12 Wind and Microclimate

12.1 Introduction

No revisions were necessary to this EIAR chapter in responding to Dun Laoghaire - Rathdown County Council (DLR CC) decision to request Further Information dated 25th March 2026 in respect of LRD26A/0051/WEB.

B-Fluid Limited has been commissioned by Oval Target Limited' to carry out a Wind and Micro-climate Modelling Study for a strategic housing development on a site of approx. c. 4.56 ha (overall) and is located at St. Teresa's, Temple Hill, Monkstown, Blackrock, Co. Dublin.

Figure 12.1: Proposed development

This Chapter is completed by Dr. Cristina Paduano, Dr. Arman Safdari, and Dr. Sadia Siddiqa.

Dr. Cristina Paduano is a Chartered Engineer (CEng) and member of Engineers Ireland who specialises in computational fluid dynamics applications for urban environment and the construction industry with over 15 years of experience. She holds a PhD in Mechanical Engineering from Trinity College Dublin, with M.Eng and B.Eng in Aerospace Engineering.

Dr. Arman Safdari is a CFD Modelling Engineer who specialises in computational fluid dynamics applications. He is an expert in airflow modelling, heat and mass transfer and multi-phase flow simulations. He holds a PhD in Mechanical Engineering from Pusan National University, a M.Sc. and B.Sc. in Mechanical Engineering.

Dr. Sadia Siddiqa is a CFD Modelling Engineer and member of Engineers Ireland (MIEI) specialising in computational fluid dynamics applications. With expertise in modeling fluid flows, airflow patterns, and heat/mass transfer, she's skilled at applying her knowledge to solve real-world challenges in fluid dynamics. She holds a PhD in Computational Mathematics from COMSATS University, where her research focused on CFD applications.

Wind microclimate studies identify the possible wind patterns around the existing environment and proposed development under mean and peak wind conditions typically occurring in Dublin.

This assessment is performed through advanced Computational Fluid Dynamics (CFD) which is a numerical method used to simulate wind conditions and its impact on the development and to identify areas of concern in terms of downwash/funnelling/downdraft/critical flow accelerations that may likely occur. The Advanced CFD numerical algorithms applied here are solved using high performance computing cluster.

These results will be utilized by Oval Target Limited's design team to configure the optimal layout for the proposed development with the aim of achieving a high-quality environment, suitable for the intended scope of use for each area or building (i.e. to provide a comfortable and pleasant environment for potential pedestrians) and not to introduce any critical wind impact on the surrounding areas and on the existing buildings.

The next sections describe in detail the wind and microclimate modelling performed, it's methodology and assumptions which B-Fluid Ltd. has adopted for this study, together with impacts of the proposed development on the existing environment.

12.2 Objective of Wind and Microclimate Modelling

CFD wind modelling is adopted to identify areas of concern in terms of critical flows and areas where pedestrian safety and comfort could be compromised. Pedestrian Wind Comfort and Safety Studies are conducted to predict, assess and, where necessary, mitigate the impact of the residential development on pedestrian level wind conditions. The objective is to maintain comfortable and safe pedestrian level wind conditions that are appropriate for the season and the intended use of pedestrian areas. Pedestrian areas include side-walks, street frontages, pathways, building entrance areas, open spaces, amenity areas, outdoor sitting areas, and accessible roof top areas among others.

For this purpose, 12 different wind scenarios and directions have been studied as shown in Table 12.1 in order to take into consideration all the different relevant wind directions. In particular, a total of 12 compass directions on the wind rose are selected. Table shows that 270° direction (westerly

Direction (°)	Frequency (%) (2008-2022)				Total Frequency (%)
	0–5 m/s	5–10 m/s	10–15 m/s	15–30 m/s	
0°	2.0	2.0	0.5	0.2	4.7
30°	1.8	1.5	0.3	0.1	3.7
60°	2.2	1.8	0.3	0.1	4.4
90°	2.8	2.5	0.4	0.1	5.8
120°	3.0	2.2	0.3	0.1	5.6
150°	3.2	2.5	0.7	0.3	6.7
180°	2.4	2.2	0.8	0.2	5.6
210°	1.5	2.5	1.2	0.5	5.7
240°	2.2	4.5	3.5	1.5	11.7
270°	4.0	9.5	6.0	2.5	22.0
300°	3.5	6.0	3.0	1.0	13.5
330°	2.0	2.5	0.8	0.3	5.6

winds) occurs with a frequency of 22%, making it the dominant wind direction at the site. Elevated wind intensities are also observed in the 240°–300° sector, corresponding to the west-southwest to northwest directions.

Table 12.1: Summary of the most critical wind speeds in Dublin

12.3 Regulations

Good wind microclimate conditions are necessary for creating outstanding public spaces. Adverse wind effects can reduce the quality and usability of outdoor areas, and lead to safety concerns in extreme cases.

Usually, the recommended approach to wind microclimate studies is based on the building height, as presented for example in Figure 12.2.

Building Height	Recommended Approach to Wind Microclimate Studies
Similar or lower than the average height of surrounding buildings **Up to 25m**	Wind studies are not required, unless sensitive pedestrian activities are intended (e.g. around hospitals, transport hubs, etc.) or the project is located on an exposed location
Up to double the average height of surrounding buildings **25m to 50m**	Computational (CFD) Simulations **OR** Wind Tunnel Testing
Up to 4 times the average height of surrounding buildings **50m to 100m**	Computational (CFD) Simulations **AND** Wind Tunnel Testing
High Rise **Above 100m**	**Early Stage Massing Optimization:** Wind Tunnel Testing OR Computational (CFD) Simulations **Detailed Design:** Wind Tunnel Testing **AND** Computational (CFD) Simulations to demonstrate the performance of the final building design

Figure 12.2: Recommended Approach to Wind Microclimate Studies based on Building Height, as prescribed by the Wind Microclimate Guidelines for Developments in the City of London (August 2019)

Computational fluid dynamics (CFD) tools can create high quality output that provide a good understanding of fundamental flow features. The CFD models must include a detailed three-dimensional representation of the proposed development.

Maximum cell sizes near critical locations (e.g. entrances, corners, etc.) must be 0.3m or smaller. Sufficient cells should be also used between buildings with a minimum of 10 across a street canyon. However, the cell size of buildings away from the target can be larger to allow for modelling efficiency. The CFD models should represent all surrounding buildings that are within 400m from the centre of the site. Other taller buildings outside of this zone that could have an influence on wind conditions within the project site should be included for wind directions where they are upwind of the project site. The models must contain at least 3 prism layers below 1.5m height, to capture near-ground effects.

CFD analysis also reports conditions in areas away from the site where cumulative effects of a cluster of tall buildings could lead to adverse wind conditions.

12.4 Urban Wind Effects

Buildings and topography affect the speed and direction of wind flows. Wind speed increases with increasing height above the ground, assuming a parabolic profile.

Flow near the ground level encounters obstacles represented by terrain roughness/buildings that reduce the wind speed and introduce random vertical and horizontal velocity components. This turbulence causes vertical mixing between the air moving horizontally at one level, and the air at those levels immediately above and below it. For this reason, the wind velocity profile is given by a fluctuating velocity along a mean velocity value. Figure 12.3. shows the wind velocity profile, as described above.

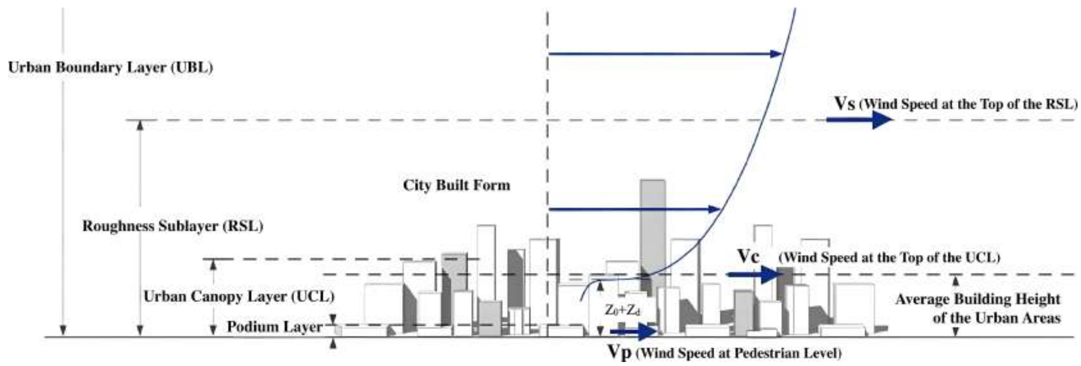


Figure 12.3: Wind Velocity Profile

In an urban context, wind speeds at pedestrian level are generally low compared with upper- level wind speeds, however, the wind can create adverse patterns when flowing in between buildings which can cause local wind accelerations or re-circulations. This wind patterns effect pedestrian safety and comfort. In general, the wind effects to be avoided/mitigated in an urban context include the following (Figure 12.4):

- **Funnelling Effects:** The wind can accelerate significantly when flowing through a narrow passage between building structures. The highest speeds are experienced at the point where the restriction of the area is the greatest.

- **Downwash Effects:** The air stream when striking a tall building can flow around it, over it and a part can be deflected towards the ground. This downward component is called downwash effect, and its intensity depends on the pressure difference driving the wind. The higher the building, the higher this pressure difference can be.

- **Corner Effects:** Wind can accelerate around the corners of the buildings. Pedestrians can experience higher wind speeds as well as more sudden changes in wind speeds. The reason for this is that there are narrow transition zones between the accelerated flows and the adjacent quiescent regions. This effect is linked to the downwash effect as the downward stream component subsequently flows around the corners towards the leeward side of the building.

- **Wake Effect:** Excessive turbulence can occur in the leeward side of the building. This can cause sudden changes in wind velocity and can raise dust or lead to accumulation of debris. This effect is also dependent on the height of the building.

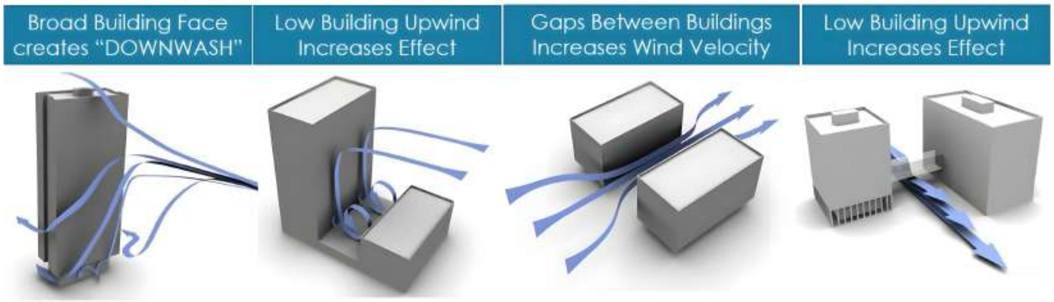


Figure 12.4: Parameters to know for Wind Conditions Assessment

The anticipation of the likely wind conditions resulting from new developments are important considerations in the context of pedestrian comfort and the safe use of the public realm. While it is not always practical to design out all the risks associated with the wind environment, it is possible to provide local mitigation to minimise risk or discomfort where required**.**

It is important that a pleasant and safe environment is provided as part of the proposed development given the importance of pedestrian and cycle access to the scheme.

12.5 Study Methodology

The method for the study of wind microclimate combines the use of Computational Fluid Dynamics (CFD) to predict wind velocities and wind flow patterns, with the use of wind data from suitable meteorological station and the recommended comfort and safety standards (Lawson Criteria).

The effect of the geometry, height and massing of the proposed development and existing surroundings including topography, ground roughness and landscaping of the site, on local wind speed and direction is considered as well as the pedestrian activity to be expected (sitting, standing, strolling and business walking). The results of the assessment are presented in the form of contours of the Lawson criteria at pedestrian level.

The assessment has comprised the following scenarios:

- **Baseline Existing Scenario**: this consists of the existing wind microclimate at the site without the proposed development.

- **Proposed Development in the Existing Scenario with Cumulative Applications (if any)**: this consists of the assessment of the wind microclimate of the site with the proposed development surrounded by existing and proposed/approved buildings.

In accordance with the guideline cited in section 12.1.2, the wind microclimate study should consider the effect of the proposed development together with buildings (existing and/or permitted) that are within 450 m from the centre of the site. Here a 800 m radius has been considered. Other taller buildings outside of this zone that could have an influence on wind conditions within the project site should be included for wind directions where they are upwind of the project site.

In particular, the following has been undertaken:

- Topography of the site with buildings (proposed and adjacent existing/permitted developments massing, depending on the scenario assessed "baseline or proposed ") have been modelled using OpenFOAM Software.

- Suitable wind conditions have been determined based on historic wind data. Criteria and selected wind scenarios included means and peaks wind conditions that need to be assessed in relation to the Lawson Criteria.

- Computational Fluid Dynamics (CFD) has been used to simulate the local wind environment for the required scenarios ("baseline or proposed").

- The impact of the proposed development massing on the local wind environment has been determined (showing the wind flows obtained at pedestrian level).

- Potential receptors (pedestrian areas) have been assessed through review of external amenity/public areas (generating the Lawson Comfort and Distress Map).

- Potential mitigation strategies for any building related discomfort conditions (where necessary) have been explored and their effect introduced in the CFD model produced.

12.5.1 Acceptance Criteria

Pedestrian Comfort Pedestrian Wind Comfort is measured in function of the frequency of wind speed threshold exceeded based on the pedestrian activity. The assessment of pedestrian level wind conditions requires a standard against which measured or expected wind velocities can be compared.

Only gust winds are considered in the safety criterion. These are usually rare events but deserve special attention in city planning and building design due to their potential impact on pedestrian safety. Gusts cause the majority of cases of annoyance and distress and are assessed in addition to average wind speeds. Gust speeds should be divided by 1.85 and these "*gust equivalent mean*" (GEM) speeds are compared to the same criteria as for the mean hourly wind speeds. This avoids the need for different criteria for mean and gust wind speeds.

The following criteria are widely accepted by municipal authorities as well as the international building design and city planning community:

- DISCOMFORT CRITERIA: Relates to the activity of the individual.
  Onset of discomfort:
  - Depends on the activity in which the individual is engaged and is defined in terms of a mean hourly wind speed (or GEM) which is exceeded for 5% of the time (Figure 12.3).

- DISTRESS CRITERIA: Relates to the physical well-being of the individual.
  Onset of distress:
  - 'Frail Person Or Cyclist': equivalent to an hourly mean speed of 15 m/s and a gust speed of 28 m/s (62 mph) to be exceeded less often than once a year. This is intended to identify wind conditions which less able individuals or cyclists may find physically difficult. Conditions in excess of this limit may be acceptable for optional routes and routes which less physically able individuals are unlikely to use.

  - 'General Public': A mean speed of 20 m/s and a gust speed of 37 m/s (83 mph) to be exceeded less often than once a year. Beyond this gust speed, aerodynamic forces approach body weight and it rapidly becomes impossible for anyone to remain standing. Where wind speeds exceed these values, pedestrian access should be discouraged.

The above criteria set out six pedestrian activities and reflect the fact that calm activity requires calm wind conditions, which are summarised by the Lawson scale, shown in Figure 12.5-12.7. Lawson scale assesses pedestrian wind comfort in absolute terms and defines the reaction of an average person to the wind. Each wind type is associated to a number, corresponding to the Beaufort scale. Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. A 20% exceedance is used in these criteria to determine the comfort category, which suggests that wind speeds would be comfortable for the corresponding activity at least 80% of the time or four out of five days.

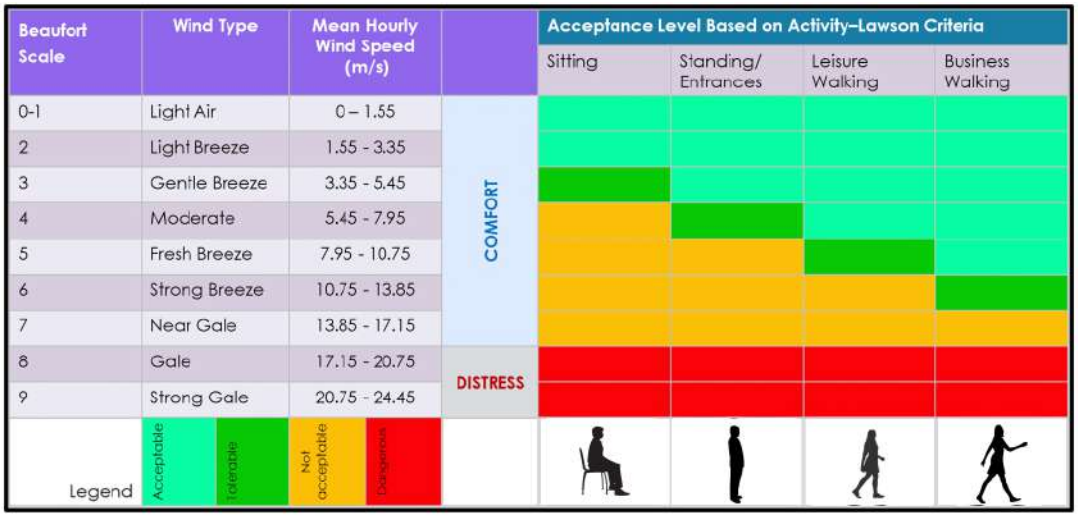
These criteria for wind forces represent average wind tolerances. They are subjective and variable depending on thermal conditions, age, health, clothing, etc. which can all affect a person's perception of a local microclimate. Moreover, pedestrian activity alters between winter and summer months. The criteria assume that people will be suitably dressed for the time of year and individual activity. It is reasonable to assume, for instance, that areas designated for outdoor seating will not be used on the windiest days of the year. Weather data measured are used to calculate how often a given wind speed will occur each year over a specified area. Pedestrian comfort criteria are assessed at 1.8m above ground level. Unless in extremely unusual circumstances, velocities at pedestrian level increase as you go higher from ground level.

Pedestrian comfort criteria are assessed at 1:8*m* above ground level. Unless in extremely unusual circumstances, velocities at pedestrian level increase as you go higher from ground level.

A breach of the distress criteria requires a consideration of:

- whether the location is on a major route through the complex,
- whether there are suitable alternate routes which are not distressful.

If the predicted wind conditions exceed the threshold, then conditions are unacceptable for the type of pedestrian activity and mitigation measure should be implemented into the design.



Beaufort Scale	Wind Type	Mean Hourly Wind Speed (m/s)		Acceptance Level Based on Activity–Lawson Criteria			
				Sitting	Standing/ Entrances	Leisure Walking	Business Walking
0-1	Light Air	0 – 1.55	COMFORT				
2	Light Breeze	1.55 - 3.35					
3	Gentle Breeze	3.35 - 5.45					
4	Moderate	5.45 - 7.95					
5	Fresh Breeze	7.95 - 10.75					
6	Strong Breeze	10.75 - 13.85					
7	Near Gale	13.85 - 17.15					
8	Gale	17.15 - 20.75	DISTRESS				
9	Strong Gale	20.75 - 24.45					
Legend	Acceptable / Tolerable	Not acceptable / Dangerous					

Figure 12.5: Lawson Scale

Pedestrian Comfort Category (Lawson Scale)	Mean and Gem wind speed not to be exceeded more than 5% of the time	Description
Sitting	4m/s	Acceptable for frequent outdoor sitting use, i.e., restaurant /café
Standing	6m/s	Acceptable for occasional outdoor sitting use, i.e., public outdoor spaces
Walking/Strolling	8m/s	Acceptable for entrances/bus stops /covered walkaways
Business Walking	10m/s	Acceptable for external pavements, walkways
Unacceptable/Distress	>10m/s	Start of not comfortable/distress level for pedestrian access

Figure 12.6: Lawson Scale – Pedestrian Comfort

Pedestrian Safety Category (Lawson Scale)	Mean and Gem wind speed not to be exceeded more than 0.0022% of the time	Description
Unsafe for public	>20m/s	Distress/safety concern for pedestrian
Unsafe for cyclists or frail person	>15m/s	Distress/safety concern for cyclist/frail person

Figure 12.7: Lawson Scale – Safety and Distress

12.5.2 Significant Criteria

The significance of on-site measurement locations are defined by comparing the wind comfort/safety levels with the intended pedestrian activity at each location, using the table provided by the Lawson Comfort and Distress Criteria (Figure 12.8).

The significance of off-site measurement locations are defined by comparing the wind comfort/safety levels with the intended pedestrian activity at each location, prior and after the introduction of the proposed development (Figure 12.9).

Significance	Trigger	Mitigation required?
Major Adverse	Conditions are "unsafe"	Yes
Moderate Adverse	Conditions are "unsuitable" (in terms of comfort) for the intended pedestrian use.	Yes
Negligible	Conditions are "suitable" for the intended pedestrian use.	No
Moderate Beneficial	Conditions are calmer than required for the intended pedestrian use (by at least one comfort category).	No

Figure 12.8: Significance Criteria for On-site Receptors

Significance	Trigger	Mitigation required?
Major Adverse	Conditions that were "safe" in the baseline scenario became "unsafe" as a result of the Proposed Development. *OR* Conditions that were "suitable" in terms of comfort in the baseline scenario became "unsuitable" because of the Proposed Development. *OR* Conditions that were "unsafe" in the baseline scenario are made worse because of the Proposed Development.	Yes
Moderate Adverse	Conditions that were "suitable" in terms of comfort in the baseline scenario are made windier (by at least one comfort category) as a result of the Proposed Development but remain "suitable" for the intended pedestrian activity.	No
Negligible	Conditions remain the same as in the baseline scenario.	No
Major Beneficial	Conditions that were "unsafe" in the baseline scenario became "safe" because of the Proposed Development.	No
Moderate Beneficial Potential Receptors	Conditions that were "unsuitable" in terms of comfort in the baseline scenario became "suitable" because of the Proposed Development. *OR* Conditions that were "unsafe" in the baseline scenario are made better as a result of the Proposed Development (but not so as to make them "safe".	No

Figure 12.9: Significance Criteria for Off-site Receptors

12.5.3 CFD Modelling Method

Computational Fluid Dynamics (CFD) is a numerical technique to simulate fluid flow, heat and mass transfer, chemical reaction and combustion, multiphase flow, and other phenomena related to fluid flows. CFD modelling includes three main stage: pre-processing, simulation and post-processing as described in Figure 12.10. The Navier-Stokes equations, used within CFD analysis, are based entirely on the application of fundamental laws of physics and therefore produce extremely accurate results providing that the scenario modelled is a good representation of reality.

This report employs OpenFoam Code, which is based on a volume averaging method of discretization and uses the post-processing visualisation toolkit Paraview version 5.5. OpenFoam is a CFD software code released and developed primarily by OpenCFD Ltd, since 2004. It has a large user base across most areas of engineering and science, from both commercial and academic organisations.

OpenFOAM CFD code has capabilities of utilizing a Reynolds Averaged Navier-Stokes (RANS) approach, Unsteady Reynolds Averaged Navier-Stokes (URANS) approach, Detached Eddy Simulation (DES) approach, Large Eddy Simulation (LES) approach or the Direct Numerical Simulation (DNS) approach, which are all used to solve anything from complex fluid flows involving chemical reactions, turbulence and heat transfer, to acoustics, solid mechanics and electromagnetics. Quality assurance is based on rigorous testing. The process of code evaluation, verification and validation includes several hundred daily unit tests, a medium-sized test battery run on a weekly basis, and large industry-based test battery run prior to new version releases. Tests are designed to assess regression behaviour, memory usage, code performance and scalability.

The OpenFOAM solver algorithm directly solves the mass and momentum equations for the large eddies that comprise most of the fluid's energy. By solving the large eddies directly no error is introduced into the calculation.

To reduce computational time and associated costs the small eddies within the flow have been solved using the widely used and recognised Smagorinsky Sub-Grid Scale (SGS) model. The small eddies only comprise a small proportion of the fluids energy therefore the errors introduced through the modelling of this component are minimal.

