

DAYLIGHT + SUNLIGHT ANALYSIS

**PROPOSED RESIDENTIAL DEVELOPMENT AT THE JUNCTION OF GRANGE ROAD,
NUTGROVE AVENUE AND LORETO TERRACE, RATHFARNHAM, DUBLIN 14.**

**CLARIFICATION OF ADDITIONAL INFORMATION Reg. Ref.
SD22A/0126**

By

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September 2022

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1.0 Glossary

Vertical Sky Component

Ratio of the part of illuminance, at a point on a given vertical plane, that is received directly from a CIE (Commission Internationale De L'Eclairge) standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky;

No Skyline

Sky factor is a room based assessment that looks at how much of the sky any particular point in the room can see. The working plane represents a level of usual activities e.g. working at a desk, eating dinner, cooking food and the aim is that the no-skyline (the line behind which no skylight is received) excludes those spaces

CIE Standard Overcast Sky;

A completely overcast sky, which is the darkest at the horizon and brightest at the zenith (vertically overhead);

Annual Probable Sunlight Hours (APSH):

The long-term average of the total number of hours during the year in which direct sunlight reaches the unobstructed ground (when clouds are taken into account);

Average Daylight Factor (ADF).

This is the ratio of total daylight flux incident on the working plane to the area of the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane due to an unobstructed CIE Standard Overcast Sky.

Daylight, Natural Light:

Combined Sunlight and Skylight;

Sunlight:

Part of solar radiation that reaches the earth's surface as parallel rays after selective attenuation by the atmosphere;

Skylight:

Part of solar radiation that reaches the earth's surface as a result of scattering in the atmosphere;

Spatial Daylight Autonomy (sDA):

Spatial Daylight Autonomy (sDA) examines whether a space receives enough daylight during standard operating hours (8 a.m. to 6 p.m.) on an annual basis using hourly illuminance grids on the horizontal work plane. sDA is calculated virtually through computational simulation with precise parameters. It references a local climate file to run hourly illuminance maps in the lighting software package.

2.0 Introduction

This impact assessment on residential amenity has been prepared as a response to the Clarification of Additional Information request from South Dublin County Council dated 12th August 2022, relating to a planning application for the proposed development at the junction of Grange Road, Nutgrove Avenue and Loreto Terrace, Rathfarnham, Dublin 14.

The additional information requests are as follows;

Additional Information Request Item 6-

Sunlight/Daylight.

The reconfigured units are provided with a variety of shapes and layouts. There is concern regarding some of the units, in terms of levels on sunlight and daylight. The applicant should supply a Sunlight and Daylight Analysis by way of additional information which should assess the scheme against the BS EN 17037 standard.

The units of concern are:

- Units 9, 22 and 35 are long, narrow, single-aspect studio units. There is concern that the 'no sky line' and internal light levels would not be adequate.*
- A number of single aspect units at ground level appear to be sited under an overhang at first floor. There is concern that the 'no sky line', vertical sky component, and internal light levels, would indicate insufficient lighting to habitable spaces. This applies to units 2, 3, 4, 5, 7, 8, 9, and 10.*
- Unit 26 is provided with opaque glazing along one side which would be ok, but for the subdivision of the living space and lack of any view from the only window serving the main living area. This is not considered to be an appropriate treatment for a habitable room. Unit 26, which is provided in place of permitted unit 211, should be reconfigured to maximise the unobstructed light to living areas.*

The clarification additional information requests are as follows;

Clarification of Additional Information Request Item 3-

- The 3D model referred to in the report is not shown, and it is not clear that balconies / overhangs have been taken into account in all assessments.

- Reference image 8 does not appear to back up the claim that each room assessed on the ground floor meets BRE requirements for a 'no sky line'; however no legend is provided with the image.

- The assessment submitted does not assess the development against the BS EN 17037 standard as it relates to internal light levels.

- ADF calculations are rounded to the nearest whole percentage, i.e. 1% or 2%. This allows for measures to be up to 50% short of the minimum target standard while still presenting as meeting the standard. More accurate figures should be provided.

The architects have redesigned many aspects of the scheme in keeping with the additional information and clarification of additional information request, and we consider the purpose of this report to be a response to:

1. Concerns over the daylight, sunlight and internal levels and quality of habitable space in units of concern as mentioned in additional information request mainly relating to the units sited to be under an overhang at first floor.
2. Provide evidence that the development is assessed against the BS EN 17037 standard.

The proposed building was modelled in software accredited for this purpose, according to a detailed methodology which is outlined below.

A proper reference standard of daylight and internal light levels for the spaces in question was determined after a review of the available international standards for lighting design, access to daylight and internal light levels.

The analysis was carried out, and the results compared to the required standard. Some improvements were made to the design to optimise access to daylight to improve internal light levels, and calculations were repeated, these results are listed below.

The general standard daylight was also assessed in the units of concern (units 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 21, 25, 26, 27, & 34) by calculation of daylight factors in all habitable rooms.

The overall standard of the scheme was found to be sufficient as detailed below.

3.0 Existing Site and Current Proposal

The subject site is located at the junction of Grange Road, Nutgrove Avenue and Loreto Terrace, Rathfarnham, Dublin 14 which measures 0.2638 ha. The site is surrounded by Grange Road to the west, Loreto Terrace to the south, Nutgrove Avenue to the north and Loreto to the East, the site has a frontage of 24m approximately along Nutgrove Avenue and approximately 48m along Loreto Terrace.

Loreto Terrace beyond the site provides access to a narrow cul-de-sac on the eastern side of the site and to the southwest by Loreto Terrace the carriageway ranges in widths from 7m close to its junction with Grange Road to 5.5m in the southern corner of the subject site. There is a 2m footpath which runs along the edge of the site.

The subject site does not accommodate any buildings or structures and comprises a level area of land under unkempt grass which is fenced off and unoccupied. The junction between Grange Road and Nutgrove Avenue is controlled by signals and there is also an area across the road which is open space. The site is surrounded by several bungalows with dormers and two storey dwellings.

The site is in a suitable, accessible location and of adequate size to accommodate a sustainable density of a residential development.



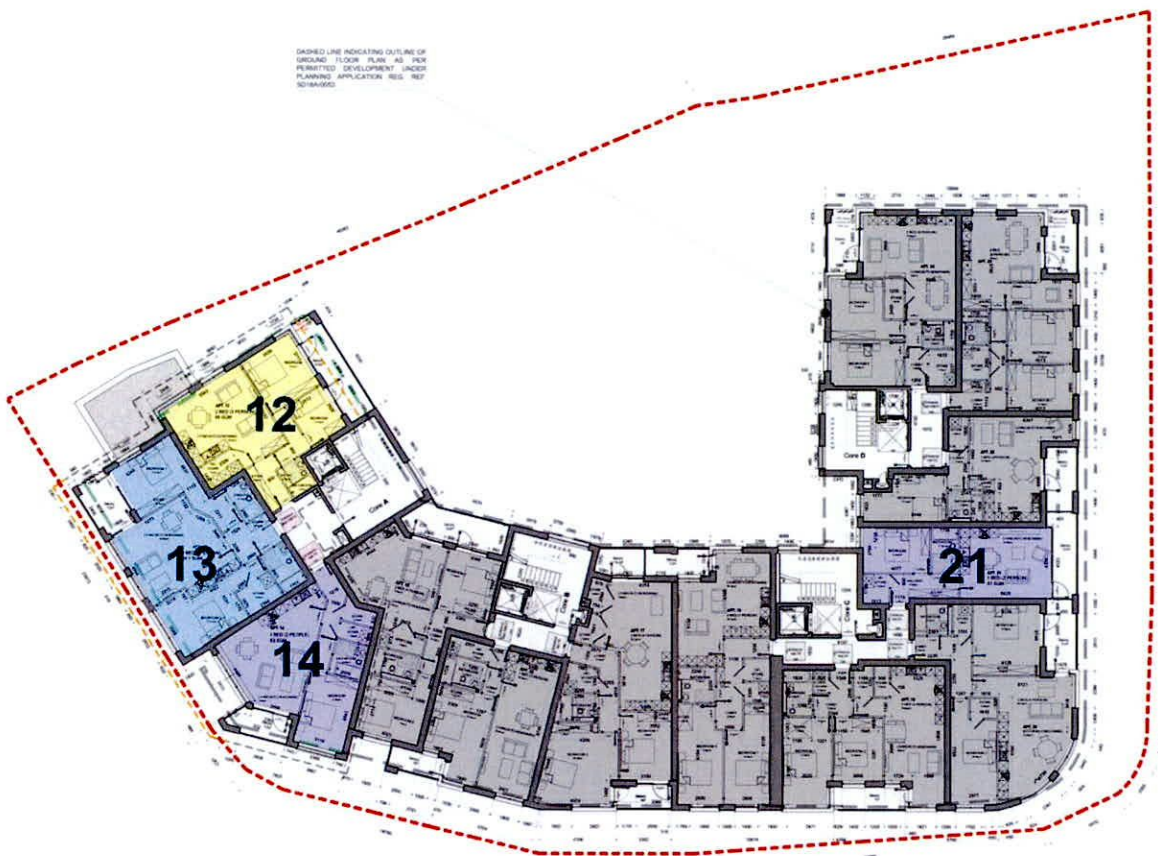
Reference Image 1: Satellite Map Extract

Site Boundary 



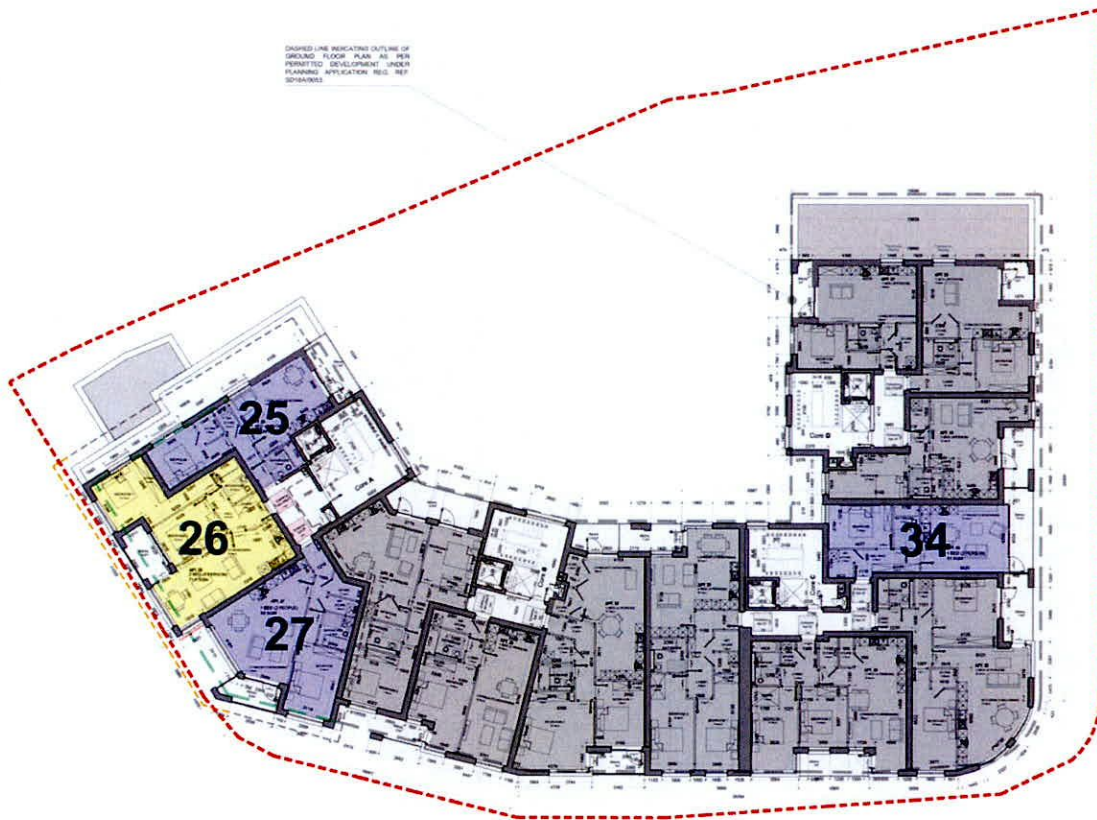
Reference Image 2: Ground Floor Plan showing the units of concern

Site Boundary



Reference Image 3: First Floor Plan showing the units of concern

Site Boundary



Reference Image 4: Second Floor Plan showing the units of concern

Site Boundary 

4.0 Assessment Methodology

4.1 Software Used for Analysis

The software used for this analysis was the 3D Sketch Up Model - Plug In: MBS Daylight and Extension: DL-Light for Sketch Up Version 5.1.0.7.

