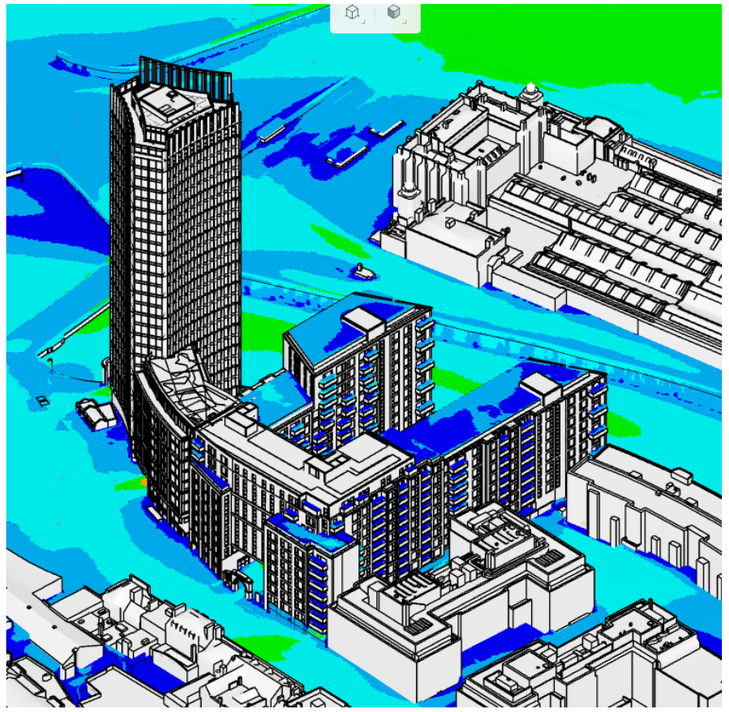
Parkgate Street Blocks B1 & C, Dublin 8



Microclimatic Wind Analysis and Pedestrian Comfort Report

IN2 Project No. D2453

05/12/2024

REV00

Revision History

Date	Revision	Description
05/12/2024	00	Issued for planning

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1.0 Executive Summary

This report compiles the results of Microclimatic Wind Analysis and Comfort Conditions undertaken by IN2 Engineering Design Partnership for the proposed residential development at Parkgate Street, Dublin 8, based on 3D modelling information received from Reddy A+U, comprising of assessments for predicted Wind Conditions to the local environment.

The proposed development consists of Block B 1and C of an overall development, which includes the Block A tower as part of a separate planning application. The site is located just north of Heuston Station and bound by Parkgate St to the north and the River Liffey to the south. A complete development description is included in Section 2.0. The surrounding site terrain consists generally of densely developed buildings to all directions, with the exception of the Northwest, which comprises of the relatively open spaces of Phoenix Park. These varying terrain types have been accounted for within the wind simulations undertaken.

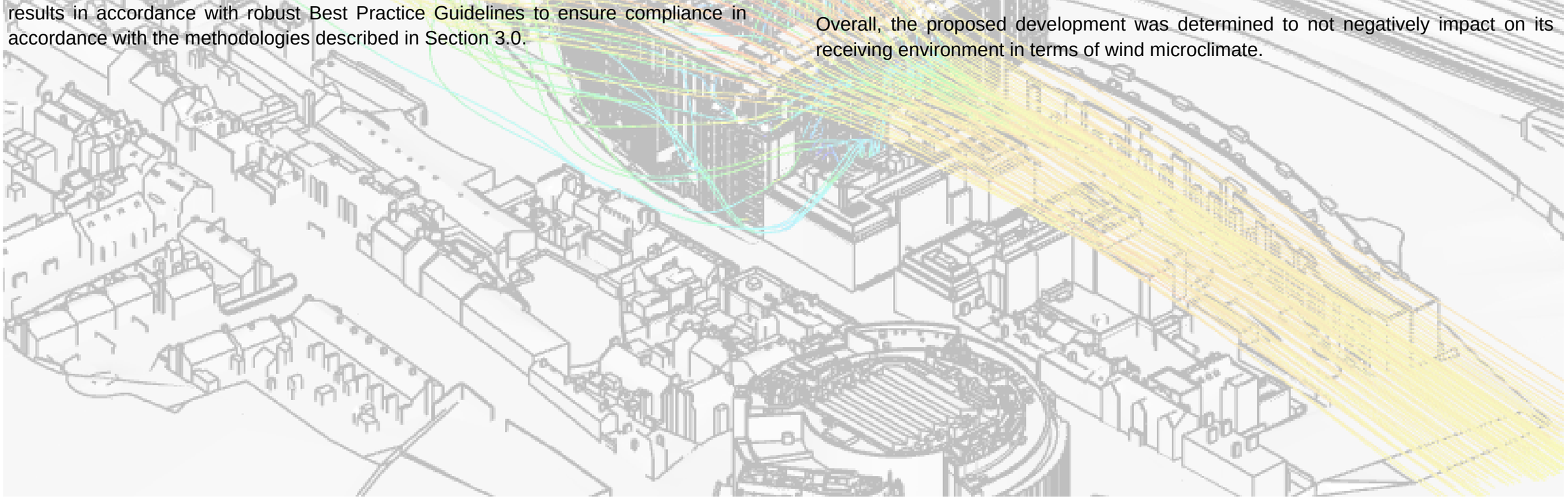
The report summarises the analysis undertaken, and conclusions determined from simulations performed with regards to Wind/ Pedestrian Comfort, in all cases validating results in accordance with robust Best Practice Guidelines to ensure compliance in accordance with the methodologies described in Section 3.0.

Wind Analysis was assessed utilising Airflow Simulation techniques through Computational Fluid Dynamics (CFD) SimScale software for the proposed development as detailed in Section 4.0. This determined regions of positive and negative pressures and associated predicted wind velocities for the proposed development for varying wind speeds and directions.

These wind simulations were then compiled and assessed against Lawson Criteria (Lawson LDDC Comfort) Methodology - an assessment method for Pedestrian Comfort to predict activity suitability (sitting/ standing etc.) for persons in the vicinity of the development as outlined in Section 3.2. The analysis illustrated how conditions for pedestrians at all Ground Level Open spaces were determined to have comfortable wind conditions suitable for “Outdoor Dining”, “Pedestrian Sitting / Standing”, “Pedestrian Walking” or “Business Walking”, with no adverse wind affects predicted to occur. All doorways were also determined to be in sheltered areas, allowing for easy access into and out of the building.

The balcony / amenity areas are deemed to be suitable for “Pedestrian Standing/Pedestrian Sitting/Outdoor Dining” indicating good conditions for pedestrian usage.

Overall, the proposed development was determined to not negatively impact on its receiving environment in terms of wind microclimate.



2.0 Development Description

Ruirside Developments Limited is seeking planning permission with a life of 8 years for Large-Scale Residential Development, at a site (c. 0.82 ha), at No. 42A Parkgate Street, Dublin 8. This is a brownfield site of former Parkgate Printing Works, now known as Parkgate House, with Protected Structures on site including (a) riverside stone wall; (b) turret; (c) square tower; and (d) stone arch. The proposed development adjoins consented development within the same application site boundary, including LRD6042/23 (Block B2 – 40no. apartments, café/restaurant unit (236 sq m) and community/cultural space (c. 52 sq m)) and SHD-310567-21 (Block A – 198no. apartments and restaurant/café (c.187 sq m)). The proposed development comprises mixed use residential, community and commercial redevelopment (c. 25,777 sq m gross floor area), accommodated in 2no. blocks (Block B1 and Block C) ranging in height from 8 to 13 storeys with basement and undercroft, and including: 316no. apartments (178no. 1-bed units and 138no. 2-bed units), with associated private balconies on all building elevations and communal roof terraces at Levels 07, 08, 09 and 12; ancillary internal residents' amenity facilities (c.226 sq m); multi-functional space accommodating co-working/cultural/community/exhibition uses available for public hire (c.496 sq m); ground level retail (c.147 sq m); and all associated and ancillary demolition, conservation, landscaping and site development works.