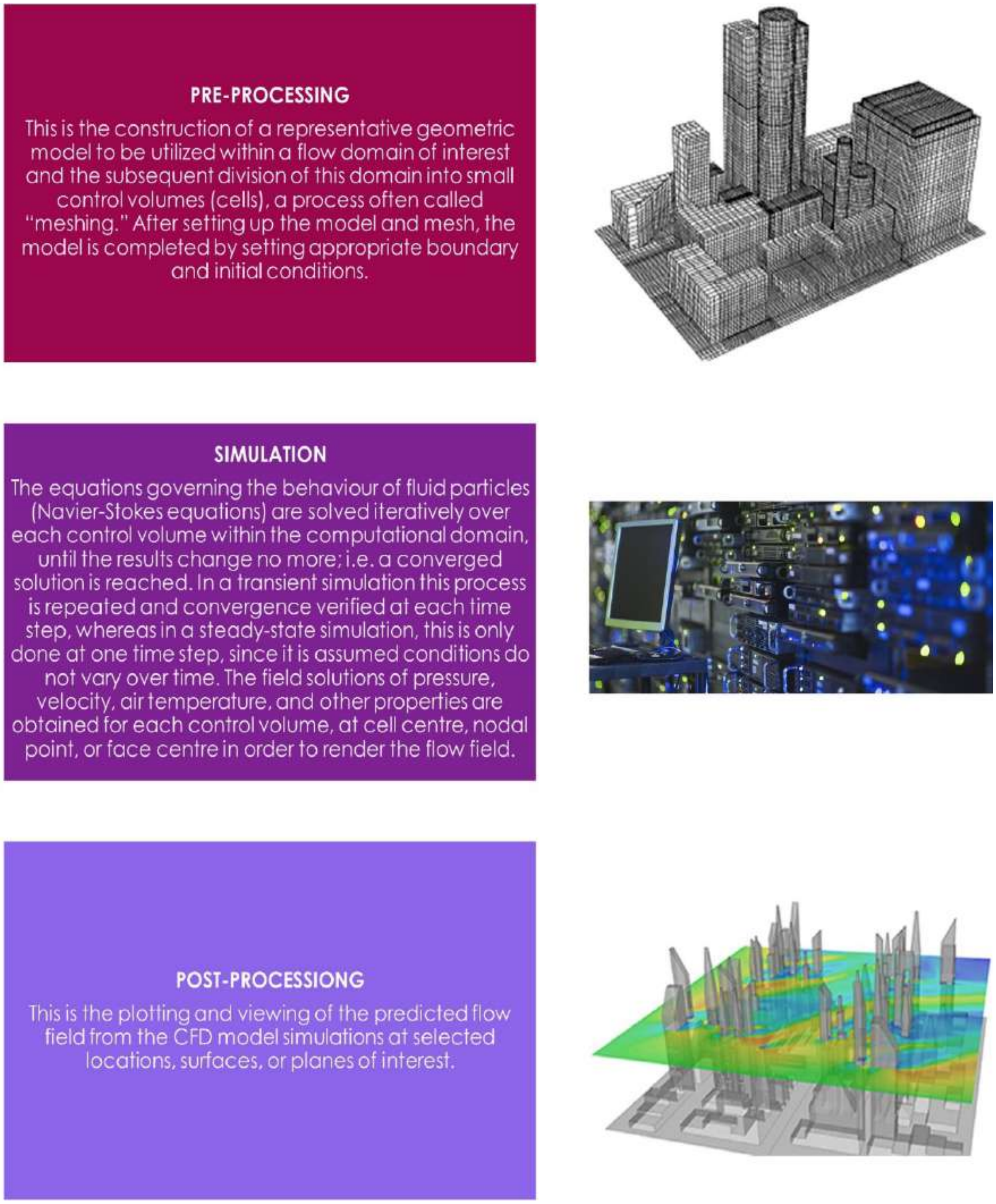


Figure 12.10: CFD Modelling Process Explanation

The error introduced by modelling the small eddies can be considered of an acceptable level. Computational time will be reduced by modelling the small eddies (compared to directly solving).

12.5.4 Modelled Geometry

The extent of the built area (e.g. buildings, structures or topography) that is represented in the numerical domain depends on the influence of the features on the region of interest. According to the Best Practice Guideline (COST Action 732), a building with height H (height of the tallest proposed building is ≈22 m) may have a minimal influence if its distance from the region of interest is greater than 6-10H (we considered 800 m which is even larger than required).

The modelled layout and dimensions of the surrounding environment are outlined in the table below (Table 12.2).

	MODELLED CFD ENVIRONMENT DIMENSIONS		
	Width	**Length**	**Height**
Computational Domain	**Approx. 1200 m**	**Approx. 1200 m**	**Approx. 160 m**

Table 12.2: Modelled Environment Dimensions

A 3D view of the proposed development massing model in the domain is presented in Figure 12.11.

Geometries used in this study include two parts:

- The massing model of the proposed development, which is generated based on drawings provided by Oval Target Limited;
- The massing model of the building blocks within 800m from the development (colored in white).

Figure 22.11: 3D View of the Massing Models of the Proposed Development (in red) and Surrounding Building Blocks (in white).

12.5.5 Boundary Conditions

For each wind directions, an initial wind velocity was set based on logarithmic wind profile. Surfaces within the model were specified as having 'no slip' condition. This boundary condition, ensures that flow moving parallel to a surface is brought to rest at the point where it meets the surface. All the other domain boundaries are set as "Open Boundaries".

The wind velocity data provided by the historical data collection and by the local data measuring are used in the formula below for the logarithmic wind profile to specify the wind velocity profile (wind velocity at different heights) to be applied within the CFD model:

$$u_{(z)} = \frac{u^{\star}}{K} \cdot ln(\frac{z+z_0}{z_0})$$

where:

- $u_{(z)}$ = wind speed measured at the reference height z
- z = height to measure $u_{(z)}$
- z_0 = roughness length selected according to Eurocode
- u^* = friction velocity
- K = Karman constant

12.5.6 Computational Mesh

The computational mesh used in this report is created using OpenFOAM utilities blockMesh and snappyHexMesh. It is a hybrid mesh containing a structured background grid and an unstructured hexahedron-dominated mesh in the near-wall region. The largest cell has a depth of 5 m, where the smallest has a depth of 0.15 m. The total cell count is approx. 120 million. An isometric view of the geometry captured by the computational mesh is shown in Figure 12.12.

In this study, all simulations employ the SIMPLE algorithm to perform the pressure–velocity coupling (simpleFoam solver in OpenFOAM). All terms in the RANS equations are discretized using the nominally second-order cell-centred finite volume method, where gradient and Laplacian terms are discretized using Gaussian integration with linear interpolation. Convection/advection terms are discretized using a second-order accurate linear-upwind scheme.

The computational mesh was decomposed using the SCOTCH algorithm. All simulations in this study are performed in parallel on an in-house HPC cluster. Key parameters of the CFD model used in this wind microclimate study are summarised in Table 12.3.

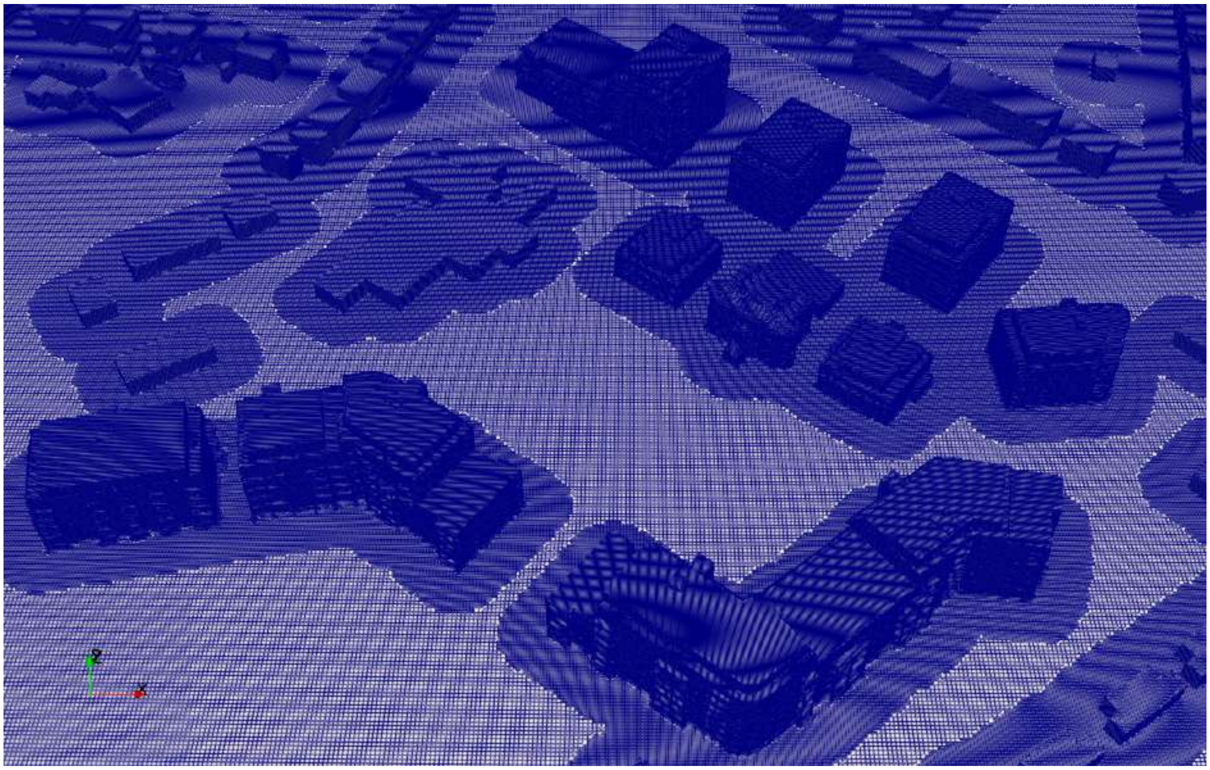


Figure 32.12 Computational Mesh of Proposed Development:

KEY PARAMETERS OF THE CFD MODEL	
Air Density (ρ)	1.2 kg/m^3
Turbulence Model	k-ω SST Model
Cell Size	Approx. 0.15 m at the development Approx. 0.3 m in the surroundings 5 m elsewhere
Total Cell Count	Approx. 120 million

Table 12.3: Key parameters of the CFD model for each wind scenario

12.6 The Existing Receiving Environment (Baseline)

In this sub-section, wind impact has been assessed on the existing receiving environment considered as the existing buildings and the topography of the site prior to construction of the proposed development (Figure 12.13). A statistical analysis of 30 years historical weather wind data has been carried out to assess the most critical wind speeds, directions and frequency of occurrence of the same. The aim of this assessment has been to identify the wind microclimate of the area that may cause critical conditions for pedestrian comfort criteria.

The wind microclimate of the baseline scenario is defined by the wind patterns that develop on the site and its the surroundings (existing buildings and topography) under the local wind conditions relevant for the assessment of the Pedestrian Comfort and Distress.

In this scenario the assessment has considered the impact of wind on the existing area. Results of wind microclimate at pedestrian level (1.8m height - flow speeds) are collected throughout the modelled site. These flow velocities identify if locally, wind speeds at pedestrian-level are accelerated or decelerated in relation to the undisturbed reference wind speed due to the presence of the existing baseline environment.

The impact of these speeds are then combined with their specific frequency of occurrence and presented in the maps that show the area of comfort and distress in accordance with Lawson Criteria, these maps are produced at pedestrian level on the ground and identify the suitability of each area to its prescribed level of usage and activity.

Figure 12.13: Existing Receiving Environment (Baseline Situation).

12.6.1 Local Wind Conditions

Proposed development will be situated at St. Teresa's, Temple Hill, Monkstown, Blackrock, Co. Dublin. The Existing Environment site is shown in Figure 12.14. The area considered for the existing environment and proposed development assessment comprises a 2km² area around the Proposed development as represented in Figure 12.15.

Figure 12.14: Proposed development Site Location and Existing Environment.

Figure 12.15: Extents of Analysed Existing Environment Around Proposed development (a 2km² area is shown as a red box around the development).

12.6.2 Topography and Built in Environment

Figure 12.16. shows an aerial photograph of the terrain surrounding the construction site at Proposed development.

The proposed development site is located at St. Teresa's, Temple Hill, Monkstown, Blackrock, Co. Dublin. The site benefits from good accessibility to public transport infrastructure, with Monkstown and Blackrock DART stations located within reasonable walking distance, in addition to several Dublin Bus routes serving the surrounding road network. The proximity to Blackrock and Monkstown village centres provides access to a range of local amenities, services, and employment opportunities within the immediate vicinity of the site.

The area surrounding the site can be characterized as a suburban residential environment with a mix of low- to mid-rise buildings, mature landscaping, and established urban form. As a result, a degree of sheltering can be expected for wind approaching from several directions due to the surrounding built environment and vegetation. For the purposes of this study, the wind conditions are therefore considered representative of a suburban urban context, and no distinction is made between individual wind directions in terms of terrain classification.

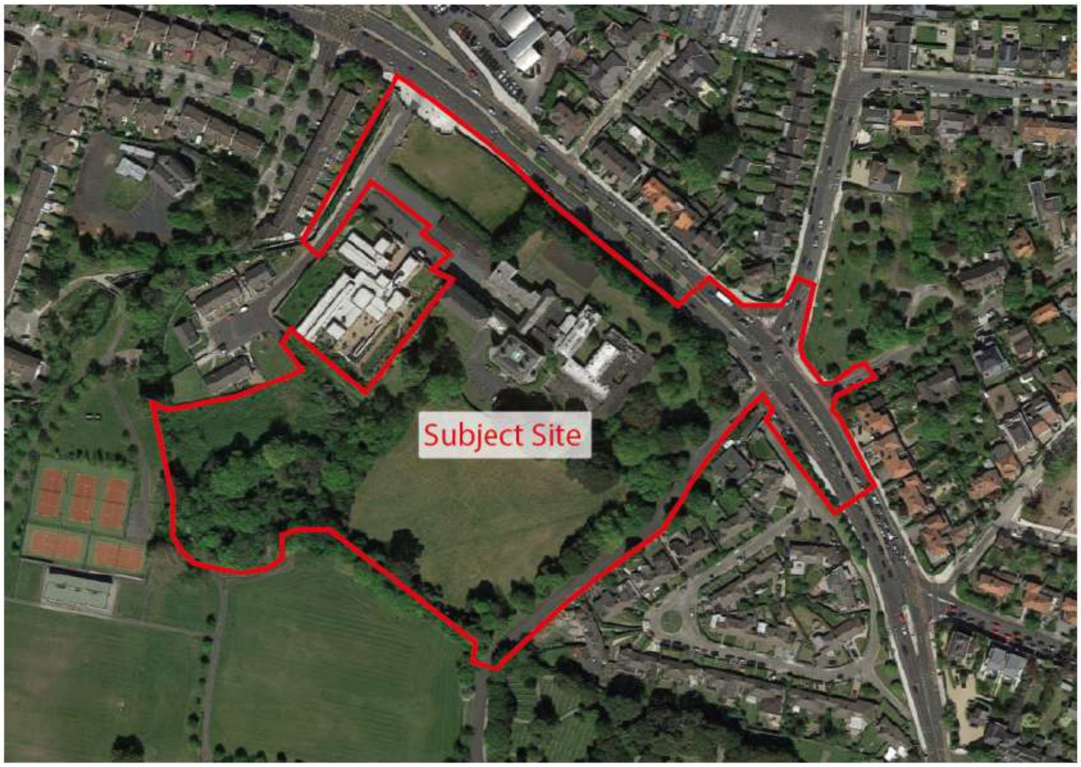


Figure 12.16: Built-in Environment Around Construction Site at Proposed development

12.6.3 Wind and Microclimate Conditions

This analysis considers the whole development being exposed to the typical wind condition of the site. The building is oriented as shown in the previous sections. The wind profile is built using the annual average of meteorology data collected at Dublin Airport Weather Station. Figure 12.17. shows on the map the position of Proposed development and the position of Dublin Airport.

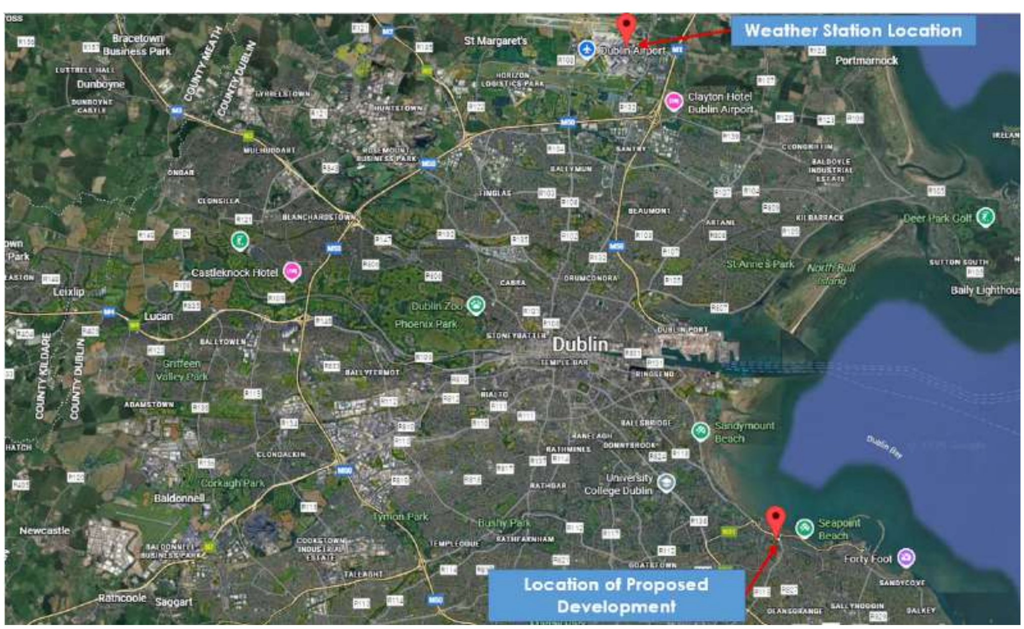


Figure 12.17: Map Showing the Position of Proposed Development and Dublin Airport.

Regarding the transferability of the available wind climate data following considerations have been made:

- **Terrain:** The meteorological station is located in the flat open terrain of the airport, whereas the development site is located in urban area with dense built-in structure with buildings of at least 10m height and above.

- **Mean Wind Speeds:** Due to the different terrain environment, the ground-near wind speeds (at pedestrian level) will be lower at the construction site compared to the meteorological station at the airport.

- **Wind Directions:** The landscape around the development site can in principle be characterized as flat terrain. Isolated elevations in the near area of the development should have no influence on the wind speed and wind directions. With respect to the general wind climate no significant influence is expected. Based on the above considerations it can be concluded that the data from the meteorological station at Dublin Airport are applicable for the assessment of the wind comfort at the development site.

The assessment of the wind comfort conditions at the new development will be based on a discrete set of wind data throughout a year (annual wind statistic) provided by Meteoblue for Dublin Airport meteorological wind station. In this study, a 08-discrete set of wind directions is utilized to evaluate the probability of exceedance at any given threshold speed. A Weibull probability distribution is employed to transform the provided wind data into a continuous distribution for each wind direction. From the Weibull distribution function, the probability (P) for each wind direction can be obtained by:

$$P = e^{(-\frac{U}{c})^k}$$

Where *c* is the scale parameter and *k* is the shape parameter for a wind speed *U*.

Statistical analysis of the number of hours and magnitudes of wind is performed in order to indicate the pedestrian comfort and distress analysis as per Lawson Criteria. Each of the wind directions were interpolated to calculate the probability that a velocity threshold will be exceeded. Based on the criterion of occurrence frequency, if the proposed site is exposed to a wind from a specific direction for more than 5 percent of the time, then the microclimate analysis should consider the impact of this wind (accounting for its direction and most frequent speed) on the local microclimate. However, to get complete picture we ran simulations for wind from 08 distinct directions around the development.

As stated above, the local wind climate is determined from historical meteorological data recorded at Dublin Airport meteological wind station. The data set analyzed for this assessment is based on the meteorological data associated with the maximum daily wind speeds recorded over a 15-year period between 2008 and 2022 at a weather station at the airport, which is located 10m above ground. Figure 12.18 shows the wind speed record during the latest 5 years.

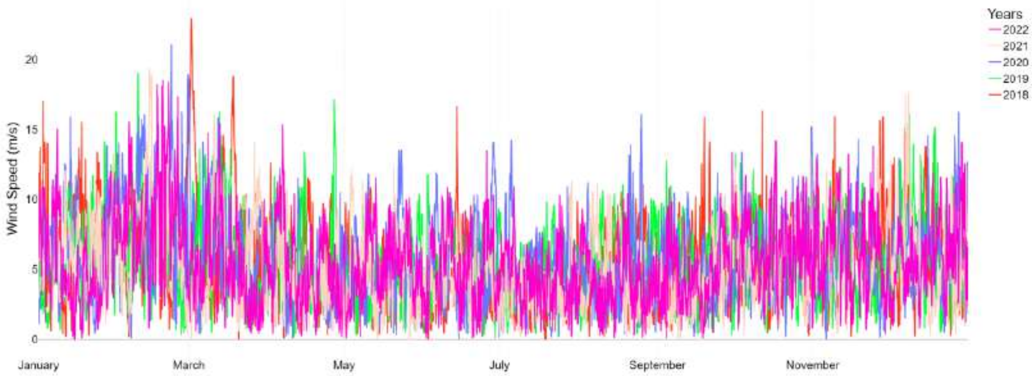


Figure 12.18: Local Wind Conditions – Wind Speed – 2018-2022.

Figure 12.19 displays a wind speed diagram for Dublin, illustrating the number of days per month when the wind attains specific speeds. It is evident from this figure that strong winds are more prevalent during the winter season (December, January, and February) and the start of spring season (March) compared to other seasons.

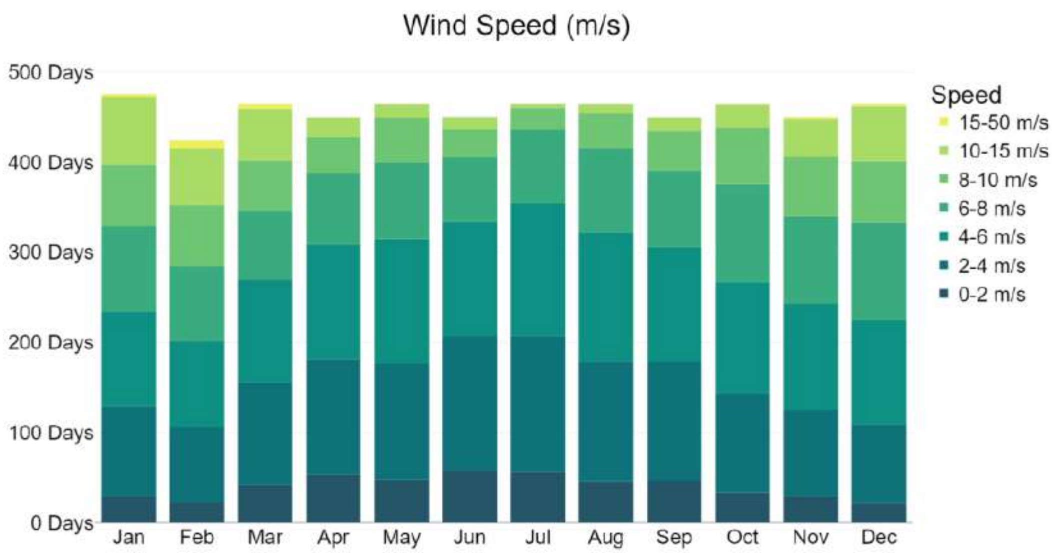


Figure 12.19: Dublin Wind Speed Diagram.

Figure 12.20 displays the wind rose for the Dublin revealing the percentage of wind coming from different directions over a 15-year period. Detailed percentages for each direction are outlined in Table 12.4. As depicted in Figure 12.16 and highlighted in Table 12.4, the highest probability of wind occurrence lies in the wind blowing from 240° to 300° with 270° being most prevalent. This finding indicates that west winds contribute significantly to the probability of discomfort exceedance.

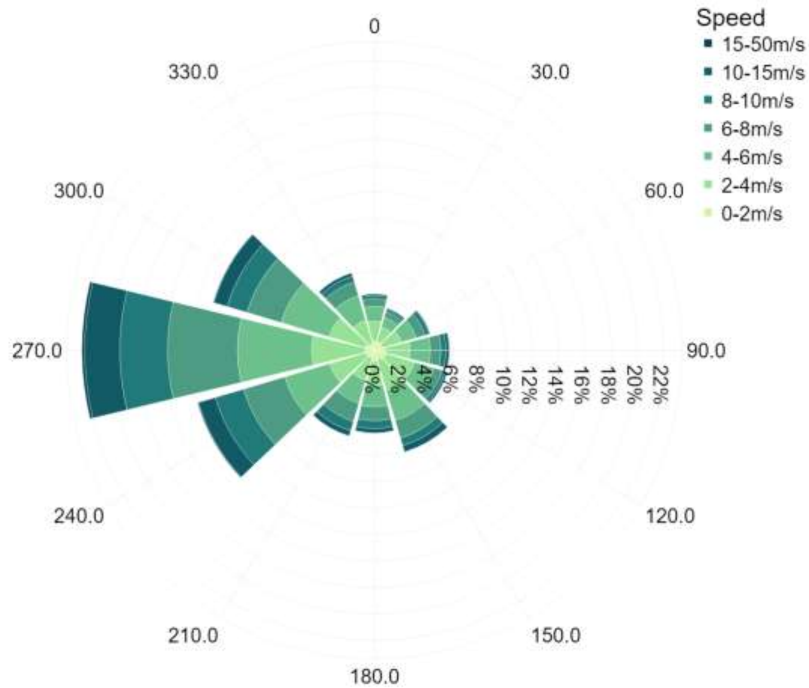


Figure 12.20: Dublin Wind Rose.

Wind Direction	Scale Parameter	Shape Parameter	Roughness Length (z_0)	Frequency
270.00°	1.80	6.11	0.30	22.22%
240.00°	2.07	6.55	0.30	13.98%
300.00°	1.66	5.18	0.30	12.83%
150.00°	1.35	3.88	0.30	8.10%
210.00°	2.05	6.02	0.30	6.75%
180.00°	1.49	4.62	0.30	6.33%
330.00°	1.60	4.38	0.30	6.14%
120.00°	0.92	1.70	0.30	5.86%
90.00°	1.15	3.08	0.30	5.74%
60.00°	1.82	4.80	0.30	4.42%
0.00°	1.42	3.81	0.30	4.28%
30.00°	1.22	3.33	0.30	3.34%

Table 12.4: A Detailed Table Includes Wind Occurrences, Wind Patterns and Roughness Lengths for Different Wind Directions.

In addition to the annual statistical analysis of wind occurrences (Figure 12.20), a detailed examination has been conducted to comprehend the wind conditions during each season. As illustrated in Figure 12.21, the wind patterns in spring closely resemble those in summer, with a higher percentage of winds coming from the east and north-east compared to the same direction in summer. Although in autumn the wind pattern is similar to winter, during winter, the winds occur more frequently and are stronger. In general, the predominant winds come from the west at higher speeds compared to other wind directions throughout all seasons.

