Internal Daylight Report

MAA Architects

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SRE

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Executive Summary

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The Internal Daylight Analysis has been undertaken by SRE Ltd for the Proposed Development at Waldegrave Mews, London Borough of Richmond, on behalf of MAA Architects (the Client) in order to assess the predicted internal daylight levels.

In accordance with standard practice and in support of planning, the Client wishes to ensure that habitable rooms, including living spaces within the Proposed Development, have sufficient natural light. Modelling and calculations have been conducted following the recommended internal daylight standards as detailed in BRE guidance "Site Layout Planning for Daylight and Sunlight" (PJ Littlefair 2011), the British Standard of practice for daylight (BS 8206-2) and the CIBSE Lighting Guide LG 10 Daylighting and Window Design.

The assessment has been carried out for a total of 15 no. rooms on the ground floor to represent 'worst-case scenarios'.

The daylight simulation is based on Radiance software through the graphical user interface (GUI) of Ladybug and Honeybee tools plugins in Rhino/Grasshopper. Radiance uses the backward ray-tracing method to calculate the Average Daylight Factor (ADF) within all occupied areas of the building.

The results of the internal daylight analysis demonstrate that all 15 no. rooms exceed the recommendations set out by industry guidance. Therefore, it is anticipated that the residential units in the Proposed Development will receive adequate levels of internal daylighting.

Introduction

1.0 Introduction

The Internal Daylight Analysis has been undertaken by SRE Ltd for the Proposed Development at Waldegrave Mews, London Borough of Richmond on behalf of MAA Architects (the Client), in order to assess the predicted internal daylight levels within the Proposed Development.

This study assesses the internal daylight distribution of the habitable rooms of the Proposed Development. The assessment is undertaken in accordance with the BRE and British Standard guidance.

The daylight simulation is based on Radiance software through the graphical user interface (GUI) of Ladybug and Honeybee tools plugins in Rhino/Grasshopper. Radiance uses the backward ray-tracing method to calculate the Average Daylight Factor (ADF) within all occupied areas of the building.

The relevant neighbouring buildings are included in this assessment due to their distance from the Proposed Development.

1.1 The Application Site & Proposed Development

The Proposed Development consists of the construction of 18 no. new residential dwellings comprising of one and two beds at the rear of the existing premises (herby referred to as Waldegrave Mews). In addition, the existing premises at 189 Waldegrave Road will be refurbished to provide a new mixed use building providing employment space on the ground floor, with a two bed maisonette unit on the first and second floors.

The site is bounded by a railway line to the West, residential to the North and South, and a mix of residential and commercial to the East along Waldegrave Road.

Figure 1 – Proposed Site Plan (MAA Architects)

Principles and Methodology

2.0 Principles and Methodology

Daylighting is an important parameter for the assessment of a building's energy performance and quality of space. The human visual system is extremely well adapted to daylight and the benefits to human health are well documented. The use of daylight in buildings can significantly reduce peak energy loads associated with artificial lighting and therefore reduce the energy consumption and overall greenhouse gas emissions of the Proposed Development.

2.1 Average Daylight Factor (ADF)

Traditionally, daylight has been evaluated quantitatively, using the Average Daylight Factor (ADF). The daylight factor is defined as a ratio that represents the amount of illumination available indoors relative to the illumination present outdoors at the same time under an overcast sky.

ADF is normally expressed as a percentage of the illuminance available to an unobstructed point outdoors, under an overcast sky of known luminance and luminance distribution. This is the most detailed of the daylight calculations and considers the physical nature of the rooms and windows, including; window transmittance, window size, room size, angle of external obstruction and room surface reflectivity.

Although there are various recommendations for typical Average Daylight Factor values, an average value between 2% and 5% is considered satisfactory. The BRE guide recommends an ADF of 5% or more if there is no supplementary electric lighting, or 2% or more if supplementary electric lighting is provided. However, interiors with very high ADFs (over 6%) sometimes have problems with summertime overheating or excessive heat loss in winter.