3.0 Methodology

3.1 Microclimatic Wind Analysis

In order to determine the predicted wind patterns around the proposed development, airflow simulations were undertaken using Computational Fluid Dynamics (CFD) software (SimScale). This enabled an assessment of the site wind conditions: highlighting zones of high pressure, negative pressure, and air movement for varying wind conditions.

An initial 3D representational model of the existing buildings and their immediate surroundings was created, and simulations undertaken for 12 cardinal wind directions.

Wind Climate Data was taken from the Global Wind Atlas. This utilises a microscale modelling system, enabling localised wind data to be obtained for high resolution (250m grid) topography, including representation of both natural landscaping such as hills, ridges, as well as urban environments.

Fig 3.1.1 illustrates Global Wind Atlas data for the general Dublin area, indicating average wind speed at 10m height. The relative sheltering of the Urban area can be seen, in contrast to Dublin Airport to the North, and Dublin/ Wicklow mountains to the South, and exposed coastal locations.

Recorded wind speeds for Dublin Airport are relatively high- in what is one of Europe's windier meteorological weather station locations. The identified site at Parkgate Street, Dublin 8 is seen to be in a relatively sheltered area as highlighted in Fig 3.1.1. On a macro level, the site is surrounded by Phoenix Park to the northwest, and dense urban spaces on all other sides.

The CFD simulations utilised wind profiles accounting for terrain effects. Allowing for the nature of the site and location, a surface roughness layer profile representative of "Towns, villages, agricultural land with many or high hedges, forests and very rough and uneven terrain (z_0=0.4m height)" was utilised, derived from GIS survey analysis [1].

Figures 3.1.2 and 3.1.3 indicates the modelled long-term annual "Wind Rose" obtained from the Global Wind Atlas for the site at Parkgate Street. The rose diagrams illustrate the frequency that wind will be from a certain direction and at what speed. It can be seen how the prevailing South-westerly / Westerly winds entirely predominate due to the Atlantic gulf stream, with only lower occurrence from other directions.

[1] European Space Agency's Climate Change Initiative Land Cover (CCI-LC) dataset v2.0.7.

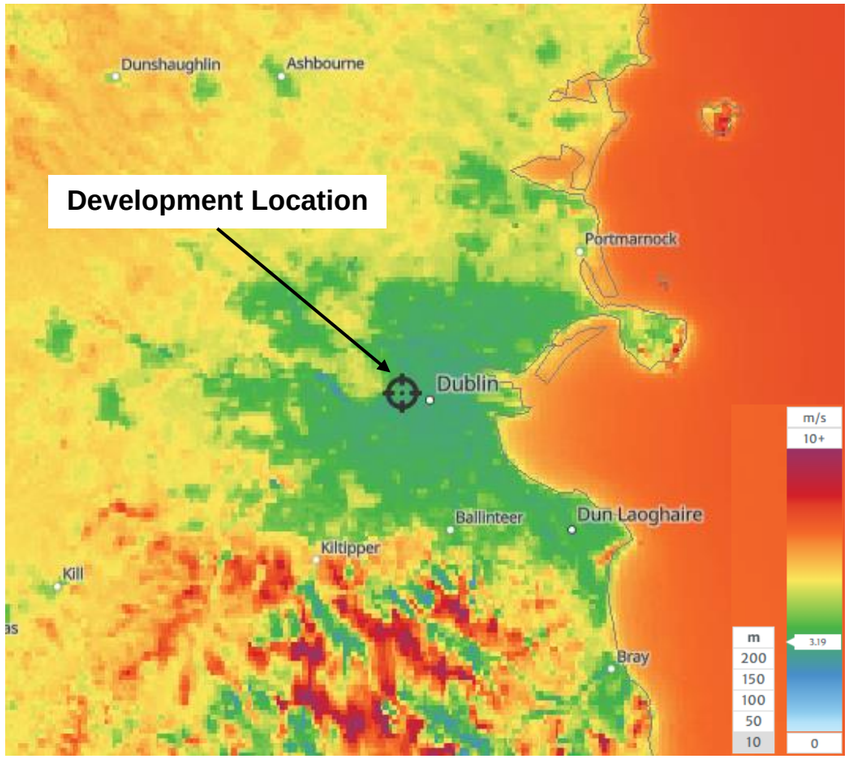


Fig 3.1.1 – Mean Wind Speeds across Dublin – Global Wind Atlas

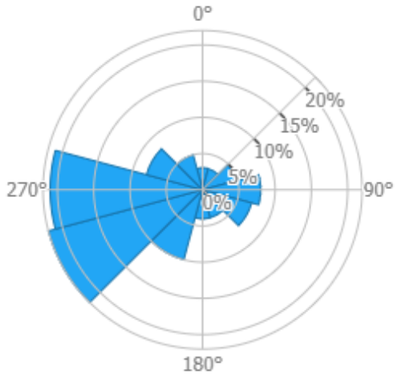


Fig 3.1.2 – Wind Frequency Rose for Parkgate Street – Global Wind Atlas

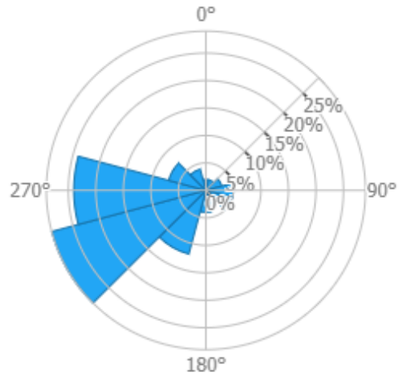


Fig 3.1.3 – Wind Speed Rose for Parkgate Street – Global Wind Atlas

3.1 Microclimate Wind analysis (Cont'd)

As per Fig 3.1.4, 3D representational model of the proposed development and its surroundings was created, and simulations undertaken for 12 cardinal wind directions.

The analysis included representational models of adjacent commercial and residential buildings, including buildings currently under construction.

The CFD simulations form the basis of the Pedestrian Wind Comfort Analysis undertaken, which is described in detail in Section 3.2 below.

The methodology calculates predicted airflow patterns around buildings for all wind orientations and calculates average velocity applying weighting based on probability of occurrence throughout the year. It should be noted that wind effects around buildings for prevailing westerly wind conditions are deemed to have more of a potential impact to pedestrian discomfort, as these will occur on a more regular occurrence.

However, it should be noted that the methodology assesses averaged (hourly) wind conditions for the purposes of general pedestrian comfort and does not intend to predict gusting, abnormal nor potential future climate change conditions.

Nevertheless, the Lawson Criteria methodology basis, as described in detail below, has been proven to be a robust means of analysing Pedestrian Comfort and its basis has been successfully adapted and implemented in both National Standards (Netherlands NEN.8100) and Design Guidelines (City of London – Wind Microclimate Guidelines (2019)). There are currently no Irish or European Standards for Pedestrian Comfort.

