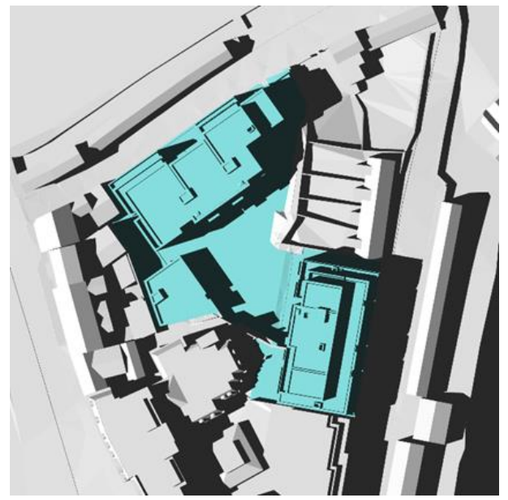
Templar Place

Balbriggan



Daylight & Sunlight Report

IN2 Project No. D2045

29/07/2021

REV02

Revision History

Date	Revision	Description
05/07/2021	00	Initial issue for review
26/07/2021	01	Issue for review
29/07/2021	02	Updated for Comments

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1.0 Executive Summary

This report compiles the daylight and sunlight analysis as undertaken by IN2 Engineering Design Partnership for the Proposed development at Balbriggan.

The report summarises the analysis undertaken, and conclusions determined for the proposed arrangements.

Section 2.0 introduces the various Guidelines and Standards utilised throughout the Daylight / Sunlight analysis undertaken, with the methodology of how they are implemented the detailed in the relevant sections.

Section 3.0 illustrates the results from the amenity sunlight analysis as undertaken based on the BRE best practice for garden amenities. The proposed amenity space was found to receive excellent sunlight availability with 84% of the amenity spaces receiving more than two hours of daylight on March 21st significantly more than the BRE minimum of 50%.

The impact of the proposed development was assessed in Section 4.0. The neighbouring buildings were assessed for both VSC, a measure of potential daylight, and Annual Probable Daylight Hours, a measure of direct sunlight. Both assessments determined that there would be no negative impact as a result of the proposed development on the dwellings on High Street. The units on Quay Street were found to be impacted for daylight but not Annual Probable Sunlight Hours, however this minor impact in the potential for daylight is offset by the wider planning benefits of rejuvenation of the street. The Annual Probable Sunlight Hours assessment determines the annual sunlight impact on a window and the winter sunlight impact through a quantitative assessment. Appendix A includes site shading diagrams displayed on an hourly basis for the Equinox and Summer/ Winter Solstices. However, these are for illustrative purposes only as the images are subjective and only relate to 3 days of the year, where as the Annual Probable Sunlight Hours calculations accounts for all available annual sunlight hours for Dublin.

The internal daylight analysis, as detailed in section 5.0, has been undertaken for all units across the development. The analysis determined that 97% of rooms were in excess of the prescribed guidelines as set out within this report, for average daylight factors (ADF). This extent of compliance was achieved through design development, with increased glazing/ reduced balcony depths / balcony locations etc. applied to ensure the residences can benefit from maximised daylight availability.

Two appendices have been included in the report for clarity on guidelines and standards implications / comparisons.

Appendix A: Site Shading Diagrams, illustrative shading diagrams to be read in conjunction with quantitative assessment as contained within section 4.0.

Appendix B: EN Daylight Standards: a comparative assessment between BS.8206-2 and the incoming EN.17037 was undertaken based on a methodology adopted from that included in the UK National Annex to the Standard and is included in Appendix B (see section 2.0 for relevance of standard). This analysis determined generally good correlation between the existing and new standards applied, with those rooms deemed compliant in the former methodology also achieving compliance under the latter.

Appendix C: Alternative Daylight Calculations: a second daylight assessment was carried out to determine the average daylight factor (ADF) that would be achieved for the full spaces. This assessment provides the raw values without the space delineation as set out in Section 5.0.

In summary, this report confirms that best practice Sunlight and Daylight availability have been ensured for the proposed Balbriggan development, with no undue impact on existing neighbouring environment.

2.0 Standards and Guidelines

The following standards and guidance documents have been consulted when compiling this report to ensure compliance with the various Daylight and Sunlight requirements as applicable and relevant:

a) Sustainable Urban Housing: Design Standards for New Apartments (December 2020) (the **"2020 Apartment Guidelines").** These are guidelines issued under section 28 of the 2000 Planning and Development Act.

b) The Building Research Establishment's (BRE) Site Layout Planning for Daylight and Sunlight: A guide to good practice (BRE 209) (2nd edition) (the **"BRE Guide").**

c) British Standard BS 8206-2:2008 – "Lighting for Buildings – Part 2: Code of Practice for Daylighting" (the "**2008 British Standard**").

d) British Standard BS EN 17037:2018 – Daylight in Buildings (the "**2018 British EN Standard**").

e) Irish Standard IS EN 17037:2018 (the "**2018 Irish EN Standard**").

It should be noted at the outset that the 2008 British Standard has been superseded by the 2018 British Standard. This is the UK implementation of EN 17037:2018, which was approved by the CEN on 29 July 2018. In Ireland, EN 17037:2018 has been implemented by the 2018 Irish Standard. The texts of the 2018 British Standard and the 2018 Irish Standard are the same, with one exception. The exception is that the 2018 British Standard contains an additional "National Annex" which specifically sets out requirements within dwellings, to ensure some similarity to the now superseded 2008 British Standard.

The 2020 Apartment Guidelines state:

"[6.5] The provision of acceptable levels of natural light in new apartment developments is an important planning consideration as it contributes to the liveability and amenity enjoyed by apartment residents. In assessing development proposals, planning authorities must however weigh up the overall quality of the design and layout of the scheme and the measures proposed to maximise daylight provision with the location of the site and the need to ensure an appropriate scale of urban residential development.

[6.6] Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2:2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision.

[6.7] Where an applicant cannot fully meet all of the requirements of the daylight provisions above, this must be clearly identified and a rationale for any alternative, compensatory design solutions must be set out, which planning authorities should apply their discretion in accepting taking account of its assessment of specific. This may arise due to a design constraints associated with the site or location and the balancing of that assessment against the desirability of achieving wider planning objectives. Such objectives might include securing comprehensive urban regeneration and or an effective urban design and streetscape solution."

It can be noted from this section that the 2020 Apartment Guidelines continue to refer to the BRE Guide (published in 2011) and to the 2008 British Standard. They do not take into account the 2018 British Standard and/or the 2018 Irish Standard and as the BRE Guide is still current and applicable, the 2011 edition will therefore provide the basis for the assessments detailed within this report.

The BRE Guide

The BRE Guide describes its purpose in the following terms in the "Summary" section (v):

> *"This guide gives advice on site layout planning to achieve good sunlighting and daylighting both within buildings and in the open spaces between them. It is intended to be used in conjunction with the interior daylight recommendations in the [2008] British Standard… It contains guidance on site layout to provide good natural lighting within a new development; safeguarding of daylight and sunlight within existing buildings nearby; and the protection of daylighting of adjoining land for future development."*

The BRE Guide also notes that:

> *"It (the guide) is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location. Appendix F explains how this can be done in a logical way, while retaining consistency with the British Standard recommendations on interior daylighting."*

> *"The guide is intended for building designers and their clients, consultants and planning officials. The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design (see Section 5). In special circumstances the developer or planning authority may wish to use different target values. For example, in a historic city centre, or in an area with modern high rise buildings, a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings."*

Therefore, if the situation arises where the targets identified within the Guide are not achieved, these should be highlighted and either justified in the context of the development / site or where relevant and applicable, compensatory measure will be proposed. In the context of this report, any deviations from the Guides recommendations have therefore been identified, with an approach throughout to ensure that good quality daylight/sunlight in achieved through analysis and design improvements as far as practicable and viable as detailed in the report as relevant.

The main sections in the guide that the assessments within this report will reference (as applicable) are:

1. Light from the Sky (Daylight) – *Based on a theoretical mathematical uniform sky (CIE overcast sky) which does not alter based on orientation.*
    - 1.1. New Development – Within this section the guide sets values for internal Average Daylight Factors (ADF) for various space types and relevant calculation methodologies.
    - 1.2. Existing Buildings – The guide sets a quantitative assessment method for determining the impact of new developments on light from the sky (VSC) on existing neighbouring buildings.
2. Sunlighting – *Based on site location, longitude and latitude, and solar azimuths. i.e. buildings south of a site will not be impacted for sunlight in the northern hemisphere.*
    - 2.1. New Development – This topic is addressed in the 2020 Apartment Guidelines under the issue of dual aspect units and is not covered within this report.
    - 2.2. Existing Buildings – As above, the guide has quantitative assessment for determining the impact of sunlight on existing neighbouring buildings.
    - 2.3. Gardens and open spaces – The amenity criteria set out is used for both proposed new amenity and the impact on existing neighbouring amenities.

The specific methodology for each topic (as relevant) is detailed in the relevant section in the body of this report.

The 2008 British Standard

The BRE guide specifically refers to this standard and most of the quantitative criteria set out have already been mentioned in relation to the BRE Guide above. However the BRE guide provides more detail as to context and implementation. In relation to average daylight factor (ADF), the standard states the following:

> *"The average daylight factor… is used as the measure of general illumination from skylight. It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2%."*

However, the standard then acknowledges that lower lighting levels may be applicable for dwellings, offering minimum ADFs for different room types within dwellings, i.e. 1% for bedrooms; 1.5% for living rooms; and 2% for kitchens (Table 2), and notes that:

> *"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%."*

Whilst specifically applicable to houses, it should be noted that there is no specific reference within the British Standard to apartment internal galley type kitchens as recognised in the BRE Guide which states:

> *"2.1.14 Non-daylit internal kitchens should be avoided wherever possible, especially if the kitchen is used as a dining area too. If the layout means that a small internal galley-type kitchen is inevitable, it should be directly linked to a well daylit living room."*

The standard's guidance on loss of daylight and sunlight to existing buildings is similar to, but less extensive or detailed than, that contained in the BRE Guide, and in particular Appendix F of the BRE Guide.

The 2018 British and Irish Versions of the EN Standards

The EN 17037:2018 standard—which is the basis of both the 2018 British EN Standard and the 2018 Irish EN Standard—approaches the assessment of daylight provision on a different basis from that utilised in the 2008 British Standard and the BRE Guide. Instead of **average** daylight factors the standard considers a new metric based on **median** daylight, in order to ensure both extent and a degree of uniformity of daylight.

> *"A space is considered to provide adequate daylight if a target illuminance level is achieved across a fraction of the reference plane within a space for at least half of the daylight hours."*

EN 17037:2018 also address other aspects in addition to daylight - including sunlight, glare and quality of view, which are not addressed in the context of this report.

The National Annex

As is noted above, the 2018 British Standard includes a "National Annex", containing "Further recommendations and data for daylight provision in the UK and Channel Islands". This is referenced further in the appendix of this report. As there is no equivalent in the 2018 Irish Standard the 2018 British Standard National Annex will be referenced, which states:

> *"NA.1 Introduction: The UK committee supports the recommendations for daylight in buildings given in BS EN 17037:2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space (see Clause A.2) may not be achievable for some buildings, particularly dwellings. The UK committee believes this could be the case for dwellings with basement rooms or those with significant external obstructions (for example, dwellings situated in a dense urban area or with tall trees outside), or for existing buildings being refurbished or converted into dwellings. This National Annex therefore provides the UK committee's guidance on minimum daylight provision in all UK dwellings."*

NA.2 addresses minimum daylight provision in UK dwellings. It contains a table, in which target illuminance, ET (lx), levels are recommended for different room types. These are: bedroom at 100 lx; living room at 150 lx; and kitchen at 200 lx, which may be compared to EN 17037's recommendation of 300 lux (irrespective of room application). The commentary is as follows:

> *"Even if a predominantly daylit appearance is not achievable for a room in a UK dwelling, the UK committee recommends that the target illuminance values given in Table NA.1 are exceeded over at least 50% of the points on a reference plane 0.85 m above the floor, for at least half of the daylight hours."*

3.0 Site Sunlighting and Shading

3.1 Methodology

The BRE Site Layout Planning for Daylight and Sunlight Design Guide 209 provides guidance with regards to sunlighting and shading to external Amenity spaces within proposed developments.

The guidance recommends:

> *"That for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21st March".*

The methodology assesses sunlight performance at the Equinox, as this is the mid solar position throughout the year (as illustrated in Figure 3.1), with compliance indicative of spaces that will receive adequate sunlight and appealing useful spaces, including that the following attributes will be achieved as identified in BRE.209:

- Provide attractive sunlit views (all year)
- Make Outdoor Activities like sitting out and children's play more pleasant (mainly warmer months).
- Encourage plant growth (mainly spring and summer).
- Dry out the ground, reducing moss and slime (mainly in colder months).

An example analysis of Amenity Spaces is indicated in Figure 3.1. In this sample development, the main amenity space is located to the North of a building block which provides some degree of overshadowing (red contours).

For the proposed development, Figure 3.2, the main amenity space located on the ground -floor was found to be compliant with the guidelines with 84% of the amenity areas compliant, receiving at least 2 hours of direct sunlight on 21st March as defined within the guidance.

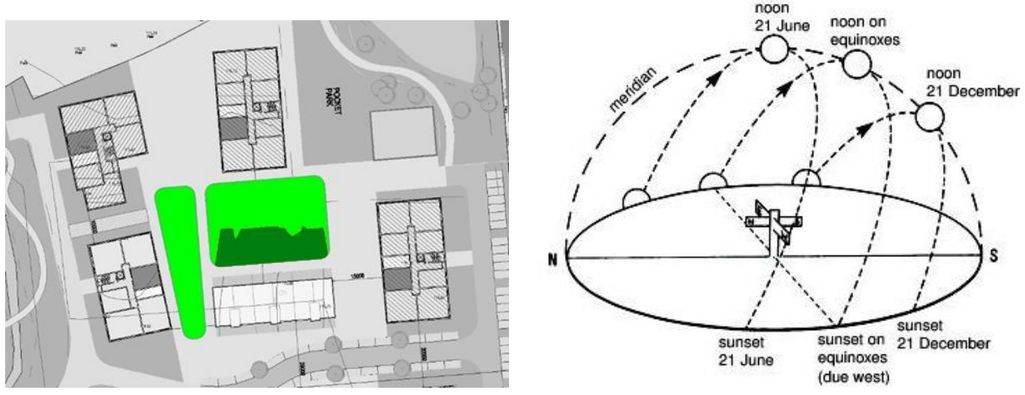


Fig 3.1 – Example Amenity Spaces

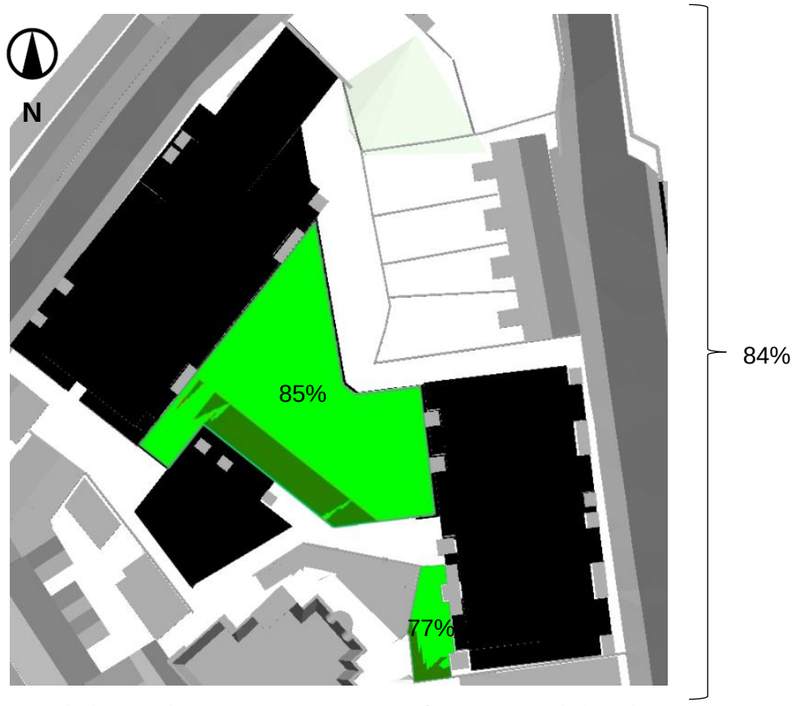


Fig 3.2 –Sunlight Availity to Amenity Spaces for Proposed Development

The guidance recommends:

> "That for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21 March".

The results as illustrated in Fig 3.3 show neighbouring gardens are not negatively impacted by the proposed development.

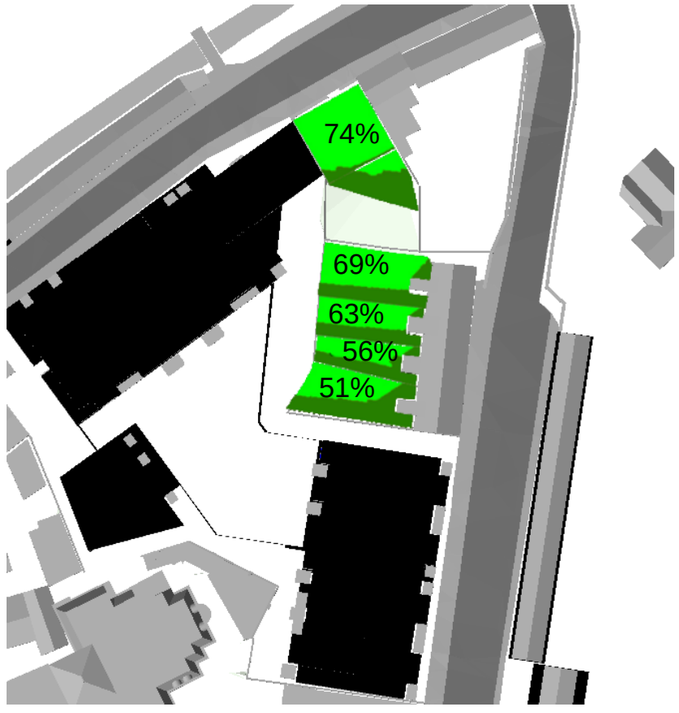
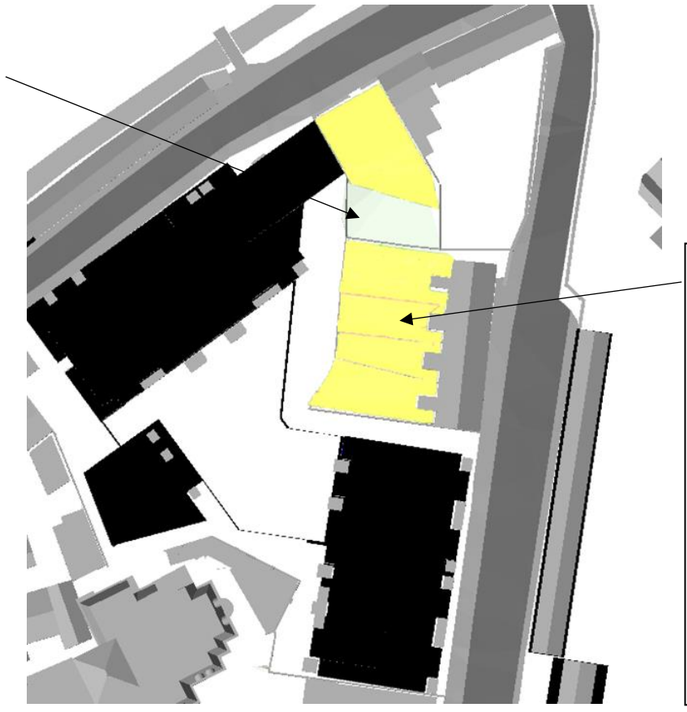


Fig 3.3 – Neighbouring Existing Residential Spaces

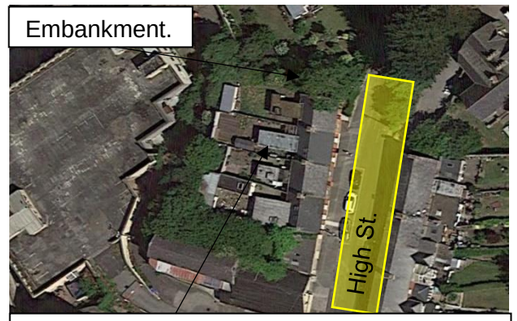
The area of the rear garden of No. 9 Quay Street is embankment, hence is not counted as part of usable open space to be assessed.



The neighbours' gardens do not factor in garden sheds or extensions built under exempted development regulations, which in each case would reduce the amount of garden open space and may impact on provision of adequate sunlight to each garden and that of their adjoining neighbours, regardless of new developments in the area.

