www.bre.co.uk

BRE Client Report

Station Yard Twickenham - Wind Microclimate Assessment

Prepared for: Solum Regeneration (Twickenham) LLP
Date: 18th November 2019
Report Number: P114674 – 1000: Issue 3

BRE
Watford, Herts
WD25 9XX

Customer Services 0333 321 8811

From outside the UK:
T + 44 (0) 1923 664000
F + 44 (0) 1923 664010
E enquiries@bre.co.uk
www.bre.co.uk

Prepared for
Joel Colthart MRICS
Solum Regeneration (Twickenham) LLP
Tempsford Hall
Sandy
Bedfordshire
SG19 2BD

Prepared by

Name Dr Paul Blackmore

Position Associate Director

Date 18th November 2019

Signature 

Authorised by

Name Gordon Breeze

Position Principal Consultant, Building Technology Group

Date 18th November 2019

Signature 

Executive Summary

It is proposed that a ground + five-storey residential block is constructed on a site adjacent to Twickenham Station, known as Station Yard. The site is currently used to provide temporary parking provision.

BRE have been appointed by Solum Regeneration (Twickenham) LLP to undertake a qualitative desk top study to consider pedestrian level wind effects around the proposed Station Yard development.

This study is based upon information provided to BRE by the Client via email which included images and drawings of the proposed building and surrounding area.

The conclusions of this desk study are:

- For all wind directions, including the prevailing southwesterly direction, the wind microclimate around the proposed Station Yard development is expected to be suitable for the intended pedestrian activities at entrances, all ground level locations on footpaths, public realm areas and adjoining areas.
- The proposed development is not expected to generate any unpleasant wind conditions around the Site or around surrounding nearby existing buildings or public realm areas.

Table of Contents

1 Introduction

It is proposed that a ground + five-storey residential block is constructed on a site adjacent to Twickenham Station, known as Station Yard. The site is currently used to provide temporary parking provision.

The site is bounded by Station Yard to the south, Mary's Terrace to the East, rail lines to the north and a bus park to the west, beyond which is the Albany Public House.

BRE have been commissioned by Solum Regeneration (Twickenham) LLP to undertake a desk study to consider potential pedestrian level wind effects around the proposed development.

This study has been undertaken by BRE as project number P114674 and is based upon proposal number P114674 dated 25th February 2019.

This study is based upon information provided to BRE by Solum via email which included images and drawings of the proposed development and surrounding area. Selected examples of these images have been incorporated as figures into this report for ease of reference. Various online maps, satellite and street-level imagery resources have also been referred to in order to understand the local context and environs of the site.

2 Methodology

This assessment is based upon the professional opinion of an experienced BRE wind engineering expert who is a Chartered Civil and Structural Engineer with over 35 years of experience in this field. It is recognised that this opinion is qualitative in nature although the assessment of wind speed conditions for the Site is based on measured meteorological data and is therefore quantitative. This approach is widely accepted by planners and developers as being an appropriate methodology to support planning applications.

The professional opinion is based upon the wind effects generated by the buildings themselves, and by their context (i.e. the surrounding buildings and the macro-scale wind environment). This assessment enables potential pedestrian level wind environment issues around the site to be identified.

The purpose of undertaking a desk study is to identify areas of potentially unpleasant winds. However, people perceive the wind differently depending upon what they are doing. For example, people sitting will tolerate less windy conditions than people walking with purpose between locations. This means that an area having unpleasant winds for sitting purposes can be completely suitable for walking.

It is not practical to evaluate every location around a scheme in terms of every pedestrian activity, and a typical activity must therefore be chosen as the basis for making an assessment. For this purpose, the activities of Strolling (leisure-walking) and Entrances at the main entrances to the buildings have been chosen as being the most appropriate benchmarks. This is discussed further in Section 6.

It is important to recognise that a location having the potential to have unpleasant wind is not the same as that location being unpleasantly windy. A desk study offers a professional opinion about the likely wind conditions and draws attention to any areas of concern; hence it is qualitative by nature. The behaviour of the wind and its interaction with buildings means that it is not possible to be certain about the actual wind conditions - conditions which could be measured by a quantitative wind tunnel study.

3 Description of the Receiving Environment

3.1 Site Location and Surroundings

The proposed development is surrounded by low to mid-rise commercial and residential buildings. To the south of the development on Station Yard are two and three storey residential buildings. Immediately to the west is an open bus terminal, beyond which is the Albany Public House which is 17.5m high[1]. To the east is Bridge House which is up to 30.5m high. To the north is the railway beyond which are residential blocks of up to six stories (approximately 18m tall).

Figures 1 and 2 show aerial views of the immediate surroundings and the site in its wider context respectively. Figure 3 shows a schematic of the current site in relation to its surrounding context and Figure 4 shows a photo of the current site.

