102
Camley Street, London N1C 4PF

Pedestrian Level Wind Microclimate Assessment
Wind Tunnel Study

Final Report 30 June 2014 – RWDI #1400433-2-B

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CONSULTING ENGINEERS & SCIENTISTS

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102 Camley St

London, UK

Final Report

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Wind Tunnel Study

RWDI #1400433-2-B
June 30, 2014

SUBMITTED TO

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A	25th June 2014	All	D. Hamlyn
B	30th June 2014	All	D. Hamlyn

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OBJECTIVE

The objective of this study was to provide a pedestrian level wind microclimate assessment, based on a series of wind tunnel tests, for the 102 Camley St development, near Kings Cross, London, hereafter referred to as the Proposed Development. This report presents a description of the methodology used and the main wind tunnel test results. Tests were conducted in the presence of the existing surroundings (including the 103 Camley St development) and cumulative surrounding buildings (including 101 Camley St, which is the subject of a separate planning application) and results are presented for the windiest (typically winter) and summer seasons. A test was also completed for the baseline case of the current Site, in the presence of the existing surroundings. Results are presented in terms of the well-known Lawson Comfort Criteria.

1. Summary

Wind tunnel tests were conducted on a 1:300 scale model of the 102 Camley St development. The investigation quantifies the wind conditions within the Site, by comparing the measured wind speeds and frequency of occurrence with the well-established Lawson Comfort Criteria.

Measurements were taken at up to 145 ground level receptors across the Site and surroundings for all wind directions. These included receptors along the building facades and corners, near main entrances, within open amenity spaces, and on pedestrian routes within and around the Proposed Development. Measurements were also taken at up to 69 receptors on terrace areas of the Proposed Development and 103 Camley St, and on the proposed development at 101 Camley St in the cumulative surroundings scenario. Analysis was conducted on a seasonal basis but the report focuses on the windiest season results and those for the summer season, when pedestrian activity generally requires calmer conditions.

Three configurations of the wind tunnel model were tested:

Configuration 1: Baseline: Current Site with existing surrounding buildings including 103 Camley St.

Configuration 2: Proposed Development with existing surrounding buildings including 103 Camley St.

Configuration 3: Proposed Development with cumulative surrounding buildings. This configuration includes 103 Camley St as previously, but also includes the proposed development at 101 Camley St as well as other consented schemes around the Site.

The wind tunnel tests for all configurations were conducted on a model devoid of trees or landscape detail in order to obtain conservative results (i.e. generate a relatively windy microclimate).

Meteorological data for London has been analysed and adjusted to the Site by modelling the effect of terrain roughness on the wind speeds approaching the Site. Results are presented in a series of 'dot-plots' to indicate the measured comfort criteria for the windiest and summer seasons for each configuration.

The overall conclusion from the assessment is that the wind microclimate around the Development with existing surroundings is mainly suitable for its intended pedestrian use. However, there are a small number of receptors that are windier than desired and where mitigation is recommended.

For Configuration 2 the highest wind speeds occur along the passageway between the wings of 102 Camley St where channeling occurs. Conditions here are predicted to be two categories windier than required for the entranceways located in this area, and one category too windy for thoroughfare use (in the windiest season). One terrace receptor is also one category windier than required for amenity use in summertime and would benefit from mitigation.

In Configuration 3, the wind environment at 102 Camley St benefits from the additional shelter provided by 101 Camley St. However, conditions one category windier than desired for entranceway use and amenity use remain, as do occasional strong winds. Mitigation would therefore be recommended at the relevant locations. At 101 Camley St, one amenity area at ground level and a number of roof terraces are windier than required and mitigation measures have been proposed. Some of these terraces are also subject to occasional strong winds. These terraces are more directly exposed to the prevailing south-westerly wind, and also wind is channeled through the gap between the two parts of the 101 Camley St building.

Mitigation measures have been proposed, including the use of soft landscaping or porous screening in amenity and thoroughfare areas, recessing or screening at entranceways and taller balustrades and soft landscaping on terrace areas.

2. Site Description

The OS Landranger reference grid for the Site is TQ298838. The Site is located near Kings Cross in Central London. The Site is bounded by Camley St to the west with railway lines immediately to its east. The southern part of the Site overlooks the Grand Union Canal, whilst there is commercial/warehouse development to the north of the Site. The surroundings include the new 103 Camley St mixed use development (up to 12 storeys in height) to the west of Camley St.

2.1 The Proposed Development

The Proposed Development at 102 Camley St consists of a residential building with two wings, with some commercial space at ground level. The larger wing of the building runs approximately north-south, with a smaller wing running westwards from the northern end of the building. At ground level, there is a pedestrian passageway where these two parts of the building meet. This runs approximately north-south linking thoroughfares to the north of the building with the public open amenity space created between the two wings of the building. This space extends down to the canal via steps and a ramp. There is also a small amenity space at the southern end of the building adjacent to the canal path where soft landscaping is planned. The main part of the building is 11 floors in height with some roof terrace areas on the perimeter of the eleventh floor, whilst the smaller wing of the building is eight storeys in height with a rooftop terrace above. Figure 1 shows an aerial view of the Site.

At ground level, there is an entrance to a commercial unit accessed from the public open space, as well as entrances to the main building lobbies and a commercial space accessed from the passageway between the two building wings. Above ground level, a number of the apartments have balconies.

Figure 2 presents an image of the wind tunnel model of the Proposed Development with existing surroundings. Appendix A shows a selection of photographs of the wind tunnel model for the three configurations tested; the existing Site with existing surroundings (which include 103 Camley St), the Proposed Development with existing surroundings and the Proposed Development with cumulative surroundings (including 103 Camley St and the proposed development at 101 Camley St).

3. Wind Tunnel Testing: Procedure and Methodology

The basic methodology for quantifying the pedestrian level wind environment is outlined below:

- Measure the wind speeds at pedestrian level in the wind tunnel relative to a reference wind speed;
- Adjust standard meteorological data to account for conditions at the Site;
- Combine these to obtain the expected frequency and magnitude of wind speeds at pedestrian level; and
- Compare the results with the Lawson Comfort Criteria to 'grade' conditions around the Site.

