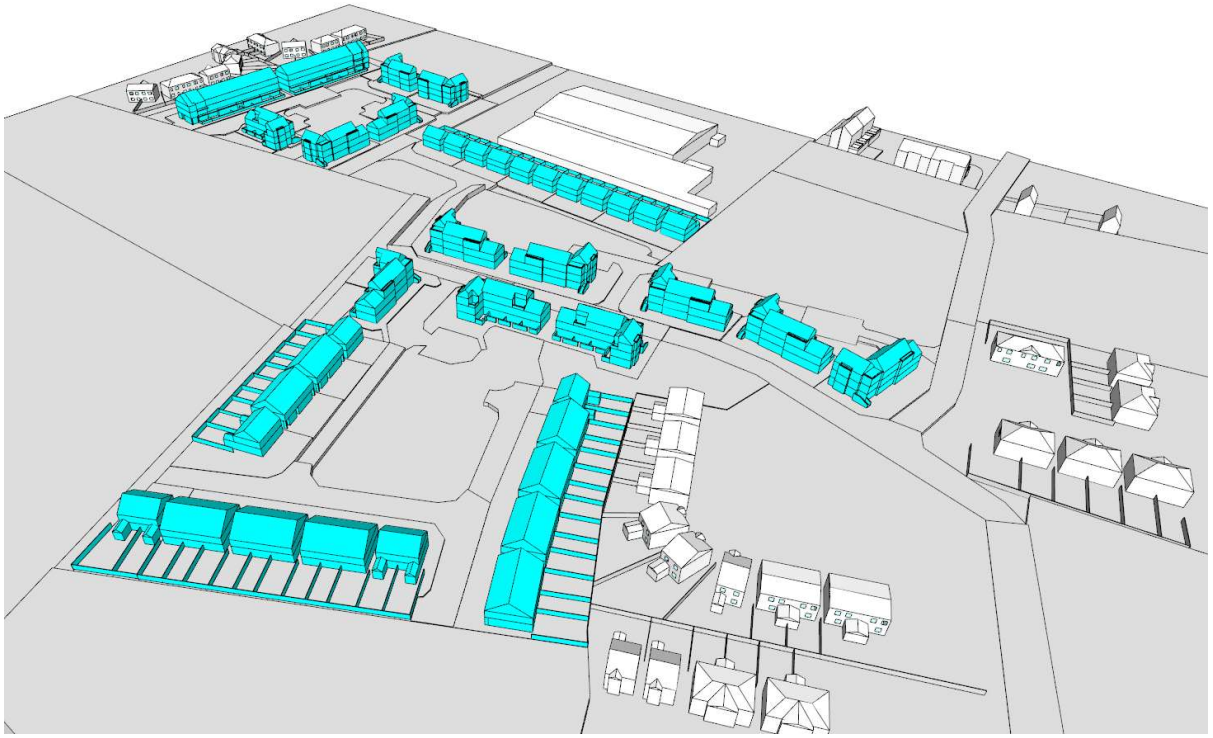
Dunlo SHD

Daylight, Sunlight and Overshadowing Study



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1 Executive Summary

This report summarises the analyses undertaken to quantify the Sunlight and Daylight performance of the proposed Ballinasloe development located in Galway, Ireland. The report focuses on measuring the daylight and sunlight impact to the existing surrounding dwellings as well as the daylight and sunlight performance within the proposed development.

1.1 Planning Authority Guidelines

Currently there are a number of different standards and guidelines which, in the writing of this report, appropriate and reasonable regard has been taken to address. It should be noted at this point that the *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* has been included within this report even though it has now been withdrawn because the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) and the BS 8206-2: 2008 directly refer to each other as noted within the BRE guide (2nd edition) itself as below.

"This guide gives advice on site layout planning to achieve good sunlight and daylight 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 British Standard Code of practice for daylighting, *BS 8206-2: 2008."*

In addition to this, The Sustainable Urban Housing: Design Standards for New Apartments December 2020 states the following in Section 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."

However, there is a new standard for the assessment of daylight access within buildings titled "*EN 17037:2018: Daylight in Buildings*" which has been adopted in Ireland as IS EN 17037:2018. This new standard is not directly referred to within the latest Planning Authority Guidelines whereas the BRE Guide (2nd Edition) and BS 8206-2:2008 are referred to.

Furthermore, the EN 17037:2018 standard has already been adopted in the UK to inform the BS EN 17037:2018 standard which supersedes BS 8206-2:2008 which is now withdrawn. It is important to note that BS EN 17037:2018 includes a National Annex which specifically addresses daylight provision in residential dwellings in the UK. A similar annex is not included in the IS EN 17037:2018 standard.

Finally, the latest BRE guide 'Site Layout Planning for Daylight and Sunlight' (3rd edition) has just been published (June 2022). This now directly links to the new daylighting standards EN 17037:2018. Aside from the refinements to the BRE guide, the assessments are the same as what is found within the 2nd edition.

With regards to interior daylighting and external sunlight exposure in particular, where different methodologies are found in each of the different standards, all methodologies have been employed for completeness to ensure appropriate and reasonable regard has been taken to address all assessments under all of the different standards. For clarity these are listed below and the following Section 1.2 denotes which standard is applicable for each assessment type:

- BRE Guide – 2nd Edition/3rd Edition of BR 209 BRE Site Layout Planning for Daylight and Sunlight
- BS 8206-2:2008 – Lighting for Buildings – Part 2: Code of Practice for Daylighting
- IS EN 17037:2018 – Daylight in Buildings
    - This is the Irish implementation of the European EN 17037:2018 standard
- BS EN 17037:2018 – Daylight in Buildings
    - This is the UK implementation of the European EN 17037:2018 standard. It supersedes BS 8206-2:2008 which is withdrawn in the UK. The BS EN standard includes a National Annex which addresses daylight requirements specific to dwellings which is notable as Ireland's climate matches closely with the UK.

1.2 Reference Standards & Summary of Assessments Undertaken

The various daylight and sunlight assessments that were undertaken using the IES VE software are based on a number of different standards which are referenced in the individual sections of this report. For clarity, the assessments that were undertaken are summarised below as well as the reference standards that were used for each (where applicable):

- **Shadow Analysis**
    - Assessed using shadow images cast at key times throughout the year, i.e. March 21st, June 21st and December 21st to determine if any overshadowing impact occurs and to what extent to any existing neighbouring dwellings in accordance with the BRE Guide (2nd and 3rd Editions).
- **Sunlight to Amenity Spaces**
    - Assessed using annual Solar Exposure calculations to determine any impact to existing amenities and the sunlight received and also to assess the proposed developments amenity spaces to derive how much sunlight they can expect to receive in accordance with the BRE Guide (2nd and 3rd Editions).

- **Sunlight to Existing Buildings**
    - Assessed using the Annual Probable Sunlight Hours (APSH) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd & 3rd Edition) - to determine any impact to sunlight received to the existing neighbouring building main living areas.
- **Sunlight to Proposed Buildings**
    - Assessed using the Annual Probable Sunlight Hours (APSH) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition)
    - Assessed using Solar Exposure calculations in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)
    - In both assessments above the aim is to derive how much sunlight proposed development can expect to receive.
- **Daylight to Existing Buildings**
    - Assessed using the Vertical Sky Component (VSC) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd & 3rd Edition) - to determine any impact to existing daylight received to the existing building neighbouring the site.
- **Daylight to Proposed Development**
    - Assessed using the Average Daylight Factor (ADF) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition)
    - Assessed in accordance with IS EN 17037:2018 Method 2 (BRE Guide 3rd Edition)
    - Assessed in accordance with BS EN 17037:2018 National Annex Method 2 (BRE Guide 3rd Edition)
    - In all assessments above the aim is to derive how much daylight will be received within each of the apartments within the proposed development.
- **View Out**
    - Assessed in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)
- **Glare**
    - Assessed in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)

The following can be concluded based on the assessments undertaken:

1.3 Shadow Analysis

The shadow analysis illustrates different shadows being cast at key times of the year (March 21st, June 21st and December 21st) for the Existing Situation and the Proposed Scheme. The results from the study are summarised as follows:

Previous Project Phase – PI Ref 19/1978 (Under Construction)

No additional shading from the proposed development is observed on this property throughout the year.

75-96 Esker Fields

Minimal additional shading from the proposed development is observed on these residential properties on March 0800. Additional shading is also observed in December 1000-1400. No additional shading is observed at any other periods throughout the year.

15-21, 28-40 Beechlawn Heights

Minimal additional shading from the proposed development is observed on these residential properties on March 1800, June 2000 and December 1400. No additional shading is observed at any other periods throughout the year.

33-45 Dun Esker

Minimal additional shading from the proposed development is observed on these residential properties on March 1800. No additional shading is observed at any other periods throughout the year.

The potential shading impact is quantified via the "Sunlight to Amenity Spaces" and "Daylight to Existing Buildings" sections of this report.

1.4 Sunlight to Amenity Spaces

The BRE Guide (2nd and 3rd Editions) states that for a space to appear adequately sunlit throughout the year, at least half of a garden or amenity space should receive at least 2 hours of sunlight on March 21st. In the case of existing amenity spaces, if they are already below the 50% threshold then the BRE recommends the results are kept to within 80% of the existing situation with the proposed development in place.

Existing Amenity Spaces

On March 21st the existing amenity spaces will receive the same level of sunlight with the proposed development in place. In all cases the results comply with the recommendations in the BRE Guide outlined above.

Proposed Amenity Spaces

On March 21st, 90% of the combined proposed communal amenity areas and 98% of the combined proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight over their total combined area. All amenity areas provided will be quality spaces in terms of sunlight.

In addition, all individual areas tested are achieving at least 2 hours of sunlight over 50% of their area on the 21st of March.

1.5 Sunlight to Existing Buildings

This study considers the existing scheme and tests if the Annual Probable Sunlight Hours (APSH) results for the living room windows are greater than 25% annual and 5% winter sunlight or are greater than 0.8 times their former value with the proposed development in place.

Based on the criteria outlined in Section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, none of the existing buildings fit the requirements to be assessed and as such the APSH assessment was not conducted for these properties. The BRE guide (2nd and 3rd Editions) notes that there should be no impact to sunlight for these properties.

"It is not always necessary to do a full calculation to check sunlight potential. The guideline above is met provided either the following is true:

- If the window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal. Again, obstructions within 90° of due north need not be counted."

Given the statement above the existing properties adjacent to the proposed development were verified noting that, in a section perpendicular to the window wall, no angle subtended more than 25° and, in some cases, they were also sitting to the south of the proposed development. Therefore, none of the existing property were included in the assessment and they were excluded on the basis, as noted in section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, that these windows need not be analysed as sunlight impact will be unnoticeable to the occupants.

1.6 Sunlight to Proposed Development

For the sunlight to proposed development assessment, two standards have been analysed: BS 8206-2:2008 (BRE Guide 2nd Edition) and IS EN 17037:2018 (BRE Guide 3rd Edition). The results under each standard are summarised below.

BRE Guide 2nd Edition / BS 8206-2:2008

Within the BS 8206-2:2008 standard (BRE Guide 2nd Edition), when discussing annual probable sunlight hours regarding proposed developments, it is noted that:

"The degree of satisfaction is related to the expectation of sunlight. If a room is necessarily North facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary".

This is also reflected in the BRE Guide (2nd Edition) which states:

"The BS 8206-2 criterion applies to rooms of all orientations, although if a room faces significantly north of due east or west it is unlikely to be met."

Based on the above criteria for the BRE Guide 2nd Edition/BS8206-2:2008, all main living room windows within the proposed development apartments and duplexes have been assessed and a sampling of the house types properties have been assessed with the results included in the following sections.

The sample was aligned with the properties selected for the daylight sampling. As such a sample were chosen from the middle of rows or locations that were in close proximity to neighbouring proposed properties which would be seen as worst-case location as a check on performance with regards to sunlight. Properties in the same orientation will produce very similar if not identical results.

Of the 102 no. points tested, 94 no. points (92%) meet the BRE recommended values over both the annual and winter periods. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, i.e. windows facing *"significantly north of due east or west"* or as a consequence of the impact of balcony projections.

It should be noted that in the development of any apartment type building achieving in the region of 75% to 80% for this assessment would be considered very high and factors such as site constraints and ultimately orientation play a huge part to the outcome of this assessment. In some instances, particularly a scheme like this where you have apartments on either side of a rectangular block, 50% would be the highest percentage achievable. This is because the apartments on one side are not able to meet the requirements based on orientation as noted and the inclusion of balconies within the design scheme (as a requirement).

BRE Guide 3rd Edition / IS EN 17037:2018

As the sunlight exposure assessment in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition) considers the orientation of the rooms similar to the BRE Guide 2nd Edition/ BS 8206-2:2008 assessment above, it can also be concluded that the criteria for rooms facing significantly north of due east or west is unlikely to be met.

Of the 102 no. points tested, 95 no. points (93%) meet the BRE Guide 3rd Edition / IS EN 17037:2018 sunlight exposure recommendations of greater than 1.5 hours on March 21st. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, or as a consequence of the impact of balcony projections.

Overall, the sunlight provision results to the proposed development in accordance with IS EN 17037:23018 are considered excellent in the context of a suburban environment, due to the fact that not all living rooms can face south and the inclusion of balconies.

Note, the sunlight exposure results are visually represented in Appendix B.

1.7 Daylight to Existing Buildings

Based on the criteria outlined in Section 2.2.5 of the BRE guidance (2nd and 3rd Editions), none of the neighbouring dwellings need to be included within the VSC assessment as they did not meet the criterion as laid out within the BRE guide.

It is not always necessary to do a full calculation to check daylight potential. The guideline above is met provided the following is true:

- no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal.

Given the statement above the existing surrounding dwellings and the proposed development were verified noting that in a section perpendicular to the window wall, no angle subtended more than 25°. Therefore, as noted above, none of the existing adjacent dwellings have been included within the VSC assessment as the daylight impact will be unnoticeable to the occupants for these properties.

1.8 Daylight to Proposed Development

For the daylight to proposed development assessment, three standards have been analysed: BS 8206-2:2008 (BRE Guide 2nd Edition), IS EN 17037:2018 and BS EN 17037:2018 National Annex (BRE Guide 3rd Edition). The results under each standard are summarised below.

To note, a sample of the duplexes and houses have been selected as these property types do not experience the same daylight issues that apartments generally do. As such a sample were chosen from the middle of rows or locations that were in close proximity to neighbouring proposed properties which would be considered a worst-case location as a check that there were no performance issues with regards to daylight.

BRE Guide 2nd Edition / BS 8206-2:2008

Across the proposed development, 100% of the tested rooms are achieving Average Daylight Factors (ADF) in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition) when Living/Kitchen/Dining spaces are assessed as whole rooms against a 2% ADF target and Bedrooms against a 1% ADF target.

BRE Guide 3rd Edition / IS EN 17037:2018

It is important to note that IS EN 17037:2018 (BRE Guide 3rd Edition) does not provide different illuminance targets for different space types. Therefore, in the case of residential developments; bedrooms, living rooms, kitchens and combined LKDs all have the same daylight provision targets.

There are two methods to assess daylight provision to the interior which are based on target values in either Table A.1 or Table A.3 of IS EN 17037:2018 which are summarised as follows:

Method 1: This calculation method uses the daylight factor targets on the reference plane as per Table A.3 (refer to Section 10.1.2 of this report). The assessment is carried out on a representative day and time during the year, i.e. 21st September @ 12:00 under standard CIE overcast sky conditions.

Method 2: This calculation method uses the illuminance targets on the reference plane as per Table A.1 (refer to Section 10.1.2 of this report). The assessment is carried out for each hour over the course of the year (8,760 hours) using a local weather file which accounts for varying sky conditions and sun positions throughout the year.

As outlined in Section 5.1.4 of the standard, the verification of daylight provision can be determined using either an adequate software or on-site measurements. When using a software, *"a representative model of the space is required together with the key parameters (such as any significant nearby obstructions, the assigned surface reflectance values and glazing transmissivity) that are a reasonable representation of those for the actual, completed building. This can be determined using either Method 1 or Method 2."*

Based on the above criteria, the daylight provision to the proposed development has been assessed using an adequate software (i.e. IES VE), using the Method 2 climate-based approach and targeting the minimum recommended values outlined in Table A.1 of IS EN 17037:2018.

The Method 2 climate-based approach was selected as it is a far more accurate assessment method compared to Method 1. Climate based daylight modelling (CBDM) is more accurate compared to a calculation based on a single day during the year, i.e. Method 1. The amount of daylight varies throughout the year, primarily due to the sun's position, so it is essential the impact of daylight variance is properly considered. CBDM utilises an annual simulation linking location, shading, climate data (including solar intensity and cloud cover) together with the building properties. This provides a complete overview on how the daylight performance varies throughout the year due to changes in these factors.

Across the proposed development, 98% of the tested rooms are achieving the daylight provision targets in accordance with Table A.1 of IS EN 17037:2018 using Method 2.

BRE Guide 3rd Edition / BS EN 17037:2018 National Annex

In the UK, EN17037:2018 was adopted to form "BS EN 17037:2018". However, a National Annex was included which states:

"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."

Whereas IS EN 17037:2018 does not provide different illuminance targets for different space types, the BS EN 17037:2018 National Annex provides target illuminance values for bedrooms, living rooms and kitchens within residential developments as per Table NA.1 (refer to Section 10.1.3 of this report). It is also important to note that as the climate in Ireland is similar to the UK, the targets outlined in the BS EN National Annex could also be applied to dwellings in Ireland.

The BS National Annex also states:

"Where one room in a UK dwelling serves more than a single purpose, the UK committee recommends that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx."

Therefore, combined LKDs were assessed using a 200 lux target illuminance (E_T).

Across the proposed development, 100% of the tested rooms are achieving the daylight provision targets in accordance with Table NA.1 of BS EN 17037:2018 using Method 2.

1.9 View Out

The View Out assessment is related to buildings such as offices or schools where seating layouts are typically fixed compared to domestic settings where an occupant can move around the space freely. In their own home occupants can choose to sit near to or even at a window which will inevitably provide the varying layers of a 'View Out' such as the ground, landscape or sky. This ability to choose their position within a domestic setting means they would always have access to a position in the apartment with the minimum requirements of 'View Out'. Therefore, all the properties would meet the minimum requirement as outlined in IS EN 17037:2018/ BS EN 17037:2018 National Annex (BRE Guide 3rd Edition).

1.10 Glare

As outlined in IS EN 17037:2018/ BS EN 17037:2018 National Annex (BRE Guide 3rd Edition), a Glare assessment is suggested in spaces where the *"expected activities are comparable to reading, writing or using display devices and the user is not able to choose freely their position and viewing direction".* Given that occupants within a domestic setting are free to move

around, on this basis a glare assessment for the proposed development has not been carried out.

1.11 Observations

It is important to note that the recommendations within the BRE Guide (2nd and 3rd Editions) itself states "*although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design*", Although this is true appropriate and reasonable regard has still been taken to the BRE guide.

Whilst the results shown relate to the criteria as laid out in the BRE Guide (2nd and 3rd Editions), it is important to note that the BRE targets are guidance only and should therefore be used with flexibility and caution when dealing with different types of sites.

In addition, the foreword of BS 8206-2:2008 (BRE Guide 2nd Edition) also states "*The aim of the standard is to give guidance to architects, builders and others who carry out lighting design. It is recognised that lighting is only one of many matters that influence fenestration. These include other aspects of environmental performance (such as noise, thermal equilibrium and the control of energy use), fire hazards, constructional requirements, the external appearance and the surroundings of the site. The best design for a building does not necessarily incorporate the ideal solution for any individual function. For this reason, careful judgement needs to be exercised when using the criteria given in the standard for other purposes, particularly town planning control.*"

Taking all of the above information into account and based on the results from each of the assessments undertaken, the proposed development performs well when compared to the recommendations in the BRE Guide 2nd Edition/ BS 8206-2:2008 and the BRE Guide 3rd Edition / IS EN 17037:2018 /BS EN 17037:2018 National Annex. With regards to the existing properties there is a negligible impact when considering sunlight and daylight as a result of the proposed development and the proposed development itself performs well with the same regard.

2 Introduction

This report summarises the analyses undertaken to quantify the Sunlight and Daylight performance of the proposed Ballinasloe development located in Galway, Ireland. The report focuses on measuring the daylight and sunlight impact to the existing surrounding dwellings as well as the daylight and sunlight performance within the proposed development.

2.1 Development Description

The proposed development consists of residential development (c. 15,992 m^2 gross floor area), consisting of 165 No residential units and all associated and ancillary site development and infrastructural works, hard and soft landscaping and boundary treatment works, including:

The development will consist of:

- Block A1 and A2, each consisting of 6 No Two-Bed Ground Floor apartments, 1 No One-Bed ground Floor apartment, 6 No Three-Bed First Floor Duplex Units, and 1 No Three-Bed Second Floor apartment.
- Blocks B1 to B3 and B6 to B13 inclusive, each consisting of 2 No Two-Bed Ground Floor Duplex Units, 2 No Three-Bed Ground Floor Duplex Units, 1 No Two-Bed Second Floor apartment, and 1 No One-Bed Second Floor apartment,
- Blocks B4 and B5 inclusive, each consisting of 1 No Two-Bed Ground Floor Duplex Unit, 2 No Three-Bed Ground Floor Duplex Units, 1 No Two-Bed Second Floor Apartment and 1 No One-Bed Second Floor apartment.
- House Type C : 32 No Two-Bed units in semi-detached pairs
- House Type E : 27 No Three-Bed units in triplet arrangements
- provision of 281 No. on-site car parking spaces incorporating 163 No. spaces for residents of the apartment/duplexes, and 118 No in-curtilage car parking spaces for the housing units
- Provision of all water, surface water, foul drainage, utility ducting and public lighting and all associated siteworks and ancillary services.
- All ancillary site development works including access roadways, footpaths, cycle ways, pedestrian links, Bicycle Sheds, waste storage areas, communal and open space, site landscaping, and boundary treatments.

3 BRE – Site Layout Planning for Daylight and Sunlight (2nd and 3rd Editions)

Access to daylight and sunlight is a vital part of a healthy environment. Sensitive design should provide sufficient daylight and sunlight to new residential developments while not obstructing light to existing homes nearby.

The 2nd and 3rd Editions of the BR 209 BRE Site Layout Planning for Daylight and Sunlight, advise on planning developments for good access to daylight and sunlight and is widely used by local authorities to help determine the performance of new developments.

3.1 Impact Classification Discussion

BRE guidance in Appendix I (BRE Guide 2nd Edition) and Appendix H (BRE Guide 3rd Edition) – Environmental Impact Assessment suggests impact classifications as minor, moderate and major adverse. It provides further classifications of these impacts with respect to criteria summarised in the table below.

Where the loss of skylight or sunlight fully meets the guidelines in the BRE guide (2nd and 3rd Editions), the impact is assessed as negligible or minor adverse. Where the loss of skylight or sunlight does not meet the BRE guidelines, the impact is assessed as minor, moderate or major adverse.

Impact	Description
Negligible adverse impact	• *Loss of light well within guidelines,* ***or*** • *only a small number of windows losing light (within the guidelines)* ***or*** *limited area of open space losing light (within the guidelines)*

Minor adverse impact (a)	• *Loss of light only just within guidelines* ***and***
	  ○ *a larger number of windows are affected* ***or***
	  ○ *larger area of open space is affected (within the guidelines)*

Minor adverse impact (b)	• *only a small number of windows or limited open space areas are affected* • *the loss of light is only marginally outside the guidelines* • *an affected room has other sources of skylight or sunlight* • *the affected building or open space only has a low-level requirement for skylight or sunlight* • *there are particular reasons why an alternative, less stringent, guideline should be applied*
Major adverse impact	• *large number of windows or large open space areas are affected* • *the loss of light is substantially outside the guidelines* • *all the windows in a particular property are affected* • *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight (living rooms / playground)*

4 Methodology

4.1 Planning Authority Guidelines

It should be noted for completeness, that there is a new standard for the assessment of daylight access within buildings entitled "IS EN 17037:2018: Daylight in Buildings". This new standard is not currently directly referred within the 'Urban Development and Building Heights', guidelines for Planning Authorities 2018 or the Sustainable Urban Housing: Design Standards for New Apartments December 2020.

Whereas the BRE 209 or *BS 8206-2:2008* are currently referred within the Urban Development and Building Heights, guidelines for Planning Authorities 2018 and the Sustainable Urban Housing: Design Standards for New Apartments December 2020 which states the following in Section 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."

In addition, the *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' which* has been included within this report even though it has now been withdrawn because the *BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) and the BS 8206-2: 2008 directly refer to each other as noted within the BRE guide itself as below.*

"This guide gives advice on site layout planning to achieve good sunlight and daylight both within buildings and int the open spaces between them. It is intended to be used in conjunction with the interior daylight recommendations in the British Standard Code of practice for daylighting, *BS 8206-2: 2008."*

These standards have also been noted to be accepted by An Bord Pleanala.

Therefore, with regards to the different methodologies applied within this report, for clarity these are listed below and the following section 1.2 denotes which standard is applicable for each assessment type:

- BRE Guide – 2nd Edition of BR 209 BRE Site Layout Planning for Daylight and Sunlight

BS 8206-2:2008 – Lighting for Buildings – Part 2: Code of Practice for Daylighting Currently there are a number of different standards and guidelines which in the writing of this report

appropriate and reasonable regard has been taken to address. It should be noted at this point that the *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' has been included within this report even although it has* now *been* withdrawn because the *BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) and the BS 8206-2: 2008 directly refer to each other as noted within the BRE guide itself as below.*

"This guide gives advice on site layout planning to achieve good sunlight and daylight both within buildings and int the open spaces between them. It is intended to be used in conjunction with the interior daylight recommendations in the British Standard Code of practice for daylighting, *BS 8206-2: 2008."*

In addition to this, The Sustainable Urban Housing: Design Standards for New Apartments December 2020 states the following in Section 6.6:

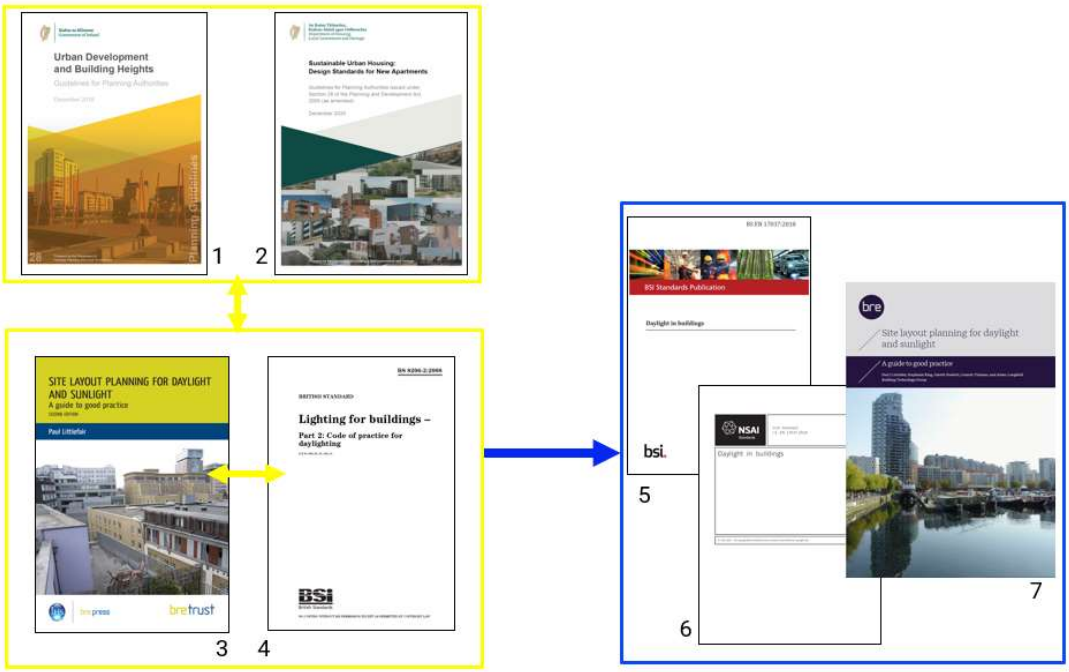
"Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken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

However, there is a new standard for the assessment of daylight access within buildings titled "*EN 17037:2018: Daylight in Buildings*" which has been adopted in Ireland as IS EN 17037:2018. This new standard is not directly referred to within the latest Planning Authority Guidelines whereas the BRE Guide and BS 8206-2:2008 are referred to.

