Report for: Glenveagh Living Limited
Project No: 14194

Knocknacarra District Centre, Rahoon, Galway

Daylight, Sunlight and Overshadowing Study

Document created by:

Integrated Environmental Solutions Limited

International Sustainability Consulting Developers of the IES **<Virtual Environment>**

Issued For:	**Prepared by:**	**Checked by:**	
Comment	Eirini Mouroutsou Project Consultant	Douglas Bell Project Manager	
Version:	**Date:**	**Revision Details:**	**Approved by:**
8	17/10/2019	Final Report	John Gleeson

Contents

Executive Summary

This report was completed to quantify the Sunlight / Daylight performance of the proposed development both in terms of performance within the proposed development and on the following neighbouring properties:

- Gateway - Phase 1
- Gaelscoil Mhic Amhlaigh Primary School
- Dwellings located to the East

The following can be concluded based on the studies undertaken.

Daylight Analysis of existing buildings (outside the site boundary)

For the following locations considered:

- **Gaelscoil Mhic Amhlaigh Primary School – Educational**
  - 13 out of 19 classrooms have a VSC value greater than 27%. For the rest of the spaces, given that there are dual and triple aspect rooms receiving sunlight from unobstructed views and all of the remaining points have larger than conventional windows on the building, as such they receive adequate daylight in line with BRE guidance.
- **Gort Na Bró Dwellings – Residential**
  - All of the points tested have a vertical sky component value of at least 27% or no less than 0.80 that of the value for the existing situation and therefore exceed the BRE recommendations.

Sunlight to the Existing and Proposed Amenity Spaces

As mentioned above under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that 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 the 21st of March.

Existing Amenity Areas (out with the site boundary):

The images within the sunlight to amenities section of this report (section 6) highlight that all of the Gort Na Bró dwellings rear gardens would continue to receive at least 2 hours of sunlight over half of the amenity on the 21st of March and therefore exceed the BRE recommendations. The images highlight that the proposed development has little to no effect on the amount of sunlight received to these exiting rear gardens.

Proposed Amenity Spaces:

The images of the proposed development highlight the proposed scheme amenity areas would exceed this BRE recommendations stated above and would receive excellent levels of sunlight throughout the year.

Average Daylight Factors

BRE guidelines recommend a daylight factor of 1.0 in bedrooms and 1.5 in living.

We have tested daylight levels of the worst-case apartments of which 96% have Average Daylight Factors (ADF) above the recommendations of the BRE guidelines.

As mentioned the daylight levels have been tested on the worst-case apartments located on the Ground, First and Second Floors of the proposed development and therefore the overall percentage would increase to in excess of 98% if we included all the apartments within the development i.e. those located on the third, fourth and fifth floors.

Discussion

It should be noted that the guidance in 'Site layout planning for daylight and sunlight: a guide to good practice' is not mandatory and the Report 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.

Whilst the results shown relate to the criteria as laid out in the BRE guidance targets it is important to note that the BRE targets have been drafted primarily for use in low density suburban development and should therefore be used with flexibility and caution when dealing other types of sites. Despite this, the site performs well in relation to the metrics considered in this report.

Overall, the results demonstrate that the proposed development performance predominantly exceed the BRE recommendations from the BRE ‘Site Layout Planning for Daylight and Sunlight’ guide, sometimes referred to as BRE Digest 209.

1 Introduction

This report was complete to quantify the Sunlight / Daylight impact of the proposed mixed-use development on the following areas:

- Gateway - Phase 1
- Gaelscoil Mhic Amhlaigh Primary School
- Dwellings located to the East

The focus of the study considers the following items with respect to the proposed new development:

- **Shadow Analysis** - A visual representation analysing any potential changes that may arise from the proposed development on to the neighbouring existing developments.
- **Daylight Analysis of Existing Buildings** - via consideration of Vertical sky component (VSC).
- **Sunlight to the Existing and Proposed Amenity Spaces** – via annual sunlight hours comparison.
- **Average Daylight Factors** – analysis of internal daylight levels of the proposed development.

The analysis was completed using the IES VE software.

The assessment is based on recommendations given in BRE – Site Layout Planning for Daylight and Sunlight guide.

2 Methodology

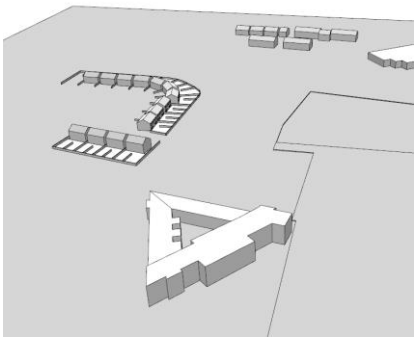
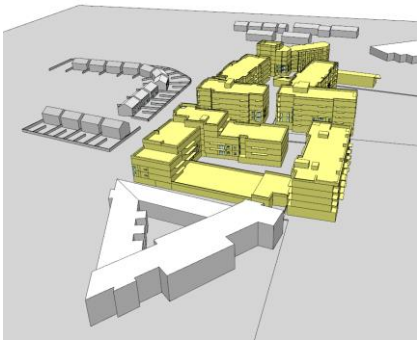
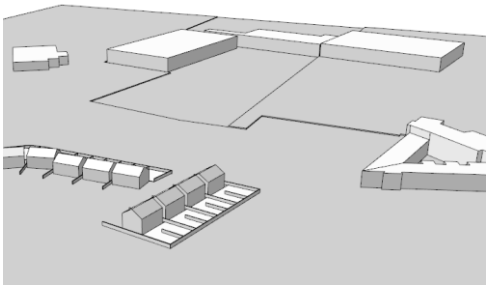
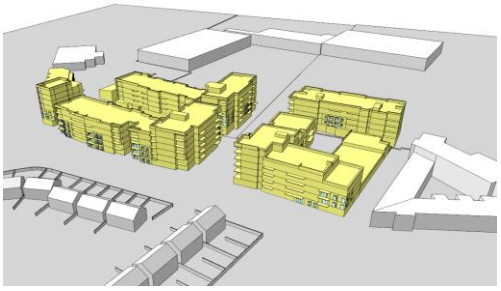
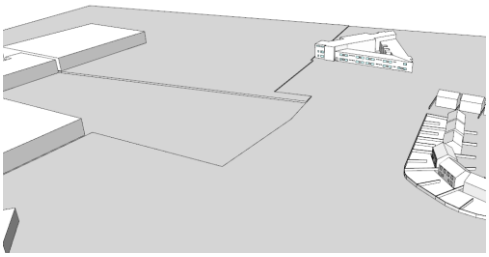
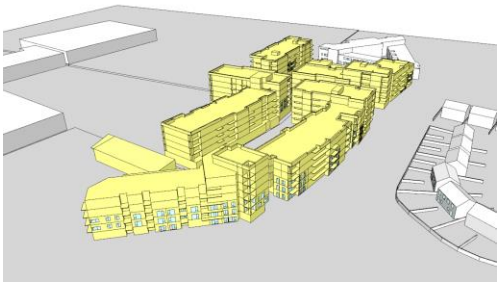
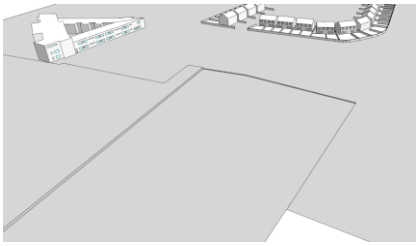
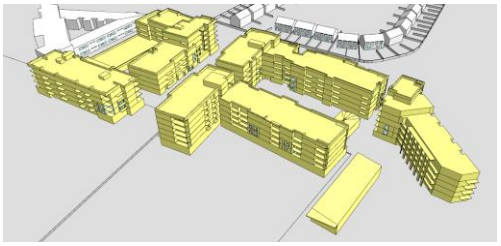
2.1 Orientation

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

Orientation
 
 

2.2 Proposed models

The following images show the models created for use across various views:

	Existing Situation	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		

2.3 Potential Sensitive Receptors

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

	Gaelscoil Mhic Amhlaigh Primary School – Educational
	Gort Na Bró Dwellings – Residential

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

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

The BRE Report, Site layout planning for daylight and sunlight: a guide to good practice (BR209), advises on planning developments for good access to daylight and sunlight, and is widely used by local authorities to help determine the impacts of new developments.

3.1 Impact classification discussion

BRE guidance in Appendix I – Environmental Impact Assessment suggests impact classifications as minor, moderate and major adverse. It provides further classifications of these impacts with respect to criteria as follows;

Negligible to minor adverse impacts	*Fully meets guidelines in BRE report*
Negligible adverse impact	• *Loss of light well within guidelines, or* • *only a small number of windows or limited area of open space losing light (within the guidelines)*
Minor adverse impact (a)	• *Loss of light only just within guidelines, or* • *A large number of windows or large areas of open space areas 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 only has a low level requirement for skylight or sunlight* • *there are particular reason 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 only 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)*

3.2 Conventional Windows

The BRE Guide talks about Conventional window design based on the discussions around these it could be determined that this term refers to windows typical with a sill height of 800mm – 1000mm as shown in the images below.

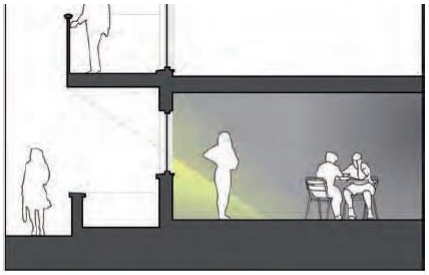


Figure 10: Balconies and projecting access ways can restrict daylight to rooms lit by windows below them

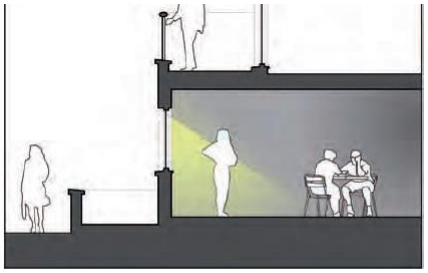
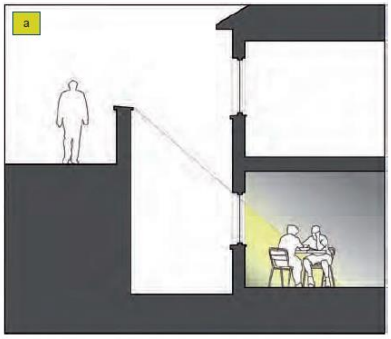
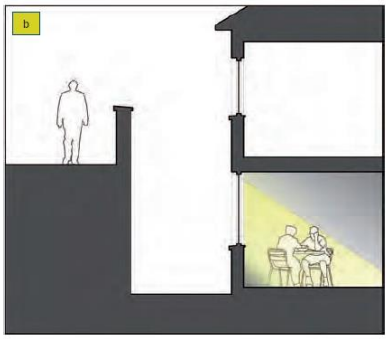


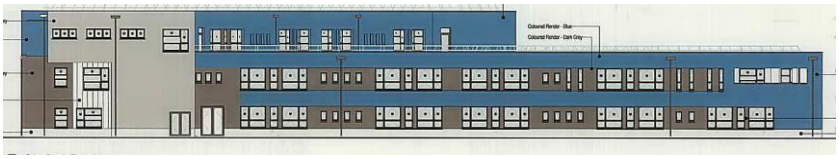
Figure 11: Section showing stepped back rooftop access ways. This gives improved daylight compared to a conventional section (see Figure 10).

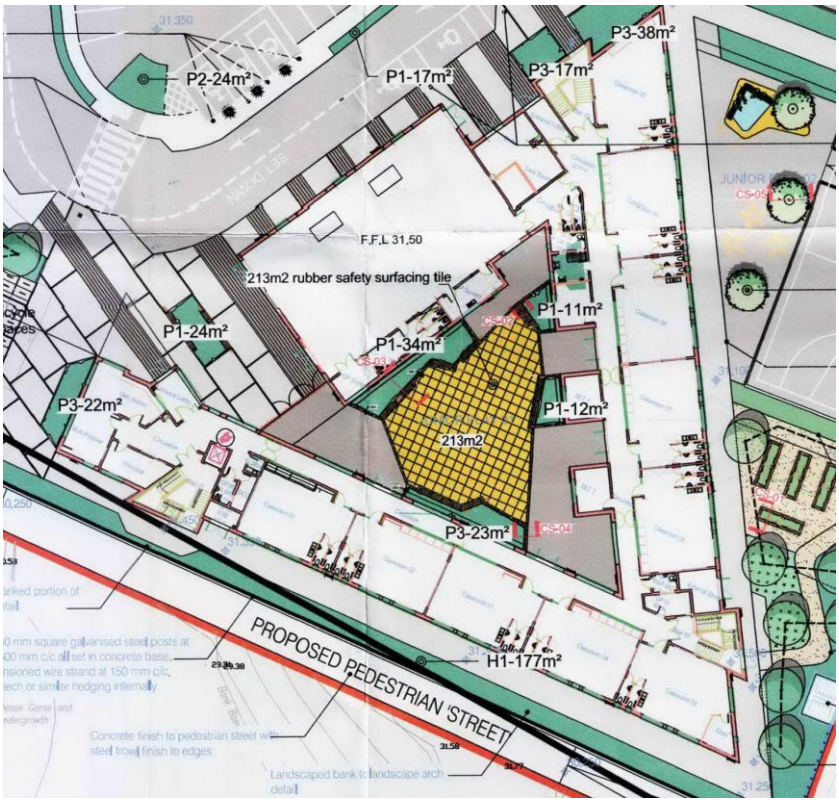




3.2.1 Windows on adjacent properties

Windows shown on Gaelscoil Mhic Amhlaigh Primary School appear to be larger than conventional windows.