3.1 Simulation of Atmospheric Winds

The wind is turbulent, or gusty, and this turbulence varies depending upon the site. It is necessary to reflect these differences in the wind tunnel test. In addition, the atmospheric boundary layer is a shear flow which means that the mean wind speed increases with height. Modeling these effects is achieved by a combination of grid, barrier and floor roughness elements to create a naturally-grown boundary layer that is representative of urban or open country conditions, as appropriate. The detailed proximity model around the Site was used to fine-tune the flow and create conditions similar to those expected at full scale.

3.2 Measurement Technique

Wind speed measurements were made using Irwin probes. These probes measure the pressure at a scaled 1.5m height above ground (or roof level) and also at the surface, from which the wind speed is obtained using a calibrated relationship. For pedestrian comfort studies, the mean wind speed is required as well as a measure of the peak wind speed at each measurement location. The typical equivalent full scale time period for measuring the mean wind speed is around 15 minutes, whereas the peak wind speed is taken as the wind speed exceeded for 1% of the time.

Wind speeds at each location were measured for all wind directions with 0° representing a wind blowing from the north and 90° a wind blowing from the east.

3.3 Scaling

The length scale of the model was 1:300 and the velocity scale was approximately 1:2 for strong winds. Consequently the time scale for the tests was 1:150, or in other words 1 second in the wind tunnel is equivalent to 150 seconds at full scale.

3.4 Meteorological Data

Meteorological data derived from the main airport meteorological stations (i.e. Heathrow, Gatwick and Stansted) in London have been corrected to standard conditions of 10m above open flat level country terrain. The meteorological station data is then adjusted to the Site using the methodology implemented in the BREVe3 software package.

The meteorological data for London used in this report are presented in Appendix B as wind roses by season (refer to Figure 14) with the wind speed divided into Beaufort Force ranges (see Table 4, Appendix C). The radial axis indicates the cumulative number of hours per season that the wind speed exceeds the particular Beaufort Force. The seasons are defined as spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February).

The meteorological data indicate that the prevailing wind direction throughout the year is from the south-west. This is typical for many areas of southern England. There is a secondary peak from north easterly winds, especially during the spring, and these tend to be cold winds.

The combination of meteorological data, Site altitude and velocity ratios permits the percentage of time that wind speeds are exceeded at ground level on the Site to be evaluated. The locations can then be assessed using 'comfort criteria', as described below.

3.5 Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the measurements can be compared. This report uses the Lawson Criteria, which have been established for some thirty years and have been widely used on building developments across the United Kingdom. The comfort criteria, which seek to define the reaction of an average pedestrian to the wind, are described in Table 3 and illustrated in Figure 15 (both found in Appendix C). If the measured wind conditions exceed the threshold then conditions are unacceptable for the stated pedestrian activity and the expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.

The criteria set out six pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The six categories are sitting, standing, entering/leaving a building, leisure walking, business walking and roadway/car-park, in ascending order of activity level. In other words, the wind conditions in an area for sitting need to be calmer than a location that people merely walk past. The distinction between leisure walking and business walking is that in the business scenario, where pedestrians are on site because their livelihood depends upon it, they will be more tolerant of stronger winds.

The criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season.

The wind microclimate assessment is written for the Development on the basis that the local wind conditions are expected to meet the desired target conditions which best represent the pedestrian usage within the Site.

3.6 Strong Winds

Lawson also specified a lower limit strong wind threshold when winds exceed Beaufort Force 6 (B6). Notification of exceedance greater than one hour in the year is required. Exceedance of this threshold may indicate a need for remedial measures or a careful assessment of the expected use of that location e.g. is it reasonable to expect vulnerable pedestrians to be present at the location on the windiest day of the year?

In the UK, stronger winds are associated with areas which would be classified as suitable for business walking or roadway use. In a mixed-use, urban development, business walking and roadway conditions would not usually form part of the 'target' wind environment and would usually require mitigation due to pedestrian comfort considerations. This mitigation would also reduce the frequency of, or even eliminate, any strong winds.

For locations where the wind speed exceeds Beaufort Force 6, which are found on a pedestrian thoroughfare, the results are unlikely to generate nuisance to pedestrians. However, where there is an exceedance of Beaufort Force 7 or 8, we would expect pedestrians to experience difficulty in walking.

If the wind speed exceeds Beaufort Force 6 in a proposed external seating area or outside an entrance, these conditions would be unacceptable and would require mitigation. However, if the wind speed exceeded Beaufort Force 6 then the area is likely to be classified as suitable for leisure walking, business walking or roadway use and so would require mitigation to satisfy the Lawson Comfort Criteria in any case.

It is RWDI's practice to report incidence when Beaufort Force 6, 7 and 8 are exceeded for more than 1 hour per annum. The results for this study are presented in Table 2 which also shows the wind direction that contributes most to the strong winds.

4. Results

4.1 Details of the Analysis

To account for the difference in height and terrain roughness between meteorological conditions at the airport and the Site it is necessary to apply correction factors to the wind tunnel velocity ratios. Correction factors (mean factors) were computed for a full range of wind directions from 0° through to 360°. The reference height in the wind tunnel was at the equivalent full-scale height of 120 metres. Table 1 presents the mean factors for the Site.

4.2 Desired Pedestrian Activity around the Development

Generally, for an urban mixed-use or residential development the target conditions are as follows:

- Leisure walking during the windiest season on pedestrian thoroughfares;
- Standing/entrance conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year; and
- Sitting at outdoor seating and amenity areas during the summer season when these areas are more likely to be frequently used by pedestrians.

The business walking and roadway classifications are usually avoided because of their association with occasional strong winds unless they are on a minor pedestrian route or a route where pedestrian access could be controlled in the event of strong winds.

Achieving a sitting classification in the summer usually means that same receptor would be suitable for standing in the windiest season because winds are stronger at this time. This is considered an acceptable occurrence for the majority of external amenity spaces because other factors such as air temperature and precipitation influence people's perceptions about the 'need' to use seating in the middle of winter.

