Strategic Housing Development (SHD) at Former O'Devaney Gardens,
Dublin 7

Bartra ODG Limited (Applicant)

Microclimatic Wind Analysis and Pedestrian Comfort Report
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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 Strategic Housing Development at O'Devaney Gardens, Dublin 7, on behalf of Bartra ODG Limited, comprising of assessments for predicted Wind conditions to the local environment.

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 3.0 and 4.0, respectively.

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

These wind simulations were then compiled and assessed against Lawson Criteria Methodology- an assessment method for Pedestrian Comfort in order to predict activity suitability (sitting/ standing etc.) for persons in the vicinity of the development.

As per the Urban Development and Building Heights Guidelines (2018), the analysis undertaken identified that the proposed development was determined to not unduly impact on the local wind micro-climate, with no instances of down-draft effects predicted to be introduced to the receiving environment.

Ground level spaces and courtyard amenity spaces within the proposed development are determined to be predominantly suited to "Pedestrian Sitting/ Standing", in accordance with the Lawson Criteria methodology utilised.

Similarly, practically all roof terrace amenity spaces are deemed to be suited to "Pedestrian Sitting/Standing", and therefore suited to their intended use as amenity spaces. Localised mitigation measures in the form of landscaping and wind screens were incorporated to the roof terraces of Blocks 4 and 6, improving pedestrian comfort in these areas.

All balconies within the proposed development are predicted by the Lawson Criteria methodology utilised to be suited to "Pedestrian Sitting", and therefore suited to their intended use as private amenity spaces.

2.0 Methodology

2.1 Wind Analysis

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.

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, such as hills, ridges, and land use, including 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, however, the particular site location at O'Devaney Gardens is identified, which is an area relatively sheltered on a macro level, within the Dublin City area.

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 "Urban Terrain (z_0=0.4m height)" was utilised, derived from GIS survey analysis[1].

Figures 2.1.2 and 2.1.3 indicates the long-term annual "Wind Rose" obtained from the Global Wind Atlas for the site at O'Devaney Gardens, Dublin 7. 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 Westerly South-Westerly winds entirely predominate due to the Atlantic gulf stream, with only lower occurrence from other directions.

