Internal Daylight and Sunlight Report

9-13 Grape Street
Project No: 7356

January 29, 2015

DAYLIGHT+SOLAR DESIGN

gia

Client	Project Met
Architect	Robin Partington Architects
Project Title	9-13 Grape Street
Project Number	7356
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Revisions		Date:	Notes:	Signed:
	A	29/01/15	Basement and Ground Floor converted to commercial	ML

1. Executive Summary

The purpose of this report is to ascertain whether the proposed redevelopment will provide residential accommodation considered acceptable in terms of daylight and sunlight.

This report is a revision of the Internal Daylight and Sunlight Report dated 6th August 2014. Since the assessments were undertaken in August 2014, the basement and ground floors of the proposal have been converted to commercial use and have therefore been excluded from this report.

It is worth pointing out that the site faces a number of constraints:

- The density of the urban fabric of central London, which restricts the sky visibility and consequently the daylight availability to the building's façade. Therefore to preserve the privacy for the future occupants permanent fritting has been added to the southwest facing windows. This will not affect the internal daylight results materially;

- The retained southwest façade, which sets limitations to the window apertures.

GIA has been instructed to work alongside Robin Partington Architects to maximise the daylight ingress within the rooms where the daylight availability is lowest, taking into account the above constraints.

In order to ascertain whether the levels of internal daylight seen can be considered acceptable, all habitable rooms within the proposed redevelopment have been assessed for Average Daylight Factor (ADF), No Sky Line (NSL) and Room Depth Criterion (RDC).

The results of the assessments undertaken have shown that the new built 4th floor sees very good levels of daylight, with all rooms achieving ADF and NSL values well in excess of the minima recommended by the BRE, and all applicable rooms are designed in accordance with the RDC.

Levels of daylight falling short of the recommendations are seen on the lower floors. This is due to the retained façades, to generous size of the rooms and to the obstruction caused by the surrounding buildings. However, this is typical of schemes of this nature in a central London location and is further illustrated by the similar levels of ADF achieved within the rooms of the existing King Edward Mansions located opposite the proposed redevelopment at 6-18 Grape Street.

The levels of NSL follow the same trend of the ADF, with better daylight distribution being achieved on higher storeys. All rooms have been designed in accordance with the RDC where this is applicable.

With daylight levels at the lower floors being in line with those seen in similar developments and very good levels of daylight seen on the top floor, it is considered that the daylight performance of the proposed redevelopment will be commensurate to the occupants' expectations given the retained nature of the façade and the central London location.

As recommended by the BRE, all windows serving living areas facing within 90 degrees of due south have been assessed for Annual Probable Sunlight Hours (APSH).

The results of the assessments undertaken have shown that three living areas located on the 2nd, 3rd and 4th floor will comply with the BRE's recommendations both throughout the year and during the winter months.

Lower levels of APSH are seen on the lower floors and in the north living areas, where the obstruction caused by the surrounding buildings is greatest. This is typical of central London locations, where buildings are in close proximity of each other.

We can therefore conclude that the levels of sunlight seen in the proposed building are commensurate with occupants' expectations of central London accommodation and therefore acceptable.

2. Introduction and Objective

GIA has been instructed to provide a report upon the potential availability of Daylight and Sunlight to the proposed accommodation within the residential scheme prepared by Robin Partington Architects. GIA was specifically instructed to carry out the following:

- To create a 3D computer model of the proposal based upon drawings prepared by Robin Partington Architects.
- Carry out a daylight assessment using the methodologies set out in the BRE guidelines for Average Daylight Factor, No-Sky Line and Room Depth Criterion.
- Carry out a sunlight assessment using the methodologies set out in the BRE guidelines for Annual Probable Sunlight Hours (APSH) to the fenestration facing within 90 degrees of due south.
- Prepare a report setting out the analysis and our findings.

3. BRE guidelines

The Building Research Establishment (BRE) have set out in their handbook *Site Layout Planning for Daylight and Sunlight a Guide to Good Practice (2011),* guidelines and methodology for the measurement and assessment of daylight and sunlight within proposed buildings. This document states that it is also intended to be used in conjunction with the interior daylight recommendations found within the *British Standard BS8206-2:2008* and *The Applications Manual on Window Design* of the Chartered Institution of Building Services Engineers (CIBSE).

The guide also provides advice on site layout planning to determine the quality of daylight and sunlight within open spaces between buildings.

It is important to note, however, that this document is a guide whose stated aim *"is to help rather than constrain the designer".*

The document provides advice, but also clearly states that it *"is not mandatory and this document should not be seen as an instrument of planning policy."* The report acknowledges also in its introduction that *"in special circumstances the developer or planning authority may wish to use different target values. For example, in a historic City centre a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings."*

It is an inevitable consequence of the built up urban environment that daylight and sunlight will be more limited in these areas. It is well acknowledged that in such situations there may be many other conflicting and potentially more important planning and urban design matters to consider other than just the provision of ideal levels of daylight and sunlight.

3.1. Daylight

The BRE set out various methods for assessing the daylight within a proposed building within section 2.1 and Appendix C of the handbook. The summary of this, given at the end of section 2.1 of the guide, states as follows:

> *"In general, a building will retain the potential for good interior diffused daylighting provided that on all its main faces:*
>
> *A. No obstruction, measured in a vertical section perpendicular to the main face, from a point two metres above ground level, subtends an angle of more than 25 degrees to the horizontal;*
>
> *Or*
>
> *B. If (A) is not satisfied, then all points on the main face on a line two metres above ground level are within four metres (measured sideways) of a point which has a vertical sky line component of 27% or more."*

3.1.1. Vertical Sky Component (VSC)

This method of assessment can be undertaken using a skylight indicator or a Waldram diagram. It measures from a single point, at the centre of the window if known at the early design stage, the quantum of sky visible taking into account all external obstructions. Whilst these obstructions can be either other buildings or the general landscape, trees are usually ignored unless they form a continuous or dense belt of obstruction.