Figure 1 The proposed development site

[1] All building heights are AOD

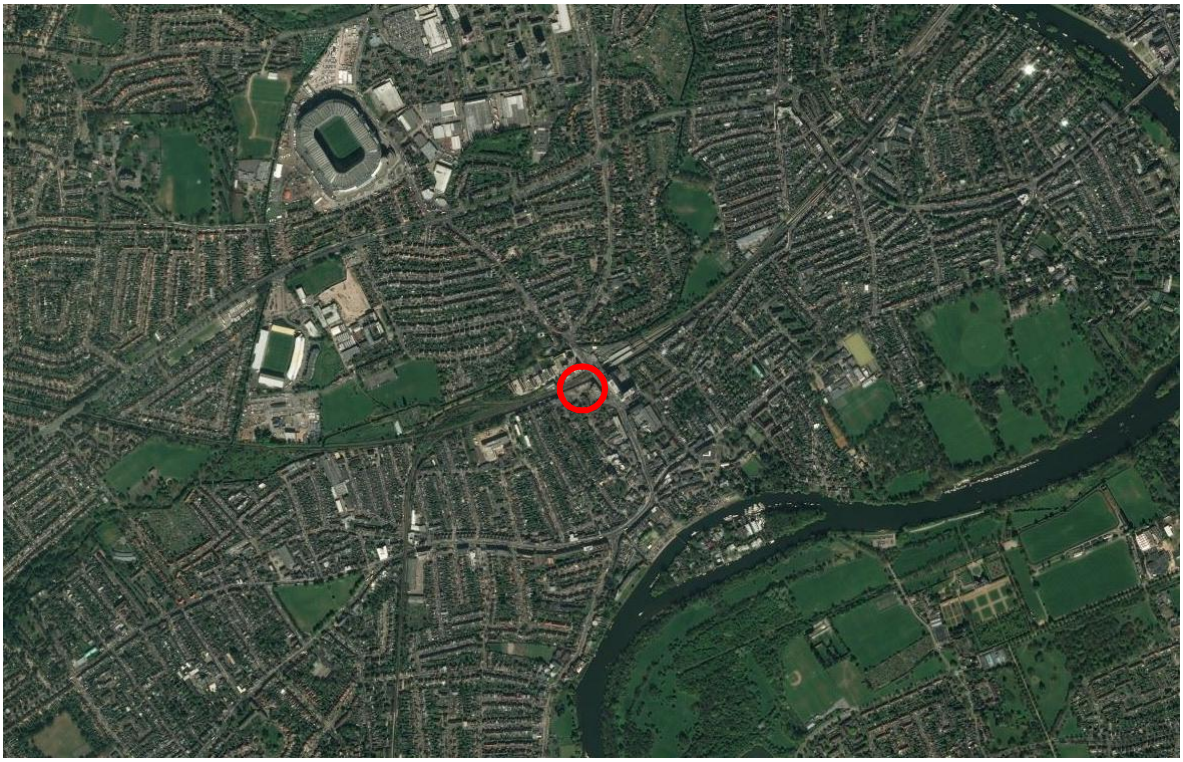

Figure 2 Aerial view of the site (circled in red) in its wider context

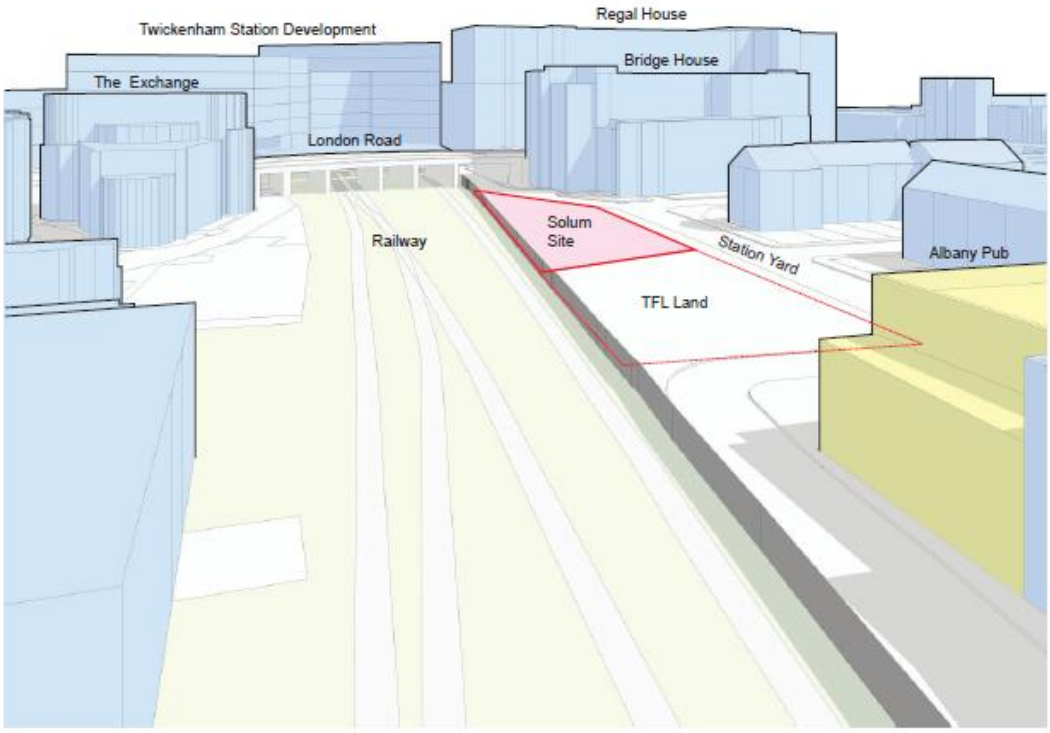

Figure 3 View looking from the west towards the development site

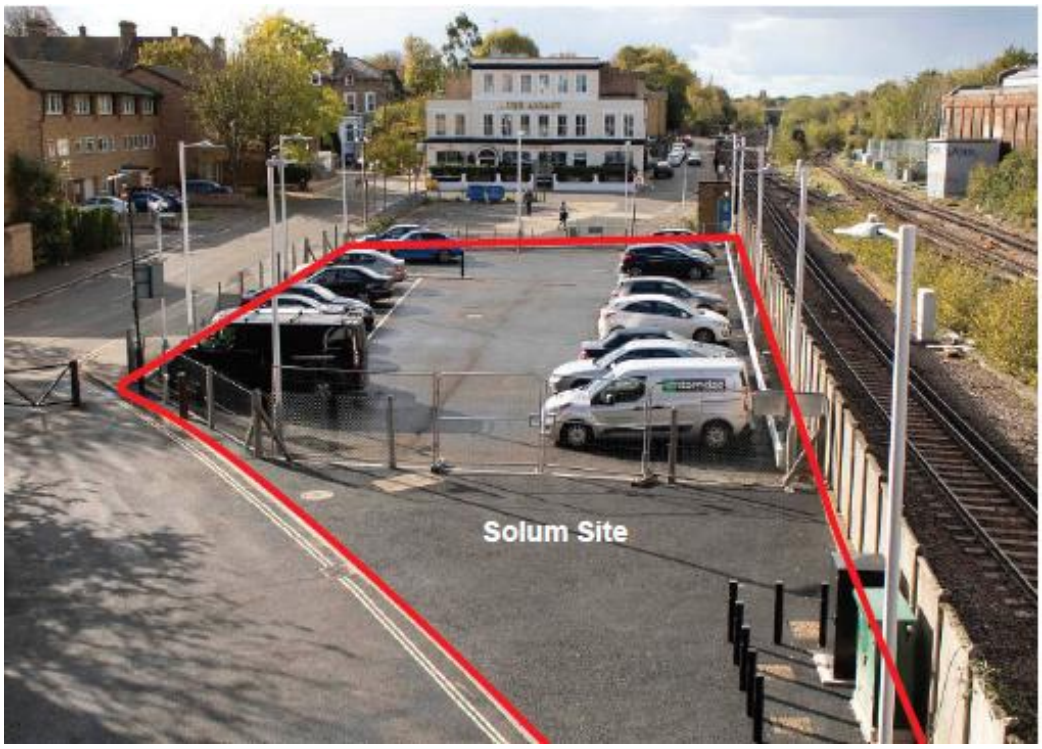

Figure 4 View of the site looking from the east

3.2 The Proposed Development

The proposed Station Yard development comprises of a ground + five storey residential building. The proposed building is essentially rectangular with an inset 6th floor. Figures 5 and 6 show the south and west elevations of the proposed building in context with the surrounding buildings. Figure 7 shows a plan of the ground floor with the entrances marked. The main pedestrian entrance is on the south elevation on Station Yard. There is a secondary entrance on the north elevation facing the railway. There are six other occasional entrances, four on the north elevation and two on the east elevation. The entrances on the north elevation open into; the residents bicycle store, water tank room, the refuse and recycling store and the LV room. The two entrances on the east elevation are into the electricity substation.

