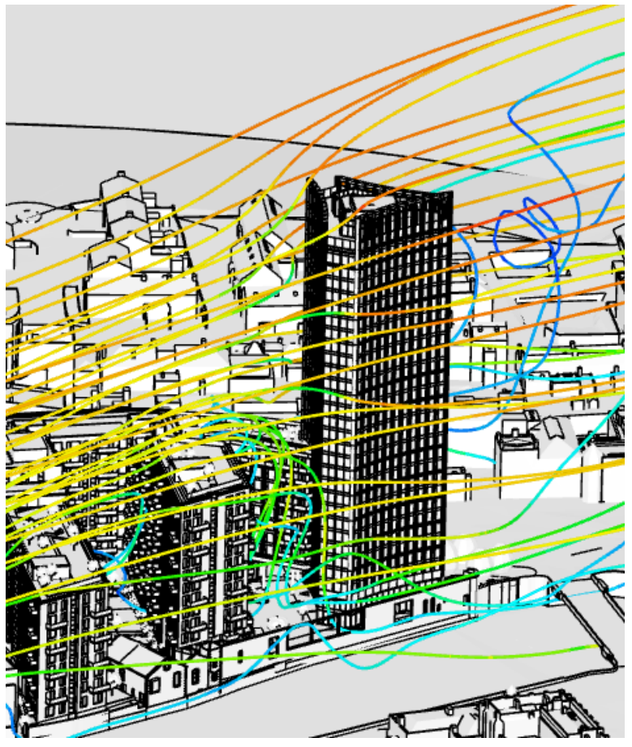
Parkgate Street Blocks A & B2 Amendment, Dublin 8



Microclimatic Wind Analysis and Pedestrian Comfort Report

IN2 Project No. D2453

05/03/2025

REV01

Revision History

Date	Revision	Description
26/02/2025	00	Issued for Planning
05/03/2025	01	Updated for comments and issued for Planning

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1.0 Executive Summary

This report compiles the results of Microclimatic Wind Analysis and Pedestrian Comfort Conditions undertaken by IN2 Engineering Design Partnership for the proposed amendment to the 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 amendment consists of Blocks A and B2, with changes to the massing of Block A as well as internal layout adjustments. The site is located just north of Heuston Station and bound by Parkgate St to the north and the River Liffey to the south. 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 2.0.

Wind Analysis was assessed utilising Airflow Simulation techniques through Computational Fluid Dynamics (CFD) SimScale software for the proposed development as detailed in Section 3.0. 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 of ground level, for residential balconies within the proposed development, and for the planned rooftop amenity spaces to both Blocks A and B2.

The analysis at Ground Level Open spaces determined all areas have comfortable wind conditions, with no adverse wind affects predicted to occur. All ground level doorways were also determined to be in sheltered areas, allowing for ease of access into and out of the building.

The proposed residential balcony areas within Block B2 were deemed to be suitable for “Pedestrian Sitting/Outdoor Dining”, which were further improved by the addition of balcony separation screens at the more exposed upper levels (L.08).

The rooftop amenity space on Block A was predicted to be suitable for majority “Outdoor Dining”, with some small areas of “Pedestrian Sitting” as well, proving excellent comfort conditions, particularly due to the sheltering effects from winds by the proposed 2m screening on all sides.

For the initial design, the rooftop amenity space on Block B2 was determined to be unsuitable for occupant usage mainly due to downwash effects from the adjacent Block A tower under prevailing wind conditions. However, through the implementation of mitigation measures including landscaping and increased height of screens, the predicted comfort was significantly improved across the space. The majority of the space was deemed suitable for “Pedestrian Standing” or better, with seated elements generally located in sheltered areas suitable for seating.

Overall, the proposed amendment was determined to not negatively impact on its receiving environment in terms of wind microclimate, with also design development ensuring best practice compliance for both private and public amenity spaces.

2.0 Methodology

2.1 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 2.1.1 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 2.1.1. 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 2.1.2 and 2.1.3 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.

