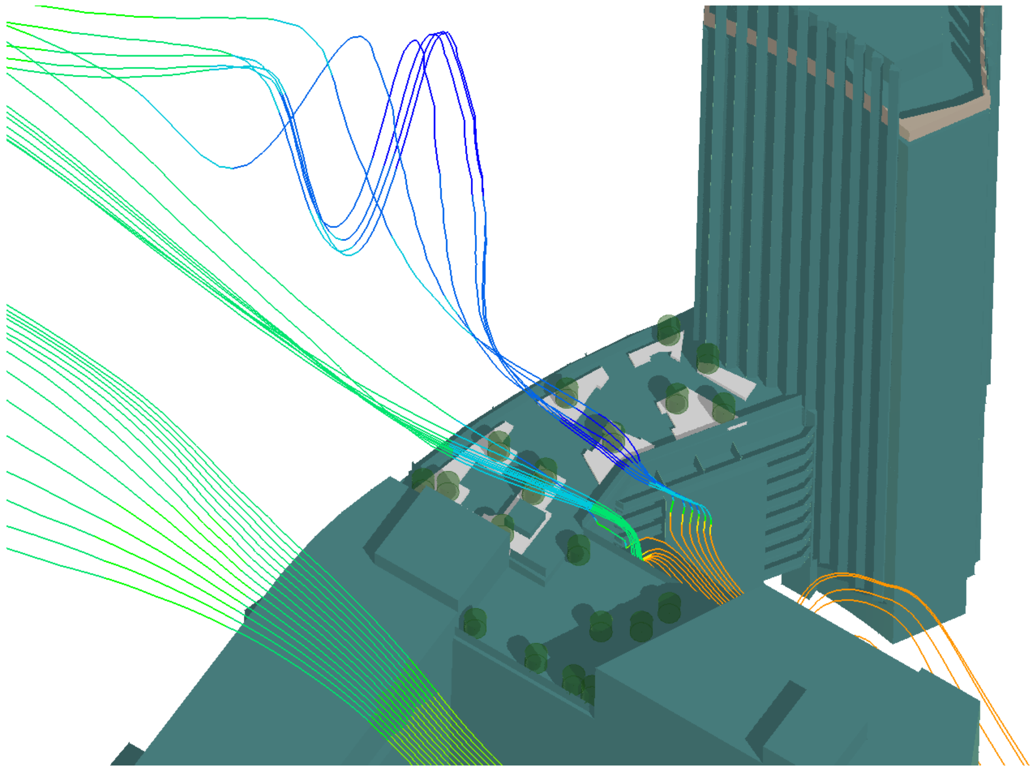
Parkgate Street
Block B2 Amendment



Microclimatic Wind Analysis and Pedestrian Comfort

IN2 Project No. D2012
16/10/2023
REV01

Revision History

Date	Revision	Description
16/10/2023	00	Issued for review

IN2 Engineering Design Partnership operates a formal Integrated Management System, with certification to ISO: 9001 Quality Management System, ISO: 14001 Environmental Management System and OSHAS: 18001 Health and Safety Management System.

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1.0 Executive Summary

This report compiles the results of Microclimatic Wind Analysis undertaken by IN2 Engineering Design Partnership for the proposed redesign of Block B2 at Parkgate Street, Dublin 8, comprising of assessments for predicted Wind conditions to the ground level and rooftop amenity space within the proposed development.