Furthermore, the EN 17037:2018 standard has already been adopted in the UK to inform the BS EN 17037:2018 standard which supersedes BS 8206-2:2008 which is now withdrawn. It is important to note that BS EN 17037:2018 includes a National Annex which specifically addresses daylight provision in residential dwellings in the UK. A similar annex is not included in the IS EN 17037:2018 standard.

Finally, the latest BRE guide 'Site Layout Planning for Daylight and Sunlight' (3rd edition) has just been published (June 2022). This now directly links to the new daylighting standards EN 17037:2018. Aside refinements to the BRE guide, the assessments are the same to what is found within the (2nd edition).

Therefore, with regards to interior daylighting and external sunlight exposure in particular, where different methodologies are found in each of the different standards, all have been carried out for completeness to ensure appropriate and reasonable regard has been taken to address all assessments under all of the different standards.



The diagram above illustrates the relationship between the standards and guidance documents which are listed out below.

- (1) Urban Development and Building Heights
- (2) The Sustainable Urban Housing: Design Standards for New Apartments
- (3) BRE Guide – 2nd Edition of BR 209 BRE Site Layout Planning for Daylight and Sunlight
- (4) BS 8206-2:2008 – Lighting for Buildings – Part 2: Code of Practice for Daylighting
- (5) BS EN 17037:2018 – Daylight in Buildings
    - This is the UK implementation of the European EN 17037:2018 standard. It supersedes BS 8206-2:2008 which is withdrawn in the UK. The BS EN standard includes a National Annex which addresses daylight requirements specific to dwellings which is notable as Ireland's climate matches closely with the UK.
- (6) IS EN 17037:2018 – Daylight in Buildings
    - This is the Irish implementation of the European EN 17037:2018 standard
- (7) BRE Guide – 3rd Edition of BR 209 BRE Site Layout Planning for Daylight and Sunlight

4.2 Reference Standards & Summary of Assessments Undertaken

The various daylight and sunlight assessments that were undertaken using the IES VE software are based on a number of different standards which are referenced in the individual sections of this report. For clarity, the assessments that were undertaken are summarised below as well as the reference standards that were used for each (where applicable):

- **Shadow Analysis**
    - Assessed using shadow images cast at key times throughout the year, i.e. March 21st, June 21st and December 21st to determine if any overshadowing impact occurs and to what extent to any existing neighbouring dwellings in accordance with the BRE Guide (2nd and 3rd Editions).

- **Sunlight to Amenity Spaces**
    - Assessed using annual Solar Exposure calculations to determine any impact to existing amenities and the sunlight received and also to assess the proposed developments amenity spaces to derive how much sunlight they can expect to receive in accordance with the BRE Guide (2nd and 3rd Editions).
- **Sunlight to Existing Buildings**
    - Assessed using the Annual Probable Sunlight Hours (APSH) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd & 3rd Edition) - to determine any impact to sunlight received to the existing neighbouring building main living areas.
- **Sunlight to Proposed Buildings**
    - Assessed using the Annual Probable Sunlight Hours (APSH) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition)
    - Assessed using Solar Exposure calculations in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)
    - In both assessments above the aim is to derive how much sunlight proposed development can expect to receive.
- **Daylight to Existing Buildings**
    - Assessed using the Vertical Sky Component (VSC) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd & 3rd Edition) - to determine any impact to existing daylight received to the existing building neighbouring the site.
- **Daylight to Proposed Development**
    - Assessed using the Average Daylight Factor (ADF) method in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition)
    - Assessed in accordance with IS EN 17037:2018 Method 2 (BRE Guide 3rd Edition)
    - Assessed in accordance with BS EN 17037:2018 National Annex Method 2 (BRE Guide 3rd Edition)
    - In all assessments above the aim is to derive how much daylight will be received within each of the apartments within the proposed development.
- **View Out**
    - Assessed in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)
- **Glare**
    - Assessed in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition)

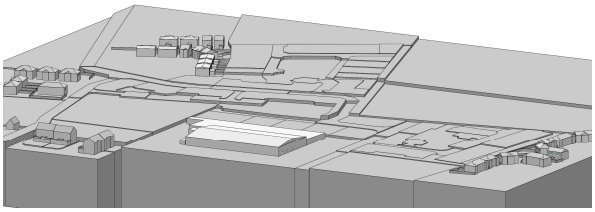
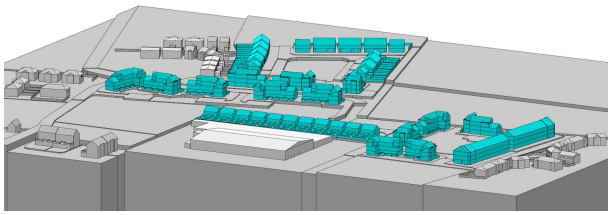
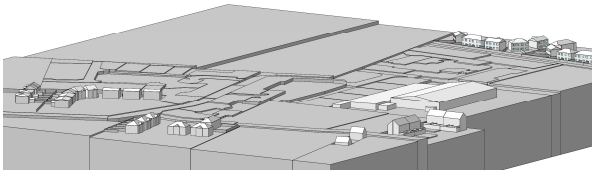
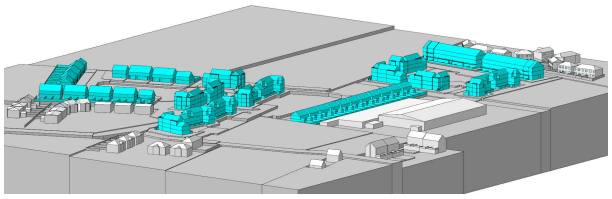
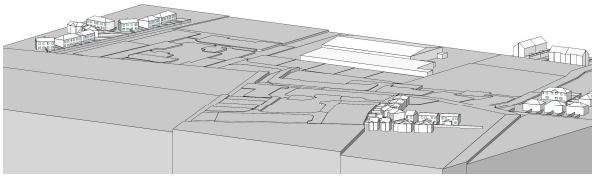
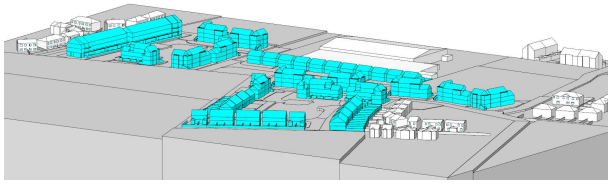
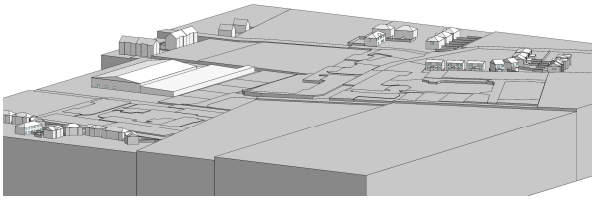
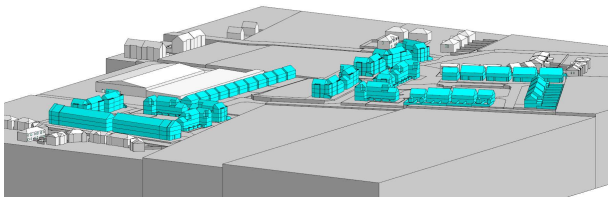
4.3 Orientation

The model orientation has been taken from drawings provided by the Architect with the resulting angle shown below used in the analysis.

Orientation	
	
	

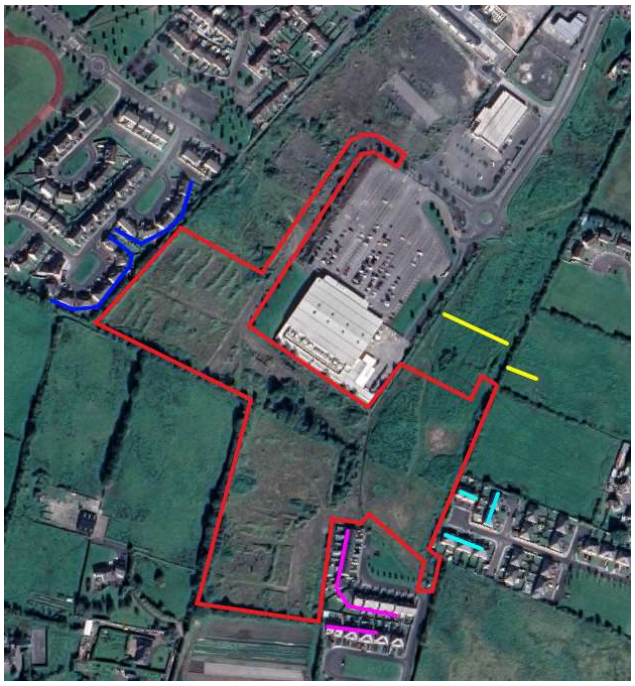
4.4 Proposed Model

The following images illustrate the models created from the architectural information provided and the use of Google/Bing maps where information was absent.

	Existing Scheme	Proposed Scheme
View looking from North of Site		
View looking from East of Site		
View looking from South of Site		
View looking from West of Site		

4.5 Potential Sensitive Receptors

To help understand the potential impact to surrounding buildings, potential sensitive receptors were identified as illustrated below.



	Proposed Site (approximate site boundary)
	Previous Project Phase - PI Ref 19/1978 (Under Construction)
	75-96 Esker Fields
	15-21, 28-40 Beechlawn Heights
	33-45 Dun Esker

5 Shadow Analysis

The statistics of Met Eireann, the Irish Meteorological Service, show that the sunniest months in Ireland are May and June, based on 1981-2010 averages or latest: https://www.met.ie/climate/30-year-averages.

The following can also be shown:

- During December a mean daily duration of 1.7 hours of sunlight out of a potential 7.3 hours sunlight each day is received (i.e. only 23% of potential sunlight hours).
- During June a mean daily duration of 5.8 hours of sunlight out of a potential 15.9 hours sunlight each day is received (i.e. only 36% of potential sunlight hours).

Therefore, the impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months.

This section will consider the shadows cast by the proposed development on the following dates:

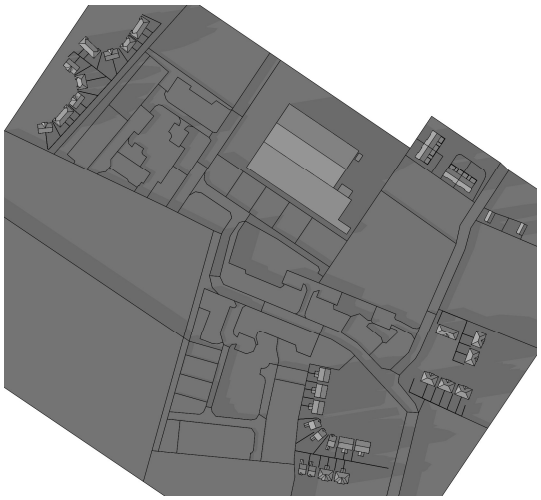
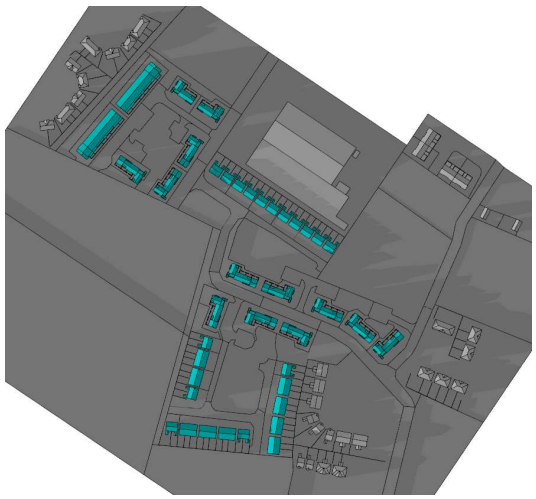
- March 21st / September 21st (Equinox)
- June 21st (Summer Solstice)
- December 21st (Winter Solstice)

These images illustrate shadows cast for 'perfect sunny' conditions with no clouds and assumed that the sun is shining for every hour shown. Given the discussion above it is important to remember that this is not always going to be the case.

5.1 Plan View

5.1.1 March 21st

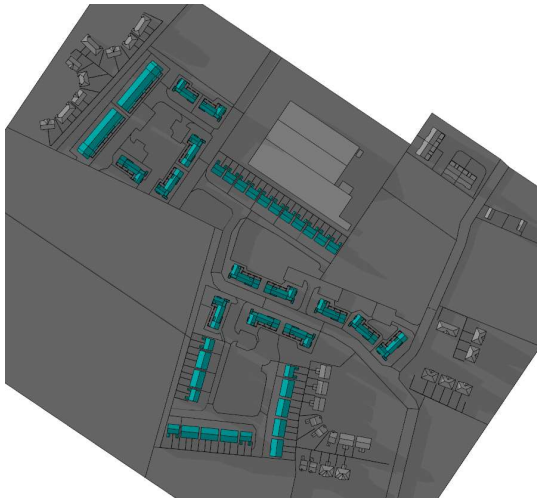
	Existing	Proposed
March 21st - 8:00		
March 21st - 10:00		
March 21st - 12:00		

	Existing	Proposed
March 21st - 14:00		
March 21st - 16:00		
March 21st - 18:00		

5.1.2 June 21st

	Existing	Proposed
June 21st - 8:00		
June 21st - 10:00		
June 21st - 12:00		

	Existing	Proposed
June 21st - 14:00		
June 21st - 16:00		
June 21st - 18:00		

	Existing	Proposed
June 21st - 20:00		

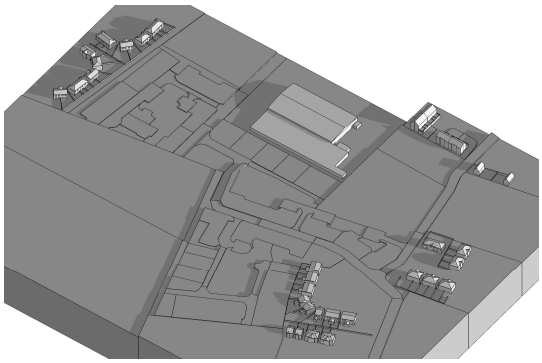
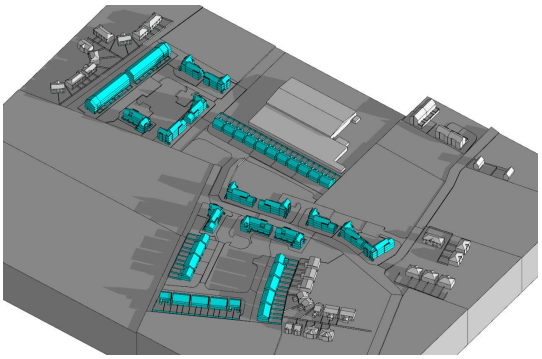
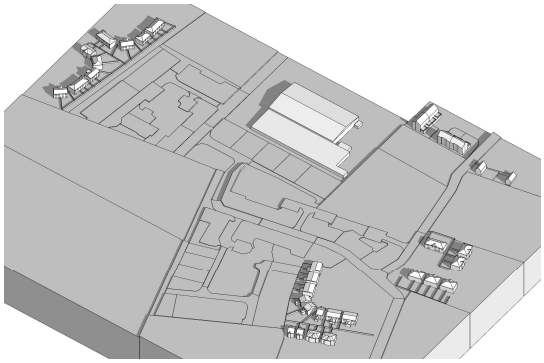
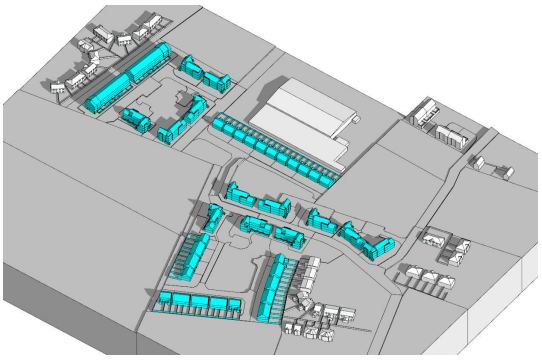
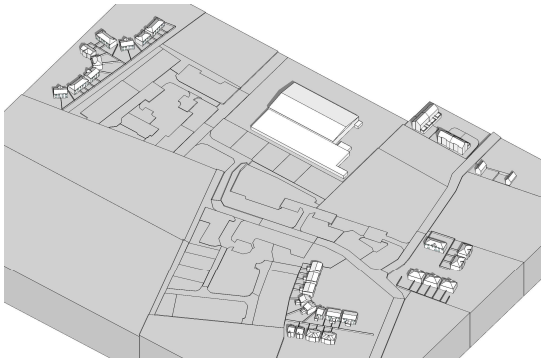
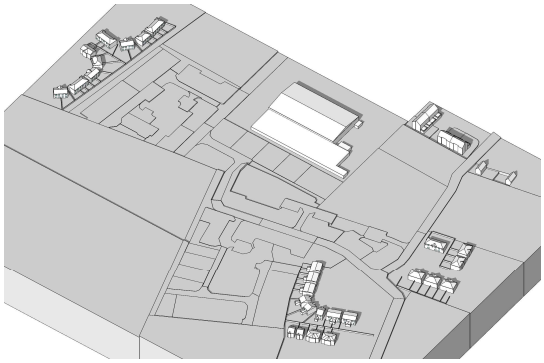
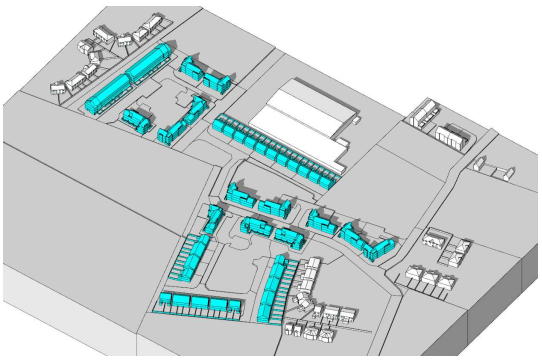
5.1.3 December 21st

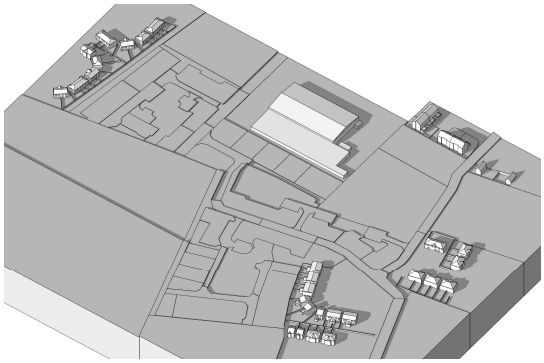
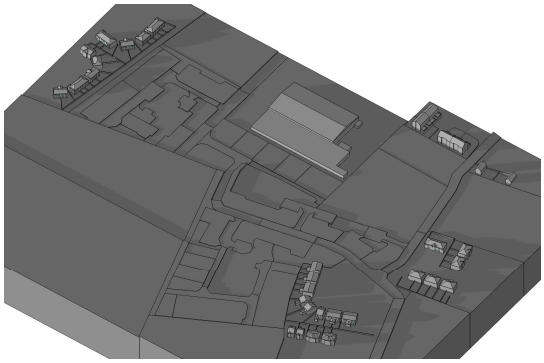
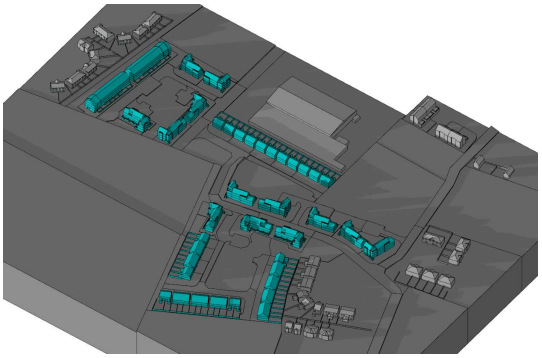
	Existing	Proposed
December 21st - 8:00		
December 21st - 10:00		
December 21st - 12:00		

	Existing	Proposed
December 21st - 14:00		
December 21st - 16:00		

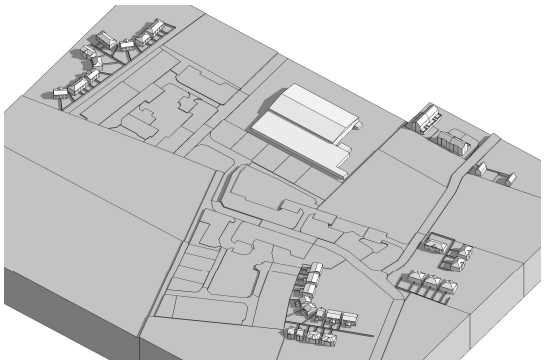
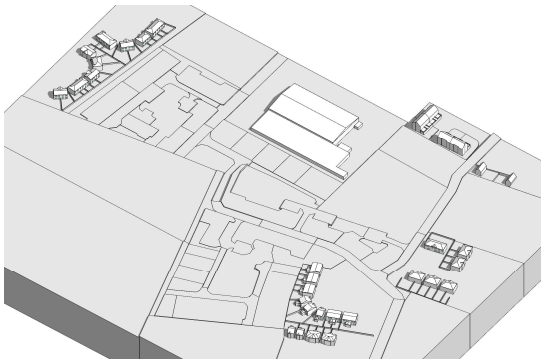
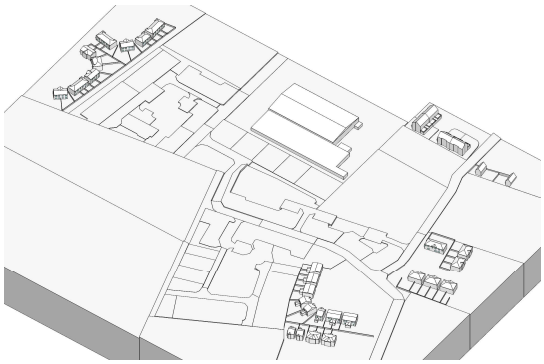
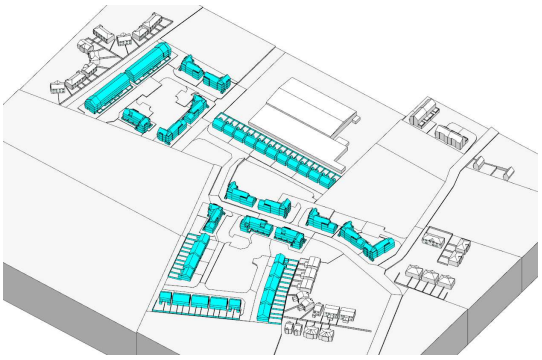
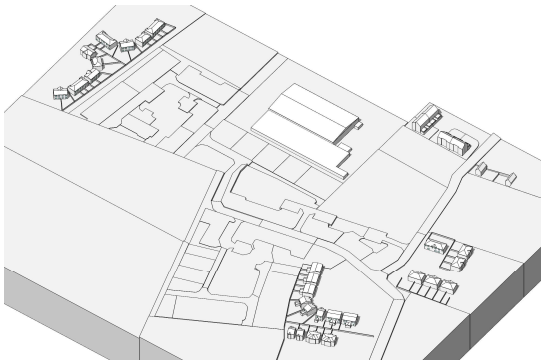
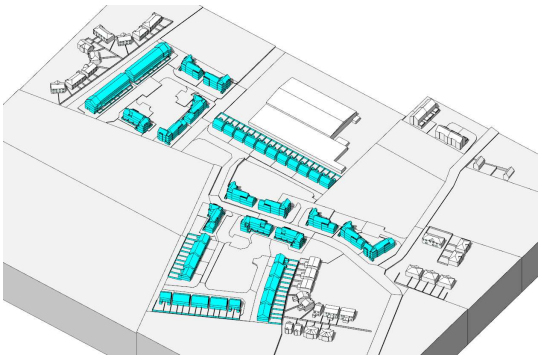
5.2 3D View