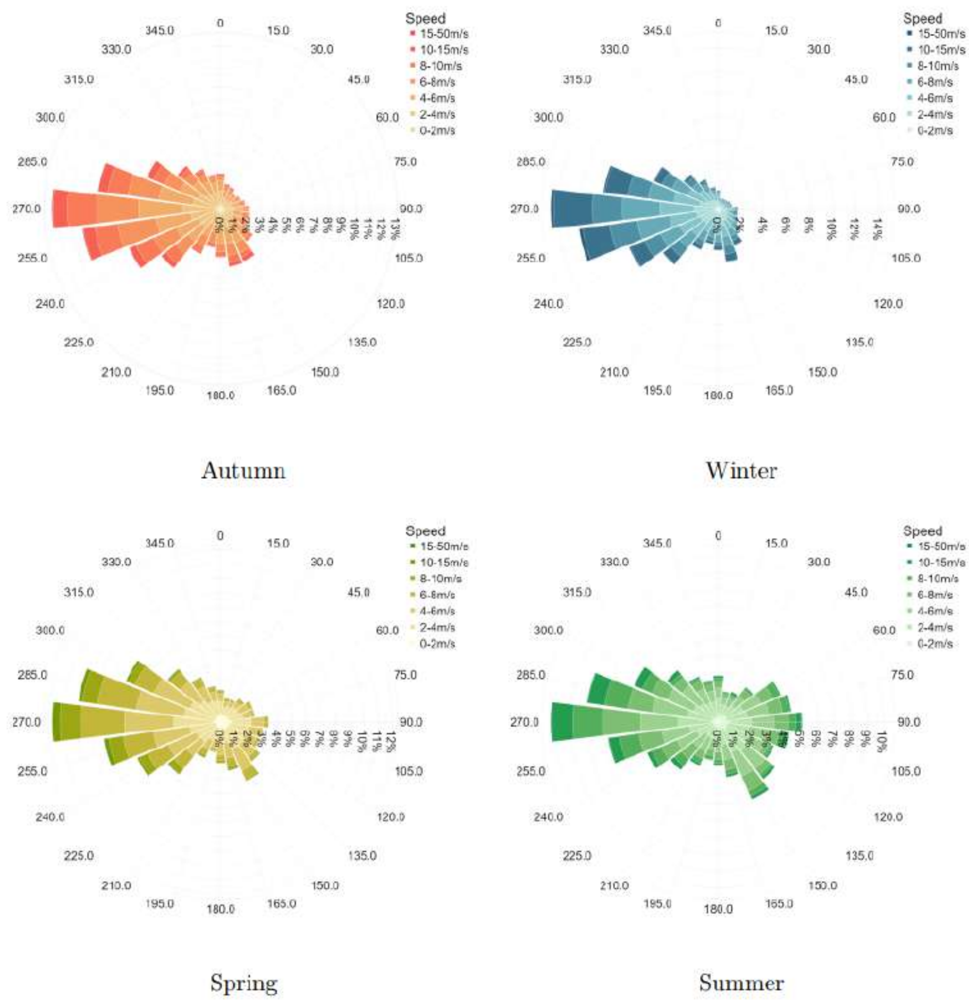


Figure 12.21: Wind Speeds and Wind Directions at Different Seasons.

12.6.4 Existing Wind Microclimate

Results of wind speeds and their circulations at pedestrian level of 1.8m above the development ground are presented in Figures 12.22 to 12.33 in order to assess wind flows at ground floor level of proposed development.

Wind flow speeds are shown to be within tenable conditions. Higher velocity and recirculation effects are found in the existing site.

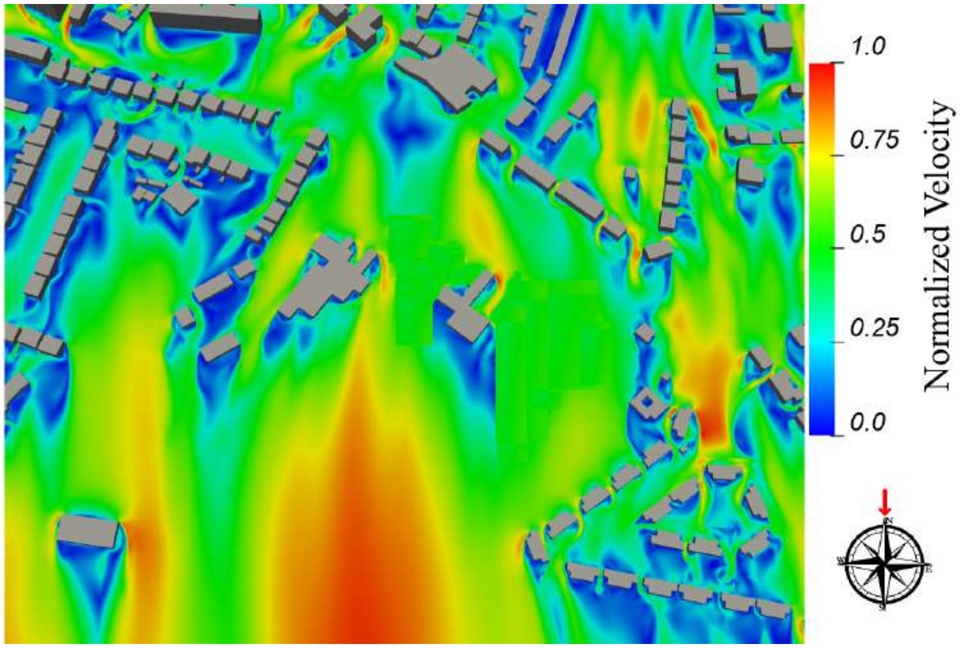


Figure 12.22: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: North

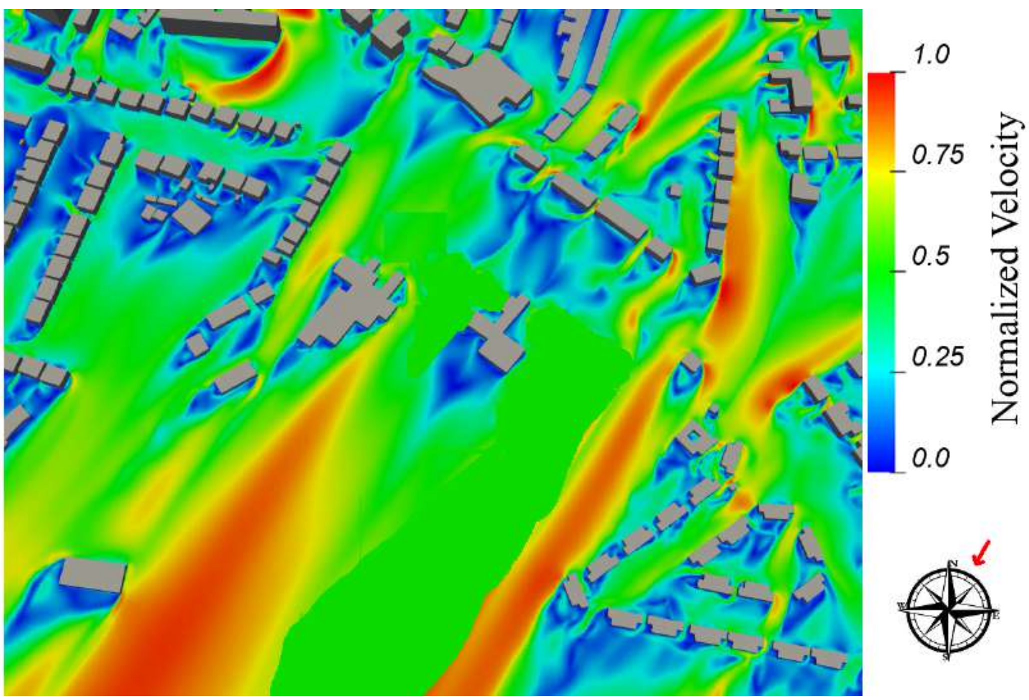


Figure 12.23: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: North-North-East

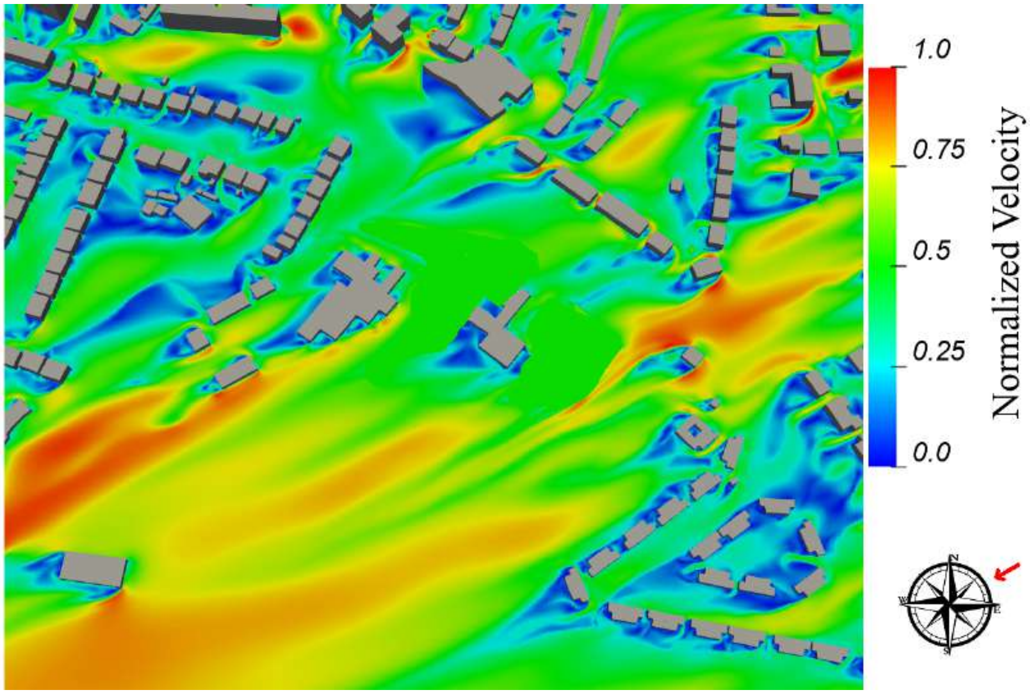


Figure 12.24: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: East North-East

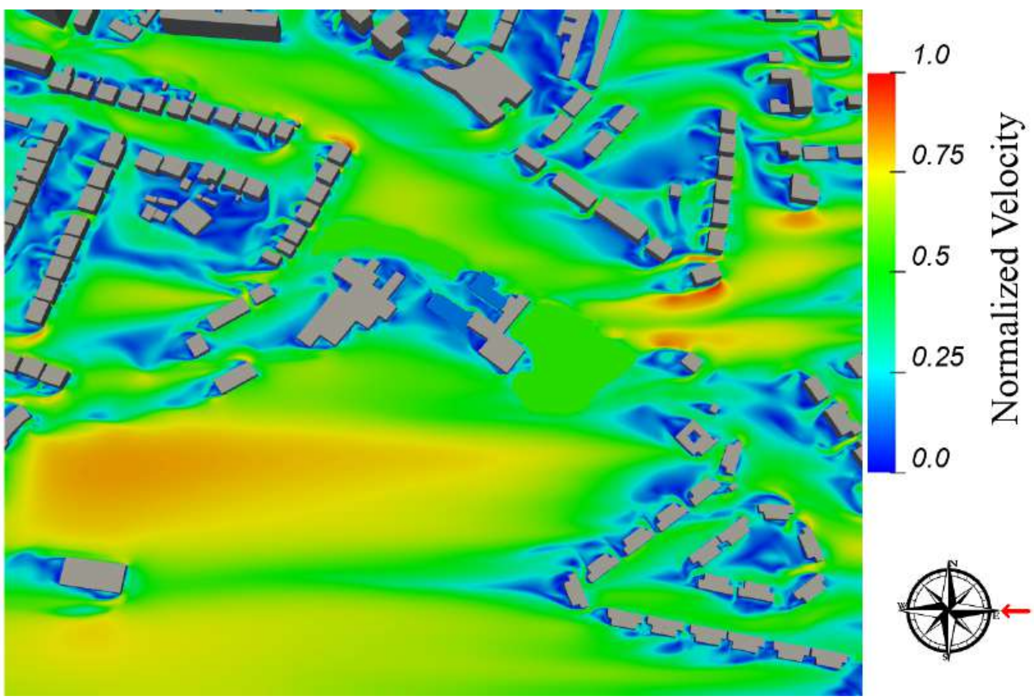


Figure 12.25: Flow Velocity Results at Z=1.8m above the ground Wind Direction: East

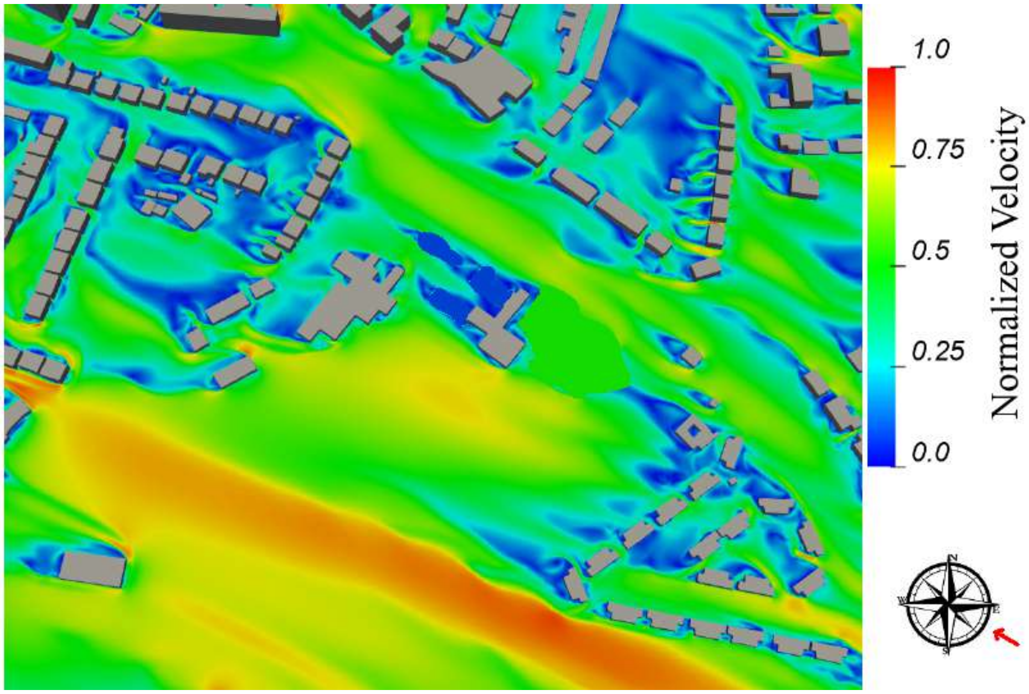


Figure 12.26: Flow Velocity Results at Z=1.8m above the ground Wind Direction: East-South-East

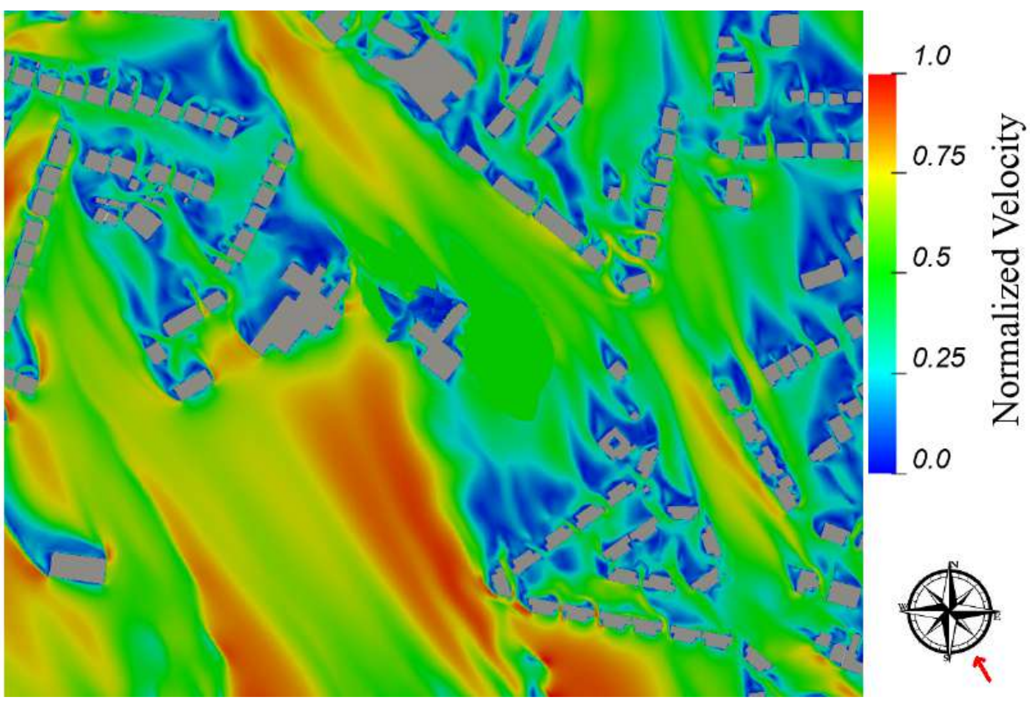


Figure 12.27: Flow Velocity Results at Z=1.8m above the ground wind Direction: South South-East

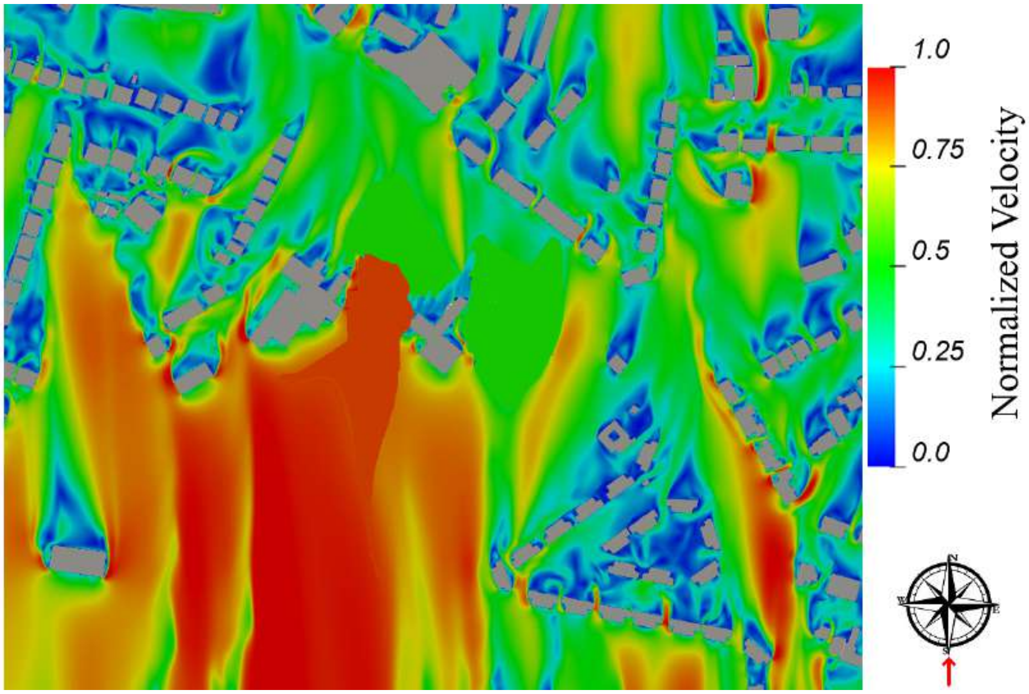


Figure 12.28: Flow Velocity Results at Z=1.8m above the ground Wind Direction: South

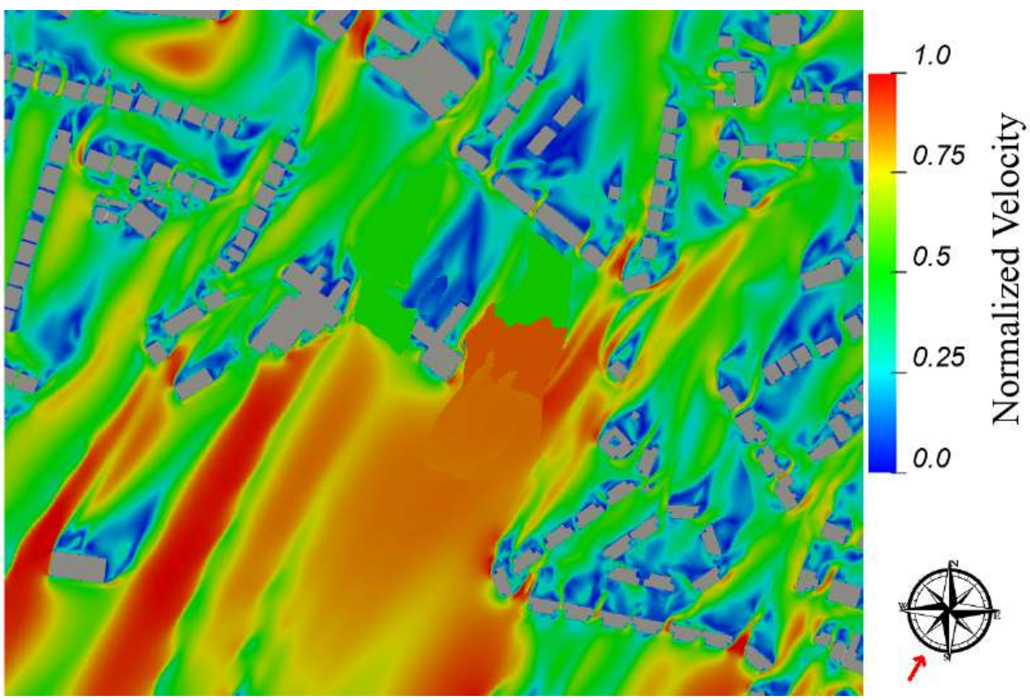


Figure 12.29: Flow Velocity Results at Z=1.8m above the ground Wind Direction: South-South-West

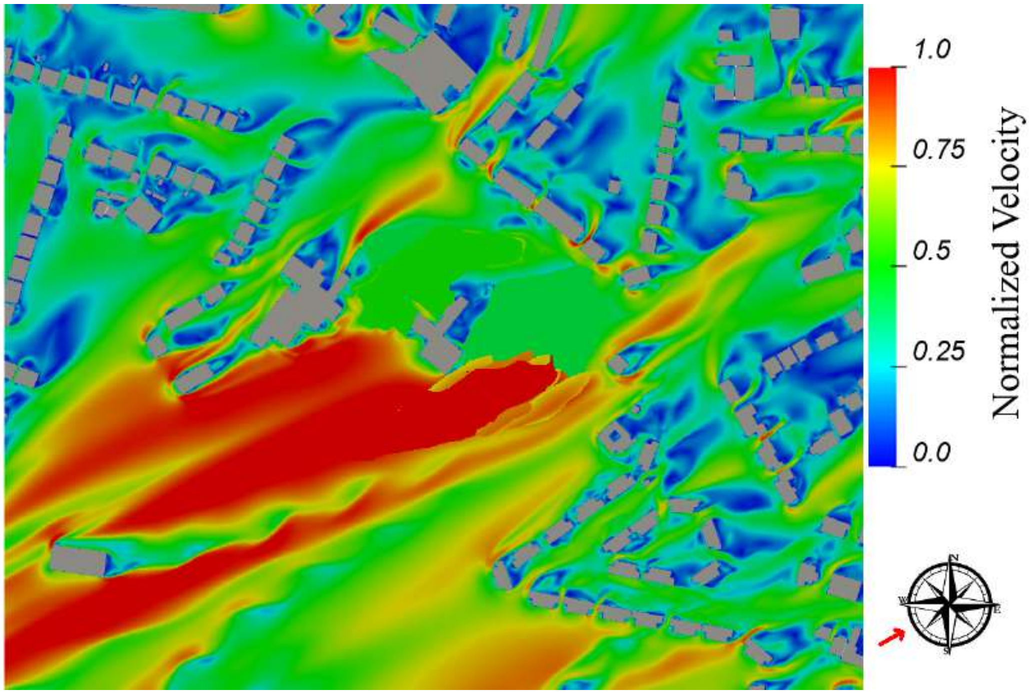


Figure 12.30: Flow Velocity Results at Z=1.8m above the ground Wind Direction: West South-West