Fig 3.4 Compliance Indication Key

Compliance	
Near-Compliance	
Non-Compliance	

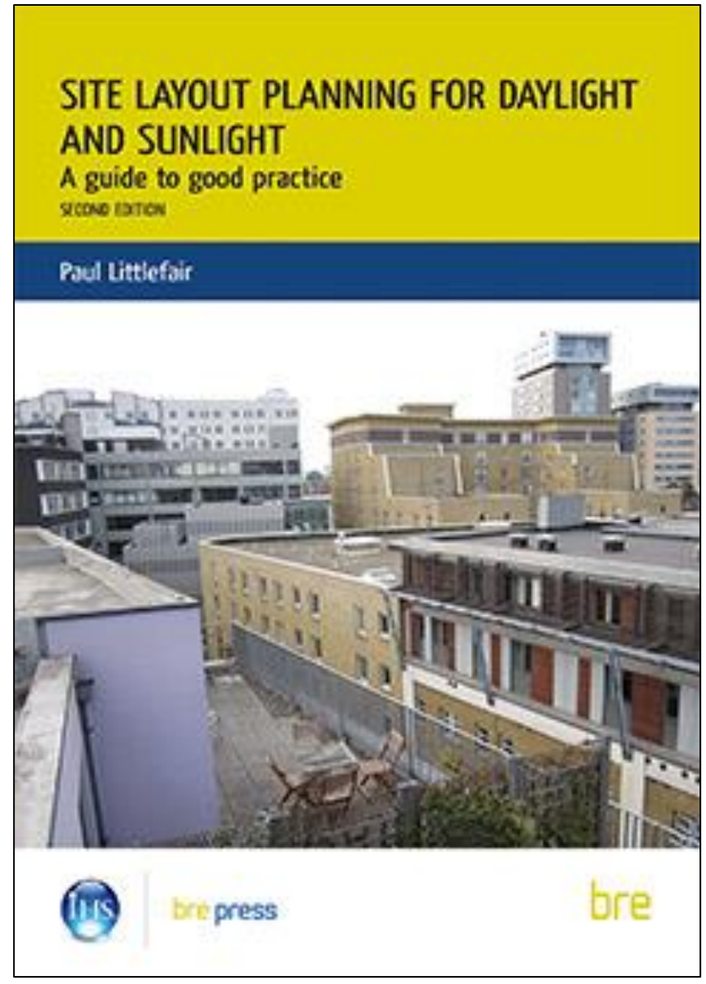


Extensions built under exempted development regulations.

4.0 Impact on Neighbouring Buildings

4.1 Guidance

As set out within the introduction, the impact on existing buildings has been assessed utilising quantitative assessment method as detailed in the BRE publication “Site Layout Planning for Daylight and Sunlight – A guide to good Practice (Second Edition)”



BRE Guidelines state:

Light from the Sky

> *“If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if either:*
>
> - *The VSC (Vertical Sky Component) measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value.”*

The analysis is based on measuring the VSC at the existing main windows. As per the BRE Guide, main windows included, living rooms, kitchens, and bedrooms. Existing windows with VSC above 27% after proposed development are considered to still receive good daylight availability and therefore not adversely affected.

Sunlighting

> *“If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:*
>
> - *receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March* ***and***
> - *receives less than 0.8 times its former sunlight hours during either period* ***and***
> - *has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours.”*

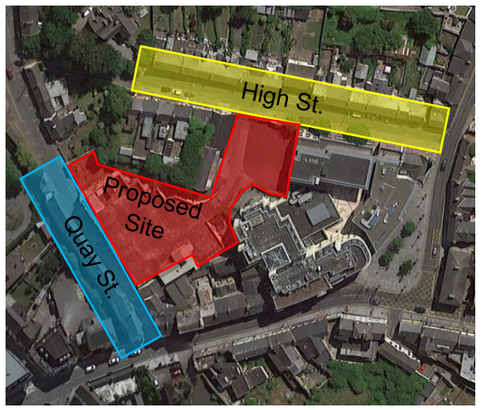
4.2 Methodology

The analysis looks to assess main windows, main living rooms and conservatories. For annual sunlight hours and winter sunlit hours, windows within 90° of south are assessed.

The following neighbouring buildings were assessed.

- High Street
- Quay Street

Analysis was undertaken by calculating sunlight availability pre and post-development for indicative window locations centred on the façade of each dwelling as illustrated in Figure 4.1 below.



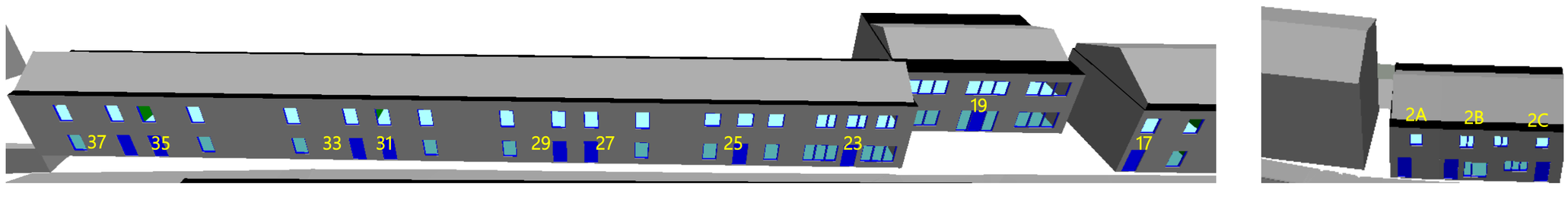


Fig 4.1 – Indicative Window Locations assessed for adjacent dwellings at High Street & Quay Street

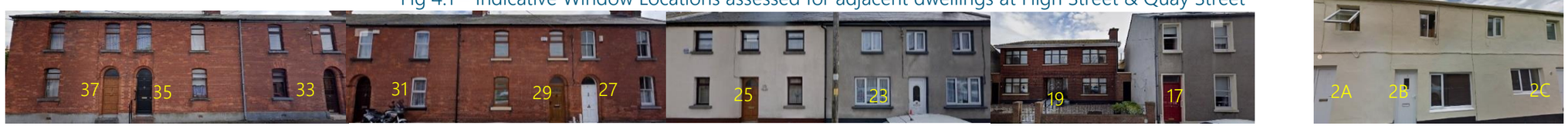


Fig 4.2 – Google Maps images of relevant buildings

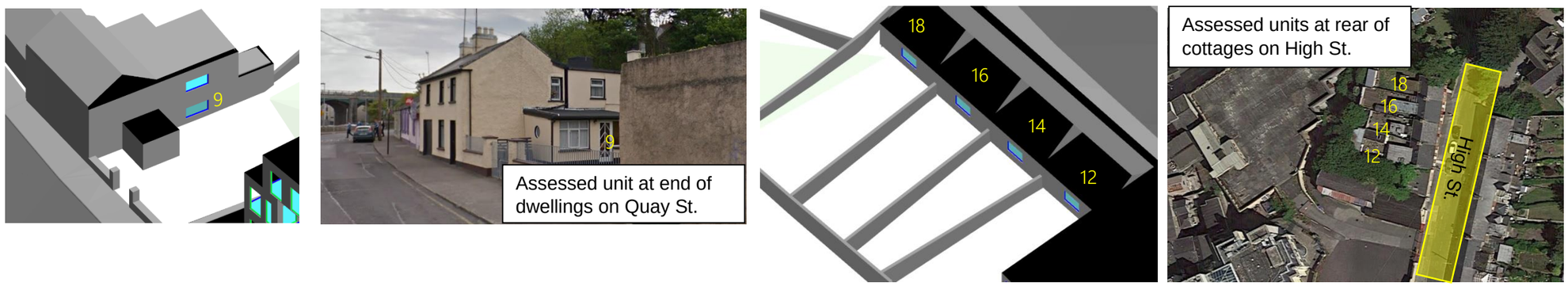


Fig 4.3 – Additional Indicative Window Locations & Google Maps images for surrounding dwellings

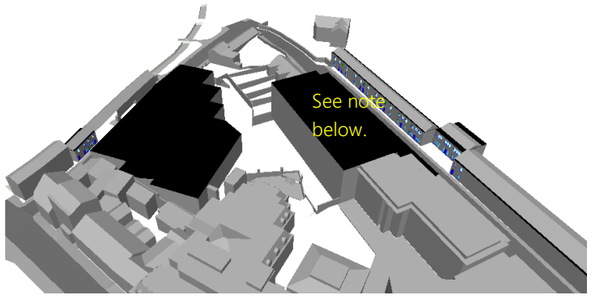


Fig 4.4 – Base case model

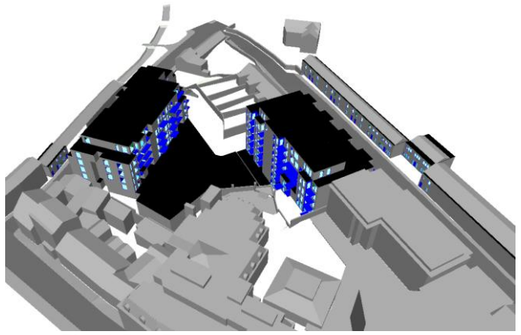


Fig 4.5 – Proposed development model

In the case of the High Street dwellings an alternative benchmark has been utilised based on the guidance in Appendix F of the BRE guide. In this case the existing site is underdeveloped as it consists of mainly hardscape Figure 4.6. In order to allow a fair assessment of the site, a benchmark building has been included in lieu of this. This benchmark building was derived from the adjacent apartment site on High Street as shown in Figure 4.7.

Fig 4.6 – Underdeveloped site located on High Street

Fig 4.7 – Benchmark building adjacent to underdeveloped site located on High Street

4.2 Methodology (Cont'd)

BRE methodology looks to assess the impact of light on residential dwellings therefore for Quay Street only numbers 2A, 2B, and 2C were relevant for assessment.

It can be noted that 2A, 2B and 2C looked to have been originally a single residential property that was subdivided into bedsits/flats in the past.

Residential	
Commercial	

Fig 4.8 – Commercial units excluded from sunlight assessment located on Quay Street

4.3 Results - VSC

The analysis determined that the dwellings on High Street were deemed not impacted, as VSC values were predicted to be equal or above that of the alternative benchmark values (Existing VSC). The units on Quay Street were found to be impacted, however this minor impact in the potential for daylight is offset by the wider planning benefits of rejuvenation of the street. It can also be noted that the Annual Probable Sunlight Hours were not negatively impacted as detailed in Section 4.4.

Room Reference	VSC Benchmark (%)	VSC Proposed (%)	Proposed/Benchmark	Status
High Street GF 37	33.21	33.86	102%	Pass
High Street GF 35	31.22	32.35	104%	Pass
High Street GF 33	29.53	30.76	104%	Pass
High Street GF 31	25.06	28.04	112%	Pass
High Street GF 29	22.94	25.73	112%	Pass
High Street GF 27	21.75	23.35	107%	Pass
High Street GF 25	21.43	23.09	108%	Pass
High Street GF 23	21.21	22.81	108%	Pass
High Street GF 19	21.83	22.39	103%	Pass
High Street GF 17	20.45	21.52	105%	Pass

Room Reference	VSC Existing (%)	VSC Proposed (%)	Proposed/Existing	Status
Quay Street GF 2A	Note: Living room is not facing development, hence no VSC calculated for associated unit.			
Quay Street GF 2B	17.60	14.54	83%	Pass
Quay Street GF 2C	18.95	13.95	74%	Minor Impact
Quay Street GF 9	27.85	25.60	92%	Pass
High Street GF 12	37.74	28.11	74%	Pass
High Street GF 14	38.02	32.77	86%	Pass
High Street GF 16	38.17	34.14	89%	Pass
High Street GF 18	38.45	34.50	90%	Pass

Fig 4.9 – Predicted VSC Results

4.4 Results - Sunlight

Similarly, analysis undertaken for sunlight availability determined BRE compliance with regards to the relevant existing dwellings on Quay Street, confirming received sunlight would not be adversely affected by the proposed new development as Annual Probable Sunlight Hours remains above 25% and Winter Probable Sunlight Hours remains above 5%.

As only windows within 90° of south are assessed under this methodology (as sun is in the south of the sky in the northern hemisphere), the assessment is applicable to the dwellings in Quay Street facing the proposed development and not High Street as these windows are facing west.

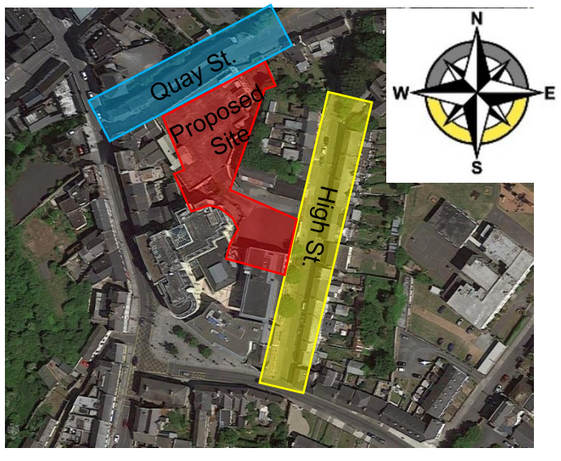
The guidance recommends:

Sunlighting

> *"If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:*
>
> - *receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March* ***and***
> - *receives less than 0.8 times its former sunlight hours during either period* ***and***
> - *has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours."*

Room Reference	APSH Existing (%)	APSH Proposed (%)	Proposed/Existing (%)	WPSH Existing (%)	WPSH Proposed (%)	Proposed/Existing (%)
Quay Street GF 2A	Note: Living room is not facing development, hence no APSH calculated.					
Quay Street GF 2B	40	31	0.77	4	7	1.49
Quay Street GF 2C	44	29	0.65	4	6	1.38
Quay Street GF 9	39	36	0.91	8	7	0.85

Fig 4.10 – Predicted ASHP Results



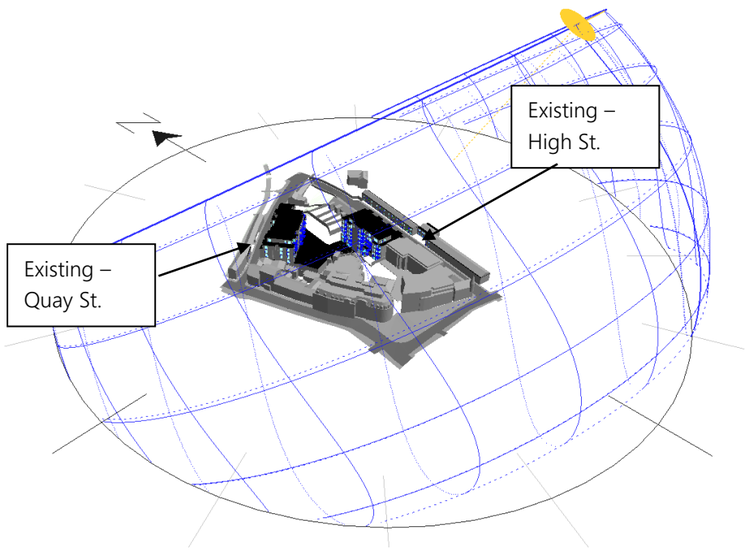


Fig 4.11 – Proposed and Existing Development, with Sunpath Diagram indicated

5.0 Daylight Analysis

5.1 Methodology

Daylighting analysis was undertaken for the proposed residential development using Tas lighting software to determine Average Daylight Factors (ADF's) in accordance with BRE 209 and BS. 8206-2, as referenced in the Sustainable Urban Housing: Design Standards for New Apartments (December 2020), as well as an assessment comparison to BS EN 17037 (National Annex). These guidelines and standards have been outlined in section 2.0.

ADF's were determined for a CIE Overcast Sky equivalent to providing an external, unobstructed ground illumination level of 10,000 Lux. CIE Overcast skies are theoretical sky models, with brightness highest at the zenith and reducing to the horizon, but also unidirectional (as illustrated in Figure 5.0.1); therefore ADF's do not differ for façade orientation, with North facing rooms achieving identical metric performance to South facing, (all else being equal), as results account for diffuse natural light only and exclude any direct sunlight effects.

The daylight analysis accounted for all aspects that can potentially restrict natural light availability including any adjacent / opposing buildings, along with explicitly modelling Building Details as illustrated in Figure 5.0.2 such as balcony structures, window frames, reveal and cill depth etc. in accordance with the architectural design.

The daylighting models were calculated based on the following assumptions regarding transmittance and reflectance (based on measured manufacturer's test data):

- Glazing Transmission = 70%
- Ceilings: 82% reflectance (BS 00E55 White)
- Walls: 62% reflectance (BS 10C31 Ivory)
- Floors: 36% reflectance (BS 00A05 Platinum Grey)

Daylight Factors for each space were then calculated for a working plane height of 0.85m on a 0.1 x 0.1m grid basis to enable a detailed calculation within each room, the average of which was then determined to calculate ADF.

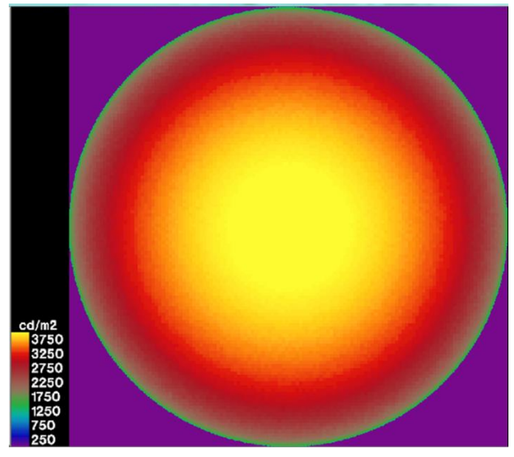


Fig 5.0.1 - CIE Overcast sky as viewed from below.

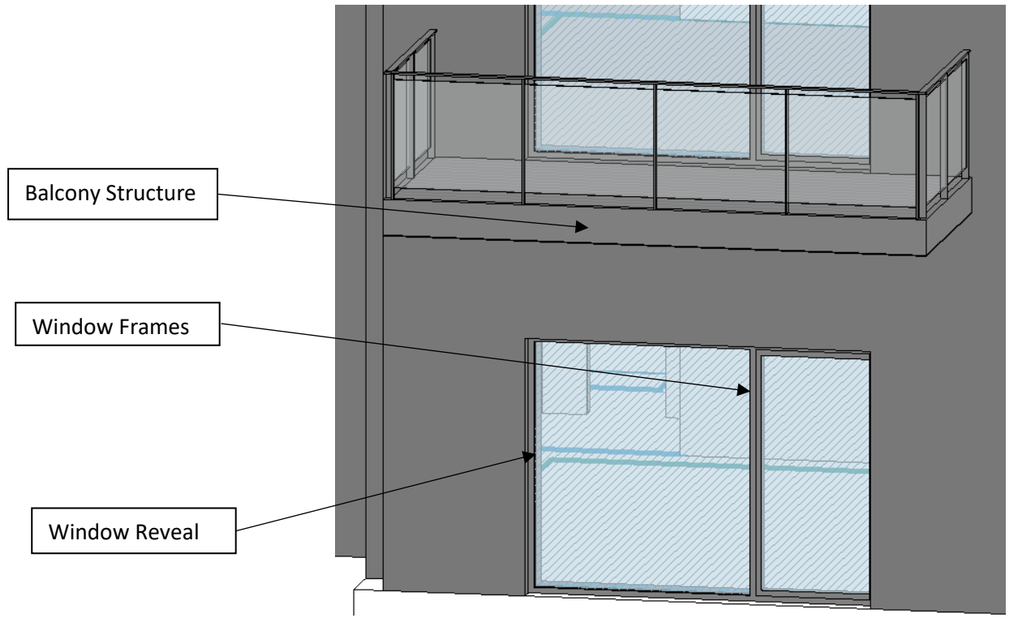


Fig 5.0.2 – Sample Building Details included within Daylight Analysis

5.0 Methodology (Cont'd)

In relation to daylight, the BRE Guide suggest that:

> *"Daylight provision in new rooms may be checked using the average daylight factor (ADF). The ADF is a measure of the overall amount of daylight in a space… [The 2008 British Standard] recommends an ADF of 5% for a well daylit space and 2% for a partly daylit space. Below 2% the room will look dull and electric lighting is likely to be turned on. In* ***housing*** *[the 2008 British Standard] also gives minimum values of ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms." (emphasis added)*

These daylighting targets (as also utilised within BS.8206-2) were originally introduced in British Standards Code of Practice CP3 Chapter 1 Part 1 released in 1964 and were based on surveys undertaken of UK dwellings in preceding years.

The higher ADF target for Kitchens was in recognition of the task-based nature of lighting requirements- as opposed to environmental considerations, in particular "Opinions were recorded for the kitchen in relation to the work centres at the stove, sink and work-table"[1] in the surveying that informed this target, which was based on achieving an illuminance level of 200 Lux at these task based areas for an assumed 10,000 Lux sky (hence 2% ADF). It may be noted that this surveying was also undertaken at a time that artificial lighting within kitchens would have been rudimentary- i.e. predating cooker-hood lighting etc.