Figure 5 South Elevation

Figure 6 West elevation

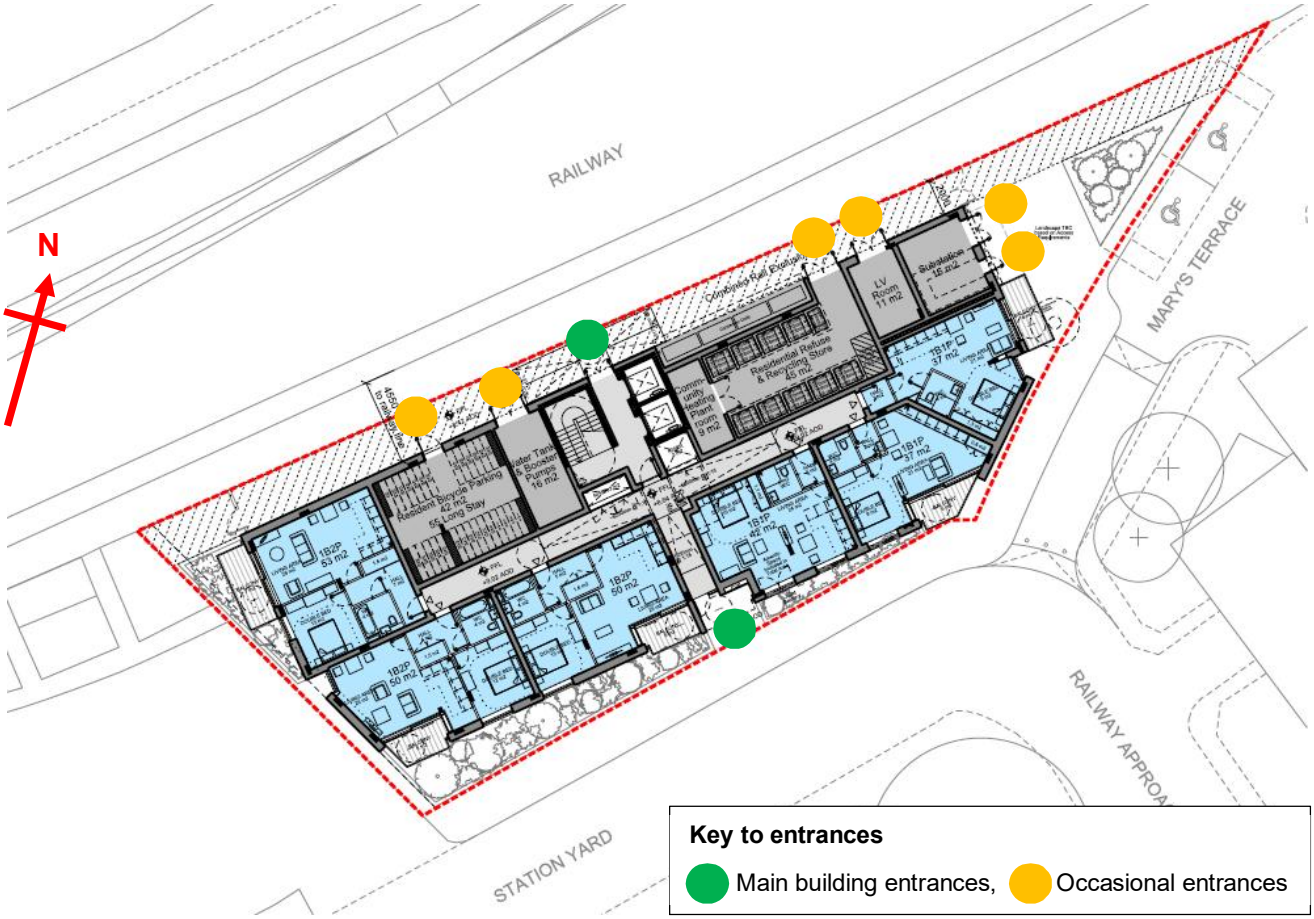

Figure 7 Plan view of the proposed development showing entrances into the building

4 Comfort Criteria

Wind conditions for pedestrian comfort are generally based on the Beaufort wind scale which describes wind effects on land for a range of mean wind speeds. Table 1 shows the Beaufort wind scale and describes the effects attributable to each wind speed range[2].

Beaufort scale	Description	Mean wind speed range		Effects
		(m/s)	(mph)	
B0	Calm	0–0.2	0–0.5	No noticeable wind, smoke rises vertically
B1	Light air	0.3–1.5	0.7–3.4	Direction of wind shown by smoke drift but not wind vanes
B2	Light breeze	1.6–3.3	3.6–7.4	Wind felt on face, leaves rustle
B3	Gentle breeze	3.4–5.4	7.6–12.1	Wind extends light flag, leaves in constant motion
B4	Moderate breeze	5.5–7.9	12.3–17.7	Raises dust and loose paper; hair disarranged, clothing flaps
B5	Fresh breeze	8.0–10.7	17.9–24.0	Small trees in leaf begin to sway; limit of agreeable wind on land
B6	Strong breeze	10.8–13.8	24.2–30.9	Umbrellas used with difficulty; force of the wind felt on the body; wind noisy, frequent blinking
B7	Near gale	13.9–17.1	31.1–38.3	Inconvenience felt when walking; difficult to walk steadily; hair blown straight
B8	Gale	17.2–20.7	38.5–46.4	Generally impedes progress; walking difficult to control; great difficulty with balance in gusts
B9	Strong gale	20.8–24.4	46.6–54.7	People blown over by gusts; slight structural damage
B10	Storm	24.5–28.4	54.9–63.6	Seldom experienced inland; trees uprooted, significant structural damage
B11	Violent storm	28.5–32.2	63.8–72.1	Very rarely experienced; accompanied by widespread structural damage
B12	Hurricane	> 32.3	> 72.4	Countryside devastated; winds of this force only occur in hurricanes and tornadoes

