

Chapter 12:

Wind

12.0 Wind

12.1 INTRODUCTION

This chapter of the EIAR assesses the impact of the Glencairn residential development on the wind conditions affecting activities in areas within and surrounding the development. This report describes the methods used to assess these impacts in terms of pedestrian comfort and safety.

The presence of taller buildings among lower buildings provides the potential for windiness in surrounding areas. The windiness depends on both the massing of the buildings within their surroundings, their orientation with respect to the wind, and the local climate.

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The study is based on drawings and computer-generated imagery provided by O’Mahony Pike Architects, an evaluation of aerial views of the site, local climate conditions, the landscape design by Brady Shipman Martin and Arup’s previous extensive experience of wind studies around buildings.

12.2 STUDY METHODOLOGY

The criteria used to describe windiness in this study are those of T.V. Lawson of Bristol University, extracted from “The evaluation of the windiness of a building complex before construction”, T.V. Lawson, London Docklands Development Corporation. These are used widely in Ireland, UK and around the world. Even without wind tunnel testing, these criteria are useful to define windiness in terms of acceptability for particular activities.

Table 12.1: Comfort Criteria as Defined by T.V. Lawson

Activity	Description
Sitting	Regular use for reading a newspaper and eating and drinking
Standing	Appropriate for bus stops, window shopping, building entrances, and public amenity spaces such as parks
Strolling	General areas of walking and sightseeing
Business walking	Local areas around tall buildings where people are not expected to linger

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.

The acceptability of windy conditions is subjective and depends on a number of other factors, which are not mentioned below such as windiness of the general environment, 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 12.1. This study is qualitative as is normal for relatively low-rise buildings. Further investigations should normally be carried out to quantify windiness when it is considered probable that the distress criteria would be exceeded in areas intended for everyday access or if wind comfort issues that are identified in a desk study prove difficult to resolve.

12.2.1 Comfort Levels

The onset of discomfort depends on the activity in which the individual is engaged. The conditions described below 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. In the following assessment, the words 'sitting', 'standing', 'strolling' and 'business walking' are used to describe comfort levels of windiness as described in Table 12.1.

12.2.2 Distress Levels

The comfort criteria above describe more frequent wind conditions. There is also a distress criterion (Table 12.2) for 'General Public Access', equivalent to a 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.

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 (83 mph) 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, and some types of vehicles may also be vulnerable to resulting crosswinds.

Table 12.2: Distress Criteria as Defined by T.V. Lawson

Activity	Description
General Public Access	Above which the less able and cyclists may at times find conditions physically difficult
Able-bodied Access	Above which it may become impossible at times for an able bodied person to remain standing

12.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

12.3.1 Wind Climate

Met Éireann's meteorological station at Dublin Airport is the closest meteorological station to Dublin and to the site. The expected statistics for wind strength and direction are based on historic wind data recorded at this weather station. The most common and strongest winds in Dublin come from the southwest and west. These are relatively warm and often bring rain. The winds from the east are not as common as the westerlies, however, they are relatively cold, which can make them as annoying as the stronger westerlies.

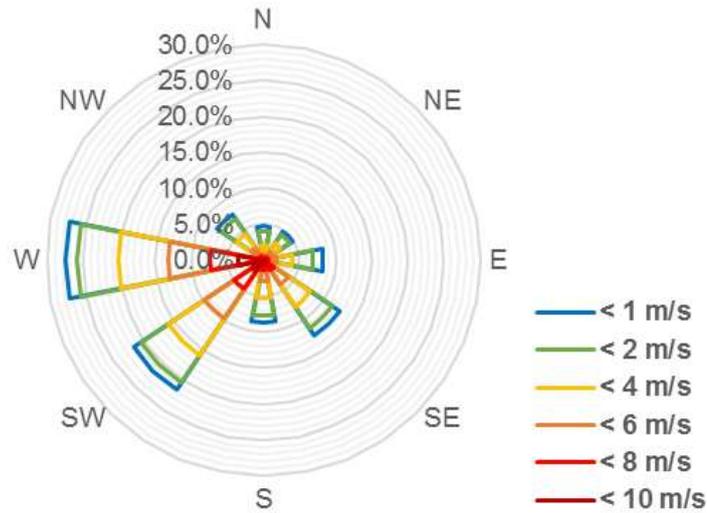


Figure 12.1: Dublin Airport Wind Rose

12.3.2 Receiving Environment

The existing site is located within the curtilage of Glencairn House. It is situated in the foothills of the Dublin / Wicklow mountains on the southern edge of suburban Dublin. Existing sites nearby, such as Sandyford Industrial Estate and Carrickmines retail park are known to be windy.



