Wind Force is a long-established scale to describe wind speeds in terms of its observable effects. Increasing Beaufort Wind Force indicates increasing wind speeds from B0 (calm) to B11 (violent storm). The Beaufort Wind Force scale and corresponding wind speed range are identified in Table 2.

The Lawson Comfort Criteria defines the percentage of time that certain Beaufort Force levels are exceeded. These are threshold values of wind speeds for different pedestrian activities. For example, spaces for seating require lower wind speeds, whereas for more transient activities, stronger winds are more likely to be tolerated by pedestrians. The pedestrian activities covered by the Lawson Comfort Criteria are defined as follows:

- Sitting: Appropriate for long term sitting, for example sitting outside a café;
- Entrance use: Appropriate for pedestrians entering and/or leaving a building;
- Standing: Appropriate for waiting at bus stops, window shopping, etc.;
- Leisure walking: Appropriate for strolling;
- Business/brisk walking: Appropriate for more 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; and
- Roadways/car parks: Appropriate for more open areas where pedestrians are not expected to linger.

For each of the six pedestrian activities an upper threshold is defined, beyond which conditions are unacceptable for the stated activity. If the conditions are below the threshold then they are described as 'tolerable', and therefore suitable for the stated activity. The table below summarises the threshold values for each pedestrian activity. For example, it shows that for leisure walking, if Beaufort Force 4 (B4) is exceeded for more than 4% of the time, the wind conditions would be unsuitable for the stated activity

at that location but may be suitable for business walking.

STRONG WINDS

The Lawson Criteria also specify a lower limit strong wind criterion when winds exceed Beaufort Force 6 (B6). Exceeding this criterion 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).

The local wind environment can be affected by the form and relative position of the buildings. The most common effects are summarised on the following page.

Table 1: Beaufort Wind Force Scale

Beaufort Wind Force Scale	Hourly Average Wind Speeds (m/s)	Description	Upper Threshold of Wind Speeds
B0	<0.45	Calm	Smoke rises vertically
B1	0.45 – 1.55	Light Air	Direction by smoke drift but not by wind vanes
B2	1.55 – 3.35	Light Breeze	Wind felt on face, leaves rustle, wind vane moves
B3	3.35 – 5.60	Gentle Breeze	Leaves and twigs in motion, wind extends a flag
B4	5.60 – 8.25	Moderate Breeze	Raises dust and loose paper, small branches move
B5	8.25 – 10.95	Fresh Breeze	Small trees in leaf sway
B6	10.95 – 14.10	Strong Breeze	Large branches begin to move, telephone wires whistle
B7	14.10 – 17.20	Near Gale	Whole trees in motion
B8	17.20 – 20.80	Gale	Twigs break off, personal progress impeded
B9	20.80 – 24.35	Strong Gale	Slight structural damage, chimney pots removed
B10	24.35 – 28.40	Storm	Trees uprooted, considerable structural damage
B11	28.40 – 32.40	Violent Storm	Damage is widespread, unusual in the UK

Table 2: Beaufort Wind Force Scale

Prescribed Usage	Upper Threshold of Wind Speeds
Road and car parks	6% > Beaufort Wind Scale 5 (B5)
Business walking	2% > B5
Leisure Walking	4% > B4
Pedestrian standing / Entrance doors	6% > B3
Sitting	1% > B3

DOWNWASH EFFECT

The air stream when striking a tall building can flow around it, over it and a part deflected towards the ground. This downward component is called downwash effect and its intensity depends on the pressure difference driving the wind. The higher the building, the higher this pressure difference can be.

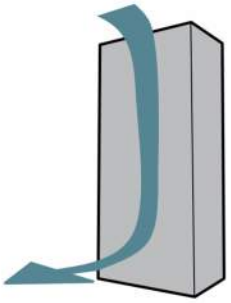


Figure 3: Downwash microclimate effect

CORNER EFFECT

Wind can accelerate around the corners of the buildings. Pedestrians can experience higher wind speeds as well as more sudden changes in wind speeds. The reason for this is that there are narrow transition zones between the accelerated flows and the adjacent quiescent regions. This effect is linked to the downwash effect as the downward stream component subsequently flows around the corners towards the leeward side of the building.

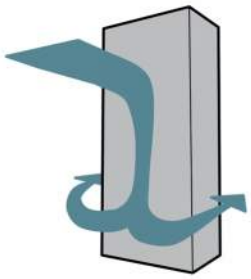


Figure 4: Corner effect

WAKE EFFECT

Excessive turbulence can occur in the leeward side of the building. This can cause sudden changes in wind velocity and can raise dust or lead to accumulation of debris. This effect is also dependent on the height of the building.

Figure 5: Wake effect

FUNNELLING EFFECT

The wind can accelerate significantly when flowing through a narrow passage between building structures. The highest speeds are experienced at the point where the restriction of the area is the greatest.

It is important to note that pedestrian comfort, apart from the mechanical effects of the wind and the intended use of external spaces as described above, is also affected by the severity of the thermal effects of the wind.

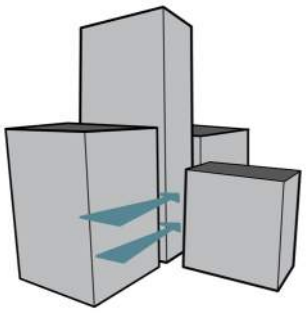


Figure 6: Funnelling effect

SIGNIFICANCE CRITERIA

The adopted scale for the significance criteria provides a logical comparison of the measured wind environment with the desired wind environment. Hence a beneficial effect implies that a location has a wind environment that is better suited to its intended use and mitigation is not required. By contrast, an adverse effect indicates that the predicted wind environment within an area is less suited to its intended use and mitigation measures should be considered. The minor, moderate and major categories indicate the severity of the difference between the desired microclimate and the actual microclimate. A negligible impact implies that the wind conditions are 'tolerable' for the intended pedestrian activity.

For example, if the desired wind conditions at a particular location are required to be suitable for standing, but the predicted wind conditions are suitable for leisure walking, the difference between the desired and predicted wind condition is 1 step windier than desired. In this case, the significance of the effect would therefore be identified as a minor adverse.

The significance criteria do not specifically address sensitivity of receptors, as this is implicitly contained in the concept of "desired" wind conditions; for instance, amenity areas and main building entrances are considered sensitive receptors, as relatively calm conditions would be required at these locations.

Thoroughfares or areas intended for more active pursuits would be considered less sensitive, as pedestrians would be more tolerant of windier conditions. As the wind microclimate assessment quantifies local wind microclimate at various locations on the site, all receptors evaluated in this assessment will have a local value.

SENSITIVE RECEPTORS

Sensitive receptors are external zones which are the most susceptible to pedestrian comfort. They include areas that are likely to be frequently populated by residents, pedestrians, visitors, neighbouring building users and employees of the proposed development. The most sensitive receptors in this assessment have been selected on the basis of the intended use and include:

- building entrances including both residential and commercial
- existing and proposed amenity spaces including main pedestrian thoroughfares

The relative sensitivity is automatically included in the assessment. For example, a location indicated as being intended for a playground, which might be considered a sensitive receptor, would be assessed against a criterion of sitting or standing conditions, whereas a pavement would typically be assessed against a criterion of leisure and business walking. Due to the site's characteristics, some receptors represent roads and car parks.