Table 1 The Beaufort scale of wind effects on land

This wind microclimate assessment is based upon a set of comfort criteria developed by Lawson with respect to people's perception of the suitability of the wind conditions for a range of activities from 'long-term sitting' (for example at open-air cafés), through 'standing' and 'strolling' and finally to 'business walking'. The more sedentary the activity, the lower the acceptable comfort threshold will be. Table 2[1] gives a description of the Lawson comfort criteria and the threshold wind speeds. The use of the Lawson comfort criteria has been shown to represent good standards of UK environmental practice and is widely accepted by Local Planning Departments. The conditions have also been assessed for safety using the Lawson 'distress criteria' which have been developed for use in assessing the onset of wind-induced 'distress'. These are based on a probability of exceedance of 0.025% of a given threshold windspeed per year, or 0.040% exceedance per month and equate to approximately one exceedance per year or per

[2] P Blackmore, BRE Digest 520, Wind Microclimate Around Buildings, May 2011

month. The threshold mean windspeeds used are Beaufort 7 (15m/s) for frail people and cyclists and Beaufort 8 (20m/s) for the general public in areas where frail people or cyclist would not normally be expected.

It should be recognised that the full Lawson comfort assessment can only be carried out with quantitative measurements of pedestrian level mean and gust wind speeds obtained from a wind tunnel study. The wind microclimate assessment carried out in this study uses expert judgement and experience to qualitatively apply the Lawson comfort criteria to the pedestrian microclimate around the development.

Activity	Lawson comfort criteria	
	Unacceptable	Tolerable
Roads and car parks, business walking, fast walking from A to B	10.7 m/s (B5) > 6%	10.7 m/s (B5) > 2%
People at work, workers around buildings	10.7 m/s (B5) > 2%	7.9 m/s (B4) > 2%
Pedestrian strolling, slow walking with occasional stops, shopping, short-term standing eg at bus stops	7.9 m/s (B4) > 4%	5.4 m/s (B3) > 6%
Long-term sitting – in open-air cafes, parks, etc. for periods of more than about 10 min	5.4 m/s (B3) > 6%	3.3 m/s (B2) > 6%
Entrances and exits of buildings or areas where there is a risk of sudden exposure to wind	5.4 m/s (B3) > 6%	3.3 m/s (B2) > 4%
Covered areas – pedestrian seating areas under cover, places of high cultural significance	5.4 m/s (B3) > 1%	3.3 m/s (B2) > 4%

Table 2 The Lawson comfort criteria and threshold mean wind speeds

5 Meteorological Data

Wind records have been obtained from the Met Office from a weather station at Heathrow Airport which will be representative of the wind conditions at the Station Yard Site.

Joint frequency tables of wind speed and direction over a ten-year period are presented in Figure 9 in the form of 'wind roses' for the summer and winter months, and also for the year as a whole. Analysis of these records shows that the prevailing wind direction throughout the year is south westerly which is typical of much of the UK.

