

Tiznow Property Company Limited
(Comer Group Ireland)

**City Park Development at the
Former Tedcastles Site**

Wind Microclimate Assessment

267365-ARUP-XX-XX-RP-YW-0004

P02 | 28 March 2022

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Job number 267365




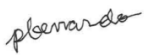
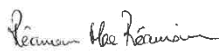

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Executive Summary

The proposed City Park development is situated at the former Tedcastles site, Centre Park Road, Cork. The proposed development will consist of 6 mixed-used residential blocks with dedicated courtyards, roof terraces and lower ground car parks. The landmark building Block A is 35-stories tall, while the remaining blocks stand between 6 and 10-stories tall. The proposed development includes retail and amenity spaces at ground level and podium level.

This report assesses the impact of the proposed development on the wind conditions affecting pedestrian activities within and surrounding the development, and describes the method used to assess these impacts in terms of pedestrian comfort and safety (distress).

The objectives of the wind assessment are as follows:

- Evaluate the local microclimate that is experienced on site and examine the level of pedestrian comfort within the proposed development
- Propose mitigation measure to alleviate the corresponding issues relating to pedestrian comfort and distress
- Assessment of the effectiveness of the mitigation measures, which are adopted in the design, at alleviating pedestrian discomfort and distress.

The criteria used to describe windiness in this study are those of TV Lawson of Bristol University, extracted from “The evaluation of the windiness of a building complex before construction”, TV Lawson, London Docklands Development Corporation. These are used widely in Ireland, UK and around the world.

The assessment was carried out using Computational Fluid Dynamics (CFD). The assessment has been undertaken in the following key locations:

- Pedestrian thoroughfares
- Entrances
- Public and communal seating areas
- Balconies and terraces

The following mitigation measures are implemented in the design:

- Landscaping plan, shown in Figure 30, that proposes trees, high hedge and shrub planting (1.5m), together with retention of the existing trees.
- 1.8m high side screens on both sides on balconies prone to distress: Eastern facade of Block C facing the Village Plaza; Eastern façade of Block D overlooking the Play Gardens.
- 1.8m high balustrades on roof terraces: 2nd floor communal open space in Block A; Upper three terraces in Block A; 8th floor roof terrace in Block C; 6th floor roof terrace in Block D; 8th floor roof terrace in Block F.

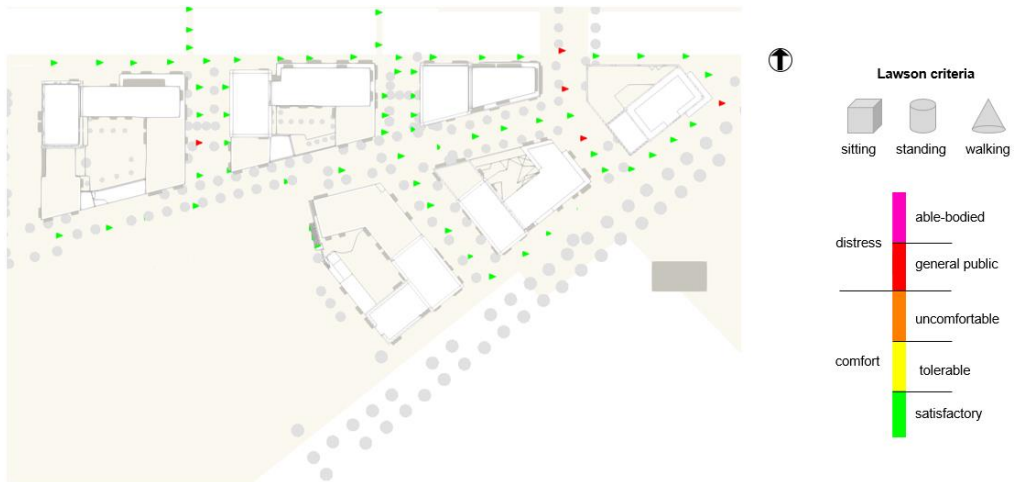


Figure E1: Lawson criteria at key locations long thoroughfares (mitigation)



Figure E2: Lawson criteria in seating areas (mitigation)

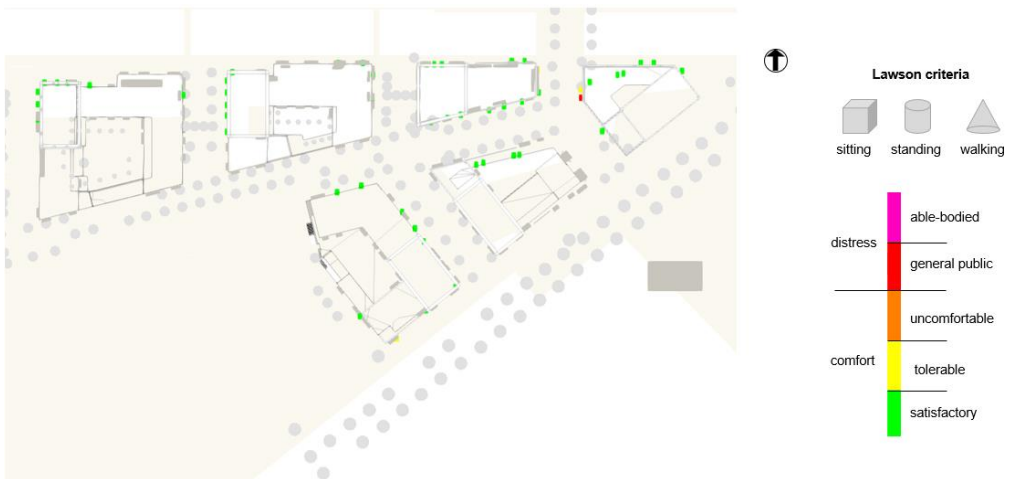


Figure E3: Lawson criteria at entrances (mitigation)



Figure E4: Lawson criteria for balconies and terraces in Block A (baseline)

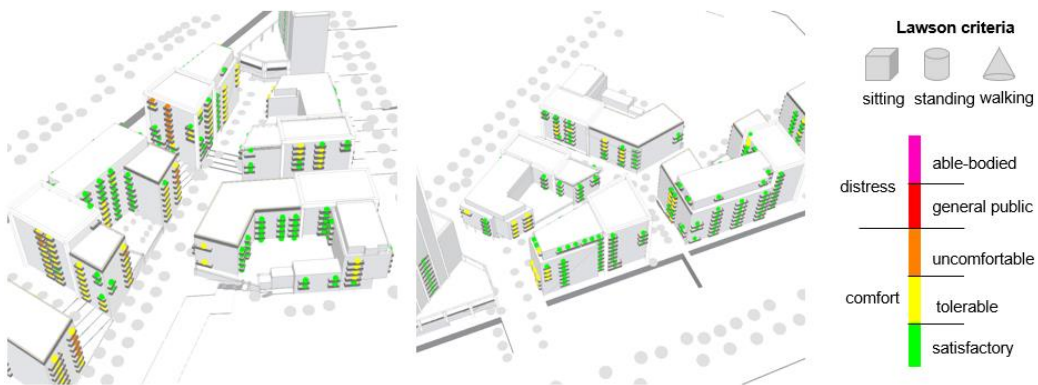


Figure E5: Lawson criteria for balconies and terraces in Block B, C, D and E (mitigation)

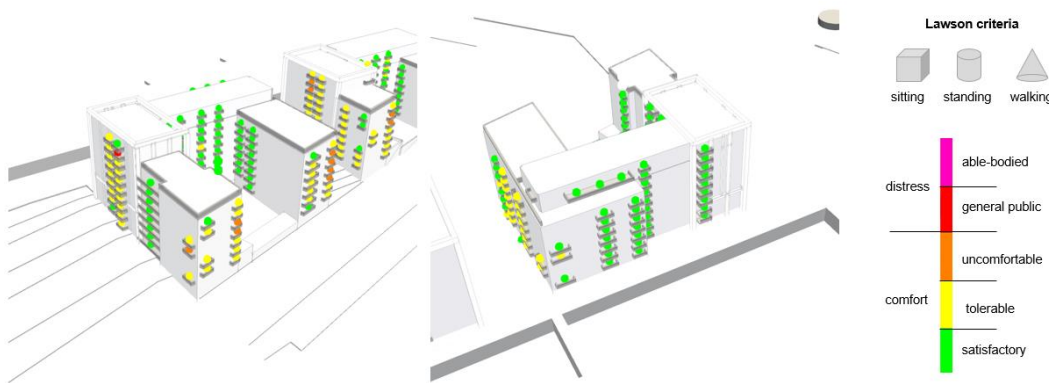


Figure E6: Lawson criteria for balconies and terraces in Block F (baseline)

The conclusions of the Northern Site wind microclimate study are as follows:

- Overall, the proposed development is expected to provide a suitable environment for pedestrians and occupants to carry out a wide variety of ‘sitting’, ‘standing’ and ‘strolling’ activities.
- Wind mitigation measures have been adopted throughout the design to reduce the windiness across the site and to assist in keeping wind conditions within acceptable limits. Mitigations include landscaping, balcony screens and higher balustrades.