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

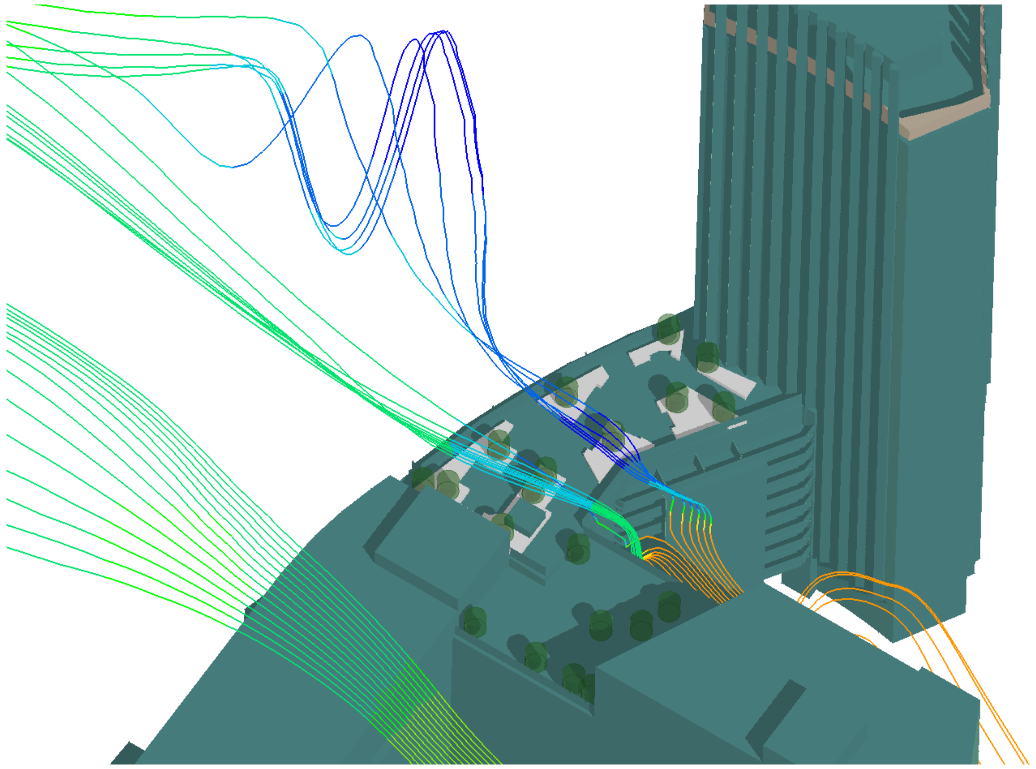
Detailed assessment of predicted Wind conditions and associated Pedestrian Comfort were undertaken in Sections 2.0 and 3.0, respectively.

Wind Analysis was assessed utilising Airflow Simulation techniques, calculating predicted pressures and velocities throughout the proposed development site.

These wind simulations were then compiled and assessed against Lawson Criteria Methodology- an assessment method for Pedestrian Comfort adopted internationally as National Standards/ City Guidelines (Netherlands/ London respectively) that enables utilisation of recorded meteorological station data of annual hourly averaged wind speed and direction (in this case from Dublin Airport), terrain effects and the form of the proposed built environment in order to predict activity suitability (sitting/ standing etc.) for persons in the vicinity of the development.

This analysis undertaken identified that the proposed amendment to the development was determined to not introduce any adverse wind effects to the rooftop amenity space, with the space generally deemed suitable for short/long term sitting activity as designed.

The analysis also identified no deterioration of wind conditions at ground level of the permitted scheme as a result of the block B redesign.



2.0 Wind Analysis

2.1 Methodology

In order to determine the predicted wind patterns around the proposed development, airflow simulations were undertaken using Computational Fluid Dynamics (CFD) software (Phoenics / Flair).

This enabled an assessment of the site wind conditions: highlighting zones of high pressure, negative pressure, and air movement for varying wind conditions.

A 3D representational model of the proposed building and its immediate surroundings was created, and simulations undertaken for 12 cardinal wind directions.

The CFD simulations utilised wind profiles accounting for terrain effects. Allowing for the nature of the site and location, a boundary layer profile representative of "Suburb, Forest, Regular Large Obstacle Coverage (0.75m height)" was utilised.

Figure 2.1.1 indicates predicted pressure co-efficient contours for the prevailing 240° wind direction. Red contours indicate regions of positive pressure, green as neutral and blue negative.

Figure 2.1.2 illustrates predicted wind velocities across the development, at 90m above ground level.

The CFD simulations form the basis of the Pedestrian Comfort Analysis undertaken, which is described in detail in Section 6.0 below.