With reference to living and cooking areas, the BRE Guide states:

> *"2.1.13 Living rooms and kitchens need more daylight than bedrooms, so where there is a choice it is best to site the living room or kitchen away from obstructions…"*

However additionally, and with specific relevance for apartments, the BRE guide states:

> *"2.1.14 Non-daylit internal kitchens should be avoided wherever possible, especially if the kitchen is used as a dining area too. If the layout means that a small internal galley-type kitchen is inevitable, it should be directly linked to a well daylit living room."*

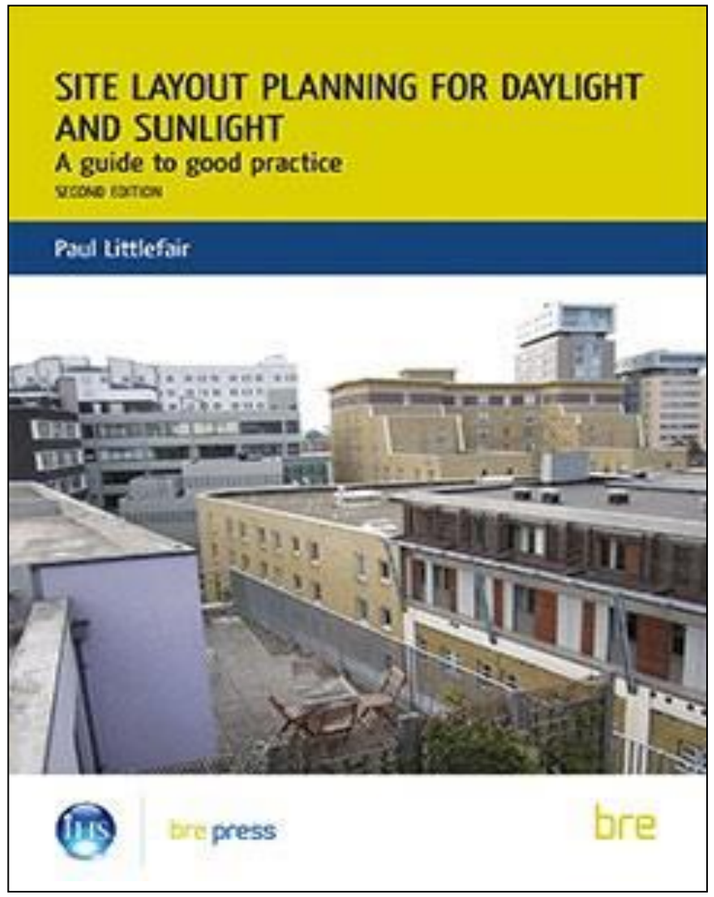


Fig 5.0.3 – The BRE Guide

[1] National Research Council of Canada – Performance Standards for Space and Site Planning for Residential Development- 1968

5.0 Methodology (Cont'd)

It may be noted therefore that for the purpose of analysis, and allowing that there is no other specific guidelines within BRE 209 for **apartment** typologies (in particular Kitchen / Living / Dining (KLD) areas), the Kitchenettes to Apartments have been excluded as these types of galley kitchens do not provide dining/sitting area.

The associated requirement within BS.8206-2 for "Kitchens" (ADF>2.0%) was developed for residential **housing** where the kitchen would be an identifiable separate room with seating and where occupants would be expected to eat and spend time as well as being generally present throughout the day.

As the daylight analysis has been undertaken to ensure good continual **environmental** performance for the apartments, analysis has been undertaken assessing the Living/Dining areas of the KLD's, excluding the kitchenette where **task-based** lighting is required on an intermittent basis. Whilst BRE 209 does not specifically reference Dining areas, these have been included within the zone of analysis allowing for the benefit of maximising daylight availability to the table space for envisaged variety of uses in addition to eating where, light would be beneficial – i.e. work from home, school / college homework, reading, writing etc..

The delineation of typical spaces for this scheme is illustrated in Figs 5.04 setting out the assessed areas (green) and excluded spaces (orange) as transient area / door ways / galley kitchen etc.. Zones of analysis can also be clearly seen in presented results of calculated contours of predicted daylight availability in section 5.2.

With regard to the above, the minimum values targeted for relevant spaces are:

- > 1.5% for Living/ Dining Areas
- > 1.0% for Bedrooms

Notwithstanding the above, it may be noted that these are minimum targets, and that the vast majority of spaces were determined to comfortably exceed the values, as summarised in the results section below. In addition, sub-standard daylighting performance has been avoided wherever viable and practical with the following design enhancements applied to maximise natural light availability and therefore internal environments:

- Maximise glazing,
- Minimise / offset balcony structures,
- Increase glazing / floor heights.

Fig 5.0.4 – Sample analysis space for Living / Dining Space & Bedroom

5.1 Results Summary

Figure 5.1.1 indicates the overall summary of ADF's determined for the Proposed Development, at each floor level. It can be seen that **97%** of Living/ Dining and Bedrooms assessed (totalling 221 of 228 rooms) were determined to be compliant based on the following compliance, in accordance with BS.8206-2: 7

- > 1.5% for Living/ Dining Areas
- > 1.0% for Bedrooms

However, aside from meeting minimum requirements, most Living/ Dining Areas and Bedrooms were determined to receive Daylighting comfortably exceeding these ADF targets, it was determined that 50% of the living spaces achieved an ADF in excess of 3%, as illustrated in Figure 5.1.2., with over 85% achieving 2.0%. Similarly, the average daylight factor in the bedrooms across the scheme was in excess of 2.5% highlighting the high levels of daylight available to the majority of the development.

Building	Pass Rate	No. Rooms
A	97%	113
B	96%	107
C	100%	8
Total	97%	228

Fig 5.1.1 – Daylight Summary – Development

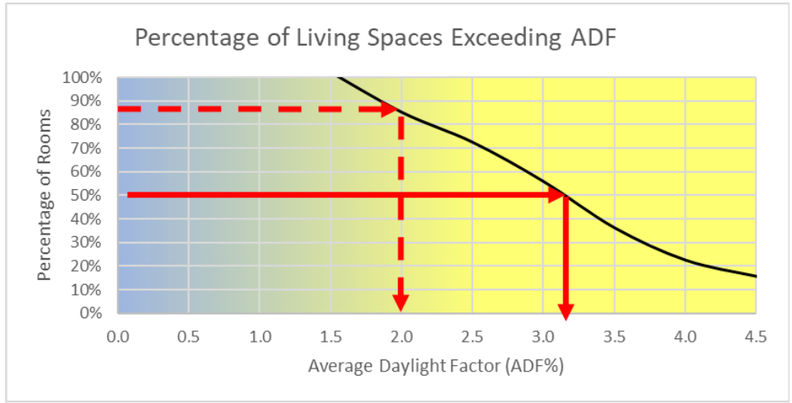


Fig 5.1.2 – Frequency Graph for Living / Dining Spaces

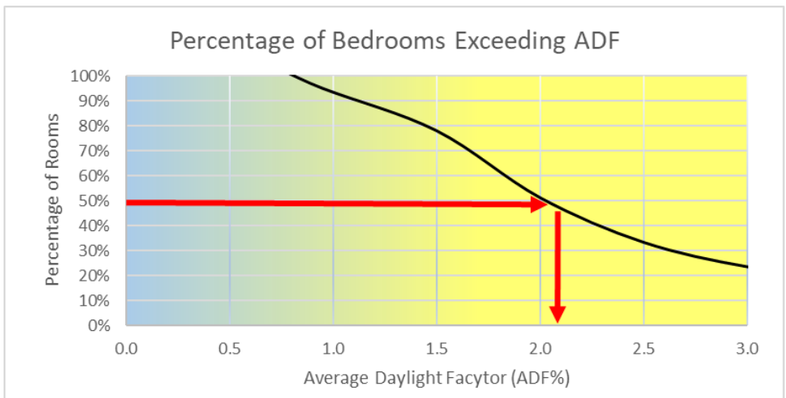


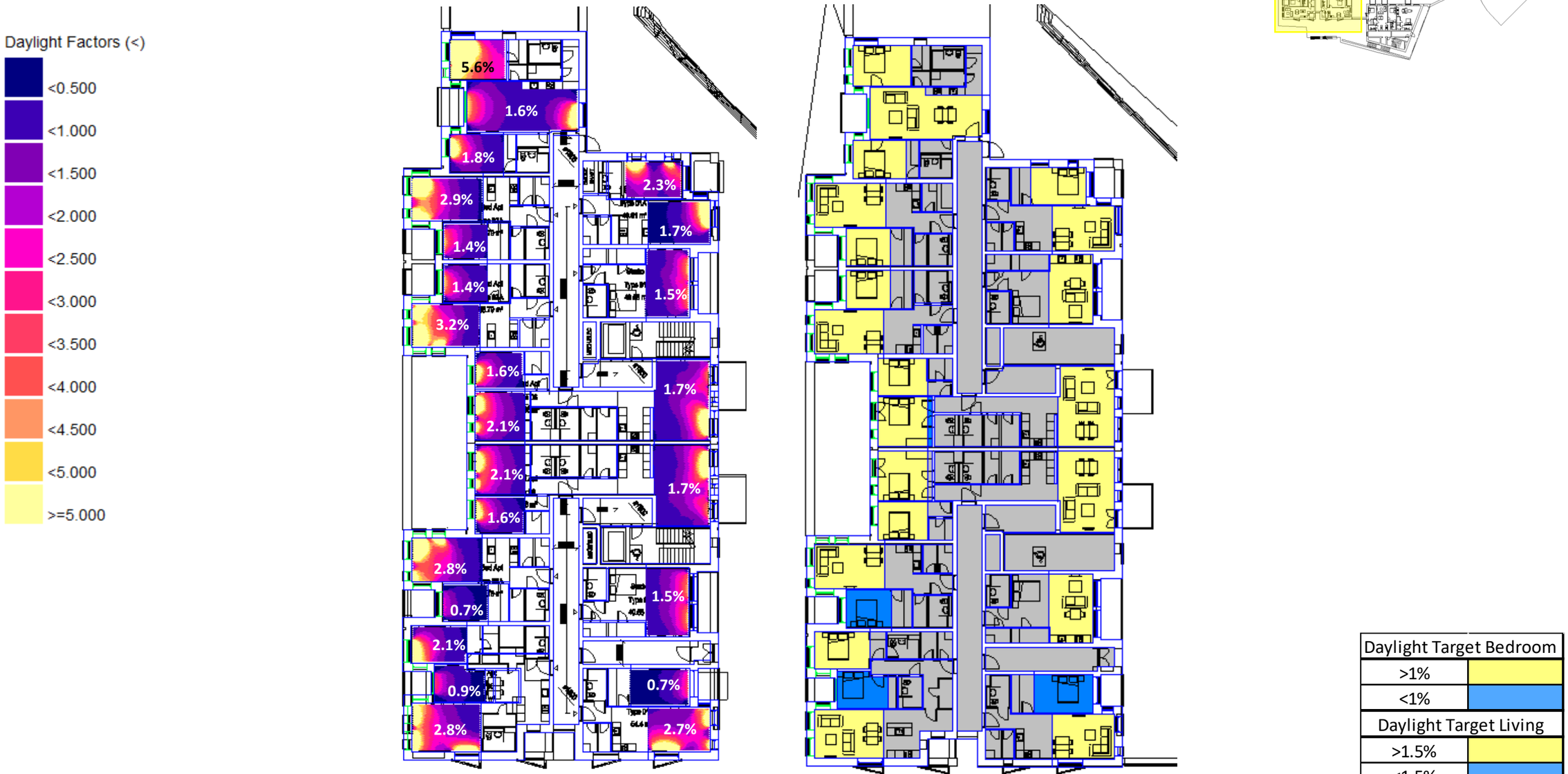
Fig 5.1.3 – Frequency Graph for Bedrooms

Internal Daylight Analysis

5.2 Building A – First Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

21 of 24 rooms exceed the BRE guidelines on the first floor of Building A.

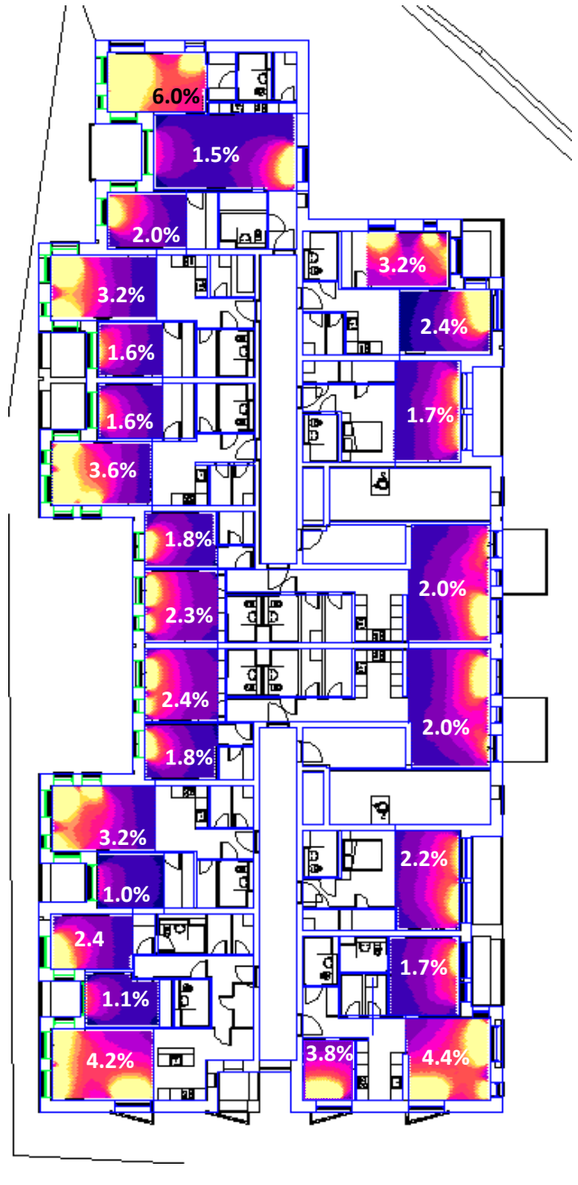


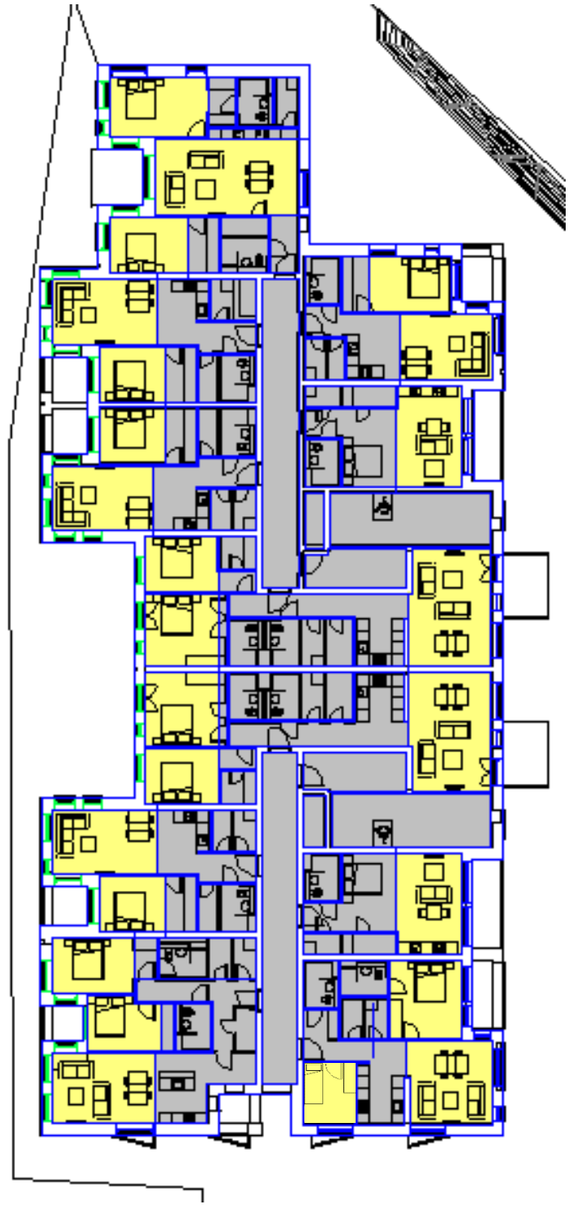
Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.3 Building A – Second Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

25 of 25 rooms exceed the BRE guidelines on the second floor of Building A.



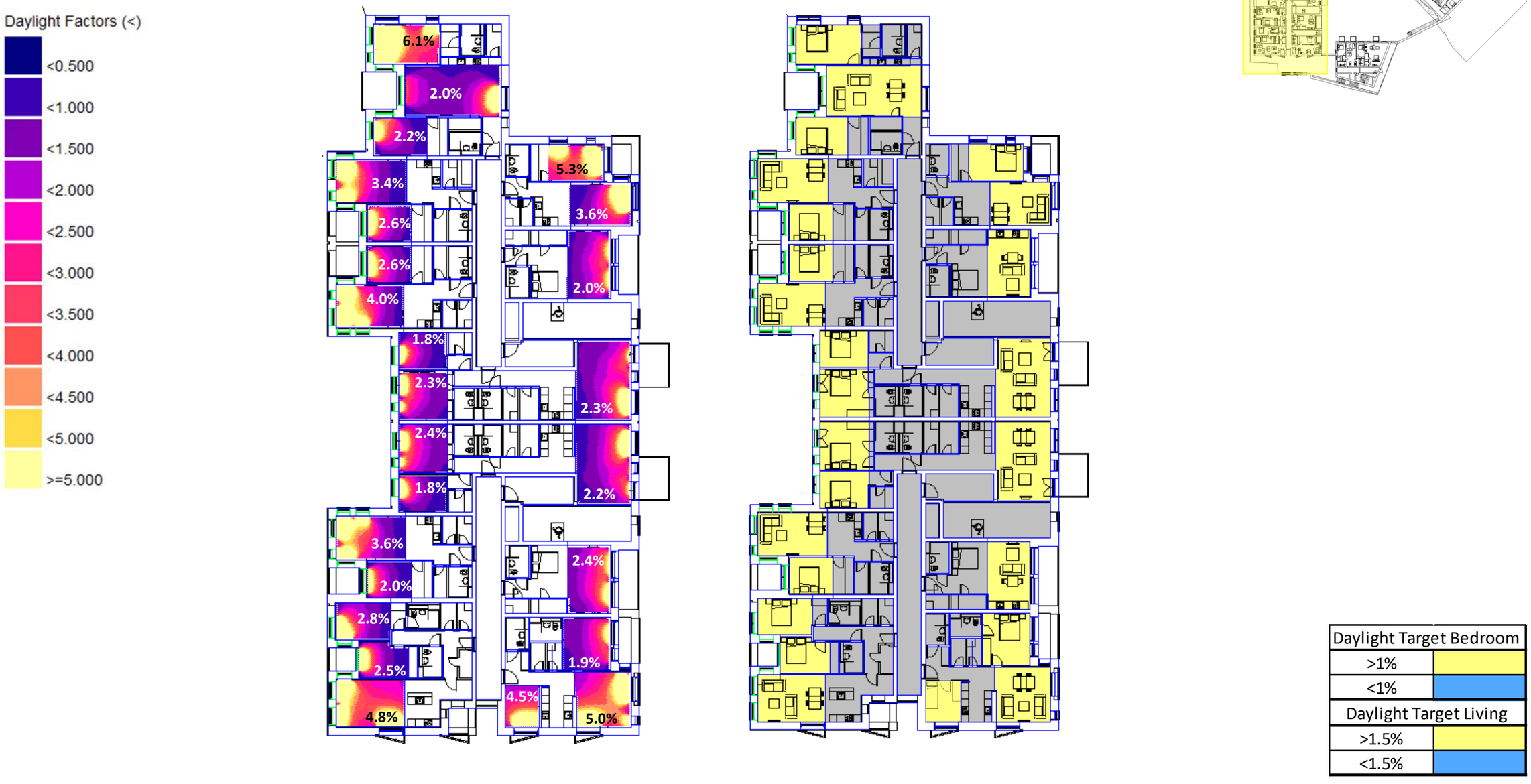


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.4 Building A – Third Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

25 of 25 rooms exceed the BRE guidelines on the third floor of Building A.



Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.5 Building A – Fourth Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

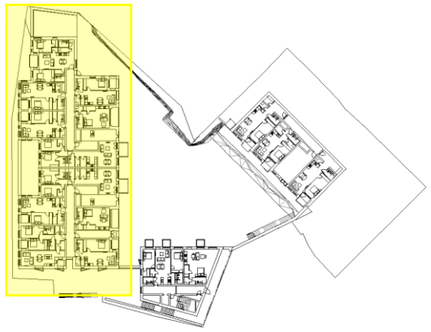
25 of 25 rooms exceed the BRE guidelines on the fourth floor of Building A.