Table 3: The sensitivity receptor's significance criteria

Significance Criteria	Description
Major beneficial	Wind conditions are 3 steps calmer than the desired levels
Moderate beneficial	Wind conditions are 2 steps calmer than the desired levels
Minor beneficial	Wind conditions are 1 step calmer than the desired levels
Negligible	Wind conditions are tolerable for desired use
Minor adverse	Wind conditions are 1 step windier than the desired levels
Moderate adverse	Wind conditions are 2 steps windier than the desired levels
Major adverse	Wind conditions are 3 steps windier than the desired levels

INPUT DATA

GENERAL METEOROLOGICAL DATA

Joint frequency tables of wind speeds, divided into ranges of the Beaufort Scales and direction, on a monthly and annual basis for 30-degree sectors, were obtained from the UK Meteorological Office for London. This data was considered the most appropriate representation of the local wind climate on site and was used in the assessments.

As demonstrated in the seasonal wind roses in Figure 7, there are two dominant wind directions namely from the south-southwest (210°) and north-east (30°). Therefore, these wind directions are expected to be the most important directions of relevance to the site and would contribute most to pedestrian comfort levels.

Calculations were carried out for 12 wind directions, every 30 degrees.

Prevailing winds from the south-southwest quadrant occur throughout the year, while secondary prevailing winds from the north-east quadrant occur during late spring and early summer. The north-easterly winds are not as strong as those from the south-southwest but occur for a similar amount of time during this period and are considerably cooler. Winds from the south-southwest quadrant typically account for 45% of all wind for the Site.

The meteorological station data obtained was adjusted to the site conditions.

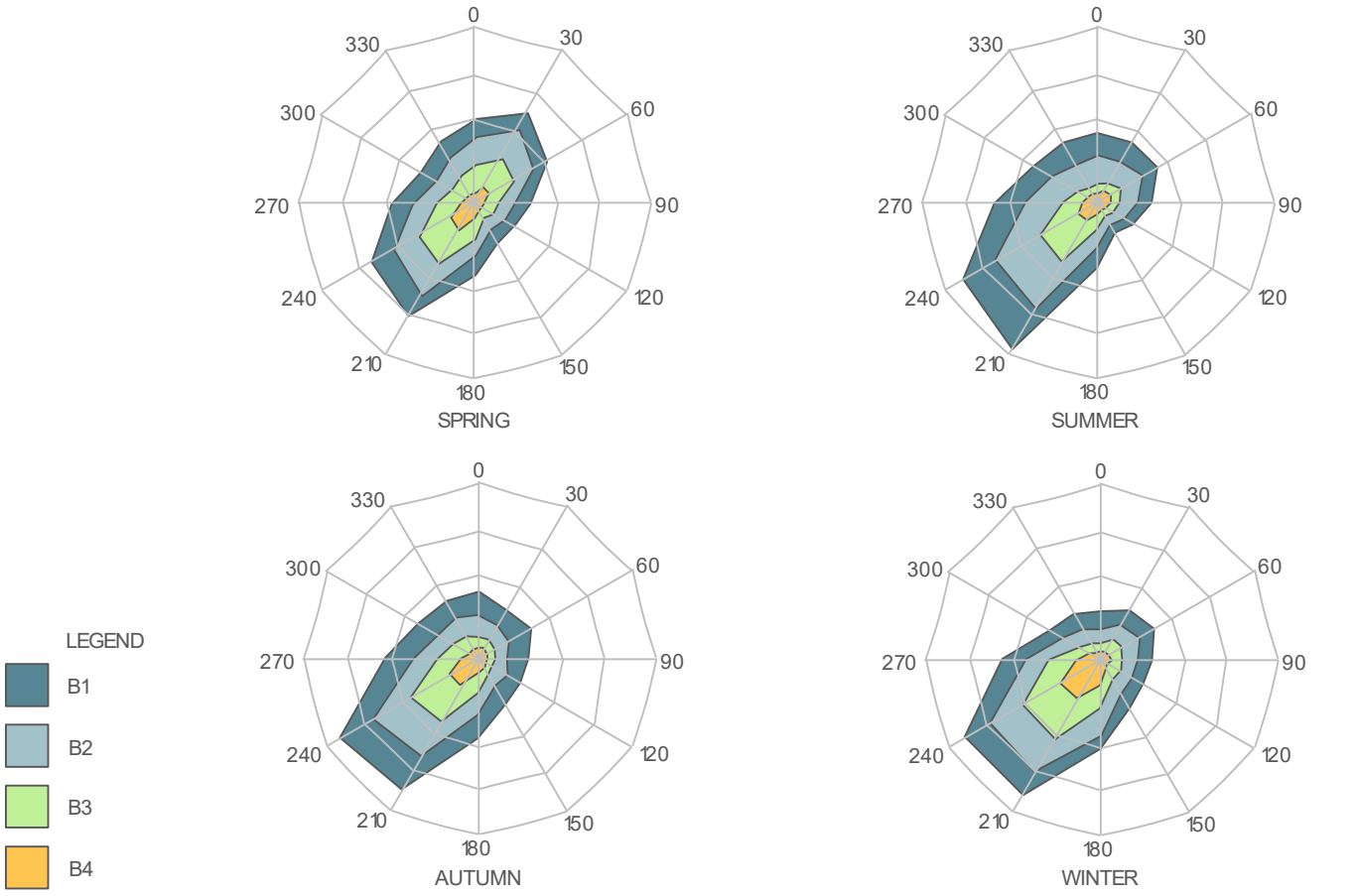


Figure 7: Seasonal wind rose.

TECHNICAL APPROACH

Specialist computer software for Computational Fluid Dynamics (CFD) was used to numerically simulate wind flows around the complex environment of the proposed development.

CFD modelling involves the solution of the equations of fluid motion using numerical techniques. The region of interest is divided into numerous small cells and the equations governing the fluid flow are solved within each cell. This allows a comprehensive assessment of velocity variation within the calculation domain to be derived. To improve the resolution of the results, the CFD mesh is refined in the areas of most interest.

There is often a trade-off between detailed models and the use of computational resources in a balanced manner for such analysis. The use of excessively fine computational grids should be generally avoided especially when the models of the physical processes are comparatively crude. The opposite extreme should also be avoided. In CFD analysis, there is the need for balanced accuracy models and resolution which can make optimal use of computer resources. This way the analysis can offer useful insights. For this reason, detailed landscaping elements and trees were omitted from the CFD model to avoid adding unnecessary complexity at this stage of the analysis. This is a worst-case approach as such elements could generally render the computed wind speeds more benign.

3D computer models of the existing and proposed scenarios were generated, capturing the overall geometry and massing of the existing, proposed and cumulative buildings. The main domain of the CFD model extended by approximately 250m from the centre of the proposed development to allow topographic features in the surrounding area (including buildings) which can influence wind flow, to be modelled. Wind speed, direction and turbulence were predicted in a number of locations on and around the site.

As the exact details of the proposed landscaping across the proposed scheme are not fixed at this time, the CFD models were run without detailed landscaping. The CFD model results can therefore be considered as a worst-case scenario. In practice, wind conditions would be more benign when landscaping and planting are taken into account. The results of the CFD simulations consist of colour contour images. They represent a slice through the modelled domain at predetermined heights (namely 1.5m above ground level and 1.5m above raised courtyard or terrace level (where applicable)).