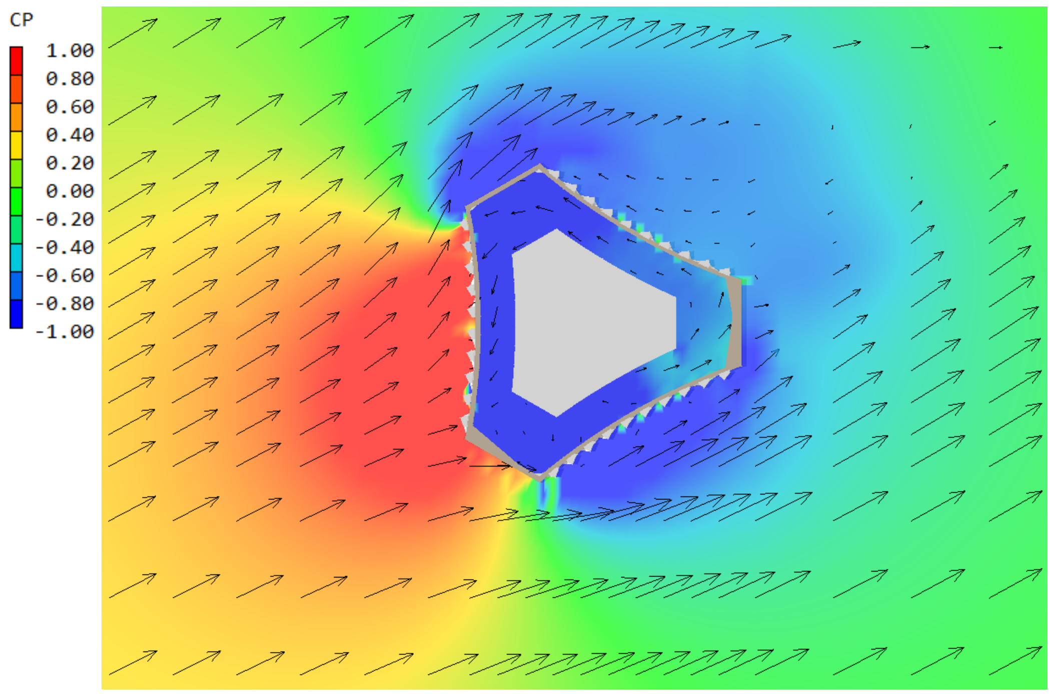


Fig 2.1.1 - Pressure Coefficients at 90m above Ground Level – 2m Balustrade

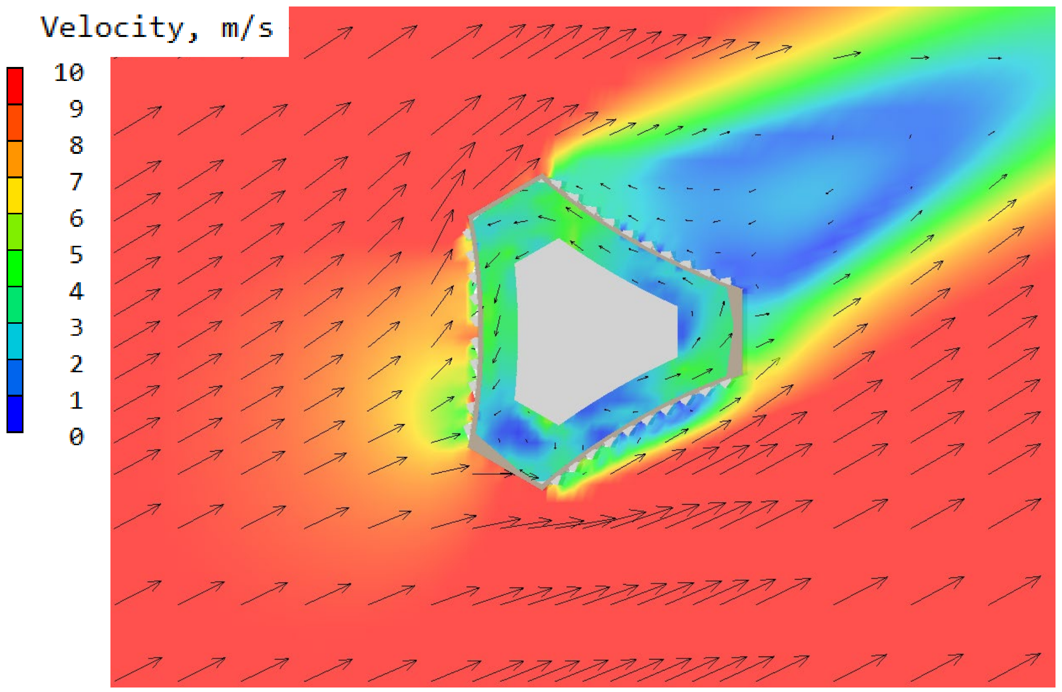


Fig. 2.1.2 Wind Velocity at 90m above Ground Level – 2m Balustrade

3.0 Pedestrian Comfort

3.1 Methodology

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 form.

Figure 3.1.1 illustrates the Lawson Criteria scale, which ranges from areas deemed suitable for long term sitting through to regions uncomfortable for pedestrian comfort. Walking leisurely areas, for example, are defined as areas that would not experience wind velocities in excess of 5.3m/s for more than 2% of the year, whereas uncomfortable areas would experience averaged wind velocities greater than 7.6m/s for more than 2% of the year.

The 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 3.1.2.

The band indicated as "Suitable for short term sitting / standing" (cyan contours) corresponds to that of that for the vast majority of time (94%) throughout the year, winds will be "Light" at a Beaufort Force of B3 (average hourly wind speeds 3.35-5.60 m/s) defined as "Leaves and twigs in motion: wind extends a flag". For only 4% of the time are average winds predicted to be in excess of this: i.e. "Moderate" B4 Beaufort Force described as "Raises dust and loose paper: small branches move".

The assessment identifies area where potential wind occurrence, based on probability of wind direction and speed, would either be mitigated (long term sitting/ short term sitting) or exacerbated (walking fast / 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.