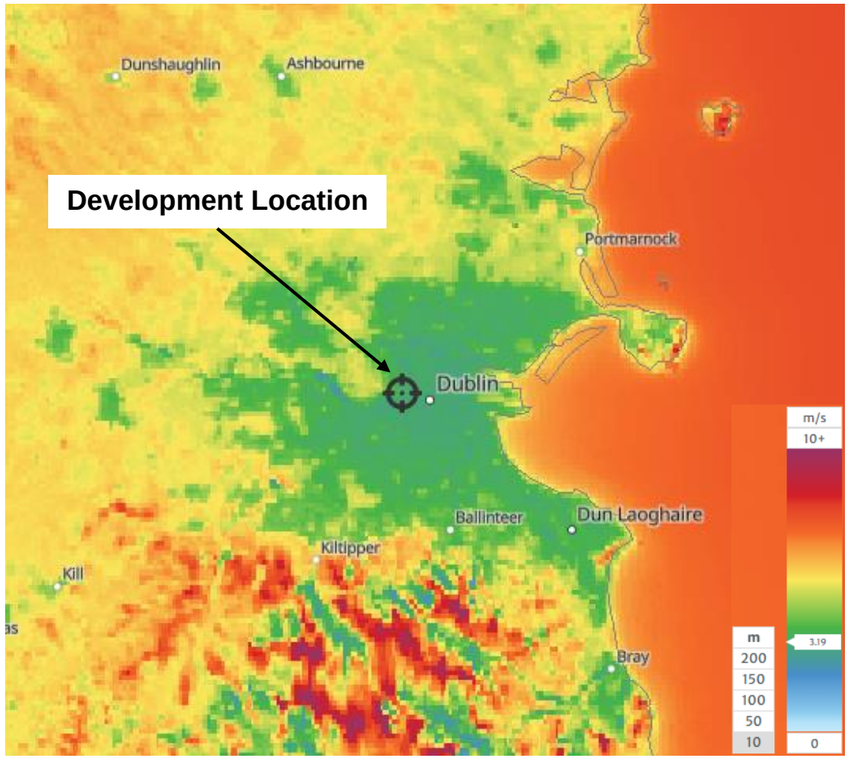

Fig 2.1.1 – Mean Wind Speeds across Dublin – Global Wind Atlas

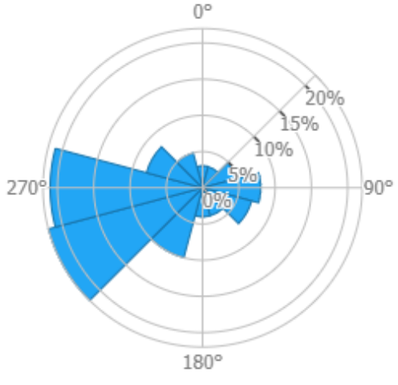

Fig 2.1.2 – Wind Frequency Rose for Parkgate Street – Global Wind Atlas

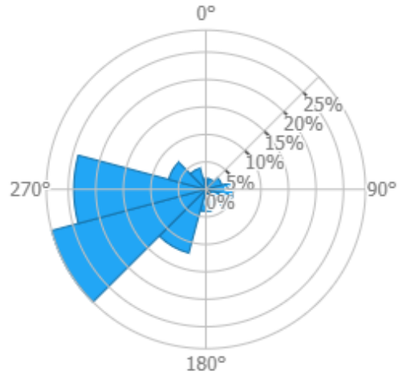

Fig 2.1.3 – Wind Speed Rose for Parkgate Street – Global Wind Atlas

2.1 Microclimate Wind analysis (Cont'd)

As per Fig 2.1.4, 3D representational model of the proposed amendment 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 2.2 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.

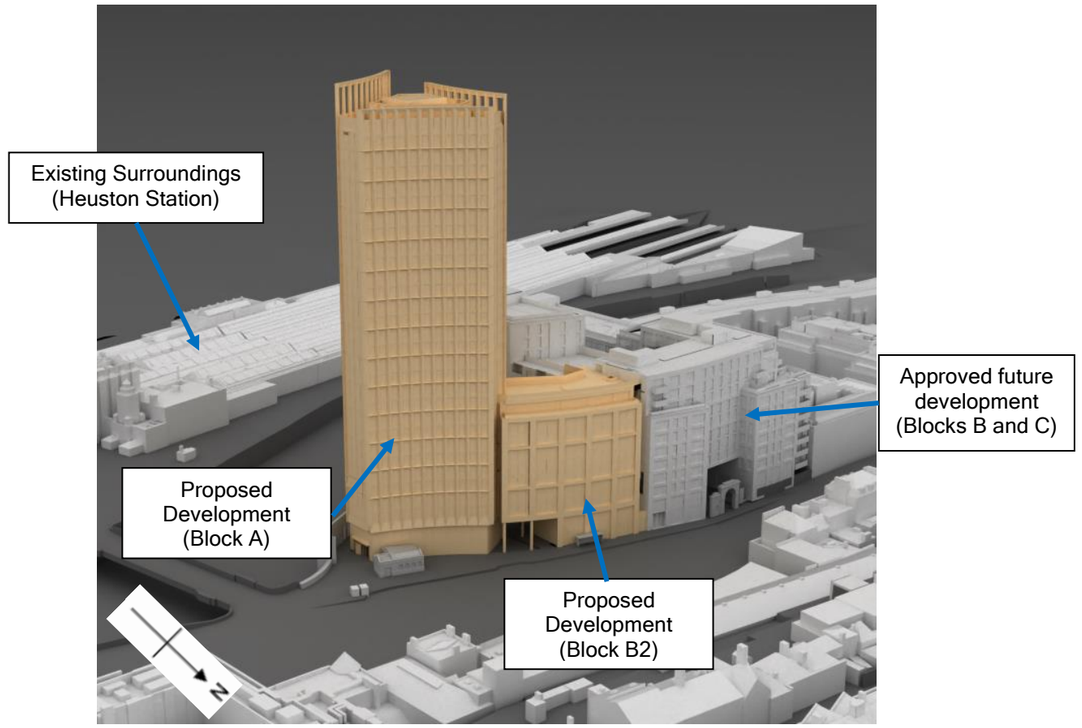

Fig 2.1.4 – 3D Model of Proposed Development Amendment and Neighbouring Buildings

2.2 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 2.2.1.