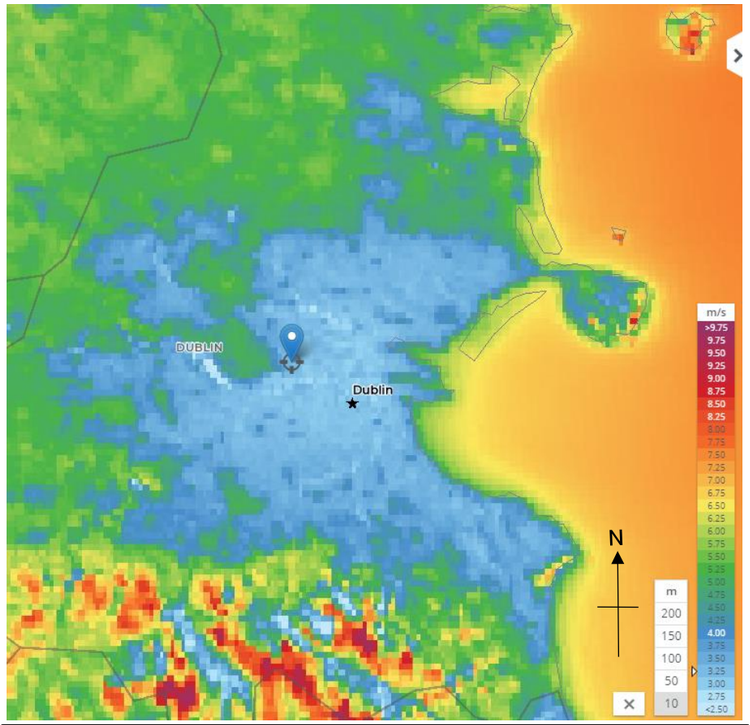

Fig 2.1.1 – Mean Wind Speeds across Dublin – Global Wind Atlas

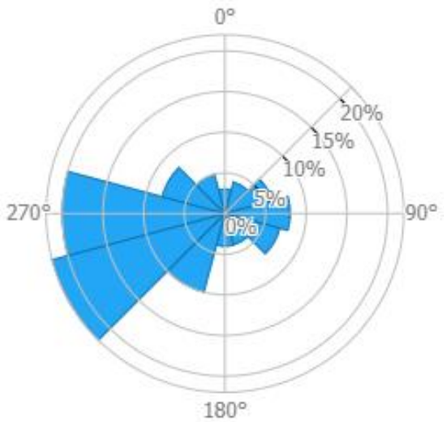

Fig 2.1.2 – Wind Frequency Rose for Dublin Airport – Global Wind Atlas

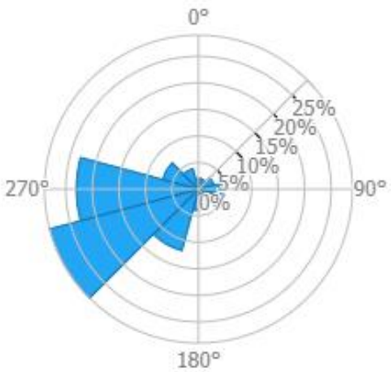

Fig 2.1.3 – Wind Speed Rose for Dublin Airport– Global Wind Atlas

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

2.0 Methodology

2.1 Wind Analysis (Cont'd)

As per Fig 2.1.4, 3D representational model of the proposed development and its surroundings was created, and simulations undertaken for 12 cardinal wind directions.

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 SW 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)).

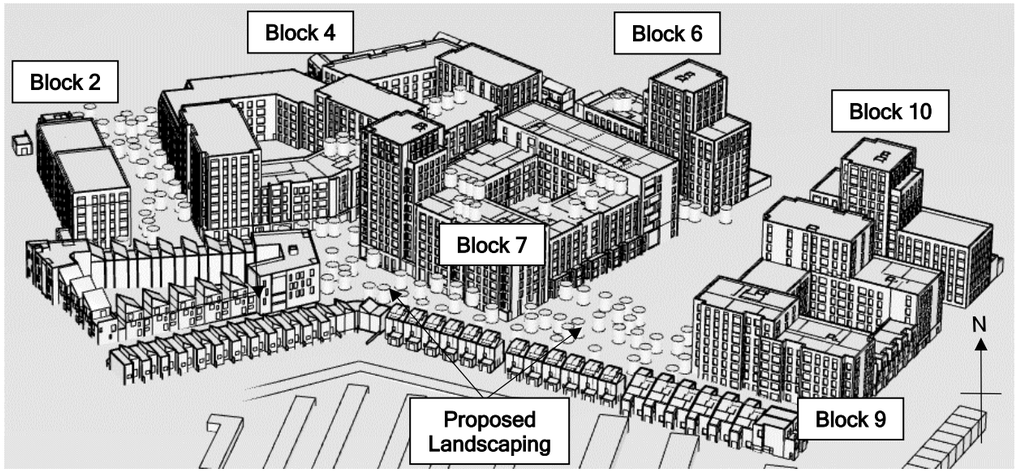

Fig 3.1.4 – 3D Model of Proposed O'Devaney Gardens SHD Development

2.0 Methodology

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, 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 area 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

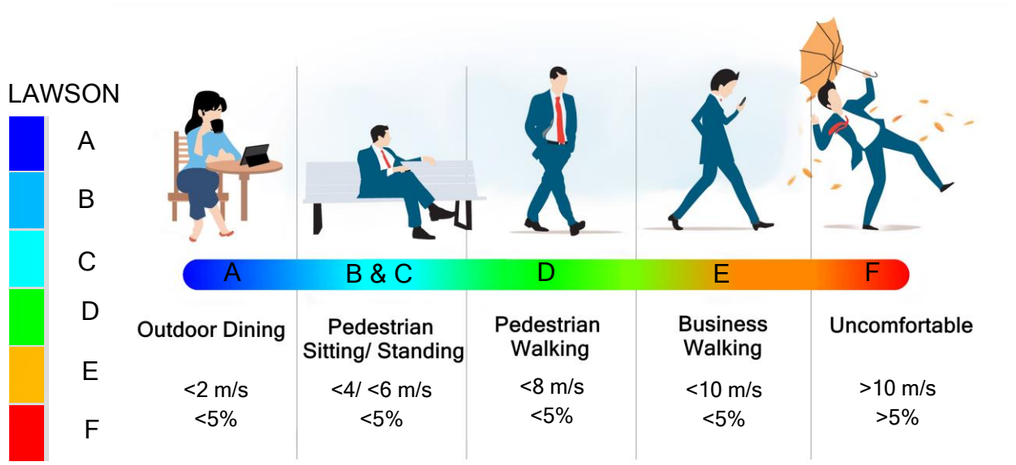

Fig 2.2.2 Lawson Scale

3.0 Wind Analysis

3.1 Wind Analysis Results

Figure 3.1.1 illustrates predicted wind velocities across the development under prevailing SW wind conditions, at 1.5m above ground level.