4 Shadow Analysis

The statistics of Met Eireann, the Irish Meteorological Service, show that the sunniest months in **Galway** 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 1.6 hours of sunlight out of a potential 8.1 hours sunlight each day is received (i.e. only 20% of potential sunlight hours).
- During June a mean daily duration of 5.2 hours of sunlight out of a potential 15.8 hours sunlight each day is received (i.e. only 33% of potential sunlight hours).

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

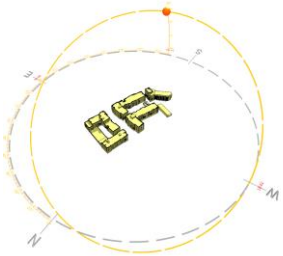
This section will consider the shadows cast for the Proposed development for the following dates;

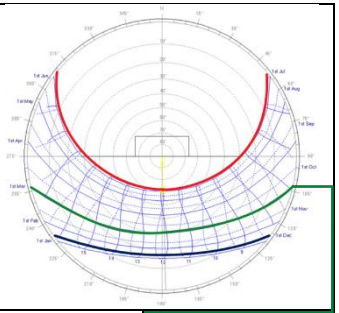
- December 21st (Winter Solstice)
- March 21st / September 21st (Equinox)
- June 21st (Summer solstice)

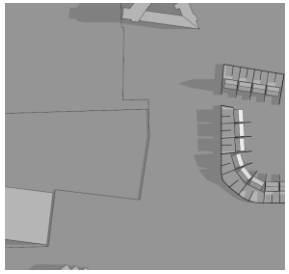
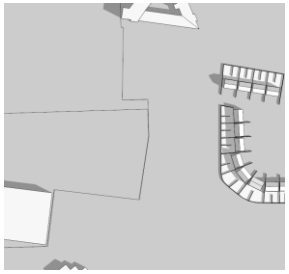
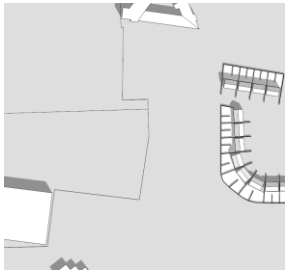
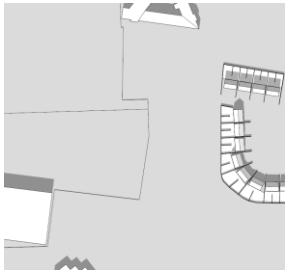
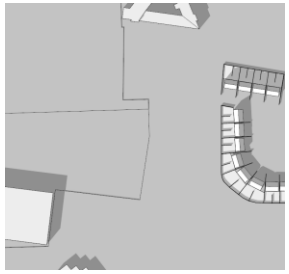
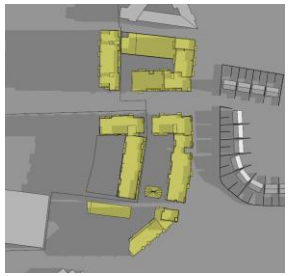
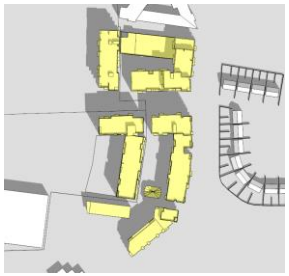
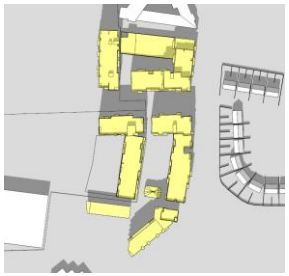
These images will show shadows cast for 'perfect sunny' conditions with no clouds and assumed that the sun is out for every hour shown. Given the discussion above it is important to remember that this is not always going to be the case.

4.1 Plan View

4.1.1 March 21st





					Existing Situation
					Proposed Scheme
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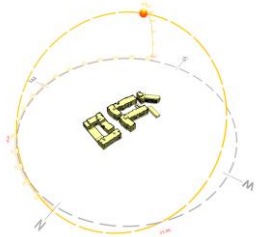
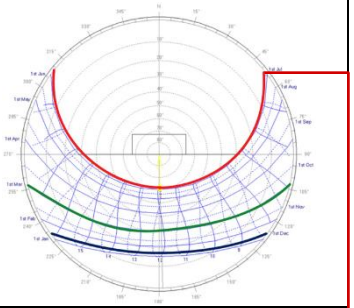
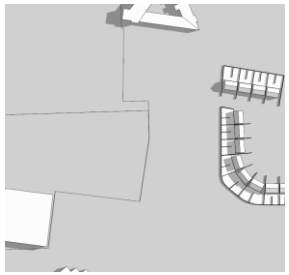
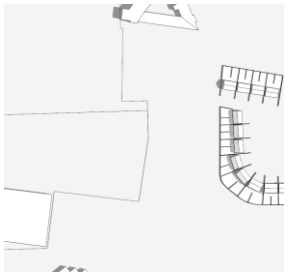
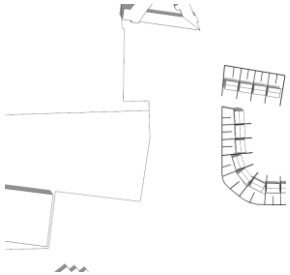
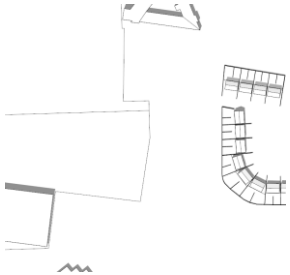
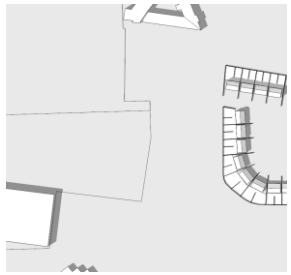
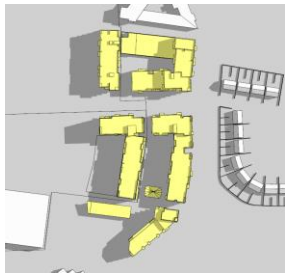
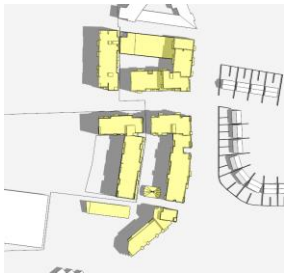
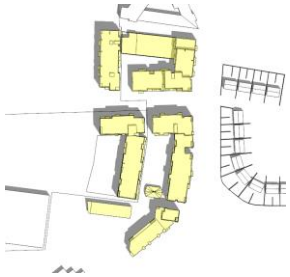
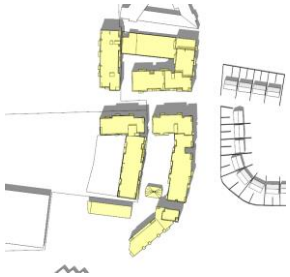
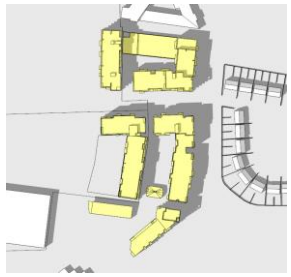
4.1.2 June 21st





					**Existing Situation**
					**Proposed Development**
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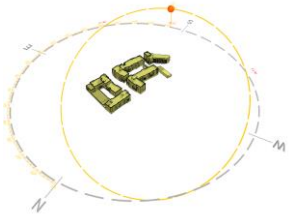
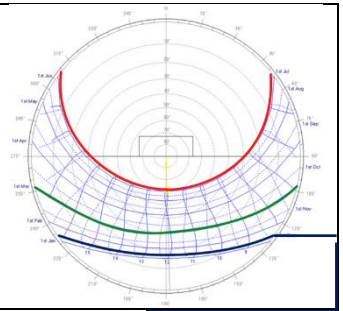
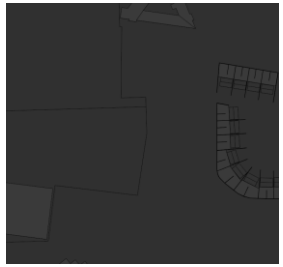
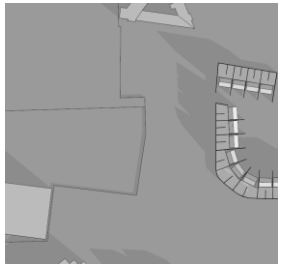
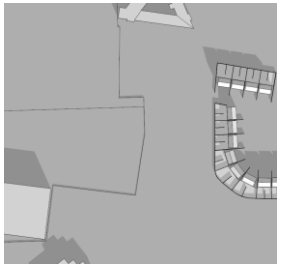
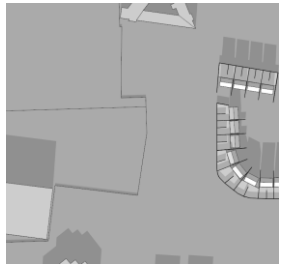
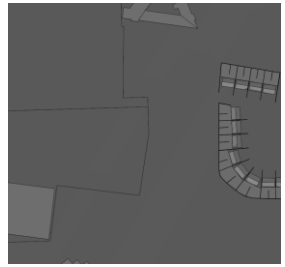
4.1.3 December 21st





					**Existing Situation**
					**Proposed Scheme**
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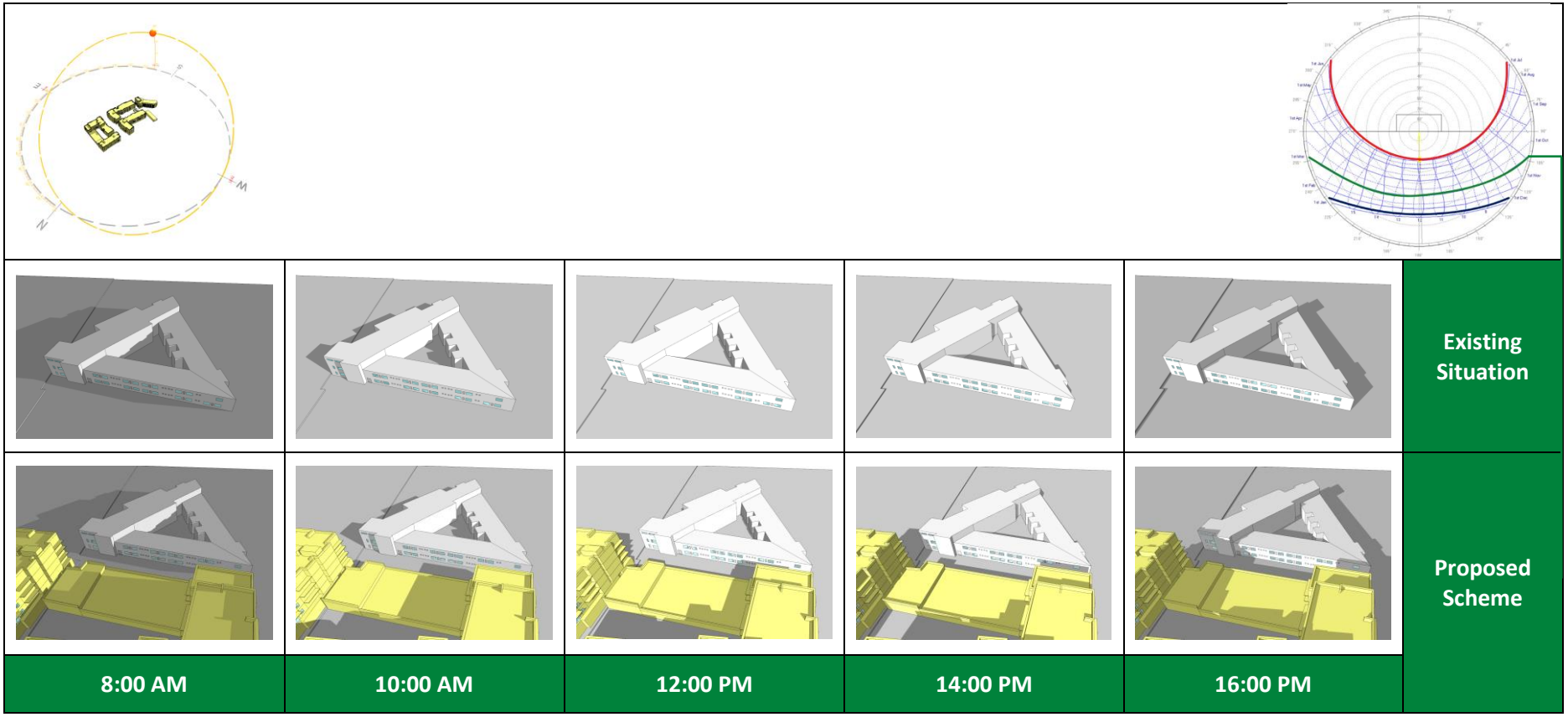
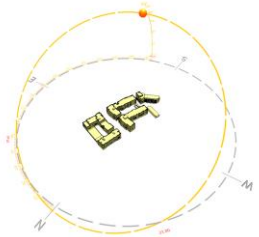
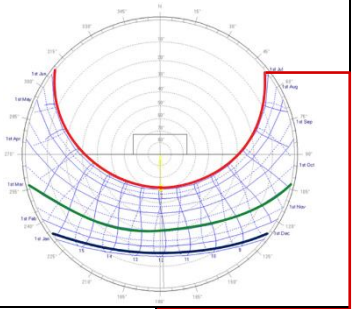
4.2 View 01: Looking over Gaelscoil Mhic Amhlaigh Primary School