The VSC method is a useful 'rule of thumb' but has some significant limitations in determining the true quality of daylight within a proposed building. It does not take into account the size of the window, any reflected light off external obstructions, any reflected light within the room, or the use to which that room is put. Appendix C of the guide goes into more detail on these matters and sets forward alternative methods for assessment to overcome these limitations.

Appendix C of the BRE guide: Interior Daylighting Recommendations, states:

> *"The British Standard for daylighting, and the CIBSE Applications manual: window design, contain advice and guidance on interior daylighting. This guide to good practice is intended to be used in conjunction with them, and its guidance is intended to fit in with their recommendations.*
>
> *For skylight, the British Standard and the CIBSE manual put forward three main criteria, based on the average daylight factor, room depth, and the position of the no skyline."*

These assessments are set out below.

3.1.2. Average Daylight Factor (ADF)

> *"If a predominantly daylit appearance is required, then df 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, and should be attained even if a predominantly daylit appearance is not required."*

This method of assessment takes into account the total glazed area to the room, the transmittance quality of the glazing proposed, the total area of the room surfaces including ceilings and floors, and the internal average reflectance for the room being assessed. The method also takes into account the Vertical Sky Component and the quantum of reflected light off external surfaces.

This is, therefore, a significantly more detailed method of assessment than the Vertical Sky Component method set out above.

3.1.3. Room Depth Criterion (RDC)

Where it has access to daylight from windows in one wall only, the depth of a room can become a factor in determining the quantity of light within it. The BRE guidance provides a simple method for examining the ratio of room depth to window area. However, whilst it does take into account internal surface reflections, this method also has significant limitations in that it does not take into account any obstructions outside the window and therefore draws no input from the quantity of light entering the room.

3.1.4. No Sky Line (NSL)

This third method of assessment is a simple test to establish where within the proposed room the sky will be visible through the windows, taking into account external obstructions. The assessment is undertaken at working plane

height (850mm above floor level) and the method of calculation is set out in Appendix D of the BRE handbook.

Appendix C of the BRE handbook states *"if a significant area of the working plane lies beyond the no skyline (i.e., it receives no direct skylight), then the distribution of daylight in the room will look poor and supplementary electric lighting will be required."* To guarantee a satisfactory daylight uniformity, the area which does not receive direct skylight should not exceed 20% of the floor area, as quantified in the BS 8206 Part2 2008.

3.1.5. Summary

The Average Daylight Factor gives a more detailed assessment of the daylight within a room and takes into account the highest number of factors in establishing a quantitative output.

However, the conclusion of Appendix C of the BRE guide states:

> *"All three of the criteria need to be satisfied if the whole of the room is to look adequately daylit. Even if the amount of daylight in a room (given by the Average Daylight Factor) is sufficient, the overall daylight appearance will be impaired if its distribution is poor."*

In most urban areas it is important to recognise that the distribution of daylight within a room may be difficult to achieve, given the built up nature of the environment. Consequently, most local authorities seek to ensure that there is sufficient daylight within the room as determined by the Average Daylight Factor calculation. However, the additional recommendations of the BRE and British Standard for residential accommodation, set out above, ought not to be overlooked.

3.2. Sunlight

The BRE provide guidance in respect of sunlight quality for new developments within section 3.1 of the handbook. It is generally acknowledged that the presence of sunlight is more significant in residential accommodation than it is in commercial, and this is reflected in the BRE document.

It states, *"in housing, the main requirement for sunlight is in living rooms, where it is valued at any time of the day, but especially in the afternoon. Sunlight is also required in conservatories. It is viewed as less important in bedrooms and in kitchens where people prefer it in the morning rather than the afternoon."*

The BRE guide considers the critical aspects of orientation and overshadowing in determining the availability of sunlight at a proposed development site.

The guide proposes minimizing the number of dwellings whose living room face solely north unless there is some compensating factor such as an appealing view to the north, and it suggests a number of techniques to do so. Further to this it discusses massing solutions with a sensitive approach to overshadowing, so as to maximize access to sunlight.

At the same time it acknowledges that the site's existing urban environment may impose orientation or overshadowing constraints which may not be possible to overcome.

So as to quantify sunlight access for interiors where sunlight is expected, it refers to the BS 82606-2 criterion of Annual Probable Sunlight Hours. APSH is defined as *"the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness at the location in question."* In line with the recommendation, APSH is measured from a point on the inside face of the window, should the locations have been decided. If these are unknown, sunlight availability is checked at points 1.6m above the ground or the lowest storey level on each main window wall, and no more than 5m apart. If a room has multiple windows on the same wall or on adjacent walls, the highest value of APSH should be taken into account. If a room has two windows on opposite walls, the APSH due to each can be added together.

The summary of section 3.1 of the guide states as follows:

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

At least one main window faces within 90 degrees of due south;

and

The centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21 September and 21 March. "

In paragraph 3.1.11 the BRE guidance suggests that if a room faces significantly North of due East or West it is unlikely to meet the recommended levels proposed by the BS 8206-2. As such, it is clear that only windows facing within 90 degrees of due South can be assessed using this methodology.