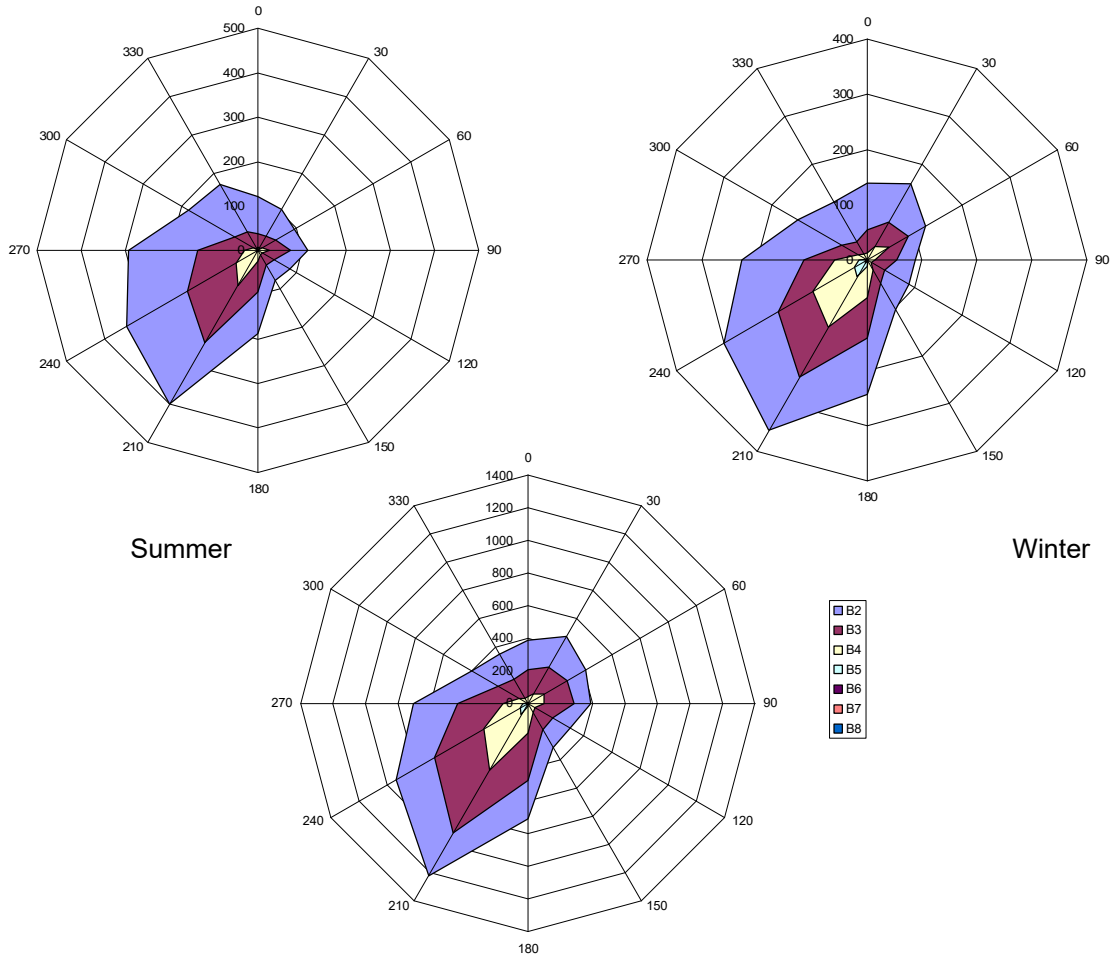

Figure 9 Wind roses for the London area

6 Expected Wind Conditions Around the Proposed Development

6.1 Behaviour of the Wind

Wind fundamentally consists of the motion of air. It is the amount of air motion and how this motion is perceived that affects how windy a place is judged to be. A property of air is that it has inertia. This means that air does not move unless a force acts upon it. In layman's terms, air can be thought of as being 'lazy' and, given the choice, will always take the easiest path around a building. Understanding this issue is important when desk studies such as this are undertaken. This is because comments about wind conditions around a site can only be based upon a judgement about the likely routes that air will take. These judgements are tempered by experience of similar projects, and by knowledge of potential wind problems that might be encountered.

High-speed winds are usually produced by the passage of large-scale weather systems. These weather systems are created by the convective circulation pattern that results from differential heating of the earth's surface at the poles and the equator. This convective pattern combines with the effects of the earth's rotation to produce prevailing south-westerly winds across much of Ireland. Such winds not only come from this direction more often than any other, but they also tend to be the strongest winds that can occur. It is however important to consult wind records from a meteorological station close to the site of any proposed development in order to confirm the local prevailing wind direction before undertaking a desk study such as this. A site's proximity to the coast or topological features, such as mountains or lakes, can mean that winds may blow from alternative directions to the typical south-westerly.

Nearer to the ground, effects of surface roughness associated with buildings, trees and other obstructions influence certain aspects of the behaviour and properties of the wind. The ground level winds experienced by the public are influenced strongly by the geometry of nearby buildings. In general, the nearer the building is to a given location; the more strongly its influence is felt. Thus, although the local pedestrian level wind conditions (both the relative strength and gustiness of the wind and its direction) are influenced by nearby buildings, the frequency of occurrences of such winds, and the mean wind strength itself, are determined by wind conditions far above the earth's surface.

6.2 Overview of wind effects and their impact on pedestrian activities

Windward vortices are a phenomenon common to many tall buildings, especially those which rise above their surroundings and provide a significant frontage to the prevailing wind. High-speed winds from higher levels above the ground may be deflected downwards by the windward building façade, which can cause significant nuisance and/or distress to pedestrians in the vicinity. Entrances to buildings are particular areas of concern.

Another potentially problematic pedestrian level wind phenomenon occurs when winds (including perhaps those deflected to ground level by a windward vortex) accelerate around the windward corners of buildings. Such conditions can be particularly uncomfortable for pedestrians passing from a sheltered area with calm wind conditions immediately into a windy location as they step past the corner of an affected building.

As already mentioned, the target Lawson pedestrian comfort criterion, as defined in Table 2, around the development will be Strolling around the building, Long-term sitting on the resident's roof terrace and Entrances at the main entrances to the building. The expected wind conditions around the development have been compared with these benchmark criteria.

Entrance doors are generally wind-sensitive locations because people walking out from a windless conditioned indoor environment to outdoors are immediately confronted with the effects of the wind and can perceive the wind to be stronger than it actually is. For this reason, particular attention should be paid to the wind conditions around doorway locations. Entrances located at unprotected corners of buildings where winds tend to 'whip' around from one façade to the next can be particularly problematic.

