Rugby School

**Rokeby House**
**Lamb's Conduit Street**
**Camden**
**WC1N 3LX**

# Proposed Passenger Lift
# &
# Penthouse Extension


# DAYLIGHT & SUNLIGHT ANALYSIS

November 2011

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# 1. Scope of Instructions & Brief

**Description**

AHP Architects & Surveyors Ltd have been instructed by the Governing Body of Rugby School to prepare design proposals for a new penthouse extension and external passenger lift at Rokeby House, Camden. Preliminary proposals were formally discussed with the planning officer, at which time concerns were raised regarding the impact of the new lift shaft and associated access platforms on daylight levels within the adjacent living rooms within Rokeby House.

To address this issue, AHP have prepared a daylight study to assess the likely impact of the proposed works on the neighbouring living spaces.

1.1 This study has been carried out in accordance with the recommendations of the Building Research Establishment Report "Site Layout Planning for Daylight & Sunlight 1991".

1.2 The result templates, which are attached at the rear, illustrate the results for the daylight assessments.

1.3 3D views showing Rokeby House in the context of existing surrounding buildings are included at Appendix A.

**Policy Guidelines**

1.3 This study has been carried out in accordance with the recommendations of the Building Research Establishment Report "Site Layout Planning for Daylight & Sunlight 1991".

1.4 Camden Council planning policy confirms that the Council will normally have regard to the guidelines:-

Camden Council Development Policies – Local Development Framework (adopted November 2010

**Policy DP26 – Managing the impact of development on occupiers & neighbours**

Planning permission will only be granted for development which satisfies the following criteria:-

- The Council will protect the quality of life of occupiers and neighbours by only granting permission for development that does not cause harm to amenity (including overshadowing, outlook, sunlight, daylight and artificial light levels).

- To assess whether acceptable levels of daylight and sunlight are available to habitable spaces, the Council will take into account the standards recommended in the British Research Establishment's Site Layout Planning for Daylight and Sunlight – *A Guide to Good Practice (1991)*.

1.5 The BRE Guide is intended for building designers and their clients, consultants and planning officials. The advice given is not mandatory and the Report should not be seen as a part of planning policy. Its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly because natural lighting is only one of the many factors in site layout design. In certain circumstances, the developer or planning authority may wish to use alternative target values.

1.6 Whilst technical analysis can be carried out in accordance with numerical guidelines and reported factually by comparison with those guidelines, the final assessment as to whether affected dwellings are left with acceptable amounts of daylight and sunlight in an inner city context where the findings are to be interpreted in a flexible manner is a matter of subjective opinion.

**METHODOLOGY**

1.7 The Daylight & Sunlight assessments have been undertaken by reference to the Building Research Establishment (BRE) Guidelines "Site Layout Planning for Daylight & Sunlight. A Guide to Good Practice".

1.8 The BRE Report advises that daylight and sunlight levels should be assessed for the main habitable rooms of neighbouring residential properties. Habitable rooms in residential properties are defined as kitchens, living rooms and dining rooms. Bedrooms are less important as they are mainly occupied at night time. The Report also makes reference to other property types, which may be regarded as "sensitive receptors" such as schools, hospitals, hotels and hostels, small workshops and most offices.

**Daylight**

1.9 The BRE Guide states that:-

*"If, for any part of the new development, the angle from the centre of the lowest affected window to the head of the new development is more than 25°, then a more detailed check is needed to find the loss of skylight to the existing buildings."*

1.10 The BRE Guidelines propose several methods for calculating daylight. The 2 main methods predominantly used are those involving the measurement of the total amount of skylight available:-

- vertical sky component (VSC) and
- Average Daylight Factor (ADF).

i. The VSC calculation is a general test of potential for daylight to a building, measuring the light available on the outside plane of windows.

ii. The second recognised method of assessment for daylight is the Average Daylight Factor (ADF) calculation which assesses the quality and distribution of light within a room served by a window and takes into account the VSC value, the size and number of the windows and room and the use to which the room is put. The ADF is the effective proportion of sky visibility available as luminance within a room. Rather than simply assessing the external

obstructions as seen from a window, as in the VSC analysis, the ADF calculation takes the external sky visibility and incorporates it within a calculation that takes account of window size, number of windows, internal room surface area, glass transmittance and internal surface reflectance.

Where the analysis shows that the VSC results show values outside the BRE standards, we would then analyse the ADF results and this has been provided for completeness.

The ADF is calculated using the following formula:- $df = \frac{TA_w \theta\%}{A(1-R^2)}$

Where:

- T is the diffuse visible transmittance of the glazing, including corrections for dirt on glass and any blinds or curtains. (For clean clear single glass, a value of 0.8 can be used)
- Aw is the net glazed area of the window ($m^2$)
- A is the total area of the room surfaces: ceiling, floor, walls, doors and windows ($m^2$)
- R is their average reflectance. For fairly light-coloured rooms a value of 0.5 can be taken
- Θ is the angle of visible sky in degrees derived from the vertical sky component.

The BRE Report advises that, where supplementary electric lighting is available, the minimum standards of ADF that should be attained are 2% for kitchens, 1.5% for living rooms and 1% for bedrooms.