It is also worth noting how paragraph 5.3 of the BS 8206-2 suggests that with regards to sunlight duration "the degree of satisfaction is related to the expectation of sunlight if a room is necessarily north facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary".

3.3. Further relevant information

Further information can be found in *The Daylight in Urban Areas Design Guide* (Energy Saving Trust CE257, 2007) which provides the following recommendation with regards to VSC levels in urban areas:

"If 'theta' (Visible sky angle) is greater than 65º (obstruction angle less than 25º or VSC at least 27 percent) conventional window design will usually give reasonable results.

If 'theta' is between 45º and 65º (obstruction angle between 25º and 45º, VSC between 15 and 27 percent), special measures such as larger windows and changes to room layout are usually needed to provide adequate daylight.

If 'theta' is between 25º and 45º (obstruction angle between 45º and 65º, VSC from 5 to 15 percent), it is very difficult to provide adequate daylight unless very large windows are used.

If 'theta' is less than 25º (obstruction angle more than 65º, VSC less than 5 percent) it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed."

4. Methodology

In order to undertake the daylight and sunlight assessments set out above, we have prepared a three dimensional computer model and used specialist lighting simulation software.

The three dimensional representation of the proposed development has been modelled using the scheme drawings provided to us by Robin Partington Architects. This has been placed in the context of its surrounding buildings which have been modelled from survey information, photogrammetry, OS and site photographs. This allows for a precise model, which in turn ensures that analysis accurately represents the amount of daylight and sunlight available to the building facades, internal and external spaces, considering all of the surrounding obstructions and orientation.

4.1. Simulation assumptions

Where no values for reflectance, transmittance and maintenance factor were specified by the designer the following values from *BS 8206-2:2008, Annex A, tables A.1-A.6* were used for the calculation of Average Daylight Factor values. These values are shown in table 1.

According with the specifications provided by the Architects, a material with reflectance of 0.4 was used for the internal floors.

We assume that the fritting be translucent and covering up to 50% of the fritted area.

Reflectance values:		**Maintenance factors:**	Tv(normal)	A.3	A.4	A.5	A.6	Tv(total)
Surrounding	0.2	Double Low-E (frames modelled)	0.75	8	1	1	1	0.69
Pavement	0.2	Double Low-E (frames not modelled)	0.75	8	1	1	0.8	0.55
Grass	0.1	Double Low-E (inclined, frames modelled)	0.75	8	2	1	1	0.63
Yellow brick	0.3	Double Low-E (inclined, frames not modelled)	0.75	8	2	1	0.8	0.50
Red brick	0.2	Double Low-E (horizontal, frames modelled)	0.75	8	3	1	1	0.57
Concrete	0.4	Double Low-E (horizontal, frames not modelled)	0.75	8	3	1	0.8	0.46
Internal walls (light grey)	0.68							
Internal ceiling (white paint)	0.85	Single (frames modelled)	0.9	8	1	1	1	0.83
Internal floor (medium to light veneer)	0.3	Single (frames not modelled)	0.9	8	1	1	0.8	0.66
		Single (inclined, frames modelled)	0.9	8	2	1	1	0.76
Transmittance values:		Single (inclined, frames not modelled)	0.9	8	2	1	0.8	0.60
		Single (horizontal, frames modelled)	0.9	8	3	1	1	0.68
Double glazing:		Single (horizontal, frames not modelled)	0.9	8	3	1	0.8	0.55
Pilkington K Glass 4/16/4 Argon filled 90%	Tv= 0.75							
		Double Translucent Low-E (frames modelled)	0.74	8	1	1	1	0.68
Single glazing:		Double Translucent Low-E (frames not modelled)	0.74	8	1	1	0.8	0.54
Pilkington Optifloat Clear, Annealed, 4mm	Tv=0.90	Double Translucent Low-E (inclined, frames modelled)	0.74	8	2	1	1	0.62
		Double Translucent Low-E (inclined, frames not modelled)	0.74	8	2	1	0.8	0.50
Translucent glazing:		Double Translucent Low-E (horizontal, frames modelled)	0.74	8	3	1	1	0.56
Pilkington Optifloat Opal - 4mm K /16/4mm Opal	Tv= 0.74	Double Translucent Low-E (horizontal, frames not modelled)	0.74	8	3	1	0.8	0.45

Table 1: Typical reflectance, transmittance and maintenance factors

5. Conclusions

The purpose of this report is to ascertain whether the proposed redevelopment will provide residential accommodation considered acceptable in terms of daylight and sunlight.

It is worth pointing out that the site faces a number of constraints:

- The density of the urban fabric of central London, which restricts the sky visibility and consequently the daylight availability to the building's façade. Therefore to preserve the privacy for the future occupants permanent fritting has been added to the southwest facing windows. This will not affect the internal daylight results materially;

- The retained southwest façade, which sets limitations to the window apertures.

GIA has been instructed to work alongside Robin Partington Architects to maximise the daylight ingress within the rooms where the daylight availability is lower taking into account these constraints. This has resulted in internal layouts optimised in order to introduce the maximum level of daylight possible.

5.1. Conclusion on Daylight

All habitable rooms within the proposed redevelopment have been assessed for Average Daylight Factor (ADF), No Sky Line (NSL) and Room Depth Criterion (RDC).

The results of the assessments undertaken have shown that the new built 4th floor sees very good levels of daylight, with all rooms achieving ADF and NSL values well in excess of the minima recommended by the BRE, and all applicable rooms are designed in accordance with the RDC.