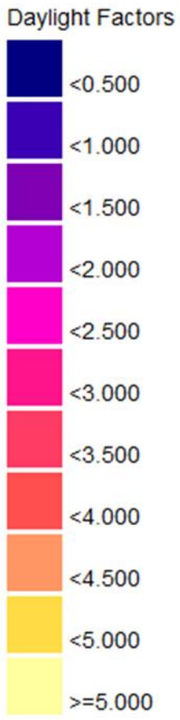
Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

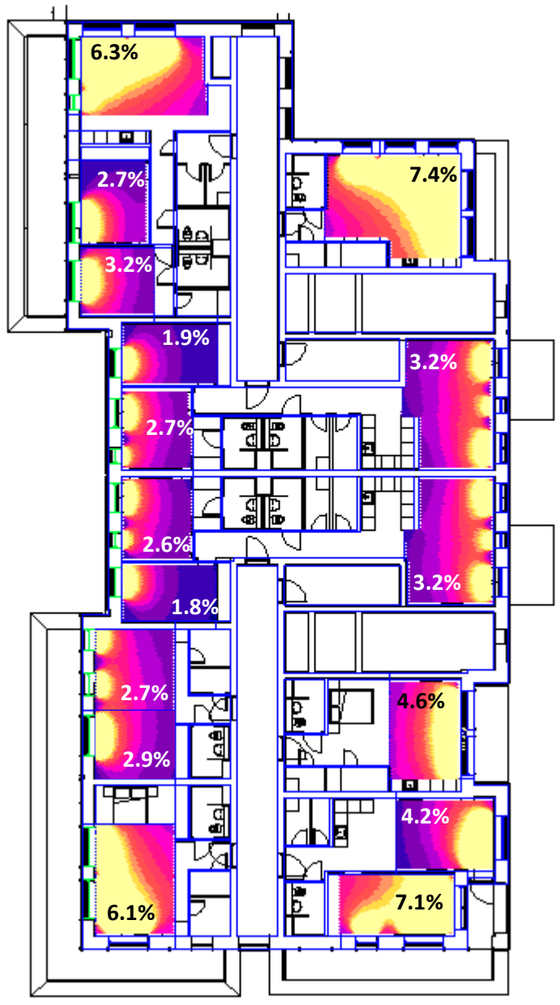
5.6 Building A – Fifth Floor

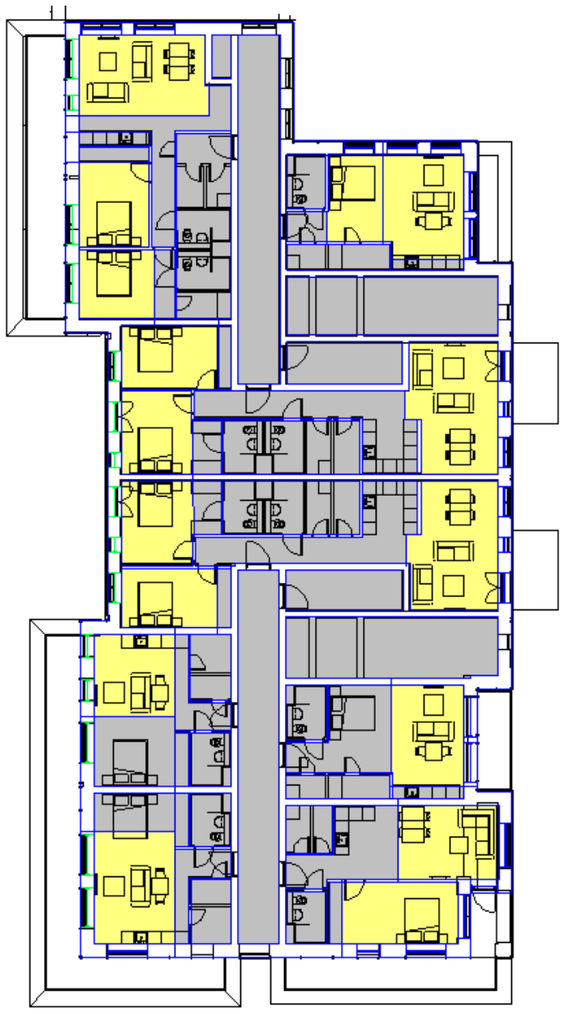
Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

16 of 16 rooms exceed the BRE guidelines on the fifth floor of Building A.







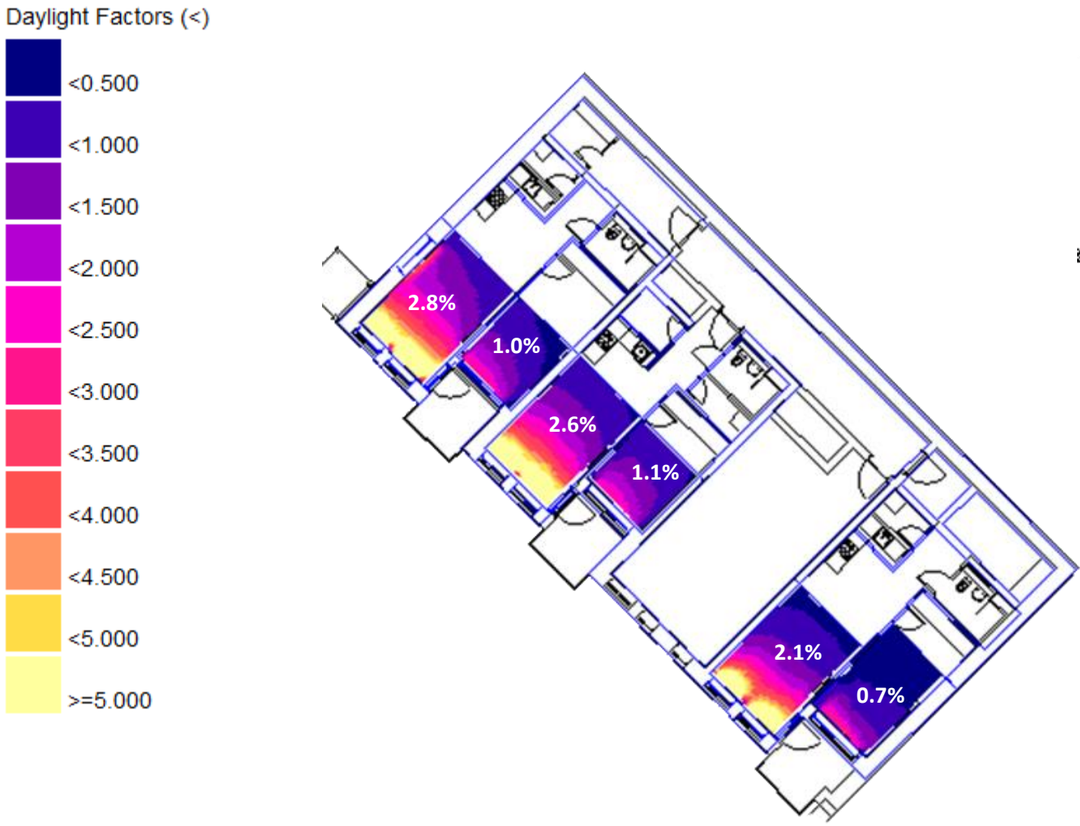


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.7 Building B – -2 Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

5 of 6 rooms exceed the BRE guidelines on the -2 floor of Building B.

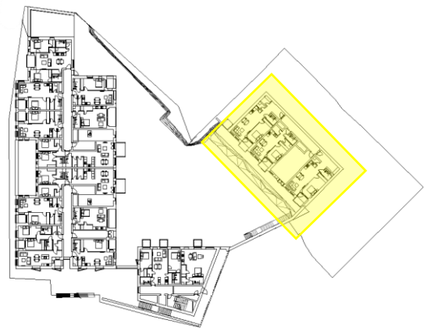


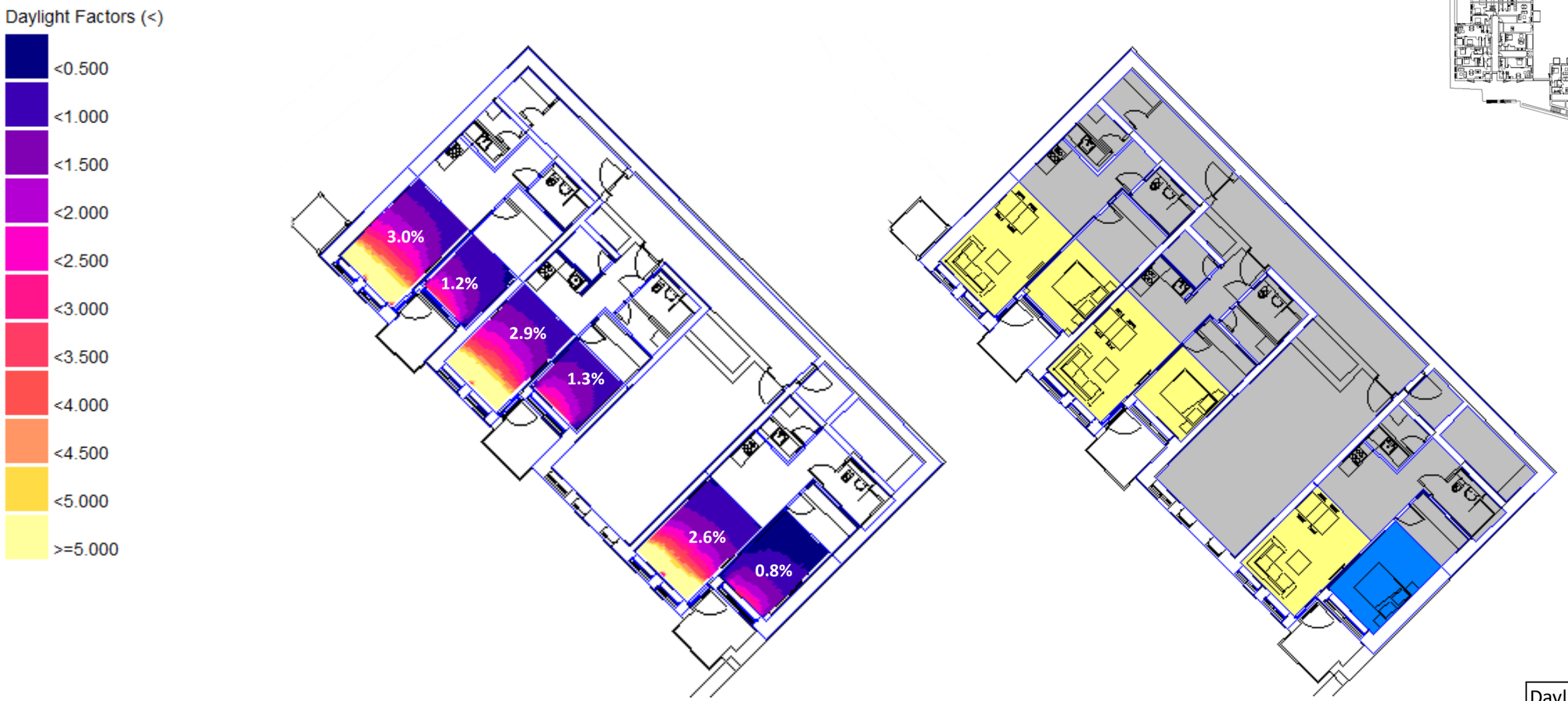
Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.8 Building B – -1 Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

5 of 6 rooms exceed the BRE guidelines on the -1 floor of Building B.



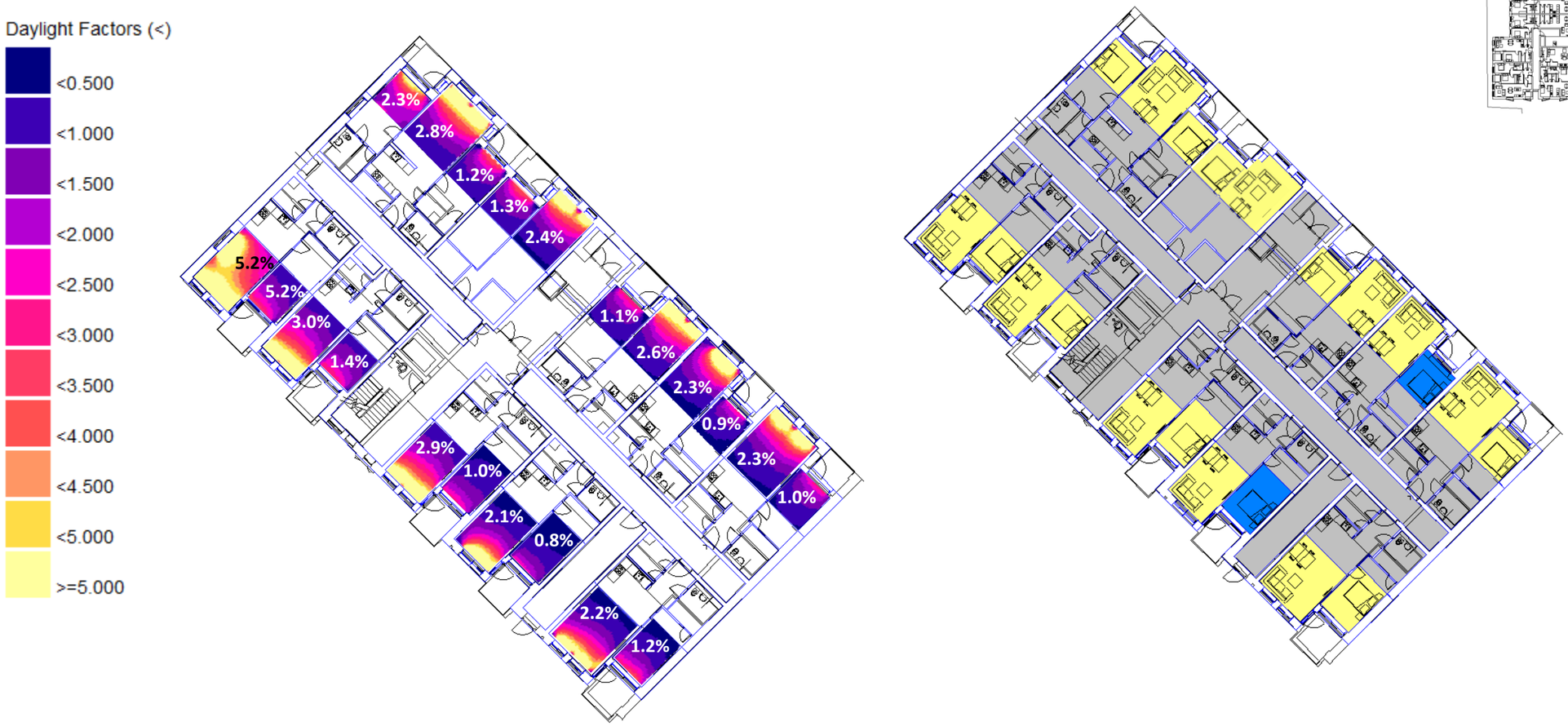


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.9 Building B – Ground Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

19 of 21 rooms exceed the BRE guidelines on the ground floor of Building B.

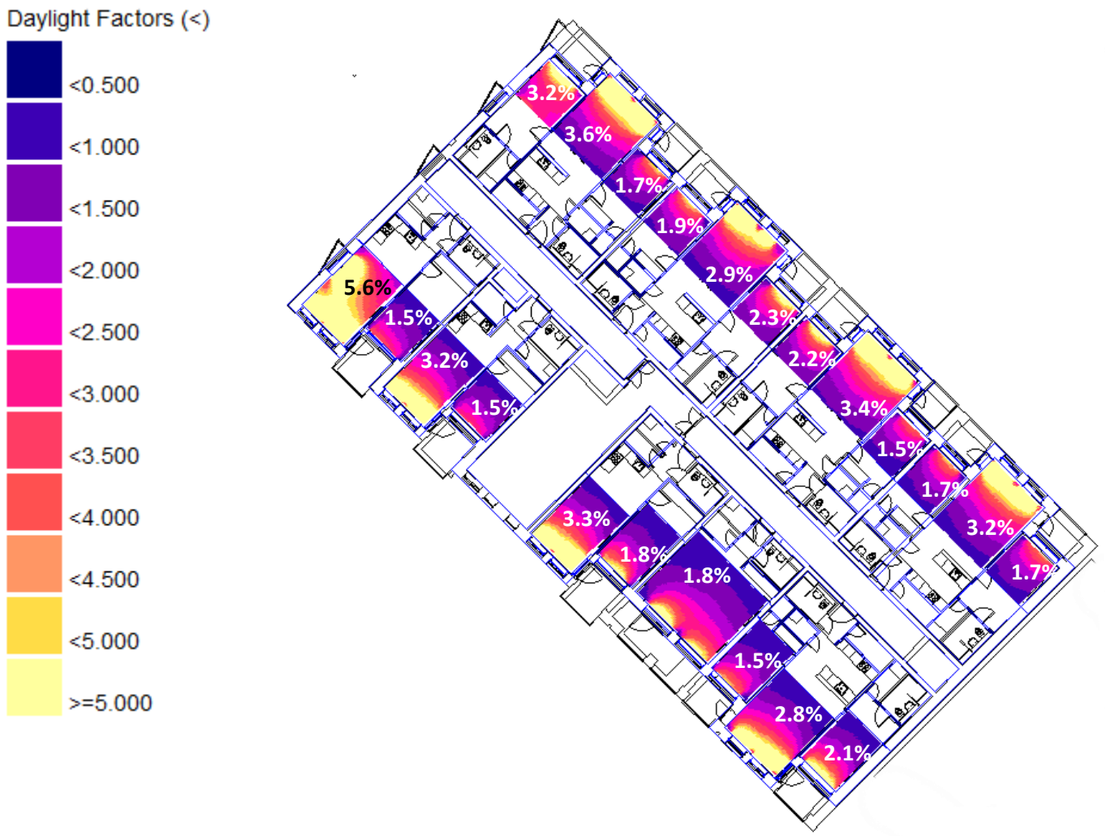


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.10 Building B – First Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

22 of 22 exceed the BRE guidelines on the first floor of Building B.

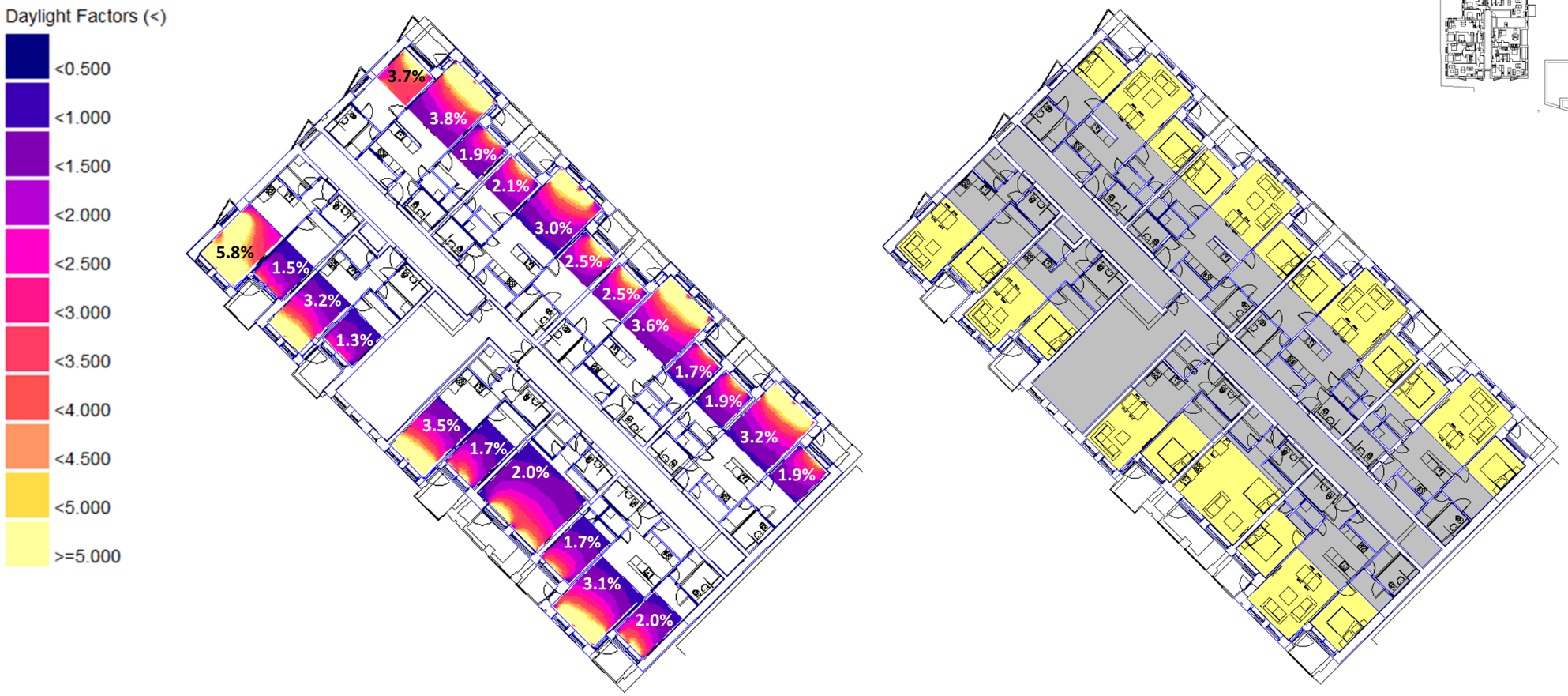


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.11 Building B – Second Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

22 of 22 exceed the BRE guidelines on the second floor of Building B.