4.3 Performance Against the Lawson Criteria

Appendix D summarizes the comfort criteria results, for each season, around the Site and existing surroundings (Configuration 1) and for the Proposed Development and existing surroundings (Configuration 2), which includes 103 Camley St. A cumulative assessment has also been completed (Configuration 3) for the Proposed Development which takes into consideration the presence of neighbouring proposed developments within a 360m radius of the Site, including both 103 Camley St (part of the baseline configuration) and the proposed development at 101 Camley St.

5. Discussion

5.1 Wind Assessment

5.1.1 Configuration 1: Existing Site and Existing Surroundings

Figure 3 and Figure 4 show the windiest and summer season results at ground level and terrace levels in areas accessible to residents or the general public around the existing Site and existing surroundings. This forms the baseline configuration against which the effects of the Proposed Development on the wind microclimate can be assessed. The figures also show conditions at terraces on 103 Camley St. Conditions on and around 103 Camley St were measured as a baseline so that any effects caused by the Proposed Development or cumulative developments on the wind environment at this building would be identifiable.

The wind microclimate at 115 (ground-level) locations, for the windiest season (typically winter), is summarised as follows:

- Forty locations are suitable for sitting;
- Sixty-nine locations are suitable for standing/entrance use;
- Six locations are suitable for leisure walking

The wind microclimate for the windiest season at 27 terrace and balcony locations on the existing 103 Camley St building is summarized as a baseline below.

- Thirteen locations are suitable for sitting; and
- Fourteen locations are suitable for standing/entrance use.

Ground Level

During the windiest season, the ground level wind conditions within the Site are suitable for sitting, standing or leisure walking (Figure 3). The leisure walking conditions are observed at receptors 2, 3, 38, 60, 67 and 83. These are all understood to be thoroughfare locations, and hence all ground-level wind comfort conditions are appropriate for their intended use.

In summertime, 104 receptors recorded wind conditions suitable for sitting (Figure 4) and 11 receptors recorded conditions suitable for standing. Of these, only one receptor (location 74) is in an area intended as public open space. If this area has an amenity purpose, then the predicted wind comfort conditions here are one category windier than required for summertime amenity use. However, there is soft landscaping in the form of tree planting present in this area, which would be expected to provide mitigation. Conditions at all other receptor locations are suitable for the proposed usage in the summer season.

Terrace Areas and Balconies on 103 Camley St

On the terrace levels and balconies, summertime conditions are suitable for sitting at all measurement locations apart from terrace receptors 143, 156 and 164 which are suitable for standing. If these areas have an amenity use, this would be one category windier than required.

Occurrence of Strong Winds

For Configuration 1, the only exceedance of Beaufort Force 6 for an hour or more per year is at receptor 83, for 1.3 hours per year. This is a thoroughfare location, and hence exceeding the Beaufort Force 6 threshold for a small number of hours per year is unlikely to cause nuisance to pedestrians.

5.1.2 Configuration 2: Proposed Development and Existing Surroundings

Figure 5 and Figure 6 show the windiest and summer season results at ground level within and around the Proposed Development and existing surroundings. The Figures also present the seasonal results at terraces on 102 and 103 Camley St.

The wind microclimate at 135 ground-level locations within and around the Proposed Development and its immediate surroundings, for the windiest season, is summarized as follows:

- Forty-eight locations are suitable for sitting;
- Sixty-eight locations are suitable for standing/entrance use;
- Eight locations are suitable for leisure walking; and
- One location is suitable for business walking

The wind microclimate at 41 terrace and balcony locations on 102 and 103 Camley St, for the windiest season, is summarized as follows.

- Twenty-four locations are suitable for sitting; and
- Seventeen locations are suitable for standing/entrance use.

Ground Level

Overview

During the windiest season, the wind environment across the Development is suitable for a range of uses, from sitting to business walking.

Leisure walking conditions are observed at receptors 33, 38, 65, 68, 83, 89, 90, and 131. Business walking conditions are observed at receptor 108 only. These locations are areas where thoroughfare usage is expected, with the exception of receptor 108, which is adjacent to building entrances.

Thoroughfares

Around the Development, the wind microclimate was measured as suitable for sitting, standing or leisure walking during the windiest season at all ground level receptors with the exception of receptor 108.

For a thoroughfare, the target conditions would be suitable for leisure walking and therefore the results meet this criterion or are calmer than desired with the exception of receptor 108. At receptor 108, conditions are windier than required for thoroughfare use and would require mitigation. The reason for windy conditions in this area is the channeling of the prevailing south-westerly wind through the passageway at receptor 108 as a result of the orientation of the 102 Camley St building.

Entrances

Entranceway locations around the Proposed Development experience a wind microclimate suitable for sitting or standing/entrance use throughout the year (Figures 5 and 6) which satisfies the target

condition, except for entrances in the passageway at 102 Camley St, where business walking conditions were measured in the windiest season.

At receptor 108 in this passageway conditions are therefore two categories windier than required and mitigation measures would be required to shelter the entranceway in this area, as well as reducing wind speeds to a level appropriate for thoroughfare use.

Amenity Spaces

In summertime, all receptors located in ground level amenity spaces were suitable for sitting, which is the target categorization.

Terrace Areas and Balconies

On the terrace levels, summertime conditions are suitable for sitting at most measurement locations on 103 and 102 Camley St with the exceptions of receptors 162 and 164 on 103 Camley St and 170 on the southern end of 102 Camley St. Standing conditions were measured at receptor 164 in the baseline configuration, whilst conditions at receptor 162 are one category windier compared to the baseline. Further investigation reveals that conditions at receptor 162 fall at the very lower end of the standing categorization (1.03% of the time with wind speeds above Beaufort force 3 in the summer season compared to a 1.0% threshold). Hence these conditions are unlikely to cause nuisance to residents. Balcony conditions are suitable for sitting at all balcony measurement locations.

In the case of terrace-level receptor 170, mitigation measures would be recommended in order to reduce wind speeds to a level appropriate for summertime amenity usage. These conditions are likely to be due to corner accelerations of the prevailing south-westerly wind around the south-east corner of the terrace on 102 Camley St.