Levels of daylight falling short of the recommendations are seen on the bottom floors, due to the retained façade and to the obstruction caused by the surrounding buildings. However, this is typical of schemes of this nature in a central London location and is further illustrated by the similar levels of ADF achieved within the rooms of the existing King Edward Mansions located opposite the proposed redevelopment at 6-18 Grape Street.

All bedrooms above first floor, with the exception of two (room no. 12, located at second floor, and room 19 located on the third floor), meet or exceed the recommended 1% ADF. Given the limited daylight availability to the proposed building's retained windows, the living areas falling short of recommendation on floors 1 to 3 do so due to their generous dimensions.

The levels of NSL follow the same trend of the ADF, with better daylight distribution on higher storeys. All rooms have been designed in accordance with the RDC where this is applicable.

With daylight levels at the lower floors being in line with those seen in similar developments and very good levels of daylight seen on the top floor, it is considered that the daylight performance of the proposed redevelopment will be commensurate to the occupants' expectations given the retained nature of the façade and the central London location.

5.2. Conclusion on Sunlight

As recommended by the BRE, all windows serving living areas facing within 90 degrees of due south have been assessed for Annual Probable Sunlight Hours (APSH).

The results of the assessment undertaken have shown that the living area located on the 4th floor and the south living areas on the 2nd and 3rd floors will comply with the BRE's recommendations both throughout the year and during the winter months.

Lower levels of APSH are seen on the bottom floors and in the north living areas, where the obstruction caused by the surrounding buildings is greatest. This is typical of central London locations, where buildings are in close proximity of each other.

We can therefore conclude that the levels of sunlight seen in the proposed building are commensurate with occupants' expectations of central London accommodation.

