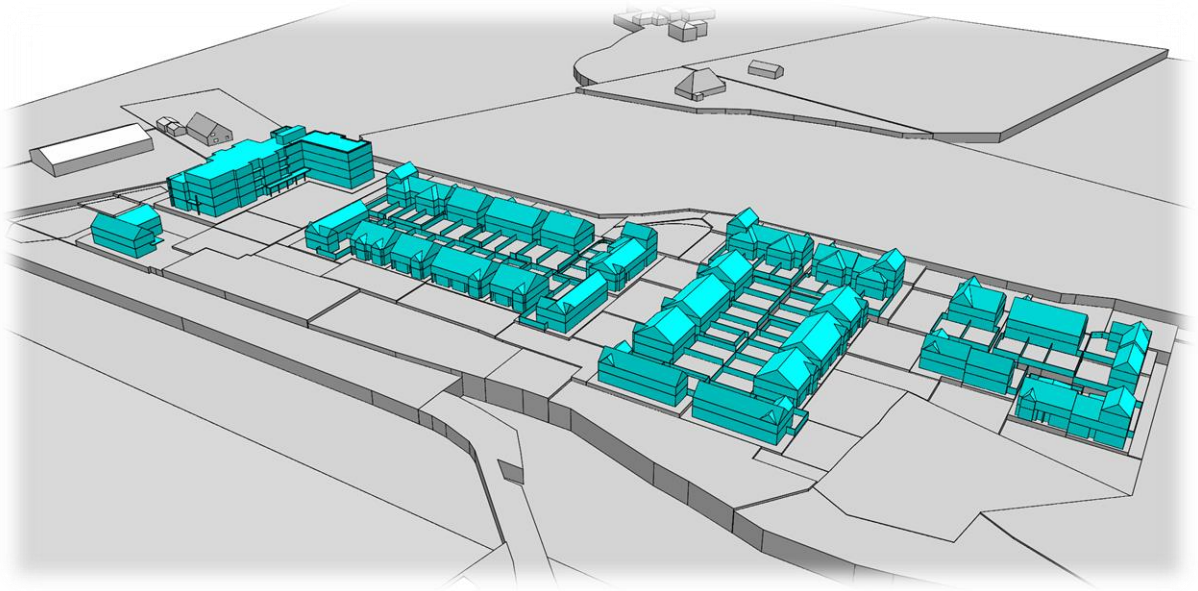
Proposed Development at Rosshill, Galway

Daylight, Sunlight and Overshadowing Study



Report For: Alber Developments Ltd

Project No: 15665

Version History

Document created by:
Integrated Environmental Solutions Limited
International Sustainability Consulting Developers of the IES **<Virtual Environment>**

Issued For:	**Prepared by:**	**Checked by:**	
Comment	Amanda Saade Project Consultant	Dónal O'Connor Associate Director	
Version:	**Date:**	**Revision Details:**	**Approved by:**
1	01-07-2021	Draft for Comment	Dónal O'Connor, Associate Director
2	02-07-2021	Final for Planning	Dónal O'Connor, Associate Director

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1 Executive Summary

This report summarises the analysis undertaken to quantify the Sunlight / Daylight performance of the proposed development at Rosshill, Galway. The report focuses on measuring the daylight and sunlight impact of the proposed development when compared to the existing situation. The report also focuses on the proposed design. The following can be concluded based on the analysis undertaken.

1.1 Daylight Analysis of Existing Buildings

This study considers the proposed scheme and tests if the VSC results for the windows of the adjacent existing buildings are greater than either 27% or 0.8 times their former value (that of the existing situation). All points tested exceed the BRE requirements.

1.2 Shadow Analysis

The shadow analysis illustrates different shadows being cast at three key times of the year (March 21st, June 21st and December 21st) for the existing scenario and with the proposed development in place. It should be noted that sunlight is less prevalent during the winter months and as such the impact of overshadowing will be greatly reduced. Taking this into account, the proposed development has a negligible overshadowing impact on the adjacent residential building nearest the site.

1.3 Sunlight to Existing and Proposed Amenity Spaces

One existing amenity space was analysed and it still receives the same amount of sunlight even with the proposed development in place, thus complying with BRE Guidelines.

On the 21st of March, the proposed roof terrace area situated within the development site will receive at least 2 hours of sunlight on 98% of its area, exceeding BRE recommendations.

On the 21st of March, the proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight on 97% of its area, exceeding BRE recommendations.

On the 21st of March, the sample of proposed private garden amenity areas tested will receive at least 2 hours of sunlight on 50% of its area, meeting BRE recommendations. When calculated for the 21st of June, this percentage increases to 95%.

When combined, all amenity areas including the roof terrace, public amenities and private garden sample areas, will receive at least 2 hours of sunlight on March 21st on 90% of their combined area, significantly exceeding the minimum BRE recommendations of 50%.

1.4 Annual Probable Sunlight Hours

Even though there is more than a 4% drop in APSH when comparing the annual results for each window, the loss of sunlight will not be noticeable as both the annual and winter APSH results are more than 25% for annual and 5% for winter respectively with the proposed development in place. Furthermore, both the APSH annual and winter APSH results are more than 0.8 times their former value. Taking all the APSH results into consideration, the impact of the proposed development on surrounding existing buildings will comply with the BRE Guidelines.

1.5 Average Daylight Factors

Across the proposed development, 86% of the tested rooms in the Apartment Building are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines when Living/Kitchen/Dining spaces are assessed as whole rooms against a 2% ADF target. This increases to 100% when Living/Kitchen/Dining spaces are assessed as whole rooms against a 1.5% ADF target.

Furthermore, 99% of the tested rooms in the Houses are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines (1.5% ADF target for the Living areas and 2% ADF target for the Kitchen/Dining areas).

1.6 Observations

It should be noted that the guidance in the BRE Guidelines is not mandatory and the guide 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 the above, the site performs well in relation to the metrics considered in this report.

In addition, the BS 8206-2:2008 it also notes, "*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.*"

The approach within this report is further supported by the national policy guidance noted in the Sustainable Urban Housing: Design Standards for New Apartments, Section 6.7 which states:

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

Taking all of the above information into account, overall the results demonstrate that the proposed development performs well when compared to the BRE recommendations in the BRE 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" by Paul Littlefair, 2011 sometimes referred to as BRE Digest 209 and the "BS 8206-2:2008: Lighting for Buildings - Part 2: Code of Practice for Daylighting".

