Barnhill, Barberstown, Barnhill and Passifyoucan, Clonsilla, Dublin 15

Wind Microclimate Assessment

4th July 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Johannes Theron Graduate Engineer	James Wells Associate Director	Robert Murphy Technical Director	Robert Murphy Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Alanna Homes

Prepared by:

AECOM Limited

Aldgate Tower

2 Leman Street

London E1 8FA

United Kingdom

aecom.com

Table of Contents

Figures

Tables

Wind Microclimate

1.1 Introduction

1.1.1 This document reports the findings of an assessment of the likely significant effects on Wind Microclimate as a result of the Proposed Development. The assessment considers the potential for the Proposed Development to affect the Wind Microclimate at pedestrian level in public areas and balconies.

1.1.2 The Proposed Development has the potential to affect Wind Microclimate due to:

- Redirection of high-level winds to pedestrian level;
- Acceleration of winds through building 'canyons';
- Funnelling through narrowing spaces;
- Acceleration around corners; and
- Diverting winds to neighbouring areas,

amongst other possible effects.

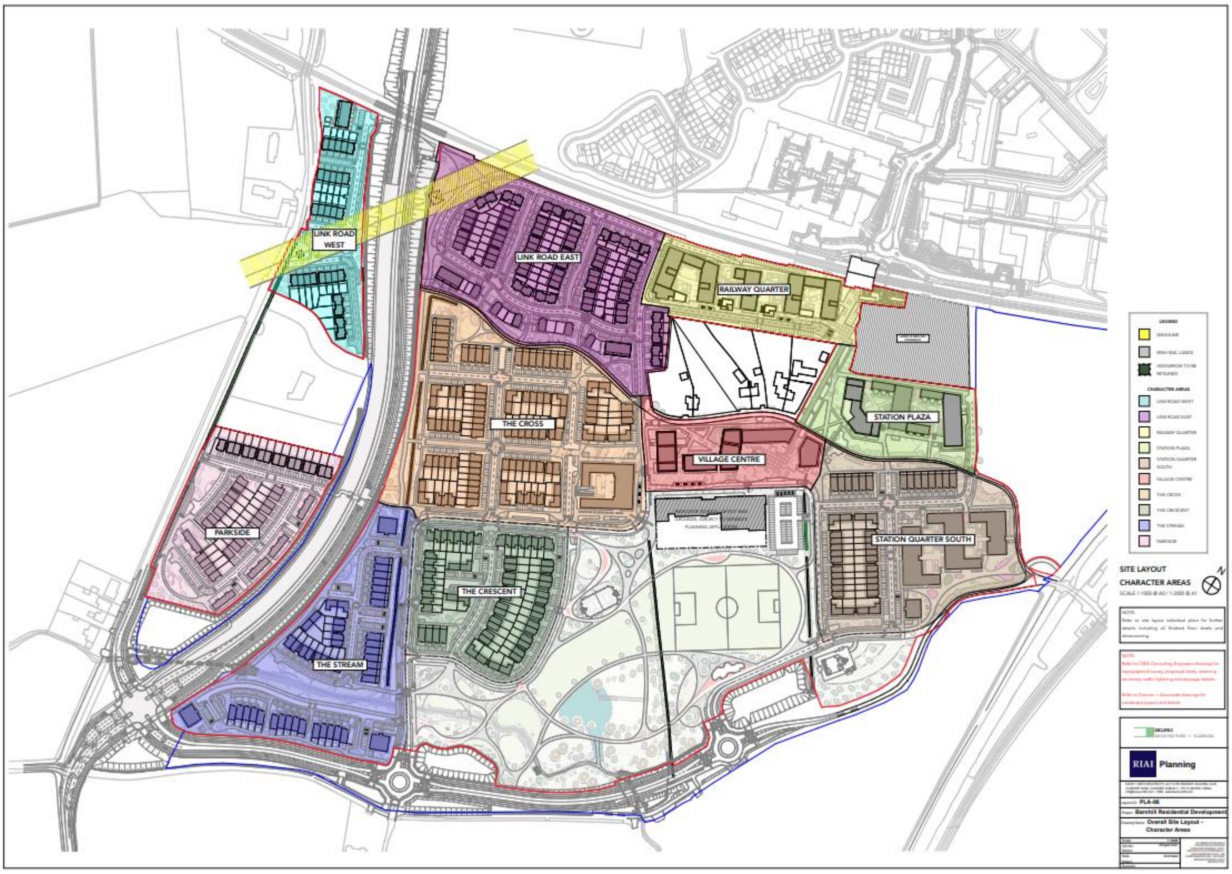

Figure 1.1.1: Proposed Landscape Layout

1.2 Assessment Methodology

1.2.1 This section of this assessment presents the following:

- Information sources that have been consulted throughout the preparation of this assessment;
- The methodology behind the assessment of wind micro-climate effects, including the criteria for the determination of sensitivity of receptors, importance of resource, and magnitude of change from the existing 'Baseline' condition to the Proposed scenario;
- An explanation as to how the identification and assessment of potential Wind Microclimate effects has been reached; and

Basis of Assessment

1.2.2 Table 1 outlines the sources of information that define the Proposed Development that have been reviewed and form the basis of the assessment of likely significant effects on Wind Microclimate.

Table 1: Wind Microclimate basis of assessment

Proposed Development Information	How has the information informed the assessment?
For Wind Study 12.08.2020.dwg XS_Full Survey Old – ITM.dwg	Reference site topology and relative positioning.
XS_LAP Survey Old – ITM – 3D.dwg XS_Survey – ITM – With New Survey Area – October 2020.dwg	Reference site topology with stream and relative positioning.
21154_LP_FOR ARCH.pdf	Reference positions of buildings, trees, and mitigation.
P18119-CWO.pdf	Reference shape of buildings. (CWOB)
A2 Block-CROSS APT.dwg A3-A4-A5 Block-STATION Q APT.dwg APT-4-8-TYPE 1-TYPE *.dwg	Reference shape of buildings. (CWOB)
Barnhill - Delphi - 3D Site Plan B.3dm	Reference shape and position of buildings. (Delphi)
Exploded Version of Current Ongar Distributor Road 3D surface - May 2022.dwg	Reference site topology with link road.
ii. Parkside 2019_035.1*.pdf	Reference shape of buildings. (CDP)

Scope of the Assessment

1.2.3 The Wind Microclimate assessment has focused on the following effects:

- Construction effects:
  - Construction effects have not been quantitatively simulated; instead, a qualitative discussion of the wind effects during this construction phase has been undertaken. This is based on professional judgement by visual inspection of the output of the computational fluid dynamics (CFD) simulations, regional wind climate and experience of typical building aerodynamics. Construction plant, site hoardings and any temporary buildings that may be required during construction are presumed to be below 10m.
  - It is assumed that the Site will be hoarded off from public access when construction begins, therefore comfort and safety in these areas are issues dealt with via the relevant construction procedures regarding health and safety.
- Operational effects

- The assessment has considered the impacts at the site and in the wider local area on pedestrian comfort and distress due to changes to the local wind environment at the operation of each additional phase and when the Proposed Development is fully complete and occupied.
- The construction of a new development is likely to change the Wind Microclimate conditions within the surrounding built environment. The extent of this change depends on the form of the new buildings. Where buildings are significantly different in size, form, orientation or height from their predecessors or neighbours, winds can be introduced which may affect the comfort and distress of pedestrians.

