DAYLIGHT AND SUNLIGHT STUDY FOR THE PROPOSED GROUND FLOOR CONVERSION AT THE BACK OF 36-37 GREAT RUSSELL STREET, LONDON, WC1B 3PP

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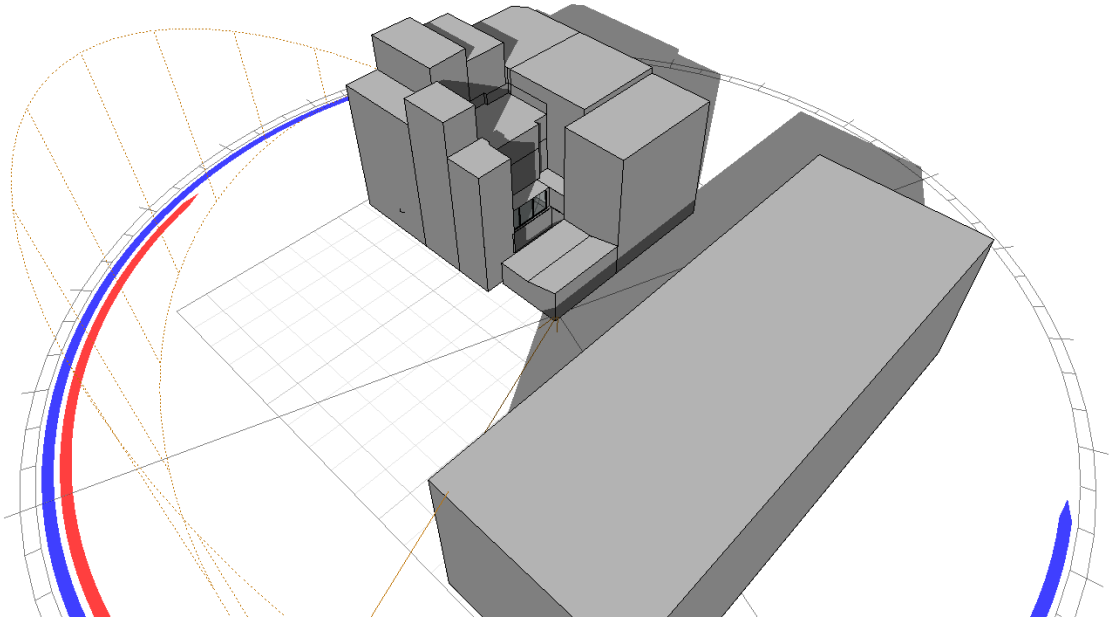

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1. INTRODUCTION

The purpose of this study is to evaluate the daylight and sunlight performance of the proposed conversion located on the ground of an existing building at the back of 36-37 Great Russell Street, London, WC1B 3PP. The building that already exists there (see Figures 1a,1b,1c,1d) comprises of a lower ground floor, a ground floor, as well as another 4 floors above and the proposed development (see Figures 2a,2b) is concerned with the conversion of the ground floor at the back of the building into one habitable unit composed of a kitchen-living-sleeping room.

This daylight and sunlight study is going to look at the daylight and sunlight performance of all proposed new habitable rooms based on the BRE 2022 criteria. There is no impact of the proposed development on nearby buildings in terms of daylight and sunlight, as the external volume of the building will remain the same.