Figure 12.2: Existing Glencairn Residential Development Site (Source: Google Maps)

The Wicklow mountains (Figure 12.3 and 12.4) to the south of Dublin influence the wind microclimate in the vicinity of Dublin. The local data from Dublin Airport was transposed to the development site using the ESDU (Engineering Sciences Data Unit) methodology, which is compatible with Irish practice for wind loading.

The Wicklow Mountains tend to shelter the city from southerly winds. Given the location of the site, the more usual southwesterly winds are likely to manifest as west or northwest winds, but possibly slightly lighter as the development is in the lee of the mountains. They are also likely to produce more frequent southeasterly winds which are uncommon in other parts of the country. Southwesterly winds may also present as southerly winds.



Fig 12.3: Wicklow Mountains



Fig 12.4: South Dublin / North Wicklow

A conservative approach has been adopted in considering the influence of the mountains on the local wind microclimate. It is assumed that the prevailing west southwesterly winds are more likely to occur as northwesterly winds, while southerly winds might appear as southeasterly winds. In this study, the wind speeds from the northwest and southeast have been increased to account for the influence of the mountains, however, no reduction in speed has been applied to southerly and southwesterly winds that might benefit from shelter from the mountains. The wind roses of the 95th percentile or ‘5% of the time’ winds at 1.5m and 10m above ground level on the proposed development site are presented in Figures 12.5 and 12.6.

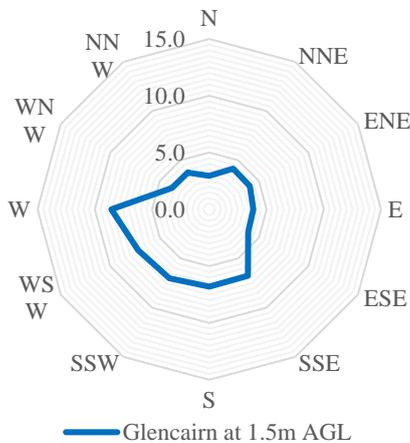


Figure 12.5: 95th Percentile Assessed Wind Speed [m/s] at 1.5m AGL

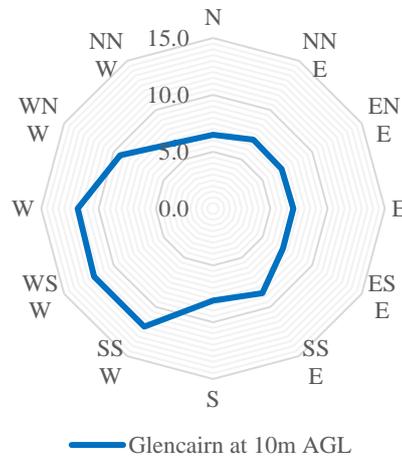


Figure 12.6: 9th Percentile Assessed Wind Speed [m/s] at 10m AGL

Examination of the wind roses above reveals that the existing site is frequently exposed to stiff breezes (i.e. ~6m/s from the northwest and southeast) close to ground level. Swathes of mature trees along the northern and western boundaries of the site help provide shelter from the wind. The wind effects on the existing conditions are predominantly expected to be in the ‘strolling’ range.

12.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

Glencairn residential development is located within the curtilage of Glencairn House. Glencairn House and associated buildings / structures are identified as a protected structure on the Record of Protected Structures

referred to as downdrafting. The building heights range from 2 storeys to 5 storeys across the Glencairn residential development site.

12.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

12.5.1 Construction Phase

The potential effects on wind microclimate at the site during the construction phase have not been assessed as they depend on the phasing of the development.

