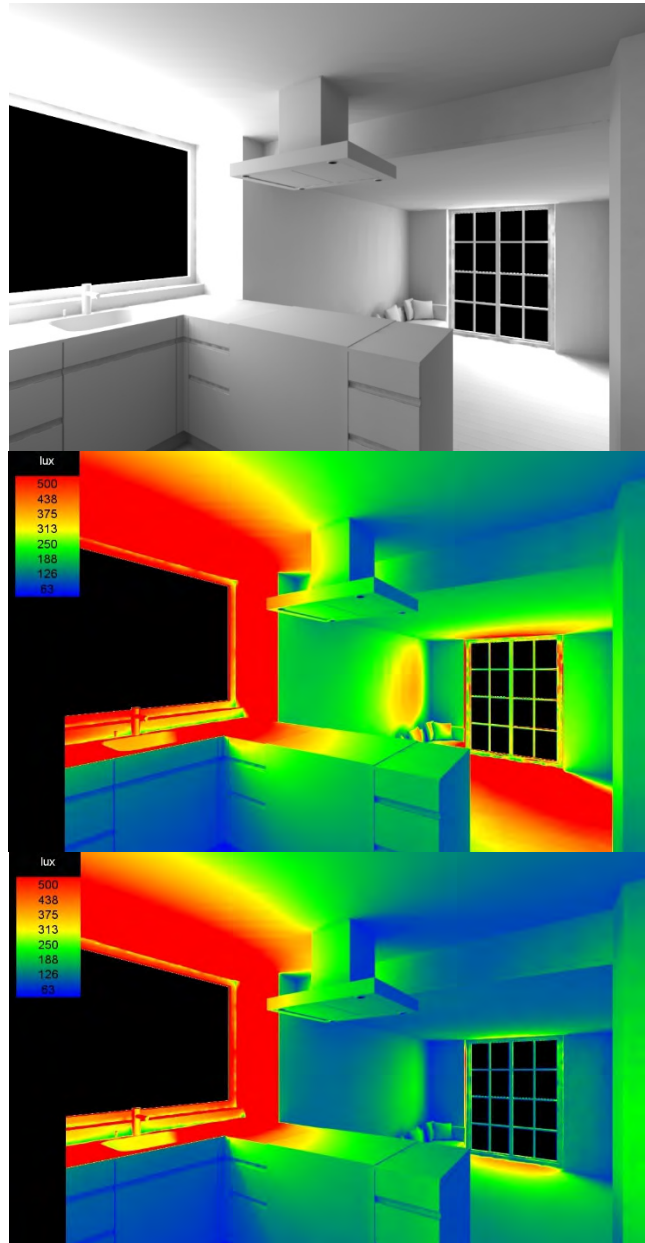


Daylight/Sunlight report

Extension to existing 6 units
and creation of 3 additional units at
106-116 Westfield Road, Caversham
Reading RG4 8HJ



May 2019
Avalon Construction and Design

Contents

1	Introduction	3
1.1	Executive Summary	3
1.2	References	4
1.2.1	Building Codes	4
1.2.2	The European Committee for Standardization, CEN	5
1.2.3	The International Organization for Standardization, ISO	5
1.2.4	Design Guidelines	5
1.3	Adopted guideline and target	6
1.4	Method and model	6
2	Analysis	8
2.1	Existing units/rooms with existing East Facing windows to the main elevation (Westfield Road)	8
2.1.1	Bedroom 0102 and 0302 at ground floor	9
2.1.2	Bedroom 0206 and Living/kitchen 0201 at ground floor	10
2.1.3	Living/Kitchen 0401 and 0701 at first floor	11
2.1.4	Bedroom 0503 and 0603 at first floor	12
2.2	Existing units/rooms with potential opening to the North and South side elevations	13
2.2.1	Living/Kitchen 0101 and 0301 at ground floor	14
2.3	New units/rooms with new openings to the West facing rear elevation	15
2.3.1	Bedroom 0209 and Living 0205 at ground floor	16
2.3.2	Bedroom 0403 and 0703 at first floor	17
2.3.3	Living/Kitchen 0501 and 0601 at first floor	18
2.4	New units/rooms to the loft space	19
2.4.1	Living/Kitchen 0802 and 0902 at first floor	20
2.4.2	Bedroom 0804 and 0904 at Second floor	21
2.4.3	Bedroom/Study 0805 and 0905 at Second floor	22
3	Assessment	23
3.1	Findings	23

1 Introduction

1.1 Executive Summary

This report supports the Planning Application for the extension to building containing 6 units to create 9 units at 106-112 Westfield Road Caversham, Reading RG4 8HJ.

A Pre-Application was submitted, and concerns were expressed about the access of sunlight/daylight to some of the units. At point (f) -Quality of residential accommodation/sustainability - the Pre-Application response states:

The proposed layout would result in a number of one-bedroom units with minimal windows/rooflights. Particularly, units 4, 5, 8 and 9 are dual aspect flats but with only one small window at each end. Similarly, all other flats provide only minimal access to sunlight potentially exacerbated by the orientation of the property.

Finally, unit 13's bedroom appears to not have any access to natural light. It would be expected that a daylight/sunlight assessment be provided with the application to ensure that a minimum standard of daylight is achieved in each flat.

The scheme has been amended in comparison with the Pre-Application proposal so the above reference to specific units (e.g. reference to flats 4, 5, 8, 9, and 13) is superseded as the scheme now comprises 9 unit (adding 3 units to the six existing flats) against 13 of the initial scheme.

The proposed scheme extends the existing building to the rear creating a new façade where the main front to Westfield Road the windows are unchanged in size and position to preserve the streetscape and the appearance of the building.

Therefore, the frameworks for the sunlight/daylight analysis has been set as follows:

- a. Existing units/rooms with existing East Facing windows to the main elevation (Westfield Road)
- b. Existing units/rooms with potential opening to the North and South side elevations
- c. New units/rooms with new openings to the West facing rear elevation
- d. New units/rooms to the loft space

Given the necessity of preserving the streetscape and the appearance of the building on the Westfield Road façade, there was little opportunity for the sunlight/daylight analysis to guide the design of those rooms (a) to optimise the access to natural light.

For all the other units/rooms (b, c, and d), the Sunlight/daylight analysis offered guidance to the design to optimise the access to natural light and taking into considerations also other connected matters (such as overlooking/privacy).

1.2 References

1.2.1 Building Codes

Legislation related to daylighting has historically been defined by one or more of the following criteria: window or glazing area in relation to the room area or facade area; quantity of daylight by daylight factor in a point in the room or as an average daylight factor of the room area; sunlight provision for a specific day or season; and a view to the outside environment (Boubekri, 2004):

- Requirements for windows and their glazing area in relation to room area or facade area. It is important to stress that legislation that mandates a minimum ratio of glazing area cannot be considered as daylight legislation, since it does not translate the actual daylight presence inside the room or building; it does not consider factors such as outside boundary conditions, building overhangs, permanent shading, glass configuration or transmittance.
- The quantity of indoor illumination inside a room. Levels for daylighting are generally described as preferred or recommended - either by specific illuminance (lux) levels on a workplane or by daylight factor (DF). Daylight factor is the most recognised performance indicator used to specify daylight conditions in buildings. The advantage of the DF method is that it is quick to calculate, and can be used in the early design process. It enables the validation of the quantity, uniformity and spatial distribution of diffuse daylight in rooms, giving architects and designers what they need to make informed decisions.
- The provision of sunlight and its duration. This type of legislation, usually referred to as “solar zoning legislation”, attempts to guarantee building occupants access to sunlight for a predetermined period of time during the day,

season and year. Considerations of sunlight access and its duration will influence the decision on orientation, the disposition of rooms and their windows, selection of solar shading devices and consideration of the surroundings. In countries such as Japan and China, solar zoning relates to public health, safety and welfare.

- A view to the outside environment provides buildings' occupants with information about orientation, and weather and times changes throughout the day. This kind of legislation calls attention to window sill-height, glazing width (or the sum of widths for all windows) as a fraction of facade area, and type of glazing material used.