The table included in this summary identifies the key data used for the ADF analysis and the results for the rooms, in comparison with the room use. The theta value in the calculation has been derived from the same VSC results also reported in this summary.

1.11 The ADF assesses actual light distribution within defined room areas, whereas the VSC considers potential light. British Standard 8206, Code of Practice for Daylighting recommends ADF values of 1% in bedrooms, 1.5% in living rooms and 2% in kitchens. For other uses, where it is expected that supplementary electric lighting will be used throughout the daytime, such as in offices, the ADF value should be 2%. There is no general requirement within the BRE Guidelines to assess ADF values, other than for neighbouring residential buildings. The Average Daylight Factor is more reliable than the VSC daylight test. This is because the Average Daylight Factor test takes into account a range of variables which the other tests do not. For example, only the Average Daylight Factor test takes into account the size of the window and whether the room has more than one window. These are important factors which affect the level of illumination within a room.

1.12 Photographic records and associated measurements taken from existing & proposed plans and elevation drawings have been used for the purpose of calculating the VSC and ADF. Recognised default values have been used to ascertain glass transmittance and reflectance of internal surfaces.

1.13 The rooms to be assessed under this study are the existing living rooms to flats on every floor level to the east side of the main stair core in Rokeby House.

1.14 The daylight assessment has been undertaken using the VSC and ADF calculation methods. All relevant windows have been considered for each of these methods.

**Significant Criteria**

1.15 In describing the significant criteria as set out below, it should be noted that they have been developed to protect residential properties, which are the most sensitive receptors.

1.16 The Guidance given by BRE has been used as a basis for the criteria to assess the Development's potential impacts. The BRE guidance specifies:

*"…In special circumstances the developer or planning authority may wish to use different target values. For example, in an historic city centre a higher degree of obstruction may be unavoidable…"*

1.17 The report adds:

*"…Different criteria may be used, based on the requirements for daylighting in an area viewed against other site layout constraints."*

**Daylight**

1.18 The BRE Guidance is summarised in the below table and this has been used as the basis for the criteria used in the assessment of daylight and sunlight impacts.

| **Test:** | **British Research Establishment (BRE) Criteria:** |
|---|---|
| **Daylight** | A window may be adversely affected if the vertical sky component **(VSC)** measured at the centre of the window is less than 27% and less than 0.8 times its former value.<br><br>A room may be adversely affected if the average daylight factor **(ADF)** is less than 1% for a bedroom, 1.5% for a living room or 2% for a kitchen. For offices a minimum figure of 2% is required. |

**Other Factors for Consideration**

1.19 Given that the windows to the living rooms in Rokeby House are south-east facing, we have also carried out an assessment to ascertain whether the hours of available sunlight are reduced and if so, whether they remain within acceptable limits.

1.20 British Standard 8206 recommends that at least 25% of the available annual probable sunlight hours be available at the reference point, including at least 5% of annual probable sunlight hours in the winter months, between 21st September and 21st March.

1.21 If the available sunlight hours are both less than the amount given above and less than 0.8 times their former value, either over the whole year or just during the winter months, then the occupants of the building will notice the loss of sunlight.

**Baseline Conditions**

1.23 An analysis of the impact of the existing buildings (the baseline conditions) against which to compare any potential impact arising from the development has been undertaken based on the survey information provided by existing & proposed drawings and photographic evidence.

1.24 An analysis of the existing daylight levels enjoyed by the relevant neighbouring properties have been undertaken in order to provide a baseline against which the impacts arising from the proposed development can be assessed. The detailed results of this analysis are presented in the tables under appropriate headings.

# 2. Results – Proposed Development

**Daylight VSC & ADF**

The results of the Vertical Sky Component (VSC) are presented in the graphs & tables at Appendix 2A. The Average Daylight Factor (ADF) analysis on the relevant overlooking windows are presented in the tables at Appendix 3.

The findings may be summarised below under appropriate headings.

Vertical Sky Component

2.1 Using graphical calculators overlaid on the floor plans the VSC has been calculated for each window under consideration. Separate calculations were used to establish existing (pre-development) light levels and expected light levels post development.
It can be seen that the VSC at the lower ground, ground and first floor windows is below the normal threshold limit of 27°, suggesting that light levels are currently less than acceptable limits. The second floor window VSC is on the threshold whilst the third floor window exceeds the threshold. Results such as these are common in inner city locations where the height and proximity of surrounding buildings inevitably impact upon light levels. In the case of Rokeby House, the existing buildings that most significantly impact on light levels are Spen's House and the terrace of buildings in Great Ormond Street to the south.

Resultant readings for the post development scenario indicate a further reduction in in the VSC will be experienced at every window being evaluated, however the reduced VSC is greater than 0.8 of the original value. It is therefore deemed that the reduction would not be discernible to occupants of those rooms.

Although the close proximity of the new lift shaft to the windows being assessed would suggest a more significant reduction in light levels, the calculations show that the new structure largely falls within the zone of where the view of the sky is obscured by Spen's House.

Average Daylight Factor

2.2 Where not all the VSC figures meet the guidelines, the BRE suggests that an ADF test is undertaken if the potential light (VSC) is poor on the outside face of glazing. The results of the ADF analysis of the relevant rooms are presented in the summary table at Appendix 3.

