

11.0 WIND

11.1 INTRODUCTION

This report assesses the impact of the Phase 2 Clay Farm residential development, Ballyogan Road, Dublin 18, on the wind conditions affecting activities in areas within and surrounding the development. Other microclimate issues such as temperature and moisture are not considered to be significantly affected by 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.

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.

11.2 STUDY METHODOLOGY

The following methodology of T.V. Lawson of Bristol University has been widely used for the wind tunnel investigation of windiness around buildings in London and around the world. It compares well with other international guidance. Although no wind tunnel or computational fluid dynamics (CFD) study has been carried out in this instance, the descriptions of the degree of windiness have been found to be helpful in making desk study conclusions.

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.

In general, the acceptability criteria are for both comfort and safety; the first, discomfort criteria, relates to the activity of the individual and the second, distress criteria, relates to their physical well-being. Acceptable discomfort and distress criteria for different kinds of use are described in section 1.2.1 and 1.2.2. Further investigations should normally be carried out to quantify windiness when it is considered probable that the distress criteria would be exceeded or if wind comfort issues that are identified in a desk study prove difficult to resolve.

11.2.1 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 1.

11.2.2 Distress levels

There is a criterion to define the onset of distress. For the 'General Public', this is 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. 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.

Table 11.1 : Comfort Criteria

Activity	Description
Sitting	Long-term stationary activities: <ul style="list-style-type: none"> - Reading a book / newspaper - Sitting in a coffee shop - Picnic in the park
Standing	Short-term stationary activities: <ul style="list-style-type: none"> - Waiting at a bus stop - Standing at a building entrance
Strolling	Relaxed travel: <ul style="list-style-type: none"> - Leisurely stroll - Sightseeing - Window shopping
Business walking	Necessary travel: <ul style="list-style-type: none"> - Walking between origin and destination - Cycling

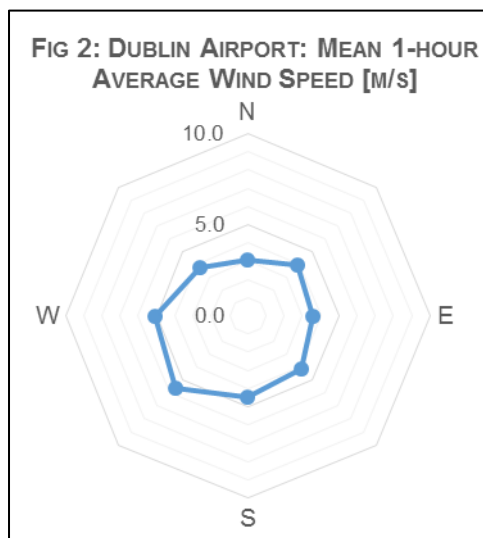
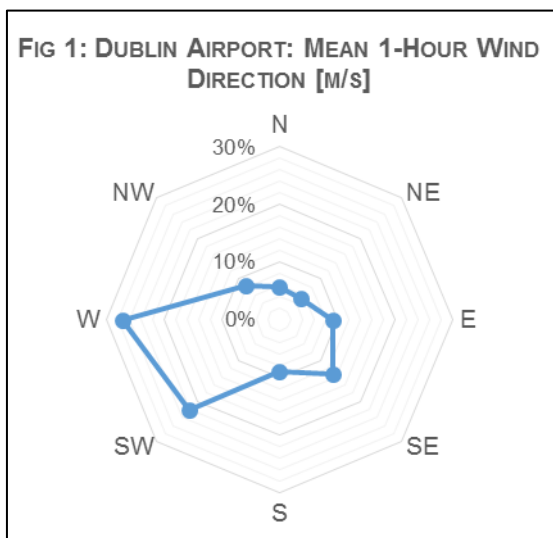
Note: A classification of ‘business walking’ does not mean that a location will never be suitable for ‘sitting’, however, it is likely to occur relatively infrequently.

11.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

11.3.1 Wind Climate

Met Eireann’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.

Figures 11.1 and 11.2: Mean wind direction and wind speed, Dublin Airport



11.3.1 Receiving Environment

The existing site is currently a greenfield site. It is situated in the foothills of the Dublin / Wicklow mountains on the southern edge of suburban Dublin. Existing sites nearby, such as Carrickmines retail park are known to be windy.



