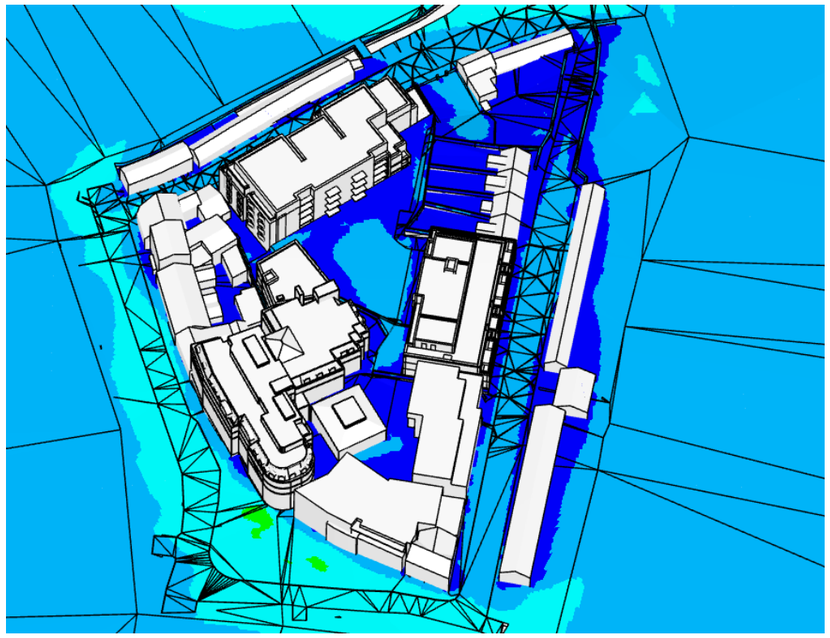
Templar Place

Balbriggan
Co. Dublin



Microclimatic Wind Analysis and Pedestrian Comfort Report
IN2 Project D2045
19/07/2021
Rev. 01

Revision History

Date	Revision	Description
22/06/2021	00	Issue of Initial Results
19/07/2021	01	Issue for review

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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 Templar Place, Balbriggan based on the 3D modelling information received from McCauley Daye O'Connell Architects, 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 was undertaken in Sections 3.0 and 4.0.

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.

The analysis undertaken identified that the proposed development was determined to not unduly impact on the local wind micro-climate, with no adverse wind 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 "Outdoor Dining" and "Pedestrian Sitting", in accordance with the Lawson Criteria methodology utilised.

Similarly, all roof terrace amenity spaces are deemed to be suited to "Outdoor Dining" and "Pedestrian Sitting" and are therefore suited to their intended use as amenity spaces.