2 Introduction

This report was completed to quantify the daylight and sunlight performance of the proposed development at Rosshill, Galway with regards to the neighbouring buildings.

2.1 Analysis Performed

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

- **Daylight Analysis of Existing Buildings** - via consideration of the Vertical Sky Component (VSC) results.
- **Shadow Analysis** - A visual representation analysing any potential changes that may arise to the neighbouring existing developments when comparing the existing scenario to the scenario with the proposed development in place.
- **Sunlight to Existing and Proposed Amenity Spaces** – via sunlight hours simulation.
- **Average Daylight Factors**: via consideration of the Average Daylight Factor (ADF) for the proposed development.

The analysis was completed using the IES VE software.

The assessment is based on recommendations outlined in the BRE *'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice*' guide (BRE Guidelines) which is also referred to as BRE 209.

3 Methodology

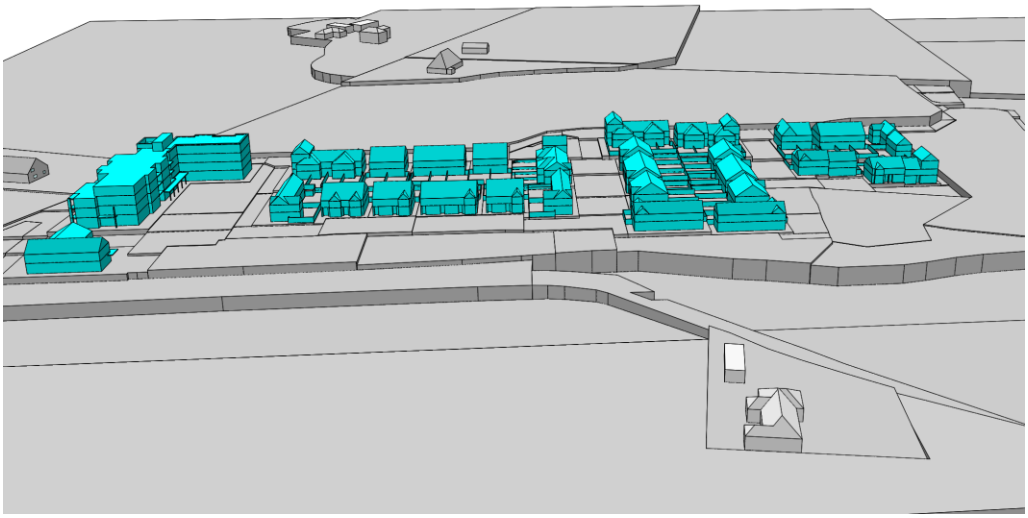
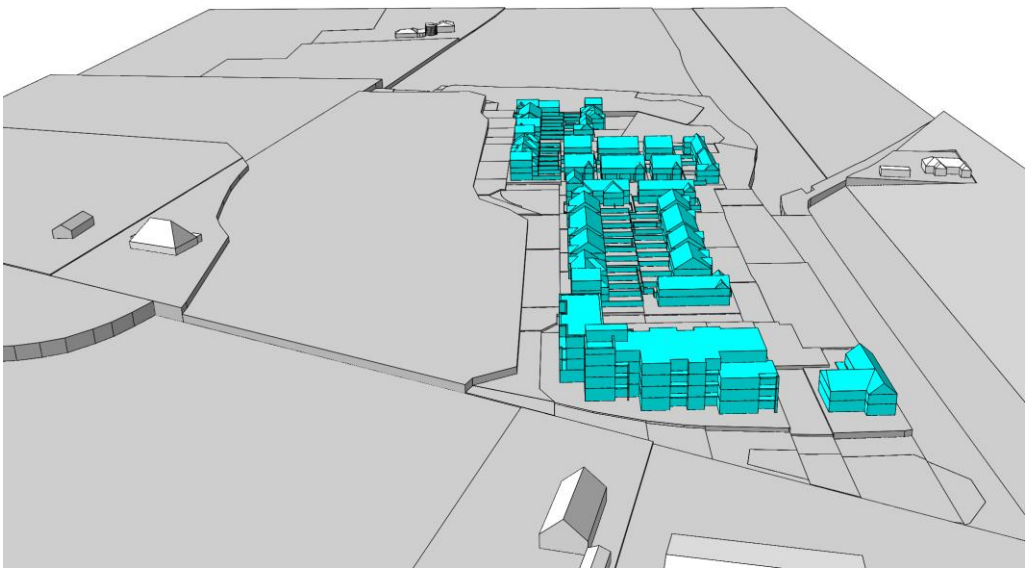
3.1 Orientation

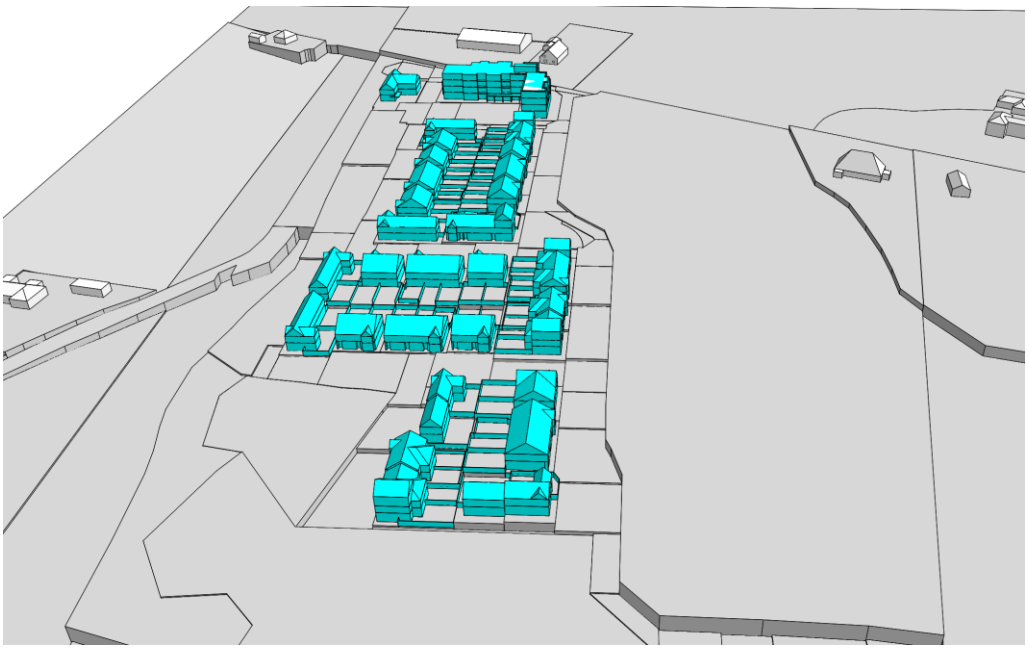
The model orientation has been taken from the drawings provided by the Architect, with the resulting angle shown below used in the analysis.