Figure 1a: *Satellite view of the site (source: google maps)*

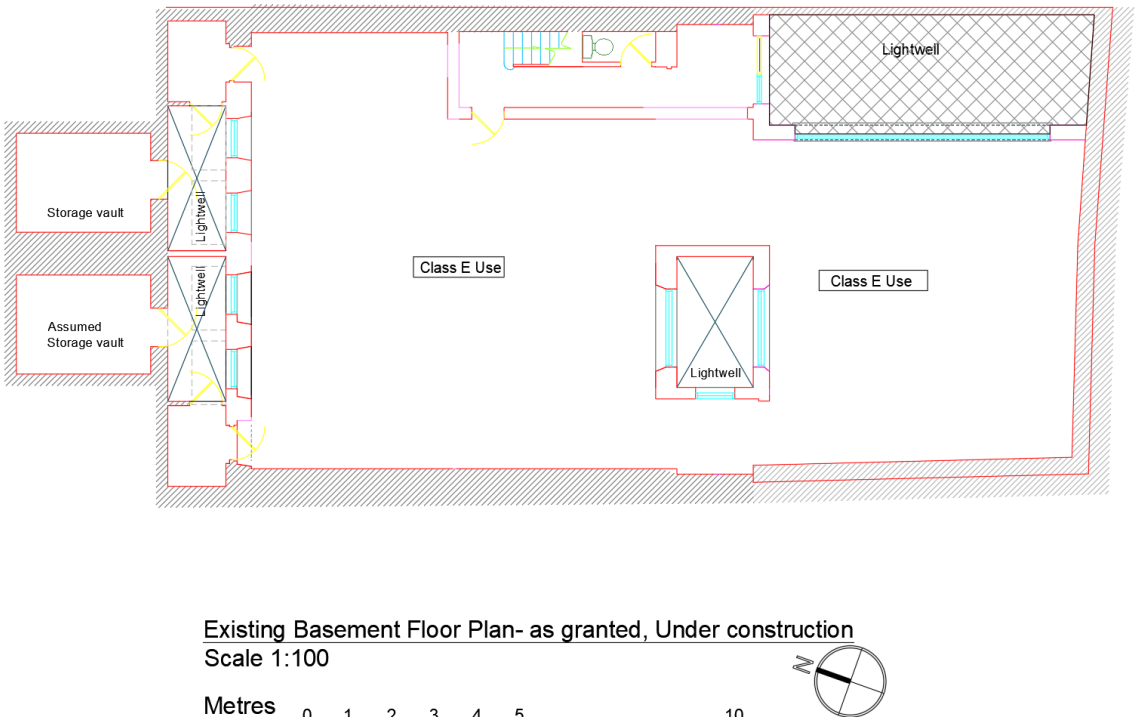


Figure 1b: *Existing Ground Floor Plan (as granted, under construction)*

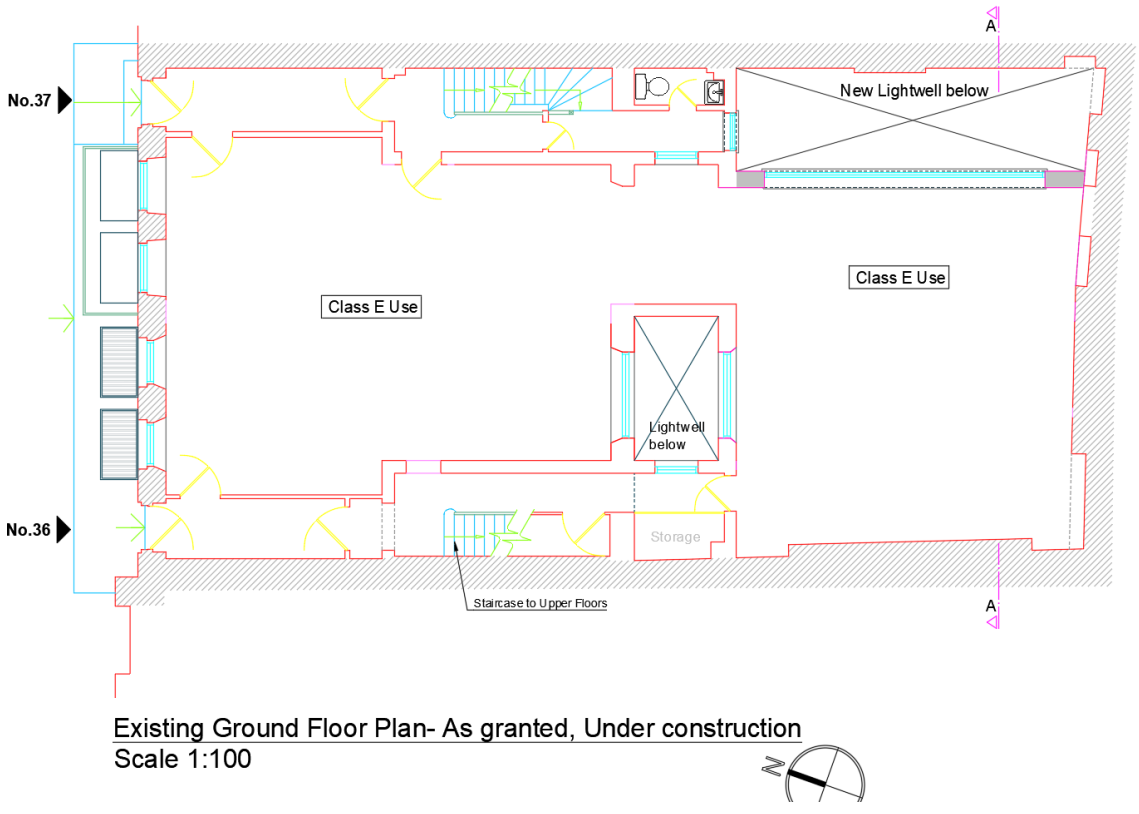