2.3 Using the formula prescribed by the BRE, the resultant ADF table indicates that all windows comfortably exceed the minimum standard. The minimum standard for living rooms is 1.5% and the results show an ADF ranging between 2.5 – 3.1%. Although acceptable reduction factors or not prescribed by the BRE, the results show the resultant ADF's are between 0.85-0.94 of the original values.

**Sunlight**

2.4 To establish the annual available sunlight at each reference window, the graphical calculator published by the BRE was overlaid on building plans. The resultant graphs & tables at Appendix 2B shows the resultant sunlight hours for the existing condition and as would be experienced post-development.

2.5 It can be seen that the available sunlight would be reduced in all cases, with the more significant reduction being to the upper storey windows where the factor of reduction is more than 0.8 of the original value. Annual available sunlight post-development ranges between 33% & 46%, comfortably exceeding the 25% recommended threshold. Winter sunlight availability will remain unchanged by the proposed development. The recommended minimum winter value will be met at lower ground floor level and will be comfortably exceeded on all other levels.

# 3. Conclusion

3.1 The site is situated in an urban location surrounded by 2-5 storey buildings creating a sense of enclosure typical of an inner city site.

3.2 Daylight levels at the windows are generally below current accepted recommendations due to the overshadowing cause by adjacent tall buildings.

3.2 To assess the extension's potential impact on daylight on neighbouring properties a baseline assessment was undertaken. The main methods of assessment included the 25o angle assessment, Vertical Sky Component (VSC) and ADF method for daylight analysis using the template drawings provide by the Building Research Establishment.

3.3 The VSC results show that light levels at the external face of the assessed windows will be reduced but the resultant VSC is greater than 0.8 of the original value, indicating that the reduction is unlikely to be perceived by the occupants.

3.4 The ADF results show that the average daylight factor within the assessed rooms would be reduced by the proposed development, but the resultant ADF comfortably exceeds the minimum recommended threshold for living rooms.

**Stephen Cattle RIBA**
**Architect**
**For AHP Architects & Surveyors**

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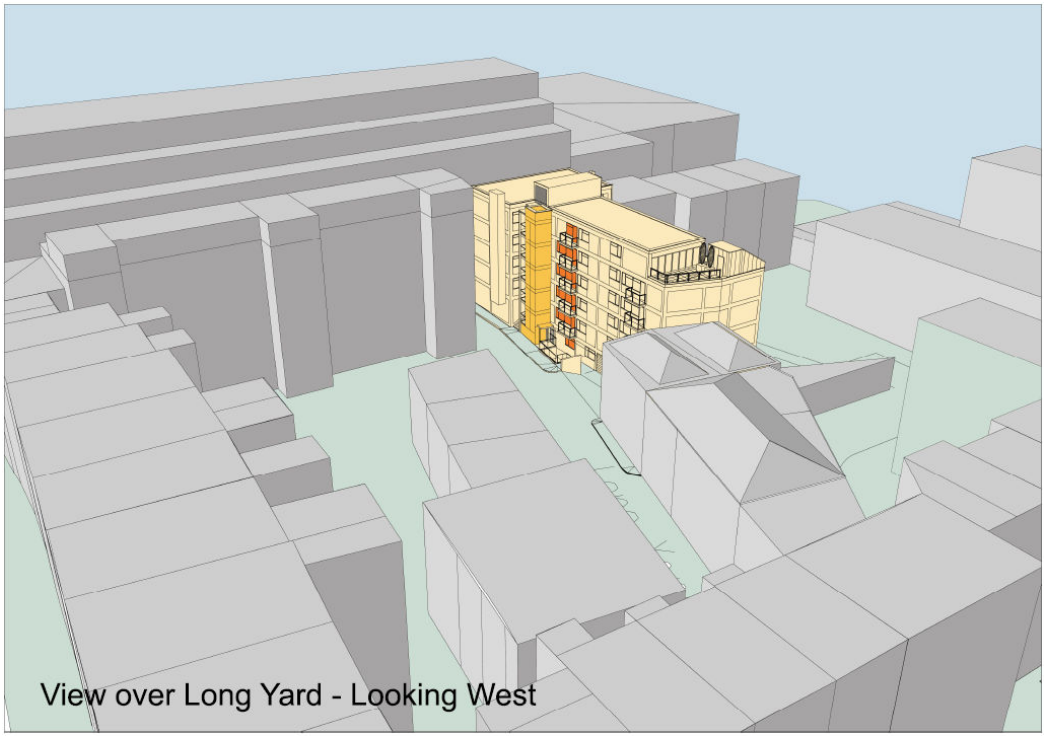
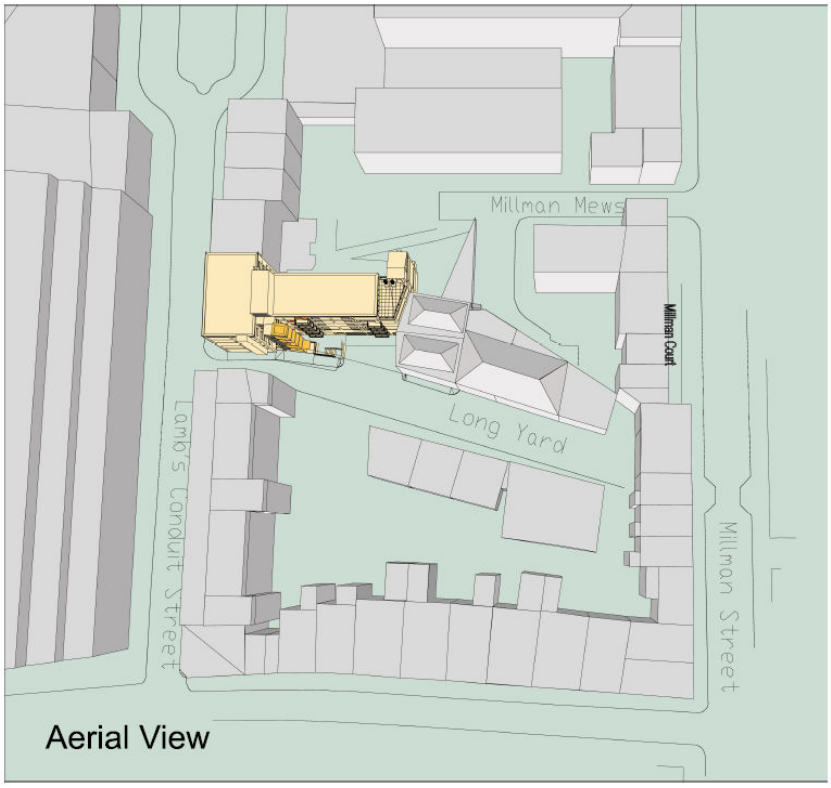
# APPENDIX 1