The minimum recommendations for dwellings, as outlined in the BRE good practice guide, are:

- 2.0% for kitchens,
- 1.5% for living rooms, and
- 1.0% for bedrooms.

In addition, other regional guidance in the form of the Greater London Authority's (GLA) note on daylight was taken into account when interpreting the results. The note published by GLA states the following:

"BRE guidelines confirm that the acceptable minimum ADF target value depends on the room use. That is 1% for bedroom, 1.5% for living room and 2% for a family kitchen. In cases where one room serves more than one purpose, the minimum ADF should be that for the room with the higher value. Notwithstanding this, the independent daylight and sunlight review states that, in practice, the principal use of rooms designed as a 'living room/kitchen/dining' is a living room. Accordingly, it would be reasonable to apply a target of 1.5% to such rooms."

Therefore, an ADF of 1.5% has been used as the criteria for the living spaces in this assessment.

2.2 Methodology

This study is based on guidelines set out in the BRE *Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice*. The assessment has been conducted using Radiance software through the GUI of Ladybug and Honeybee tools plugins in Rhino/Grasshopper.

A 3D model has been built based on the latest architectural drawings. A perspective view of the model can be seen in Figure 2.

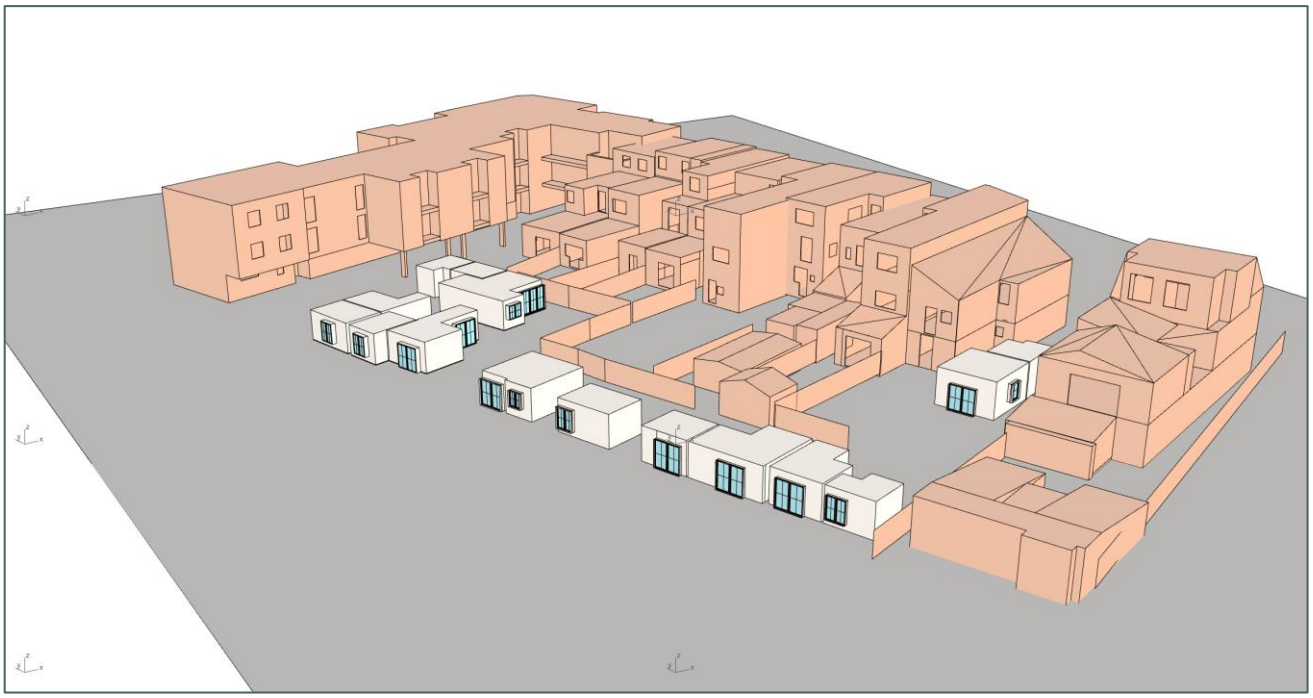

Figure 2 - Perspective view of the model with assessed spaces from the Southwest

The simulations assess Average Daylight Factor of 15 no. habitable rooms within 7 no. flats on the ground floor to represent the 'worst-case scenarios'. Table 1 summarises the list of assessed rooms in the Proposed Development.