- Most thoroughfares in and around the development are expected to experience wind conditions that are suitable for their intended use.
- The provision of street furniture and soft landscaping features, such as trees, will be helpful in alleviating windiness along thoroughfares. However, some residual windiness remains in the Village Plaza and the Passive Recreation space.
- The Village Plaza and the Café Spill Out space is subject to similar levels of windiness with the provision of street furniture and soft landscaping features. There is an expectation to use these spaces in good-weather conditions.
- The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances except the northwestern retail unit in Block A. The provision of screens or planters at these entrances would be beneficial helpful in providing local shelter to pedestrians accessing the northwestern retail unit of Block A.
- Most of the public seating spaces experience wind conditions that are ‘comfortable’ for standing and short-term seating, like bench seating use. It is anticipated that these will be attractive spaces in good-weather conditions.
- It is apparent the mature trees along Centre Park Road are beneficial in reducing the windiness in the seating area at the northeast corner of Block A.
- The provision of more robust landscaping or screens around the seating areas in the Café Spill Out space and the seating area at the northeastern corner of Block A is necessary to ensure adequate shelter for ‘sitting’ all year round.
- The second floor terrace in Block A is windy due to wind funnelling between Blocks A and C. A taller balustrade or local wind measures on the terrace are required to provide more shelter and make the space more comfortable for its intended use.
- The terraces on the top floors are exposed to high speed winds due to the height of the block. The provision of taller balustrades or panels to segregate terraces into smaller sections may help reduce windiness to more suitable levels.
- The implementation of a management strategy to prohibit access the second floor and top floor terraces in Block A during adverse weather events will prevent pedestrian exposure to distressing wind conditions.
- The provision of higher balustrades on the 6th floor terrace of Block E and the 8th floor terraces on Blocks D and F will reduce the windiness on these terraces.
- The provision of 1.8m tall screens on both sides of the balconies on the eastern façade of Block C facing the Village Plaza and Block D overlooking the Play Gardens ensures these spaces remain calm and attractive spaces for their occupants.
- The introduction of the future permitted and planned developments, which includes the former Cork Warehouse Site, the former Ford Distribution Site and the future school development, is expected to be beneficial in improving wind conditions along thoroughfares.

1 Introduction

1.1 Overview

The proposed City Park development is situated at the former Tedcastles site, Centre Park Road, Cork. The proposed development will consist of 6 mixed-used residential blocks with dedicated courtyards, roof terraces and underground carparks. The landmark building Block A is 34-stories tall, while the remaining blocks stand between 5 and 9 stories tall. The proposed development includes retail and amenity spaces at ground level and podium level.



Figure 1: Site location (source of the base map: Google Maps)

The windiness in and around the proposed development depends on both the massing of the buildings within their surroundings, their orientation with respect to the wind, and the local wind climate.

This report assesses the impact of the proposed development on the wind conditions affecting pedestrian activities within and surrounding the development, and describes the method used to assess these impacts in terms of pedestrian comfort and safety (distress). The assessment of discomfort and distress of pedestrians has been carried out in accordance with the Lawson Comfort Criteria [1]. The study is based on the drawings provided by C+W O'Brien Architects and the landscaping plan provided by Park Hood Landscaping Architects.

1.2 Objectives

The objectives of the wind assessment are as follows:

- Evaluate the local microclimate that is experienced on site and examine the level of pedestrian comfort within the proposed development
- Propose mitigation measure to alleviate the corresponding issues relating to pedestrian comfort and distress
- Assessment of the effectiveness of the mitigation measures, which are adopted in the design, at alleviating pedestrian discomfort and distress.

2 Study Methodology

It is important to understand the wind microclimate around a proposed development in order to assess the level of pedestrian comfort. The assessment has been undertaken in the following key locations:

- Pedestrian thoroughfares
- Entrances
- Public and communal seating areas
- Balconies and terraces

2.1 Lawson Comfort Criteria

The criteria used to describe windiness in this study are those of TV Lawson of Bristol University, extracted from “The evaluation of the windiness of a building complex before construction”, TV Lawson, London Docklands Development Corporation. These are used widely in Ireland, UK and around the world.

The acceptability of windy conditions is subjective and depends on several other factors, including but not limited to, normal clothing for the time of the year, expectations of the wind environment, air temperature, humidity and sunshine and most notably the activities to be performed in the area being assessed. The Lawson Criteria describe acceptability for particular activities in terms of 'comfort' and 'distress' (or safety). Acceptable conditions for various activities in order of increasing windiness are described in Table 1.

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.

2.1.1 Comfort Levels

The 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, see above) which is

exceeded for 5% of the time. The conditions, as described in Table 1, are the limiting criteria for comfort. For ideal conditions, the windiness will be a category better than outlined above. For more sensitive activities, such as regular use for external eating, conditions should be well within the ‘sitting’ category. Ireland is a windier climate than the UK, where these criteria were developed. It is generally accepted that residents in windier climates are more resilient to stronger winds. Therefore, a slight exceedance of the limiting criteria for comfort is not considered significant.

Table 1: Comfort Criteria as Defined by TV Lawson

Activity	Description	Wind speed exceeded less often than 5% of the year (m/s)				
		0 – 4	4 – 6	6 – 8	8 – 10	> 10
‘sitting’	Regular use for reading a newspaper and eating and drinking	Satisfactory	Tolerable	Uncomfortable	Uncomfortable	Uncomfortable
‘standing’	Appropriate for bus stops, window shopping, building entrances, and public amenity spaces such as parks	Satisfactory	Satisfactory	Tolerable	Uncomfortable	Uncomfortable
‘strolling’	General areas of walking and sightseeing	Satisfactory	Satisfactory	Satisfactory	Tolerable	Uncomfortable
‘business walking’	Local areas around tall buildings where people are not expected to linger	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Uncomfortable

Note: A classification of ‘business walking’ does not mean that a location will never be suitable for ‘sitting’, however, it is likely to occur relatively infrequently.

Legend

	Satisfactory
	Tolerable
	Uncomfortable

2.1.2 Distress Levels

There is a criterion to define the onset of distress. For the ‘General Public’, this is equivalent to an hourly mean speed of 15 m/s and a gust speed of 28 m/s 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.

Table 2: Distress Criteria as defined by TV Lawson

Activity	Description	Wind speed to be exceeded less often than once a year (m/s)
General Public Access	Above which the less able and cyclists may at times find conditions physically difficult	15
Able-Bodied Access	Above which it may become impossible at times for an able-bodied person to remain standing	20

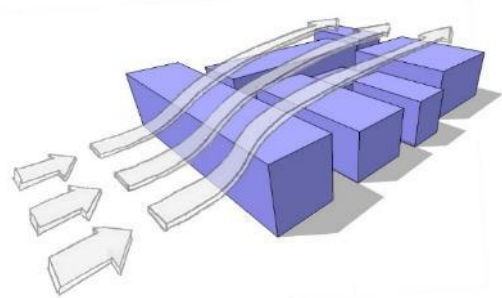
There is a further limiting distress criterion beyond which even ‘Able-Bodied’ individuals may find themselves in difficulties at times. This corresponds to a mean speed of 20 m/s and a gust speed of 37 m/s to be exceeded less often than once a year. Aerodynamic forces may exceed body weight in stormy conditions, which makes it difficult for anyone to remain standing. Where wind speeds exceed these values, pedestrian access should be limited.

2.2 Key Flow Mechanisms

There are certain flow patterns that can result in increased flow velocities. The main flow mechanisms of concern are described below:

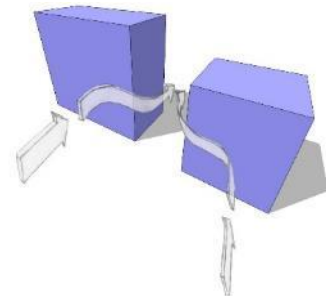
1. Exposure and Shelter:

When buildings of similar height are in close proximity to each other, the first line of buildings can shelter the buildings behind from the wind. However, if the gap is relatively large, the building upstream may not provide adequate shelter. In this case, the higher velocity high level wind from above may descend to ground and therefore, this may create an inclement environment for pedestrians.



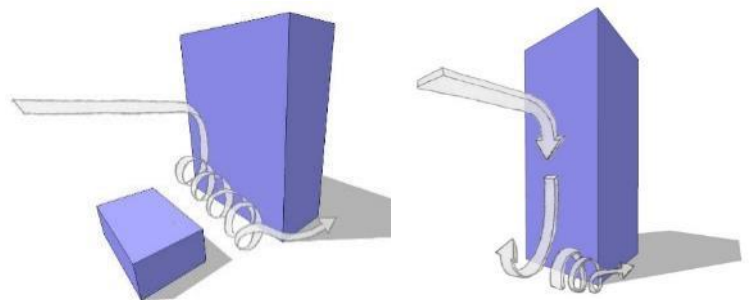
2. Funnelling:

When the gap between buildings is relatively narrow in comparison to their overall width, a large volume of wind is forced through the narrow opening. It is necessary for the wind speed to increase through the opening, which can result in discomfort for pedestrians.



3. Downdraft:

When buildings are considerably taller than the other buildings in their surroundings, they can re-direct the high-speed winds that they interact with at a high level down to ground in the form of a downdraft. The downdraft effect can be further exacerbated by lower level buildings in close proximity upstream.



2.3 Computational Fluid Dynamics (CFD)

Computational Fluid Dynamics (CFD) is a numerical technique intended to simulate various phenomena related with fluid flow. The analysis includes three main stages: pre-processing, CFD simulations and post-processing. The CFD simulations performed in this study were made using the software OpenFOAM with a 3D steady-state Reynolds’ Average Navier-Stokes (RANS) approach, commonly used in CFD studies of this kind.