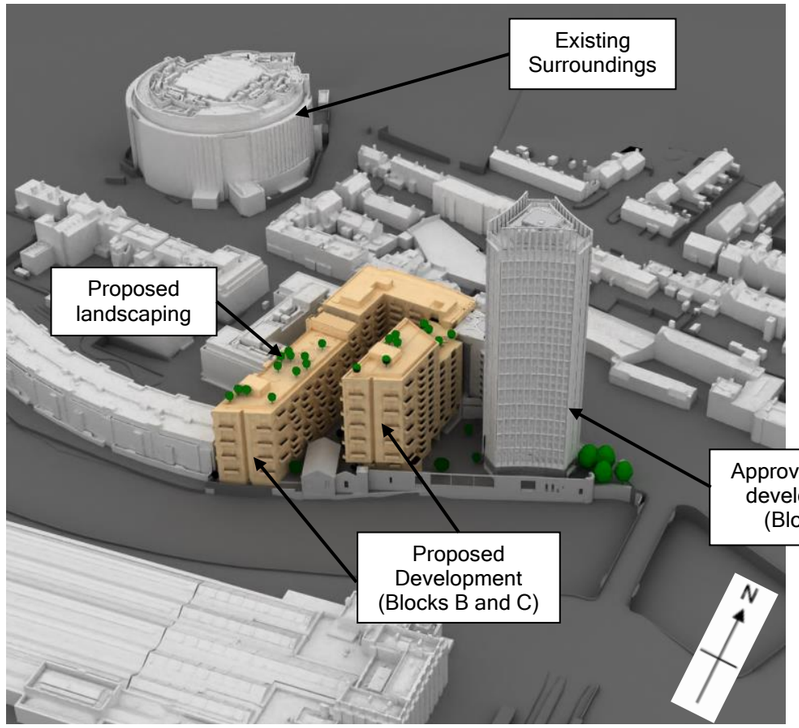


Fig 3.1.4 – 3D Model of Proposed Development and Neighbouring Buildings

3.2 Pedestrian Comfort

Pedestrian Wind Comfort was assessed utilising the “Lawson Criteria” scale, which has been developed as a means of assessing the long-term suitability of urban areas for walking or sitting, accounting for both microclimatic wind effects (i.e. site location and prevailing winds) and microclimatic air movement associated with wind forces influenced by the localised built environment forms and landscaping effects.

The original Lawson Criteria (as described in Building Aerodynamics, Tom Lawson, Imperial College Press, 2001) assesses probability of wind discomfort based on the Beaufort Scale as referenced in Figure 3.2.1.

Figure 3.2.2 illustrates the Lawson Criteria scale, as developed, and implemented to the City of London Guidelines as utilised and assessed within the report (termed LDDC Lawson Comfort Scale), which ranges from areas deemed suitable for long-term sitting through to regions uncomfortable for pedestrian comfort. “Pedestrian Walking” areas, for example, are defined as areas that would not experience wind velocities in excess of 8m/s for more than 5% of the year, whereas uncomfortable areas would experience averaged wind velocities greater than 10m/s for more than 5% of the year.

The assessment identifies areas where potential wind occurrence, based on probability of wind direction and speed, would either be mitigated (Outdoor Dining/ Pedestrian Sitting and Standing) or exacerbated (Business Walking/ Uncomfortable) due to proposed massing from potential developments.

However, it should be noted that in terms of pedestrian comfort, the Lawson Criteria assesses solely for wind/associated air velocity effects. Therefore, other environmental aspects that may influence a space’s microclimate, such as exposure to sunlight and envisaged temperature variation throughout the year are not accounted for within this methodology.

Beaufort Force	Hourly-Average Windspeed m/s	Description of Wind	Noticable Effect of Wind
0	<0.45	Calm	Smoke rises vertically
1	0.45 - 1.55	Light	Direction shown by Smoke drift but not by vanes
2	1.55 - 3.35	Light	Wind felt on faces: leaves rustle: wind vane moves
3	3.35 - 5.60	Light	Leaves and twigs in motion: wind extends a flag
4	5.60 - 8.25	Moderate	Raises dust and loose paper: small branches move
5	8.25 - 10.95	Fresh	Small trees in leaf sway
6	10.95 - 14.10	Strong	Large branches begin to move: telephone wires whistle
7	14.10 - 17.20	Strong	Whole trees in motion

Fig 3.2.1 Beaufort Scale

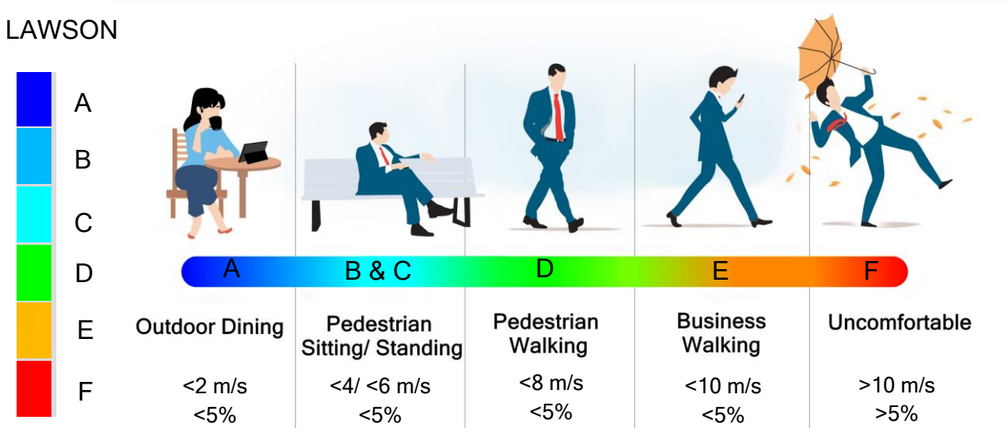


Fig 3.2.2 LDDC Lawson Comfort Scale

3.3 Areas of Assessment

All outdoor spaces where there is expected to be pedestrian activity have been assessed for pedestrian comfort.

For the Pedestrian Comfort Analysis, the assessed spaces have been grouped into the following sections:

1. Ground level surroundings: all ground areas surrounding the development where pedestrians will be walking and / or entering the buildings (highlighted in blue in Fig 3.3.1).

2. Balconies: private amenity area for each apartment (highlighted in green in Fig 3.3.1).

3. Rooftop amenity space: seating area with landscaping on the roof of the development (highlighted in pink in Fig 3.3.1).

Fig 3.3.1 Assessed External Amenity Spaces

4.0 Wind Analysis

4.1 Pressures and Velocities

Figures 4.1.2 and 4.1.3 illustrate the predicted wind coefficient of pressure and velocities across the development under prevailing (240°N) wind direction at 1.5m above ground level. Figure 4.1.1 shows a subset of velocity streamlines from the prevailing wind direction.

The wind pressures in Fig 4.1.2 exhibit higher pressure zones forming on the western façade of the building. As illustrated by the Fig 4.1.1, this is caused by the height of the building. The wind flows freely over the neighbouring developments, then is impacts the western side of the proposed development where it is forced down onto ground level and then around to the north of the building. Because the pressure is consistent across the façade, there is no significant acceleration of wind allowing the ground level to remain comfortable. This also serves to shelter the rest of the proposed development from the brunt of the prevailing wind.

As illustrated in the wind velocities shown in Fig 4.1.2, there are some higher velocity areas on roadways, through the underpass, and next to the wall openings overlooking the River Liffey. However, as shown in Section 5.0 these velocities are not high enough to cause discomfort and are typical for air flow around buildings.