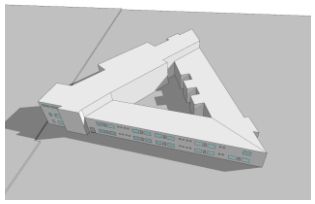
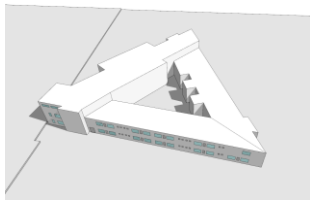
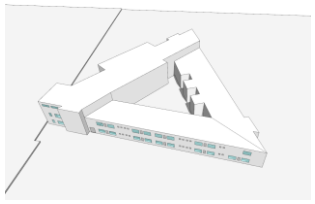
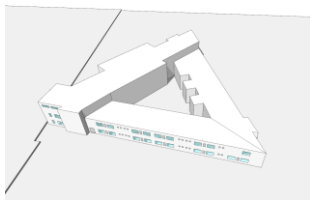
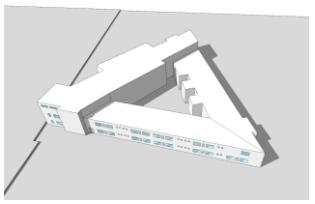
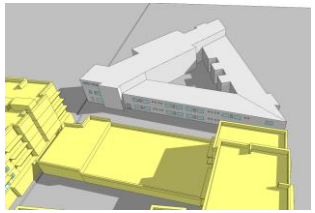
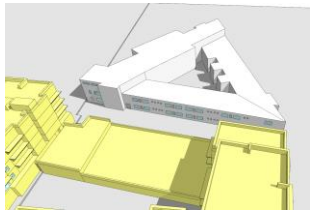
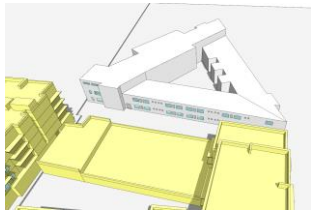
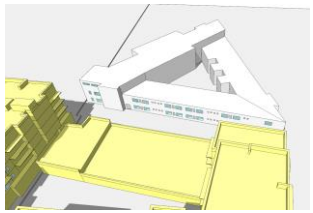
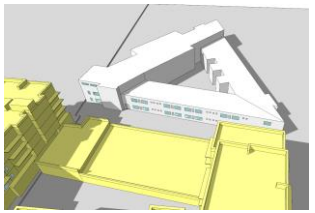
4.2.1 March 21st



4.2.2 June 21st





					**Existing Situation**
					**Proposed Development**
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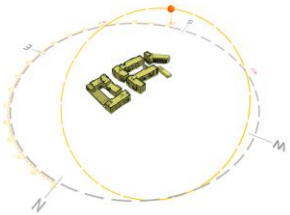
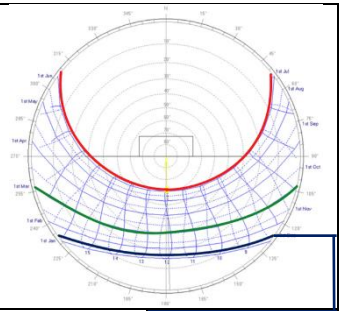
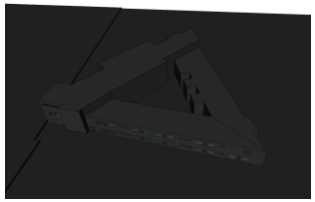
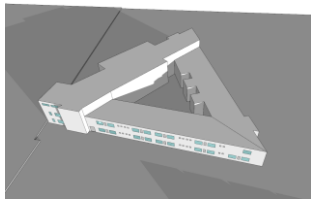
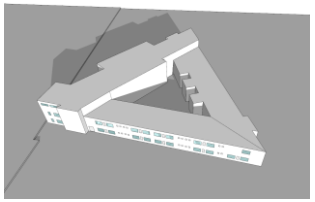
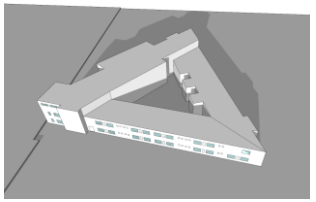
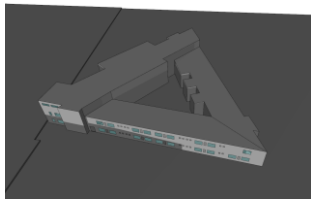
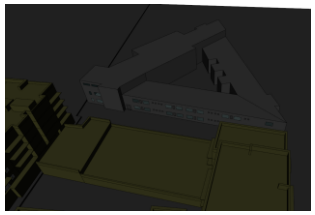
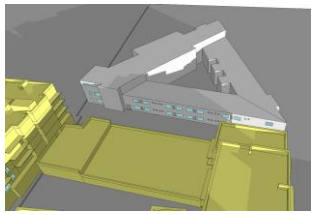
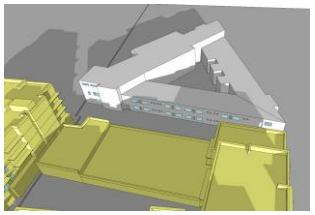
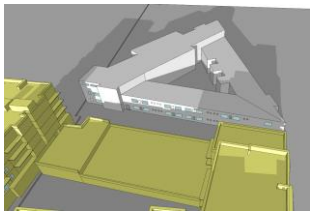
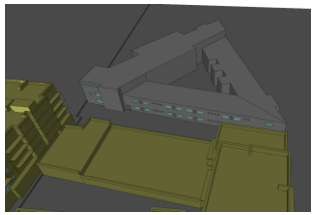
4.2.3 December 21st

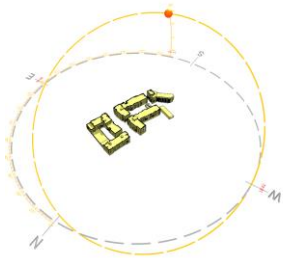


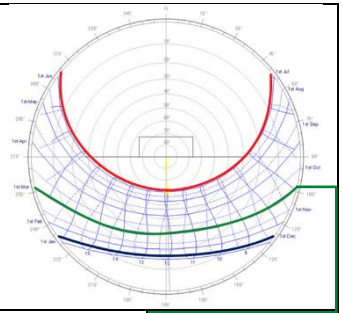


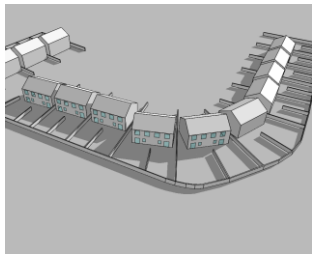
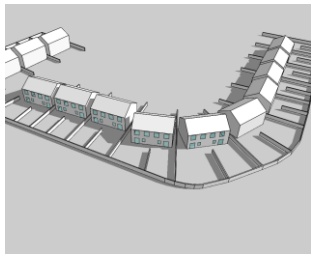
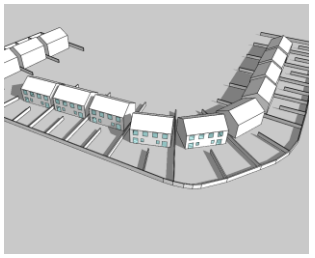
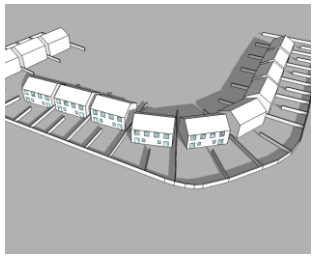
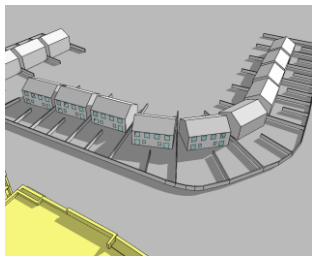
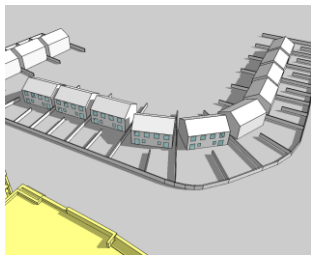
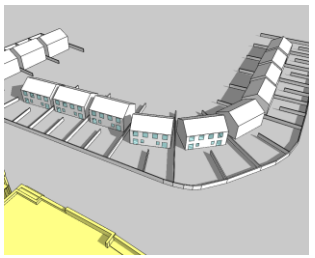
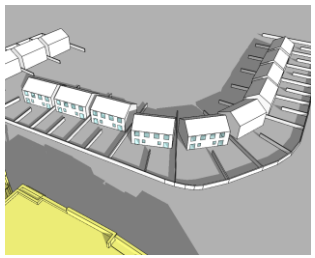
					**Existing Situation**
					**Proposed Scheme**
8:00 AM	**10:00 AM**	**12:00 PM**	**14:00 PM**	**16:00 PM**	

4.3 View 02: Looking over Gort Na Bró

4.3.1 March 21st





					Existing Situation
					Proposed Scheme
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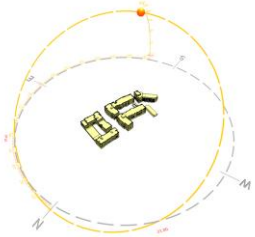
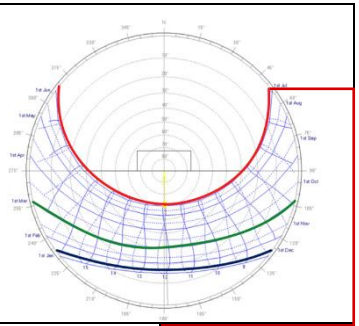
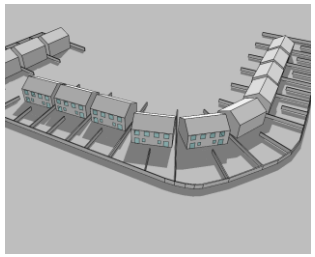
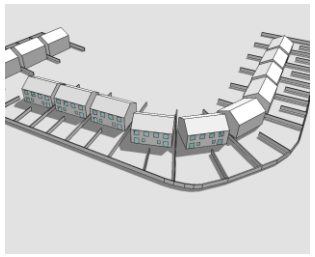
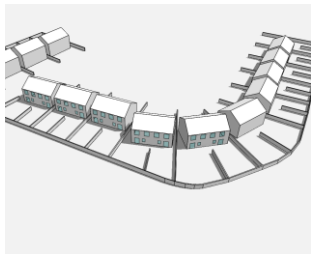
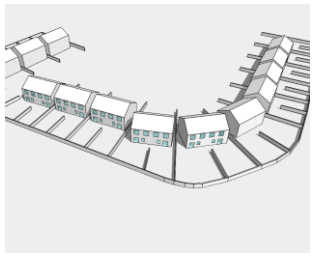
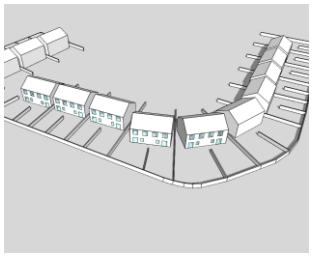
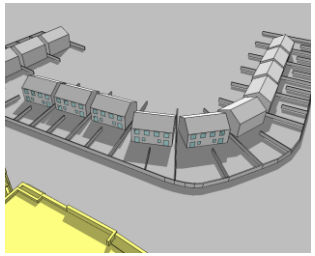
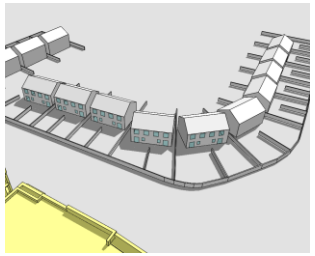
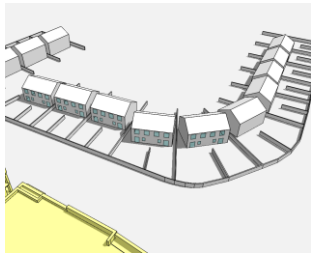
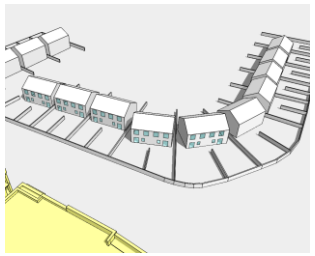
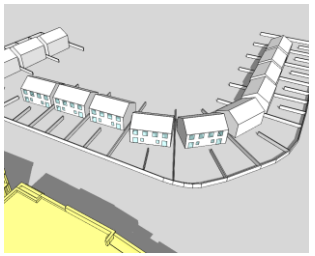
4.3.2 June 21st





