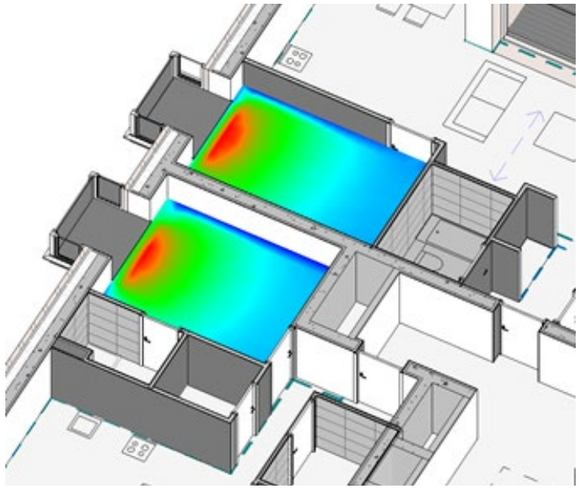
Lands at Hollystown-Kilmartin, Sites 2&3 and Local Centre Hollywoodrath, Dublin 15



Daylight & Sunlight Analysis

IN2 Project No. D2036

10/12/2021

REV03

Revision History

Date	Revision	Description
24/11/2021	00	Issued to Design Team for Comment
01/12/2021	01	Apartment Unit Areas added for applicable Compensatory Measures
06/12/2021	02	Revised in accordance with comments received from Brady Shipman Martin
10/12/2021	03	Finalised Issue

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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 Hollystown/ Kilmartin Strategic Housing Development (SHD) located at Hollywoodrath, Dublin 15. The report summarises the analysis undertaken, and conclusions determined for the proposed arrangements.

The proposed SHD includes sites located at both Kilmartin and Hollystown, generally comprising of apartments and housing units respectively and Section 2.0 provides an Overview of the Development, detailing also which areas were analysed for Daylight (Kilmartin Apartments and Hollystown Triplex unit) and Sunlight (Kilmartin Podium, residential amenity and public open space and Hollystown Public Realm) respectively.

Daylight and Sunlight Analysis was undertaken in accordance with requirements within the Sustainable Urban Housing: Design Standards for New Apartments (2020) document, which in turn infer compliance to a range of Standards and Best Practice Guidelines which are detailed in Section 3.0. Amenity Sunlight analysis was based on methodology described in BR.209 Site Layout Planning for Daylight and Sunlight (2nd Edition). Internal Daylight Analysis was assessed based on requirements of BS.8206-2, testing compliance for predicted Average Daylight Factor (ADF) in both Kitchen/ Living/ Dining (KLD's) and Bedrooms to achieve at least ADF=2.0% and 1.0% respectively throughout the whole room space.

Section 4.0 illustrates the results from the Amenity Sunlight analysis as undertaken for the proposed development. Both Kilmartin (all Communal Private Amenity areas) and Hollystown (Public Realm) were determined to comfortably exceed BRE requirements, with practically all areas receiving potential sunlight in accordance with the methodology. Therefore, all spaces assessed were deemed to be suitable for use as external amenity areas in terms of ensuring plentiful sunlight throughout the year.

Internal Daylighting analysis was undertaken for all Apartments within the Kilmartin area of the development, as well as assessing the Triplex unit in Hollystown area. Section 5.0 includes results of the comprehensive analysis undertaken, analysing KLD's and Bedrooms to meet ADF = 2.0%+/ 1.0%+ respectively, demonstrating how compliance was determined for **97%** of the total apartment rooms (349 rooms of 120 apartments) assessed. In addition to 97% of spaces achieving minimum compliance, the daylighting provision throughout the development was determined to be very good, with the median ADF determined for KLD's being 2.6% - i.e. 50% of apartments were calculated to have daylighting performance at least 30% above minimum compliance levels. In the small quantity of rooms (3% or 11 no.) where minimum ADF compliance could not be demonstrated, compensatory measures (larger apartment unit size/ dual-lit apartment etc.) to offset reduction in daylighting have been provided for relevant apartments and these are identified in Section 5.2 in accordance with 2020 Apartment Guidelines. In addition, where KLD's were found to be non-compliant (i.e. ADF below 2.0%) daylighting improvement measures were ensured in each case to at least attain a minimum level of ADF = 1.5%+. For Hollystown area of the development, the triplex unit typology has been assessed and full ADF compliance determined.

A comparative assessment between BS.8206-2 and the incoming EN.17037 Standard for daylight was undertaken based on a methodology adopted from that included in the UK National Annex to the Standard and is included as a technical Appendix A. This analysis determined generally good correlation between the existing and new standards applied, with those rooms generally deemed compliant in the former methodology also being so under the latter, with overall compliance determined to be similar (circa 97%) for the Kilmartin apartments between the two methodologies.

In summary, this report confirms that Best Practice Sunlight and Daylight Availability have been ensured for the proposed Hollystown-Kilmartin development, with both Amenity areas being well sunlit and good Daylighting achieved to the apartments/ triplex units.

2.0 Development Overview

2.1 Kilmartin

The proposed development relates to at a site of c. 25.3 ha at the townlands of Hollystown, Kilmartin, Hollywoodrath, Cruiserath, Yellow Walls, Powerstown, and Tyrrelstown, Dublin 15, which includes lands in the former Hollystown Golf Course and lands identified under the Kilmartin Local Area Plan 2013 (as extended). The lands are bound by the R121 and Hollywoodrath residential development to the east, the under construction Bellingsmore residential development to the south and north, the former Hollystown Golf Course to the north, Tyrrellstown Educate Together National School, St.Luke's National School and Tyrellston Community Centre to the west and south and the existing Tyrrellstown Local Centre to the south.

The proposed development will consist of the development of 548 no. residential units, consisting of 147 apartments/duplexes and 401 houses, ranging in height from 2 to 5 storeys and including retail/café unit, 2 no. crèches, 1 no. Montessori, 1 no. community hub, car and bicycle parking, open space, public realm and site infrastructure over a site area of c. 25.3 ha. On lands to the north of the application site (referred to as Hollystown Sites 2 & 3) the proposed development includes for 428 units consisting of 401 no. 2 and 3 storey houses and 27 no. apartments set out in 9 no. 3-storey blocks. On lands to the south of the application site and north of the Tyrellstown Local Centre (referred to as Kilmartin Local Centre) the proposed development includes 120 no. apartment/duplex units in 4 no. blocks ranging in height from 3 to 5 storeys. The local centre includes 2 no. crèches (including 1 standalone 2 storey crèche), 1 no. Montessori, a retail/café unit, and 1 no. community hub.

Fig. 2.1.1 –Kilmartin Local Centre Site Plan (19072C-OMP-01-SP-DR-A-1002)

Development Overview (Cont'd)

The following areas within the Kilmartin area of the development were assessed for Sunlight and Daylight Analysis, as indicated also in Figure 2.1.2:

- Internal Daylight Analysis to all 120 Apartments (Blocks A, B, C and D), assessing all applicable Kitchen/ Living/ Dining (KLD's) and Bedrooms (349 rooms total).
- External Sunlight Availability to landscaped Podium between Blocks B and C as well as entire amenity area.

As the Daylight Analysis was undertaken to demonstrate compliance to National Design Standards for New Apartments, all non-residential areas were excluded from assessment. The relevant Standards and Guidelines utilised for the analysis are discussed in detail in Section 3.0 below.

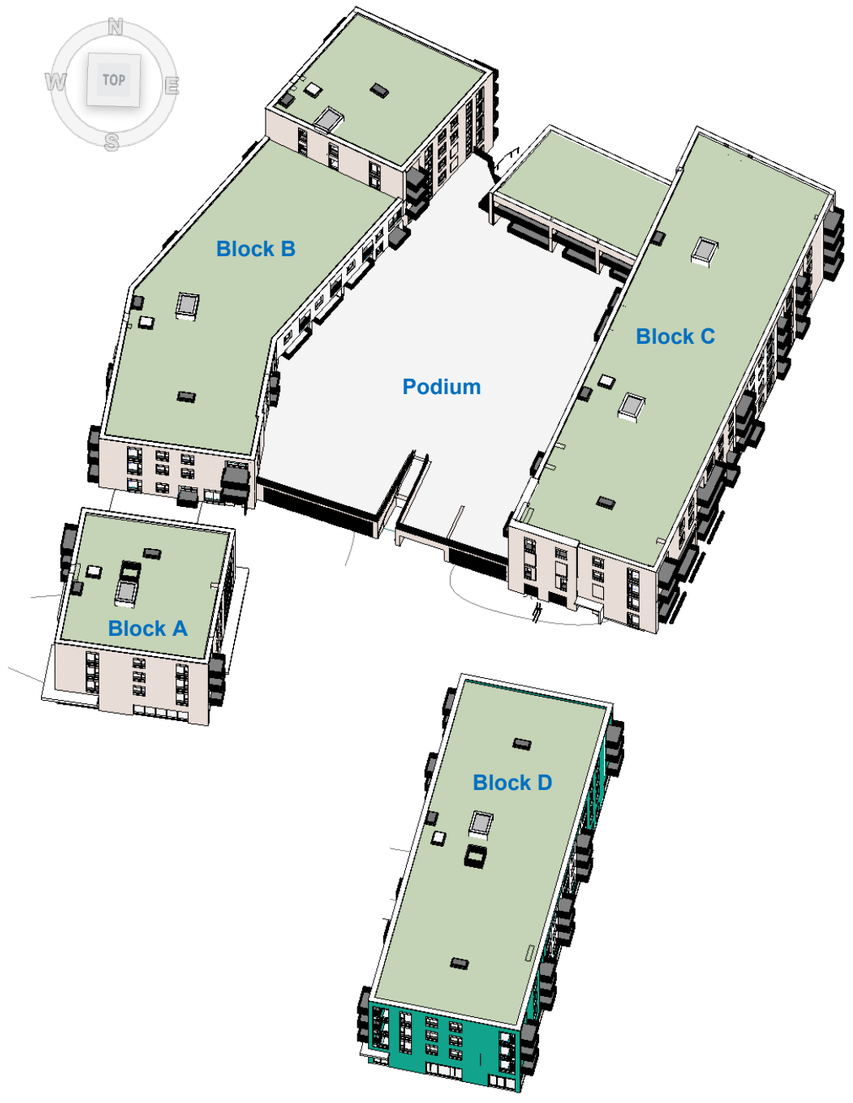


Fig. 2.1.2 – Kilmartin Local Centre: Assessment Areas

2.2 Hollystown

On lands to the north of the application site (referred to as Hollystown Sites 2 & 3) the proposed development includes for 428 units consisting of 401 no. 2 and 3 storey houses and 27 no. apartments set out in 9 no. 3-storey blocks.

Fig. 2.2.1 –Hollystown Sites 2 & 3: Site Plan (DG 20152-P-0004B)

Development Overview (Cont'd)

The following areas within the Hollystown development were assessed for Sunlight and Daylight Analysis, as indicated also in Figure 2.2.2:

- Internal Daylight Analysis to all floors of the Triplex Units (Types 1.K/ 1.K (m) as located in Fig. 2.2.2, assessing all applicable Kitchen/ Living/ Dining (KLD's) and Bedrooms
- External Sunlight Availability throughout Public Realm.

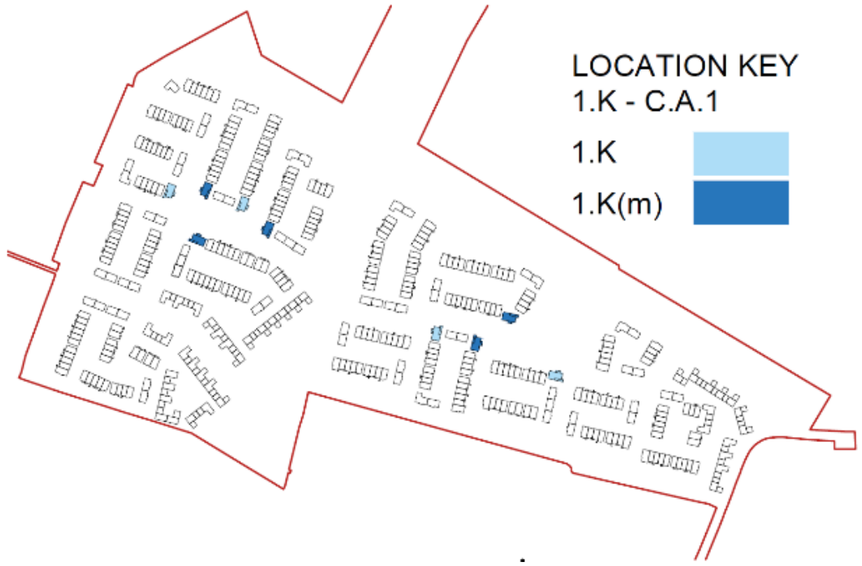


Fig. 2.2.2 – Hollystown Sites 2&3: Triplex Locations

Development Overview (Cont'd)

Section 3.0 introduces the various Guidelines and Standards utilised throughout the Daylight / Sunlight analysis undertaken. The specific methodology for each topic (as relevant) is detailed in the relevant section in the body of this report as identified.

Metric	Analysis Type	Assessment Methodology	Compliance Guidelines Targets	Reference section of this report
Sunlight	Proposed Development	Compliance with dual aspect requirements	2020 Apartment Guidelines	Not covered in this report. Refer to Architectural documentation.
Sunlight	Existing Neighbouring Buildings	Annual Probable Sunlight Hours	BRE 209	Not Applicable to this development- no neighbouring buildings to (greenfield) site.
Sunlight	Proposed Development Amenity Spaces	Sunlight Hours	BRE 209	Section 4.0 – Site Sunlighting and Shading Kilmartin: All Communal Areas Hollystown: Public Realm
Sunlight	Existing Neighbouring Buildings Amenity Spaces	Sunlight Hours	BER 209	Not Applicable to this development- no neighbouring buildings to (greenfield) site.
Daylight	Proposed Development	Average Daylight Factors	BRE 209	Section 5.0 – Internal Daylight Analysis Kilmartin: 120 no. Apartments Hollystown: 1 no. Triplex typology
Daylight	Existing Neighbouring Buildings	Vertical Sky Component	BRE 209	Not Applicable to this development- no neighbouring buildings to (greenfield) site.

Fig. 2.2 –Development Areas of Analysis

3.0 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) Fingal County Council Development Plan 2017-2023, (the "**Development Plan"**).

c) 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").**

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

e) British Standard BS EN 17037:2018 – Daylight in Buildings (the "**2018 British EN Standard**") and its **National Annex**.

f) 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 alternative daylight targets within dwellings (recognising that residential buildings require lower light levels), which ensures also some continuity to the 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 (2nd Edition) is still current and applicable, the 2011 edition and associated 2008 British Standard has therefore been utilised to provide the basis for the assessments detailed within this report. Comparative compliance analysis between 2008 and 2018 (British) Standards was also undertaken and is included in Appendix A.

The Development Plan

Fingal County Council Development Plan states within Objective DMS30:

> *"Ensure all new residential units comply with the recommendations of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (B.R.E. 1991) and B.S. 8206 Lighting for Buildings, Part 2 2008: Code of Practice for Daylighting or other updated relevant documents."*

Additionally, guidance is given to sunlight availability under the guidance of dual aspect (for non-urban locations).

> *"There is a requirement that the minimum number of dual aspect apartments that may be provided in any single apartment scheme shall be 50%."*

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 measures should be proposed. In the context of this report, any deviations from the Guide's recommendations have therefore been identified, with an approach throughout to ensure that good quality daylight/sunlight is achieved, with design improvements having been incorporated as far as practicable and viable (as detailed in the report where relevant).

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

1. Light from the Sky (Daylight) – *Based on a theoretical mathematical (CIE overcast) sky) which is brightest at zenith, darkest at horizon, but does not alter for 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. This has been assessed for this project.

    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. As no existing buildings are in the vicinity of the site, this has not been assessed for this project.

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 – The BRE Guide has quantitative assessment for determining the impact of sunlight on existing neighbouring buildings. As with Daylight Impact, this has not been assessed for this project as there are no neighbouring dwellings in the vicinity of the site.

    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 applicable) 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, in particular with regards to its Appendix F.

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 factor within the room as assessed previously, the standard considers a new metric based on **median** daylight, in order to ensure both extent and uniformity of daylight in a space.

> *"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 accounts for Project location throughout the EU (so Daylight percentage targets for Dublin are higher than say, Athens) as well as addressing 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."*

Table NA.5 of the National Annex indicates Median Daylight Factor (MDF) targets based on the above illumination (lux) levels for various locations throughout the UK. As one location indicated (Finningley) has coincidentally the same Annual Median Diffuse Illumination levels as Dublin (14,900 lux, Table A.3), the following MDF targets can be derived:

- KLD: MDF = 1.3%+ (to exceed 200 Lux)
- Bedroom: MDF = 0.7%+ (to exceed 100 Lux)

It may be reiterated that MDF differs from Average Daylight Factor (ADF) and the former for a space will generally be higher than the latter. A comparative analysis between these metrics has been included in Appendix A.