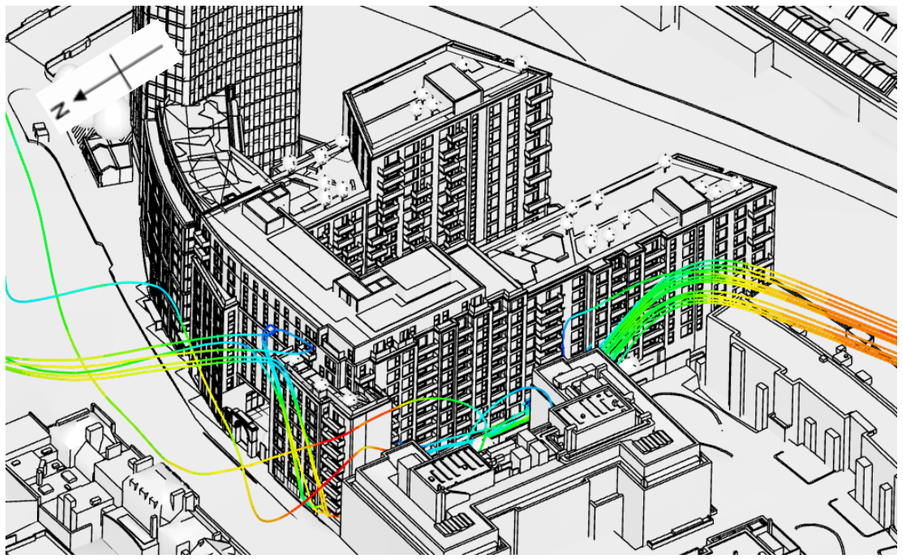


Fig. 4.1.1 – Wind velocity streamlines from prevailing SW wind direction

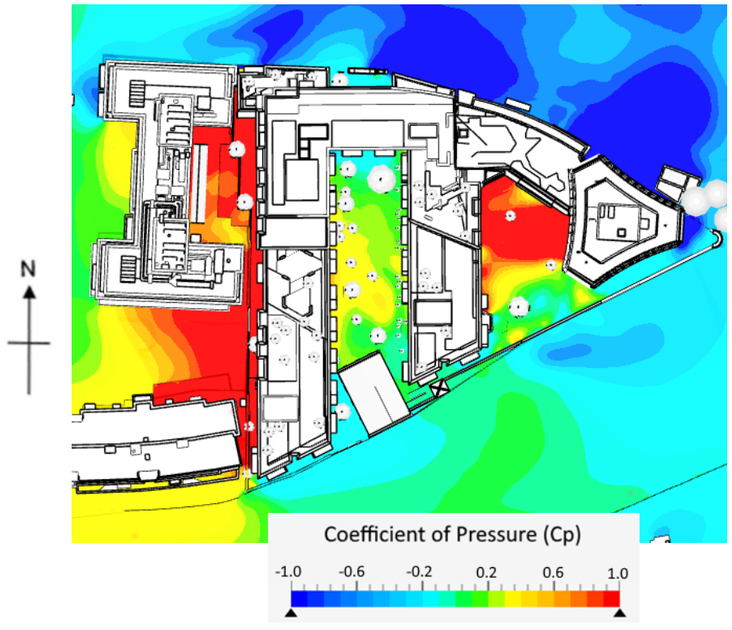


Fig. 4.1.2 – Wind Pressures at 1.5m Above Ground Level

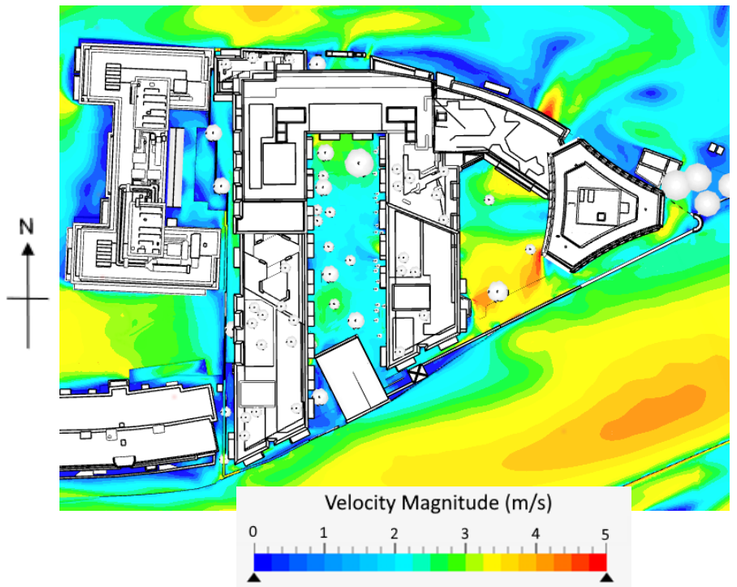


Fig. 4.1.3 – Average Wind Velocities at 1.5m Above Ground Level

5.0 Pedestrian Comfort

5.1 Ground Level Open Space

The Pedestrian Comfort at the ground level for the proposed development and its surrounding areas was assessed by predicting the Lawson Criteria values at 1.5m above ground level.

The scale in Fig 5.1.1 outlines the Lawson Criteria Scale utilised. Blue contours illustrate the most sheltered regions, areas deemed “Suitable for Outdoor Dining”. Light Blue/ Cyan contours indicate regions “Suitable for Pedestrian Sitting” and “Pedestrian Standing” respectively. Green contours indicate areas “Suitable for Pedestrian Walking”, with orange illustrative of being “Suitable for Business Walking”. Red areas highlight zones as “Uncomfortable”.

The Lawson Criteria results for ground level are shown in Fig 4.1.2. There were no red “Uncomfortable” areas in the analysis. There is an area of “Business Walking” through the underpass of Block B2, but this area is small and is planned to be a walkway, so this will not adversely impact the occupants. All other areas were deemed to be “Pedestrian Walking” or lower, with most of the ground level amenity being suitable for “Pedestrian Sitting”. Around all ground level doorways, the comfort levels were pedestrian standing or lower, indicating easy access to the building.

Ground level landscaping was considered in the analysis in line with the plans received from Mitchell and Associates. The results from this analysis are shown in Fig. 4.1.3, where the trees serve to decrease the localised wind effects, particularly to the extent of area predicted to be suitable for “Pedestrian or Business Walking” areas.

Overall, the majority of the site would be deemed suitable for “Pedestrian Sitting/Outdoor Dining/Pedestrian Standing/Pedestrian Walking”. This would provide good conditions for pedestrian usage and indicates that no adverse wind effects were predicted to occur.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig. 5.1.1 – Lawson Criteria

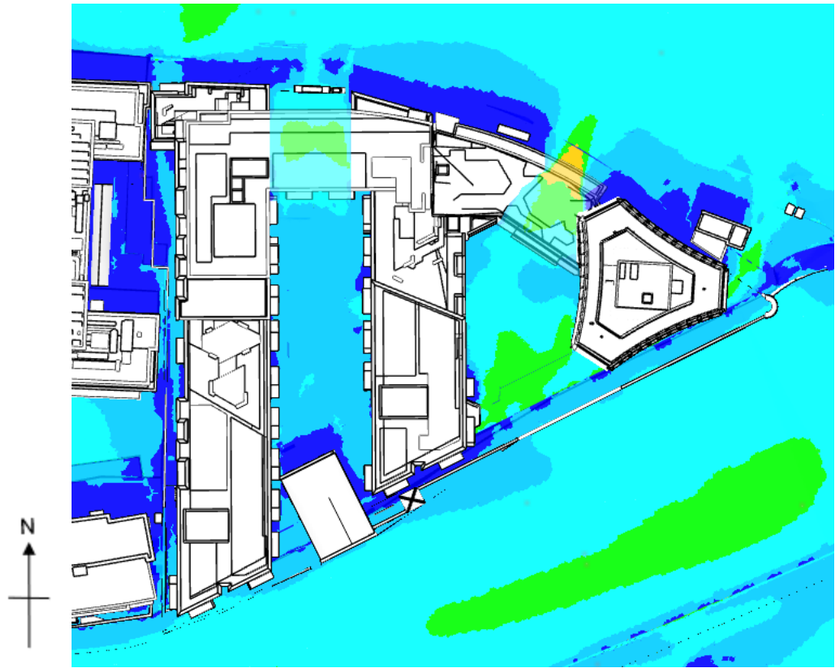


Fig. 5.1.2 – Lawson Criteria Results at 1.5m above ground level without landscaping.