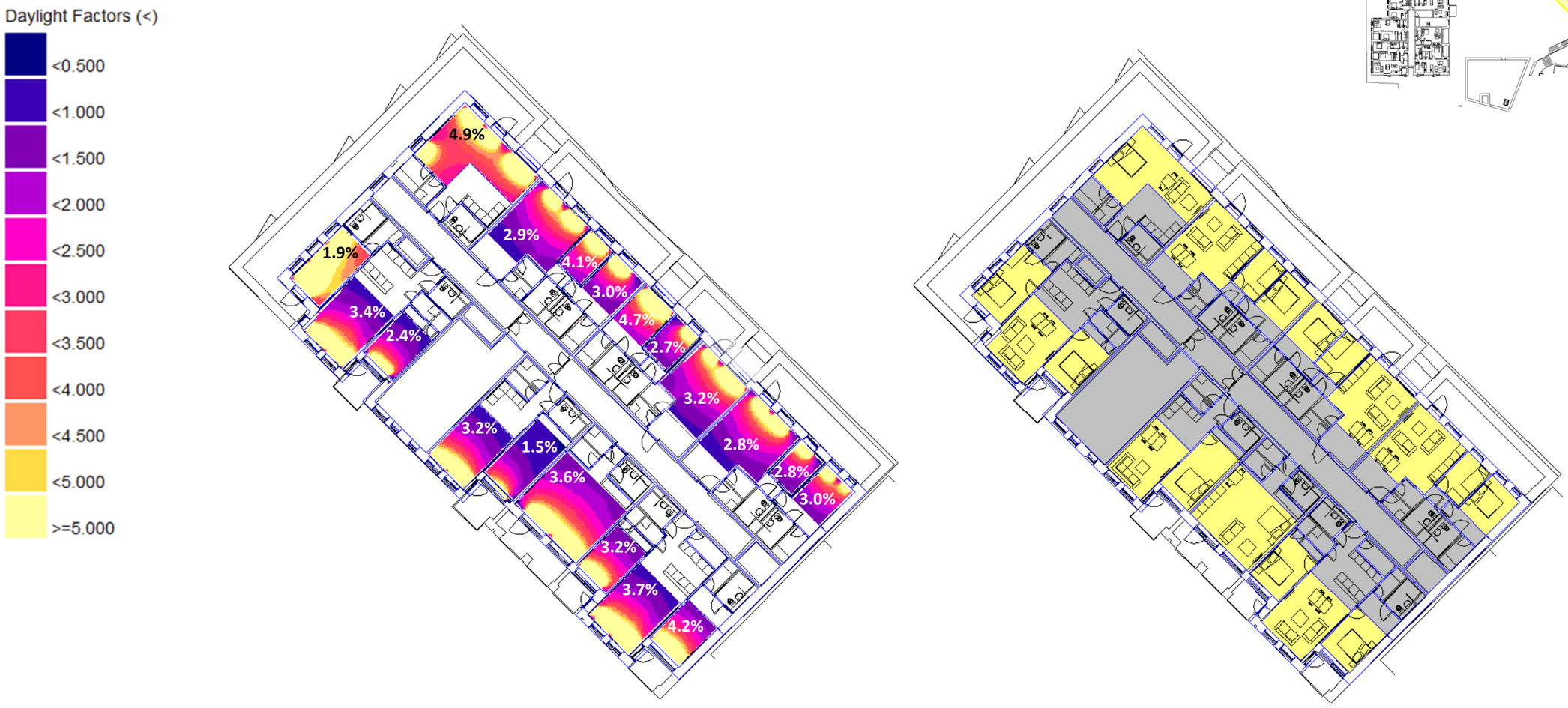


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.12 Building B – Third Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

22 of 22 exceed the BRE guidelines on the third floor of Building B.

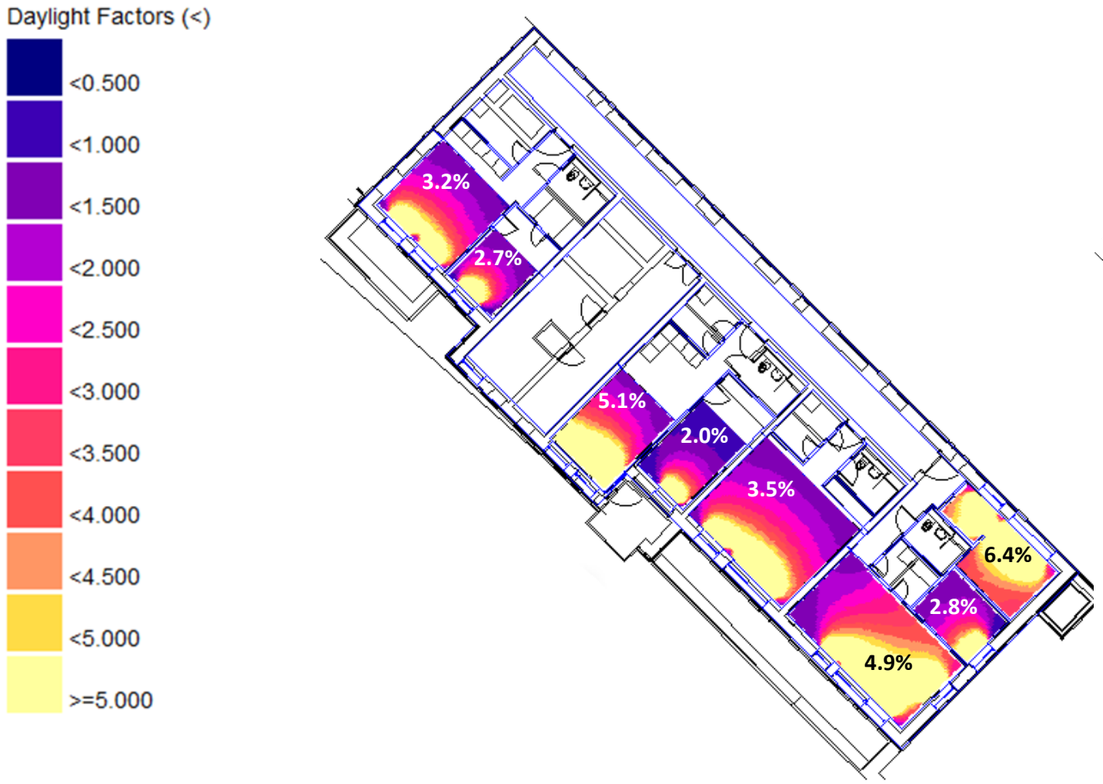


Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

5.13 Building B – Fourth Floor

Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

8 of 8 exceed the BRE guidelines on the fourth floor of Building B.

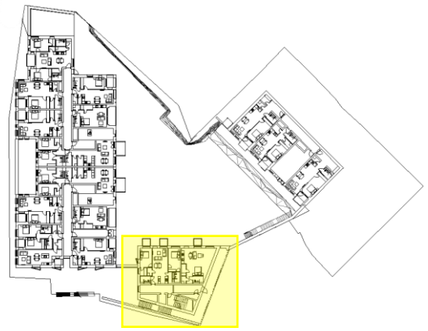


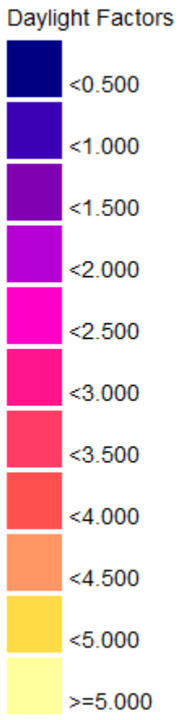
Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

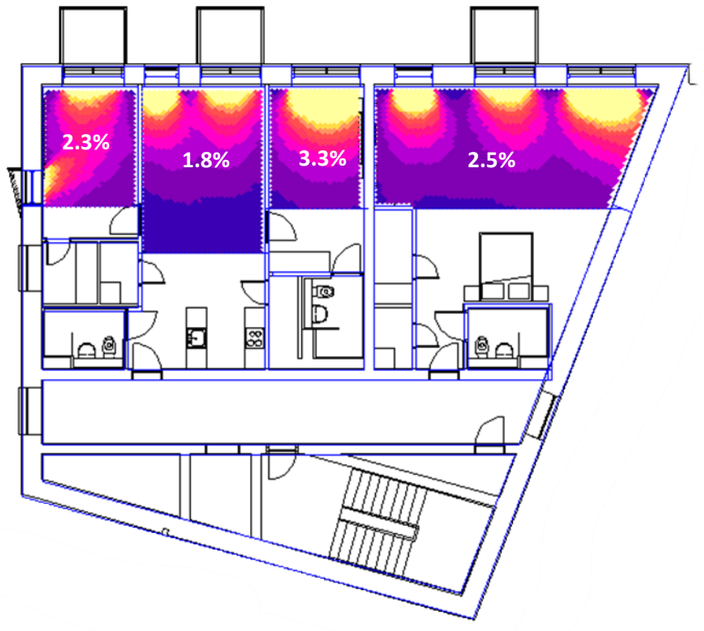
5.14 Building C – Ground Floor

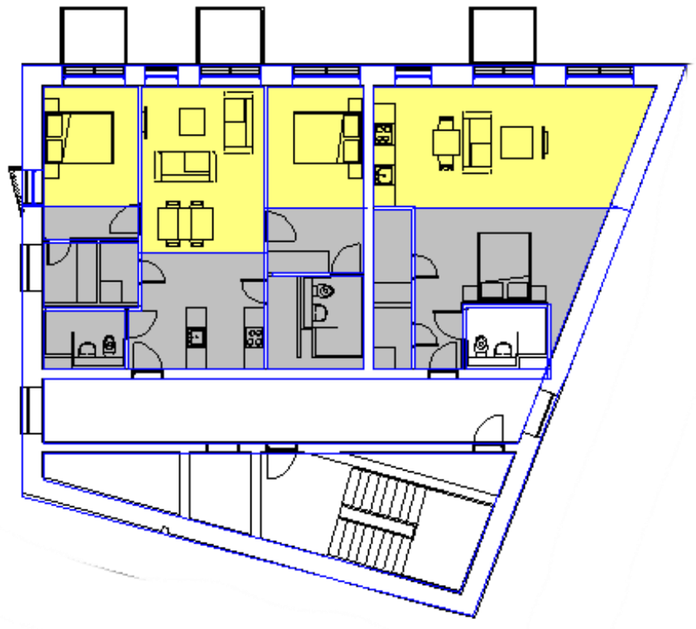
Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

All rooms exceed the BRE guidelines on the ground floor of Building C.







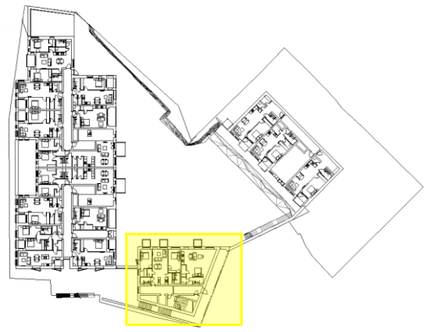


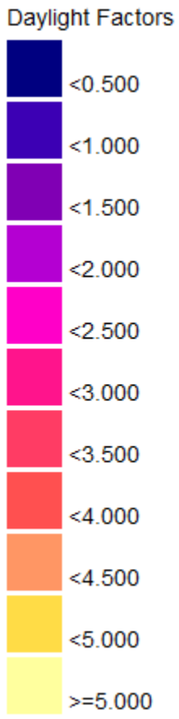
Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

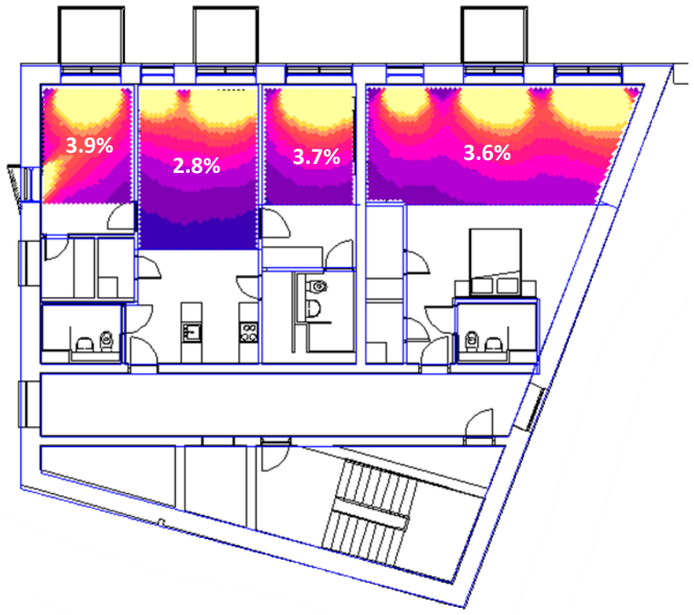
5.15 Building C – First Floor

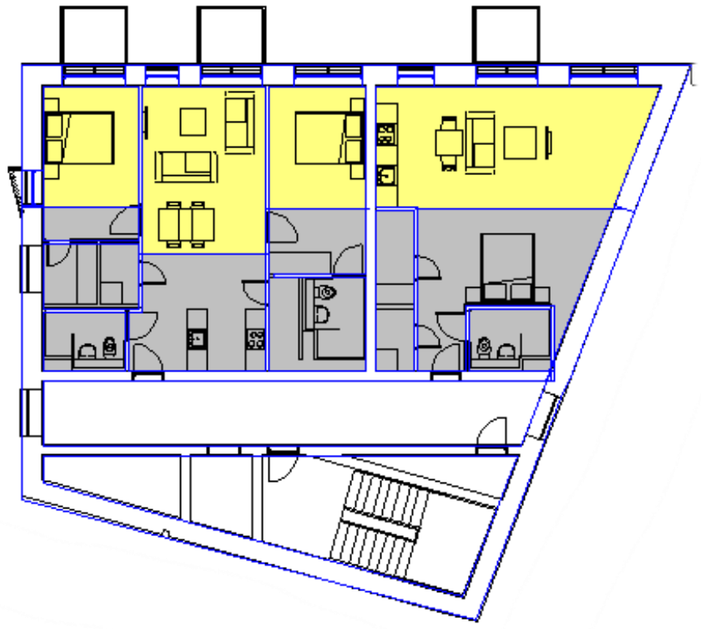
Daylighting Analysis as illustrated below, determined the following daylighting performance with associated Average Daylight Factors (ADF's).

All rooms exceed the BRE guidelines on the first floor of Building C.









Daylight Target Bedroom	
>1%	
<1%	
Daylight Target Living	
>1.5%	
<1.5%	

APPENDIX A – Site Shading Diagrams

Equinox March 21st

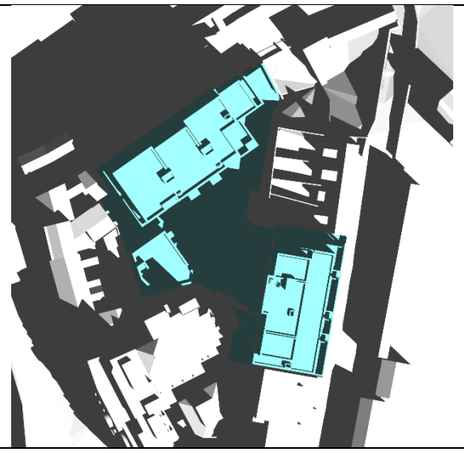
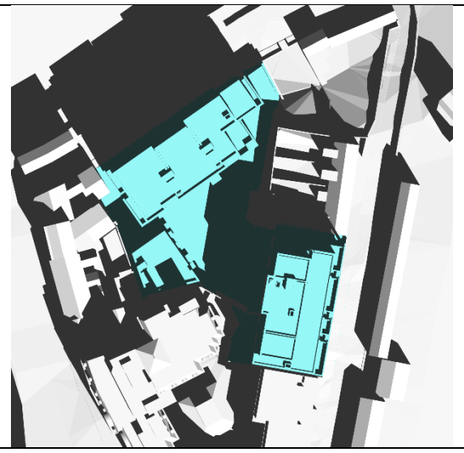
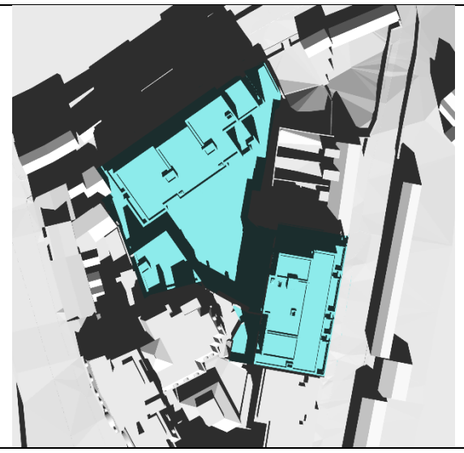
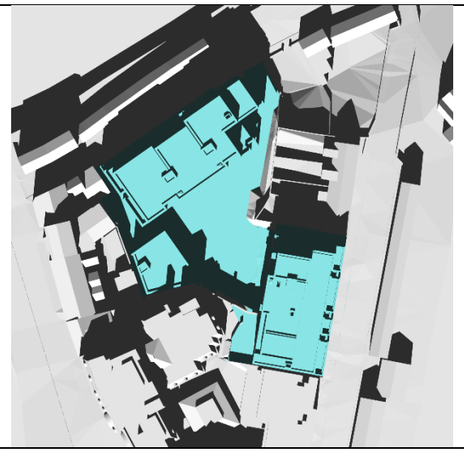
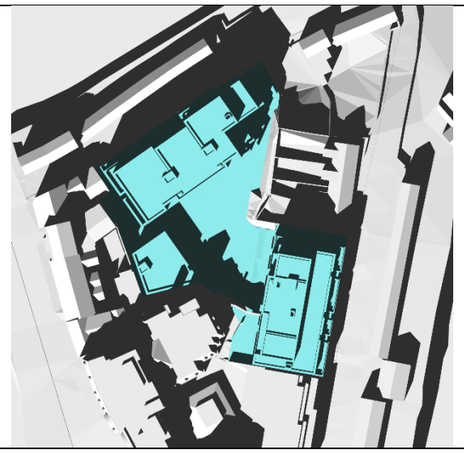
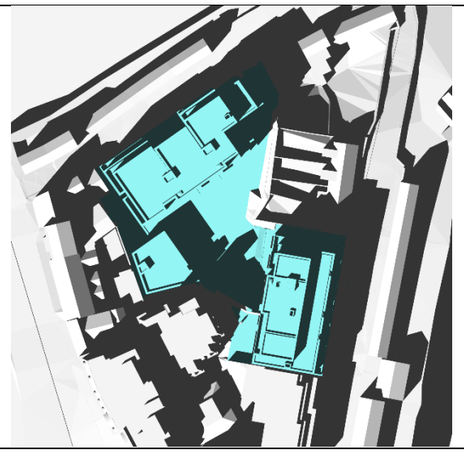
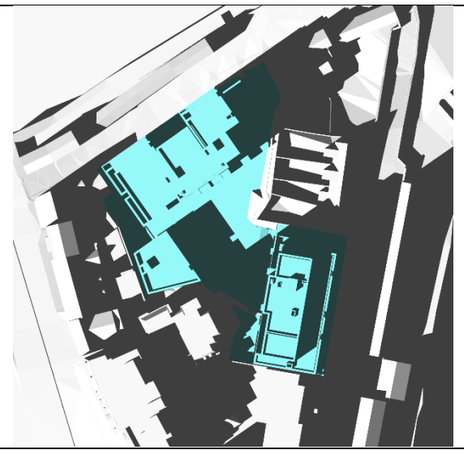
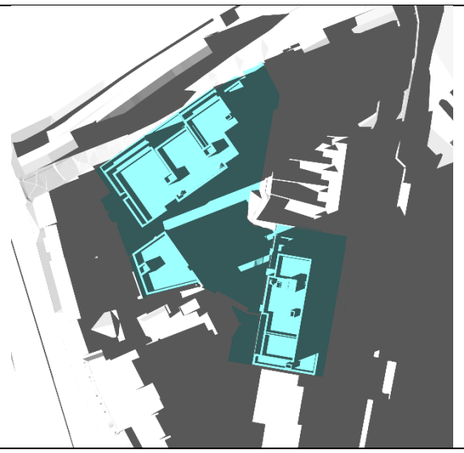
			
