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Alex Ferguson
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12 September 2018

To whom it may concern

1003 – 15b St Georges Mews
Re: Internal Daylight Study

In 2009, Skelly & Couch LLP carried out a study to assess whether the proposed conversion of 15B St. George's Mews from an office space to a dwelling met the requirements set out in the BRE report Site layout planning for daylight and sunlight: A guide to good practice, 1991, and BS 8206-2:2008. Whilst the BRE document has subsequently been updated to a 2011 version, the requirements set out in this document and the British Standard requirements are still the same.

Our client is now proposing to submit a new application for conversion based on a slightly revised set of plans to those modelled in the original analysis. Having reviewed the plans and the proposed amendments and compared them to the original modelling we can confirm that we stand by the conclusions of the original report and see no reason for this modelling or report to be updated. Indeed, all of the proposed alterations are likely to have a positive impact on the results originally reported and thus the proposals should be considered to meet the minimum requirements for new dwellings.

Yours faithfully

Mark Skelly
Founding Director

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Enc: - Internal Daylight Study – dated 11/June 2009

SKELLY&COUCH
Building Environment & Services Engineering Consultants

15B ST GEORGE'S MEWS

INTERNAL DAYLIGHT STUDY

An internal daylight and sunlight study has been undertaken to determine whether the proposed conversion of 15B St. George's Mews from an office space to a dwelling meets the recommended guidance outlined in the BRE report *Site layout planning for daylight and sunlight: A guide to good practice*. The report should only be considered as a form of guidance, but compliance with this document is expected to be sufficient justification for any circumstances that deviates from its recommendations.

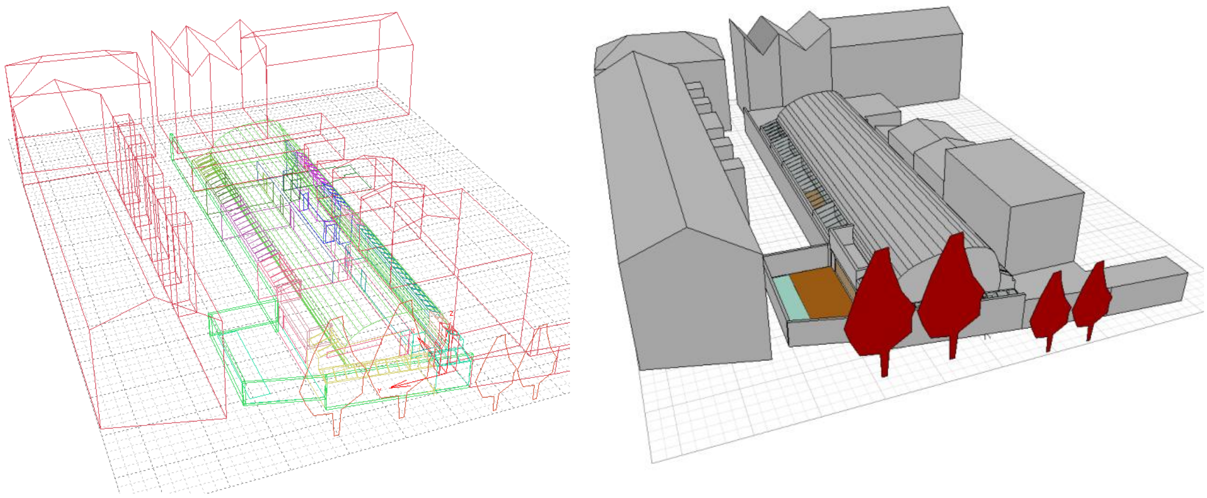

Diagram 1 St. George's Mews modelled on Autodesk Ecotect

Average daylight factor

The daylight factor is defined as *the ratio of the illuminance at a particular point within an enclosure to the simultaneous unobstructed outdoor illuminance under the same sky conditions, expressed as a percentage* [1]. Rooms in dwellings are considered to have a predominantly daylit appearance with an average daylight factor of 2%. A space with an average daylight factor of at least 5% is regarded as well lit, and thus supplementary artificial lighting is not normally required during the daytime. If the average daylight factor in a space is between 2% and 5%, electric lighting is likely to be necessary.

Even if the average daylight factor of 2% if not achievable, it is highly recommended that the dwelling meets the minimum values as listed in Table 1. When a space falls in more than one room type, the minimum average daylight factor should be that for the room type with highest value. In this case, the proposed kitchen also serves as a living room, thus the minimum average daylight factor for this space should be 2%.