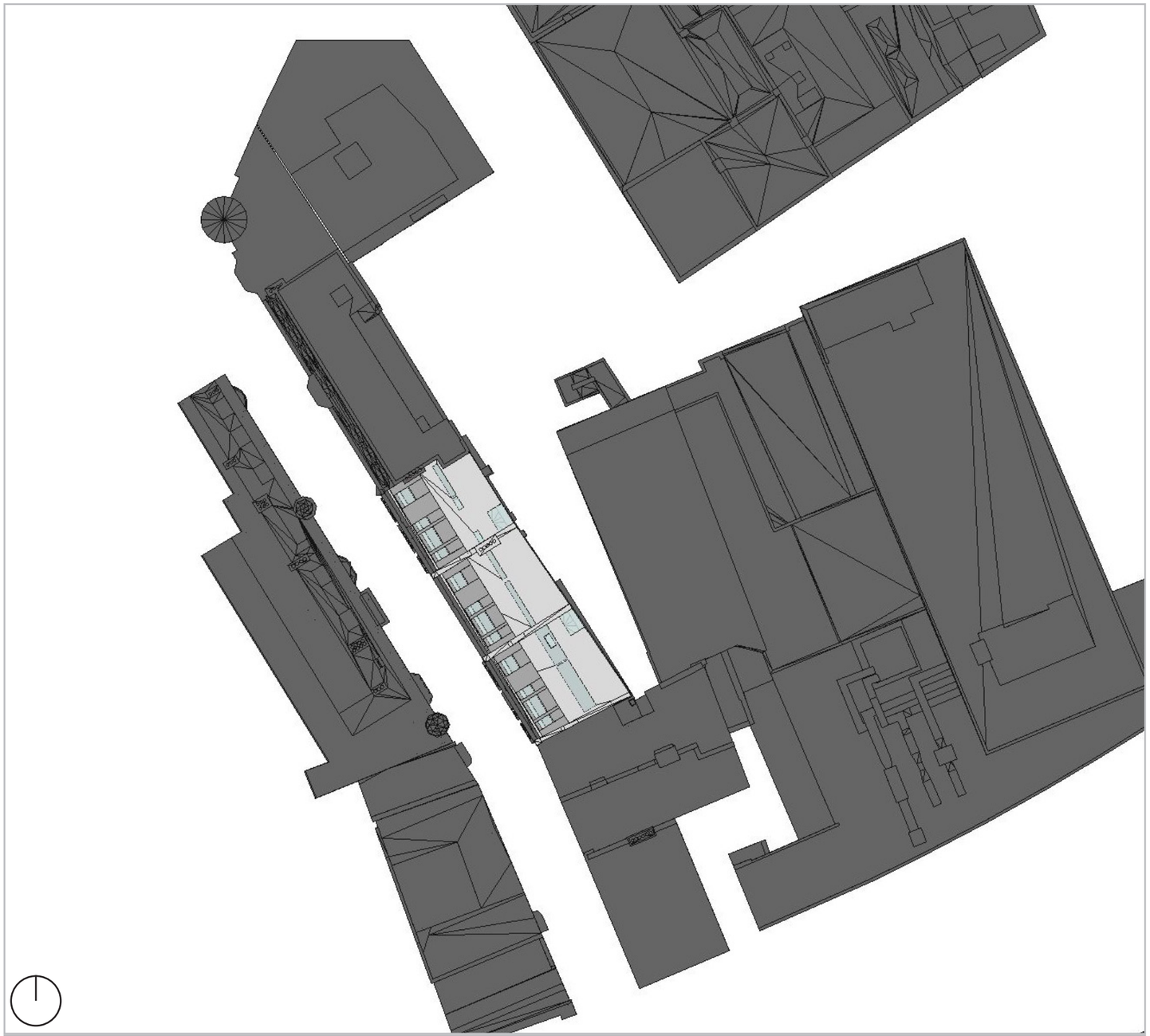

Figure 1: Top View

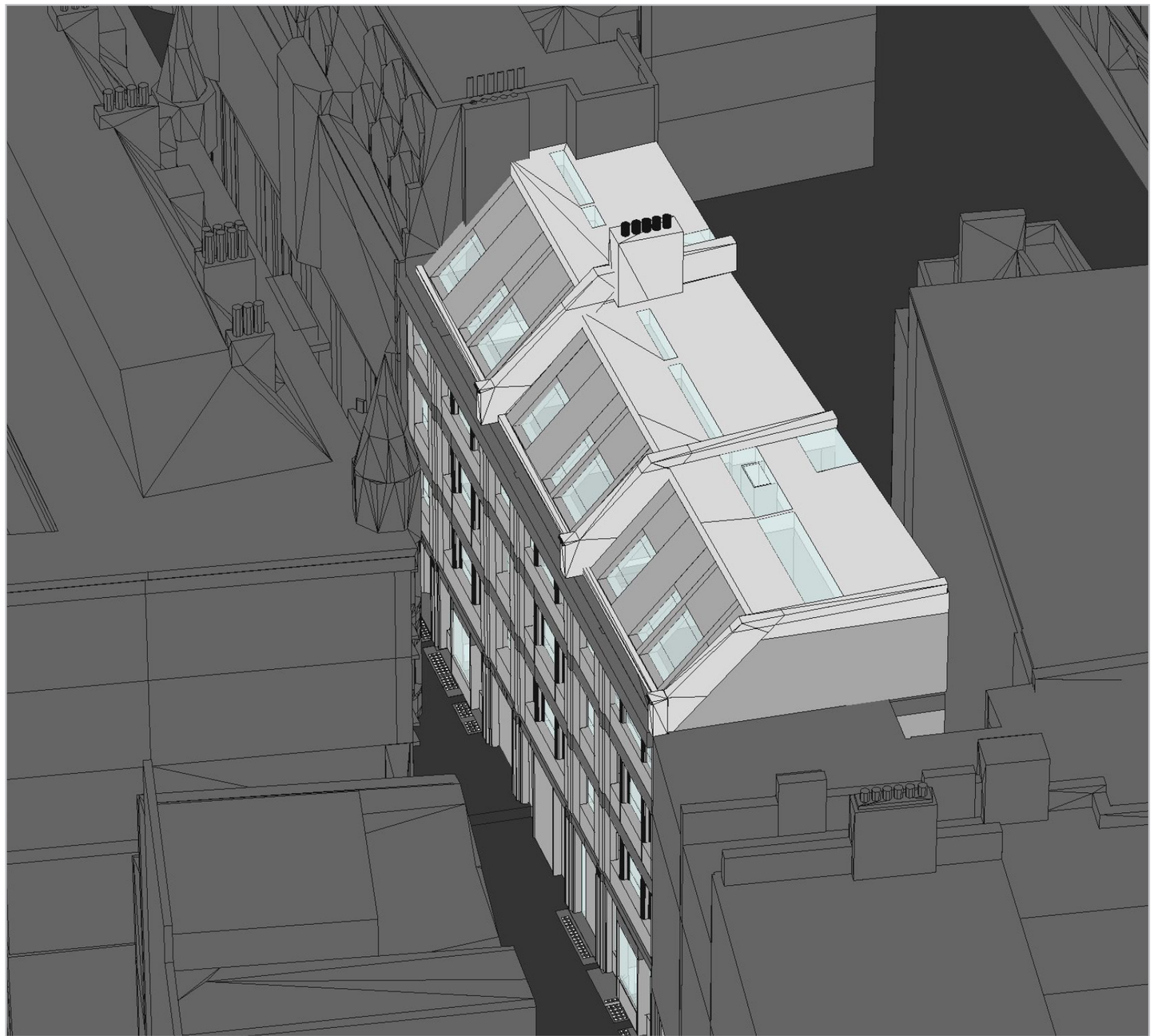

Figure 2: Perspective View

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
First Floor				
6	Bedroom	0.4	11	Met
7	Living Room	0.5	14	Met
8	Bedroom	0.5	21	Met
9	Bedroom	0.6	37	Met
10	Living Room	0.5	53	Met
11	Bedroom	2.6	98	Met