Figure 1c: *Existing Ground Floor Plan (as granted, under construction)*

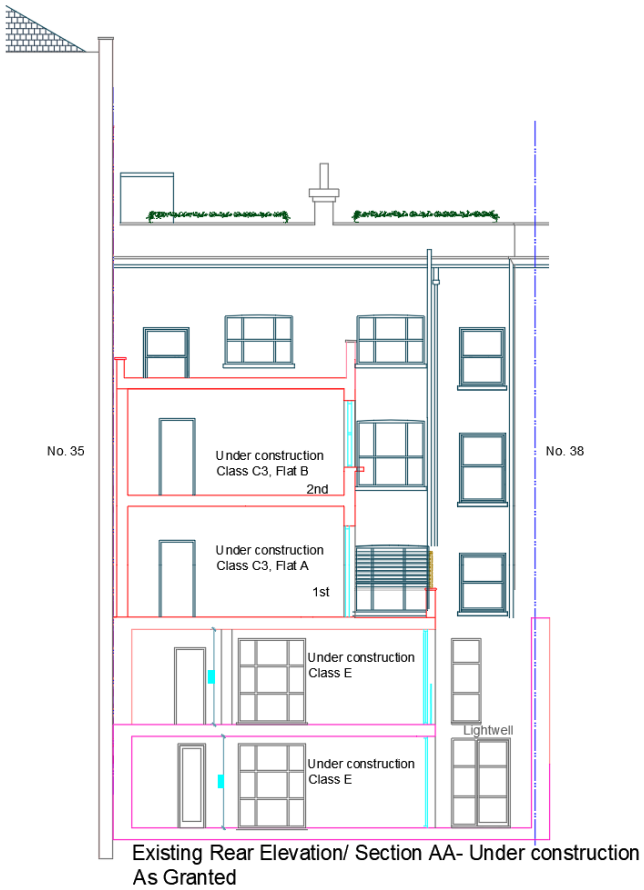


Figure 1d: *Existing Elevations*

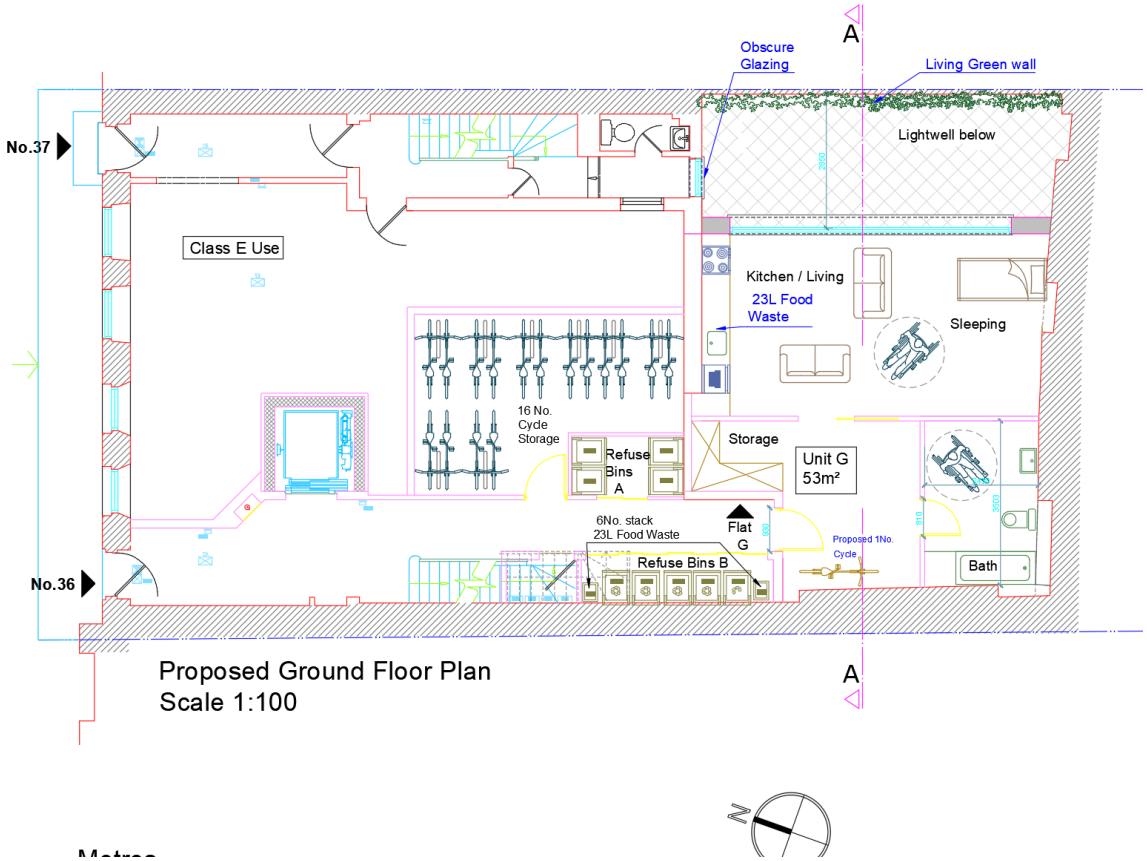
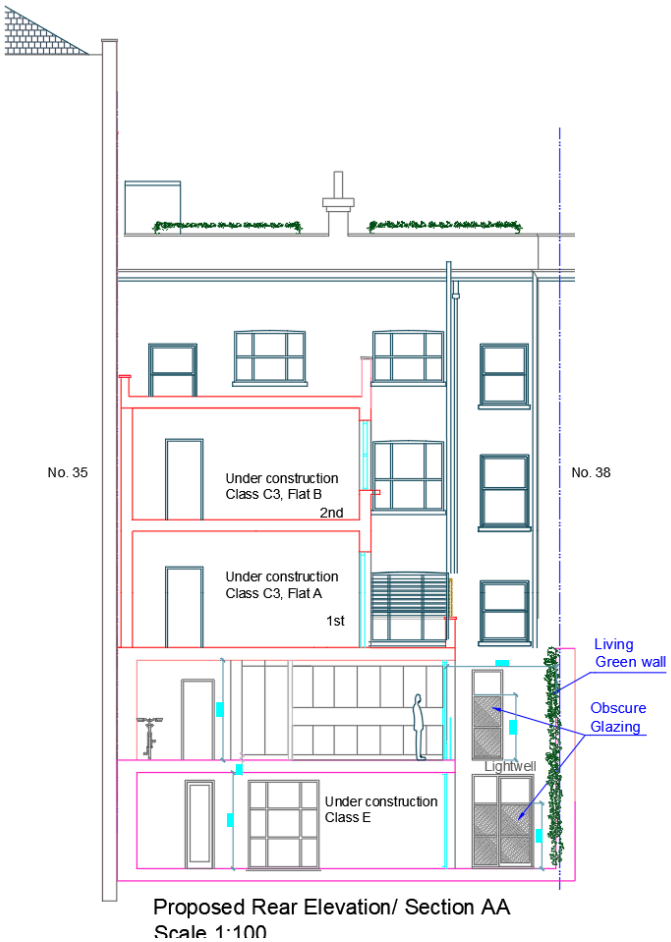


