


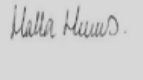


Daylight & Sunlight Simulation Analysis

123 Goldhurst Terrace
London, NW6 3EX

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EXECUTIVE SUMMARY

A detailed daylight and sunlight study has been carried out on the proposed dwelling at 123 Goldhurst Terrace, London, NW6 3EX.

The analysis is based upon the Building Research Establishment (BRE) guidelines '**Site Layout Planning for Daylight and Sunlight**', which provides the criteria and methodology for calculation in connection to daylight and sunlight.

The RADIANCE lighting simulation package, developed by the Lawrence Berkeley Laboratory in California, in conjunction with IES modelling software and interface has been used to perform the daylight simulations.

Calculations for Annual Sunlight Availability were performed using IES modelling software SUNCAST.

The overall outcome indicates that all bedrooms of the dwelling at 123 Goldhurst Terrace will be receiving good levels of daylight to provide well lit spaces, taking into account the orientation and the site location. The gym, located on the lower ground floor, does not achieve a good daylight factor. However, taking into consideration that the room will not be permanently used, the daylight conditions prove sufficient for its use. Additionally, there are no requirements regarding the daylight of gym areas.

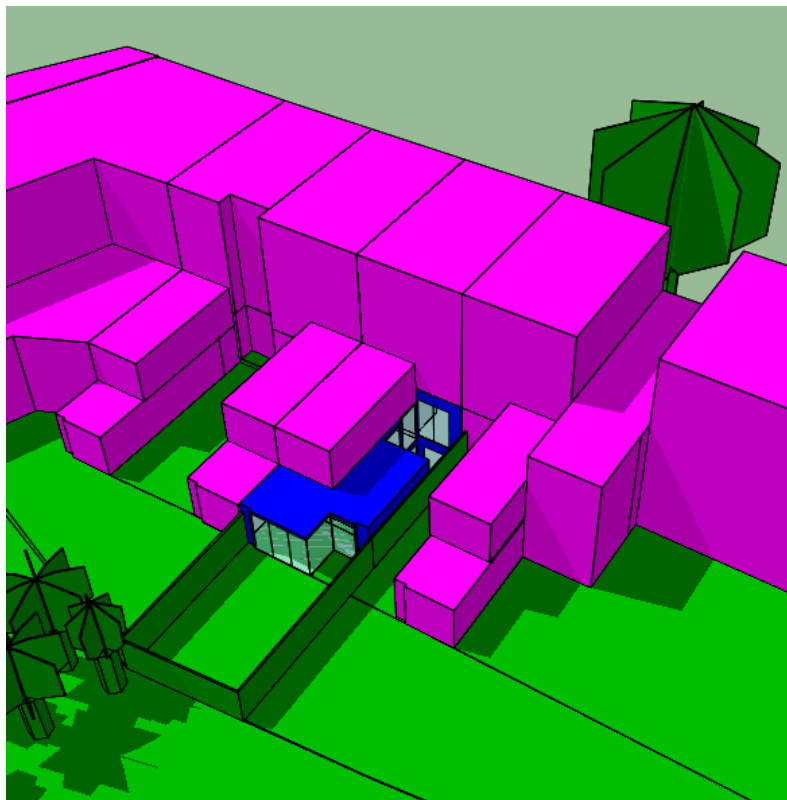


Figure 1: 3D representation of the dwelling and the surrounding area.

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SECTION 1 INTRODUCTION

GENERAL

- ERS Consultants Ltd has been appointed to carry out an assessment of the daylight and sunlight available at the proposed at 123 Goldhurst Terrace, London.
- The BRE document; 'Site Layout Planning for Daylight and Sunlight' has been used as the base for this assessment.
- The proposed building has been modelled using Integrated Environmental Solutions Virtual Environment (IES-VE), version 2019.0.1.0.
- Each individual window and glazed door has been tested, the location of each of those windows/doors can be identified in the location plan as shown in Fig 3 and Fig 4.
- Based on the BRE document, the following methods were used for measuring the daylight and sunlight:
 - Vertical Sky Component (VSC)
 - No Sky Line
 - Average Daylight Factor (ADF)
 - Annual Probable Sunlight Hours (APSH)

THE SITE

The site is located in London (at 123 Goldhurst Terrace, London, NW6 3EX), the location in the IES model was assigned as London. The proposal includes a 5-bedroom dwelling with Living-room and Kitchen/Dining area.



Figure 2: Location of Proposed Site

DOCUMENTS CONSIDERED

The model has been constructed based on the architectural drawing provided. A list of the drawing references are listed in Table 1 below.