MBS Daylight:

The software requires 3D models of the proposed development. You can then perform window calculations to determine the Vertical Sky Component (VSC) and the Annual Probable Sunlight Hours (APSH). Additionally room calculations for Average Daylight Factor (ADF) as well as Daylight Distribution (also known as No Sky Line) can be calculated.

The results are delivered in both textural (Excel file) and graphical format, as Waldram Diagrams and as a quick visual pass/fail/nearly 'traffic light' system within the SketchUp® programme itself. Any modifications or cutbacks you make to the proposed design can then be quickly analysed again."

DL- Light:

"DL-Light is a suite of SketchUp extensions designed by De Luminae, to study natural light in SketchUp models. It can help architects, urban planners or energy professionals to estimate daylight ambiance in new or renovated buildings. It addresses various designer needs during the design process, and provide results adapted to current project level of definition.

All DL-Light tools use in background validated Radiance software for physically based simulations. Results provided by DL-Light tools have validated against test case projects and cross-checked with other shadow calculation tools.

All extensions can be used on the same SketchUp model.

De Luminae DL-Light tools provide the following tools:

- *SunExposure extension*
- *SkyViewFactor extension*
- *Watt extension*
- *Watt Reduction Factor extension*
- *Daylight Factor extension*
- *Calculation of BREEAM Daylight Factor requirements*
- *Daylight Factor (EN 17037) extension*
- *Daylight Autonomy extension*

- *Calculation of BREEAM Daylight requirements*
- *SEPP65 extension*
- *Vertical Sky Component (VSC) Extension*
- *Annual Probable Sun Hours (APSH) Extension*
- *No-sky Line Extension*
- *Sky Factor Extension*
- *Horizontal Sight Angle Extension*
- *Horizontal Sight Angle (EN 17037) Extension"*

4.2 Modelling – Sources of Information

Architect's Clarification of Further Information Drawings:

The AutoCAD format of the revised design by CDP Architecture was utilised.

1. The room geometries were modelled in keeping with the design provided within tolerance of roughly 25 mm.
2. The windows were modelled in keeping with the design provided, to a level of details appropriate for the needs of the analytical software.
3. Windows are considered daylight portals for analysis and windows of equal glazed area and location were included in the model, including translucent properties where indicated in the design.
4. Balustrades and privacy screens were shown in diagrammatic form, including translucent properties where indicated in the design.
5. All detail of building geometry not relevant for daylight and internal light level calculations was omitted.
6. The 3D representations shown in this report are provided to demonstrate the method used in our analysis. They are not intended to illustrate the visual appearance of the scheme, and should not be considered in any assessment of visual amenity or planning considerations other than the standard of natural light and internal light levels.

Third Party Topographical Survey:

A topographical survey was conducted by a professional third-party topographical survey company named Murphy Surveys, which provided accurate geometric information on the immediate architectural context.

Along with the survey, a detailed photographic survey was also conducted. We used this data to accurately show the heights and plan dimensions of nearby walls and roofs.

4.3 Determination of Relevant Design Standards

In order to prove the sufficiency of daylight in the units specifically mentioned in the further information and clarification of further information request, we conducted research into various design standards for daylight analysis to identify the correct “measure of success” for this scenario.

We would define the scenario as follows:

- A habitable space
- In a constrained design context
- Where the appearance of being predominantly lit by daylight cannot reasonably be achieved.

There are many sources of design guidance for daylight design, but few definitive legislative minimum standards, which can be referenced to determine adequacy of the rooms in the units of concern.

Specifically, there are few definitive standards relating to internal light levels in bedrooms.

In a recent article, Prof. DTG Strong, B.Sc. (Hons), D. Phil. (Oxon.), C. Eng. FCIBSE, FEI of the UK’s Building Research Establishment provided the following summary of the practice of controlling daylight standards through legislation in various jurisdictions:

Legislative requirements ensuring adequate daylight provision in new buildings

Building Code (or Building Regulation) requirements associated with ensuring adequate daylight have been introduced in New Zealand (habitable spaces only), Portugal, Germany, Sweden, Australia (for ventilation), France, China, Singapore and Belgium (dwellings only).

In countries with Building Code requirements associated with daylight, they are generally based on Average Daylight Factor and/or minimum window sizes as a % of floor area (and/or wall area).

There are no minimum legal requirements associated with daylight in Switzerland, Denmark, Ireland, UK, USA and South Africa.

However, it is important to note that most countries have (as a minimum) informative codes and standards requiring “sufficient” daylight or illumination, but with mandatory levels not being satisfied.

International daylight standards:

The most widely referenced standards related to daylight and internal light levels are:

ISO8995:2022 Lighting of Indoor Work Places

4.7 Daylight

EN 12464-1:2002 Light and Lighting – Light of Work Places -Part 1: Indoor Places

4.9 Energy

4.10 Daylight

BS 8206-2 Light for Buildings. Part 2: Code of Practice for Daylighting

The existing daylight standards are informative and are not intended to be applied in a prescriptive manner. For this reason, although being referenced in many national building codes/regulations, the standards are generally used to provide guidance regarding best practice rather than being used for compliance reinforcement.

Environmental Rating Systems for Buildings

The survey identified the increasingly important role (and function) of building environmental rating systems (such as BREEAM, LEED, Greenstar, Greenmark, etc) in establishing and assessing daylight requirements in buildings. In countries where there are no building codes requirements associated with daylight, environmental rating systems are increasingly being adopted as the basis of providing de-facto standards.

All the major environmental assessment schemes award credits for daylight. With the exception of special provisions within LEED (see below) credits are generally based on DF (and/or window size as a % of floor area)”

We reviewed the sources mentioned above.

The British implementation of this standard (BS EN 17037) includes a “National Annex” with requirements for dwellings that mean it is comparable with the previous standard (BS8206). In Ireland, there is only IS EN 17037:2018. Unlike the British Standard (BS EN 17037), the Irish implementation does not contain a National Annex. The ‘Sustainable Urban Housing: Design Standards for New Apartments’ the ‘Urban Development and Building Heights Guidelines for Planning Authorities” do not mention, address or require compliance with the European Standard or the Irish implementation.

As a consequence of this, we have carried out a comprehensive daylighting analysis using both standards, providing daylighting results in terms of Average Daylight Factor (based on previous British Standard - BS 8206-2), Daylight Factor (based on current European Standard - EN 17037) and Spatial Daylight Autonomy based on the National Annex within the British implementation of the European Standard (BS EN 17037). The sunlight component of this assessment has been carried out in accordance with existing BRE guidance (BR209).

It is important that the guidelines that exist in relation to daylight and sunlight are read in the correct context and are not viewed as mandatory requirements. Requirements for daylight should be balanced against other elements of the design such as thermal performance (which is directly impacted by the size, shape and location of glazing) and the risk of overheating due to excessive glazing areas. This approach will ensure an optimal overall solution is reached for the development.

4.4 Average Daylight Factor (ADF)

The method of calculation selected for the daylight analysis for this development is the Average Daylight Factor (ADF). This is the most detailed and thus most accurate method which considers not only the amount of sky visible from the vertical face of the window, but also the window size, room size and room use. The Average Daylight Factor (ADF) is a ratio between indoor illuminance and outdoor illuminance expressed as a percentage. In dwellings, the following figures should be used to assess if there is a good level of natural light in a space.

- Bedrooms = 1% ADF
- Living / Kitchen / Dining = 2% ADF

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** (unobstructed sky) and the quantum of reflected light off external surfaces.

ADF can be calculated using the following formula:

$$\text{ADF} = \frac{T \cdot M \cdot A_w \cdot \cos^2 \theta}{A \cdot (1 - R)}$$

Where: T= diffuse visible transmittance of the glazing, including corrections. For clean, clear double glazing with a low E coating a value of 0.68 can be used. As per BRE 209.

M= is the maintenance factor of the glass, allowing for the effects of dirt. BS8206-2:2008 section A1.3 recommends a value of 0.9 for vertical glazing in an urban location.

A_w= is the net glazed area of the windows, in m² . I have assumed 15% mullions.

θ= is the angle of visible sky in degrees. It should be measured half way up the window. A= is the total area of the room surfaces: ceiling, floor, walls and windows, in m² .

R= is the average reflectance of a room. For a fairly light-coloured room a value of 0.5 can be used.

It is important to note that Vertical Sky Component Analysis was not used as part of the analysis as a more detailed Average Daylight Factor has been undertaken. The VSC is a simple geometrical calculation which provides an early indication of the potential for daylight entering the space. However, it does not assess or quantify the actual daylight levels inside the rooms.

4.5 No Sky Line

This method assesses the change in position of the No Sky Line between the existing and proposed situations. Sky factor is a room based assessment that looks at how much of the sky any particular point in the room can see. The working plane represents a level of usual activities e.g. working at a desk, eating dinner, cooking food and the aim is that the no-skyline (the line behind which no skylight is received) excludes those spaces. It does take into account the number and size of windows to a room, but still does not give any qualitative or quantitative assessment of the light in the room, only where sky can or cannot be seen.

There will be a good distribution of light in the room if at least 80% of the working plane receives direct skylight.

The above assessments have been carried out using computer-based methods. Three-dimensional computer models of the existing site, the existing buildings, and the proposed development have all been generated and simulated under appropriate sky conditions in order to obtain accurate predictions.

It is important to note that whilst the methods presented in the BRE guide provide designers and planners with a clear and objective way of assessing the sunlight and daylight levels associated with a new development, the particular performance targets which are included in the guide are intended to be used with a degree of discretion and flexibility. Within the introductory section 1.6 of the BRE guide the following advice is provided:

“The advice given here is not mandatory and this guide should not be seen as an instrument of planning policy; Its aim is to help rather than constrain the designer.”