Table 2: Assessment Data

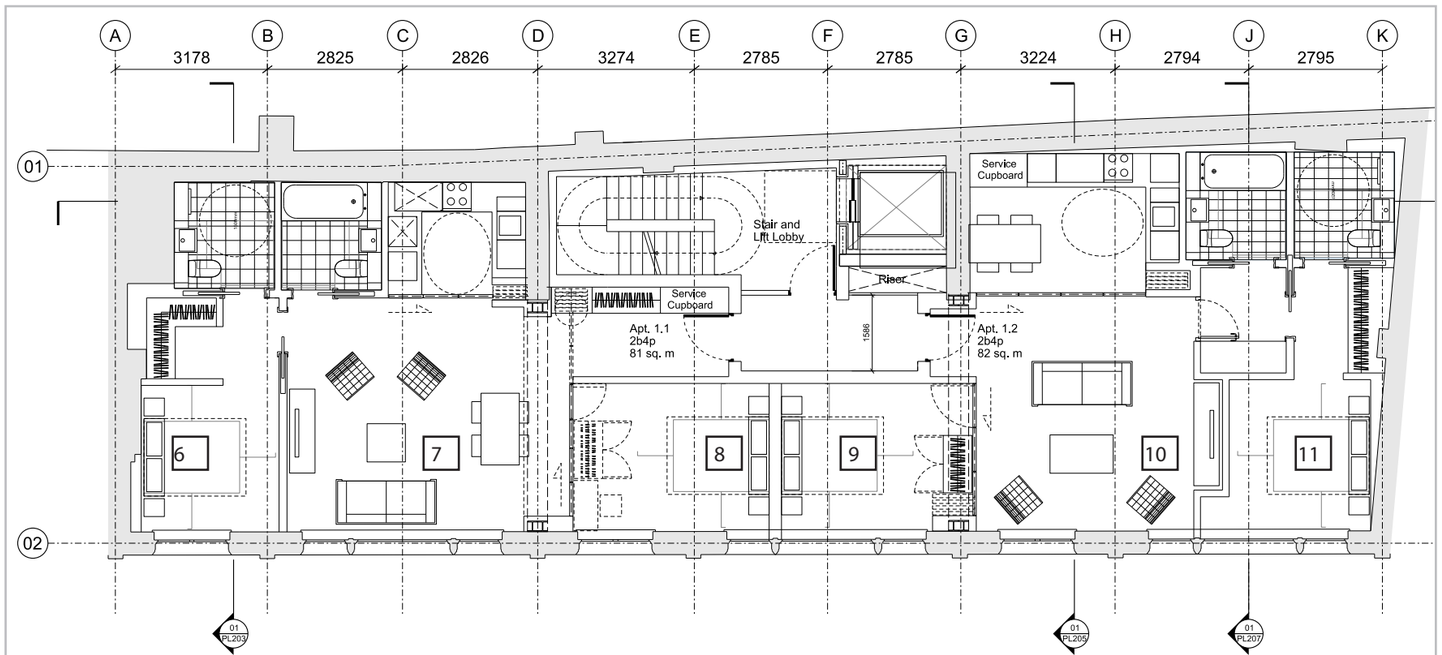

Figure 3: Floor Plan

		Daylight Quantum	Distribution of Daylight	
Room Ref.	**Room Use**	**ADF (%)**	**NSL (%)**	**RDC**
Second Floor				
12	Bedroom	0.6	21	Met
13	Living Room	0.9	17	Met
14	Bedroom	1.1	38	Met
15	Bedroom	1.0	47	Met
16	Living Room	1.1	75	Met
17	Bedroom	3.4	99	Met

Table 3: Assessment Data

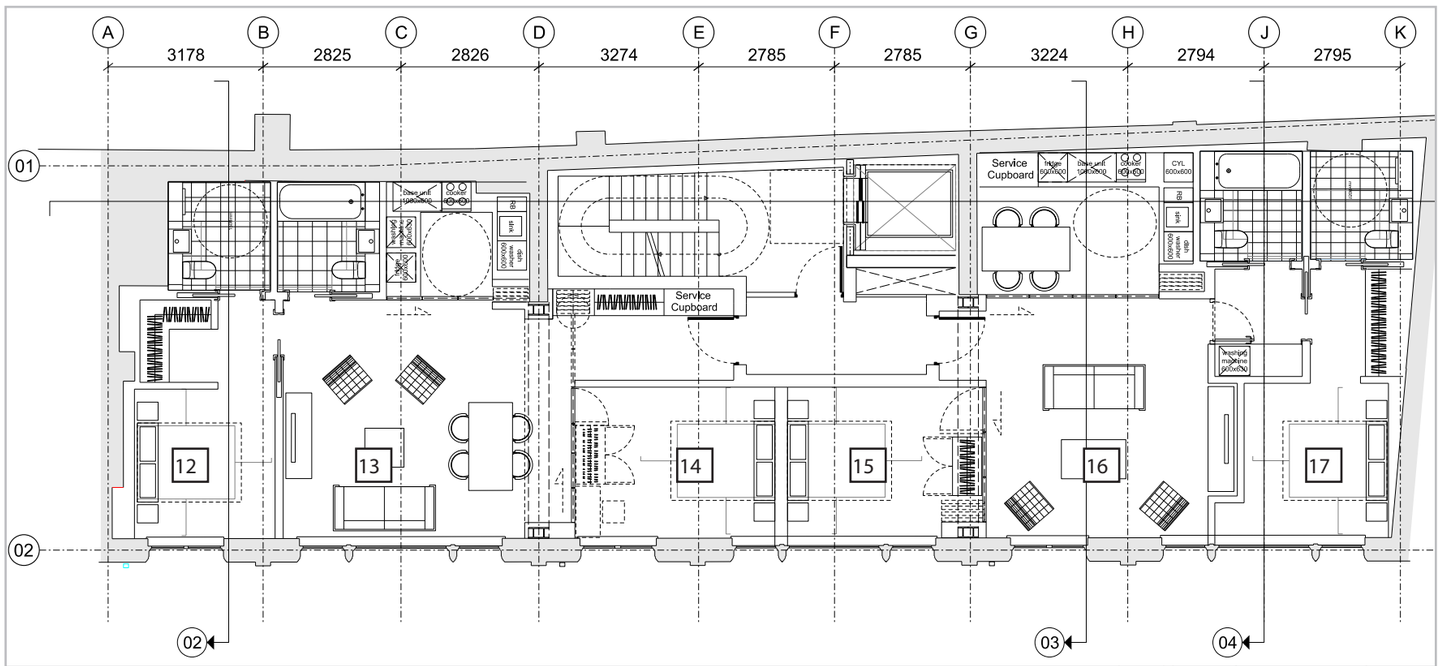

Figure 4: Floor Plan

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
Third Floor				
18	Living Room	3.6	99	Met
19	Bedroom	0.5	38	Met
20	Bedroom	1.3	51	Met
21	Living Room	2.8	100	Met