Wind velocities across the proposed development are predicted to be relatively benign.

The results illustrate some acceleration of winds between Block 4 and 7, however, owing to the wide relatively wide streets, and extent of proposed landscaping, this is not excessive.

The CFD simulations form the basis of the Pedestrian Comfort Analysis undertaken, which is described in detail in Section 4.0 below.

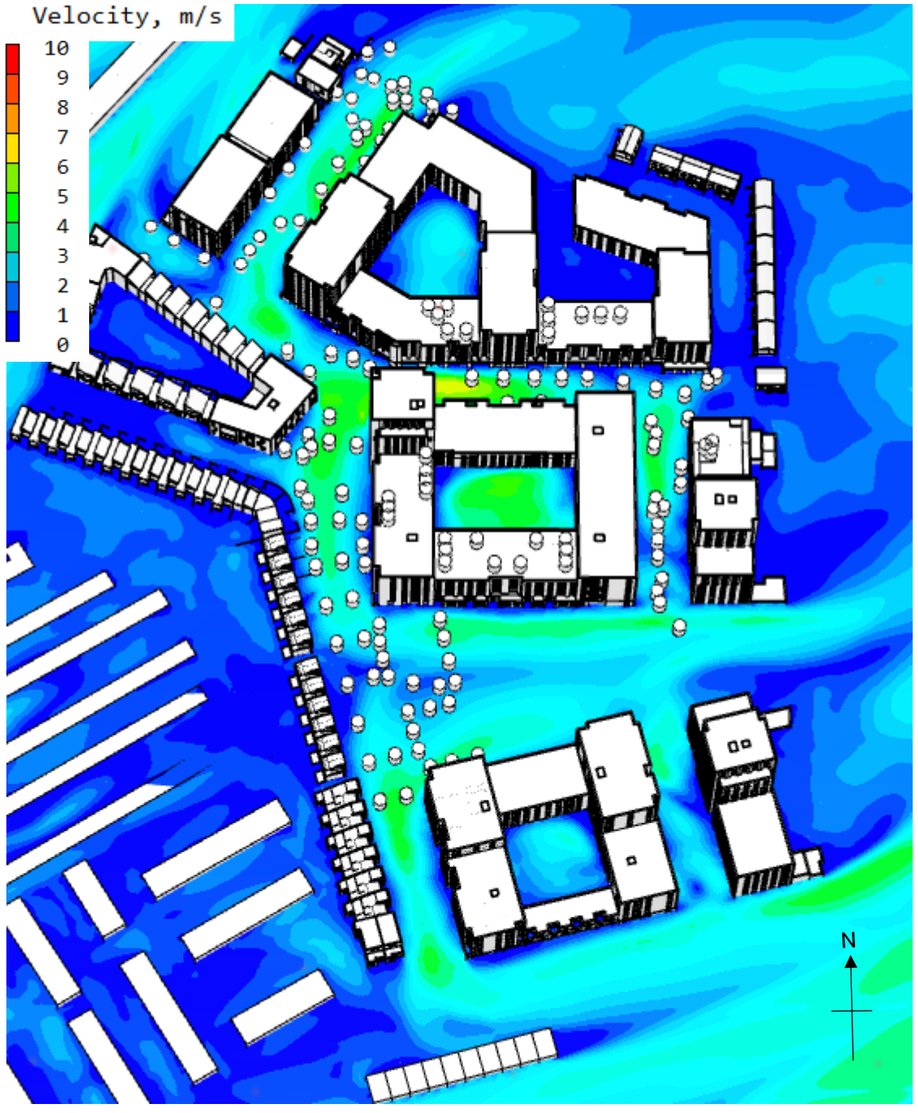

Fig. 3.1.1 - Wind Velocity at 1.5m above Ground Level

4.0 Pedestrian Comfort

4.1 Ground Level Results

CFD simulations were undertaken to determine the Lawson Criteria results for the proposed development.

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

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".

As per Fig. 4.1.1, conditions at ground level have been determined to be predominantly suitable for "Pedestrian Sitting/ Standing", as illustrated by light blue/ cyan contours.