Figure 2.2.2 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 2.2.1 Beaufort Scale

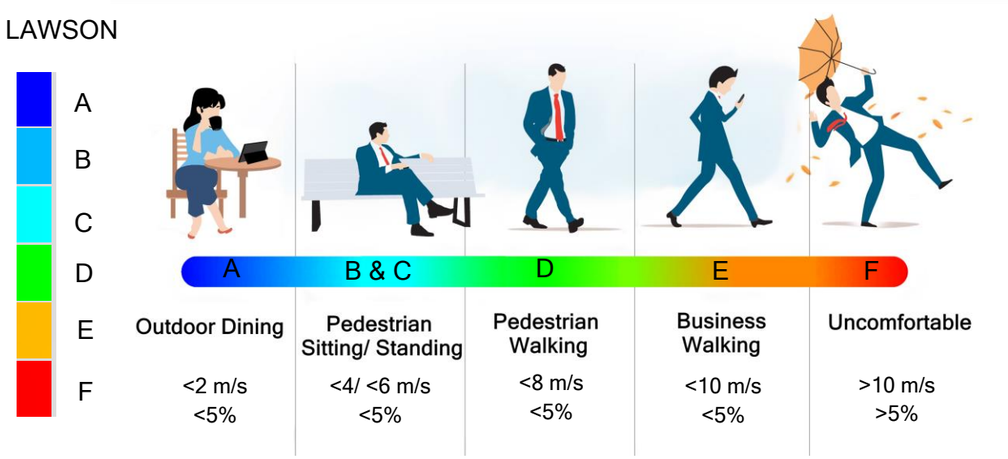

Fig 2.2.2 LDDC Lawson Comfort Scale

2.3 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 green in Fig 2.3.1).
2. Balconies: private amenity area for each applicable apartment (highlighted in blue in Fig 2.3.1): Block B2 Levels L.01 to L.08. Note that the proposed Block A does not include any private balconies and instead wintergardens were provided. These winter gardens were not assessed for wind comfort since they can be fully enclosed.
3. Rooftop amenity space: communal open space with landscaping on the roof of the development (highlighted in pink in Fig 2.3.1): Block A L.28, Block B2 L.09.

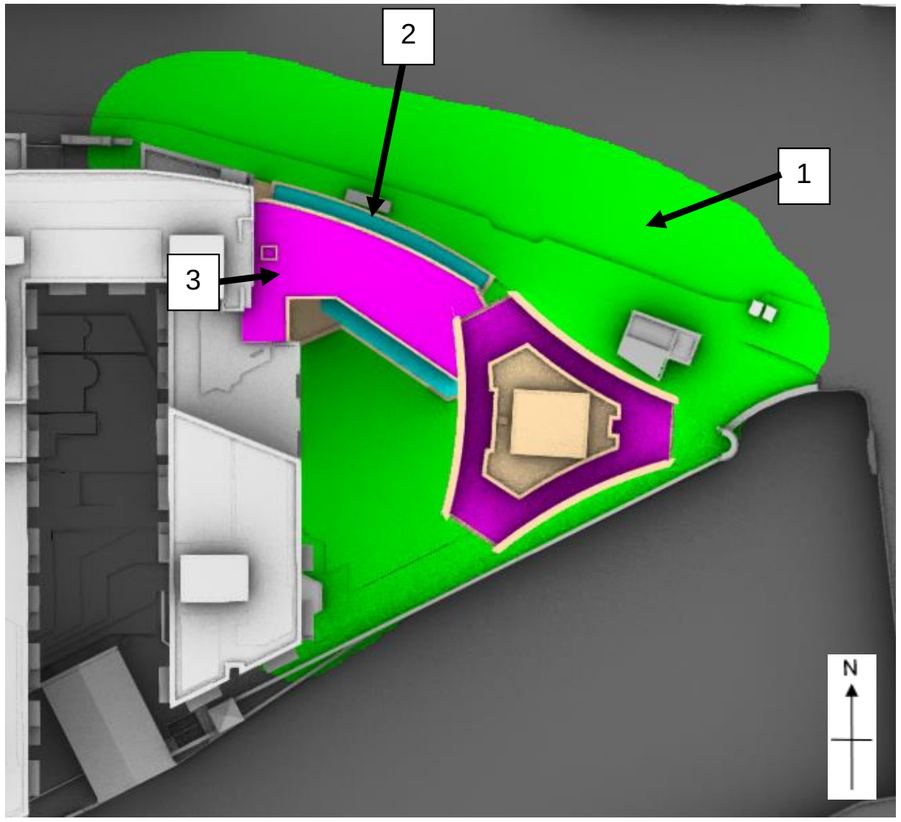

Fig 2.3.1 Assessed External Amenity Spaces

3.0 Wind Analysis – Prevailing Winds

Figure 3.1.1 illustrates the predicted wind velocity streamlines across the roof level amenity space on Block B2 under the prevailing 240° (south-westerly) wind direction at average met wind speed (5.0 m/s) for the initial proposed design.