Depending on the order of the development, windiness may be greater than in the final condition. If it is the intention for parts of the development to become operational before construction is completed, then temporary mitigation may be needed or desirable to achieve safe access. It is appropriate, however, to seek guidance on this as the detailed phasing is known.

12.5.2 Operational Phase

The retention of the existing mature trees and landscaping is beneficial in sheltering the development from the wind. The mature trees are a similar scale to the residential units and apartments, which is beneficial in terms of the provision of effective shelter from the wind. The dense vegetation to the north provides shelter to a large proportion of the development, including the apartment blocks. The existing residential development to the east and the south roughens the upstream fetch and reduces the exposure of the development to easterly and southerly winds. It is not anticipated that the proposed development will significantly exacerbate the existing wind conditions across the site. Local increases in wind speed will occur near corners of the more exposed buildings. It is recommended that pedestrians should be guided away from these areas and the soft landscaping should be provided at the corners of buildings to provide localised shelter from the wind. Where high speeds winds are likely to coincide with balconies, consideration should be given to re-entrant balconies or the provision of adequate screening.

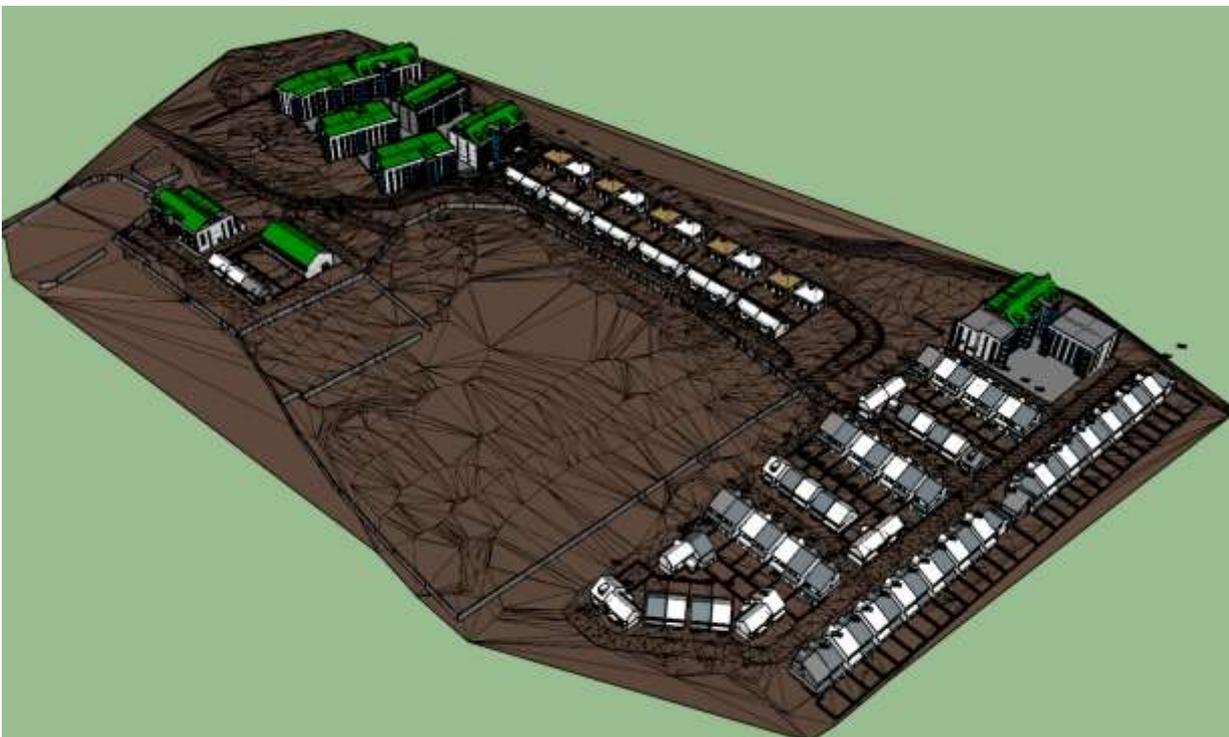


Fig 12.8: Proposed Development at Glencairn

12.5.3 Effects of Northwesterly Winds

The western blocks are likely exposed to northwesterly winds running along the M50. The continuous nature of the westernmost block will help shelter the other blocks further downstream. It is likely that the wind will be directed around the block and there is potential for high speed winds to form at either end of the westernmost block. Without any mitigation, it is anticipated that the wind speeds at these corners would be in the 'business walking' range. On occasion, pedestrians may find the wind speeds distressing. The lawn areas on either side of the block are identified as amenity spaces and therefore, they would not be considered suitable for their intended use. The landscape design includes the provision of soft landscaping along the Luas boundary. This vegetation will be helpful in providing more localised shelter for pedestrians in these areas. It should be noted that the likelihood of pedestrians encountering these higher speed winds are reduced as there are no entrances, accesses or walkways on the western side of the block. In addition, the woodland trails as planned in the landscape design do guide pedestrians away from this corner.

The westernmost balconies are fully exposed to northwesterly winds running along the M50. The provision of winter gardens on this face will protect occupants from exposure to frequent moderate to strong winds. It enables occupants to make the most of the amenity of this space. It is likely that the balconies at either end of the westernmost blocks will be exposed to transverse winds and the provision of screens on either side of these outstand balconies will help shelter occupants from these winds.