1.2.2 The European Committee for Standardization, CEN

In several European Standards involving daylight, the general benefits of daylight tend to be explained as follow:

- The design illuminance levels needed to enable people to perform visual tasks efficiently and accurately shall be obtained by means of daylight, electric light or a combination of both.
- Windows are strongly favoured in buildings for the daylight they deliver, and for the visual contact they provide with the outside environment. It is important to ensure windows do not cause visual or thermal discomfort, or loss of privacy.
- Potential energy savings by using daylight
- Light is important to people's health and well-being.

In EN 12464-1:2011, the importance of daylight is taken into account and requirements for lighting are generally applicable whether it is provided by daylight, artificial lighting or a combination of both.

1.2.3 The International Organization for Standardization, ISO

Several ISO working groups include daylight as an element in their work groups. At present, one standard (ISO, 2014a) applies to calculations methods for daylight in both existing buildings and the design of new and renovated buildings.

1.2.4 Design Guidelines

Several independent authorities publish guidance material and set the criteria for best practice in the profession. These are the Chartered Institution of Building Services Engineers (CIBSE), UK and the Illuminating Engineering Society of North America

(IESNA), USA. As an example, CIBSE has published its Lighting Guides on Daylighting and window design, and IESNA has published a standard on approved method: IES Spatial Daylight Autonomy (SDA) and Annual Sunlight Exposure (ASE) (IESNA, 2013), which describes a new suite of metrics of daylighting performance in an existing buildings and new designs, from concept to construction documents.

Several established and much-used methods of assessing, rating, and certifying the sustainability of buildings, such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Methodology), and DGNB (Deutsche Gesellschaft für nachhaltiges Bauen), make recommendations for daylight as part of their assessment schemes. Overall, daylight factor is the most common indicator in most of them, but the calculation methods and benchmarks are different. Apart from daylight factor as an indicator, a view to the outside, glare control, and illuminance levels are frequently used parameters for describing visual comfort.

1.3 Adopted guideline and target

For the purpose of this Report, the analysis has been conducted to check the compliance against BREEAM requirements and double checked against LEED as follows:

- BREEAM > at least 80% of floor area in occupied spaces has an average daylight factor of 2% or more. In domestic buildings, Kitchens achieve a minimum daylight factor of at least 2%; living rooms, dining rooms and studies achieve a minimum average daylight factor of at least 1.5%, and 80% of the working plane should receive direct light from the sky.
- LEED > through computer simulation that the applicable spaces achieve daylight illuminance levels of a minimum of 25 foot-candles (fc) (270 lux) and a maximum of 500 fc (5400 lux) in a clear sky condition on September 21 at 9 a.m. and 3 p.m. Areas with illuminance levels below or above the range do not comply.

1.4 Method and model

The analysis has been developed through computer simulation to calculate daylight factor and illuminance.

For the simulation it has been used VELUX DAYLIGHT VISUALIZER 2, Version 2.8.4, May 2015.

The BIM model (figure 1) used for the architectural design has been exported into OBJ format for the simulation (figure 2), including also the surroundings which could have an impact on the daylight factor such as overbearing volumes/buildings, pavements, etc.

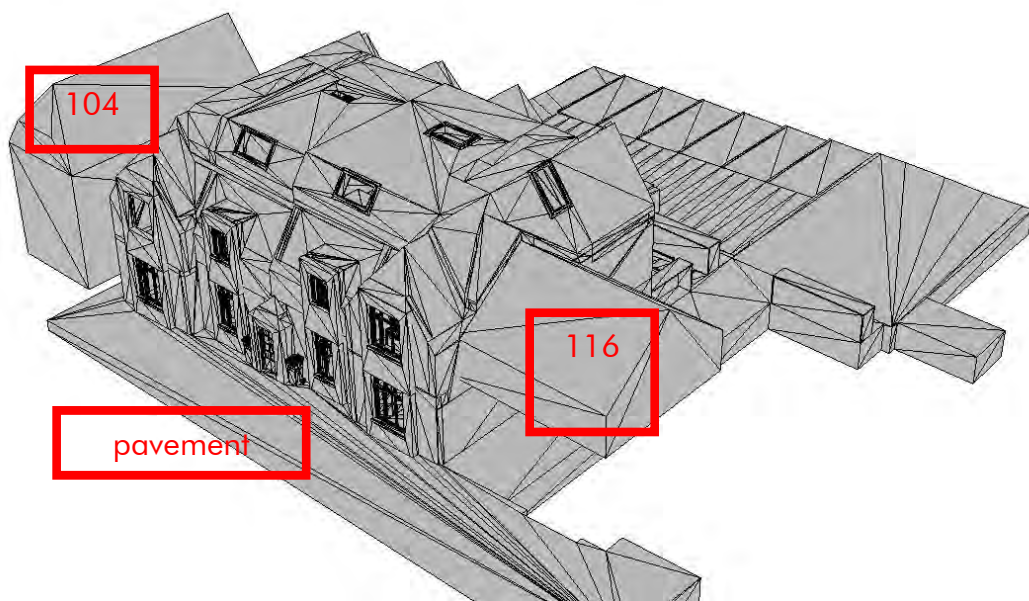


Figure 1

The OBJ model used for the simulation includes the surroundings with a potential impact on the daylight calculation such as the building at 104 Westfield Road (to the left) and the overbearing volume connecting to 116 Westfield Road (to the right)

2 Analysis

2.1 Existing units/rooms with existing East Facing windows to the main elevation (Westfield Road)

The analysis regards the rooms at ground and first floor with existing windows to Westfield Road as follows:

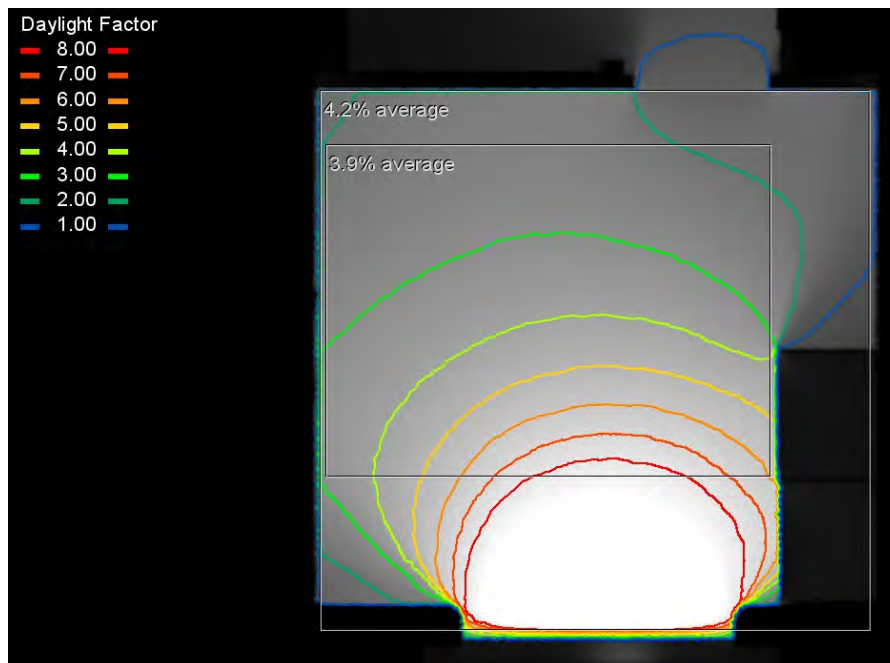
Bedroom 0102 (Flat 1, GF), Bedroom 0206 and Dining/Kitchen 0201 (Flat 2, GF), Bedroom 0302 (Flat 3, GF), Living/dining 0401 (Flat 4, FF), Bedroom 0503 (Flat 5, FF), Bedroom 0603 (Flat 6, FF), Living/dining 0701 (Flat 7, FF).