Figure 2a: *Proposed ground floor plan*



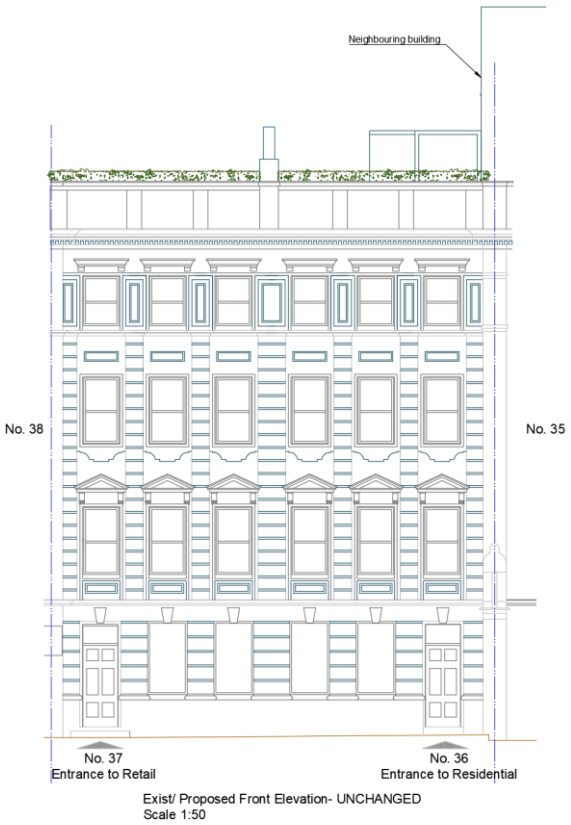


Figure 2b: *Elevations of proposed conversion*

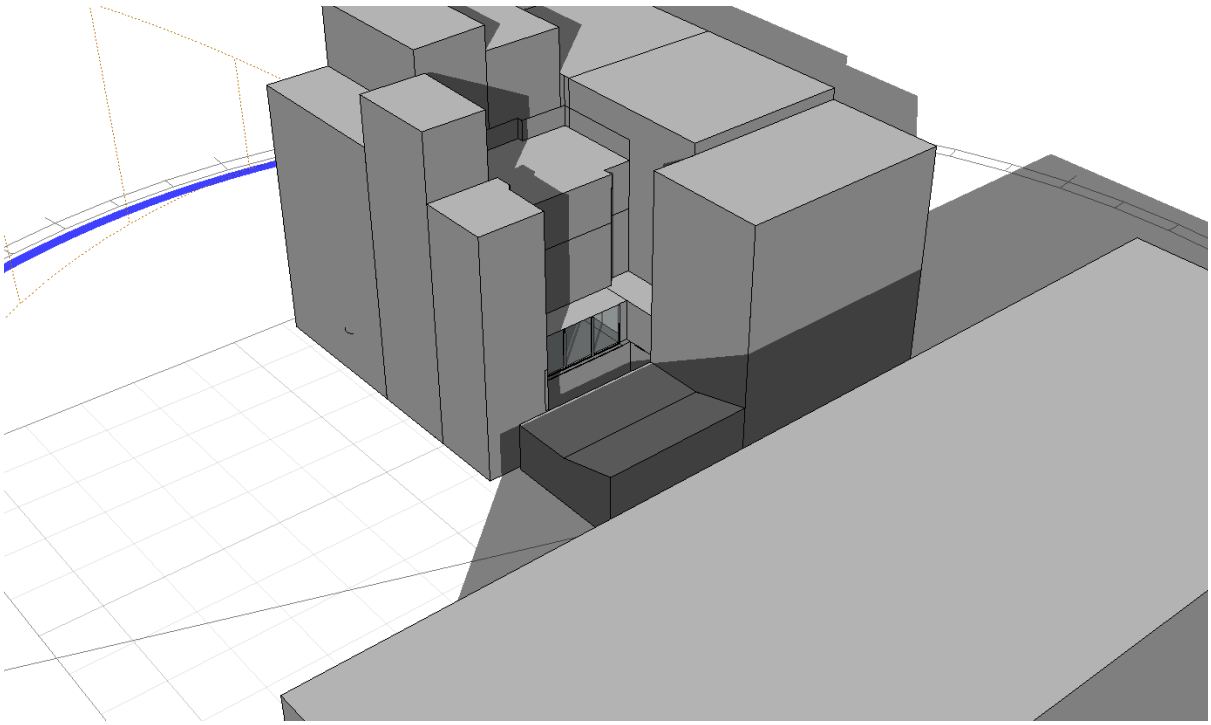


Figure 3: *3D Model of the building and site*

Figure 4: *Satellite view of the site (source: google maps)*

2. APPROACH

The proposed conversion on the ground floor, at the back of the existing building does not change the outer geometry of the building. The existing building remains the same in terms of massing and therefore there will be no change on the shading the existing building produces versus what the proposed conversion will produce. As such there will be on difference in impact to all nearby buildings and gardens and hence there is no need to perform daylight impact calculations to nearby properties.

This study will focus on the daylight and sunlight performance of all proposed new habitable rooms at the back of the lower ground and ground floors, in accordance with the BRE 209 Daylight and Sunlight Planning Guide (2022).

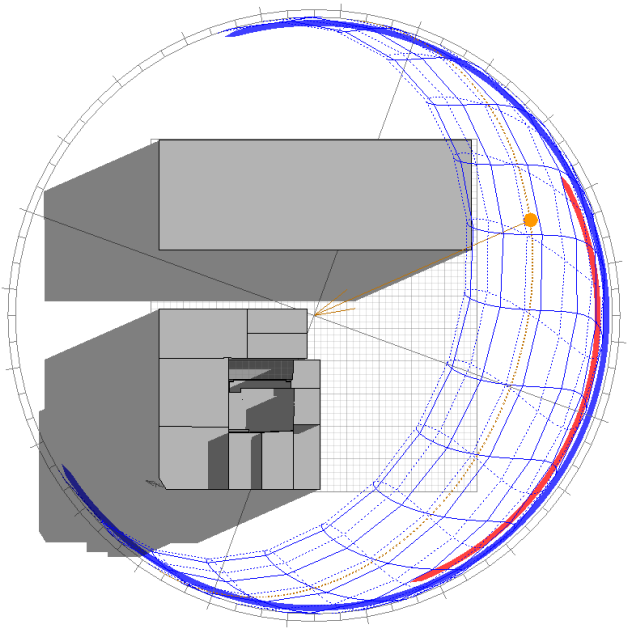


Figure 5: *Plan view of the site, including the proposed development and surrounding buildings.*

In order to perform the necessary calculations, building performance modelling was used, in the form of building simulation software, specialising in lighting simulation. In this case AUTODESK ECOTECT Analysis was used to setup the required 3D models.

Drawings, in order to construct 3D models, were provided by the client and their architect: Tal Arc Architects. The 3D models constructed for simulations were optimised for a daylight and sunlight analysis, thus the models were constructed in such a way so that the massing of nearby buildings was captured, with necessary external and window geometry modelled for the building in question, along with internal layout details for the analysis.

Vegetation (including small and large trees) is present in the wider area, but this was not included in the analysis, in order to investigate the maximum potential for daylight and sunlight on the proposed conversions. This is in line with Section G3.2 and G3.3 from the BRE Lighting and Daylight Planning Guide (2022).

In terms of daylight performance of the proposed new development, all the habitable rooms (bedrooms, kitchen/living spaces) were calculated and more specifically the daylight factors over a grid of points was calculated for all such rooms, as suggested by the BRE 209 guide.

The reflection of surfaces is very important for daylight performance. The intention of the architects is to specify white colours for walls and ceiling on all proposed new rooms. As a worst case scenario though, it was decided that the reflectance values on surfaces as proposed by the BRE 209 Guide were used: Floors: 0.2, Interior Walls: 0.5, Ceilings: 0.7. The reflection levels could potentially represent a fairly dark carpet, a coloured wall and a white ceiling. This represents a common scenario in terms surface reflection for simulations at this stage in a design. As the architects intend to use white colour on ceiling and walls, then the daylight levels inside the room would

be slightly higher than what is predicted in this report. As instructed by the architect a double glazing system with clear glass was simulated as part of the model for all windows.

The targets set in terms of daylight performance were provided by the Building Research Establishment (BRE) 209 guide (2022), that suggests minimum daylight factors for habitable rooms for new developments, as can be seen in the following table.

Table 1. BRE 209 (2022) *Daylight Factor requirements for new dwellings*

Summary of requirements
BRE 209 Guidance (2022) Appendix C -UK National Annex (Table C3) Specific recommendations for daylight provision in UK dwellings Minimum daylight provisions in all UK dwellings: Target daylight factors to achieve over at least 50% of the assessment grid in UK domestic habitable rooms with vertical and/or inclined daylight apertures -For kitchens: **1.4%** -For living rooms: **1.1 %** -For bedrooms: **0.7%**

The above table lists the main targets to be met by the proposed rooms, as minimum requirements. On this basis, a series of calculations and simulations were performed in order to determine the daylight performance of the proposed rooms. The simulations, included a calculation of daylight factors over a grid of points (set at 850mm above floor level – desk level), and have incorporated all simulation recommendations from the BRE209 (2022) guide.