4.0 Amenity Sunlight

4.1 Methodology

BRE 209 provides guidance with regards to sunlighting and shading to external Amenity spaces within proposed developments. An example analysis of Amenity Spaces is indicated in Figure 4.1.1. In this sample development, the main amenity space is located to the North of a building block which provides some degree of overshadowing (dark green contours).

The guidance recommends for both new developments and existing respectively:

> *"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".*
>
> *"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 methodology assesses sunlight performance at the Equinox (March 21st), as this is the mid solar position throughout the year where the sun rises and sets directly in the East and West (as illustrated in Fig.4.1.2). Compliance to this criterion ensures external amenity areas will receive adequate sunlight and be 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).

Fig 4.1.1. –Sample Overshadowing to Amenity,
(Illustrative only- not related to Kilmartin project

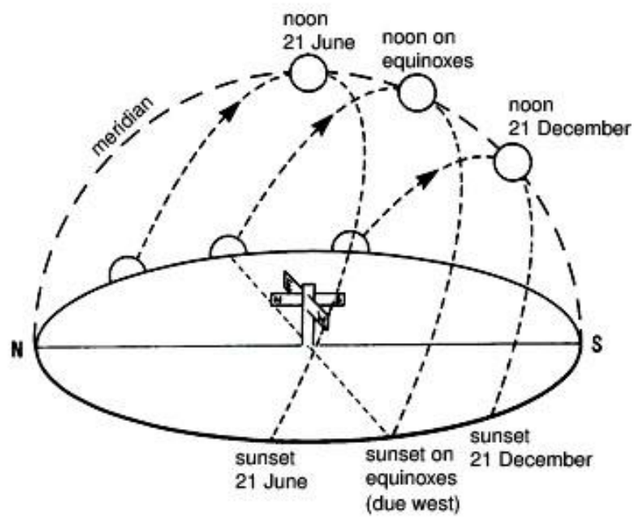


Fig 4.1.2. –Sun Path Diagram

4.2 Analysis

4.2.1 Kilmartin

The Podium space between Kilmartin Blocks B and C was analysed with potential sunlight/ shadowing being determined for each hour of the Equinox Day, for a 0.5m grid spacing.

Figure 4.2.1.1 illustrates the total potential sunlit hours through the day simulated. The open southerly aspect of Kilmartin Podium Amenity Space maximises sunlight availability, Potential sunlight was found to be highest (6-8 hours of the day) in the centre of the Podium space, reducing slightly (4-6 hours) adjacent to the building Blocks B and C due to shadowing in afternoon/ morning respectively.

However, in order to be deemed well sunlit in accordance with the BRE methodology, areas are deemed well sunlit where sunlight can be received for at least 2 hours of the simulated day, Figure 4.2.1.2 confirms how the Podium Amenity space was found to be fully compliant with the guidelines with 99% of the amenity area receiving at least 2 hours of direct sunlight on 21st March- comfortably exceeding the minimum 50% area as defined within the BRE Guide. The ground level area was also fully compliant with 96% of amenity area compliant with the guidelines as per Fig. 4.2.1.3, ensuring communal residential amenity areas and creche play areas are fully compliant and receive excellent sunlight throughout the day..

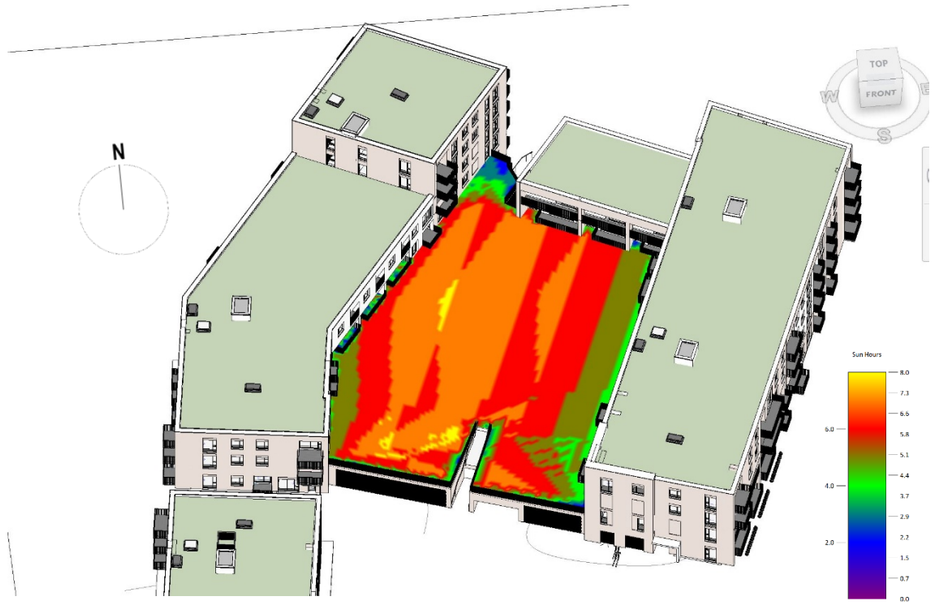


Fig 4.2.1.1 –Sunlight Hours to Kilmartin Podium Amenity Space

Fig 4.2.1.2 –Extent of Sunlight Compliance to Kilmartin Podium Amenity

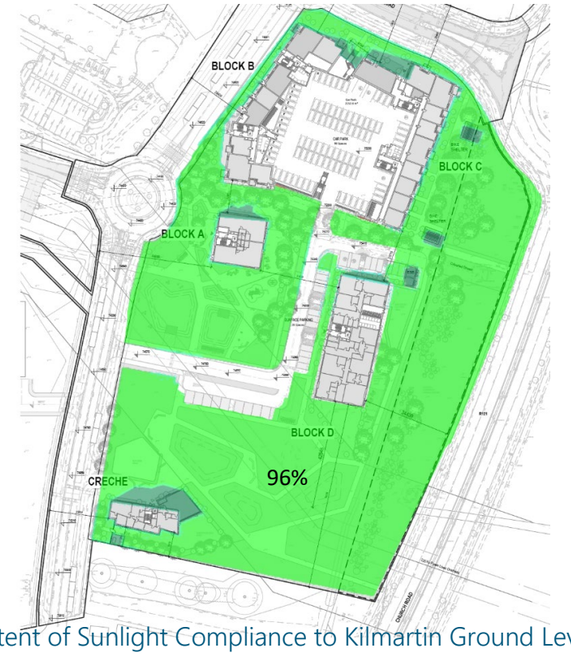


Fig 4.2.1.3 –Extent of Sunlight Compliance to Kilmartin Ground Level Amenity

4.2.2 Hollystown

Amenity Sunlight analysis was also undertaken for the communal spaces in the Hollystown area of the site, with all Public Realm areas assessed to determine whether they can receive at least 2 hours of potential sunlight through an Equinox Day, in accordance with BRE requirements.

Figure 4.2.2 indicates how it was determined that at least 2 hours of sunlight could be received throughout the entire public realm, ensuring full compliance with the BRE methodology.

Fig 4.2.2 –Extent of Sunlight Compliance to Hollystown Public Realm

5.0 Daylight Analysis

Daylighting analysis was undertaken for the proposed residential development using radiance lighting simulation 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 sill depth etc. in accordance with the architectural design. Building geometry was exported directly from Architectural Revit model to ensure accuracy of modelling analysis, with daylighting contour results then imported and embedded as information in the BIM model.

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 0.25 x 0.25m grid basis to enable a detailed calculation within each room, the average of which was then determined to calculate ADF.

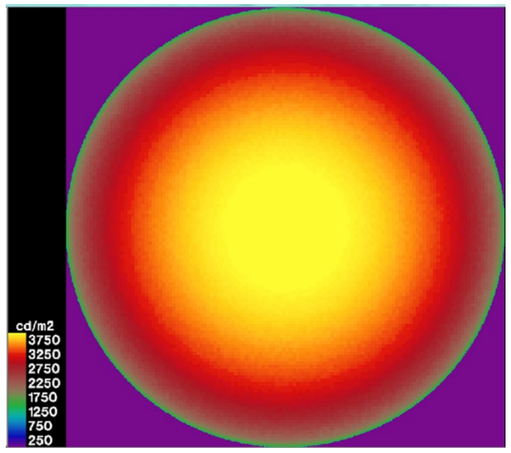


Fig 5.0.1 - CIE Overcast sky as viewed from below.

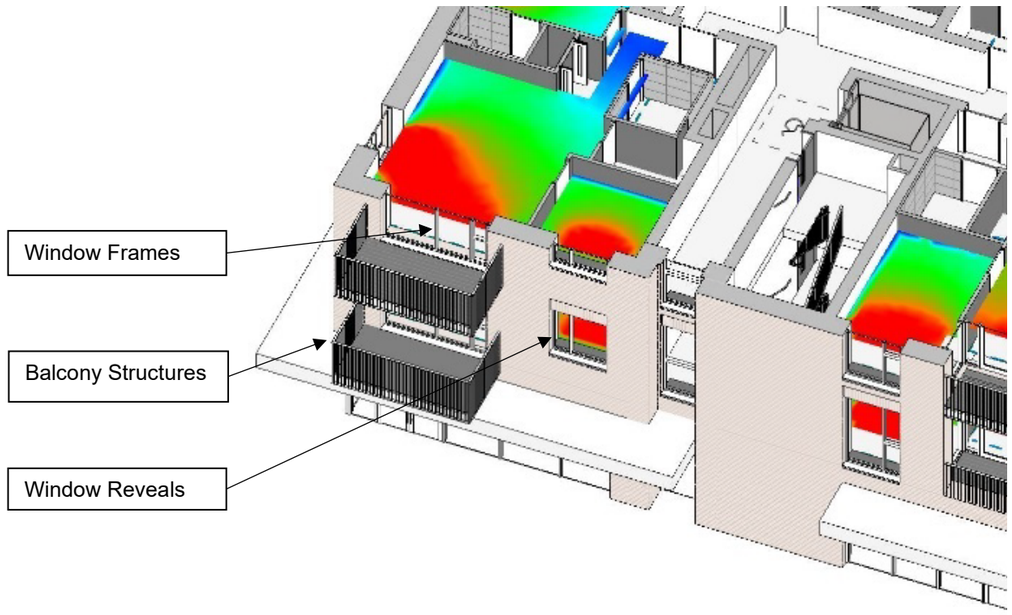


Fig 6.0.2 – Typical BIM model utilised for Daylight Analysis

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)*

The 2008 British Standard further clarifies the targets by stipulating:

> *"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%."*

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

- 2.0%+ for Kitchen/Living/ Dining Areas (KLD)
- 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.

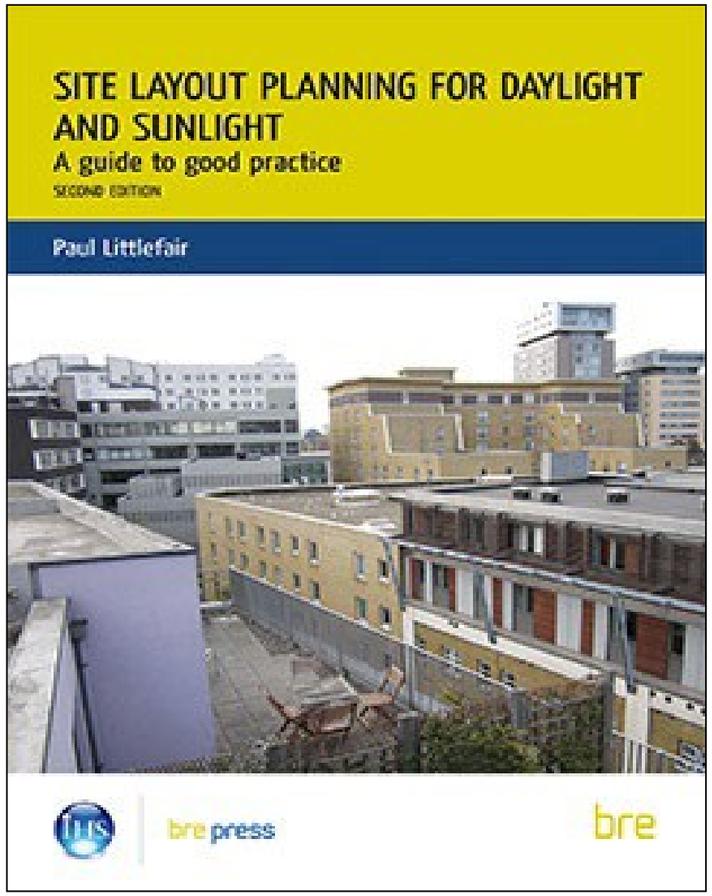


Fig 5.0.3 – The BRE Guide

Methodology (Cont'd)

Whilst the ADF results detailed in sections below confirm the finalised design performance for the proposed development, the Daylighting analysis for the project has been integral to the design process throughout, with modifications being incorporated where possible to maximise daylighting performance.

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:

These design modifications, undertaken throughout design development have included:

- Increase or maximisation of Glazing Areas.
- Modification of offsetting of balcony structures to maximise sky view.
- Internal Space Planning adjustments to ensure daylit areas (KLD's and Bedrooms) are located in areas where natural daylight is maximised.

An example of design development and associated modifications to maximise daylighting for a 2 Bed (3 Person) Apartment located at Level 01 in Block B Kilmartin is illustrated in Fig's 5.0.4 and 5.0.5.

Fig. 5.0.4 indicates the initial apartment configuration, with balcony centralised to the KLD space. However, whilst the bedrooms were determined to receive excellent daylighting, the KLD was below target (1.5%). This was due to the balcony location being overhead of the KLD window (blocking brightest section of the sky), compounded by the facade recess.

The relocation of the balcony to in front of a Bedroom (whilst still maintaining door access from the KLD) enabled sky view to be maximised to the KLD as indicated in Fig. 5.0.5, resulting in excellent daylighting performance (ADF=2.6% to overall).

Such design modifications were undertaken for a wide range of apartment types throughout the development, resulting in excellent overall compliance levels detailed below.

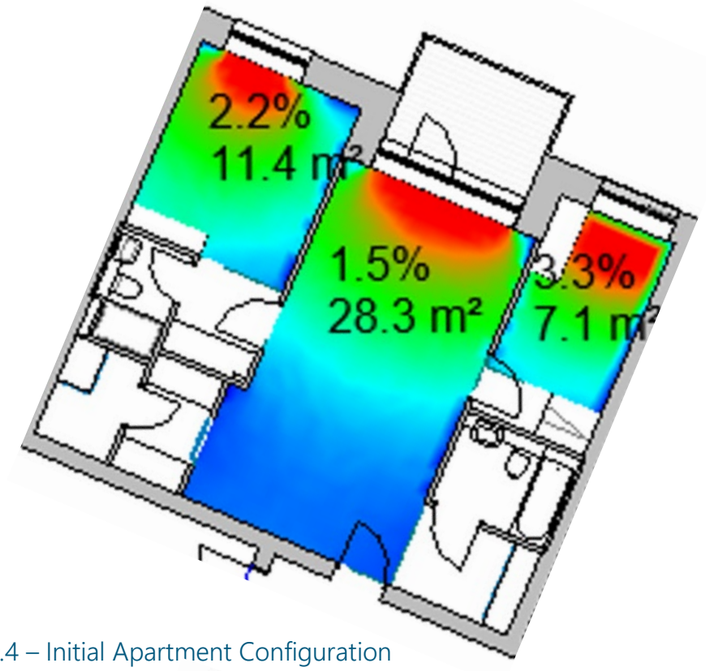


Fig 5.0.4 – Initial Apartment Configuration

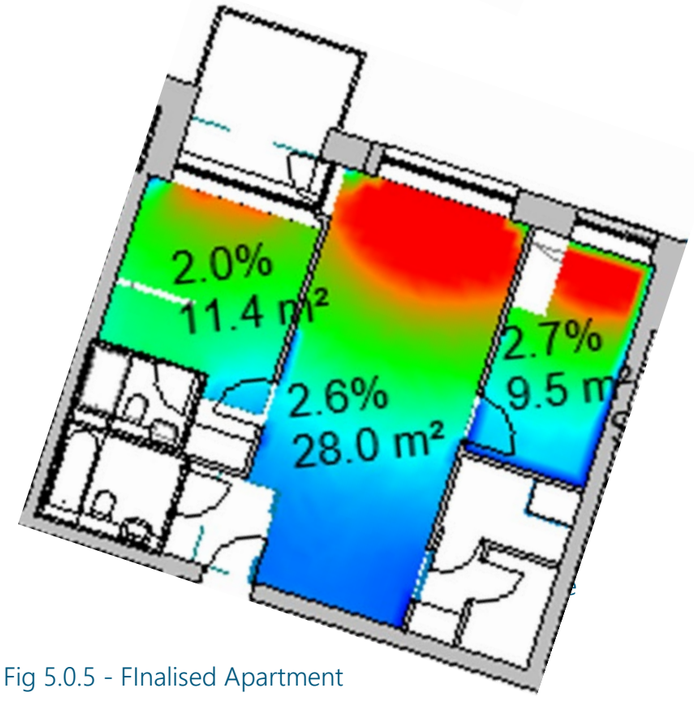


Fig 5.0.5 - FInalised Apartment

5.1 Results Summary

Figure 5.1.1 illustrates the overall summary of Average Daylight Factor (ADF) compliance determined for the proposed Kilmartin apartments development, indicating pass/ fail numbers determined for each Block and at each floor level for the following criteria.