Another consideration within the assessment is the ground roughness. Wide, open spaces permit the wind to blow down to ground level generating conditions similar to that of open countryside, even within a built-up area.

The surface roughness applied to the CFD model corresponds to open country, which is a worst-case approach. The surrounding buildings were subsequently included in the computer model to reflect the existing context. The turbulence effects were modelled using a k-ε model which is the most accepted and most widely used turbulence model.

The CFD results were assessed at different heights representing the wind conditions at the following locations:

- main entrances to the proposed development and adjacent existing buildings;
- existing amenity spaces;
- main pedestrian routes;
- main roads and car parks; and,
- balcony and raised amenity spaces.

The contour plots for a selection of these cases (see appendix) show flow patterns and wind speeds. Blue and green contours indicate areas with a high level of shelter and calm conditions, whereas yellow and red areas indicate higher wind speeds.

Once the predicted wind speed on each receptor was computed for each wind direction and model configuration, analysis was carried out to derive the probability of exceeding the wind speed thresholds and then compare it against the Lawson criteria. This analysis entailed the use of wind climate statistics in the form of a Weibull cumulative distribution, which is typically used.

ASSESSMENT RESULTS

PROPOSED DEVELOPMENT CONDITIONS

The proposed condition of this assessment includes the proposed development with the existing surrounding context. Wind directions at 30° increments were modelled for the site (twelve in total), in addition to the wind microclimate at 1.5m, 15m, 31m, 34m, 37.5m and 39.5m above ground level for the proposed condition. Potential impacts on the local wind microclimate following the completion of the proposed development would include:

- Changes in wind conditions around the perimeter of the proposed development due to the new building form and height potentially affecting the suitability of that surrounding area's usage; and
- Ensuring that the wind conditions are suitable for the desired uses within the site in particular the proposed amenity spaces, vehicular and pedestrian routes, as well as building entrances.

The results are represented using coloured contours at various levels:

- 1.5m above ground level - to reflect wind speeds at the ground level; and,
- 15m above ground level - to simulate wind conditions at above ground balconies at the proposed on-site development (4th floor);
- 31m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (9th floor);
- 34m above ground level - to simulate wind speeds at above ground balconies and terraces at the proposed on-site development (10th floor);
- 37.5m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (11th floor); and,
- 39.5m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (12th floor).

The sensitive receptors analysed are numbered from 1 to 52 and their locations are detailed in the site plans in Appendix A – Receptor Locations. The proposed condition wind results for all directions at ground level (1.5m) are presented in Appendix B – Proposed Condition. Results for other levels can be provided separately where required.

The analysis indicates that 32 out of the 52 sensitive receptors experience either a negligible or beneficial impact in comparison to their intended use. These 32 receptors were located at ground level and indicates that the proposed development does not have a significant adverse impact on pedestrian level wind conditions. Of the remaining 20 receptors, one receptor was located on the ground floor level and was located within an open park space. In reality, it is expected to perform better as there will be topography to provide mitigation that has not been modelled in the current assessment as a worst-case approach. The remaining 19 receptors located at higher locations experience varying adverse effects. Higher degree of wind exposure on high locations such as balconies is usually anticipated too and this should be accounted for when interpreting the results.

Therefore, it can be concluded that no significant offsite impact is anticipated on the neighbouring areas as a result of the proposed development at Ringers Road.

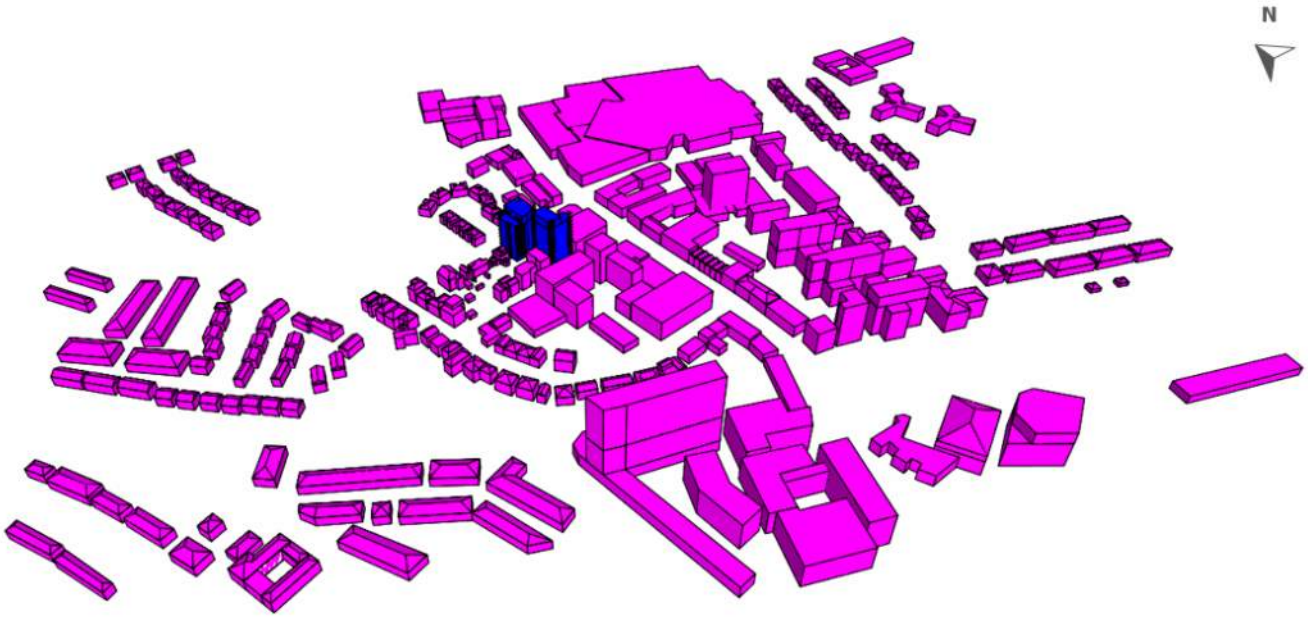


Figure 8: Aerial view of the site - Proposed configuration. (Proposed development in blue, surrounding context in pink).

CUMULATIVE CONDITIONS

The cumulative assessment takes into account any future proposed developments within the vicinity of the site which have received planning consent at the time of the application and may impact upon the wind conditions around the site.

The locations of the assessed cumulative buildings are displayed in Figure 9 overleaf and are highlighted in green. These include:

- S2 Estates
- Countryside Scheme
- Purelake Scheme

The cumulative condition wind results for all directions at ground level (1.5m) are presented in Appendix C. Results for other levels can be provided separately where required.

Wind directions at 30° increments were modelled for the site (twelve in total), in addition to the wind microclimate at 1.5m, 15m, 31m, 34m, 37.5m and 39.5m above ground level for the cumulative condition.

The results are represented using coloured contours at various levels:

- 1.5m above ground level - to reflect wind speeds at the ground level; and,
- 15m above ground level - to simulate wind conditions at above ground balconies at the proposed on-site development (4th floor);
- 31m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (9th floor);
- 34m above ground level - to simulate wind speeds at above ground balconies and terraces at the proposed on-site development (10th floor);
- 37.5m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (11th floor); and,
- 39.5m above ground level - to simulate wind speeds at above ground balconies at the proposed on-site development (12th floor).

The analysis indicates that all 32 of the 52 sensitive receptors located at ground floor level experience either a negligible or beneficial impact in comparison to their intended use.