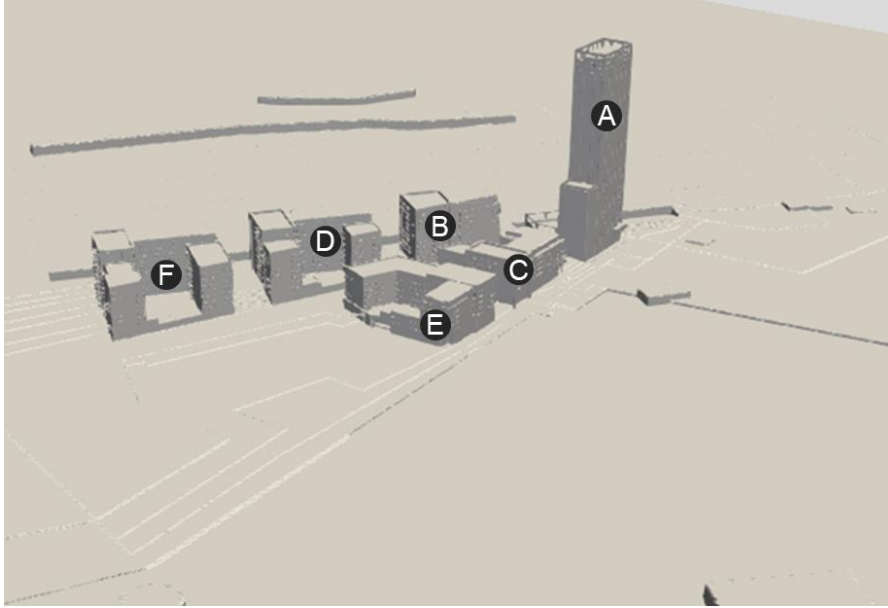


Figure 2: Baseline scenario – City Park development (Blocks A to F) + surrounding context only

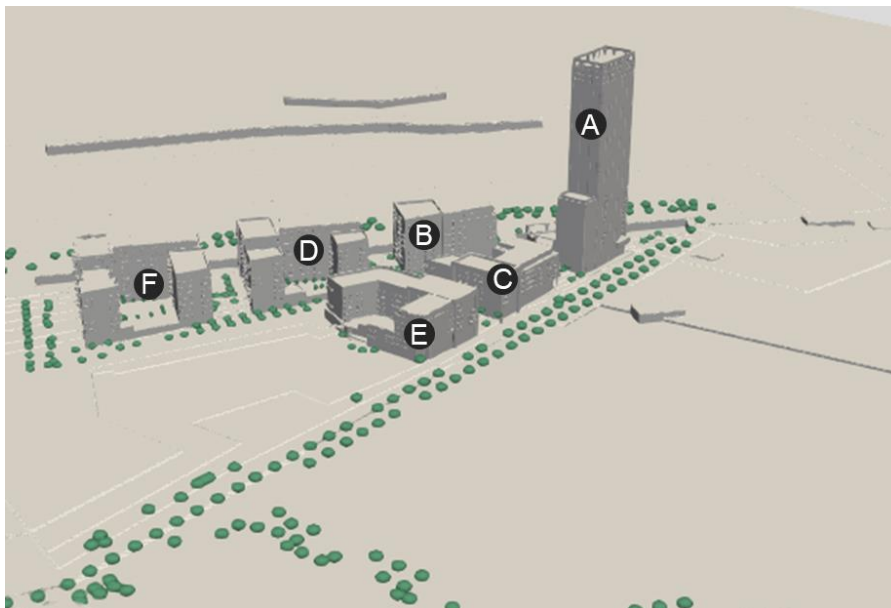


Figure 3: Mitigation scenario – Baseline + landscaping + other mitigation measures

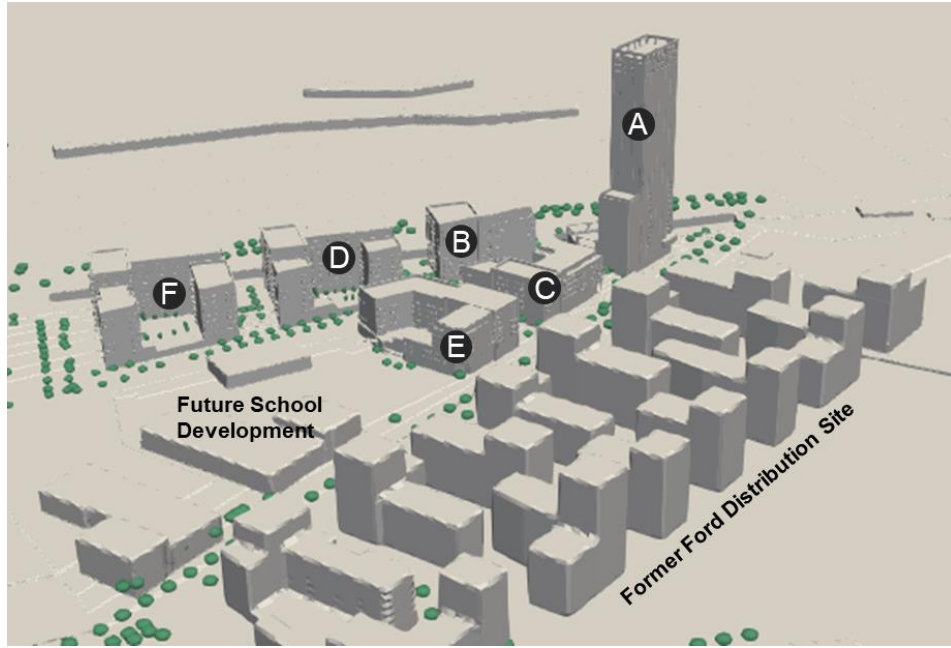


Figure 4: Future scenario – Mitigation + permitted developments + school masterplan

3 Existing Receiving Environment

3.1 Site Location and Surrounding Area

The proposed City Park development is situated at the former Tedcastles site, Centre Park Road, Cork. The proposed development is situated at the former Cork Warehouse Company site, Monahan Road, Cork. It is bounded by Centre Park Road to the south, Marina Greenway to the North. The site is adjacent to the former Ford Distribution Site (site granted permission April 2021).



Figure 5: Site context (Source of the base map: Google maps)

The site occupies majority of the northern part of a larger masterplan that includes a Strategic Housing Development (SHD) at the former Cork Warehouse Company Site and along Centre Park Road immediately southwest of the proposed development site. The proposed buildings at the former Cork Warehouse Company site and Ford Distribution site (Figure 5) have been included in the wind assessment of the proposed development in future surroundings (Section 5).

3.2 Proposed Development

The proposed development will consist of 6 mixed-used residential blocks with dedicated courtyards, roof terraces and underground carparks. The landmark building Block A is 35-stories tall, while the remaining blocks stand between 6 and 10-stories tall. The proposed development includes retail and amenity spaces at ground level and podium level.

The public amenity spaces within the proposed development, which are identified in Figure 6 below, include: the Village Plaza; the Amphitheatre, the Play Gardens (including Café Spill Out space), the Passive Recreation space and the Rain Garden.

The main thoroughfares that permit access to the proposed development are Centre Park Road and the Marina Greenway. Access from Centre Park Road is via Street B or the Village Plaza. A number bridge over the Open Water Channel facilitate access to the site via the Marina Greenway.

Street B is the main vehicular access through the site and it also offers a route for pedestrians. The thoroughfares through the Passive Recreation and Play Gardens link Street B with the walkway alongside the Open Water Channel. The Amphitheatre links Street B with the Village Plaza. The Village acts a link between the Centre Park Road and the Marina Greenway.

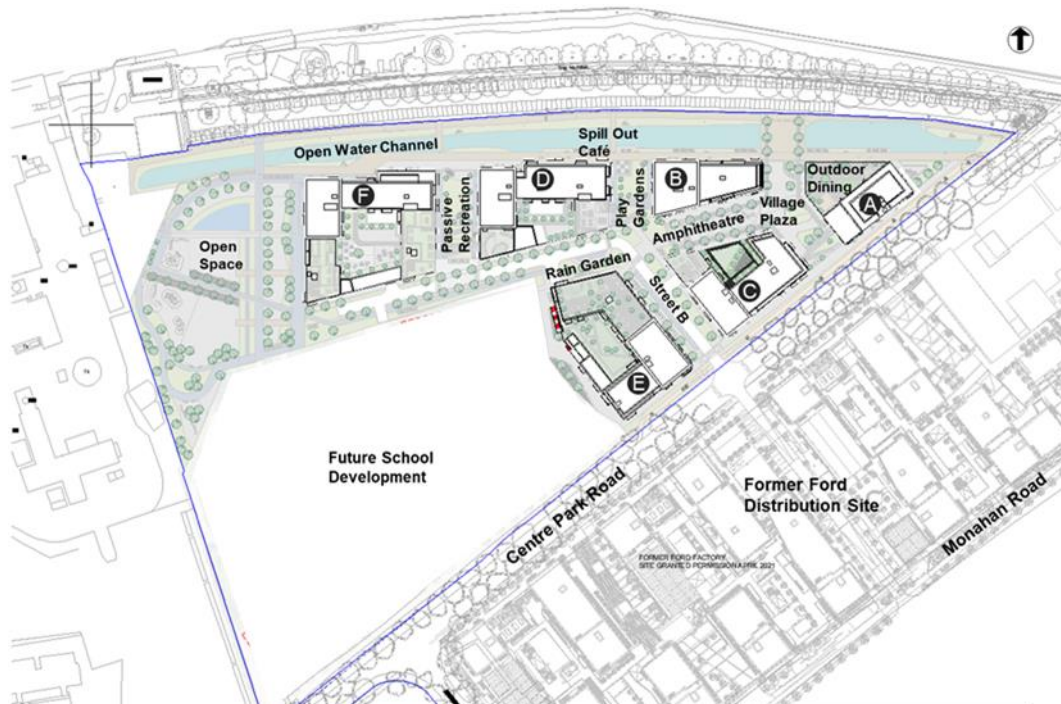


Figure 6: Proposed layout of the City Park development at former Tedcastles site

3.2.1 Block A

Block A is a 35-storey building that includes a restaurant, bar, retail and amenity spaces on the lower levels. There is a roof terrace on the second floor that includes outdoor seating areas. The apartments from floor 3 to 11 include recessed balconies, while winter gardens are provided in the apartments on the 12th floor and above. Terraces surround the top three floors of Block A.