# 3D VIEWS


View over Long Yard - Looking West


View over Lamb's Conduit Street - Looking South East


View over Millman Street - Looking South West


Millman Mews
Millman Court
Long Yard
Lamb's Conduit Street
Millman Street
Aerial View

# APPENDIX 2

## (A) Vertical Sky Component (VSC) Graphs

## (B) Average Sunlight Graphs

*Appendix 2A*

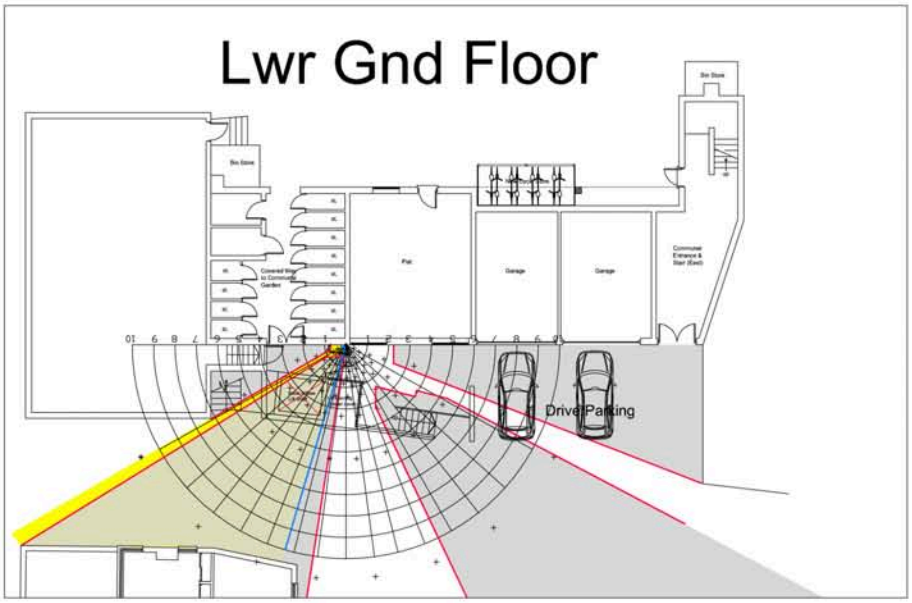
***Vertical Sky Component (VSC)***

**Lwr Gnd Floor**

Extg. vertical sky component = 18.5%

Prop. vertical sky component =16.75%