The following assessments consider wind approaching from the four principle directions and from the prevailing south westerly direction.

6.3 Northerly wind

To the north of the site are the six storey Exchange building and six storey Wharf House and a new building under construction at Twickenham station. These buildings are of similar height or taller than the proposed development and will therefore provide significant shelter.

Immediately adjacent to the proposed development to the north is the railway which is approximately 30m wide. Northerly winds will be brought down to ground level over the railway in the wake of the upstream buildings and will blow on to the northern face of the proposed development. There is the potential for a windward vortex to form on the northern elevation causing some downwash which will be accelerated around the ends of the building. There are no entrances near the ends of the building and given the relatively low height of the proposed development and the shelter from upwind buildings any downwash will be weak. Given that northerly winds are not prevailing, it is therefore expected that the wind conditions along the northern elevation will be suitable for the intended pedestrian activities of entrances and pedestrian strolling.

In summary: The Site is relatively well sheltered from northerly winds and northerly winds will be infrequent and will have a lower magnitude than the prevailing south westerly winds, as shown in the wind rose in Figure 9. Some downwash is expected on the north elevation; however, the strength of the wind is not expected to be significant and the wind conditions at the entrances on this face are expected to be suitable for entrances. It is judged that the wind conditions around the proposed development will be suitable for Entrances at all main and occasional entrances and for Pedestrian Strolling on walkways and amenity areas around the proposed development and there are not expected to be any adverse wind impacts around this development from northerly winds.

6.4 Easterly Winds

Winds approaching from the east will pass over Regal House (40m tall) the nearby Bridge House (30.5m tall). These building are both taller than the proposed development and will provide significant shelter from easterly winds.

The proposed development is aligned approximately east-west and so presents its narrow elevation to easterly winds. The only entrances on the eastern elevation are into the electricity substation. These will only use used on an occasional basis. There is not expected to be any significant downwash on the eastern elevation or significant flow acceleration.

In summary: easterly winds are relatively infrequent and will be of relatively low magnitude. Upwind buildings will tend to break up the wind flow and provide shelter from easterly winds and the wind conditions are expected to be suitable for the intended pedestrian activities at all locations.

6.5 Southerly Winds

To the south of the proposed development are two and three storey pitched roof residential buildings, estimated to be up to about 12m tall plus several trees and other vegetation. These will all provide some shelter from southerly winds. However, the proposed development will be three to four stories taller than the nearby surrounding buildings on the south elevation.

Southerly winds will therefore blow on to the exposed face of the southern elevation and will be deflected down towards ground level. However, the proposed development has several balconies see Figure 9, which will help to breakup the wind flow on this face and given the relatively small exposed face of the development it is unlikely that a windward vortex will form. The main entrance to the development is near the centre of the southern face. This entrance is recessed by a distance of approximately 2m and sheltered from downwash by the protruding balconies above so given that southerly winds are not prevailing it is not expected that there will be any significant adverse wind conditions at this entrance from southerly winds.

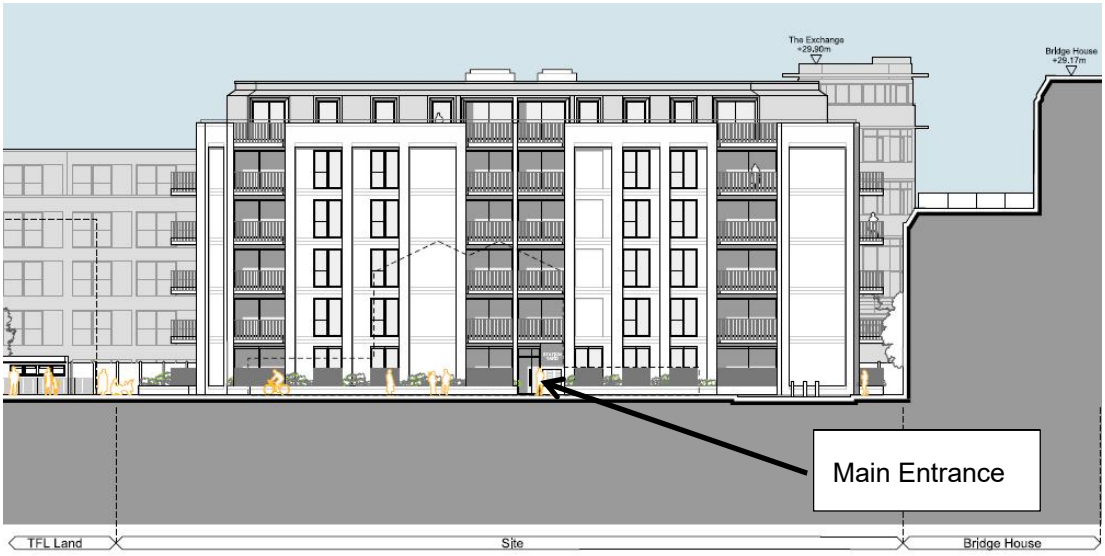

Figure 9 View of the south elevation of the proposed development

In summary: southerly winds are not expected to generate an adverse wind impact on walkways or other pedestrian areas or at the main entrance to the development. All locations are expected to be suitable for Strolling or Entrances as appropriate.