It is envisaged that the residential housing in the centre of the development will be relatively well sheltered from the wind. The eastern side of the development is more exposed to the wind. The level of windiness experienced will be typical of most suburban residential housing developments in Dublin. In general, it is anticipated that the wind speeds will be suitable for 'standing' and it is possible that 'sitting', is achievable in some areas with suitable low level planting.



Fig 12.9: Northwesterly Wind Effects at Glencairn

12.5.4 Effects of Westerly Winds

The western blocks are likely exposed to westerly winds running along the M50. The continuous nature of the westernmost block will help shelter the other blocks further downstream. It is likely that the wind will be directed around the block and there is potential for high speed winds to form at the downstream end of the westernmost block. Without any mitigation, it is anticipated that the wind speeds at these corners would be in the 'business walking' range. On occasion, pedestrians may find the wind speeds distressing. It is envisaged that lawn areas around the blocks will be used as amenity space and therefore, it would be unsuited to its intended without any wind mitigation in place. The landscape design includes the provision of vegetation along the Luas boundary at the end of this block. This soft landscaping should help provide more localised shelter for pedestrians in these areas. It should be noted that the likelihood of pedestrians encountering these higher speed winds are reduced as there are no entrances, accesses or walkways on the western side of the block. In addition, the woodland trails as planned in the landscape design do guide pedestrians away from this corner.

In addition, it is envisaged that there will be funnelling of wind between the western blocks. The speed-up is predicted to occur at the southern end of the courtyards. It is anticipated that the wind speeds at these corners will be in the range suitable for 'business walking'. Careful consideration should be given to the configuration of the courtyards to ensure that pedestrians are protected for these winds.

The southern blocks and the associated car park to the south are exposed to the westerly winds. It is anticipated that the higher speed winds will occur near the eastern corner of the southernmost block. . Without any mitigation, it is anticipated that the wind speeds at these corners would be in the 'business walking' range. On occasion, pedestrians may find the wind speeds distressing. It is beneficial that the crèche facilities can be accessed from the northside of the block. It is only occupants of the apartments that are likely to use the car parking. It is recommended that the pedestrian walkway is re-aligned away from the corner or curtailed to guide pedestrians away from these higher speed winds. In addition, soft landscaping should be provided to offer localised shelter from the wind.

The Lime Avenue should act as a wind break depending on extent of growth. If the lime trees are trimmed extensively, they will not provide much shelter. It is anticipated that the easternmost apartment block will be exposed to westerly winds at ground level. It is likely that high speed winds could form near the corners of these blocks. Without any mitigation, it is anticipated that the wind speeds at these corners would be in the 'business walking' range. On occasion, pedestrians may find the wind speeds distressing. It recommended that pedestrians should be guided away from these areas and the soft landscaping should be provided at the corners of buildings to provide localised shelter from the wind.