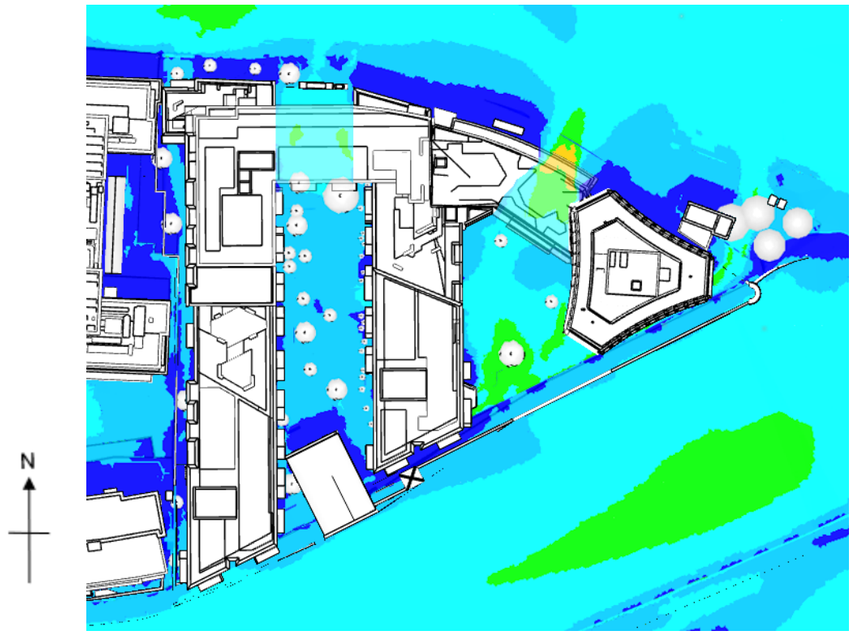


Fig. 5.1.3 – Lawson Criteria Results at 1.5m above ground level with landscaping.

5.2 Rooftop Amenity Spaces

The Pedestrian Comfort at the rooftop amenity for the proposed development was assessed by predicting the Lawson Criteria values at 1.5m above the roof levels. The scale in Fig 5.2.1 outlines the Lawson Criteria Scale utilised.

The analysis was run with and without the proposed landscaping provided by Mitchell and Associates. The Lawson Criteria results for amenity spaces without trees are shown in Fig 5.2.2, and with trees in Fig 5.2.3.

Sheltering screens were also included in the analysis as per the design provided by Reddy A+U. These screens are highlighted in Fig 5.2.2, with the red lines indicating a 1.3m tall solid panel, and the yellow line indicating a 2.0m tall solid panel. The only area where a 2.0m tall panel was required was on the western side of the amenity space circled in Fig 5.2.2 and 5.2.3.

It was deemed that the majority of the assessed spaces would be suitable for “Pedestrian Sitting/Outdoor Dining” even without the proposed landscaping. However, the addition of trees does provide a noticeable sheltering affect, as can be seen in the decrease in size of “Pedestrian Standing” areas on the top left roof amenity space (circled areas in Figs 5.2.2 and 5.2.3).

Overall, the majority of the areas would provide excellent conditions for pedestrian usage and indicates that no adverse wind effects were predicted to occur.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig. 5.2.1 – Lawson Criteria

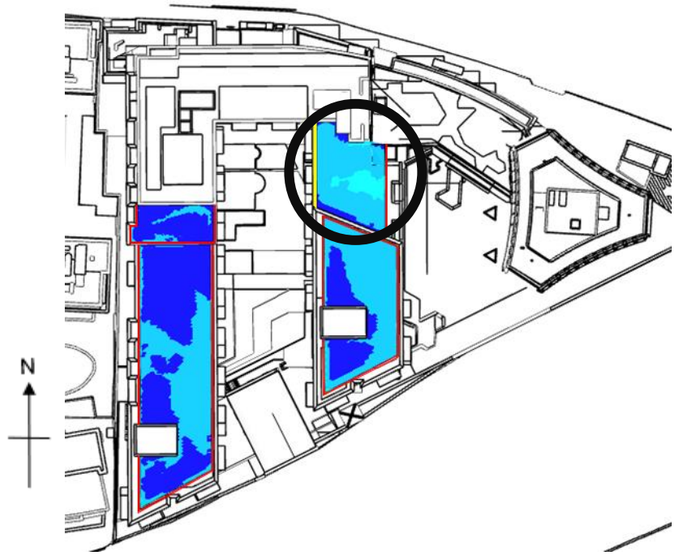


Fig. 5.2.2 – Lawson Criteria results at 1.5m above rooftop amenity excluding landscaping.

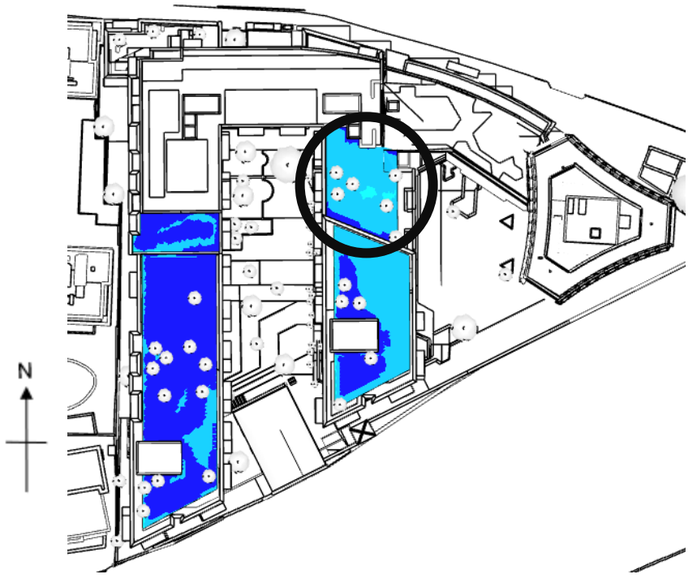


Fig. 5.2.3 – Lawson Criteria results at 1.5m above rooftop amenity including landscaping.

5.3 Balconies

The Pedestrian Comfort at the individual apartment balconies for the proposed development was assessed by predicting the Lawson Criteria values at 1.5m above the balcony levels. The scale in Fig 4.3.1 outlines the Lawson Criteria Scale utilised.

All balconies are surrounded by a 1.1m tall solid balustrade, in line with the designs provided by Reddy A+U. These balustrades serve to provide sheltering to all balconies, mitigating many of the negative effects derived from the height of the proposed development.

Figure 5.3.1 shows an example of the balcony results, with full results for all balconies available in Sections 5.3.1 and 5.3.2. Section 5.3.1 illustrates the results for the perimeter façade balconies, and Section 5.3.2 illustrates the results for the courtyard façade balconies.

As shown, all balconies consist of majority “Outdoor Dining” or “Pedestrian Sitting” areas. There are some areas suitable for “Pedestrian Standing”, but these are concentrated on the edge of the balconies and will not significantly impact occupant comfort.

Overall, all balconies are designed are predicted to be suitably comfortable with regards to wind.

Fig. 5.3.1 – Subset of balcony Lawson Criteria results.