6.6 Westerly winds

To the west of the proposed development there is an open fetch along the railway lines of approximately 100m. Upwind is then a recent development of four storey residential buildings. The ground here rises up and is some 5m above the ground level at the development Site so the height of these buildings is of a similar height to the proposed development. There are also several mature trees to the west. These will

all provide some shelter to the proposed development although this will be limited due to their upwind distance from the Site.

The proposed development has its narrow elevation facing west so there is unlikely to be a windward vortex on this narrow face and there will be little accelerated flow around the upwind northwest corner or downwind southwest corner. There are no entrances on the west elevation nor near the westerly ends of the building and no public access around the western end.

It is judged that there are unlikely to be any unpleasant wind effects from westerly winds and all locations around the building are expected to be suitable for the intended pedestrian activities.

In summary: westerly winds will blow on to the narrow west elevation of the proposed development. There are no entrances near the western end and no public access around the western end of the building. It is judged that for westerly winds, the ground level wind speeds around the proposed development will be suitable for the intended pedestrian activity of Strolling.

6.7 Southwesterly winds

The prevailing wind direction at this Site is strongly south westerly (direction 210°). The strongest and most frequent winds will blow from this direction. Winds blowing from this direction will pass over a long fetch of mainly three storey buildings. Immediately to the southwest of the Site there is the Albany Public House (17.5m high and 40m away from the Site) followed by a narrow open area of land owned by TFL and currently used as a parking area for buses. This area could potentially be developed in the future.

The upwind buildings will provide some shelter although the approaching wind is likely to be brought down to ground level in the open area to the southwest of the development. The proposed development presents its narrow elevation to southwesterly winds so wind blowing on to this face is unlikely to generate a windward vortex or to create strongly accelerated wind flow around the western corners of the development.

There is no pedestrian access around the western end of the proposed development and there are no entrances near the western end. Therefore, it is judged that for southwesterly winds all locations around the building will be suitable for the intended pedestrian activities.

In summary: southwesterly winds will blow on to the narrow west elevation of the proposed development. There are no entrances and no public access around the western end of the building. It is judged that for southwesterly winds, the ground level wind speeds around the proposed development will be suitable for Strolling in public access areas and Entrances at the entrances.

6.8 Assessment of Distress Conditions

The assessment of pedestrian comfort conditions discussed in Sections 6.3 to 6.8 have been based on the Lawson comfort criteria which have been shown to represent good standards of environmental practice and is widely accepted by Local Planning Departments. The conditions have also been assessed for safety using the Lawson ‘distress criteria’ which have been developed for use in assessing the onset of wind-induced ‘distress’. The Lawson distress criteria are based on a probability of exceedance of 0.025% of a given threshold windspeed per year, or 0.040% exceedance per month and equate to approximately one exceedance per year or per month. The threshold mean windspeeds used are

Beaufort 7 (15m/s) for frail people and cyclists and Beaufort 8 (20m/s) for the general public in areas where frail people or cyclist would not normally be expected.

A qualitative assessment of the distress criteria has been carried out for this proposed development. In general, distress criteria might be expected to be exceeded at exposed corners and other areas of accelerated flow around either large or high-rise buildings. Due to the height and massing of the Station Yard development and its location in a built-up urban environment, there are not expected to be any areas of significant accelerated flow around the building.

Therefore, from this assessment it is concluded that neither the upper nor lower distress criteria will be exceeded at any locations around the proposed Station Yard development.

7 Conclusions

It is proposed that a ground + five-storey residential block is constructed on a site close to Twickenham Station, known as Station Yard. The site is currently used to provide temporary parking provision.

The site is bounded by Station Yard to the south, Mary's Terrace to the East, rail lines to the north and a bus park to the west, beyond which is the Albany Public House.

BRE have been commissioned by Solum Regeneration (Twickenham) LLP to undertake a desk study to consider potential pedestrian level wind effects around the proposed development.

This study is based upon information provided to BRE by the Client via email which included images and drawings of the proposed building and surrounding area.

The conclusions of this desk study are as follows:

- For all wind directions, including the prevailing southwesterly direction, the wind microclimate around the proposed Station Yard development is expected to be suitable for the intended pedestrian activities at entrances, all ground level locations on footpaths, public realm areas and adjoining areas.
- The proposed development is not expected to generate any unpleasant wind conditions around the Site or around surrounding nearby existing buildings or public realm areas and the distress criteria and not expected to be exceeded.