Occurrence of Strong Winds

For Configuration 2, there are four receptors where the wind speed exceeds Beaufort Force 6 for more than one hour. These are receptors 65, 68, 89 and 108. Of these, receptor 108 exceeds Beaufort Force 7 for more than one hour per year.

Receptors 65, 68 and 89 are on thoroughfares, and as such, exceeding the Beaufort Force 6 threshold for a small number of hours per year is unlikely to cause nuisance to pedestrians.

Receptor 108 is located in a passageway at 102 Camley St where entrances are also located. Wind speeds here exceed Beaufort Force 7 for two hours per year and mitigation measures will be required to reduce the speed of strong winds at this receptor.

5.1.3 Configuration 3: Proposed Development and Cumulative Surroundings

Figures 7-10 show the windiest and summer season results at ground level within and around the Proposed Development and cumulative surroundings, including the proposed development at 101 Camley St and the existing development at 103 Camley St. The Figures also present the seasonal results at terraces and balconies on 101, 102 and 103 Camley St.

The wind microclimate is marginally calmer than that reported for the existing surroundings because of the additional shelter provided by the neighbouring cumulative buildings.

The list of cumulative schemes[1] included on the wind tunnel model includes the following:

- Kings Cross Central

[1] The consented developments included in the testing were selected based on their proximity to the Site.

- 11-13 St Pancras Way
- Camley St Masterplan to the north of 102 and 103 Camley St

The number of receptors within the Development was 214. The wind microclimate at 145 ground-level locations within and around the Proposed Development and its immediate surroundings, for the windiest season, is summarized as follows:

- Sixty-six locations are suitable for sitting;
- Seventy-six locations are suitable for standing/entrance use; and
- Three locations are suitable for leisure walking.

The wind microclimate at 69 terrace and balcony locations within and around the Proposed Development and cumulative surroundings, for the windiest season, is summarized as follows. This includes terraces and balconies on 101, 102 and 103 Camley St.

- Forty locations are suitable for sitting;
- Twenty-one locations are suitable for standing/entrance use;
- Seven locations are suitable for leisure walking; and
- One location is suitable for business walking.

Ground Level

Overview

During the windiest season, the wind environment across the Development at ground level is suitable for a range of uses, from sitting to leisure walking.

Leisure walking conditions in the windiest season were measured at receptors 83, 108 and 150.

Thoroughfares

Around the Development the wind microclimate was measured as suitable for sitting, standing or leisure walking during the windiest season at all thoroughfare measurement locations. For thoroughfare usage, the wind conditions are therefore suitable for the desired use throughout the year (or calmer).

Entrances

Most entranceway receptors around the Proposed Development experience a wind microclimate suitable for sitting or standing/entrance use throughout the year (Figures 7 and 9) which satisfies the target condition. The exceptions to this are the entrances located in the passageway between the two wings of 102 Camley St, where leisure walking conditions were measured in the windiest season. These conditions are one category windier than required for entranceway use, and mitigation measures are therefore advised to create shelter outside the entrances. The higher wind speed in this area results from the orientation of 102 Camley St which faces the prevailing south-westerly wind direction and leads to winds being channeled through the ground level passageway between the two parts of the building. It should be noted that the wind speeds in this area are reduced in this configuration compared to Configuration 2. This is as a result of the additional shelter from prevailing south-westerly winds provided by the cumulative development at 101 Camley St.

Amenity Spaces

In summertime, all receptors in ground level amenity spaces were suitable for sitting with the exception of receptor 150 where conditions were suitable for standing. Sitting conditions would be the target for amenity spaces in summertime and hence mitigation measures would be recommended at

this location. It should be noted that the planned landscaping scheme may bring reductions in wind speed, and that soft landscaping can typically provide reductions in wind speed of up to one category, particularly when established and in full leaf.

Terrace and Balcony Areas

At the roof terrace levels, the wind environment is suitable for sitting in the summer at all but eleven measurement locations.

These locations are mainly on 101 Camley St. Conditions suitable for standing in summertime were measured at receptors 174-5, 177-180, 187-188 and 190) with conditions suitable for leisure walking in summertime measured at receptor 189. The latter corresponds to a business walking categorization in the windiest season.

Receptors 178-180 and 187-189 do not have an amenity purpose, and hence conditions at these receptors would be appropriate (as the roofs would only be accessed for maintenance activity when the weather conditions were amenable). At receptors 174, 175, 177, and 190, amenity use is intended and conditions are expected to be one category windier than required in summertime. These correspond to the higher terrace areas on 101 Camley St which are exposed to stronger winds. In these areas, local mitigation measures are recommended to reduce wind speeds and achieve a sitting classification in summer.

Finally, at receptor 169 at terrace level on 102 Camley St., conditions suitable for standing in summertime were measured. This is one category windier than required for amenity use, and hence mitigation measures would be recommended at this location.

Occurrence of Strong Winds

For Configuration 3 there are five receptors where the wind speed exceeds Beaufort Force 6 for more than one hour. These are receptors 108, 175, 177, 180 and 189. Of these, the wind speed at receptor 189 exceeds Beaufort Force 7 for one hour per year.

Receptor 108 is in the passageway between two parts of 102 Camley St, and is adjacent to entranceways, where mitigation has already been advised to maintain pedestrian comfort. Mitigation measures are also recommended due to the occurrence of strong winds at this location.

Receptors 175 and 177 are in amenity areas accessible to residents. As these areas have amenity usage, mitigation would be recommended to reduce the occurrence of strong winds at these receptors, noting that mitigation has already been recommended to ensure comfort for summertime use of these spaces.

Receptors 180 and 189 are on roof-top areas not accessible to residents, but accessible for maintenance of plant etc. As such, exceeding the strong wind thresholds for a small number of hours per year is unlikely to cause nuisance as maintenance would not normally be carried out during the windiest periods of the year.

6. Mitigation Measures

The wind tunnel tests were conducted on a model devoid of trees and soft landscape detail in order to obtain conservative results (i.e. generate a relatively windy microclimate). In general, planting and other landscape enhancements increase shelter within a development, particularly when the trees and plants are established and in full leaf, or if coniferous varieties are used.