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Table I Recommended minimum average daylight factor

Room type	Minimum average daylight factor (%)
Bedroom	1
Living rooms	1.5
Kitchen	2

The diagrams below illustrate the average daylight factor values achieved for specific rooms using Ecotect Radiance. Radiance is a lighting simulation program, which uses the Monte Carlo approach and deterministic ray tracing to achieve more accurate results than the BRE Splitflux method. The CIE Overcast Sky condition was used in all calculations to obtain the worst case daylight value.

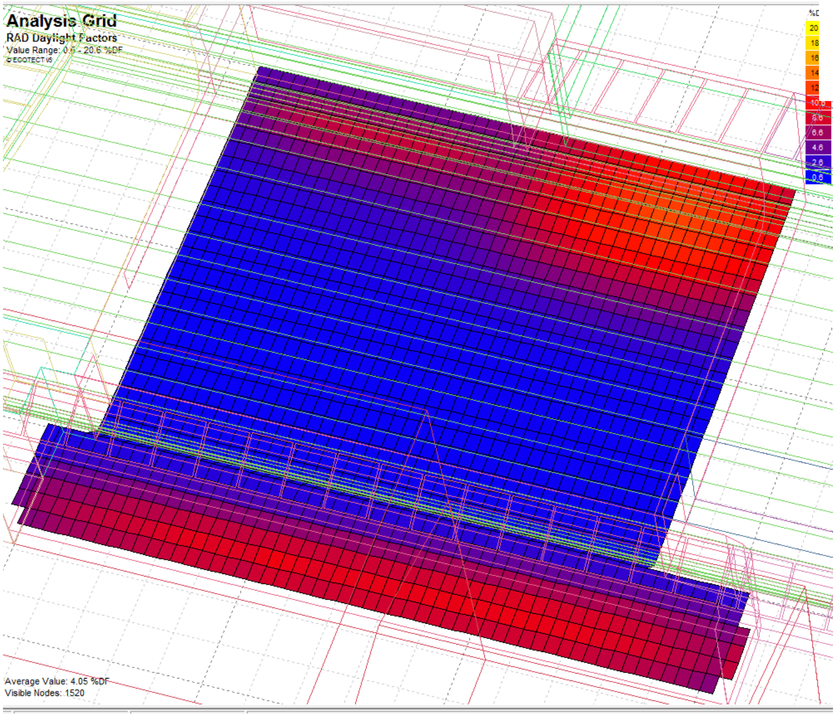


Diagram 2 Average daylight factor for Kitchen

The average daylight factor is above the recommended value at 4.05%, providing a reasonably well lit space. The uniformity of the illuminance is uneven, which will be particularly noticeable at the rear end of the room where the daylight factor is typically 0.8-1%. Supplementary electric lighting will therefore be required.