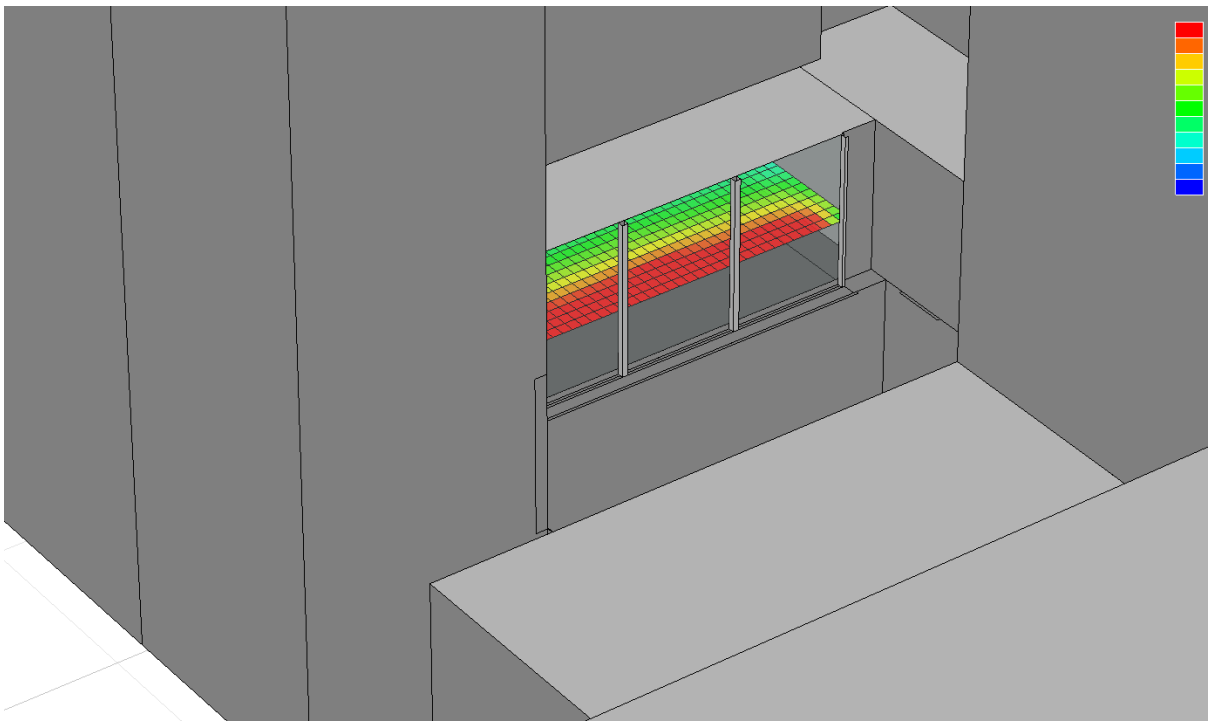


Figure 6: *Model used for Daylight Factor calculations for the proposed development*

3. RESULTS AND DISCUSSION

3.1 Daylight Factors of proposed habitable rooms

The results of the daylight factor simulations revealed that the proposed new unit, which is composed of one habitable room (Kitchen-Living-Sleeping) receives more than the minimum recommended levels of daylight factor, as can be seen in Table 2. In fact, because of the shallow depth of the room as well as the multiple windows present, the targets are far surpassed.

Table 2. *Daylight Factors and grid areas meeting the BRE209(2022) targets*

Floor	FLAT	ROOM	Target DF to achieve over at least 50% of the assessment grid	% area of grid (in a room) that meets target DF minimum
Ground	A	Kitchen-Living-Sleeping	1.4%	100%

In order to provide a more qualitative view of the results, a graph of the daylight factor results for the room can be seen in Figure 7, where the distribution of daylight over a working plane can be seen in plan view. Furthermore, in Figure 8, the individual DF achieved for each grid point can be seen.