The remaining receptors are at higher locations and experience varying adverse effects. The results are consistent with what is usually anticipated at higher locations. It is worth noting that while these receptors experienced adverse effects, the results showed an improvement in the wind levels experienced when compared to the proposed scenario. Therefore, wind conditions are anticipated to improve in the future when the consented schemes are completed.

Consequently, it can be concluded that no significant adverse impact is anticipated in the neighbouring areas as a result of any future works within the vicinity of the Ringers Road development site under the cumulative condition.

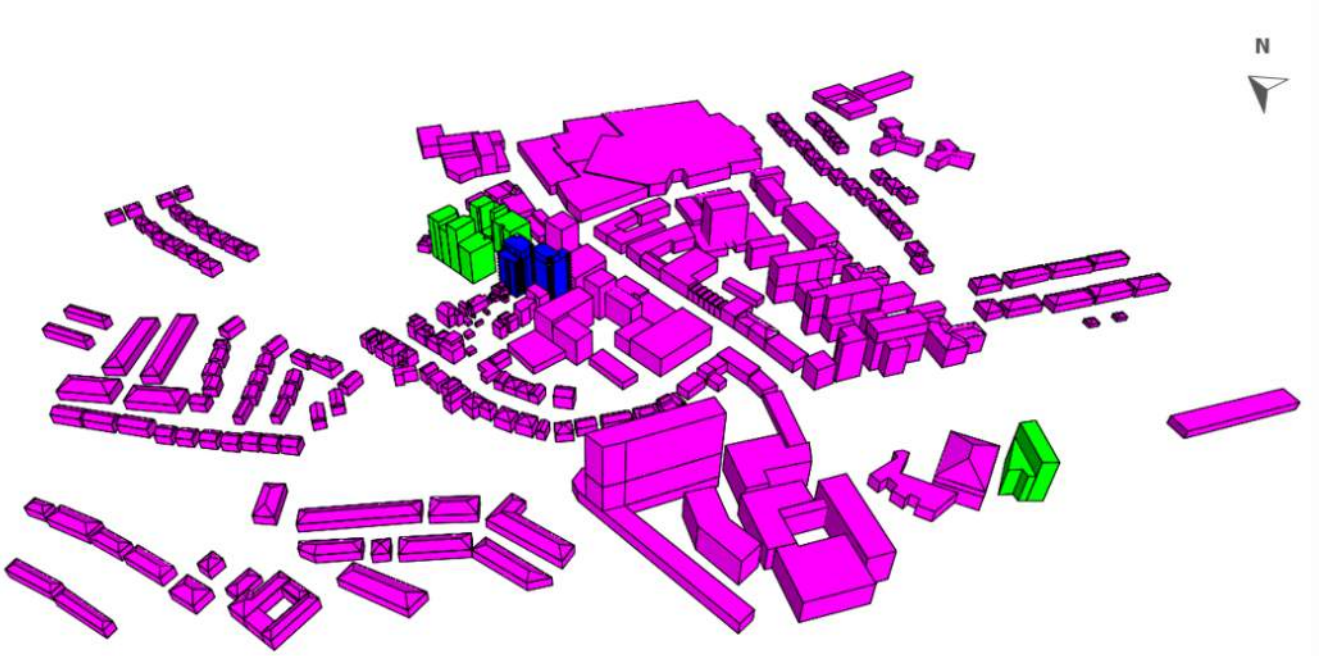


Figure 9: Aerial view of the site - Cumulative configuration. (Proposed development in blue, surrounding context in pink, consented schemes in green).

Table 4: Summary of the potential impacts for the proposed development and cumulative development scenarios.

Receptor	Area Intended Use	Proposed		Cumulative	
-	-	Wind condition for	Significance criteria	Wind condition for	Significance criteria
1	Leisure walking	Standing	Minor beneficial	Standing	Minor beneficial
2	Leisure walking	Sitting	Moderate beneficial	Sitting	Moderate beneficial
3	Leisure walking	Standing	Minor beneficial	Sitting	Moderate beneficial
4	Standing	Standing	Negligible	Sitting	Minor beneficial
5	Leisure walking	Standing	Minor beneficial	Standing	Minor beneficial
6	Car Park	Standing	Major beneficial	Standing	Major beneficial
7	Leisure walking	Leisure walking	Negligible	Leisure walking	Negligible
8	Leisure walking	Standing	Minor beneficial	Standing	Minor beneficial
9	Leisure walking	Standing	Minor beneficial	Leisure walking	Negligible
10	Leisure walking	Leisure walking	Negligible	Standing	Minor beneficial
11	Car Park	Standing	Major beneficial	Standing	Major beneficial
12	Standing	Standing	Negligible	Standing	Negligible
13	Standing	Standing	Negligible	Sitting	Minor beneficial
14	Sitting	Standing	Minor adverse	Sitting	Negligible
15	Car Park	Standing	Major beneficial	Standing	Major beneficial
16	Standing	Sitting	Minor beneficial	Sitting	Minor beneficial
17	Sitting	Sitting	Negligible	Sitting	Negligible
18	Standing	Standing	Negligible	Sitting	Minor beneficial
19	Leisure walking	Standing	Minor beneficial	Sitting	Moderate beneficial
20	Business Walking	Standing	Moderate beneficial	Sitting	Major beneficial
21	Car Park	Standing	Major beneficial	Sitting	Major beneficial
22	Business Walking	Sitting	Major beneficial	Sitting	Major beneficial
23	Standing	Sitting	Minor beneficial	Sitting	Minor beneficial
24	Car Park	Sitting	Major beneficial	Sitting	Major beneficial
25	Car Park	Sitting	Major beneficial	Sitting	Major beneficial
26	Car Park	Sitting	Major beneficial	Sitting	Major beneficial
27	Business Walking	Sitting	Major beneficial	Sitting	Major beneficial
28	Leisure walking	Sitting	Moderate beneficial	Standing	Minor beneficial
29	Standing	Sitting	Minor beneficial	Sitting	Minor beneficial
30	Business Walking	Sitting	Major beneficial	Sitting	Major beneficial
31	Standing	Sitting	Minor beneficial	Sitting	Minor beneficial
32	Business Walking	Standing	Moderate beneficial	Sitting	Major beneficial

Receptor	Area Intended Use	Proposed		Cumulative	
-	-	Wind condition for	Significance criteria	Wind condition for	Significance criteria
33	Standing	Standing	Negligible	Standing	Negligible
34	Sitting	Standing	Minor adverse	Standing	Minor adverse
35	Sitting	Standing	Minor adverse	Standing	Minor adverse
36	Sitting	Business walking	Major adverse	Leisure walking	Moderate adverse
37	Sitting	Business walking	Major adverse	Leisure walking	Moderate adverse
38	Sitting	Business walking	Major adverse	Leisure walking	Moderate adverse
39	Sitting	Leisure walking	Moderate adverse	Leisure walking	Moderate adverse
40	Sitting	Business walking	Major adverse	Business walking	Major adverse
41	Sitting	Leisure walking	Moderate adverse	Leisure walking	Moderate adverse
42	Sitting	Standing	Minor adverse	Standing	Minor adverse
43	Sitting	Leisure walking	Moderate adverse	Standing	Minor adverse
44	Sitting	Standing	Minor adverse	Standing	Minor adverse
45	Sitting	Business walking	Major adverse	Leisure walking	Moderate adverse
46	Sitting	Leisure walking	Moderate adverse	Leisure walking	Moderate adverse
47	Sitting	Business walking	Major adverse	Leisure walking	Moderate adverse
48	Sitting	Leisure walking	Moderate adverse	Leisure walking	Moderate adverse
49	Sitting	Business walking	Major adverse	Business walking	Major adverse
50	Sitting	Leisure walking	Moderate adverse	Leisure walking	Moderate adverse
51	Sitting	Business walking	Major adverse	Business walking	Major adverse
52	Sitting	Business walking	Major adverse	Business walking	Major adverse