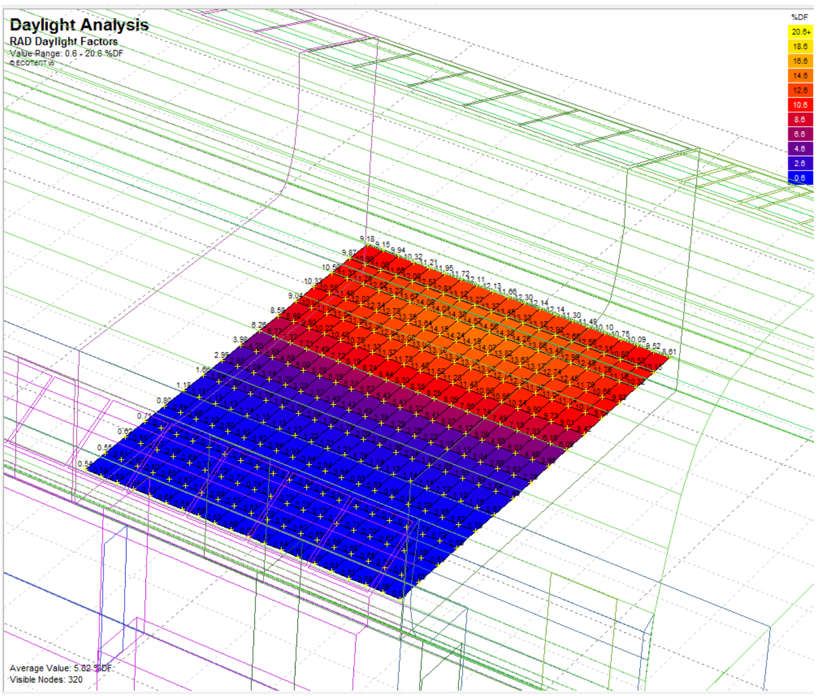


Diagram 3 Average daylight factor for Bedroom Living 1

The average daylight factor of bedroom 1 is 5.82%, which is significantly higher than the recommended percentage for bedrooms. However, as the diagram 3 illustrates, a significant proportion of the room achieved low daylight factor value suggesting that complementary electric lighting will be necessary.

Table 2 shows the average daylight factor achieved for a selection of main rooms. The results were all above the 2% recommended value for a predominantly daylit appearance. Although several rooms achieved values above 5%, the overall daylit appearance is impaired due to the uneven distribution of daylight (further explained below). This is evidential from diagrams 2 & 3, where rear ends of the rooms away from the windows have significantly low daylight factor, generally below 1%. This suggests that supplementary electric lighting may be required.

Table 2 The average daylight factor achieved for a selection of rooms

Room	Minimum recommended average daylight factor	Radiance average daylight factor achieved
Kitchen & Library	2	4.05
Studio / home office	-	7.16
Bedroom living 1	1.5	5.82
Bedroom living 2	1.5	3.22

Master bedroom/bathroom	1	8.91
Gym	-	4.07
Library	-	5.39
Plantroom	-	4.06

No-sky line

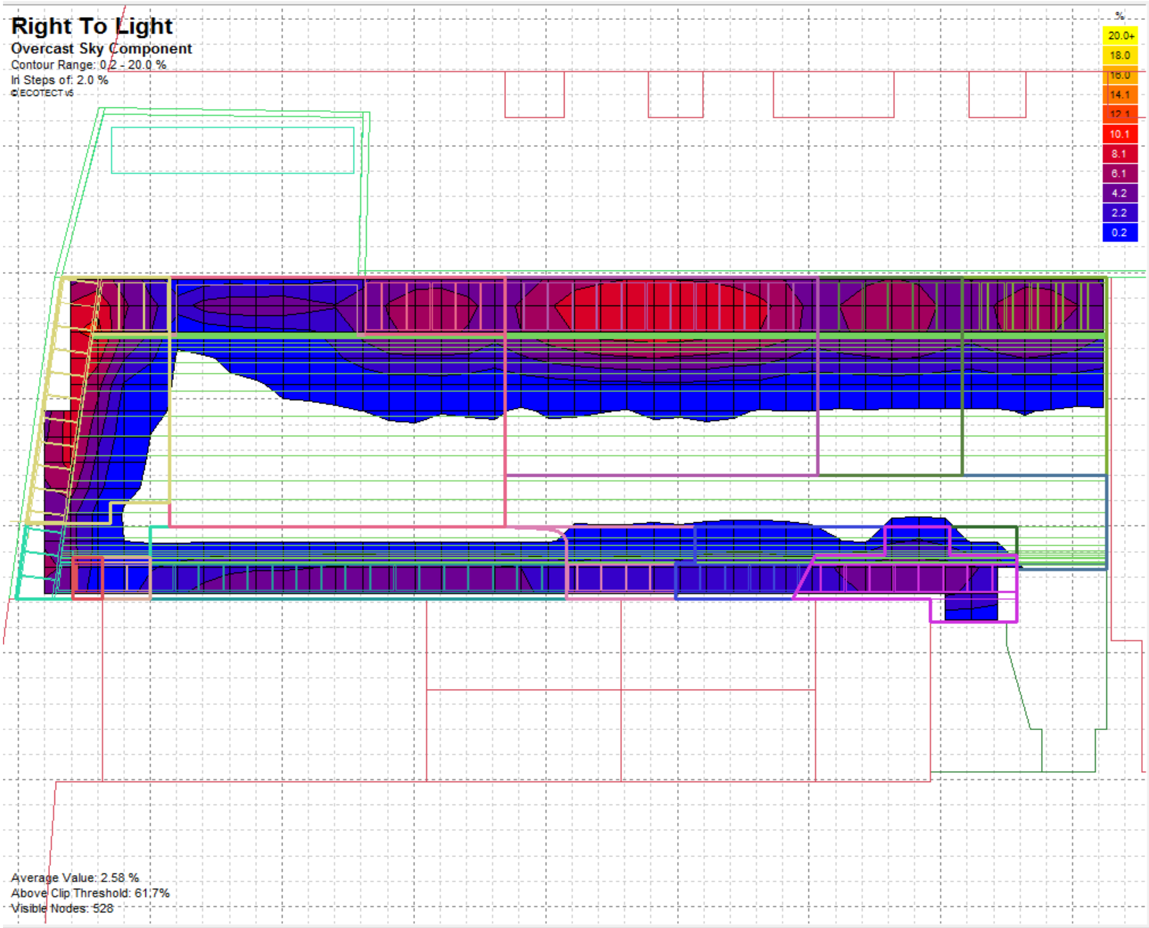
The no-sky line is an outline representing the area that receives no direct skylight. If a significant area of the working plane, typically more than 20%, lie behind the no-sky line, the uniformity of daylight will be considered unsatisfactory. This will also be the case where the depth of the room is too large in comparison with the height and width of the windows.