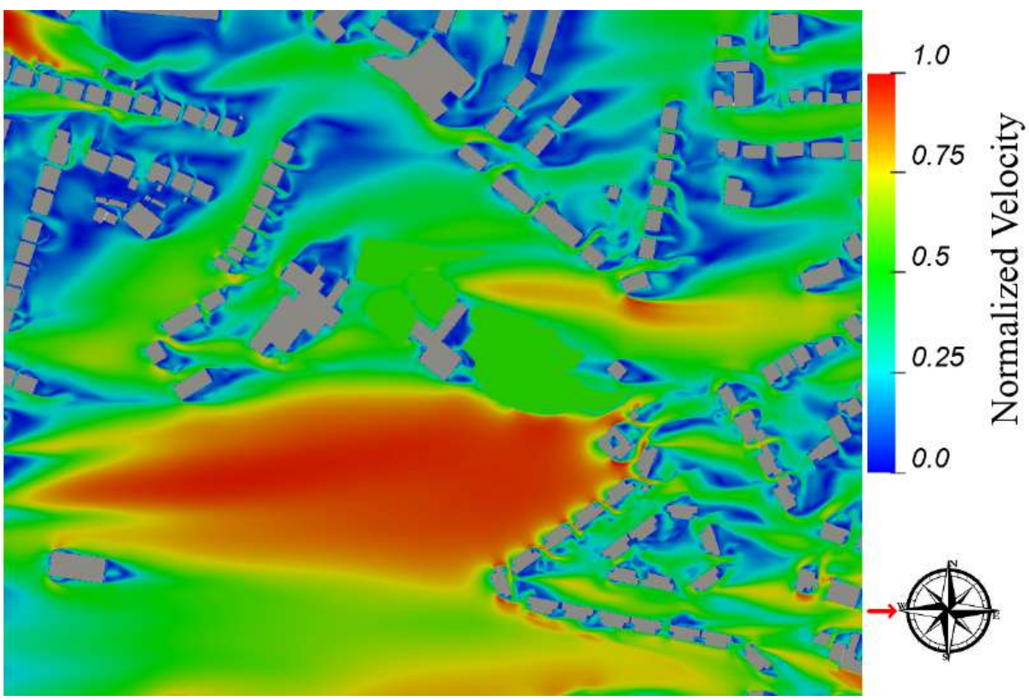


Figure 12.31: Flow Velocity Results at Z=1.8m above the ground Wind Direction: West

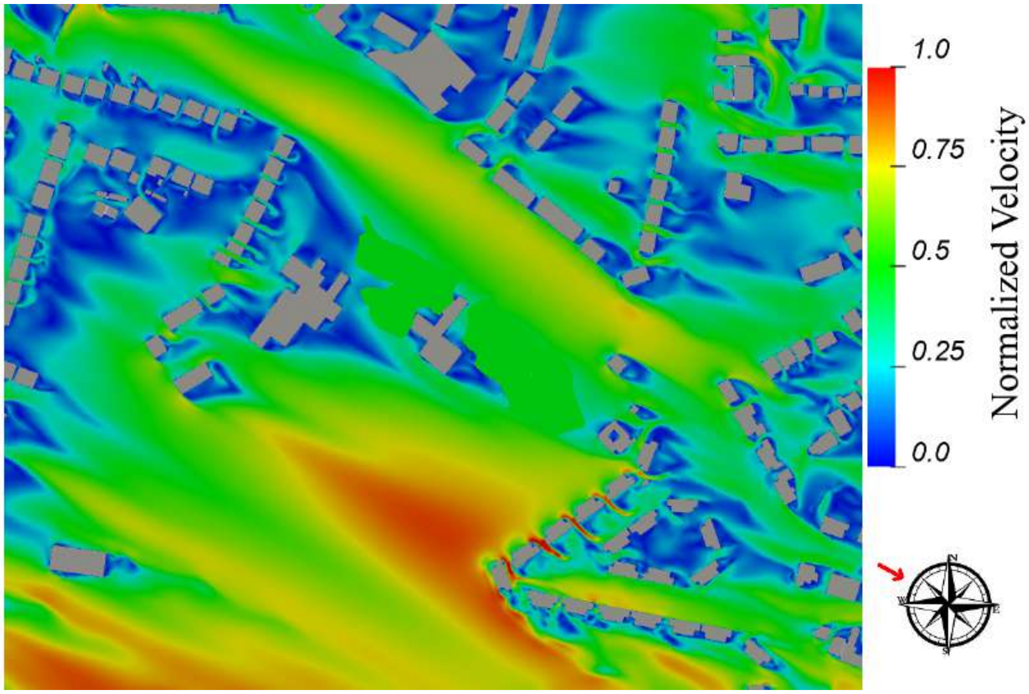


Figure 12.32: Flow Velocity Results at Z=1.5m above the ground Wind Direction: West-North-West

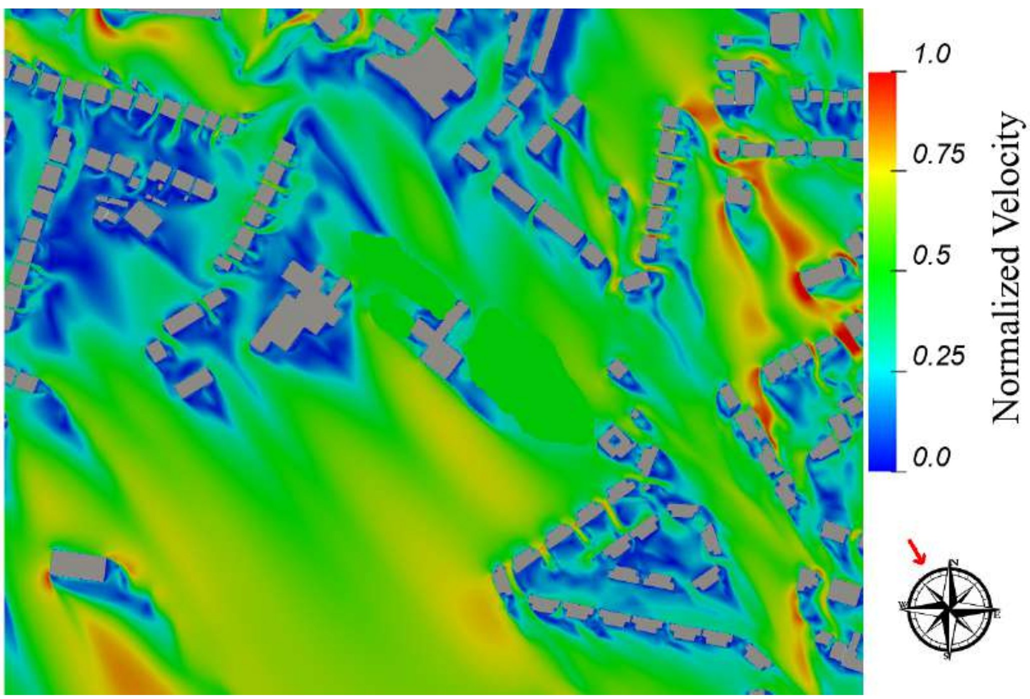


Figure 12.33: Flow Velocity Results at Z=1.5m above the ground Wind Direction: North North-West

12.6.5 Impact of Pedestrian Comfort and Distress

The wind flow results obtained simulating the different direction and wind speeds, are combined with wind frequencies of occurrence to obtain comfort ratings at pedestrian level in all areas included within the model. The comparison of comfort ratings with intended pedestrian activities is shown in the Lawson Comfort and Distress Map that follows. The comfort/distress conditions are presented in Figures 12.34 using a colour coded diagram formulated in accordance with the Lawson Criteria.

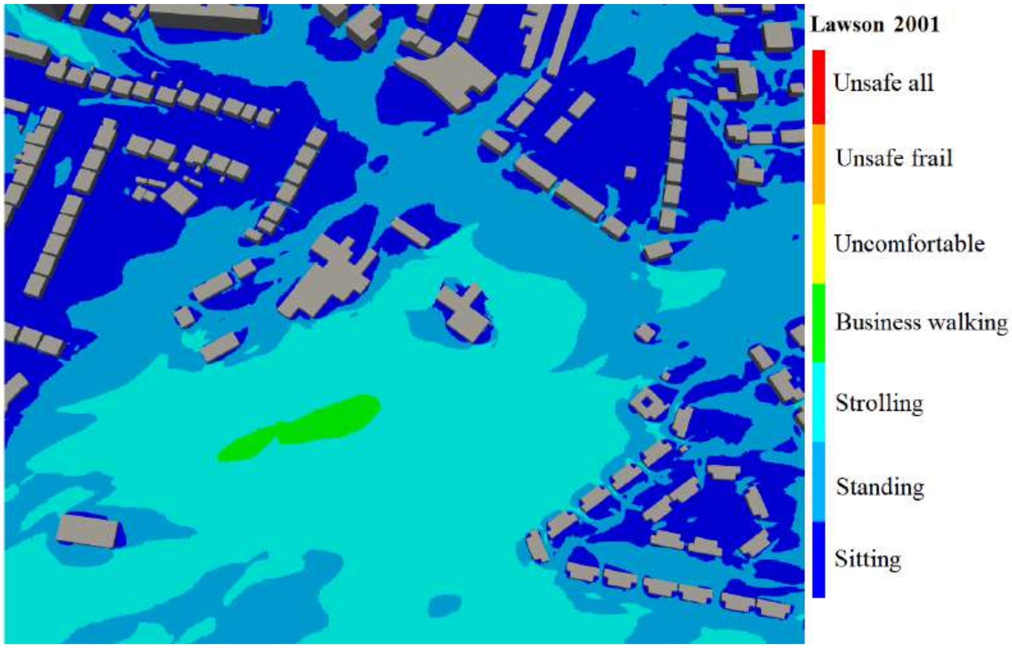


Figure 12.34: Existing Environment- Comfort and Distress Lawson Wind Map.

From the simulation results the following observations are pointed out:

- The assessment of the baseline scenario has shown that no area is unsafe and no conditions of distress are created in the existing environment under the local wind climate.

- The site is usable for sitting/standing/strolling, the roads in the surrounding are usable for their intended scope.

The subject site benefits of a valid planning permission for 291 no. residential units granted under SHD ABP-303804-19.

12.7 Characteristics of the Proposed Development

Oval Target Limited intends to apply for permission for development of a Large-Scale Residential Development comprising amendments to previously permitted development (Strategic Housing Development ABP-303804-19) on a site of approx. 4.56 ha at 'St. Teresa's House' (A Protected Structure); 'St. Teresa's Lodge' (A Protected Structure); and associated entrance gates (A Protected Structure) at Temple Hill and Temple Road, Monkstown, Blackrock, Co. Dublin.

The proposed development will consist of amendments to a development previously permitted under Strategic Housing Development ABP-303804-19 (291 no. residential units, a crèche facility and heights of 1-8 storeys) to provide for a new residential and mixed use development (1 – 8 storeys overall) of 414 no. residential apartment units in total (a proposed uplift of 123 no. residential units) with associated crèche facility, a new café and residential amenity space. The revised overall residential mix is 8 no. studio units, 164 no. 1 bed units, 159 no. 2 bed units, and 83 no. 3 bed units.

The proposed development will consist of:

1. Amendments to previously permitted Blocks C1, C2, C3, D1, E1, E2, E3, E4 and E5 as follows:

- A revised building design for Block C1 from previously permitted building (3 storeys overall) consisting of 7 no. apartment units (6 no. 2 bed units and 1 no. 3 bed unit) to now comprise **10 no. apartment units** (4 no. 1 bed units and 6 no. 2 bed units) – an uplift of 3 no. residential units in total. Amendments will include minor revisions to overall height of the building (remains 3 storeys overall) and revisions to elevations and building footprint.
- A revised building design for Block C2 from previously permitted building (3 storeys overall) consisting of a crèche facility (approx. 286 sq m) at level 00 and 4 no. apartment units at level 01 and 02 (3 no. 2 bed units and 1 no. 3 bed unit) to now comprise a crèche facility of approx. 401 sq m at level 00, associated outdoor play area space of 302 sq m and **6 no. apartment units** (2 no. 1 bed units and 4 no. 2 bed units) at levels 01 and 02 – an uplift of 2 no. residential units in total and increased crèche floor area size by approx. 115 sq m. Amendments will include minor revisions to overall height of the building (remains 3 storeys overall) and revisions to elevations and building footprint.
- A New Block C3 (1 storey over basement level) comprising residential amenity space of approx. 451 sq m.
- The omission of previously permitted Block D1 (5 storeys overall) and basement level comprising 50 no. apartment units (15 no.1 bed units, 23 no. 2 bed units and 12 no. 3 bed units) to now deliver new Block D1 (4 - 7 storeys over new basement level) comprising **125 no. apartment units** (19 no. 1 bed units, 68 no. 2 bed units and 38 no. 3 bed units) – an uplift of 75 no. residential units in total.
- The omission of previously permitted Block E1 (5 storeys overall) comprising 14 no. apartment units (9 no. 2 bed units, 4 no. 3 bed units and 1 no. 3 bed duplex unit) to now deliver new Block E1 (4 - 7 storeys) comprising **61 no. apartment units** (7 no. studio units, 6 no. 1 bed units, 26 no. 2 bed units and 22 no. 3 bed units) – an uplift of 47 no. residential units in total.
- The omission of previously permitted Block E2 (5 storeys overall) comprising 15 no. apartment units (9 no. 2 bed units, 4 no. 3 bed units and 2 no. 3 bed duplex units) to now deliver new Block E2 (6 storeys) comprising **50 no. apartment units** (1 no. studio unit, 25 no. 1 bed units, 20 no. 2 bed units and 4 no. 3 bed units) – an uplift of 35 no. apartment units in total.
- The omission of permitted Blocks E3 (5 storeys), E4 (4 storeys) and E5 (5 storeys) previously providing for 38 no. units in total (27 no. 2 beds, 8 no. 3 beds and 3 no. 3 bed duplex units).
- Each residential unit has associated private open space in the form of a terrace / balcony.

The above new proposals extend to a total of **252 residential units**. Blocks A1, B1, B2, B3, B4, Block H (St. Teresa's House) remain as originally permitted with no further amendments as part of this proposal (162 no. units in total and permitted heights of 3-8 storeys).

2. The structures for demolition across the site remain as permitted with no further amendments proposed. This includes any structures previously permitted for demolition that still remain on site and the removal of associated remnants of low / retaining walls and in-ground concrete steps.
3. An amended proposal for Block G (St. Teresa's Lodge) (1 storey) including a change of use from previously permitted 1 no. 1 bed unit to a new café of approx. 67.4 sq m. This proposal will again seek permission for the dismantling/deconstruction of the existing St. Teresa's Lodge (Gate Lodge) (approx. 38.56 sq m) and the demolition of a lean to extension (approx. 28.5 sq m) as previously permitted under Strategic Housing Development ABP-303804-19. The current amendment proposal seeks permission to relocate and reconstruct St. Teresa's Lodge in a new location (180 m southwest of its original position and located adjacent to Rockfield Park) using original roof timbers, decorative elements and rubble stonework, with original brickwork cleaned and re-used where appropriate. The non - original extension (approx. 28.5 sq m) will be again removed as previously permitted. The current proposal seeks further extension of this

building (approx. 28.88 sq m) and a change of use from residential (1 no. unit) to café use to deliver a Part M compliant single storey building of approx. 67.4 sq m.

4. A revised landscape plan now provides for:
    - Public open space in the form of a central parkland, garden link, woodland park (incorporating an existing folly) and a tree belt (approx. 11,238 sqm overall).
    - Communal open space is now proposed in the form of entrance gardens, plazas, terraced gardens and roof terraces (approx. 3,620 sqm overall).
    - Provision is also now made for 2 no. new pedestrian connections to Rockfield Park on the southern site boundary (1 no. adjacent to the proposed relocated Gate Lodge and 1 no. at the hammerhead adjacent to Block E2) and all other pedestrian connections remain as permitted under SHD ABP-303804-19.
5. A revised total of 244 no. car parking spaces (a decrease of 28 no. spaces) and 962 no. bicycle spaces (an uplift of 296 no. spaces) are proposed. The no. of motorcycle spaces remains as permitted at 20 no. spaces.
6. The development also provides for revised proposals for Bin Storage areas, Bike Storage areas, life safety generator room, ESB substations and switch rooms with a combined floor area of approx. 609 sq m all at surface level.
7. Access to the development generally remains as permitted under Strategic Housing Development ABP-303804-19, which provides for works to the existing entrance to the overall site via Temple Hill and Temple Road to deliver the realignment and upgrade of the existing signalised junction and associated footpaths, with minor modifications to the junction layout to provide for improved and safer vehicular access/egress to the site and to/from St. Vincent's Park. Emergency vehicular access and pedestrian/cycle access also remains as permitted via a secondary and long-established existing access point along Temple Hill. There are no works proposed to the existing gates (Protected Structure) at this location. There are minor modifications proposed to the northeastern boundary walls and access gateway to 'Carmond' to facilitate alignment improvements for safe access/egress serving St. Vincent's Park.
8. The associated site and infrastructural works include provision for water services; foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works; green roofs; PV panels; boundary treatment; internal roads and footpaths.

This planning application is accompanied by a Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR).

This Wind Microclimate Study identifies the possible wind patterns that form when wind moves through a built environment and evaluates how the proposed development is going to modify those patterns. Wind Microclimate is defined as the wind flow experienced by people and the subsequent influence it has on their activities. Wind can accelerate or re-circulate through buildings in such a way to compromise the comfort / safety of pedestrians, and the capacity of using the public realm / external places in accordance with their designated intended use development within the existing urban context.

The proposal includes all associated site works, under, on or over ground to facilitate the development. Figure 12.35 shows a view of the proposed development (in red) and existing surround buildings (in white).

Figure 12.35: Proposed Development.

12.7.1 Potential Receptors

Potential receptors for the wind assessment are all pedestrian or cycle circulation routes, building entrances and leisure open areas within the site and in neighboring adjacent areas. The pedestrian level is considered at 1.8m above ground.

Figure 12.36 shows the pedestrian and cycle activity area on the ground around the development. These areas are considered as sensitive potential receptors for the wind microclimate.

Figure 12.36: Potential Sensitive Receptors on the Ground-Pedestrian Activities Area.

Off-Site Potential Receptors ID	Description
A.	Sr. Louise's Park
B.	Junction of Temple Road and N31
C.	Junction of Craigmore Gardens and N31
D.	N31
E.	Junction of Temple Park Ave. and N31
F.	St. Vincent's Park
G.	Rockfield Park

Tables 12.5-12.6- lists the descriptions of potential receptors as shown in Figure12.36.

Table 12.5 List of Off-Site Receptors.

On-Site Potential Receptors ID	Description
1.	Adjacent to E1 and E2
2.	Between E1 and D1
3.	Forecourt of D1
4.	Between D1 and C2
5.	Between C2 and H
6.	Between C1 and H
7.	Between Alzheimer Society of Ireland building and C1
8.	In front of A1
9.	Between A1 and B1
10.	Between B1 and B2
11.	Between B2 and B3
12.	Between B3 and B4

Table 12.6 List of On-Site Receptors.

12.8 Potential Impact of the Proposed Development

This section assessed the potential impact of the proposed development on the already existing environment, and the suitability of the proposed development to create and maintain a suitable and comfortable environment for different pedestrian activities.

12.8.1 Construction Phase

As the finalization of the development proceeds, the wind setting at the site would progressively conform to those of the completed development. Due to the fact that windier conditions are acceptable within a construction area (not accessible to the public), and the proposed development would not be the reason for critical wind conditions on-Site (and are slightly calmer when the development is in site), the impacts evaluated on-Site are considered to be insignificant. Thus, the predicted impacts during construction phase are identified as not significant or negligible.

In summary, as construction of the St. Teresa's Development progresses, the wind conditions at the site would gradually adjust to those of the completed development. During the construction phase, predicted impacts are classified as negligible.

12.8.2 Operational Phase

This section shows CFD results of wind microclimate assessment carried out considering the "Operational Phase" of St. Teresa's Development. In this case the assessment has considered the impact of wind on the existing area including the proposed St. Teresa's Development. Wind simulations have been carried out on all the various directions for which the development could show critical areas in terms of pedestrian comfort and safety.

Results of wind microclimate at pedestrian level (1.8m height - flow speeds) are collected throughout the modelled site (potential receptors). These flow velocities identify if locally, wind speeds at pedestrian-level are accelerated or decelerated in relation to the undisturbed reference wind speed due to the presence of the existing baseline environment.

The impact of these speeds are then combined with their specific frequency of occurrence and presented in the maps that show the area of comfort and distress in accordance with Lawson Criteria, these maps are produced at pedestrian level on the ground or on the courtyards, and identify the suitability of each areas to its prescribed level of usage and activity.

12.8.3 Proposed Wind Microclimate

Results of proposed wind speeds and their circulations at pedestrian level of 1.5m above the potential receptors are presented in Figures 12.37 to 12.48 in order to assess wind flows at the ground floor level of Proposed Development.

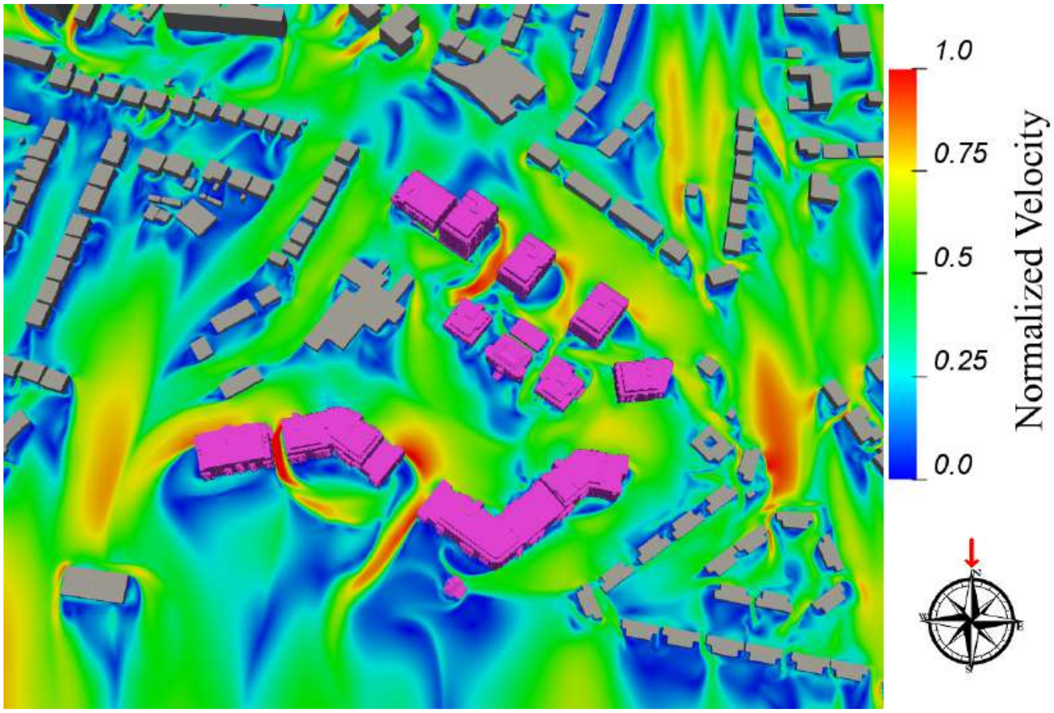


Figure 12.37: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: North

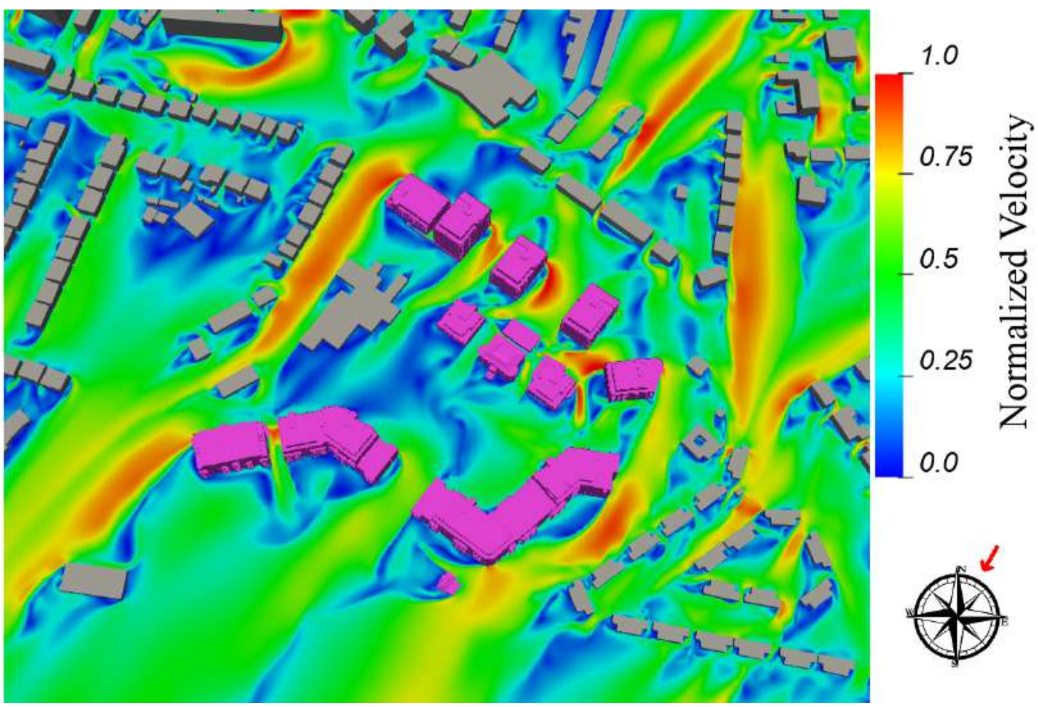


Figure 12.38: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: North-North-East