Mitigation would be required where business walking or windier conditions are reported on thoroughfares or where leisure walking or windier conditions are reported near building entrances (for the windiest season). Mitigation would also be required where standing/entrance conditions or windier are expected during the summertime at external amenity spaces.

For the three configurations tested, the wind environment at most receptors across the Site is suitable for (or calmer than) the target wind environment. However, there are small exceedances of the target wind conditions in a number of locations in each configuration, and a few instances of larger exceedances of the required comfort and strong wind conditions in Configuration 2, due to channeling of wind through the passageway at 102 Camley St.

The areas where exceedances have occurred are summarised below together with potential mitigation options where the wind microclimate is expected to be too windy for the intended use of the space.

Configuration 1: Baseline (Empty) Site and Existing Surroundings including 103 Camley St

This is the baseline case against which the results of Configurations 2 and 3 may be compared. With the baseline current Site and existing surroundings including 103 Camley St, only a small number of receptors measured wind speeds which were higher than desirable for the use of the space. These are listed below:

- Receptor 74 at the southern end of 103 Camley St. recorded conditions suitable for standing in summertime within a space shown as having amenity usage. In this type of space, sitting conditions in summertime would be targeted. However, there is soft landscaping in the form of tree planting present in this area, which would be expected to reduce wind speed locally.

- Terrace receptors on 103 Camley St were instrumented in case wind conditions at these locations were altered by the presence of future development. In the baseline case, conditions at roof receptors 143, 156 and 164 were all suitable for standing in summer. If these spaces have an amenity use, this is one category windier than the required (sitting) condition in the summer season.

- It should be noted that the above are pre-existing conditions and hence the discussion that follows will not recommend mitigation in these locations unless the conditions are made windier by the presence of new development.

Configuration 2: Proposed Development at 102 Camley St and Existing Surroundings including 103 Camley St

In this configuration, there were two main exceedances of the required wind conditions, which are listed below:

- Conditions at receptor 108 are suitable only for business walking in the windiest season, whilst standing conditions would be targeted due to the entranceways located within the passageway in 102 Camley St. This is due to wind being channelled through the gap provided by the passageway, which forms a route for air movement from the upwind south-westerly side of 102 Camley St (the public open space), to the leeward northern façade (under the prevailing south-westerly winds). Mitigation would be required to reduce wind speeds by two categories at the entranceway and one category in the passageway itself. This could be achieved by the recessing of entranceways in the passageway combined with measures such as porous screening or public art at each end of the passage.
- Conditions at terrace receptor 170 on 102 Camley St are one category windier than required for amenity use in summertime. This is due to the acceleration of the wind around the corner of the building. Mitigation could be achieved by the use of soft landscaping or porous screens on the terrace to the west of receptor 170 (which would reduce wind speeds) or a taller balustrade around the terrace area.

Configuration 3: Proposed Development at 102 Camley St and Cumulative Surroundings including 101 Camley St and 103 Camley St (Existing)

For this configuration, conditions around 102 Camley St were less windy than in Configuration 2; however there were still a number of exceedances of the required wind conditions around the three buildings. These are described below:

- Receptor 108 in the passageway between the two wings of 102 Camley St was suitable for leisure walking in the windiest season. There are entranceways present in this passageway and hence, conditions suitable for standing/entrance usage are the target at this receptor. Mitigation measures could include adding side screens to the entranceways and/or recessing entrances. Porous screens could also be used to reduce the wind speed through the passageway.

- Receptor 150, in the amenity space between the two parts of 101 Camley St was suitable for standing in summertime when sitting conditions in summertime would be targeted. Mitigation of the higher wind speeds in this area could be achieved by soft landscaping or the use of porous screens or other obstacles (e.g. public art) to reduce ground level wind speeds.

- A number of terraces in Configuration 3 have summertime conditions one category windier than required for summertime amenity use. This applies to terrace receptors 174, 175, 177 and 190 where amenity use by residents is anticipated. To achieve sitting conditions in these areas, the use of taller balustrades combined with soft landscaping or porous screens would be recommended to provide mitigation. Similar measures would also be recommended at receptor 169 at terrace level on 102 Camley St, where summertime conditions are expected to be one category windier than required.

- Strong winds were noted at one ground level location. At receptor 108 in the passageway between the two parts of 102 Camley St, winds in excess of Beaufort Force 6 are anticipated for 1.8 hours per year. This small exceedance would be considered acceptable on a thoroughfare but is windier than required in an area where entranceways are located. The

mitigation measures proposed above for the entranceways near this receptor would also help mitigate strong winds.

- Strong winds were noted at a number of roof-top locations. These were receptors 175, 177, 180 and 189. Receptors 180 and 189 are in roof-top areas not believed to be accessible to residents, and as such, the wind environment will not be considered further. At receptors 175 and 177, where exceedances of Beaufort force 6 were measured in roof terrace locations accessible to residents, mitigation measures would be advised. It should be noted that mitigation has already been recommended for reasons of comfort in these locations and the mitigation measures proposed are also expected to reduce the occurrence of strong winds.

7. Concluding Remarks

In conclusion:

1. The meteorological data for the Site indicate prevailing winds blow from the south-westerly quadrant throughout the year, with secondary winds from the north-easterly direction particularly during the springtime.
2. The wind microclimate for the current Site (Configuration 1 – the baseline configuration) indicates that the existing wind microclimate is relatively calm, with a small number of ground and terrace locations one category windier than desired for summertime amenity usage.
3. For the case of the Proposed Development and existing surroundings (including 103 Camley St), the majority of the ground level receptors experienced a wind environment that was either suitable for or calmer than the targeted conditions. However, at receptor 108 the wind environment was two categories windier than desired due to wind being channeled through the passageway in 102 Camley St. This occurs as a result of the orientation of the L-shaped building facing the prevailing south-westerly winds. Entrances are present at this location and hence standing conditions are targeted whilst business walking conditions were measured. Mitigation measures are advised which could take the form of screening and recessing entranceways. Finally, terrace receptor 170 is one category windier than required for summertime amenity use and mitigation measures in the form of higher balustrades, screening or soft landscaping are recommended.
4. For the case of the Proposed Development and cumulative surroundings (including both the existing 103 Camley St development and the proposed 101 Camley St development), conditions one category windier than desired for amenity spaces were measured at ground level receptor 150 and at terrace amenity space receptors 174, 175, 177 and 190. Strong winds were measured at 175 and 177. Finally, at receptor 108 at 102 Camley St, wind speeds one category too high for entranceway use and strong winds in excess of Beaufort Force 6 were measured in the passageway between the two wings of the building. Mitigation by means of porous screens or screened/recessed entranceways is recommended. The issues noted in this area are due to channeling of the prevailing south-westerly wind through the passageway as a result of the orientation of the 102 Camley St building.