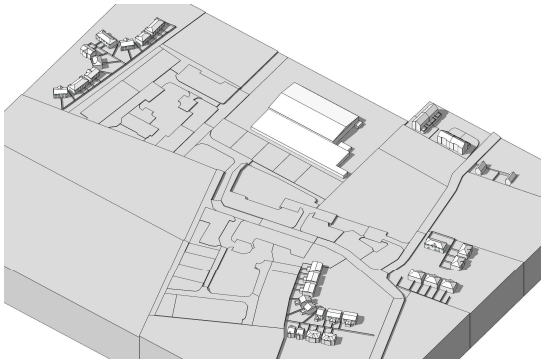
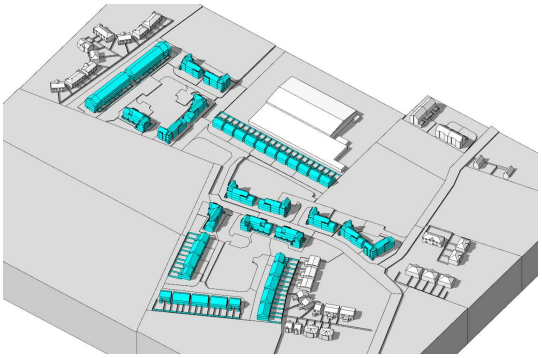
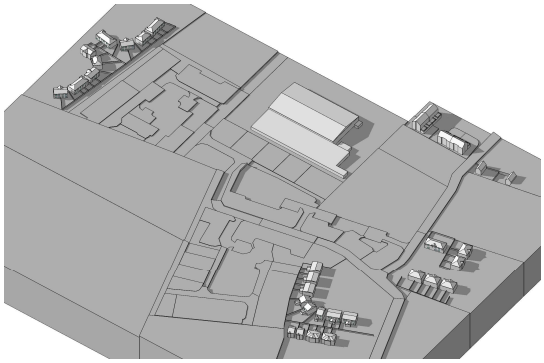
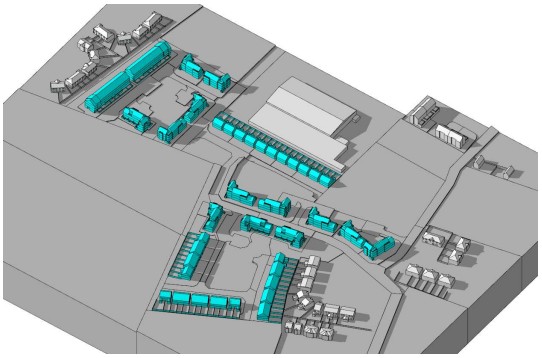
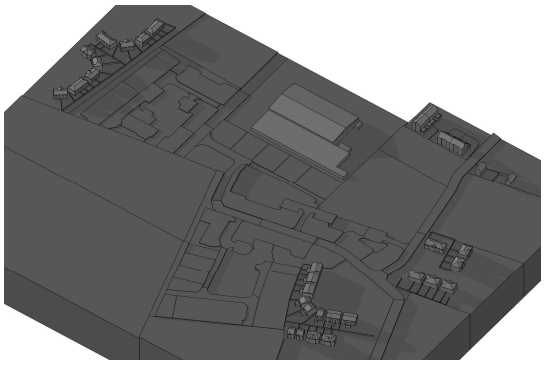
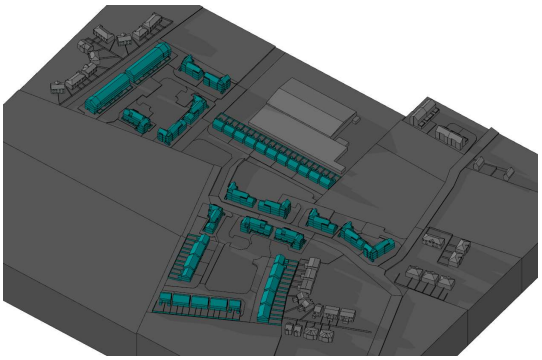
5.2.1 March 21st

	Existing	Proposed
March 21st - 8:00		
March 21st - 10:00		
March 21st - 12:00		
March 21st - 14:00		

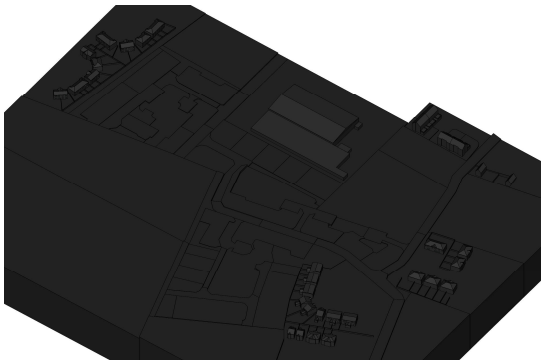
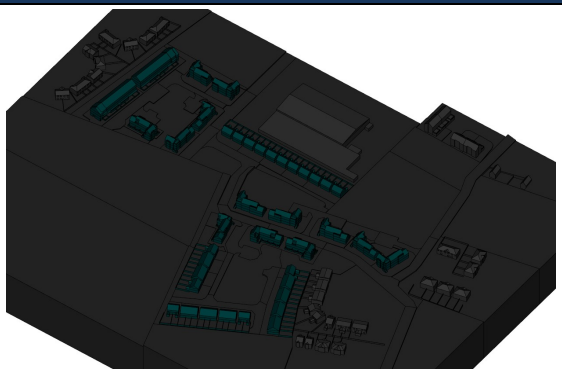
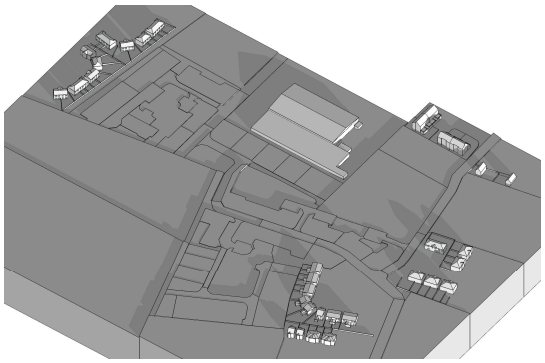
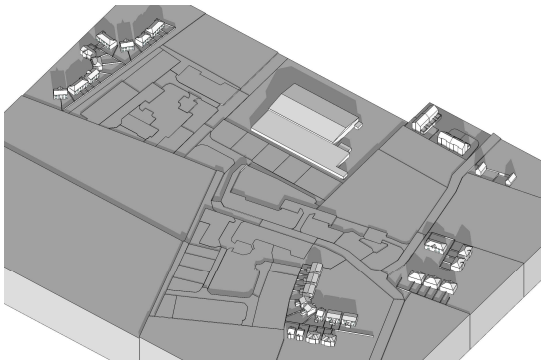
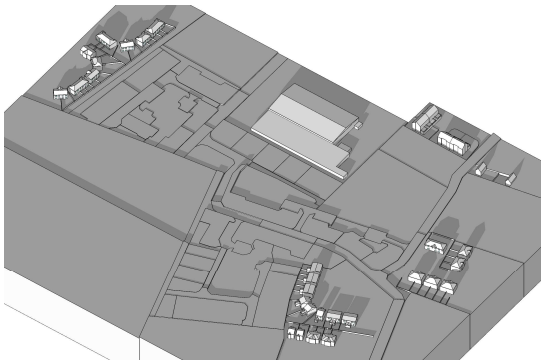
	Existing	Proposed
March 21st - 16:00		
March 21st - 18:00		

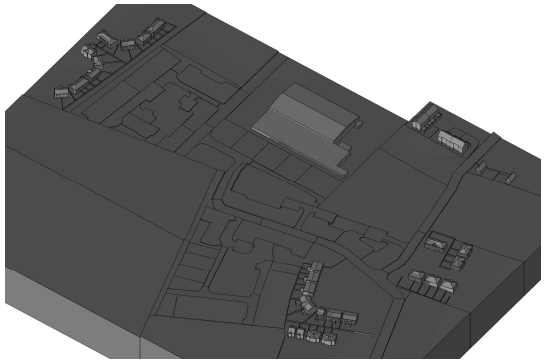
5.2.2 June 21st

	Existing	Proposed
June 21st - 8:00		
June 21st - 10:00		
June 21st - 12:00		
June 21st - 14:00		

	Existing	Proposed
June 21st - 16:00		
June 21st - 18:00		
June 21st - 20:00		

5.2.3 December 21st

	Existing	Proposed
December 21st - 8:00		
December 21st - 10:00		
December 21st - 12:00		
December 21st - 14:00		

	Existing	Proposed
December 21st - 16:00		

5.3 Discussion

The shadow analysis illustrates different shadows being cast at key times of the year (March 21st, June 21st and December 21st) for the Existing Situation and the Proposed Scheme. The results from the study are summarised as follows:

Previous Project Phase – PI Ref 19/1978 (Under Construction)

No additional shading from the proposed development is observed on this property throughout the year.

75-96 Esker Fields

Minimal additional shading from the proposed development is observed on these residential properties on March 0800. Additional shading is also observed in December 1000-1400. No additional shading is observed at any other periods throughout the year.

15-21, 28-40 Beechlawn Heights

Minimal additional shading from the proposed development is observed on these residential properties on March 1800, June 2000 and December 1400. No additional shading is observed at any other periods throughout the year.

33-45 Dun Esker

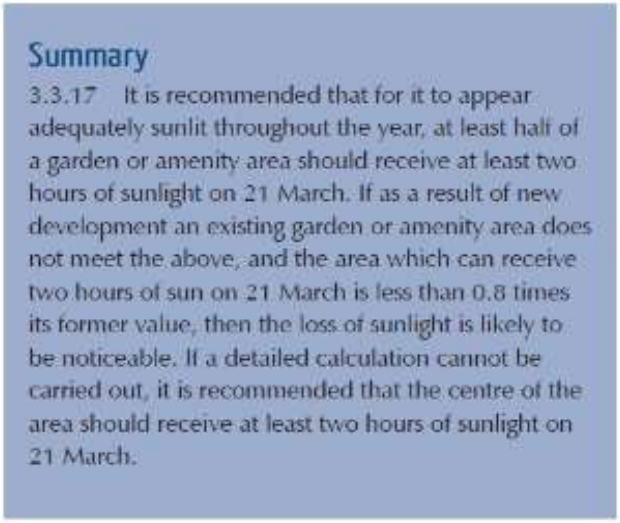
Minimal additional shading from the proposed development is observed on these residential properties on March 1800. No additional shading is observed at any other periods throughout the year.

The potential shading impact is quantified via the “Sunlight to Amenity Spaces” and “Daylight to Existing Buildings” sections of this report.

6 Sunlight to Amenity Spaces

6.1 Guidance Requirements

The impact of the proposed development on the sunlight availability to the amenity spaces will be considered to determine how the amenity spaces perform when assessed against the BRE Guide (2nd and 3rd Editions) which states the following in Section 3.3.17:



Summary

3.3.17 It is recommended 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.

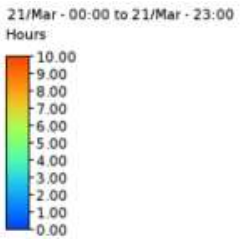
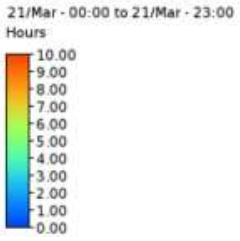
The BRE Guide (2nd and 3rd Editions) states that for a space to appear adequately sunlit throughout the year, at least half of a garden or amenity space should receive at least 2 hours of sunlight on March 21st.

6.1.1 Existing Amenity Spaces

As stated above for a space to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least 2 hours of sunlight on March 21st. This analysis performed on the following amenity spaces highlighted below:

Existing Amenity Spaces	
Existing Amenities	

6.1.1.1 Existing Amenity Spaces Results

Prior to Development in place: Absolute Scale Showing all Hours of Sunlight Received	
	
Proposed Development in place: Absolute Scale Showing all Hours of Sunlight Received	
	

Prior to Development in place: Hours of Sunlight > 2 Illustrated in Red	
Receives more than 2 hours of sunlight Receives less than 2 hours of sunlight	
Proposed Development in place: Hours of Sunlight > 2 Illustrated in Red	
Receives more than 2 hours of sunlight Receives less than 2 hours of sunlight	

6.1.1.2 Existing Amenity Results

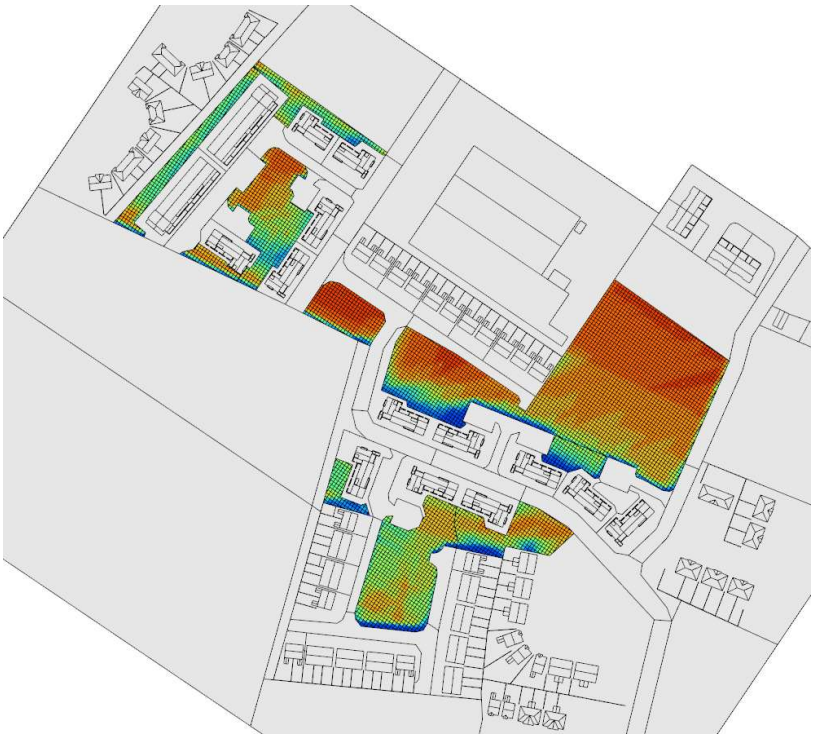
Existing Amenity Results

Ref	Area (m^2)	Existing Area >2 hrs		Existing Area with Proposed Development in Place >2 hrs		Proposed vs Existing (%)	Comment
		(m^2)	(%)	(m^2)	(%)		
1	120	80	67%	80	67%		✓
2	47	13	28%	13	28%	100%	✓
3	55	34	62%	34	62%	100%	✓
4	47	27	57%	27	57%	100%	✓
5	99	90	91%	86	87%	96%	✓
6	151	135	89%	135	89%	100%	✓
7	260	242	93%	229	88%	95%	✓
8	128	109	85%	109	85%	100%	✓
9	47	28	60%	28	60%	100%	✓
10	63	31	49%	31	49%	100%	✓
11	122	73	60%	73	60%	100%	✓
12	195	129	66%	129	66%	100%	✓
13	283	236	83%	236	83%	100%	✓
14	132	106	80%	106	80%	100%	✓
15	60	42	70%	35	58%	83%	✓

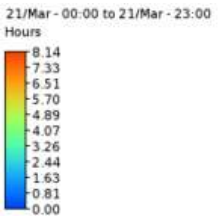
Ref	Area (m^2)	Existing Area >2 hrs		Existing Area with Proposed Development in Place >2 hrs		Proposed vs Existing (%)	Comment
		(m^2)	(%)	(m^2)	(%)		
16	51	32	63%	32	63%	100%	✓
17	40	24	60%	20	50%	83%	✓
18	95	81	85%	81	85%	100%	✓
19	166	150	90%	150	90%	100%	✓
20	317	233	74%	233	74%	100%	✓
21	211	166	79%	166	79%	100%	✓
22	102	72	71%	72	71%	100%	✓
23	100	69	69%	69	69%	100%	✓
24	96	86	90%	86	90%	100%	✓
25	108	92	85%	92	85%	100%	✓
26	141	119	84%	119	84%	100%	✓
27	131	112	85%	112	85%	100%	✓
28	129	105	81%	105	81%	100%	✓
29	127	104	82%	104	82%	100%	✓
30	189	163	86%	163	86%	100%	✓
31	73	43	59%	43	59%	100%	✓
32	70	40	57%	40	57%	100%	✓
33	69	35	51%	35	51%	100%	✓
34	74	44	59%	44	59%	100%	✓
35	72	38	53%	38	53%	100%	✓
36	153	114	75%	114	75%	100%	✓
37	234	168	72%	168	72%	100%	✓
38	299	248	83%	248	83%	100%	✓
39	208	178	86%	178	86%	100%	✓
40	72	26	36%	26	36%	100%	✓
41	69	27	39%	27	39%	100%	✓
42	87	29	33%	29	33%	100%	✓
43	82	31	38%	31	38%	100%	✓
44	85	30	35%	30	35%	100%	✓
45	103	41	40%	41	40%	100%	✓
46	189	105	56%	105	56%	100%	✓

6.1.2 Proposed Amenity Spaces

6.1.2.1 Proposed Communal and Public Amenity Spaces

Absolute Scale Showing All Hours of Sunlight Received	
21/Mar - 00:00 to 21/Mar - 23:00 Hours 11.00 9.90 8.80 7.70 6.60 5.50 4.40 3.30 2.20 1.10 0.00	
Area Showing >2 Hours	
Receives more than 2 hours of sunlight Receives less than 2 hours of sunlight	

6.1.2.2 Proposed Private Amenity Spaces

Absolute Scale Showing All Hours of Sunlight Received	
	
Area Showing >2 Hours	
Receives more than 2 hours of sunlight Receives less than 2 hours of sunlight	

Proposed Public Amenities

Proposed Communal Amenities

Communal Amenity:

Ref.	Total Area (m2)	Area Receiving >2h (m2)	Percent Receiving >2h	Comment
1 (Communal Area)	1,014	986	97%	✓
2 (Communal Area)	771	759	98%	✓
3 (Communal Area)	285	257	90%	✓
4 (Communal Area)	2,721	2,421	89%	✓
5 (Communal Area)	563	423	75%	✓
6 (Communal Area)	377	329	87%	✓
7 (Communal Area)	1,452	1,312	90%	✓
Total	**7,183**	**6,487**	**90%**	✓

Public Amenity:

Ref.	Total Area (m2)	Area Receiving >2h (m2)	Percent Receiving >2h	Comment
8(Public Open Space)	2,175	2,155	99%	✓
9(Public Open Space)	1,082	1,050	97%	✓
10 (Public Open Space)	8,843	8,763	99%	✓
11 (Public Open Space)	3,065	2,825	92%	✓
Total	**15,165**	**14,793**	**98%**	✓

Proposed Private Amenities

Private Amenity:

Ref.	Total Area (m2)	Area Receiving >2h (m)	Percent Receiving >2h	Comment
1	61	44	72%	✓
2	41	22	54%	✓
3	42	26	62%	✓
4	41	23	56%	✓
5	42	24	57%	✓
6	54	35	65%	✓
7	53	33	62%	✓
8	48	36	75%	✓
9	59	44	75%	✓
10	60	46	77%	✓
11	73	52	71%	✓
12	61	42	69%	✓
13	54	37	69%	✓
14	53	37	70%	✓

On March 21st, 90% of the combined proposed communal amenity areas and 98% of the combined proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight over their total combined area. All amenity areas provided will be quality spaces in terms of sunlight.

In addition, all individual areas tested are achieving at least 2 hours of sunlight over 50% of their area on the 21st of March.

6.2 Discussion

As outlined in Section 3.3.17 of the BRE Guide (2nd and 3rd Editions), for a space to appear adequately sunlit throughout the year, at least half of the garden or amenity area should receive at least 2 hours of sunlight on March 21st. In the case of existing amenity spaces, if they are already below the 50% threshold then the BRE recommends the results kept to within 80% of the existing situation with the proposed development in place.

Existing Amenity Spaces

On March 21st the existing amenity spaces will receive the same level of sunlight with the proposed development in place. In all cases the results comply with the recommendations in the BRE Guide outlined above.

Proposed Amenity Spaces

On March 21st, 90% of the combined proposed communal amenity areas and 98% of the combined proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight over their total combined area. All amenity areas provided will be quality spaces in terms of sunlight.

In addition, all individual areas tested are achieving at least 2 hours of sunlight over 50% of their area on the 21st of March.

7 Sunlight to Existing Buildings

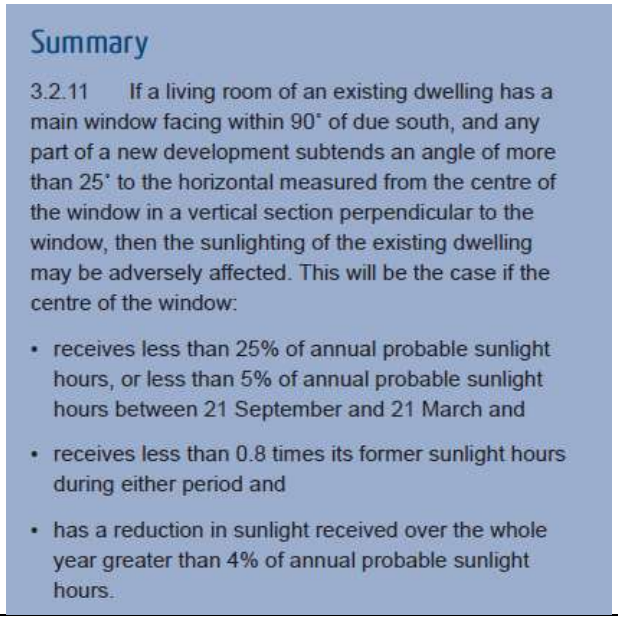
7.1 Guidance – BRE Guide (2nd Edition) / BS 8206-2:2008

The British Standard BS 8206-2:2008 recommends that interiors where the occupants expect sunlight should receive at least one quarter (25%) of annual probable sunlight hours, including at least 5% of annual probable sunlight hours during the winter months, between 21st September and 21st March.

Here 'probable sunlight hours' means the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness for the location in question.

If a window reference point can receive more than 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours during the winter months between 21st September and 21st March, then the room should still receive enough sunlight. Any reduction in sunlight access below this level should be kept to a minimum.

If the available sunlight hours are both less than the amount given and less than 0.8 times their former value, either over the whole year or just during the winter months (21st September to 21st March) and reduction in sunlight across the year has a greater reduction than 4%, then the occupants of the existing building will notice the loss of sunlight.



Summary

3.2.11 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.

BRE 2nd and 3rd Editions guidance document Site Layout Planning for Daylight and Sunlight

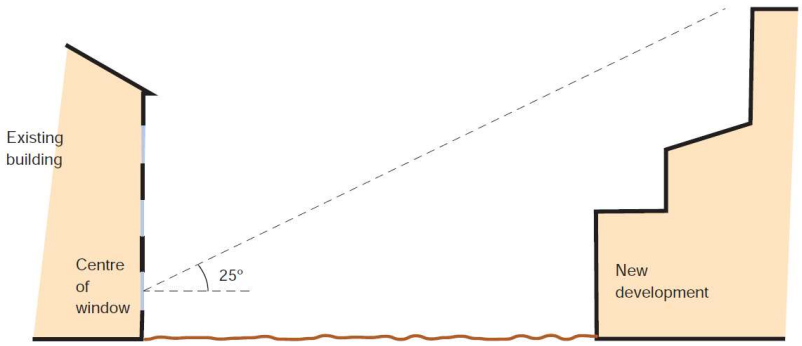
As such this study will compare the Existing Scheme and Proposed Schemes and consider if the values on the existing buildings meet the requirements outlined above when compared to their former value (that of the Existing scheme).

7.2 APSH Exclusions

The BRE recommendations note that if a new development sits within 90° of due south of any main living room window of an existing dwelling, then these should be assessed for APSH. However, there are several exceptional cases in which APSH is not required to be calculated, as indicated below:

3.2.7 It is not always necessary to do a full calculation to check sunlight potential. The guideline above is met provided either of the following is true:

- If the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window (NB obstructions within 90° of due north of the existing window need not count here).
- The window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal (Figure 14 in Section 2.2). Again, obstructions within 90° of due north of the existing window need not be counted.
- The window wall faces within 20° of due south and the reference point has a VSC (section 2.1) of 27% or more.



BRE 2nd and 3rd Editions guidance document Site Layout Planning for Daylight and Sunlight

Consequently, APSH will only be calculated for adjacent windows which meet the following conditions:

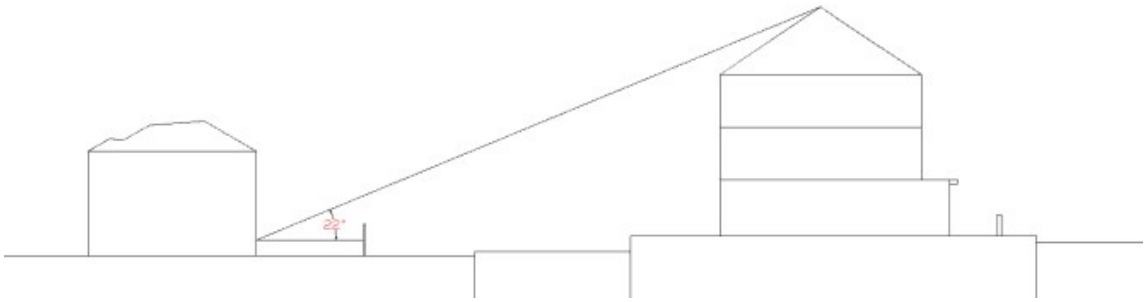
1. The existing building has living room with a main window which faces within 90 degrees of due south.
2. Existing building is located to the North, East, or West of the Proposed Development.
3. The VSC of the existing window is less than 27%.

Based on the criteria outlined in Section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, none of the existing buildings fit the requirements to be assessed and as such the APSH assessment was not conducted for the adjacent properties. The BRE guide (2nd and 3rd Editions) notes that there should be no impact to sunlight for these properties "It is not always necessary to do a full calculation to check sunlight potential. The guideline above is met provided either the following is true:

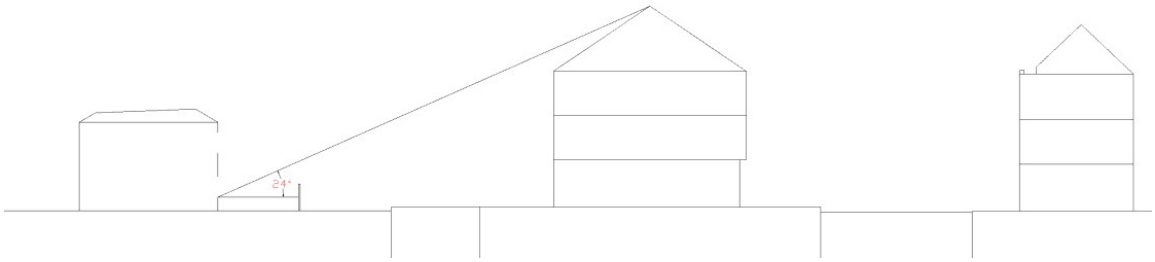
- If the window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal. Again, obstructions within 90° of due north need not be counted."

Given the statement above the surrounding dwellings adjacent to the proposed development were verified noting that, in a section perpendicular to the window wall, no angle subtended more than 25° and, in some cases, they were also sitting to the south of the proposed development. Therefore, none of the existing adjacent properties were included in the assessment, and they were excluded from this assessment on the basis, as noted in section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, that these windows need not be analysed as sunlight impact will be unnoticeable to the existing occupants. To note, as an added check the 25-degree rule was carried out for good measure on all neighbouring buildings regardless of orientation in relation to the proposed development as can be seen from the following images.