1.2.4 The CFD analysis modelled the following 2 cases based on the above scenarios.

- Baseline – long-lived existing site geometry before any construction begins.
- Proposed – geometry of the completed proposed development within the remaining existing site geometry.

No significant cumulative schemes were identified.

Methodology

1.2.5 The wind environment has been considered not only immediately adjacent to the Site but also in the wider local area. The zone of influence of a building on the wind microclimate can be very large, but the magnitude of its influence diminishes as distance from the building increases.

1.2.6 Sensitive receptors are taken to be those locations with pedestrian access both within the Site boundary and its immediate surroundings.

1.2.7 All receptors are at 1.5m above the respective floor level, except for balconies which are 0.8m above their respective floor levels. The wind microclimate baseline has been assessed on a continuous surface (receptors) throughout the Site and surroundings. The receptors cover external areas and do not include spaces within buildings.

1.2.8 The baseline has been established through CFD modelling methods, details of which can be found outlined in the following section.

1.2.9 The lateral boundary is set using the following guidance, "For the single building model, the lateral […] boundary should be set 5H or more away from the building" [1] where *H* represents the height of the building".

1.2.10 This lateral boundary was applied to all Proposed buildings and nearby tall buildings. Figure 1.2.1 shows the approximate site boundary in red with a blue circle with a radius of approximately 550m superimposed. The CFD model domain, and therefore the extent of the wind analysis, does not extend beyond this blue circle. However, the yellow spoked circle in Figure 1.2.1 shows that additional regions beyond the explicitly modelled CFD domain are considered to ensure appropriate inlet conditions around the domain.

1.2.11 The assessment used 30 years of wind data and was sourced from data.gov.ie.

Figure 1.2.1: Approximate model domain size indicated by blue circle. Approximate development boundaries in red. Influence of the area up to the yellow circle are considered. Satellite imagery from Google Maps.

Lawson Methodology

1.2.12 To determine the construction effects, a qualitative discussion has been included using professional judgement by visual inspection, based on the output of the CFD simulations for the Baseline and Proposed scenarios.

1.2.13 To determine the effects of the Proposed Development when complete and operational, a 3D model is constructed of the built environment, incorporating the geometry of the development within the same surroundings as the Baseline scenario.

1.2.14 The models include existing surrounding buildings, including ground topography to a sufficient radius such that local wind effects are represented. Minor geometrical details (such as street furniture, foliage, rooftop plant, etc.) are not included in the CFD models. The models produced enable a quantitative analysis of flow characteristics in the microclimate around the buildings.

1.2.15 The investigation is performed using CFD models constructed using the general purpose Ansys CFX CFD package. Boundary conditions are applied to represent atmospheric wind and surface roughness. Simulations are performed of wind at a representative high velocity from 36 wind directions around the compass.

1.2.16 The results of the CFD simulations are interrogated and compared with metrics of user comfort criteria. This is a quantitative assessment that provides indicative wind velocities around the Site. Pedestrian comfort levels are based on the widely used Lawson criteria [2], developed by T.V. Lawson of the University of Bristol. The Lawson method uses a summation of probabilities of wind conditions to assess the comfort of the area.

1.2.17 Pedestrian comfort plots are coloured according to Table 2.

Table 2: Lawson comfort criteria

Category	Comfort category	Threshold wind velocity (m/s)	Colour Scale	% Exceedance
I	Pedestrian sitting	4	Blue	5%
II	Pedestrian standing	6	Green	5%
III	Pedestrian walking	8	Yellow	5%
IV	Business walking/Cycling	10	Red	5%
V	Unacceptable for pedestrian comfort	>10	Magenta	5%

1.2.18 The CFD results were analysed including a brief discussion of possible causes of undesirable flow features and possible measures to counteract these.

1.2.19 The distress criteria used follows the Lawson LDDC Method, as set out in Building Aerodynamics [2]. These state that for frail/elderly pedestrians or cyclists, the hourly mean wind speed should exceed 15 m/s (approximately equivalent to Beaufort 7) for less than 0.025% of the year (approximately 2.19 hours) to be considered distressful. For the general public, the hourly mean wind speed limit should exceed 20 m/s (approximately equivalent to Beaufort 9) for less than 0.025% of the year. Should these be exceeded for more than 0.025% of the year, the method informs the wind engineer to consider if 'the location [is] on a major route through the complex, and are there suitable alternate routes which are not "distressful"?'.

Methodology for Determining Cumulative Effects

1.2.20 A cumulative scenario is not included in this assessment as no significant cumulative developments were identified within the model domain.

Limitations and Assumptions

1.2.21 This assessment considers wind pedestrian comfort in the general urban environment but does not consider more specialised wind design requirements (e.g. sailing, aviation, sports, particle transport, fire safety, etc.).

1.2.22 As a reasonable conservative measure minor geometrical details (such as street furniture, offsite foliage, rooftop plant, etc.) are not included in the modelling.

1.2.23 Where an adverse effect for the distress criteria is identified outside the red line boundary, the effect is reported in this assessment. As the off-site areas of the model do not include any vegetation, or small features (bus stops, benches, bins, posts, street furniture etc.) which can act to slow the wind, it is considered that a conservative case is modelled.

1.2.24 No specific off-site mitigation measures are modelled or proposed as part of this assessment. On-site mitigation, if required, is likely to be in the form of evergreen planting, porous screens or awnings. Alternatively, this may involve closing pedestrian access to breached areas during high winds if an alternative route around an unacceptable region is not available.

1.2.25 Necessary geometric simplifications are made to the building geometry.

1.3 Assessment Inputs

Geometry

1.3.1 Geometric representations of the development site and its surroundings have been generated for the baseline and proposed scenarios.

1.3.2 Figure 1.3.1, Figure 1.3.2, Figure 1.3.3, Figure 1.3.4, and Figure 1.3.5 show the geometry for the Baseline case as simulated in the investigation for this assessment. The site boundary is shown with a thick white line. Off-site buildings are shown in brown.