4.6 Daylight Factor Using EN 17037

The new standard, EN17037, recommends using daylight illuminance testing; requiring that a room obtains certain lux levels over 50% and 95% of the space for 50% of daylight hours. Minimum, medium and high levels are recommended as a means by which to judge the performance of a room. The recommendations are as follows:

- Minimum – 300 lux exceeded over 50% of the space (median illuminance) and 100 lux exceeded over 95% of the space (minimum illuminance), for 50% of daylight hours
- Medium – 500 lux for median and 300 for minimum for 50% of daylight hours
- High – 750 lux for median and 500 lux for minimum for 50% daylight hours

4.7 Spatial Daylight Autonomy (sDA) Using BS EN 17037:2018

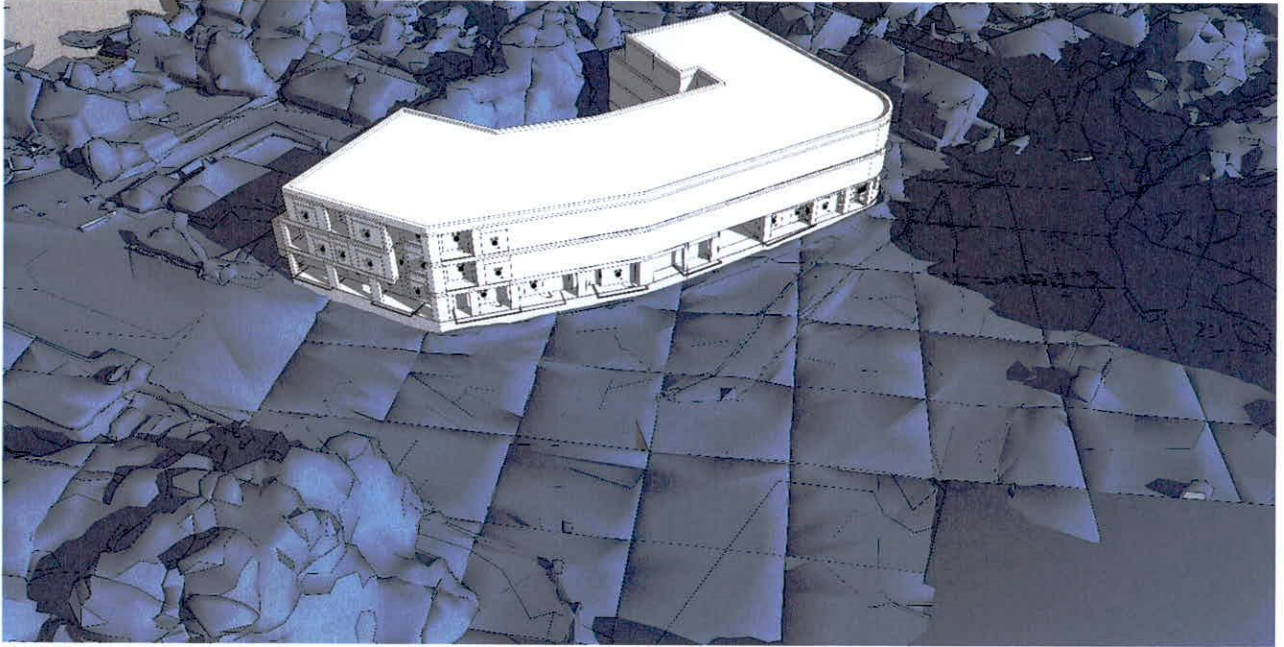
The spaces were also assessed for spatial daylight autonomy using the British National Annex illuminance targets shown below. This BS EN standard includes a national annex which provides adjusted illuminance targets for each room type as shown in Table NA.1 — Values of target illuminance for room types in UK dwellings, the minimum target daylight provisions for bedrooms and kitchen/living spaces are:

- Kitchen/Living - 200 Lux achieved over at least 50% of the reference plane (0.85m) and
- Bedrooms - 100 Lux achieved over at least 50% of the reference plane (0.85m)

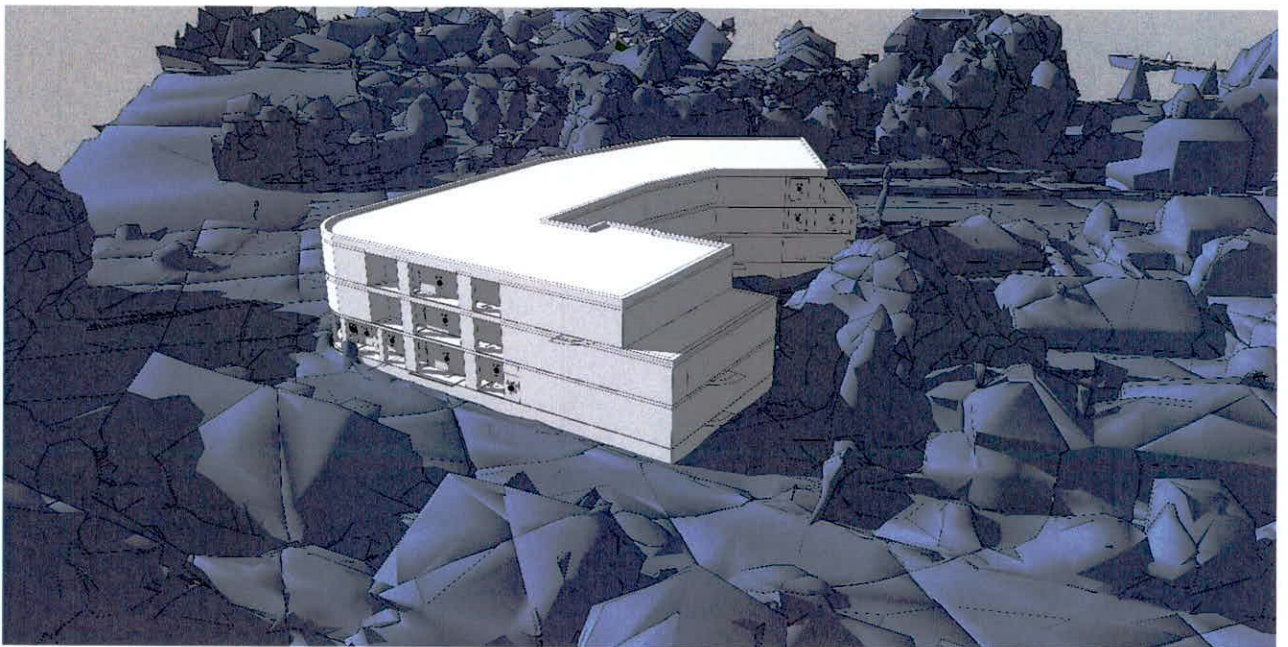
Table NA.1 — Values of target illuminance for room types in UK dwellings