- ADF = 2.0%+ for Kitchen / Living/ Dining (KLD) Areas
- ADF = 1.0%+ for Bedrooms

It can be seen that the overwhelming number of rooms assessed: 97**%** (totalling 338 of 349 rooms) were determined to be compliant based on the following compliance, in accordance with BS.8206-2. Where rooms were deemed to be non-compliant (11 of 349 or 3%), their associated compensatory measures are described in Section 5.2 below.

In addition, triplex unit at Hollystown were assessed and found to be compliant.

All daylighting results are compiled in Section 5.3 below.

BLOCK	A			B			C			D			TOTAL		
	Pass	Fail	Total	Pass	Fail	Total	Pass	Fail	Total	Pass	Fail	Total	Pass	Fail	Total
L00	-	-	-	18	0	18	21	1	22	-	-	-	39	1	40
L01	11	0	11	28	3	31	27	5	32	28	0	28	94	8	102
L02	11	0	11	36	0	36	39	2	41	28	0	28	114	2	116
L03	11	0	11	10	0	10	32	0	32	28	0	28	81	0	81
L04	-	-	-	10	0	10	-	-	-	-	-	-	10	0	10
TOTAL	33	0	33	102	3	105	119	8	127	84	0	84	338	11	349
	100%	*0%*		*97%*	*3%*		*94%*	*6%*		*100%*	*0%*		***97%***	***3%***	

Fig 5.1.1 – Tabulated ADF Results Summary (Kilmartin apartments)

Results Summary (Cont'd)

Whilst the summary table indicates minimum compliance, the vast majority of apartments comfortably exceed this, with excellent daylighting performance achieved.

Fig. 5.1.2 illustrates the frequency of ADF values for *all* apartments as assessed, as determined to be achieved in KLD's throughout the Kilmartin development.

From this analysis it was determined that the average KLD ADF throughout the development was **2.8%,** with a median (i.e. at least half of apartments exceed this) of **2.6%**, confirming the excellent daylighting performance achieved through design development for the apartments.

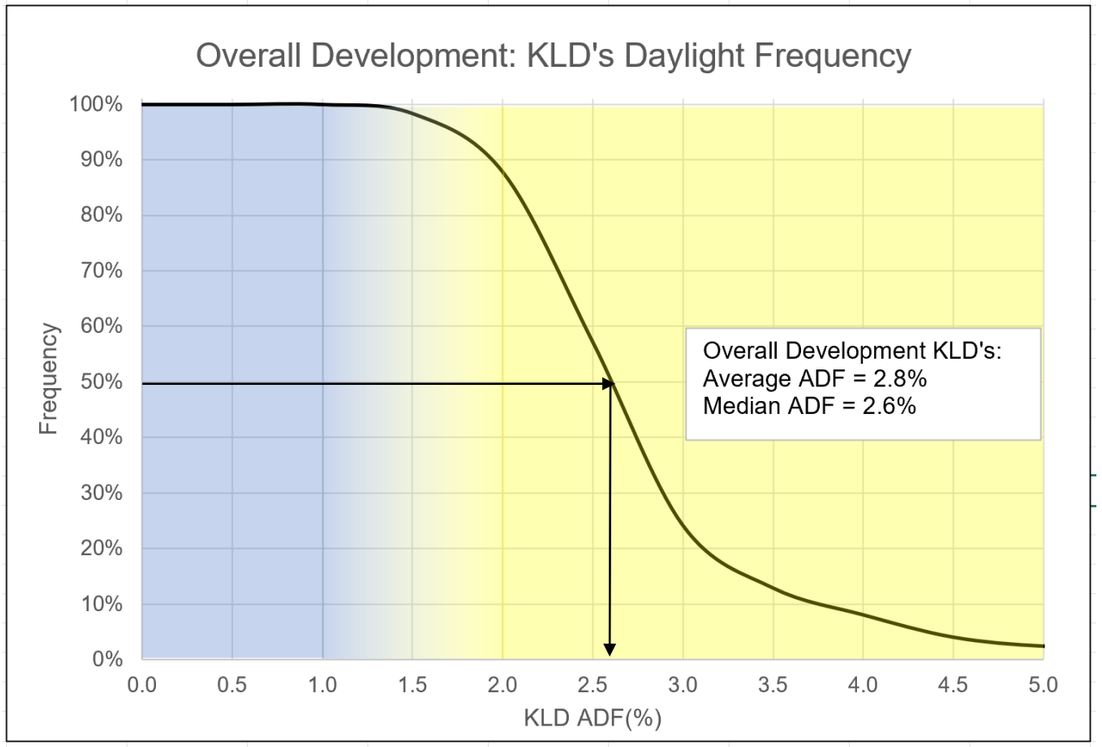


Fig 5.1.2 – KLD's – Daylight (ADF) Frequency throughout Kilmartin development

5.2 Compensatory Measures

The 2020 Apartment Guidelines state the following:

> *"[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."*

Compensatory Design Solutions

All units, which do not achieve the 2.0% ADF target for shared Kitchen/Living/Dining (KLD) rooms, include compensatory measures in accordance with the requirements of the *Sustainable Urban Housing – Design Standards for New Apartments 2020*.

The compensatory measures for the Kilmartin apartment units are annotated where applicable in the detailed results analysis below and summarised as follows:

1. Unit Size exceeds Guidelines

The *Sustainable Urban Housing – Design Standards for New Apartments 2020* require that the majority of units in a development exceed the minimum floor area standards by 10%. All 12 units which do not achieve the 2.0% ADF for KLD are larger than the minimum floor area standard required. Some units are designed to exceed the minimum floor area standard by up to 40% and each are detailed in Section 5.3 below.

2. Additional External Private Amenity Space

Some units where KLD targets are not achieved are located at Ground (or Podium) level, where natural light availability is lower than upper storeys. However, for these apartment units, all have been provided with access to external Private Amenity Spaces.

3. Own Door Access

In addition to their private amenity space, these Ground Floor Units are provided with own door access, as opposed to from shared circulation space.

4. Duplex Unit

Similarly, apartments at lower storeys where KLD's are below target are generally of Duplex arrangement.

5. Dual Aspect Unit

A large proportion of the development (in excess of 50%) has been designed as Dual Aspect units, providing good overall access to daylight, irrespective of individual rooms where ADF targets were lower than recommended guidelines.

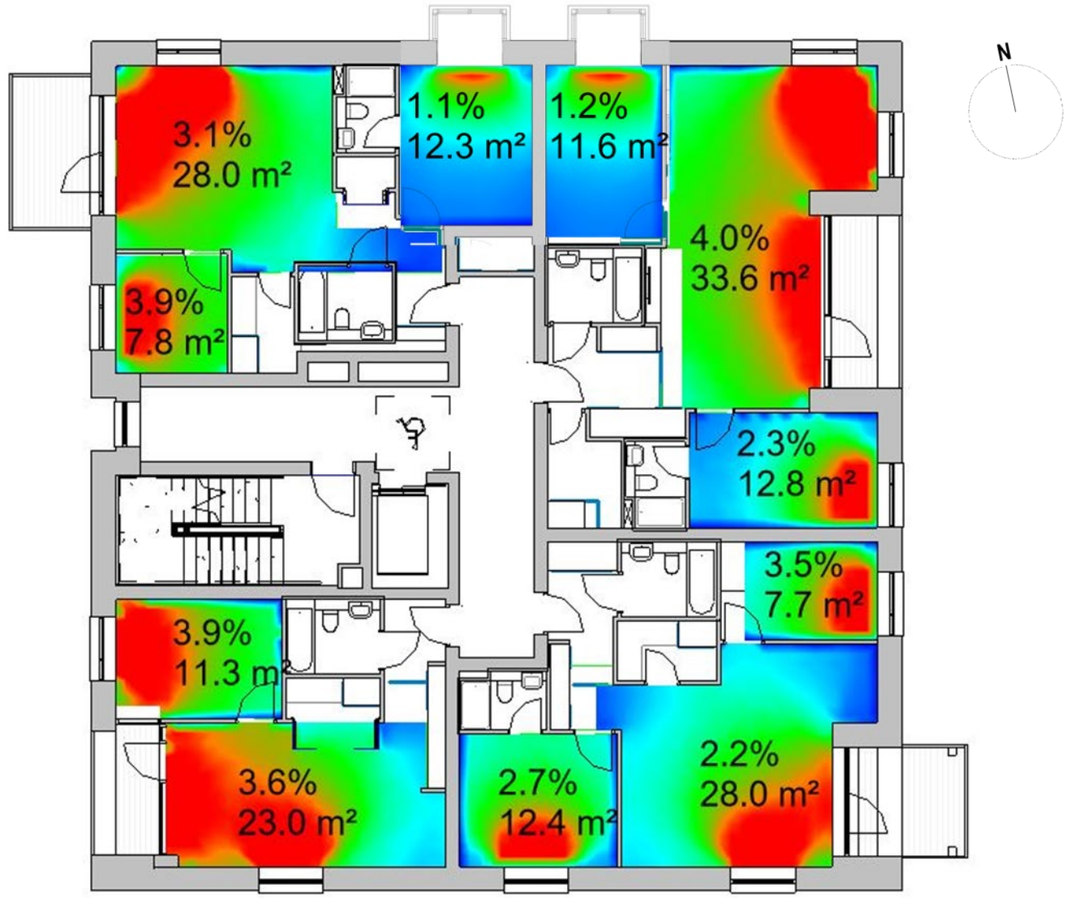
6. Increased Balcony Provision to Unit

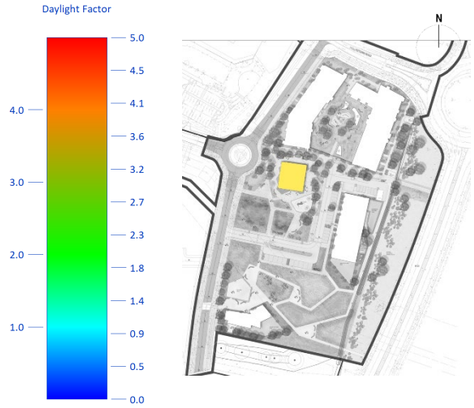
One apartment unit where the KLD is below target ADF has been provided with a large balcony with dual aspect, open also to southerly direction to maximise sunlight availability.

5.3 Internal Daylight Analysis

Kilmartin Block A– Level 01

All spaces on this floor were found to be compliant.



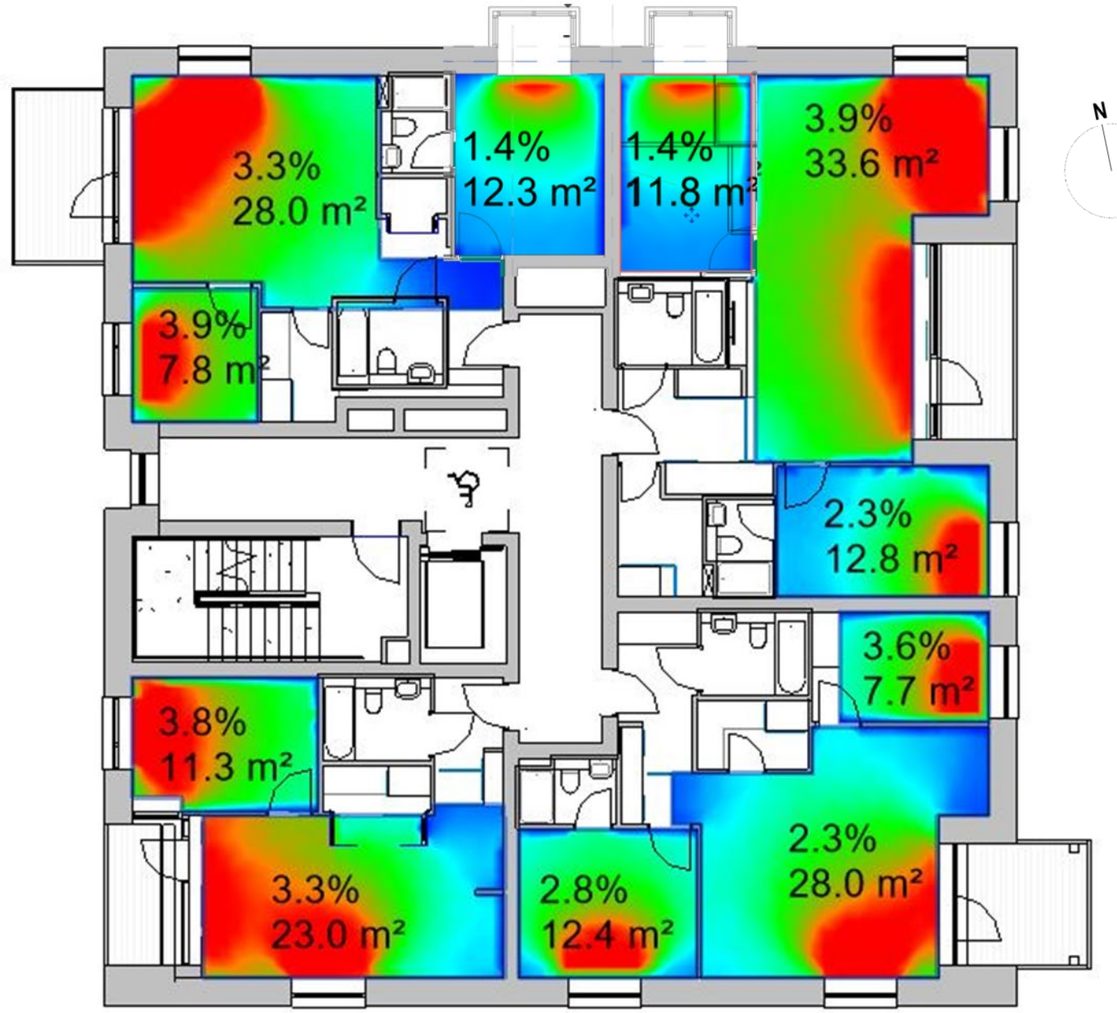


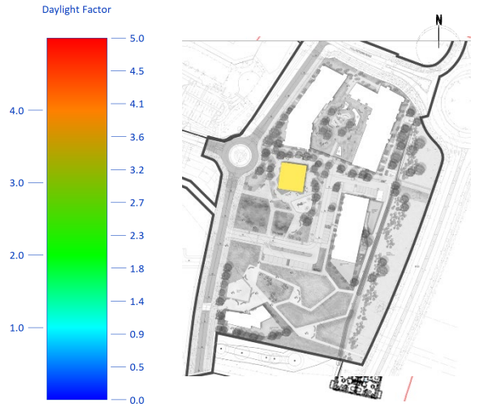
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block A– Level 02

`All spaces on this floor were found to be compliant.