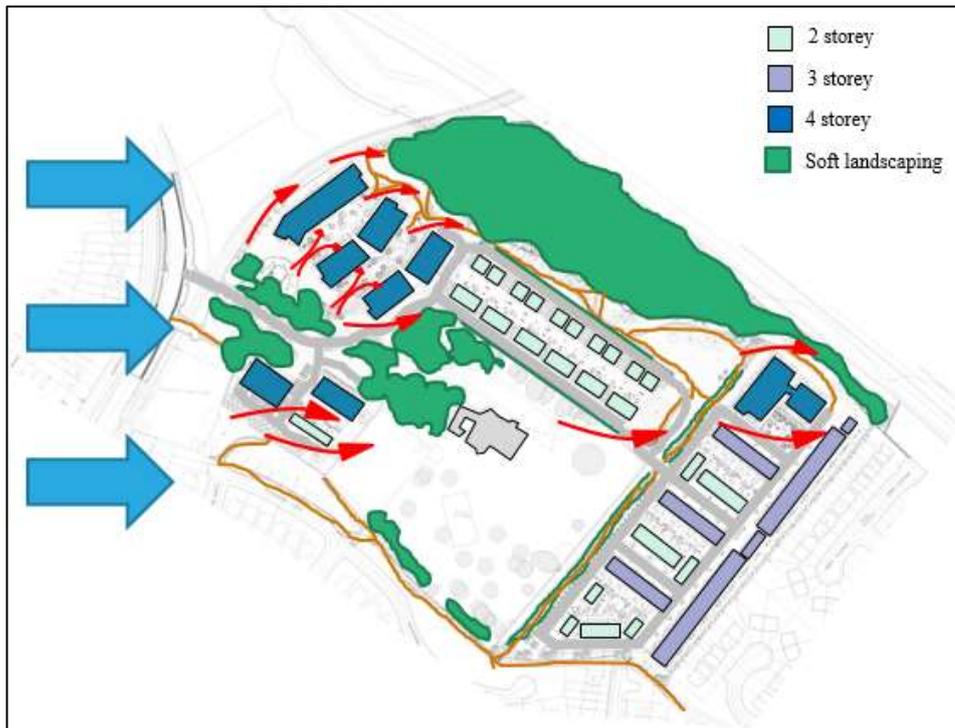


Fig 12.10: Westerly Wind Effects at Glencairn

Elsewhere, it is envisaged that the housing in the centre of the development will be relatively well protected from the wind. The housing to the east is more open. The level of windiness experienced will be typical of most suburban residential housing developments in Dublin. In general, it is anticipated that the wind speeds will be suitable for 'standing' and it is possible that 'sitting', is achievable in some areas with suitable low level planting.

It is likely that outstand balconies near the upstream corners of the eastern apartment blocks are also likely to encounter similar high speed wind conditions. It is anticipated that these balconies would not be suited for their intended use without any mitigation. The provision of screens on either side of these balconies will help shelter occupants from these winds.

12.5.5 Effects of Southerly Wind

It is envisaged that there will be funnelling of wind between the western blocks. The speed-up is predicted to occur at the southern end of the courtyards. It is anticipated that the wind speeds at these corners will be in the range suitable for 'business walking'. Careful consideration should be given to the configuration of the courtyards to ensure that pedestrians are protected for these winds.

The apartment blocks nearest the Glencairn Luas stop, at the southern end of the site, have limited shelter from southwesterly winds. It is envisaged that there will be funnelling of wind between these blocks. It is anticipated that the wind speeds in these areas may be distressing for pedestrians. It is recommended that pedestrians should be guided away from these areas and the soft landscaping should be provided at the corners of buildings to provide localised shelter from the wind.

It is likely that high speed winds could form near the corners of the easternmost block. It is anticipated that the wind speeds at these corners would be in the 'business walking' range. On occasion, pedestrians may find the wind speeds distressing. It is recommended that pedestrians should be guided away from these areas and the soft landscaping should be provided at the corners of buildings to provide localised shelter from the wind.