5.3.1 Perimeter Façade Balcony Results

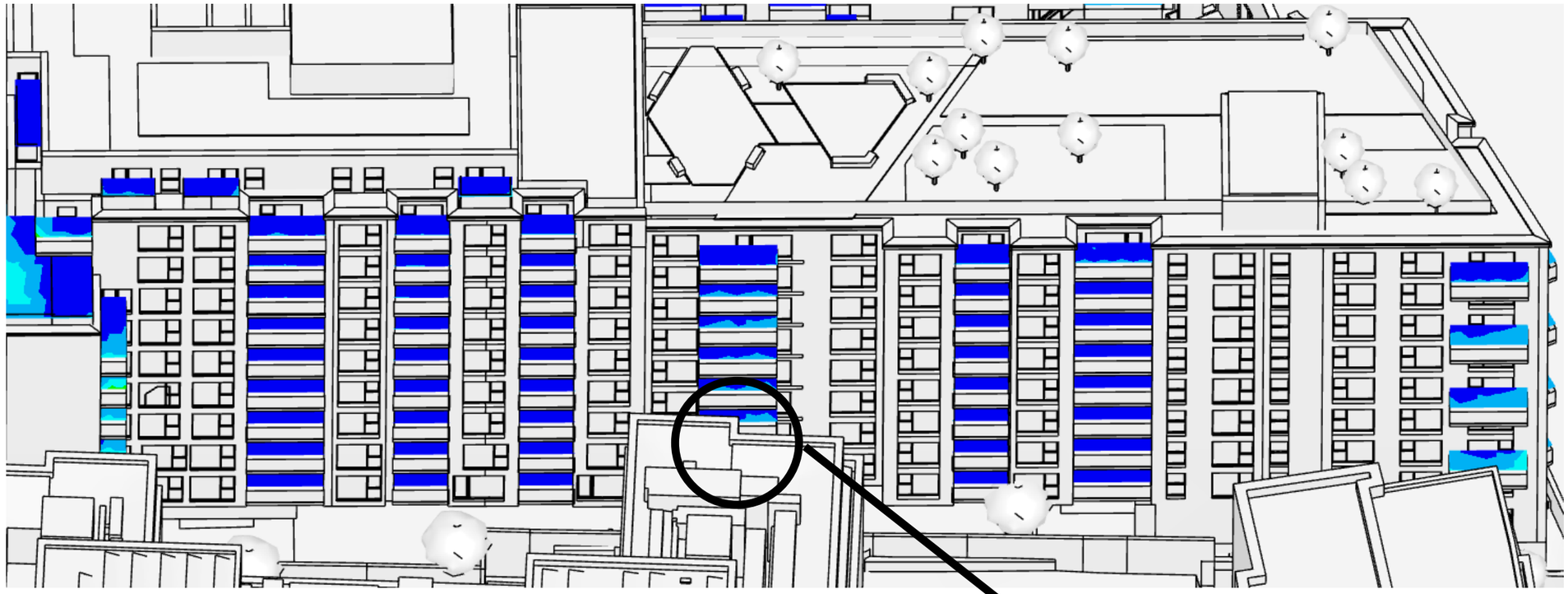
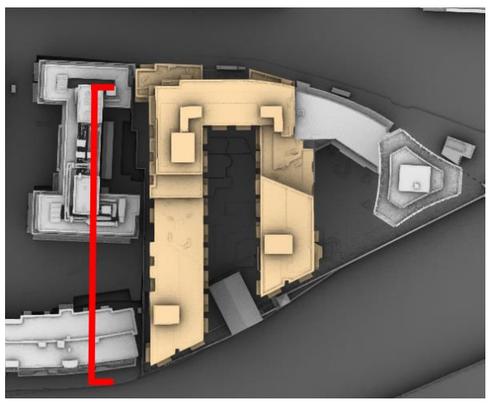
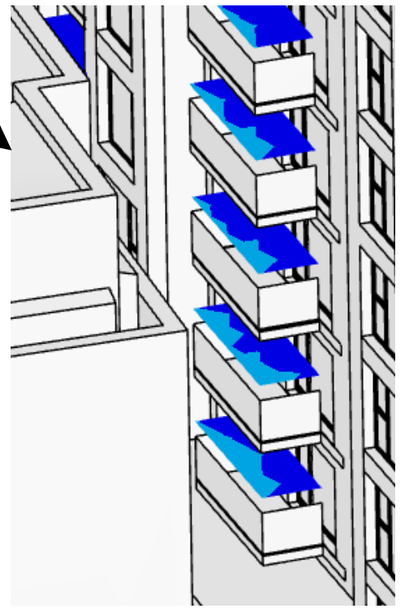
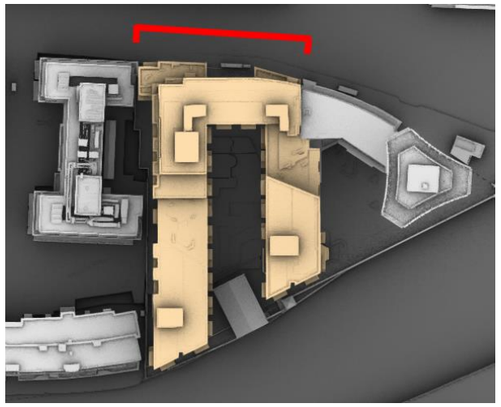


Fig. 5.3.1 – Lawson Criteria results for western perimeter balconies.



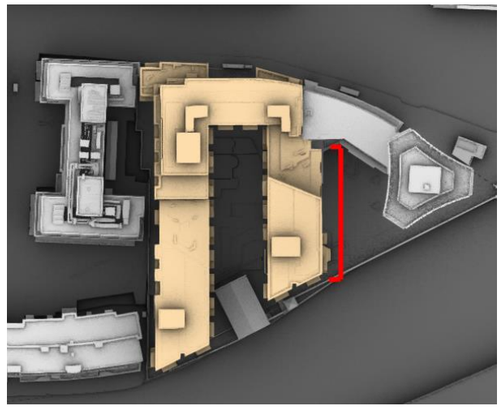
A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable





A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Fig. 5.3.2 – Lawson Criteria results for northern perimeter balconies.



A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

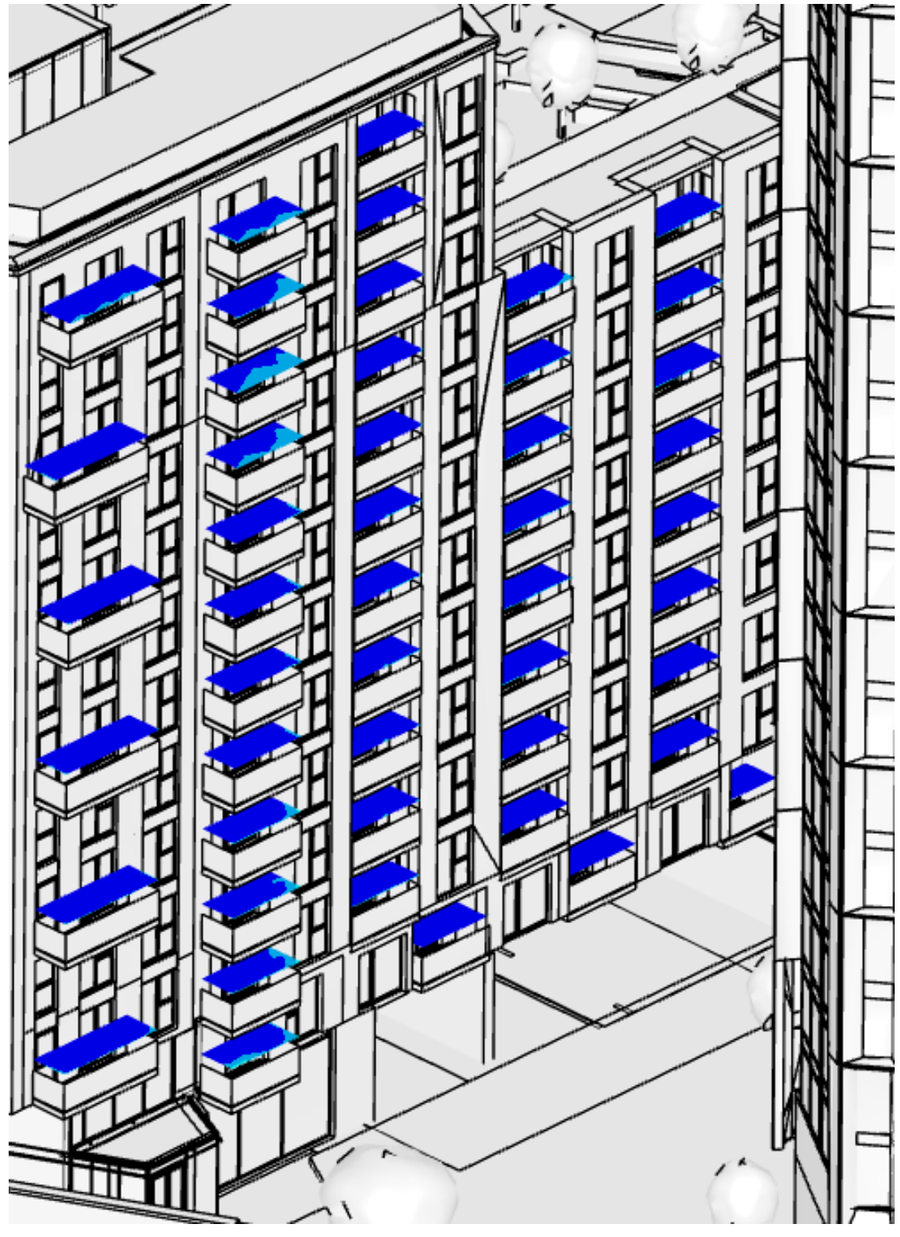
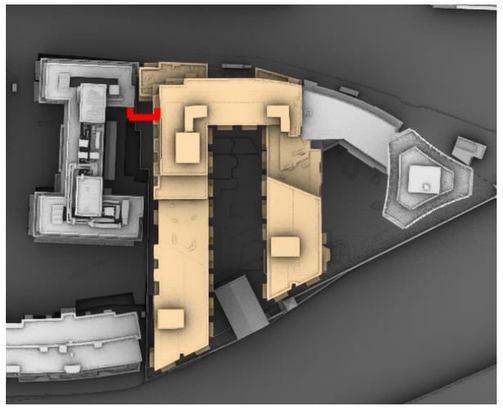
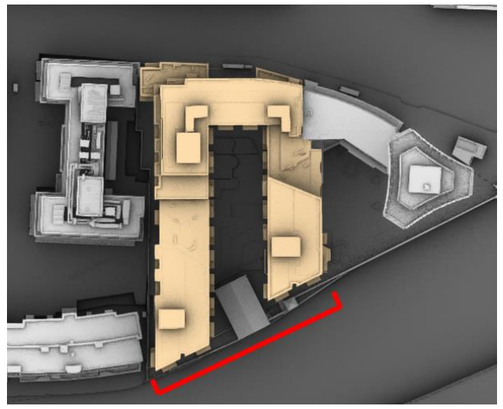