As shown, the majority of airflow across the proposed amenity space was determined to be driven by downwash off Block A. A series of design iterations were then undertaken in conjunction with Reddy A+U and Mitchell and Associates Landscape Architects to assess how successful wind mitigation measures could be implemented. These measures are discussed further in Section 4.0.

Figure 3.1.2 indicates the predicted improvement of the mitigation measures on airflow across the Block B2 roof amenity space. Overall, the additional measures were determined to reduce the velocity of the wind from the prevailing direction across the proposed amenity area, in particular at the interface of the two buildings.

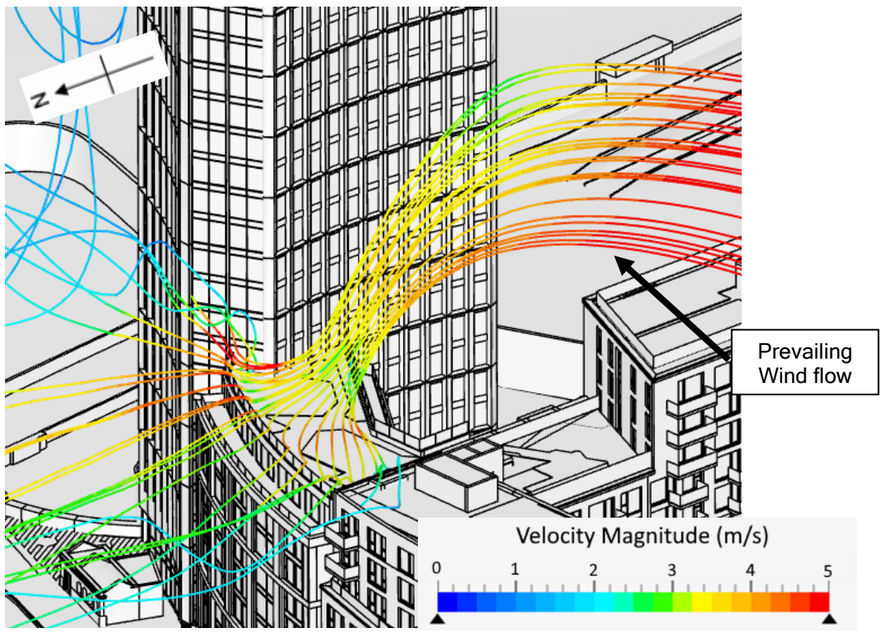

Fig. 3.1.1 – Wind velocity streamlines from prevailing SW wind direction across the roof the Block B2 for the initial design.

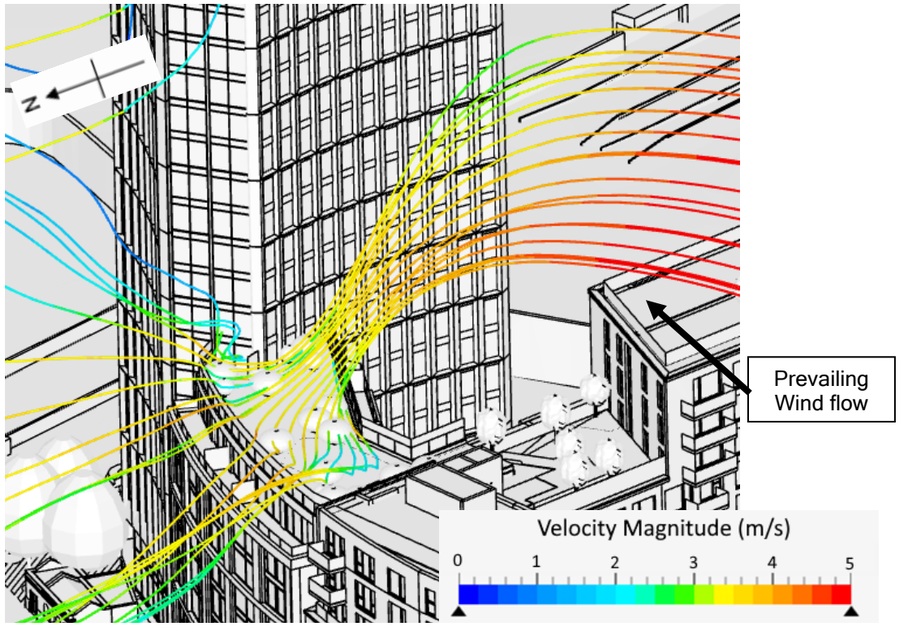

Fig. 3.1.2 – Wind velocity streamlines from prevailing SW wind direction across the roof the Block B2 for the finalised design.

4.0 Pedestrian Comfort

4.1 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 4.1.1 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 illustrated in Fig 4.1.2. There were no “Uncomfortable” areas determined in the analysis. There were two areas of “Business Walking” identified underneath Block B2 and to the south of Block A, but these areas are small and intended to be walkways without any proposed seating, indicating the occupants will not be adversely impacted. All other areas were deemed to be appropriate for “Pedestrian Walking” or better, with most of the ground level amenity being suitable for “Pedestrian Standing / Sitting”. Around all ground level doorways, the comfort levels were pedestrian standing or lower, indicating ease of access to the building.