Figure 11.3: Existing Residential Development at Clay Farm Phase II Site

The Wicklow mountains (Figure 11.4 and 11.5) 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. The more usual west winds are likely to manifest as 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.



Figure 11.4: Wicklow Mountains

Figure 11.5: 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 11.6 and 11.7.

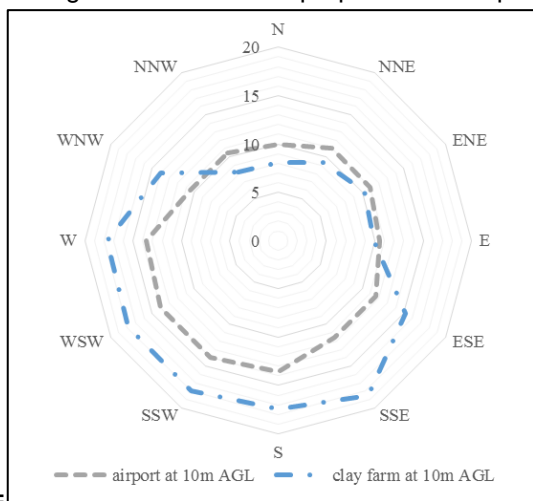


Figure 11.6: 95th Percentile Assessed Wind Wind Speed [m/s] at 1.5m AGL

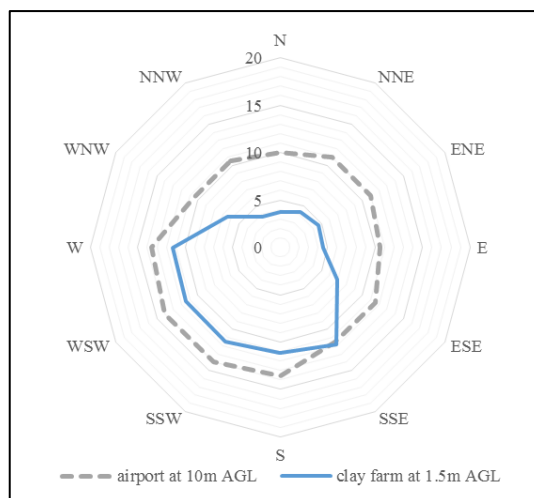


Figure 11.7: 9th Percentile Assessed Wind Speed [m/s] at 10m AGL

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 boundaries of the site that do help provide shelter from the wind. The wind effects on the existing conditions are predominately expected to be in the ‘strolling’ range.

11.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development is a site at Clay Farm, Ballyogan Road, Dublin 18, and is located to the south west of the permitted Phase 1 Clay Farm residential development (Reg. Ref. D15A/0247 & ABP Ref.: PL06D.246601). The site is bound to the east by Stepside Golf Club, to the south by Cruagh Wood and

Stepaside Park and to the west by Clay Farm House and undeveloped lands. The application site has an overall area of 20.5 hectares.

The development will consist of a residential development of 927 no. residential units, a neighbourhood centre containing a childcare facility with a GFA of 607 sq.m and 2 no. retail units each with a GFA of 85 sq.m, and includes the associated section of the Clay Farm Loop Road from the bridge road link with Phase 1 to the south western site boundary, associated internal roads, pedestrian and cycle paths, open space, and all associated site and infrastructural works. The application site has an overall area of 20.5 hectares.

The residential component of the development consists of 365 no. houses and 562 no. apartments, to be provided as follows:

- 9 no. 3 bed two storey terraced houses with a GFA of 125.5 sq.m (Type B1);
- 33 no. 3 bed two storey terraced houses with a GFA of 113.8 sq.m (Type B2);
- 2 no. 3 bed two storey terraced houses with a GFA of 119.4 sq.m (Type B3);
- 201 no. 4 bed three storey terraced houses with a GFA of 169.5 sq.m (Type C1);
- 76 no. 3 bed two storey terraced houses with a GFA of 112 sq.m (Type C2);
- 3 no. 4 bed three storey terraced houses with a GFA of 139 sq.m (Type C3);
- 34 no. 4 bed three storey terraced houses with a GFA of 171.8 sq.m (Type D1);
- 7 no. 3 bed two storey terraced houses with a GFA of 121.9 sq.m (Type D2);
- 16 no. apartment blocks (W01-07 & E01-09) ranging from three to six no. storeys in height, over undercroft / basement car parking, and which contain a total of 113 no. 1 bed apartments with a GFA of 51 sq.m and 383 no. 2 bed apartments with a GFA of 88 sq.m. The apartment blocks also contain 48 no. 3 bed duplex / own door apartment units ranging in size from 110 sq.m to 114 sq.m GFA.
- 18 no. 3 bed duplex / own door apartment units are located at the neighbourhood centre ranging in size from 110 sq.m to 115 sq.m in a three to four storey building (which also contains the childcare facility and retail units at ground floor level).

Bin and cycle storage areas are proposed within the apartment blocks and single and double bin stores are proposed for the houses. 3 no. electricity sub-stations are proposed for the site. A total of 1,478 no. car parking spaces including 730 no. spaces for the houses, 732 no. spaces for the apartment blocks and 16 no. spaces for the childcare facility and retail units at the neighbourhood centre are proposed. The associated site and infrastructural works include foul and surface water drainage, attenuation tanks, open space including playgrounds, a MUGA (multi-use games area) and exercise units, cycle spaces, landscaping, boundary walls and fences, internal roads, cyclepaths and footpaths. The application site includes the possible linear earthworks (DU026-087), a Recorded Monument, located along the northern site boundary.

A building which is taller than its surroundings has the potential to create increased windiness at ground level. This is due to upper-level winds being brought down by the tall building to ground-level, a mechanism usually referred to as downdrafting. The building heights range from 2 storeys to 6 storeys across the Clay Farm site. The taller buildings are built into the escarpment such that overall the buildings are a similar height across the development. As a result, downdrafting is unlikely to occur.



Figure 11.8: Residential Development at Clay Farm Phase 2 Site Layout Plan

11.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

11.5.1 Construction Phase

The potential effects on wind microclimate at the site during the construction phase have not been directly assessed. Instead, professional judgement has been used to assess the likely conditions during these stages of development.

As construction of the proposed development proceeds from a greenfield site, the wind conditions at the site would gradually adjust to those of the completed development. However, during the latter stages of construction, it may be necessary to implement the advised mitigation measures in areas which have been predicted to be windier than desired, if it is the intention for parts of the development to become operational before construction is completed.

11.5.2 Operational Phase

Given the configuration, orientation and separation between the blocks in the proposed development, the exposure of the site will continue to be relatively open and it is not anticipated that the proposed development will significantly exacerbate the existing wind conditions across the site. It is anticipated that local increases in wind speed will occur close to building corners.



Figure 11.9: Proposed Development at Clay Farm

Northwesterly Winds

The apartment buildings are aligned along the ridge that runs northwest/southeast across the site. This is a beneficial configuration as the apartment buildings upstream will help shelter the buildings further downstream from the worst effects from the wind. It is anticipated that the western apartment blocks no. 1, 6 and 7 will suffer the worst effects of the northwesterly winds but, in turn, will provide shelter to the blocks further downstream. The highest wind speeds are likely to occur at the upwind corners. It is anticipated that the wind speeds at these corners might exceed the wind conditions suitable for 'business walking' and therefore, mitigation should be provided where pedestrians are likely to be subjected to these wind speeds.