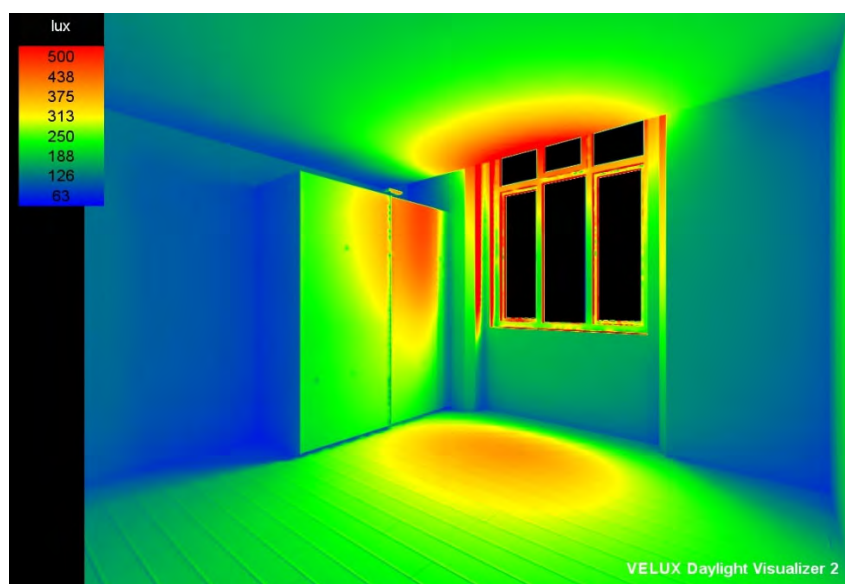
As some of these rooms are mirrored (0102/0302, 0206/0201, 0401/0701, 0503/0603) and the differences are not significant for the purpose of the sunlight/daylight analysis, the report shows the analysis for just one of the rooms, as the findings for the equivalent room on the other side are comparable.

2.1.1.1 Bedroom 0102 and 0302 at ground floor

- DATA > The room measures 11.5 m² (3.20 x 3.50 m). The existing window size is 1490 mm (W) X 1850 mm (H). The sill level is at 840 mm from FFL in bedroom 0102 and at 970 mm from FFL in bedroom 0302: the difference of the sill level is not significant for the purpose of the analysis as it has little effect on the daylight factor.
- BREEAM > The analysis shows an Average Daylight factor of 4.2% of the overall floor space and 3.9% excluding the area next to the window.



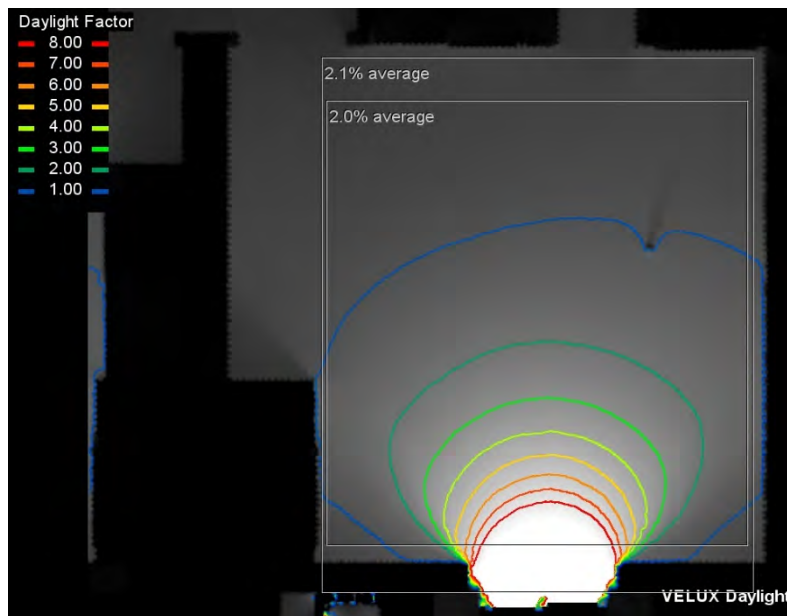
- LEED > The most unfavorable condition for the Illuminance calculation is at 3 pm of the designed day (21st September) in a clear sky condition. The analysis shows that the room has an average above 250 lux.



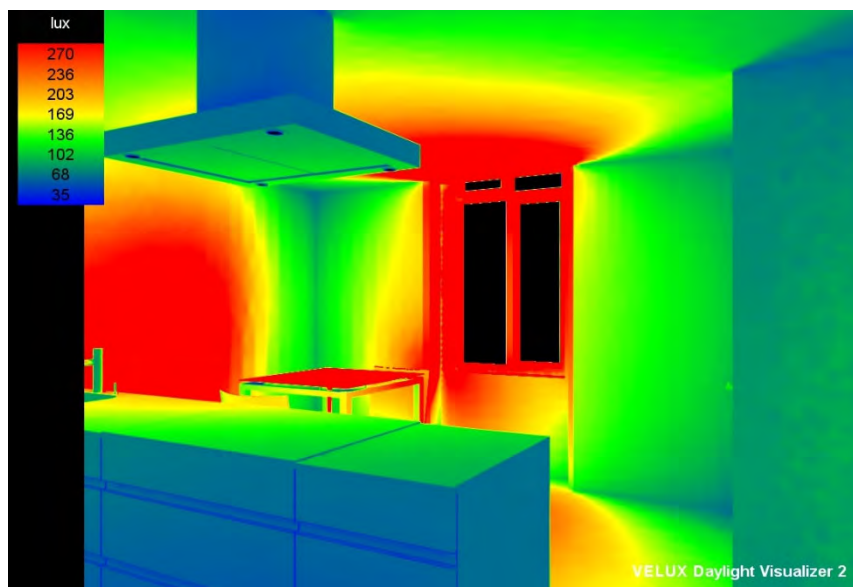
- ASSESSMENT > The room complies with BREEAM and LEED

2.1.2 Bedroom 0206 and Living/kitchen 0201 at ground floor

- DATA > The room measures 16.1 m² (4.20 x 4.00 m). The existing window size is 976 mm (W) X 1860 mm (H). The sill level is at 760 mm from FFL both in bedroom 0206 and living/kitchen 0201. It is noted that the result is more important for room 0201 as the use (kitchen) would require higher level both as Daylight factor and Illuminance.
- BREEAM > The analysis shows an Average Daylight factor 2.1% of the overall floor space and 2.0% excluding the area next to the window.



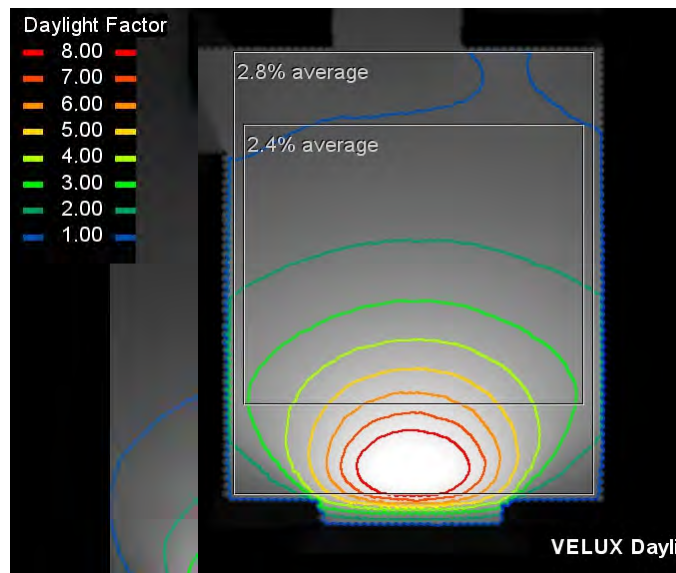
- LEED > The Illuminance calculation at 9 pm of the designed day (21st September) shows that just a portion of the surface achieve 270 Lux and the worktop has 136 Lux.