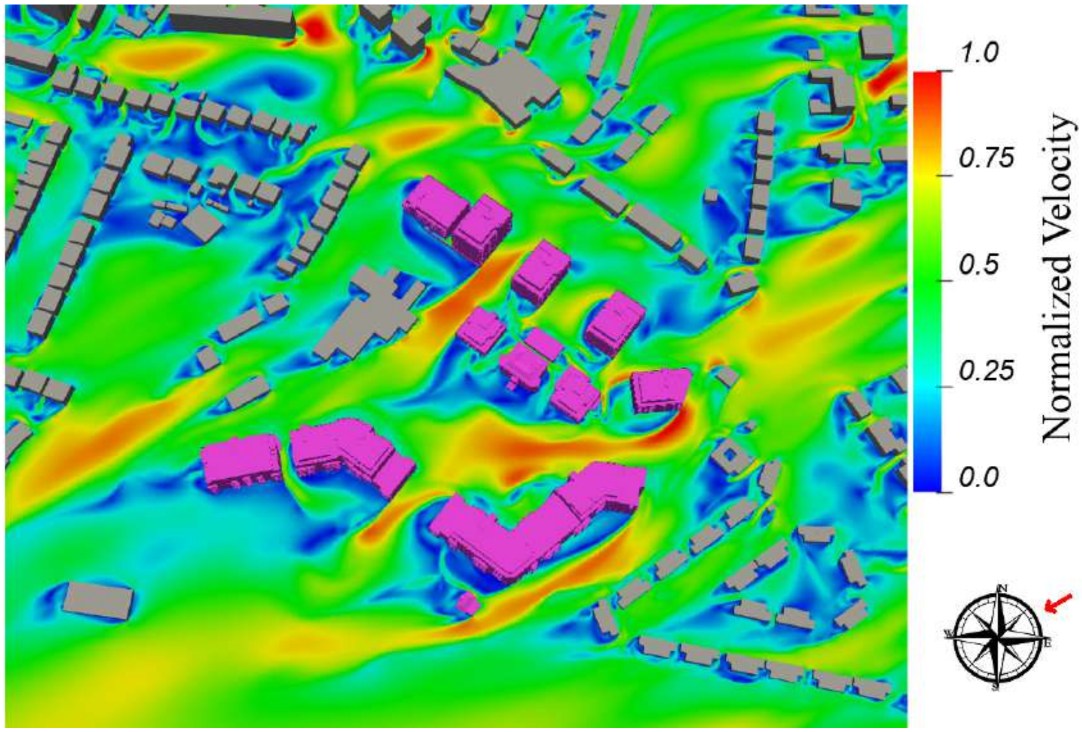


Figure 12.39: Flow Velocity Results at Z=1.8m above the ground - Wind Direction: North-East-East

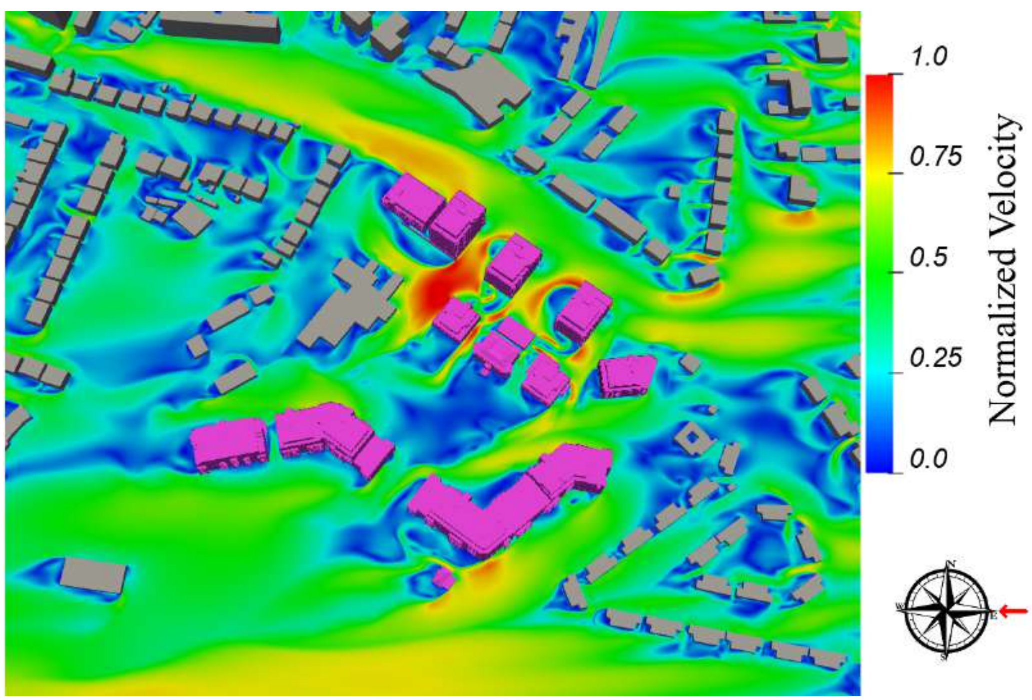


Figure 12.40: Flow Velocity Results at Z=1.8m above the ground Wind Direction: East

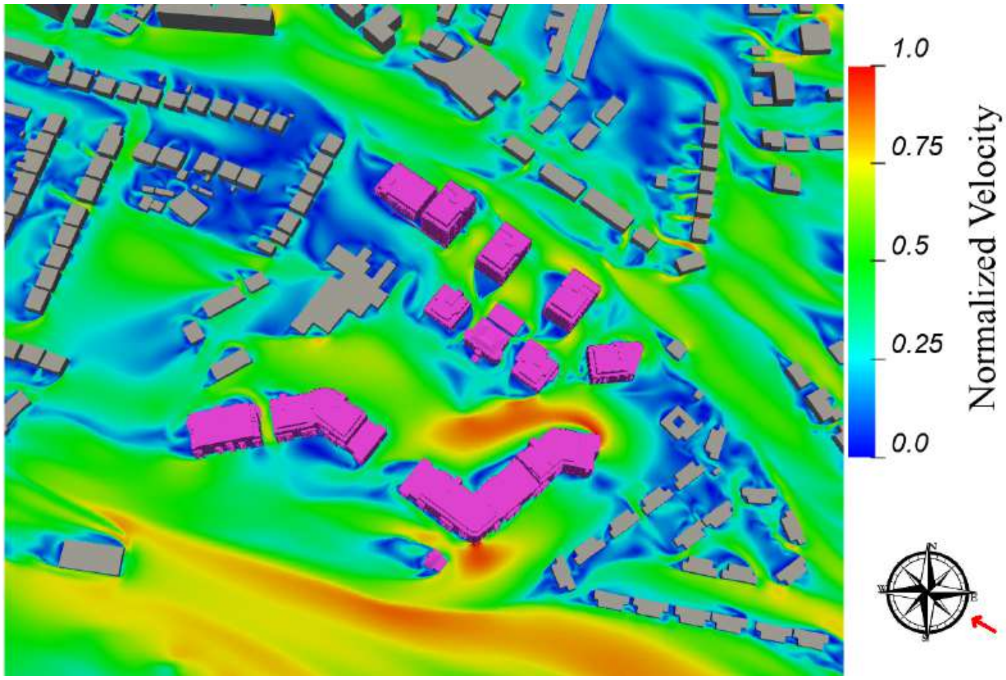


Figure 12.41: Flow Velocity Results at Z=1.8m above the ground Wind Direction: East-East-South

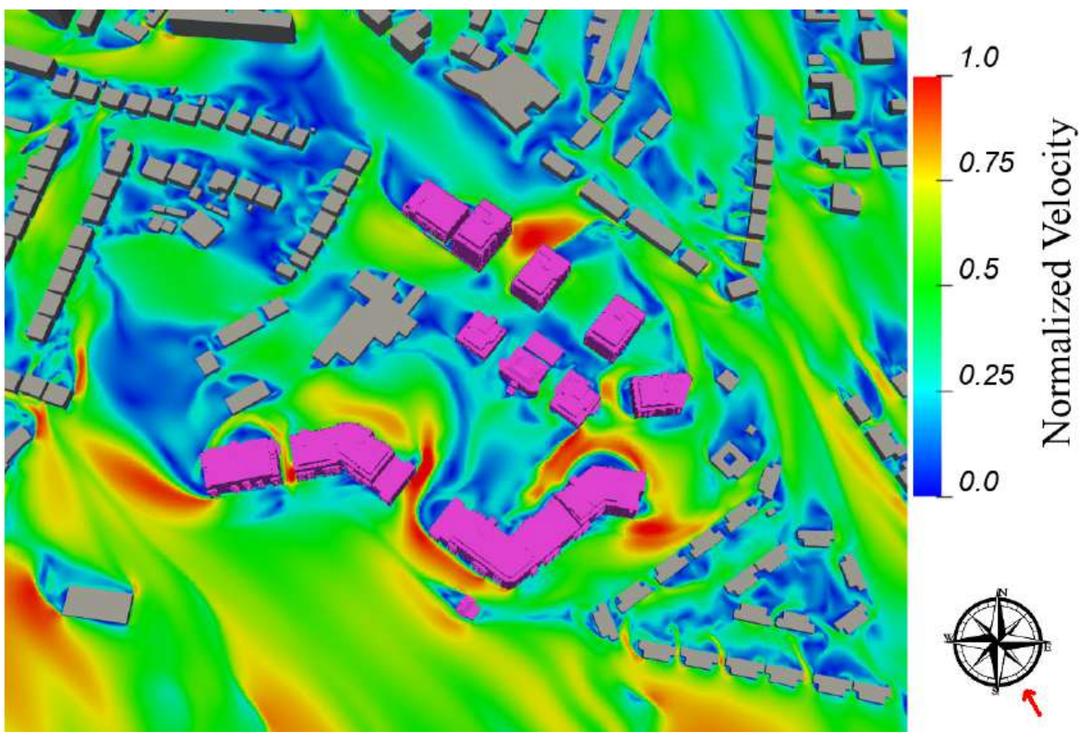


Figure 12.42: Flow Velocity Results at Z=1.8m above the ground wind Direction: South--East

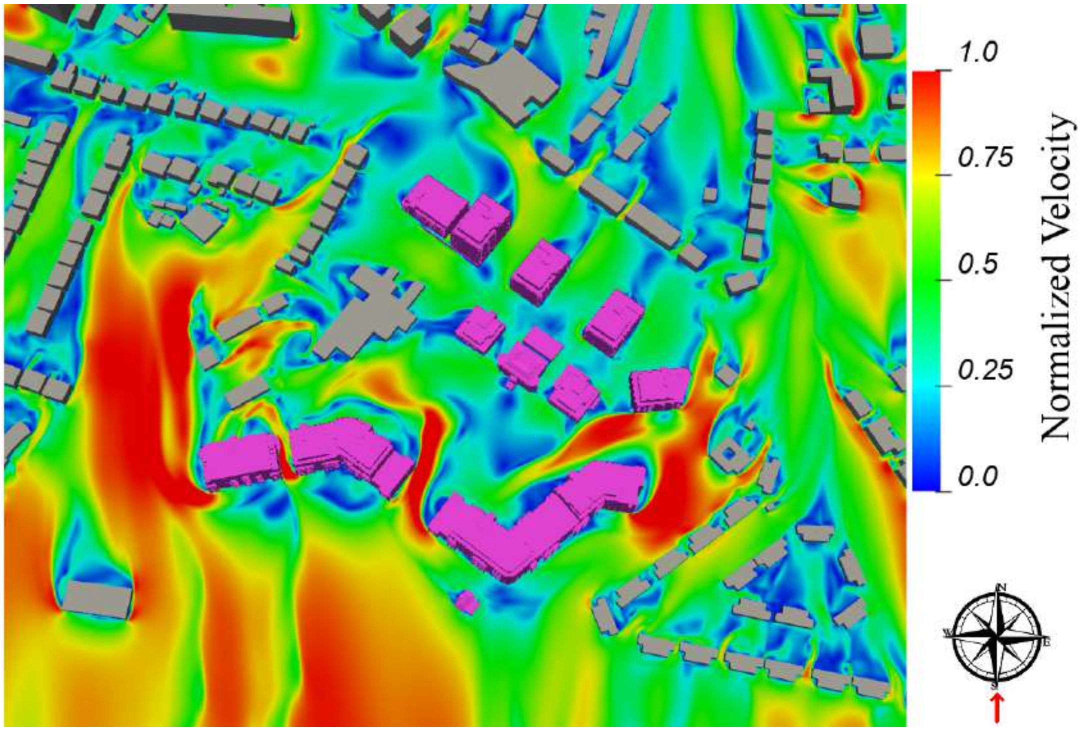


Figure 12.43: Flow Velocity Results at Z=1.8m above the ground Wind Direction: South

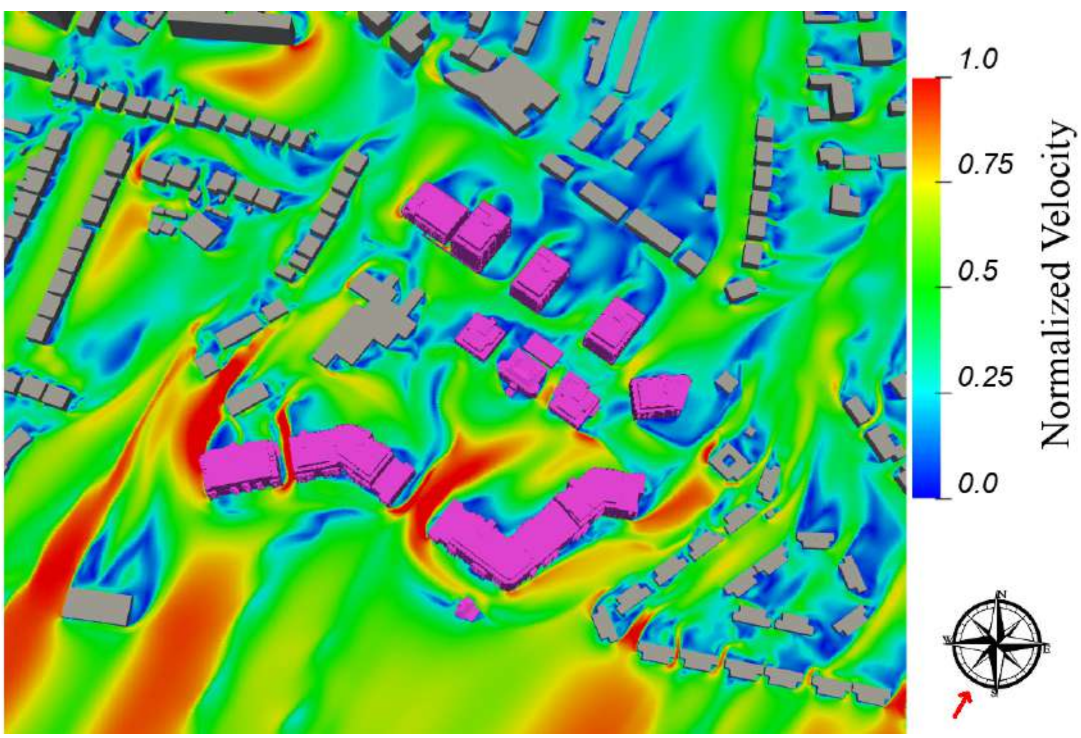


Figure 12.44: Flow Velocity Results at Z=1.8m above the ground Wind Direction: South-South-West

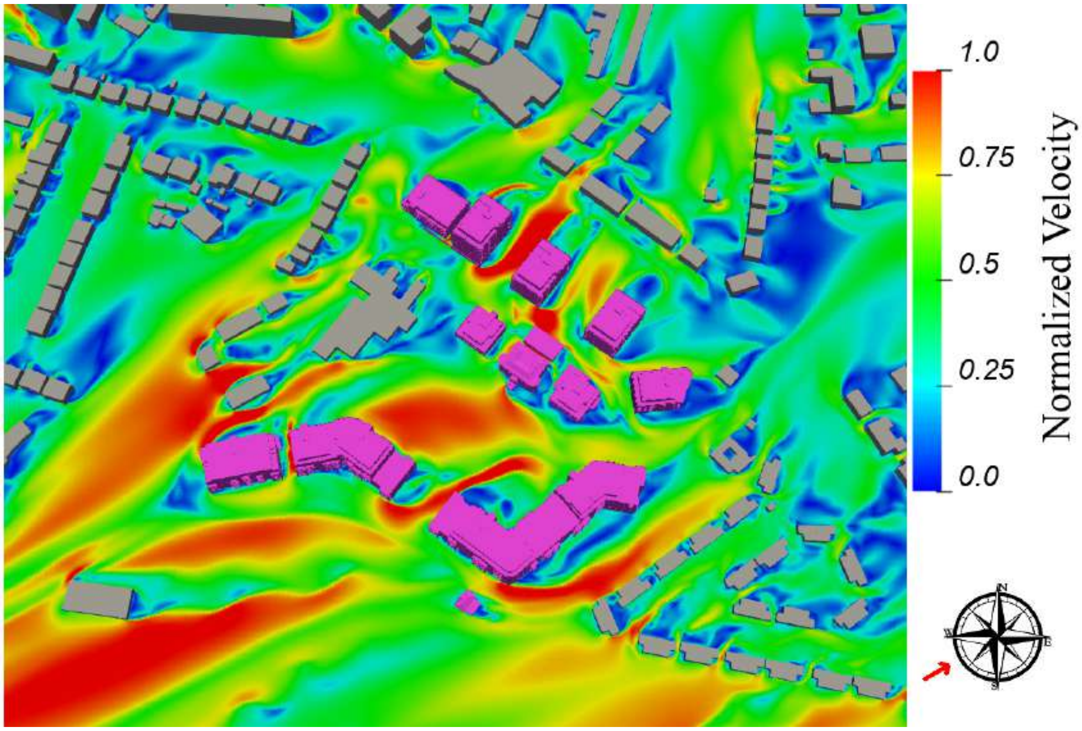


Figure 12.45: Flow Velocity Results at Z=1.8m above the ground Wind Direction: South-West

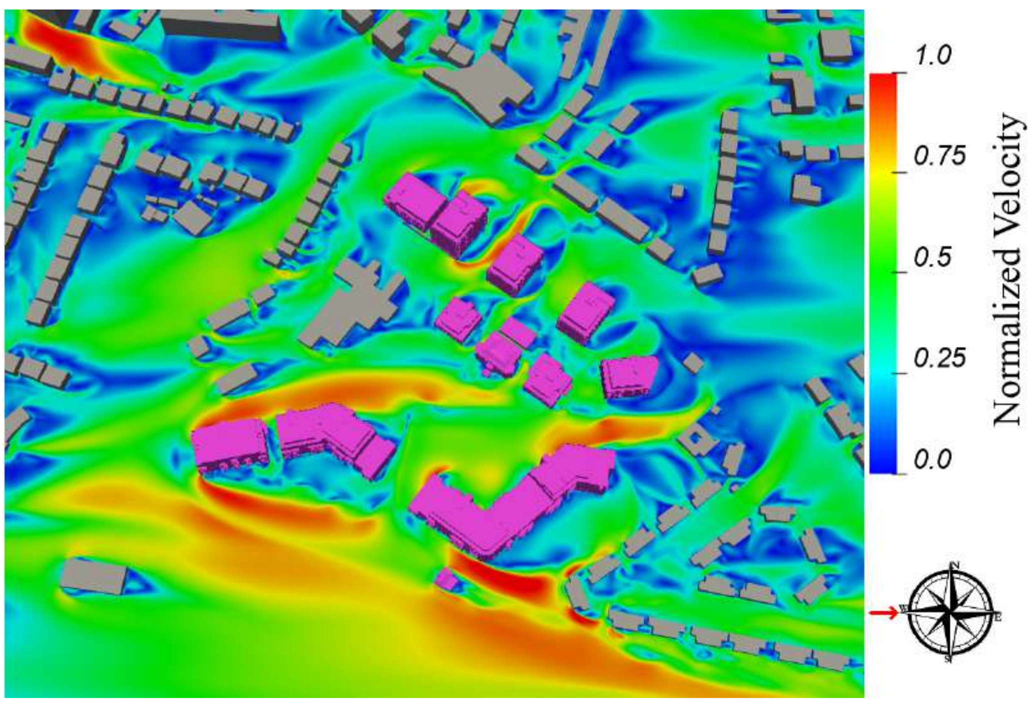


Figure 12.46: Flow Velocity Results at Z=1.8m above the ground Wind Direction: West

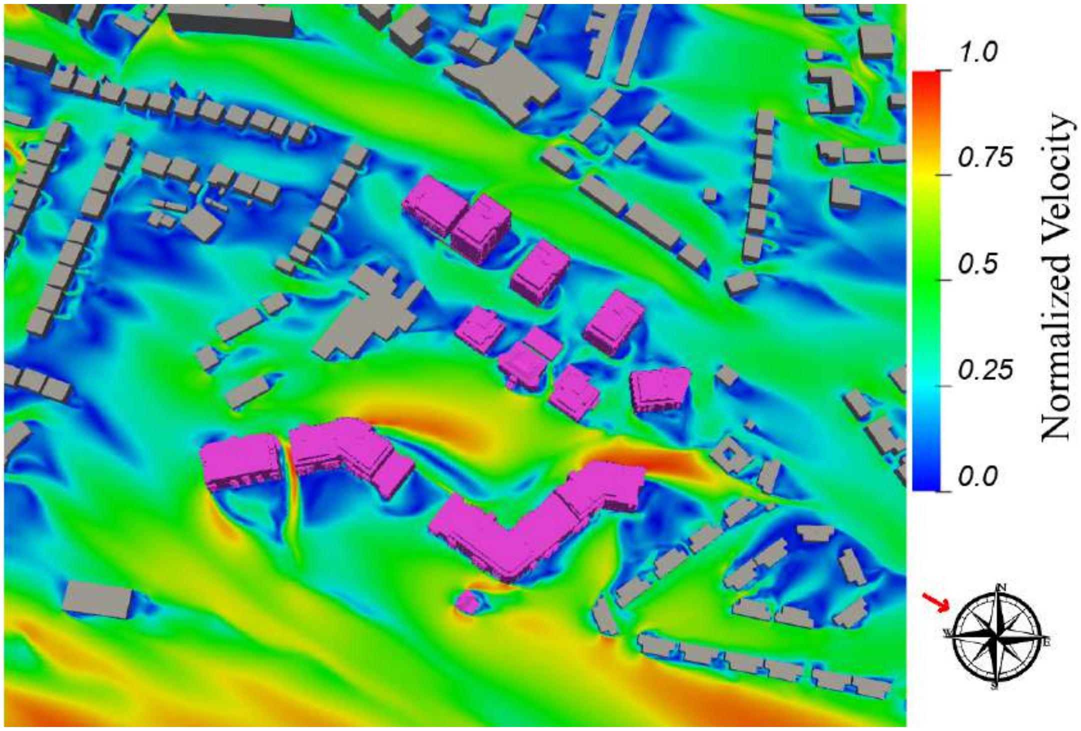


Figure 12.47: Flow Velocity Results at Z=1.8m above the ground Wind Direction: West-North-West

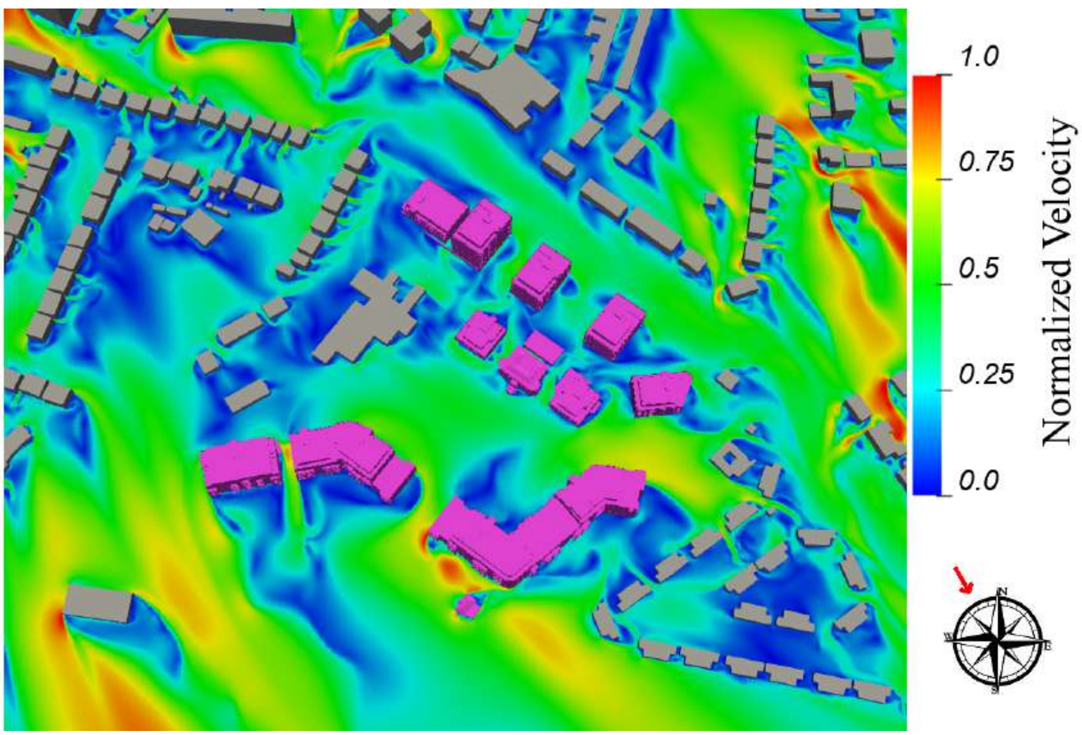


Figure 12.48: Flow Velocity Results at Z=1.8m above the ground Wind Direction: North-West

12.8.4 Impact of Pedestrian Comfort and Distress

The wind flow results obtained simulating the different direction and wind speeds, are combined with wind frequencies of occurrence to obtain comfort ratings at pedestrian level in all areas included within the model. The comparison of comfort ratings with intended pedestrian activities is shown in the Lawson Comfort and Distress Map that follows. The comfort/distress conditions are presented in Figure 12.49 using a colour coded diagram formulated in accordance with the Lawson Criteria.