Table 4: Assessment Data

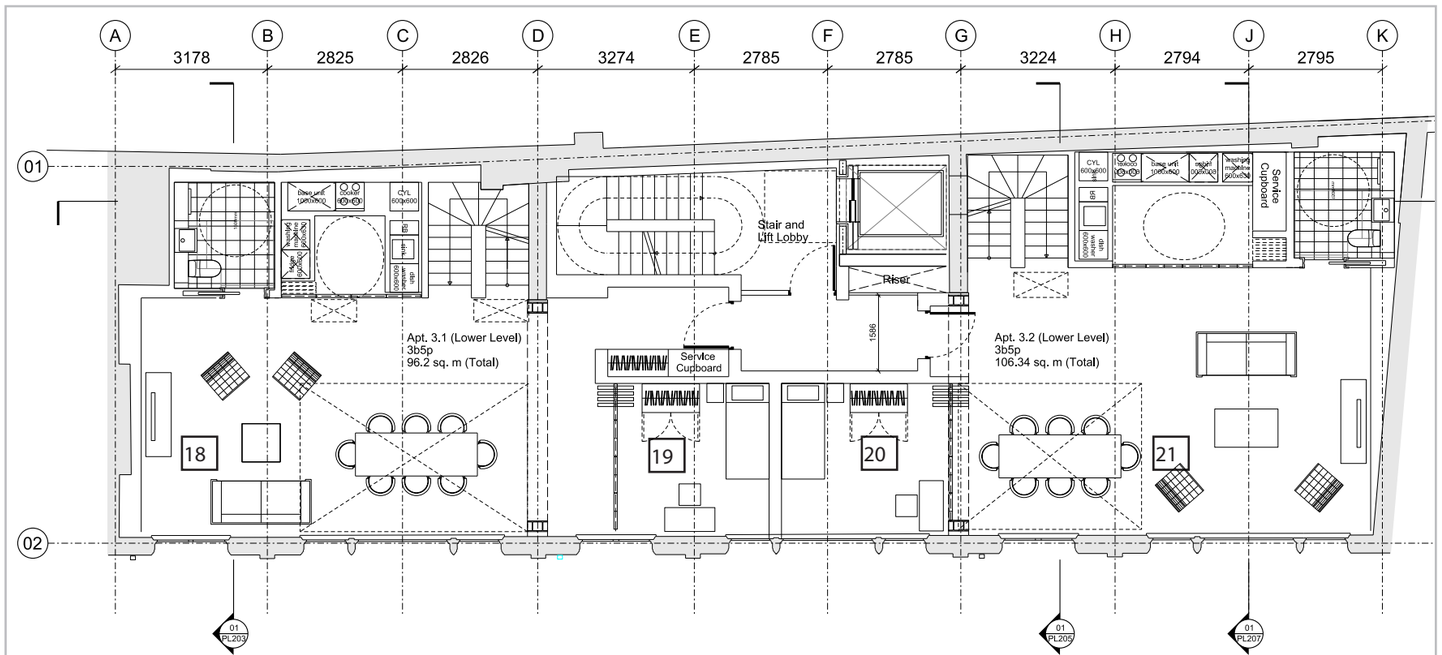

Figure 5: Floor Plan

Room Ref.	Room Use	Daylight Quantum ADF (%)	Distribution of Daylight NSL (%)	RDC
Fourth Floor				
22	Bedroom	6.5	90	Met
23	Bedroom	4.9	93	Met
24	Bedroom	9.9	99	Met
25	Bedroom	21.1	100	Met