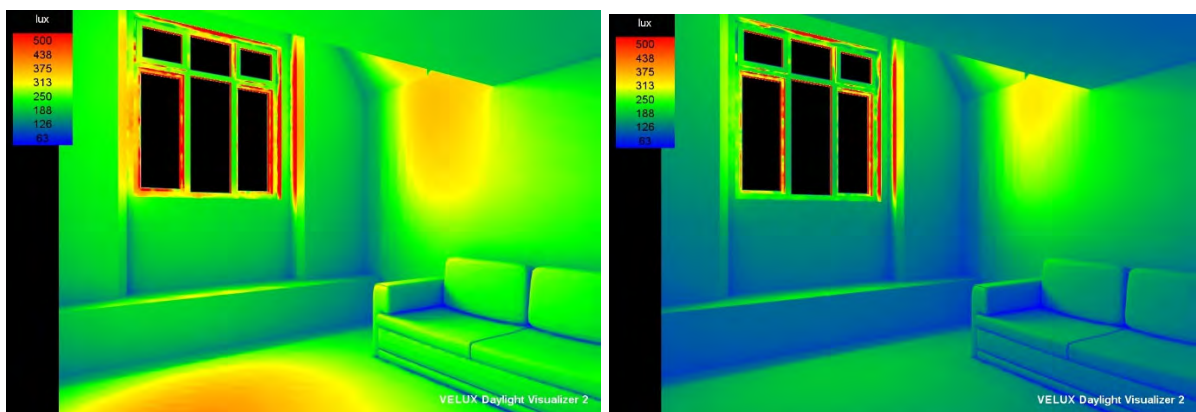
- ASSESSMENT > The room complies with BREEAM but it doesn't with LEED

2.1.3 Living/Kitchen 0401 and 0701 at first floor

- DATA > The room measures 18.1 m² (3.48 x 4.20 m). The existing window size is 1490 mm (W) X 1660 mm (H). The sill level is at 1200 mm from FFL in room 0401 and at 1340 mm from FFL in room 0701: the difference of the sill level is not significant for the purpose of the analysis as it has little effect on the daylight factor.
- BREEAM > The analysis shows an Average Daylight factor 2.8% of the overall floor space and 2.4% excluding the area next to the window.



- LEED > The Illuminance calculation shows a good level in the living area at 9 am (image to the left) of the designed day (21st September) but it is insufficient at 3 pm (image to the right).

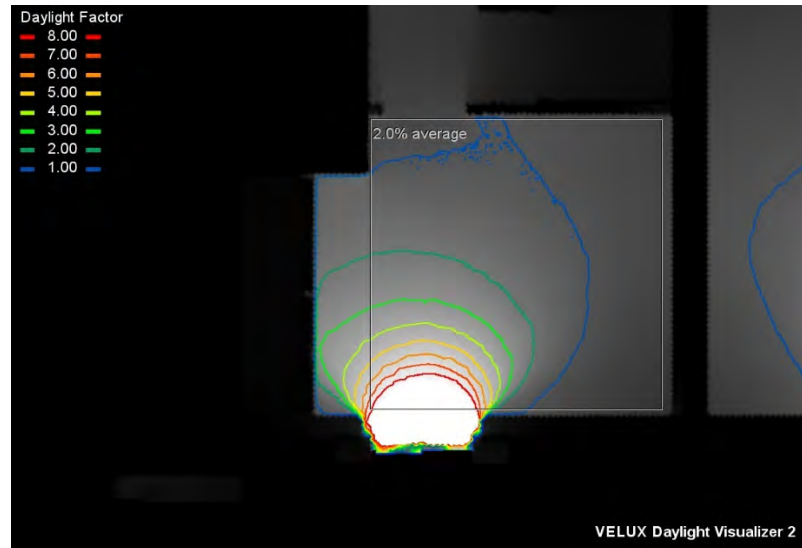


- ASSESSMENT > The room complies with BREEAM but it doesn't completely comply with LEED

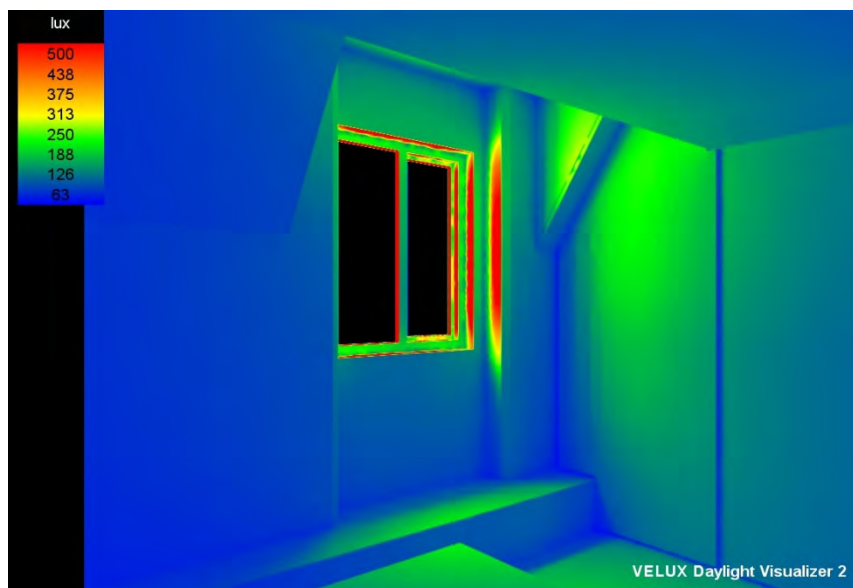
2.1.4 Bedroom 0503 and 0603 at first floor

DATA > The room measures 11.7 m² (2.80 x 3.45 m). The existing window size is 976 mm (W) X 1260 mm (H). The sill level is at 1150 mm from FFL both in room 0501 and room 0601.

BREEAM > The analysis shows that the minimum Average Daylight factor 2% is achieved in the room excluding the area next to the window.



LEED > Even in the most favourable condition at 9 pm of the designed day (21st September) calculation shows that the level of illuminance is not sufficient in the room.



ASSESSMENT > The room complies with BREEAM but it doesn't with LEED

2.2 Existing units/rooms with potential opening to the North and South side elevations

The analysis regards the living/kitchen rooms at ground floor of the side units (Flat 1 and Flat 3).

In this case the west facing glazed doors to the patio are new openings which could be potentially sized to match the requirement. However, other considerations – design of the façade, proximity of the building at 104 Westfield Road, furniture layout – put some restriction in designing those openings. Furthermore, the rooms being quite deep in comparison with the width, an initial analysis showed poor level of illuminance just where this is required the most: to the kitchen area.

The above suggested to introduce two new windows to the side of the room (position A and B) to bring as much light as possible in the kitchen area.

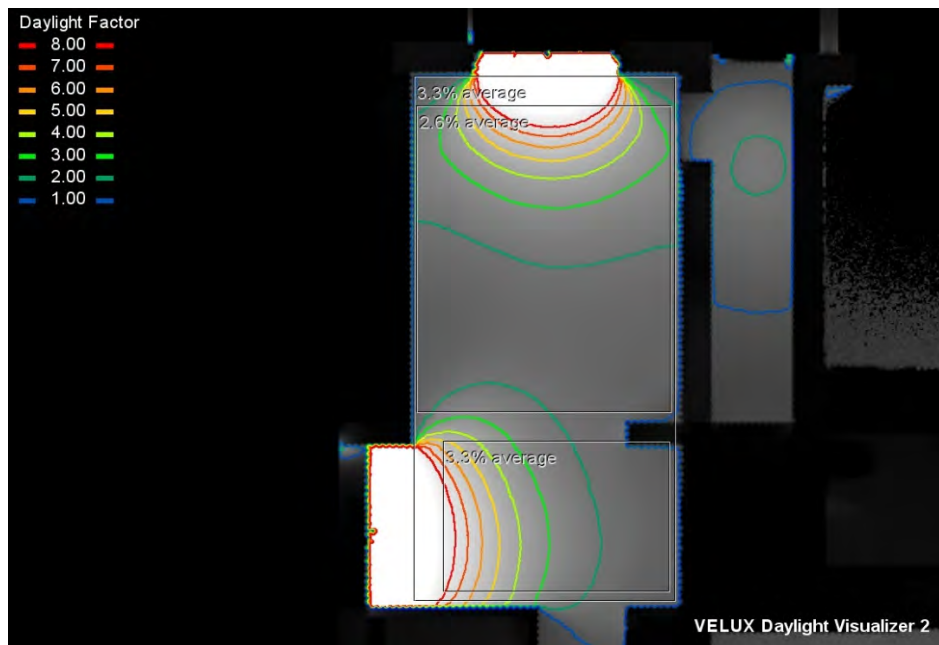
These openings are partially covered (A looks towards the alley separating 106 from 104 Westfield Road and B looks toward the roadway giving access to the rear garden which is covered by the volume connecting 112 to 116 Westfield Road) and they require obscured glass for privacy issues. To compensate those unfavourable condition, the windows have been designed to be as wide as possible to maximise their contribution in bringing natural light into the room.