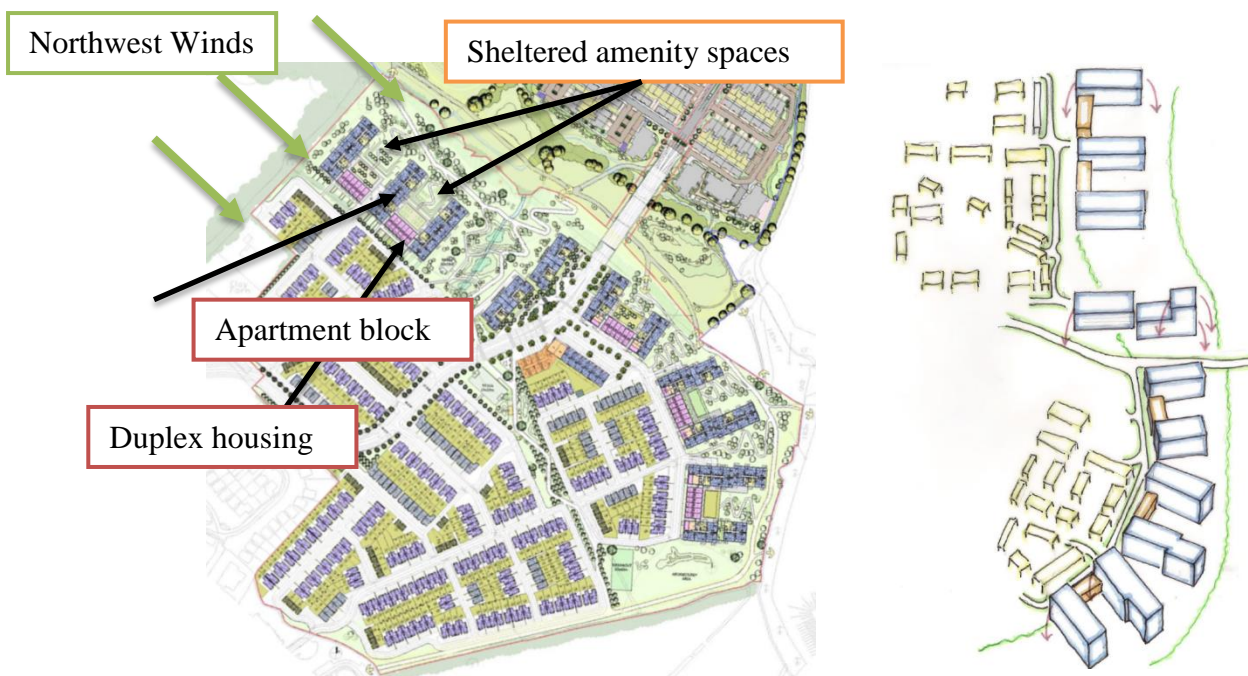


Figure 11.10 : Northwesterly winds across Site

It is likely that outstand balconies near the upstream corners of these buildings are also likely to encounter similar high speed wind conditions. Further measures are recommended to mitigate these effects so that these balconies become attractive amenity spaces for occupants.

It is anticipated that the wind conditions behind the apartment buildings will be much calmer. It is anticipated the wind conditions in the public amenity areas behind the duplex housing will be in the 'sitting' or 'standing' range and therefore, it should be suitable for its intended use.

There is a mature clump of trees situated outside the northwestern boundary of the site. This help provide additional shelter from the wind. The wind conditions elsewhere within the development are expected to be in the 'strolling' range and would be suitable for the intended use of the area.

Effects of Southeasterly Winds

As stated above, the apartment buildings are aligned along the ridge that runs northwest/southeast across the site. This is a beneficial configuration as the eastern apartment blocks no. 7 and 9 will provide shelter to the other buildings across the site from the southeasterly winds. The highest wind speeds are likely to occur at the upwind corners. It anticipated that the wind speeds at these corners might exceed the wind conditions suitable for 'business walking'. Mitigation measures should be implemented where pedestrians are likely to be subjected to these wind speeds.

It is likely that outstand balconies near the upstream corners of these buildings are also likely to encounter high speed wind conditions. Further measures are recommended to mitigate these effects so that these balconies become attractive amenity spaces for occupants.

Except between the most southeasterly blocks, it is anticipated that the wind conditions behind the apartment buildings will be much calmer. It is anticipated the wind conditions in the public amenity areas behind the duplex housing will be in the 'sitting' range and therefore, it should be suitable for its intended use.