					Existing Situation
					Proposed Development
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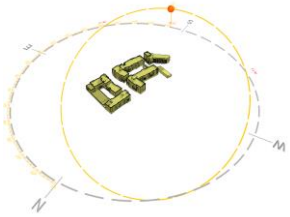
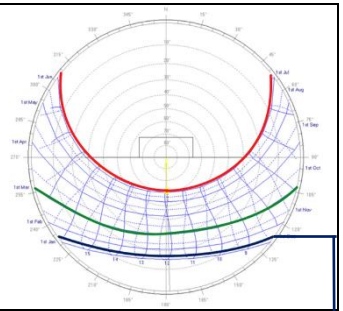
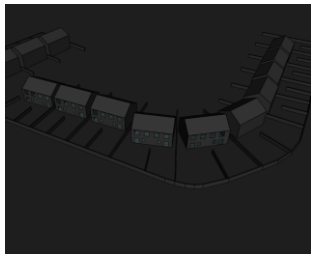
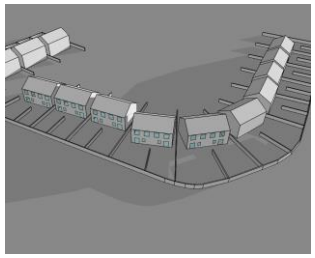
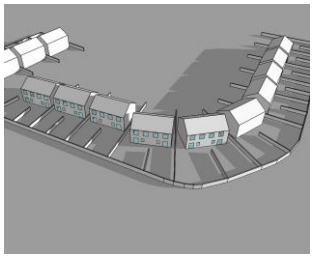
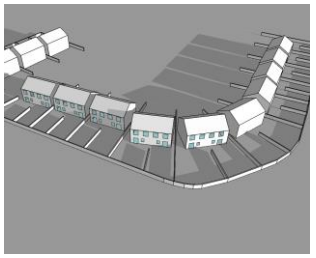
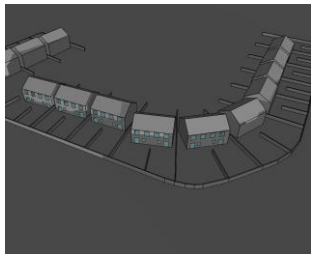
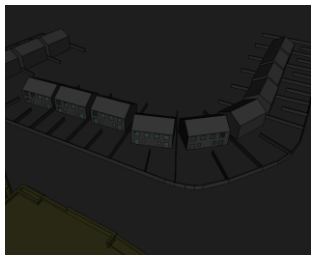
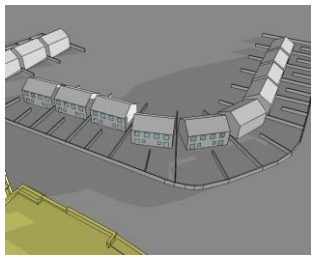
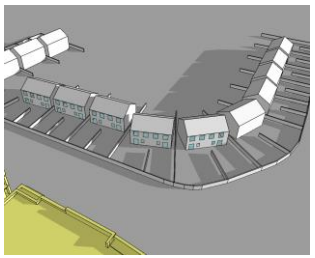
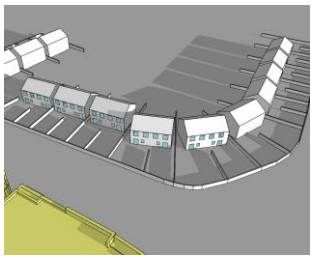
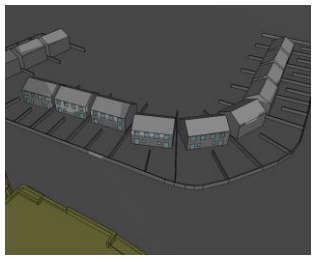
4.3.3 December 21st





					Existing Situation
					Proposed Scheme
8:00 AM	10:00 AM	12:00 PM	14:00 PM	16:00 PM	

4.4 Discussion

Shading from the proposed development is summarised as follows based on the analysis of images above:

- **Morning (until 12h00)**
    - **Gaelscoil Mhic Amhlaigh Primary School** –

      No additional shading is visible between March and June from the proposed development on the existing school as the shadows cast are contained within the development site.

      Additional shading is visible from the proposed development on the existing primary school during December as the school sits to the North of the development site. This is limited to the winter months when the impact caused by overshadowing is generally least noticeable. (Please refer to Met Eireann notes in section 4 of this report)

    - **Gort Na Bró Residential Dwellings** – no additional shading visible from the proposed development on the existing residential dwellings, as they sit to the East of the development site.

- **Midday (from 12h00 until 16h00)**
    - **Gaelscoil Mhic Amhlaigh Primary School** –

      Minimal additional shading is visible in March and June from the proposed development on the existing school as the majority of the shadows cast are contained within the development site.

      Again, additional shading is visible from the proposed development on the existing primary school during December as the school sits to the North of the development site. This is limited to the winter months when the impact caused by overshadowing is generally least noticeable. (Please refer to Met Eireann notes in section 4 of this report)

    - **Gort Na Bró Residential Dwellings** – no additional shading visible from the proposed development on the existing residential dwellings, as they sit to the East of the development site.

- **Late Afternoon (from 16h00)**
    - **Gaelscoil Mhic Amhlaigh Primary School** –

      Minimal additional shading is visible in March and June from the proposed development on the existing school as the majority of the shadows cast are contained within the development site.

      Again, additional shading is visible from the proposed development on the existing primary school during December as the school sits to the North of the development site. This is limited to the winter months when the impact caused by overshadowing is generally least noticeable. (Please refer to Met Eireann notes in section 4 of this report)

    - **Gort Na Bró Residential Dwellings** – no additional shading visible from the proposed development on the existing residential dwellings, as they sit to the East of development site.

In terms of shading on the neighbouring primary school, the impact during the periods more likely to be 'sunny' i.e. March and June appears minimal.

The residential dwellings on Gort Na Bró are observed to be unaffected by the shadows cast from the proposed development as they sit East to the development site.

5 Daylight Analysis of Existing Buildings

5.1 Guidance Requirements

BRE Site layout planning for daylight and sunlight (Section 2.2)

When designing a new development, it is important to safeguard the daylight to nearby buildings. The BRE's 2011 guidance provide 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 Permitted 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 finding the vertical sky component at the centre of key reference points. The vertical sky component definition from the BRE's 2011 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 the Radiance module of the IES VE software.

For typical Schemes the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight which states the following in Section 2.2.7

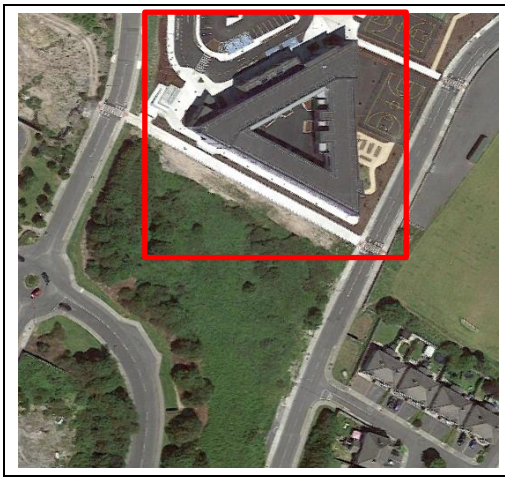
> 2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants 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.

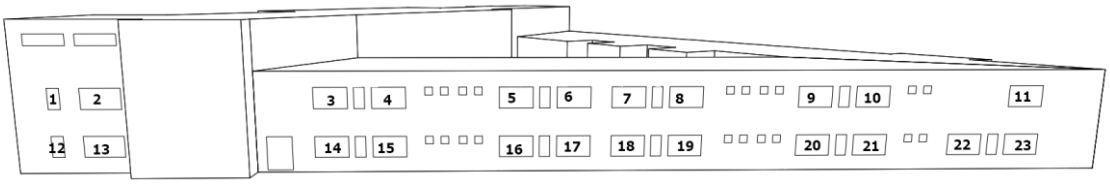
As such this study will compare the Existing Situation and Proposed Schemes and consider whether any reduction with be greater than 20%.

5.2 Assessment

5.2.1 Gaelscoil Mhic Amhlaigh Primary School

Based on the above the following locations have been modelled:





Points	Existing Situation VSC	Proposed Scheme VSC	Proposed VSC % of Existing Situation	Space Type	Comment
1	38.33	25.77	67%	Multi-Purpose/ Admin	✓ 4
2	36.22	24.93	69%	Office	✓ 3
3	38.41	30.42	79%	Classroom	✓ 1
4	38.74	31.07	80%	Classroom	✓ 1
5	38.81	31.61	81%	Classroom	✓ 1
6	38.81	31.37	81%	Classroom	✓ 1
7	38.92	30.04	77%	Classroom	✓ 1
8	38.79	30.36	78%	Classroom	✓ 1
9	38.72	27.29	70%	Classroom	✓ 1
10	38.84	24.97	64%	Classroom	✓ 2
11	38.78	25.00	64%	Classroom	✓ 2
12	38.10	22.27	58%	Multi-Purpose/ Admin	✓ 4
13	36.11	21.59	60%	Office	✓ 3
14	38.09	27.59	72%	Classroom	✓ 1
15	38.36	28.53	74%	Classroom	✓ 1
16	38.51	28.50	74%	Classroom	✓ 1
17	38.56	28.29	73%	Classroom	✓ 1
18	38.54	27.91	72%	Classroom	✓ 1
19	38.62	27.16	70%	Classroom	✓ 1
20	38.35	23.13	60%	Classroom	✓ 2
21	38.40	20.27	53%	Classroom	✓ 2
22	38.38	18.85	49%	Classroom	✓ 2
23	38.37	21.12	55%	Classroom	✓ 2

The following conclusions can be made:

✓ [1] These classrooms have a vertical sky component of at least 27% in line with BRE recommendations. This equates to 68% (13 out of 19) of the classrooms tested and 61% of all points tested.

Therefore, these points are all compliant with the BRE recommendations.

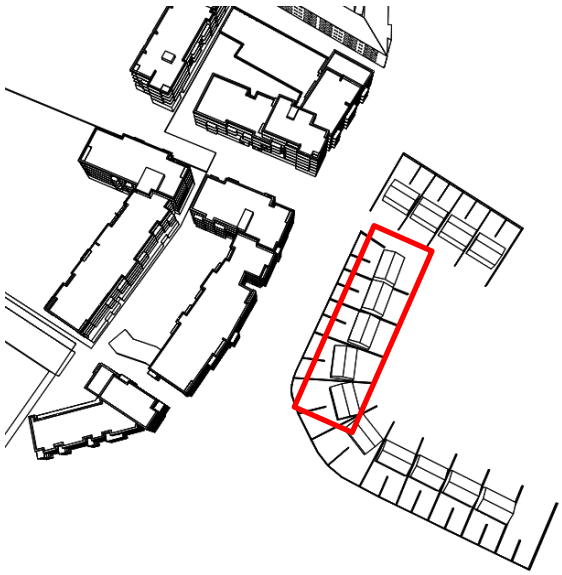
✓ [2] For the remaining six classrooms, the tested windows on the south elevation resultant VSC values sit between 19% and 25%, hence adequate daylight should still be expected given the larger than conventional windows on this building. In addition, two of these six rooms have dual aspect with unobstructed windows facing east and west ensuring that these classrooms are receiving sufficient levels of daylight in line with the BRE recommendations as noted in section 5.1.1 above.

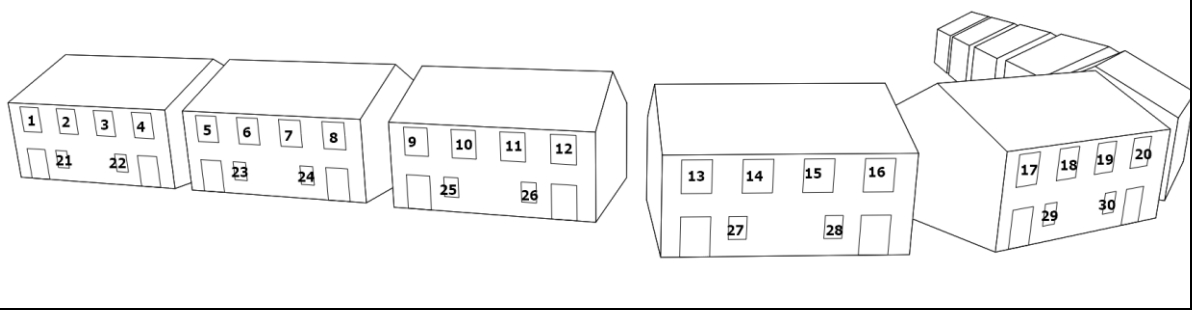
✓ [3] For these two windows tested, the reduction in the vertical sky component value is greater than 0.8 of its former value. The resultant VSC values sits between 22% and 25% and hence adequate daylight should still be expected given the larger than conventional windows on this property recommendations as noted in section 5.1.1 above.

✓ [4] For the two multi-purposes windows tested on the South elevation, the reduction in the vertical sky component value is greater than 0.8 of its former value. The resultant VSC values sit between 22% and 26% and hence adequate daylight should still be expected given the larger than conventional windows on this building. Above all, these rooms are triple aspect with unobstructed windows facing westwards and northwards ensuring that these spaces are receiving sufficient levels of daylight in line with the BRE recommendations as noted in section 5.1.1 above.

5.2.2 Gort Na Bró Dwellings

Based on the above the following locations have been modelled:





Points	Existing Situation VSC	Proposed Scheme VSC	Proposed VSC % of Existing Situation	Comment
1	38.57	31.86	83%	✓ 1
2	38.59	32.07	83%	✓ 1
3	38.56	32.09	83%	✓ 1
4	38.67	31.81	82%	✓ 1
5	38.52	31.65	82%	✓ 1
6	38.55	31.56	82%	✓ 1
7	38.61	31.70	82%	✓ 1
8	38.65	31.93	83%	✓ 1
9	38.47	31.67	82%	✓ 1
10	38.73	31.83	82%	✓ 1
11	38.57	31.71	82%	✓ 1
12	37.77	31.11	82%	✓ 1
13	38.78	32.11	83%	✓ 1
14	38.77	32.37	83%	✓ 1
15	38.67	32.54	84%	✓ 1
16	38.70	32.90	85%	✓ 1
17	38.69	35.20	91%	✓ 1
18	38.85	35.21	91%	✓ 1
19	38.52	35.49	92%	✓ 1
20	38.85	35.76	92%	✓ 1
21	38.41	30.78	80%	✓ 1
22	38.23	30.40	80%	✓ 1
23	38.29	30.30	79%	✓ 1
24	38.43	29.94	78%	✓ 1
25	38.27	29.76	78%	✓ 1
26	37.51	29.22	78%	✓ 1
27	38.55	30.77	80%	✓ 1
28	38.36	31.27	82%	✓ 1
29	38.54	34.17	89%	✓ 1
30	38.55	34.61	90%	✓ 1

The following conclusions can be made:

✓ 1 All of the tested points have a Proposed VSC greater than 27% or not less than 0.8 times their former value (that of the Existing Situation) and therefore exceed BRE recommendations.