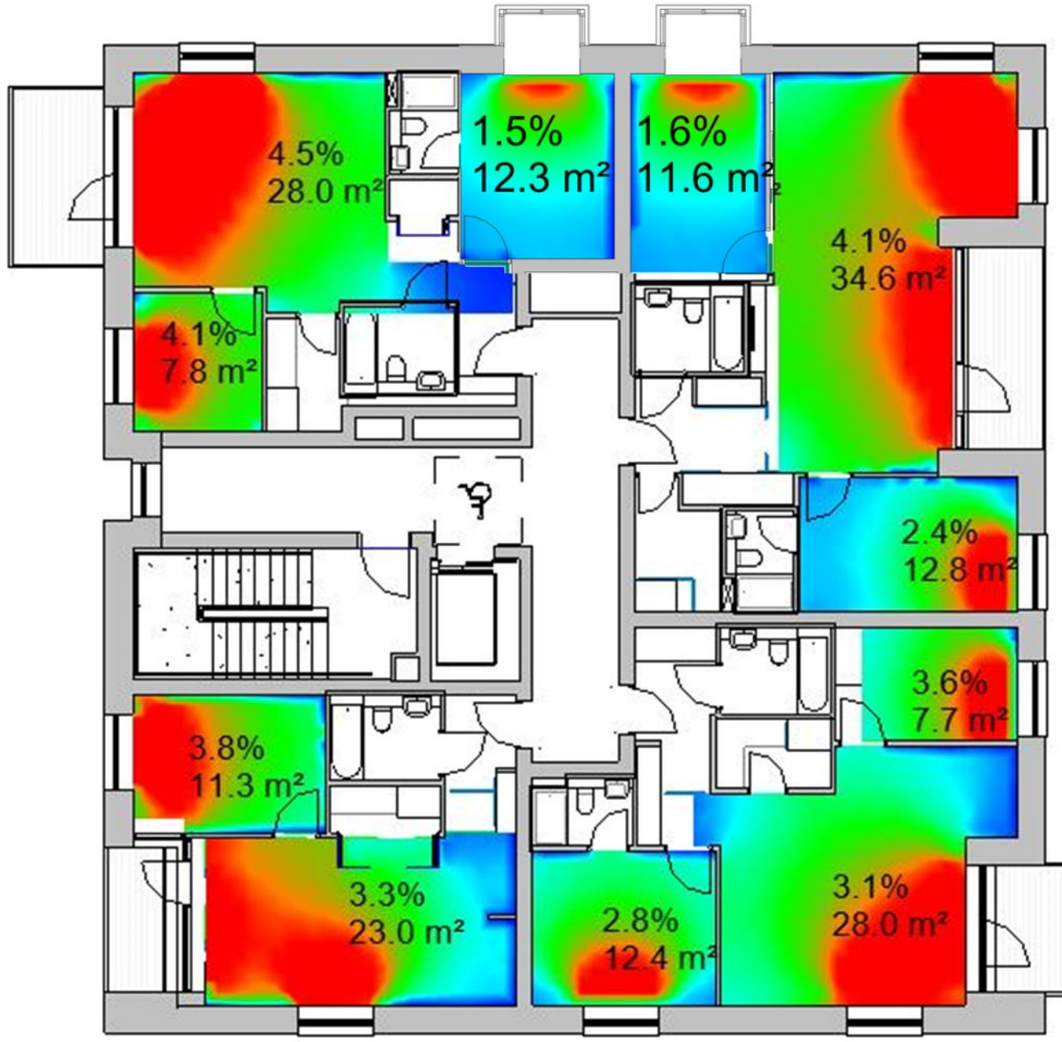


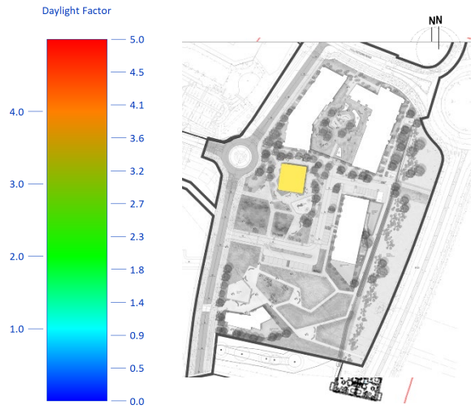
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block A– Level 03

All spaces on this floor were found to be compliant.



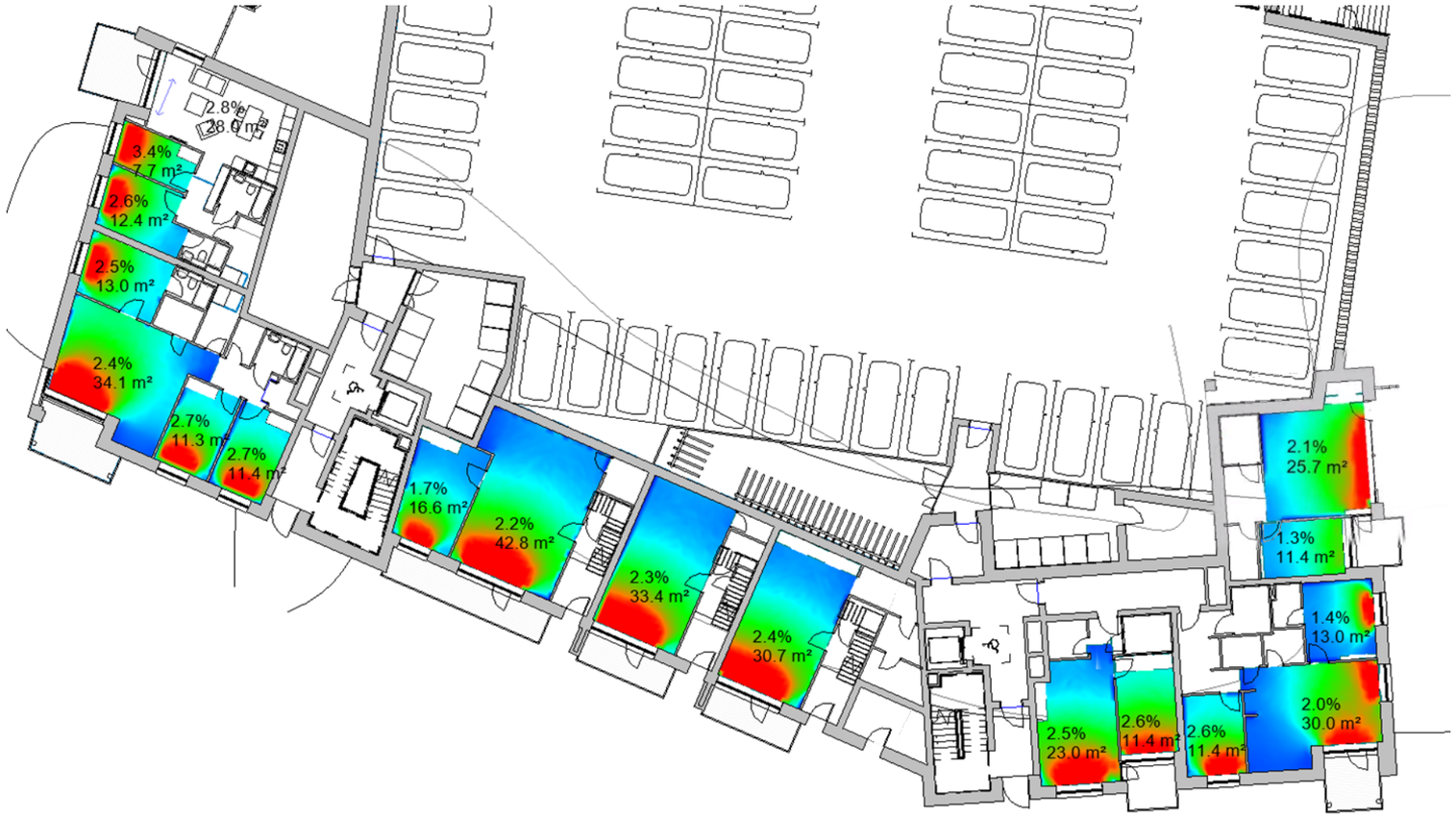


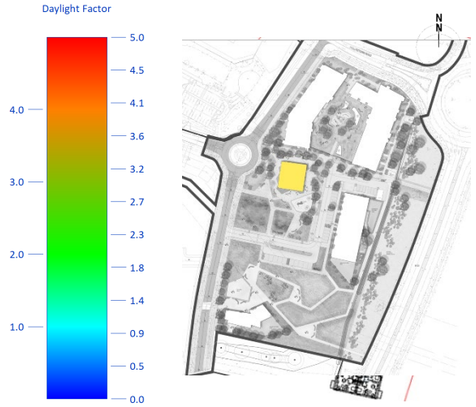
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block B – Level 00

All spaces on this floor were found to be compliant.





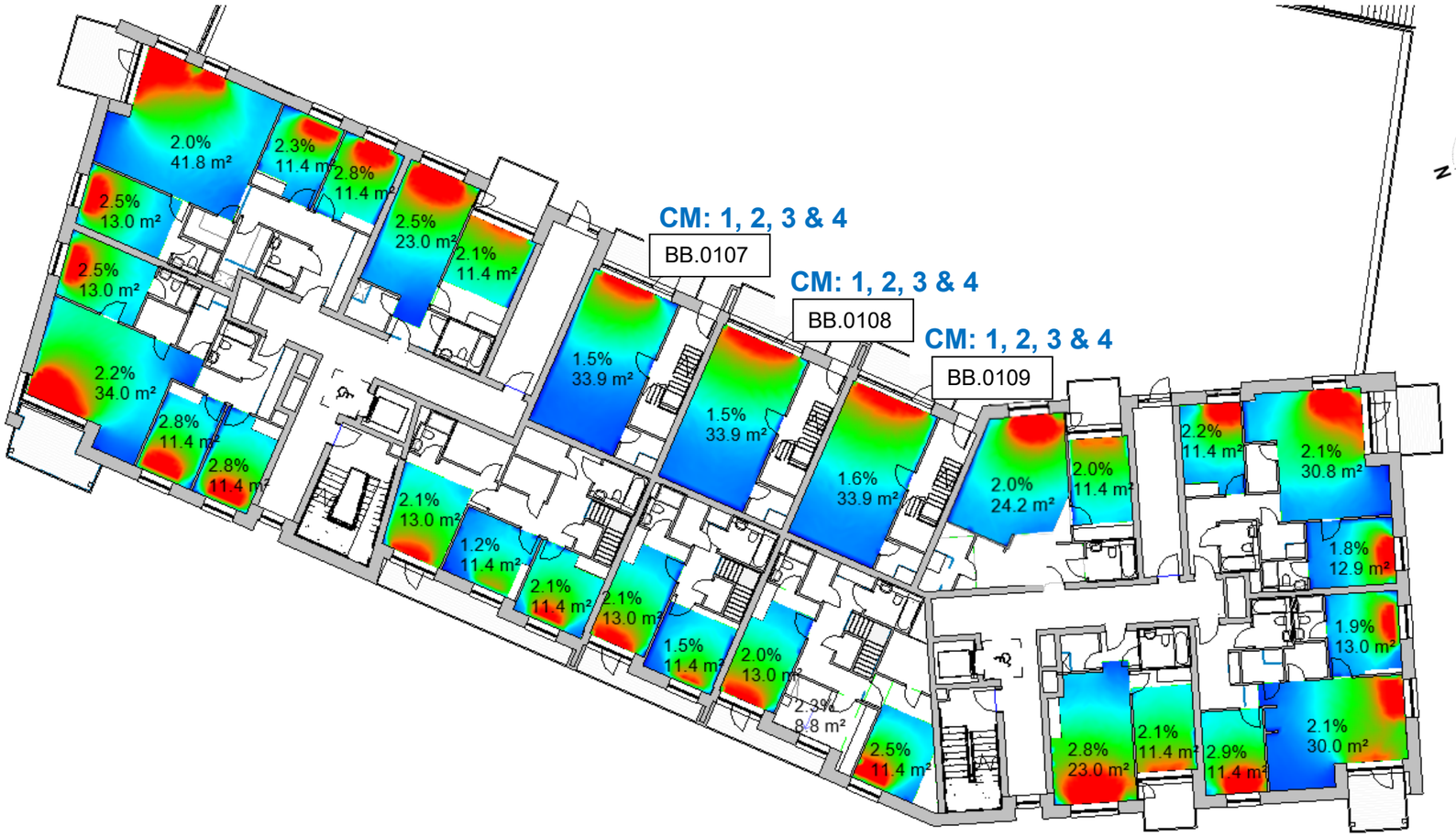
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

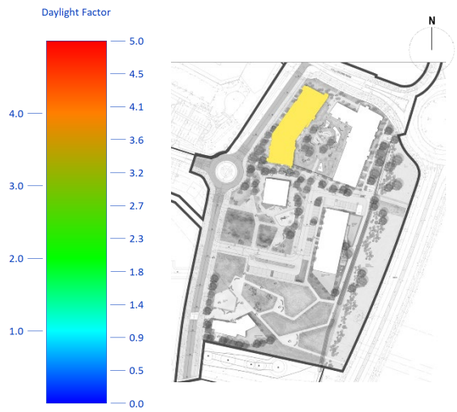
Internal Daylight Analysis

Kilmartin Block B – Level 01

All spaces on this floor were found to be compliant, with the exception of three KLD spaces, for which compensatory measures provided are indicated. Each of these three Apartments (BB.0107-0109) are duplex units and are considerably oversized, being 97m^2 in lieu of 73m^2 minimum requirement (+33%).

Compensatory Measures
1: Unit size exceeds Guidelines
2: Additional External Private Amenity
3: Own Door Access
4: Duplex Unit
5: Dual Aspect Unit
6: Increased Balcony Provision to Unit



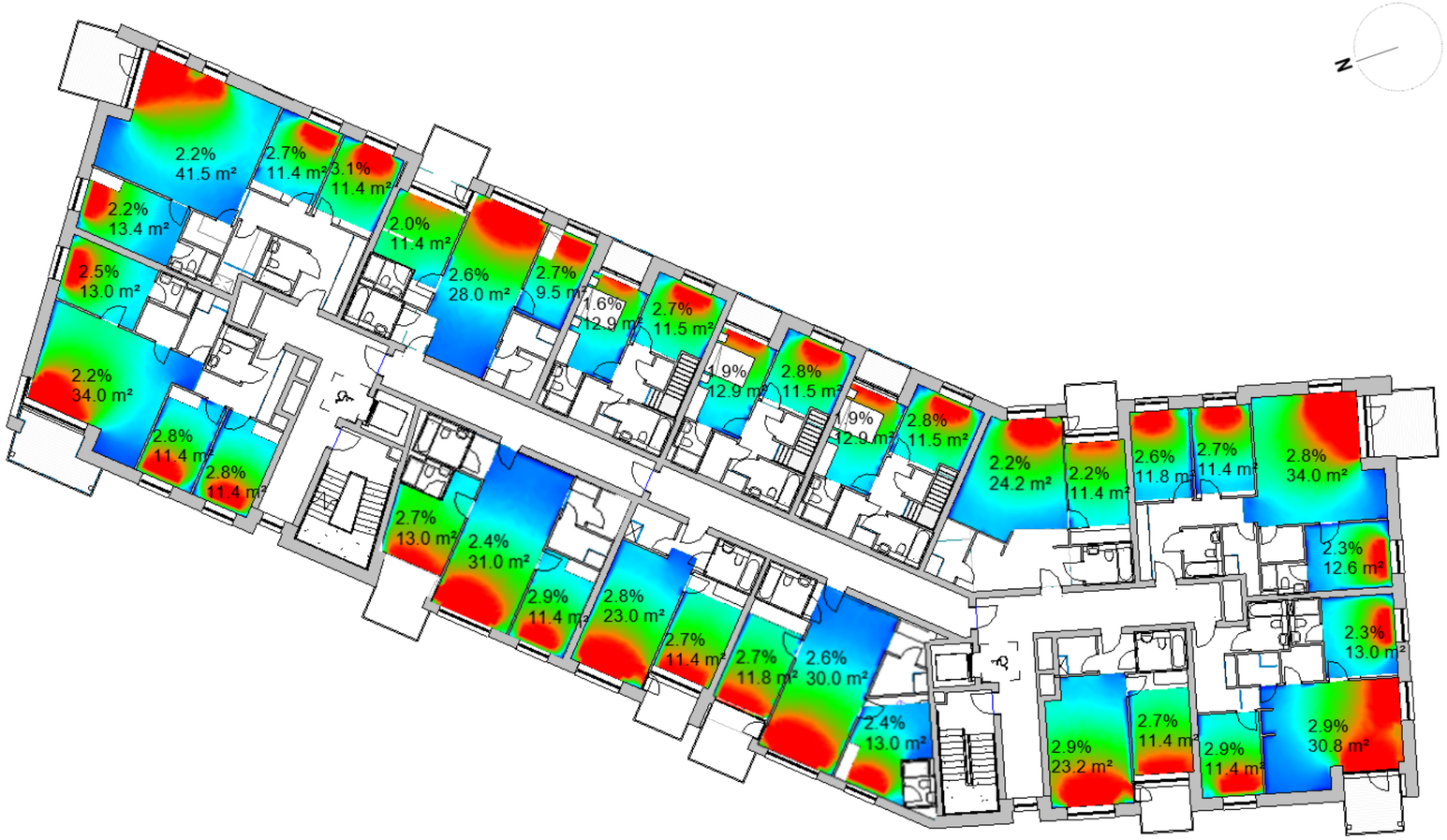


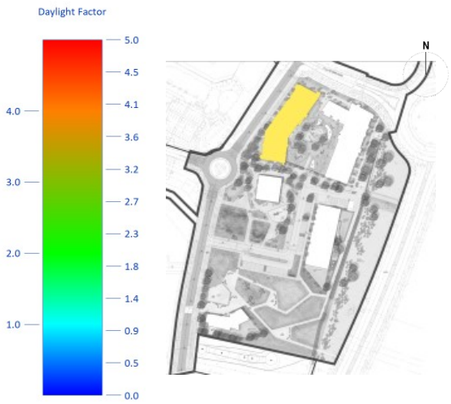
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block B Results – Level 02

All spaces on this floor were found to be compliant.