While some regions more suited to "Pedestrian Walking" (green contours) are predicted to occur along the street between Block 4 and Block 7, this is expected to occur towards the centre of the street, away from pedestrian footpaths, and proposed building entrances.

The proposed Creche play area to the north of Block 2 has been determined to be suited to "Outdoor Dining/ Pedestrian Sitting" and is therefore deemed appropriate for its intended use. This space benefits from the strategic placement of the proposed planting along the street between Block 2 and 4.

All courtyard amenity spaces within the proposed development are determined by the Lawson methodology to be suitable for "Pedestrian Sitting/ Standing", and are therefore suitable for their intended use as amenity spaces.

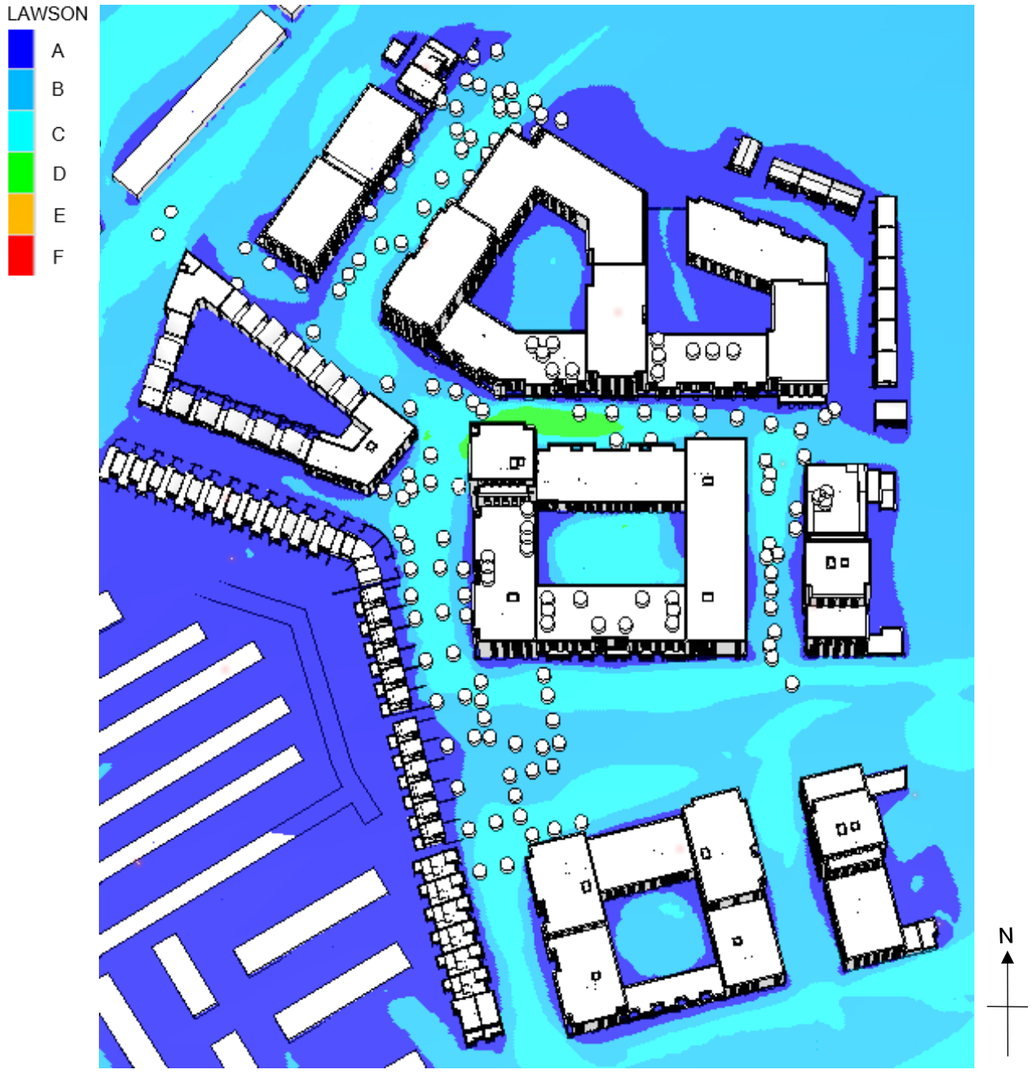

Fig. 4.1.1 – Lawson Criteria Results at 1.5m Above Ground Level

4.0 Pedestrian Comfort

4.2 Roof Terrace Level Results

Figure 4.2.2 illustrates results of pedestrian comfort results at roof terrace levels across the development. All roof terrace levels intended to be accessible to occupants have been analysed.