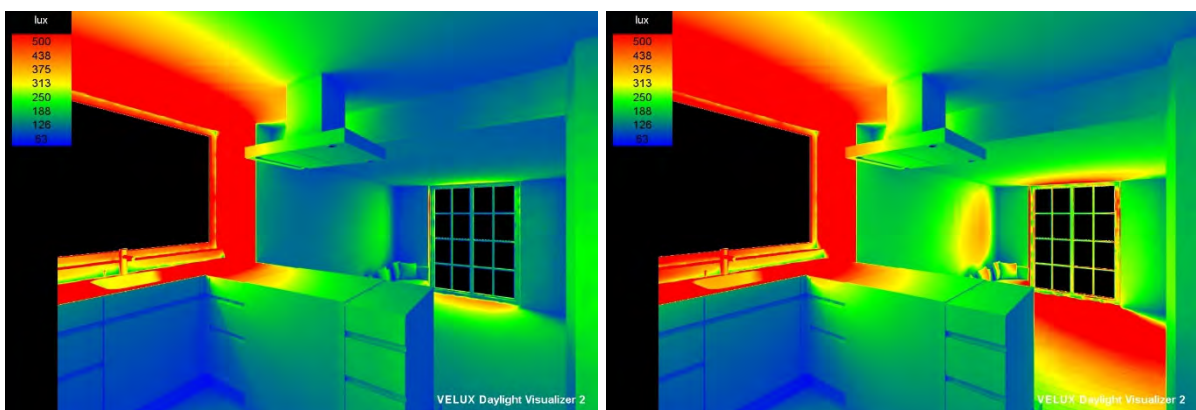
2.2.1 Living/Kitchen 0101 and 0301 at ground floor

DATA > The room measures 19.9 m² (3.48 x 5.90 m). The west facing glazed door size is 1600 mm (W) X 2300 mm (H) – floor to ceiling. The side window is 1800 (W) x 1400 (H) with sill level is at 900 mm just above the kitchen worktop. Obstructions and obscured glazing have been considered in the calculation for the side window.

BREEAM > The analysis shows an Average Daylight factor of 2.6% excluding the area next to the window.



LEED > The Illuminance calculation shows a good level in kitchen area both at 9 am (image to the left) and at 3 pm of the designed day (21st September) when the illuminance level is as required also for the living area.

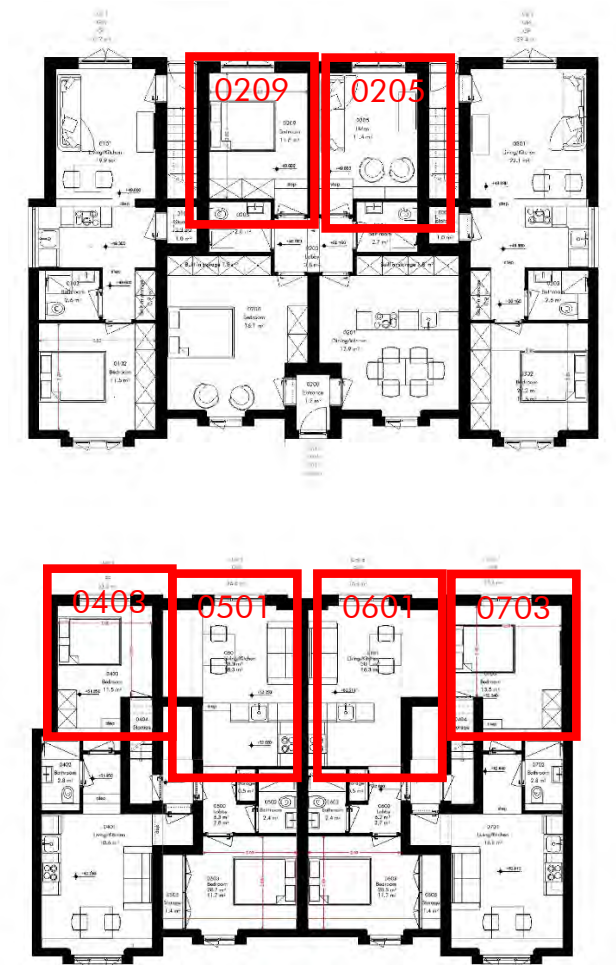


ASSESSMENT > The room complies both with BREEAM and LEED

2.3 New units/rooms with new openings to the West facing rear elevation

The analysis regards the rooms at ground and first floor with new West facing doors and windows to Westfield Road as follows:

Bedroom 0209 and Living 0205 (Flat 2, GF), Bedroom 0402 (Flat 4, FF), Living/Kitchen 0501 (Flat 5, FF), Living/Kitchen 0601 (Flat 6, FF), Bedroom 0703 (Flat 7, FF).

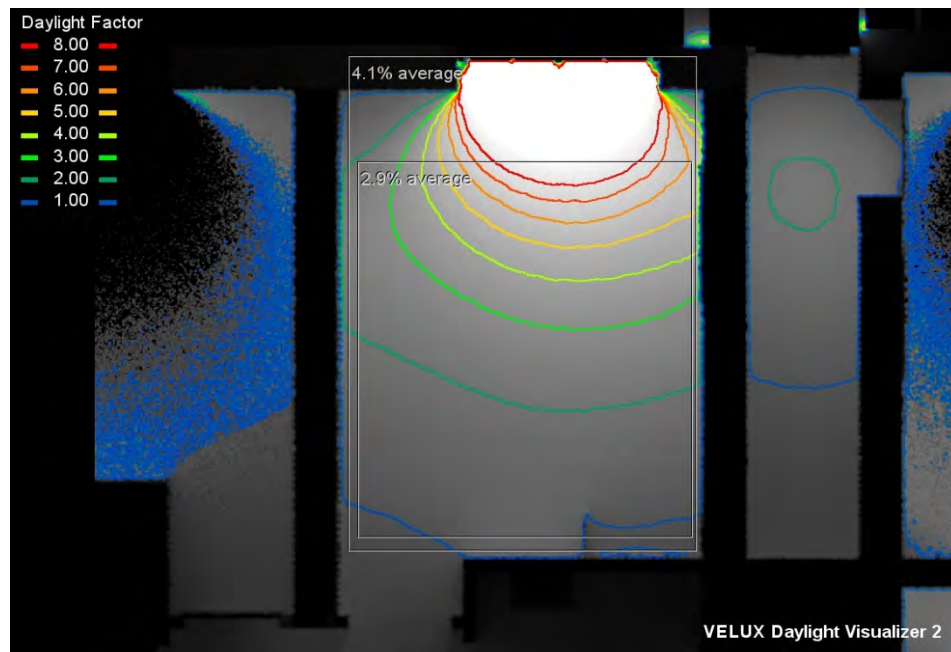


As some of these rooms are mirrored (0209/0205, 0403/0703, 0501/0601) and the differences are not significant for the purpose of the sunlight/daylight analysis, the report shows the analysis for just one of the rooms, as the findings for the equivalent room on the other side are comparable.