5.3 Discussion

For the following locations considered:

- **Gaelscoil Mhic Amhlaigh Primary School – Educational**
    - Including the dual and triple aspect rooms receiving sunlight form unobstructed views, 78% (18 out of 23) of these spaces are projected to have a vertical sky component of at least 27% in line with the BRE recommendations. All of the remaining points, have larger than conventional windows on the property and as such should receive adequate daylight in line with BRE guidance.
- **Gort Na Bró Dwellings – Residential**
    - All of the points tested have a vertical sky component value of at least 27% or no less than 0.80 that of the value for the existing situation in line with the BRE requirements.

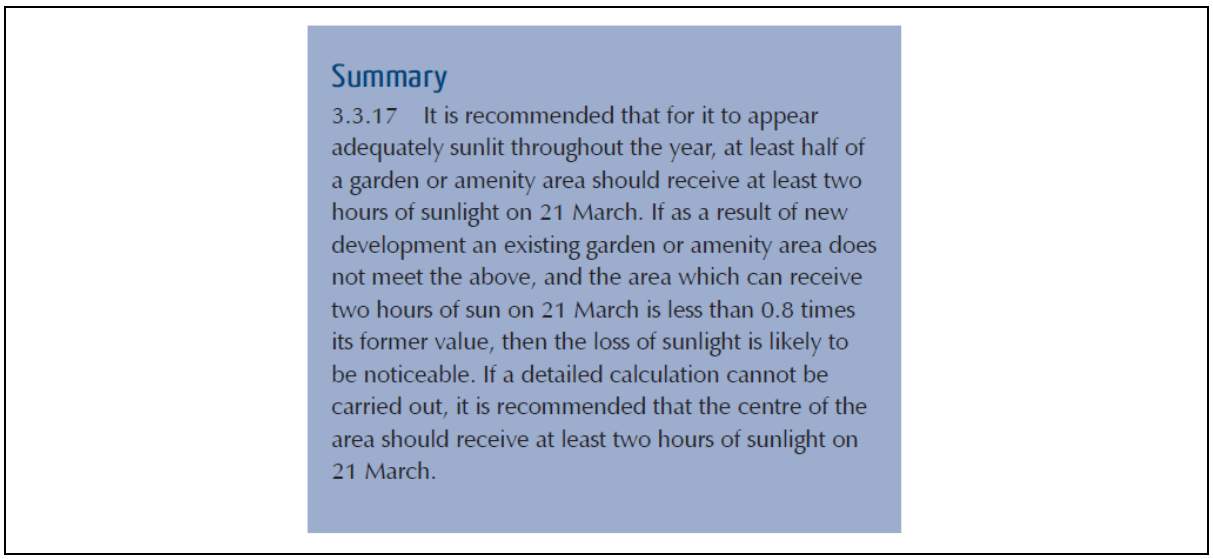
In summary, 91% (48 out of 53) of the points tested have a vertical sky component value of at least 27% or no less than 0.8 that of the value for the existing situation in line with the BRE recommendations. As such, the impact of the proposed development can be classified under the BRE as a 'minor adverse impact' considering that;

- only a small number of windows are affected
- the loss of light is only marginally outside the guidelines.

6 Sunlight to the Existing and Proposed Amenity Spaces

6.1 Requirements

The impact of the development proposal on the sunlight availability in the amenity areas will be considered to determine how they perform when assessed against the BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight which states the following in Section 3.3.17;

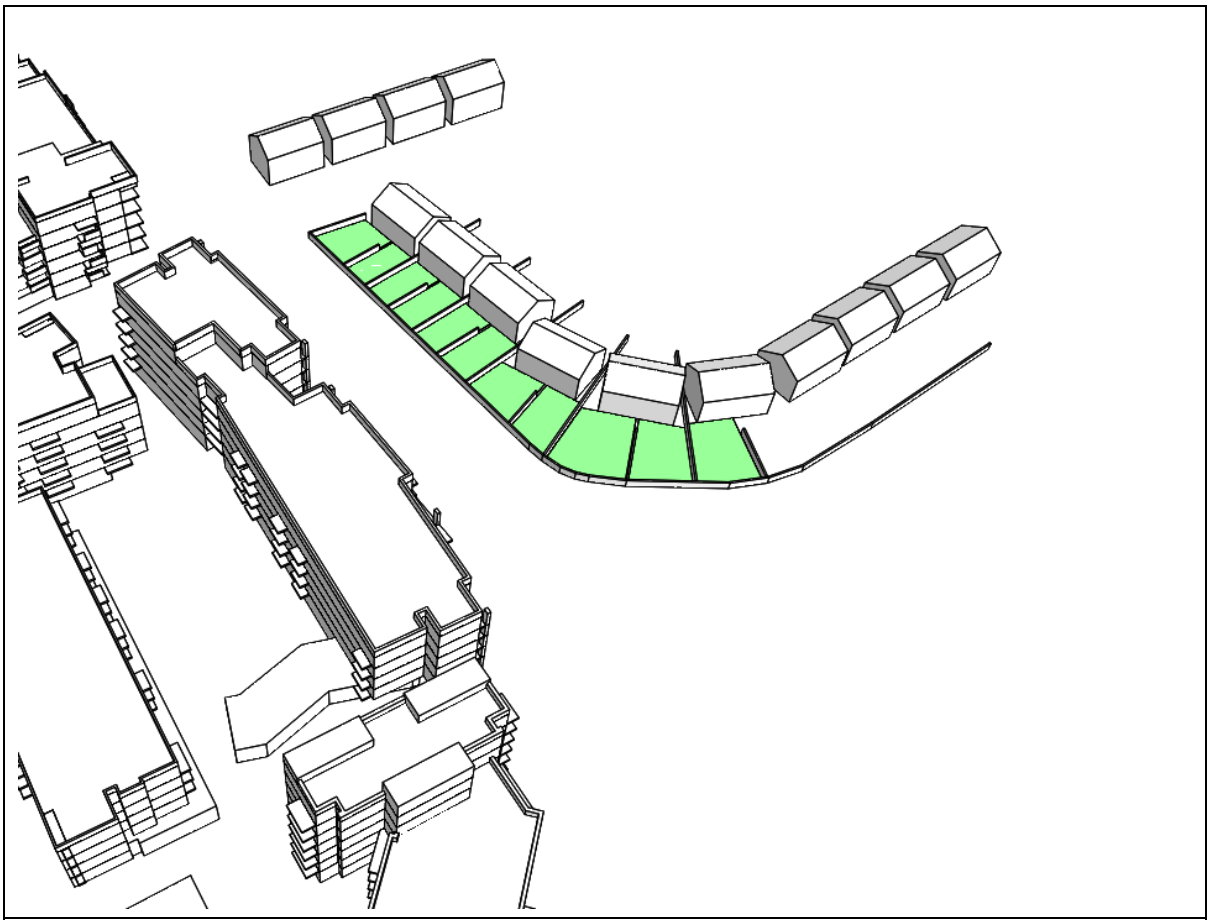


BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight states in 3.3.17 that for a space to, appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least 2 hours of sunlight on 21st March.

6.2 Existing Amenity Areas

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 21st March.

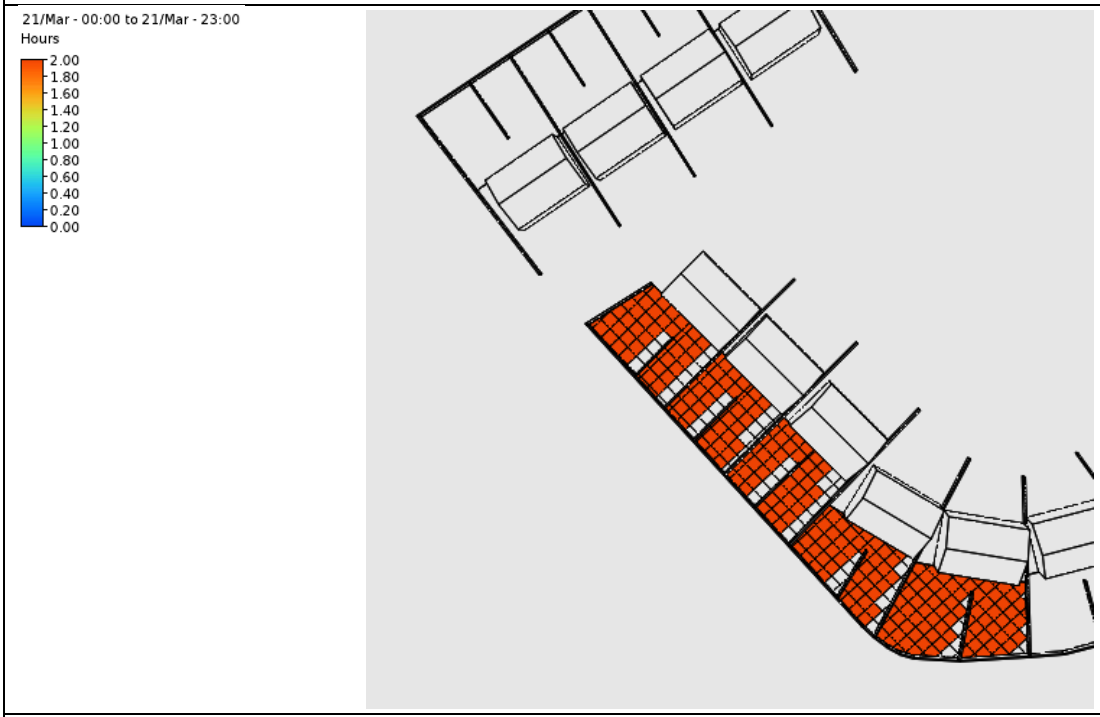
This analysis will be performed on the following existing amenity spaces shown in the images below:



Gort Na Bró Dwellings

The following images shows the predicted results with respect to this space receiving at least 2 hours of sunlight on 21st March, across the gridded cells.

Existing Situation: showing hours > 2 in red
(Any gridded cells area below 2 hours are shown as grey)



Proposed Scheme: showing hours > 2 in red
(Any gridded cells area below 2 hours are shown as grey)

6.2.1 Discussion

As mentioned previously under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that 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 the 21st of March.

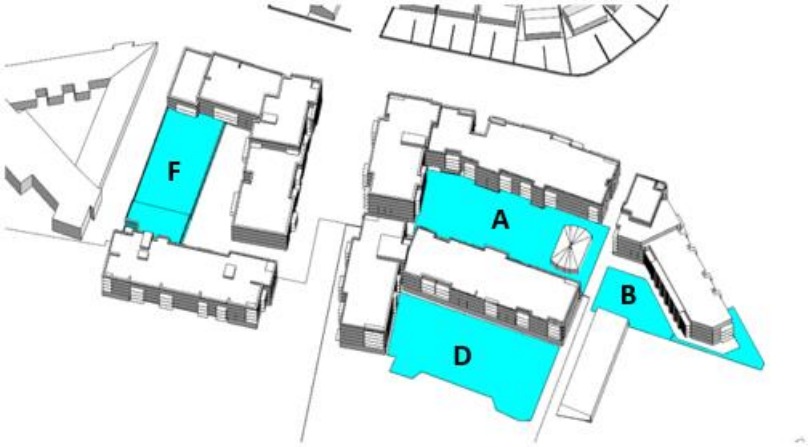
The images above highlight that all of the Gort Na Bró dwellings rear gardens would continue to receive at least 2 hours of sunlight over half of the amenity on the 21st of March in line with the BRE recommendations. The images highlight that the proposed development has little to no effect on the amount of sunlight received to these exiting rear gardens.

6.3 Proposed Amenity Areas

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 21st March.

This analysis will be performed on the following Dun Laoghaire Urban Framework Plan Proposal and Proposed amenity spaces shown in the images below:

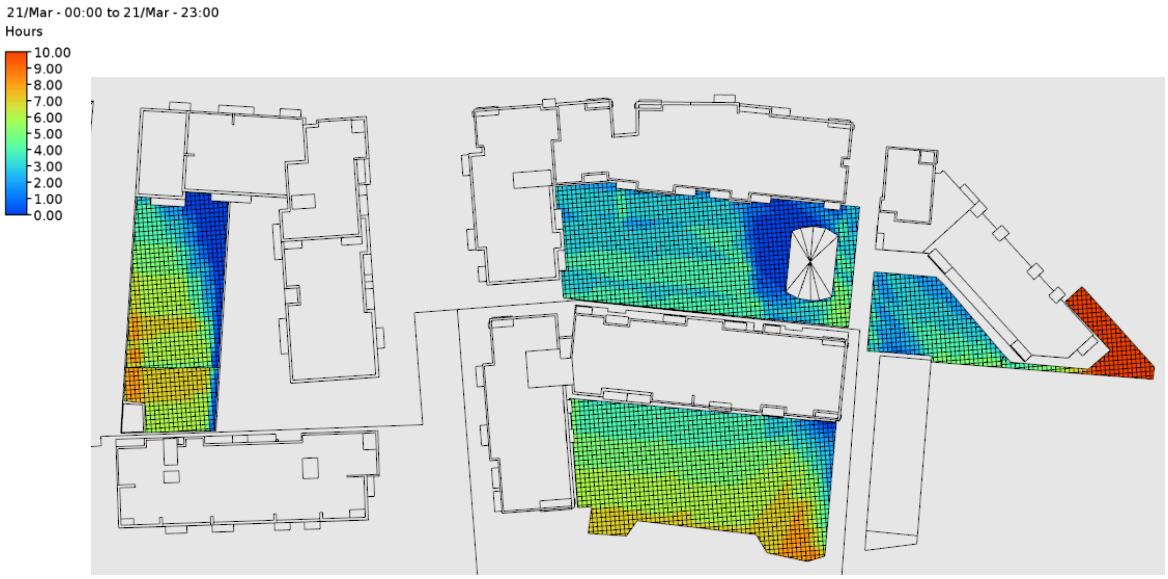
6.3.1 Proposed Scheme



Proposed Scheme Amenity Areas

The following images shows the predicted results with respect to this space receiving at least 2 hours of sunlight on 21st March, across the gridded cells.