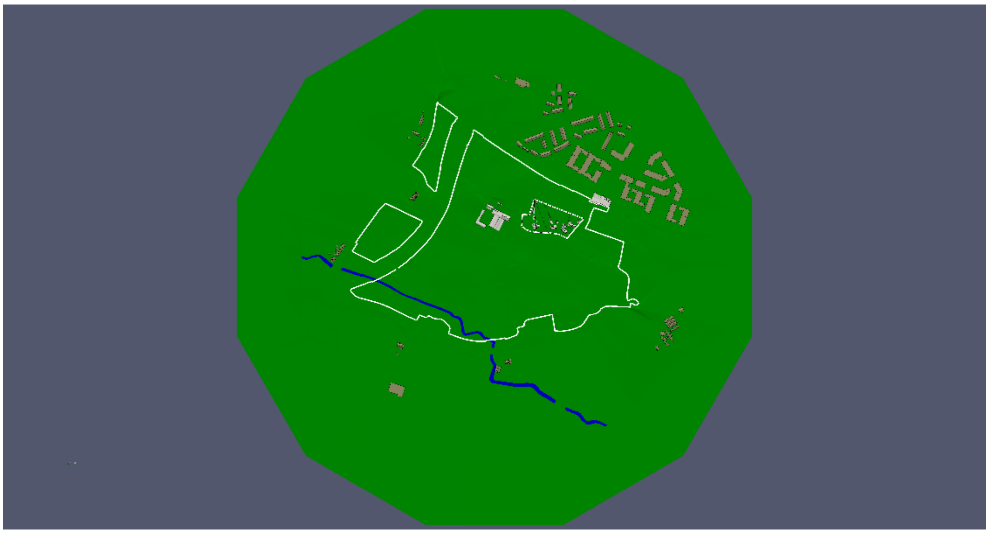

Figure 1.3.1: Baseline Model Geometry - Plan View of the Domain Extents

Figure 1.3.2: Baseline Model Geometry - Plan View of the Development Site

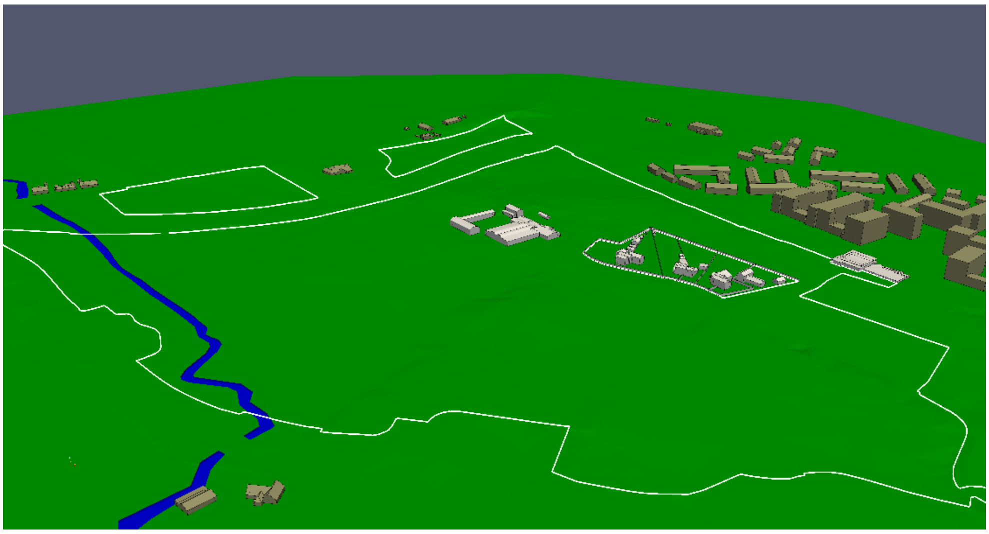

Figure 1.3.3: Baseline Model Geometry - Perspective View from Southeast

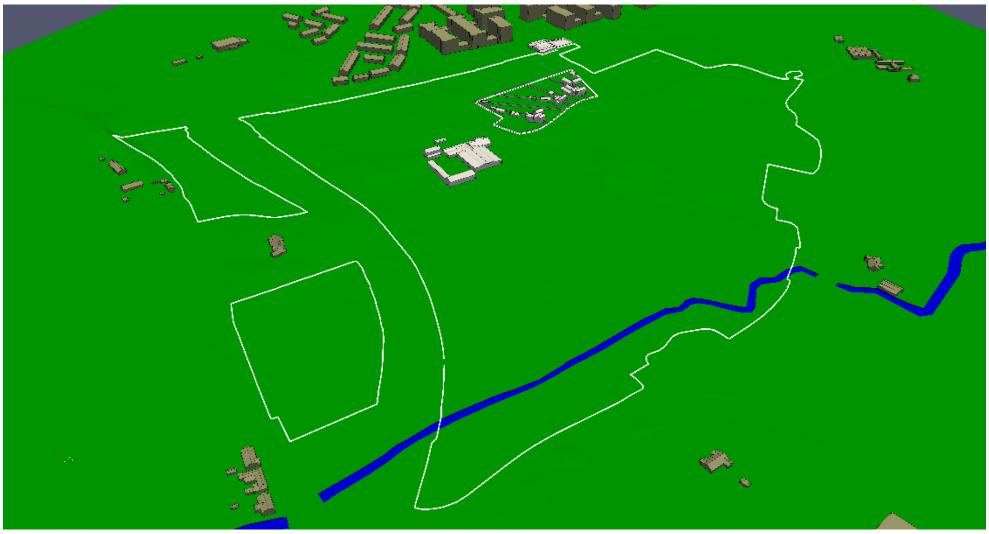

Figure 1.3.4: Baseline Model Geometry - Perspective View from Southwest

Figure 1.3.5: Baseline Model Geometry - Perspective View from Northwest

1.3.3 The development site is divided up into 10 character areas. These are shown in Figure 1.1.1.

1.3.4 Figure 1.3.6, Figure 1.3.7, Figure 1.3.8, Figure 1.3.9, and Figure 1.3.10 shows the geometry for the Proposed case as simulated in this investigation. The site boundary is shown with a thick white line. Off-site buildings are shown in brown.

Figure 1.3.6: Proposed Model Geometry - Plan View of the Domain Extents

Figure 1.3.7: Proposed Model Geometry - Plan View of the Development Site

Figure 1.3.8: Proposed Model Geometry - Perspective View from Southeast

Figure 1.3.9: Proposed Model Geometry - Perspective View from Southwest

Figure 1.3.10: Proposed Model Geometry - Perspective View from Northwest

1.3.5 Figure 1.3.11, Figure 1.3.12, Figure 1.3.13, Figure 1.3.14, Figure 1.3.15, Figure 1.3.16, Figure 1.3.17, and Figure 1.3.18 shows plan views of character areas in the proposed development with mitigation features highlighted according to the colours in Table 4.

1.3.6 Heights of fences, hedges and planters are 2m, 1m, and 2m tall, respectively. Planters have a solid base 1m tall.

Figure 1.3.11: Proposed Model Geometry - Plan View of 'Link Road West' Character Area

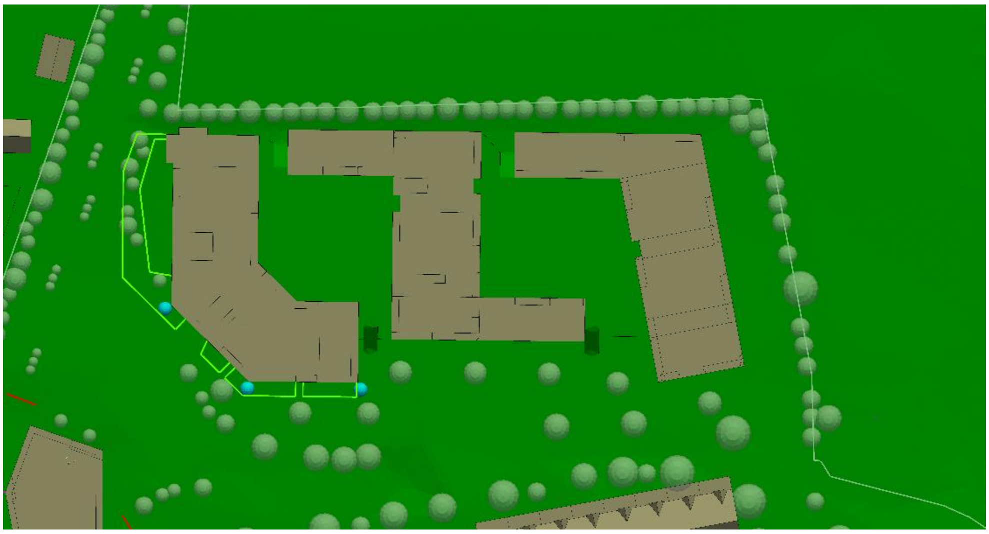

Figure 1.3.12: Proposed Model Geometry - Plan View of 'Station Plaza' Character Area