Overall, the majority of the site would be deemed suitable for “Outdoor Dining / Pedestrian Sitting / Standing / 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. 4.1.1 – Lawson Criteria

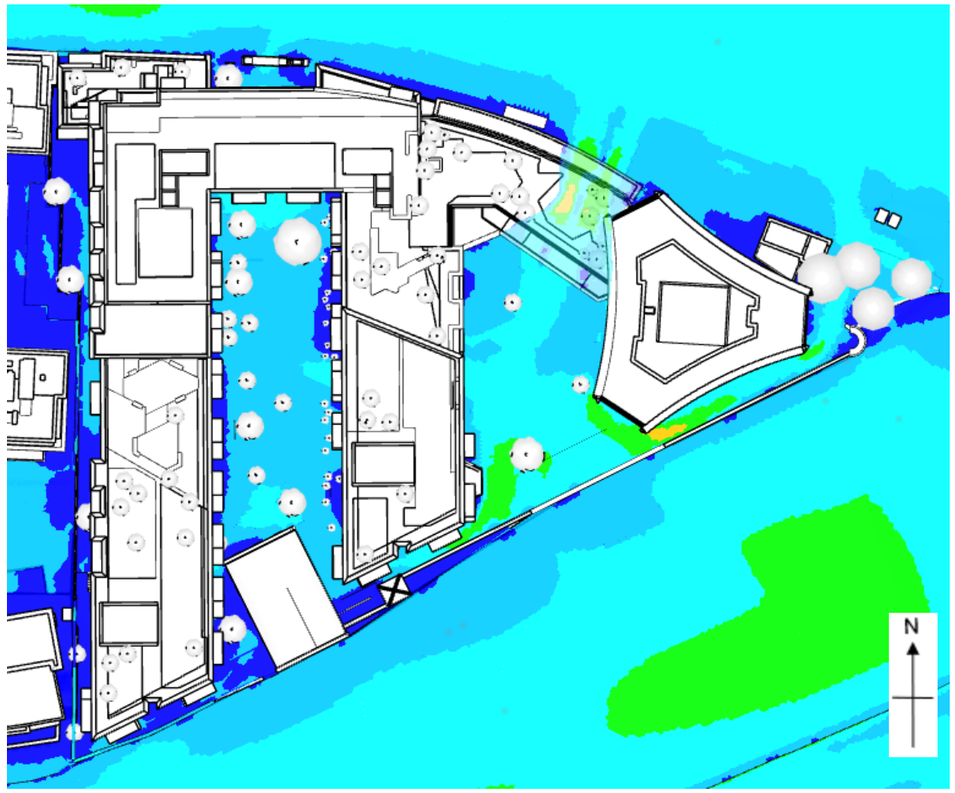

Fig. 4.1.2 – Lawson Criteria Results at 1.5m above ground level.

4.2 Balconies

The Pedestrian Comfort at the individual apartment balconies for the proposed B2 development was assessed in a similar manner as for ground level by utilising the Lawson Criteria.

Figure 4.2.2 illustrates the predicted pedestrian comfort results for the balconies on the south façade of Block B2. All balconies on L.01 to L.07 were deemed to be well sheltered, providing excellent conditions for occupant usage.

The balconies on L08, however, were predicted to be less suitable for occupants as illustrated by the area determined to be suitable for “Pedestrian Standing” as opposed to seating. Mitigation measures to improve conditions to these balconies at L.08 were then assessed, as detailed below.