Absolute Scale showing all hours



Custom Scale - showing hours > 2 in red
(Any gridded cells area below 2 hours are shown as grey)

6.3.2 Amenity Area percentages

Amenity Area Location	Area (m^2)	Area (m^2) receiving at least 2hour of sunlight	Percentage of area receiving at least 2hour of sunlight
Block A	1743	1339	76.8
Block B	607	592	97.5
Block D	1602	1579	98.5
Block F	1089	877	80.53

6.3.3 Discussion

As mentioned previously under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that 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 the 21st of March.

The images above highlight the proposed scheme amenity areas would exceed this BRE recommendations stated above and would receive excellent levels of sunlight throughout the year.

7 Average Daylight Factors

This section addresses daylight to the proposed apartments.

BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight 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.

From BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight

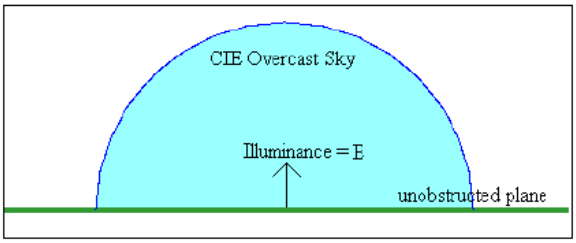
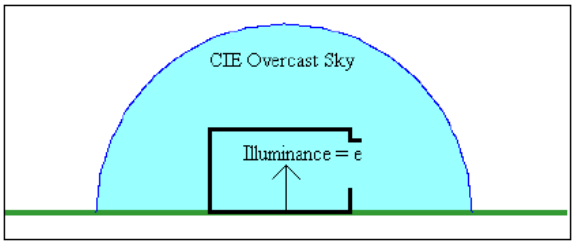
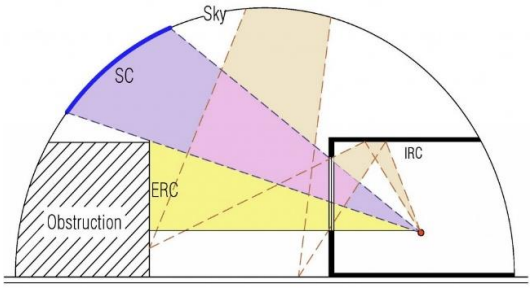
From this the recommended Average Daylight Factors (ADF) are therefore;

- Bedrooms – 1.0%
- Living Rooms – 1.5%

This study will consider the predicted average daylight factor to the proposed Phase 2B apartments. Analysis has been carried by using the Radiance module of IES VE software to quantify the metrics describe below.

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

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.

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

7.1 Assumptions

The following assumptions are to be used in the study:

- Sky Conditions: Standard CIE overcast sky
- Time (24hr): 12:00
- Date: 21 September
- Working Plane: 0.85m
- Floor to Ceiling Height 2.55 m (Blocks A, B, D, E & F)
- External Wall Thickness: 0.45 m (Blocks A, B, D, E & F)

The following Surface Reflectance's are to be used in the study:

Material Surface	Reflectance
External Wall	0.50
Internal Partition	0.50
Roof	0.20
Ground	0.20
Floor/Ceiling (Floor)	0.20
Floor/Ceiling (Ceiling)	0.70

Glazing Transmittance:

- Light Transmittance: 70%
- Assumed Window Frame thickness: 50 mm

7.2 Discussion

The full results for the rooms considered can be seen in the Appendix. It should be noted that the 'worst' case locations have been tested on the lower floors i.e. rooms on the upper floors will generally have unobstructed views and should meet the BRE recommendations.

98% of the tested rooms in the proposed scheme are projected to have an Average Daylight Factors (ADF) above the recommended Average Daylight Factors (ADF) in line with the BRE guidelines.

This number across the scheme would be expected to increase above 98% if all of the upper and outwards facing rooms were included in the results.

These are summarised as follows:

Block A:

Tested	45	
Bedroom above BRE recommendations	28	
Living Room above BRE recommendations	16	
Below BRE recommendations	1	Bedroom
	98 %	

Block B:

Tested	30	
Bedroom above BRE recommendations	17	
Living Room above BRE recommendations	10	
Below BRE recommendations	3	X3 Bedrooms
	90 %	

Block D:

Tested	26	
Bedroom above BRE recommendations	17	
Living Room above BRE recommendations	7	
Below BRE recommendations	2	
	92 %	

Block E:

Tested	14
Bedroom above BRE recommendations	8
Living Room above BRE recommendations	6
Below BRE recommendations	0
	100 %

Block F:

Tested	29
Bedroom above BRE recommendations	19
Living Room above BRE recommendations	10
Below BRE recommendations	0
	100 %

Total:

Tested	144
Bedroom above BRE recommendations	89
Living Room above BRE recommendations	49
Below BRE recommendations	6
	96 %

8 Conclusion

The following can be concluded based on the studies undertaken.

8.1 Shadow Analysis

The Shadow analysis shows different shadows being cast at some times of the year for the proposed scheme. The images show what potential shadows could be cast and this is quantified in the further sections of the report.

8.2 Daylight Analysis of existing buildings (out with the site boundary)

For the following locations considered:

- **Gaelscoil Mhic Amhlaigh Primary School – Educational**
  - 13 out of 19 classrooms have a VSC value greater than 27%. For the rest of the spaces, given that there are dual and triple aspect rooms receiving sunlight from unobstructed views and all of the remaining points have larger than conventional windows on the building, as such they receive adequate daylight in line with BRE guidance.
- **Gort Na Bró Dwellings – Residential**
  - All of the points tested have a vertical sky component value of at least 27% or no less than 0.80 that of the value for the existing situation and therefore exceed the BRE recommendations.

Sunlight to the Existing and Proposed Amenity Spaces

As mentioned above under Section 3.3.17 of BRE's Site Layout Planning for Daylight and Sunlight states that 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 the 21st of March.

Existing Amenity Areas (out with the site boundary):

The images within the sunlight to amenities section of this report (section 6) highlight that all of the Gort Na Bró dwellings rear gardens would continue to receive at least 2 hours of sunlight over half of the amenity on the 21st of March and therefore exceed the BRE recommendations. The images highlight that the proposed development has little to no effect on the amount of sunlight received to these exiting rear gardens.

Proposed Amenity Spaces:

The images of the proposed development highlight the proposed scheme amenity areas would exceed this BRE recommendations stated above and would receive excellent levels of sunlight throughout the year.

Average Daylight Factors

BRE guidelines recommend a daylight factor of 1.0 in bedrooms and 1.5 in living.

We have tested daylight levels of the worst-case apartments of which 96% have Average Daylight Factors (ADF) above the recommendations of the BRE guidelines. If we increased the number of units tested our percentage of apartments which exceed the ADF recommendations of the BRE guidelines would increase further.

Discussion

It should be noted that the guidance in 'Site layout planning for daylight and sunlight: a guide to good practice' is not mandatory and the Report 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.

Whilst the results shown relate to the criteria as laid out in the BRE guidance targets it is important to note that the BRE targets have been drafted primarily for use in low density suburban development and should therefore be used with flexibility and caution when dealing other types of sites. Despite this, the site performs well in relation to the metrics considered in this report.

Overall, the results demonstrate that the proposed development performance predominantly exceed the BRE recommendations from the BRE ‘Site Layout Planning for Daylight and Sunlight’ guide, sometimes referred to as BRE Digest 209.

9 Appendix

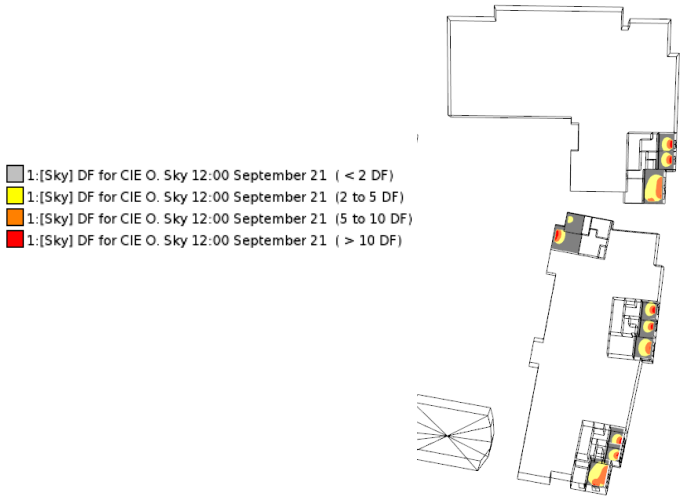
9.1 Average Daylight Factor Results

The following conclusions can be made:

- ✓ All these rooms have an average daylight factor of not less than the recommended minimum values (1.5% for living rooms and 1.0% for bedrooms) as stated under BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight. Therefore, these rooms are all compliant with BRE recommendation.
- \- All these rooms have an average daylight factors less than the recommended minimum values (1.5% for living rooms and 1.0% for bedrooms).

9.1.1 Block A

9.1.1.1 Level 00



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L00: A-01_Bedroom 01	Bedroom	3.17	✓
2	L00: A-01_Bedroom 02	Bedroom	3.29	✓
3	L00: A-01_Living	Living Room	3.32	✓
4	L00: A-02_Bedroom 01	Bedroom	1.06	✓
5	L00: A-02_Living	Living Room	1.53	✓
6	L00: A-03_Bedroom 01	Bedroom	3.33	✓
7	L00: A-03_Bedroom 02	Bedroom	3.15	✓
8	L00: A-03_Living	Living Room	2.95	✓
9	L00: A-04_Bedroom 01	Bedroom	3.79	✓
10	L00: A-04_Bedroom 02	Bedroom	2.66	✓
11	L00: A-04_Living	Living Room	3.04	✓

9.1.1.2 Level 01

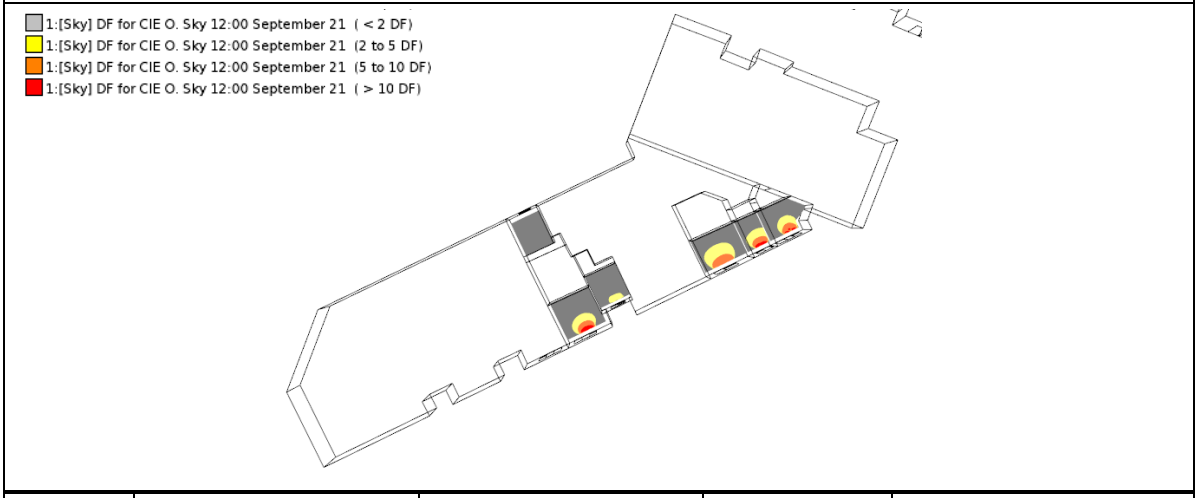
Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L01: A-01_Living	Living Room	1.82	✓
2	L01: A-01_Bedroom 01	Bedroom	1.78	✓
3	L01: A-02_Living	Living Room	1.55	✓
4	L01: A-02_Bedroom 02	Bedroom	1.03	✓
5	L01: A-02_Bedroom 01	Bedroom	1.02	✓
6	L01: A-03_Bedroom 01	Bedroom	2.87	✓
7	L01: A-03_Bedroom 02	Bedroom	2.97	✓
8	L01: A-03_Living	Living Room	3.07	✓
9	L01: A-04_Bedroom 01	Bedroom	0.87	-
10	L01: A-04_Bedroom 02	Bedroom	1.11	✓
11	L01: A-04_Living	Living Room	2.50	✓
12	L01: A-05_Bedroom 01	Bedroom	3.08	✓
13	L01: A-05_Bedroom 02	Bedroom	2.82	✓
14	L01: A-05_Living	Living Room	2.62	✓
15	L01: A-06_Bedroom 01	Bedroom	3.69	✓
16	L01: A-06_Bedroom 02	Bedroom	2.59	✓
17	L01: A-06_Living	Living Room	2.63	✓

