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**Daylight Assessment**

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## 1.0 INTRODUCTION

1.1 This report provides a quantitative assessment of the levels of daylight that would be achieved within the bedroom and living room/kitchen of proposed basement level flat at the above address.

1.2 The assessment has been undertaken in full accordance with the guidelines set out in the Building Research Establishment (BRE) document *"Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice"* (BR209, Second Edition 2011). The introduction states:

> *"The guide is intended for building designers and their clients, consultants and planning officials. The advice given here is not mandatory and this document should not be seen as an instrument 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 many factors in site layout design"*

1.3 This assessment has been carried out using the following information:

- The planning application drawings prepared by EngineRoom;
- Ordnance Survey Superplan digital mapping of the area;
- Photographs and aerial photography of the site and its surroundings.

1.4 It is supported by analytical plots attached in the appendices.

## 2.0 METHODOLOGY

### Average Daylight Factor

2.1 For the assessment of daylight within rooms in new development or where existing residential buildings are altered or extended, the Average Daylight Factor (*df*) method can be used. The *df* is defined as the average internal illuminance as a percentage of the unobstructed external illuminance under standard overcast conditions. This takes into account the amount of light reaching the windows serving the rooms, the size of the windows, the size of the room and the transmittance and cleanliness of the windows and the size and reflectance of wall surfaces within the rooms.

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

*Where:*

*T is the diffuse visible transmittance of the glazing (typically 0.68 for clean, clear double glazing with a low emissivity coating and 0.8 for single glazing);*

*M is the "maintenance factor", the cleanliness of the windows (1.0 for recently cleaned windows and 0.96 and 0.92 for vertical windows in rural/suburban and inner urban locations respectively)[1] A lower maintenance factor can be used for skylights and rooflights if not easily accessible for regular cleaning.*

*Aw is the net glazed area excluding frames (sqm);*

*A is the total area of the room surfaces: ceiling, floor, walls and windows (sqm); and,*

*R is the average reflectance of internal wall and floor surfaces (For white painted walls and light coloured floors reflectance levels of 0.85 and 0.4 are used proportionally).*

2.3 θ is the angle of visible sky in degrees. This can either be derived by measuring the angle subtended by an obstacle opposite a window – where this is a constant height and parallel to the window – or where the height and alignment of obstacles is more complex, by working out the vertical

[1] *Daylighting and window design (Lighting Guide 10),* CIBSE (1999)

sky component (VSC) at the centre of windows serving the rooms being tested.

2.4 The VSC can be calculated either using the skylight indicator and guidance provided in Appendix A of the BRE Guide or by using the Waldram diagram as explained in Appendix B. In this case the latter approach has been used and the resultant plot is provided at Appendix 1. The plot graphically depicts the impact of the surrounding solid obstructions. The un-shaded areas represent the amount of skylight received at a window. In this case daylight reaching the window is partly filtered by the railings.

2.5 In relation to interior daylighting, the BRE guidelines state that:

> *"If a predominately daylit appearance is required, then df [Average Daylight Factor] should be 5% or more if there is no supplementary electric lighting, or 2% or more if supplementary electric lighting is provided. There are additional recommendations for dwellings, of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms. These last are minimum values of average daylight factor, which should be attained even if a predominately daylit appearance is not required".*

2.6 The above targets are also set out in British Standard BS 8206: Part 2.

**Room depth**

2.7 In addition to the above, paragraph C13 of the Guide recommends that:

> *If a daylit room is lit by windows in one wall only, the depth of the room, L, should not exceed the limiting value given by:*
>
> *L/W + L/H should be less than 2/1-$R_b$*
>
> *Where:*
>
> *W is the room width*
>
> *H is the window head height above the floor level*
>
> *Rb is the average reflectance of surfaces in the rear half of the room (away from the window)*

2.8 The Guide notes that if L exceeds the limiting value, the rear half of a room will tend to look gloomy.

## 3.0 RESULTS

### Average Daylight Factor

3.1 A pair of Waldram plots have been produced for point at the centres of the glazed apertures serving the bedroom (Reference Point 1) and living room/kitchen (RP2) (Appendix 1). The dark green area represents the effect of solid objects – in this case the wall of the lightwell – and the light green represents the railings. Typically, railings allow about 70% of daylight to pass through.