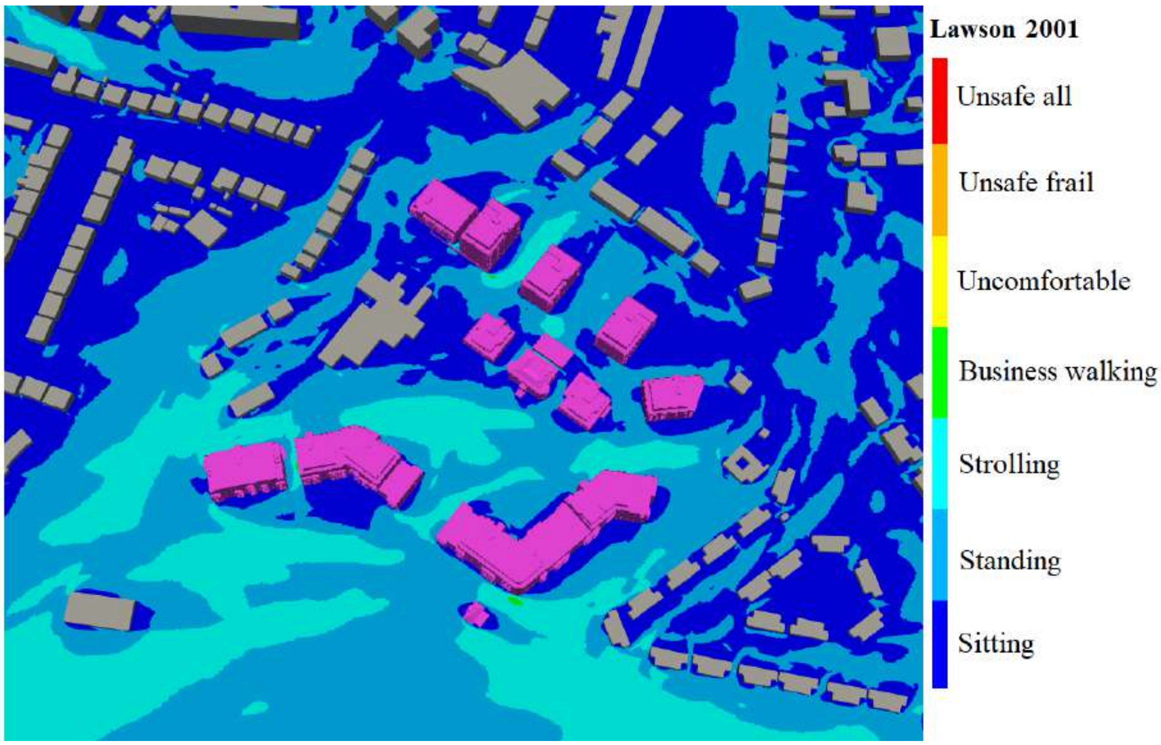


Figure 12.49: Ground Floor - Lawson Discomfort Map - 3D View.

In summary, the following conclusions can be made observing the results of the wind microclimate analysis and comparing the results obtained, under the same wind conditions for the baseline scenario versus the proposed development scenario:

- The assessment of the proposed scenario has shown that no area is unsafe, and no conditions of distress are created by the proposed development.
- All the roads proposed can be used for their intended scope.
- The wind microclimate of the proposed development is comfortable and usable for pedestrians.

As a result of the proposed development construction, the wind on the surrounding urban context maintains the suitability of the surrounding urban environment for its intended purpose.

Tables 12.7 - 12.8 presents the pedestrian comfort levels for various off-site and on-site and locations, respectively. As shown in the table, none of the areas are deemed unsafe, and all on-site receptors around the development are suitable for at least standing comfort level.

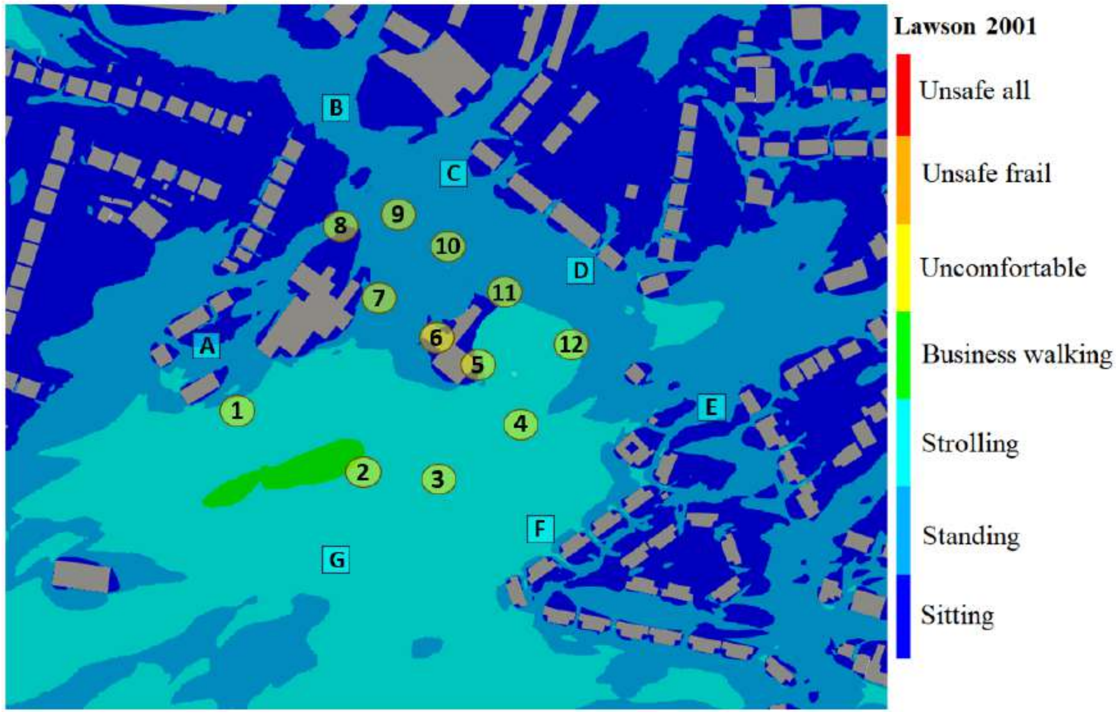
Reference point	Description	Sitting	Standing	Strolling	Business walking		Distress and Safety
A.	Sr. Louise's Park	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
B.	Junction of Temple Road and N31	Acceptable	Acceptable	Acceptable	Acceptable		Safe.
C.	Junction of Craigmore Gardens and N31	Acceptable	Acceptable	Acceptable	Acceptable		Safe.
D.	N31	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
E.	Junction of Temple Park Ave. and N31	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
F.	St. Vincent's Park	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
G.	Rockfield Park	Tolerable	Acceptable	Acceptable	Acceptable		Safe.

Table 12.7: Pedestrian Comfort Levels versus Proposed Pedestrian Activities – Off-Site Receptors.

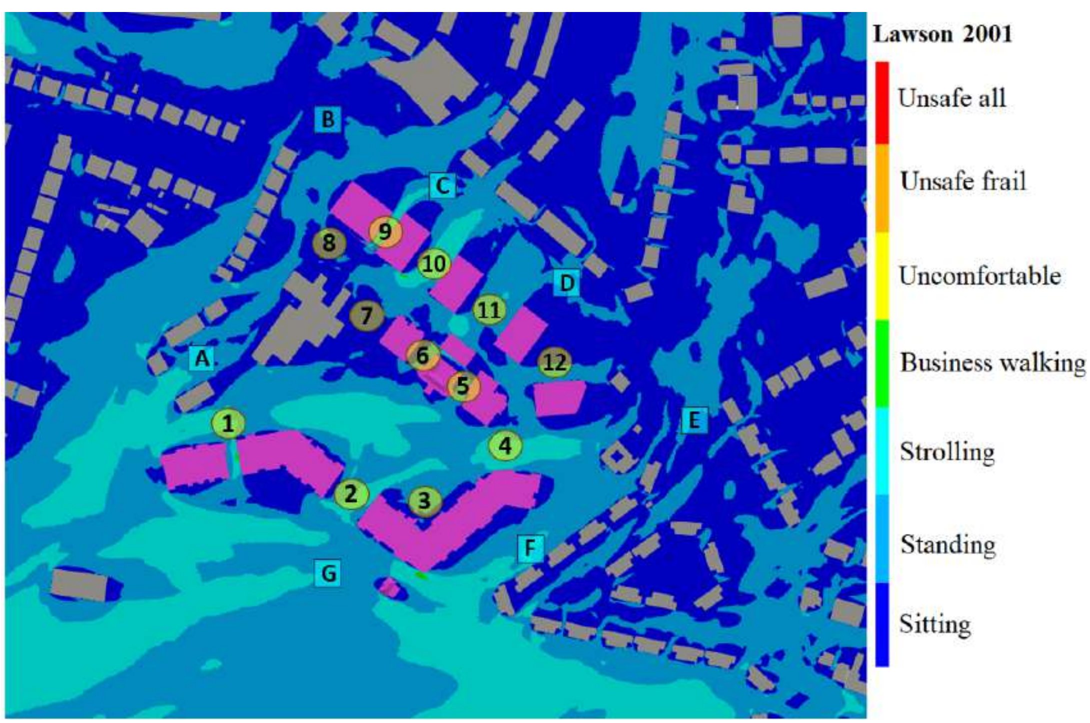
Reference point	Description	Sitting	Standing	Strolling	Business walking		Distress and Safety
1.	Adjacent to E1 and E2	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
2.	Between E1 and D1	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
3.	Forecourt of D1	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
4.	Between D1 and C2	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
5.	Between C2 and H	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
6.	Between C1 and H	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
7.	Between Alzheimer Society of Ireland building and C1	Acceptable	Acceptable	Acceptable	Acceptable		Safe.
8.	In front of A1	Acceptable	Acceptable	Acceptable	Acceptable		Safe.
9.	Between A1 and B1	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
10.	Between B1 and B2	Tolerable	Tolerable	Acceptable	Acceptable		Safe.
11.	Between B2 and B3	Tolerable	Acceptable	Acceptable	Acceptable		Safe.
12.	Between B3 and B4	Tolerable	Acceptable	Acceptable	Acceptable		Safe.

Table 12.8: Pedestrian Comfort Levels versus Proposed Pedestrian Activities – On-Site Receptors.

A comparison of Lawson Discomfort Maps for the baseline scenario and the proposed scenario is presented in Figure 12.50.



Baseline Scenario



Proposed Scenario

Figure 12.50: Comparison Wind Microclimate Conditions (Lawson Comfort/Distress Map).

12.2Tables 12.9 and 12.10 show the intended baseline and proposed wind conditions off-site as well as potential on-site receptors, respectively, around the development. These tables show that there are no distress areas for pedestrians including frail users and cyclists. Furthermore, the site and surrounding urban areas are safe for all users.

Off-Site Potential Receptors	Baseline Conditions	Proposed Development Conditions	Impact Significance
A. Sr. Louise's Park	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
B. Junction of Temple Road and N31	Suitable for Standing/Strolling.	Suitable for Sitting/Standing/Strolling. (Safe/No distress)	Negligible
C. Junction of Craigmore Gardens and N31	Suitable for Standing/Strolling.	Sitting/Standing/Strolling. (Safe/No distress)	Negligible
D. N31	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
E. Junction of Temple Park Ave. and N31	Suitable for Sitting/Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
F. St. Vincent's Park	Suitable for Strolling.	Suitable for Strolling. (Safe/No distress)	Moderate Adverse
G. Rockfield Park	Suitable for Strolling	Suitable for Standing/Strolling. (Safe/No distress)	Negligible

Table 12.9: Significance Impact of the Proposed Development Versus Baseline Conditions for Comfort – Off-Site Receptors.

Table 12.10: Significance Impact of the Proposed Development Versus Baseline Conditions for Comfort – On-Site Receptors.

On-Site Potential Receptors	Baseline Conditions	Proposed Development Conditions	Impact Significance
1. Adjacent to E1 and E2	Suitable for Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
2. Between E1 and D1	Suitable for Strolling.	Suitable for Sitting/Standing/Strolling. (Safe/No distress)	Negligible
3. Forecourt of D1	Suitable for Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
4. Between D1 and C2	Suitable for Strolling.	Suitable for Sitting/Standing/Strolling. (Safe/No distress)	Negligible
5. Between C2 and H	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
6. Between C1 and H	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
7. Between Alzheimer Society of Ireland building and C1	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
8. In front of A1	Suitable for Sitting/Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
9. Between A1 and B1	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
10. Between B1 and B2	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
11. Between B2 and B3	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible
12. Between B3 and B4	Suitable for Standing/Strolling.	Suitable for Standing/Strolling. (Safe/No distress)	Negligible

12.8.5 Balconies

The flow behaviour on the balconies is examined using the vertical slices shown in the figure 12.51. These slices allow a clear visualization of airflow patterns at balcony level, enabling detailed analysis of flow interactions around the building facades. It is evident that all the balconies are deemed safe for occupants, with no distress areas identified.

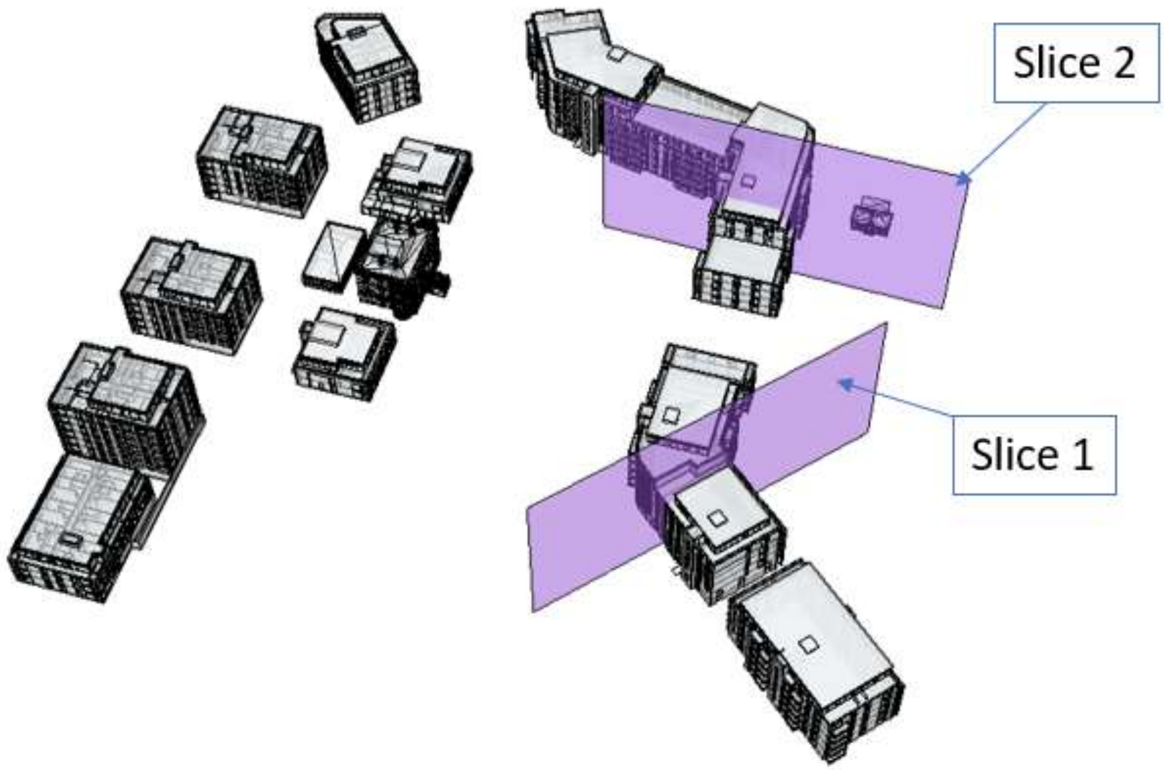


Figure 12.51: Vertical Slices Location.

Flow on Slice 1:

Flow along the balconies for Slice 1 is presented here, highlighting the airflow patterns and interactions observed at the balcony level for this slice.