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

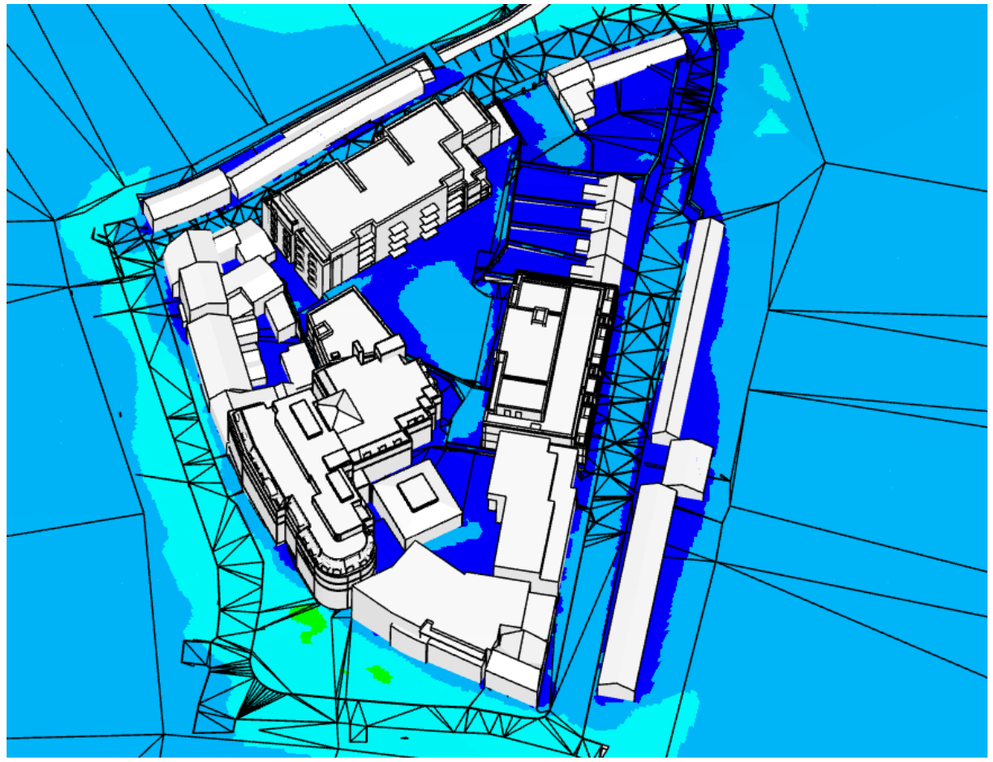

Fig 1.1 – CFD Model of Templar Place Scheme

2.0 Wind Analysis

2.1 Methodology

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, 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 Balbriggan is identified in Fig 2.1.1, which is an area slightly sheltered by the town of Balbriggan to the South and South-West but lies on the coast and will be subject to offshore winds from the South-East, as illustrated by the Wind Rose.

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" (z0=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 Balbriggan. 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 predominate due to the Atlantic gulf stream. Offshore winds from the South-East are also shown to have an impact on the site, with only lower occurrence from other directions.