In the case of rooflights, uneven distribution of daylight in the room occurs when the distance between the adjacent openings is large in comparison with the ceiling height. This is an issue with the existing building design as a significant amount of rooms are lit primarily by one row of rooflights. The effects of poor distribution can be mitigated by ensuring that the reflectances of the floor and ceiling are as high as possible. This is currently the case in the office and is helped by the curved nature of the ceiling.

Sky component

The no-sky line can be calculated using the sky component values. Values less than 0.2% are considered to be behind the no-sky line. Diagram 4 shows the overcast sky component data achieved.

Diagram 4 Overcast sky component



The non-shaded sections illustrate areas of the space that achieved less than 0.2% sky component. Rooms with over 20% of working plane behind the no-sky line are deemed to have poor daylight distribution; these include the kitchen, home office, bedroom 1 and bedroom 2. Out of these four rooms, approximately half of the space in the kitchen has an overcast sky component of less than 0.2%, whereas for the remaining three rooms, the figure is closer to a third of the area.

While the uniformity of daylight is not as important in bedrooms, the results clearly needs to be improved for the kitchen and home office spaces. It could be argued however, that as the contours for the overcast sky components in the diagram above follow a relatively even vertical gradient, the interchange between natural daylight and electrical lighting will be gradual, preventing patchy lighting. While erratic shades of light and darkness would be irritating, the gradual "dimming" pattern can be considered as architecturally attractive.

Although additional windows would increase the amount of direct skylight received, there is the concern of privacy, particularly as the neighbouring buildings are taller and at close proximity. For a good balance between the two factors, it is recommended that extra windows are not installed. However, the use of wall/ceiling materials that have high reflectance values and the diffused roof glazing on the windows should reduce the variation in daylight.

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Sunlight duration

The British Standard recommends that *interiors in which the occupants have a reasonable expectation of direct sunlight should receive at least 25% of probable sunlight hours. At least 5% probable sunlight hours should be received during the winter months, between 21st September and 21st March* [2].

The total amount of probable sunlight hours available for the duration of a year is 8760 hours; therefore 25% of this value is 2190 hours. With neighbouring buildings at such close proximity, shadowing is a clear problem, especially during the winter months. The nearby trees are assumed to be deciduous and therefore excluded from calculations for September to March.

Diagram 5 below illustrates the amount of shadowing for the 21st of each month of a standard year. The time was set to noon, when the sun is at its highest peak, to ensure the best possible comparison.