Orientation	
	
	

3.2 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.

	Proposed Development
View looking from North of Site	
View looking from East of Site	

View looking from South of Site	
View looking from West of Site	

3.3 Potential Sensitive Receptors

To help understand the proposed development's impact on surrounding buildings, potential sensitive receptors were identified as illustrated below.

Potential Sensitive Receptors

	Site Boundary
	Rosshill – Residential 1
	Rosshill – Residential 2
	Rosshill – Residential 3
	Rosshill – Residential 4

Note: Only the 'Rosshill Road – Residential 1' shown above in yellow is included in the calculations as the distance from the proposed development to the remaining properties are more than 3 times its height above the lowest window and does not subtend more than 25 degrees at the lowest window.

4 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 residential developments while not obstructing light to existing homes nearby.

The BRE Guidelines 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.

4.1 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 summarised in the table below.

Where the loss of skylight or sunlight fully meets the BRE Guidelines, 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)*

5 Daylight Analysis of Existing Buildings

5.1 Guidance Requirements

When designing a new development, it is important to safeguard the daylight to nearby buildings. The BRE Guidelines 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 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 Guidelines 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 Guidelines state the following in Section 2.2.7:

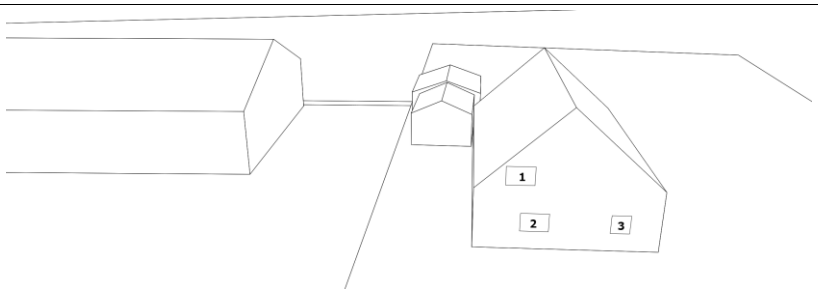
> 2.2.7 If this VSC is greater than 27% then enough skylight should still be reaching the window of the existing building. Any reduction below this level should be kept to a minimum. If the VSC, with the new development in place, is both less than 27% and less than 0.8 times its former value, occupants 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 scheme and proposed schemes and consider if the values on the existing buildings are above 27% or not less than 0.8 times their former value (that of the existing scheme).

5.2 Assessment

Based on the methodology outlined above, the following locations have been modelled and analysed:

5.2.1 View 1: Rosshill – Residential 1



Points	Existing Situation VSC	Proposed Scheme VSC	Proposed VSC as a % of Existing Situation	Comment
1	39.14	35.55	91%	✓
2	39.04	34.36	88%	✓
3	39.03	34.56	89%	✓

The following conclusions can be made:

✓ All of the points tested have a VSC value greater than 27% with the proposed development in place. Therefore, these points exceed BRE recommendations.

5.3 Discussion

This study considers the proposed scheme and tests if the VSC results are greater than either 27% or 0.8 times their former value (that of the existing situation). Of the 3 points tested 100% exceed the BRE requirements.

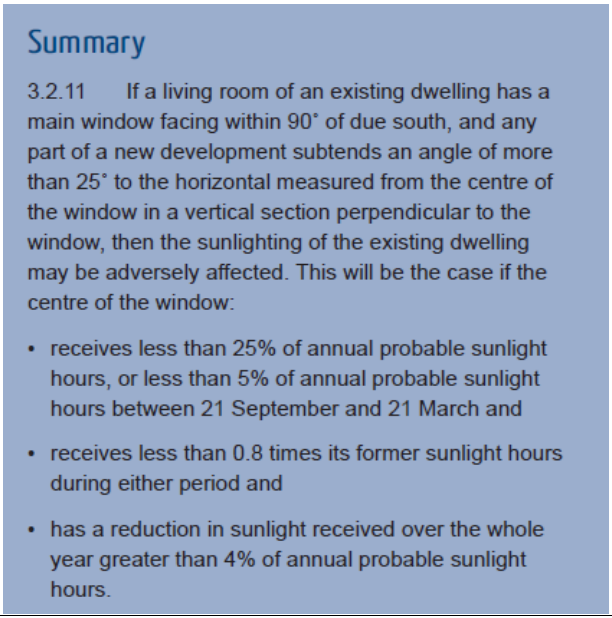
6 Annual Probable Sunlight Hours (APSH)

The British Standard BS 8206: Part 2:1992 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 21 September and 21 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.

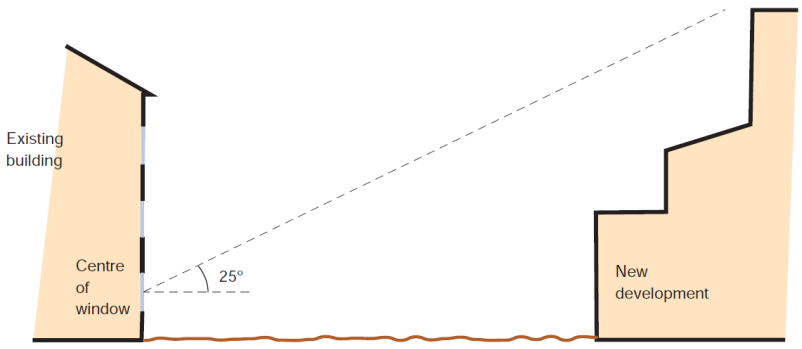
BRE's 2011 guidance document Site Layout Planning for Daylight and Sunlight

6.1 APSH Exclusions

The BRE recommendations note that if a new development sits within 90° 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 do not need 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's 2011 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%.