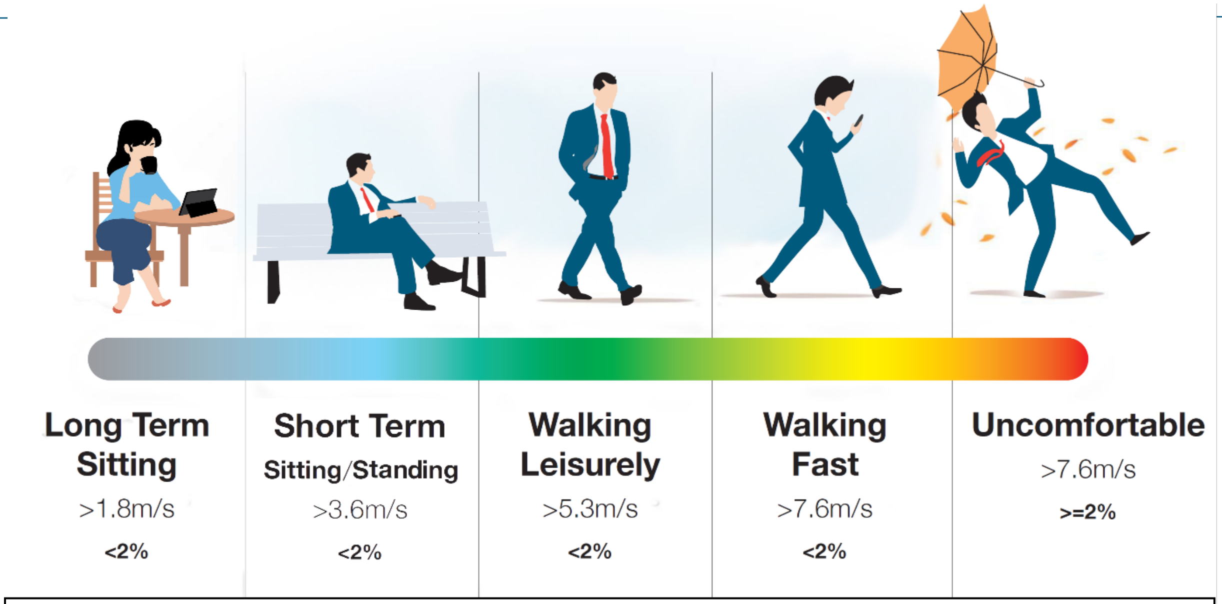


Fig 3.1.1 Lawson Scale

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

	USE SYMBOL	UNACCEPTABLE	TOLERABLE	CRITERIA
Roads and Car Parks	A	6% > B5	2% > B5	10 9
People Around Buildings	B	2% > B5	2% > B4	9 7
Pedestrian Walk-through	C	4% > B4	6% > B3	8 6
Pedestrian Standing	D	6% > B3	6% > B2	6 4
Entrance Doors	E	6% > B3	4% > B2	6 3
Sitting	F	1% > B3	4% > B2	5 3

Fig 3.1.2 Beaufort Scale and Classic Wind Comfort Definitions

3.0 Pedestrian Comfort

3.1 Methodology (Cont'd)

In terms of microclimate assessment, wind data for the nearest meteorological station at Shannon Airport was utilised. Analysis is based on frequency of hourly wind speeds and direction data included in European Wind Atlas for Dublin Airport. Wind data and subsequent analysis is therefore based on hourly averages and does not include for example, intermittent gusting effects.

Figure 3.1.3 indicates the long-term annual "Wind Rose" for Dublin Airport. The rose diagram illustrates the frequency that wind will be from a certain direction and at what speed. It can be seen how the prevailing Westerly winds entirely predominate due to the Atlantic gulf stream, with only lower occurrence from other directions. Recorded wind speeds are also high- in what is one of Europe's windier meteorological weather stations.

Furthermore, higher wind speeds (which accentuate pedestrian discomfort) occur for prevailing Westerly conditions and therefore will predominate in terms of the potential impact on pedestrian comfort as analysed 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 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 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)).