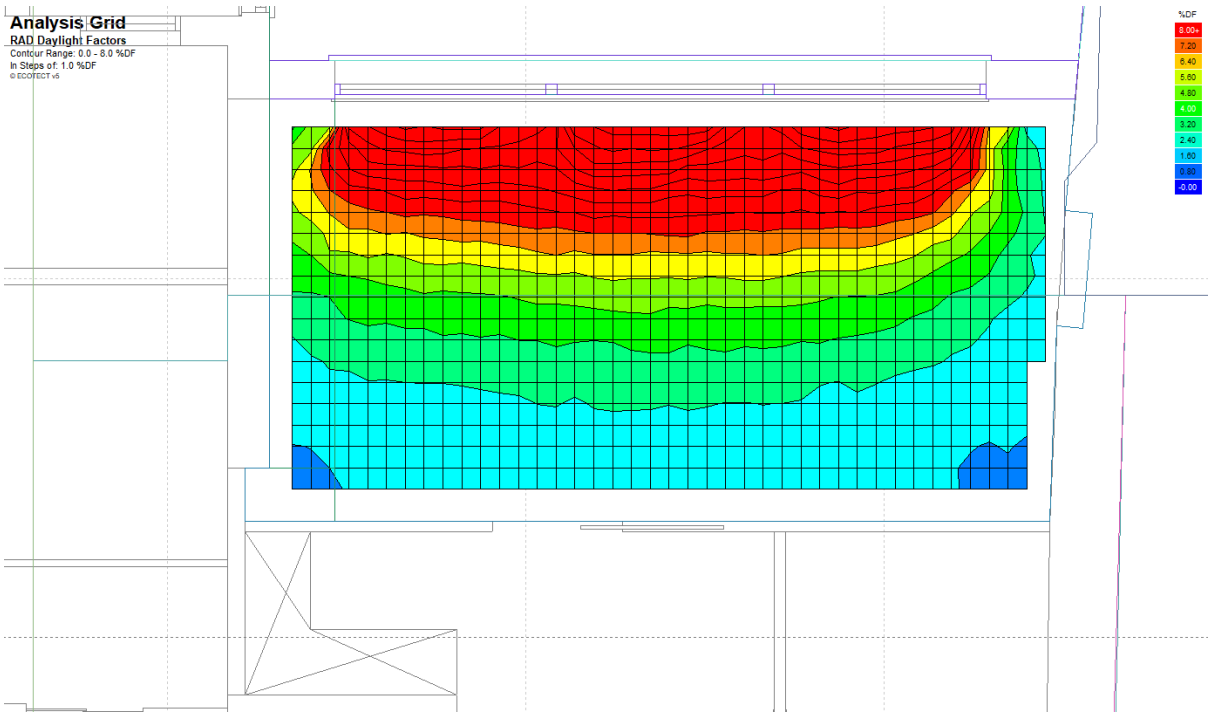


Figure 7: *DF distribution over all proposed habitable rooms on the proposed ground floor (scale 0-8%DF, contours every 1%DF)*

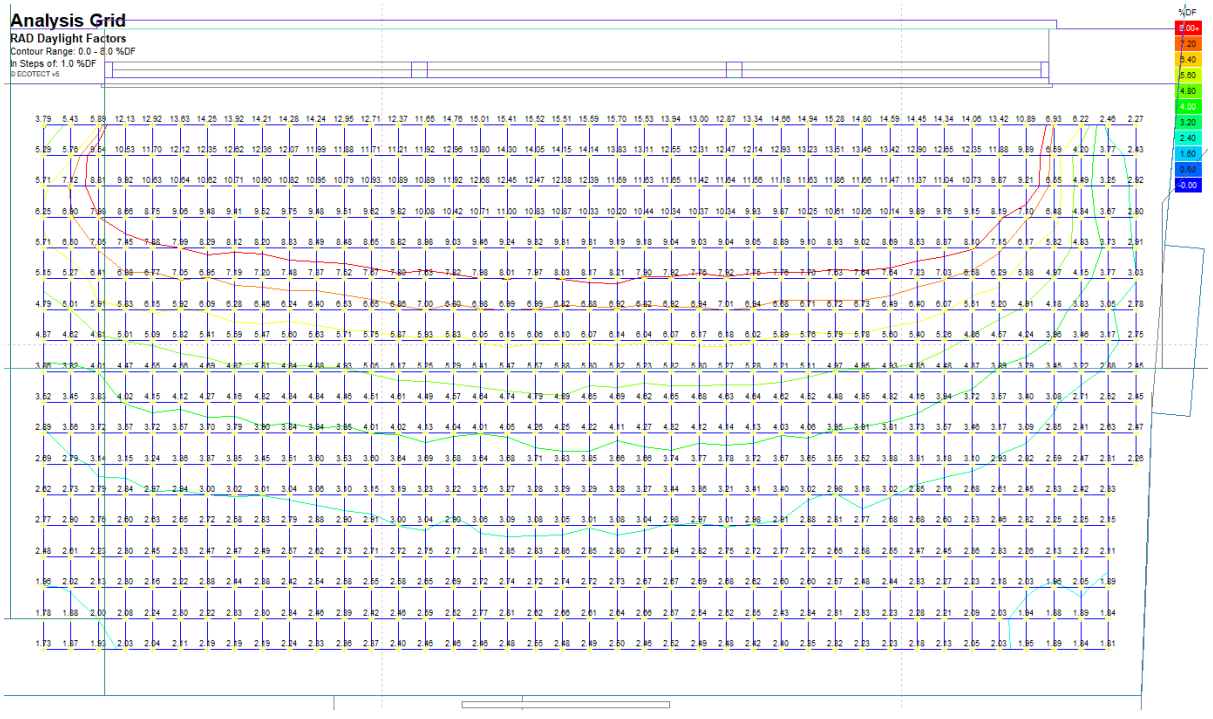


Figure 8: *DF values for each grid point*

3.2 Sunlight to windows of proposed habitable rooms

The BRE 209 (2022) suggests that at least one main window wall faces within 90 degrees of due South and that a habitable room (preferably living room) can receive a total of at least 1.5 hours of sunlight on the 21st of March (section 3.1.15 of the BRE guide).

From the results in Table 3 it can be seen that all windows receive less than 1.5 hours of sunlight on the 21st of March. Two windows receive 1 hour of sunlight on that day and one window received 0 hours of sunlight. Figure 9 provides a visual of which windows receive sunlight on the 21st of March.

In order to provide a more comprehensive view of the sunlight performance of these windows, an Annual Probable Sunlight Hours calculations was performed. Even though there are no specific targets to be met on this calculation, it does provide a more in-depth understanding of how much sunlight these windows are exposed to over the whole year and it can be seen that this ranges from 167 hours, all the way up to 641 hours of sunlight over the whole year, suggesting that there is sunlight reaching these windows for a number of hours over the year.

Figure 11 shows the shading mask at the centre of each window. Each one of the shading masks shows the full exposure to the sun of each window over the whole year. It can be seen that there is some variation between windows, but all of them receive some sunlight in the morning for a few months. The exact amount of probable sunlight is shown at the last column of Table 3.

Table 3. *Sunlight Hours for proposed habitable windows on 21st of March*

Floor	Flat	Room	Window Orientation	Window ID	Sunlight Hours on 21/March (hours)	Annual Probable Sunlight Hours (All Year)
Ground	A	Kitchen-Living-Dining	North-East	7841	1	641
Ground	A	Kitchen-Living-Dining	North-East	7843	1	404
Ground	A	Kitchen-Living-Dining	North-East	7842	0	167