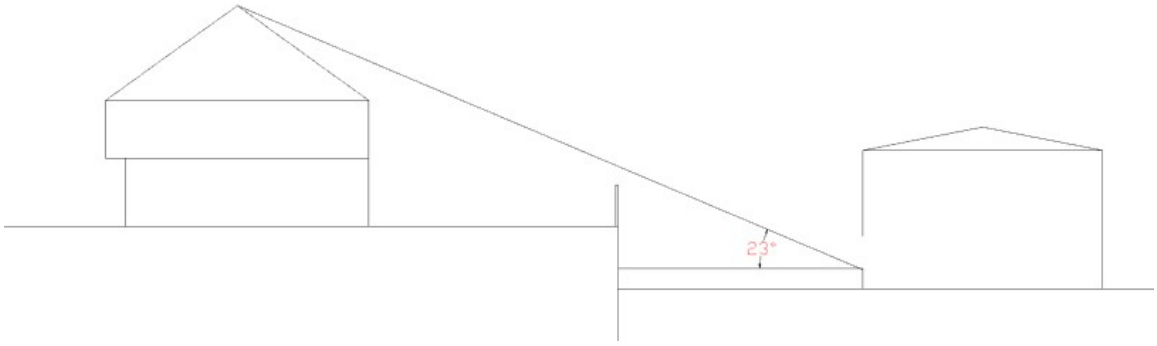
View 1: Esker Fields Dwellings


Site Section – Qualification of 25° Rule (22° Angle Observed)

View 2: Esker Fields Dwellings


Site Section – Qualification of 25° Rule (24° Angle Observed)

View 3: Beechlawn Heights Dwellings


Site Section – Qualification of 25° Rule (23° Angle Observed)

7.3 Discussion

This study considers the proposed scheme and tests if the Annual Probable Sunlight Hours (APSH) results for the living room windows are greater than 25% annual and 5% winter sunlight or are greater than 0.8 times their former value with the proposed development in place.

Based on the criteria outlined in Section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, none of the existing buildings fit the requirements to be assessed and as such the APSH assessment was not conducted for these properties. The BRE guide (2nd and 3rd Editions) notes that there should be no impact to sunlight for these properties.

"It is not always necessary to do a full calculation to check sunlight potential. The guideline above is met provided either the following is true:

- If the window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal. Again, obstructions within 90° of due north need not be counted."

Given the statement above the existing properties adjacent to the proposed development were verified noting that, in a section perpendicular to the window wall, no angle subtended more than 25° and, in some cases, they were also sitting to the south of the proposed development. Therefore, none of the existing property were included in the assessment and they were excluded on the basis, as noted in section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, that these windows need not be analysed as sunlight impact will be unnoticeable to the occupants.

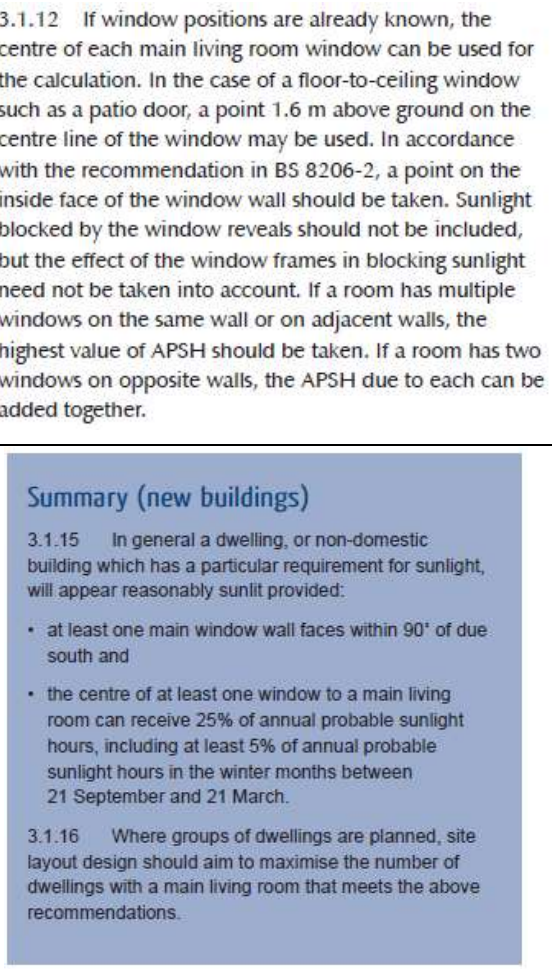
8 Sunlight to Proposed Development

8.1 Guidance – BRE Guide (2nd Edition) / BS8206-2:2008

The British Standard BS 8206-2:2008 recommends that interiors where the occupants expect sunlight should receive at least one quarter (25%) of annual probable sunlight hours, including at least 5% of annual probable sunlight hours during the winter months, between 21st September and 21st March. Here 'probable sunlight hours' means the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness for the location in question.

If a window reference point can receive more than one quarter of annual probable sunlight hours, including at least 5% of annual probable sunlight hours during the winter months between 21st September and 21st March, then the room should still receive enough sunlight. Any reduction in sunlight access below this level should be kept to a minimum.

As stated in Section 3.1.12 of the BRE Guide (2nd Edition), "If window positions are already known, the centre of each main living room window can be used for the calculation".



3.1.12 If window positions are already known, the centre of each main living room window can be used for the calculation. In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground on the centre line of the window may be used. In accordance with the recommendation in BS 8206-2, a point on the inside face of the window wall should be taken. Sunlight blocked by the window reveals should not be included, but the effect of the window frames in blocking sunlight need not be taken into account. If a room has multiple windows on the same wall or on adjacent walls, the highest value of APSH should be taken. If a room has two windows on opposite walls, the APSH due to each can be added together.

Summary (new buildings)

3.1.15 In general a dwelling, or non-domestic building which has a particular requirement for sunlight, will appear reasonably sunlit provided:

- at least one main window wall faces within 90° of due south and
- the centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21 September and 21 March.

3.1.16 Where groups of dwellings are planned, site layout design should aim to maximise the number of dwellings with a main living room that meets the above recommendations.

Extract from the BRE Guide (2nd Edition)

8.2 Guidance – BRE Guide 3rd Edition / IS EN 17037:2018

Section 5.3.1 of IS EN 17037:2018 states that *"exposure to sunlight is an important quality criterion of an interior space and can contribute to human well-being."* Table A.6 from IS EN 17037:2018 summarises the recommendation for daily sunlight exposure.

Table A.6 — Recommendation for daily sunlight exposure

Level of recommendation for exposure to sunlight	Sunlight exposure
Minimum	1,5 h
Medium	3,0 h
High	4,0 h

Within the context of a domestic property, BRE Guide 3rd Edition/IS EN 17037:2018 states that at least one habitable space within a dwelling should receive the recommended minimum value of 1.5 hours of sunlight on the 21st of March. The test is carried out on a clear, cloud free day.

8.3 APSH & Sunlight Exposure Assessment

Based on the above criteria for both the BRE Guide 2nd Edition/BS8206-2:2008 and BRE Guide 3rd Edition/IS EN 17037:2018, all main living room windows within the proposed development have been assessed with the results included in the following sections.

Please note, the "Comment" symbol in each of the tables represents the following:

BRE Guide 3nd Edition / BS 8206-2:2008

✓/✓ For these locations, both the annual and winter APSH results are greater than 25% and 5% respectively.

x /✓ For these locations, the annual APSH results are less than the recommended values, however, the winter APSH results are greater than 5%.

✓ / x For these locations, the winter APSH results are less than the recommended values, however, the annual APSH results are greater than 25%.

x / x For these locations, both the annual and winter APSH results are less than the recommended values.

BRE Guide 3rd Edition / IS EN 17037:2018

✓ These rooms achieve the minimum 1.5 hours of recommended sunlight exposure on March 21st.

x These rooms do not achieve the minimum 1.5 hours of recommended sunlight exposure on March 21st.

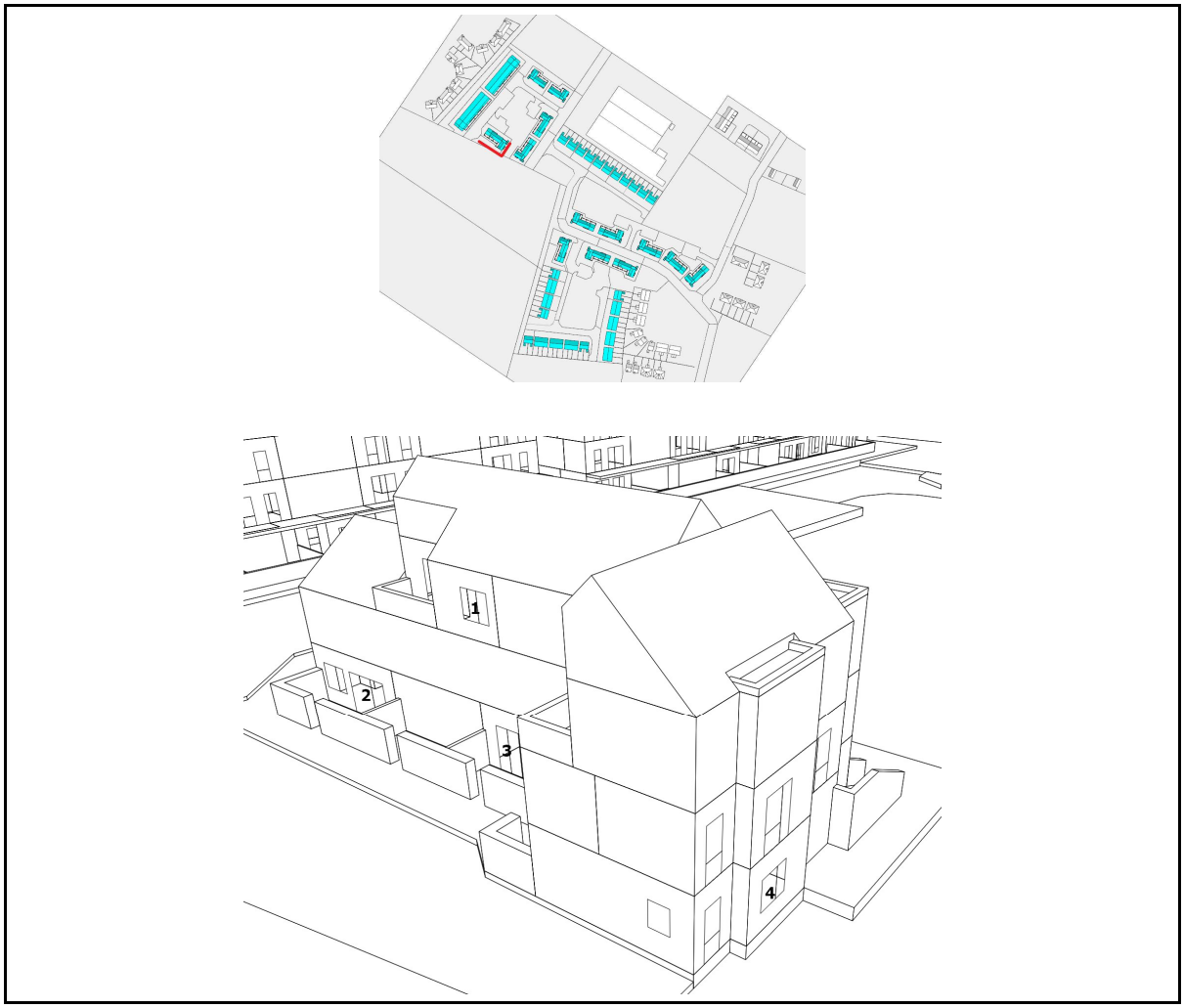
8.3.1 View 01 – Duplex A

Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	62.86	22.34	✓/ ✓	✓
2	33.44	16.54	✓/ ✓	✓
3	36.70	18.87	✓/ ✓	✓
4	57.77	25.13	✓/ ✓	✓
5	62.55	25.23	✓/ ✓	✓
6	49.41	20.04	✓/ ✓	✓
7	61.28	25.03	✓/ ✓	✓
8	62.14	26.84	✓/ ✓	✓
9	26.55	13.07	✓/ ✓	✓
10	63.76	25.84	✓/ ✓	✓
11	28.95	18.68	✓/ ✓	✓
12	62.87	25.72	✓/ ✓	✓
13	50.32	21.27	✓/ ✓	✓
14	64.04	26.79	✓/ ✓	✓
15	50.38	18.89	✓/ ✓	✓
16	62.44	24.77	✓/ ✓	✓
17	38.37	20.94	✓/ ✓	✓
18	35.40	16.22	✓/ ✓	✓

8.3.2 View 02 – Duplex A

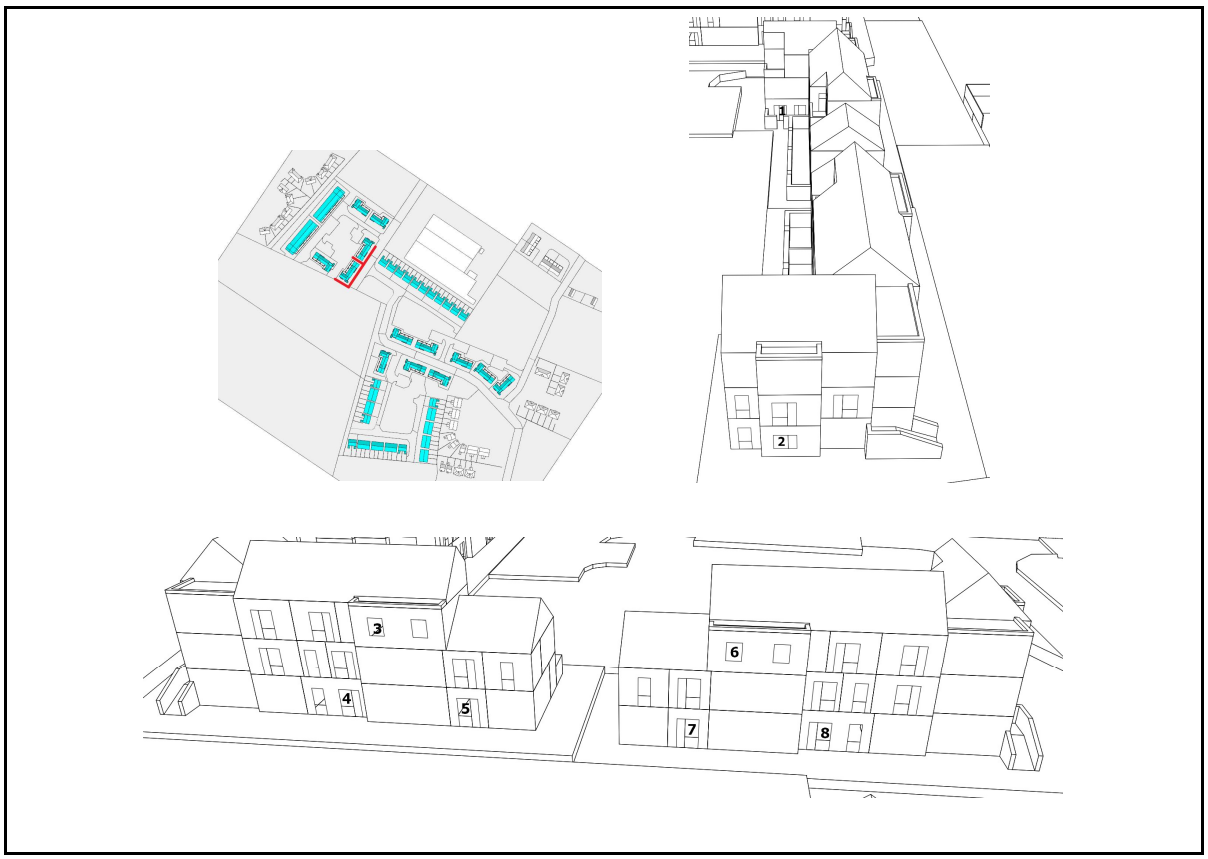
Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	30.28	7.75	✓/✓	✓
2	29.63	7.75	✓/✓	✓
3	28.70	7.56	✓/✓	✓
4	29.58	7.75	✓/✓	✓
5	29.82	7.75	✓/✓	✓
6	29.28	7.55	✓/✓	✓

8.3.3 View 03 – Duplex B1



Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	49.56	17.82	✓/ ✓	✓
2	53.34	19.03	✓/ ✓	✓
3	41.73	13.97	✓/ ✓	✓
4	51.65	23.00	✓/ ✓	✓

8.3.4 View 04 – Duplexes B2 & B3



Ref8.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	27.20	5.23	✓/✓	✓
2	71.79	32.36	✓/✓	✓
3	64.43	26.68	✓/✓	✓
4	60.09	24.87	✓/✓	✓
5	60.53	26.01	✓/✓	✓
6	64.60	26.57	✓/✓	✓
7	60.55	25.09	✓/✓	✓
8	50.70	17.66	✓/✓	✓

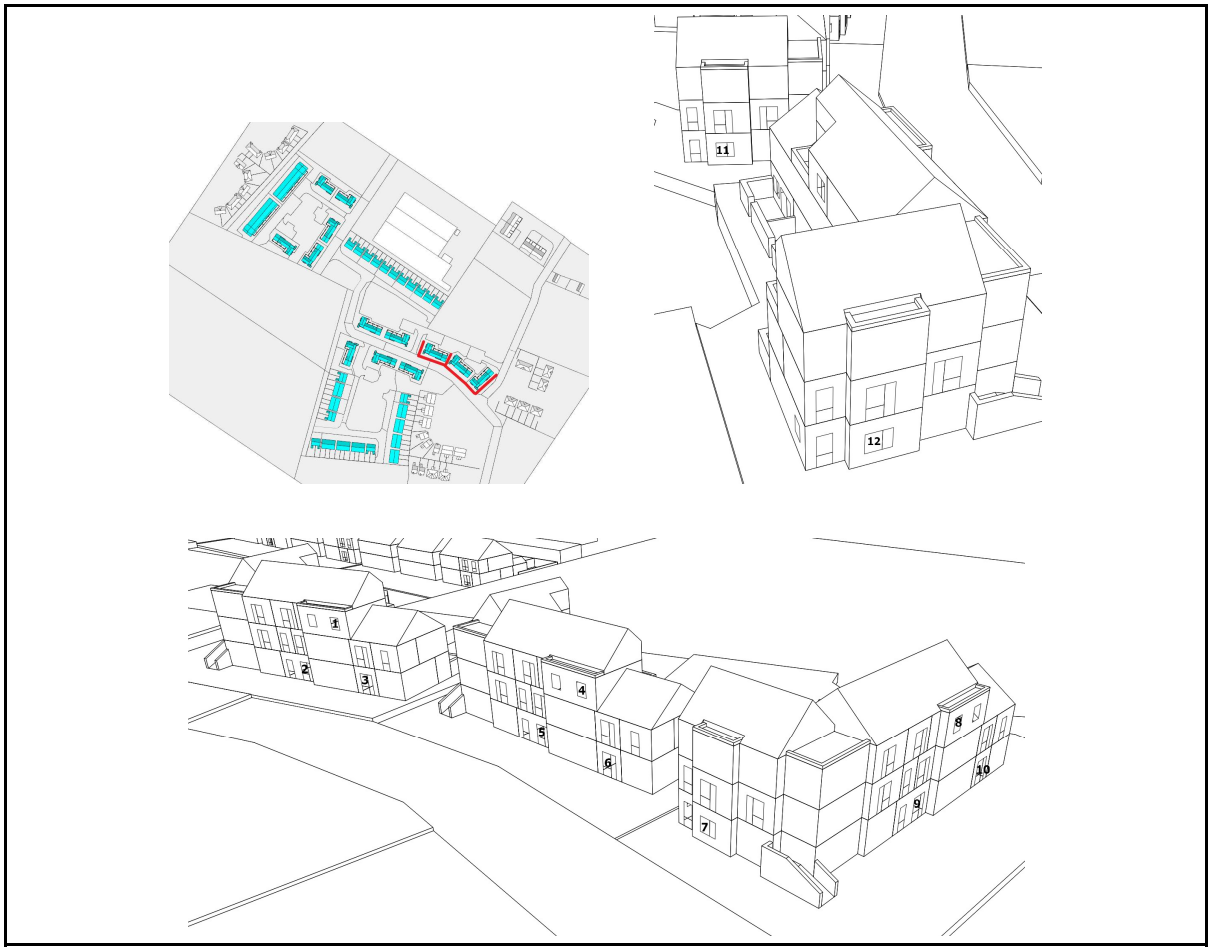
8.3.5 View 05 – Duplex B4 & B5

Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	73.09	33.61	✓/ ✓	✓
2	60.36	26.81	✓/ ✓	✓
3	61.12	25.92	✓/ ✓	✓
4	66.01	27.98	✓/ ✓	✓
5	63.70	26.38	✓/ ✓	✓
6	25.86	7.39	✓/ ✓	✓
7	21.71	6.91	x /✓	✓

8.3.6 View 06 – Duplexes B6 & B7

Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	75.35	32.39	✓/✓	✓
2	55.05	19.84	✓/✓	✓
3	63.10	20.84	✓/✓	✓
4	72.95	30.26	✓/✓	✓
5	58.18	16.99	✓/✓	✓
6	49.52	17.67	✓/✓	✓
7	49.82	15.47	✓/✓	✓
8	36.62	9.86	✓/✓	✓

8.3.7 View 07 – Duplexes B8, B9 & B10

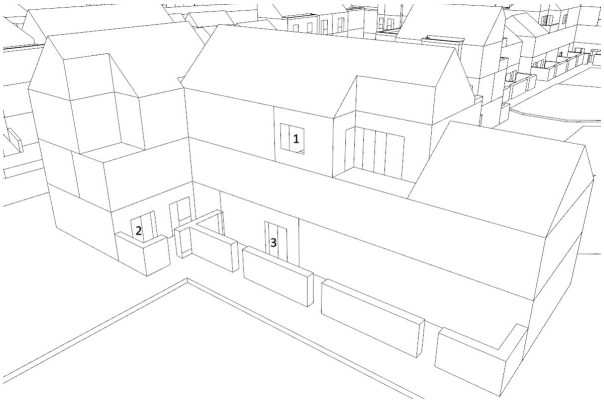


Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	76.01	33.37	✓/✓	✓
2	59.02	23.34	✓/✓	✓
3	70.28	29.47	✓/✓	✓
4	70.68	31.69	✓/✓	✓
5	54.70	22.87	✓/✓	✓
6	60.99	26.04	✓/✓	✓
7	63.58	27.32	✓/✓	✓
8	71.83	31.69	✓/✓	✓
9	65.83	29.20	✓/✓	✓
10	66.87	28.84	✓/✓	✓
11	24.26	1.70	x / x	x
12	8.92	3.85	x / x	✓

8.3.8 View 08 – Duplexes B11 & B12

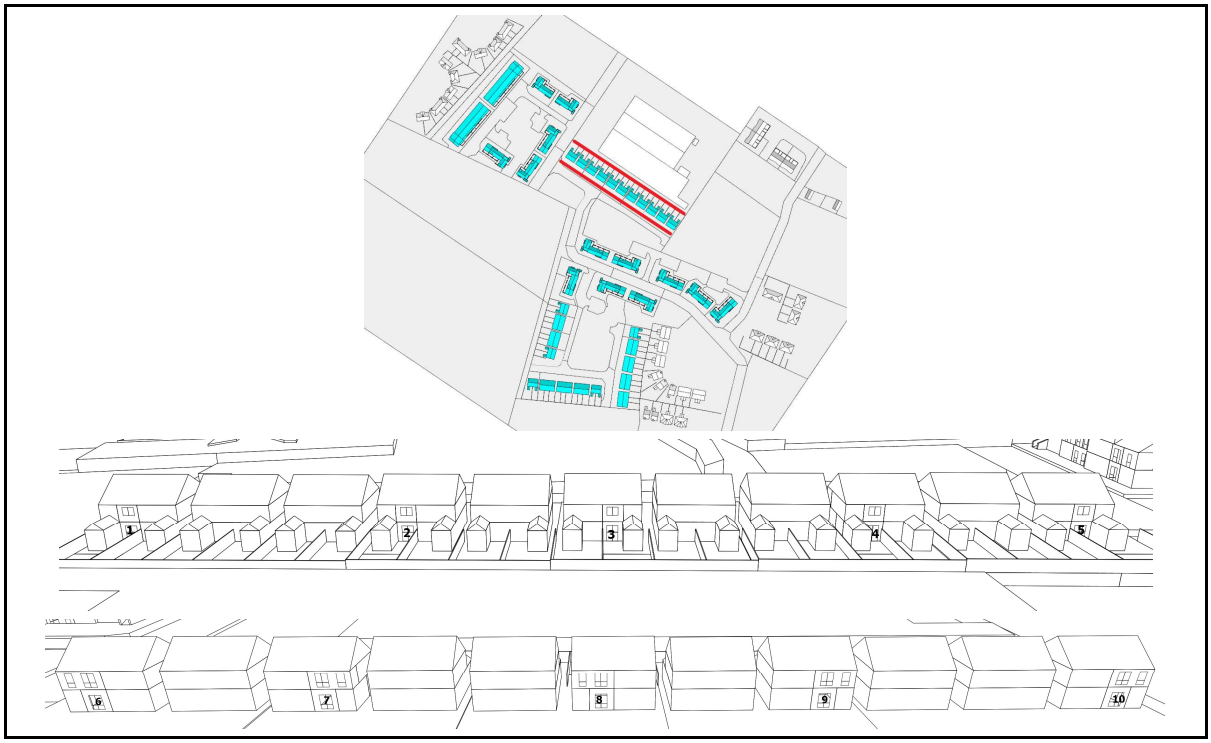
Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	72.66	36.35	✓/✓	✓
2	35.61	13.82	✓/✓	✓
3	49.06	19.20	✓/✓	✓
4	55.56	19.81	✓/✓	✓
5	73.43	30.99	✓/✓	✓
6	54.73	18.43	✓/✓	✓
7	43.65	14.41	✓/✓	✓
8	68.93	26.68	✓/✓	✓