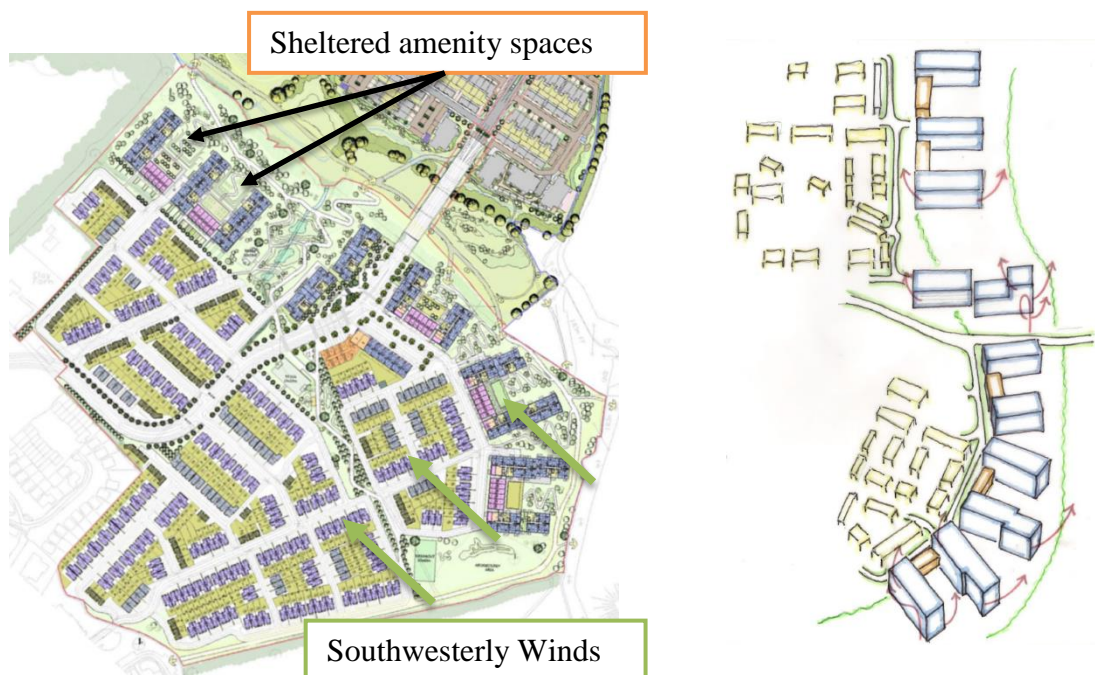


Figure 11.11: Southeasterly winds across Site

There is a mature clump of trees situated outside the southeastern boundary of the site. This helps provide additional shelter from the wind. The wind conditions elsewhere within the development are expected to be in the 'strolling' range and would be suitable for the intended use of the areas.

Effects of Southerly Winds

At times when the winds are approaching from the south, it is expected the residential housing upstream should provide some shelter to the apartment blocks given that they are relatively similar in height and the topography falls to the north. It is anticipated that the configuration, orientation and separation between the blocks do not present a significant obstruction to the wind. However, it is expected that the southerly winds produce strong winds near ground level. It is anticipated that wind conditions across the site might range from 'strolling' to 'business walking'.

It is likely that outstand balconies along the sides of these buildings will encounter high speed wind conditions. Further measures are recommended to mitigate these effects so that these balconies become attractive amenity spaces for occupants.



Figure 11.12: Southerly Winds

It is anticipated the wind conditions in the public amenity areas behind the duplex housing will be in the 'sitting' range and therefore, it should be suitable for its intended use.

Winds from Other Directions

It is expected that the Wicklow Mountains will provide reasonable shelter to the proposed development from winds from the southwest. Instead, the proposed development will be subject to stronger northwesterly, southerly and southeasterly winds in comparison to other areas in Dublin.

It is estimated that the winds from the north and the east will be less strong than from other directions.

11.6 POTENTIAL CUMULATIVE IMPACTS

The proposed development consists of relatively low level buildings ranging between 2 storeys and 6 storeys in height. The taller buildings are built into the escarpment such that overall the buildings are a similar height across the development. The provision of these buildings is slightly to increase the overall roughness on 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.

Similarly, the permitted developments in the Stepside / Ballyogan area, including the permitted Phase 1 development to the north, are residential in nature and they consist of a mix of relatively low-level 5 to 6 storey apartment blocks and lower level residential housing and duplexes. The increased terrain roughness arising from these developments may have a slight beneficial impact if it is situated further upstream of the proposed development.