Reduction 0.905

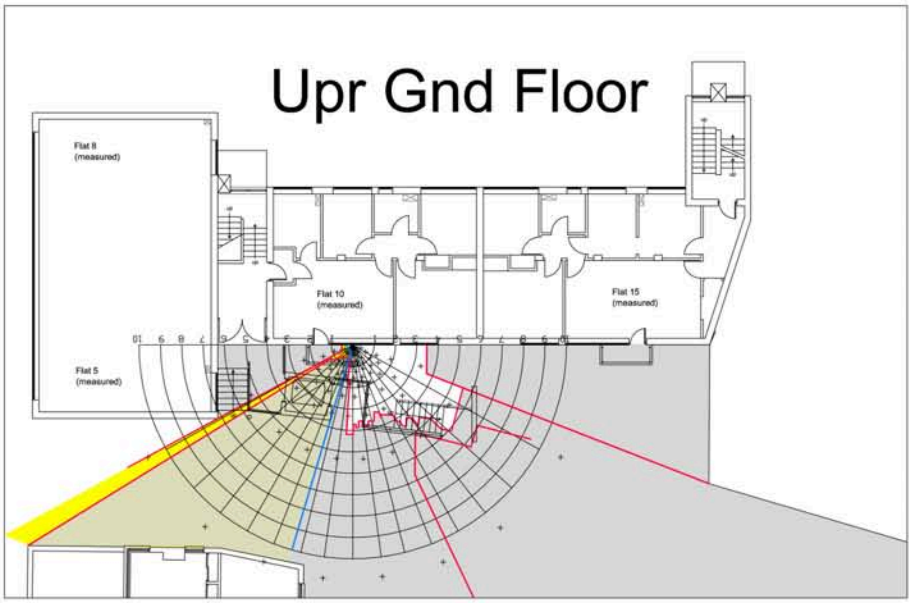



**Upr Gnd Floor**

Extg. vertical sky component = 21.5%

Prop. vertical sky component = 18%

Reduction 0.837

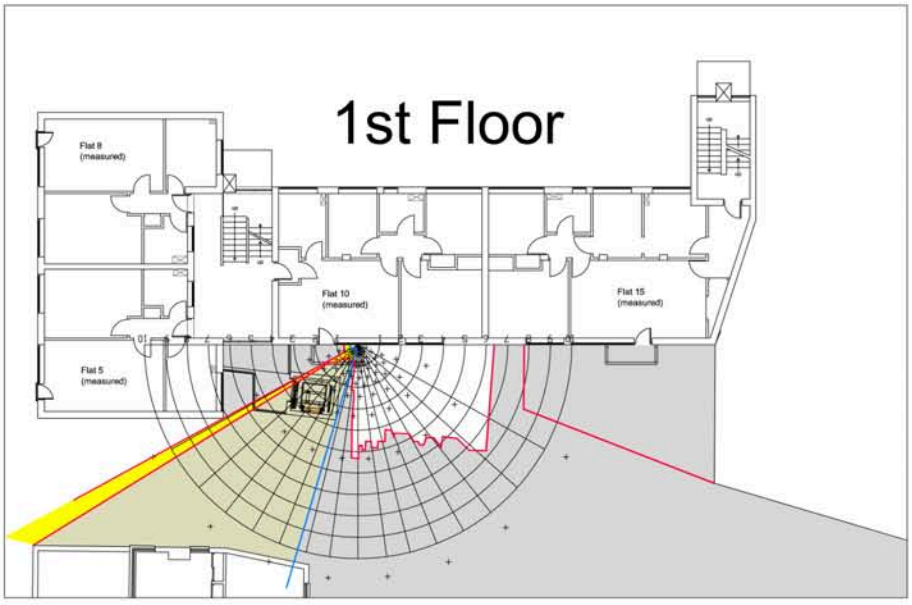



**1st Floor**

Extg. vertical sky component = 23.5%

Prop. vertical sky component = 20%

Reduction 0.851



*Appendix 2A*

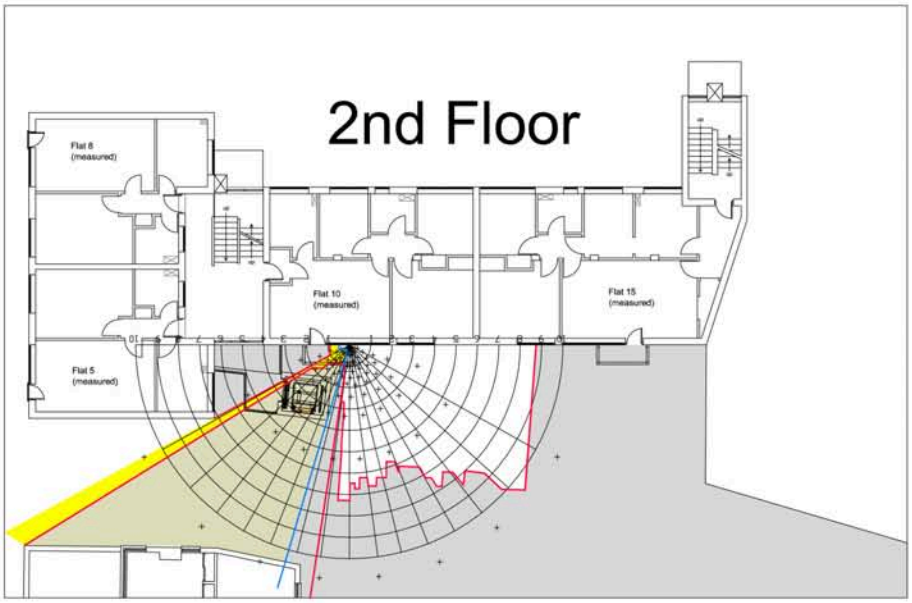
***Vertical Sky Component (VSC)***

**2nd Floor**

Extg. vertical sky component = 27.0%

Prop. vertical sky component = 22.5%

Reduction 0.833