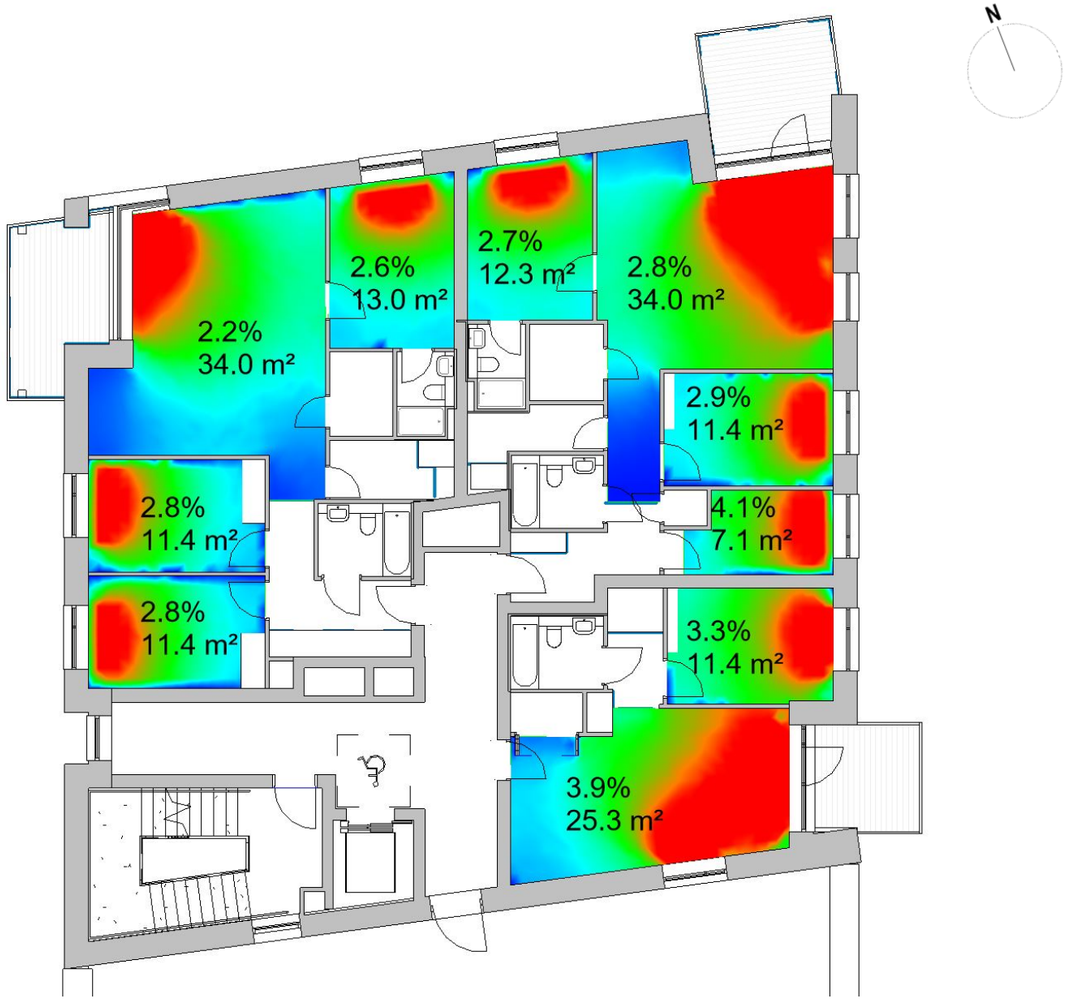


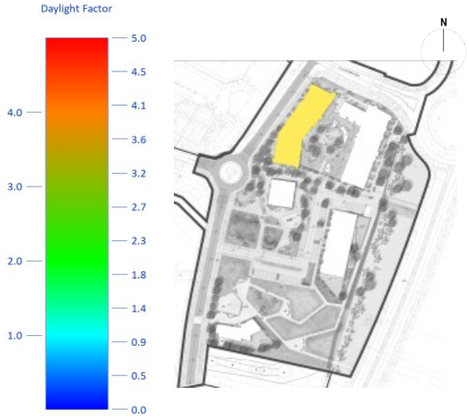
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block B Results – Level 03

All spaces on this floor were found to be compliant.



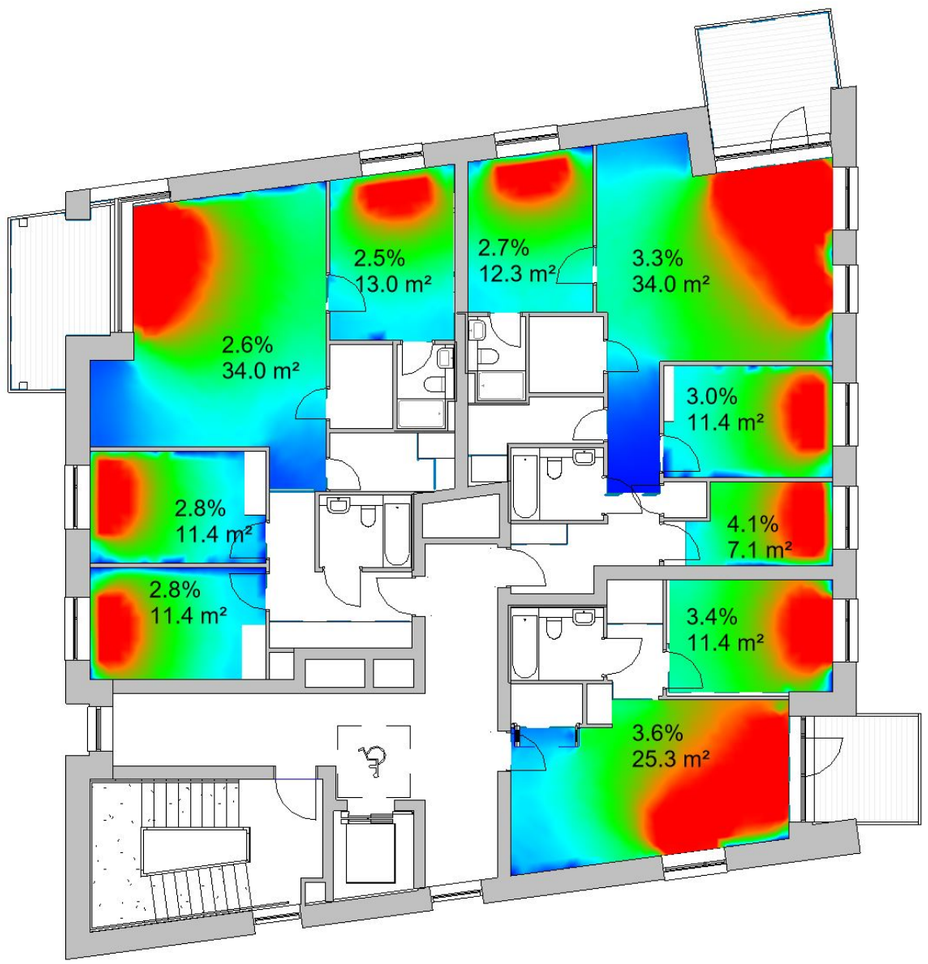


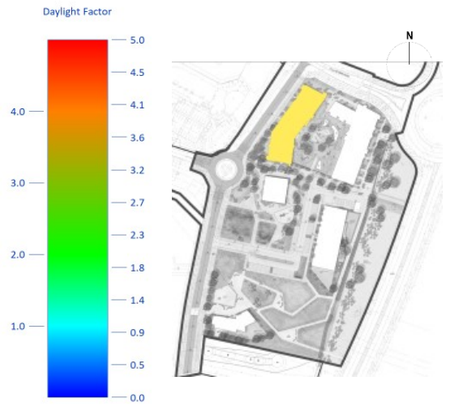
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block B Results – Level 04

All spaces on this floor were found to be compliant.



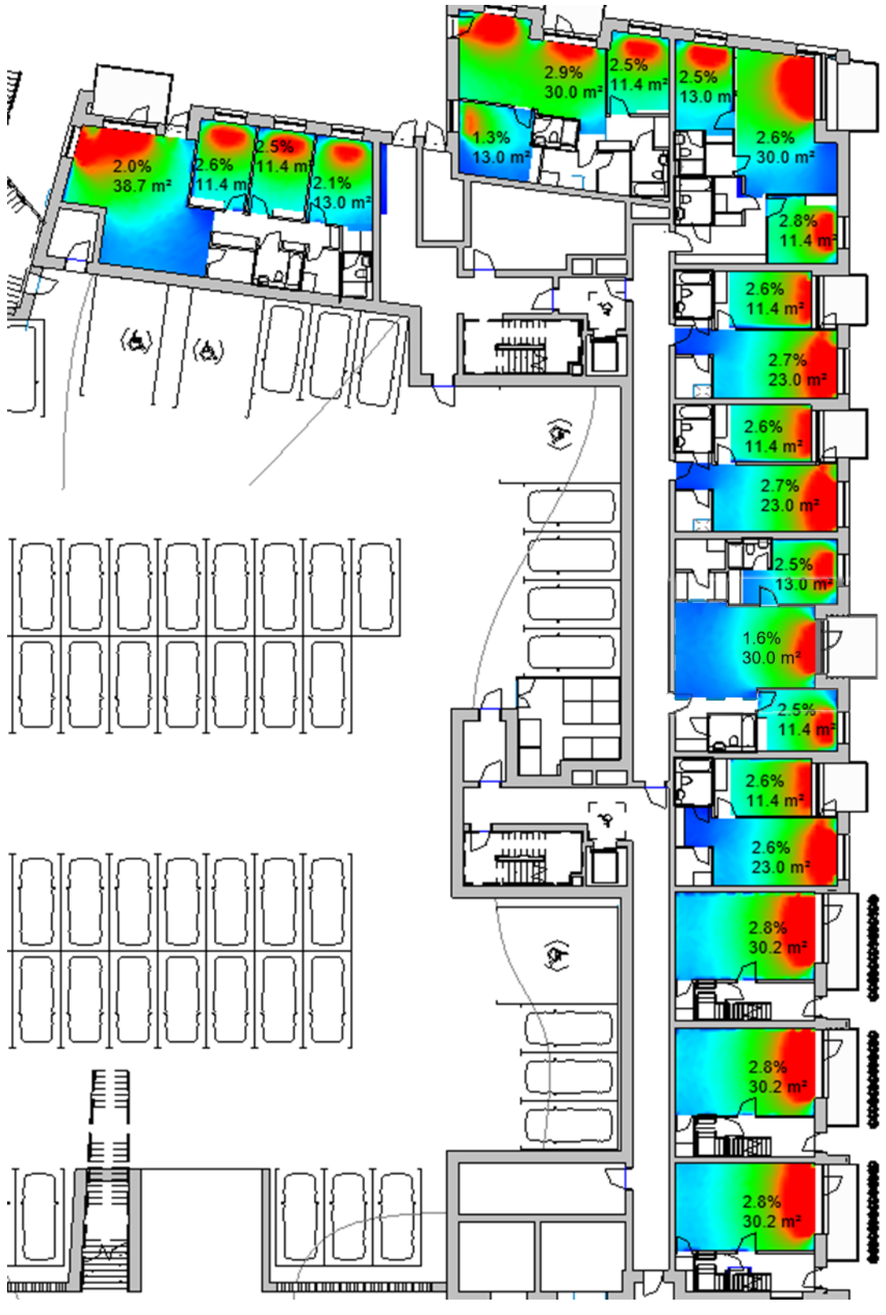


Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

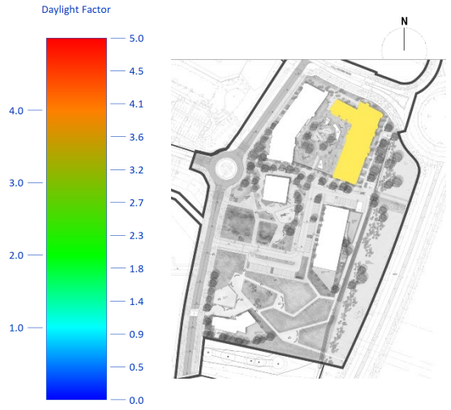
Kilmartin Block C Results – Level 00

All spaces on this floor were found to be compliant, with the exception of one KLD space. for which compensatory measures provided are indicated, which is 9% larger than minimum requirements at 79.8m^2 (73.0m^2 required).



BC.0006

CM: 1 & 2



Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Compensatory Measures
1: Unit size exceeds Guidelines
2: Additional External Private Amenity
3: Own Door Access
4: Duplex Unit
5: Dual Aspect Unit
6: Increased Balcony Provision to Unit

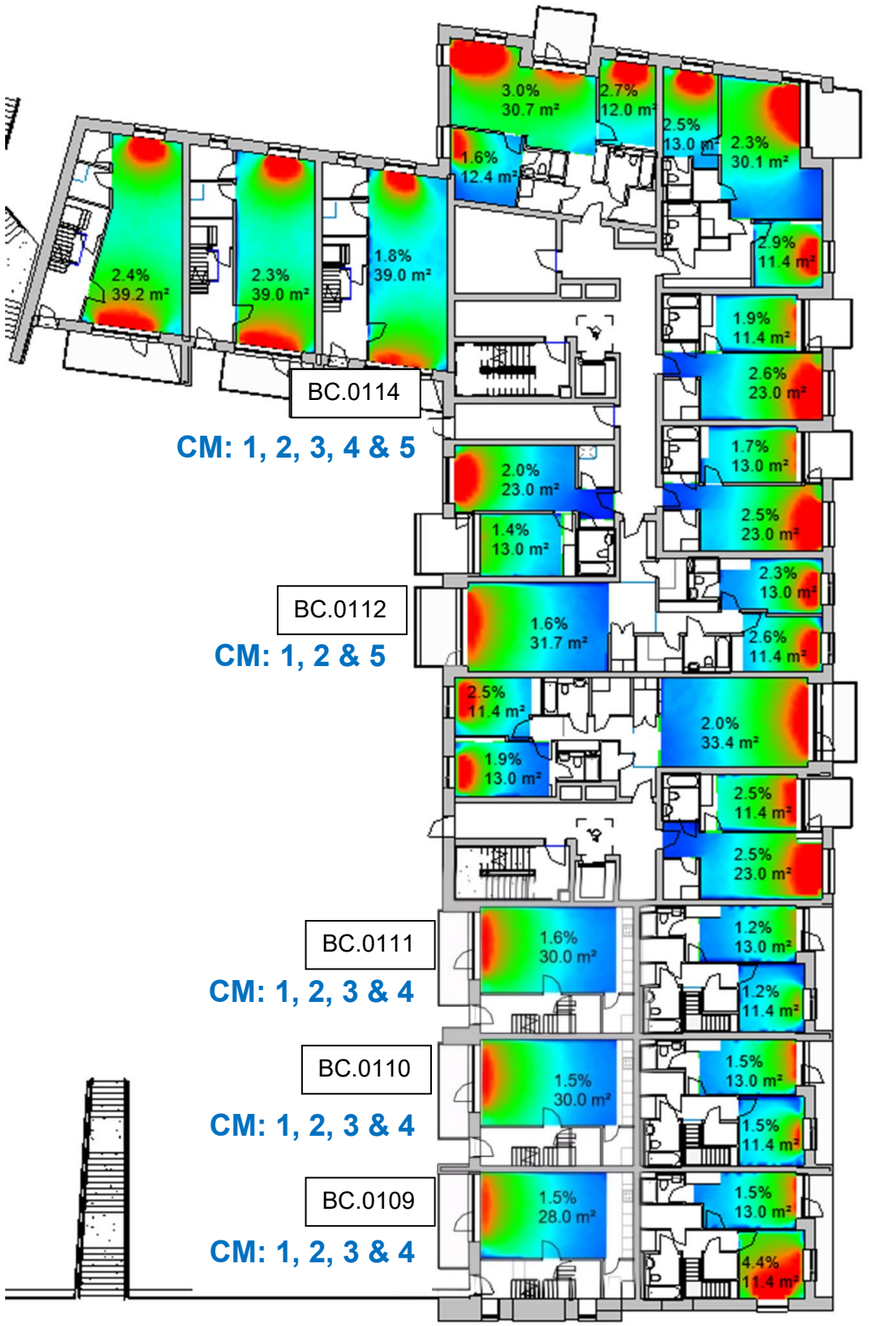
Internal Daylight Analysis

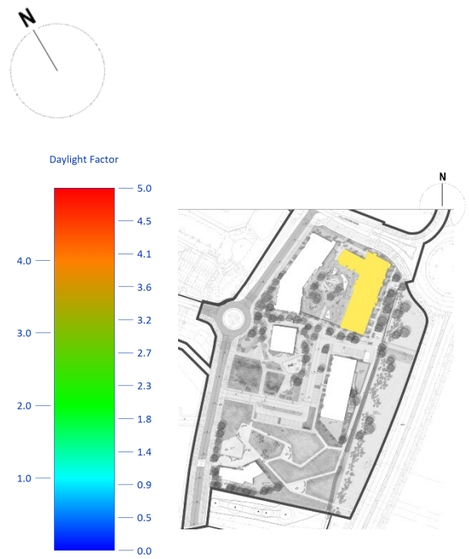
Kilmartin Block C Results – Level 01

All spaces on this floor were found to be compliant, with the exception of five KLD spaces, for which compensatory measures provided are indicated. The unit sizes for apartments where compensatory measures are identified comfortably exceed minimum guidelines as below:

BC.0114: 125m^2 -v- 90m^2 (+39%).
BC.0112: 95.8m^2 -v- 73m^2 (+31%).
BC.0111: 97m^2 -v- 73m^2 (+33%).
BC.0110: 96.5m^2 -v- 73m^2 (+32%).
BC.0109: 103.5m^2 -v- 73m^2 (+42%).