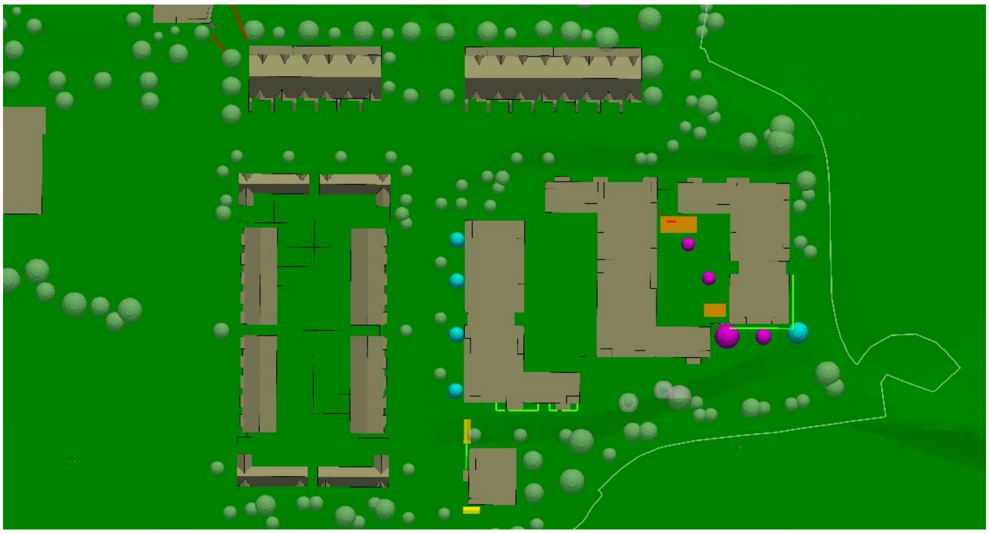

Figure 1.3.13: Proposed Model Geometry - Plan View of 'Station Quarter South' Character Area

Figure 1.3.14: Proposed Model Geometry - Plan View of 'Village Centre' Character Area

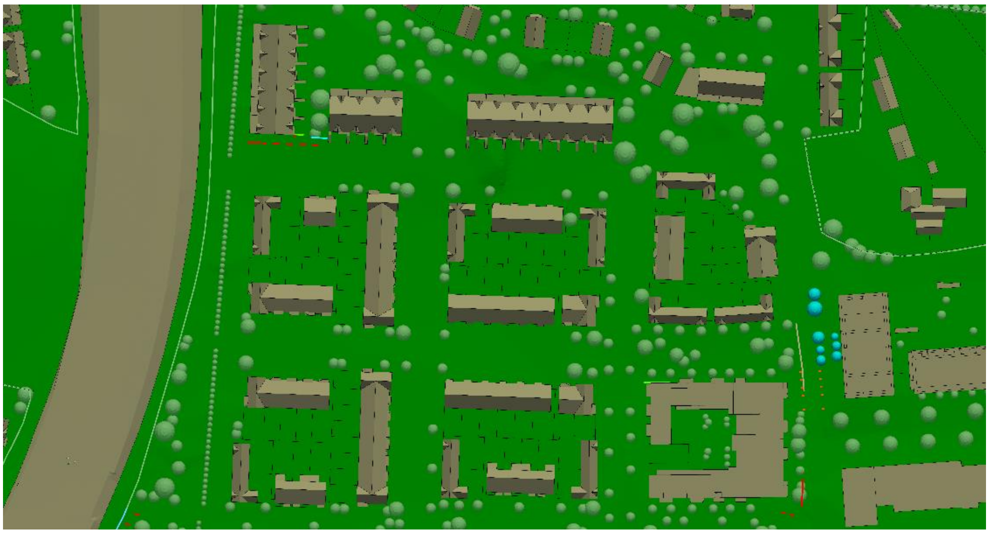

Figure 1.3.15: Proposed Model Geometry - Plan View of 'The Cross' Character Area

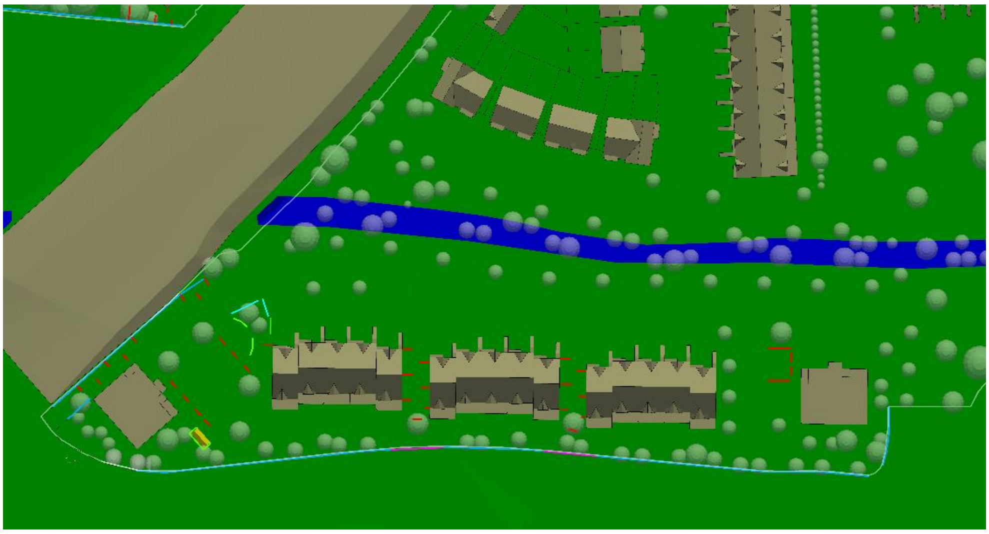

Figure 1.3.16: Proposed Model Geometry - Plan View of 'The Stream' Character Area, South of the Stream

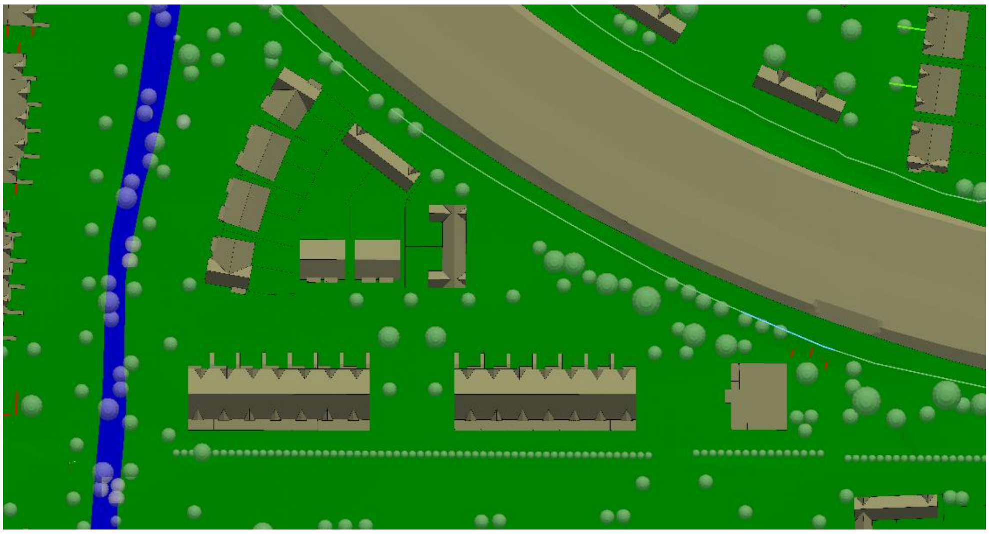

Figure 1.3.17: Proposed Model Geometry - Plan View of 'The Stream' Character Area, North of the Stream