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. 4.2.1 – Lawson Criteria

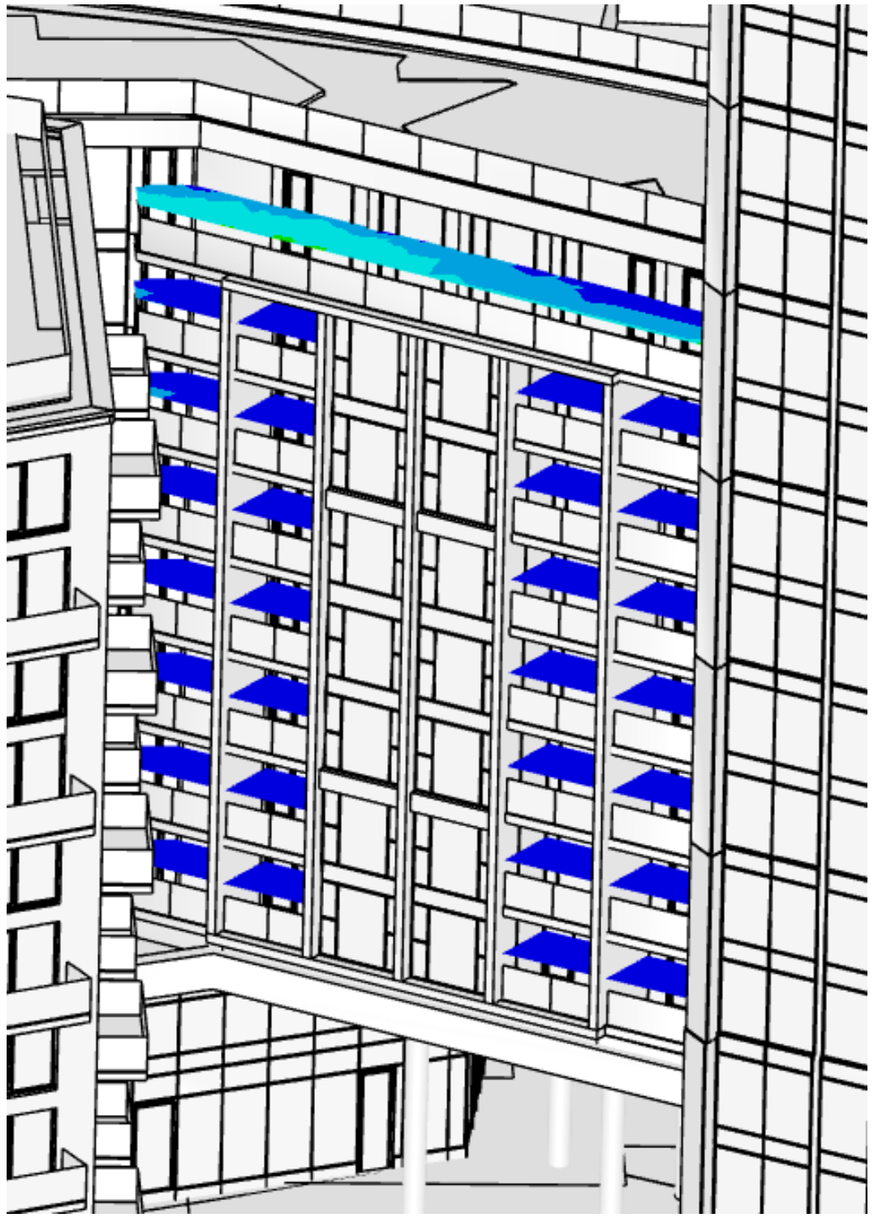

Fig. 4.2.2 – Lawson Criteria Results B2 South Façade Balcony Results.

Figure 4.2.3 presents the predicted comfort results for the L.08 balconies as initially designed in more detail. To improve wind conditions, 2.0m tall privacy screens were integrated to the design between balcony sections. Figure 4.2.4 indicates the finalised design, with the alterations shown in blue.

The Lawson Criteria results for the updated design are illustrated in Fig 4.2.5. As shown, with the additional measures the balcony spaces on Block B2 L08 were predicted to be comfortable, with the entire area deemed suitable for “Outdoor Dining / Pedestrian Sitting”.

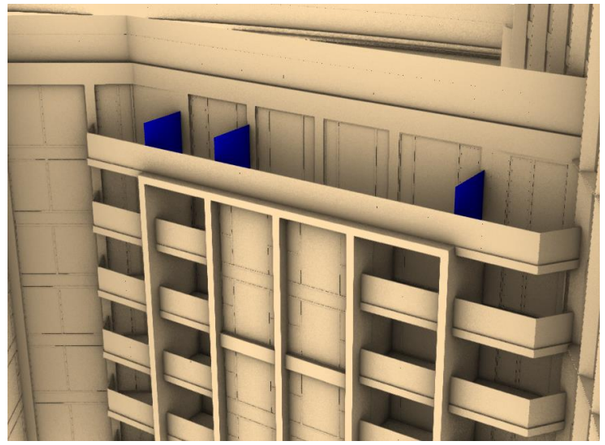

Fig. 4.2.4 – Privacy screens added to Block B2 L08 balconies.

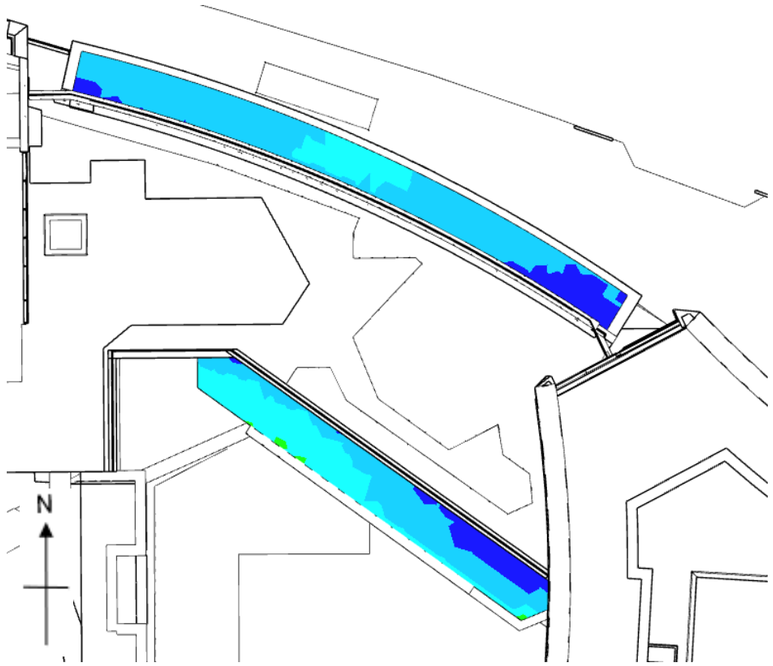

Fig. 4.2.3 – Lawson Criteria Results for Block B2 L08 balconies as initially designed.