Compensatory Measures
1: Unit size exceeds Guidelines
2: Additional External Private Amenity
3: Own Door Access
4: Duplex Unit
5: Dual Aspect Unit
6: Increased Balcony Provision to Unit





Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

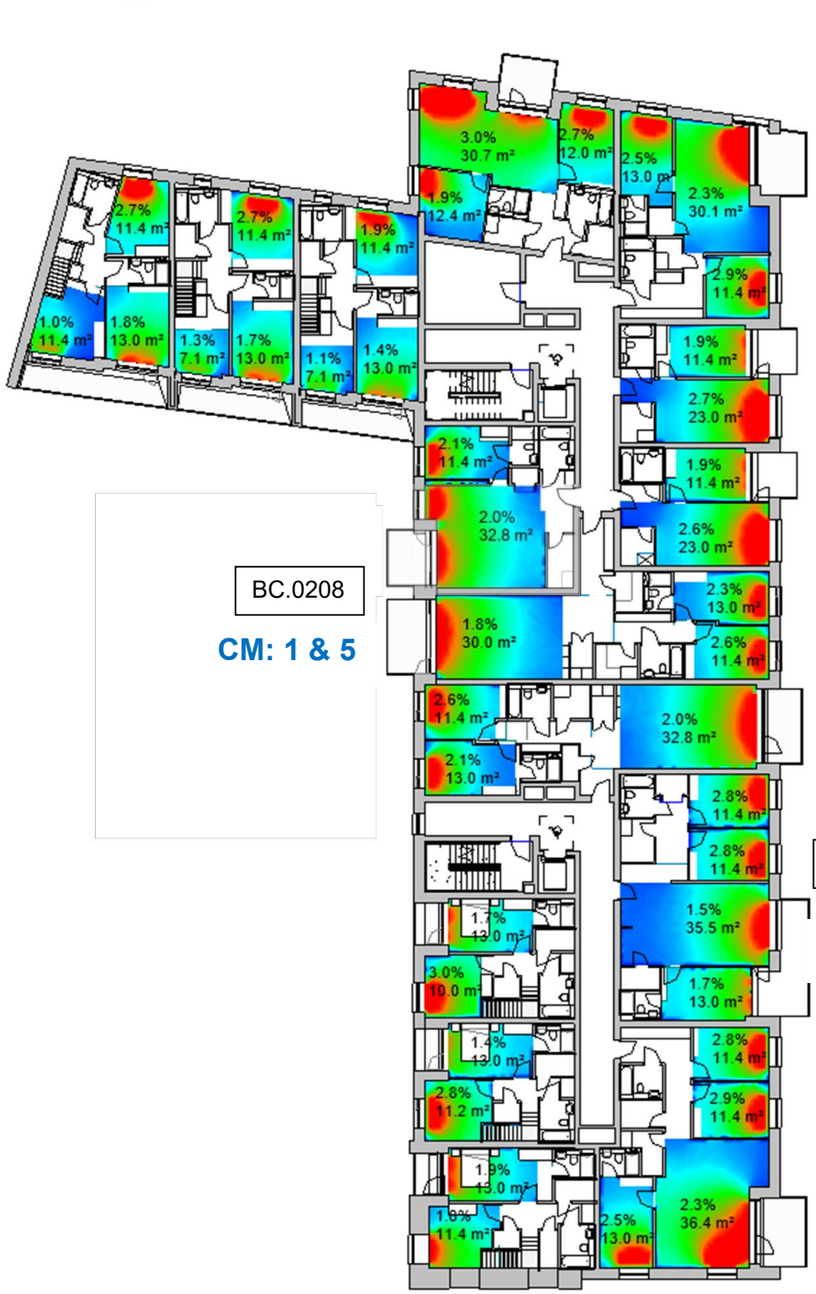
Kilmartin Block C Results – Level 02

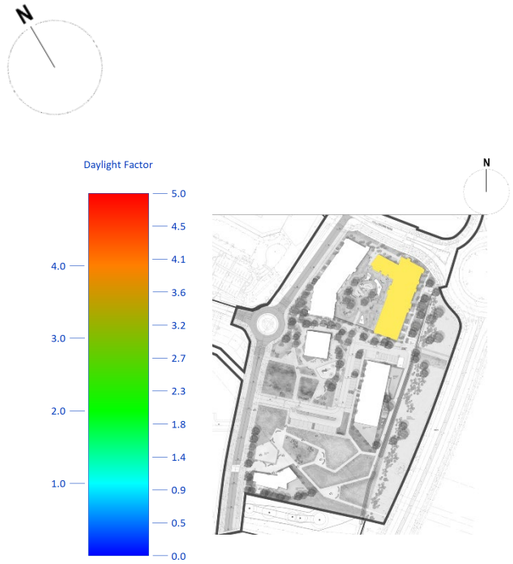
All spaces on this floor were found to be compliant, with the exception of three KLD spaces, for which compensatory measures provided are indicated.

Apartments where areas exceed minimum guidelines are as below:

b. BC.0208: 97.6m^2 -v- 73m^2 (+34%).
c. BC.0206: 98.9m^2 -v- 90m^2 (+10%).

In addition BC.0206 has been provided with 12.5m^2 of balcony area, in comparison to 9m^2 minimum guidelines (+39%), in addition to ensuring southernly aspect.





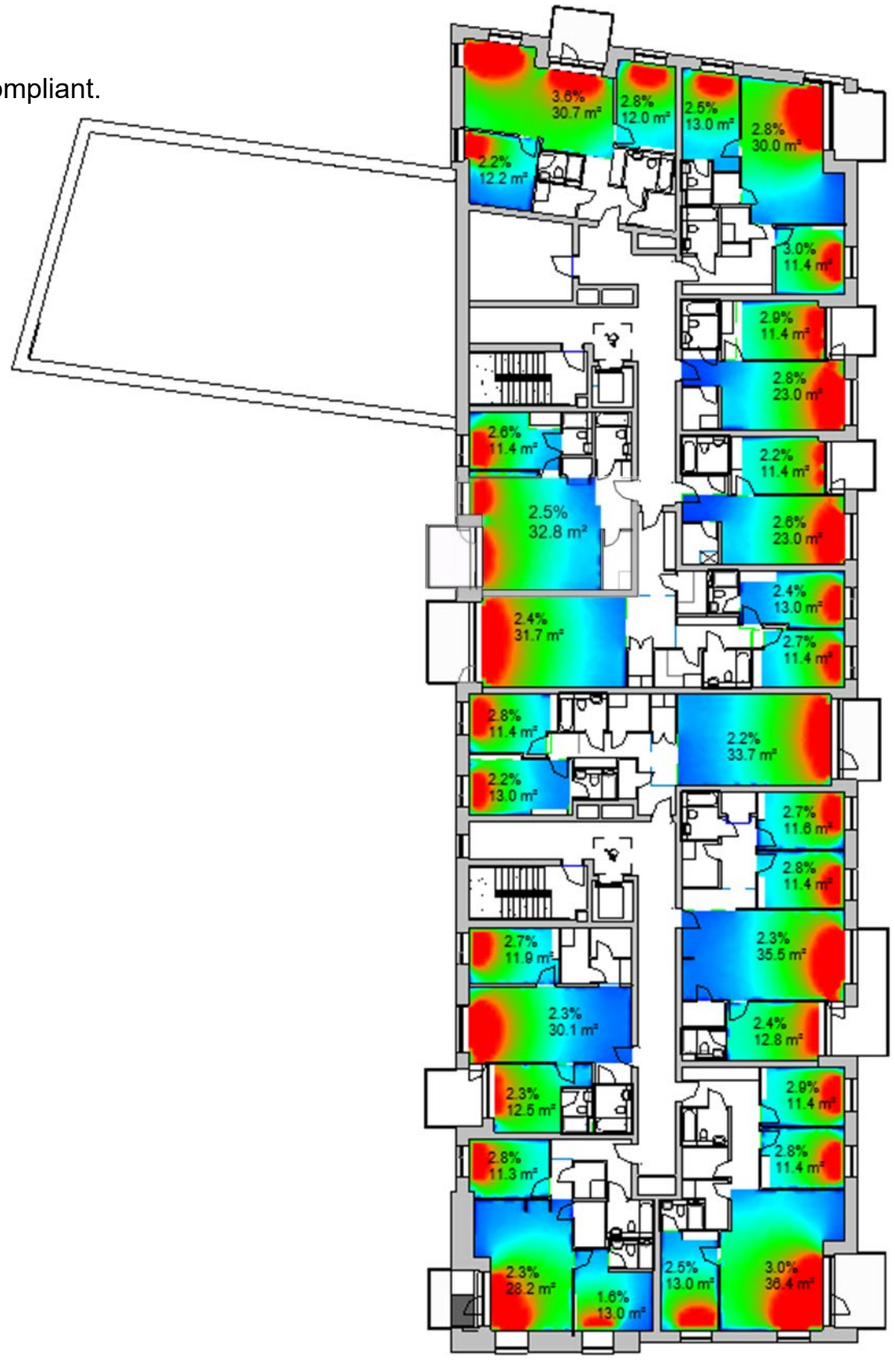
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

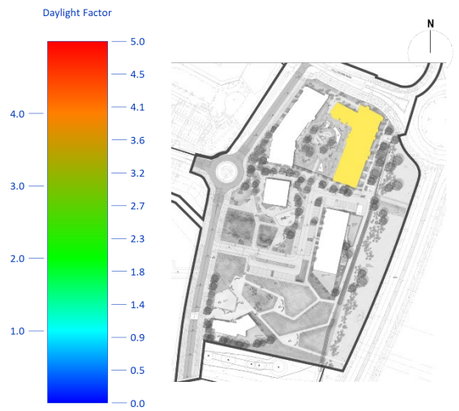
Compensatory Measures
1: Unit size exceeds Guidelines
2: Additional External Private Amenity
3: Own Door Access
4: Duplex Unit
5: Dual Aspect Unit
6: Increased Balcony Provision to Unit

Internal Daylight Analysis

Kilmartin Block C Results – Level 03

All spaces on this floor were found to be compliant.



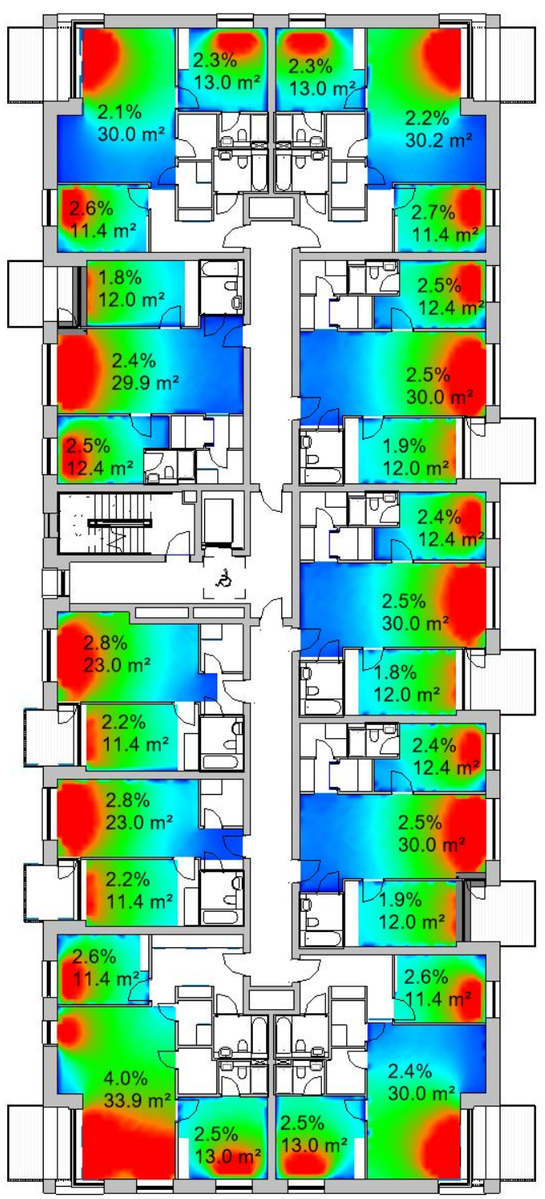


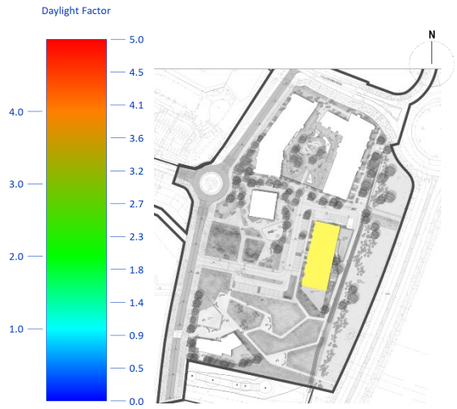
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block D Results – Level 01

All spaces on this floor were found to be compliant.



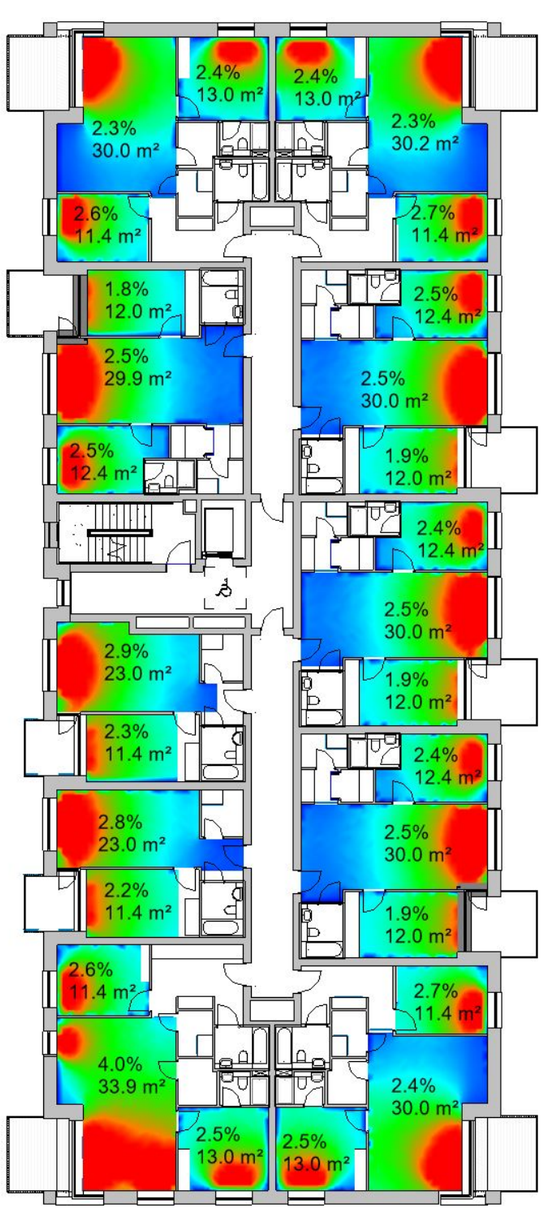


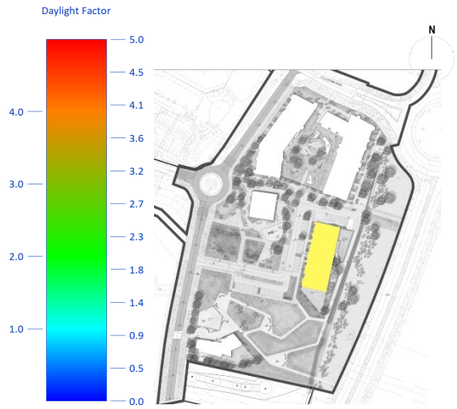
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block D Results – Level 02

All spaces on this floor were found to be compliant.