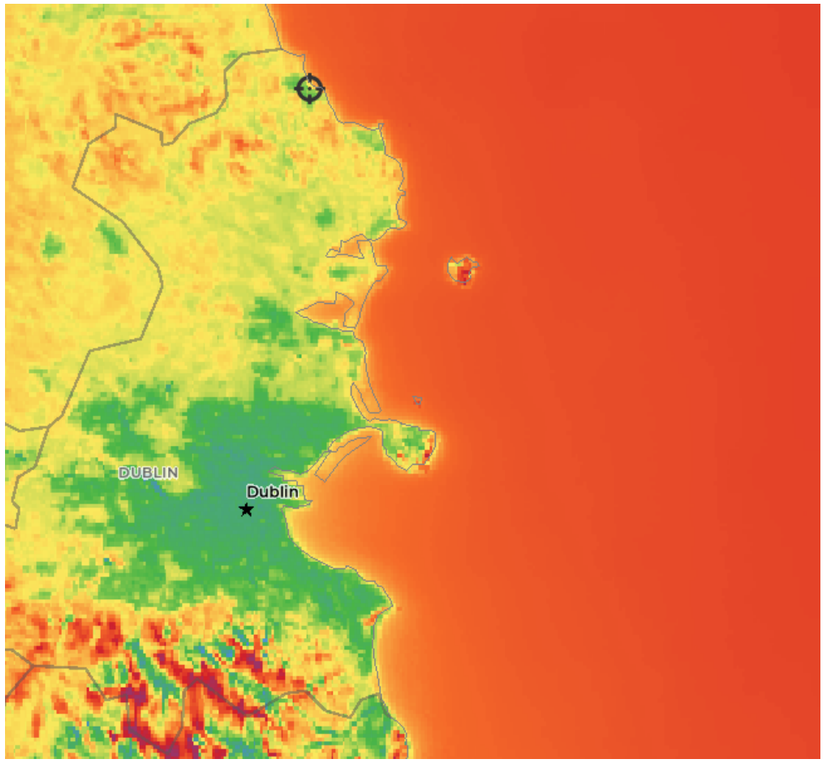

Fig 2.1.1 – Mean Wind Speeds across Dublin – Global Wind Atlas

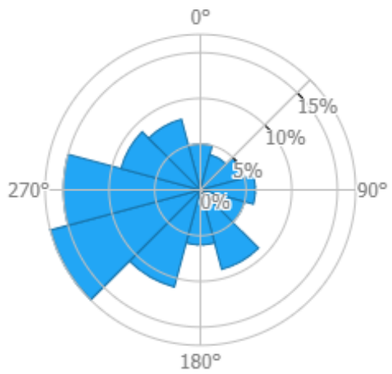

Fig 2.1.2 – Wind Frequency Rose for Balbriggan – Global Wind Atlas

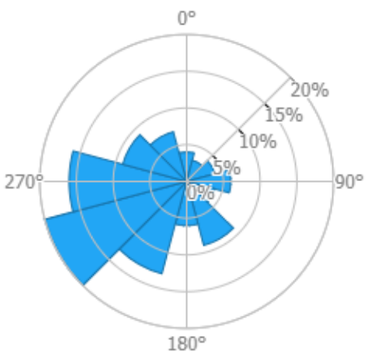

Fig 2.1.3 – Wind Speed Rose for Balbriggan – Global Wind Atlas

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

2.0 Wind Analysis

2.2 Methodology (Cont'd)

Fig 2.1.4 outlines the 3D representational model of the proposed development and its surroundings that was created based on current architectural modelling information, and simulations were undertaken for 12 cardinal wind directions.

Fig 2.1.5 shows the CFD simulation results which 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)).