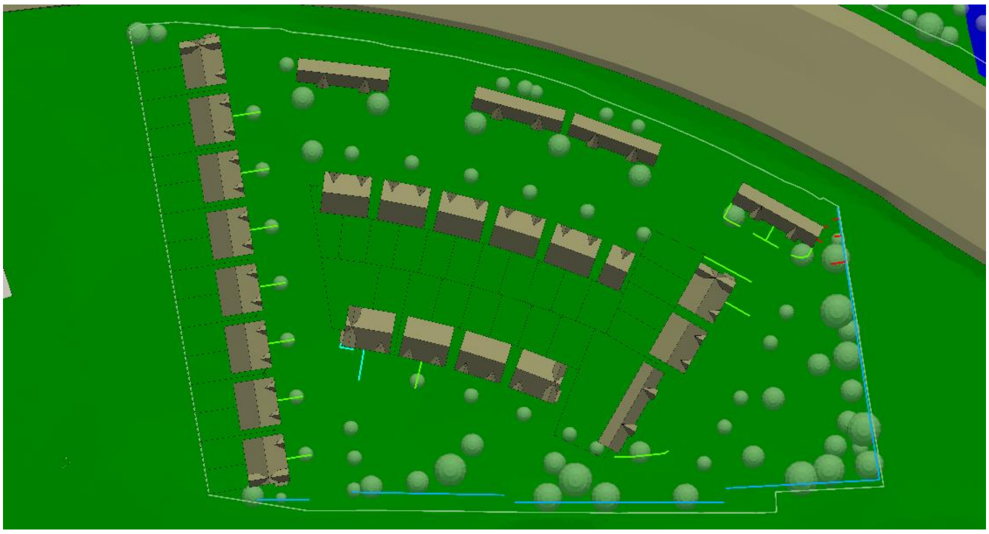

Figure 1.3.18: Proposed Model Geometry - Plan View of 'Parkside' Character Area.

***NB The bottom left house was updated since the simulation was ran. This change is small and not likely to affect the wind microclimate significantly. Please see* Figure 1.3.19**

Figure 1.3.19: Updated layout, house at bottom left of image (Parkside)

Boundary Conditions

1.3.7 Solid surfaces are modelled as non-slip boundaries with roughness values as shown in Table 3.

1.3.8 Vegetation and porous screens have been modelled as subdomains with estimated [3] loss coefficients as shown in Table 4. The higher the loss coefficient, the greater the resistance to flow.

Table 3: Sand-grain Roughness Values for Solid Boundaries

Surface	k_s, Sand-grain Roughness [m]	Colour in Geometry Figures
Buildings (on-site)	0.01	(white)
Buildings (surroundings)	0.01	
Ground	0.10	
River	0.00 (smooth)	

Table 4: Loss Coefficients of Mitigation Features

Feature	Loss Coefficient	Height [m]	Colour in Geometry Figures
Fence	Solid	2.0	**(lines)**
Screen	1.8	1.0 (above fence), 6.35	**(lines)**
Railing	0.2	1.0	**(lines)**
Planter	0.875 [m^{-1}] (solid up to 1m)	2.0	**(lines)**
Hedge	0.875 [m^{-1}]	1.0	**(lines)**
Extra Hedge	0.875 [m^{-1}]	1.0	**(lines)**
Pergola	3.0	~ 3.0	
Banners	Solid	2.0 (starting 3m up)	**(lines)**
Extra Trees	0.875 [m^{-1}]	(starting 1m up)	
Bike Shelter	Solid	1.0 (starting 1m up)	

Intended Pedestrian Uses

1.3.9 Figure 1.1.1 shows the landscape layout for the proposed development. This can be used to infer intended pedestrian uses.

1.4 Results

Lawson Distress (20 m/s) – General Public

1.4.1 Figure 1.4.1 and Figure 1.4.2 show the Lawson Distress results at 1.5 m above ground for a 20 m/s wind speed threshold – this is representative of danger to able-bodied pedestrians according to the Lawson method.

1.4.2 Distress, shown in red, indicates regions where the analysis predicts wind speeds of 20 m/s or greater for 2.19 hours (0.025%) or more of a typical year (as determined by historical weather data).

1.4.3 The site boundary is shown with a white line.

1.4.4 Both scenarios (Baseline and Proposed) did not indicate distress with a 20 m/s threshold on site or on balconies.

Figure 1.4.1: Baseline Distress (20 m/s) - No Distress Indicated

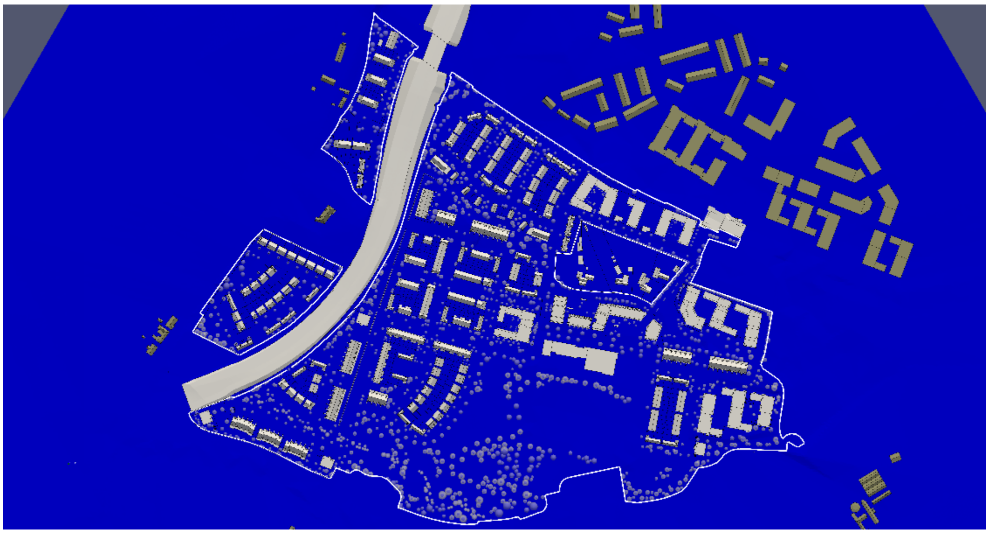

Figure 1.4.2: Proposed Distress (20 m/s) - No Distress Indicated

Lawson Distress (15 m/s) – Frail/Elderly and Cyclists

1.4.5 Figure 1.4.3 and Figure 1.4.4 show the Lawson Distress results at 1.5 m above ground for a 15 m/s wind speed threshold – this is representative of danger to frail/elderly pedestrians and cyclists according to the Lawson method.

1.4.6 Figure 1.4.5 shows the 15 m/s Lawson Distress for the proposed scenario 0.8 m above the balconies of the apartment block in the 'Village Centre' character area.

1.4.7 Distress, shown in red, indicates regions where the analysis predicts wind speeds of 15 m/s or greater for 2.19 hours (0.025%) or more of a typical year (as determined by historical weather data).

1.4.8 The site boundary is shown with a white line.

1.4.9 Both scenarios (Baseline and Proposed) did not indicate distress with a 20 m/s threshold on site or on balconies.

1.4.10 The baseline scenario indicates widespread regions of distress throughout the proposed development site.

1.4.11 The proposed scenario does not indicate distress on site, except for a region by the south-eastern most point of the site and tiny regions on the corners of balconies.