Table 1: Drawings reference

Description	Drawing Reference
Floor Plan	141 012 P01 PROPOSED_ block plan 141 013 P04 PROPOSED_ ground floor and lower ground floor plan
Elevations & Sections	141 014 P01 PROPOSED_ front and rear elevations 141 015 P01 PROPOSED_ side elevation 141 016 P01 PROPOSED_ section AA & section BB

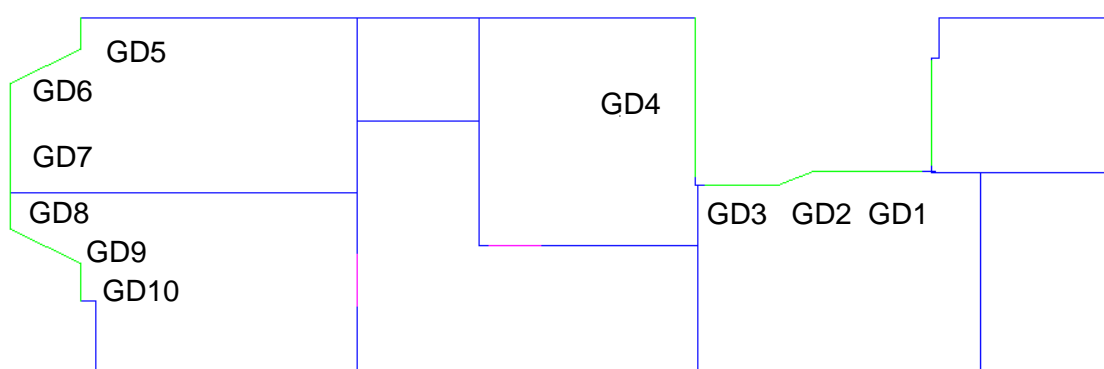


Figure 3: Basement floor openings

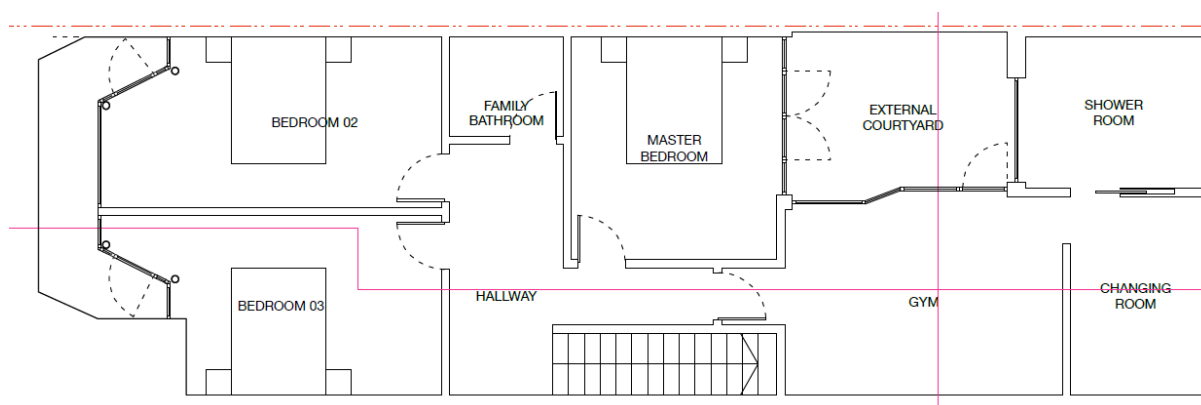


Figure 4: Basement floor plan

SECTION 2 TESTS & RESULTS

VERTICAL SKY COMPONENT (VSC)

The BRE document definition of the (VSC) is: Ratio of the part of illuminance, at a point on a given vertical plane, that is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

The VSC is usually expressed as a percentage and the maximum value for a completely unobstructed window is slightly less than 40%. The recommendations set down in the BRE report, 'Site layout for daylight and sunlight, a guide to good practice', would indicate, for residential properties, that a VSC value of greater than 27% is acceptable. However, a 20% VSC is considered to be good for an urban area.

It should be noted that the Guide itself, within the introduction, states that the advice given was not mandatory and the Guide should not be seen as an instrument of planning policy, its aim being to help rather constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly.

The introduction of the BRE guide, gives an example of urban areas being a case where there is a need for flexibility and altering the target values criteria where appropriate. Appendix F of the BRE guide is dedicated to the use of alternative values and demonstrates the manner in which the criterion for skylight was determined. The RADIANCE lighting simulation package in IES-VE, has been used to perform the daylight simulations. The windows analysed are shown in Figure 3, and the room function is listed in Table 2.