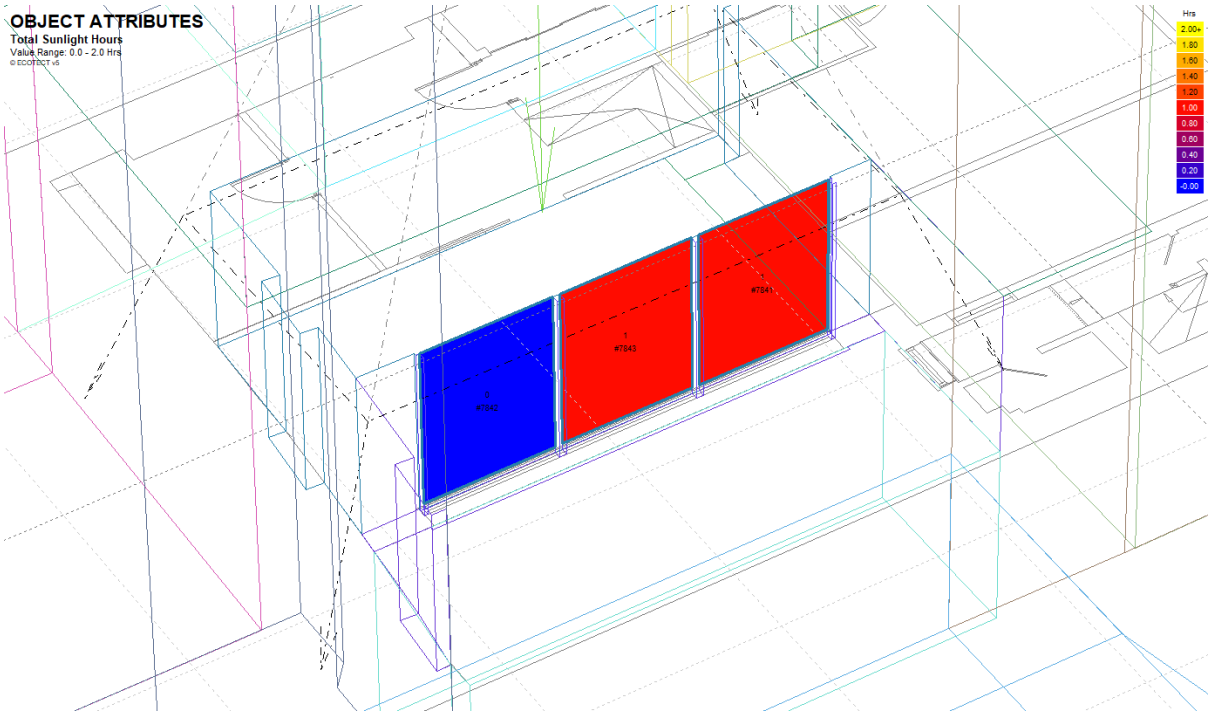


Figure 9: *Sunlight Hours received on windows on the 21st of March*

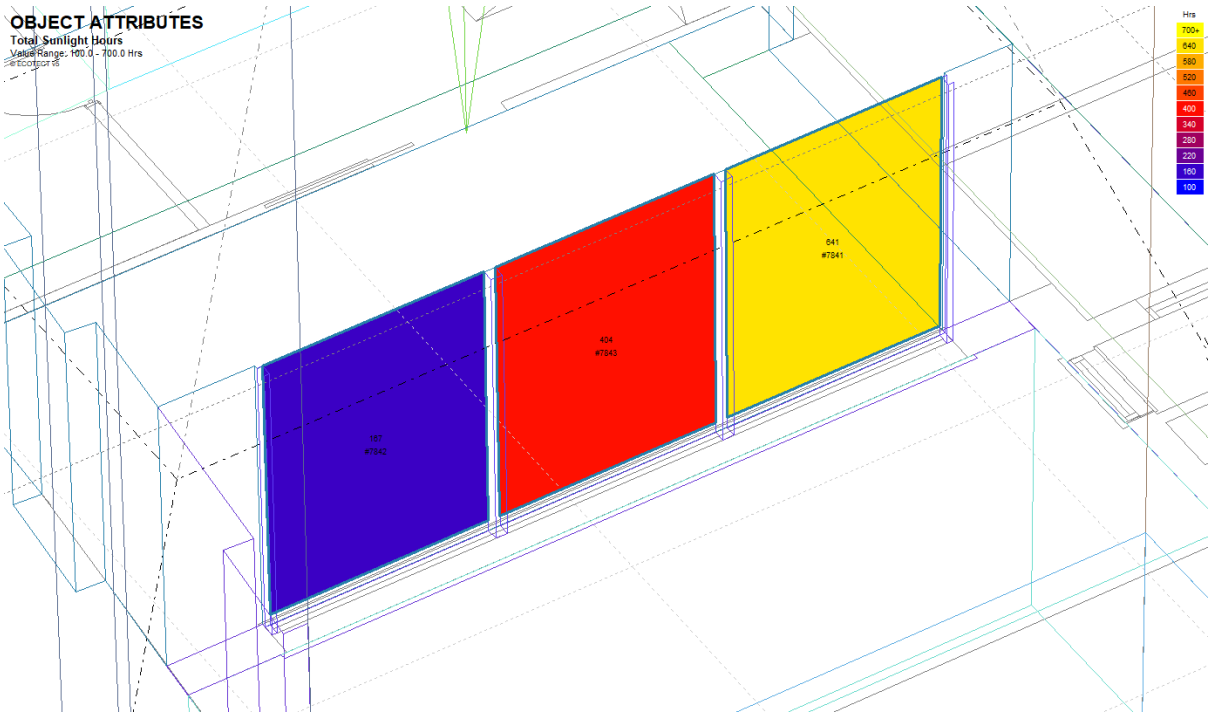


Figure 10: *Sunlight Hours received on windows over the whole year*

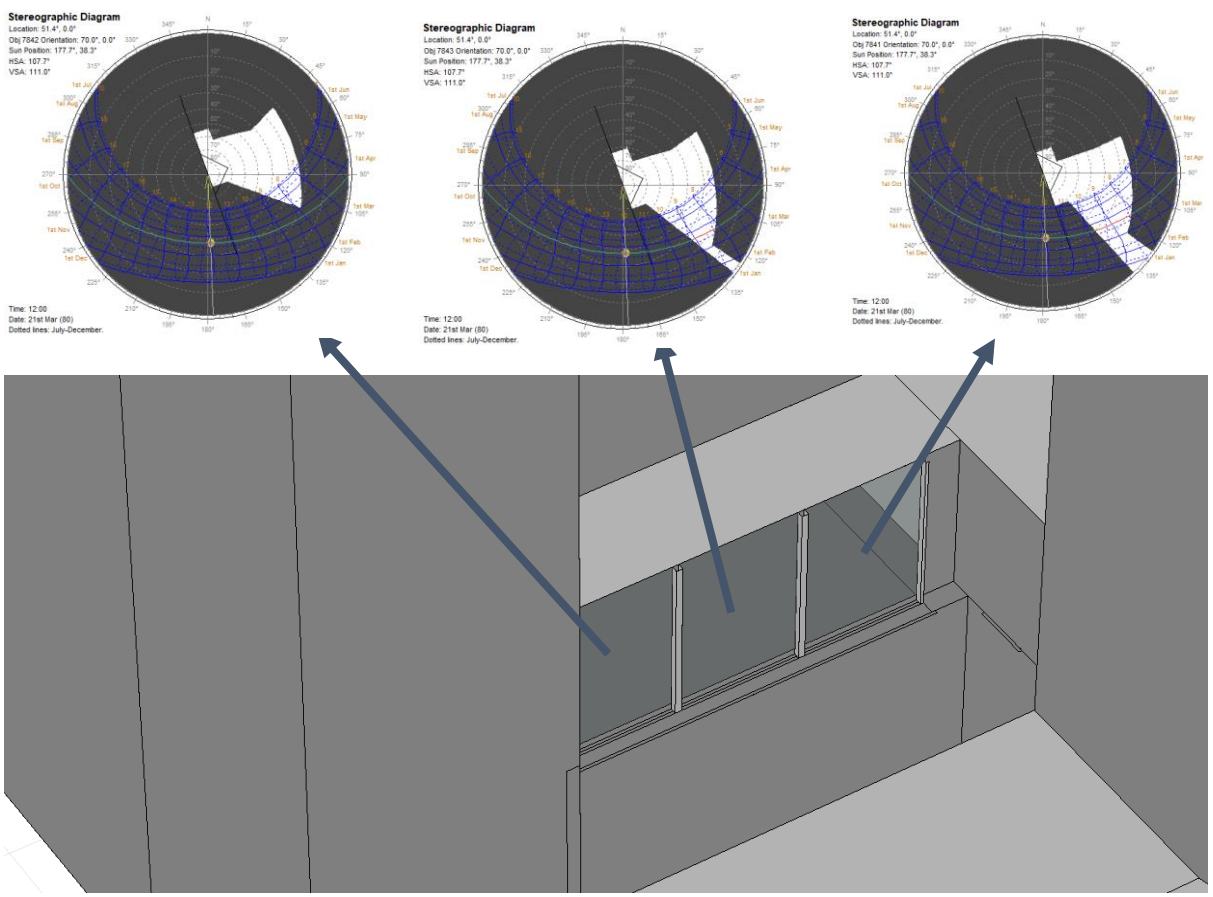


Figure 11: *Shading masks at the centre of each window, showing shading and exposure to the sun over the whole year*

4. CONCLUSIONS

This study looked into the daylight and sunlight performance of the habitable room of the proposed conversion on the ground floor at the back of the existing building located on 36-37 Great Russell Street, London, WC1B 3PP. The study was conducted in accordance with the BRE Site and Layout Planning for Daylight and Sunlight Guide (2022) criteria for daylight and sunlight. It was found that in terms of daylight, the proposed habitable room (the Kitchen-Living-Sleeping room) exceeded the minimum recommended levels of daylight factors. In terms of sunlight performance on the 21st of March the proposed flat did not meet the 1.5 hours minimum and fell short by half an hour, as it only achieved 1 sunlight hour. However, additional analysis on sunlight performance over the whole year, revealed that all windows will receive sunlight over the course of a year, ranging from 167 to 641 Annual Probable Sunlight hours.

As the proposed conversion did not alter the external geometry of the existing building, there would be no additional shading impact on nearby buildings and hence no such study was necessary.

APPENDIX A

Excerpts from the BRE Lighting and Site Layout Planning Guide (2022)

2.2.2 ' The guidelines given here are intended for us for rooms in adjoining dwellings, where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed.

2.2.4 ‘Loss of light to existing windows need not be analysed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing windows. In these cases the loss of light will be small.’

2.2.7 ‘If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. This value of VSC typically supplies enough daylight to a standard room when combined with a window of normal dimensions, with glass area around 10% or more of the floor area. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.80 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear gloomier, and electric lighting will be needed more of the time. In presenting results, ratios of VSC should be given to at least two decimal places (for example 0.79 or 0.81) or as the equivalent percentage loss (for example 21% or 19%).'