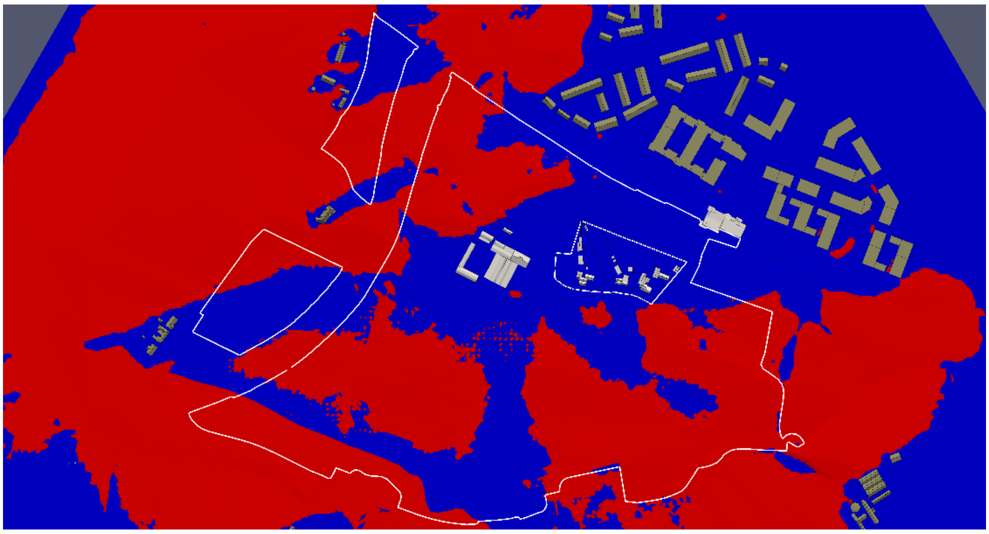

Figure 1.4.3: Baseline Distress (15 m/s) - Distress shown in Red

Non Distress Distress

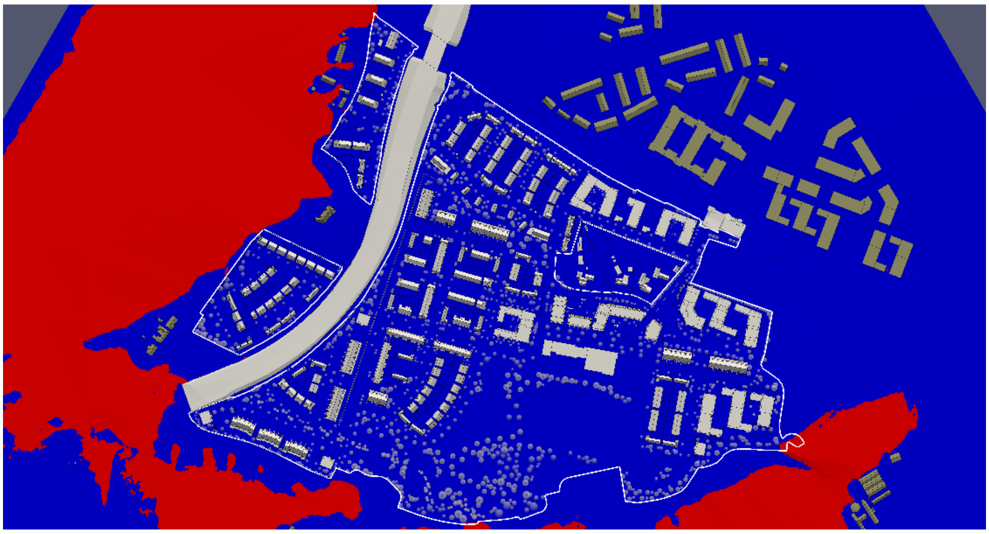

Figure 1.4.4: Proposed Distress (15 m/s) - Distress shown in Red

Non Distress Distress

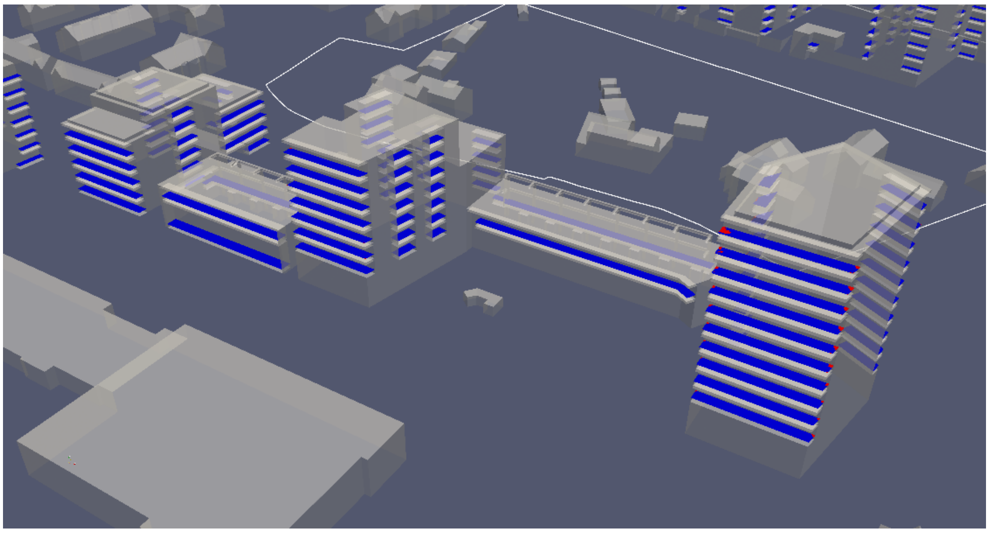

Figure 1.4.5: Proposed Distress (15 m/s), Apartment Block in 'Village Centre' Character Area

Non Distress Distress

Lawson Comfort

1.4.12 Figure 1.4.6 and Figure 1.4.7 show the Lawson Comfort results for the two scenarios of this study as reported 1.5 m above ground – a standard representative pedestrian height.

1.4.13 Figure 1.4.8 shows the Lawson Comfort results for the proposed scenario 0.8 m above the balconies of the apartment block in the 'Village Centre' character area.

1.4.14 Refer to Table 2 for the interpretation of colours in terms of Lawson comfort categories.

1.4.15 Within each colour category, the brightness is graded to provide a finer scale – darker shades indicate windier/less comfortable conditions.

1.4.16 The site boundary is shown with a white line.

1.4.17 The baseline scenario indicates that the site is mostly comfortable for business walking and cycling, with more comfortable conditions near the buildings where there is some shelter from the wind. No regions not comfortable for any pedestrian activity are indicated at the existing site within the site boundary.

1.4.18 The proposed scenario shows that the site is comfortable for at least pedestrian walking – except for the region at the south-eastern most point of the site, where it is suitable for business walking and cycling. Additionally, the entrances to all buildings are suitable for at least standing, except for possibly two houses in the 'Link Road West' character area.

1.4.19 Some balconies have small regions suitable for pedestrian walking but are otherwise suitable for standing or sitting.