Wind Direction>>	0	30	60	90	120	150	180	210	240	270	300	330
Mean Factor at 120m	1.40	1.43	1.43	1.45	1.37	1.36	1.42	1.42	1.39	1.36	1.36	1.37

Table 1: BREVe3 mean factors at reference height (120m above ground level)

Location	Beaufort Force Exceedance	Direction	Hours per Annum
Configuration 1 – Baseline – Current Site with Existing Surroundings including 103 Camley St			
83	B6	220	1.3
Configuration 2 – Proposed Development with Existing Surroundings including 103 Camley St			
65	B6	220	4.7
68	B6	220	4.5
89	B6	220	1.4
108	B7	220	2.0
Configuration 3 – Proposed Development with Cumulative Surroundings including both 103 and 101 Camley St			
108	B6	230	1.8
175	B6	220	1.4
177	B6	220	1.2
180	B6	180	1.2
189	B7	200	1.0

Table 2: Annual Exceedance of Strong Winds (& Most Frequent Wind Direction)

Figure 1: Aerial Photograph of the Site (approx. extent of 102 Camley St Site highlighted)

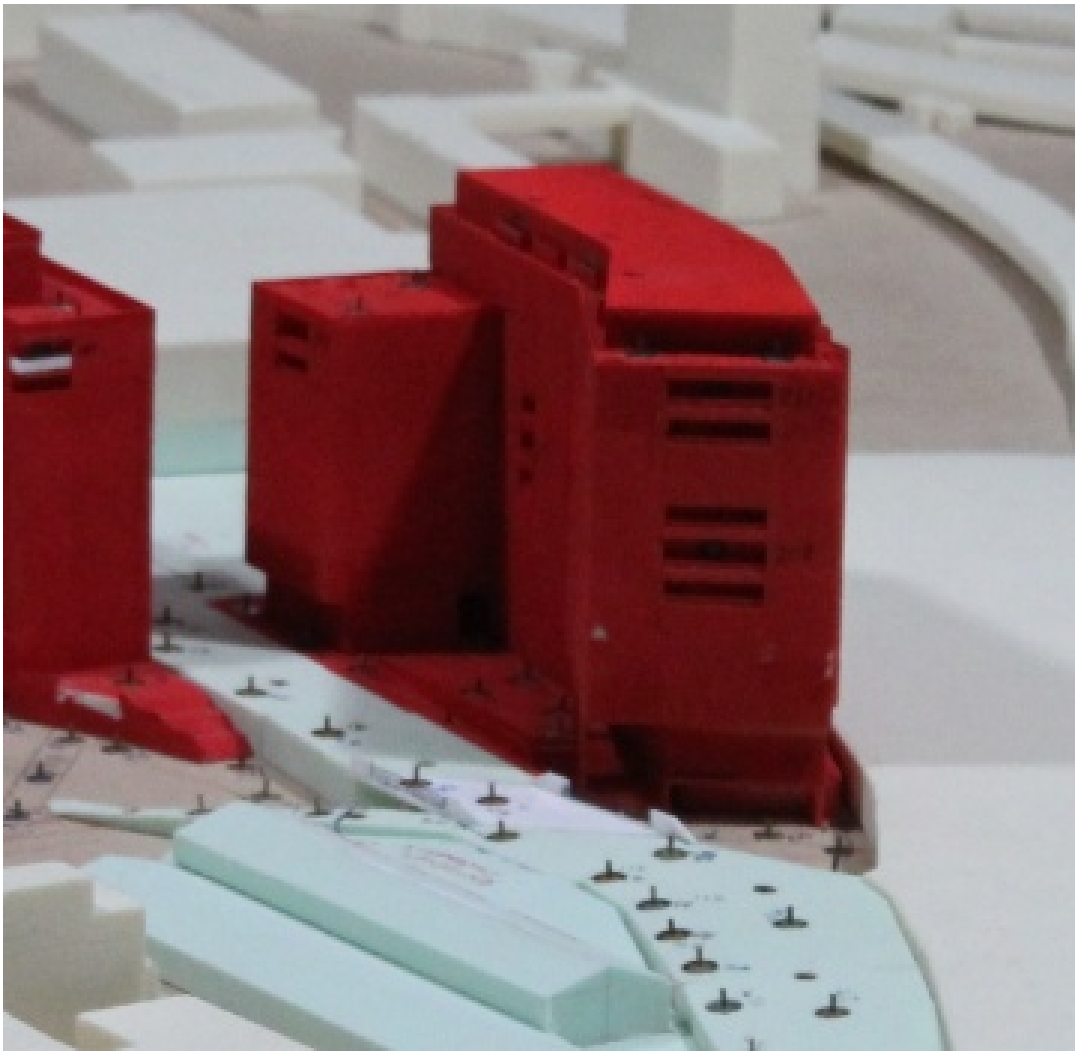

Figure 2: Photo of the Model of the Proposed Development at 102 Camley St and existing surroundings including 103 Camley St (view from South)