Potential Sensitive Receptors

	Site Boundary
	Rosshill – Residential 1
	Rosshill – Residential 2
	Rosshill – Residential 3
	Rosshill – Residential 4

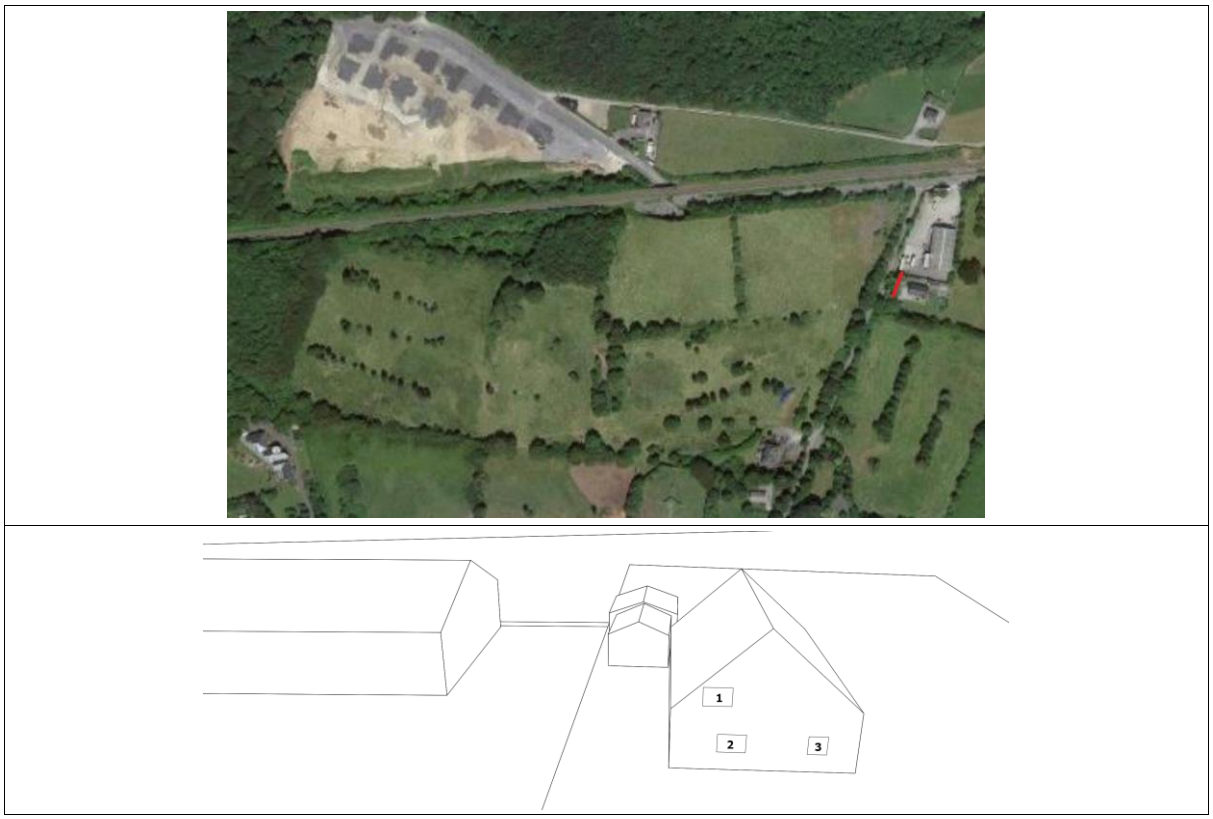
Note: Only the 'Rosshill Road – Residential 1' shown above in yellow is included in the calculations as the distance from the proposed development to the remaining properties are more than 3 times its height above the lowest window and does not subtend more than 25 degrees at the lowest window.

6.2 APSH Results

The following results summarise the sunlight available to buildings adjacent to the proposed development via Annual Probable Sunlight Hours.

Based on the methodology above, the following locations have been modelled and analysed:

6.2.1 View 1: Rosshill – Residential 1



Points	Existing Scheme APSH		Proposed Scheme APSH		Proposed Scheme APSH as a % of the Existing Scheme		Comment
	Annual	Winter	Annual	Winter	Annual	Winter	
1	43.75	14.58	37.23	14.58	85%	100%	✓/✓
2	43.06	13.89	35.63	13.69	83%	99%	✓/✓
3	43.06	13.89	34.58	13.65	80%	98%	✓/✓

The following conclusions can be made:

✓/✓ Both the annual and winter APSH results are greater than 25% and 5% respectively, as well as being more than 0.8 times their former value with the proposed development in place

6.3 Discussion

This study considers the proposed scheme and tests if the APSH results are impacted by the proposed development.

Even though there is more than a 4% drop in APSH when comparing the annual results for each window, the loss of sunlight will not be noticeable as both the annual and winter APSH results are more than 25% for annual and 5% for winter respectively with the proposed development in place. Furthermore, both the APSH annual and winter APSH results are more than 0.8 times their former value. Taking all the APSH results into consideration, the impact of the proposed development on surrounding existing buildings will comply with the BRE Guidelines.

7 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 7.4 hours sunlight each day is received (i.e. only 22% of potential sunlight hours).
- During June a mean daily duration of 6.4 hours of sunlight out of a potential 16.7 hours sunlight each day is received (i.e. only 38% 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.

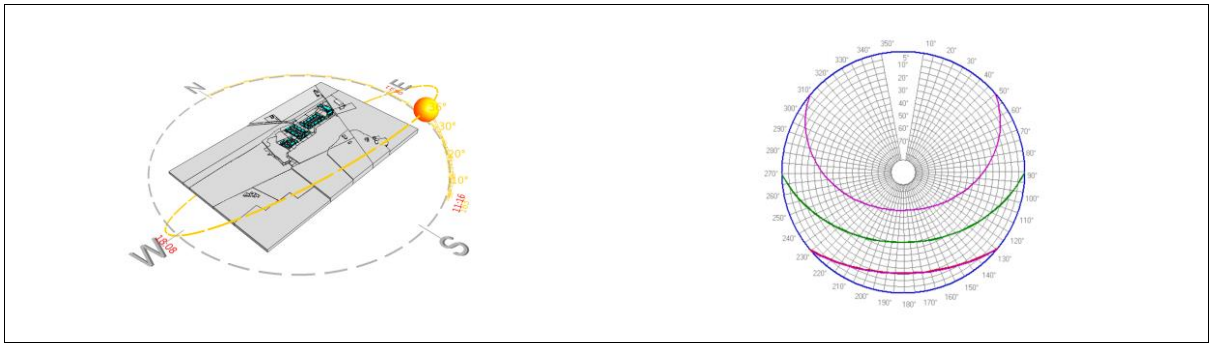
This section will consider the shadows cast by the proposed development on the following dates:

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

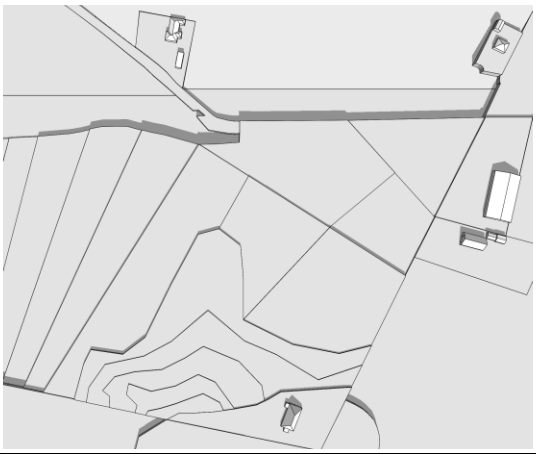
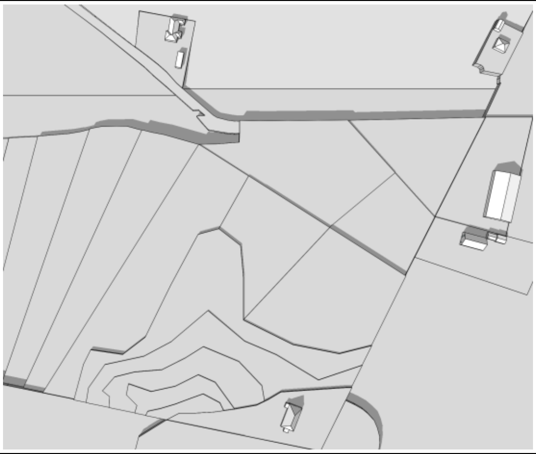
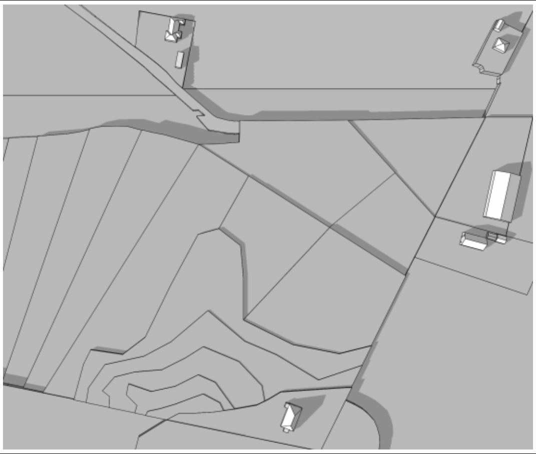
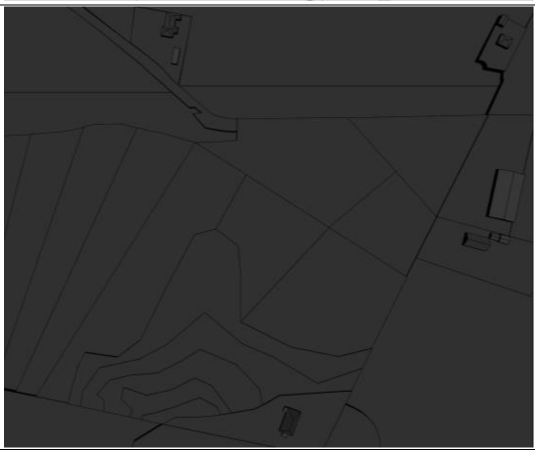
These images illustrate shadows cast for 'perfect sunny' conditions with no clouds and assumed that the sun is shining for every hour shown. Given the discussion above it is important to remember that this is not always going to be the case.