Diagram 5 The effects of shadowing for each month of a standard year

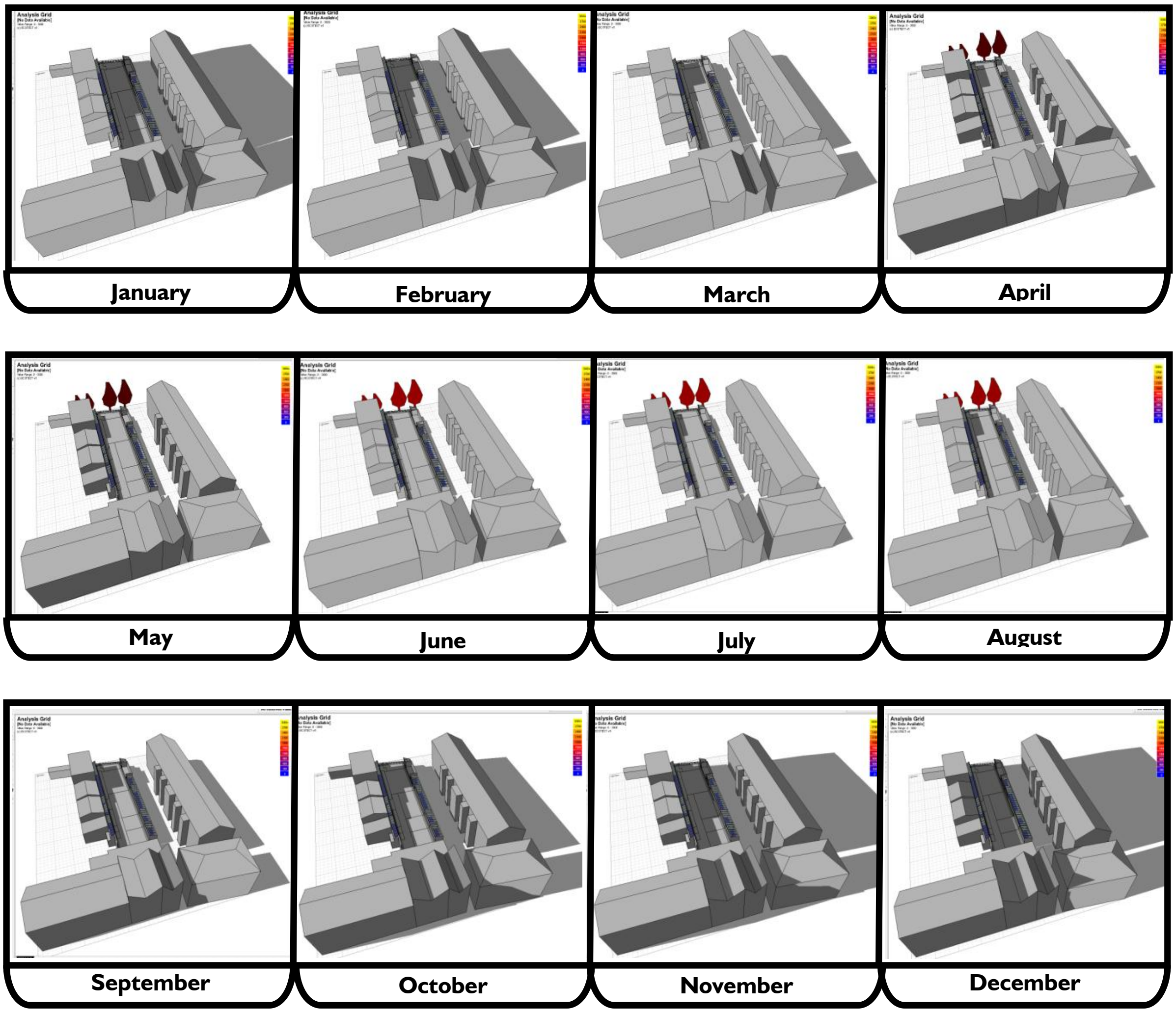
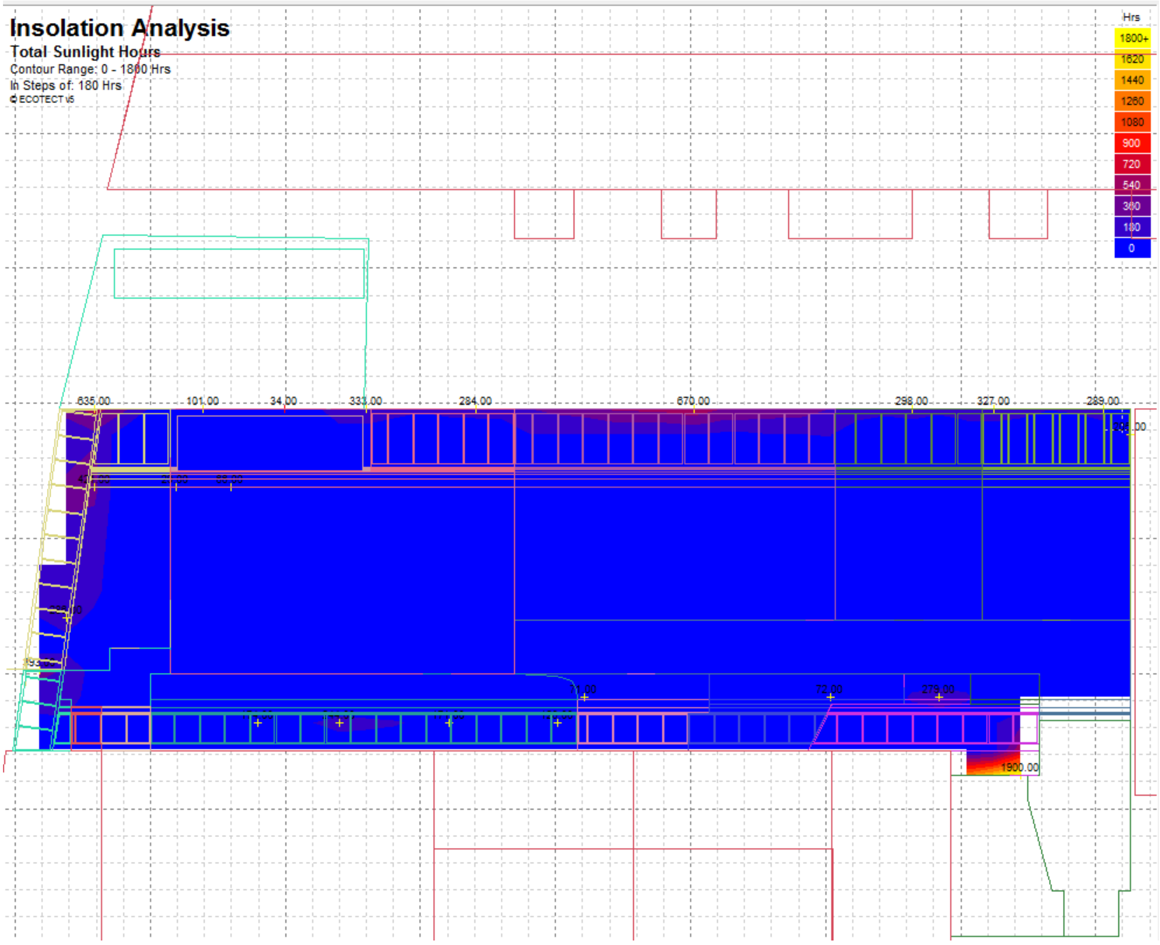