3.2 From the Waldram plots the unimpeded VSC (white area) and the VSC via the railings can be measured. For RP1 these are 6% and 7% respectively. Taking into account the effect of the railings, the latter figure is reduced to 4.9% (7 x 0.7), giving an overall VSC level of 10.9%. For RP2 the unimpeded VSC and VSC via the railings are 6.1.% and 7.6% respectively. Applying the 70% factor to the latter gives an overall VSC level of 11.4%

3.3 This can then be converted into a value for θ, the angle of visible sky, using Table C1 of the BRE guidance.

| | *Room use* | *Orientation* | *Ref Point* | *Vertical Sky Component* | *Angle of visible sky θ* |
|---|---|---|---|---|---|
| | Bedroom | North-east facing | 1 | 10.9% | 36.5 |
| | Living/kitchen | North-east facing | 2 | 11.4% | 37.3 |

Table 3.1: Vertical sky component and values for angle of visible sky θ

3.4 The area of the floor/ceiling/wall surfaces within the two rooms, and areas of glass within the apertures to these rooms, have been measured from the application drawings. These, and all the other parameters that affect the level of daylight in the room, are summarised below.

| *Room use* | *Transmittance (T)* | *Maintenance Factor (M)* | *Net glazed area (Aw) [sqm]* | *Room surfaces (A) [sqm]* | *Average reflectance (R)*[1] |
|---|---|---|---|---|---|
| Bedroom | 0.68 | 0.94 | 4.4 | 60.2 | 0.72 |
| Living/kitchen | 0.68 | 0.94 | 5.1 | 111.0 | 0.71 |

1. Based on white painted walls and light timber floors or light coloured carpet taking into account the wall/floor ratio

Table 3.2: Values for the calculation of Average Daylight Factors

3.1 Applying the formula set out in above to RP1:

$$df = \frac{TMAw\theta}{A(1-R^2)}$$

$$df = \frac{0.68x0.94x4.4x36.5}{60.2(1-0.72^2)}$$

$$df = \frac{102.66}{28.99}$$

$$\boldsymbol{df = 3.54\%}$$

3.2 Applying the formula set out in above to RP2:

$$df = \frac{TMAw\theta}{A(1-R^2)}$$

$$df = \frac{0.68x0.94x5.1x37.4}{111.0(1-0.71^2)}$$

$$df = \frac{121.92}{55.04}$$

$$\boldsymbol{df = 2.21\%}$$

3.3 The levels of Average Daylight Factor (*df*) recommended by the BRE and set out in the British Standard BS8206 for kitchens, living rooms and bedrooms is 2.0%, 1.5% and 1% respectively.

3.4 By virtue of the significant areas of glazing to be provided, both basement level habitable rooms would receive Average Daylight Factor levels that would exceed the BRE targets for kitchens, living rooms and bedrooms.

## Room Depth

3.5 The table below applies the room depth formula to the bedroom and living/kitchen space. It demonstrates that the room depth test is satisfied for both rooms.

| | *Room use* | *Room depth* | *Room width* | *Window head ht* | *reflectance Rb*[1] | *L/W + L/H* | *2/1-Rb* | |
|---|---|---|---|---|---|---|---|---|
| | Bedroom | 4.8 | 2.6 | 2.2 | 0.72 | 4.0 | 7.2 | PASS |
| | Living/kitchen | 8.7 | 3.2 | 2.2 | 0.71 | 6.7 | 6.9 | PASS |

1. Based on white painted walls and light timber floors or light coloured carpet taking into account the wall/floor ratio