7.1 Plan View

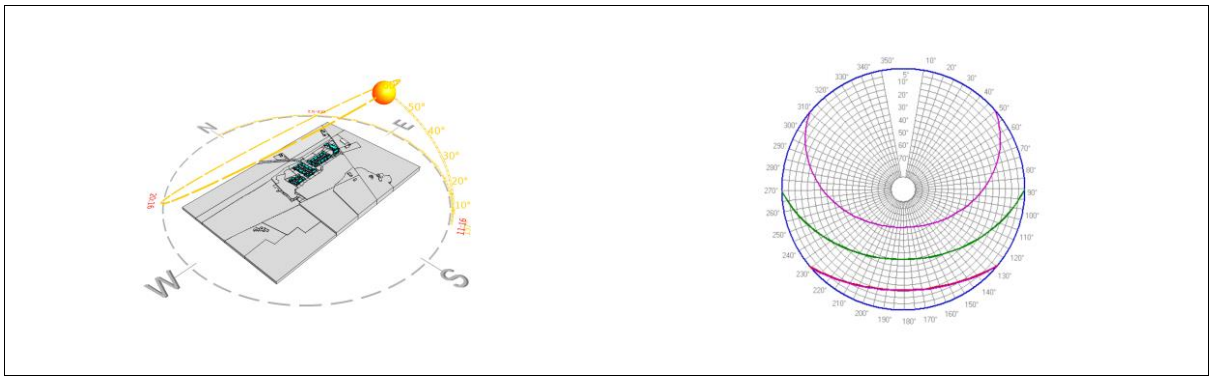
7.1.1 March 21st



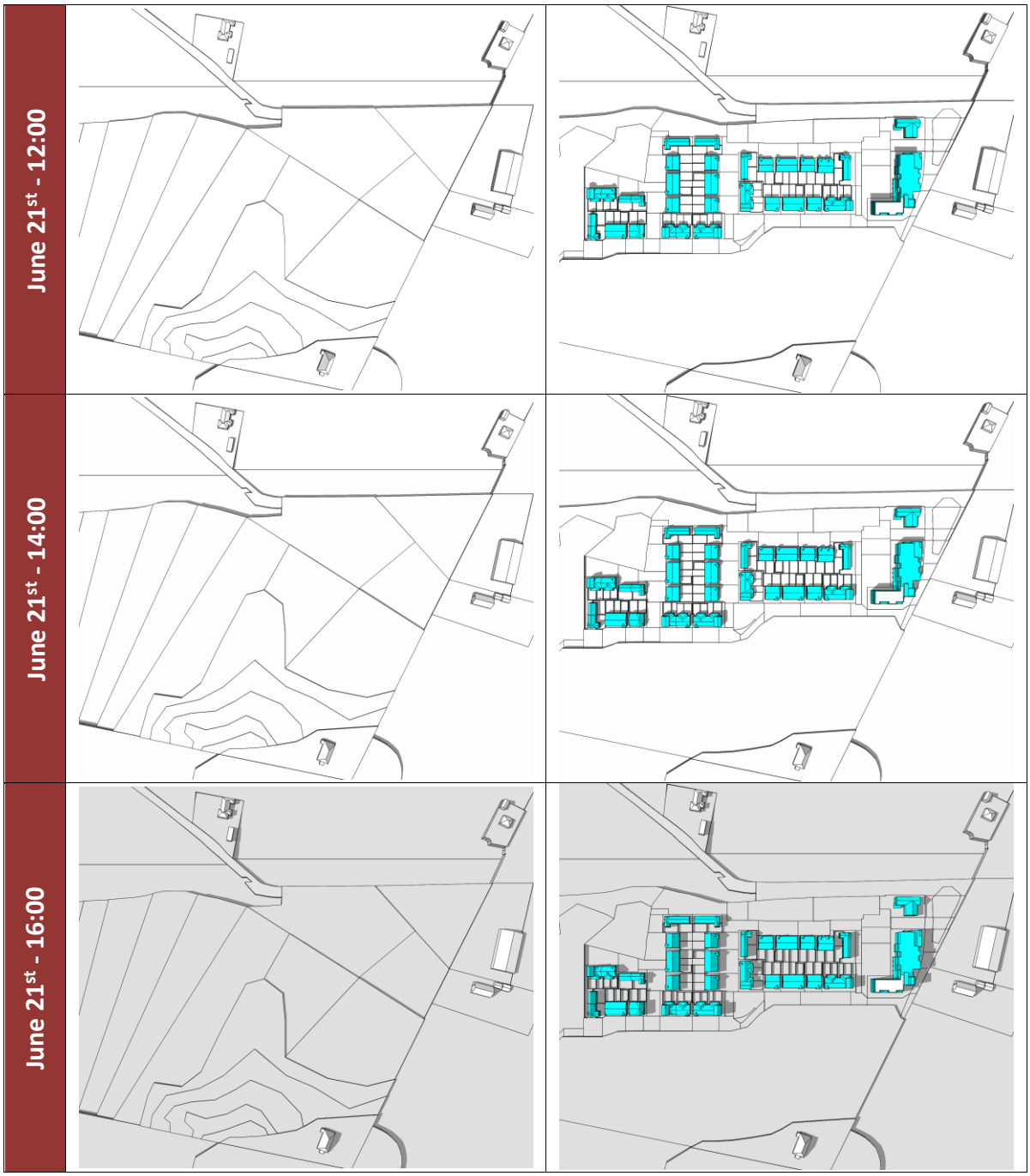
	Existing	Proposed
March 21st - 8:00		
March 21st - 10:00		

March 21st - 12:00		
March 21st - 14:00		
March 21st - 16:00		
March 21st - 18:00		

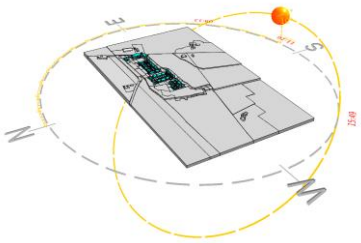
7.1.2 June 21st

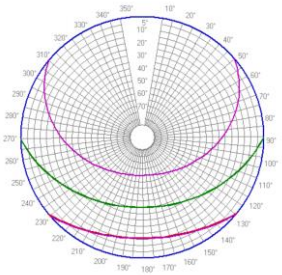


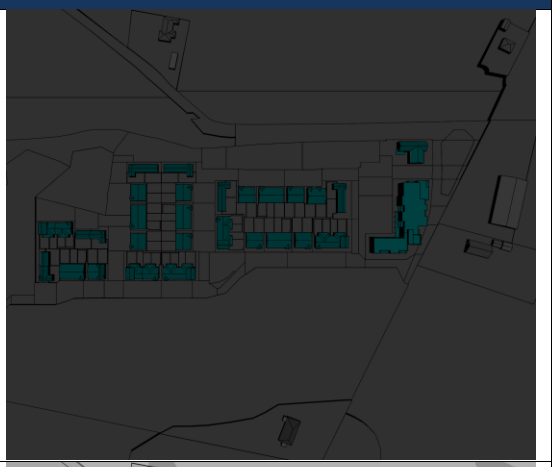
	Existing	Proposed
June 21st - 8:00		
June 21st - 10:00		