Room type	Target illuminance E_T (lx)
Bedroom	100
Living room	150
Kitchen	200

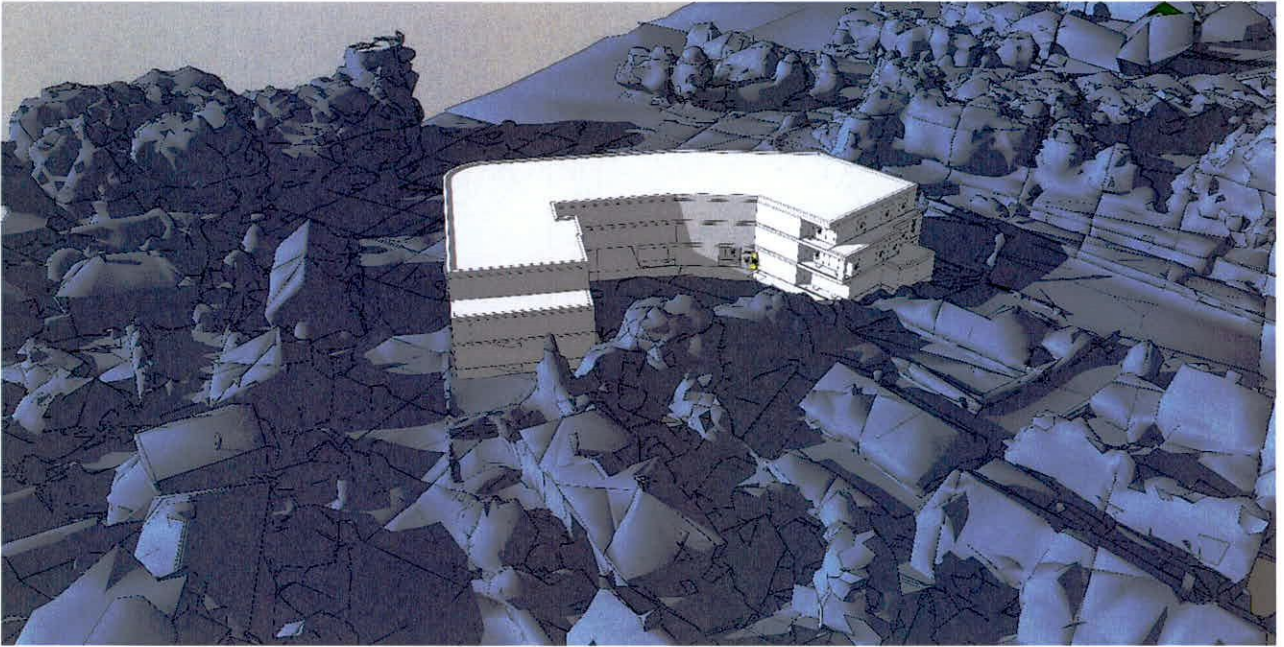
5.0 Simulation Model Images



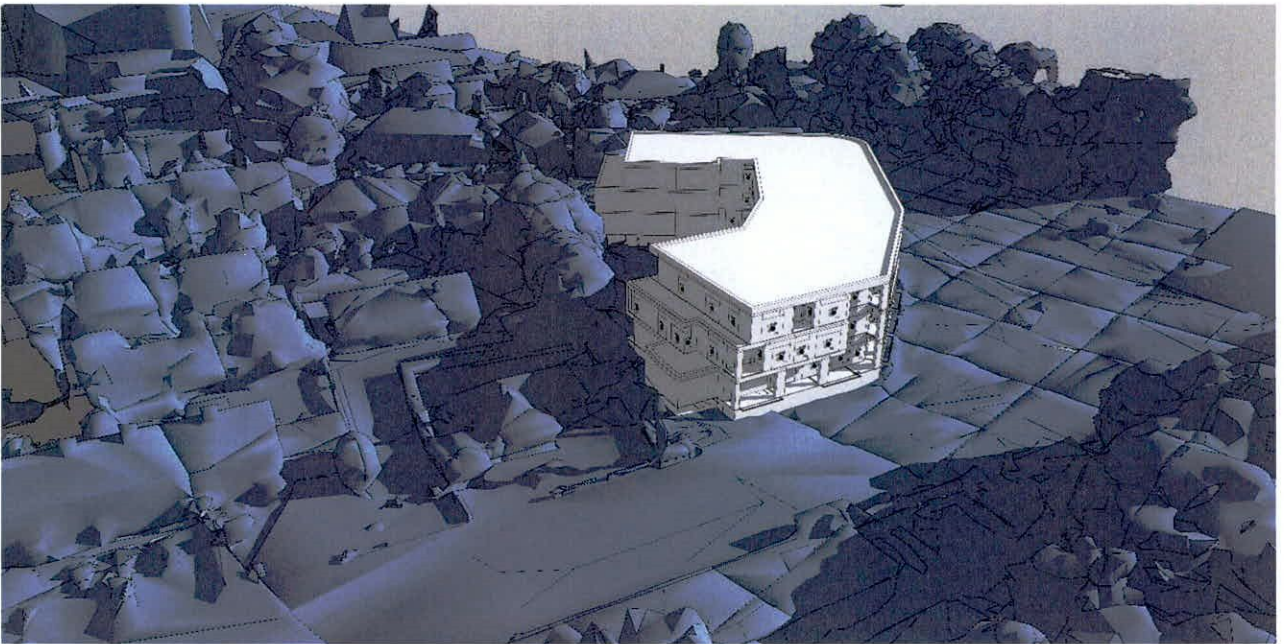
Reference Image 5: North-West View



Reference Image 6: South-West Elevation View



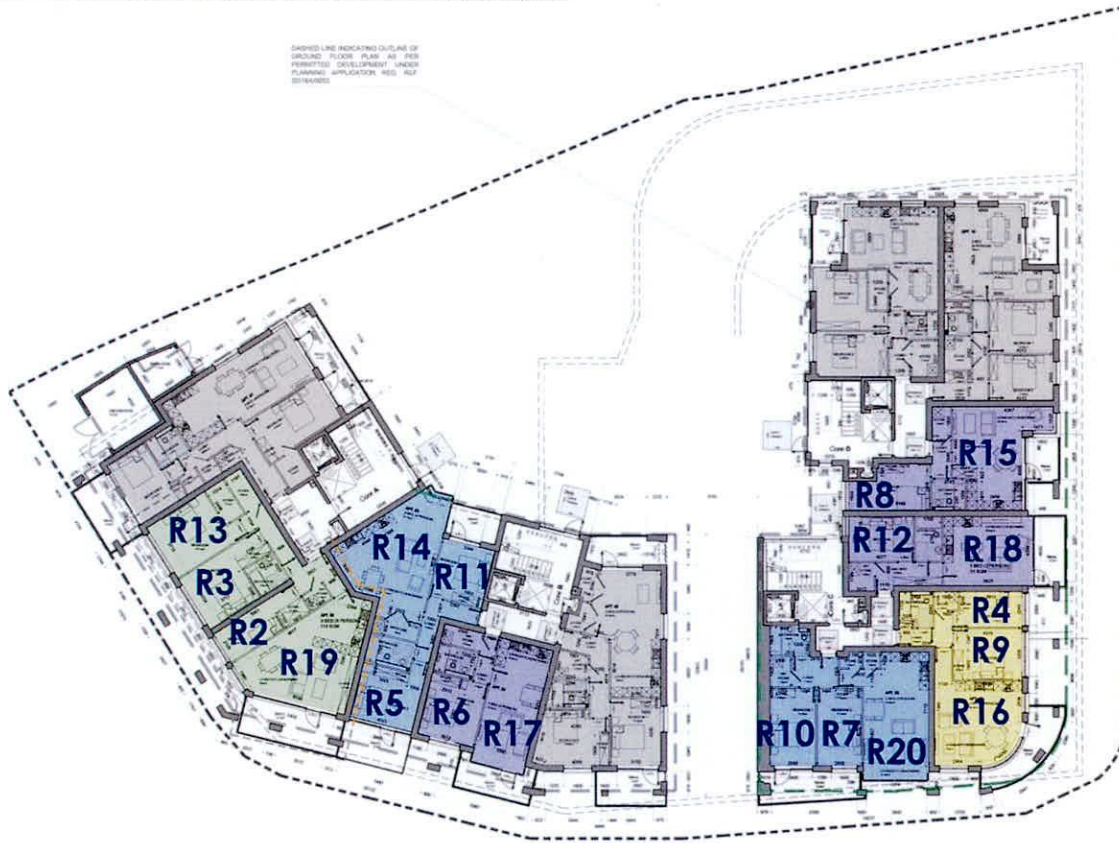
Reference Image 7: South- East Elevation View



Reference Image 8: North- East Elevation View

6.0 Assessment Results

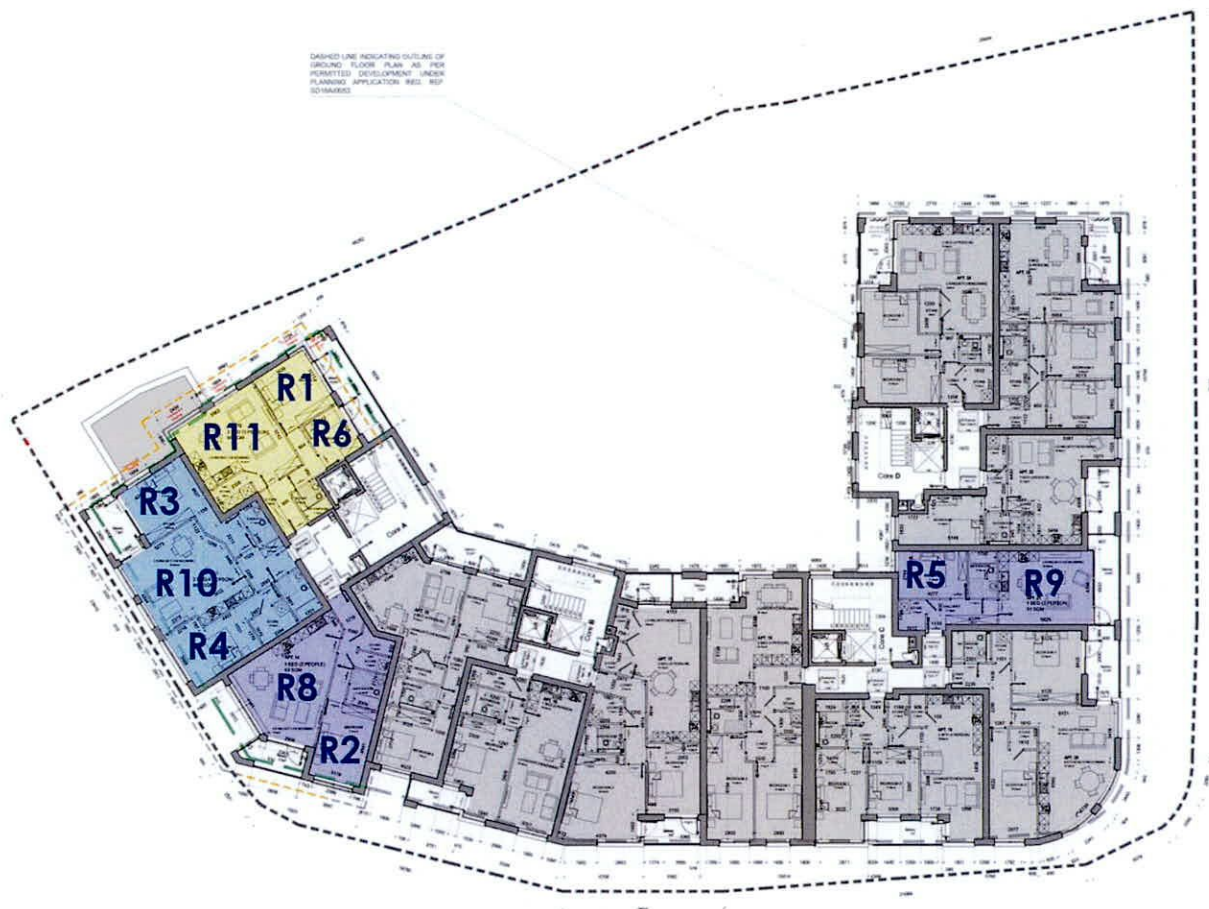
6.1 Average Daylight Factor (ADF) Analysis



Reference Image 9: Ground Floor Level Assessed Rooms

Floor Name	Unit No.	Unit Type	Room Name	Room Use	ADF Pr	Required Val
Ground Floor	2	3 Bed Apt	R13	Bedroom	1.069563	1
			R3	Bedroom	1.11751	1
			R2	Bedroom	1.830811	1
			R19	LKD	2.341394	2
	3	2 Bed Apt	R5	Bedroom	1.179291	1
			R11	Bedroom	1.100464	1
			R14	LKD	2.141752	2
	4	1 Bed Apt	R6	Bedroom	1.1365	1
			R17	LKD	2.234502	2
	6	2 Bed Apt	R10	Bedroom	1.797347	1
			R7	Bedroom	1.220512	1
			R20	LKD	2.445859	2
	7	2 Bed Apt	R4	Bedroom	1.155533	1
			R9	Bedroom	1.758372	1
			R16	LKD	3.403651	2
	8	1 Bed Apt	R12	Bedroom	1.455577	1
			R18	LKD	2.658785	2
	9	1 Bed Apt	R8	Bedroom	1.758372	1
R15			LKD	2.987794	2	

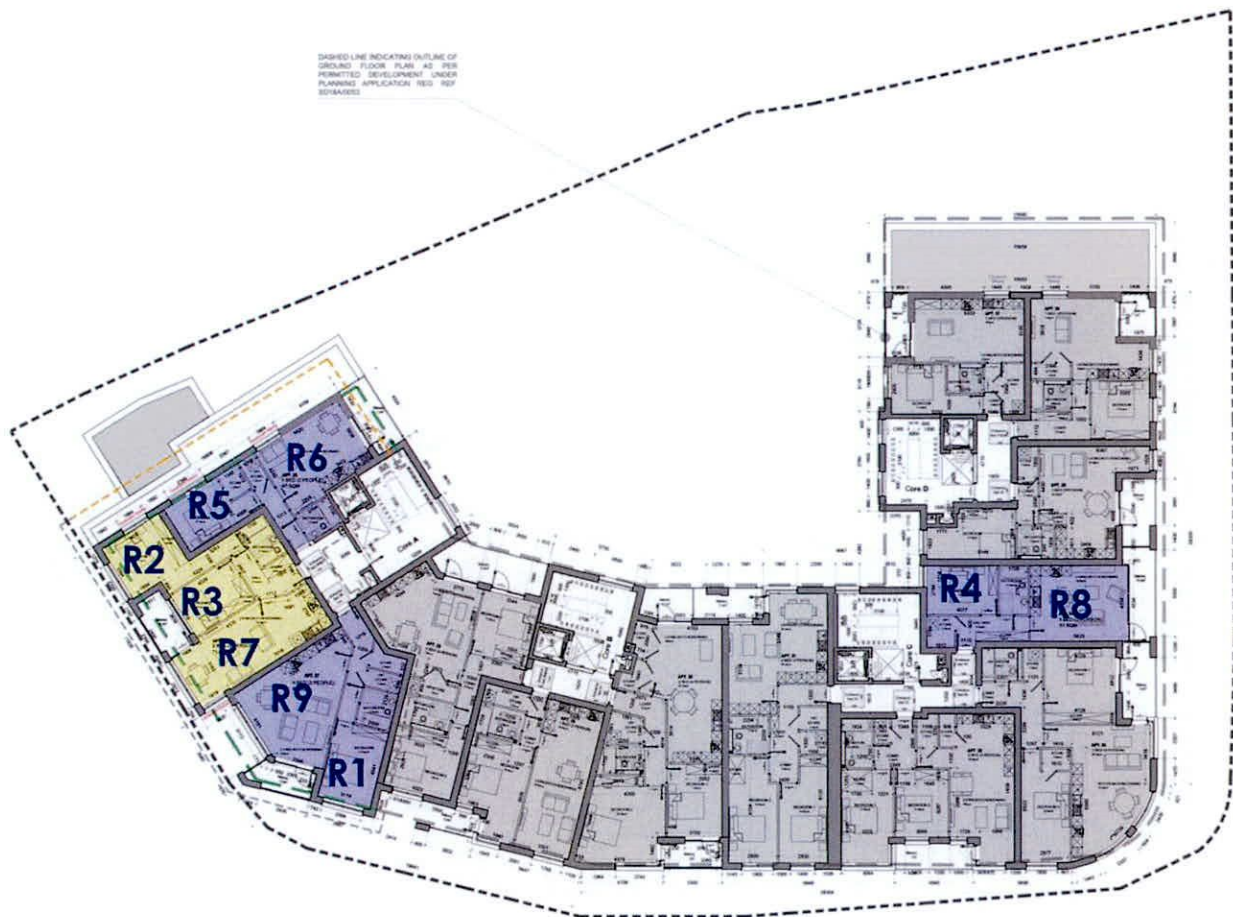
Table 1: ADF Results - Ground Floor Assessed Rooms



Reference Image 10: First Floor Level Assessed Rooms

Floor Name	Unit No.	Unit Type	Room Name	Room Use	ADF Pr	Required Val
First Floor	12	2 Bed Apt	R1	Bedroom	4.133764	1
			R6	Bedroom	2.076059	1
			R11	LKD	3.103473	2
	13	2 Bed Apt	R3	Bedroom	2.37595	1
			R4	Bedroom	2.944459	1
			R10	LKD	2.850838	2
	14	1 Bed Apt	R2	Bedroom	2.962401	1
			R8	LKD	2.544523	2
	21	1 Bed Apt	R5	Bedroom	1.01331	1
			R9	LKD	2.101277	2