Table 5: Summary of receptor results

Impact	Proposed	% of Total	Cumulative	% of Total
Major beneficial	10	19%	12	23%
Moderate beneficial	4	8%	3	6%
Minor beneficial	10	19%	12	23%
Negligible	8	15%	6	12%
Minor Adverse	5	10%	5	10%
Moderate adverse	6	12%	10	19%
Major adverse	9	17%	4	8%
Total number of receptors	52	100%	52	100%

CONCLUSION

Overall, it can be concluded that there will be no significant adverse impacts on wind and microclimate conditions on the neighbouring areas as a direct result of the proposed Ringers Road development.

PROPOSED DEVELOPMENT

A wind assessment was undertaken for the worst-case scenario Ringers Road development. The methodology adopted CFD modelling and compared the predicted results of carefully selected receptors to the intended use of those areas. The computer model set-up and overall methodology constitutes a worst-case approach. Analysis of the results was carried out to relate to the predicted wind speed to the Lawson pedestrian comfort criteria which is currently the most widely accepted industry standard.

The analysis indicates that 31 out of the 52 sensitive receptors experience either a negligible or beneficial impact in comparison to their intended use all of which were located at ground floor level. Of the remaining receptors, one receptor was located at ground level in an open space. It is expected to perform better in reality as planting in the park area will provide mitigation. The remaining receptors placed at higher locations experience varying adverse effects but this is usually anticipated due to higher degree of wind exposure on balconies at high floors.

Mitigation measures that have been included have been discussed in this report. This includes balcony balustrades and parapets.

Consequently, the wind conditions on site and with the proposed development in place were generally found to be within acceptable limits.

CUMULATIVE ASSESSMENT

A cumulative assessment was also carried out which included any proposed development with planning consent within close proximity to the site. Similar to the proposed scenario assessment, a total of 52 receptors placed at the same locations were assessed.

The analysis indicates that all 32 of the 52 sensitive receptors located at ground level experience either a negligible or beneficial impact in comparison to their intended use. The remaining receptors are at higher locations and experience minor adverse effects but this is usually anticipated due to the higher degree of exposure on balconies.

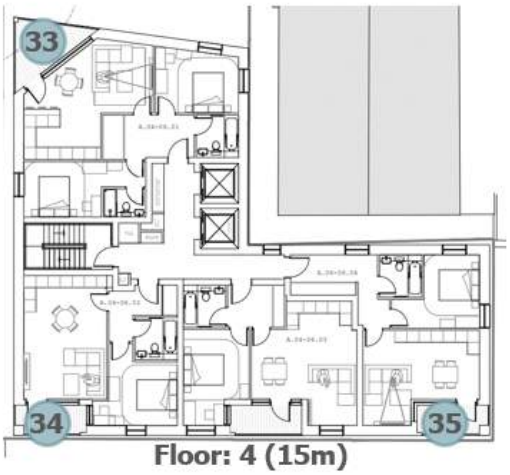
SUMMARY

The results of the wind assessment indicate that there will be no significant adverse effects on neighbouring local wind conditions as a direct result of the proposed development within the context of the existing surroundings, or as a product of future developments.

APPENDIX A – RECEPTOR LOCATIONS

GROUND LEVEL RECEPTORS.

ABOVE GROUND BALCONY RECEPTORS (BLOCK A).



Floor: 4 (15m)

Floor: 9 (31m)

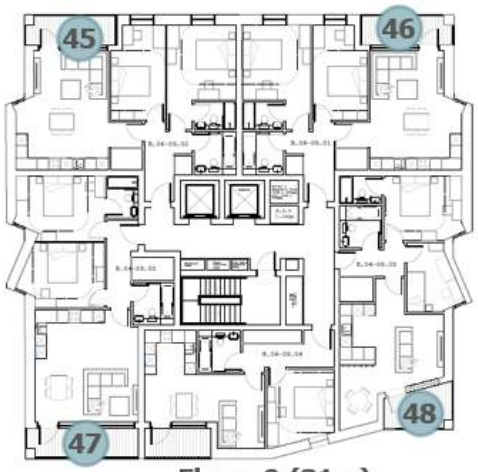
Floor: 10 (34m)

Floor: 12 (39.5m)

1 Sitting 1 Leisure walking 1 Car park 1 Standing 1 Business walking

ABOVE GROUND BALCONY RECEPTORS (BLOCK B).

Floor: 4 (15m)



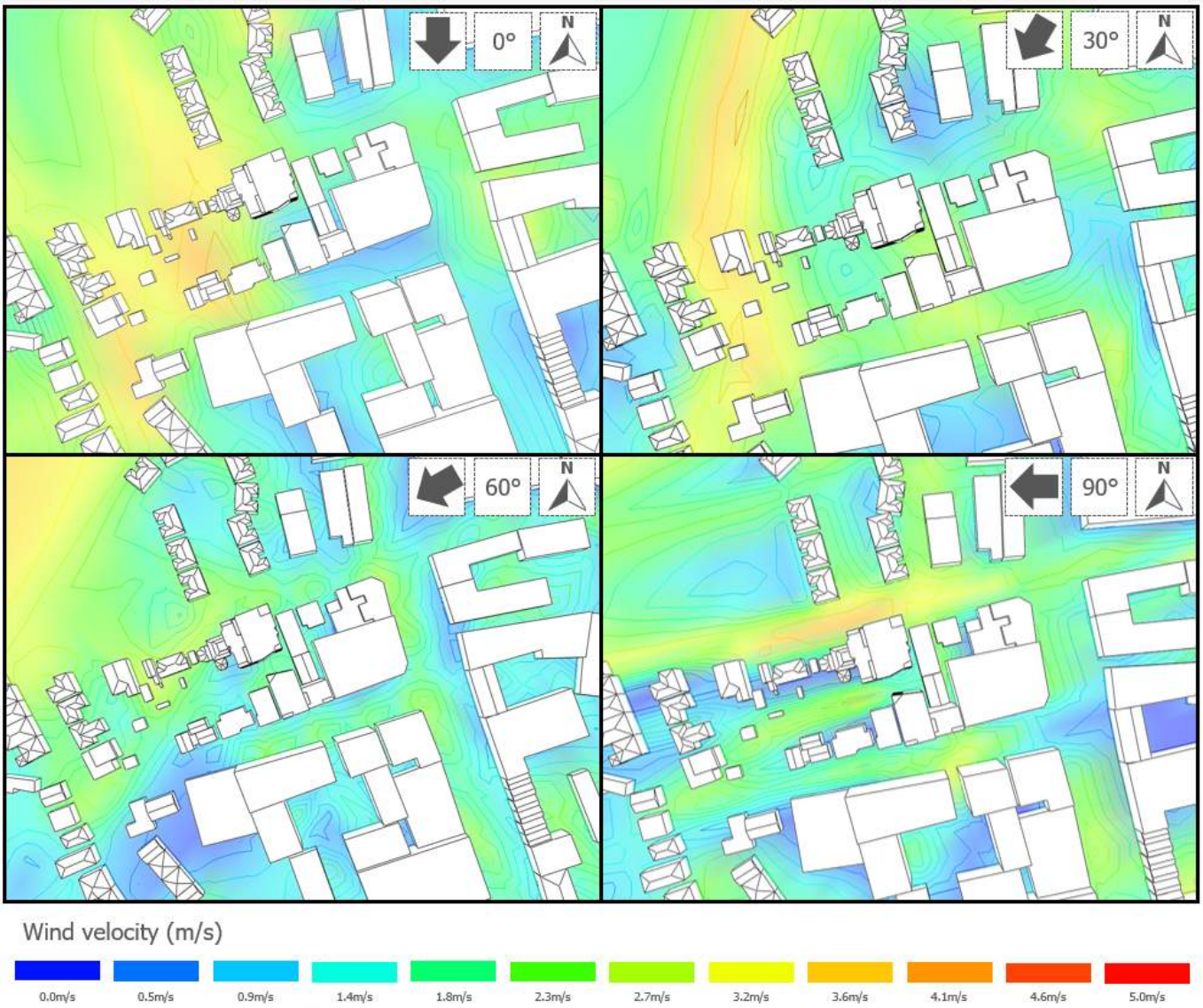
Floor: 9 (31m)