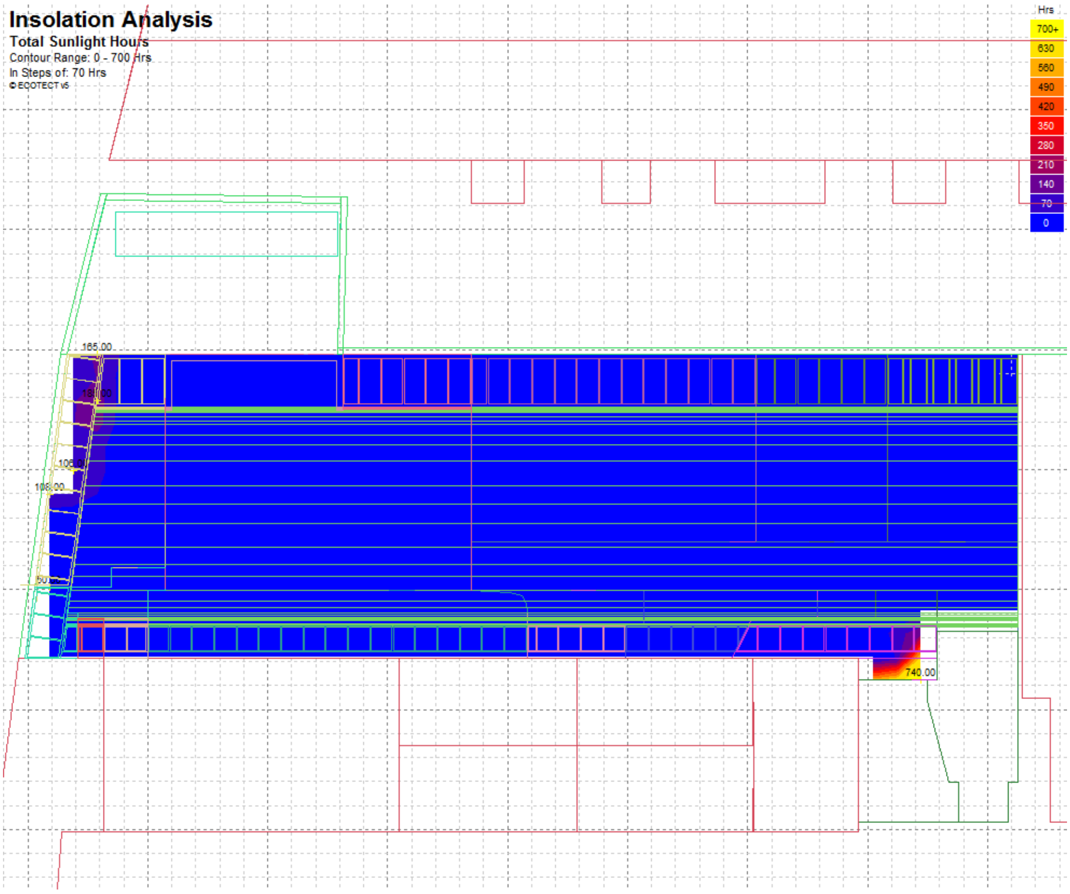
Diagram 6 shows the total sunlight hours achieved during the course of a year. The trees were included in the calculation year round to represent the worst possible case. The inner spaces on the building did not receive any direct sunlight, but for spaces within 2-3 metres of the rooflights, the amount of sunlight received ranged from 171 to 1900 hours. The peak value of 1900 hours was achieved near the front entrance, yet was just below the recommended value of 2190 sunlight hours.