Table 2: ADF Results – First Floor Assessed Rooms



Reference Image11: Second Floor Level Assessed Rooms

Floor Name	Unit No.	Unit Type	Room Name	Room Use	ADF Pr	Required Val
Second Floor	25	1 Bed Apt	R5	Bedroom	3.725326	1
			R6	LKD	1.01331	2
	26	2 Bed Apt	R2	Bedroom	2.962401	1
			R3	Bedroom	2.37595	1
			R7	LKD	2.076059	2
	27	1 Bed Apt	R1	Bedroom	4.133764	1
			R9	LKD	2.101277	2
	34	1 Bed Apt	R4	Bedroom	2.944459	1
		R8	LKD	2.544523	2	

Table 3: ADF Results – Second Floor Assessed Rooms

6.2 No Sky Line (NSL) Analysis



Reference Image 12: Ground Floor – No Sky Line (NSL) Analysis

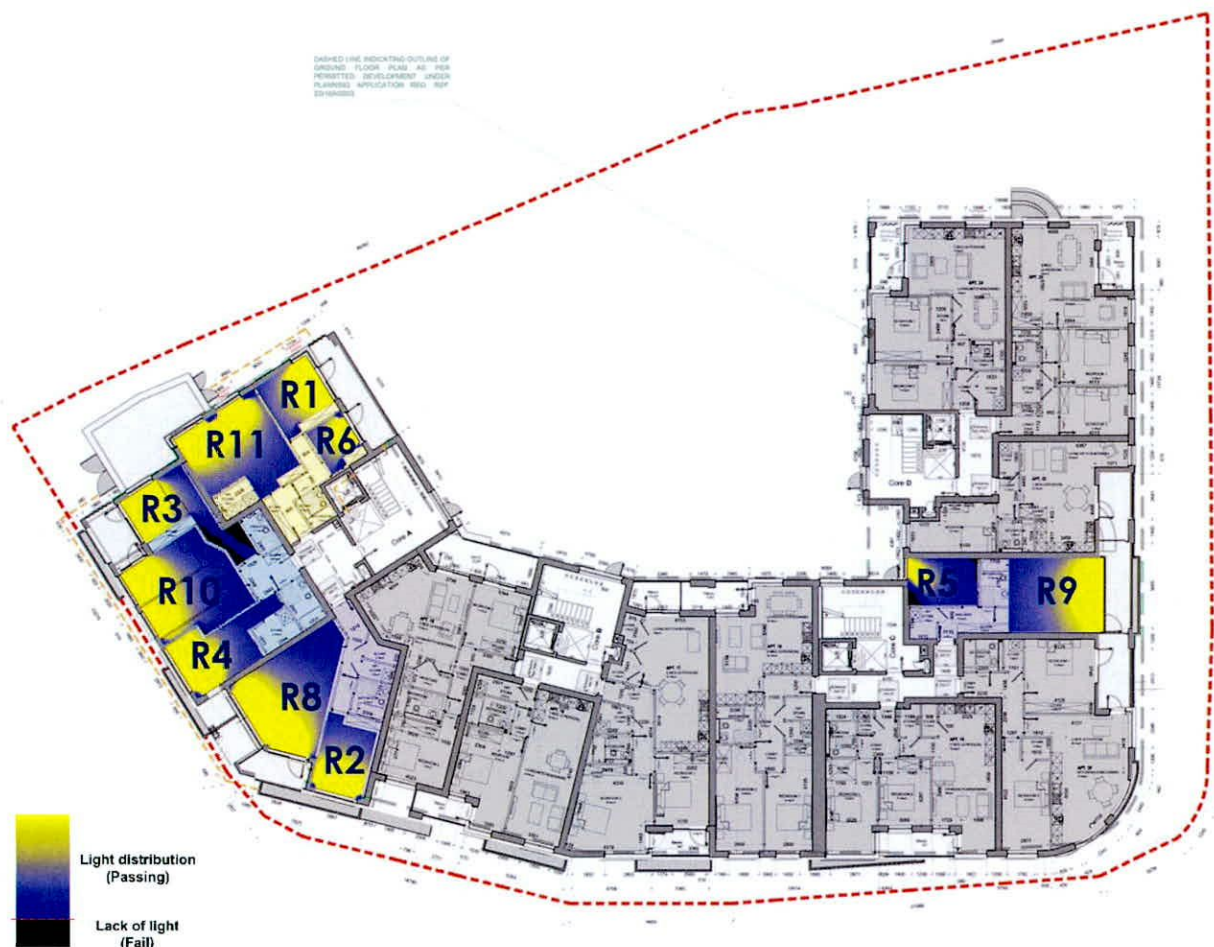
Site Boundary

Please see reference image 12 and table 4.

The assessed rooms which are part of the units of concerns as mentioned in Additional Information request, located at ground floor level under an overhang have been carefully assessed for 'no sky line' and all habitable rooms meet the minimum BRE requirements i.e., more than 80% of the working plane in the habitable rooms receives direct skylight.

Floor Name	Unit No.	Unit Type	Room Name	Room Use	Room Area (m ²)	Lit Area Pr	Proposed %
Ground Floor	2	3 Bed Apt	R13	Bedroom	19.614137	19.533422	99.59%
			R3	Bedroom	15.886145	15.585339	98.11%
			R2	Bedroom	10.329661	10.154354	98.30%
			R19	LKD	38.084348	30.449925	79.95%
	3	2 Bed Apt	R5	Bedroom	12.692789	12.007215	94.60%
			R11	Bedroom	11.302697	10.827354	95.79%
			R14	LKD	33.431254	33.40594	99.92%
	4	1 Bed Apt	R6	Bedroom	12.930959	12.753059	98.62%
			R17	LKD	23.886992	23.886992	100.00%
	6	2 Bed Apt	R10	Bedroom	12.852561	12.829034	99.82%
			R7	Bedroom	12.548613	12.425904	99.02%
			R20	LKD	29.573408	28.146989	95.18%
	7	2 Bed Apt	R4	Bedroom	9.08204	9.077316	99.95%
			R9	Bedroom	12.608271	12.593645	99.88%
			R16	LKD	29.81451	29.81451	100.00%
	8	1 Bed Apt	R12	Bedroom	10.513533	9.796726	93.18%
			R18	LKD	24.356806	24.356323	100.00%
9	1 Bed Apt	R8	Bedroom	12.234666	10.52179	86.00%	
		R15	LKD	28.486744	28.48674	100.00%	

Table 4: Ground Floor - No Sky Line (NSL) Analysis



Reference Image 13: First Floor – No Sky Line (NSL) Analysis

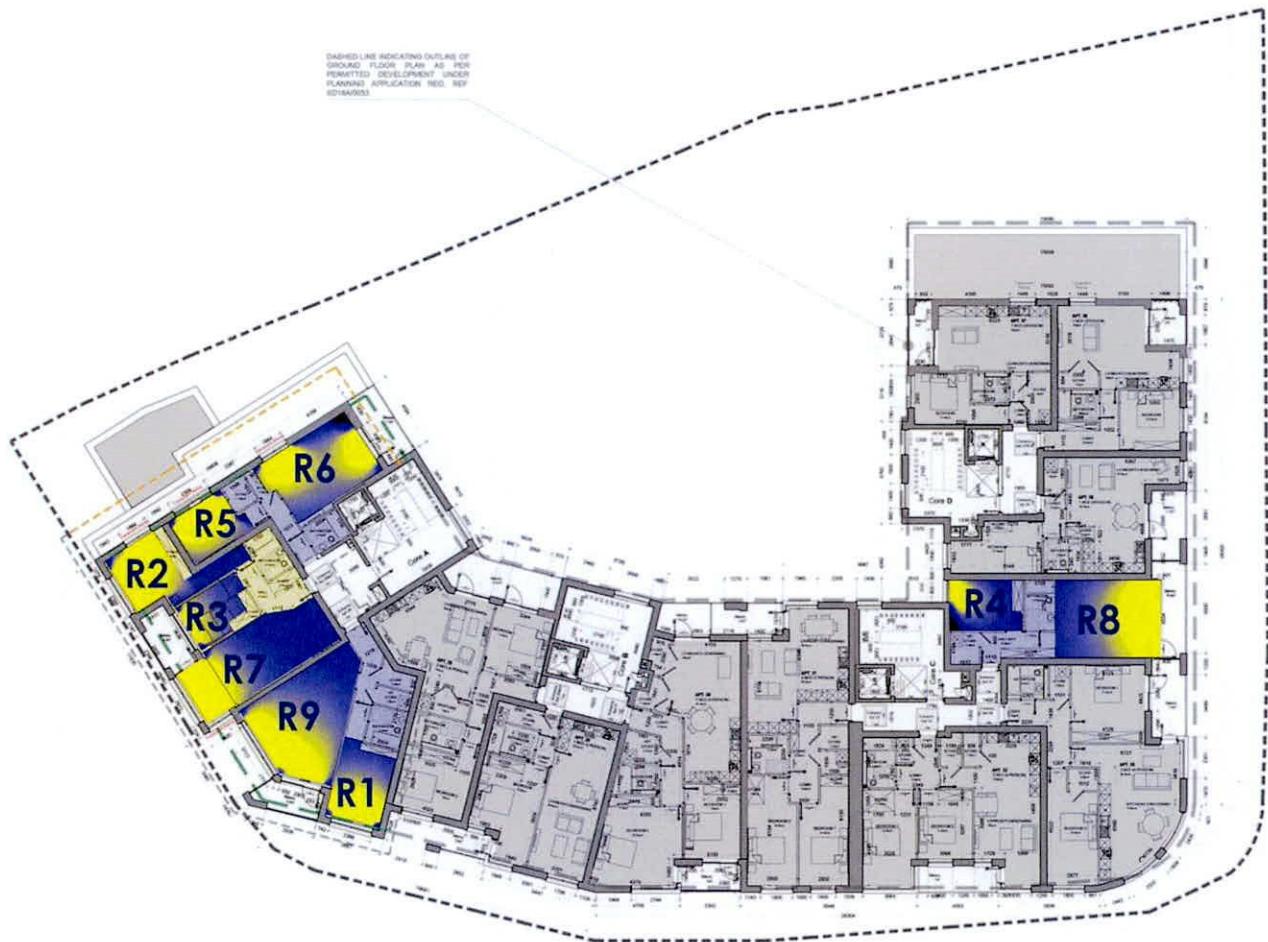
Site Boundary

Please see reference image 13 and table 5.

The modified units as per the clarification of additional information request located at first floor level have been carefully assessed for 'no sky line' and all habitable rooms meet the minimum BRE requirements i.e., more than 80% of the working plane in the habitable rooms receives direct skylight.

Floor Name	Unit No.	Unit Type	Room Name	Room Use	Room Area (m ²)	Lit Area Pr	Proposed %
First Floor	12	2 Bed Apt	R1	Bedroom	11.790575	11.739333	99.57%
			R6	Bedroom	6.417501	6.313111	98.37%
			R11	LKD	27.021571	26.926104	99.65%
	13	2 Bed Apt	R3	Bedroom	17.887086	15.362775	85.89%
			R4	Bedroom	17.30774	17.295427	99.93%
			R10	LKD	30.795831	30.768067	99.91%
	14	1 Bed Apt	R2	Bedroom	13.045397	13.029244	99.88%
			R8	LKD	30.974772	30.967	99.97%
	21	1 Bed Apt	R5	Bedroom	10.573659	9.806313	92.74%
			R9	LKD	24.368386	24.368386	100.00%

Table 5: First Floor - No Sky Line (NSL) Analysis



Reference Image 14: Second Floor – No Sky Line (NSL) Analysis

Please see reference image 14 and table 6.