9.1.1.3 Level 02

Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L02: A-01_Living	Living Room	2.09	✓
2	L02: A-01_Bedroom 01	Bedroom	1.95	✓
3	L02: A-02_Living	Living Room	1.83	✓
4	L02: A-02_Bedroom 02	Bedroom	1.19	✓
5	L02: A-02_Bedroom 01	Bedroom	1.15	✓
6	L02: A-03_Bedroom 01	Bedroom	2.90	✓
7	L02: A-03_Bedroom 02	Bedroom	3.01	✓
8	L02: A-03_Living	Living Room	2.81	✓
9	L02: A-04_Bedroom 01	Bedroom	1.12	✓
10	L02: A-04_Bedroom 02	Bedroom	1.25	✓
11	L02: A-04_Living	Living Room	2.79	✓
12	L02: A-05_Bedroom 01	Bedroom	3.10	✓
13	L02: A-05_Bedroom 02	Bedroom	2.85	✓
14	L02: A-05_Living	Living Room	2.65	✓
15	L02: A-06_Bedroom 01	Bedroom	2.73	✓
16	L02: A-06_Bedroom 02	Bedroom	2.69	✓
17	L02: A-06_Living	Living Room	2.57	✓

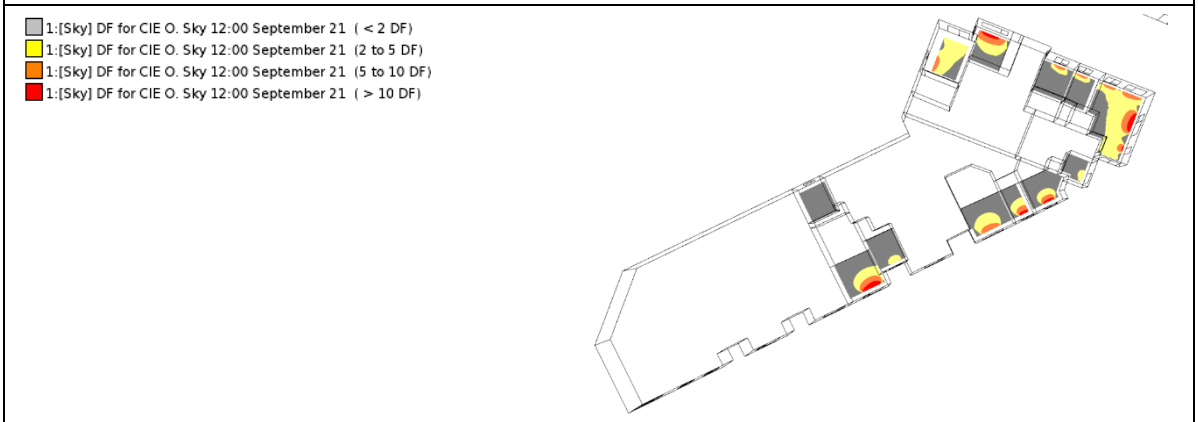
9.1.2 Block B

9.1.2.1 Level 00



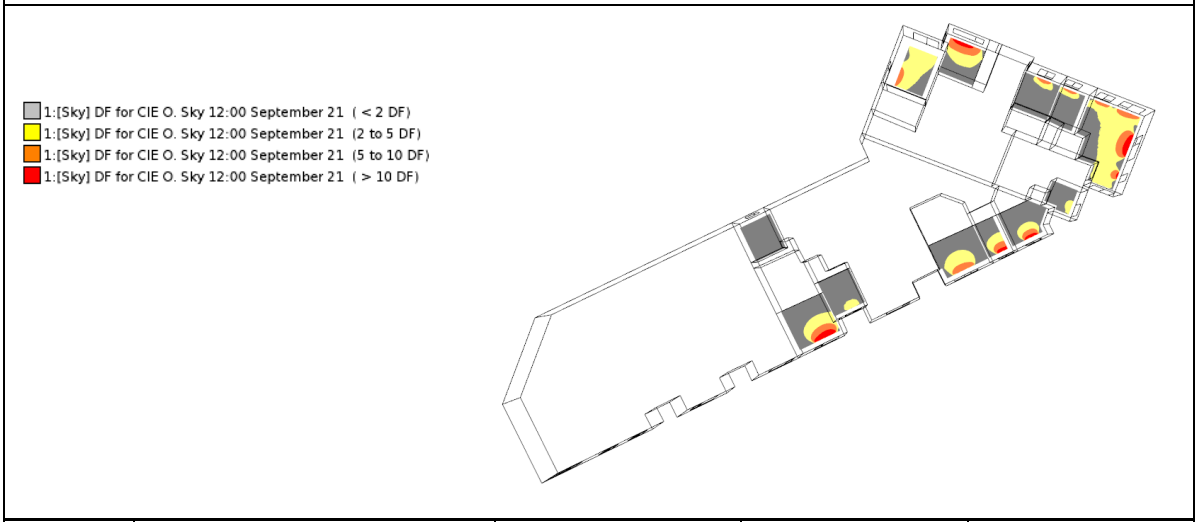
Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L00: B-02_Bedroom 02	Bedroom	1.67	✓
2	L00: B-02_Bedroom 01	Bedroom	2.39	✓
3	L00: B-02_Living	Living Room	2.23	✓
4	L00: B-01_ Bedroom 02	Bedroom	1.03	✓
5	L00: B-01_Living	Living Room	1.72	✓
6	L00: B-01_ Bedroom 01	Bedroom	0.38	-

9.1.2.2 Level 01



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L01: B-04_Living	Living Room	2.64	✓
2	L01: B-04_Bedroom	Bedroom	2.81	✓
3	L01: B-03_Bedroom 03	Bedroom	1.15	✓
4	L01: B-03_Bedroom 02	Bedroom	1.04	✓
5	L01: B-03_Living	Living Room	3.88	✓
6	L01: B-03_Bedroom 01	Bedroom	1.99	✓
7	L01: B-02_Bedroom 02	Bedroom	1.75	✓
8	L01: B-02_Bedroom 01	Bedroom	2.49	✓
9	L01: B-02_Living	Living Room	1.97	✓
10	L01: B-01_Bedroom 02	Bedroom	1.1	✓
11	L01: B-01_Living	Living Room	2.62	✓
12	L01: B-01_Bedroom 01	Bedroom	0.34	-

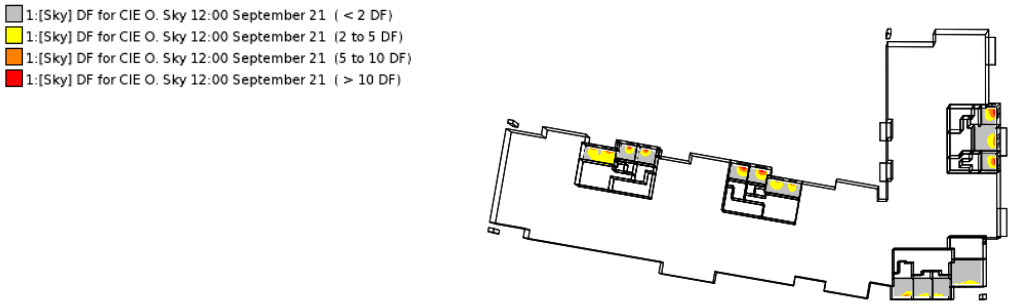
9.1.2.3 Level 02



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L02: B-04_Living	Living Room	2.83	✓
2	L02: B-04_Bedroom	Bedroom	3.4	✓
3	L02: B-03_Bedroom 03	Bedroom	1.24	✓
4	L02: B-03_Bedroom 02	Bedroom	1.16	✓
5	L02: B-03_Living	Living Room	3.07	✓
6	L02: B-03_Bedroom 01	Bedroom	1.15	✓
7	L02: B-02_Bedroom 02	Bedroom	1.62	✓
8	L02: B-02_Bedroom 01	Bedroom	2.49	✓
9	L02: B-02_Living	Living Room	1.97	✓
10	L02: B-01_Bedroom 02	Bedroom	1.12	✓
11	L02: B-01_Living	Living Room	2.56	✓
12	L02: B-01_Bedroom 01	Bedroom	0.4	-

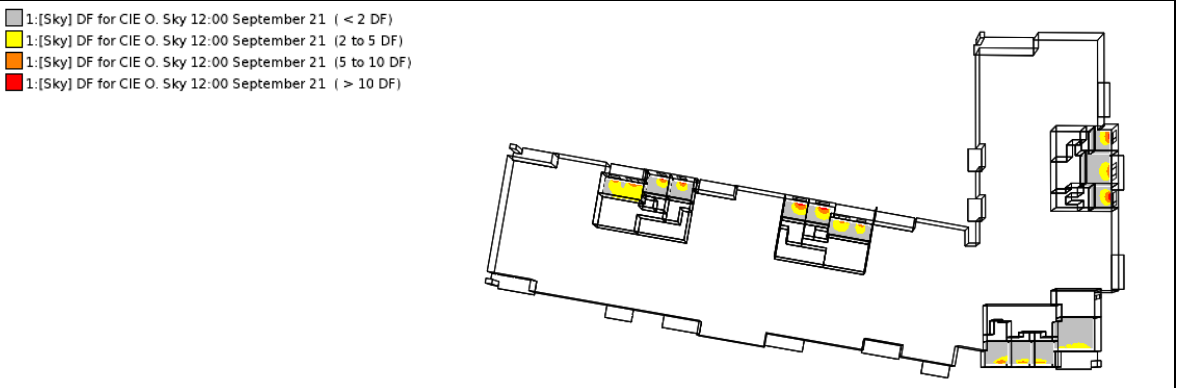
9.1.3 Block D

9.1.3.1 Level 01



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L01: D-01_Bedroom 01	Bedroom	3.02	✓
2	L01: D-01_Living	Living Room	1.82	✓
3	L01: D-01_Bedroom 02	Bedroom	2.42	✓
4	L01: D-02_Living	Living Room	1.60	✓
5	L01: D-02_Bedroom 01	Bedroom	0.89	-
6	L01: D-02_Bedroom 02	Bedroom	0.93	-
7	L01: D-02_Bedroom 03	Bedroom	1.38	✓
8	L01: D-03_Living	Living Room	2.18	✓
9	L01: D-03_Bedroom 01	Bedroom	2.64	✓
10	L01: D-03_Bedroom 02	Bedroom	2.66	✓
11	L01: D-04_Bedroom 01	Bedroom	1.67	✓
12	L01: D-04_Bedroom 02	Bedroom	2.40	✓
13	L01: D-04_Living	Living Room	2.68	✓

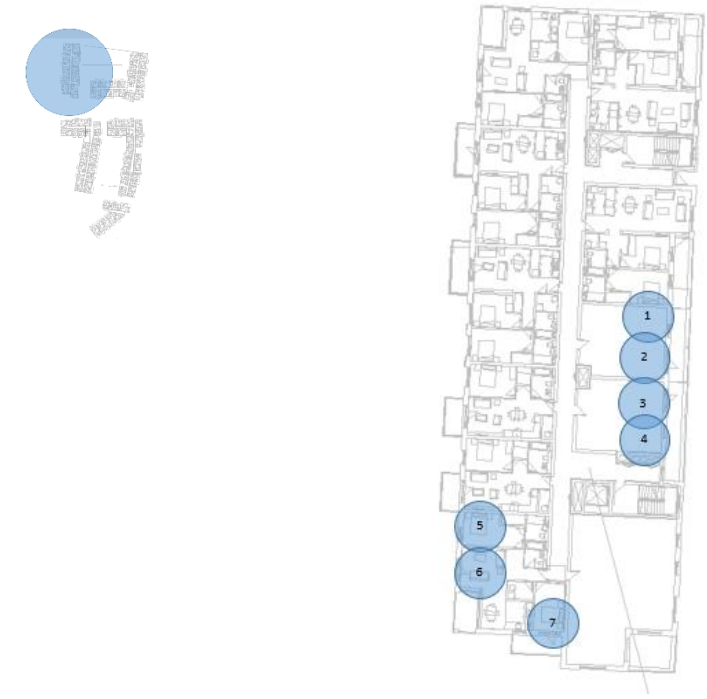
9.1.3.2 Level 02

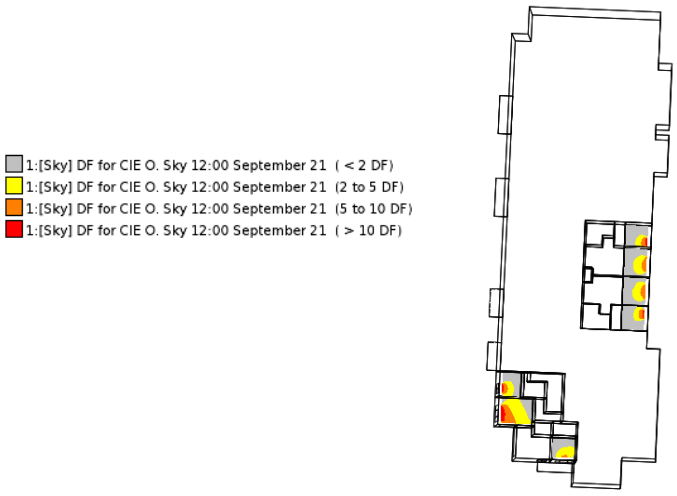


Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L02: D-01_Bedroom 01	Bedroom	2.27	✓
2	L02: D-01_Living	Living Room	1.52	✓
3	L02: D-01_Bedroom 02	Bedroom	2.63	✓
4	L02: D-02_Living	Living Room	1.94	✓
5	L02: D-02_Bedroom 01	Bedroom	1.06	✓
6	L02: D-02_Bedroom 02	Bedroom	1.11	✓
7	L02: D-02_Bedroom 03	Bedroom	1.44	✓
8	L02: D-03_Living	Living Room	2.03	✓
9	L02: D-03_Bedroom 01	Bedroom	2.71	✓
10	L02: D-03_Bedroom 02	Bedroom	2.72	✓
11	L02: D-04_Bedroom 01	Bedroom	1.86	✓
12	L02: D-04_Bedroom 02	Bedroom	2.40	✓
13	L02: D-04_Living	Living Room	2.99	✓