Figure 7: Block A ground floor layout

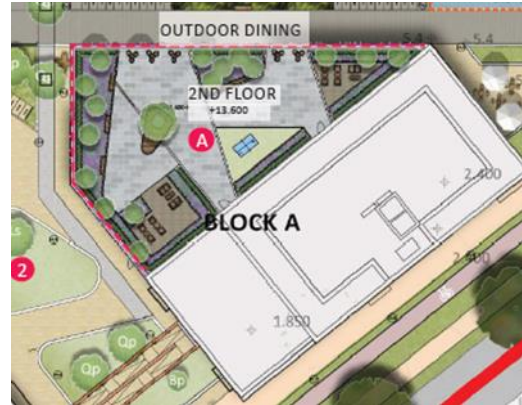


Figure 8: Block A 2nd floor roof terrace

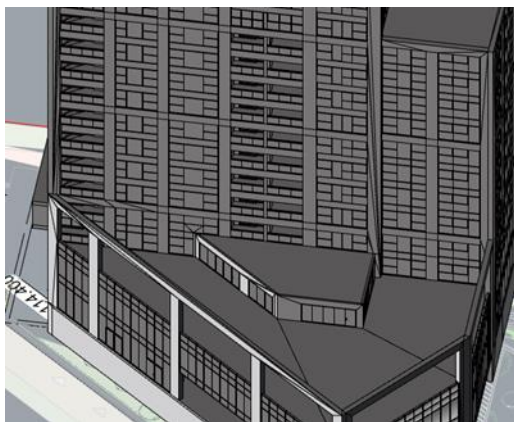


Figure 9: Block A recessed balconies

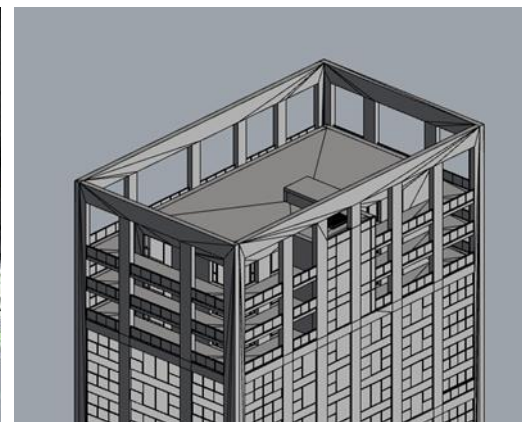


Figure 10: Block A top floor terraces

3.2.2 Block B

Block B is a 10-storey building that includes a café, bar, commercial and spaces at lower levels. Outstand balconies with solid balustrades offer private amenity space to apartment occupants.

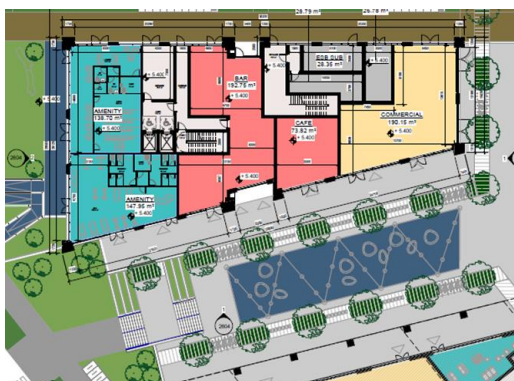


Figure 11: Block B ground floor layout

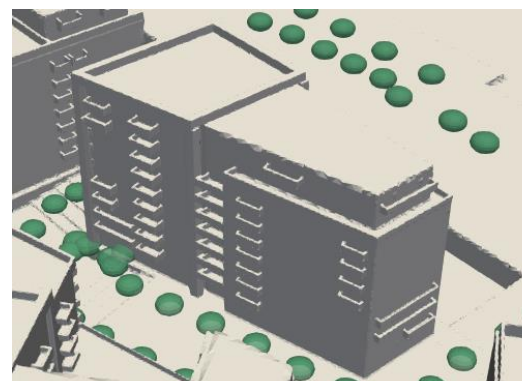


Figure 12: Isometric view of Block B

3.2.3 Block C

Block C is a 6-storey building that includes a neighbourhood centre, commercial and amenity spaces at lower levels. It contains a communal open space at podium level and north facing terrace at 5th floor level. Outstand balconies with solid balustrades offer private amenity space to apartment occupants.

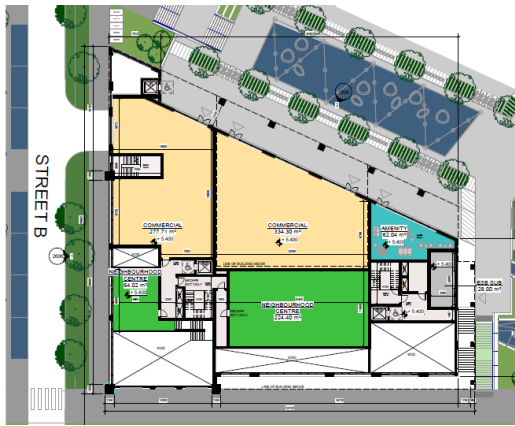


Figure 13: Block C ground floor layout

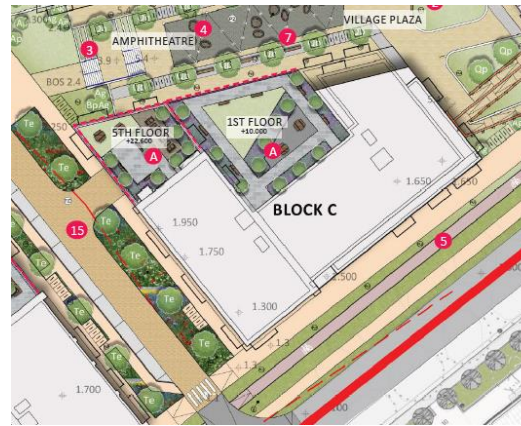


Figure 14: Block C communal open space and roof terrace

3.2.4 Block D

Block C is a 10-storey building that includes a creche, café, retail and amenity spaces at lower levels. It contains a communal open space at podium level and south facing terraces on the 8th floor. Outstand balconies with solid balustrades offer private amenity space to apartment occupants.

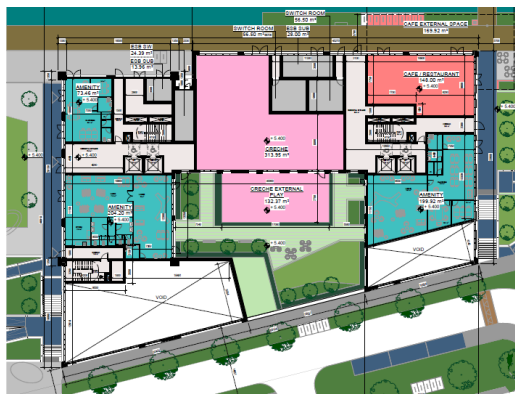


Figure 15: Block D ground floor layout

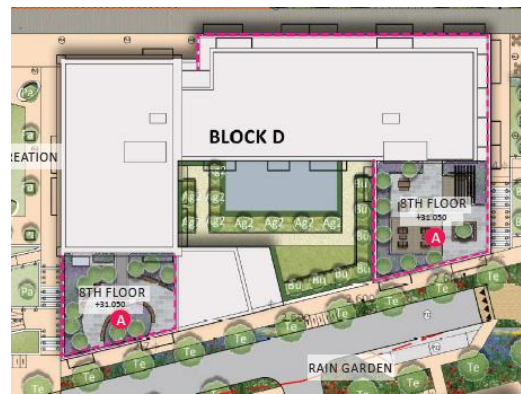


Figure 16: Block D communal open space and roof terraces

3.2.5 Block E

Block C is a 6-storey building that includes a neighbourhood centre, retail and amenity spaces at lower levels. It contains a communal open space at podium level and north facing terraces at 6th floor level. Outstand balconies with solid balustrades offer private amenity space to apartment occupants.



Figure 17: Block E ground floor layout



Figure 18: Block E communal open space and roof terrace

3.2.6 Block F

Block C is a 10-storey building that includes a creche and amenity spaces at lower levels. It contains a communal open space at podium level and south facing terraces at the 8th floor level. Outstand balconies with solid balustrades offer private amenity space to apartment occupants.