The results of the VSC for the windows and glazed doors are shown in Table 2 below. According to the BRE document, any room with two or more windows of equal size, the mean of their VSCs is taken.

It is clearly shown that the VSC results in the proposed dwelling are within the good range for an urban area.

Table 2: VSC Results

Reference	Room	Window	Elevation	VSC %
Dwelling	LGF Gym	Glazed Door (GD1)	North	4.10
		Glazed Door (GD2)	North	4.30
		Glazed Door (GD3)	North	5.61
	LGF Master bedroom	Glazed Door (GD4)	East	5.84
	LGF Bedroom 02	Glazed Door (GD5)	West	6.61
		Glazed Door (GD6)	West	2.94
		Glazed Door (GD7)	West	5.91
	LGF Bedroom 03	Glazed Door (GD8)	West	5.56
		Glazed Door (GD9)	West	5.29
		Glazed Door (GD10)	West	7.38

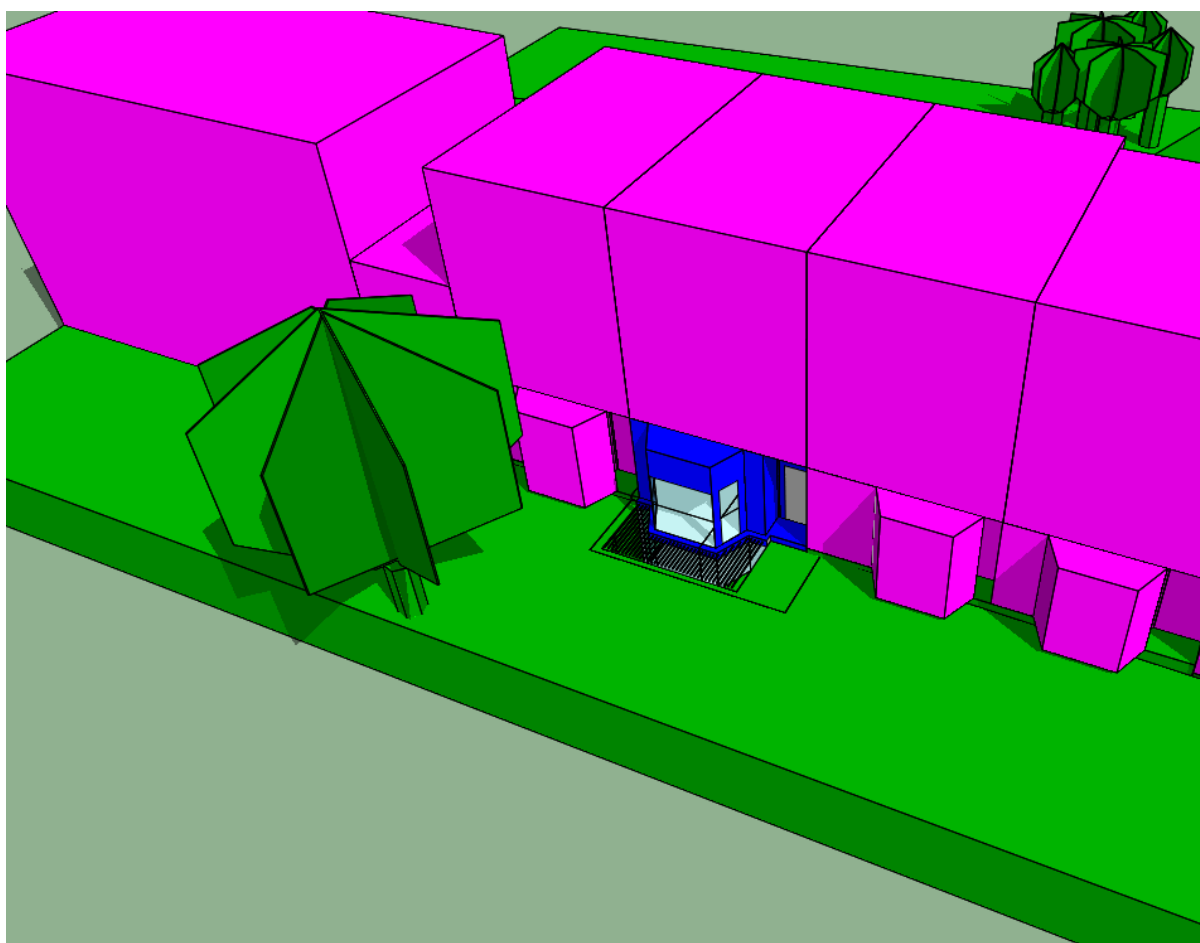


Figure 5: 3D representation of the dwelling and the surrounding trees.