Fig. 5.3.3 – Lawson Criteria results for eastern perimeter balconies.



A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable



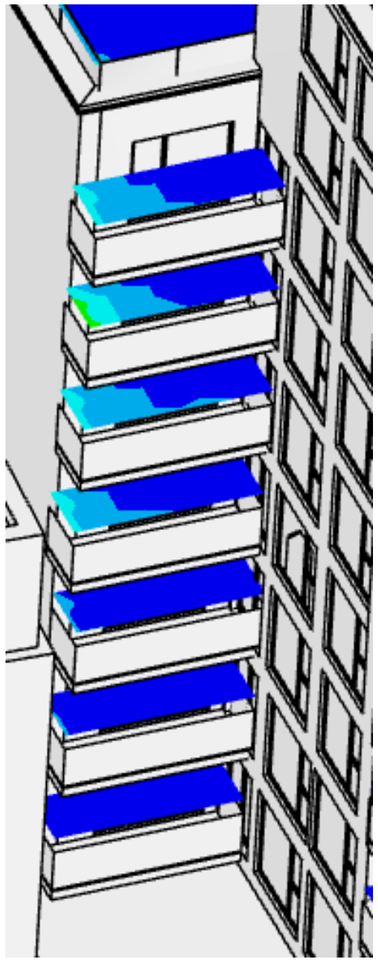


Fig. 5.3.4 – Lawson Criteria results for southern perimeter balconies.

5.3.2 Courtyard Façade Balconies

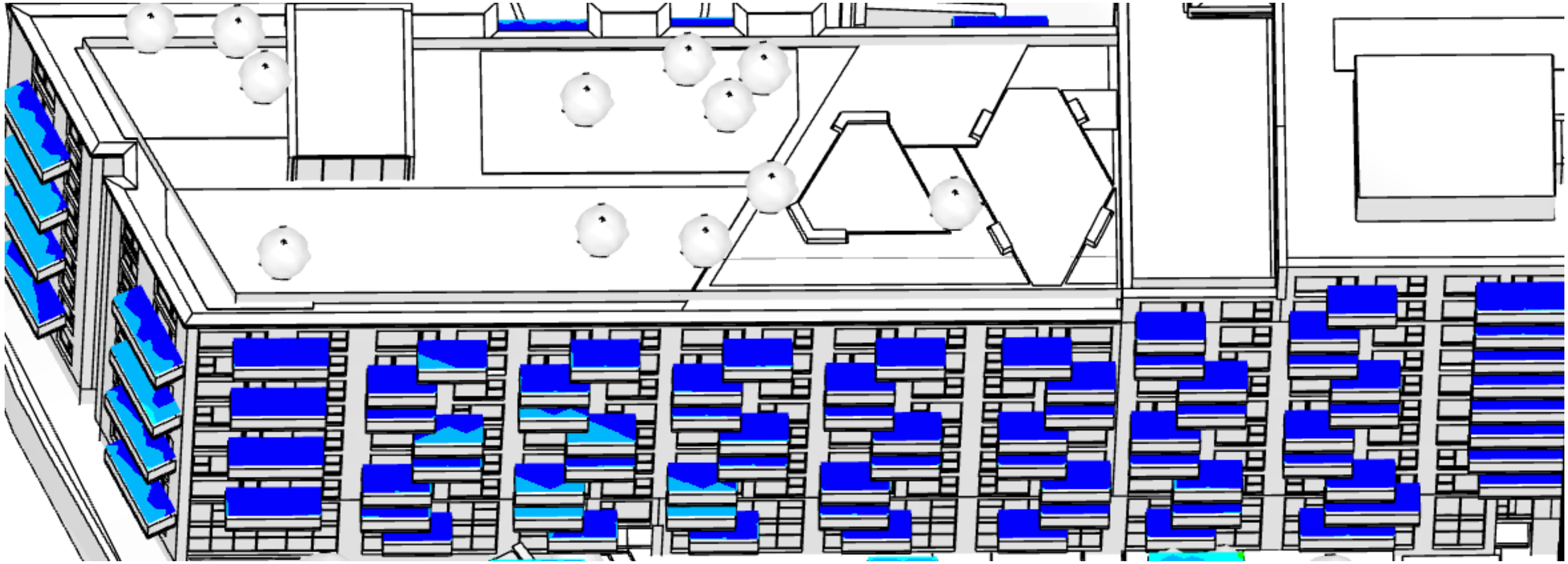
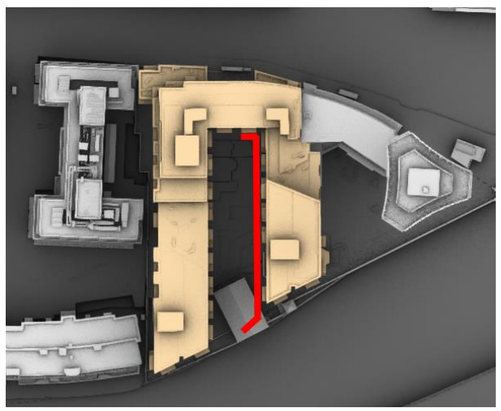
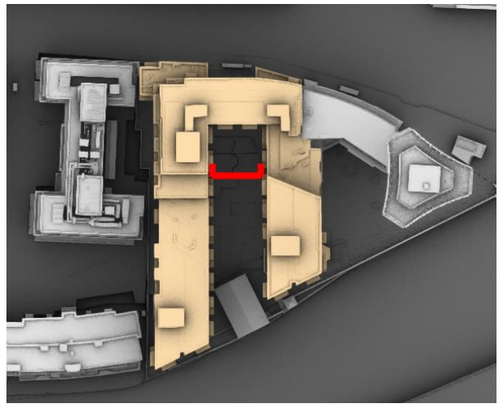


Fig. 5.3.5 – Lawson Criteria results for western courtyard balconies.