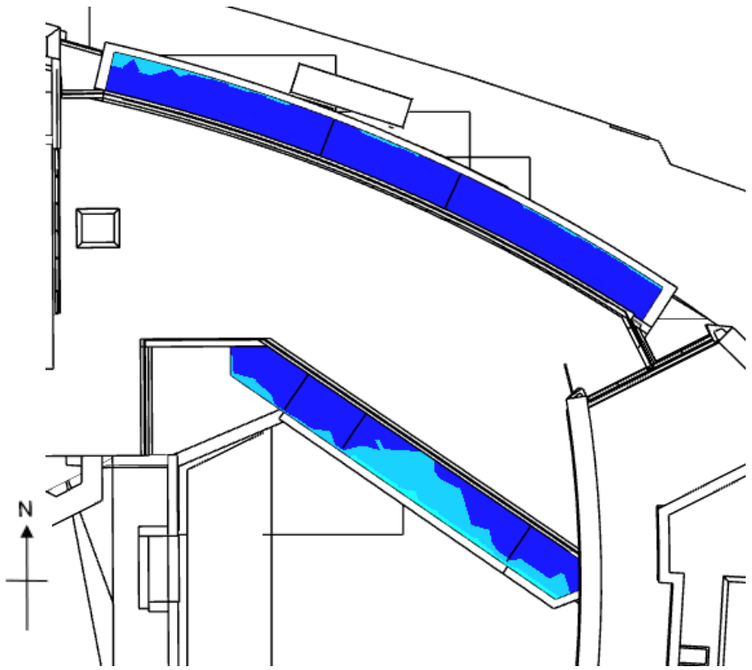

Fig. 4.2.5 – Lawson Criteria Results for Block B2 L08 balconies including privacy screens.

4.3 Rooftop Amenity Space

The predicted pedestrian comfort results at the L.28 rooftop amenity on Block A are presented in Fig 4.3.2. It was determined that the entire area was suitable for “Outdoor Dining / Pedestrian Sitting”, with the effective sheltering being achieved from the 2.0m tall screens included along the entire perimeter of the space.

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. 4.3.1 – Lawson Criteria

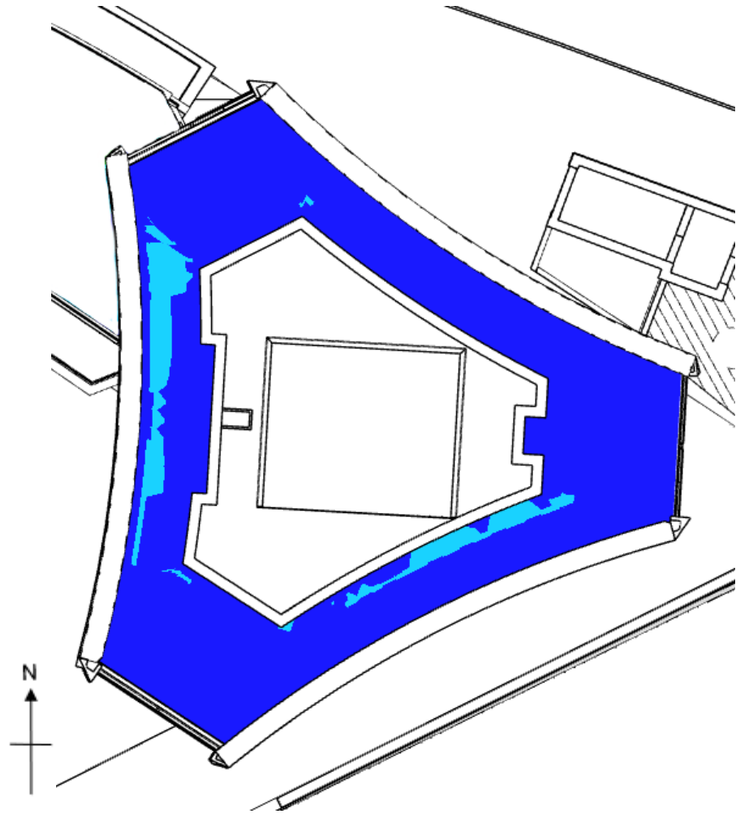

Fig. 4.3.2 – Lawson Criteria results at 1.5m above rooftop amenity of Block A.

Figure 4.3.3 illustrates the initial results for the rooftop amenity on Block B2 L.09. As shown, there was very little area predicted to be suitable for seating, with the majority of the area deemed suitable for “Pedestrian Standing”. The area of “Business Walking” near where Block B2 meets Block A was an area of concern given that this is where the doorway is located. High wind speeds in this area could lead to difficulties opening / closing the door.

Further investigation was conducted into the airflow around the amenity area, including analysing the prevailing wind flow around the space as discussed in Section 3.0. Based on this analysis, it was determined that a wall was necessary to provide wind protection to the doorway as well as an increase in height of the balustrade along the entire roof, increasing from 1.5m to 2.0m tall. These additional measures are identified in blue in Fig 4.3.4. The landscaping was also amended to reflect the updated proposal from Mitchell and Associates, which included updating the proposed tree location and heights in the range of 1.5-2.0m.