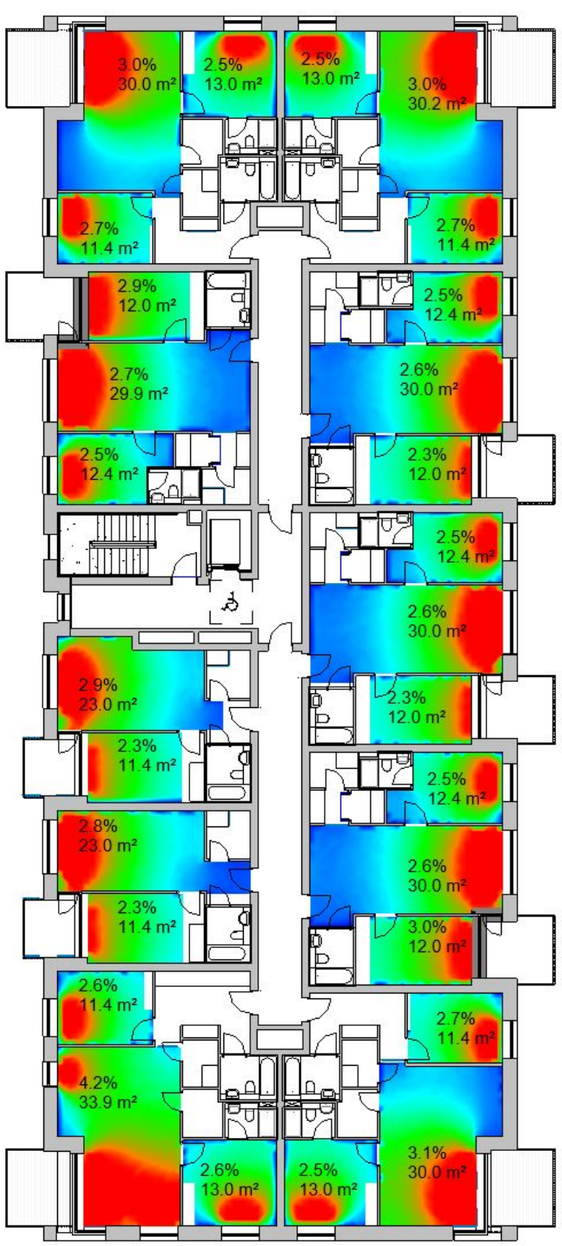


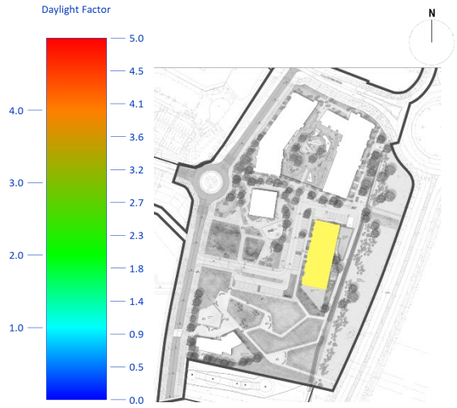
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

Kilmartin Block D Results – Level 03

All spaces on this floor were found to be compliant.



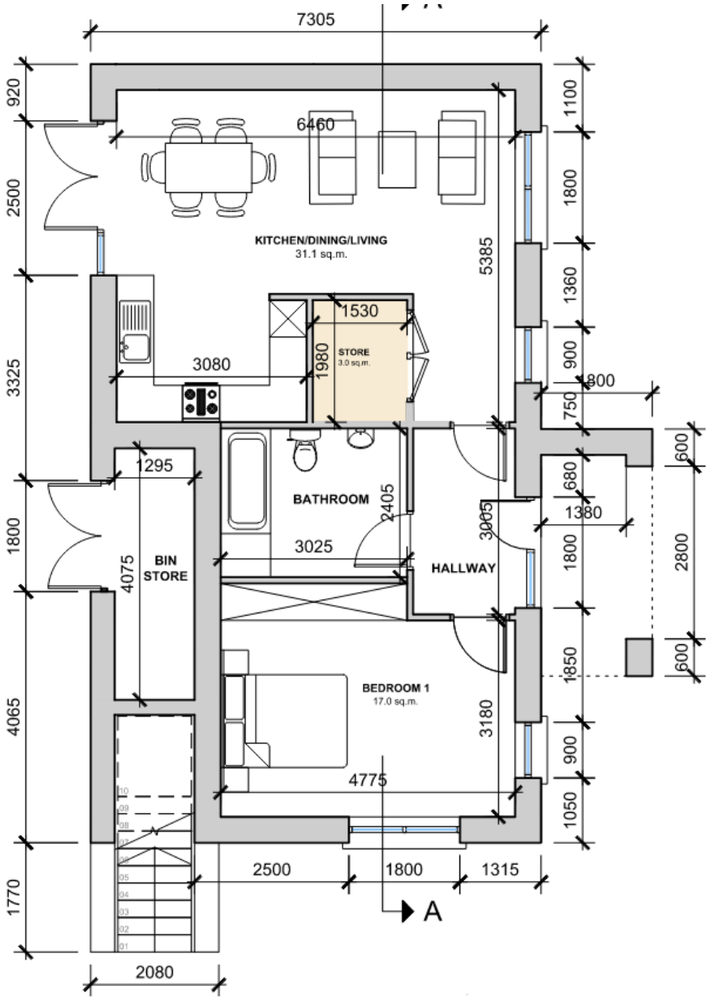


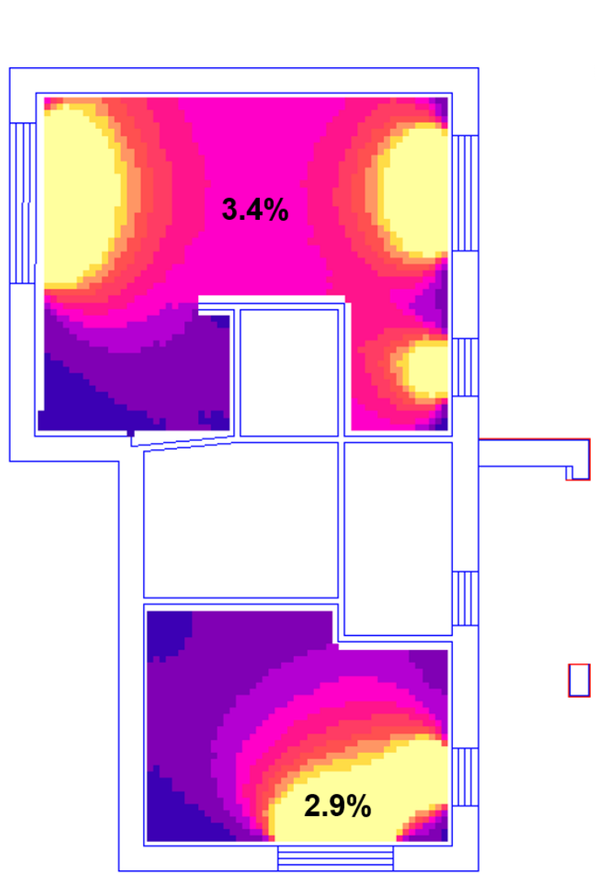
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

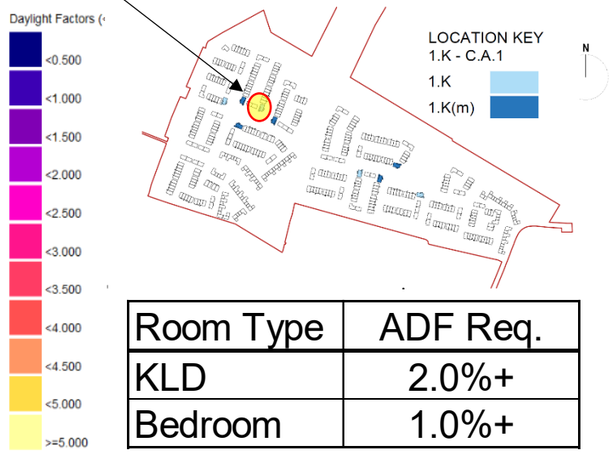
Hollystown Triplex Results – Level 00

All spaces on this floor were found to be compliant.





Triplex with Least Access to Daylight Assessed

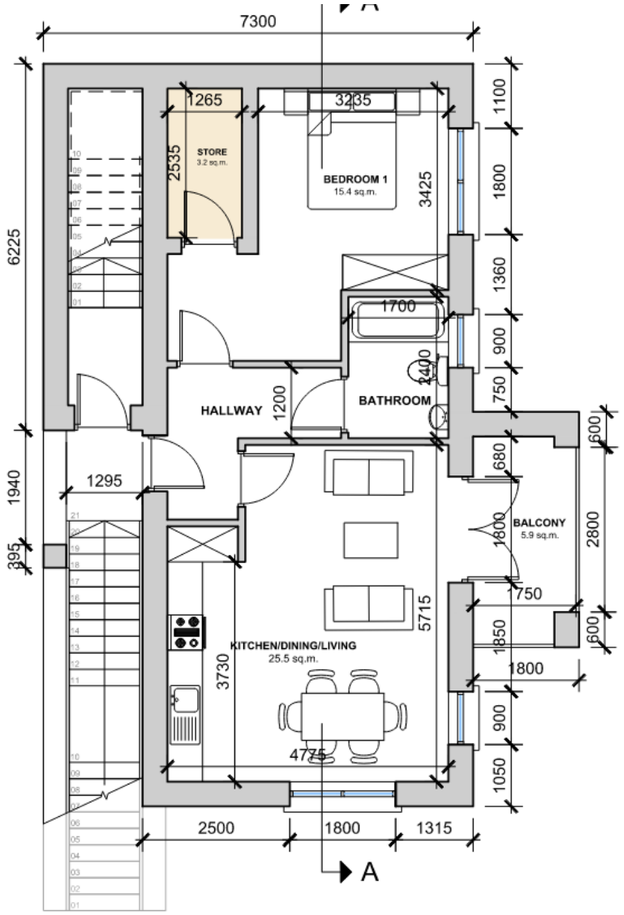


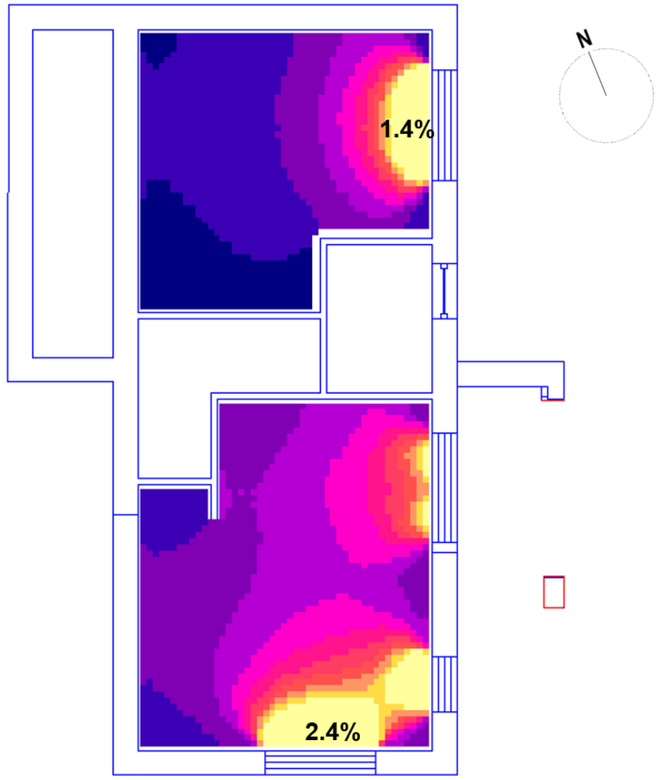
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

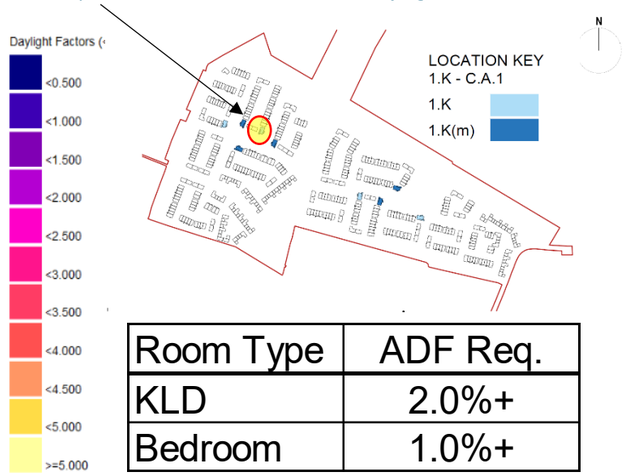
Hollystown Triplex Results – Level 01

All spaces on this floor were found to be compliant.





Triplex with Least Access to Daylight Assessed

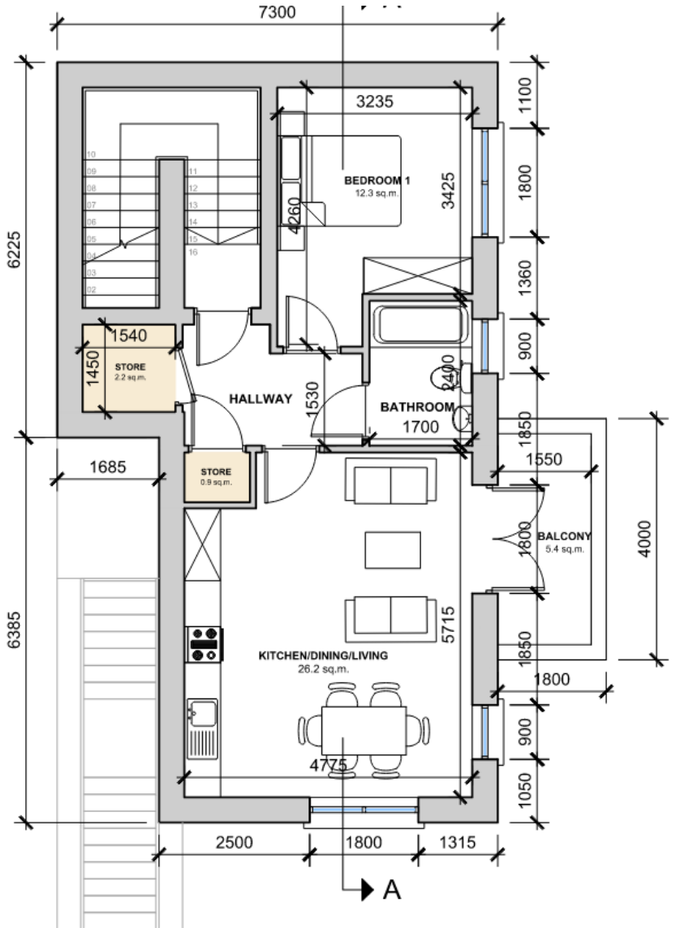


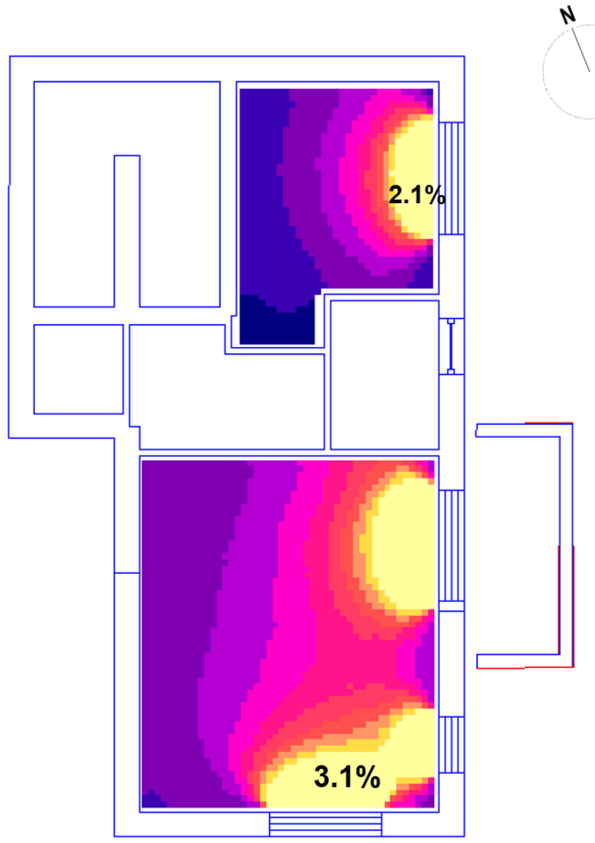
Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

Internal Daylight Analysis

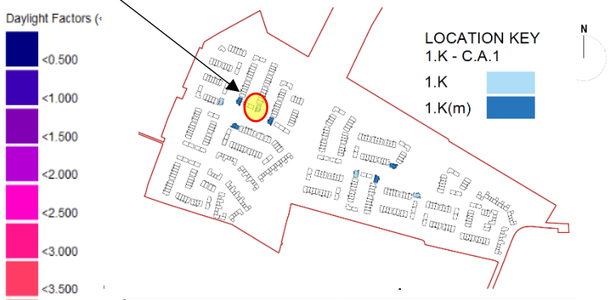
Hollystown Triplex Results – Level 02

All spaces on this floor were found to be compliant.