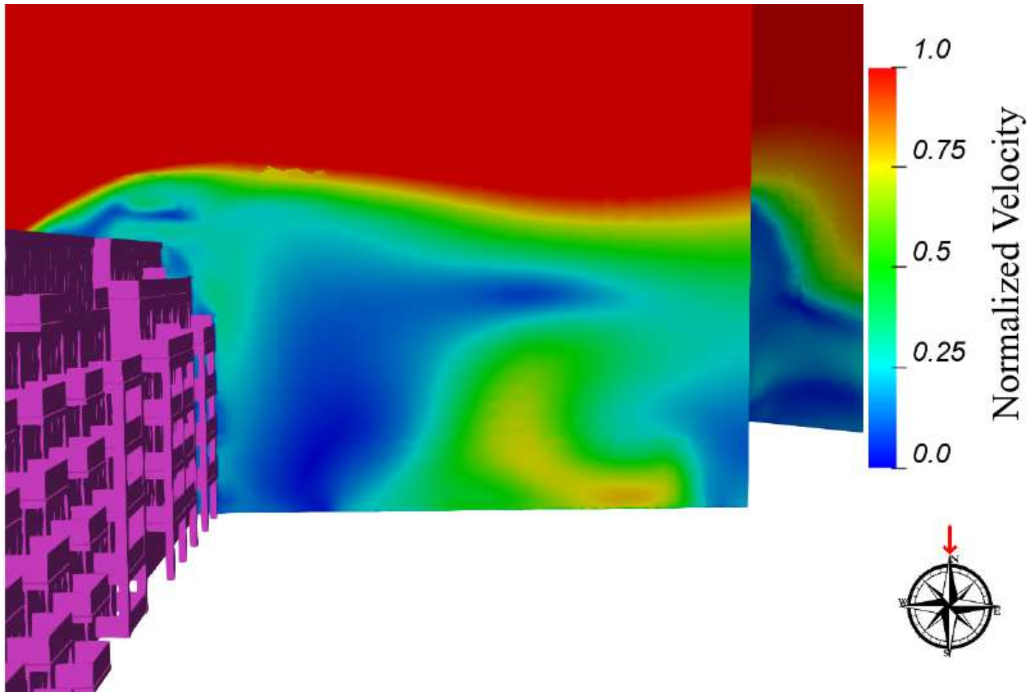


Figure 12.52.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 0°

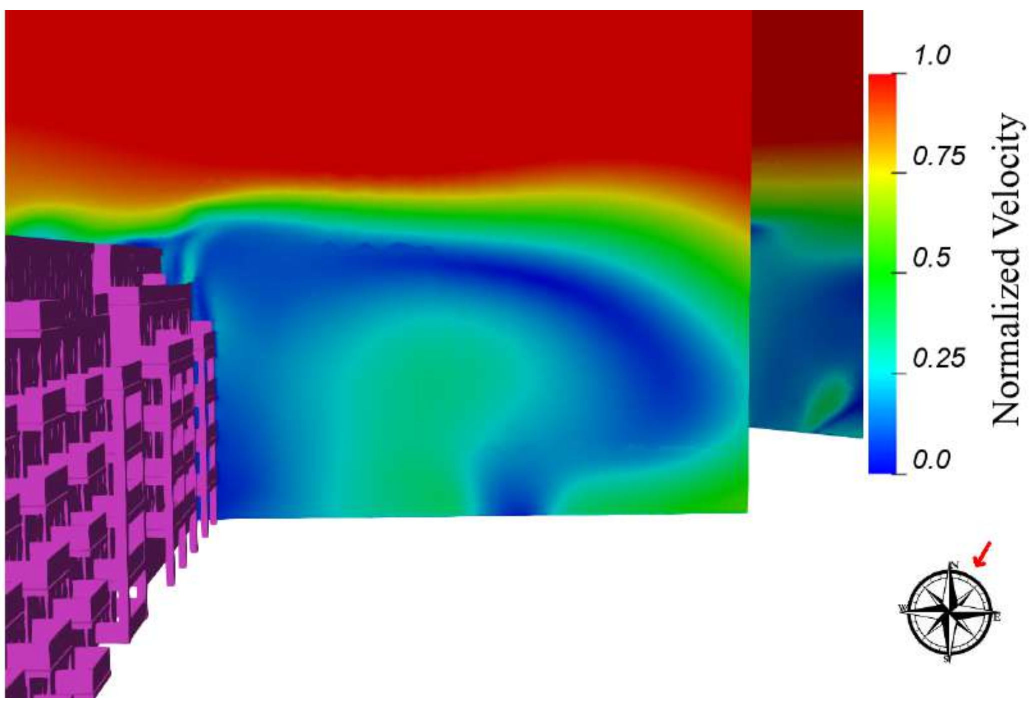


Figure 12.53.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 30°

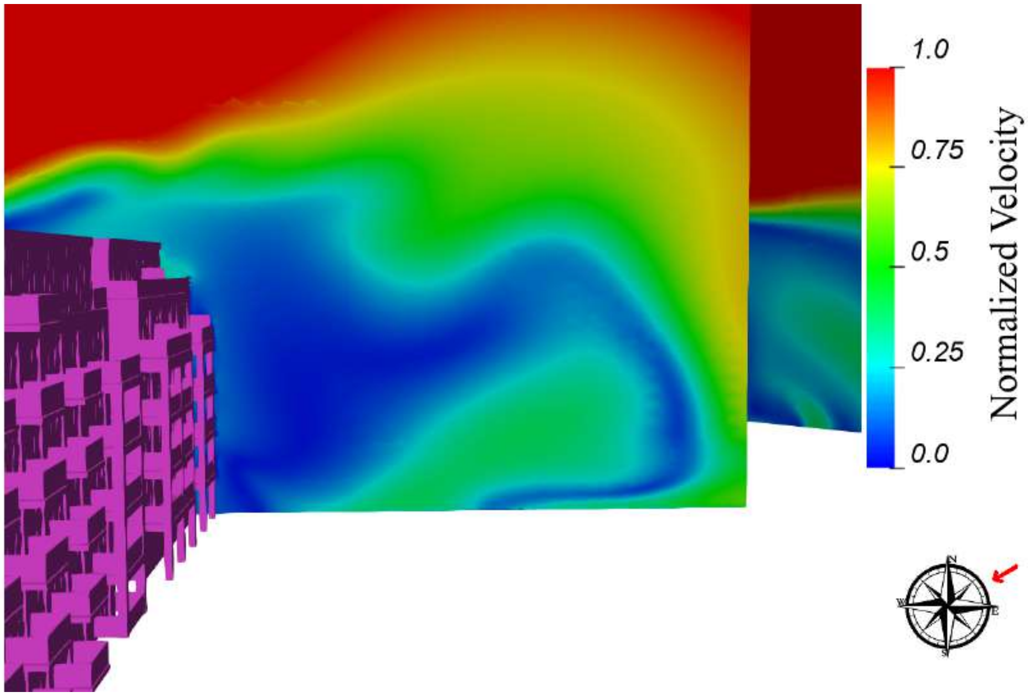


Figure 12.54.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 60°

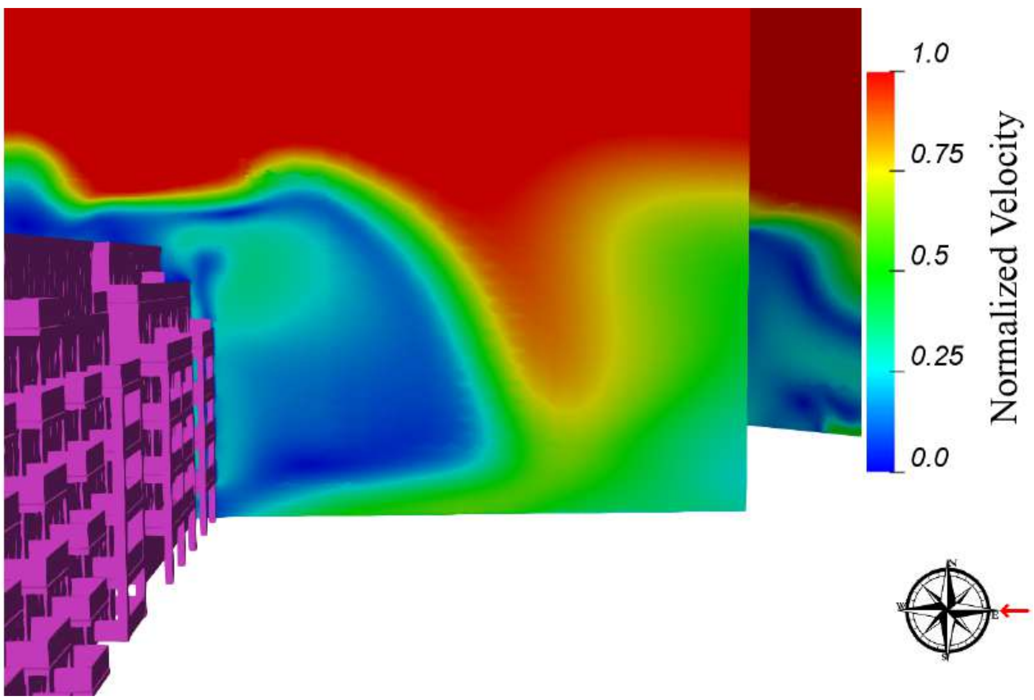


Figure 12.55.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 90°

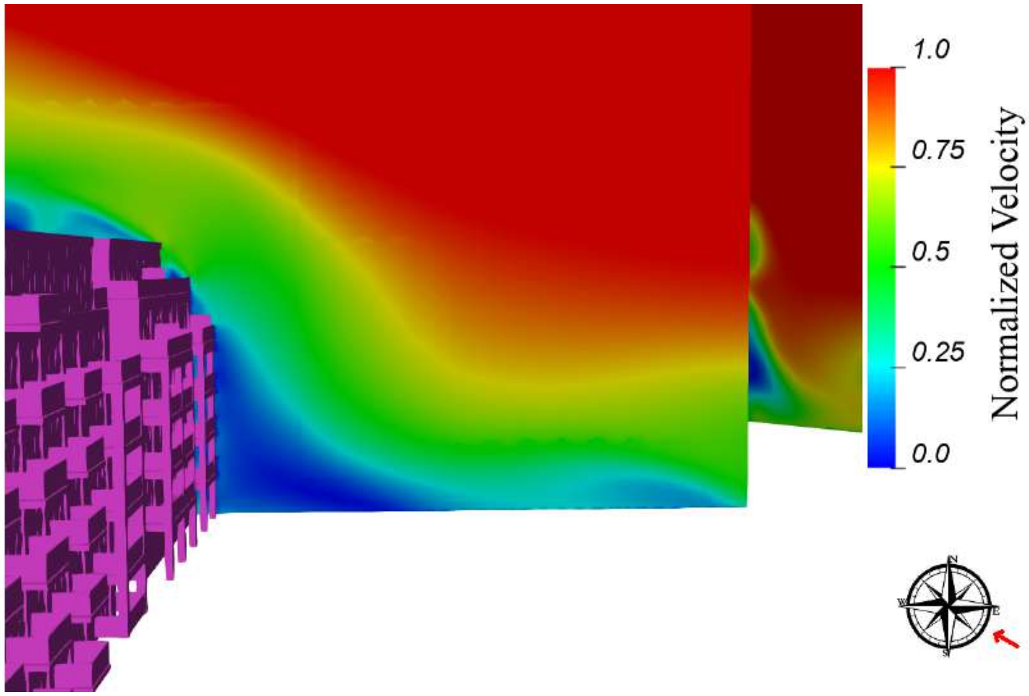


Figure 12.56.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 120°

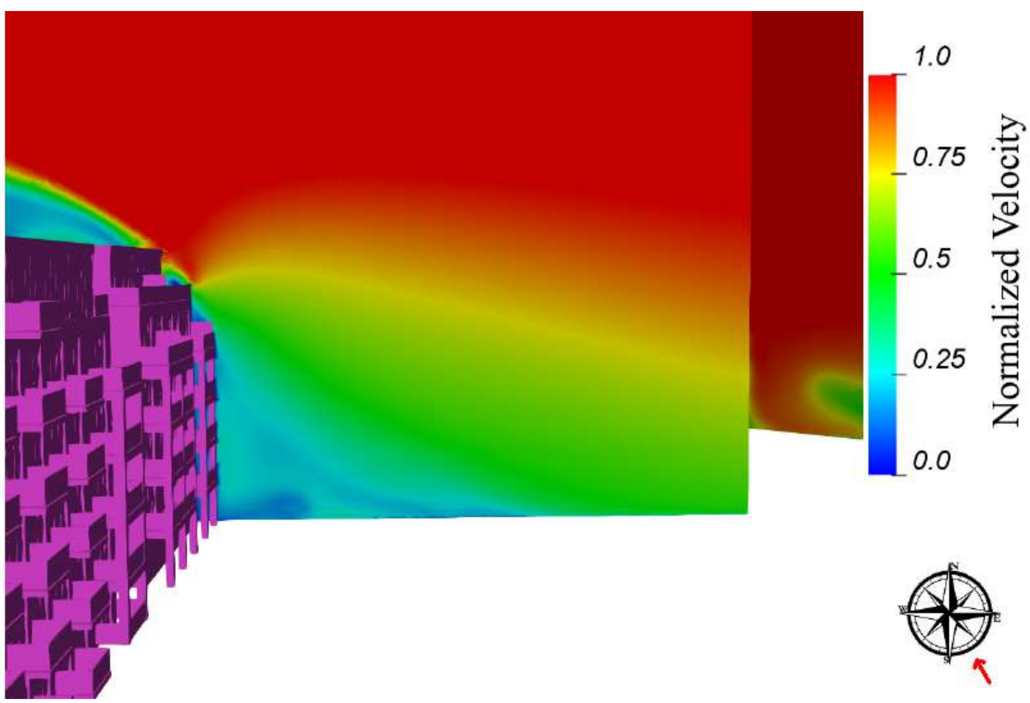


Figure 12.57.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 150°

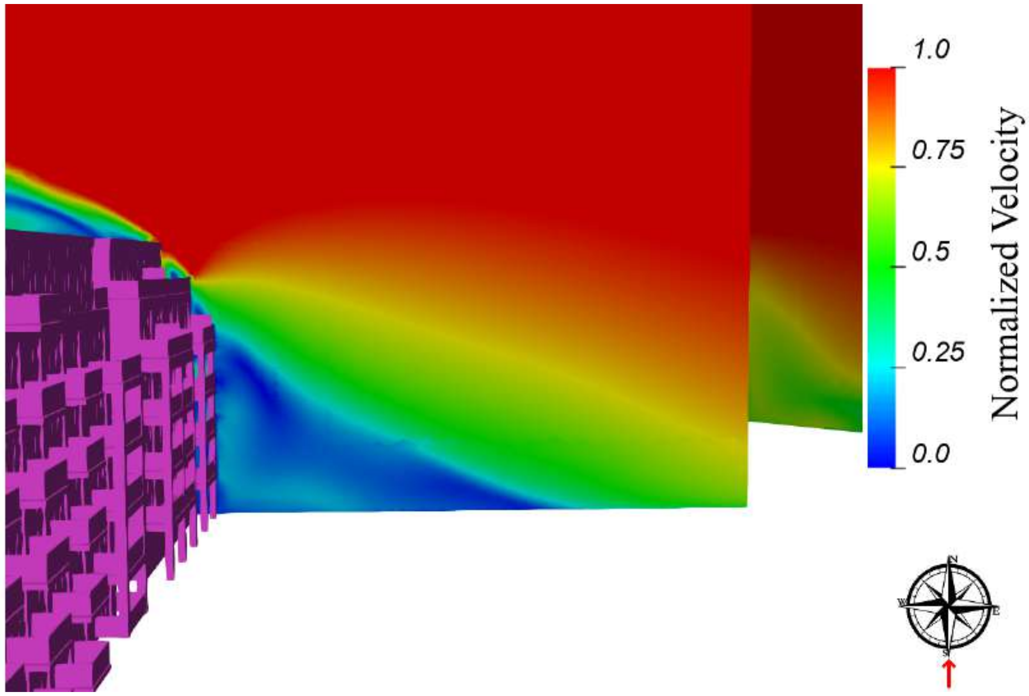


Figure 12.58.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 180°

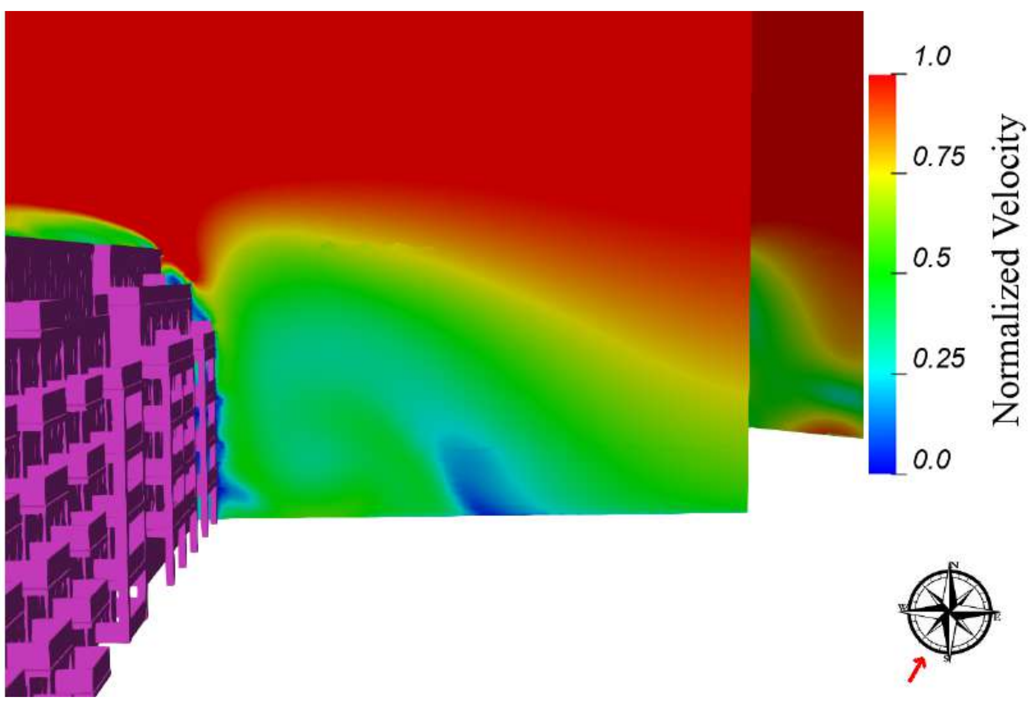


Figure 12.59.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 210°

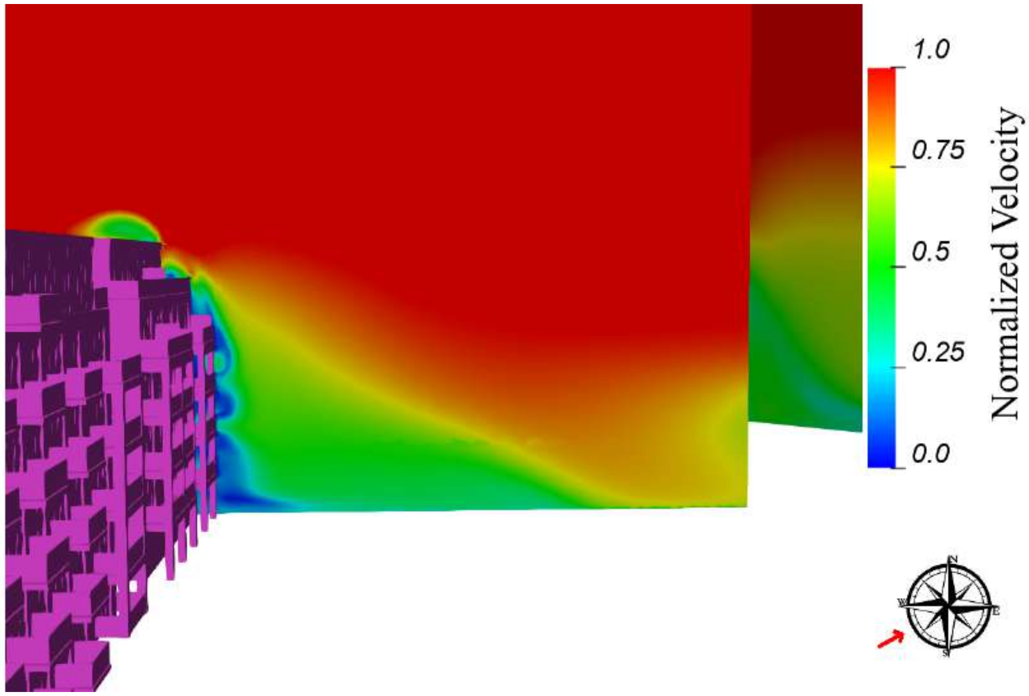


Figure 12.60.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 240°

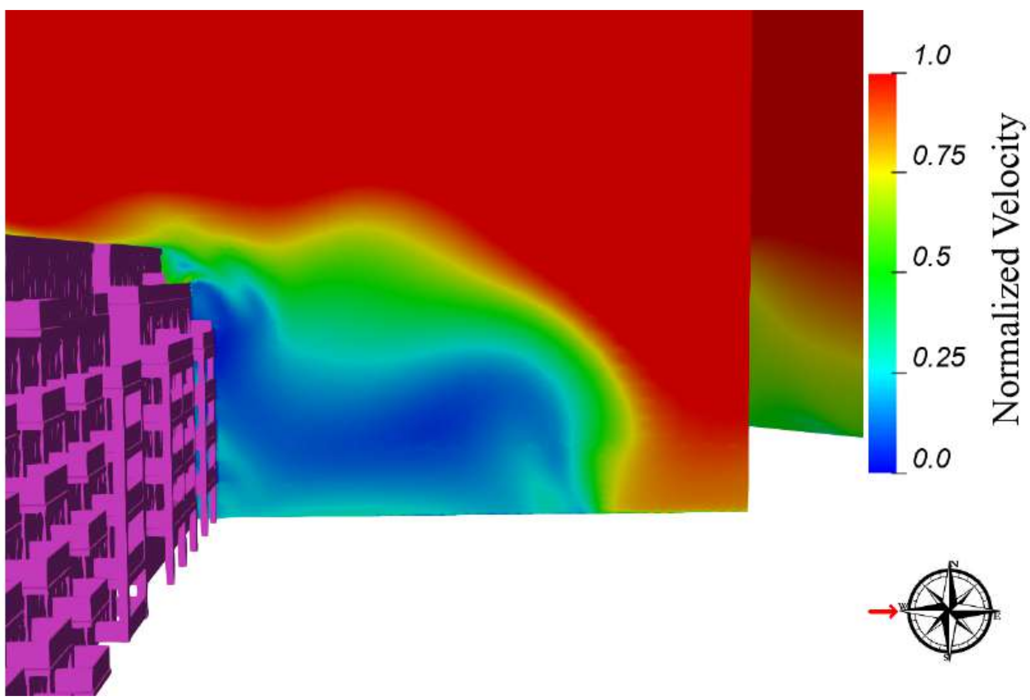


Figure 12.61.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 270°

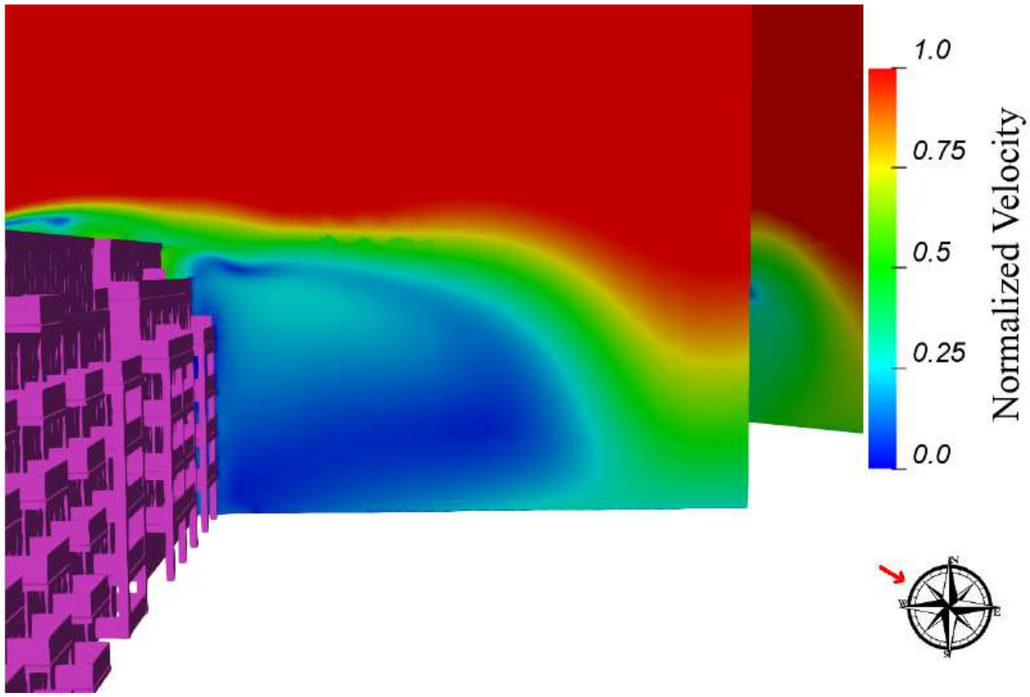


Figure 12.62.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 300°

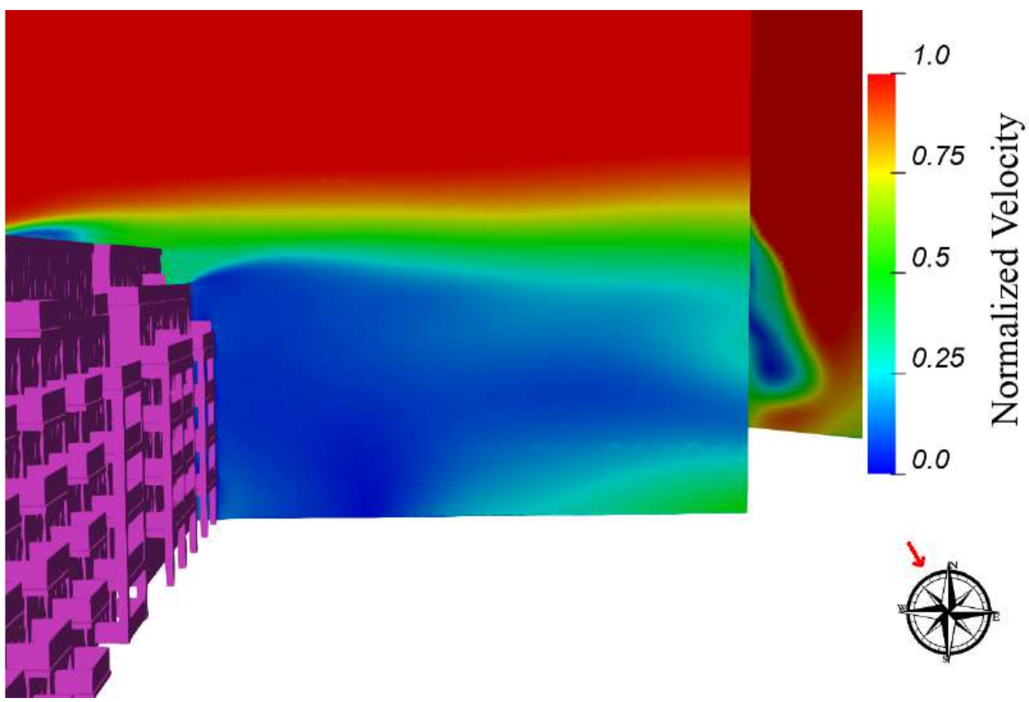


Figure 12.63.: Example of wind results on Balconies of E1- Flow Velocity Results - Wind Direction: 330°

Flow on Slice 2:

Flow along the balconies for Slice 2 is presented here, highlighting the airflow patterns and interactions observed at the balcony level for this slice.