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable





A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

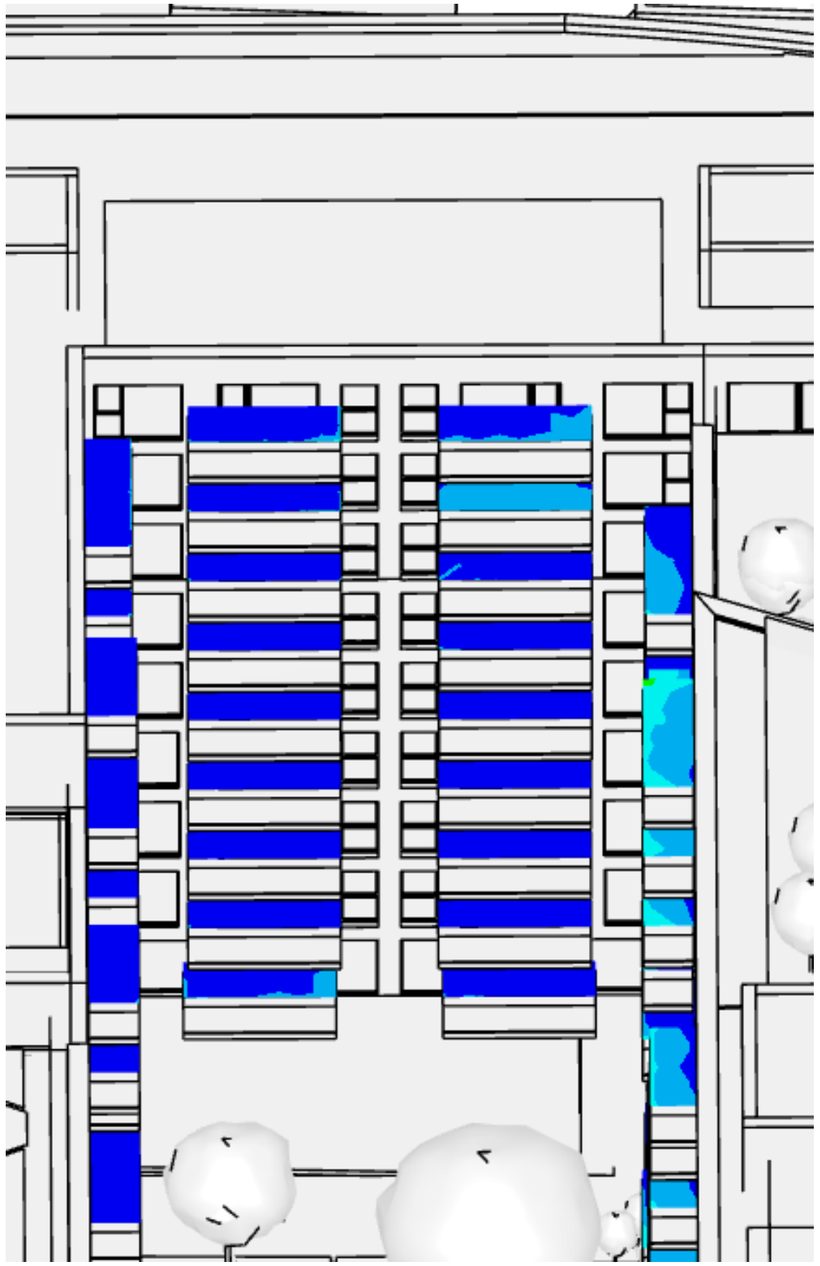


Fig. 5.3.6 – Lawson Criteria results for northern courtyard balconies.

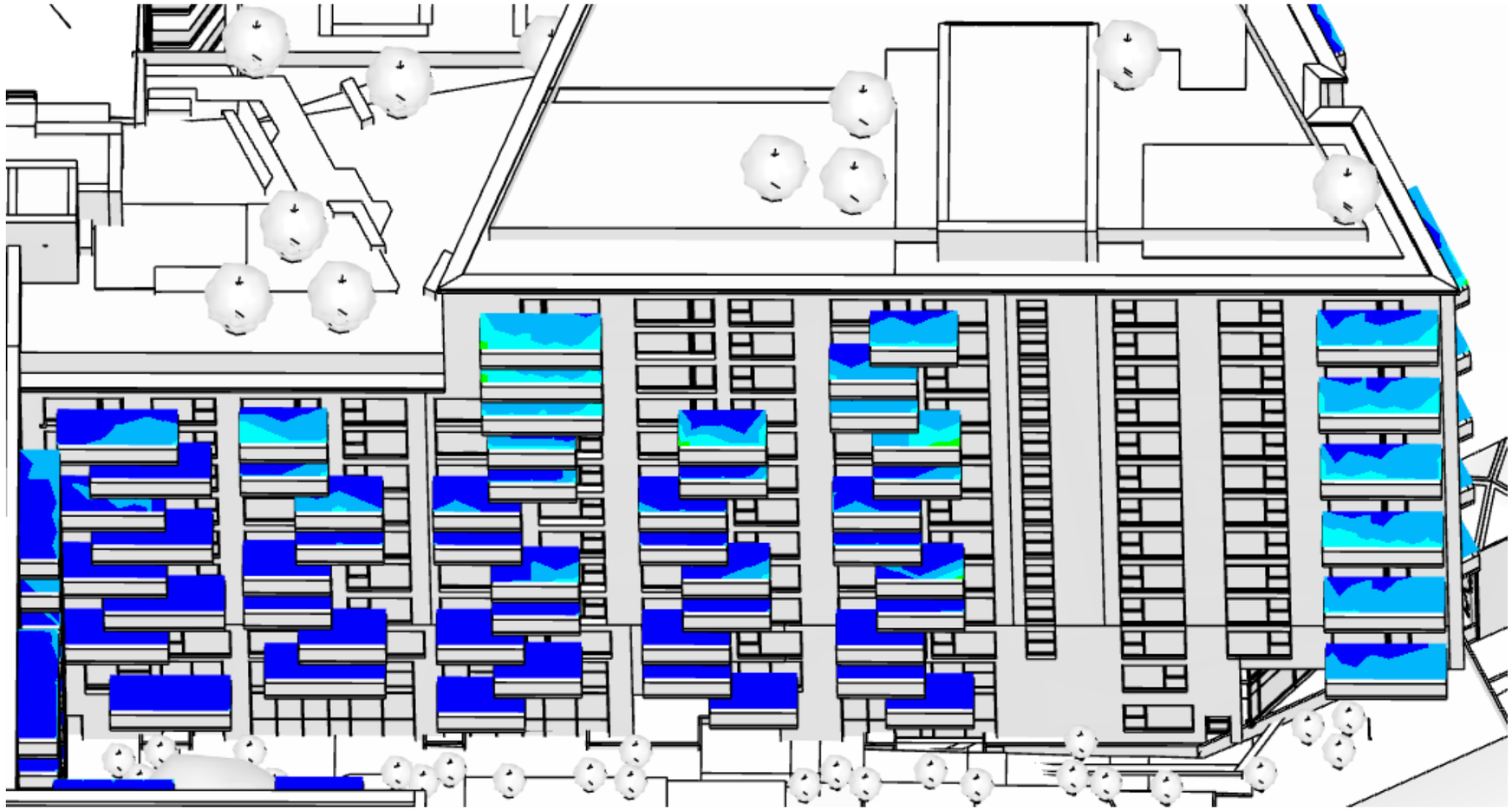
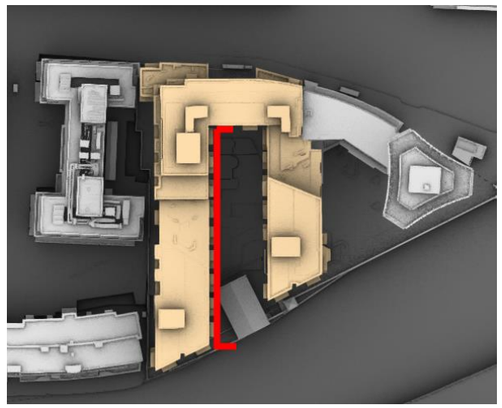


Fig. 5.3.7 – Lawson Criteria results for eastern courtyard balconies.

	A	2 m/s	< 5%	Outdoor Dining
	B	4 m/s	< 5%	Pedestrian Sitting
	C	6 m/s	< 5%	Pedestrian Standing
	D	8 m/s	< 5%	Pedestrian Walking
	E	10 m/s	< 5%	Business Walking
	U	10 m/s	> 5%	Uncomfortable



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