AVERAGE DAYLIGHT FACTOR (ADF)

The BRE document defines ADF as: The ratio of total daylight flux incident on the working plane to the area of the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky.

In housing BS 8206-2 gives minimum values of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms.

The results of the ADF for the tested rooms are shown in Table 3 below, with Fig (7-10) showing the detailed results of the room daylight factors from the model. Results are showing that the Average Daylight Factors in the tested rooms fulfill the requirements, indicating that the spaces will have sufficient daylight in relation to their use. All of the tested bedrooms achieve an ADF above or equal to 1%. The gym achieves a low average daylight factor; however, there is no required ADF for gyms in the guidelines. Furthermore, the result is sufficient when considering that a home gym is not constantly occupied.

Table 3: ADF Results

Referenc	Room	Elevation	ADF
Dwelling	Lower Ground Floor – Gym	North	0.4%
	Lower Ground Floor - Master Bedroom	East	1.4%
	Lower Ground Floor – Bedroom 02	West	1.3%
	Lower Ground Floor – Bedroom 03	West	1.0%

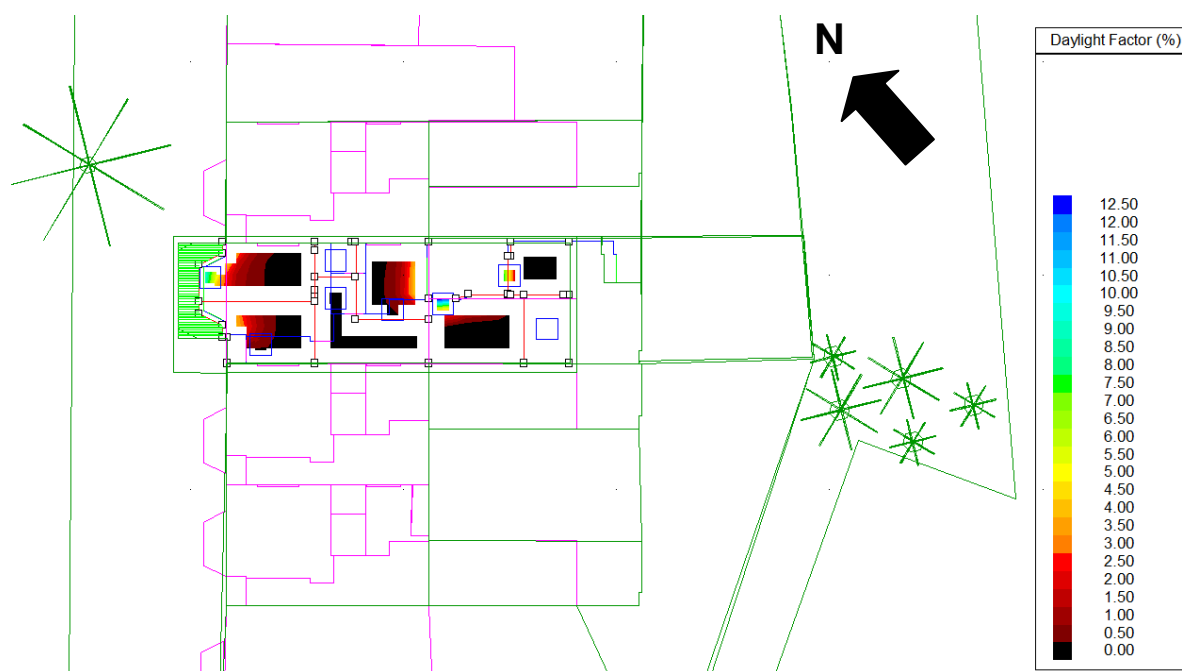


Figure 6: Daylight factor Contours for Lower Ground Floor

Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)
		Min.	Ave.	Max.		
Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=7.482m ² Margin=0.50 m	Daylight factor	0.0 %	0.4 %	2.6 %	0.03	0.00
	Daylight illuminance	1.35 lux	43.85 lux	313.98 lux	0.03	0.00
	Sky view	0.00	0.32	1.00	0.00	0.00

Figure 7: Daylight Factor Results (Lower Ground Gym)

Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)
		Min.	Ave.	Max.		
Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=6.208m ² Margin=0.50 m	Daylight factor	0.3 %	1.4 %	4.3 %	0.24	0.08
	Daylight illuminance	40.66 lux	167.38 lux	526.10 lux	0.24	0.08
	Sky view	0.00	0.92	1.00	0.00	0.00