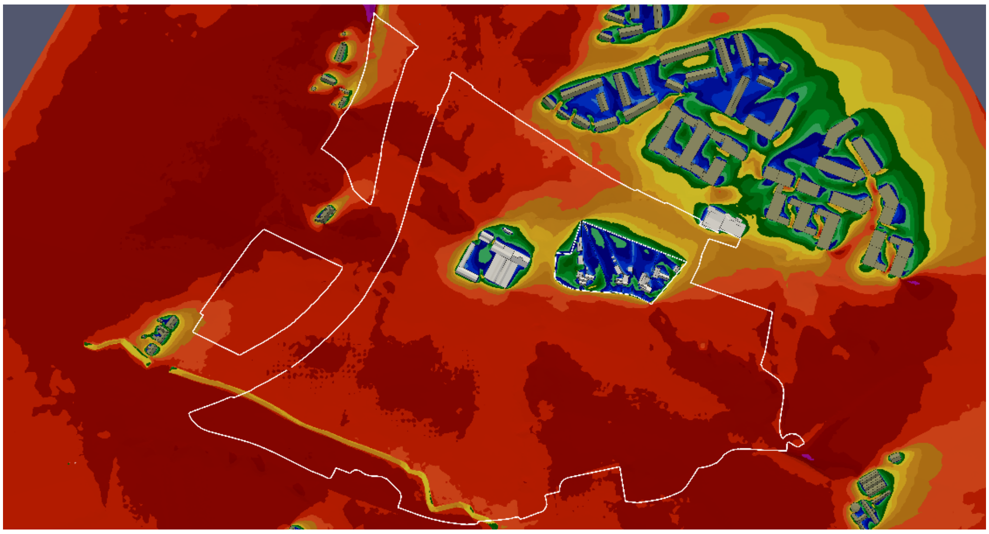

Figure 1.4.6: Baseline Comfort - Suitable for intended pedestrian activity (None)

0	Sheltered	<2.5	
I	Pedestrian sitting	4	
II	Pedestrian standing & Entrances	6	
III	Pedestrian walking	8	
IV	Business walking & Cycling	10	
V	Unacceptable for Pedestrian Use	>10	

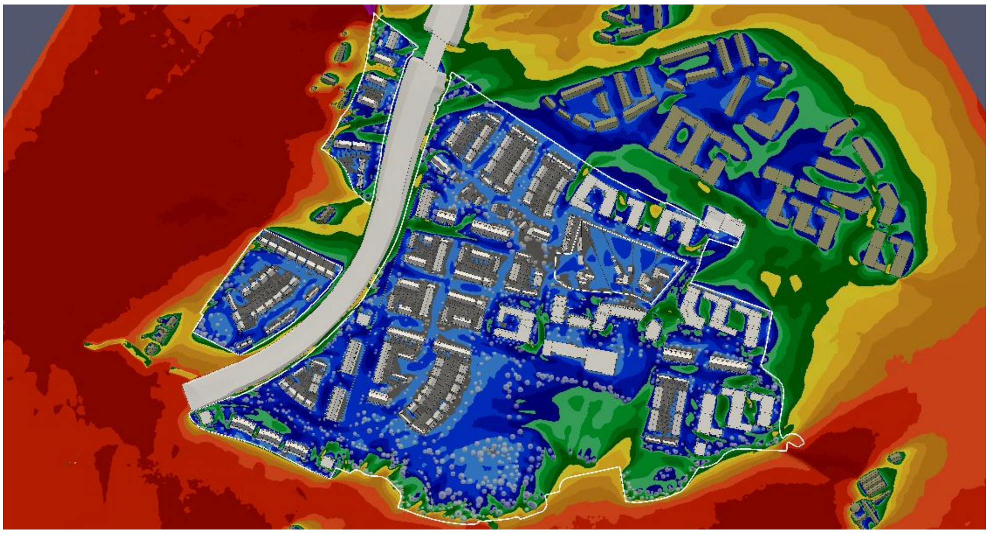

Figure 1.4.7: Proposed Comfort

0	Sheltered	<2.5	
I	Pedestrian sitting	4	
II	Pedestrian standing & Entrances	6	
III	Pedestrian walking	8	
IV	Business walking & Cycling	10	
V	Unacceptable for Pedestrian Use	>10	

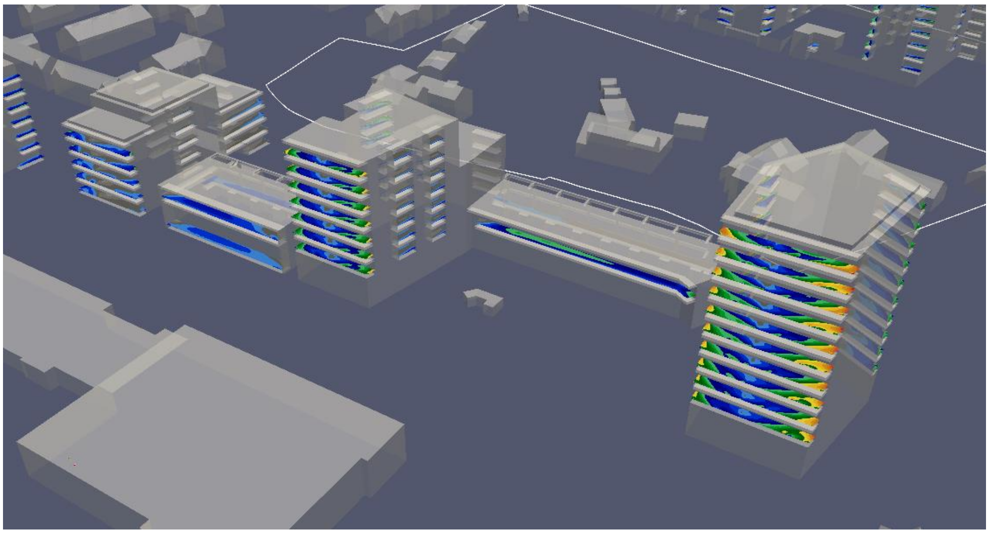

Figure 1.4.8: Proposed Comfort, Apartment Block in 'Village Centre' Character Area

0	Sheltered	<2.5	
I	Pedestrian sitting	4	
II	Pedestrian standing & Entrances	6	
III	Pedestrian walking	8	
IV	Business walking & Cycling	10	
V	Unacceptable for Pedestrian Use	>10	

1.5 Discussion

Lawson Distress (20 m/s) – General Public

1.5.1 Lawson Distress with a 20 m/s wind speed threshold is ascribed where a region is predicted to observe wind speeds greater than or equal to 20 m/s for 2.19 hours (0.025%) or more of a typical year. This speed threshold represents winds with the potential to be dangerous to able bodied pedestrians (including any lesser able categories of users).

1.5.2 For example: a region which observes wind speeds only up to 20.1 m/s but for a cumulative time of 2.2 hours in a year would be considered distressful. However, a region which observes wind speeds exceeding 100 m/s but for a cumulative time of 2.18 hours in a year would NOT be considered distressful. Furthermore, a region which observers wind speeds only up to 19.9 m/s but for a cumulative time of 100 hours in a year would also NOT be considered distressful.

1.5.3 Regions which are not indicated as distressful may still observe high wind speeds, however, according to the Lawson criteria, such occurrences would be sufficiently rare for the region to be considered safe.

1.5.4 Air flow is slowed down near solid boundaries. Observed wind speeds will be lower closer to the ground or walls of buildings and higher further from these surfaces.

1.5.5 Lawson Distress is reported 1.5 m above ground and 0.8 m above balconies. References to results “at ground level” or “on balconies” should be interpreted as reported at these heights above the respective surfaces.

1.5.6 The results of this investigation did not indicate any 20 m/s Lawson Distress, therefore the proposed development is considered safe for able bodied pedestrians according to the Lawson method.

1.5.7 The results of this investigation are based on historical weather data – it may be possible to observe microclimate conditions with higher or lower wind speeds in practice.