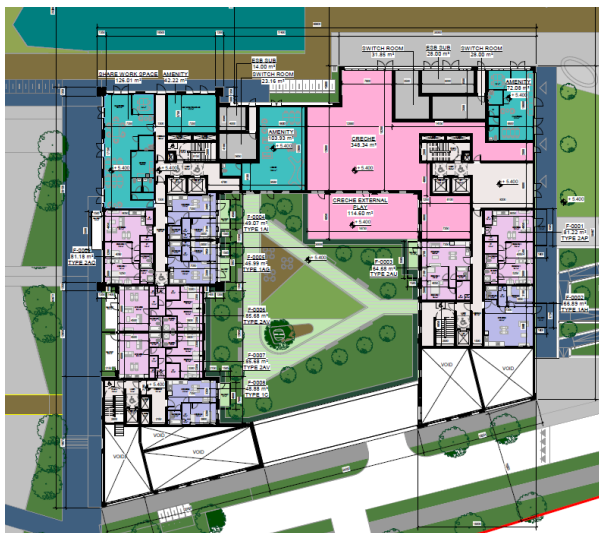


Figure 19: Block F ground floor layout

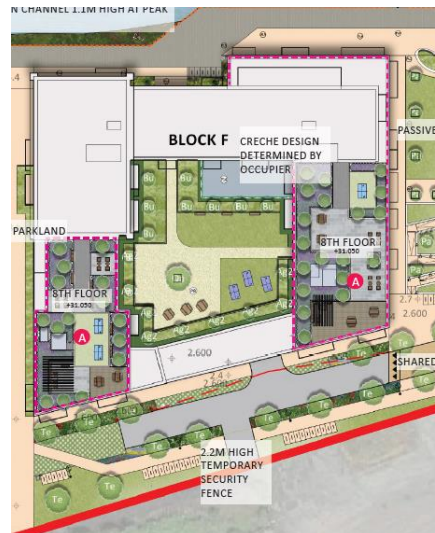


Figure 20: Block F communal open space and roof terraces

3.3 Wind Microclimate

Met Éireann’s meteorological station at Cork Airport is the closest meteorological station to Cork and to the site. The expected statistics for wind strength and direction are based on historic wind data recorded at this weather station. The meteorological data, which was associated with the hourly wind speeds recorded over a 20-year period between 2000 and 2020, was analysed. The data is recorded at a weather station at the airport.

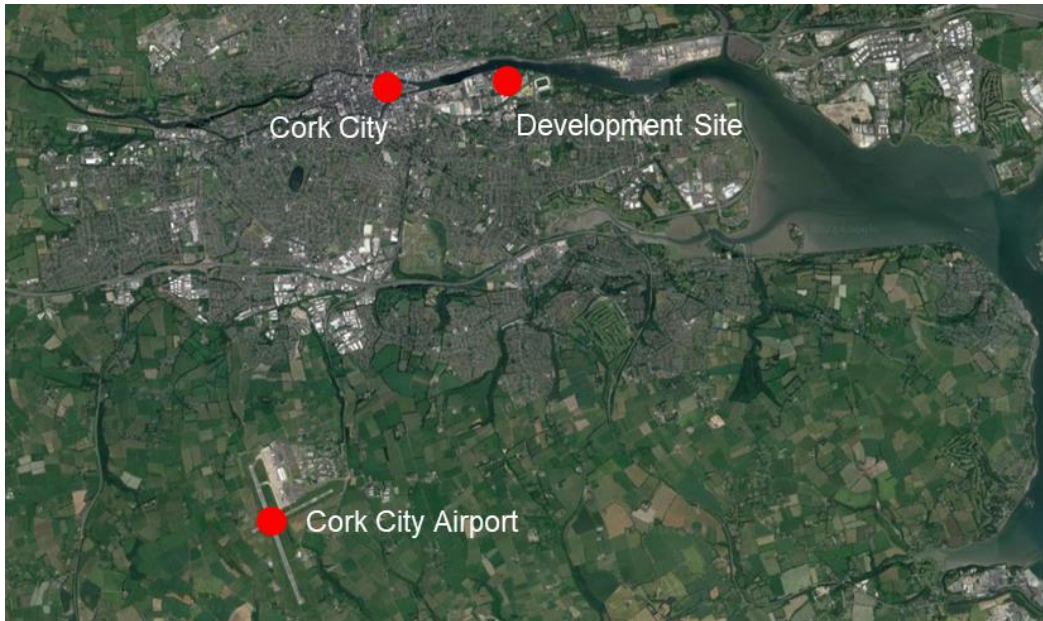


Figure 21: Location of closest weather station at Cork Airport

In this study, winds were considered to approach from twelve distinct sectors. A Weibull distribution was fitted to the wind data for each sector through the adoption of an appropriate dispersion parameter, *c*, and shape parameter, *k*. The 95th percentile and ‘once-a-year’ wind speeds were derived from cumulative Weibull distributions.

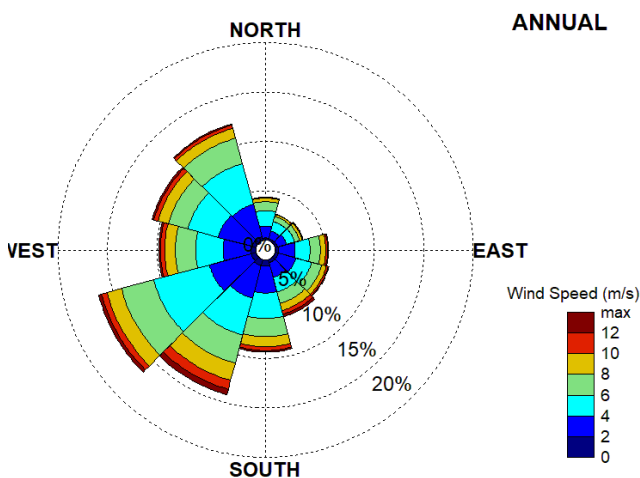


Figure 22: Cork Airport wind rose (2000-2020)

In order to account for differences in topography and terrain exposure, the local wind data from Cork Airport was transposed to the development site using the Eurocode standard EN 1991-1-4 and the ESDU (Engineering Sciences Data Unit) methodology, which is compatible with Irish practice for wind loading. The transformation considers the exposure of the site, which is a measure of the terrain roughness (i.e. size and number of obstacles) upstream of the site, and the site altitude. The exposure is dependent on the direction of the oncoming wind.

4 Proposed Development in Existing Surroundings (Baseline)

4.1 Overview

An analysis was undertaken to quantify the pedestrian comfort level at key locations in and around the development using computational fluid dynamics (CFD). The baseline study includes the proposed development in absence of landscaping and other mitigations that will be discussed in Section 5.

Overall, the proposed development provides a suitable environment for pedestrian circulation along the surrounding pedestrian routes. The spaces that surround Block A tend to be windy, as do the spaces in the gaps between Blocks B, D and F. This is mostly due to wind funnelling between the blocks.

The landscaping measures discussed in Section 5 are likely to dissipate some of the wind energy and improve the pedestrian wind environment.

4.2 Thoroughfares

The windier areas within the proposed development tend to coincide with thoroughfares and pedestrian activity is less impacted by the wind. The wind speed along the thoroughfares in and around the development are mostly in the ‘standing’ to ‘strolling’ range, as shown in Figure 23 below. These conditions are suitable for a thoroughfare, as shown in Figure 24 below.



Figure 23: Lawson wind speeds at key locations along thoroughfares (baseline)

Windiness occurs in the Village Plaza, the Play Gardens and the Passive Recreation space due to wind funnelling between the blocks. There is potential for more vulnerable pedestrians (i.e. children, the elderly, cyclists etc.) to find wind conditions distressing on occasion (i.e. approx. 10 hours a year). The provision of street furniture and soft landscaping features, such as trees, will be helpful in disrupting and dissipating the wind.

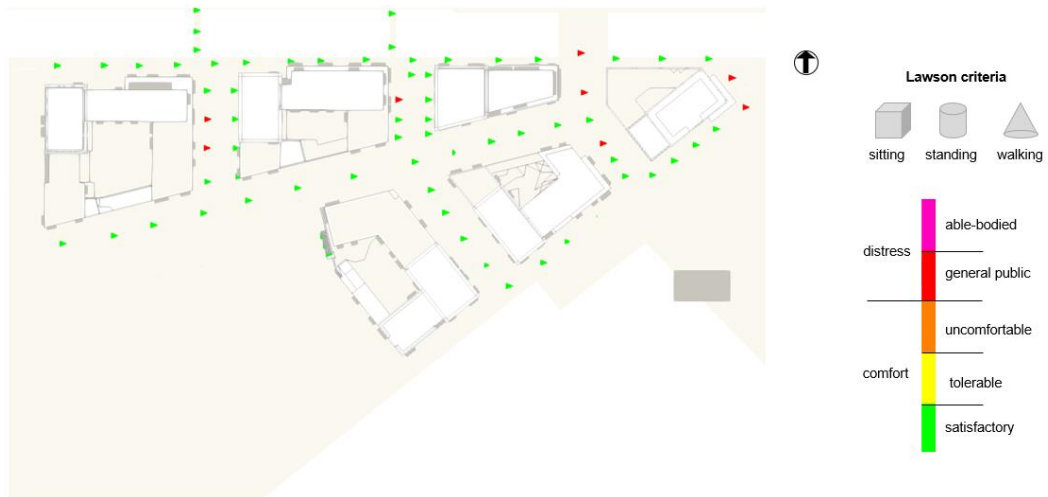


Figure 24: Lawson criteria at key locations along thoroughfares (baseline)

4.3 Public Spaces

The wind conditions in the Amphitheatre are expected to be in the ‘sitting’ to ‘standing’ range, as shown in Figures 25. It is anticipated that this will be a comfortable space for short to long-term ‘sitting’ activities.