Fig 12.11: Southwesterly Wind Effects at Glencairn

Elsewhere, it is envisaged that the housing in the centre of the development will be relatively well protected from the wind. The housing to the east is more open. The level of windiness experienced will be typical of most suburban residential housing developments in Dublin. In general, it is anticipated that the wind speeds will be suitable for ‘standing’ and it is possible that ‘sitting’, is achievable in some areas with suitable low level planting.

It is likely that balconies at the southern corners of the southern and eastern apartment blocks will encounter high speed wind conditions. It is anticipated that these balconies would not be suited for their intended use without any mitigation. The provision of screens on either side of these balconies will help shelter occupants from these winds.

12.5.6 Winds from Other Directions

It is expected that the Wicklow Mountains will provide reasonable shelter to the proposed development from winds from the south. The mature woodland that will be retained within the development helps shelter the proposed development from the northerly and easterly wind. For all these wind directions, it is anticipated that there is risk of higher speed winds occurring at a high level near the corners of apartment blocks. The provision of wind screens on both sides of outstand balconies situated near the corners of apartment blocks will help shelter occupants from these winds.

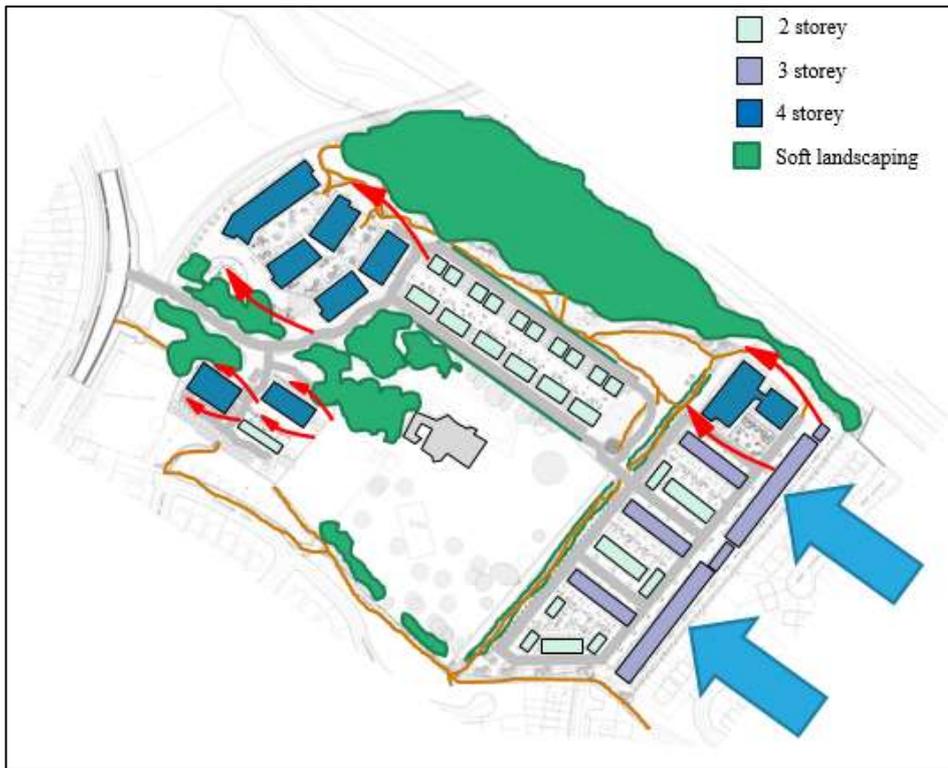


Fig 12.12: Southeasterly Wind Effects at Glencairn

12.6 POTENTIAL CUMULATIVE IMPACTS

The proposed development consists of relatively low level buildings ranging between 2 storeys and 5 storeys in height. Much of the surrounding area has been developed as low level residential housing. The provision of these buildings will slightly increase the overall roughness of the terrain. The increased roughness may act to reduce wind speeds closer to the ground. This may have a slight beneficial influence on the wind conditions on the adjacent sites further downstream depending on the wind direction. Future developments in the lands northwest of the proposed development would likely further assist in sheltering this development from the wind, if it is developed to a similar height and scale.