Table 3.3: Room Depth

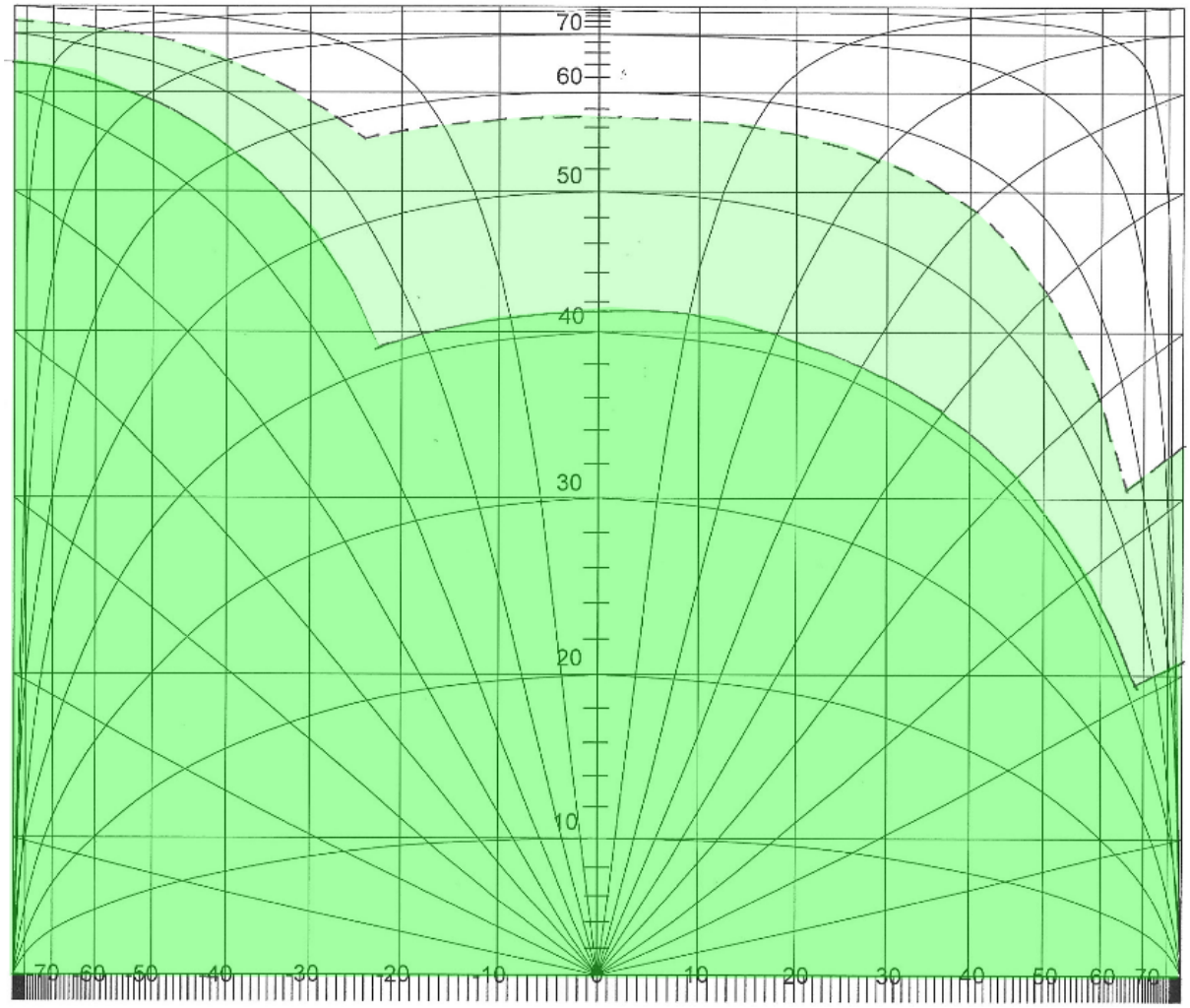
## 4.0 CONCLUSIONS

4.1 This assessment has been undertaken in full accordance with the Building Research Establishment (BRE) document "*Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice*" (BR209, 2011).