The Village Plaza is subject to windiness due to wind funnelling between the surrounding blocks. The wind speeds are in and around the ‘standing’ range. These wind conditions are very common in Cork and are expected to be ‘comfortable’ for standing and short-term sitting, like bench seating use. There is an expectation to use these spaces in good-weather conditions, which would improve on the acceptability of the estimated windiness. The provision of street furniture and soft landscaping features, such as trees, will be helpful in disrupting and dissipating the wind.



Figure 25: Lawson wind speeds in seating areas (baseline)

The Café Spill Out space in the northwest corner of the Play Gardens is windy due to wind funnelling between the blocks. Wind conditions are expected in the

‘strolling’ range, which would be uncomfortable for long-term ‘sitting’ activities. The provision of robust landscaping or screens around this seating area is necessary to ensure this space is sheltered from the worst effects of the wind and suited to its intended use.



Figure 26: Lawson criteria in seating areas (baseline)

4.4 Block A

Block A has been carefully designed to reduce its impact on pedestrian wind comfort at ground level. It is beneficial to orient its narrow face into the prevailing wind (i.e. southwesterlies) as it invites wind to flow around the building more easily. This reduces downdraft and windiness at ground level.

4.4.1 Entrances



Figure 27: Lawson criteria at entrances (baseline)

The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances except the entrance to the retail unit at the northwest corner of the block, as shown in Figure 27.

Wind speeds at the northwest retail unit entrances are in the ‘strolling’ range and there is potential for more vulnerable pedestrians to find conditions distressing on occasion. The provision of screens or planters at these entrances would be beneficial helpful in providing local shelter to pedestrians accessing the retail unit.

4.4.2 Public open spaces

The seating area to the northeast of Block A is prone to windiness due to wind accelerating around the corner of the block. Wind speeds are anticipated in the ‘standing’ to ‘strolling’ range, which would be uncomfortable for long-term ‘sitting’ activities. The provision of robust landscaping or screens around this seating area is necessary to ensure this space is sheltered from the worst effects of the wind and suited to its intended use.

The second floor terrace is expected to be windy. Wind conditions in the ‘standing’ to ‘strolling’ range. It is due to wind funnelling between Blocks A and C interacting with the terrace. There is the potential for more vulnerable pedestrians to encounter distressing wind conditions on occasion. The provision higher balustrades may be helpful in alleviating the windiness on the terrace.

4.4.3 Balconies

The balconies are considered private spaces for the residents. The balconies between floors 3 and 11 are recessed with solid balustrades. The resulting wind conditions on these balconies are in the ‘sitting’ range, as shown in Figure 28. These conditions are ‘comfortable’ to ‘tolerable’ for sitting and, thus reasonable for the intended use, as shown in Figure 28 below.

The terraces on the top floors are exposed to high speed winds due to the height of the block. In spite of the solid balustrade that surrounds the terraces, the terraces are anticipated to be windy with winds in the ‘standing’ to ‘strolling’ range. It is expected that the lower two terraces will be windier as the wind squeezes between the floors. On occasion, it is expected that pedestrians may find wind conditions on these terraces distressing. The provision of a higher balustrade may be beneficial in reducing the windiness along these terraces.



Figure 28: Lawson criteria for balconies and terraces in Block A (baseline)

4.5 Block B

4.5.1 Entrances

The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances, as shown in Figure 27.

4.5.2 Balconies

Solid balustrades are provided at all the balconies. The resulting wind conditions on most balconies are in the ‘sitting’ to ‘standing’ range, as shown in Figure 29. These conditions are ‘comfortable’ to ‘tolerable’ for sitting and, thus reasonable for the intended use.

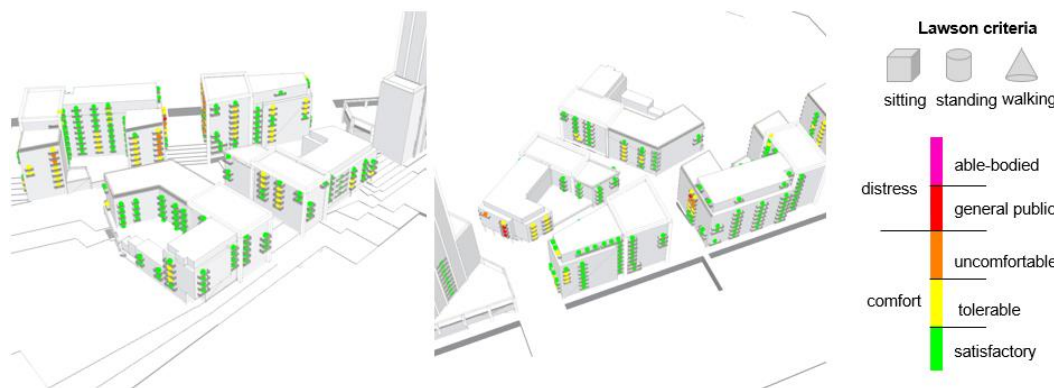


Figure 29: Lawson criteria for balconies and terraces in Block B, C, D and E (baseline)

4.6 Block C

4.6.1 Entrances

The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances, as shown in Figure 27.

4.6.2 Public open spaces

The communal open space at podium level is sheltered from the prevailing winds Block C itself. The wind speeds in the majority of the proposed outdoor seating areas are up to about 4m/s and are within the comfortable ‘sitting’ range.

The surrounding buildings offer shelter to the 5th floor roof terrace. The wind conditions in the ‘sitting’ to ‘standing’ range are expected and therefore, this space is appropriate for its intended use.

4.6.3 Balconies

Solid balustrades are provided at all the balconies. The resulting wind conditions on most balconies are in the ‘sitting’ to ‘standing’ range, as shown in Figure 29. These conditions are ‘comfortable’ to ‘tolerable’ for sitting and, thus reasonable for the intended use.

The balconies on the eastern façade facing the Village Plaza may encounter considerable windiness due to wind funnelling between Blocks A and C. Wind conditions on these balconies may be distressing at times and therefore, the provision of 1.8m tall screens on both sides of the balcony would be beneficial in ensuring these remain calm spaces for their occupants.

4.7 Block D

4.7.1 Entrances

The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances, as shown in Figure 27.

4.7.2 Public open spaces

The building surrounding the communal open space at podium level on three sides reduces the windiness in the space. The wind speeds in the majority of the space are in the ‘sitting’ to ‘standing’ range. These wind conditions are expected to be ‘comfortable’ for standing and short-term sitting, like bench seating use. There is an expectation to use these spaces in good-weather conditions, which would improve on the acceptability of the estimated windiness. The provision of landscaping features, such as trees, will be helpful in improving the amenity of the space.

The 8th floor roof terrace is more exposed to the wind. The wind conditions in the ‘sitting’ to ‘standing’ range are expected. The provision of higher balustrades in conjunction with landscape treatments on the roof will be helpful in reducing windiness on this terrace.

4.7.3 Balconies

Solid balustrades are provided at all the balconies. The resulting wind conditions on most balconies are in the ‘sitting’ to ‘standing’ range, as shown in Figure 29. These conditions are ‘comfortable’ to ‘tolerable’ for sitting and, thus reasonable for the intended use.

A few balconies on the eastern façade overlooking the Play Gardens may encounter considerable windiness due to wind funnelling between Blocks B and D. Wind conditions on these balconies may be distressing at times and therefore, the provision of 1.8m tall screens on both sides of the balcony would be beneficial in ensuring these remain calm spaces for their occupants.

4.8 Block E

4.8.1 Entrances

The wind conditions at the entrances of the proposed development meet the 'standing' limit for primary entrances, as shown in Figure 27.

4.8.2 Public open spaces

The building surrounding the communal open space at podium level on three sides limits the wind blowing through the space. The wind speeds in the majority of the space are in the 'sitting' range, which is suitable for its use.

The 6th floor roof terrace is more exposed to the wind. The wind conditions in the 'sitting' to 'strolling' range are expected with the higher wind speeds occurring near the northeast corner. The provision of higher balustrades in conjunction with landscape treatments on the roof will be helpful in reducing windiness on this terrace.

4.8.3 Balconies

Solid balustrades are provided at all the balconies. The resulting wind conditions on most balconies are in the 'sitting' to 'standing' range, as shown in Figure 29. These conditions are 'comfortable' to 'tolerable' for sitting and, thus reasonable for the intended use.

4.9 Block F

4.9.1 Entrances

The wind conditions at the entrances of the proposed development meet the 'standing' limit for primary entrances.

4.9.2 Public open spaces

The building surrounding the communal open space at podium level on three sides reduces the windiness in the space. The wind speeds in the majority of the space are in the 'sitting' range, which is suitable for its use.

The 8th floor roof terrace is more exposed to the wind. The wind conditions in the 'sitting' to 'standing' range are expected. The provision of higher balustrades in conjunction with landscape treatments on the roof will be helpful in reducing windiness on this terrace.

4.9.3 Balconies

Solid balustrades are provided at all the balconies. The resulting wind conditions on most balconies are in the 'sitting' to 'standing' range, as shown in Figure 30.

These conditions are ‘comfortable’ to ‘tolerable’ for sitting and, thus reasonable for the intended use.