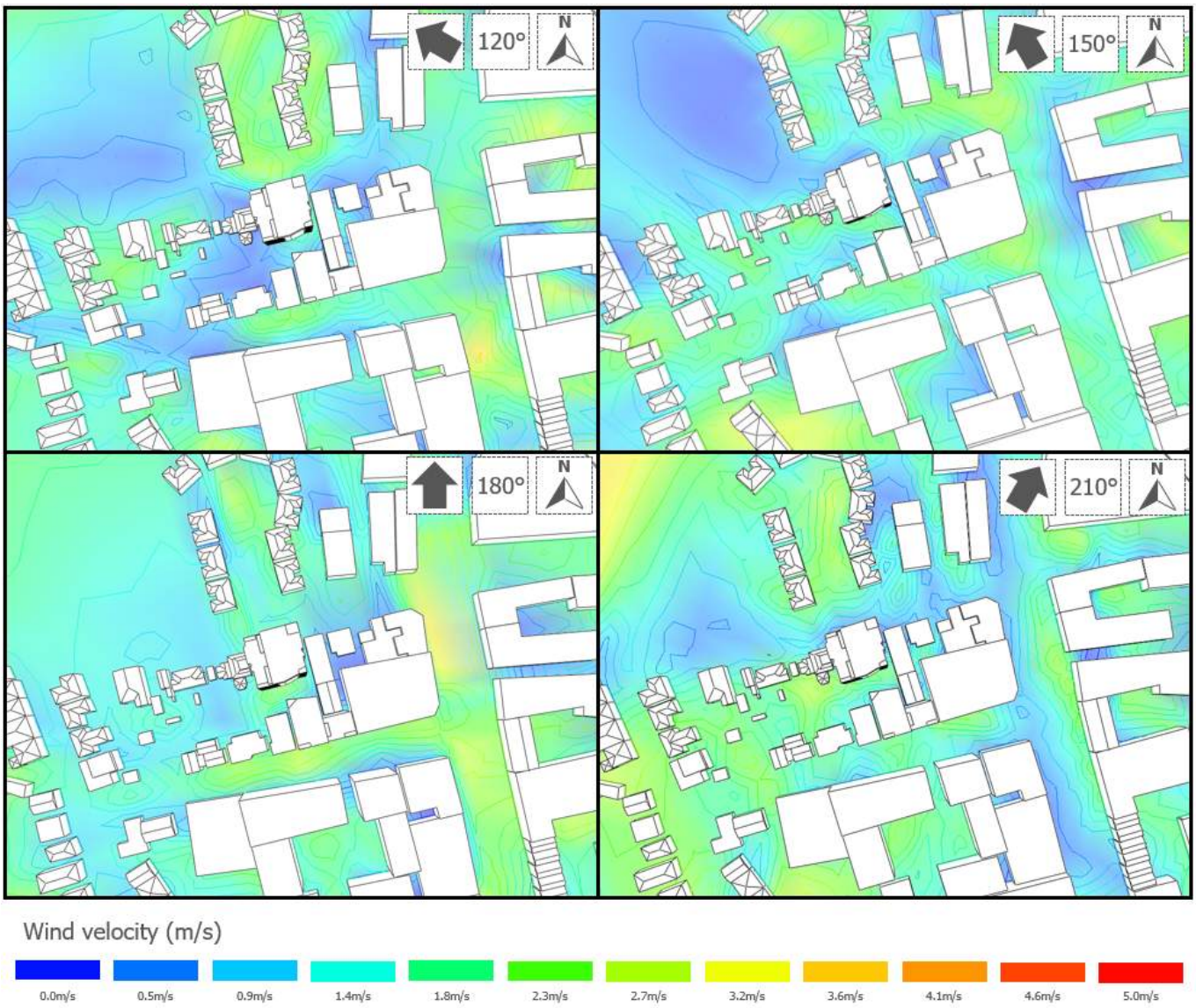
Floor: 10 (34m)

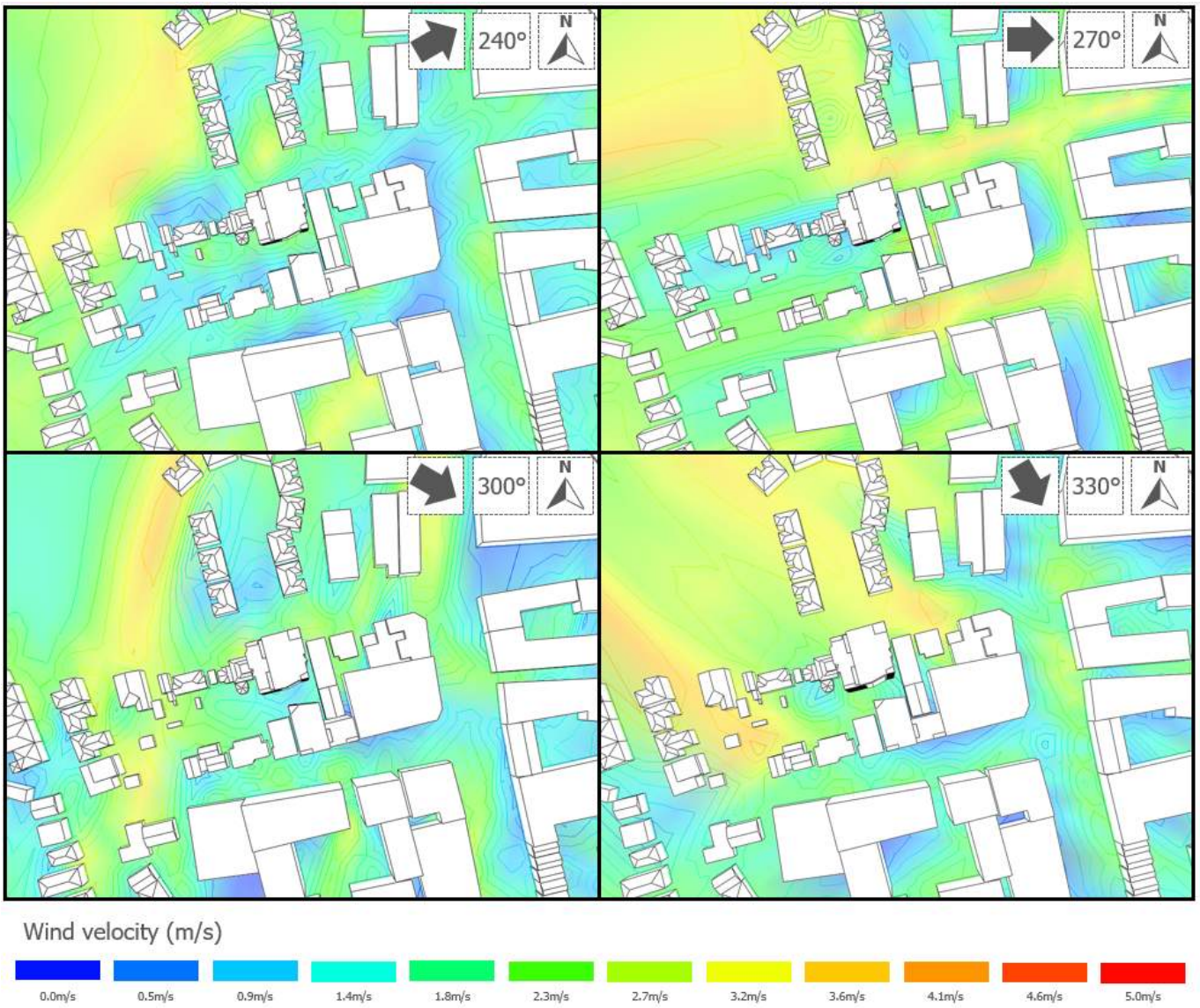
Floor: 11 (37.5m)