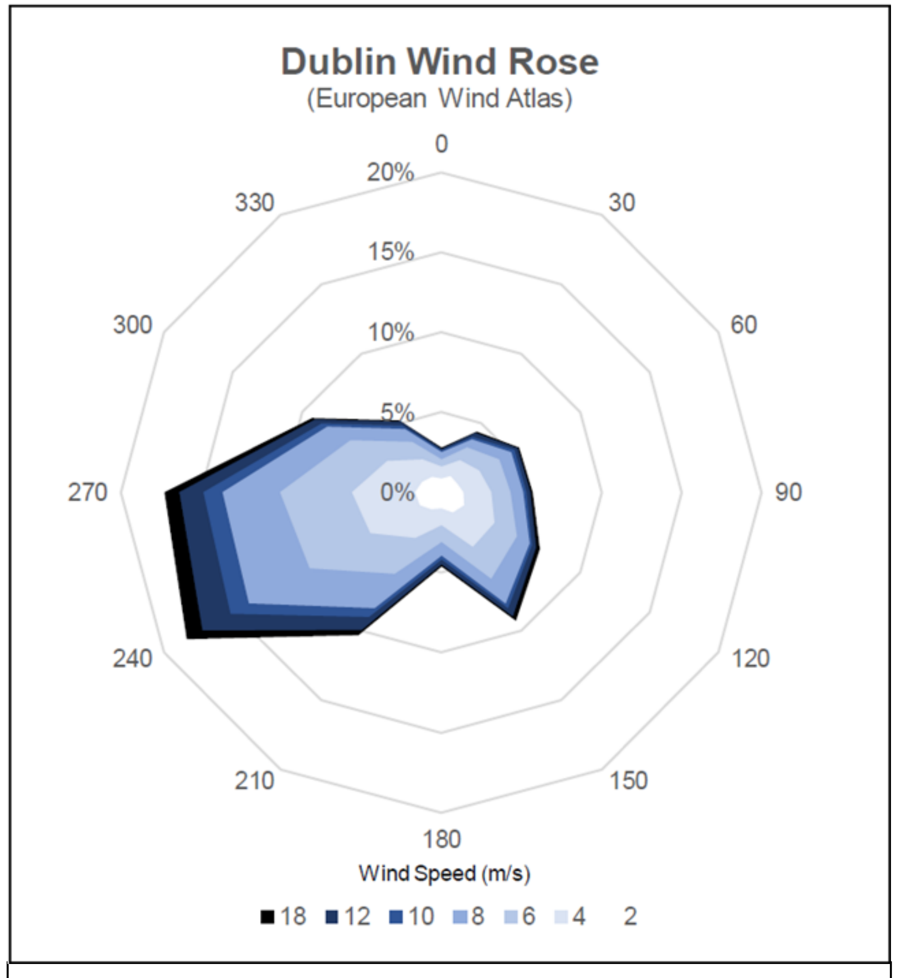


Fig. 3.1.3 - Dublin Wind Rose

3.0 Pedestrian Comfort

3.2 Analysis Results

CFD simulations were undertaken to determine the Lawson Criteria results for the proposed amended block B of the development.

Pedestrian comfort was assessed by predicting Lawson Criteria values at 1.5m above rooftop terrace level.

Grey/ cyan contours illustrate areas deemed “Suitable for Long Term Sitting” and “suitable for standing or short term sitting” respectively as well as standing. Green contours indicate areas “Suitable for Walking and Strolling”, with yellow illustrative of being “Suitable for Business Walking”. Red areas highlight zones as “Not Suitable for Pedestrian Comfort”.

Figs. 3.2.1 / 3.2.2 indicate relatively sheltered wind conditions at rooftop level, with the majority of the rooftop amenity space determined by the methodology to be suitable for “Short/Long Term Sitting”.

The analysis undertaken therefore determined that pedestrian comfort throughout the space could be generally deemed suitable for short/long term sitting activity.