Triplex with Least Access to Daylight Assessed



Room Type	ADF Req.
KLD	2.0%+
Bedroom	1.0%+

APPENDIX A - 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.*

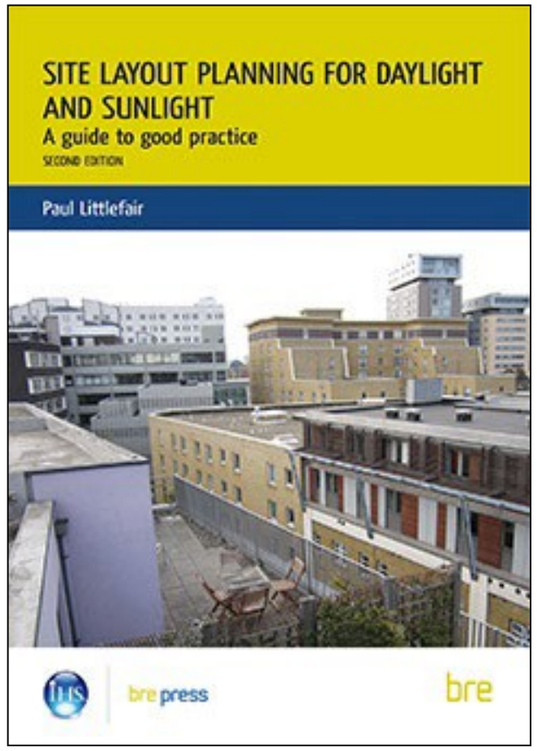
Subsequent to this guidance, a new European Standard for Daylight in Buildings (EN 17037) was released in 2018 and adopted as IS EN 17037 in January 2019. This standard does not fall under any *mandatory* directive of the EU or any Irish Statutory Instrument and therefore remains *advisory*.

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 (Dublin location)
Bedroom	100	0.7%+
KLD	200	1.3%+



A compliance comparison was then made for the KLD's between the existing B.S.8206-2008 (as referenced within BRE.209 2nd Edition, 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 3rd Edition).

Figure A.1 compares for each KLD sampled:

Average Daylight Factor (ADF) as per BS.8206-2 (horizontal axis), with rooms deemed compliant where ADF exceeds 2.0%

Median Daylight Factor (MDF) as per BS.EN.17037 Annex NA, (vertical axis), with rooms deemed compliant where MDF exceeds 1.3%.

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 (i.e. the vast majority, illustrated by green markers) and the converse also true (red markers) for the relatively few non-compliances. There were only some isolated rooms found compliant to BS.8206-2 deemed (borderline) non-compliant to the EN.17037 methodology assessed, or vice-versa, illustrated by yellow dots.

It can therefore be deduced that the forthcoming methodology understood to be introduced shortly within BRE.209 3rd Edition (based on BS.EN.17037 Annex NA), would result in differences of compliance for individual rooms, the overall compliance would be expected to be similarly high to that as analysed and assessed within this report (BS.8206-2), reflective of the design development undertaken to ensure excellent natural light availability to the apartments.

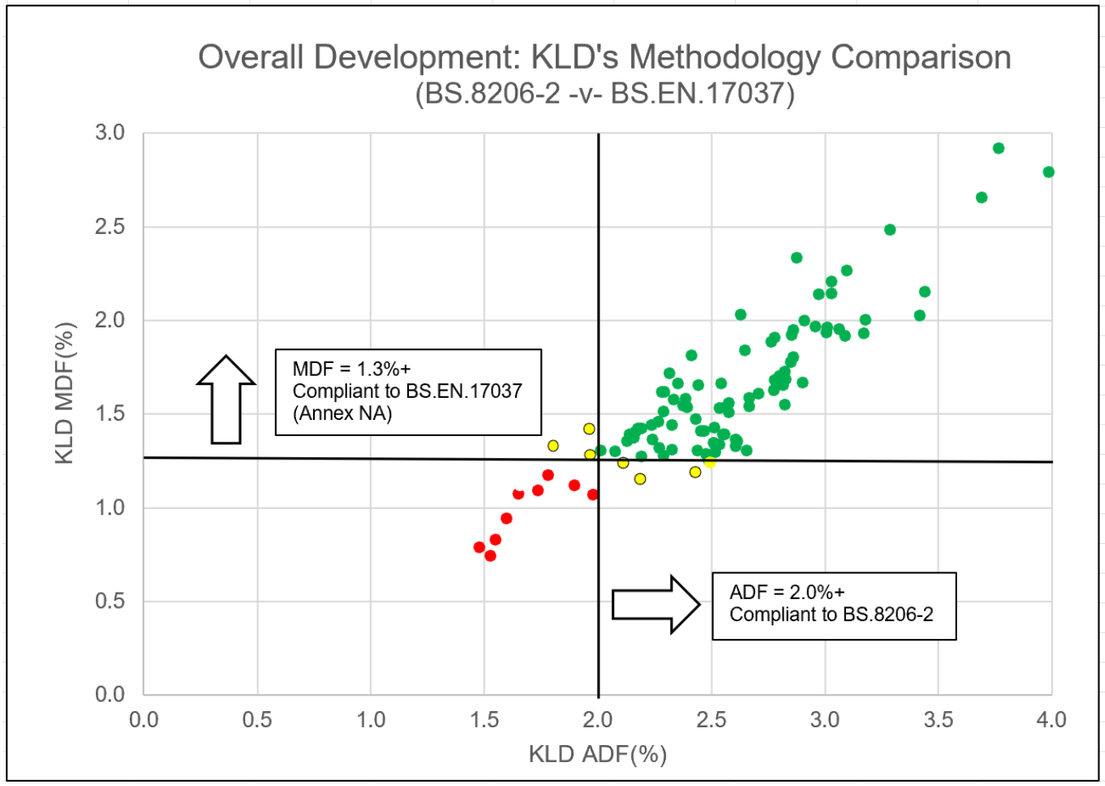


Fig A.1 – Standards Compliance Comparison

APPENDIX B – Shadow Diagrams

Equinox March 21st

The shadow diagram shows no undue impact on neighbouring buildings and amenities. Refer to section 5.0 for quantitative assessments.

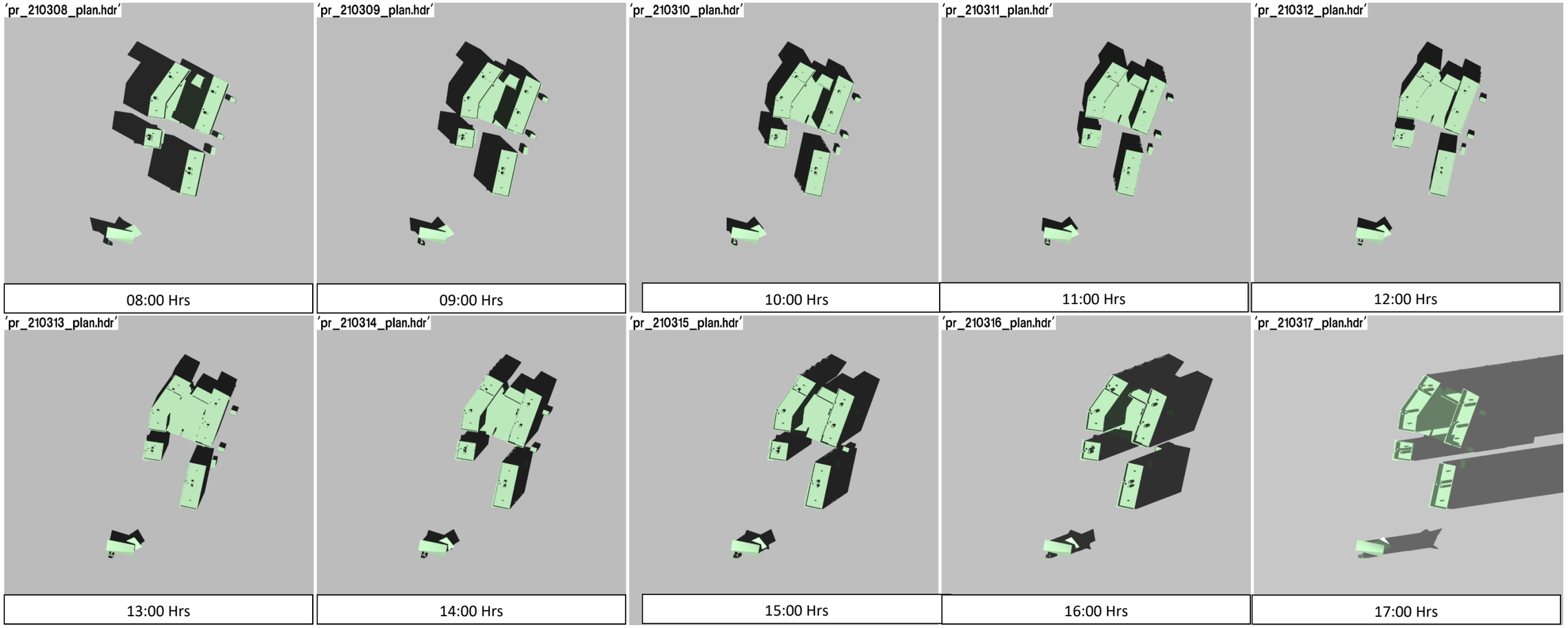


Fig B1: Sunlight and Site Shading Diagrams - Equinox (March 21st): 08:00-17:00 hrs

Summer Solstice June 21st

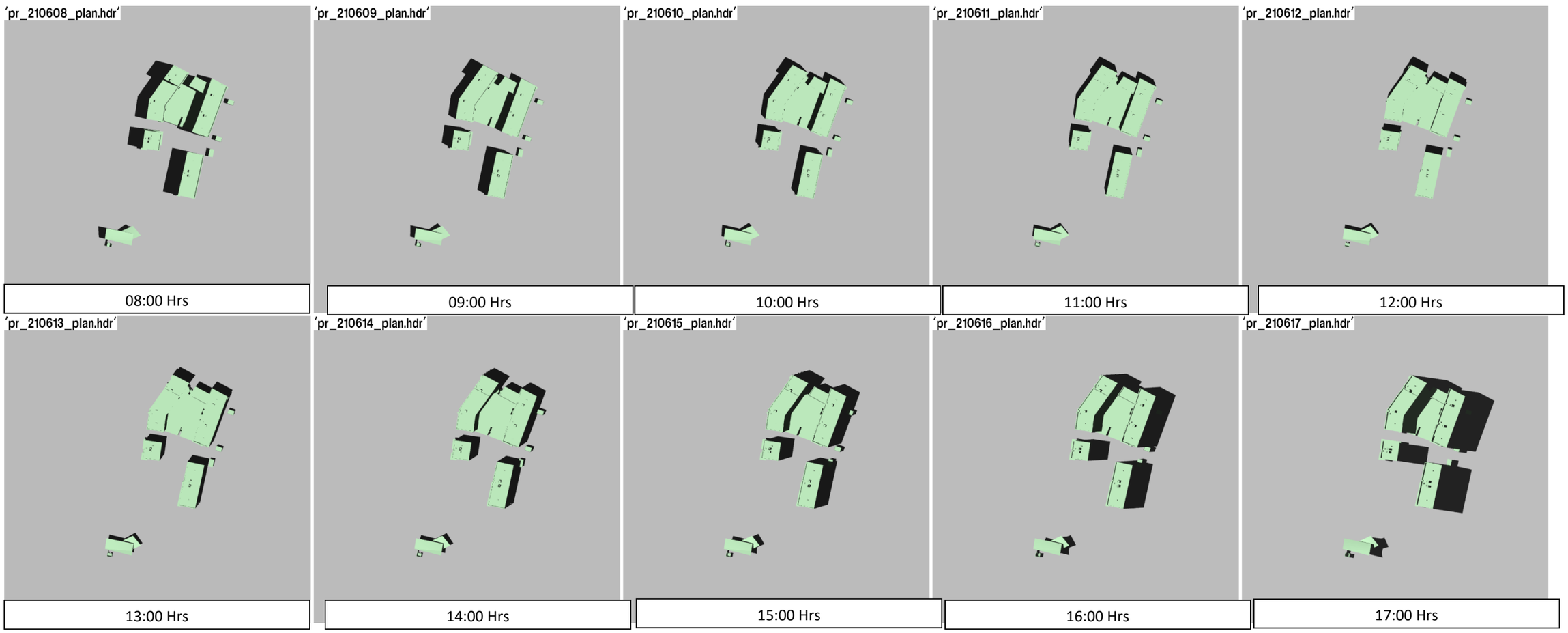


Fig B2: Sunlight and Site Shading Diagrams - Summer Solstice (June 21st): 08:00-17:00hrs

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

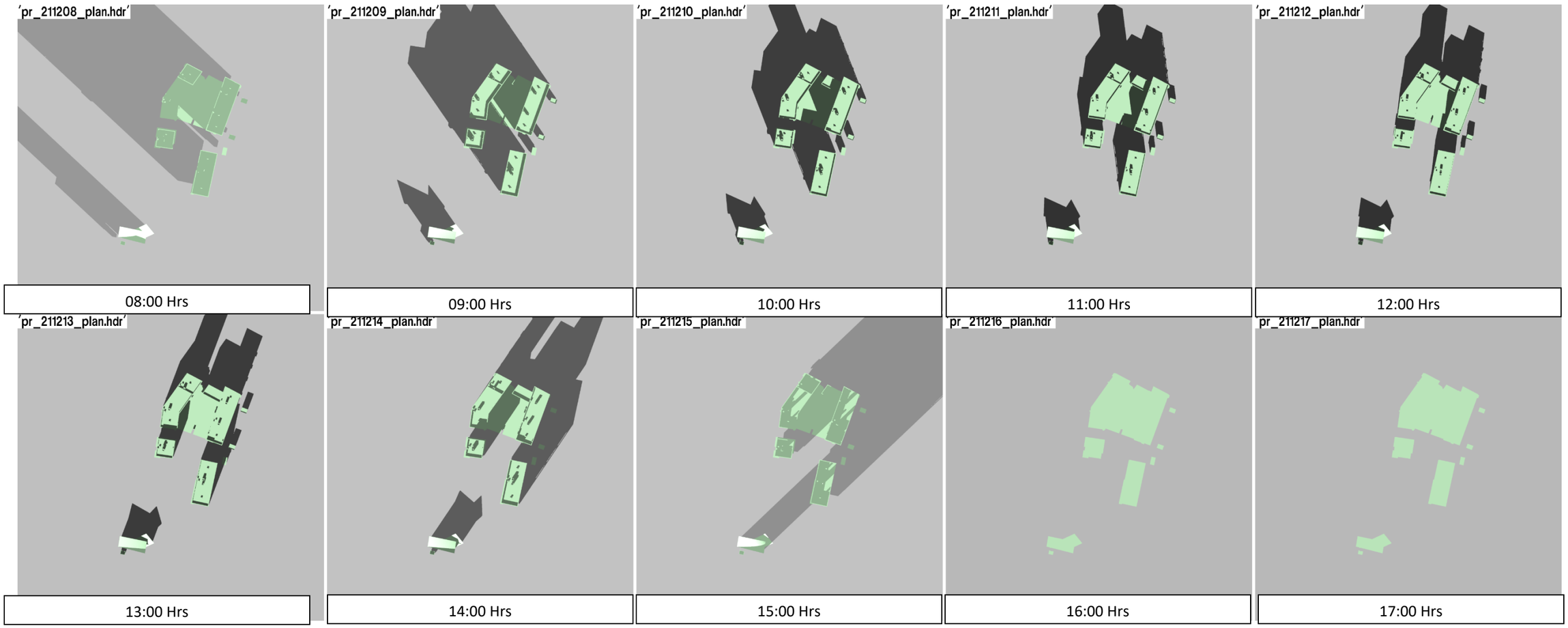


Fig B3: Sunlight and Site Shading Diagrams - Winter Solstice (December 21st): 08:00-17:00 hrs

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.