11.7 'DO NOTHING' IMPACT

In the 'Do Nothing' scenario, the proposed development will likely be exposed and quite windy even though the mature trees along the boundaries do help provide some shelter from the wind. It is anticipated that it will be unattractive for long-term stationary activities, such as reading a book, except in the public amenity spaces between apartment blocks, where winds are expected to be calmer. Balconies, particularly those near corners, may be unattractive spaces for occupants undertaking long-term stationary activities due to the likely wind conditions. Pedestrians may commonly experience in the 'strolling' range or higher throughout the development depending on wind direction. The winds may be stronger if the wind is blowing from the south. It is expected that pedestrians will be subjected to strong winds in the 'business walking' range near building corners.

11.8 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

Mitigation measures to further improve the wind conditions at the Clay Farm site include the following:

WD CONST 1: The positioning of entrances and walkways away from the corners of apartment blocks and, in particular, where the apartment block is exposed to northwesterly and southeasterly winds;

WD CONST 2: Where high wind speeds at the corners of a building are unavoidable, the provision of substantial planting or windbreaks are recommended to reduce their impact. In addition, consideration should be given to redirecting walkways, where appropriate;

WD CONST 3: 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;

WD CONST 4: 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 to provide shelter against the wind and, in particular, where balconies are situated near building corners. It should be noted wind screens will be ineffective where balconies extend around the corner of the building. In the development, there are no balconies that extend around corners.

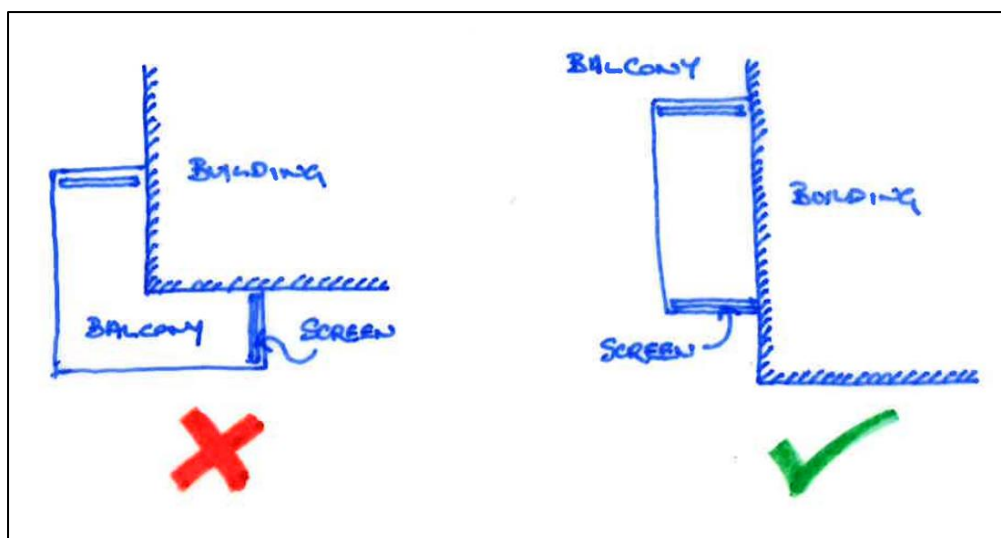


Figure 11.13: Wind Screens on Balconies

The final architectural drawings and landscape drawings demonstrate how the above suggestions have been incorporated into the design, where possible and practical, to mitigate against potential wind impacts in identified locations.

11.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

A qualitative desk study of the Phase 2 Clay Farm residential development, Ballyogan Road, Dublin 18, 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:

- The existing site is relatively 'open' and the existing conditions are predominately expected to be in the 'strolling' range;
- The wind conditions in the public realm surrounding the apartment buildings are expected to be predominantly in the 'strolling' range and would be acceptable for the intended use of the area;
- The public amenity spaces behind the apartment blocks are expected to be in the 'sitting' range and therefore, should be 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.

11.10 MONITORING

The building heights are relatively low level ranging from 2 storeys to 6 storeys across the Clay Farm site. The taller buildings are built into the escarpment such that overall the buildings are a similar height across the development. 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.

11.11 REINSTATEMENT

There is no reinstatement required in accordance with this study.

11.12 INTERACTIONS

The proposed landscape design has been considered in this study.

11.13 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

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