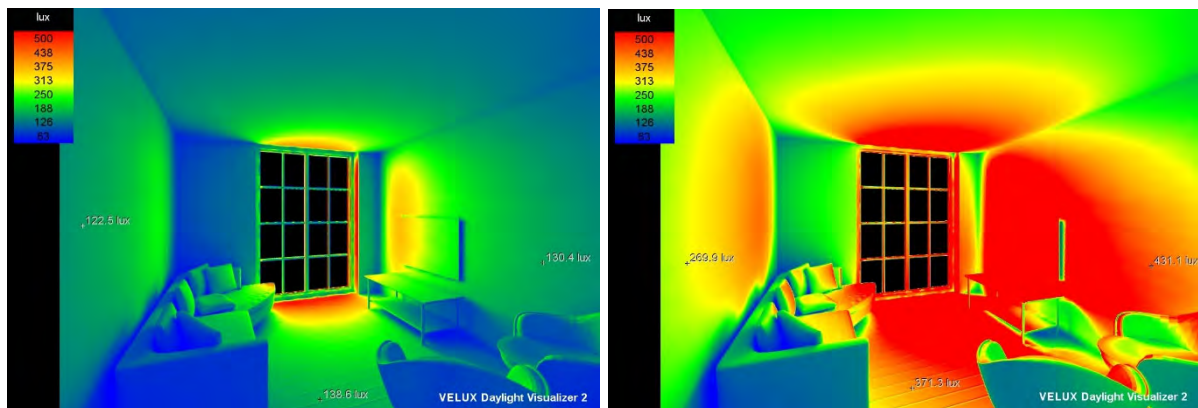
2.3.1 Bedroom 0209 and Living 0205 at ground floor

DATA > The room measures 11.6 m² (3.00 x 3.80 m). The west facing glazed door size is floor to ceiling 1600 mm (W) X 2300 mm (H).

BREEAM > The analysis shows an Average Daylight factor of 2.9% excluding the area next to the window.



LEED > The Illuminance calculation shows an acceptable level at 9 am (image to the left) and optimum level at 3 pm of the designed day (21st September).

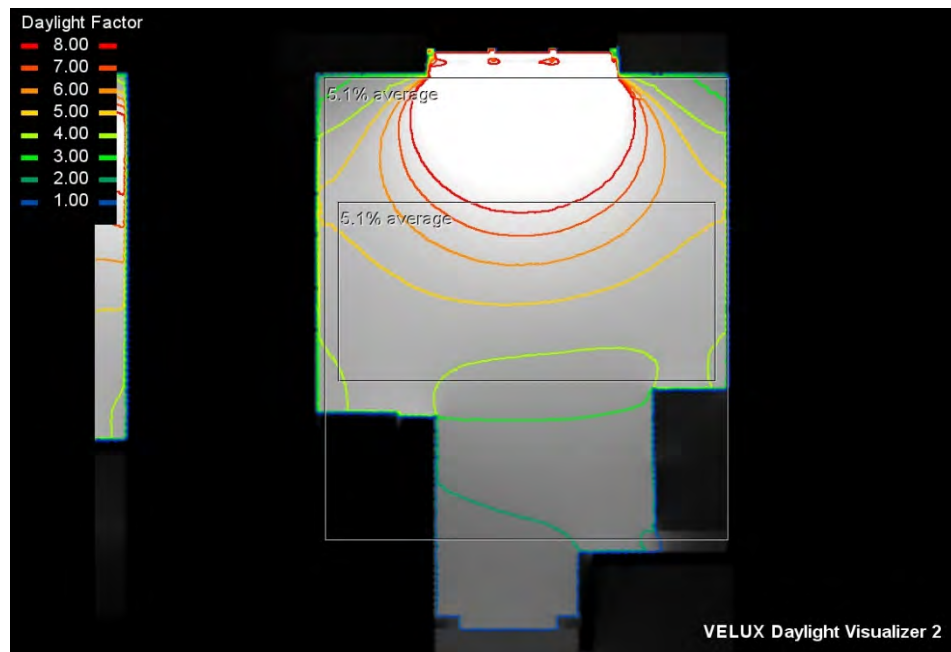


ASSESSMENT > The room complies both with BREEAM and LEED

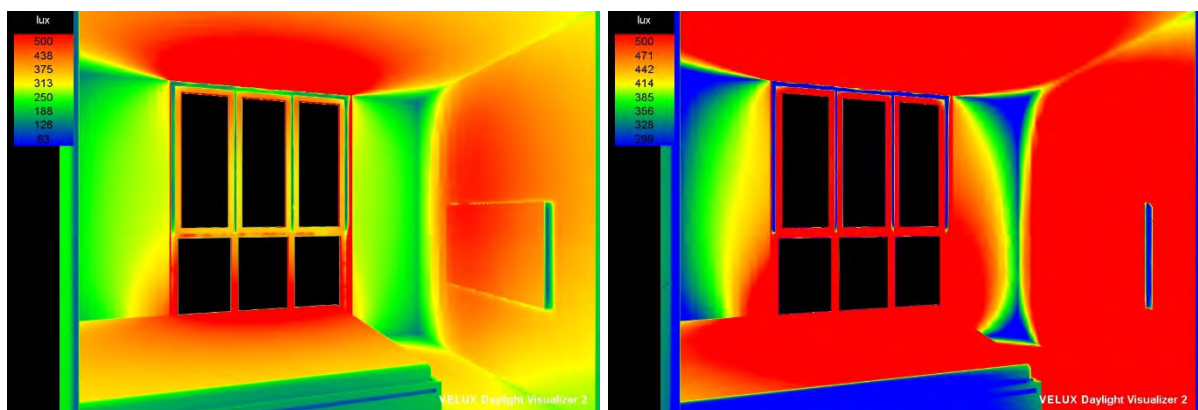
2.3.2 Bedroom 0403 and 0703 at first floor

DATA > The room measures 11.5 m² (3.00 x 4.00 m). The west facing glazed door size is floor to ceiling 1600 mm (W) X 2300 mm (H).

BREEAM > The analysis shows an Average Daylight factor of 2.9% excluding the area next to the window.



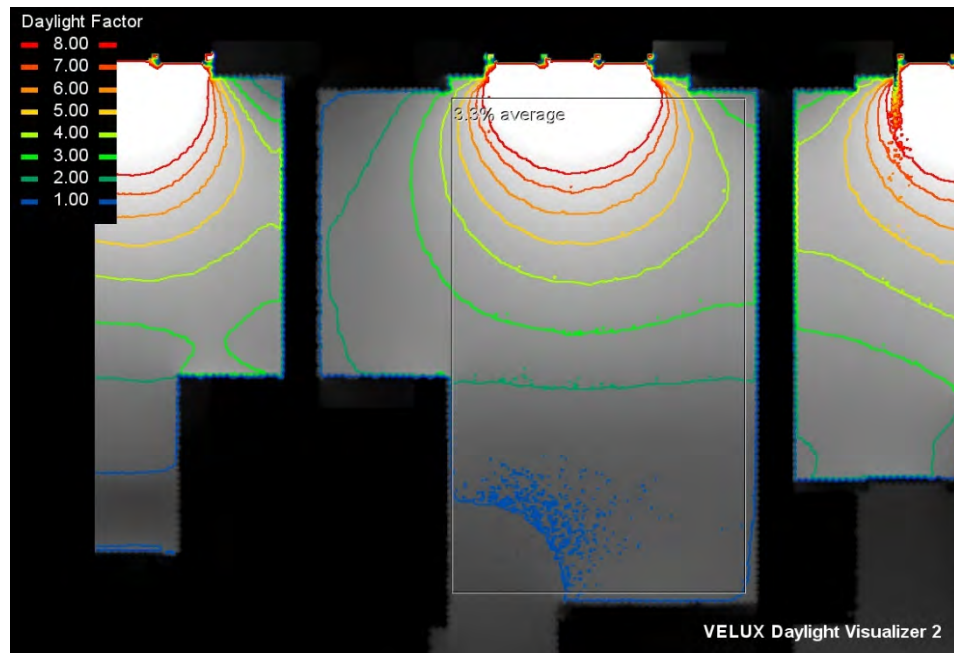
LEED > The Illuminance calculation shows level above the standard already at 9 am (image to the left). At 3 pm the level is so high to suggest that measure should be considered to avoid overheating during the summer as the window is West facing.