10:00	**11:00**	**12:00**	**13:00**
			
14:00	**15:00**	**16:00**	**17:00**

Fig A1: Sunlight and Site Shading Diagrams - Equinox (March 21st): 08:00-17:00 hrs

Summer Solstice June 21st

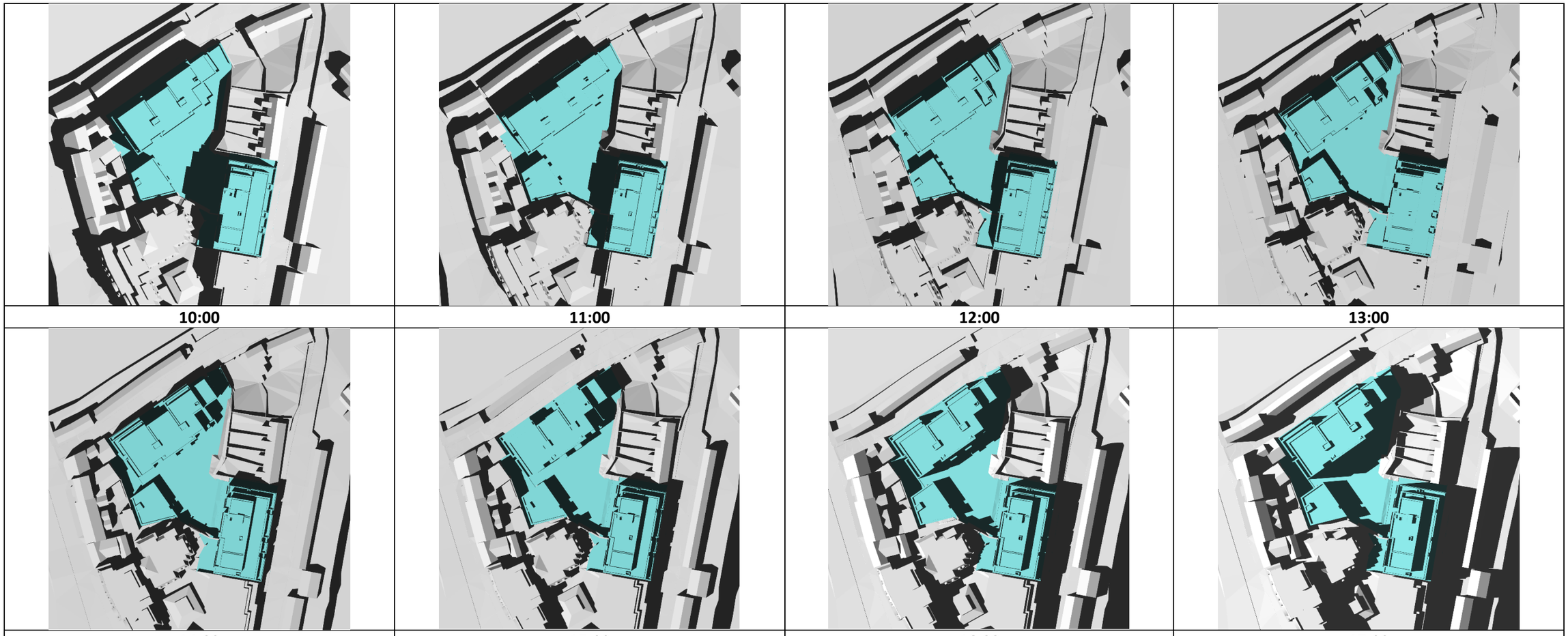


Fig A2: Sunlight and Site Shading Diagrams - Summer Solstice (June 21st): 08:00-17:00 hrs

Whilst both winter and summer solstices have been included, it should be noted that the statistics of Met Eireann, the Irish Meteorological Service, indicate that the sunniest months in Ireland are May and June. During December, Dublin receives a mean daily duration of 1.7 hours of sunlight out of a potential 7.4 hours sunlight each day (i.e. only 22% of potential sunlight hours). This can be compared with a mean daily duration of 6.4 hours of sunlight our of a potential 16.7 hours each day received by Dublin during June (i.e. 38% of potential sunlight hours). Therefore, impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months. Due to the low angle of the sun in mid-winter, the shadow environment in all urban and suburban areas are generally dense tending to make the images confusing and superfluous.

Winter Solstice December 21st

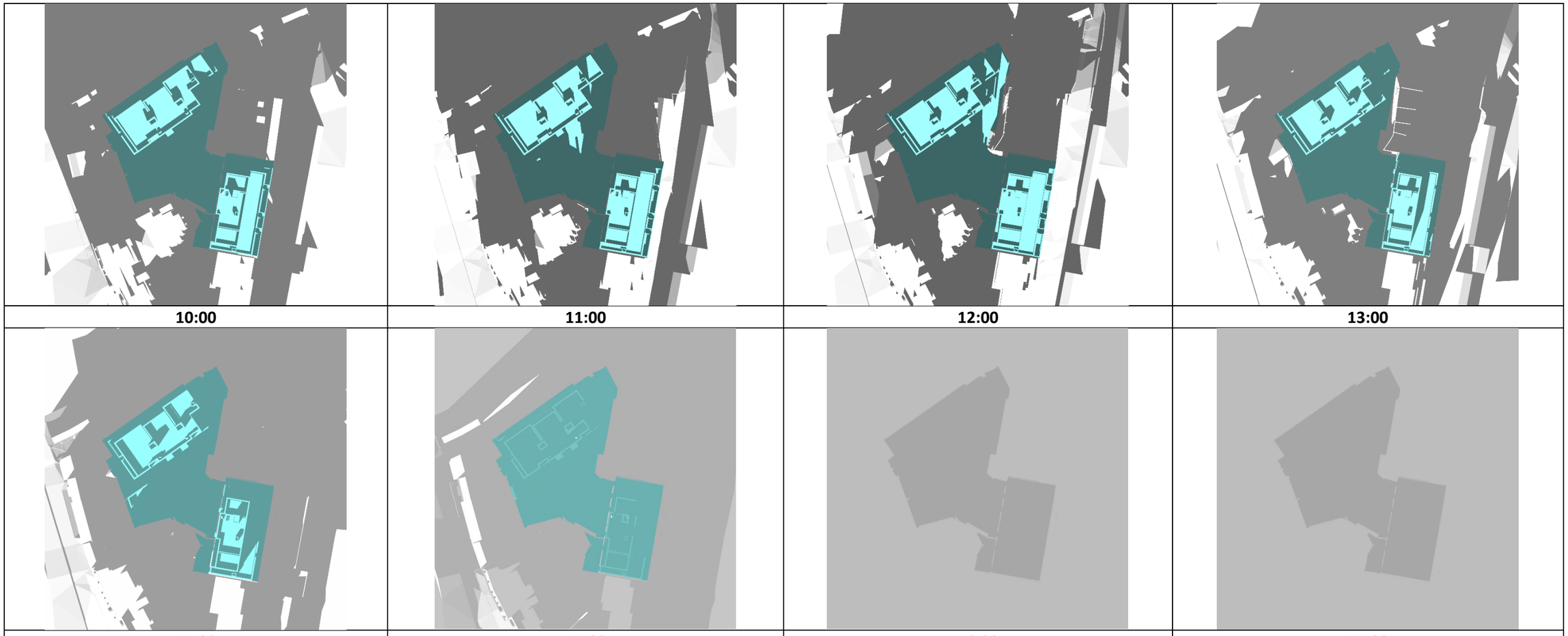


Fig A3: Sunlight and Site Shading Diagrams - Winter Solstice (December 21st): 08:00-17:00 hrs

Whilst both winter and summer solstices have been included, it should be noted that the statistics of Met Eireann, the Irish Meteorological Service, indicate that the sunniest months in Ireland are May and June. During December, Dublin receives a mean daily duration of 1.7 hours of sunlight out of a potential 7.4 hours sunlight each day (i.e. only 22% of potential sunlight hours). This can be compared with a mean daily duration of 6.4 hours of sunlight our of a potential 16.7 hours each day received by Dublin during June (i.e. 38% of potential sunlight hours). Therefore, impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months. Due to the low angle of the sun in mid-winter, the shadow environment in all urban and suburban areas are generally dense tending to make the images confusing and superfluous.

APPENDIX B – EN Daylight Standards

The Daylight Analysis section of the report assesses the Average Daylight Factors in accordance with the BRE 209 guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition). This guide is specifically referenced within Section 6.6 of The Department of Housing, Planning and Local Government document – Sustainable Urban Housing: Design Standards for New Apartments (2018) which advises that:

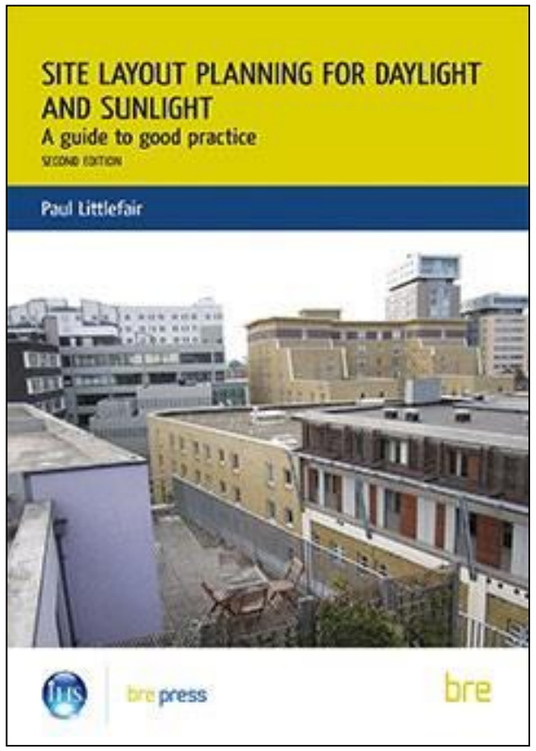
Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision.

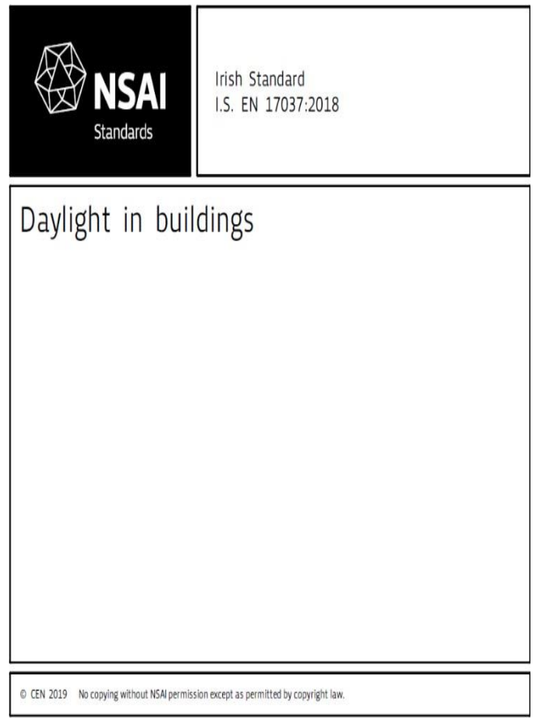
Subsequent to this guidance, a new European Standard for Daylight in Buildings (EN 17037) was released in 2018 and adopted as IS EN 17037 in January 2019. This standard does not fall under any *mandatory* directive of the EU or any Irish Statutory Instrument and therefore remains *advisory*.

On release of the EN standard within the UK, the BRE confirmed their intention to provide a National Annex, which will subsequently inform an updated and revised BRE 209 document. The rational for this Annex was that the Median Daylight Factor methodology applied within EN 17037 do not differentiate between residential and non- residential applications, with the standard stipulating a minimum target illuminance of 300 lux for all Building Applications. However, it is recognised by BRE that Dwellings have lower natural light requirements compared to non-domestic buildings (i.e. BS. 8602-2 has Average Daylight Factors of 1.0-2.0% for dwellings, as opposed to Average Daylight Factors of 2.0-5.0% for non-residential). Furthermore, providing higher daylight level in residential applications may in some instances be counter-productive in that excessive glazing provision may promote overheating.

This Annex, which was included in the British Standard version of EN 17037 identifies the target illuminances for dwellings that should be exceeded for over at least 50% of a room, and for at least half of annual daylight hours (i.e. Median). Utilising the Median External Illuminance of 14,900 Lux for Dublin (EN 17037 Table A.3) the following Median Daylight Factors may therefore be applied, adopting the methodology used in BS.EN 17037 Annex NA:

Room type	**Target illuminance** E_T (lx)	**Median Daylight Factors**
Bedroom	100	0.7%
Living room	150	1.0%





A compliance comparison was then made for the Living/ Dining Rooms between the existing B.S.8206-2008 (as referenced within BRE.209, DoHPLG Planning Guidelines and used for analysis within this report) and the BS EN.17037:2018 Annex NA (as understood to be introduced in forthcoming BRE.209 Guidelines).

Figure B.1 compares results for all Living/ Dining space.

Average Daylight Factor (ADF) as per BS.8206-2 (horizontal axis), with rooms deemed compliant where ADF exceeds 1.5%.

Extent of room where Daylight Factor exceeds BS.EN.17037 Annex NA target of 1.0% (vertical axis), with rooms deemed compliant where extent exceeds 50% (i.e. Median Daylight Factor or MDF).

This graph illustrates that the results are generally aligned under both methodologies, with rooms where compliance in accordance with B.S.8206-2 within this report has been confirmed were also generally found to be compliant to BS.EN.17037 Annex NA (green markers) and the converse non-compliances also true (red markers).

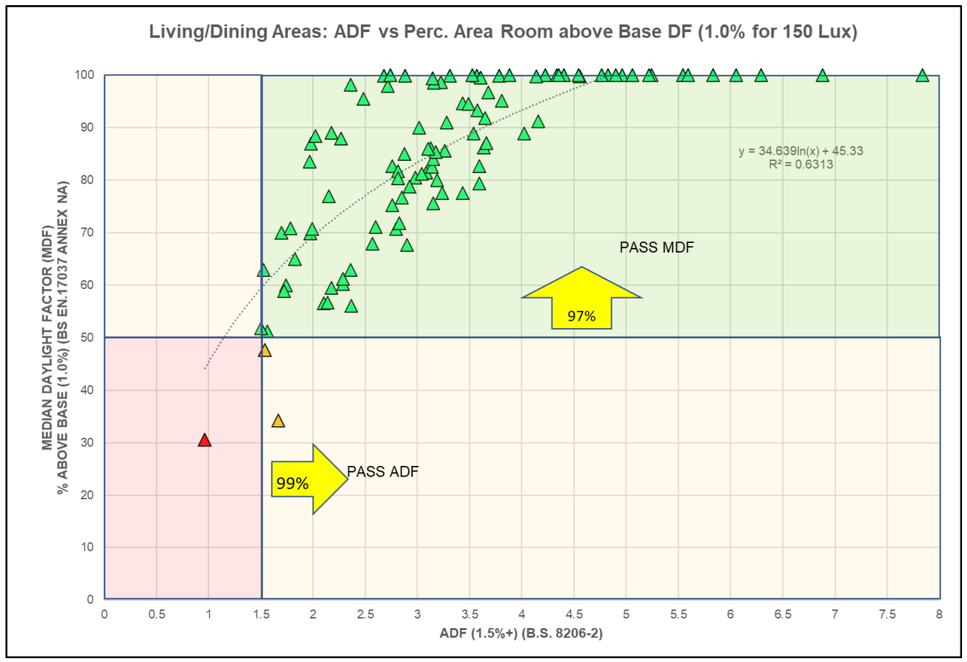


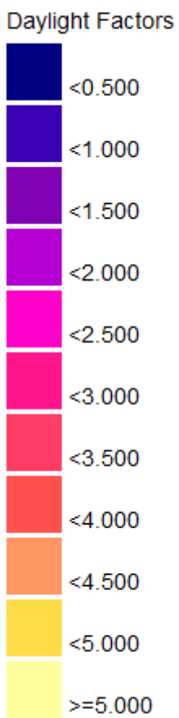
Fig B.1: Compliance Comparison: ADF-v-MDF

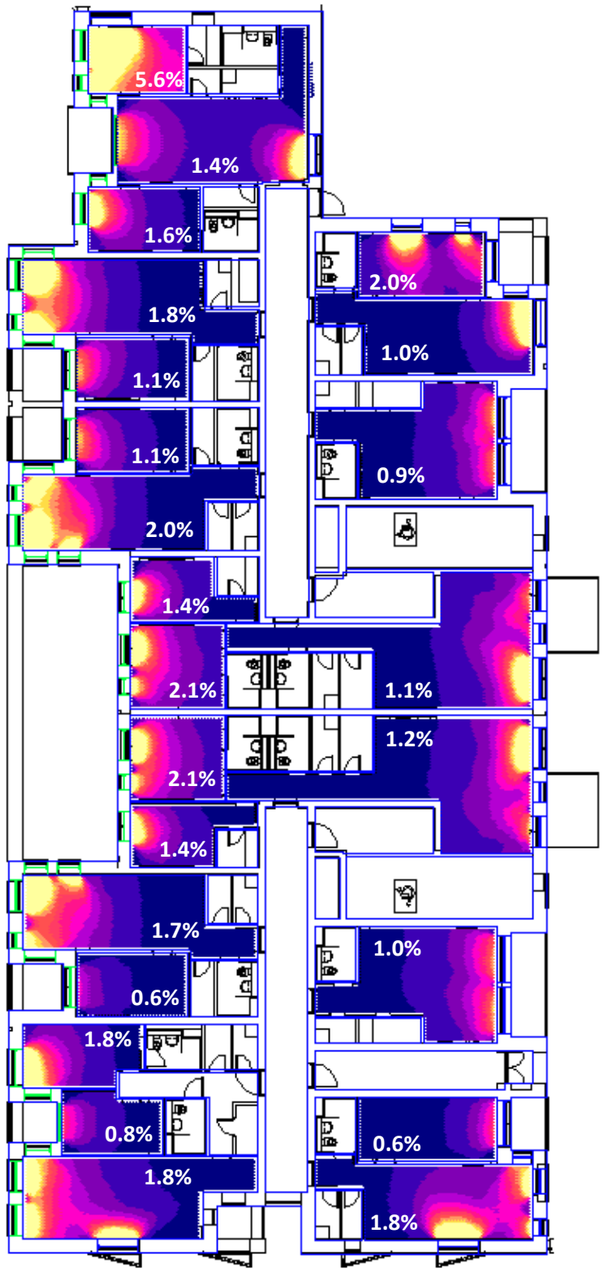
APPENDIX C – Alternative Daylight Calculations

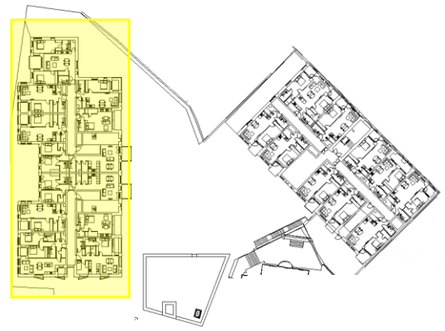
A second daylight assessment was carried out to determine the average daylight factor (ADF) that would be achieved for the full spaces.

This assessment provides the raw values without the space delineation as set out in Section 5.0.