1.5.8 Comparing the baseline and proposed scenario, result show that the proposed development does not negatively impact the wind microclimate in term of 20 m/s Lawson Distress.

Lawson Distress (15 m/s) – Frail/Elderly and Cyclists

1.5.9 Lawson Distress with a 15 m/s wind speed threshold is ascribed where a region is predicted to observe wind speeds greater than or equal to 15 m/s for 2.19 hours (0.025%) or more of a typical year. This speed threshold represents winds with the potential to be dangerous to frail/elderly pedestrians and cyclists.

1.5.10 The results of the baseline scenario indicate widespread 15 m/s Lawson Distress on and around the development site.

1.5.11 The site is relatively exposed – surrounded by sparsely developed fields to the west and southwest and mostly uniform suburbia to the east. The apartment blocks immediately to the north and northeast provide some shelter, however the prevailing wind direction is from the relatively exposed southwest direction.

1.5.12 The results of the proposed scenario indicate widespread 15 m/s Lawson Distress outside of the development site, one small region within the south-eastern most point of the development site boundary, and very small regions on the corners of some balconies.

1.5.13 Comparing the baseline and proposed scenario, result show that the proposed development positively impacts the wind microclimate in terms of 15 m/s Lawson Distress.

1.5.14 A large part of the improvement to the distress results can be attributed to the inclusion of buildings on the development site. The blockage imposed on flow incident on the site deflects the bulk of the higher speed air over the site, above the standard pedestrian height – the path of least resistance. The blockage can be considered as a primary effect – the effect is large, relatively independent of the detailed shape of the built form and this effect continues further downwind.

1.5.15 Secondary effects include downwash from tall buildings, funnelling between buildings, and acceleration around sharp corners. These effects can generate isolated regions of distress.

1.5.16 Trees and other vegetation such as hedges have been included as mitigating features. These are modelled as porous media which allow flow through whilst reducing flow velocity. The effect is to slow down the wind, which could lead to funnelling or acceleration elsewhere to some extent.

1.5.17 Other mitigating features take the form of solid fences, porous or solid screens and planters with a solid base but porous vegetation screen on top. These are strategically positioned on the corners of buildings and through gaps to slow down air or divert its flow over pedestrian level. Cumulatively, almost all indication of 15 m/s Lawson Distress is eliminated from the development site.

1.5.18 The small region indicating potential distress within the south-eastern most point of the development site boundary could likely be mitigated by placing a solid fence near the road, as is successfully implemented by the link road on the western and southwestern regions of the site.

1.5.19 Computational Wind Engineering permits high resolution reporting of the flow field, resulting in the ability to detect very small regions of potential distress, e.g. on the corners of some balconies. The 12-storey apartment block in the 'Village Centre' character area indicates such detections. Some of these regions are smaller than the size of a person and possibly breaches the limits of applicability of the Lawson method.

1.5.20 The tiny distress regions indicated on the corners of balconies are bounded on 3 of their 4 sides by walls/balustrades which greatly mitigates risk of any hazard caused by wind (eg: being blown off balance for frail/elderly pedestrians).

1.5.21 The balustrades on some of the balconies are modelled as porous screens, approximating barred rails in the proposed design. Distress on the balconies may be removed by increasing the static pressure loss coefficient of these balustrades. This can be achieved by reducing the ratio of open area to total area through the balustrades.

Lawson Comfort

1.5.22 Similarly to Lawson Distress, Lawson comfort criteria can be formulated in terms of a wind speed threshold and a proportion of time. Winds that are predicted to exceed the specified threshold for 5% of a typical year or more are considered comfortable for the assigned category. These thresholds and corresponding categories are given in Table 2.

1.5.23 The suitability of comfort results are dependent on the intended pedestrian uses. For example: a region which is intended for standing, such as the immediate vicinity of a bus shelter, should be comfortable for at least standing – that is, analysis should predict the region to have Lawson comfort in the categories of standing or sitting – to be considered suitable.

1.5.24 The results for the baseline scenario show that the development site is mostly comfortable for business walking.

1.5.25 The results for the proposed scenario show that the development site is mostly comfortable for sitting. A few regions are comfortable for pedestrian walking and one small region within the south-eastern most point of the development site boundary is comfortable for business walking.

1.5.26 Comparing the baseline and proposed scenario, results show that the proposed development positively impacts the wind microclimate in terms of Lawson comfort. This is observed as improved levels of comfort throughout the development site and its surroundings to the northeast.

1.5.27 It is recommended that the entrances to buildings should be comfortable for at least standing. Results for the proposed scenario show that the entrances to all buildings are comfortable for at least standing, except for possibly two houses in the 'Link Road West' character area. Results in this region represent a conservative estimate for the wind microclimate since additional mitigating features such as off-site vegetation to the west of the development site have not been included in the simulation – such features are expected to improve the comfort results for this area.

1.5.28 Some regions on balconies are acceptable for pedestrian walking. It is anticipated that balconies are intended to be used only as incidental seating – microclimate conditions would be acceptable for sitting depending on the calmness of a particular day rather than requiring long-term calm/sitting conditions – and the suitability is at the discretion of the individual users.

Transient Effects

1.5.29 Effects on the wind microclimate due to transient scenarios such as construction have not been simulated as quantitatively capturing these effects would be untenable given the scope of geometric variety and their rate of change.

1.5.30 During this phase, it is expected that the site would be inaccessible to the general public. Therefore, the site is not ascribed any intended pedestrian uses for assessment using the Lawson method.

1.5.31 It is also expected that on-site safety will be managed by relevant construction procedures.

1.5.32 The results for 15 m/s Lawson Distress and Lawson comfort show that the proposed development has a positive impact on the wind microclimate of the development site and its surrounds to the northeast. It is expected that the presence of hoardings and construction equipment will have a similar impact, modulated by the stage of completion.

1.6 Conclusion

1.6.1 The following scenarios have been simulated:

1. Baseline
2. Proposed

1.6.2 The results have been analysed and discussed in relation to the industry standard Lawson method.

1.6.3 This investigation shows that the wind microclimate of the proposed development site is safe for able bodied pedestrians according to the Lawson method.

1.6.4 Comparisons of the baseline and proposed scenarios show that the proposed development does not negatively impact the wind microclimate of the development site in terms of 20 m/s Lawson Distress.

1.6.5 The investigation shows that the wind microclimate of the proposed development site is almost entirely safe for frail/elderly pedestrians and cyclists according to the Lawson method.

1.6.6 One small region within the south-eastern most point of the development site boundary and some tiny regions on the corners of balconies indicate 15 m/s Lawson Distress.

1.6.7 Comparisons of the baseline and proposed scenarios show that the proposed development positively impacts the wind microclimate of the development site and its surroundings to the northeast according to the Lawson method.

1.6.8 The investigation shows that the wind microclimate of the proposed development site is comfortable for its intended pedestrian uses and is acceptable according to the Lawson method.

1.6.9 Comparisons of the baseline and proposed scenarios show that the proposed development positively impacts the wind microclimate of the development site and its surroundings to the northeast according to the Lawson method.

1.7 References

[1] Y. Tominaga, "AIJ Guidelines for Practical Applications of CFD to Pedestrian Wind Environment around Buildings," *Journal of Wind Engineering and Industrial Aerodynamics,* p. 1750, 2008.

[2] T. Lawson, Building Aerodynamics, Imperial College Press, 2001.

[3] I. E. Idelchik, Handbook of Hydraulic Resistance, 4 ed., Begell House, 2007.