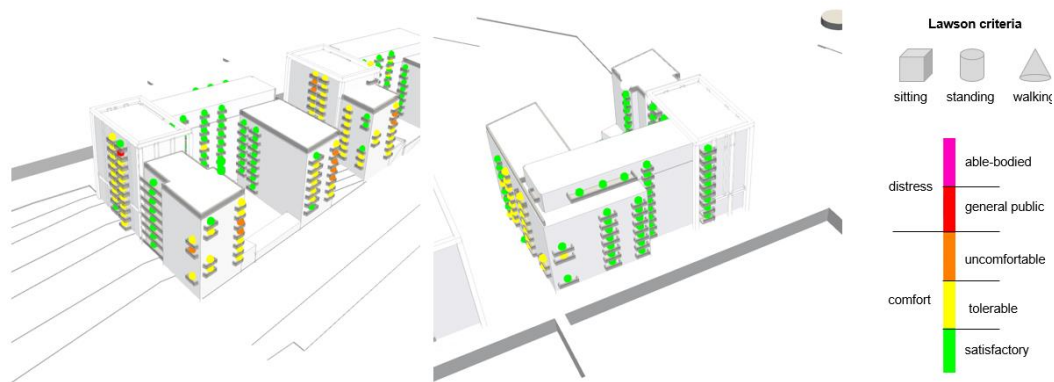


Figure 30: Lawson criteria for balconies and terraces in Block F (baseline)

5 Proposed Development in Existing Surroundings with Mitigations

5.1 Overview of the mitigation measures

This section considers the impact of mitigations on the wind conditions in and around the proposed development. The following mitigation measures are implemented in the design:

- Landscaping plan, shown in Figure 30, that proposes trees, high hedge and shrub planting (1.5m), together with retention of the existing trees.
- 1.8m high side screens on both sides on balconies prone to distress:
 - Eastern facade of Block C overlooking the Village Plaza;
 - Eastern façade of Block D overlooking the Play Gardens.
- 1.8m high balustrades on roof terraces:
 - 2nd floor communal open space in Block A;
 - Upper three terraces in Block A;
 - 8th floor roof terrace in Block C;
 - 6th floor roof terrace in Block D;
 - 8th floor roof terrace in Block F.

5.3 Public Spaces



Figure 33: Lawson criteria in seating areas (mitigation)

The Village Plaza is subject to similar levels of windiness with the provision of street furniture and soft landscaping features. The wind speeds are in and around the ‘standing’ range. There is an expectation to use these spaces in good-weather conditions, which would improve on the acceptability of the estimated windiness.

The provision of robust landscaping in the Play Gardens helps to alleviate the winds near the Café Spill Out space. Wind conditions are expected in the ‘standing’ range and are expected to be ‘comfortable’ for standing and short-term sitting. The expectation is that the space will be attractive in good-weather. The provision of more robust landscaping or screens around this seating area is necessary to ensure this space is sheltered all year round.

5.4 Block A

5.4.1 Entrances



Figure 34: Lawson criteria at entrances (mitigation)

Wind speeds remain similar at the northwest retail unit entrances with the provision of soft landscaping features in accordance with the design. The provision of screens or planters at these entrances would be beneficial helpful in providing local shelter to pedestrians accessing the retail unit.

5.4.2 Public open spaces

It is apparent that the consideration of the mature trees along Centre Park Road is beneficial in reducing the windiness at the northeast corner of Block A. However, the wind speeds still remain uncomfortable for long-term 'sitting' activities. The provision of robust landscaping or screens around this seating area is necessary to provide shelter and ensure the space is suited to its intended use.

The provision of a 1.8m high balustrade does not alleviate the windiness. The second floor terrace remains windy due to wind funnelling between Blocks A and C interacting with the terrace. It is apparent that a taller balustrade or local wind measures on the terrace are required to provide more shelter and make the space more comfortable for its intended use. A management strategy to prohibit access to the roof terrace during inclement weather (i.e. when the worst wind conditions are likely to occur) will ensure pedestrians are not exposed to distressing wind conditions.

5.4.3 Balconies

The terraces on the top floors continue to be exposed to high speed winds due to the height of the block. In spite of a higher solid balustrade that surrounds the terraces, the terraces remain windy. The provision of a taller balustrade or panels to segregate the terraces into smaller sections may be necessary to help to reduce the windiness along these terraces to more suitable levels. A management strategy to prohibit access to the roof terrace during inclement weather will avoid pedestrian exposure to distressing wind conditions.

5.5 Block C

5.5.1 Balconies

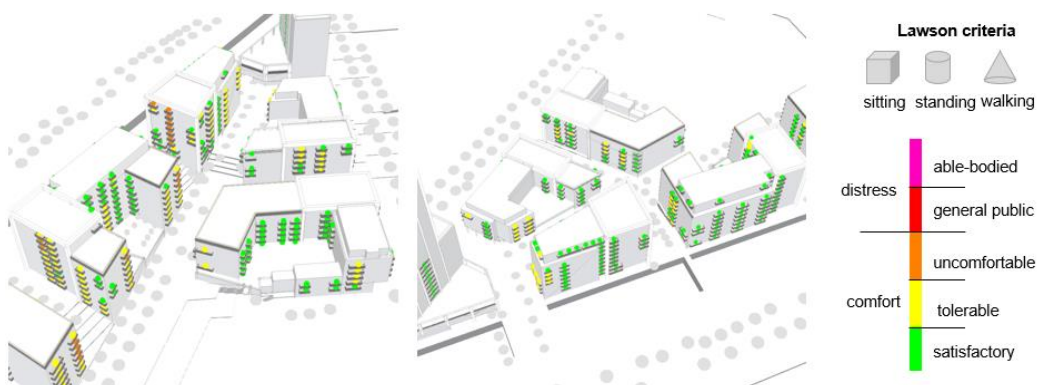


Figure 35: Lawson criteria for balconies and terraces in Block B, C, D and E (mitigation)

The provision of 1.8m tall screens on both sides of the balconies on the eastern façade facing the Village Plaza ensures these spaces remain calm and attractive spaces for their occupants.

5.6 Block D

5.6.1 Public open spaces

The provision of higher balustrades on the 8th floor terrace will reduce the windiness on this terrace. The wind conditions in the ‘sitting’ to ‘standing’ range are expected and therefore, the space is considered suitable for its intended use.

5.6.2 Balconies

The provision of 1.8m tall screens on both sides of the balconies on the eastern façade overlooking the Play Gardens ensures these spaces remain calm and attractive spaces for their occupants. The balconies are considered suitable for their intended use.

5.7 Block E

5.7.1 Public open spaces

The provision of higher balustrades reduces the exposure of the 6th floor terrace to the wind. It is anticipated that the wind conditions in the ‘sitting’ to ‘strolling’ range and suited to the intended use. The provision of landscaping on the terrace will further assist in making this an attractive space for occupants suitable for their intended use.

5.8 Block F

5.8.1 Public open spaces

The provision of higher balustrades on the 8th floor terrace will reduce the windiness on this terrace. The wind conditions in the ‘sitting’ to ‘standing’ range are expected and therefore, the space is considered suitable for its intended use.

6 Proposed Development in Future Surroundings and Mitigations

6.1 City Park Development

Future developments are proposed to the west and south of the Northern Site in the former Tedcastles and Ford Distribution sites. The proposed surrounding buildings are of similar height to Northern Site and will provide additional sheltering to the prevailing southwesterly and westerly winds.

The thoroughfares benefit the most for the additional shelter afforded by the future surroundings, while the wind conditions at entrances and public open spaces remains similar. In particular, the former Ford Site development obstructs the wind from the south. This reduces the windiness in the Village Plaza, although some residual windiness remains (fewer than 10 hours in a year).

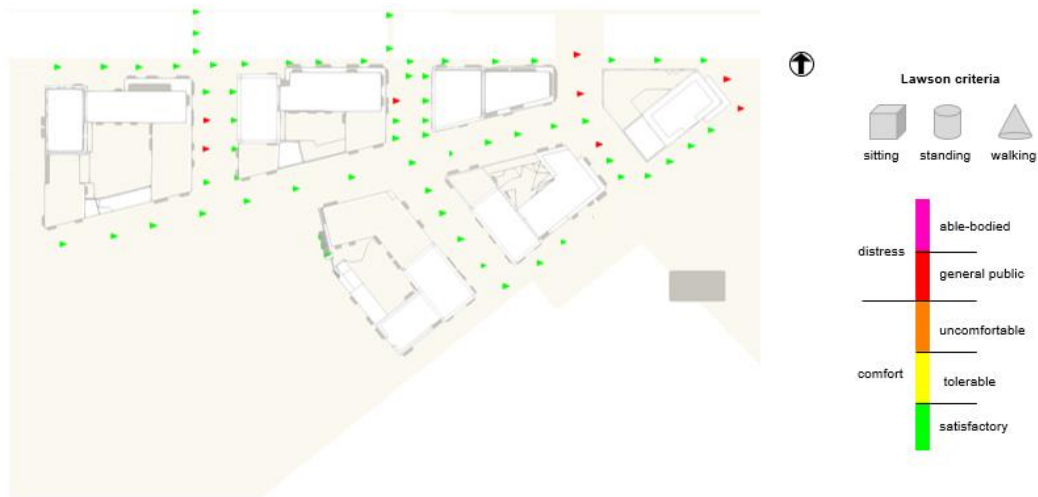


Figure 36: Lawson criteria at key locations along thoroughfares (baseline)