Table 5: Assessment Data

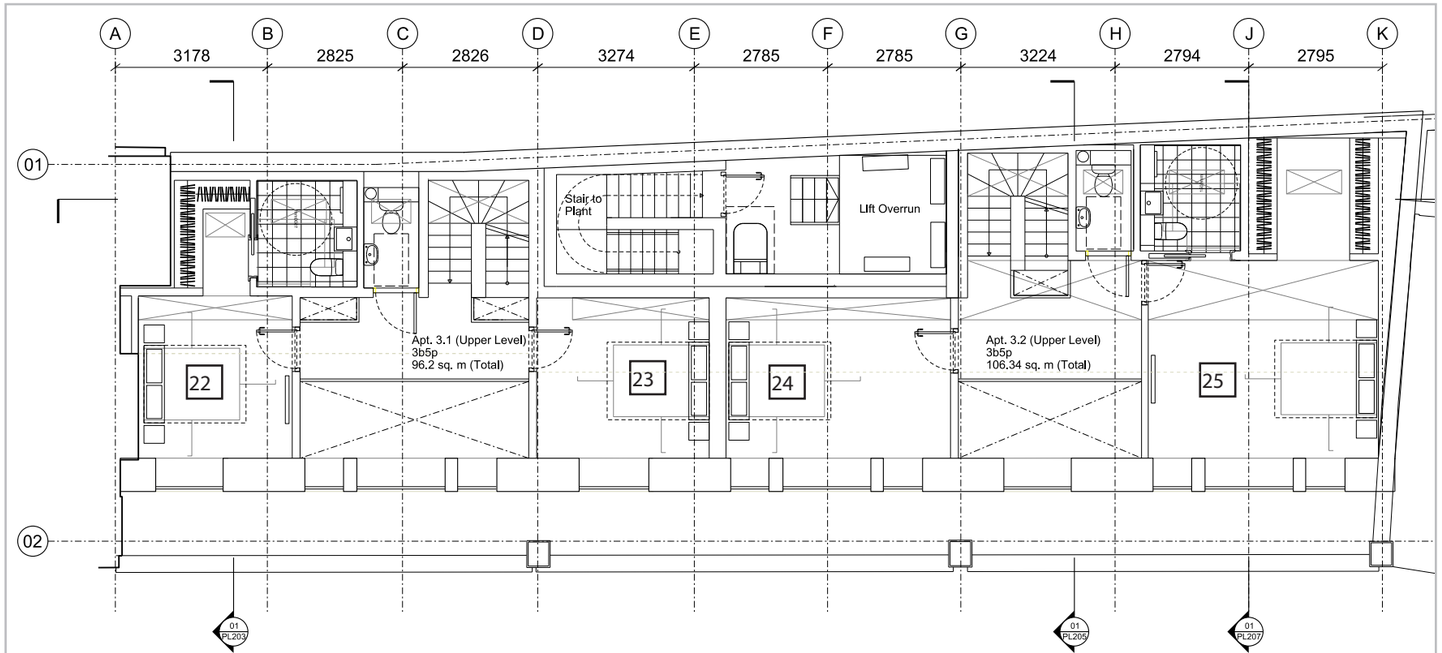

Figure 6: Floor Plan

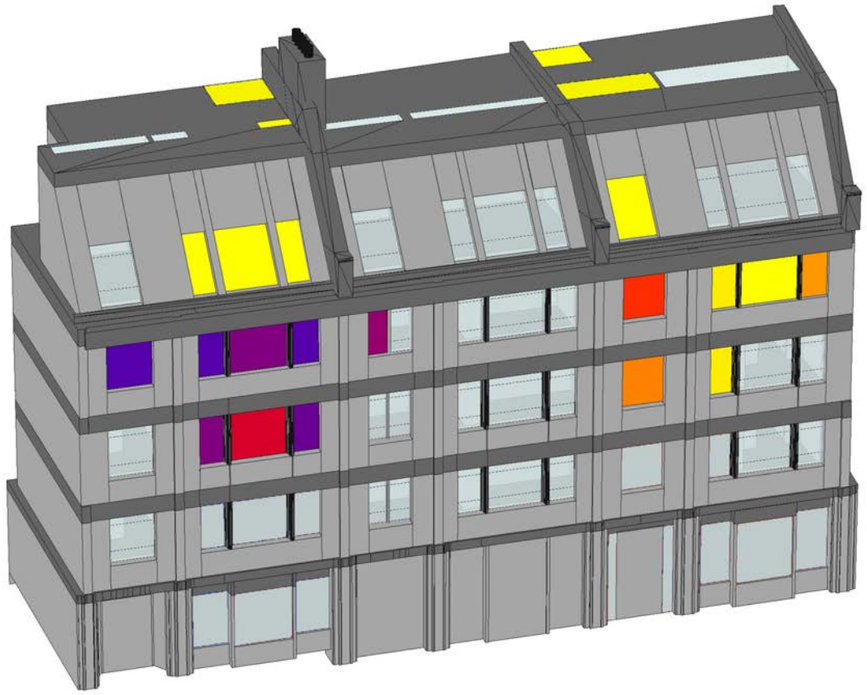

Figure 7: Annual Probable Sunlight Hours - Total

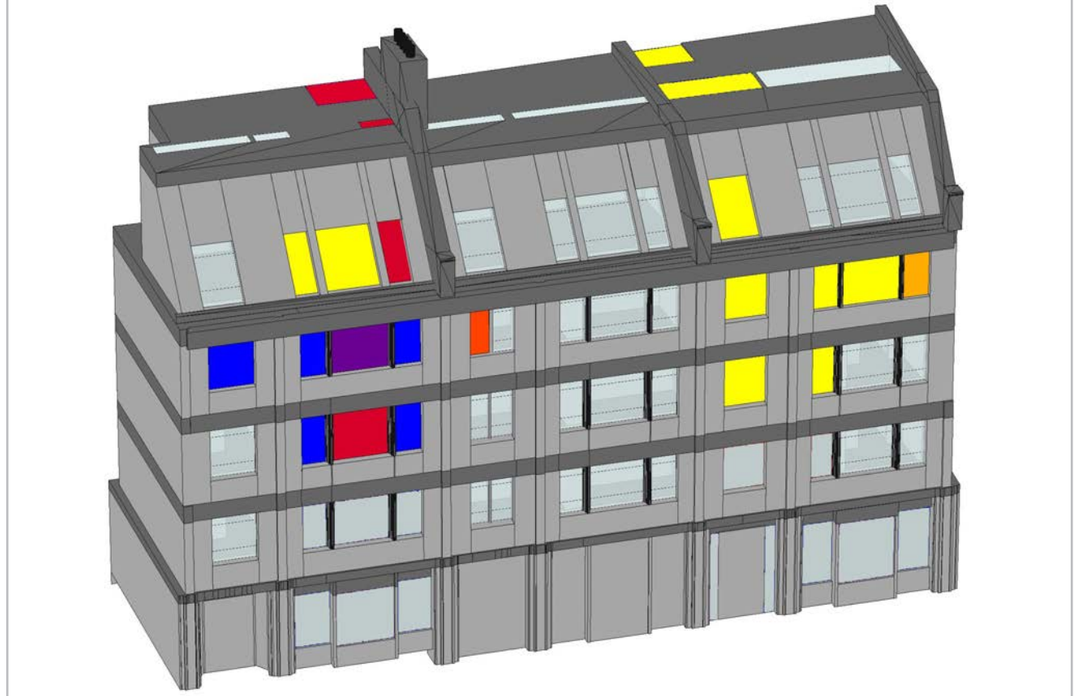

Figure 8: Annual Probable Sunlight Hours - Winter