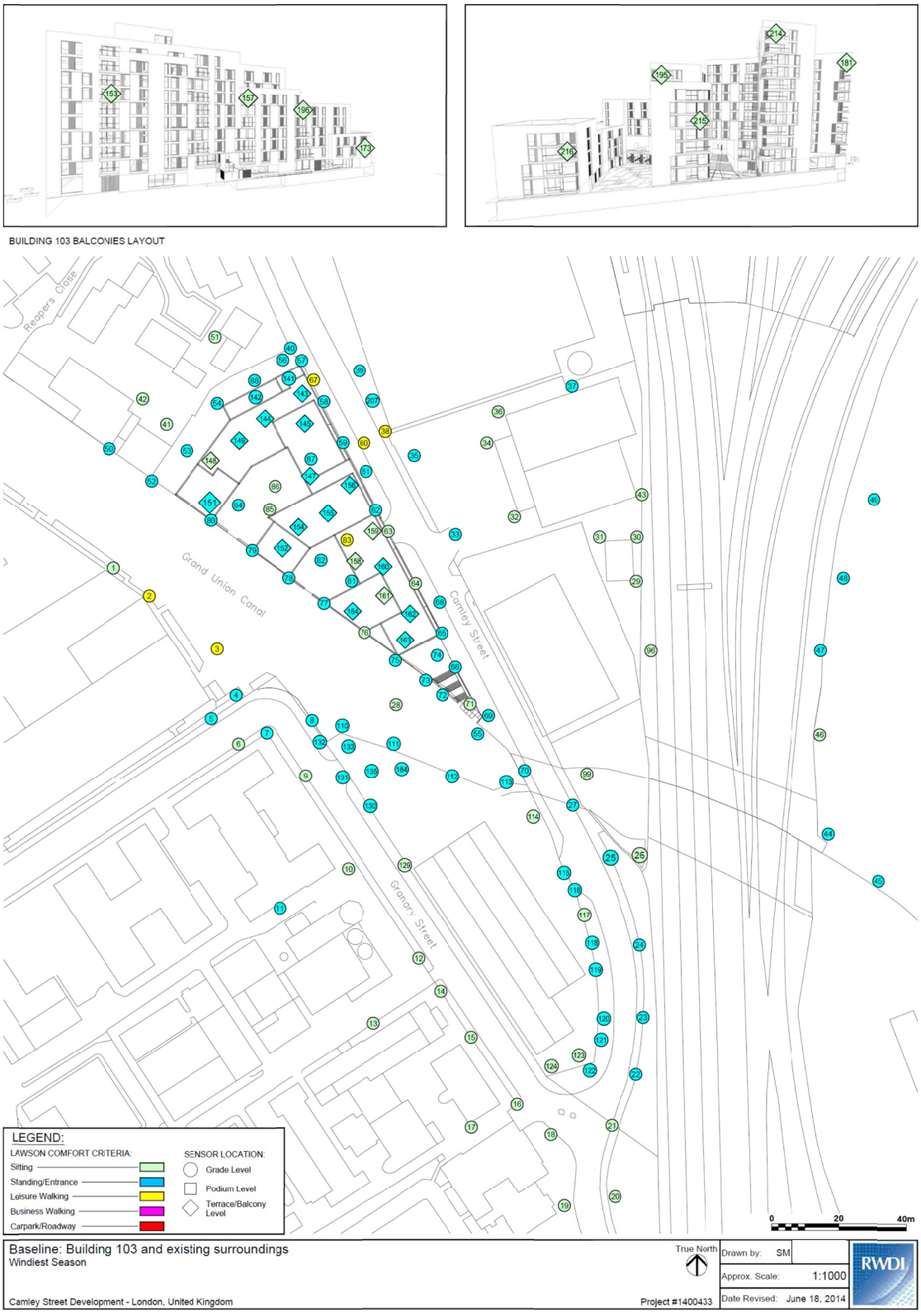

Figure 3: Configuration 1 – Lawson Comfort Criteria (Windiest Season)