9.1.4 Block E

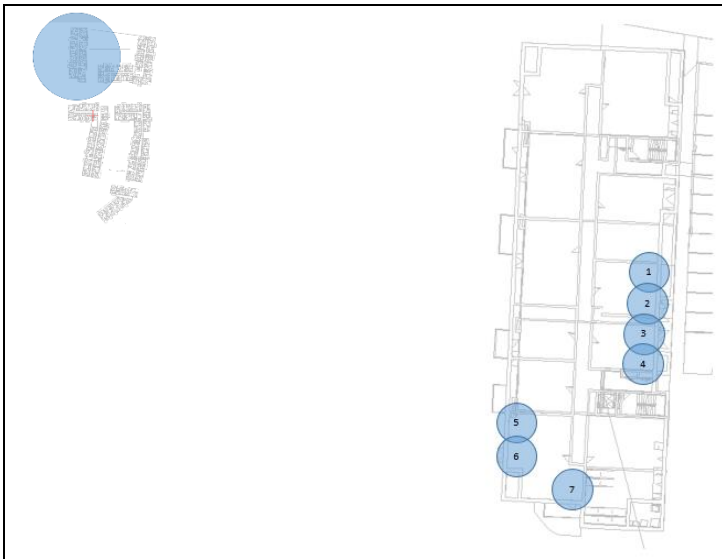
9.1.4.1 Level 01

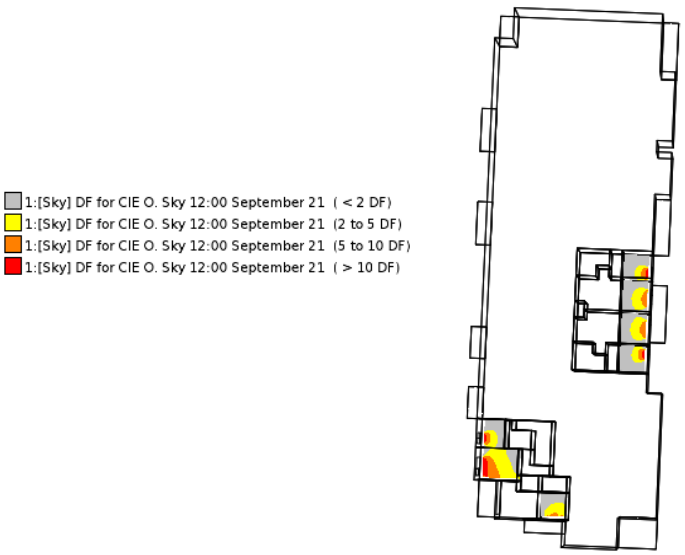




Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L01: E-01_Bedroom 01	Bedroom	1.58	✓
2	L01: E-01_Living	Living Room	2.54	✓
3	L01: E-02_Living	Living Room	2.64	✓
4	L01: E-02_Bedroom 01	Bedroom	1.68	✓
5	L01: E-03_Bedroom 02	Bedroom	2.20	✓
6	L01: E-03_Living	Living Room	3.62	✓
7	L01: E-03_Bedroom 01	Bedroom	1.98	✓

9.1.4.2 Level 02

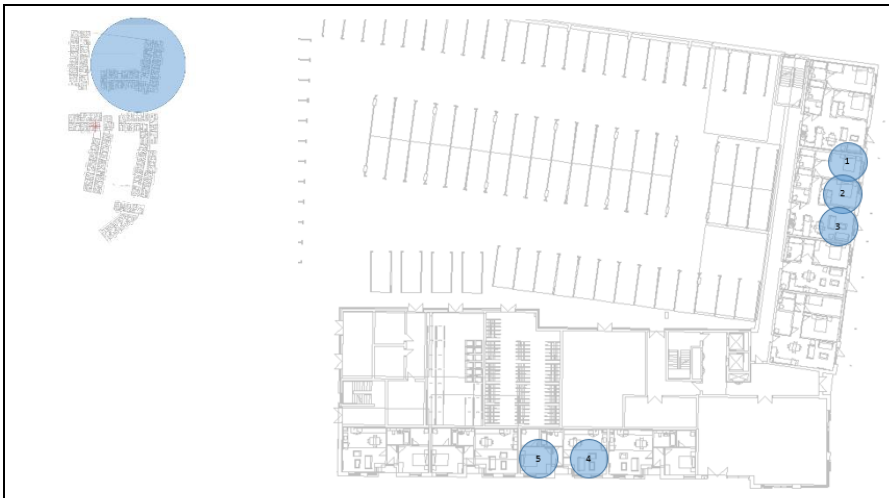


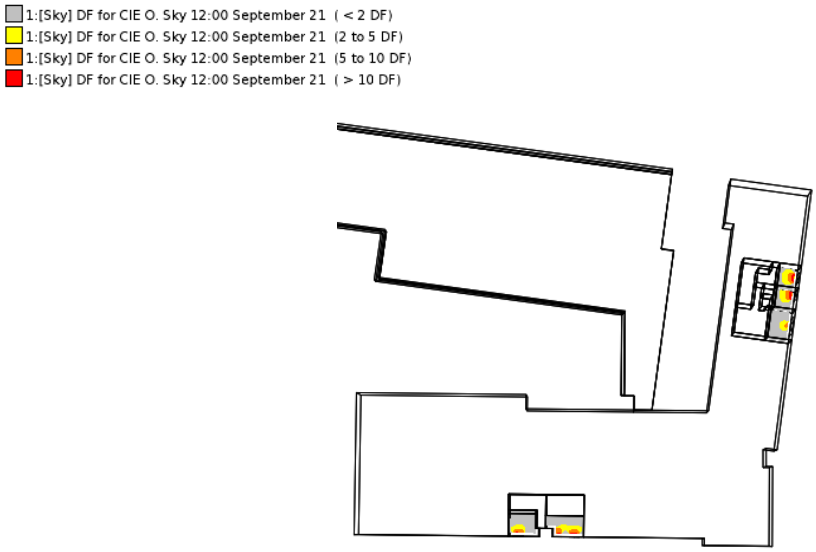


Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L02: E-01_Bedroom 01	Bedroom	1.69	✓
2	L02: E-01_Living	Living Room	2.25	✓
3	L02: E-02_Living	Living Room	2.35	✓
4	L02: E-02_Bedroom 01	Bedroom	1.81	✓
5	L02: E-03_Bedroom 02	Bedroom	2.22	✓
6	L02: E-03_Living	Living Room	3.79	✓
7	L02: E-03_Bedroom 01	Bedroom	2.17	✓

9.1.5 Block F

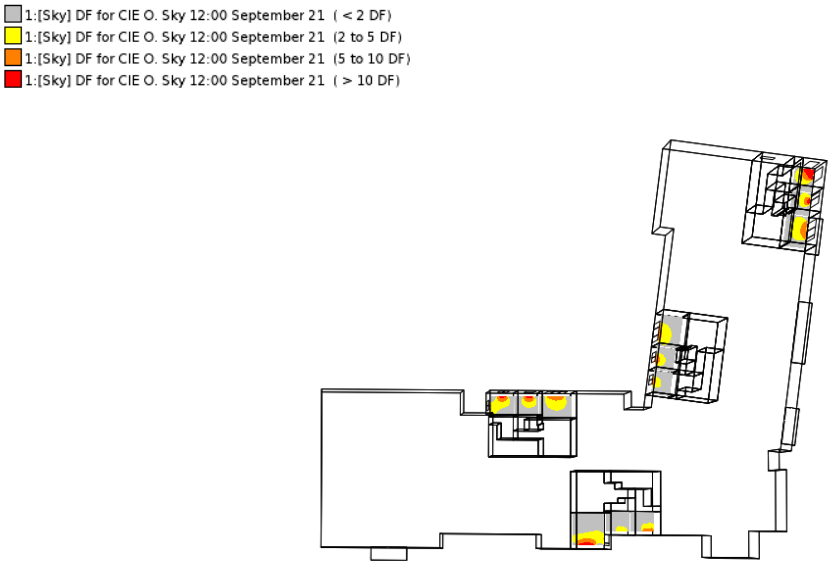
9.1.5.1 Level 00





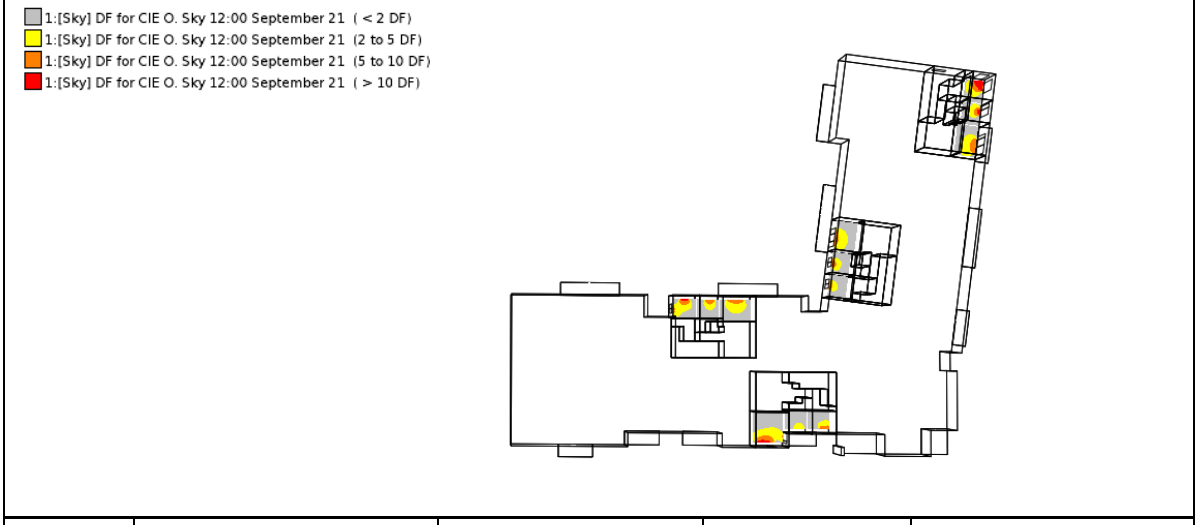
Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L00: F-01_Bedroom 01	Bedroom	3.06	✓
2	L00: F-01_Bedroom 02	Bedroom	2.52	✓
3	L00: F-01_Living	Living Room	2.70	✓
4	L00: F-02_Living	Living Room	2.74	✓
5	L00: F-02_Bedroom 01	Bedroom	2.07	✓

9.1.5.2 Level 01



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L01: F-01_Bedroom 01	Bedroom	4.42	✓
2	L01: F-01_Bedroom 02	Bedroom	2.25	✓
3	L01: F-01_Living	Living Room	3.02	✓
4	L01: F-02_Living	Living Room	1.99	✓
5	L01: F-02_Bedroom 02	Bedroom	2.49	✓
6	L01: F-03_Bedroom 01	Bedroom	1.80	✓
7	L01: F-04_Bedroom 02	Bedroom	1.75	✓
8	L01: F-04_Bedroom 01	Bedroom	1.25	✓
9	L01: F-04_Living	Living Room	2.01	✓
10	L01: F-05_Living	Living Room	2.27	✓
11	L01: F-05_Bedroom 02	Bedroom	2.39	✓
12	L01: F-05_Bedroom 01	Bedroom	2.74	✓

9.1.5.3 Level 02



Room Reference	Room Name	Room Activity	Average Daylight Factor	BRE Recommendation
1	L02: F-01_Bedroom 01	Bedroom	4.69	✓
2	L02: F-01_Bedroom 02	Bedroom	2.28	✓
3	L02: F-01_Living	Living Room	2.79	✓
4	L02: F-02_Living	Living Room	2.21	✓
5	L02: F-02_Bedroom 02	Bedroom	2.69	✓
6	L02: F-03_Bedroom 01	Bedroom	2.03	✓
7	L02: F-04_Bedroom 02	Bedroom	1.93	✓
8	L02: F-04_Bedroom 01	Bedroom	1.41	✓
9	L02: F-04_Living	Living Room	2.22	✓
10	L02: F-05_Living	Living Room	2.34	✓
11	L02: F-05_Bedroom 02	Bedroom	2.04	✓
12	L02: F-05_Bedroom 01	Bedroom	2.89	✓

EUROPE

Glasgow Head Office
Helix Building, Kelvin Campus
West of Scotland Science Park
Glasgow G20 0SP UK
T +44 (0)141 945 8500
E sales@iesve.com

Dublin
4th Floor, Castleforbes House
Castleforbes Road
Dublin 1, Ireland
T +353 (0) 1875 0104
E sales@iesve.com

NORTH AMERICA

Atlanta
834 Inman Village Parkway NE
Suite 230, Atlanta GA 30307
T +1 (404) 806 2018
E consulting@iesve.com

ASIA

Pune
Dhananjay Plaza, II Floor,
Plot No. 21, Pune- Mumbai Highway
Near Lalani Quantum / Home Decor,
Bavdhan, Pune 411 021, India
T +91 (020) 6560 2848
E india@iesve.com

AUSTRALIA

Melbourne
Level 1, 123 Camberwell Road
Hawthorn East, Melbourne
Vic 3123, Australia
T +61 (0) 3 9808 8431
E support@iesve.com

www.iesve.com