12.7 'DO NOTHING' IMPACT

In the 'Do Nothing' scenario, a large proportion of the proposed development will be sheltered from the wind due to the retention of the existing trees and woodland. However, it is anticipated that there will be areas within the proposed development where high speed winds will occur, such as at the corners of exposed blocks or at either end of the westernmost block. Higher speed winds are likely to occur at the following locations:

- At the southern end of the courtyards of the westernmost blocks;
- In the gap between the southernmost blocks;
- Near the corners of apartment blocks;
- Outstand balconies near the corner of apartment blocks;
- Outstand balconies at either end of the westernmost blocks.

Otherwise, the level of windiness experienced will be typical of most suburban residential housing developments in Dublin. In general, it is anticipated that the wind speeds will be suitable for 'standing'.

12.8 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

Design stage mitigation measures which have been incorporated into the scheme in order to improve the wind conditions at the Glencairn site include the following:

- The provision of suitable landscaping between the Luas line and the westernmost block;
- Suitable landscape treatments and careful configuration of the courtyards between the westernmost blocks;
- The provision of landscaping or wind screening along the boundary near the southernmost block;
- Re-alignment or curtailment of pedestrian walkway at the eastern corner of the southernmost blocks;
- The inclusion of additional landscaping near the Lime Avenue to act as an effective wind break on the approach to the easternmost block;
- Where high wind speeds at the corners of a building are unavoidable, the provision of substantial planting or windbreaks is provided for to reduce their impact. In addition, consideration has been given to redirecting walkways, where appropriate;
- Use landscape techniques to maintain ground roughness in any open parts of the site, and to provide local wind shelter for buildings and open spaces; earth mounding, trees, bushes, fences and open or porous walls can all contribute. Mature trees with open space around their trunks may need extra, low-level planting to avoid channelling wind at ground level. The mature clumps of trees around the edge of the site will also be beneficial at sheltering the development from the wind;
- While winter gardens and recessed balconies are most effective at sheltering occupants from the wind, the provision of 1.8m high pervious wind screens or shielding on balcony sides will provide shelter against the wind and, in particular, where balconies are situated near building corners.

12.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

A qualitative desk study of the Glencairn residential development was carried out to help assess the windiness in and around the development in terms of suitability for pedestrian activities. Given the open exposure of the site and the general windiness in Dublin the conditions throughout the development are expected to be windy. The acceptability for intended activities throughout the scheme is summarised below:

- A large portion existing site is relatively sheltered. The wind speeds are expected to be acceptable for the intended use of the area;
- High speed winds are anticipated near corners of exposed buildings.
- Without the provision of suitable landscaping between the Luas line and the westernmost block, high speed winds are anticipated between the westernmost block and the mature vegetation;
- With suitable landscaping and careful configuration of the courtyards between the westernmost blocks, it should be possible to provide a calm and sheltered environment suitable for its intended use;

- The wind conditions along the pedestrian pathways are expected to be similar to the existing site conditions and therefore, in the 'strolling' to 'business walking' ranges depending on the wind direction. These conditions are acceptable for pedestrian walk through;
- Balconies with adequate wind shielding are anticipated to be in 'sitting' or 'standing' range, which should provide occupants with an attractive living space in the summer.

12.10 MONITORING

The building heights are relatively low level ranging from 2 storeys to 5 storeys across the Glencairn residential development site. It is anticipated that the development will be constructed using conventional methods. It is recommended that the local weather conditions should be reviewed routinely, particularly for construction works carried out at a height. It is not considered necessary to undertake any formal wind speed and direction monitoring on site during the construction or operational phases.

12.11 REINSTATEMENT

There is no reinstatement required in accordance with this study.

12.12 INTERACTIONS

The proposed landscape design has been considered in this study.

12.13 REFERENCES

Lawson, TV, 1990. *The evaluation of the windiness of a building complex before construction*. London Docklands Development Corporation / Department of aerospace engineering, University of Bristol report Number TVL 9025.

Lawson, TV, 2001. *Building aerodynamics*. Imperial College Press, London, UK

Met Éireann, 2018. www.meteireann.ie visited on 23rd July 2018