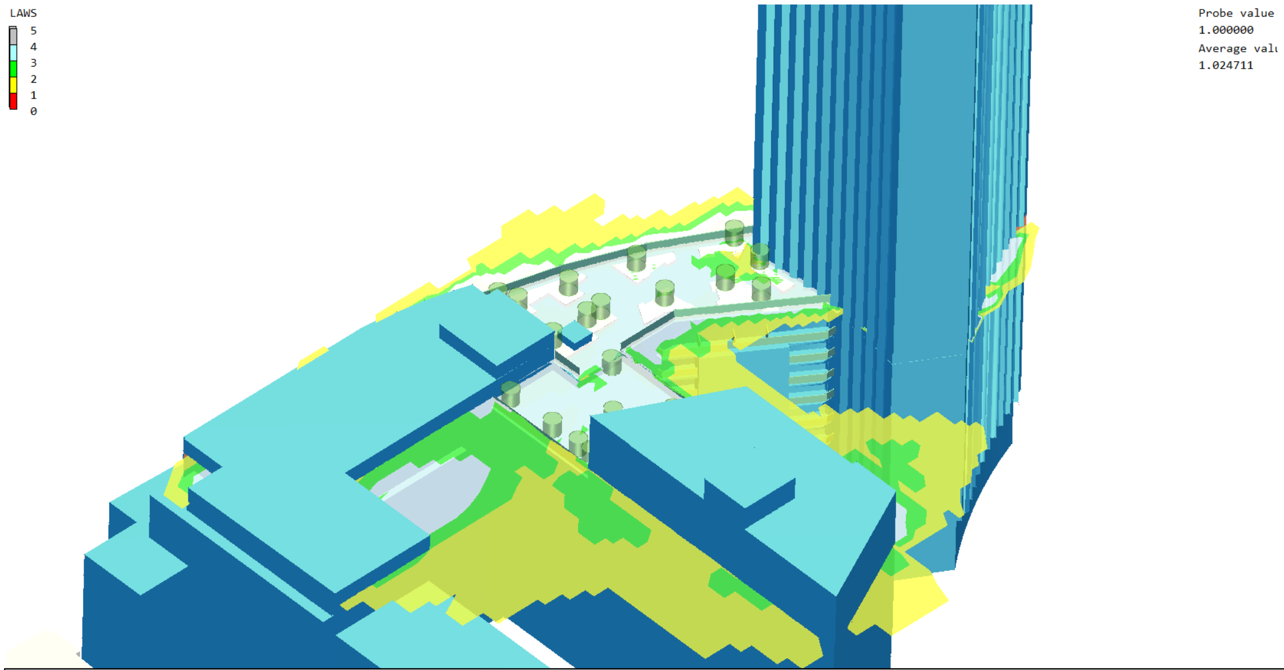


Fig. 3.2.1 - Lawson Criteria at Roof Amenity Level

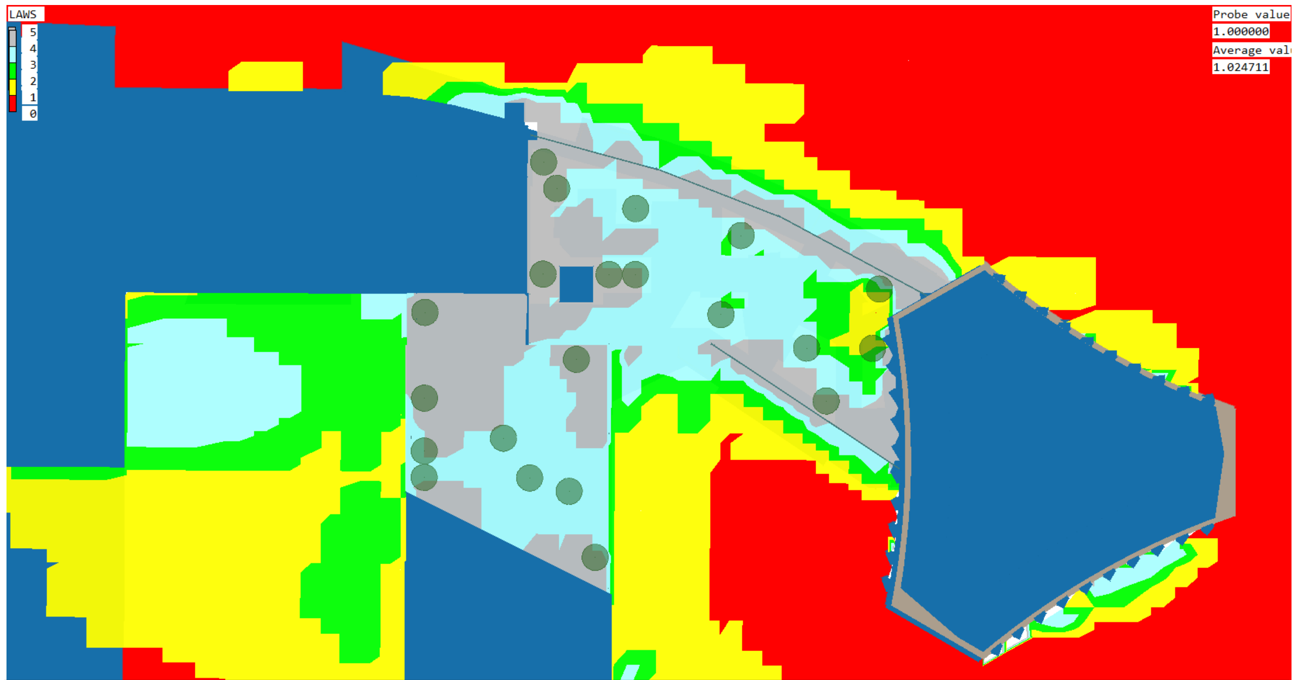


Fig. 3.2.2 - Lawson Criteria at Roof Amenity Level (Plan View)

4.0 Impact on Permitted

4.1 Permitted Amenities

A further analysis was undertaken to identify if there would be any deterioration to pedestrian comfort at ground level of the permitted scheme as a result of the proposed amendment. No negative impact was determined.