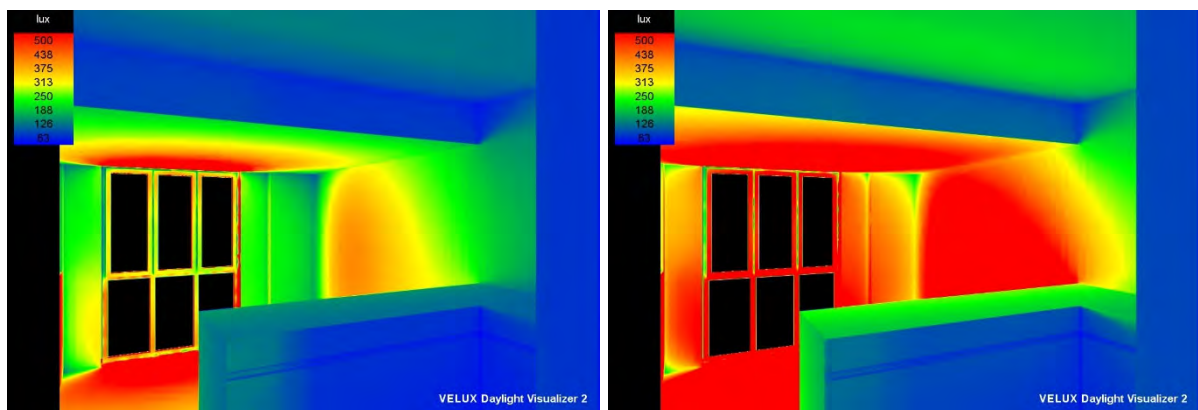
ASSESSMENT > The room complies both with BREEAM and LEED

2.3.3 Living/Kitchen 0501 and 0601 at first floor

- DATA > The room measures is a large open space measuring 30.3 m² with two west facing floor to ceiling windows 1600 mm (W) and a roof
- BREEAM > The analysis shows an Average Daylight factor of 3.3% excluding the area next to the window.



- LEED > The Illuminance calculation shows an acceptable level at 9 am (image on the left) and a good level at 3 pm as the kitchen worktop records 250 Lux in the simulation.



- ASSESSMENT > The room complies both with BREEAM and LEED

2.4 New units/rooms to the loft space

The analysis regards all the rooms at second floor (flat 8 and 9) which have large west facing windows to the rear (A), rooflight to the main front (B), to the side (C) and in the middle (D) as follows:

Living Kitchen 0802, Bedroom 0804, Bedroom 0805 (Flat 8, SF), Living Kitchen 0902, Bedroom 0904, Bedroom 0905 (Flat 9, SF),

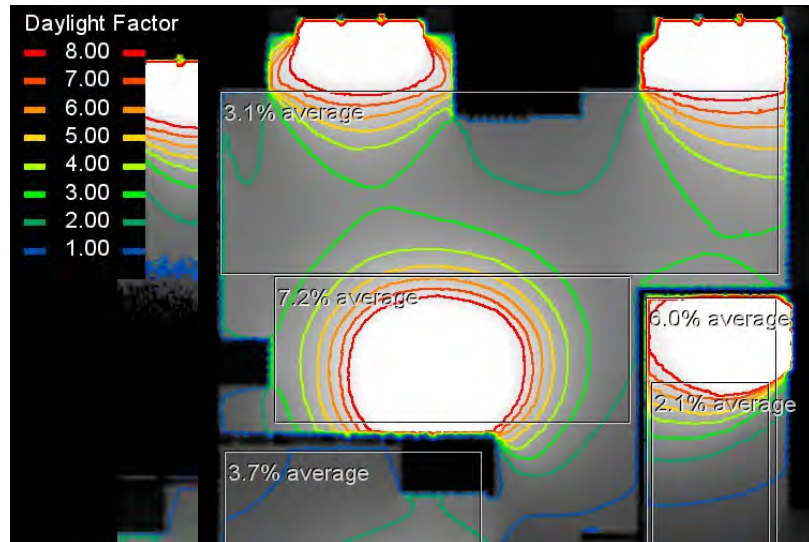


As some of these rooms are mirrored (0802/0902, 0804/0904, 0805/0905) and the differences are not significant for the purpose of the sunlight/daylight analysis, the report shows the analysis for just one of the rooms, as the findings for the equivalent room on the other side are comparable.

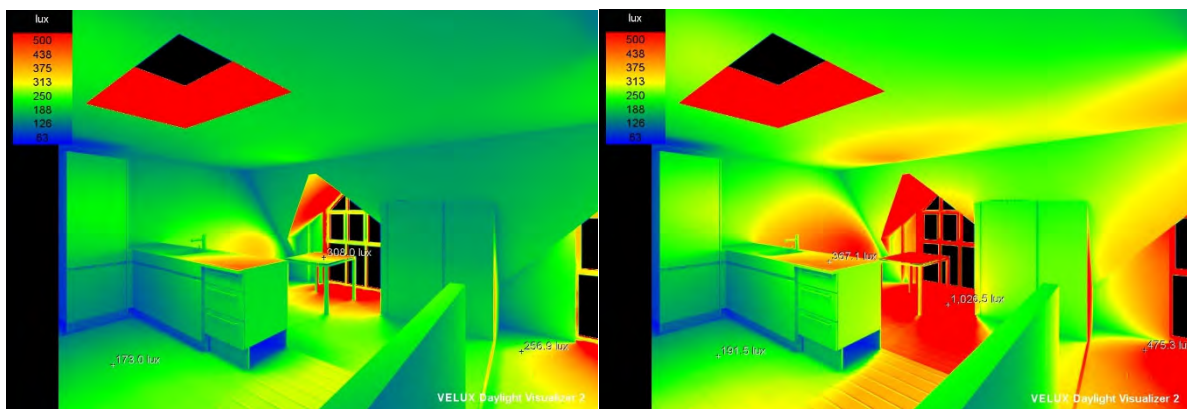
2.4.1 Living/Kitchen 0802 and 0902 at first floor

DATA > The room is a large open space measuring 30.3 m² with two west facing floor to ceiling windows 1600 mm (W) and a 1500x800 rooflight to bring light in the kitchen area.

BREEAM > The analysis shows an Average Daylight factor of 3.1% excluding the area next to the window.



LEED > The Illuminance calculation shows a good level at 9 am (image on the left) with a good distribution of the illumination and highest level at 3 pm with the kitchen worktop recording over 500 Lux in both cases.

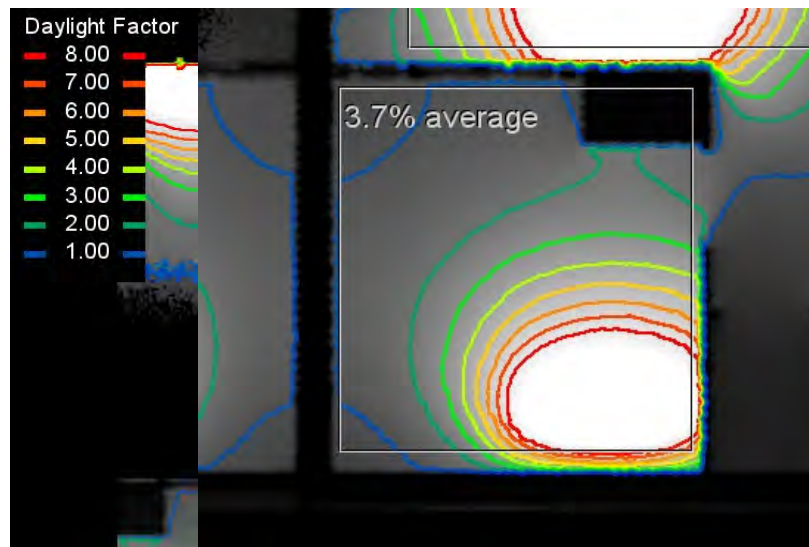


ASSESSMENT > The room complies both with BREEAM and LEED

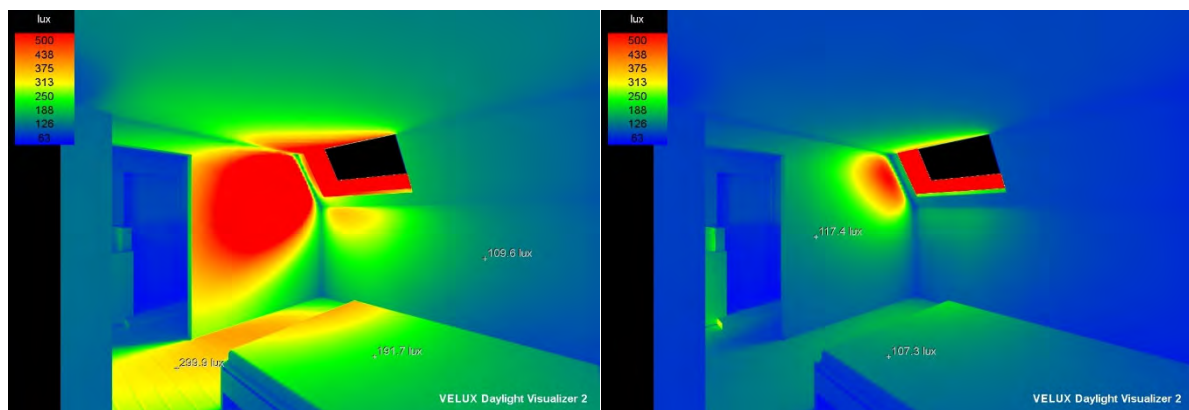
2.4.2 Bedroom 0804 and 0904 at Second floor

DATA > The room measures 12.1 m² (3.40 x 3.6 m) with a 1500x800 rooflight to the pitched roof towards Westfield Road (East facing).