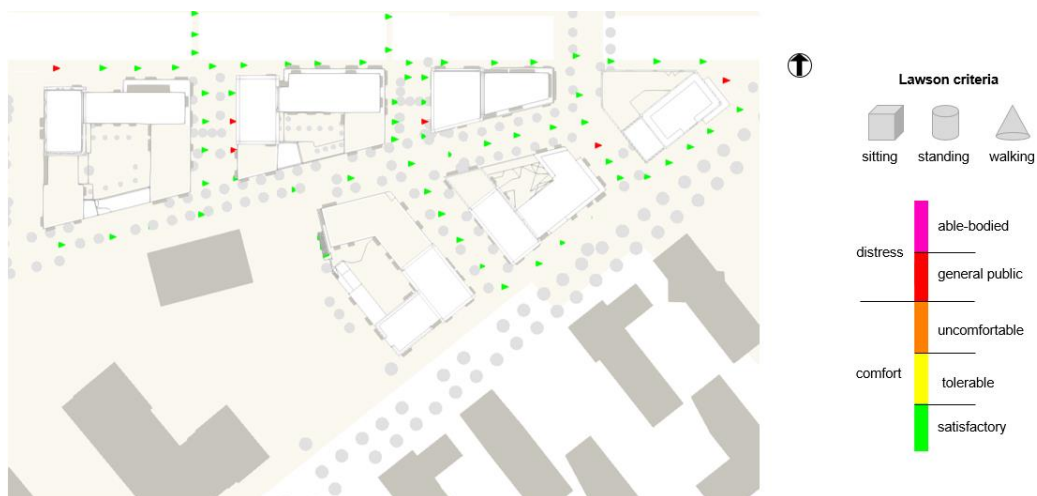


Figure 37: Lawson criteria at key locations along thoroughfares (future incl. mitigation)

6.2 Future School Development

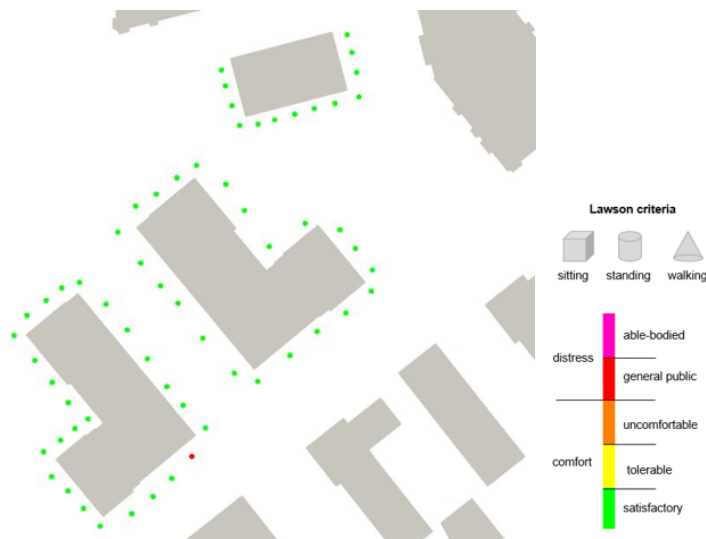


Figure 38: Lawson criteria at key locations around schools

The Future School Development is situated to the south of the proposed development and upwind from the perspective of the prevailing winds. The results shows that wind conditions in the vicinity of the Future School Development expected within ‘sitting’ to ‘standing’ range. More vulnerable pedestrians may find wind conditions distressing near building corners on occasion. However, these conditions arise due to exposure to prevailing winds and are not caused by any interaction with the proposed development site.

6.3 Former Ford Distribution Site

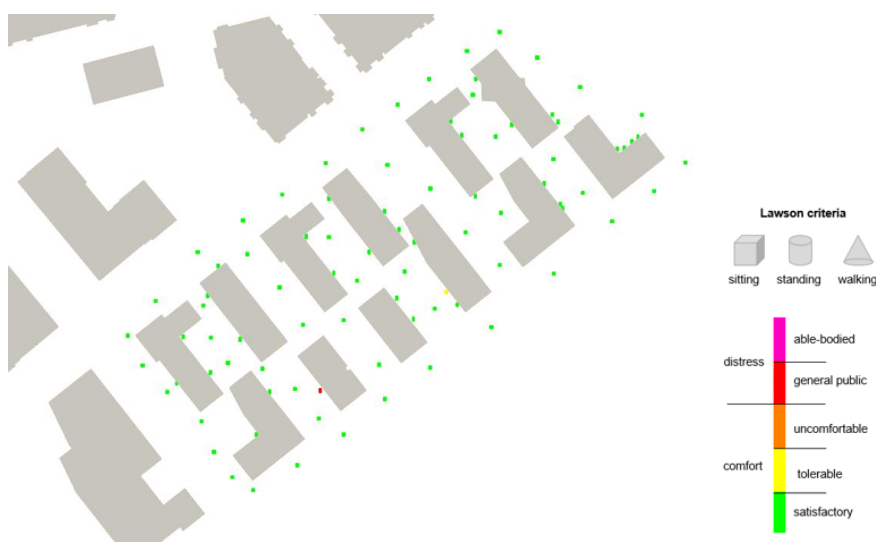


Figure 39: Lawson criteria at key locations around Former Ford Site

The results shows that the wind conditions in the public realm at ground level in Former Ford Distribution Site are expected to be within ‘sitting’ to ‘standing’ range. More vulnerable pedestrians may encounter small pockets of windiness they may find distressing on occasion. However, these conditions arise due to

exposure to prevailing winds and are not caused by any interaction with the proposed development site.

6.4 Former Cork Warehouse Site



Figure 40: Lawson criteria at key locations around Former Cork Warehouse Site

The results show that the Northern Site has no adverse impact on the public realm at ground and podium levels within the Former Cork Warehouse site. It is sheltered by the adjacent future surroundings. Wind conditions are expected to fall within the ‘sitting’ to ‘standing’ range. The future wind conditions in this development are expected to be suitable for its intended uses.

6.5 Block K – Masterplan

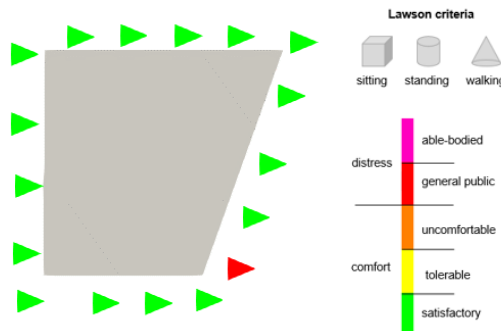


Figure 41: Lawson criteria at key locations around Block K Masterplan

The study shows that the wind conditions at Block K are expected to be within the ‘sitting’ to ‘standing’ range with only one exception. More vulnerable pedestrians may encounter windiness, which may be distressing on occasion, at the southeastern corner of the block. The windiness is due to high speed wind accelerating around the corner due to westerly winds and are not caused by any interaction with the proposed development site.

7 Conclusions

The conclusions of the Northern Site wind microclimate study are as follows:

- Overall, the proposed development is expected to provide a suitable environment for pedestrians and occupants to carry out a wide variety of ‘sitting’, ‘standing’ and ‘strolling’ activities.
- Wind mitigation measures have been adopted throughout the design to reduce the windiness across the site and to assist in keeping wind conditions within acceptable limits. Mitigations include landscaping, balcony screens and higher balustrades.
- Most thoroughfares in and around the development are expected to experience wind conditions that are suitable for their intended use.
- The provision of street furniture and soft landscaping features, such as trees, will be helpful in alleviating windiness along thoroughfares. However, some residual windiness remains in the Village Plaza and the Passive Recreation space.
- The Village Plaza and the Café Spill Out space is subject to similar levels of windiness with the provision of street furniture and soft landscaping features. There is an expectation to use these spaces in good-weather conditions.
- The wind conditions at the entrances of the proposed development meet the ‘standing’ limit for primary entrances except the northwestern retail unit in Block A. The provision of screens or planters at these entrances would be beneficial helpful in providing local shelter to pedestrians accessing the northwestern retail unit of Block A.
- Most of the public seating spaces experience wind conditions that are ‘comfortable’ for standing and short-term seating, like bench seating use. It is anticipated that these will be attractive spaces in good-weather conditions.
- It is apparent the mature trees along Centre Park Road are beneficial in reducing the windiness in the seating area at the northeast corner of Block A.
- The provision of more robust landscaping or screens around the seating areas in the Café Spill Out space and the seating area at the northeastern corner of Block A is necessary to ensure adequate shelter for ‘sitting’ all year round.
- The second floor terrace in Block A is windy due to wind funnelling between Blocks A and C. A taller balustrade or local wind measures on the terrace are required to provide more shelter and make the space more comfortable for its intended use.
- The terraces on the top floors are exposed to high speed winds due to the height of the block. The provision of taller balustrades or panels to segregate terraces into smaller sections may help reduce windiness to more suitable levels.
- The implementation of a management strategy to prohibit access the second floor and top floor terraces in Block A during adverse weather events will prevent pedestrian exposure to distressing wind conditions.

- The provision of higher balustrades on the 6th floor terrace of Block E and the 8th floor terraces on Blocks D and F will reduce the windiness on these terraces.
- The provision of 1.8m tall screens on both sides of the balconies on the eastern façade of Block C facing the Village Plaza and Block D overlooking the Play Gardens ensures these spaces remain calm and attractive spaces for their occupants.
- The introduction of the future permitted and planned developments, which includes the former Cork Warehouse Site, the former Ford Distribution Site and the future school development, is expected to be beneficial in improving wind conditions along thoroughfares.

8 References

- [1] Lawson, TV, 2001, 'Building Aerodynamics', Imperial College Press, London.