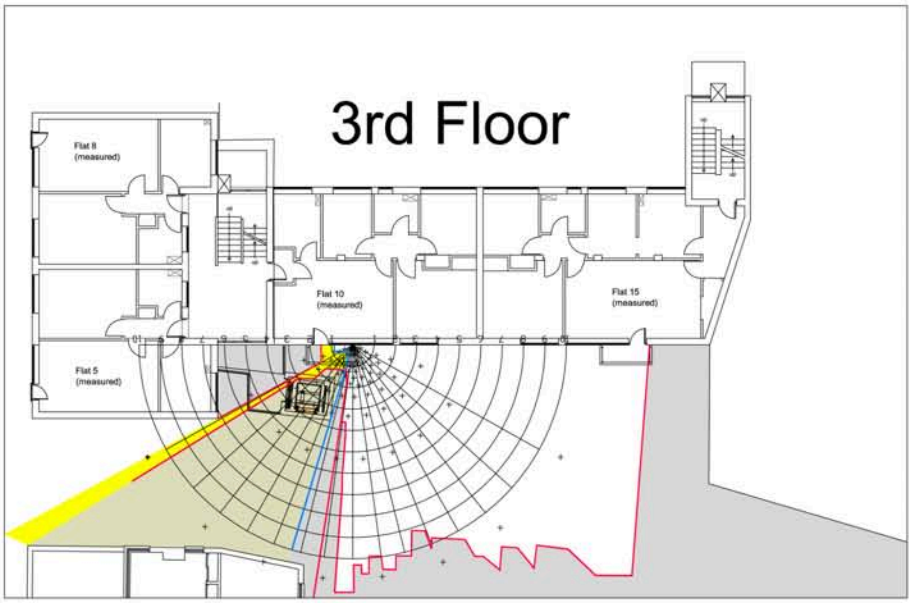



**3rd Floor**

Extg. vertical sky component = 29.25%

Prop. vertical sky component = 23.75%

Reduction 0.812



*Appendix 2B*
***Available Sunlight Hours***

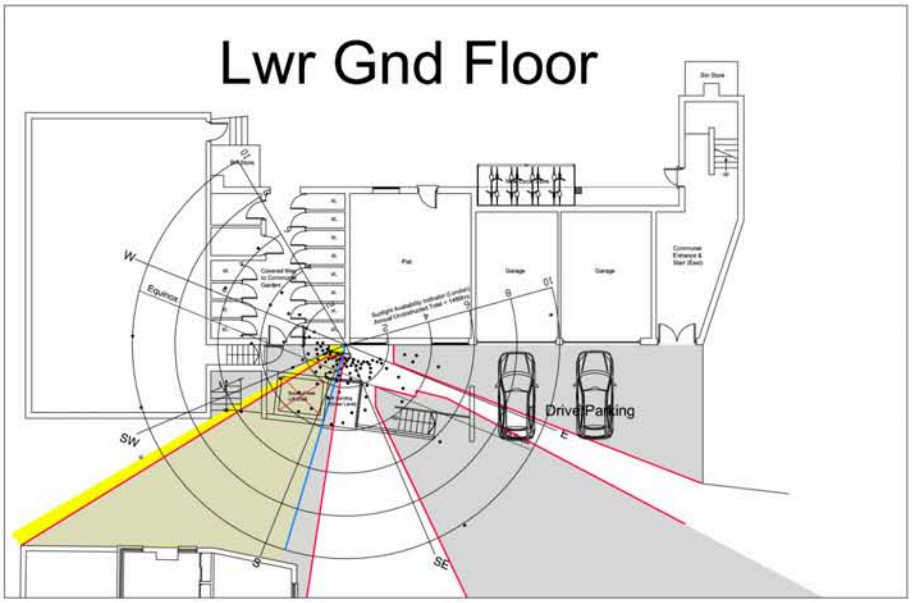
**Lower Ground Floor**

Extg. Sunlight per year
=36.0% (534.96hrs)

Prop. Sunlight per year
=33.0% (490.38hrs)

Winter Sunlight
Extg & Prop. = 5%

Reduction Factor 0.917



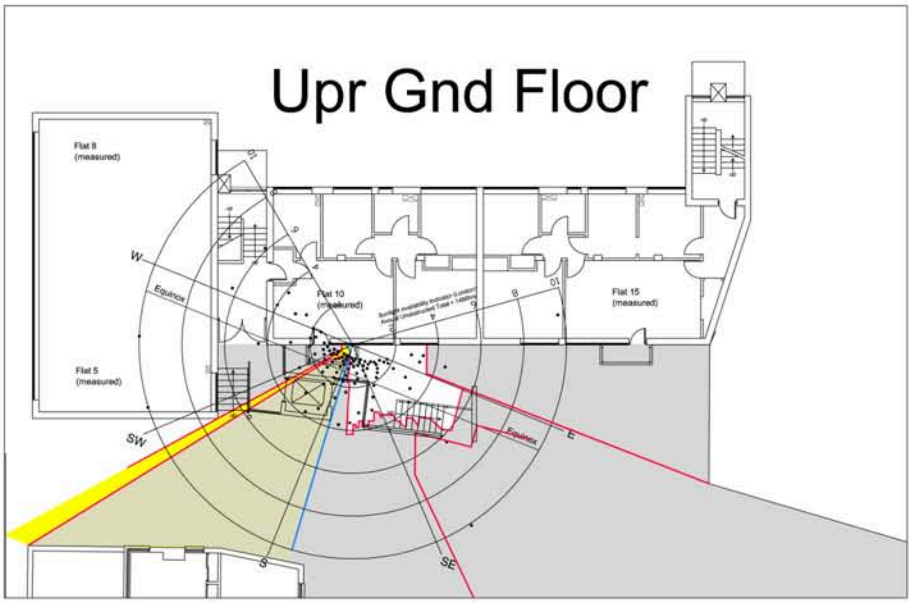

**Upper Ground Floor**

Extg. Sunlight per year
=44% (653.84hrs)