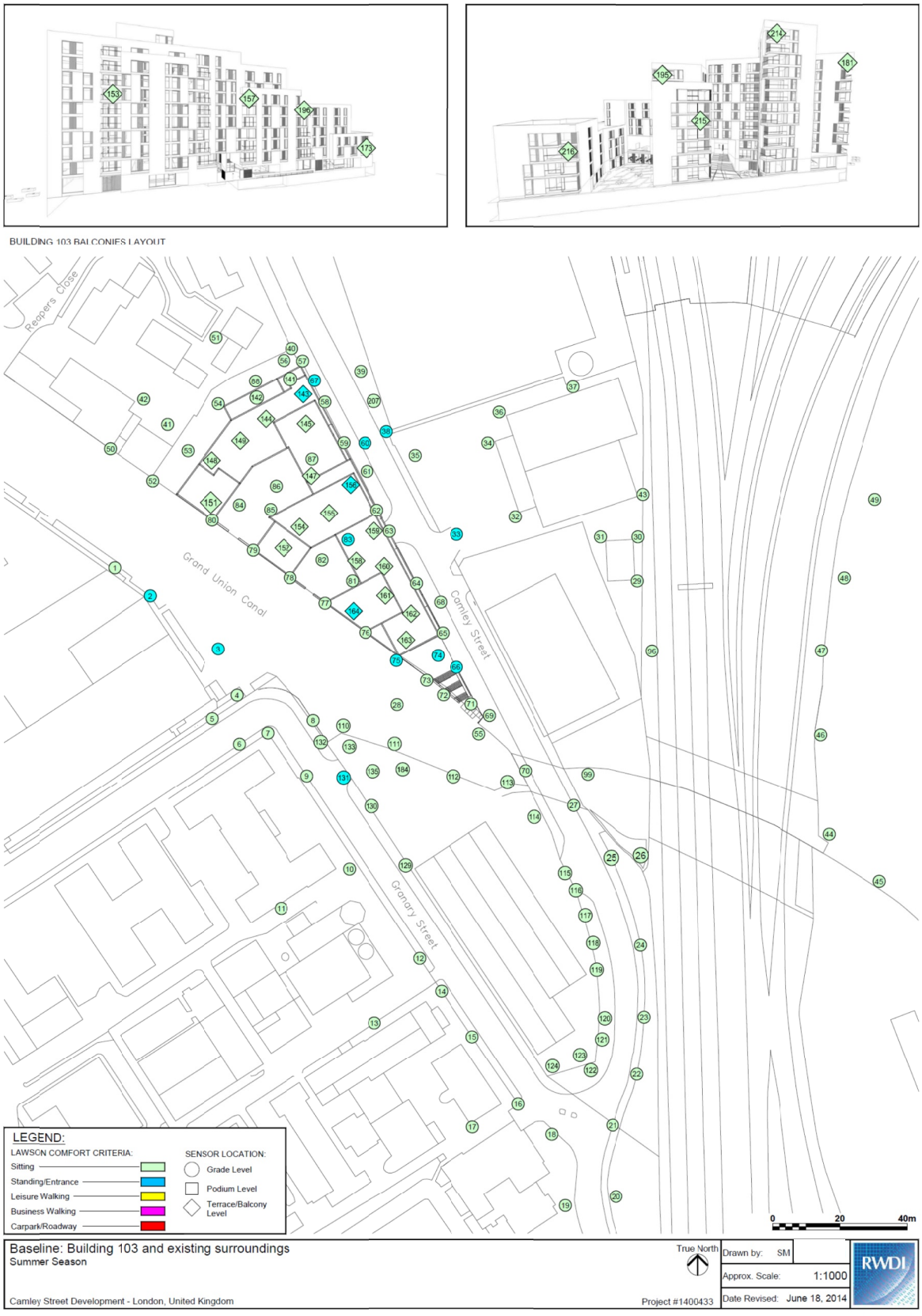

Figure 4: Configuration 1 – Lawson Comfort Criteria (Summer Season)

Figure 5: Configuration 2 – Lawson Comfort Criteria (Windiest Season)

Figure 6: Configuration 2 – Lawson Comfort Criteria (Summer Season)

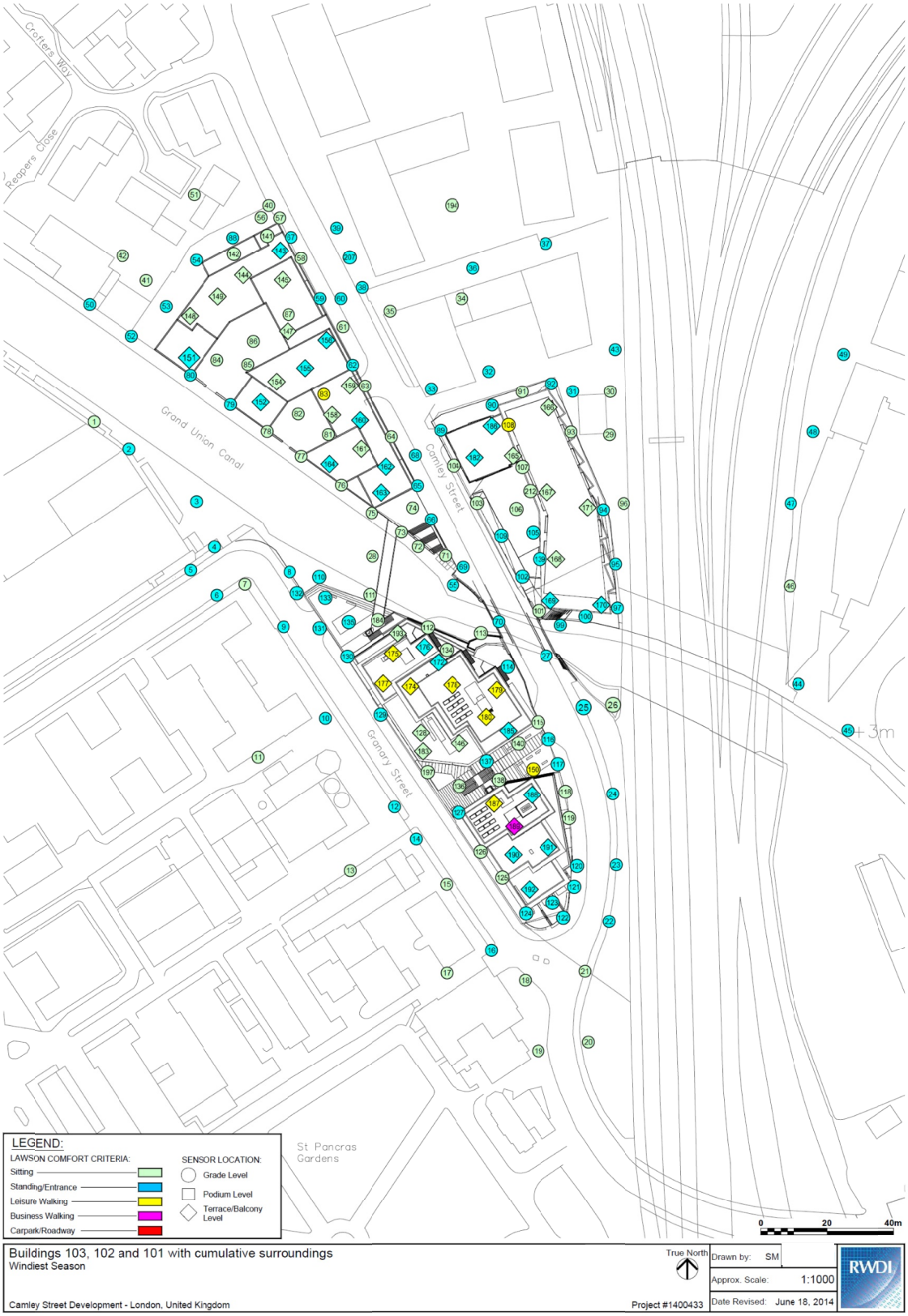

Figure 7: Configuration 3 – Lawson Comfort Criteria (Windiest Season), Ground and Terrace Levels

BUILDING 103 BALCONIES LAYOUT

BUILDING 101 BALCONIES LAYOUT

BUILDING 102 BALCONIES LAYOUT

Figure 8: Configuration 3 – Lawson Comfort Criteria (Windiest Season), Balcony Levels

Figure 9: Configuration 3 – Lawson Comfort Criteria (Summer Season), Ground and Terrace Levels

Figure 10: Configuration 3 – Lawson Comfort Criteria (Summer Season), Balcony Levels

Appendix A: Photographs of the Wind Tunnel Model

Figure 11: Current Site and Existing Surroundings including 103 Camley St (Configuration 1) – View in the Wind Tunnel (view from south)