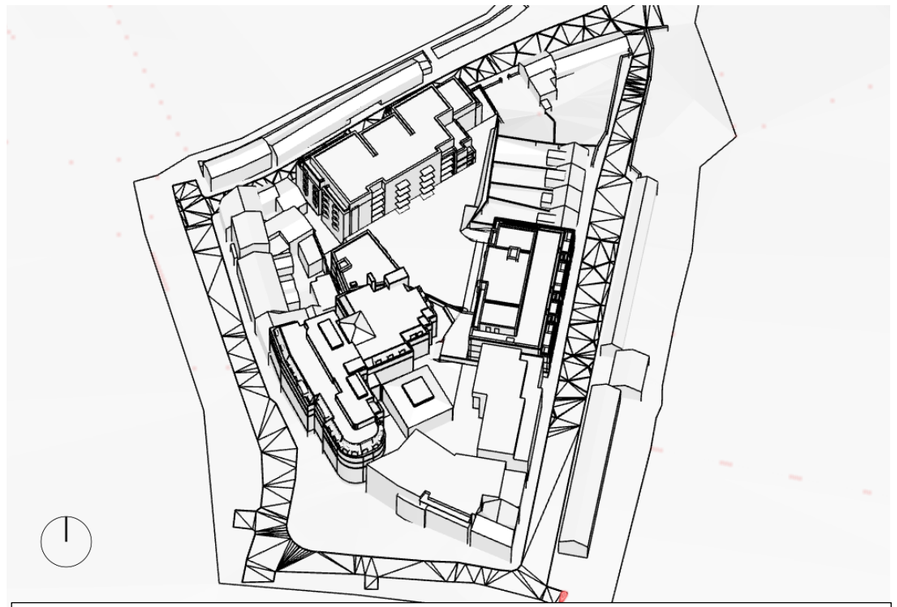

Fig 2.1.4 – 3D Representational Model of Proposed Templar Place Scheme

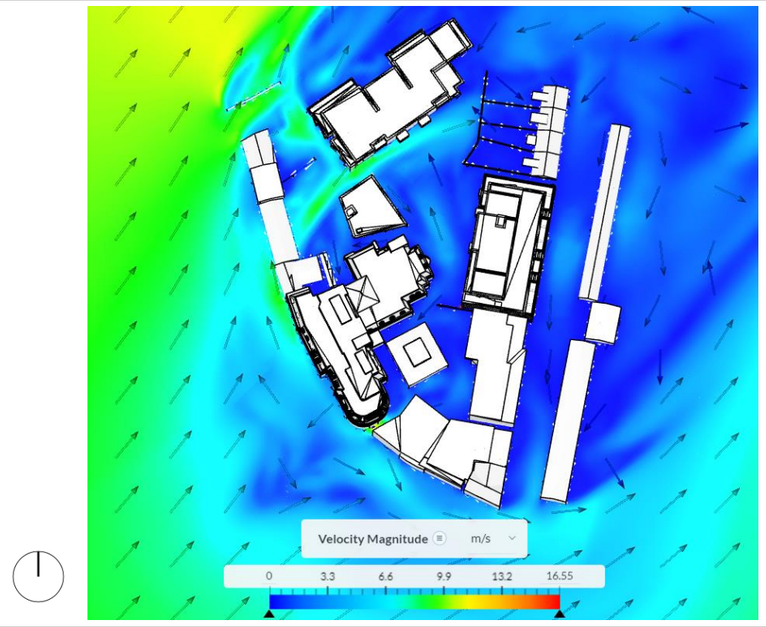

Fig 2.1.5 – Prevailing (SW) Wind Velocities across Proposed Development

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 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 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

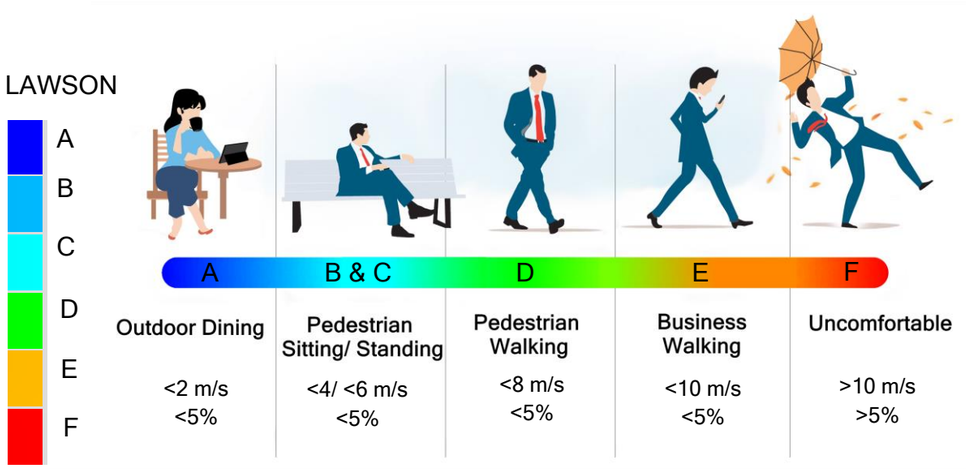

Fig 2.2.2 Lawson Scale

4.0 Pedestrian Comfort Results

4.1 Ground Level Results

Figure 4.1.1 outlines the Lawson Criteria Scale utilised to assess Pedestrian Comfort across the proposed Balbriggan development. 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”.

Fig 4.1.2 illustrates the Pedestrian Comfort results for 1.5m above the ground level of the development. The conditions have been determined to be predominantly suitable for “Outdoor Dining” and “Pedestrian Sitting”, as illustrated by dark/light blue contours.

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 Scale

Fig 4.1.2 – Lawson Criteria Results at 1.5m above Ground Level across Proposed Templar Place Development and surroundings

4.2 Roof Terraces

Figure 4.2 illustrates results of pedestrian comfort results at the proposed roof terrace level amenity space with a 0.9-metre-high balustrade surrounding the terraces. The space as analysed is determined by the Lawson methodology utilised to be predominantly suitable for “Outdoor Dining” and “Pedestrian Sitting” as indicated by the dark/light blue contours.

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

Lawson Criteria Scale

Fig 4.2 – Lawson Criteria Results for Roof Terraces across Proposed Development

4.3 Balconies

Balconies throughout the development were assessed for pedestrian comfort utilising the Lawson Criteria, as per Fig 4.3.

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.