Figure 8: Daylight Factor Results (Lower Ground Master Bedroom)

Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)
		Min.	Ave.	Max.		
Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=7.156m ² Margin=0.50 m	Daylight factor	0.2 %	1.3 %	6.0 %	0.12	0.03
	Daylight illuminance	18.91 lux	154.52 lux	729.86 lux	0.12	0.03
	Sky view	1.00	1.00	1.00	1.00	1.00

Figure 9: Daylight Factor Results (Lower Ground Floor – Bedroom 02)

Surface	Quantity	Values			Uniformity (Min./Ave.)	Diversity (Min./Max.)
		Min.	Ave.	Max.		
Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=6.080m ² Margin=0.50 m	Daylight factor	0.1 %	1.0 %	4.1 %	0.09	0.02
	Daylight illuminance	11.04 lux	117.32 lux	496.27 lux	0.09	0.02
	Sky view	1.00	1.00	1.00	1.00	1.00

Figure 10: Daylight Factor Results (Lower Ground Floor – Bedroom 03)

ANNUAL PROBABLE SUNLIGHT HOURS (APSH)

APSH is the total number of hours in the year that the sun is expected to shine on the centre of each window, allowing for average levels of cloudiness for the location in question. **This test is used to test façade within 90 degrees of due south.**

The BRE Handbook notes that:

“...a south facing window will, in general, receive most sunlight, while a north facing one will receive it only on a handful of occasions. East and west facing windows will receive sunlight only at certain times of day”.

For existing residential buildings, the BRE Handbook suggests that: *“all main living rooms of dwellings... should be checked if they have a window facing within 90° of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun”.*

Although, it is not required according to BRE Handbook, the west and east facing windows were also tested. As seen at Table 4, two out of the three tested windows achieve adequate sunlight as the Average Probable Sunlight Hours are above or almost equal to the recommended 25%.

Table 4: Annual Probable Sunlight Hours Percentages

Reference	Room	Window	Orientation	Average Probable Sunlight Hours		
				Summer	Average	Winter
Dwelling	LGF Gym	Glazed Door (GD1)	North-East	N/A	N/A	N/A
		Glazed Door (GD2)	North-East	N/A	N/A	N/A
		Glazed Door (GD3)	North-East	N/A	N/A	N/A
	LGF Master bedroom	Glazed Door (GD4)	East	6.26	0.00	6.26
	LGF Bedroom 02	Glazed Door (GD5)	North-West	N/A	N/A	N/A
		Glazed Door (GD6)	North	N/A	N/A	N/A
		Glazed Door (GD7)	West	18.96	5.76	24.72
	LGF Bedroom 03	Glazed Door (GD8)	North-West	N/A	N/A	N/A
		Glazed Door (GD9)	West	20.02	5.74	25.76

	Glazed Door (GD10)	North- West	N/A	N/A	N/A
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No SKY LINE

The No sky line is the outline on the working plane of the area from which no sky can be seen. This is to determine the light distribution in a room. The IES-ve calculation method is to define the sky view factor, which is the factor from the surface to the sky, this is *the ratio of the diffuse sky radiation received by the surface to that which would be received by the same surface if it were completely exposed to the sky* (The theory assumes that the diffuse sky radiation is isotropic).

The percentage area of no sky view is shown for each room in Table 5 below. That is based on the IES results, sky view results are also shown in Figures 7-10.

The results indicate that the bedrooms achieved the required sky view percentage on the working plane level (80%), as shown in Table 5, taking into account the surrounding external elements. The gym achieves a low sky view area, however, there are no specific guidelines for home gyms.

Table 5: Sky View Area Results

Flat	Room	Elevation	sky view area (Working Plane)
Dwelling	LGF Gym	North	32%
	LGF Master bedroom	East	92%
	LGF Bedroom 02	West	100%
	LGF Bedroom 03	West	100%

CONCLUSION

The vertical sky component daylight assessment results show that the windows and glazed doors of the tested bedrooms will receive good levels of daylight, when taking into account the urban area and location in which the proposed flat is located, and the flexibility that should be applied to the BRE guidelines in such circumstances.

The Average Daylight Factors in the bedrooms were above the recommended level. As well as the Sky view percentage and the Annual Probable Sunlight Hours.

The gym area of the house will have low daylight availability. However, when considering the use of the room and its transient use, the daylight proved sufficient. The guidelines do not state any limitations for the daylight in rooms used as gym.

Overall, the habitable rooms of the proposed lower ground floor of the dwelling at 123 Goldhurst Terrace, London, will be receiving good levels of daylight to provide well lit spaces.