Roof terraces across the development are predominantly determined by the Lawson methodology utilised to be suitable for "Pedestrian Sitting/Standing" (light blue/ cyan contours).

Mitigation measures were required at roof terrace levels of Block 4 and Block 6, to improve wind conditions in these areas. Fig 4.2.1 below illustrates results without mitigation measures. Fig 4.2.2 demonstrates improved wind conditions due to the addition of landscaping features at these roof terraces, and 1.8m high wind screening placed at Block 4 and 6 roof terrace levels. Some of the area of Block 6 roof terrace remains more suited to "Pedestrian Walking" (green contours). It is recommended that seating areas be located away from these areas, to a more sheltered region.

All roof terrace spaces have a considerable portion of their area deemed to be suitable for "Outdoor Dining/ Sitting" (blue contours). Therefore, the roof terrace levels analysed are predicted to be suitable for their intended use as amenity spaces.

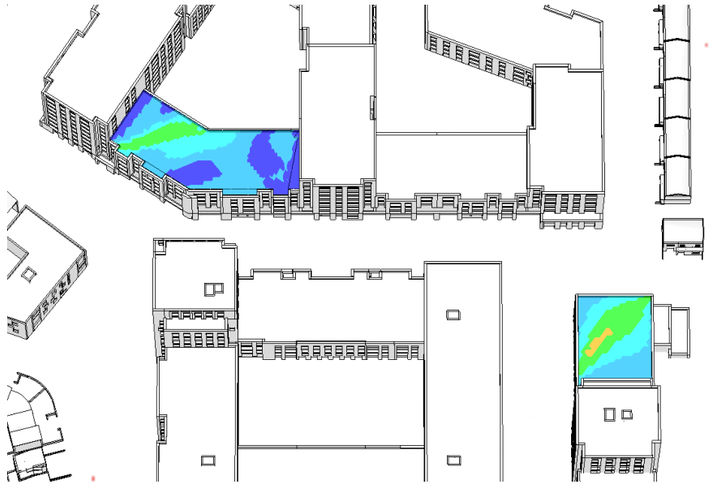

Fig. 4.2.1 – Lawson Criteria Results without Mitigation Measures

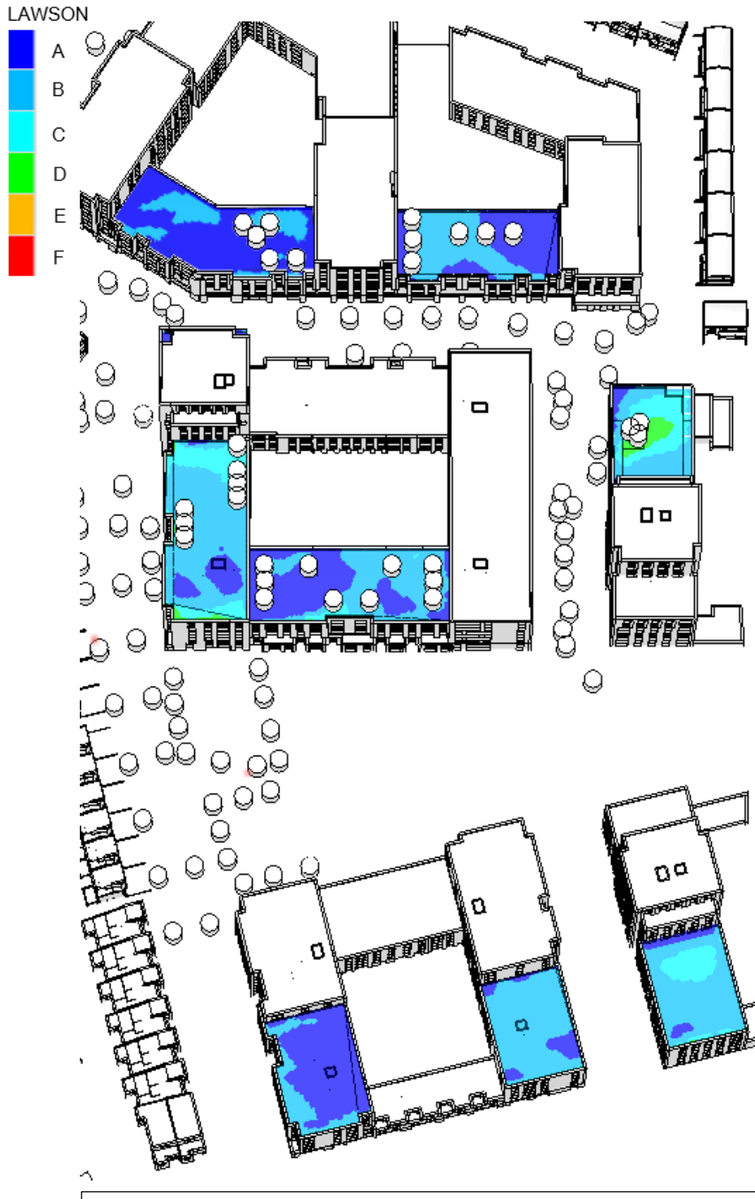