8.3.9 Views 09 – Duplex B13



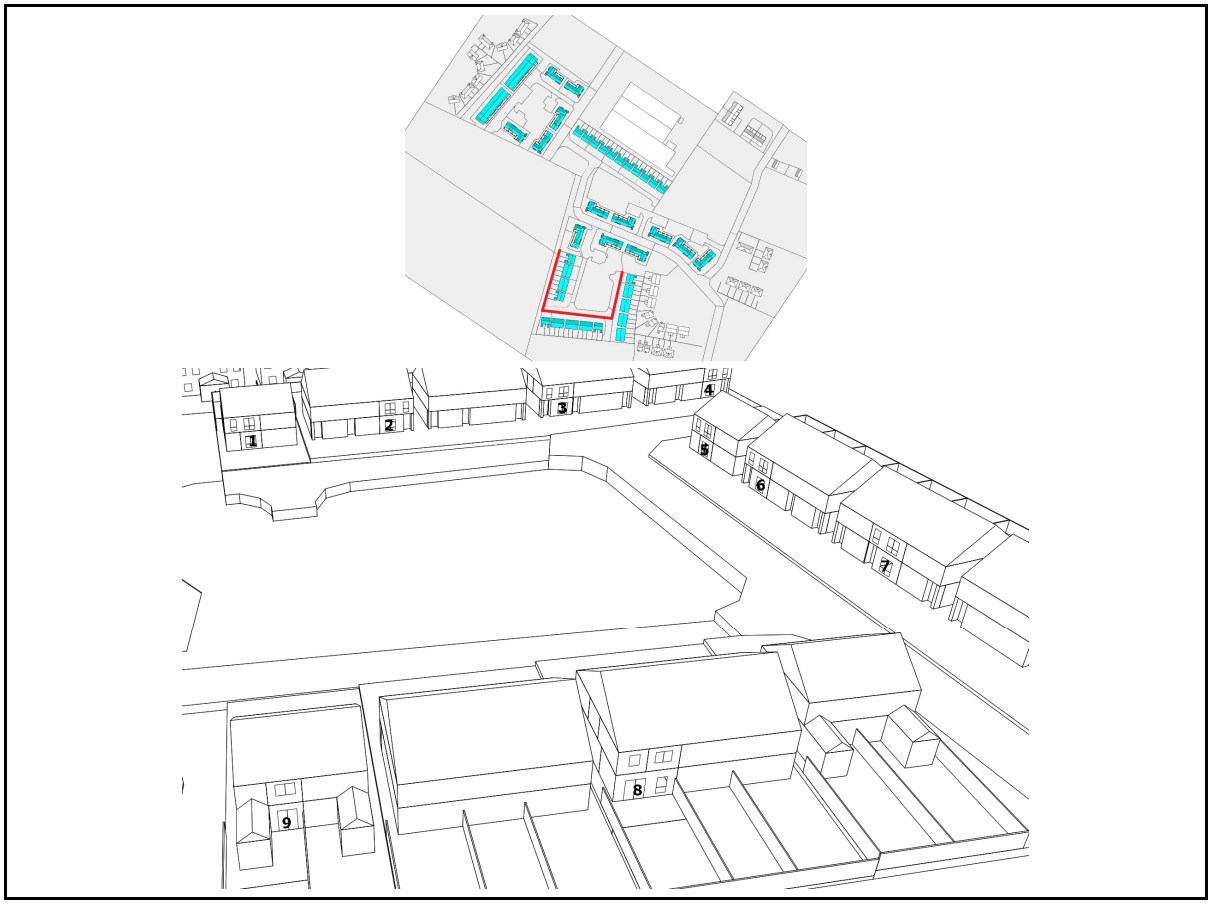
Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	40.14	13.38	✓/✓	✓
2	33.06	9.99	✓/✓	✓
3	31.30	9.21	✓/✓	✓

8.3.10 View 10 – House Type C



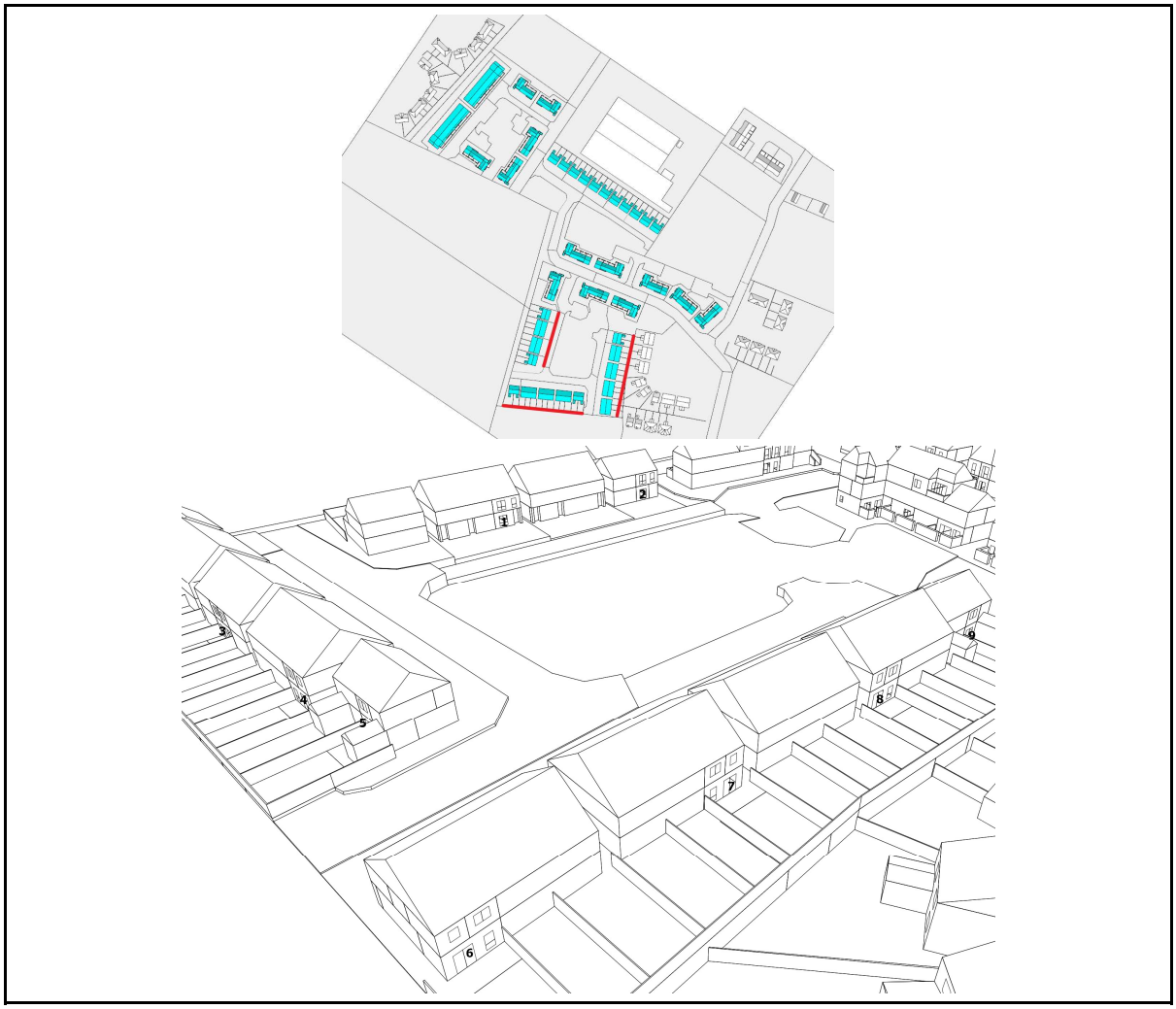
Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	2.47	0.00	x / x	x
2	2.42	0.00	x / x	x
3	9.34	0.00	x / x	x
4	2.21	0.00	x / x	x
5	9.11	0.00	x / x	x
6	67.90	32.22	✓ / ✓	✓
7	71.01	33.52	✓ / ✓	✓
8	70.28	30.14	✓ / ✓	✓
9	67.40	26.56	✓ / ✓	✓
10	65.46	24.62	✓ / ✓	✓

8.3.11 View 11 – House Types C & E



Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	36.67	11.97	✓/ ✓	✓
2	35.70	11.27	✓/ ✓	✓
3	36.80	11.68	✓/ ✓	✓
4	43.62	16.90	✓/ ✓	✓
5	9.25	0.00	x / x	x
6	11.44	0.00	x / x	x
7	14.08	0.00	x / x	x
8	35.29	9.93	✓/ ✓	✓
9	25.98	5.56	✓/ ✓	✓

8.3.12 View 12 – House Types C & E



Ref.	BRE Guide 2nd Edition / BS 8206:2008 APSH Assessment			BRE Guide 3rd Edition IS EN 17037:2018 Sunlight Exposure > 1.5 hrs
	APSH Annual (%)	APSH Winter (%)	Comment	Comment
1	53.91	20.33	✓/✓	✓
2	51.87	19.82	✓/✓	✓
3	65.71	26.30	✓/✓	✓
4	68.09	28.27	✓/✓	✓
5	42.52	16.14	✓/✓	✓
6	41.94	14.41	✓/✓	✓
7	44.81	14.06	✓/✓	✓
8	46.49	16.01	✓/✓	✓
9	33.65	8.04	✓/✓	✓

8.4 Discussion

BRE Guide 2nd Edition / BS 8206-2:2008

Within the BS 8206-2:2008 standard, when discussing annual probable sunlight hours regarding proposed developments, it is noted that:

"The degree of satisfaction is related to the expectation of sunlight. If a room is necessarily North facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary".

This is also reflected in the BRE Guide 2nd Edition which states:

"The BS 8206-2 criterion applies to rooms of all orientations, although if a room faces significantly north of due east or west it is unlikely to be met."

Of the 102 no. points tested, 94 no. points (92%) meet the BRE recommended values over both the annual and winter periods. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, i.e. windows facing "*significantly north of due east or west"* or as a consequence of the impact of balcony projections.

It should be noted that in the development of any apartment type building achieving in the region of 75% to 80% for this assessment would be considered very high and factors such site constraints and ultimately orientation play a huge part to the outcome of this assessment. In some instance and particularly a scheme like this where you have apartments on either side of a rectangular block, 50% would be as highest percentage achievable with the apartments on one side not able meet requirements purely on orientation as noted and the inclusion of balconies within the design scheme (as a requirement).

BRE Guide 3rd Edition / IS EN 17037:2018

As the sunlight exposure assessment in accordance with BRE Guide 3rd Edition / IS EN 17037:2018 considers the orientation of the rooms similar to the BRE Guide 2nd Edition / BS 8206-2:2008 assessment above, it can also be concluded that the criteria for rooms facing significantly north of due east or west is unlikely to be met.

Of the 102 no. points tested, 95 no. points (93%) meet the BRE Guide 3rd Edition / IS EN 17037:2018 sunlight exposure recommendations of greater than 1.5 hours on March 21st. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, or as a consequence of the impact of balcony projections.

Overall, the sunlight provision results to the proposed development in accordance with IS EN 17037:23018 are considered excellent in the context of a suburban environment, due to the fact that not all living rooms can face south and the inclusion of balconies.

9 Daylight to Existing Buildings

9.1 Guidance – BRE Guide (2nd Edition) / BS 8206-2:2008 & BRE Guide (3rd Edition) / IS EN 17037:2018

When designing a new development, it is important to safeguard the daylight to nearby buildings. The BRE Guide provides numerical values that are purely advisory. Different criteria may be used based on the requirements for daylighting in an area viewed against other site layout constraints. Another issue is whether the existing building is itself a good neighbour, standing a reasonable distance from the boundary and taking no more than its fair share of light. Any reduction in the total amount of skylight can be calculated by determining the vertical sky component at the centre of key reference points. The vertical sky component definition from the BRE Guide (2nd Edition & 3rd Edition) is described below:

Vertical sky component (VSC)	Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

The maximum possible VSC value for an opening in a vertical wall, assuming no obstructions, is 40%. This VSC at any given point can be tested in RadianceIES, a module of IES VE.

For typical residential schemes the BRE Guide (2nd Edition) states the following in Section 2.2.7:

> 2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window is likely to appear more gloomy, and electric lighting will be needed more of the time.

Based on the criteria outlined in Section 2.2.5 of the BRE Guide (2nd Edition), none of the existing dwellings need to be included within the VSC assessment as they did not meet the criterion as laid out within the BRE guide.

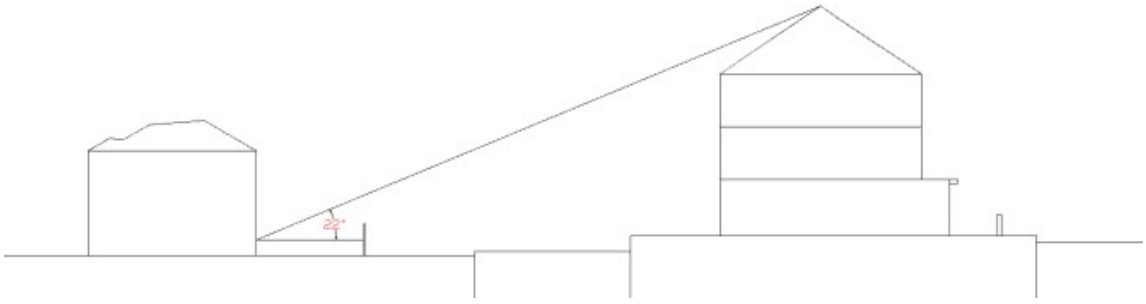
It is not always necessary to do a full calculation to check daylight potential. The guideline above is met provided the following is true:

- no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal.

Given the statement above the surrounding dwellings and the proposed development were verified noting that in a section perpendicular to the window wall, no angle subtended more than 25°. Therefore, as noted above, none of the existing dwellings have been included within the VSC assessment as the daylight impact will be unnoticeable to the occupants.

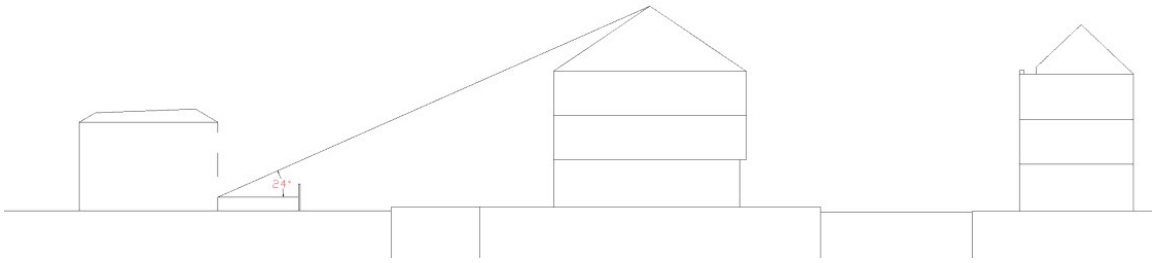
The results from the 25°degree check carried out can be seen from the images below.

View 1: Esker Fields Dwellings

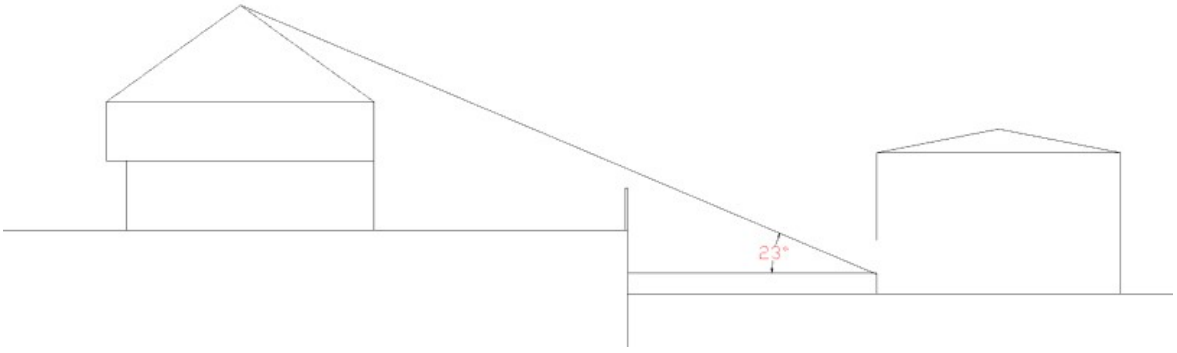


Site Section – Qualification of 25° Rule (22° Angle Observed)

View 2: Esker Fields Dwellings


Site Section – Qualification of 25° Rule (24° Angle Observed)

View 3: Beechlawn Heights Dwellings


Site Section – Qualification of 25° Rule (23° Angle Observed)

9.2 Discussion

Based on the criteria outlined in Section 2.2.5 of the BRE guidance (2nd and 3rd Editions), none of the neighbouring dwellings need to be included within the VSC assessment as they did not meet the criterion as laid out within the BRE guide.

It is not always necessary to do a full calculation to check daylight potential. The guideline above is met provided the following is true:

- no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal.

Given the statement above the existing surrounding dwellings and the proposed development were verified noting that in a section perpendicular to the window wall, no angle subtended more than 25°. Therefore, as noted above, none of the existing adjacent dwellings have been included within the VSC assessment as the daylight impact will be unnoticeable to the occupants for these properties.

10 Daylight to Proposed Development

This section addresses daylight provision to the proposed housing and duplex apartments. The purpose of the calculations is to quantify an overall percentage of units which exceeds the daylight provision recommendations. Our proposed methodology is to complete the calculations for all of the duplex apartments and a sample of the housing within the development. The objective of the design team is to maximise the number of units which exceed the minimum recommendations.

10.1 Reference Standards

The daylight provision to the proposed development was assessed against the following standards for completeness:

- BRE Guide (2nd Edition) / BS 8206-2:2008
- BRE Guide (3rd Edition) / IS EN 17037:2018
- BRE Guide (3rd Edition) / BS EN 17037:2018

The following sections summarise the various requirements of each standard.

10.1.1 BRE Guide (2nd Edition) / BS 8206-2:2008

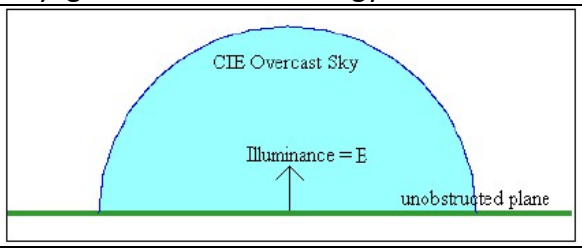
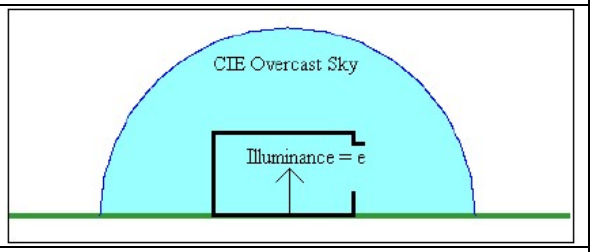
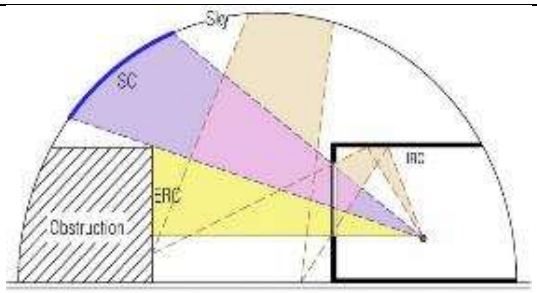
The BRE Guide (2nd Edition) states that the "*advice is not mandatory and that the guide should not be seen as an instrument of planning policy*". It should be noted when trying to achieve height and density within a development where deep plan, single aspect, combined living, kitchen and dining spaces exist (in some situations with a balcony in place as well), it is very difficult to achieve good levels of daylight across the whole space. Therefore, when considering the modelling approach noted above, results should be interpreted with flexibility as noted in the BRE guide (2nd Edition):

"Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."

10.1.1.1 Introduction to ADF

Daylight is constantly changing, so its level at a point in a building is usually defined as an average daylight factor (ADF).

This is the ratio of the indoor illuminance at the point in question to the outdoor unobstructed horizontal illuminance.

<table>
<tr><td colspan="2">Daylight Factor Methodology</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>E = illuminance on unobstructed plane</td><td>e = illuminance at point in interior</td></tr>
<tr><td colspan="2">Daylight Factor = e/E (often expressed as a percentage)</td></tr>
<tr><td colspan="2">SC – Sky Component
ERC – Externally Reflected Component
IRC – Internally Reflected Component
 

Sources of Daylight at a Point Within a Room</td></tr>
</table>

Both illuminances are measured under the same standard sky, a CIE overcast sky. Since the sun is in a particular position for only a short period each day, direct sunlight is excluded. Instead diffuse sunlight is used for average daylight calculations. Diffuse sunlight describes the sunlight that has been scattered by molecules and particles in the atmosphere but has still made it down to surface of the earth.

For average daylight factor there are three possible paths along which diffuse light can get into a room through glazed windows.

1. Light from the patch of sky visible at the point considered, is expressed as the sky component.
2. Light reflected from opposing exterior surfaces and then reaches the point, is expressed as the externally reflected component.
3. Light entering through the window but reaching the point only after reflection from internal surfaces, is expressed as the internally reflected component.

Average Daylight Factor is an average of all measured points within the space.

10.1.1.2 ADF Requirements

The BRE Guide (2nd Edition) states the following in Appendix C with respect to Average Daylight Factors (ADF):

> C4 If a predominantly daylit appearance is required, then the ADF should be 5% or more if there is no supplementary electric lighting, or 2% or more if supplementary electric lighting is provided. There are additional recommendations for dwellings of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms. These additional recommendations are minimum values of ADF which should be attained even if a predominantly daylit appearance is not achievable.

Therefore, the recommended Average Daylight Factors (ADF) are summarized as follows:

- Bedrooms – 1.0%
- Living Rooms – 1.5%
- Kitchens – 2.0%

The BRE Guide (2nd Edition) does not provide explicit guidance for an open space that is a combination of Living/Kitchen/Dining (LKD) functions. However, the BS 8206-2:2008 standard states:

"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%."

Although the above target is referenced within BS 8206-2:2008, it also states, "*The aim of the standard is to give guidance to architects, builders and others who carry out lighting design. It is recognised that lighting is only one of many matters that influence fenestration. These include other aspects of environmental performance (such as noise, thermal equilibrium and the control of energy use), fire hazards, constructional requirements, the external appearance and the surroundings of the site. The best design for a building does not necessarily incorporate the ideal solution for any individual function. For this reason, careful judgement should be exercised when using the criteria given in the standard for other purposes, particularly town planning*."

For the purposes of clarity, we have assessed all LKDs against the 2% ADF target.

10.1.2 BRE Guide (3rd Edition) / IS EN 17037:2018

As outlined in Section 5.1.2 of the IS EN 17037:2018 standard:

"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. In addition, for spaces with vertical or inclined daylight openings, a minimum target illuminance level is also to be achieved across the reference plane".

Annex A of IS EN 17037:2018 gives three levels of recommendation for the assessment of daylight provision in interior spaces which are summarised as follows:

"The three levels are: minimum, medium and high, and the minimum recommendation should be provided."

It is important to note that IS EN 17037:2018 does not provide different illuminance targets for different space types. Therefore, in the case of residential developments; bedrooms, living rooms, kitchens and combined LKDs all have the same daylight provision targets.

Table A.1 of IS EN 17037:2018 (included below) provides recommendations for daylight provision by daylight openings in vertical and inclined surfaces. Note, Table A.2 provides similar recommendations for daylight openings in horizontal surfaces, e.g. rooflights. As there are no rooflights in the proposed development, the recommendations in Table A.2 are not followed.

To achieve the minimum level of daylight provision for vertical and inclined openings as per Table A.1, the following must be achieved:

- A target illuminance (E_T) of 300 lux must be achieved on over 50% of the floor area for over 50% of the available daylight hours, and
- A minimum target illuminance (E_{TM}) of 100 lux must be achieved on over 95% of the floor area for over 50% of the available daylight hours.
- Both targets above must be satisfied for a space to be deemed compliant with the requirements.

Table A.1 — Recommendations of daylight provision by daylight openings in vertical and inclined surface

Level of recommendation for vertical and inclined daylight opening	Target illuminance E_T lx	Fraction of space for target level $F_{plane,\%}$	Minimum target illuminance E_{TM} lx	Fraction of space for minimum target level $F_{plane,\%}$	Fraction of daylight hours $F_{time,\%}$
Minimum	300	50 %	100	95 %	50 %
Medium	500	50 %	300	95 %	50 %
High	750	50 %	500	95 %	50 %
NOTE Table A.3 gives target daylight factor (D_T) and minimum target daylight factor (D_{TM}) corresponding to target illuminance level and minimum target illuminance, respectively, for the CEN capital cities.					

The recommendations in Table A.1 can also be expressed in terms of a daylight factor "D". Table A.3 provides the corresponding daylight factor (D) relative to a recommended target illuminance E_T (lx) and target minimum illuminance E_{TM} (lx) depending on the location for daylight openings in vertical and inclined surfaces. Note, Table A.4 provides similar target values for openings in horizontal surfaces, e.g. rooflights. As there are no rooflights in the proposed development, the recommendations in Table A.4 are not followed.

The extract from Table A.3 below is for Dublin with the daylight factor targets highlighted, i.e. to achieve the target illuminance (E_T) of 300 lux outlined in Table A.1, an equivalent target daylight factor is 2.0%. Furthermore, to achieve the minimum target illuminance (E_{TM}) of 100 lux outlined in Table A.1, an equivalent target daylight factor is 0.7%.

Table A.3 — Values of *D* for daylight openings to exceed an illuminance level of 100, 300, 500 or 750 lx for a fraction of daylight hours $F_{time,\%}$ = 50 % for 33 capitals of CEN national members

Nation	Capital [a]	Geographical latitude φ [°]	Median External Diffuse Illuminance $E_{v,d,med}$	*D* to exceed 100 lx	*D* to exceed 300 lx	*D* to exceed 500 lx	*D* to exceed 750 lx
Ireland	Dublin	53,43	14 900	0,7 %	2,0 %	3,4 %	5,0 %

Therefore, to achieve the minimum level of daylight provision for vertical and inclined openings as per Table A.3, the following must be achieved:

- A target daylight factor (D_T) of 2.0% must be achieved on over 50% of the floor area for over 50% of the available daylight hours, and
- A minimum target daylight factor (D_{TM}) of 0.7% must be achieved on over 95% of the floor area for over 50% of the available daylight hours.
- Both targets above must be satisfied for a space to be deemed compliant with the requirements.

There are two methods to assess daylight provision to the interior which are based on target values in either Table A.1 or Table A.3 which are summarised as follows:

Method 1: This calculation method uses the daylight factor targets on the reference plane as per Table A.3. The assessment is carried out on a representative day and time during the year, i.e. 21st September @ 12:00 under standard CIE overcast sky conditions.

Method 2: This calculation method uses the illuminance targets on the reference plane as per Table A.1. The assessment is carried out for each hour over the course of the year (8,760 hours) using a local weather file which accounts for varying sky conditions and sun positions throughout the year.

As outlined in Section 5.1.4, the verification of daylight provision can be determined using either an adequate software or on-site measurements. When using a software, *"a representative model of the space is required together with the key parameters (such as any significant nearby obstructions, the assigned surface reflectance values and glazing transmissivity) that are a reasonable representation of those for the actual, completed building. This can be determined using either Method 1 or Method 2."*

Based on the above criteria, the daylight provision to the proposed development has been assessed using an adequate software (i.e. IES VE), using the Method 2 climate-based approach and targeting the minimum recommended values outlined in Table A.1 of IS EN 17037:2018.