Prop. Sunlight per year
=40.0% (594.41hrs)

Winter Sunlight
Extg & Prop. = 8%

Reduction Factor 0.909



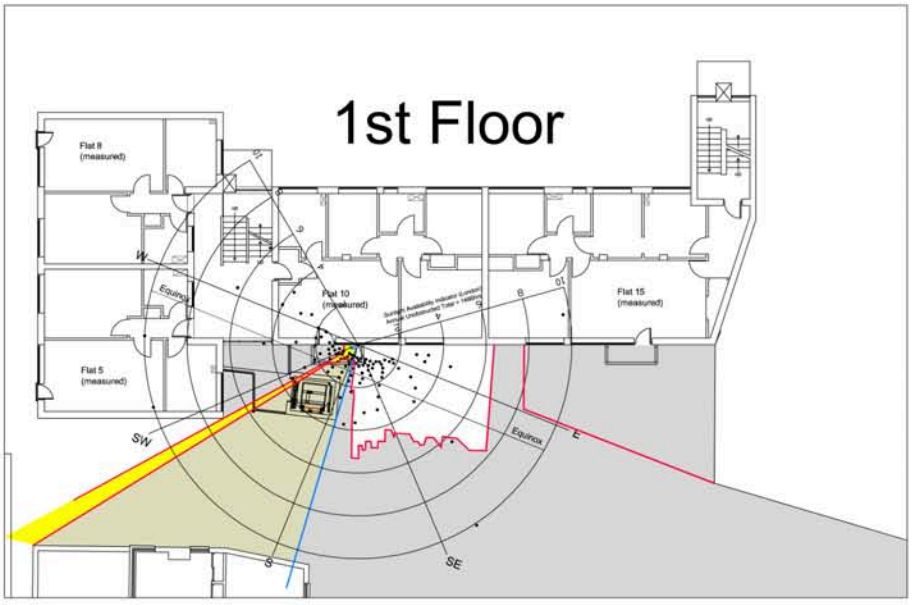

**1st Floor**

Extg. Sunlight per year
=49% (728.14hrs)

Prop. Sunlight per year
=40.5% (601.83hrs)

Winter Sunlight
Extg & Prop. = 8%

Reduction Factor 0.827



*Appendix 2B*
***Available Sunlight Hours***

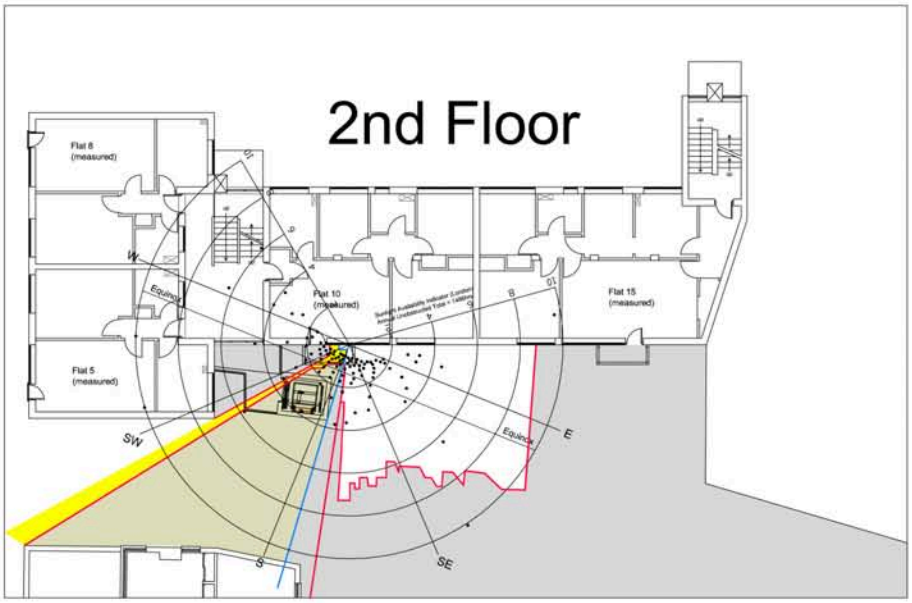
**2nd Floor**

Extg. Sunlight per year
=55.5% (824.73hrs)

Prop. Sunlight per year
=42.5% (631.55hrs)