Diagram 6 Total sunlight hours achieved during the course of a year



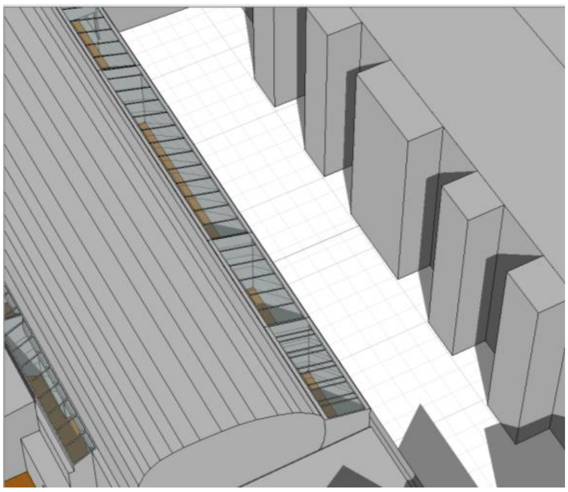
The total amount of probable sunlight hours between 21st September and 21st March totals to 4680 hours. At least 5% of this amount, 234 hours should be received by the building during these months. Diagram 7 shows the modelling results.

Diagram 7 Total sunlight hours achieved during the winter months



No sunlight hours were received by the inner spaces of the building or near the horizontal rooflights. Similar to the results above, the peak value of 740 hours was achieved at the front entrance. Aside from this area, the master bedroom was the only other space to receive sunlight during the winter months with the results ranging from 50 to 184 hours.