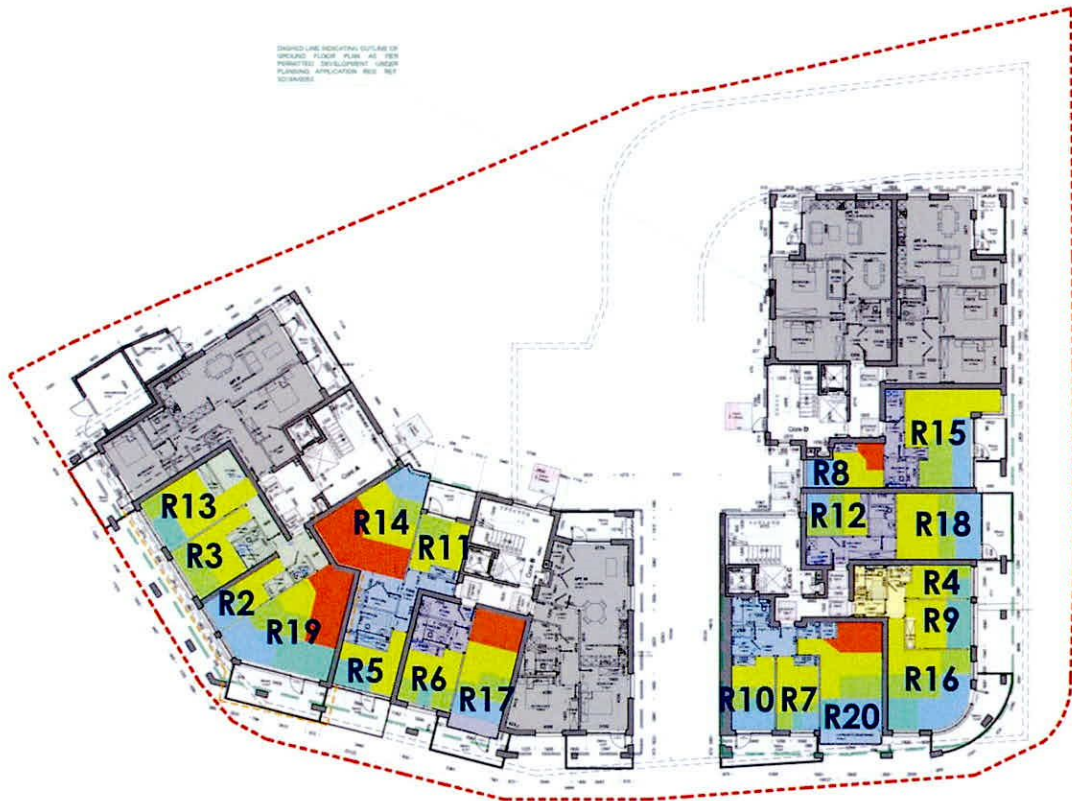
The modified units as per the clarification of additional information request located at second floor level have been carefully assessed for 'no sky line' and all habitable rooms meet the minimum BRE requirements i.e., more than 80% of the working plane in the habitable rooms receives direct skylight.

Floor Name	Unit No.	Unit Type	Room Name	Room Use	Room Area (m ²)	Lit Area Pr	Proposed %
Second Floor	25	1 Bed Apt	R5	Bedroom	10.629037	10.520743	98.98%
			R6	LKD	23.115908	22.566033	97.62%
	26	2 Bed Apt	R2	Bedroom	16.093051	15.98078	99.30%
			R3	Bedroom	9.479107	9.444138	99.63%
			R7	LKD	29.243186	29.225623	99.94%
	27	1 Bed Apt	R1	Bedroom	13.068031	13.041066	99.79%
			R9	LKD	31.029408	31.022152	99.98%
	34	1 Bed Apt	R4	Bedroom	10.568472	10.162484	96.16%
			R8	LKD	25.811273	25.811273	100.00%

Table 6: Second Floor - No Sky Line (NSL) Analysis

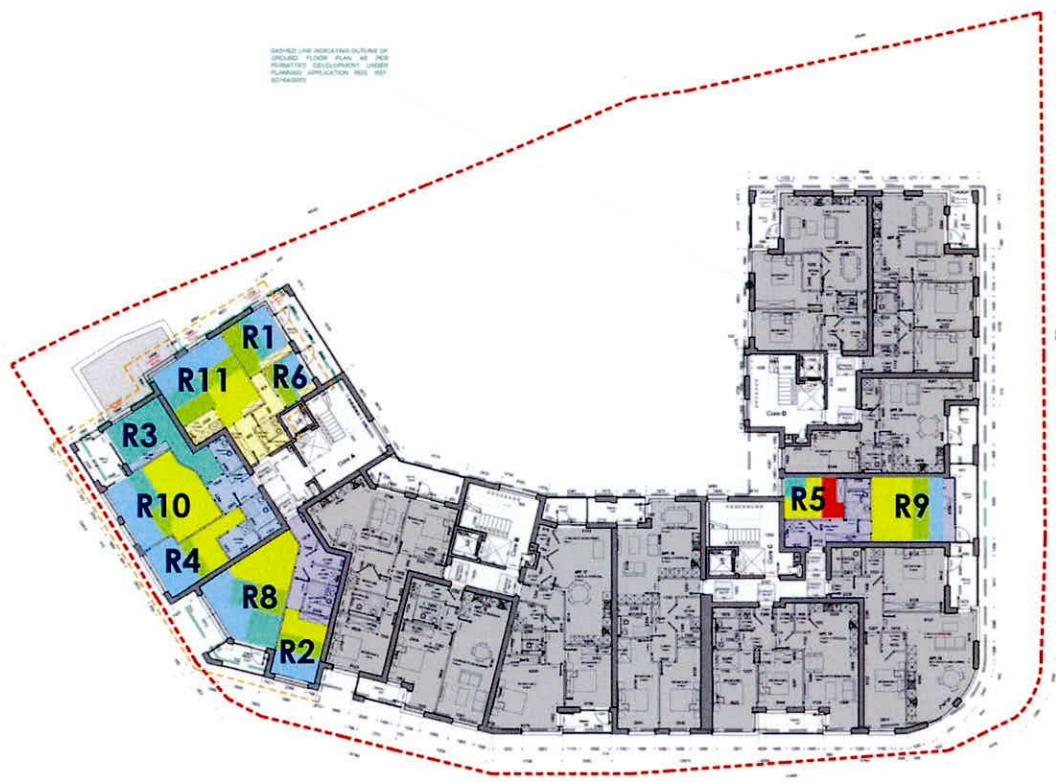
6.3 Daylight Factor Analysis

Daylight Factor (EN 17037) (synthesis)



Reference Image 15: Ground Floor – Daylight Factor Analysis

Daylight Factor (EN 17037) (synthesis)



Reference Image 16: First Floor – Daylight Factor Analysis

Daylight Factor (EN 17037) (synthesis)



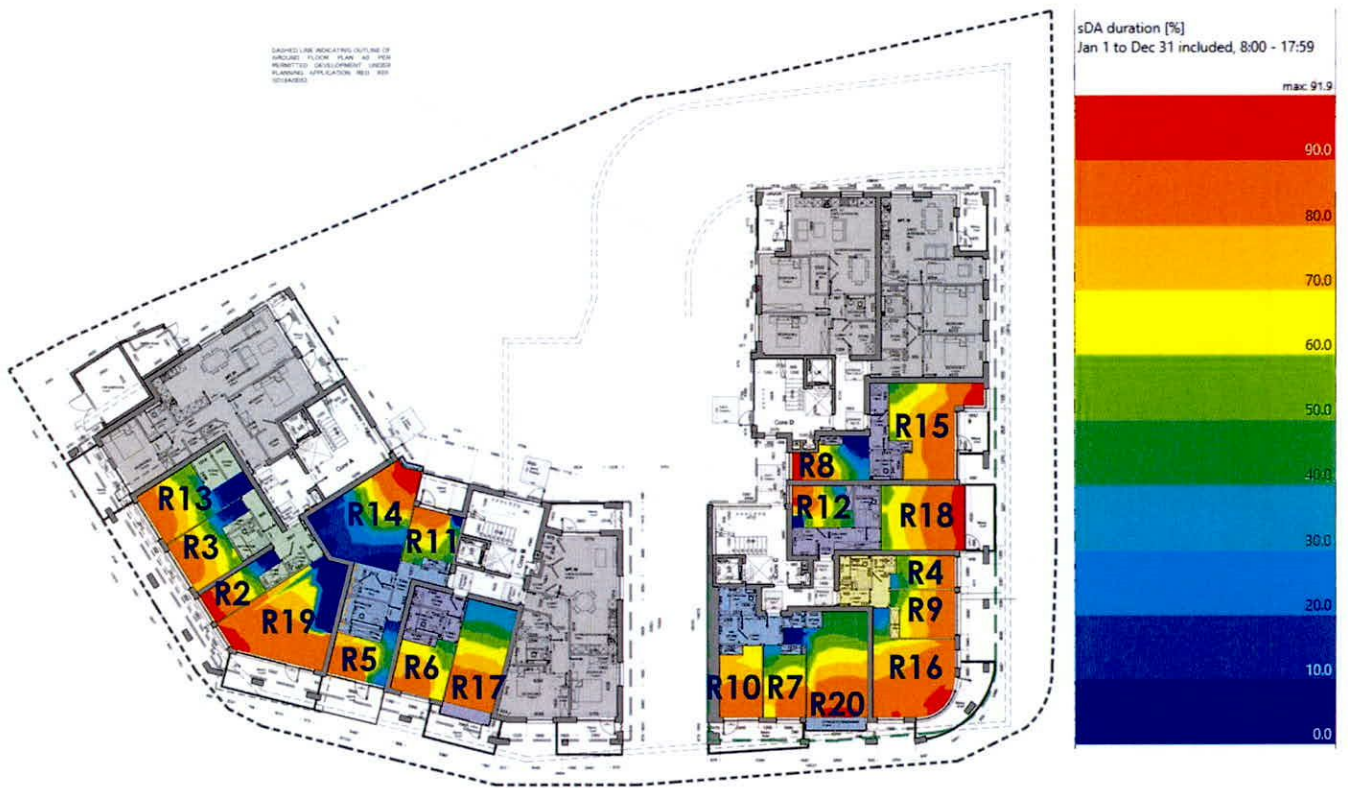
Reference Image 17: Second Floor – Daylight Factor Analysis

Please see reference images 15, 16 and 17. The Daylight Factor analysis assessed the selected units for daylight illuminance achieved by the rooms over 50 % of the daylight hours.