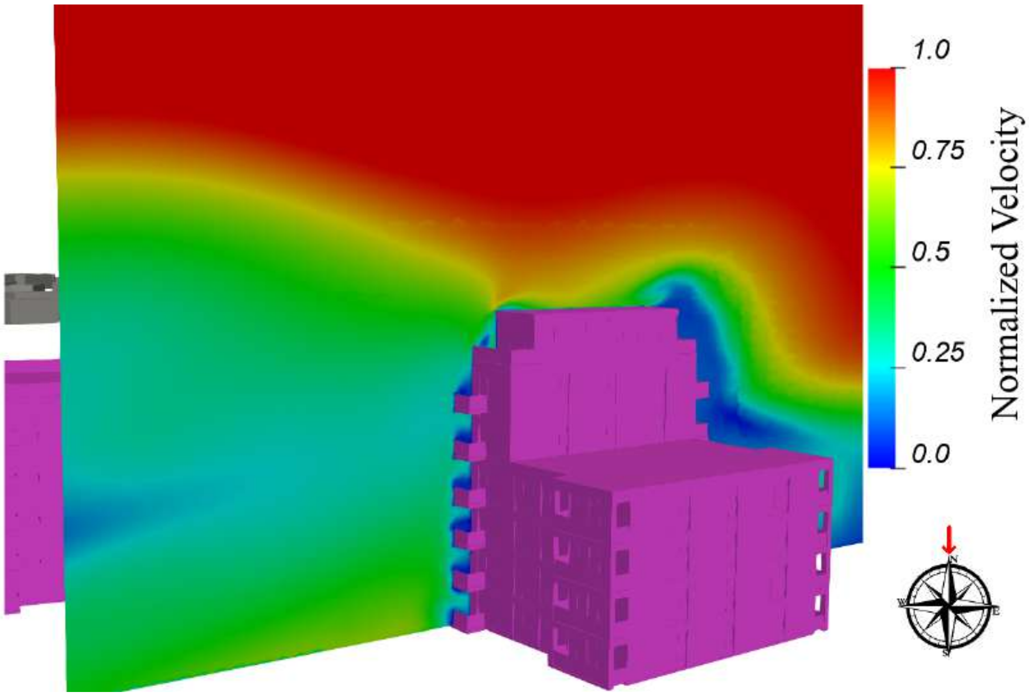


Figure 12.64.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 0°

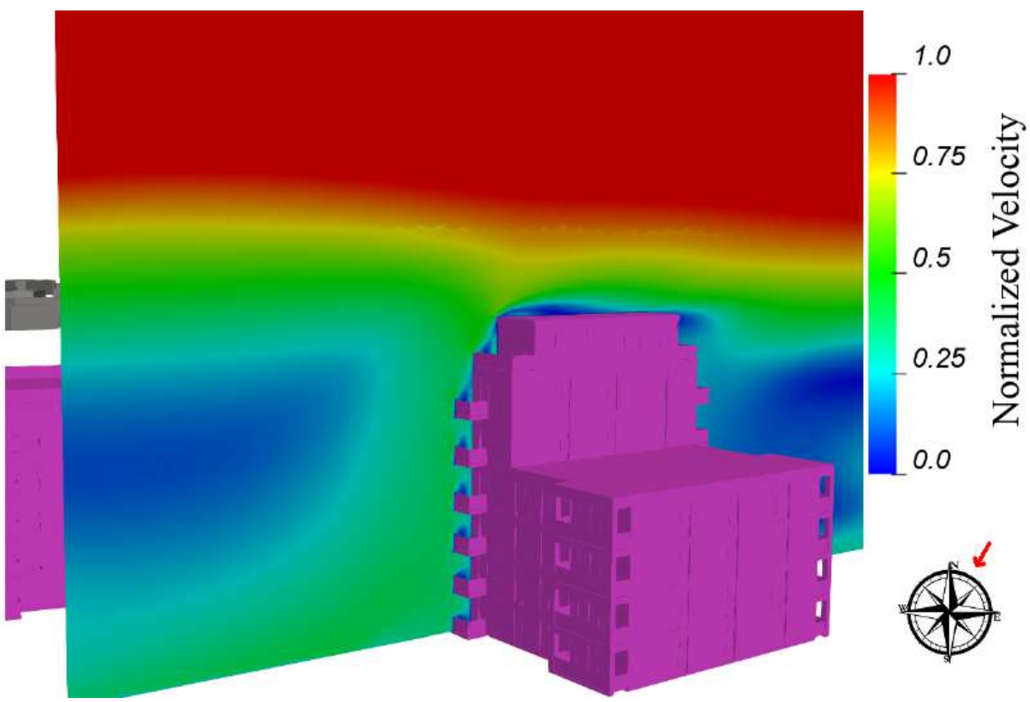


Figure 12.65.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 30°

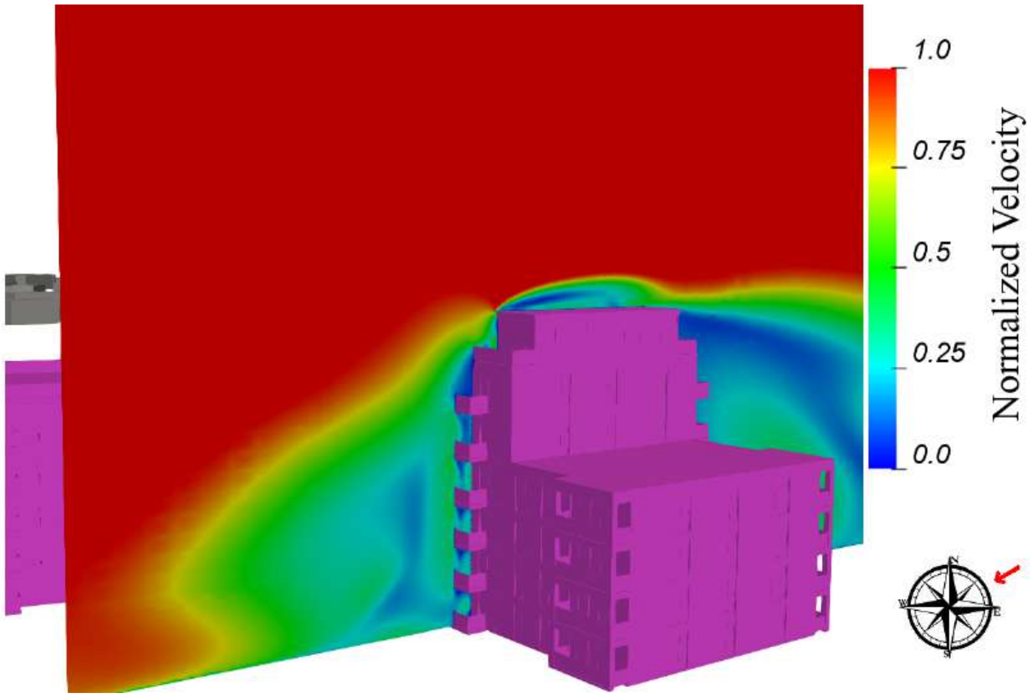


Figure 12.66.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 60°

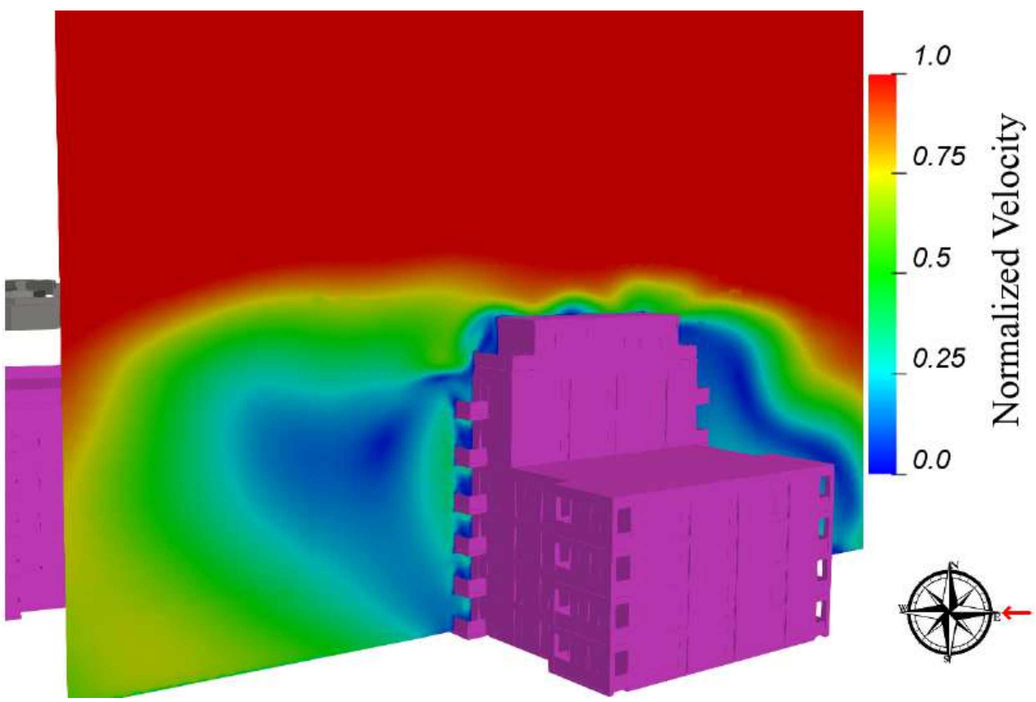


Figure 12.67.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 90°

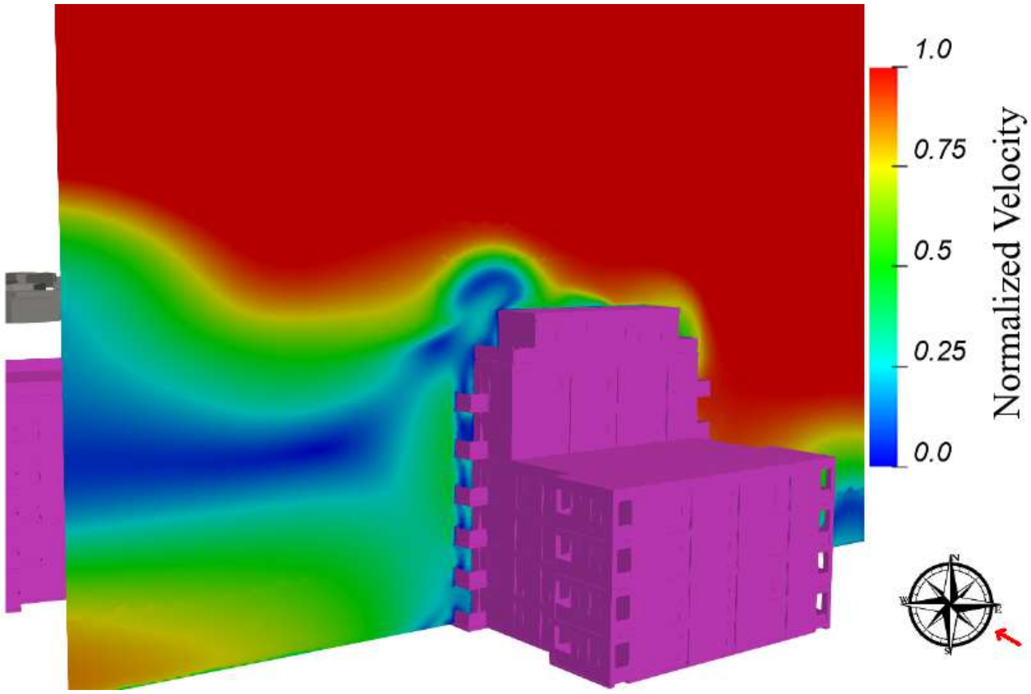


Figure 12.68.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 120°

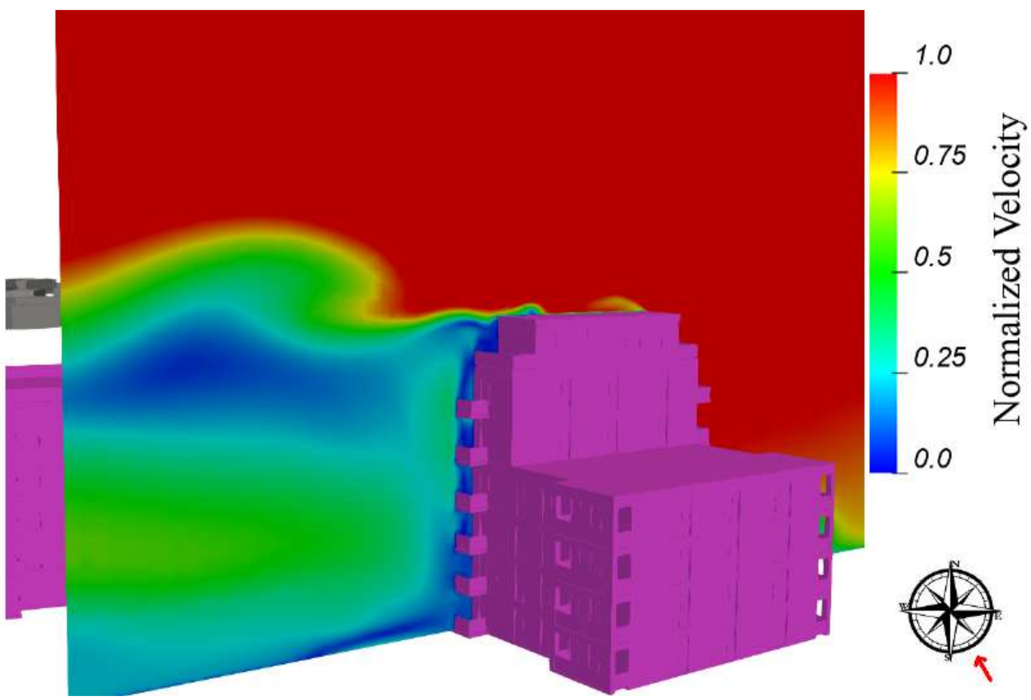


Figure 12.69.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 150°

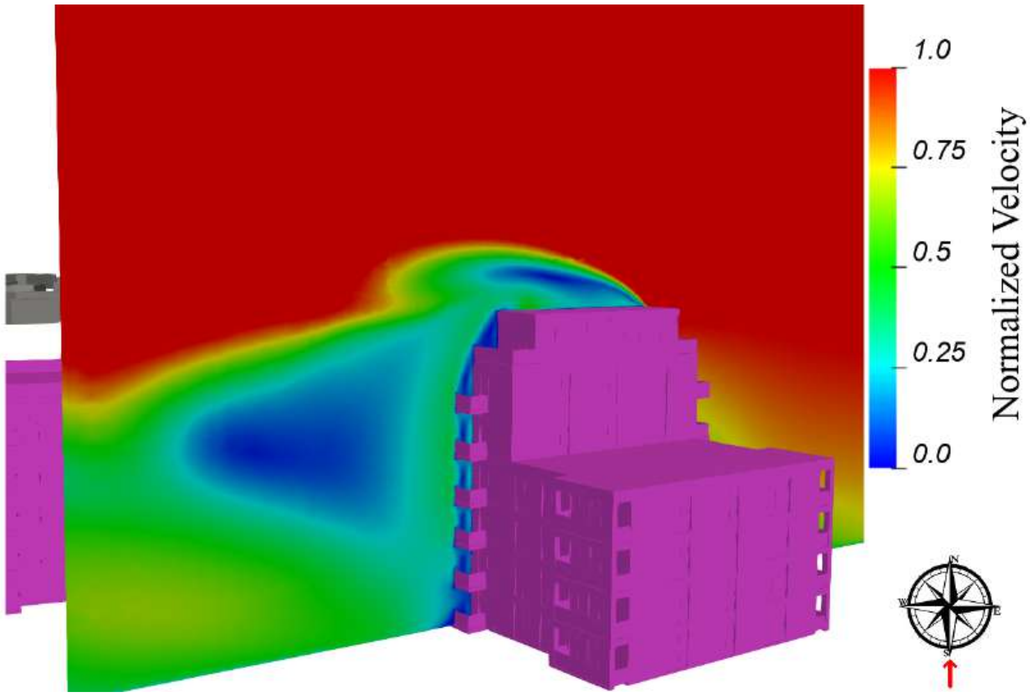


Figure 12.70.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 180°

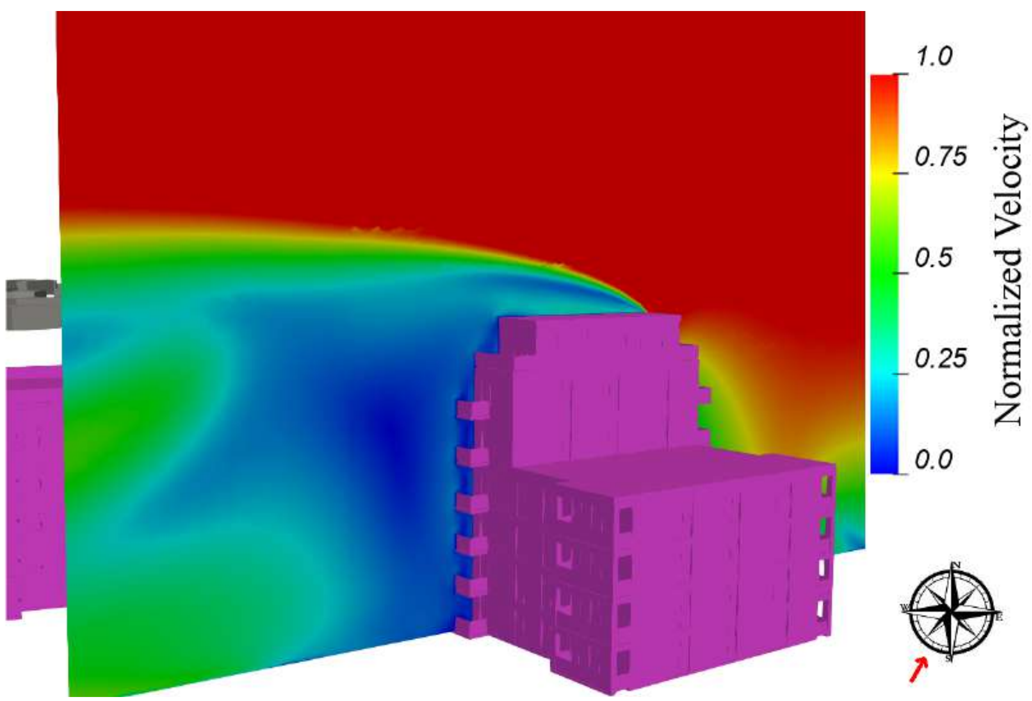


Figure 12.71.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 210°

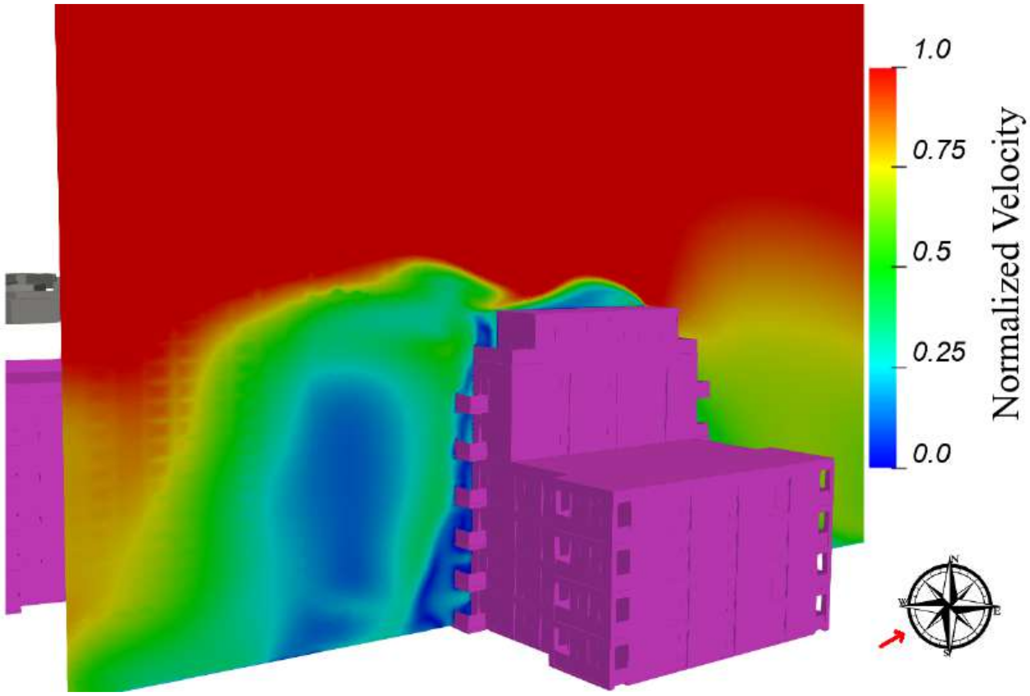


Figure 12.72.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 240°

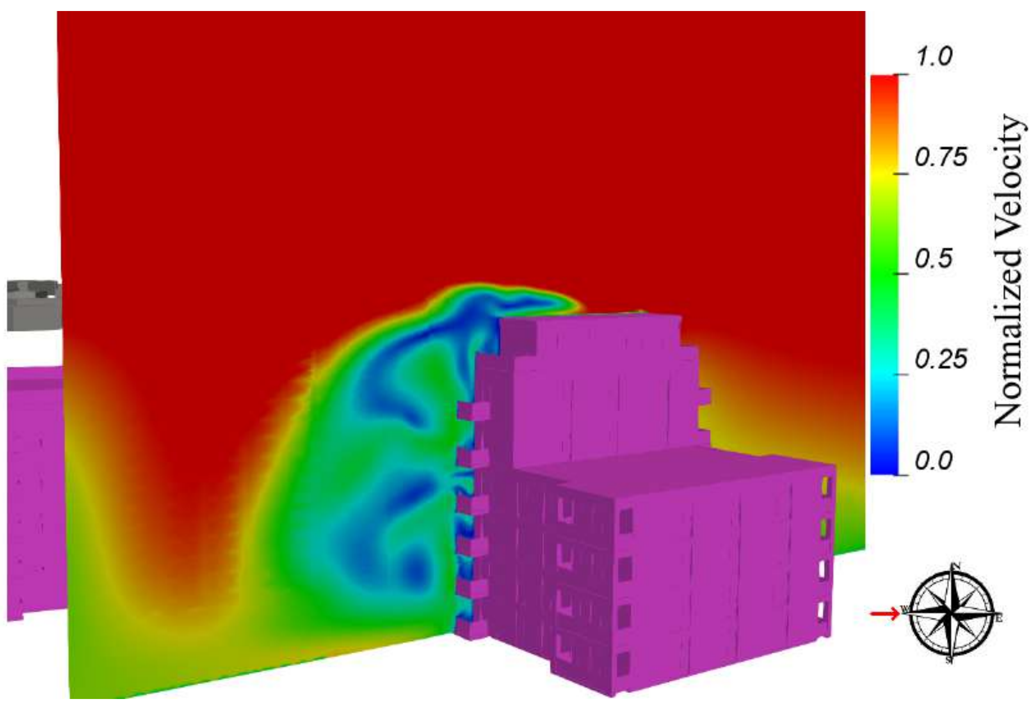


Figure 12.73.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 270°

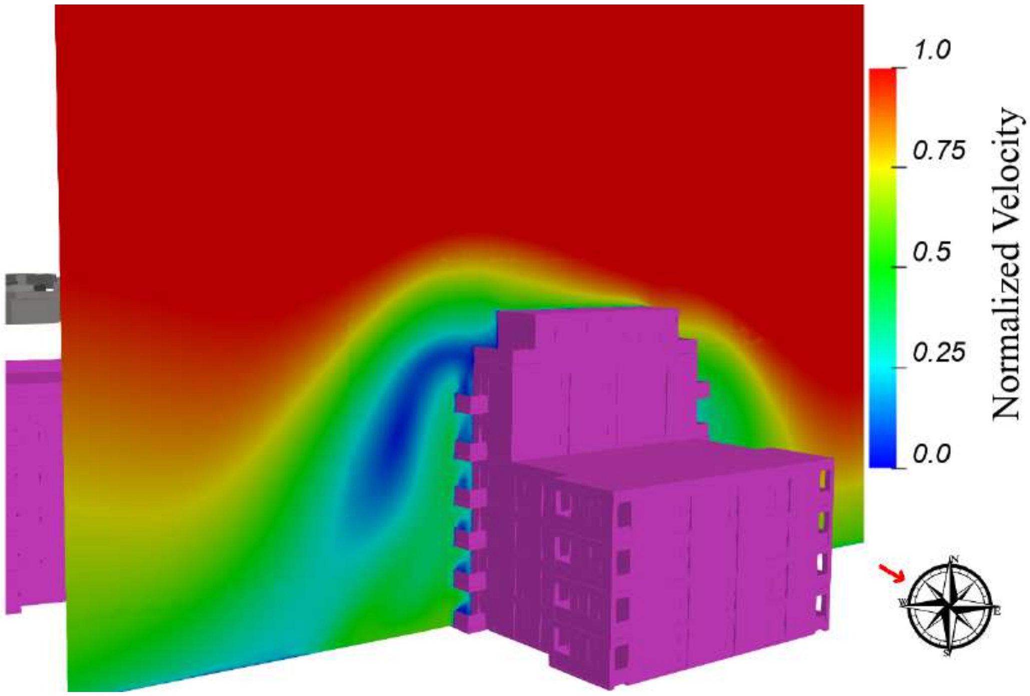


Figure 12.74.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 300°

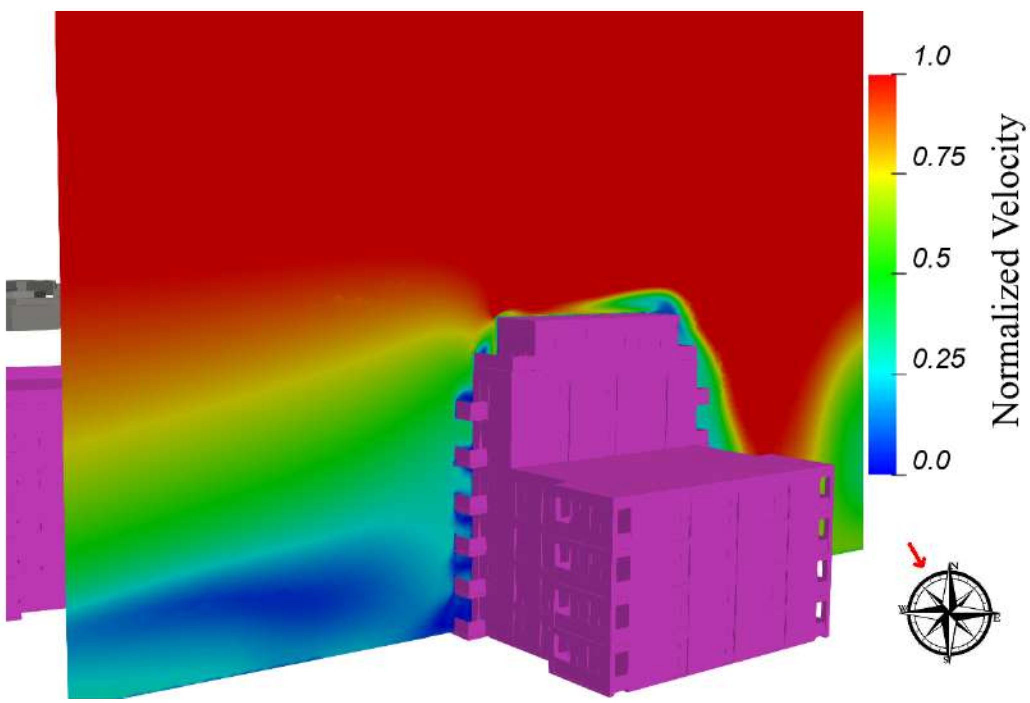


Figure 12.75.: Example of wind results on Balconies of D1- Flow Velocity Results - Wind Direction: 330°

12.8.6 Summary

This report presents the CFD modelling assumptions and results of Wind and Microclimate Modelling of proposed development at St. Teresa's, Temple Hill, Monkstown, Blackrock, Co. Dublin.

This study has been carried out to identify the possible wind patterns around the area proposed, under mean and peak wind conditions typically occurring in Dublin, and also to assess impacts of the wind on pedestrian levels of comfort/distress.

The results of this wind microclimate study have been utilized by O'Mahony Pike Architects, as project architects, to configure the optimal layout for proposed development. The aim is to achieve a high-quality environment appropriate to the intended use of each area and building. This includes providing comfortable and pleasant conditions for pedestrians, while ensuring that no critical wind impacts are introduced to surrounding areas or existing buildings.

- The wind profile was built using the annual average of meteorology data collected at Dublin Airport Weather Station purchased from Meteoblue. The local wind speed was determined from CFD simulations with combination of the parameters inside Weibull probability distribution function, which was obtained form historical meteorological data recorded 10m above ground level at Dublin Airport.

- A 12-discrete set of wind directions is used to evaluate the probability of exceedance at any given threshold speed. It is found that the prevailing wind direction in the south-west has the largest contribution of the discomfort exceedance probability.

- Microclimate Assessment of Proposed Development and its environment was performed utilizing a CFD (Computational Fluid Dynamics) methodology.

- The evaluation of the proposed scenario indicates that the planned development aligns with the Lawson Comfort Criteria, confirming that no areas are unsafe and the proposed development does not create conditions of distress. All the ground amenities outlined in the report can be utilized according to their intended scope.

- The slice of Lawson Comfort and Distress Map indicates that balconies are safe for occupants with no identified distress areas.

- As a result of the proposed development construction, the wind on the surrounding urban context remains suitable for the intended use when compared with the baseline situation.

- The proposed development does not impact or give rise to negative or critical wind speed profiles at the nearby adjacent roads, or nearby buildings. Moreover, in terms of distress, no critical conditions were found for "Frail persons or cyclists" and for members of the "General Public" in the surrounding of the development.

Therefore, the CFD study carried out has shown that under the assumed wind conditions typically occurring within Dublin for the past 15 years:

- The development is designed to be a high-quality environment for the scope of use intended of each areas/building (i.e. comfortable and pleasant for potential pedestrian), and,

- The development does not introduce any critical impact on the surrounding buildings, or nearby adjacent roads.

12.8.7 Do Nothing Scenario

In case the development will not be constructed, the wind conditions on the site will be in line with those obtained with the Baseline scenario wind microclimate.

12.9 Mitigation Measures

Beyond what is already proposed under the scope of the proposed development, no further mitigation is proposed in relation to wind.

The landscaping proposed for the development has been considered within the wind analysis carried out and its effect has been beneficial in reducing the wind speed around the development and creating calmer wind condition in areas such the parks and landscaped areas where pedestrian can be comfortable for long-term sitting. Landscaping is simulated as porous zones within the CFD model.

12.10 Residual Impacts

Wind cannot be eliminated or totally mitigated, as it depends on weather conditions, which could vary. The data of the historical wind conditions collected and reported above, show that the wind speeds likely to occur at the site are below critical values, and that a pleasant and comfortable microclimate can be maintained for most of the time and under the most frequent wind scenarios.

Gusts and storms can still occur, however; and they can create unpleasant and sometimes unsafe conditions. The pedestrian activities concerning the Lawson Comfort and Distress Criteria are not in general carried out during those weather conditions.

Having considered the above, no further changes to the proposed development design or further landscaping are suggested, as safety and pedestrian comfort will be maintained in accordance with Lawson Comfort and Distress Criteria. The significance of the impacts of the development when compared versus the baseline scenario are found to be negligible in particular to the evaluation of the entrances of the proposed development. Furthermore, pedestrian activities will benefit by the construction of the proposed development in the designed roads and amenities areas and conditions of microclimate is also improved for the off site receptor.

12.11 Monitoring

12.11.1 Construction Phase

There is no requirement to monitor wind impact during the construction phase for pedestrian comfort and distress as the designated amenity areas will not be in use during this phase of the project and pedestrians are not accessing construction sites.

12.11.2 Operational Phase

The development has been designed to conform to acceptable Lawson Criteria for Comfort and Distress following the Wind Beaufort Scale and considering the historical wind conditions of the site, there is no further element to monitor for this scope as far as the design and landscaping is maintained in place as proposed.

12.12 Reinstatement

Not Applicable.

12.13 Interactions

The principal interaction is with Chapter 5 (Population & Human Health), since the wind conditions at the proposed development site can affect the amenity and safety of residents and visitors, as discussed above. As discussed earlier, in all cases, the proposed development will deliver a wind microclimate that is either suitable for all intended pedestrian uses, or calmer than required for the intended uses. In a number of instances, the proposed development will result in an improved (i.e., calmer) wind microclimate relative to the baseline scenario. Therefore, no significant impacts on population and human health are predicted as a result of the wind effects of the proposed development.

12.14 Difficulties Encountered

No difficulties were encountered in compiling this chapter.

12.15 References

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