Building A – First Floor



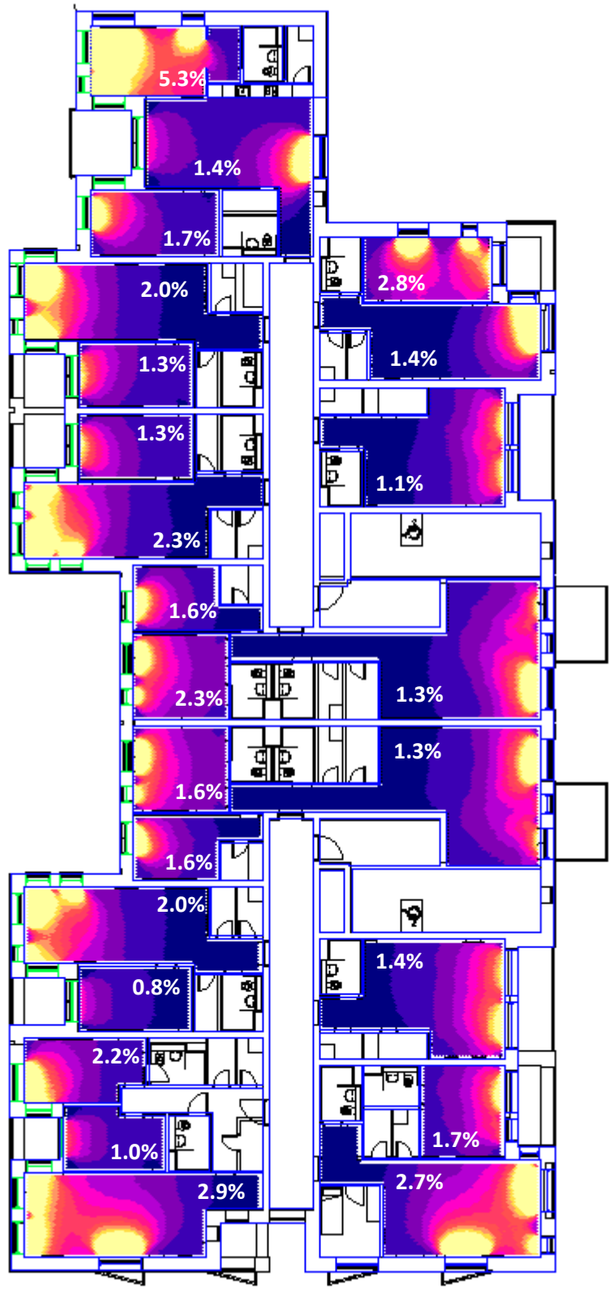


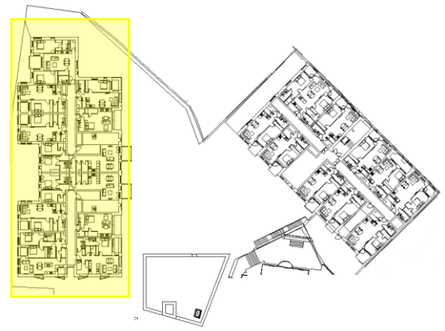


Building A – Second Floor

Daylight Factors (<)

- <0.500
- <1.000
- <1.500
- <2.000
- <2.500
- <3.000
- <3.500
- <4.000
- <4.500
- <5.000
- >=5.000

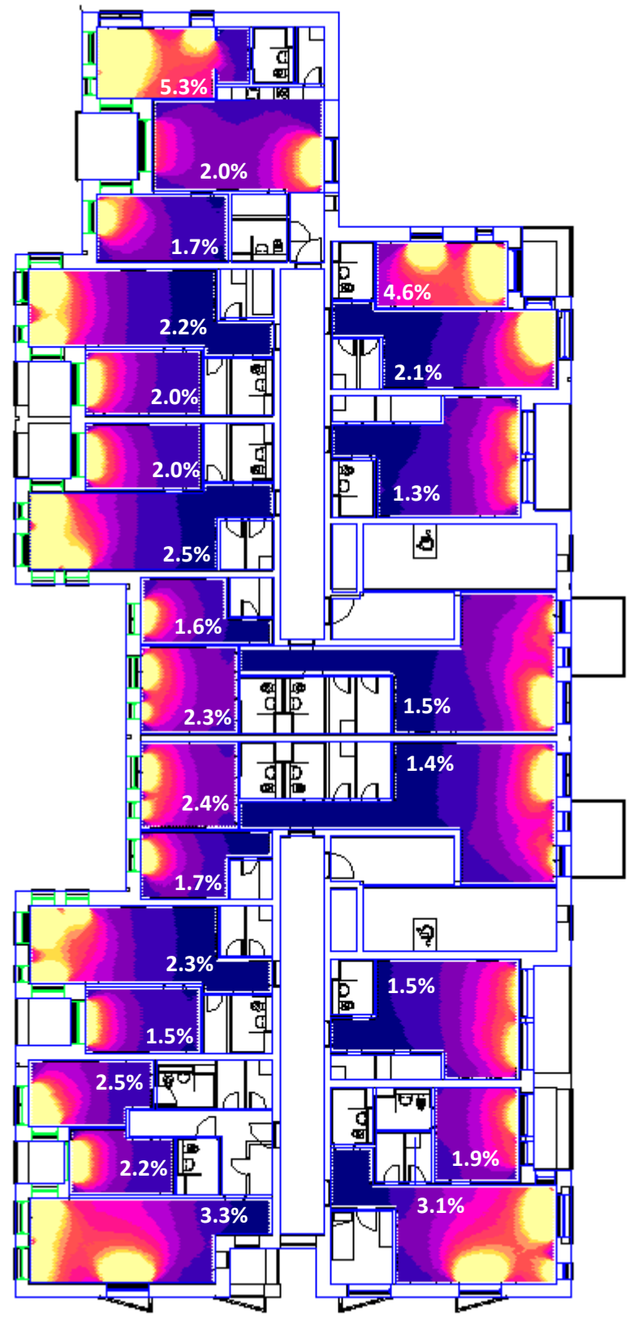




Building A – Third Floor

Daylight Factors (<)

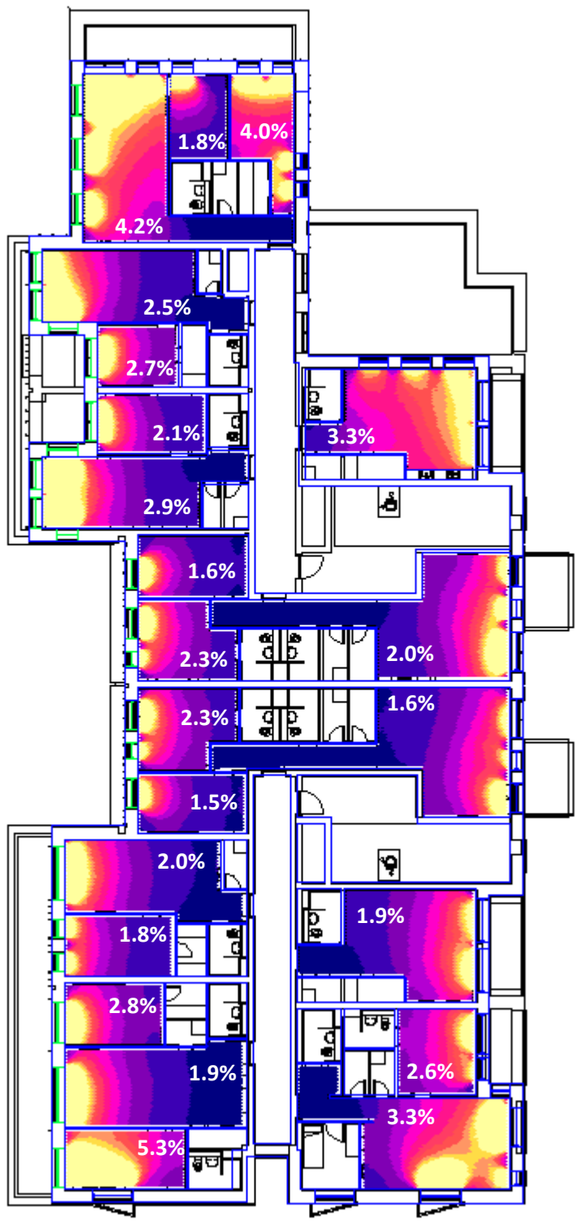
- <0.500
- <1.000
- <1.500
- <2.000
- <2.500
- <3.000
- <3.500
- <4.000
- <4.500
- <5.000
- >=5.000

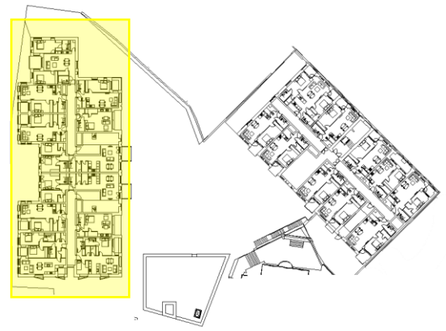


Building A – Fourth Floor

Daylight Factors (<)

- <0.500
- <1.000
- <1.500
- <2.000
- <2.500
- <3.000
- <3.500
- <4.000
- <4.500
- <5.000
- >=5.000

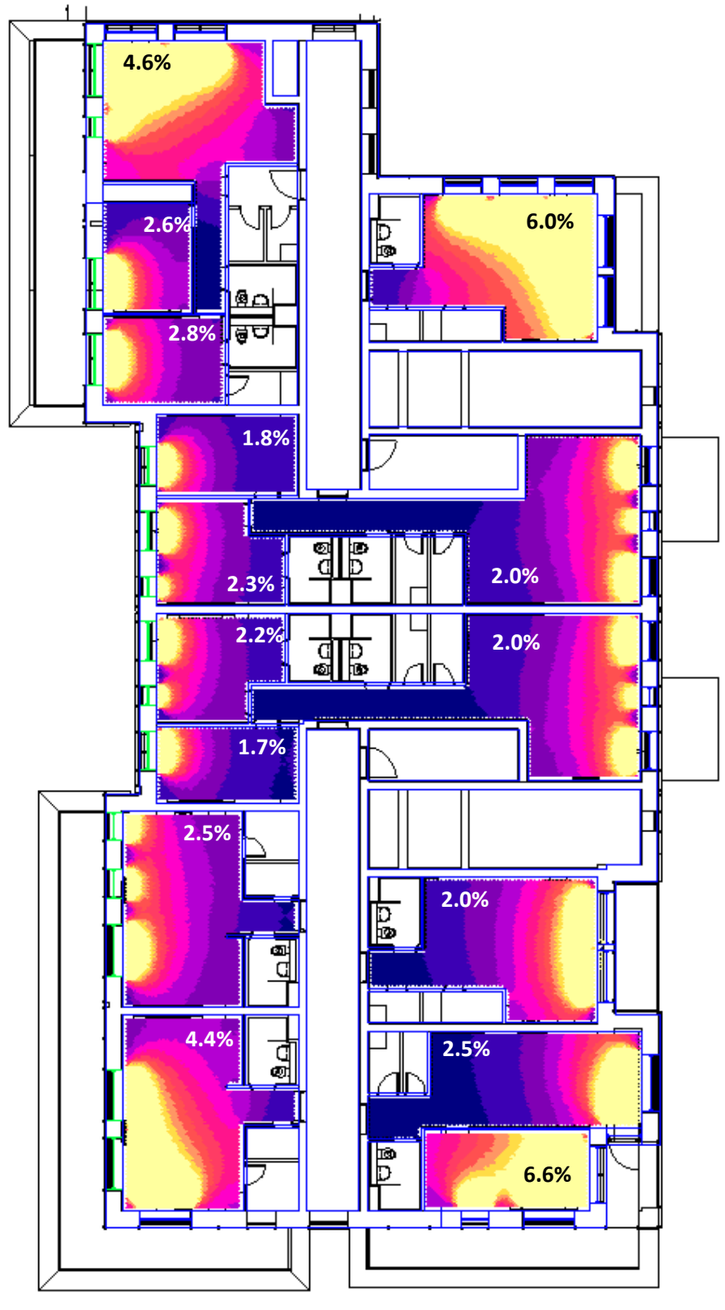




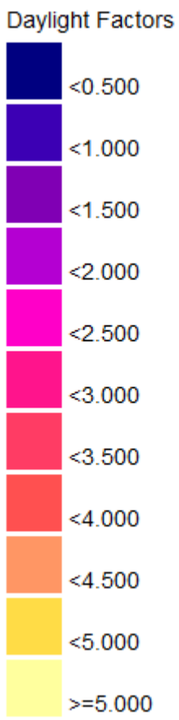
Building A – Fifth Floor

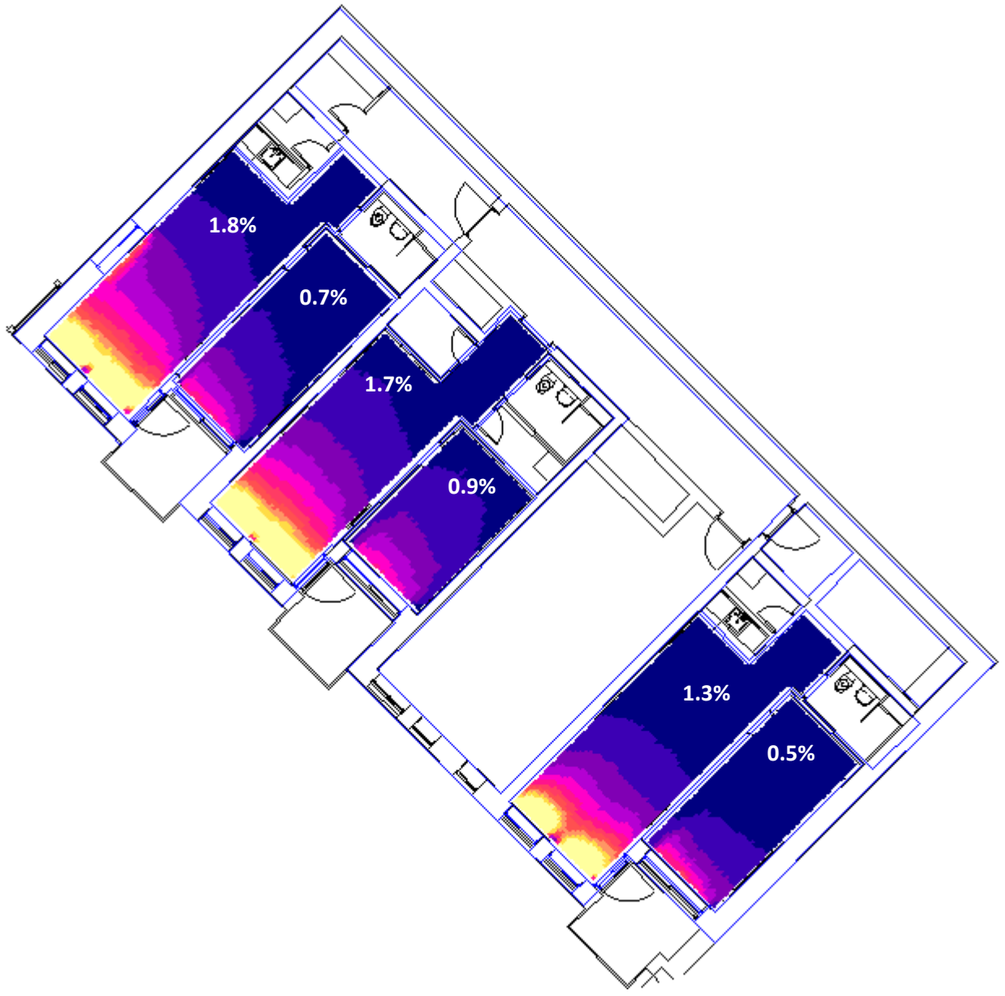
Daylight Factors (<)

- <0.500
- <1.000
- <1.500
- <2.000
- <2.500
- <3.000
- <3.500
- <4.000
- <4.500
- <5.000
- >=5.000