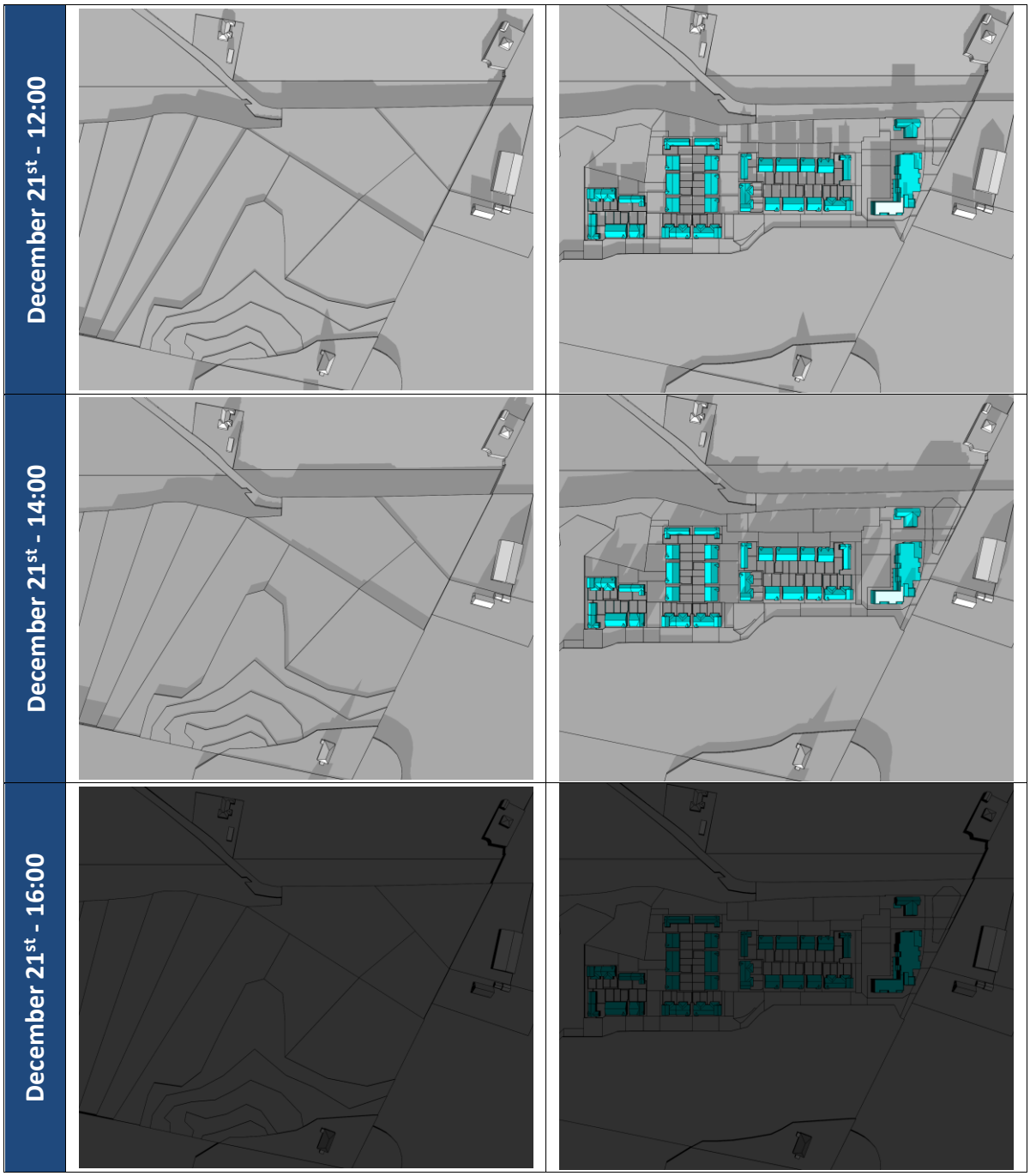

June 21st - 12:00
June 21st - 14:00
June 21st - 16:00

7.1.3 December 21st



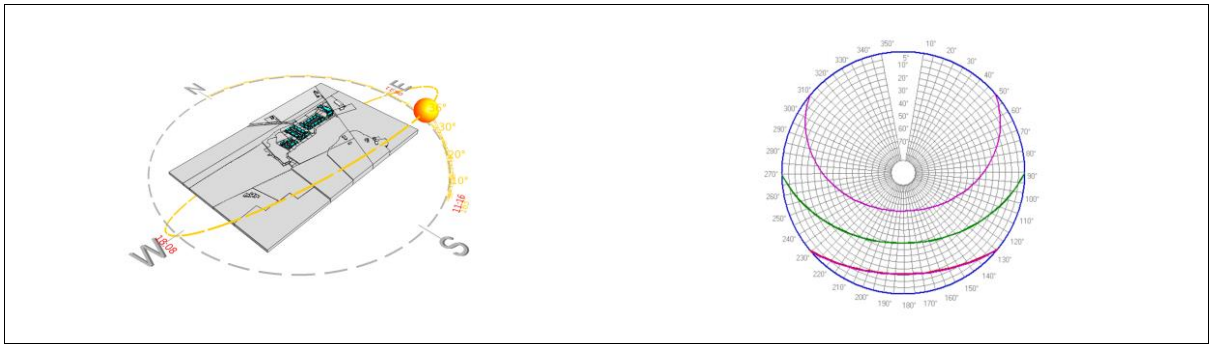


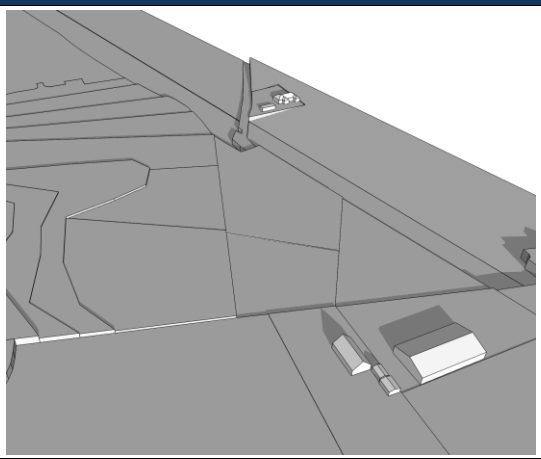
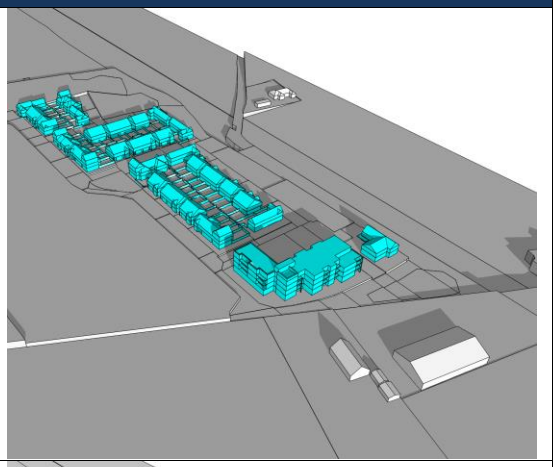
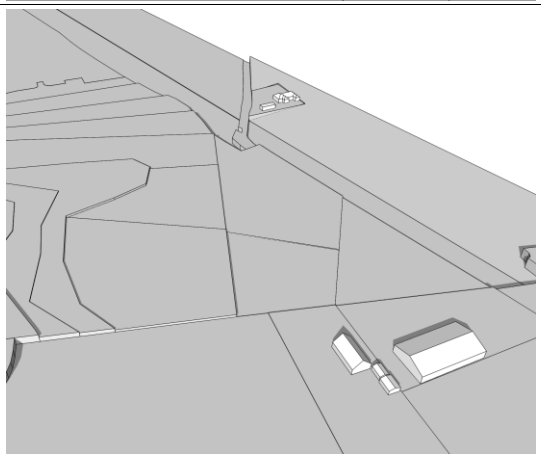
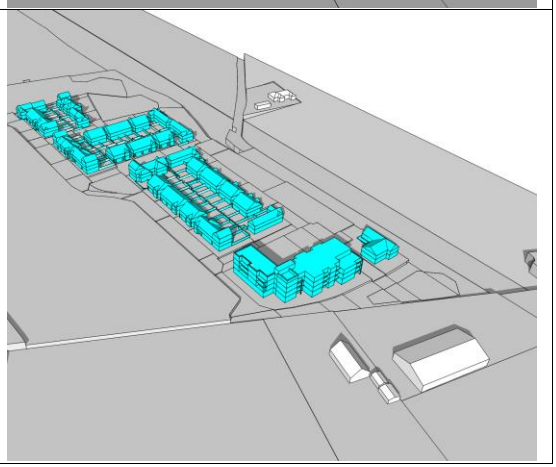
	Existing	Proposed
December 21st - 8:00		
December 21st - 10:00		