1 Sitting 1 Leisure walking 1 Car park 1 Standing 1 Business walking

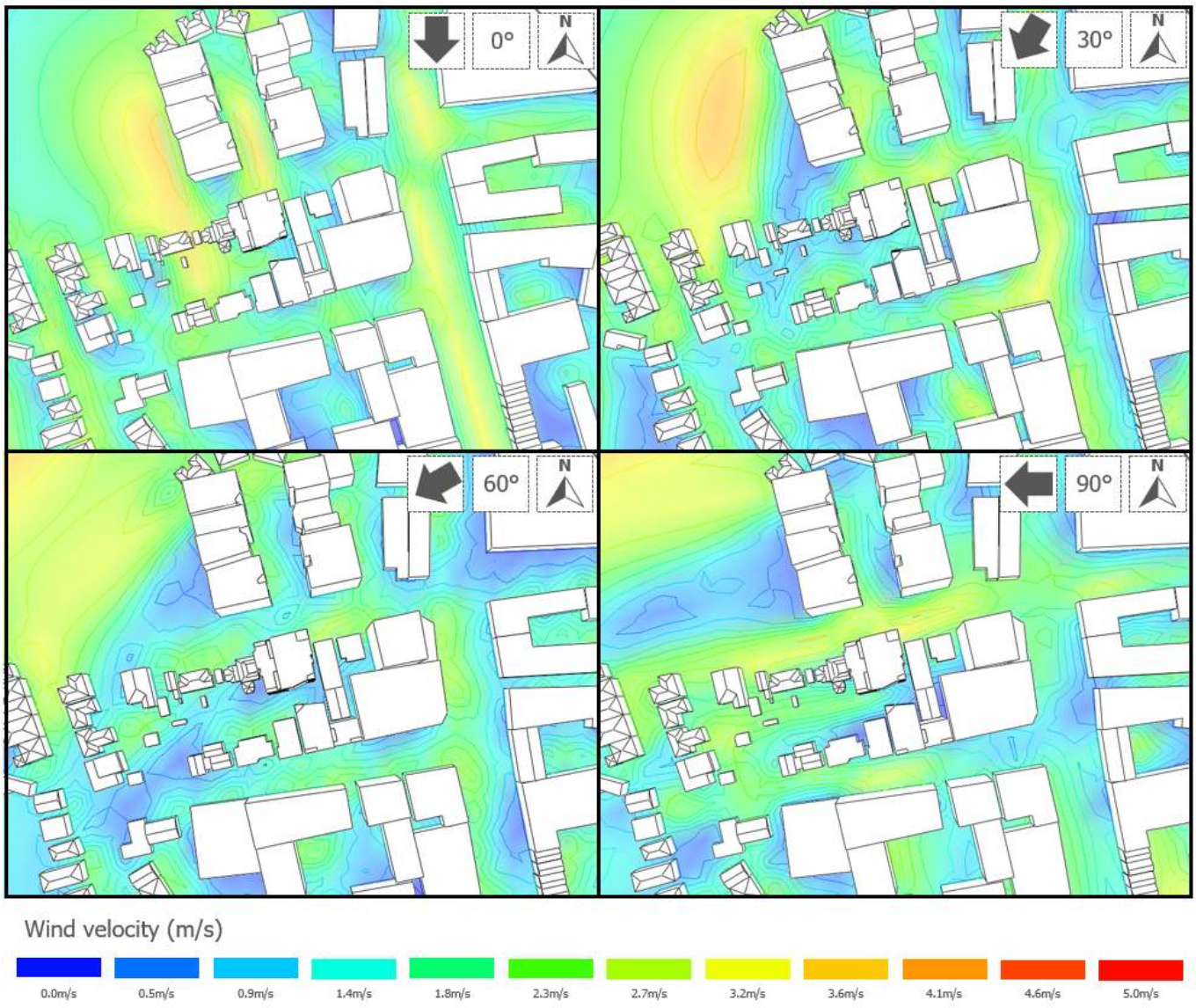
APPENDIX B – PROPOSED CONDITION

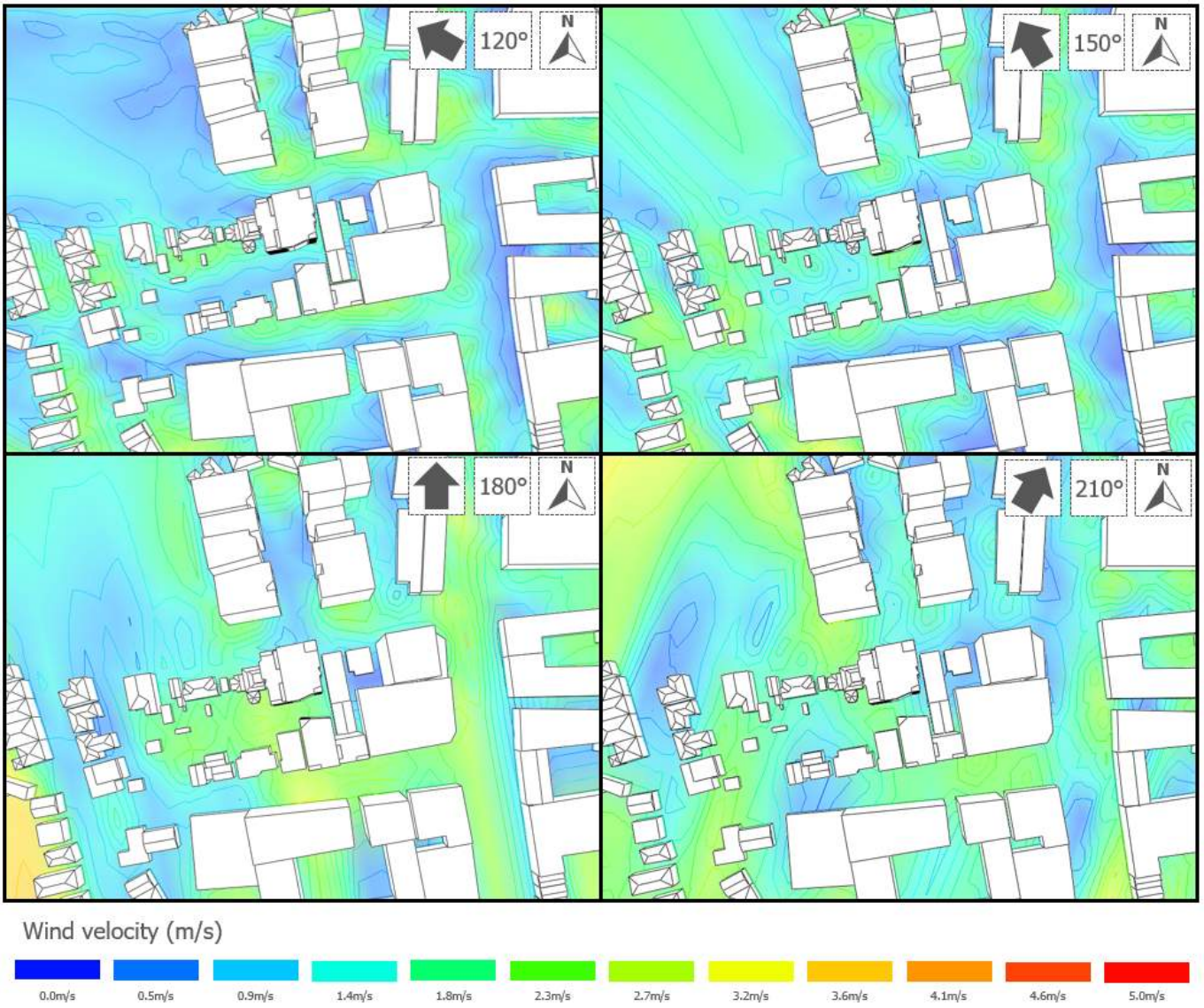



120°
N
150°
N
180°
N
210°
N
Wind velocity (m/s)
0.0m/s
0.5m/s
0.9m/s
1.4m/s
1.8m/s
2.3m/s
2.7m/s
3.2m/s
3.6m/s
4.1m/s
4.6m/s
5.0m/s


240°
N
270°
N
300°
N
330°
N
Wind velocity (m/s)
0.0m/s
0.5m/s
0.9m/s
1.4m/s
1.8m/s
2.3m/s
2.7m/s
3.2m/s
3.6m/s
4.1m/s
4.6m/s