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

Lawson Criteria Scale

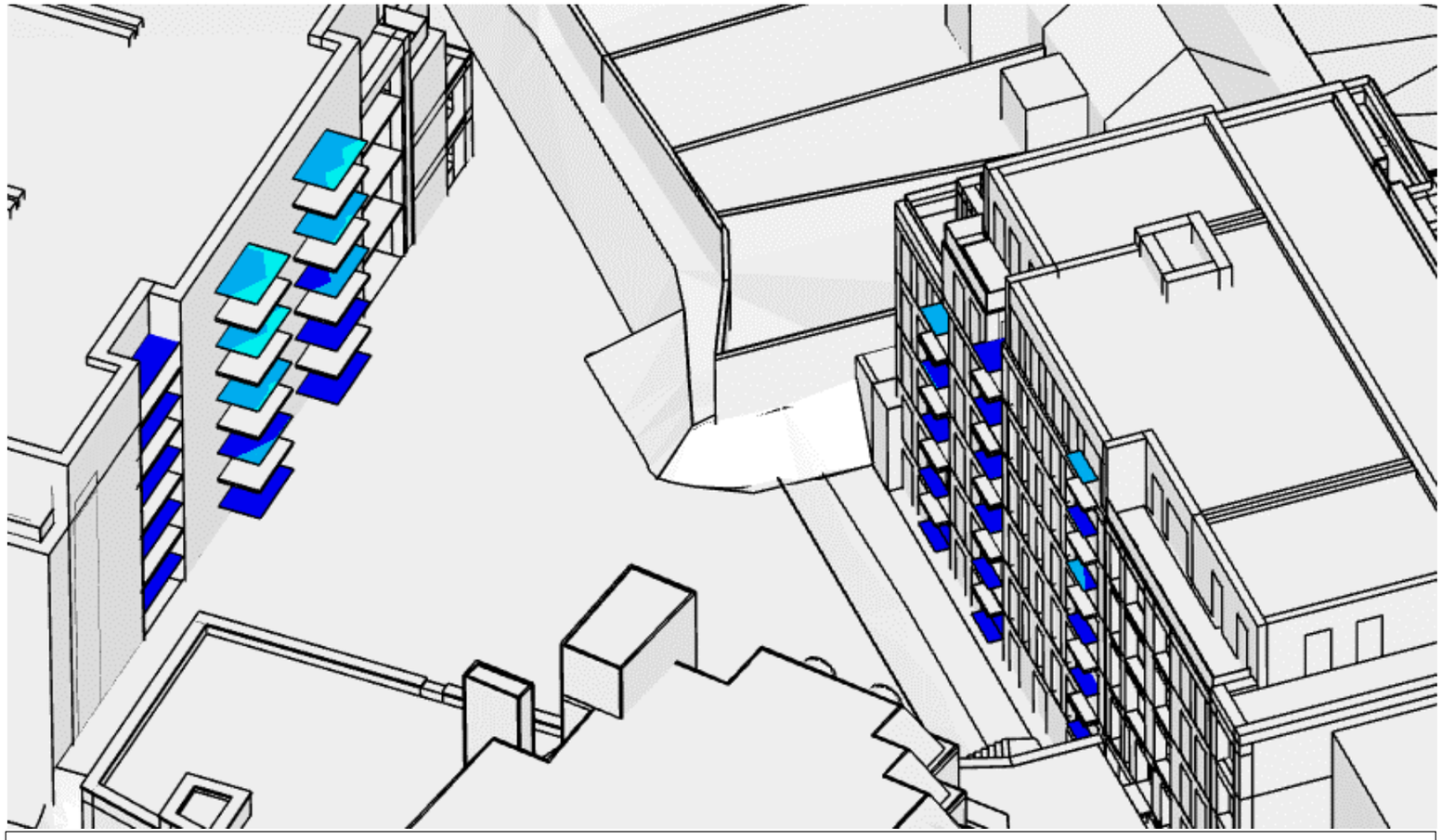

Fig 4.3 – Lawson Criteria Results for balconies across Proposed Templar Place Development

4.4 Inset Balconies

Inset balconies throughout the development were also assessed for pedestrian comfort utilising the Lawson Criteria, as per Fig 4.4.

The analysis determined that all balconies throughout the development were situated in zones suitable for “Outdoor Dining”, as shown by the dark blue contours.

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

Lawson Criteria Scale

Fig 4.4 – Lawson Criteria Results for inset balconies across Proposed Templar Place Development

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