Winter Sunlight
Extg & Prop. = 10%

Reduction Factor 0.766



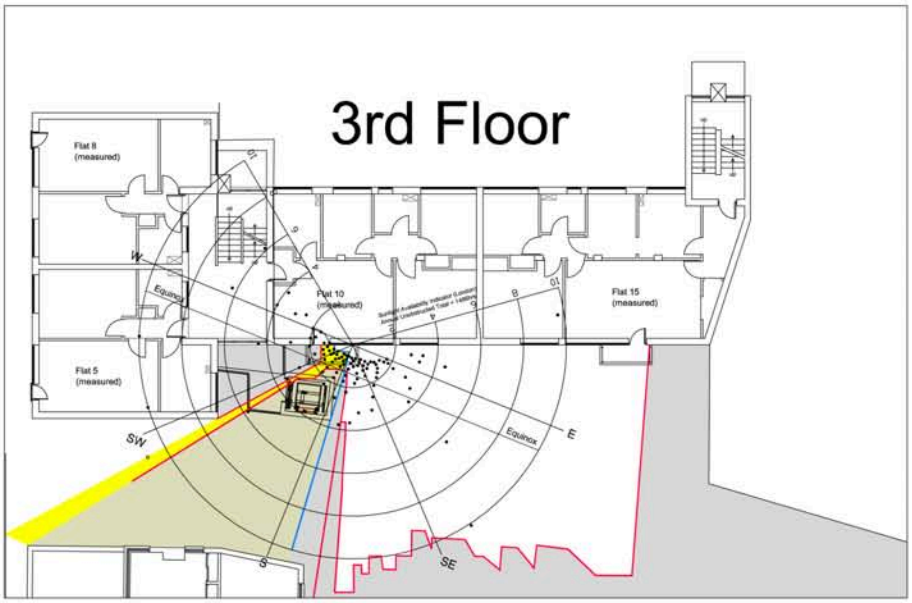

**3rd Floor**

Extg. Sunlight per year
=66% (980.76hrs)

Prop. Sunlight per year
=46% (683.56hrs)

Winter Sunlight
Extg & Prop. = 11%

Reduction Factor 0.697



# APPENDIX 3

# Average Daylight Factors (ADF)

**Calculation Tables to Ascertain Average Daylight Factors**

The ADF is calculated using the following formula:- $df = \frac{TA_w\,\theta\%}{A(1-R^2)}$

Where:

- T is the diffuse visible transmittance of the glazing, including corrections for dirt on glass and any blinds or curtains. (For clean clear single glass, a value of 0.8 can be used)
- Aw is the net glazed area of the window ($m^2$)
- A is the total area of the room surfaces: ceiling, floor, walls, doors and windows ($m^2$)
- R is their average reflectance. For fairly light-coloured rooms a value of 0.5 can be taken
- θ is the angle of visible sky in degrees derived from the vertical sky component (see Table A below).

Table A

Values of angle θ in average daylight factor equation

| Obstruction Angle (° from the horizontal) | Vertical Sky Component at centre of window (%) | Value of θ in Average Daylight Factor equation |
|---|---|---|
| 0 | 40 | 90 |
| 5 | 38 | 85 |
| 10 | 35 | 80 |
| 15 | 33 | 75 |
| 20 | 30 | 70 |
| 25 | 27 | 65 |
| 30 | 24 | 60 |
| 35 | 21 | 55 |
| 40 | 18 | 50 |
| 45 | 15 | 45 |
| 50 | 13 | 40 |
| 55 | 10 | 35 |

*Table extracted from BRE Report 209 "Site Layout Planning for Daylight & Sunlight – A Guide to Good Practice" by P J Littlefair.*

**Table B**

**Average Daylight Factor Calculations**

| Window Ref | Glass Transmission (0.8) | Net Window Area (m2) | (%) at centre of window (VSC) calculated from graphs | Value θ intrpolated from Table A | Total area of all surfaces within the test room (m2) | Average reflectance of internal surfaces | Average Daylight Factor (ADF) derived from the above formula. | Reduction Factor (compared to existing ADF) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Lower Ground (extg) | 0.8 | 4.1605 | 18.50 | 51.0 | 83.248 | 0.75 | 2.719 | |
| Lower Ground (prop) | 0.8 | 4.1605 | 16.75 | 48.0 | 83.248 | 0.75 | 2.559 | 0.941 |
| Upper Ground (extg) | 0.8 | 4.1605 | 21.50 | 56.0 | 83.248 | 0.75 | 2.985 | |
| Upper Ground (prop) | 0.8 | 4.1605 | 18.00 | 50.0 | 83.248 | 0.75 | 2.665 | 0.893 |
| First Floor (extg) | 0.8 | 4.1605 | 23.50 | 59.0 | 83.248 | 0.75 | 3.145 | |
| First Floor (prop) | 0.8 | 4.1605 | 20.00 | 52.0 | 83.248 | 0.75 | 2.772 | 0.881 |
| Second Floor (extg) | 0.8 | 4.1605 | 27.00 | 65.0 | 83.248 | 0.75 | 3.465 | |
| Second Floor (prop) | 0.8 | 4.1605 | 22.50 | 57.5 | 83.248 | 0.75 | 3.065 | 0.885 |
| Third Floor (extg) | 0.8 | 4.1605 | 29.25 | 69.0 | 83.248 | 0.75 | 3.678 | |
| Third Floor (prop) | 0.8 | 4.1605 | 23.75 | 59.0 | 83.248 | 0.75 | 3.145 | 0.855 |