The pedestrian comfort results including these additional measures are presented in Fig 4.3.5. As shown, the additional wall was determined to shelter the doorway, improving ease of access to the building / amenity. All seating areas were deemed to be in regions of “Pedestrian Standing / Sitting”, providing suitable comfort to occupants.

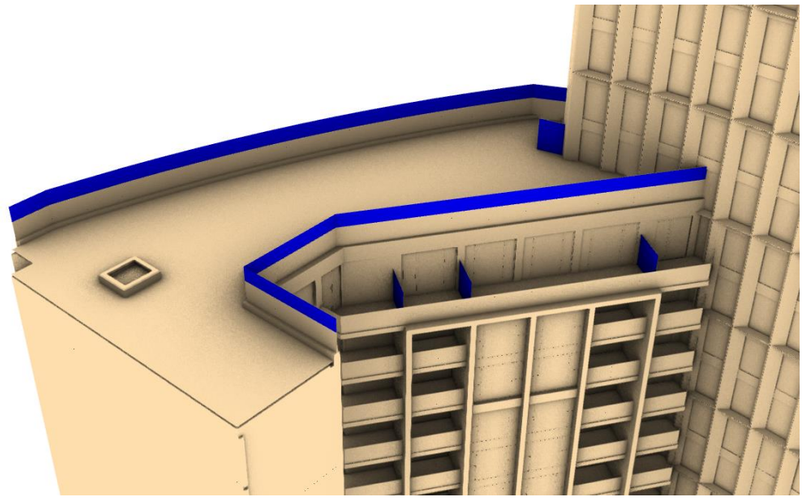

Fig. 4.3.4 – Mitigation measures (blue) added to Block B2 rooftop amenity to improve pedestrian comfort.

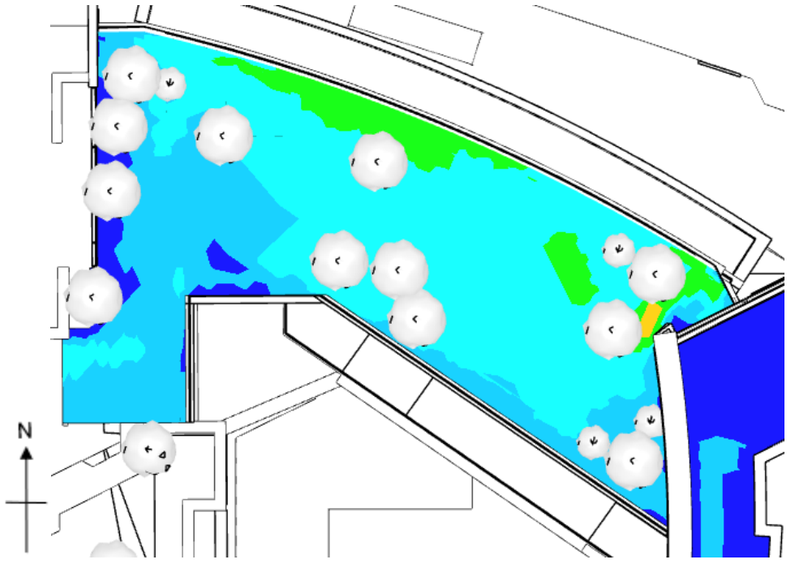

Fig. 4.3.3 – Lawson Criteria results at 1.5m above rooftop amenity of Block B2 including original proposed landscaping.

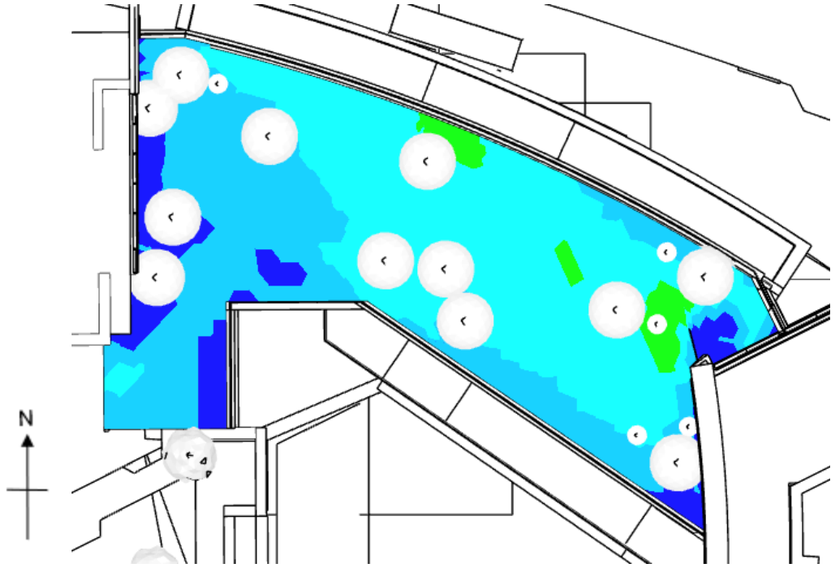

Fig. 4.3.5 – Lawson Criteria results at 1.5m above rooftop amenity of Block B2 including proposed landscaping and additional mitigation measures.

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