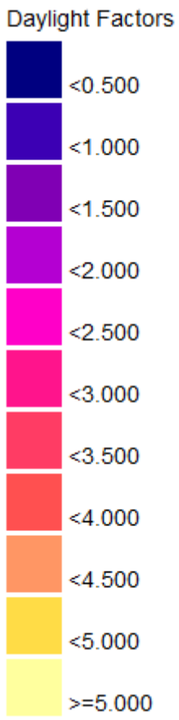


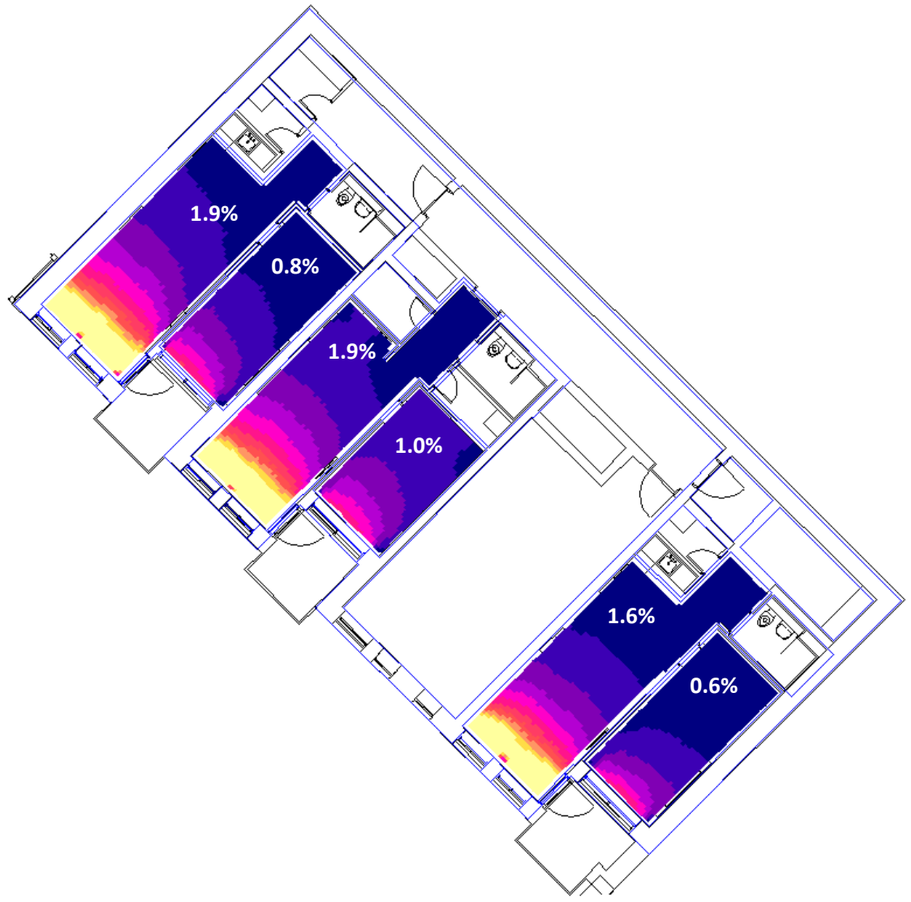
Building B – -2 Floor

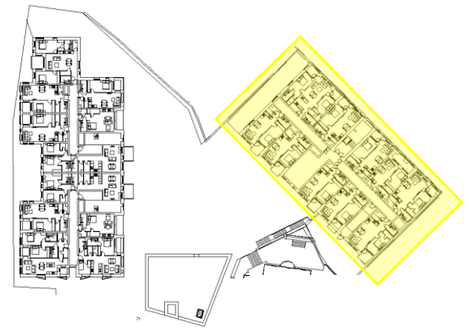




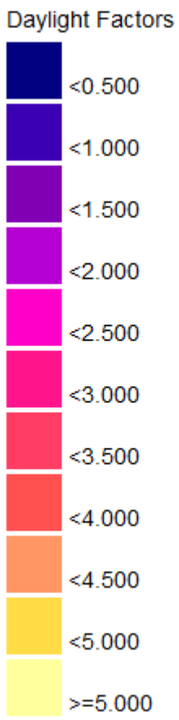
Building B – -1 Floor

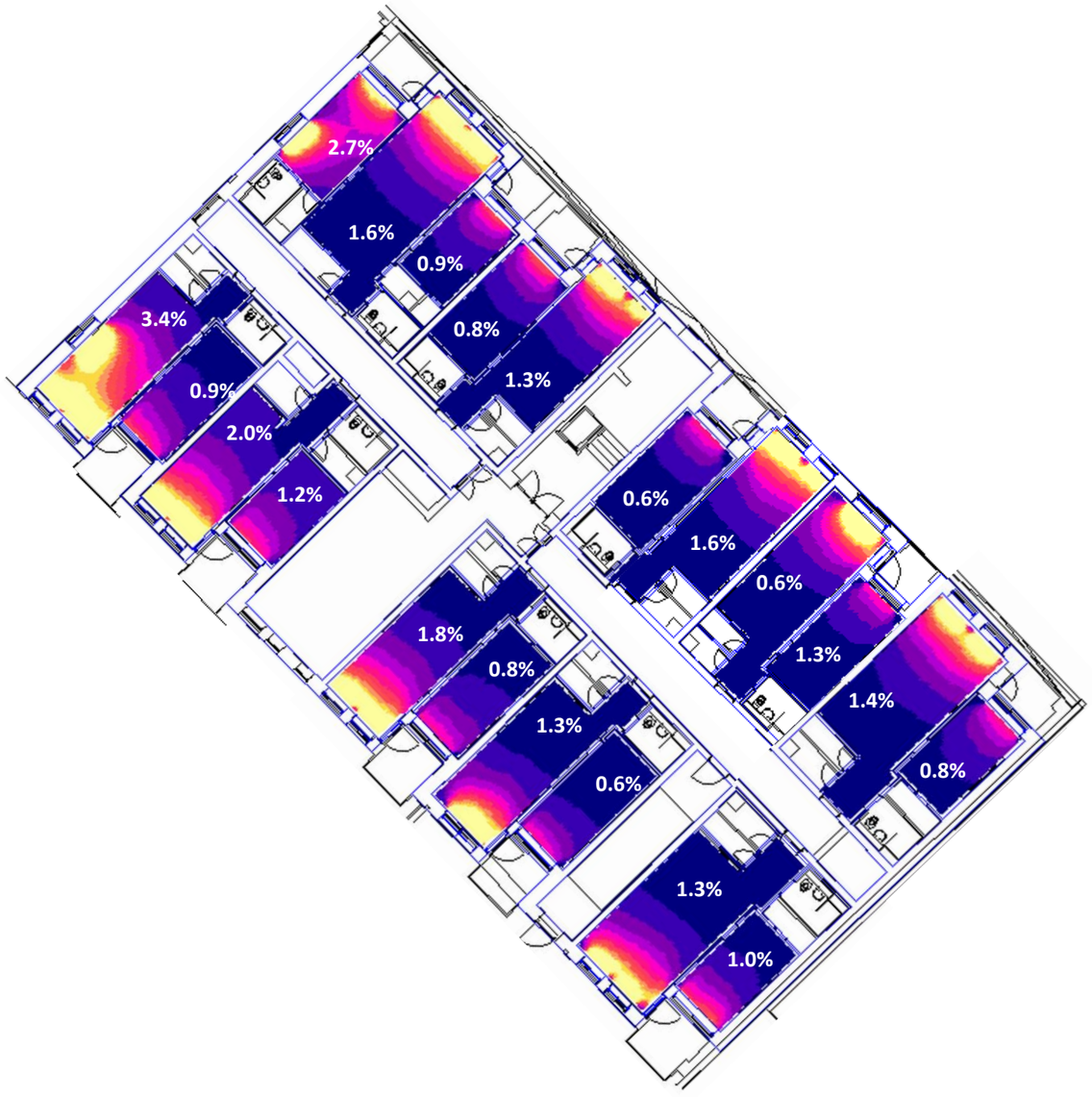


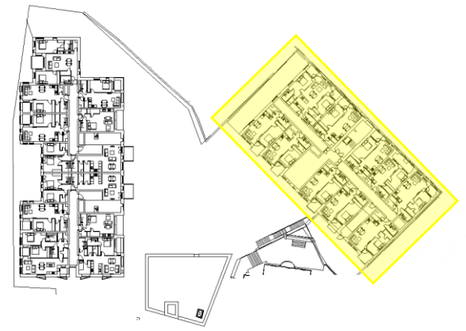




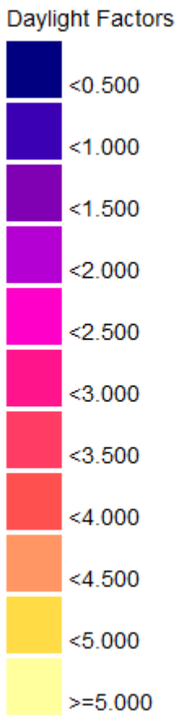
Building B – Ground Floor

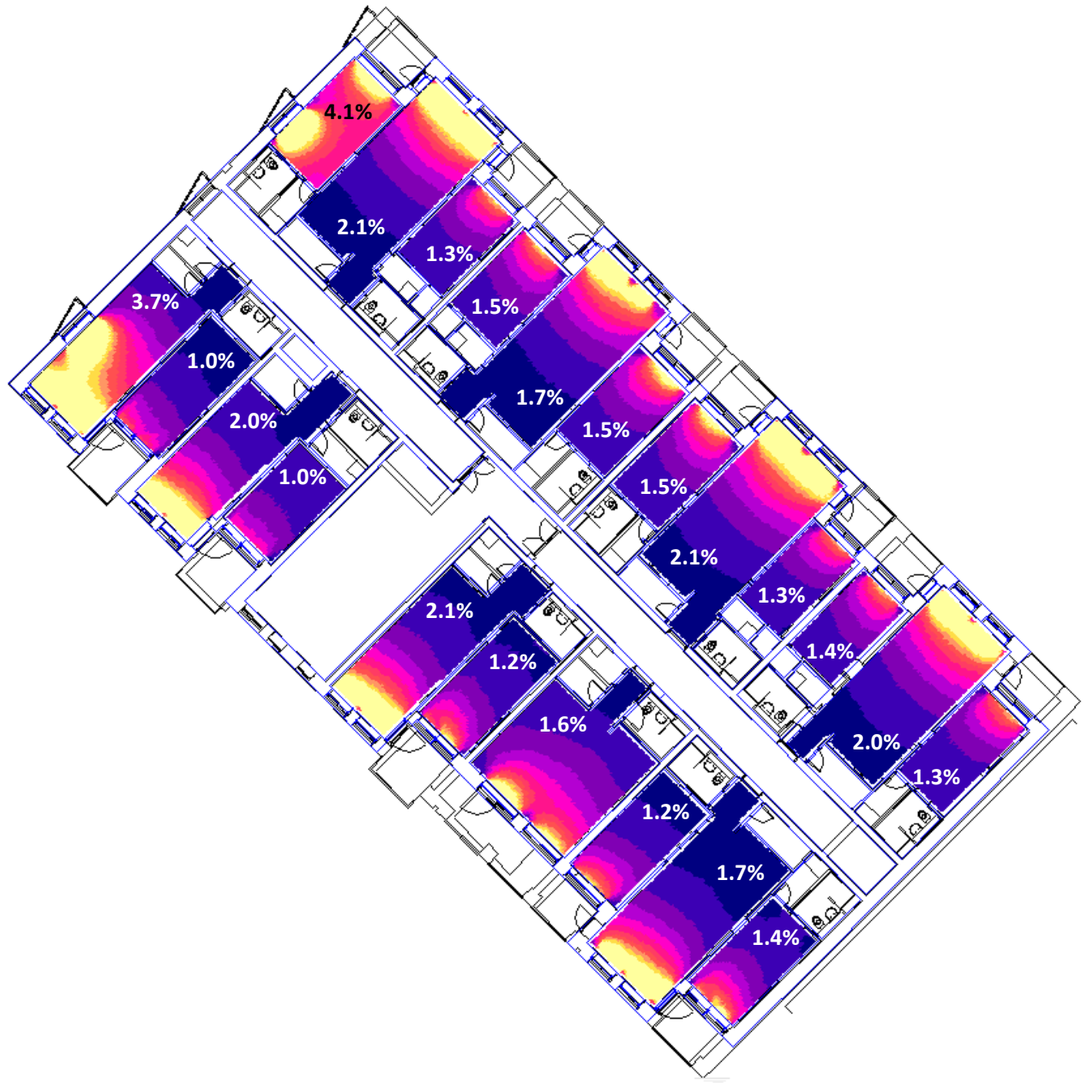




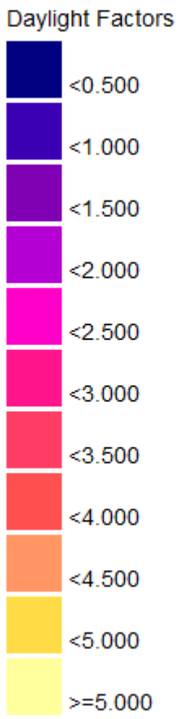


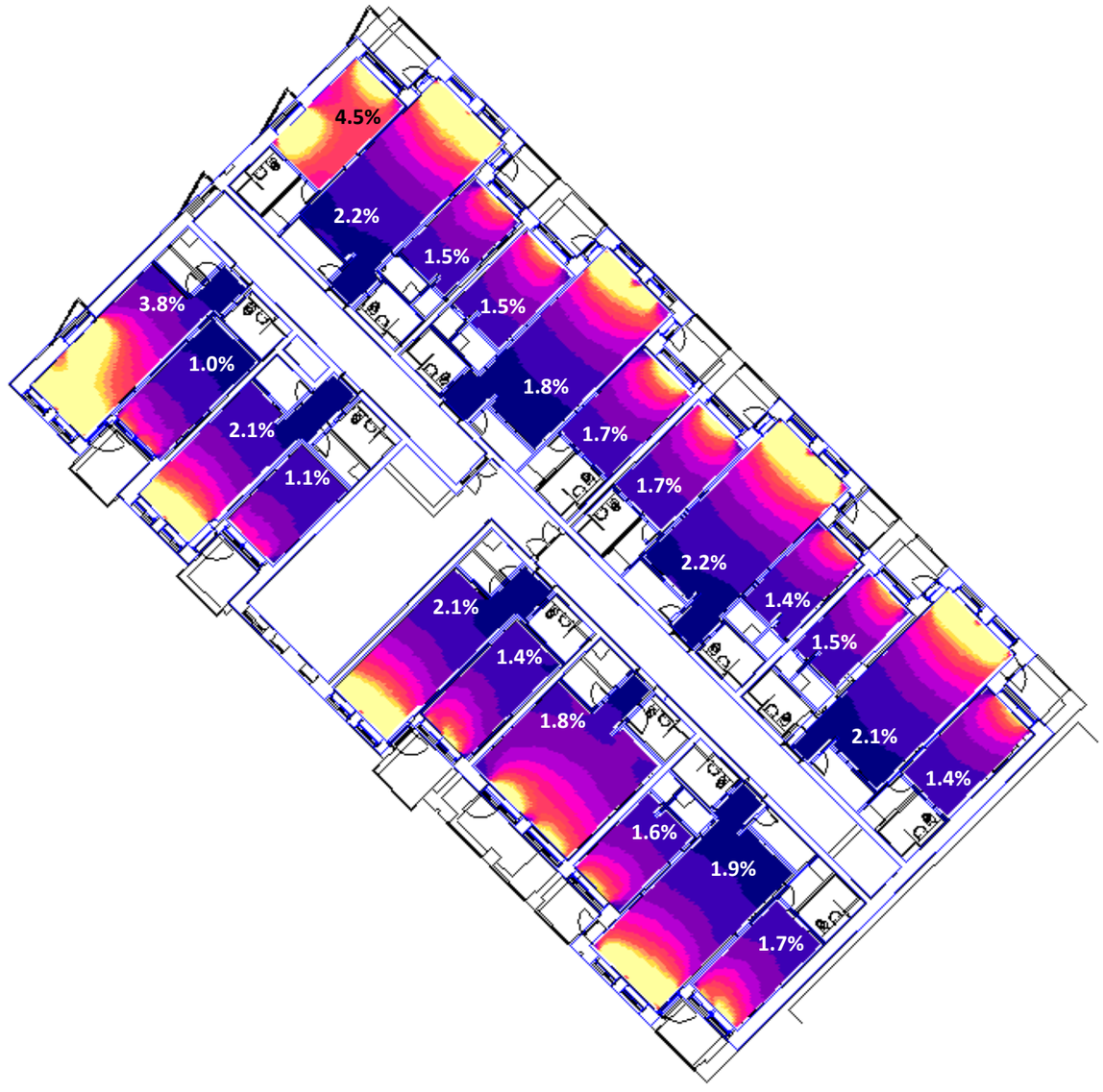
Building B – First Floor



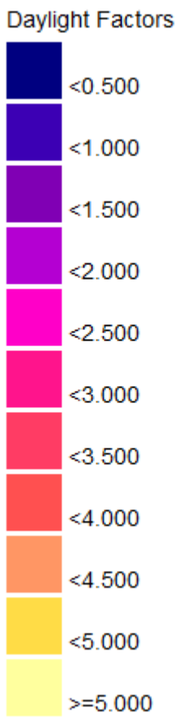


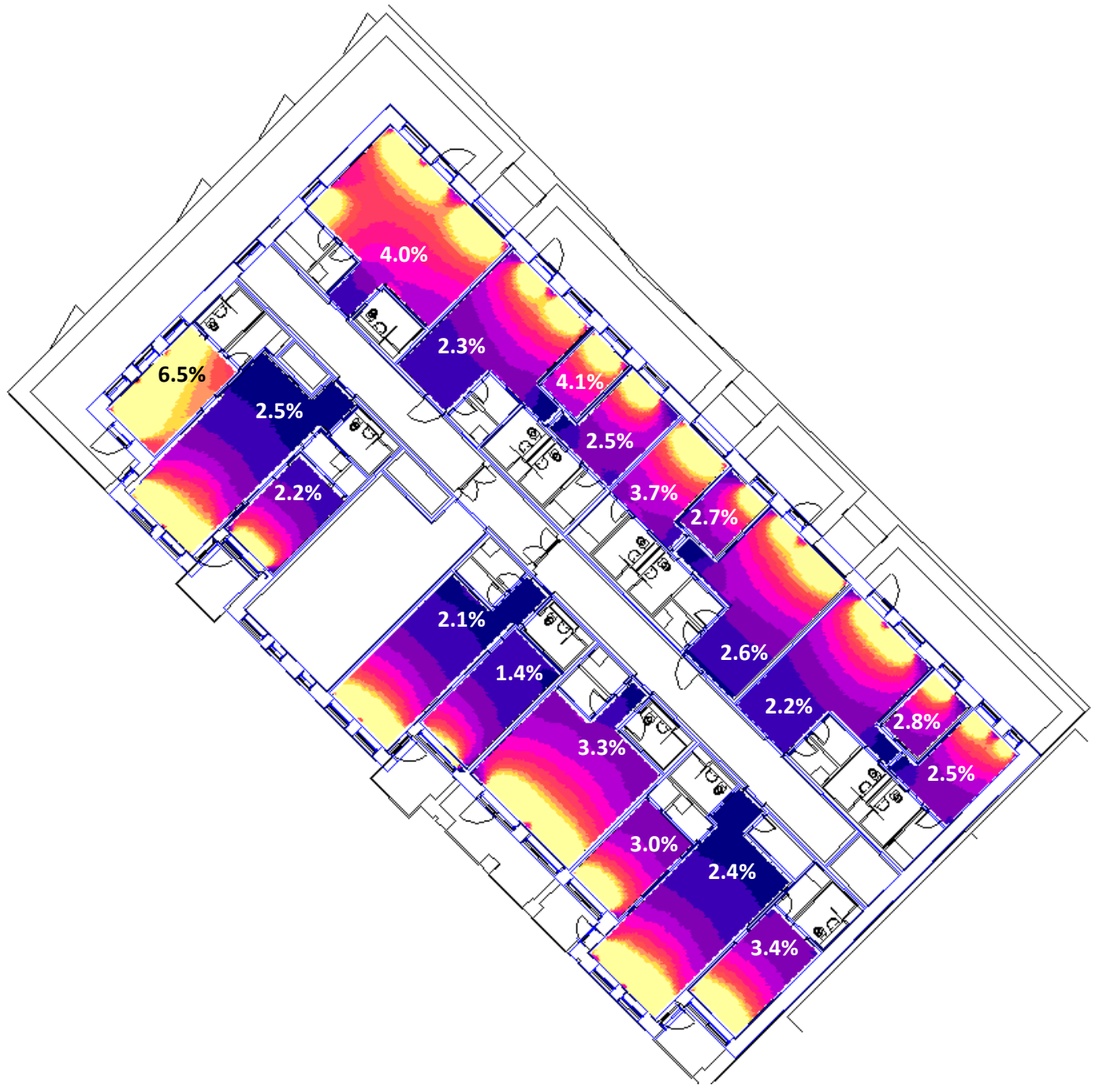
Building B – Second Floor



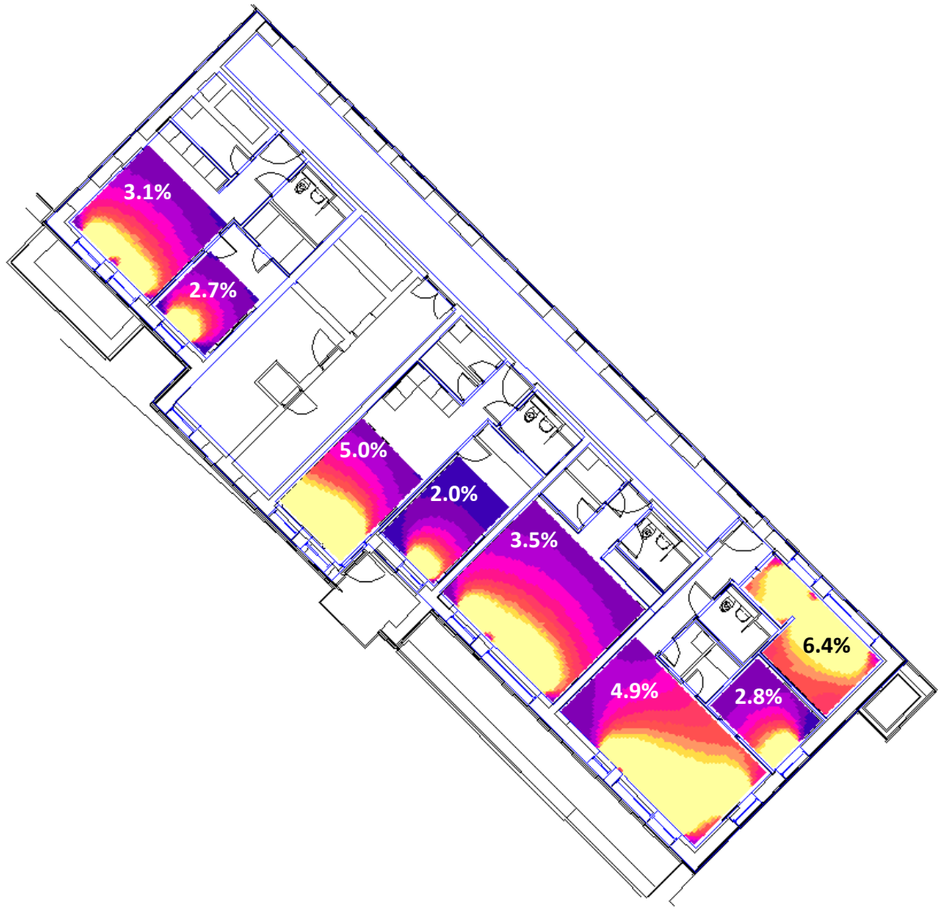


Building B – Third Floor

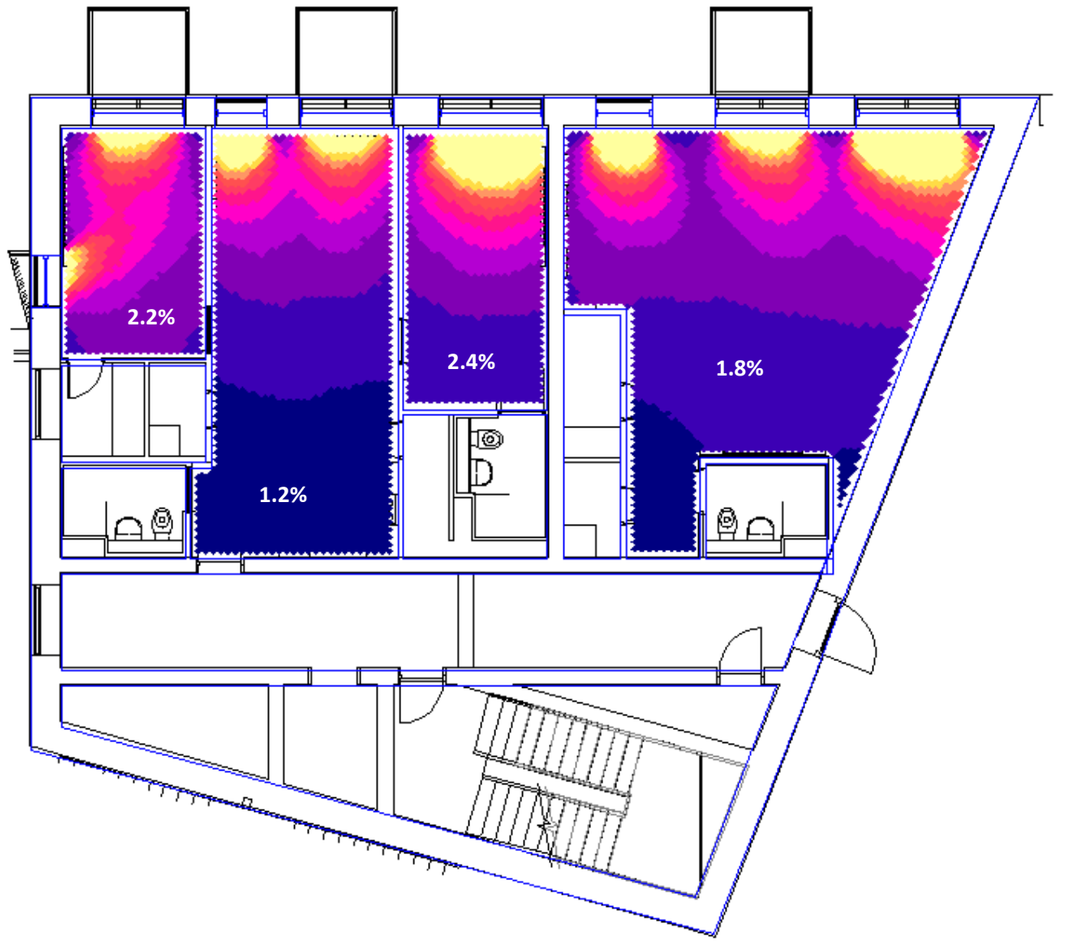




Building B – Fourth Floor



Building C – Ground Floor



Building C – First Floor