The Method 2 climate-based approach was selected as it is a far more accurate assessment method compared to Method 1. Climate based daylight modelling (CBDM) is more accurate compared to a calculation based on a single day during the year, i.e. Method 1. The amount of daylight varies throughout the year, primarily due to the sun's position, so it is essential the impact of daylight variance is properly considered. CBDM utilises an annual simulation linking location, shading, climate data (including solar intensity and cloud cover) together with the building properties. This provides a complete overview on how the daylight performance varies throughout the year due to changes in these factors.

10.1.3 BRE Guide 3rd Edition / BS EN 17037:2018 National Annex

In the UK, EN17037:2018 was adopted to form "BS EN 17037:2018". However, a "National Annex NA" was included which states:

"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."

Whereas IS EN 17037:2018 does not provide different illuminance targets for different space types, the BS EN 17037:2018 National Annex provides target illuminance values for bedrooms, living rooms and kitchens within residential developments as per Table NA.1 below. It is also important to note that as the climate in Ireland is similar to the UK, the targets outlined in the BS EN National Annex could also be applied to dwellings in Ireland.

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

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

The BS National Annex also states:

"Where one room in a UK dwelling serves more than a single purpose, the UK committee recommends that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx."

Therefore, combined LKDs are to be assessed using a 200 lux target illuminance (E_T).

Finally, the BS National Annex also states that:

"It is the opinion of the UK committee that the recommendation in Clause A.2 – that a target illuminance level should be achieved across the entire (i.e. 95 %) fraction of the reference plane within a space – need not be applied to rooms in dwellings."

Therefore, when assessing the daylight provisions in residential dwellings in accordance with BS EN 17037:2018, only the target illuminance (E_T) or target daylight factor (D_T) will be assessed for Bedrooms, Living Rooms, Kitchens (or combined LKDs) on over 50% of the floor area over 50% of the available daylight hours. The minimum target illuminance (E_{TM}) or minimum target daylight factor (D_{TM}) will not be assessed.

Based on the above criteria, the daylight provision to the proposed development has been assessed using an adequate software (i.e. IES VE), using the Method 2 climate-based approach and targeting the minimum recommended values outlined in Table NA.1 of BS EN 17037:2018.

10.2 Daylight Model Inputs

The following inputs were used in the study:

BRE Guide (2nd Edition) / BS 8206-2:2008

- Sky Conditions: Standard CIE overcast sky
- Time (24hr): 12:00
- Date: 21 September

BRE Guide (3rd Edition) / IS EN / BS EN 17037:2018

- Weather File: Galway.epw (15 year average)

Common Inputs to all Standards

- Working Plane Height: 0.85m
- Glazing Light Transmittance: 70%
- Window Frame thickness: 50 mm

The following surface reflectance values are used in the study:

Material Surface	Reflectance
External Wall	0.30/0.50
Internal Partition	0.80
Roof	0.20
Ground	0.20
Floor/Ceiling (Floor)	0.40
Floor/Ceiling (Ceiling)	0.80

10.3 Daylight Results

The following tables summarise the daylight provision results for each property type assessed within the development. Individual room results can be viewed in Appendix A.

The purpose of the calculations is to quantify an overall percentage of rooms which exceed the recommendations. The objective of the design team is to maximise the number of units which exceed the recommendations.

As outlined previously in Section 10.1.1.2, where there are combined Living/Kitchen/Dining areas (LKDs) within the development, these have been assessed as whole spaces against an initial 2% ADF target.

The results are summarised in the following tables:

Total for The Development

The overall daylight provision results for the tested spaces in the development under the various standards are summarised below. A 100% compliance rate is achieved in accordance with the BRE Guide 2nd Edition / BS 8206:2008 when LKDs are assessed against a 2% ADF target. Under BRE Guide 3rd Edition / IS EN 17037:2018 Method 2 a compliance rate of 98% is achieved, which increases to 100% under the BRE Guide 3rd Edition / BS EN 17037:2018 Method 2 National Annex.

Rooms Tested	No. Rooms
Total No. Bedrooms Tested	199
Total No. LKDs Tested	67
No. KDs Tested	14
No. Living Rooms Tested	20
Total No. Spaces Tested	**300**

BRE Guide 2nd Edition / BS 8206:2008 LKDs Assessed Against 2% ADF Target				
Room Type	**Pass (No.)**	**Pass (%)**	**Fail (No.)**	**Fail (%)**
No. Bedrooms	199	100%	0	0%
No. LKDs	67	100%	0	0%
No. KDs	14	100%	0	0%
No. Living Rooms	20	100%	0	0%
Total No.	**300**	**100%**	**0**	**0%**

BRE Guide 3rd Edition / IS EN 17037:2018 Method 2 Assessment				
Room Type	**Pass (No.)**	**Pass (%)**	**Fail (No.)**	**Fail (%)**
No. Bedrooms	199	100%	0	0%
No. LKDs	67	100%	0	0%
No. KDs	7	50%	7	50%
No. Living Rooms	20	100%	0	0%
Total No.	**293**	**98%**	**7**	**2%**

BRE Guide 3rd Edition / BS EN 17037:2018 Method 2 Assessment - National Annex				
Room Type	**Pass (No.)**	**Pass (%)**	**Fail (No.)**	**Fail (%)**
No. Bedrooms	199	100%	0	0%
No. LKDs	67	100%	0	0%
No. KDs	14	100%	0	0%
No. Living Rooms	20	100%	0	0%
Total No.	**300**	**100%**	**0**	**0%**

11 Conclusion

The following can be concluded based on the assessments undertaken:

11.1 Shadow Analysis

The shadow analysis illustrates different shadows being cast at key times of the year (March 21st, June 21st and December 21st) for the Existing Situation and the Proposed Scheme. The results from the study are summarised as follows:

Previous Project Phase – PI Ref 19/1978 (Under Construction)

No additional shading from the proposed development is observed on this property throughout the year.

75-96 Esker Fields

Minimal additional shading from the proposed development is observed on these residential properties on March 0800. Additional shading is also observed in December 1000-1400. No additional shading is observed at any other periods throughout the year.

15-21, 28-40 Beechlawn Heights

Minimal additional shading from the proposed development is observed on these residential properties on March 1800, June 2000 and December 1400. No additional shading is observed at any other periods throughout the year.

33-45 Dun Esker

Minimal additional shading from the proposed development is observed on these residential properties on March 1800. No additional shading is observed at any other periods throughout the year.

The potential shading impact is quantified via the "Sunlight to Amenity Spaces" and "Daylight to Existing Buildings" sections of this report.

11.2 Sunlight to Amenity Spaces

The BRE Guide (2nd and 3rd Editions) states that for a space to appear adequately sunlit throughout the year, at least half of a garden or amenity space should receive at least 2 hours of sunlight on March 21st. In the case of existing amenity spaces, if they are already below the 50% threshold then the BRE recommends the results are kept to within 80% of the existing situation with the proposed development in place.

Existing Amenity Spaces

On March 21st the existing amenity spaces will receive the same level of sunlight with the proposed development in place. In all cases the results comply with the recommendations in the BRE Guide outlined above.

Proposed Amenity Spaces

On March 21st, 90% of the combined proposed communal amenity areas and 98% of the combined proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight over their total combined area. All amenity areas provided will be quality spaces in terms of sunlight.

In addition, all individual areas tested are achieving at least 2 hours of sunlight over 50% of their area on the 21st of March.

11.3 Sunlight to Existing Buildings

This study considers the existing scheme and tests if the Annual Probable Sunlight Hours (APSH) results for the living room windows are greater than 25% annual and 5% winter sunlight or are greater than 0.8 times their former value with the proposed development in place.

Based on the criteria outlined in Section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, none of the existing buildings fit the requirements to be assessed and as such the APSH assessment was not conducted for these properties. The BRE guide (2nd and 3rd Editions) notes that there should be no impact to sunlight for these properties.

"It is not always necessary to do a full calculation to check sunlight potential. The guideline above is met provided either the following is true:

- If the window wall faces within 90° of due south and no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal. Again, obstructions within 90° of due north need not be counted."

Given the statement above the existing properties adjacent to the proposed development were verified noting that, in a section perpendicular to the window wall, no angle subtended more than 25° and, in some cases, they were also sitting to the south of the proposed development. Therefore, none of the existing property were included in the assessment and they were excluded on the basis, as noted in section 3.2.7 of the BRE Guide 2nd Edition and Section 3.2.9 of the BRE Guide 3rd Edition, that these windows need not be analysed as sunlight impact will be unnoticeable to the occupants.

11.4 Sunlight to Proposed Development

For the sunlight to proposed development assessment, two standards have been analysed: BS 8206-2:2008 (BRE Guide 2nd Edition) and IS EN 17037:2018 (BRE Guide 3rd Edition). The results under each standard are summarised below.

BRE Guide 2nd Edition / BS 8206-2:2008

Within the BS 8206-2:2008 standard (BRE Guide 2nd Edition), when discussing annual probable sunlight hours regarding proposed developments, it is noted that:

"The degree of satisfaction is related to the expectation of sunlight. If a room is necessarily North facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary".

This is also reflected in the BRE Guide (2nd Edition) which states:

"The BS 8206-2 criterion applies to rooms of all orientations, although if a room faces significantly north of due east or west it is unlikely to be met."

Based on the above criteria for the BRE Guide 2nd Edition/BS8206-2:2008, all main living room windows within the proposed development apartments and duplexes have been assessed and a sampling of the house types properties have been assessed with the results included in the following sections.

The sample was aligned with the properties selected for the daylight sampling. As such a sample were chosen from the middle of rows or locations that were in close proximity to neighbouring proposed properties which would be seen as worst-case location as a check on performance with regards to sunlight. Properties in the same orientation will produce very similar if not identical results.

Of the 102 no. points tested, 94 no. points (92%) meet the BRE recommended values over both the annual and winter periods. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, i.e. windows facing "*significantly north of due east or west"* or as a consequence of the impact of balcony projections.

It should be noted that in the development of any apartment type building achieving in the region of 75% to 80% for this assessment would be considered very high and factors such as site constraints and ultimately orientation play a huge part to the outcome of this assessment. In some instances, particularly a scheme like this where you have apartments on either side of a rectangular block, 50% would be the highest percentage achievable. This is because the apartments on one side are not able to meet the requirements based on orientation as noted and the inclusion of balconies within the design scheme (as a requirement).

BRE Guide 3rd Edition / IS EN 17037:2018

As the sunlight exposure assessment in accordance with IS EN 17037:2018 (BRE Guide 3rd Edition) considers the orientation of the rooms similar to the BRE Guide 2nd Edition/ BS 8206-2:2008 assessment above, it can also be concluded that the criteria for rooms facing significantly north of due east or west is unlikely to be met.

Of the 102 no. points tested, 95 no. points (93%) meet the BRE Guide 3rd Edition / IS EN 17037:2018 sunlight exposure recommendations of greater than 1.5 hours on March 21st. Where windows do not meet this recommendation, this is predominantly as a result of their orientation, or as a consequence of the impact of balcony projections.

Overall, the sunlight provision results to the proposed development in accordance with IS EN 17037:23018 are considered excellent in the context of a suburban environment, due to the fact that not all living rooms can face south and the inclusion of balconies.

Note, the sunlight exposure results are visually represented in Appendix B.

11.5 Daylight to Existing Buildings

Based on the criteria outlined in Section 2.2.5 of the BRE guidance (2nd and 3rd Editions), none of the neighbouring dwellings need to be included within the VSC assessment as they did not meet the criterion as laid out within the BRE guide.

It is not always necessary to do a full calculation to check daylight potential. The guideline above is met provided the following is true:

- no obstruction, measured in the section perpendicular to the window wall, subtends an angle of more than 25° to the horizontal.

Given the statement above the existing surrounding dwellings and the proposed development were verified noting that in a section perpendicular to the window wall, no angle subtended more than 25°. Therefore, as noted above, none of the existing adjacent dwellings have been included within the VSC assessment as the daylight impact will be unnoticeable to the occupants for these properties.

11.6 Daylight to Proposed Development

For the daylight to proposed development assessment, three standards have been analysed: BS 8206-2:2008 (BRE Guide 2nd Edition), IS EN 17037:2018 and BS EN 17037:2018 National Annex (BRE Guide 3rd Edition). The results under each standard are summarised below.

To note, a sample of the duplexes and houses have been selected as these property types do not experience the same daylight issues that apartments generally do. As such a sample were chosen from the middle of rows or locations that were in close proximity to neighbouring

proposed properties which would be considered a worst-case location as a check that there were no performance issues with regards to daylight.

BRE Guide 2nd Edition / BS 8206-2:2008

Across the proposed development, 100% of the tested rooms are achieving Average Daylight Factors (ADF) in accordance with the BS 8206-2:2008 (BRE Guide 2nd Edition) when Living/Kitchen/Dining spaces are assessed as whole rooms against a 2% ADF target and Bedrooms against a 1% ADF target.

BRE Guide 3rd Edition / IS EN 17037:2018

It is important to note that IS EN 17037:2018 (BRE Guide 3rd Edition) does not provide different illuminance targets for different space types. Therefore, in the case of residential developments; bedrooms, living rooms, kitchens and combined LKDs all have the same daylight provision targets.

There are two methods to assess daylight provision to the interior which are based on target values in either Table A.1 or Table A.3 of IS EN 17037:2018 which are summarised as follows:

Method 1: This calculation method uses the daylight factor targets on the reference plane as per Table A.3 (refer to Section 10.1.2 of this report). The assessment is carried out on a representative day and time during the year, i.e. 21st September @ 12:00 under standard CIE overcast sky conditions.

Method 2: This calculation method uses the illuminance targets on the reference plane as per Table A.1 (refer to Section 10.1.2 of this report). The assessment is carried out for each hour over the course of the year (8,760 hours) using a local weather file which accounts for varying sky conditions and sun positions throughout the year.

As outlined in Section 5.1.4 of the standard, the verification of daylight provision can be determined using either an adequate software or on-site measurements. When using a software, *"a representative model of the space is required together with the key parameters (such as any significant nearby obstructions, the assigned surface reflectance values and glazing transmissivity) that are a reasonable representation of those for the actual, completed building. This can be determined using either Method 1 or Method 2."*

Based on the above criteria, the daylight provision to the proposed development has been assessed using an adequate software (i.e. IES VE), using the Method 2 climate-based approach and targeting the minimum recommended values outlined in Table A.1 of IS EN 17037:2018.

The Method 2 climate-based approach was selected as it is a far more accurate assessment method compared to Method 1. Climate based daylight modelling (CBDM) is more accurate

compared to a calculation based on a single day during the year, i.e. Method 1. The amount of daylight varies throughout the year, primarily due to the sun's position, so it is essential the impact of daylight variance is properly considered. CBDM utilises an annual simulation linking location, shading, climate data (including solar intensity and cloud cover) together with the building properties. This provides a complete overview on how the daylight performance varies throughout the year due to changes in these factors.

Across the proposed development, 98% of the tested rooms are achieving the daylight provision targets in accordance with Table A.1 of IS EN 17037:2018 using Method 2.

BRE Guide 3rd Edition / BS EN 17037:2018 National Annex

In the UK, EN17037:2018 was adopted to form "BS EN 17037:2018". However, a National Annex was included which states:

"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."

Whereas IS EN 17037:2018 does not provide different illuminance targets for different space types, the BS EN 17037:2018 National Annex provides target illuminance values for bedrooms, living rooms and kitchens within residential developments as per Table NA.1 (refer to Section 10.1.3 of this report). It is also important to note that as the climate in Ireland is similar to the UK, the targets outlined in the BS EN National Annex could also be applied to dwellings in Ireland.

The BS National Annex also states:

"Where one room in a UK dwelling serves more than a single purpose, the UK committee recommends that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx."

Therefore, combined LKDs were assessed using a 200 lux target illuminance (E_T).

Across the proposed development, 100% of the tested rooms are achieving the daylight provision targets in accordance with Table NA.1 of BS EN 17037:2018 using Method 2.

11.7 View Out

The View Out assessment is related to buildings such as offices or schools where seating layouts are typically fixed compared to domestic settings where an occupant can move around the space freely. In their own home occupants can choose to sit near to or even at a window which will inevitably provide the varying layers of a 'View Out' such as the ground, landscape or sky. This ability to choose their position within a domestic setting means they would always have access to a position in the apartment with the minimum requirements of 'View Out'. Therefore, all the properties would meet the minimum requirement as outlined in IS EN 17037:2018/ BS EN 17037:2018 National Annex (BRE Guide 3rd Edition).

11.8 Glare

As outlined in IS EN 17037:2018/ BS EN 17037:2018 National Annex (BRE Guide 3rd Edition), a Glare assessment is suggested in spaces where the *"expected activities are comparable to reading, writing or using display devices and the user is not able to choose freely their position and viewing direction".* Given that occupants within a domestic setting are free to move around, on this basis a glare assessment for the proposed development has not been carried out.

11.9 Observations

It is important to note that the recommendations within the BRE Guide (2nd and 3rd Editions) itself states "*although it gives numerical guidelines these should be interpreted flexibly because natural lighting is only one of many factors in site layout design"*, Although this is true appropriate and reasonable regard has still been taken to the BRE guide.

Whilst the results shown relate to the criteria as laid out in the BRE Guide (2nd and 3rd Editions), it is important to note that the BRE targets are guidance only and should therefore be used with flexibility and caution when dealing with different types of sites.

In addition, the foreword of BS 8206-2:2008 (BRE Guide 2nd Edition) also states "*The aim of the standard is to give guidance to architects, builders and others who carry out lighting design. It is recognised that lighting is only one of many matters that influence fenestration. These include other aspects of environmental performance (such as noise, thermal equilibrium and the control of energy use), fire hazards, constructional requirements, the external appearance and the surroundings of the site. The best design for a building does not necessarily incorporate the ideal solution for any individual function. For this reason, careful judgement needs to be exercised when using the criteria given in the standard for other purposes, particularly town planning control.*"

Taking all of the above information into account and based on the results from each of the assessments undertaken, the proposed development performs well when compared to the

recommendations in the BRE Guide 2nd Edition/ BS 8206-2:2008 and the BRE Guide 3rd Edition / IS EN 17037:2018 /BS EN 17037:2018 National Annex. With regards to the existing properties there is a negligible impact when considering sunlight and daylight as a result of the proposed development and the proposed development itself performs well with the same regard.

12 Appendix A – Daylight Provision Results

The tables in the following sections summarise the daylight provision results for the rooms that were assessed in the proposed development. Note, within the tables the code "LKD" equates to combined Living, Kitchen, Dining area.

The results for the following daylight standards are included in each table:

- BRE Guide (2nd Edition) / BS 8206-2:2008
- BRE Guide (3rd Edition) / IS EN 17037:2018
- BRE Guide (3rd Edition) / BS EN 17037:2018 National Annex

Please note, the "Comment" symbol in each of the tables represents the following:

BRE Guide (2nd Edition) / BS 8206-2:2008

✓ These rooms have an ADF greater than the recommended minimum values (2.0% for combined L/K/Ds and 1.0% for bedrooms) as stated within the BRE Guide.

x/✓ The ADF in these rooms falls below the BRE recommendation for a L/K/D when the whole space is assessed against the 2% ADF target. However, the whole space complies with an alternative 1.5% ADF target.

x The ADF in these rooms falls below the BRE recommendation for a L/K/D when the whole space is assessed against the 2% ADF design value or in the case of Bedrooms, is less than the 1% ADF target.

BRE Guide (3rd Edition) / IS EN 17037:2018

✓ These rooms achieve both the target illuminance (E_T) and minimum target illuminance (E_{TM}) over the minimum floor area requirements, i.e. 300 lux for over 50% of their floor area (E_T) and 100 lux for over 95% of their floor area (E_{TM}).

x These rooms do not achieve both the target illuminance (E_T) and minimum target illuminance (E_{TM}) over the minimum floor area requirements.

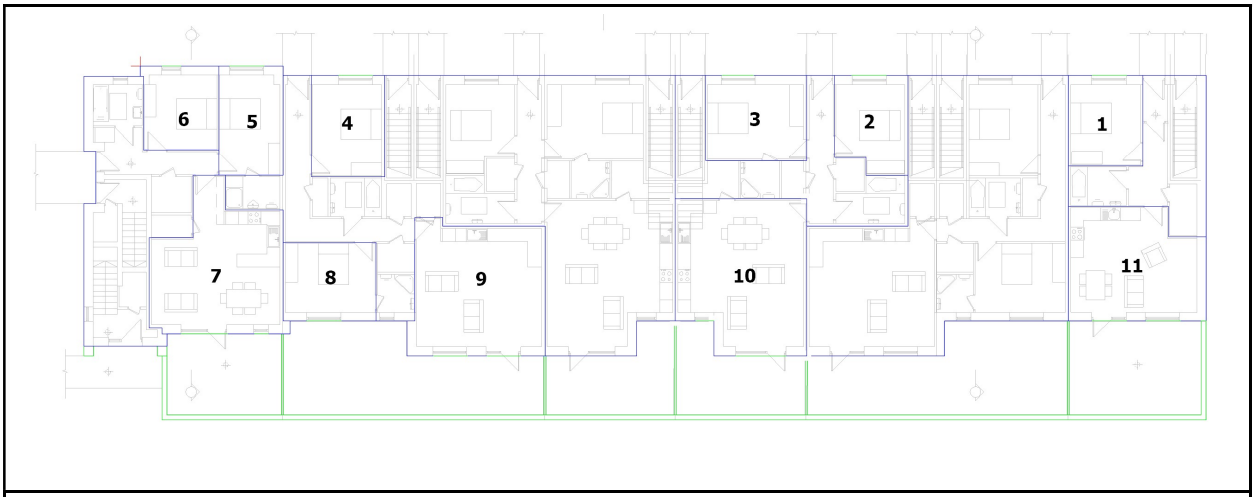
BRE Guide (3rd Edition) / BS EN 17037:2018 National Annex

✓ These rooms achieve the target illuminance (E_T) over the minimum floor area requirements, i.e. 100 lux for over 50% of bedroom floor areas, and 200 lux for over 50% of LKD floor areas.

x These rooms do not achieve the target illuminance (E_T) over the minimum floor area requirements.

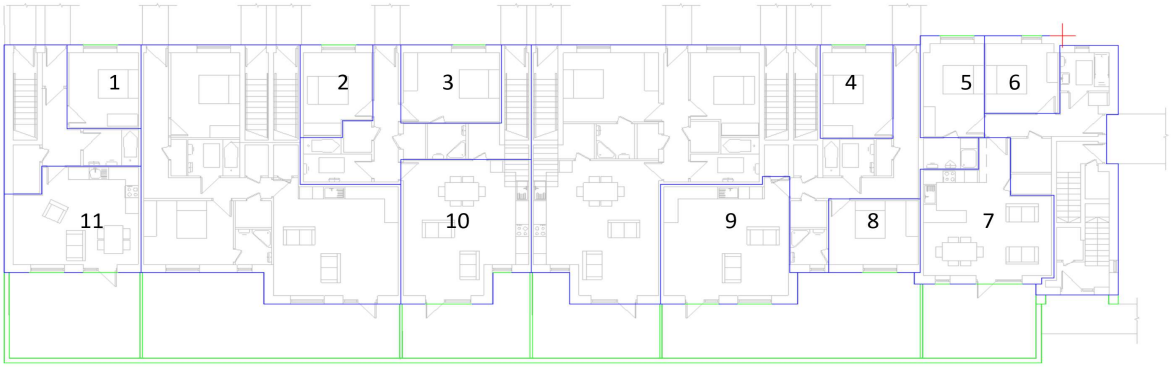
12.1 Daylight Provision Results

12.1.1 Duplex A – Level 00



A1

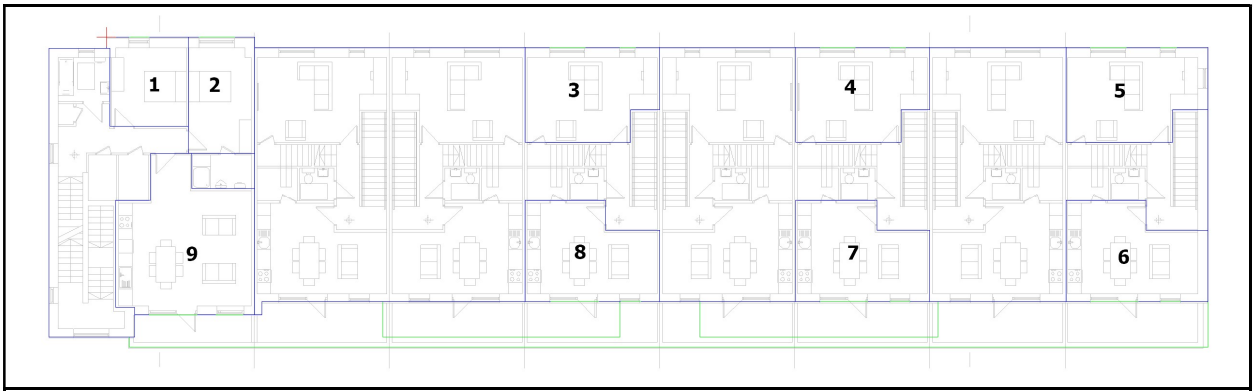
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	4.00	✓	100	100	✓	100	✓
2	Bedroom	3.69	✓	100	100	✓	100	✓
3	Bedroom	2.96	✓	74.06	100	✓	100	✓
4	Bedroom	3.20	✓	100	100	✓	100	✓
5	Bedroom	3.61	✓	100	100	✓	100	✓
6	Bedroom	2.13	✓	99.65	100	✓	100	✓
7	LKD	2.00	✓	100	100	✓	100	✓
8	Bedroom	1.76	✓	100	100	✓	100	✓
9	LKD	3.29	✓	97.68	100	✓	100	✓
10	LKD	2.01	✓	99.17	100	✓	100	✓
11	LKD	2.12	✓	100	100	✓	100	✓



A2

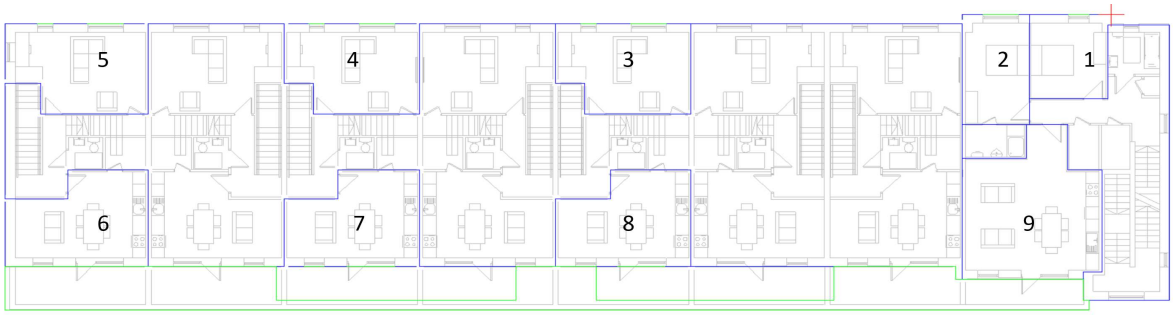
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	4.39	✓	99.24	100	✓	100	✓
2	Bedroom	4.08	✓	100	100	✓	100	✓
3	Bedroom	2.97	✓	100	100	✓	100	✓
4	Bedroom	3.15	✓	100	100	✓	100	✓
5	Bedroom	3.19	✓	100	100	✓	100	✓
6	Bedroom	2.25	✓	100	100	✓	100	✓
7	LKD	2.00	✓	100	100	✓	100	✓
8	Bedroom	1.60	✓	100	100	✓	100	✓
9	LKD	2.74	✓	100	100	✓	100	✓
10	LKD	2.08	✓	98.23	100	✓	100	✓
11	LKD	2.00	✓	100	100	✓	100	✓