Figure 4.1.1 shows the Lawson results for the ground level. The results are consistent with the analysis as submitted for the permitted scheme where the main courtyard areas are identified as being suitable for long term sitting (grey) with some localised wind acceleration under the under crofts, where areas are identified as suitable for walking and strolling.

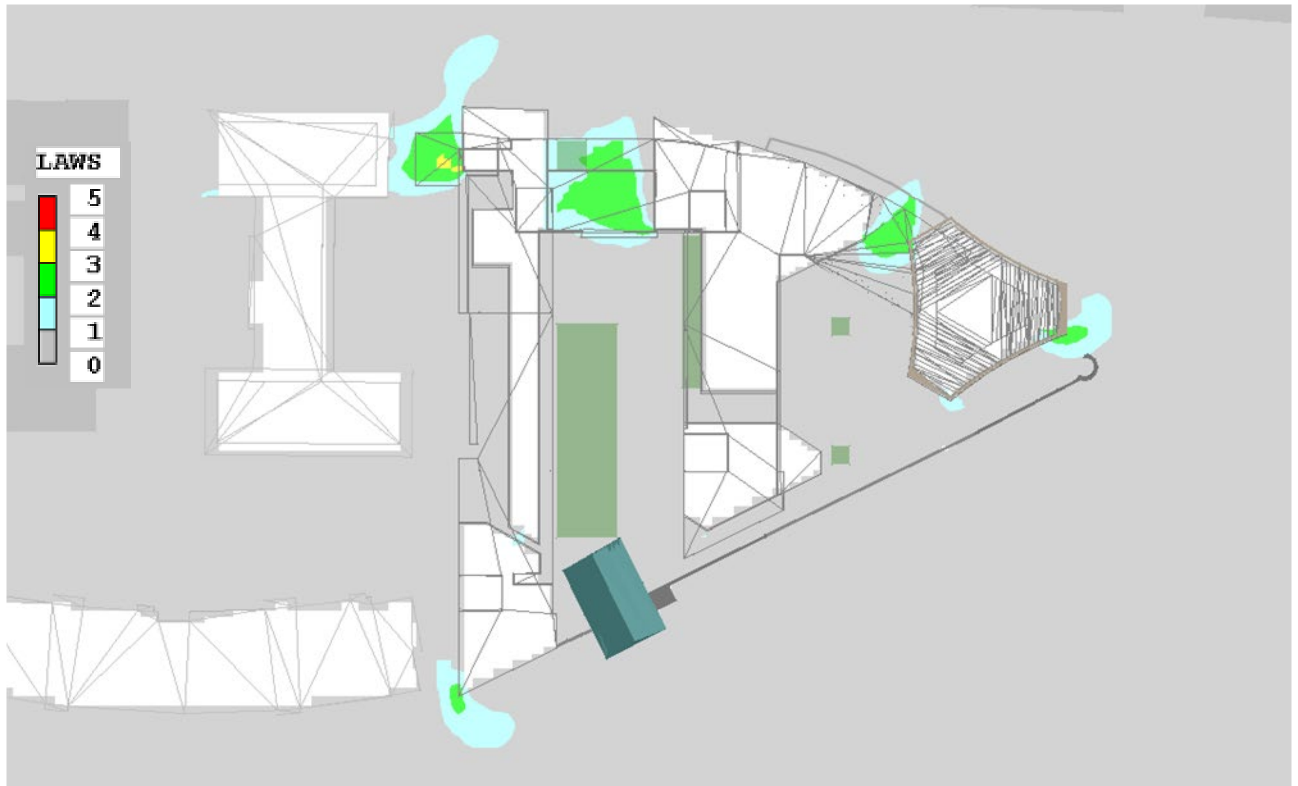


Fig. 4.1.1 - Lawson Criteria at Ground Level

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