Key points of the simulation include:

- Tested on a horizontal plane at 0.85 m above the floor,
- Grid size of 0.25m,
- Margin of 0.5m from the internal walls,
- Room surface maintenance factor of 0.9, and
- Under a standard CIE overcast sky.

	Room type	Floor area (m^2)
C.03	Bedroom 1	13.7
	Bedroom 2	8.5
	Kitchen/Living/Dining	29.3
C.02	Bedroom	17.15
	Kitchen/Living/Dining	15.38
C.01	Bedroom	12.7
	Kitchen/Living/Dining	23.2
B.03	Kitchen/Living/Dining	25.1
	Bedroom	15

B.02	Kitchen/Living/Dining	12
	Bedroom	25.4
B.00	Kitchen/Living/Dining	16.5
	Bedroom	9.1
A.02	Kitchen/Living/Dining	22.3
	Bedroom	12

Table 1 – Summary of assessed rooms

Table 2 shows the key properties that have been applied in the model, including reflectance of the internal surfaces and the visual light transmittance of the windows. They are based on standard 'neutral' colours that are likely to be applied on the relevant elements. It should be noted that changes to these figures will influence the overall results of the assessment.

	Material	Reflectance (%)
Internal walls	Offwhite plaster	80.0
Internal floor	Grey	60.0
Internal ceiling	White painted	90.0
External walls	Brick Red	40.0
External Roof	Offwhite	75.0
Glazing	Light transmittance 63%	

Table 2 - Reflectance of the surfaces and light transmittance of the glazing.

Results and Conclusions

3.0 Results and Conclusions

The ADF assessment was carried out for 15 no. habitable rooms, the results of which are shown in Table 3.

Flat No.	Room type	ADF (%)	BRE Recommended ADF (%)	Compliance
C.03	Bedroom 1	1.96	1.5	Yes
	Bedroom 2	2.15	1.5	Yes
	Kitchen/Living/Dining	5.49	1.5	Yes
C.02	Bedroom	1.98	1.5	Yes
	Kitchen/Living/Dining	5.18	1.5	Yes
C.01	Bedroom	3.9	1.5	Yes
	Kitchen/Living/Dining	7.4	1.5	Yes
B.03	Kitchen/Living/Dining	5.68	1.5	Yes
	Bedroom	2.71	1.5	Yes
B.02	Kitchen/Living/Dining	7.05	1.5	Yes
	Bedroom	5.39	1.5	Yes
B.00	Kitchen/Living/Dining	7.5	1.5	Yes
	Bedroom	4.31	1.5	Yes
A.02	Kitchen/Living/Dining	4.14	1.5	Yes
	Bedroom	1.05	1.5	Yes

Table 3 - Average Daylight Factor (ADF) analysis results by flat

The overall result of this study shows that all 15 no. assessed rooms in the Proposed Development exceed the recommendations set out by BRE Guidelines.

Therefore, it can be concluded that the Proposed Development will receive adequate internal daylight levels, which can in turn support the health, wellbeing, and productivity of the building occupants.

The bedroom of Flat B-02 and the kitchen/living/dining spaces of Flats B-01 and C-01 are seen to have very high ADFs above 6%, which may sometimes indicate problems with summertime overheating or exccessive heat loss in winter[1]. A detailed overheating analysis has been carried out for the Proposed Development and results confirm that no overheating will be experienced.

A floor plans with detailed distribution of daylight factor for all assessed spaces has been included in Appendix A.

[1] Site layout planning for daylight and sunlight – A guid to good practice, Paul Littlefair

Appendices

Appendix A – Internal DF distribution in assessed rooms

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