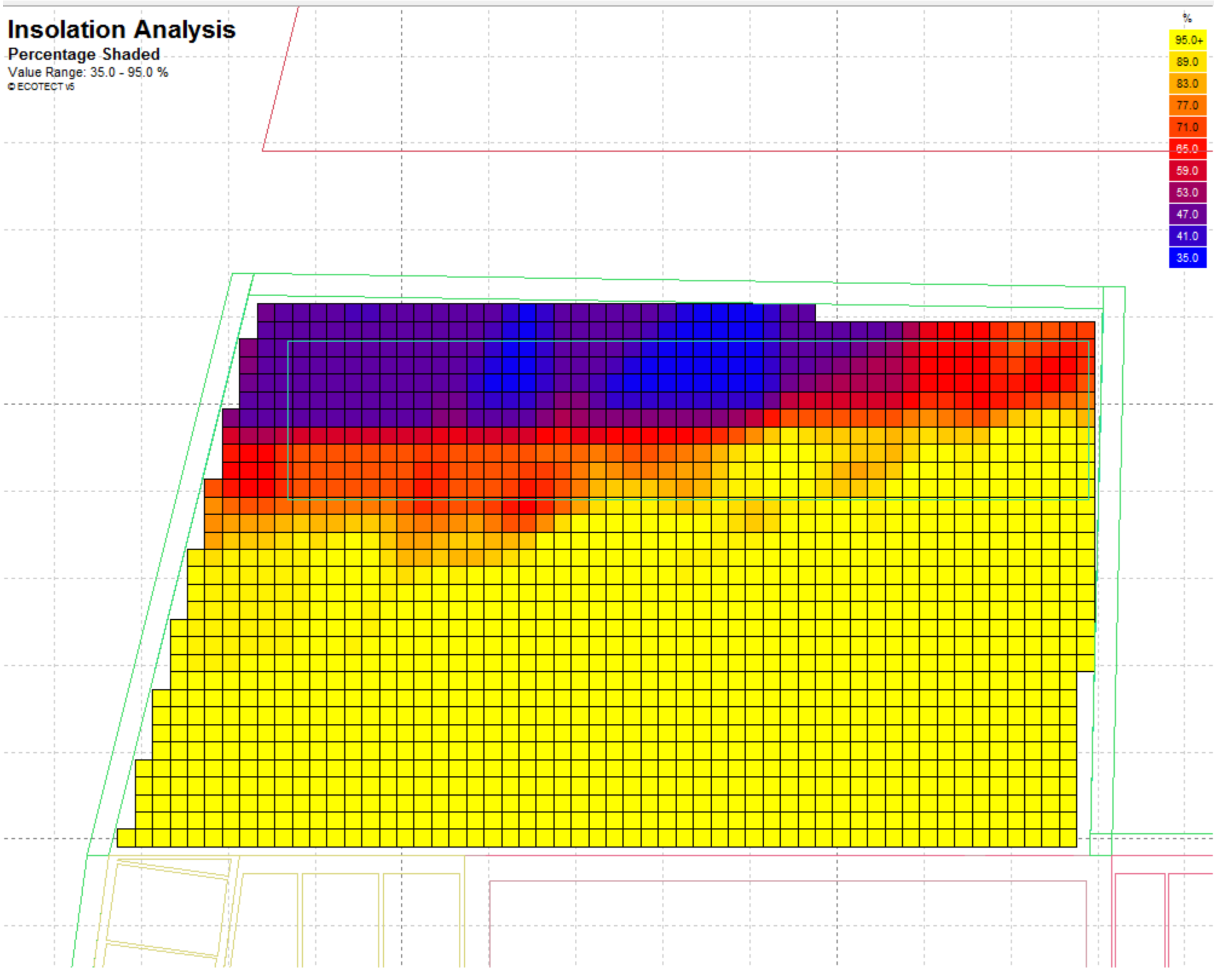
Diagram 8 Sunlight received in June



Although the lack of direct sunlight is of a concern, these results do suggest that based on the findings year round (diagram 6), most of the sunlight are received during summertime. Diagram 8 is an example of the amount of shadowing and sunlight there is in June. Electric lighting will be required in the winter months, but is likely to be only frequently necessary for April to August.

The recommended guideline for garden courtyards to appear sufficiently sunlit throughout the year is different to that of buildings. It is suggested that *no more than two-fifths of any garden area should be prevented by buildings from receiving any sun at all on 21st March*. [3]

Diagram 9 Amount of shadowing on the garden courtyard on the 21st March



The modelling results show that no section of the courtyard is permanently shaded throughout the day, albeit a large proportion is 95% shaded. Although the courtyard does meet the recommended guideline, it does mean that sunlight cannot be guaranteed for specific areas such as flowers beds. It is also worth noting that neighbouring gardens are in similar, if worst, positions.

Conclusion

All three criteria need to be met for the dwelling to be reasonably lit. Through Ecotect modelling, the proposed rooms are shown to have sufficient amount of daylight and sunlight. However the depths of the several of the rooms meant that a significant proportion of the space at the rear end lay behind the no-sky line. Despite this, there is a subtle gradation of light to darkness, allowing the use of electrical lighting to be placed strategically. The high walls and the curvature of the existing apartment above serves to retain the occupant's privacy, resulting in a good balance between the privacy of the building and the amount of daylight received.

References

1. **Autodesk Ecotect.** Ecotect WIKI
2. **British Standards Institution.** Lighting for buildings – Part 2: Code of practice for daylighting. *British Standards* BS 8206-2:2008.
3. **Building Research Establishment.** Site layout planning for daylight and sunlight: a guide to good practice. 1991