Fig. 4.2.2 – Lawson Criteria Results at Roof Terrace Levels with Mitigation Measures

4.0 Pedestrian Comfort

4.3 Balcony Level Results

Balconies throughout the development were also assessed for pedestrian comfort utilising the Lawson Criteria.

Fig 4.3.1 illustrates Lawson results for balconies at the 12th floor of the tower of Block 7, representative of the "Worst Case Scenario" for pedestrian comfort at balconies within the proposed development, owing their height above ground. These balconies are inset into the overall building mass, which aids in sheltering occupants from higher wind speeds. Balconies below the 12th floor level are predicted to experience similar or improved pedestrian comfort conditions.

The analysis determined that all balconies throughout the development were situated in zones suitable for sitting- either as "Outdoor Dining" (blue contours) or "Pedestrian Sitting" (light blue contours), as defined within the methodology, and are therefore well suited to their intended use as private amenity spaces.

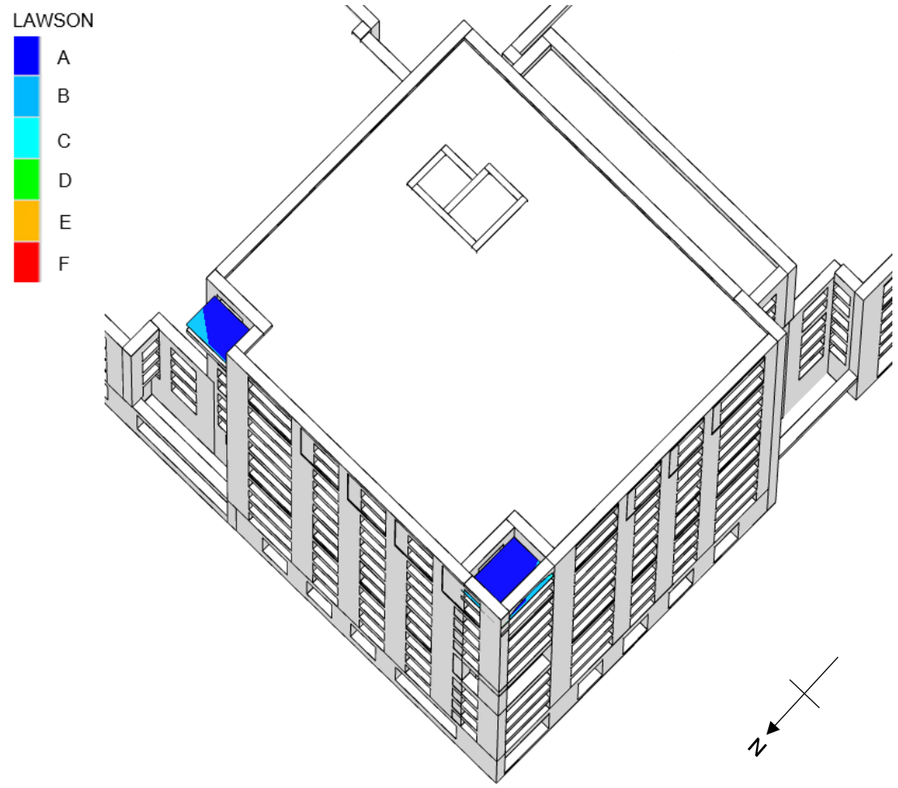

Fig. 4.3.1 – Lawson Criteria Results at Roof Terrace Levels

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