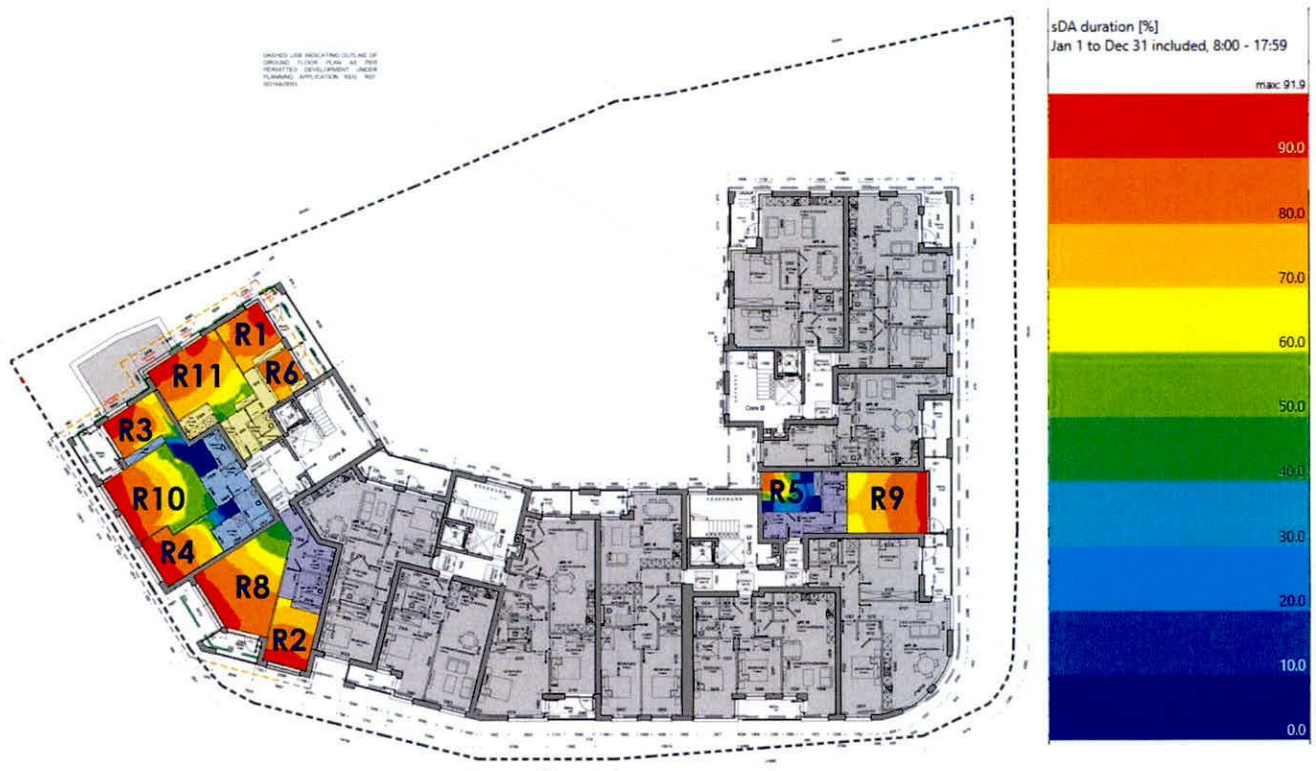
The analysis shows that the assessed rooms achieve a minimum of 300 lux over 50% of the space and over 100x over 95% of the space.

- Minimum – 300 lux exceeded over 50% of the space (median illuminance) and 100 lux exceeded over 95% of the space (minimum illuminance), for 50% of daylight hours
- Medium – 500 lux for median and 300 for minimum for 50% of daylight hours
- High – 750 lux for median and 500 lux for minimum for 50% daylight hours

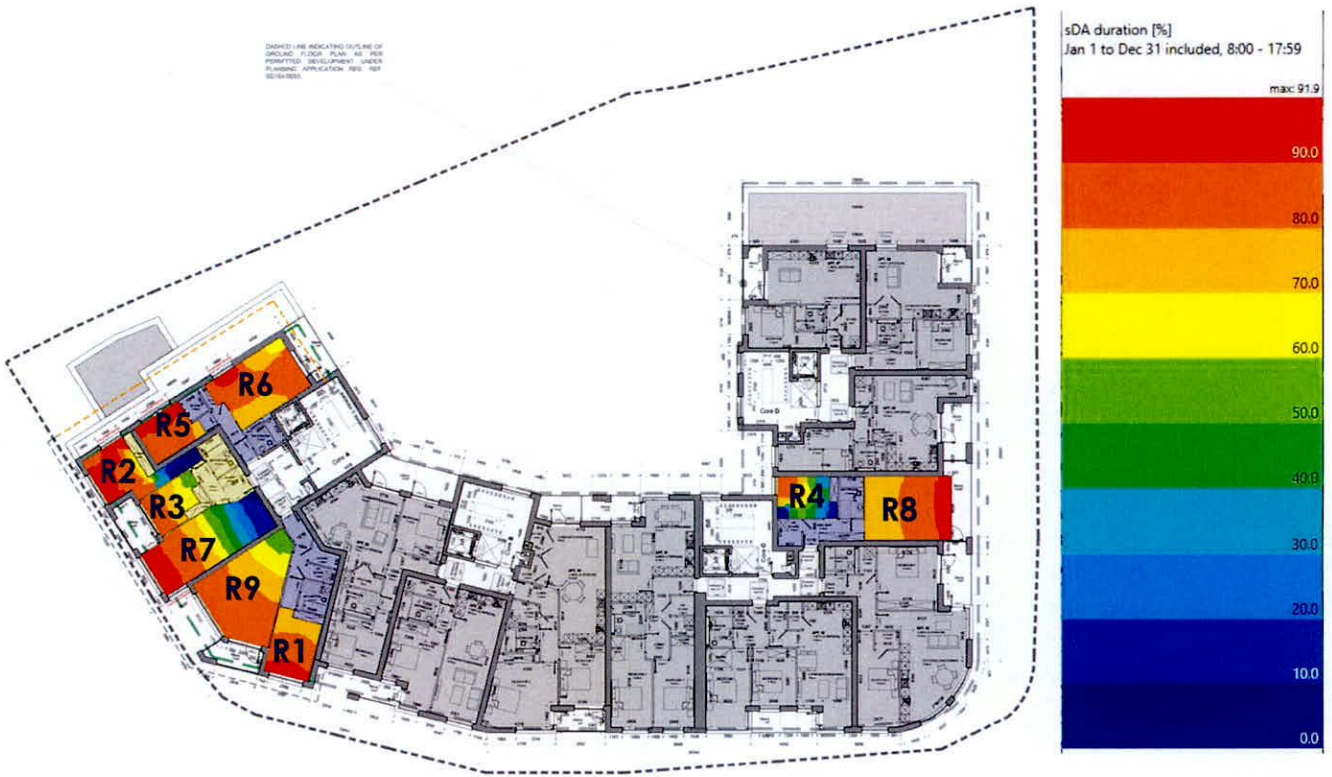
6.4 Spatial Daylight Autonomy (sDA) Analysis



Reference Image 18: Ground Floor – Spatial Daylight Autonomy Analysis



Reference Image 19: First Floor – Spatial Daylight Autonomy Analysis



Reference Image 20: Second Floor – Spatial Daylight Autonomy Analysis

6.5 Average Illuminance Analysis

Floor Name	Unit No.	Unit Type	Room Name	Room Use	Room Area (m ²)	Average LX
Ground Floor	2	3 Bed Apt	R13	Bedroom	19.614137	303.96
			R3	Bedroom	15.886145	326.31
			R2	Bedroom	10.329661	573.65
			R19	LKD	38.084348	405.28
	3	2 Bed Apt	R5	Bedroom	12.692789	329.29
			R11	Bedroom	11.302697	278.63
			R14	LKD	33.431254	357.6
	4	1 Bed Apt	R6	Bedroom	12.930959	311.41
			R17	LKD	23.886992	299.49
	6	2 Bed Apt	R10	Bedroom	12.852561	476.8
			R7	Bedroom	12.548613	479.78
			R20	LKD	29.573408	327.8
	7	2 Bed Apt	R4	Bedroom	9.08204	268.2
			R9	Bedroom	12.608271	411.24
			R16	LKD	29.81451	603.45
8	1 Bed Apt	R12	Bedroom	10.513533	391.87	
		R18	LKD	24.356806	497.66	
9	1 Bed Apt	R8	Bedroom	12.234666	560.24	
		R15	LKD	28.486744	414.22	
First Floor	12	2 Bed Apt	R1	Bedroom	11.790575	838.87
			R6	Bedroom	6.417501	588.55
			R11	LKD	27.021571	593.02
	13	2 Bed Apt	R3	Bedroom	17.887086	625.8
			R4	Bedroom	17.30774	889.53
			R10	LKD	30.795831	508.09
	14	1 Bed Apt	R2	Bedroom	13.045397	655.6
			R8	LKD	30.974772	560.24
21	1 Bed Apt	R5	Bedroom	10.573659	238.4	
		R9	LKD	24.368386	479.78	
Second Floor	25	1 Bed Apt	R5	Bedroom	10.629037	972.97
			R6	LKD	23.115908	482.76
	26	2 Bed Apt	R2	Bedroom	16.093051	1412.52
			R3	Bedroom	9.479107	224.99
			R7	LKD	29.243186	479.78
	27	1 Bed Apt	R1	Bedroom	13.068031	628.78
			R9	LKD	31.029408	394.85
34	1 Bed Apt	R4	Bedroom	10.568472	262.24	
		R8	LKD	25.811273	539.38	

*lx for an outdoor overcast illuminance 14, 900lux

Table 7: Daylighting Illuminance Analysis

The table above (table 7) shows that the average illuminance values for all bedrooms rooms significantly exceeds 100 lux and 200 lux for living/kitchen/dining (required for only half of the reference points) according to table NA2 of BS EN 17037:2018.

7.0 Assessment Summary

7.1 Average Daylight Factor (ADF) Analysis Summary

The calculated ADF results for the assessed units/rooms are summarised below:

% of Bedroom with an ADF \geq 1.00	% of Living/Kitchen with an ADF \geq 2.00
100%	100%

A detailed breakdown of the ADF result achieved in each space can be seen in Table 1, Table 2, Table 3 and Appendix A of this report.

7.2 No Sky line (NSL) Analysis Summary

Please see Reference Image 12, Reference Image 13, Reference Image 14, Table 4, Table 5, Table 6 and Appendix B of this report.

All units including the units at ground floor level sited under an overhang at first floor indicate sufficient lighting and exposure to sky in all habitable rooms. In all habitable rooms, more than 80% of the working plane receives direct skylight.

7.3 Daylight Factor Analysis Summary

Please see reference images 15, 16 and 17. The Daylight Factor analysis assessed the selected units for daylight illuminance achieved by the rooms over 50 % of the daylight hours.

The analysis shows that the assessed rooms achieve a minimum of 300 lux over 50% of the space and over 100x over 95% of the space. Thereby, meeting the requirement according to EN 17037.

- Minimum – 300 lux exceeded over 50% of the space (median illuminance) and 100 lux exceeded over 95% of the space (minimum illuminance), for 50% of daylight hours
- Medium – 500 lux for median and 300 for minimum for 50% of daylight hours
- High – 750 lux for median and 500 lux for minimum for 50% daylight hours

7.4 Spatial Daylight Autonomy (sDA) Analysis Summary

Please see reference images 18, 19, and 20 of this report.

The units/rooms were assessed using the latest British national annex provided in BS EN17037.

Spatial Daylight Autonomy – BS EN17037 British National Annex	
LKD recommended to achieve 200 lux over 50% area for at least 50% of daylight hours Bedrooms recommended to achieve 100 lux over 50% area for at least 50% of daylight hours	
Room Type	Passing (%)
Bedroom	100.0
LKD	100.0
Overall	100.0

7.5 Average Illuminance Analysis Summary

Please see Table 7 and Appendix C of this report.

The units/rooms were assessed using the latest British national annex provided in BS EN17037.

The average illuminance values for all bedrooms significantly exceed 100 lux and 200 lux for living/kitchen/dining (required for only half of the reference points) according to table NA2 of BS EN 17037:2018.

8.0 Conclusion

This report has been prepared to assess the levels of sunlight, skylight and internal light levels that would be provided within the units 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 21, 25, 26, 27, & 34 which are being proposed as part of a residential development at the junction of Grange Road, Nutgrove Avenue and Loreto Terrace, Rathfarnham, Dublin 14.