12.1.2 Duplex A – Level 01



A1

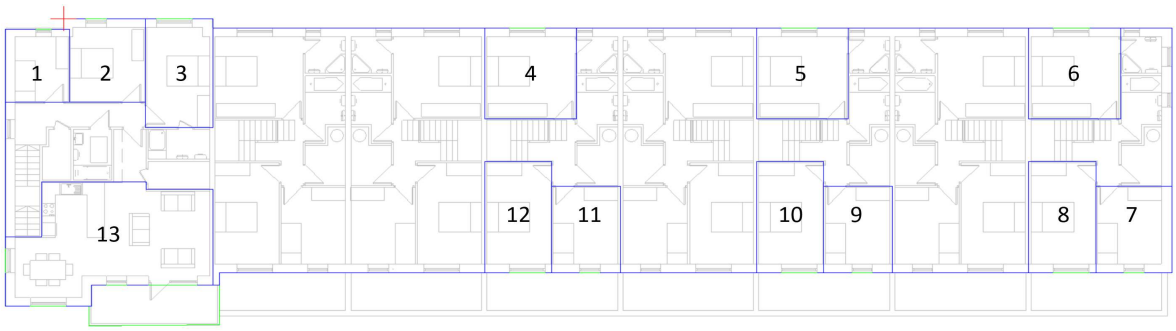
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	2.15	✓	100	100	✓	100	✓
2	Bedroom	3.36	✓	100	100	✓	100	✓
3	Living	3.35	✓	100	100	✓	100	✓
4	Living	3.35	✓	100	100	✓	100	✓
5	Living	3.36	✓	100	100	✓	100	✓
6	LKD	4.29	✓	100	100	✓	100	✓
7	LKD	4.14	✓	100	100	✓	100	✓
8	LKD	4.28	✓	100	100	✓	100	✓
9	LKD	2.02	✓	100	100	✓	100	✓



A2

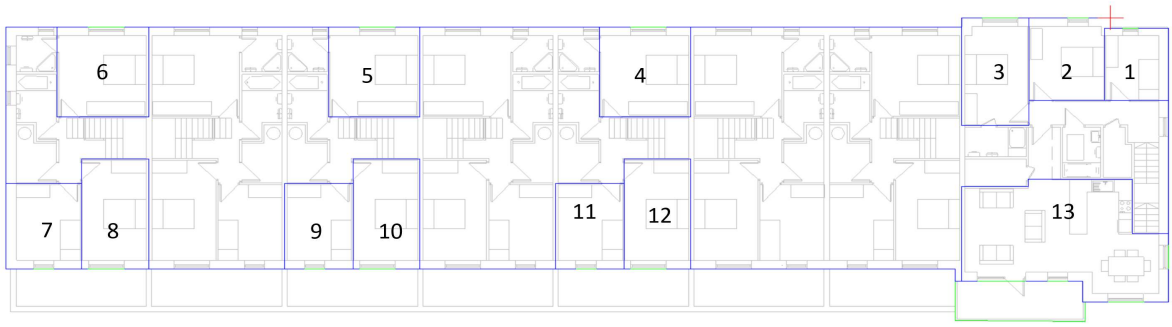
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	2.11	✓	100	100	✓	100	✓
2	Bedroom	3.30	✓	100	100	✓	100	✓
3	Living	3.34	✓	100	100	✓	100	✓
4	Living	3.35	✓	100	100	✓	100	✓
5	Living	3.34	✓	100	100	✓	100	✓
6	LKD	4.27	✓	100	100	✓	100	✓
7	LKD	4.26	✓	100	100	✓	100	✓
8	LKD	4.24	✓	100	100	✓	100	✓
9	LKD	2.01	✓	100	100	✓	100	✓

12.1.3 Duplex A – Level 02



A1

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	2.61	✓	95.11	100	✓	100	✓
2	Bedroom	2.27	✓	100	100	✓	100	✓
3	Bedroom	3.50	✓	100	100	✓	100	✓
4	Bedroom	3.38	✓	100	100	✓	100	✓
5	Bedroom	3.37	✓	100	100	✓	100	✓
6	Bedroom	3.38	✓	100	100	✓	100	✓
7	Bedroom	2.41	✓	100	100	✓	100	✓
8	Bedroom	3.23	✓	100	100	✓	100	✓
9	Bedroom	2.45	✓	100	100	✓	100	✓
10	Bedroom	3.20	✓	100	100	✓	100	✓
11	Bedroom	2.39	✓	100	100	✓	100	✓
12	Bedroom	3.21	✓	100	100	✓	100	✓
13	LKD	4.37	✓	100	100	✓	100	✓

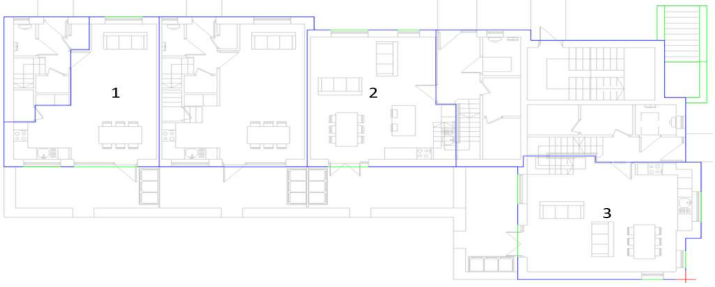


A2

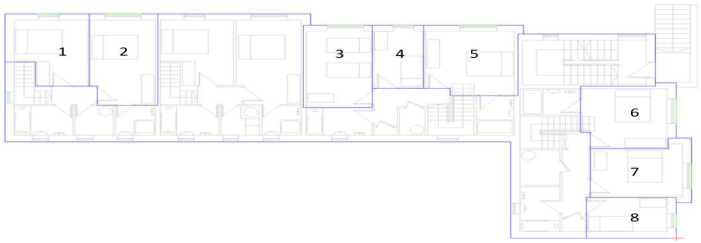
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
1	Bedroom	2.60	✓	100	100	✓	100	✓
2	Bedroom	2.26	✓	100	100	✓	100	✓
3	Bedroom	3.48	✓	100	100	✓	100	✓
4	Bedroom	3.37	✓	100	100	✓	100	✓
5	Bedroom	3.37	✓	100	100	✓	100	✓
6	Bedroom	3.38	✓	100	100	✓	100	✓
7	Bedroom	2.39	✓	100	100	✓	100	✓
8	Bedroom	3.22	✓	100	100	✓	100	✓
9	Bedroom	2.39	✓	100	100	✓	100	✓
10	Bedroom	3.21	✓	100	100	✓	100	✓
11	Bedroom	2.38	✓	100	100	✓	100	✓
12	Bedroom	3.2	✓	100	100	✓	100	✓
13	LKD	4.24	✓	100	100	✓	100	✓

12.1.4 Duplex B1

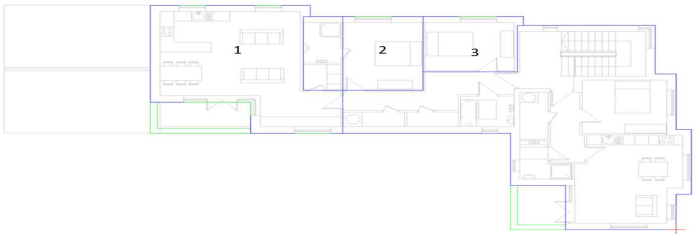
L00



L01



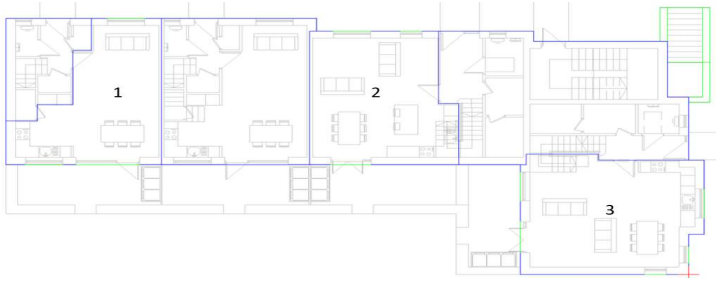
L02



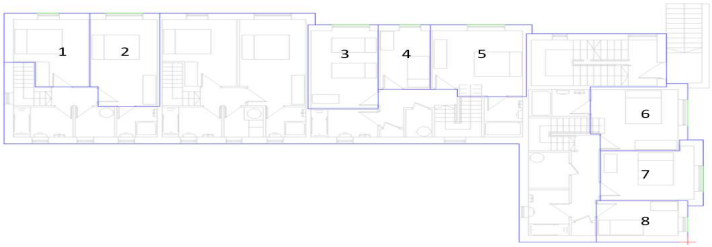
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	5.64	✓	100	100	✓	100	✓
	2	LKD	2.94	✓	100	100	✓	100	✓
	3	LKD	3.09	✓	100	100	✓	100	✓
L01	1	Bedroom	2.48	✓	100	100	✓	100	✓
	2	Bedroom	3.69	✓	100	100	✓	100	✓
	3	Bedroom	3.71	✓	100	100	✓	100	✓
	4	Bedroom	3.26	✓	97.06	100	✓	100	✓
	5	Bedroom	3.59	✓	100	100	✓	100	✓
	6	Bedroom	3.45	✓	100	100	✓	100	✓
	7	Bedroom	3.92	✓	100	100	✓	100	✓
	8	Bedroom	3.08	✓	100	100	✓	100	✓
L02	1	LKD	4.69	✓	100	100	✓	100	✓
	2	Bedroom	3.70	✓	100	100	✓	100	✓
	3	Bedroom	4.52	✓	100	100	✓	100	✓

12.1.5 Duplex B2

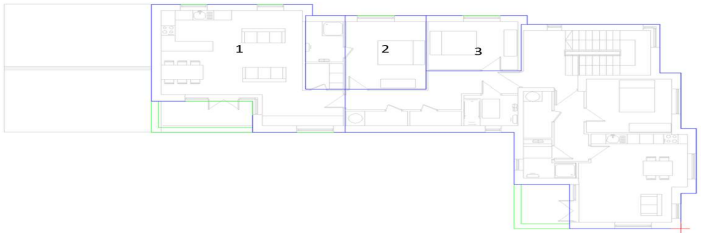
L00



L01



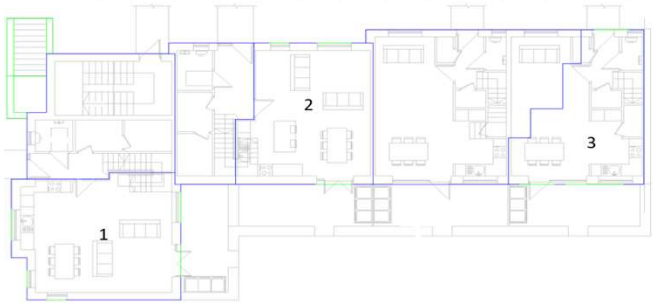
L02



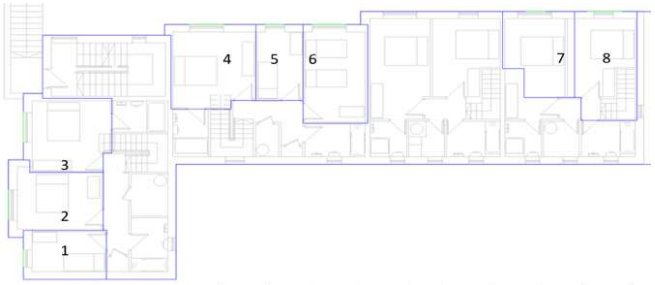
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	4.48	✓	100	100	✓	100	✓
	2	LKD	3.42	✓	100	100	✓	100	✓
	3	LKD	3.17	✓	100	100	✓	100	✓
L01	1	Bedroom	2.55	✓	100	100	✓	100	✓
	2	Bedroom	3.80	✓	100	100	✓	100	✓
	3	Bedroom	3.70	✓	100	100	✓	100	✓
	4	Bedroom	3.37	✓	100	100	✓	100	✓
	5	Bedroom	3.69	✓	100	100	✓	100	✓
	6	Bedroom	3.96	✓	100	100	✓	100	✓
	7	Bedroom	4.37	✓	100	100	✓	100	✓
	8	Bedroom	3.32	✓	100	100	✓	100	✓
L02	1	LKD	4.62	✓	100	100	✓	100	✓
	2	Bedroom	3.78	✓	100	100	✓	100	✓
	3	Bedroom	4.66	✓	100	100	✓	100	✓

12.1.6 Duplex B3

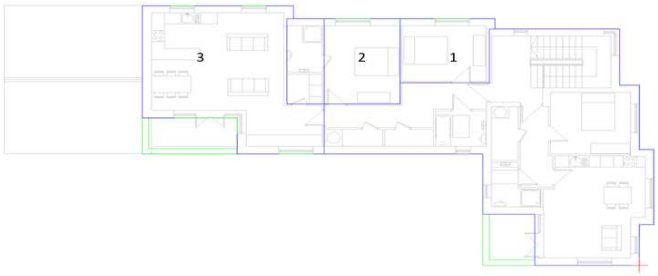
L00



L01



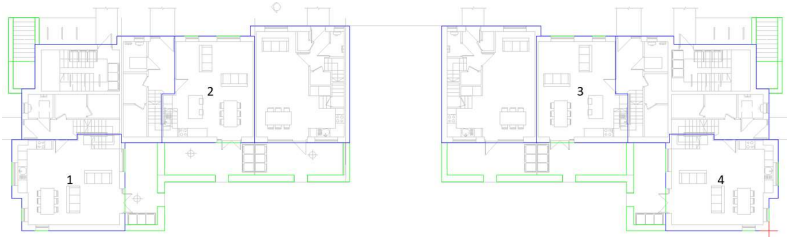
L02



Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	2.99	✓	100	100	✓	100	✓
	2	LKD	2.92	✓	97.7	100	✓	100	✓
	3	LKD	4.46	✓	100	100	✓	100	✓
L01	1	Bedroom	3.03	✓	100	100	✓	100	✓
	2	Bedroom	3.84	✓	100	100	✓	100	✓
	3	Bedroom	3.65	✓	100	100	✓	100	✓
	4	Bedroom	3.68	✓	100	100	✓	100	✓
	5	Bedroom	3.35	✓	100	100	✓	100	✓
	6	Bedroom	3.67	✓	100	100	✓	100	✓
	7	Bedroom	3.72	✓	100	100	✓	100	✓
	8	Bedroom	2.53	✓	100	100	✓	100	✓
L02	1	Bedroom	4.65	✓	100	100	✓	100	✓
	2	Bedroom	3.73	✓	100	100	✓	100	✓
	3	LKD	4.62	✓	100	100	✓	100	✓

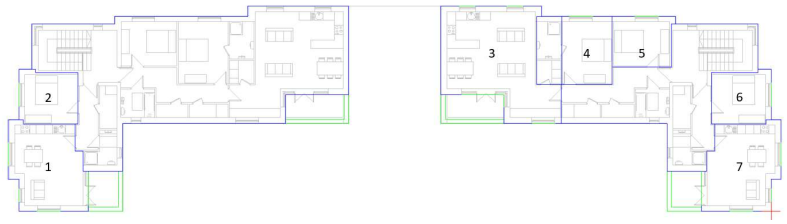
12.1.7 Duplex B4 & B5

L00



L01

L02

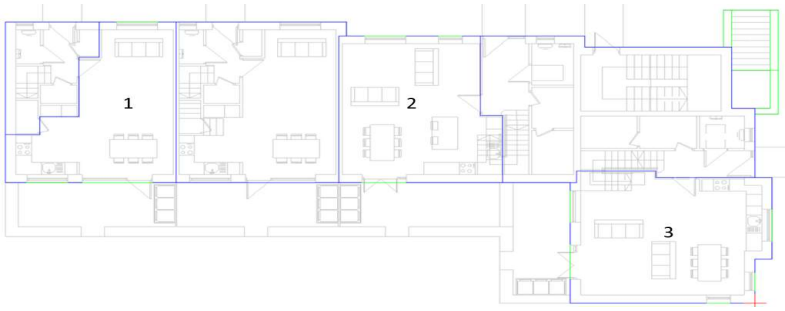


Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	3.78	✓	100	100	✓	100	✓
	2	LKD	3.32	✓	100	100	✓	100	✓
	3	LKD	3.47	✓	100	100	✓	100	✓
	4	LKD	4.14	✓	100	100	✓	100	✓
L01	1	Bedroom	3.41	✓	100	100	✓	100	✓
	2	Bedroom	4.33	✓	100	100	✓	100	✓
	3	Bedroom	4.03	✓	100	100	✓	100	✓
	4	Bedroom	3.56	✓	100	100	✓	100	✓
	5	Bedroom	3.17	✓	100	100	✓	100	✓
	6	Bedroom	3.48	✓	100	100	✓	100	✓
	7	Bedroom	3.57	✓	100	100	✓	100	✓
	8	Bedroom	3.36	✓	100	100	✓	100	✓
	9	Bedroom	3.94	✓	100	100	✓	100	✓
	10	Bedroom	3.51	✓	100	100	✓	100	✓
	11	Bedroom	3.93	✓	100	100	✓	100	✓
	12	Bedroom	3.24	✓	100	100	✓	100	✓
L02	1	LKD	7.14	✓	100	100	✓	100	✓
	2	Bedroom	4.43	✓	100	100	✓	100	✓
	3	LKD	4.76	✓	92.01	100	✓	100	✓

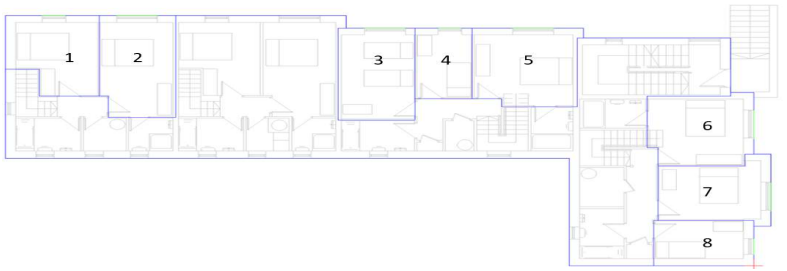
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
	4	Bedroom	3.69	✓	100	100	✓	100	✓
	5	Bedroom	4.56	✓	100	100	✓	100	✓
	6	Bedroom	3.90	✓	100	100	✓	100	✓
	7	LKD	6.96	✓	100	100	✓	100	✓

12.1.8 Duplex B6

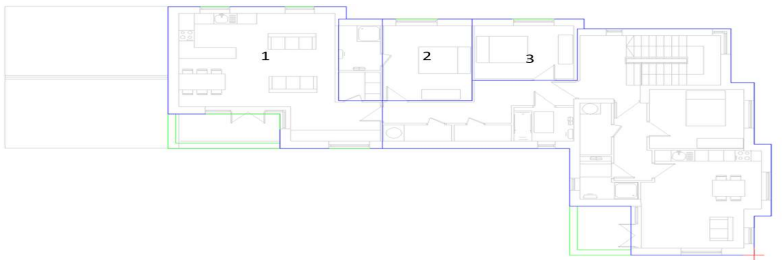
L00



L01



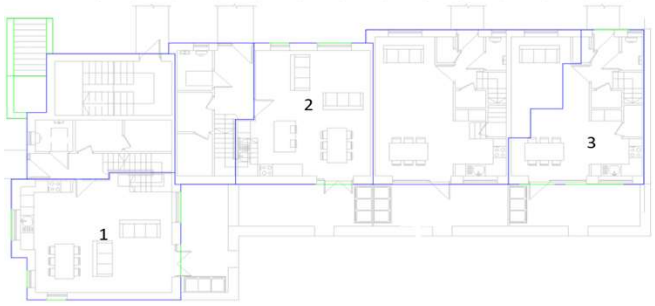
L02



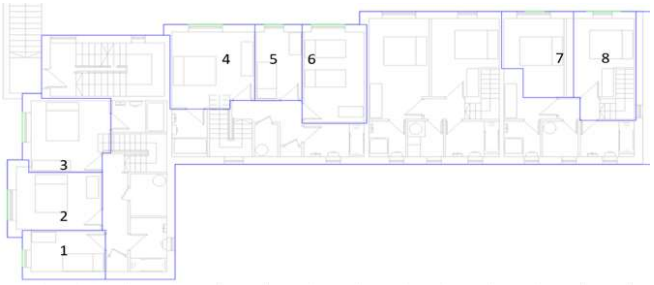
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	4.32	✓	100	100	✓	100	✓
	2	LKD	2.60	✓	98.83	100	✓	100	✓
	3	LKD	3.26	✓	100	100	✓	100	✓
L01	1	Bedroom	2.40	✓	100	100	✓	100	✓
	2	Bedroom	3.56	✓	100	100	✓	100	✓
	3	Bedroom	3.47	✓	100	100	✓	100	✓
	4	Bedroom	3.13	✓	100	100	✓	100	✓
	5	Bedroom	3.45	✓	100	100	✓	100	✓
	6	Bedroom	4.09	✓	100	100	✓	100	✓
	7	Bedroom	4.43	✓	100	100	✓	100	✓
	8	Bedroom	3.45	✓	100	100	✓	100	✓
L02	1	LKD	4.66	✓	100	100	✓	100	✓
	2	Bedroom	3.63	✓	100	100	✓	100	✓
	3	Bedroom	4.41	✓	100	100	✓	100	✓

12.1.9 Duplex B7

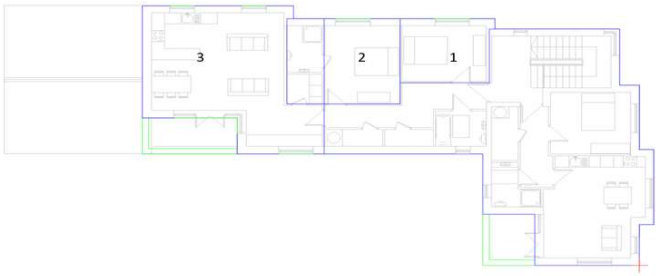
L00



L01



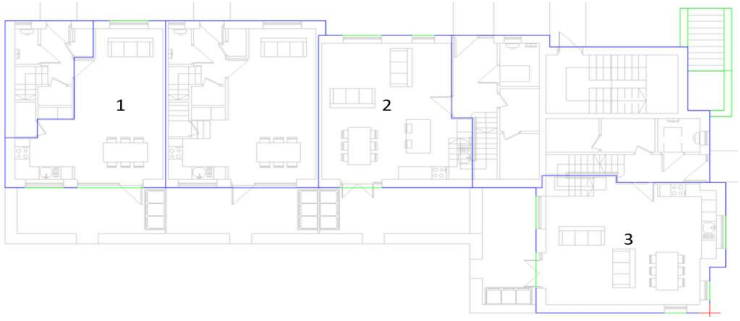
L02



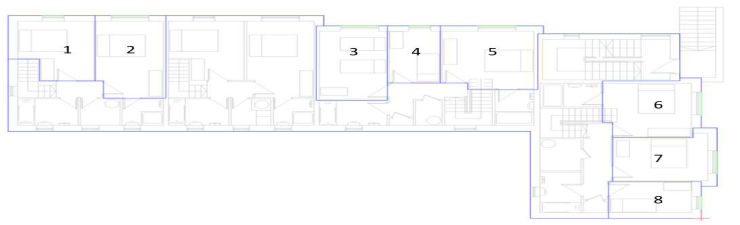
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	3.11	✓	100	100	✓	100	✓
	2	LKD	2.38	✓	95.85	100	✓	100	✓
	3	LKD	4.13	✓	100	100	✓	100	✓
L01	1	Bedroom	3.26	✓	100	100	✓	100	✓
	2	Bedroom	4.15	✓	93.45	100	✓	100	✓
	3	Bedroom	3.83	✓	100	100	✓	100	✓
	4	Bedroom	3.27	✓	100	100	✓	100	✓
	5	Bedroom	2.92	✓	100	100	✓	100	✓
	6	Bedroom	3.18	✓	100	100	✓	100	✓
	7	Bedroom	3.29	✓	100	100	✓	100	✓
	8	Bedroom	2.31	✓	100	100	✓	100	✓
L02	1	Bedroom	4.30	✓	100	100	✓	100	✓
	2	Bedroom	3.44	✓	100	100	✓	100	✓
	3	LKD	4.51	✓	100	100	✓	100	✓

12.1.10 Duplex B8

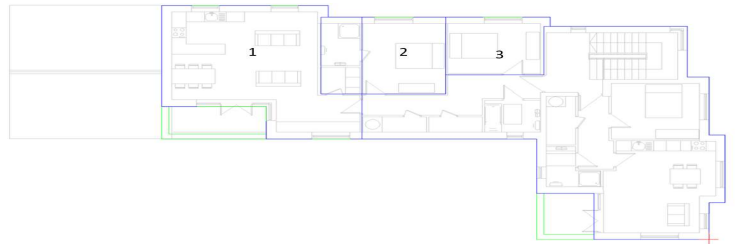
L00



L01



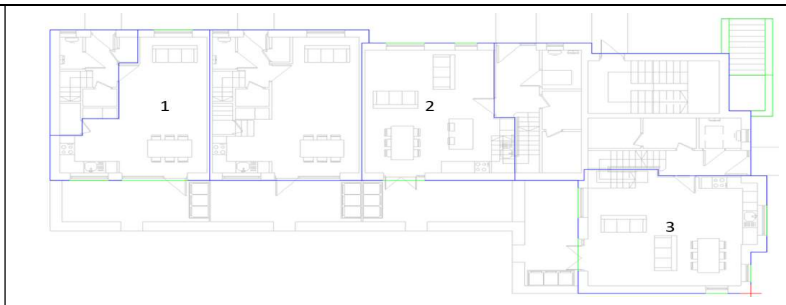
L02



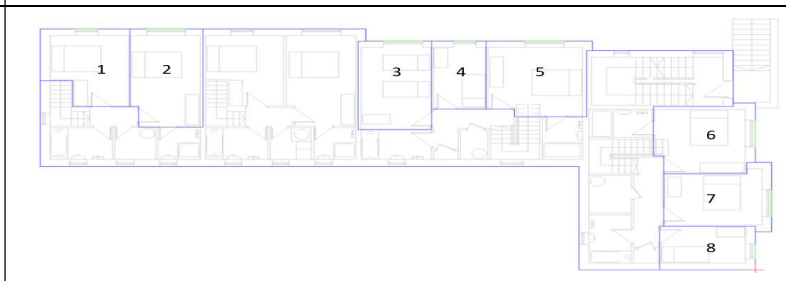
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Com ment
L00	1	LKD	4.41	✓	100	100	✓	100	✓
	2	LKD	2.65	✓	100	100	✓	100	✓
	3	LKD	3.06	✓	100	100	✓	100	✓
L01	1	Bedroom	2.58	✓	100	100	✓	100	✓
	2	Bedroom	3.77	✓	100	100	✓	100	✓
	3	Bedroom	3.54	✓	100	100	✓	100	✓
	4	Bedroom	3.18	✓	100	100	✓	100	✓
	5	Bedroom	3.46	✓	100	100	✓	100	✓
	6	Bedroom	3.77	✓	100	100	✓	100	✓
	7	Bedroom	4.08	✓	100	100	✓	100	✓
	8	Bedroom	3.23	✓	100	100	✓	100	✓
L02	1	LKD	4.70	✓	100	100	✓	100	✓
	2	Bedroom	3.69	✓	100	100	✓	100	✓
	3	Bedroom	4.43	✓	100	100	✓	100	✓