5.0m/s

APPENDIX C – CUMULATIVE CONDITION




120°
N
150°
N
180°
N
210°
N
Wind velocity (m/s)
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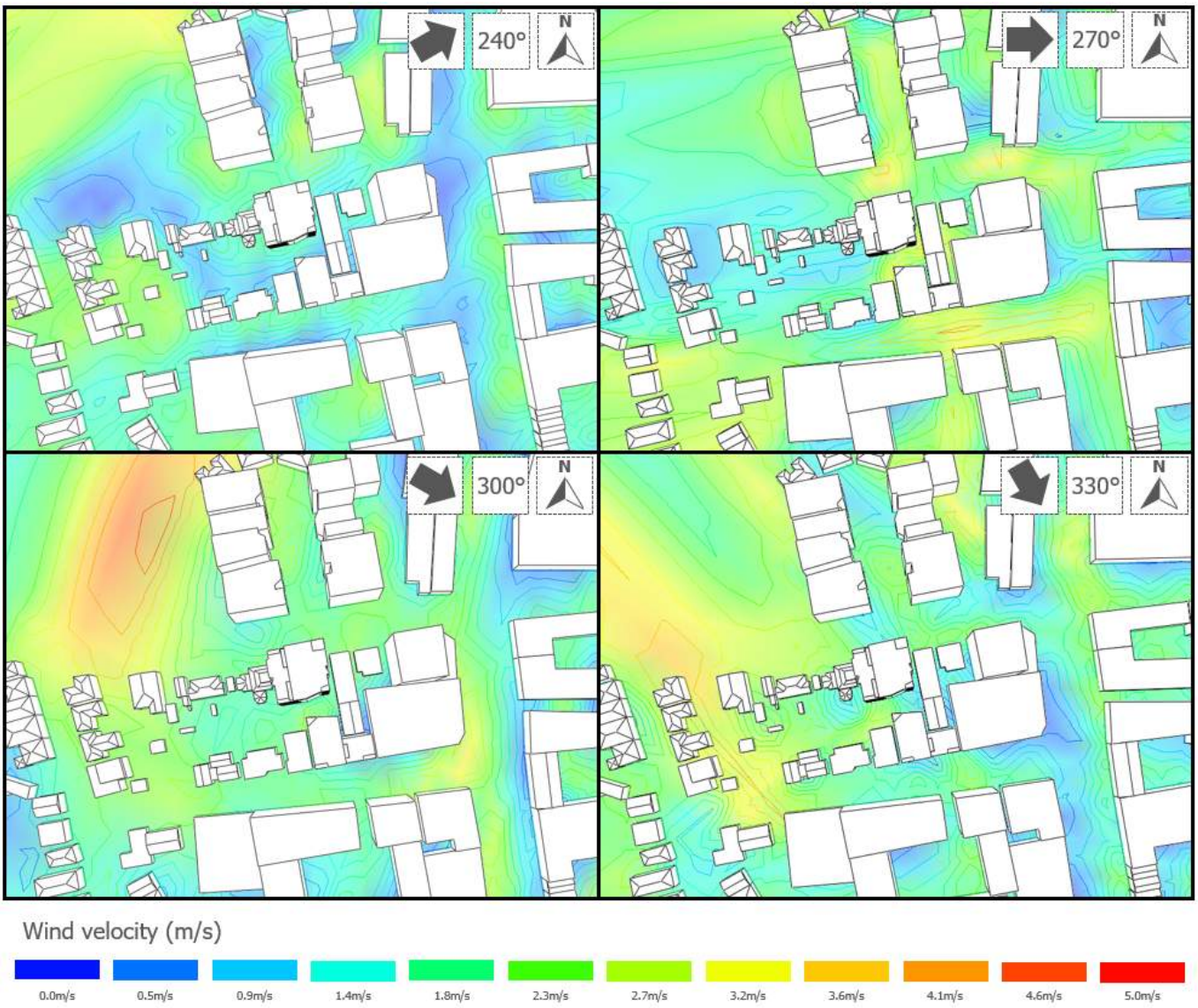
0.5m/s
0.9m/s
1.4m/s
1.8m/s
2.3m/s
2.7m/s
3.2m/s
3.6m/s
4.1m/s
4.6m/s
5.0m/s


240°
N
270°
N
300°
N
330°
N
Wind velocity (m/s)
0.0m/s
0.5m/s
0.9m/s
1.4m/s
1.8m/s
2.3m/s
2.7m/s
3.2m/s
3.6m/s
4.1m/s
4.6m/s
5.0m/s

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