Using industry standard methodologies, the following is concluded:

- Average Daylight Factor (ADF): It is concluded that adequate levels of daylight amenity and internal light levels would be available to the units of concern as illustrated through the results tables. All living/kitchen/dining rooms achieve an ADF of 2% or higher and bedrooms achieve 1% or higher. The proposed development, therefore, is considered acceptable in relation to internal light levels and sky exposure.
- No Sky Line: All units/rooms including the units at ground floor level sited under an overhang at first floor indicate sufficient lighting and exposure to sky in all habitable rooms. In all habitable rooms, more than 80% of the working plane receives direct skylight.
- Daylight Factor: All assessed units/rooms achieve a minimum of 300 lux over 50% of the space and over 100x over 95% of the space. Thereby, meeting the requirement according to EN 17037.
- Spatial Daylight Autonomy (sDA): All units assessed achieve 200 lux over 50% area for at least 50% of daylight hours in all LKD ; and 100 lux over 50% area for at least 50% of daylight hours in all Bedrooms. Thereby, the assessed rooms are considered acceptable according to the BS EN 17037 standard.
- Average Illuminance: In all units assessed, the illuminance value in bedrooms significantly exceeds 100 lux and 200 lux for living/kitchen/dining (required for only half of the reference points) according to table NA1 of BS EN 17037:2018. Thereby, meeting the requirements within BS EN 17037 standard.

From a planning perspective and for the purpose of clarification of further information, the units of concern have been assessed against the BS EN 17037 standard and thereby, it is concluded that the assessed units meet the recommended requirements set within the BS EN 17037 standard.

APPENDIX A: Average Daylight Factor (ADF) Analysis Results

Building Name	Floor Name	Room Name	Room Use	ADF Pr	Reqd Val	Meets BRE Criteria
Proposed	Ground	R3	Bedroom	0.1012		
Proposed	Ground	R3	Bedroom	1.0163		
				1.1175	1	YES
Proposed	Ground	R4	Bedroom	0.0987		
Proposed	Ground	R4	Bedroom	1.0568		
				1.1555	1	YES
Proposed	Ground	R5	Bedroom	0.0992		
Proposed	Ground	R5	Bedroom	1.0801		
				1.1793	1	YES
Proposed	Ground	R6	Bedroom	0.0972		
Proposed	Ground	R6	Bedroom	1.0393		
				1.1365	1	YES
Proposed	Ground	R7	Bedroom	0.0956		
Proposed	Ground	R7	Bedroom	1.1249		
				1.2205	1	YES
Proposed	Ground	R8	Bedroom	0.0736		
Proposed	Ground	R8	Bedroom	1.6848		
				1.7584	1	YES
Proposed	Ground	R9	Bedroom	0.1222		
Proposed	Ground	R9	Bedroom	1.2955		
				1.4177	1	YES
Proposed	Ground	R10	Bedroom	0.1405		
Proposed	Ground	R10	Bedroom	1.6568		
				1.7973	1	YES
Proposed	Ground	R11	Bedroom	0.0992		
Proposed	Ground	R11	Bedroom	1.0013		
				1.1005	1	YES
Proposed	Ground	R12	Bedroom	0.0618		
Proposed	Ground	R12	Bedroom	1.3938		
				1.4556	1	YES
Proposed	Ground	R13	Bedroom	0.0952		
Proposed	Ground	R13	Bedroom	0.9744		
				1.0696	1	YES
Proposed	First	R4	Bedroom	0.3863		
				2.9445	1	YES
Proposed	First	R5	Bedroom	0.0656		
Proposed	First	R5	Bedroom	0.9477		
				1.0133	1	YES
Proposed	First	R6	Bedroom	0.1743		
Proposed	First	R6	Bedroom	1.9017		
				2.0761	1	YES
Proposed	First	R8	LKD	0.0654		
Proposed	First	R8	LKD	0.7416		
Proposed	First	R8	LKD	0.115		
Proposed	First	R8	LKD	1.6225		
				2.5445	2	YES
Proposed	First	R9	LKD	0.1647		

Building Name	Floor Name	Room Name	Room Use	ADF Pr	Reqd Val	Meets BRE Criteria
Proposed	First	R9	LKD	1.8503		
Proposed	First	R9	LKD	0.0037		
Proposed	First	R9	LKD	0.0391		
Proposed	First	R9	LKD	0.0042		
Proposed	First	R9	LKD	0.0393		
				2.1013	2	YES
Proposed	First	R10	LKD	0.0391		
Proposed	First	R10	LKD	0.4086		
Proposed	First	R10	LKD	0.0874		
Proposed	First	R10	LKD	1.2329		
Proposed	First	R10	LKD	0.0715		
Proposed	First	R10	LKD	1.0112		
				2.8508	2	YES
Proposed	First	R11	LKD	0.1247		
Proposed	First	R11	LKD	1.7378		
Proposed	First	R11	LKD	0.0826		
Proposed	First	R11	LKD	1.1584		
				3.1035	2	YES
Proposed	Ground	R2	Bedroom	0.1252		
Proposed	Ground	R2	Bedroom	1.7056		
				1.8308	1	YES
Proposed	Second	R1	Bedroom	0.2044		
Proposed	Second	R1	Bedroom	2.8351		
				3.0394	1	YES
Proposed	Second	R2	Bedroom	0.1429		
Proposed	Second	R2	Bedroom	1.9939		
Proposed	Second	R2	Bedroom	0.1032		
Proposed	Second	R2	Bedroom	1.4586		
				3.6985	1	YES
Proposed	Second	R3	Bedroom	0.1323		
Proposed	Second	R3	Bedroom	1.443		
				1.5753	1	YES
Proposed	Second	R4	Bedroom	0.0752		
Proposed	Second	R4	Bedroom	1.1221		
				1.1973	1	YES
Proposed	Second	R6	LKD	0.0962		
Proposed	Second	R6	LKD	1.3392		
Proposed	Second	R6	LKD	0.0797		
Proposed	Second	R6	LKD	0.8729		
				2.388	2	YES
Proposed	Second	R7	LKD	0.1486		
Proposed	Second	R7	LKD	2.0675		
Proposed	Second	R7	LKD	0.0233		
Proposed	Second	R7	LKD	0.2698		
				2.5092	2	YES
Proposed	Second	R8	LKD	0.0089		
Proposed	Second	R8	LKD	0.0919		
Proposed	Second	R8	LKD	0.1818		
Proposed	Second	R8	LKD	2.1083		
Proposed	Second	R8	LKD	0.0076		

Building Name	Floor Name	Room Name	Room Use	ADF Pr	Reqd Val	Meets BRE Criteria
Proposed	Second	R8	LKD	0.0839		
				2.4823	2	YES
Proposed	Second	R9	LKD	0.1015		
Proposed	Second	R9	LKD	1.1034		
Proposed	Second	R9	LKD	0.0662		
Proposed	Second	R9	LKD	0.7509		
				2.022	2	YES

APPENDIX B: No Sky Line (NSL) Analysis Results

Building Name	Floor Name	Room Name	Room Use	Room Area	Lit Area Pr	Proposed %	Meets BRE Criteria
Proposed	Ground	R2	Bedroom	10.32966	10.15435	98.30%	YES
Proposed	Ground	R3	Bedroom	15.88615	15.58534	98.11%	YES
Proposed	Ground	R4	Bedroom	9.08204	9.077316	99.95%	YES
Proposed	Ground	R5	Bedroom	12.69279	12.00722	94.60%	YES
Proposed	Ground	R6	Bedroom	12.93096	12.75306	98.62%	YES
Proposed	Ground	R7	Bedroom	12.54861	12.4259	99.02%	YES
Proposed	Ground	R8	Bedroom	12.23467	10.52179	86.00%	YES
Proposed	Ground	R9	Bedroom	12.60827	12.59365	99.88%	YES
Proposed	Ground	R10	Bedroom	12.85256	12.82903	99.82%	YES
Proposed	Ground	R11	Bedroom	11.3027	10.82735	95.79%	YES
Proposed	Ground	R12	Bedroom	10.51353	9.796726	93.18%	YES
Proposed	Ground	R13	Bedroom	19.61414	19.53342	99.59%	YES
Proposed	Ground	R14	LKD	33.43125	33.40594	99.92%	YES
Proposed	Ground	R15	LKD	28.48674	28.48674	100.00%	YES
Proposed	Ground	R16	LKD	29.81451	29.81451	100.00%	YES
Proposed	Ground	R17	LKD	23.88699	23.88699	100.00%	YES
Proposed	Ground	R18	LKD	24.35681	24.35632	100.00%	YES
Proposed	Ground	R19	LKD	38.08435	30.44993	79.95%	YES
Proposed	Ground	R20	LKD	29.57341	28.14699	95.18%	YES
Proposed	First	R1	Bedroom	11.79058	11.73933	99.57%	YES
Proposed	First	R2	Bedroom	13.0454	13.02924	99.88%	YES
Proposed	First	R3	Bedroom	17.88709	15.36278	85.89%	YES
Proposed	First	R4	Bedroom	17.30774	17.29543	99.93%	YES
Proposed	First	R5	Bedroom	10.57366	9.806313	92.74%	YES
Proposed	First	R6	Bedroom	6.417501	6.313111	98.37%	YES
Proposed	First	R8	LKD	30.97477	30.967	99.97%	YES
Proposed	First	R9	LKD	24.36839	24.36839	100.00%	YES
Proposed	First	R10	LKD	30.79583	30.76807	99.91%	YES
Proposed	First	R11	LKD	27.02157	26.9261	99.65%	YES
Proposed	Second	R1	Bedroom	13.06803	13.04107	99.79%	YES
Proposed	Second	R2	Bedroom	16.09305	15.98078	99.30%	YES
Proposed	Second	R3	Bedroom	9.479107	9.444138	99.63%	YES
Proposed	Second	R4	Bedroom	10.56847	10.16248	96.16%	YES
Proposed	Second	R5	Bedroom	10.629037	10.520743	98.98%	YES
Proposed	Second	R6	LKD	23.11591	22.56603	97.62%	YES
Proposed	Second	R7	LKD	29.24319	29.22562	99.94%	YES
Proposed	Second	R8	LKD	25.81127	25.81127	100.00%	YES
Proposed	Second	R9	LKD	31.02941	31.02215	99.98%	YES

APPENDIX C: Average Illuminance Analysis Results BS EN 17037

Floor name	Room Name	Surface area [mm ²]	Average LX
Ground	R13	19614146	303.96
Ground	R3	15886154	326.31
Ground	R2	10329666	573.65
Ground	R19	38084365	405.28
Ground	R14	33431274	357.6
Ground	R11	11302700	278.63
Ground	R5	12692791	329.29
Ground	R6	12930967	311.41
Ground	R17	23887007	299.49
Ground	R10	12852569	476.8
Ground	R7	12548620	308.43
Ground	R20	29573422	327.8
Ground	R16	29814526	603.45
Ground	R9	12608275	411.24
Ground	R4	9082042	268.2
Ground	R18	24356817	497.66
Ground	R15	28486760	414.22
Ground	R8	12234674	368.03
Ground	R12	10513537	391.87
First	R6	6417503	588.55
First	R1	11790577	838.87
First	R11	27021586	593.02
First	R3	17887091	625.8
First	R10	30795850	508.09
First	R4	17307744	889.53
First	R8	30974793	560.24
First	R2	13045407	655.6
First	R5	10573666	238.4
First	R9	24368400	479.78
Second	R6	23115920	482.76
Second	R5	10629045	972.97
Second	R2	16093059	1412.52
Second	R3	9479109	224.99
Second	R7	29243202	479.78
Second	R9	31029427	394.85
Second	R1	13068038	628.78
Second	R4	10568477	262.24
Second	R8	25811285	539.38

*lx for an outdoor overcast illuminance 14, 900lux