12.1.11 Duplex B9

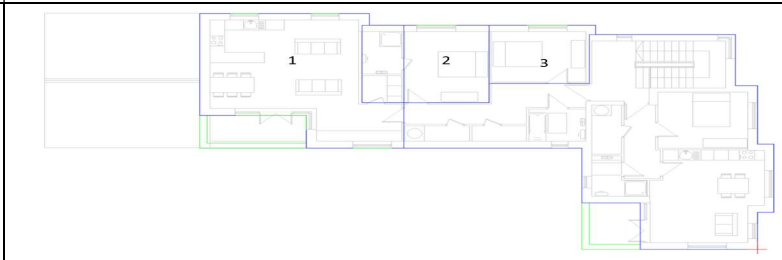
L00



L01



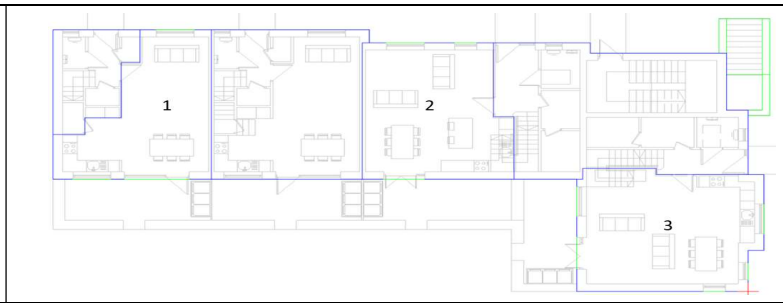
L02



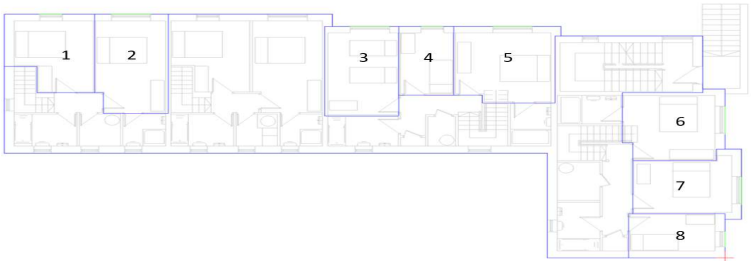
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	4.39	✓	100	100	✓	100	✓
	2	LKD	2.76	✓	100	100	✓	100	✓
	3	LKD	3.01	✓	100	100	✓	100	✓
L01	1	Bedroom	2.59	✓	100	100	✓	100	✓
	2	Bedroom	3.82	✓	100	100	✓	100	✓
	3	Bedroom	3.70	✓	100	100	✓	100	✓
	4	Bedroom	3.33	✓	100	100	✓	100	✓
	5	Bedroom	3.67	✓	100	100	✓	100	✓
	6	Bedroom	3.26	✓	100	100	✓	100	✓
	7	Bedroom	3.99	✓	100	100	✓	100	✓
	8	Bedroom	3.27	✓	100	100	✓	100	✓
L02	1	LKD	4.71	✓	100	100	✓	100	✓
	2	Bedroom	3.78	✓	100	100	✓	100	✓
	3	Bedroom	4.60	✓	100	100	✓	100	✓

12.1.12 Duplex B10

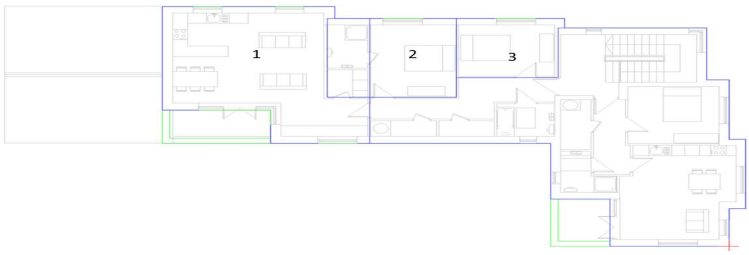
L00



L01



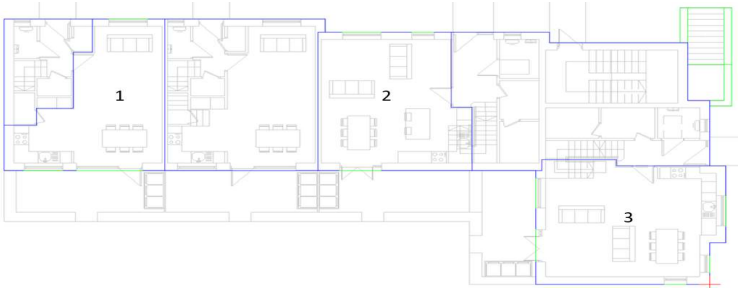
L02



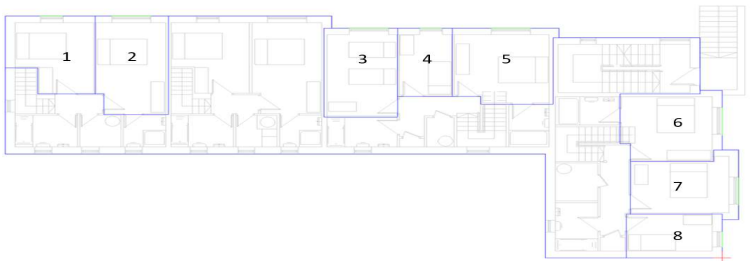
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	4.38	✓	100	100	✓	100	✓
	2	LKD	2.73	✓	100	100	✓	100	✓
	3	LKD	3.06	✓	100	100	✓	100	✓
L01	1	Bedroom	2.66	✓	100	100	✓	100	✓
	2	Bedroom	3.91	✓	100	100	✓	100	✓
	3	Bedroom	3.81	✓	100	100	✓	100	✓
	4	Bedroom	3.43	✓	100	100	✓	100	✓
	5	Bedroom	3.80	✓	100	100	✓	100	✓
	6	Bedroom	4.06	✓	100	100	✓	100	✓
	7	Bedroom	4.36	✓	100	100	✓	100	✓
	8	Bedroom	3.35	✓	100	100	✓	100	✓
L02	1	LKD	4.68	✓	98.59	100	✓	100	✓
	2	Bedroom	3.88	✓	100	100	✓	100	✓
	3	Bedroom	4.73	✓	100	100	✓	100	✓

12.1.13 Duplex B11

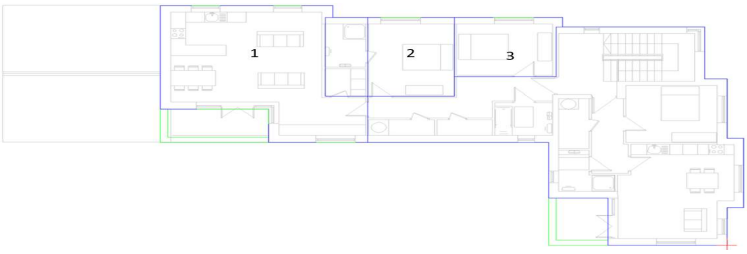
L00



L01



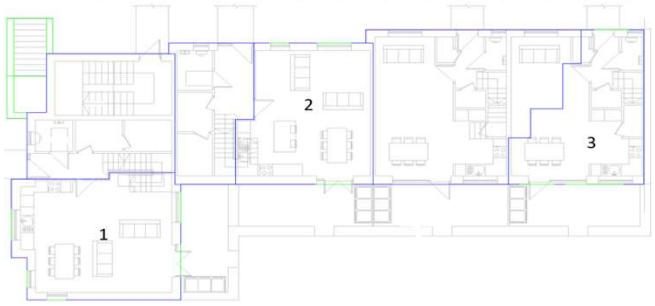
L02



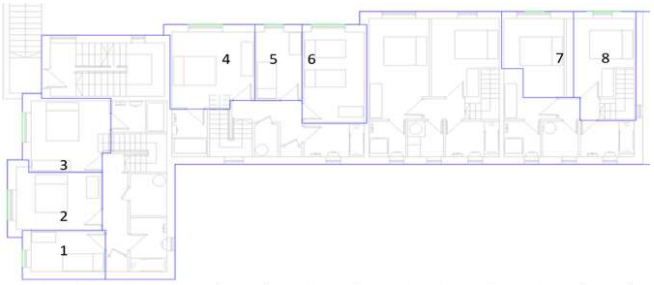
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	4.31	✓	100	100	✓	100	✓
	2	LKD	2.59	✓	100	100	✓	100	✓
	3	LKD	3.15	✓	100	100	✓	100	✓
L01	1	Bedroom	2.45	✓	95.03	100	✓	100	✓
	2	Bedroom	3.63	✓	100	100	✓	100	✓
	3	Bedroom	3.52	✓	100	100	✓	100	✓
	4	Bedroom	3.18	✓	100	100	✓	100	✓
	5	Bedroom	3.46	✓	100	100	✓	100	✓
	6	Bedroom	4.02	✓	100	100	✓	100	✓
	7	Bedroom	4.36	✓	100	100	✓	100	✓
	8	Bedroom	3.35	✓	100	100	✓	100	✓
L02	1	LKD	4.57	✓	100	100	✓	100	✓
	2	Bedroom	3.66	✓	100	100	✓	100	✓
	3	Bedroom	4.44	✓	100	100	✓	100	✓

12.1.14 Duplex B12

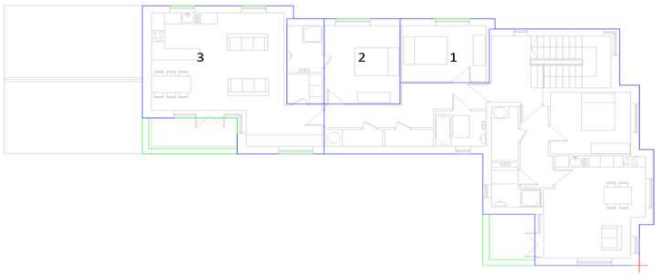
L00



L01



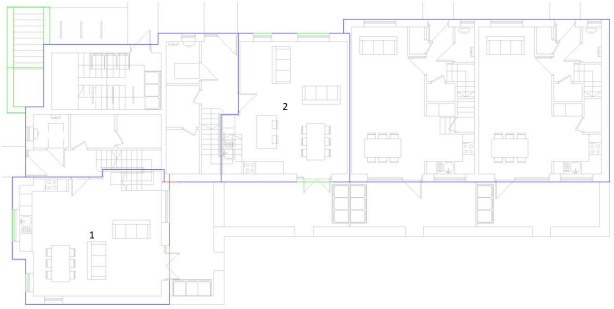
L02



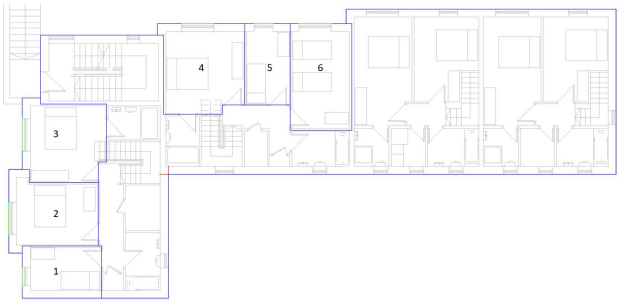
Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	2.94	✓	100	100	✓	100	✓
	2	LKD	2.43	✓	100	100	✓	100	✓
	3	LKD	4.14	✓	100	100	✓	100	✓
L01	1	Bedroom	3.02	✓	100	100	✓	100	✓
	2	Bedroom	3.90	✓	100	100	✓	100	✓
	3	Bedroom	3.69	✓	100	100	✓	100	✓
	4	Bedroom	3.35	✓	100	100	✓	100	✓
	5	Bedroom	2.99	✓	94	100	✓	100	✓
	6	Bedroom	3.28	✓	100	100	✓	100	✓
	7	Bedroom	3.37	✓	100	100	✓	100	✓
	8	Bedroom	2.36	✓	96	100	✓	100	✓
L02	1	Bedroom	4.36	✓	97.15	100	✓	100	✓
	2	Bedroom	3.52	✓	100	100	✓	100	✓
	3	LKD	4.45	✓	100	100	✓	100	✓

12.1.15 Duplex B13

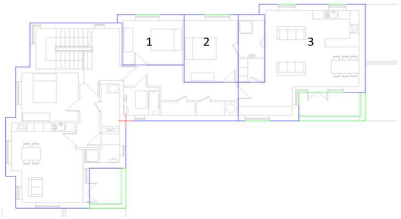
L00



L01

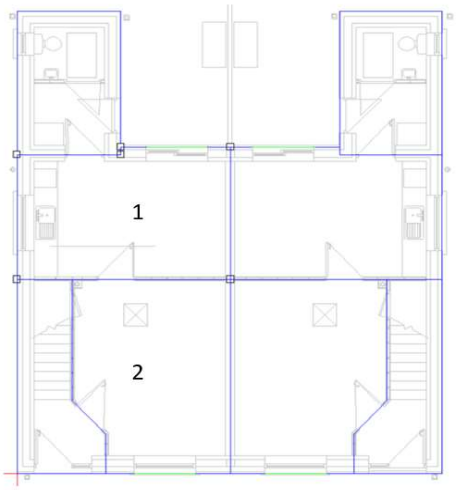


L02

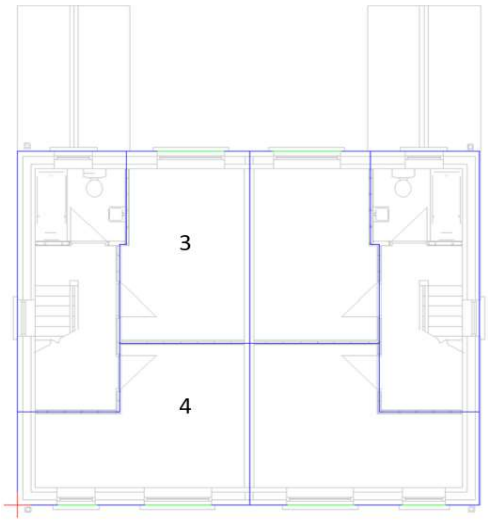


Level	Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide 3rd Edition IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
			ADF (%)	Comment	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Comment	Floor Area > E_T (%)	Comment
L00	1	LKD	2.58	✓	98.76	100	✓	100	✓
	2	LKD	2.64	✓	99.35	100	✓	100	✓
L01	1	Bedroom	2.59	✓	97.98	100	✓	100	✓
	2	Bedroom	4.18	✓	100	100	✓	100	✓
	3	Bedroom	3.81	✓	100	100	✓	100	✓
	4	Bedroom	3.57	✓	100	100	✓	100	✓
	5	Bedroom	3.19	✓	100	100	✓	100	✓
	6	Bedroom	3.52	✓	100	100	✓	100	✓
L02	1	Bedroom	4.53	✓	100	100	✓	100	✓
	2	Bedroom	3.64	✓	92.62	100	✓	100	✓
	3	LKD	4.93	✓	100	100	✓	100	✓

12.1.16 House Type C



L00



L01

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt
1	KD	2.23	✓	45.41	99.13	x	58.81	✓
2	Living	2.38	✓	100	100	✓	100	✓
3	Bedroom	3.13	✓	94.56	100	✓	100	✓
4	Bedroom	5.07	✓	100	100	✓	100	✓

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex	
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt
1	KD	2.46	✓	49.38	100	x	60.17	✓
2	Living	2.42	✓	100	100	✓	100	✓
3	Bedroom	3.26	✓	96.35	100	✓	100	✓
4	Bedroom	5.26	✓	100	100	✓	100	✓

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.57	✓	39.95	90.45	x	56.08	✓	
2	Living	2.64	✓	100	100	✓	100	✓	
3	Bedroom	3.15	✓	100	100	✓	100	✓	
4	Bedroom	5.04	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.32	✓	42.29	99	x	61.94	✓	
2	Living	2.29	✓	100	100	✓	100	✓	
3	Bedroom	3.27	✓	100	100	✓	100	✓	
4	Bedroom	5.08	✓	100	100	✓	100	✓	

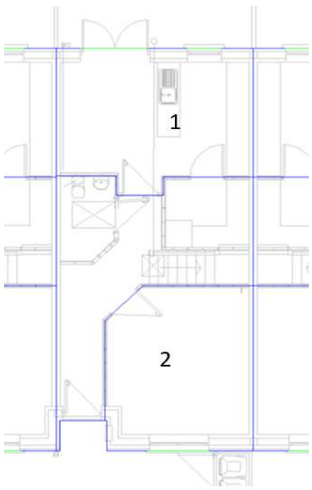
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.33	✓	43.28	99.25	x	61.94	✓	
2	Living	2.25	✓	100	100	✓	100	✓	
3	Bedroom	3.28	✓	100	100	✓	100	✓	
4	Bedroom	5.00	✓	100	100	✓	100	✓	

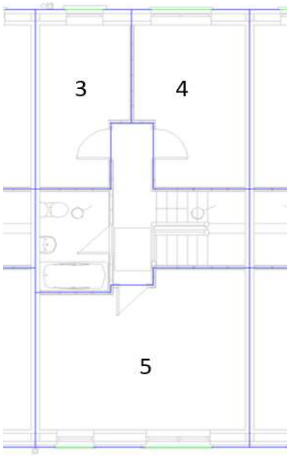
Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.19	✓	44.73	98.14	x	59.36	✓	
2	Living	2.38	✓	100	100	✓	100	✓	
3	Bedroom	3.09	✓	100	100	✓	100	✓	
4	Bedroom	5.04	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.62	✓	54.7	100	✓	76.11	✓	
2	Living	2.66	✓	100	100	✓	100	✓	
3	Bedroom	3.14	✓	100	100	✓	100	✓	
4	Bedroom	5.08	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	2.75	✓	49.31	100	x	67.55	✓	
2	Living	2.40	✓	100	100	✓	100	✓	
3	Bedroom	3.25	✓	100	100	✓	100	✓	
4	Bedroom	5.18	✓	100	100	✓	100	✓	

12.1.17 House Type E





L00	L01

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.04	✓	100	100	✓	100	✓	
2	Living	2.96	✓	100	100	✓	100	✓	
3	Bedroom	2.34	✓	98.88	100	✓	100	✓	
4	Bedroom	3.12	✓	100	100	✓	100	✓	
5	Bedroom	3.53	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.72	✓	100	100	✓	100	✓	
2	Living	3.32	✓	100	100	✓	100	✓	
3	Bedroom	2.34	✓	73.13	100	✓	100	✓	
4	Bedroom	3.08	✓	100	100	✓	100	✓	
5	Bedroom	3.54	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.69	✓	100	100	✓	100	✓	
2	Living	3.26	✓	100	100	✓	100	✓	
3	Bedroom	2.34	✓	98.88	100	✓	100	✓	
4	Bedroom	3.1	✓	100	100	✓	100	✓	
5	Bedroom	3.52	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.77	✓	100	100	✓	100	✓	
2	Living	3.28	✓	92.56	100	✓	100	✓	
3	Bedroom	2.38	✓	100	100	✓	100	✓	
4	Bedroom	3.09	✓	100	100	✓	100	✓	
5	Bedroom	3.55	✓	98.18	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.23	✓	100	100	✓	100	✓	
2	Living	3.23	✓	100	100	✓	100	✓	
3	Bedroom	2.36	✓	100	100	✓	100	✓	
4	Bedroom	3.13	✓	100	100	✓	100	✓	
5	Bedroom	3.53	✓	100	100	✓	100	✓	

Ref.	Room Activity	BRE Guide 2nd Edition BS 8206:2008		BRE Guide (3rd Edition) IS EN 17037:2018 Method 2			BRE Guide 3rd Edition BS EN 17037:2018 Method 2 National Annex		
		ADF (%)	Cmt	Floor Area > E_T (%)	Floor Area > E_{TM} (%)	Cmt	Floor Area > E_T (%)	Cmt	
1	KD	4.40	✓	100	100	✓	100	✓	
2	Living	3.22	✓	100	100	✓	100	✓	
3	Bedroom	2.26	✓	100	100	✓	100	✓	
4	Bedroom	3.07	✓	100	100	✓	100	✓	
5	Bedroom	3.49	✓	100	100	✓	100	✓	

13 Appendix B – Sunlight Exposure Results

13.1 Sunlight Exposure Results

The IS EN 17037:2018 (BRE Guide 3rd Edition) sunlight exposure results tabulated in Section 8.2 for the proposed development are visually represented in the following images. The windows highlighted in “red” achieve the minimum 1.5 hours of recommended sunlight on March 21st, while the windows highlighted in “blue” do not achieve the recommended value.

13.1.1 View 01 – Duplex A

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

18 out of 18 windows passing

13.1.2 View 02 – Duplex A

Receives more than 1.5 hours of sunlight

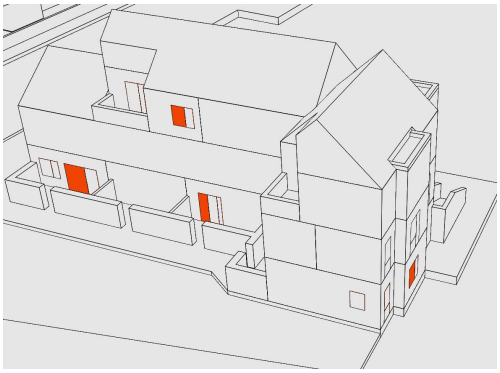
Receives less than 1.5 hours of sunlight

6 out of 6 windows passing

13.1.3 View 03 – Duplex B1

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight



4 out of 4 windows passing

13.1.4 View 04 – Duplexes B2 & B3

Receives more than 1.5 hours of sunlight

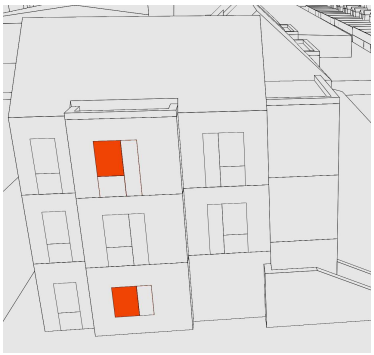
Receives less than 1.5 hours of sunlight

8 out of 8 windows passing

13.1.5 View 05 – Duplex B4 & B5

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

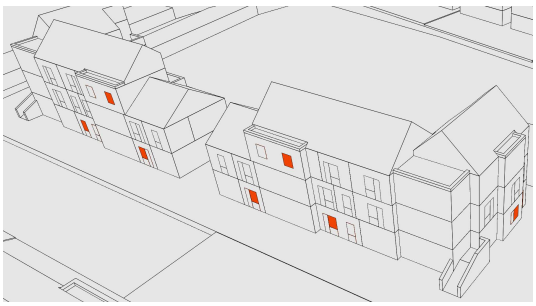


7 out of 7 windows passing

13.1.6 View 06 – Duplexes B6 & B7

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

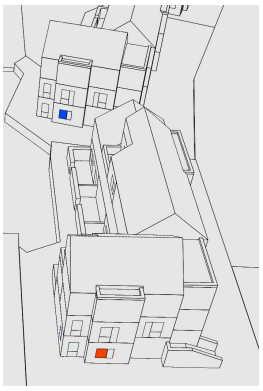


8 out of 8 windows passing

13.1.7 Views 07 – Duplexes B8, B9 & B10

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight



11 out of 12 windows passing

13.1.8 View 08 – Duplexes B11 & B12

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

8 out of 8 windows passing

13.1.9 View 09 – Duplex B13

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

3 out of 3 windows passing

13.1.1 View 10 – House Type C

ceives more than 1.5 hours of sunlight

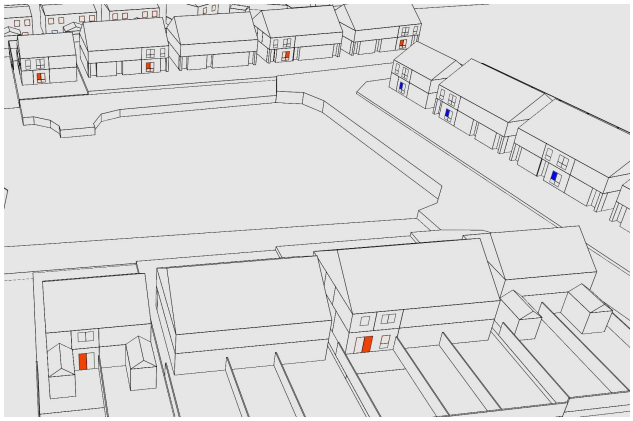
Receives less than 1.5 hours of sunlight

5 out of 10 windows passing

13.1.2 View 11 – House Type C & E

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight

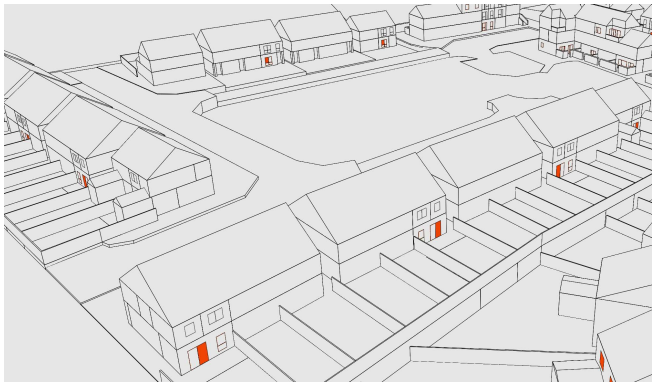


6 out of 9 windows passing

13.1.3 View 12 – House Type C & E

Receives more than 1.5 hours of sunlight

Receives less than 1.5 hours of sunlight



9 out of 9 windows passing