BREEAM > The analysis shows an Average Daylight factor of 3.7% excluding the area next to the rooflight.



LEED > The Illuminance calculation shows a good average at 9 am (image on the left) and lower level at 3 pm with as the rooflight is east facing.

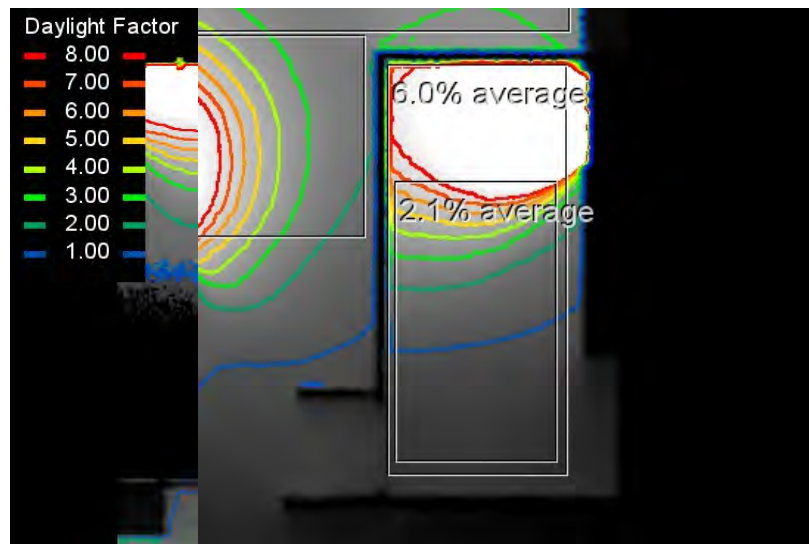


ASSESSMENT > The room complies both with BREEAM and LEED

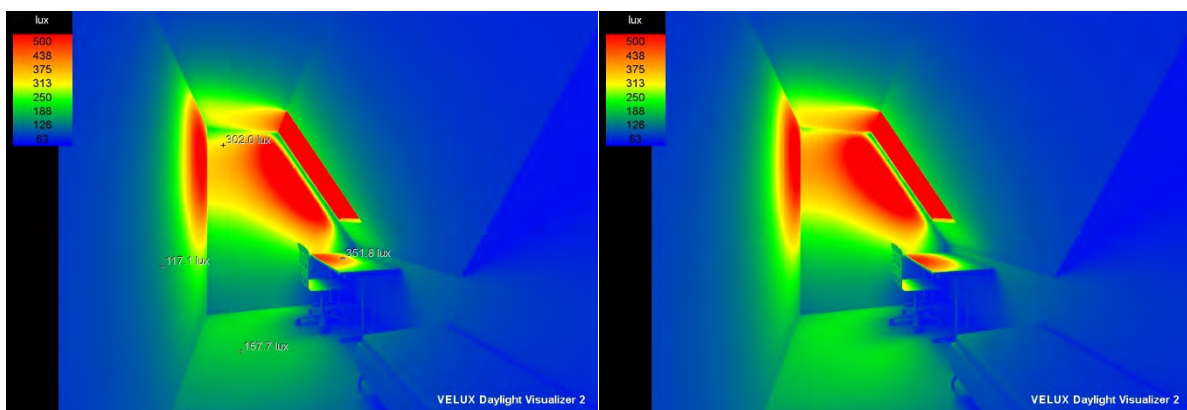
2.4.3 Bedroom/Study 0805 and 0905 at Second floor

DATA > The room measures 8.6 m² (2.15 x 4.1 m) with a 1500x800 rooflight to the pitched roof on the south (Flat 8) and north (Flat 9) side. In this case, the analysis of the illuminance has been done on the most unfavorable condition (Flat 9, north facing) where Daylight analysis doesn't depend on the orientation.

BREEAM > The analysis shows an Average Daylight factor of 2.1% excluding the area just below the rooflight.



LEED > The Illuminance calculation shows little difference between 9 am (image on the left) and 3 pm as the rooflight is north facing. However, although the average illuminance is slightly lower the standard, the good level of illuminance to the desk area makes the room acceptable.



ASSESSMENT > The room complies both with BREEAM and LEED

3 Assessment

3.1 Findings

The analysis has been done on 22 habitable rooms excluding bathrooms, lobbies, storage rooms. Each room has been checked against BREEAM requirements (Average Daylight Factor) and double checked against LEED requirement (Illuminance).

The findings are summarised in the table below:

UNIT	FLOOR	ROOM	FUNCTION	WINDOW	ORIENTATION	BREEAM LEED REF.		
Flat 1	Ground	0101	Living/Kitchen	New	West/Rear	YES	YES	2.2.1
Flat 1	Ground	0102	Bedroom	Existing	East/Front	YES	YES	2.1.1
Flat 2	Ground	0201	Dining/Kitchen	Existing	East/Front	YES	NO	2.1.2
Flat 2	Ground	0205	Living/Kitchen	New	West/Rear	YES	YES	2.3.1
Flat 2	Ground	0206	Bedroom	Existing	East/Front	YES	NO	2.1.2
Flat 2	Ground	0209	Bedroom	New	West/Rear	YES	YES	2.3.1
Flat 3	Ground	0301	Living/Kitchen	New	West/Rear	YES	YES	2.2.1
Flat 3	Ground	0302	Bedroom	Existing	East/Front	YES	YES	2.1.1
Flat 4	First	0401	Living/Kitchen	Existing	East/Front	YES	NO	2.1.3
Flat 4	First	0403	Bedroom	New	West/Rear	YES	YES	2.3.2
Flat 5	First	0501	Living/Kitchen	New	West/Rear	YES	YES	2.3.3
Flat 5	First	0503	Bedroom	Existing	East/Front	YES	NO	2.1.4
Flat 6	First	0601	Living/Kitchen	New	West/Rear	YES	YES	2.3.3
Flat 6	First	0603	Bedroom	Existing	East/Front	YES	NO	2.1.4
Flat 7	First	0701	Living/Kitchen	Existing	East/Front	YES	NO	2.1.3
Flat 7	First	0703	Bedroom	New	West/Rear	YES	YES	2.3.2
Flat 8	Second	0802	Living/Kitchen	New	West/Rear+ top rooflight	YES	YES	2.4.1
Flat 8	Second	0804	Bedroom	New	East facing rooflight	YES	YES	2.4.2
Flat 8	Second	0805	Bedroom/Study	New	South facing rooflight	YES	YES	2.4.3
Flat 9	Second	0902	Living/Kitchen	New	West/Rear+ top rooflight	YES	YES	2.4.1
Flat 9	Second	0904	Bedroom	New	East facing rooflight	YES	YES	2.4.2
Flat 9	Second	0905	Bedroom/Study	New	North facing rooflight	YES	YES	2.4.3

100% 73%

The above shows that the level of natural light is acceptable in every room.

NOTE: The only rooms where level of Illuminance doesn't match LEED requirement are some of those with small existing window to the main façade. The main facade is supposed to be inalterated to preserve the streetscape and the appearance of the window and, since the Daylight Factor is acceptable, no alteration has been suggested for those rooms/windows.