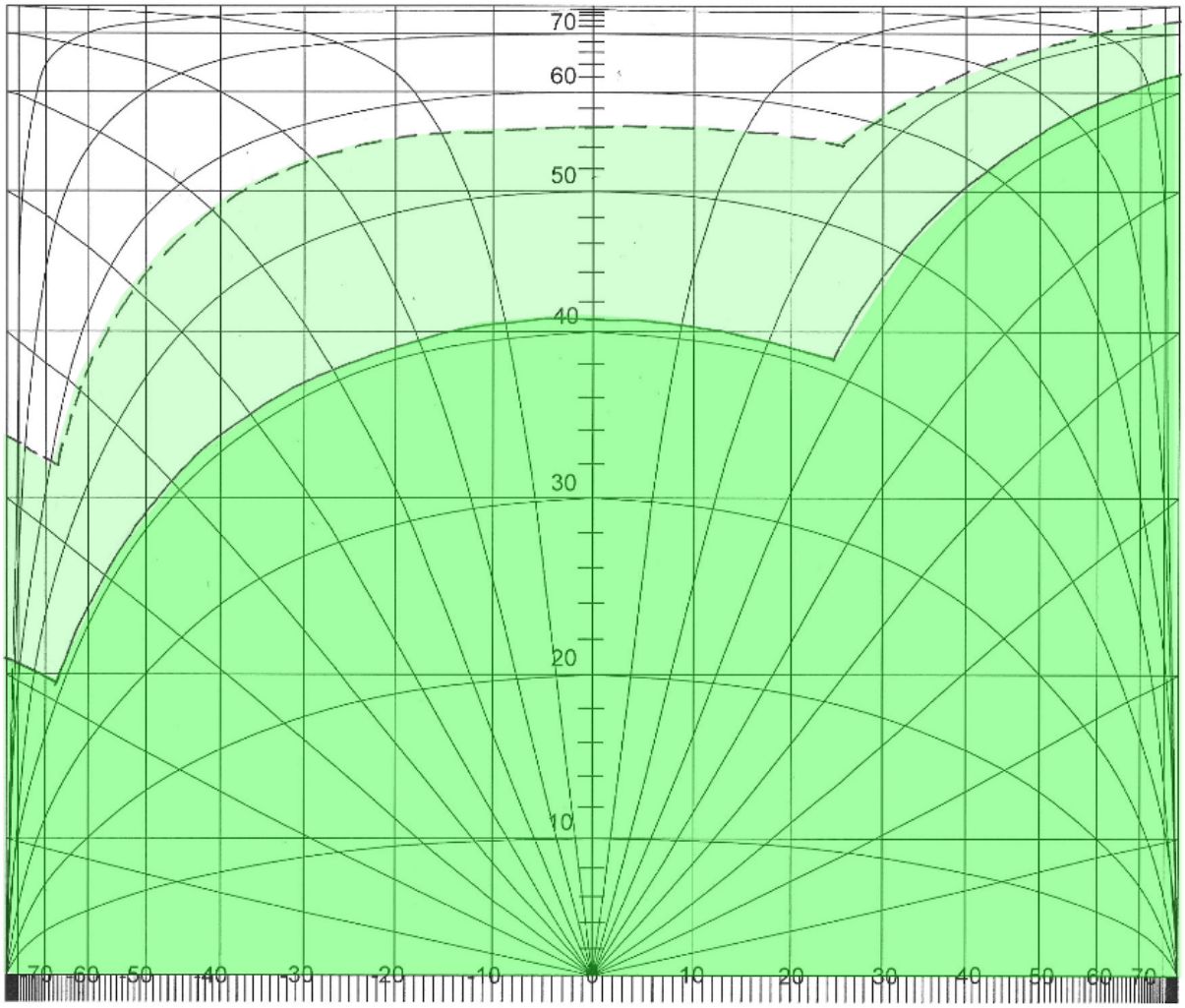
4.2 The average daylight factor (*df*) levels recommended by the BRE and set out in the British Standard BS8206 are 1% for a bedroom, 1.5% for a living room and 2% for a kitchen.

4.3 This report demonstrates that the basement level bedroom and living/kitchen area would gain levels on internal daylight that exceed the BRE requirements for kitchens, living rooms and bedrooms. Future occupiers would therefore benefit from acceptable living conditions in this respect.

## APPENDIX 1: Waldram plots




RP1: Point at the centre of the bedroom window. Effect of railing in light green.




RP2: Point at the centre of the living/kitchen window. Effect of railing in light green.