3.1.10 ‘For interiors, access to sunlight can be quantified. BS EN 17037[1] recommends that a space should receive a minimum of 1.5 hours of direct sunlight on a selected date between 1 February and 21 March with cloudless conditions. It is suggested that 21 March (equinox) be used. The medium level of recommendation is three hours and the high level of recommendation four hours. For dwellings, at least

one habitable room, preferably a main living room, should meet at least the minimum criterion.'

3.1.15 'In general a dwelling, or non-domestic building that has a particular requirement for sunlight, will appear reasonably sunlit provided:

- at least one main window wall faces within 90° of due south and

- a habitable room, preferably a main living room, can receive a total of at least 1.5 hours of sunlight on 21 March. This is assessed at the inside centre of the window(s); sunlight received by different windows can be added provided they occur at different times and sunlight hours are not double

3.2.13 'If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:

-receives less than 25% of annual probable sunlight hours and less than 0.80 times its former annual value; or less than 5% of annual probable sunlight hours between 21 September and 21 March and less than 0.80 times its former value during that period;

- and also has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.'

3.3.7 'As a check, it is recommended that at least half of the amenity areas listed above should receive at least two hours of sunlight on 21 March. It is instructive to draw the 'two hours sun contour' which marks this area on plan, because the use of specific parts of a site can be planned with sunlight in mind.'

Appendix C15: ‘C15 A UK National Annex gives specific minimum recommendations for habitable rooms in dwellings in the United Kingdom. These are intended for ‘hard to light’ dwellings, for example in basements or with significant external obstructions or with tall trees outside, or for existing buildings being refurbished or converted into dwellings. The National Annex therefore provides the UK guidance on minimum daylight provision in all UK dwellings.’

Table C3 – Target daylight factors (D_T) to achieve over at least 50% of the assessment grid in UK domestic habitable rooms with vertical and/or inclined daylight apertures			
Location	**D_T for 100 lx (Bedroom)**	**D_T for 150 lx (Living room)**	**D_T for 200 lx (Kitchen)**
St Peter (Jersey)	0.6%	0.9%	1.2%
London (Gatwick Airport)	0.7%	1.1%	1.4%