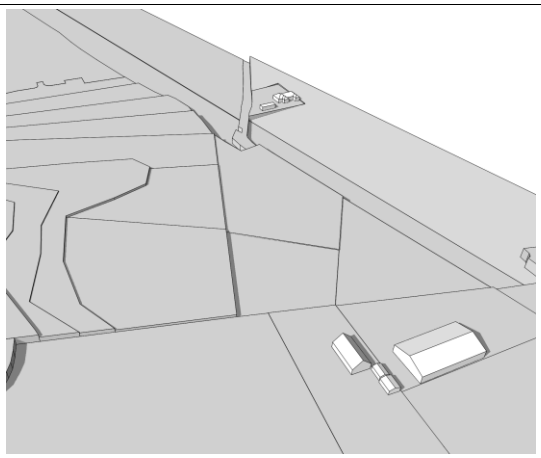
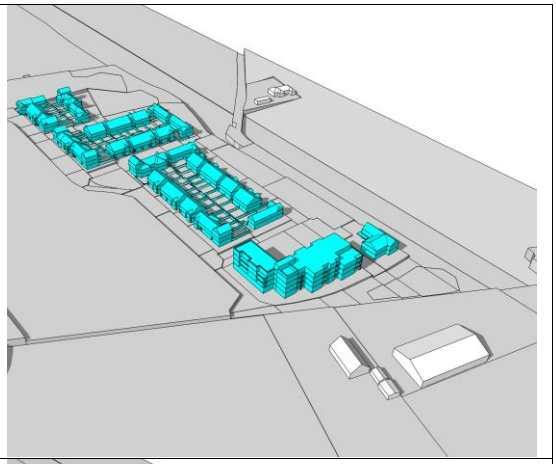
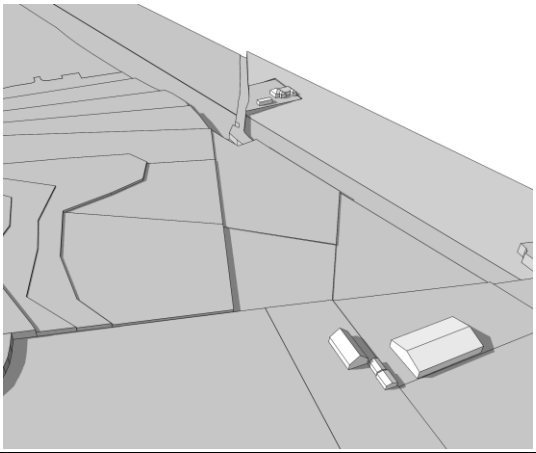
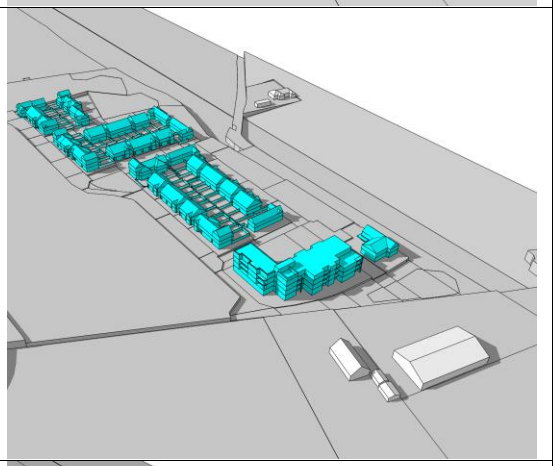
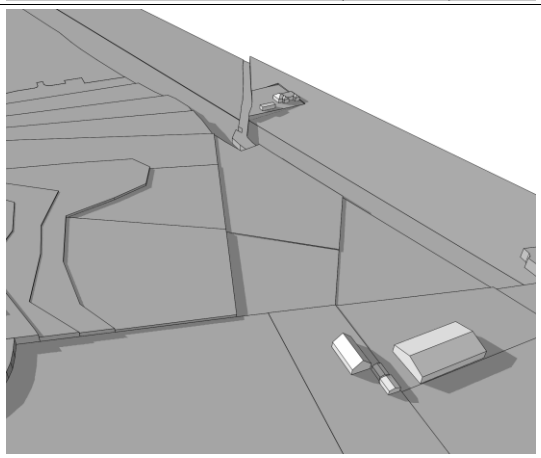
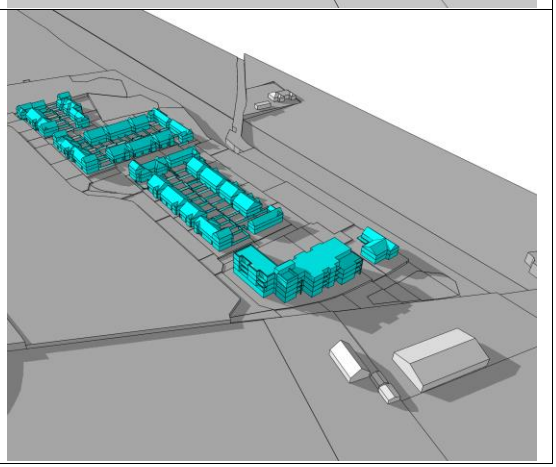

December 21st - 12:00
December 21st - 14:00
December 21st - 16:00

7.2 3D View

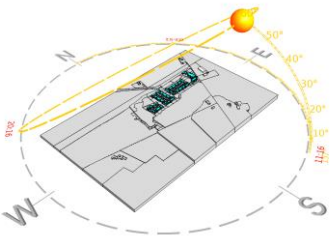
7.2.1 March 21st

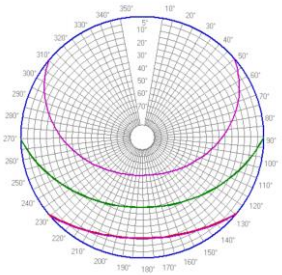


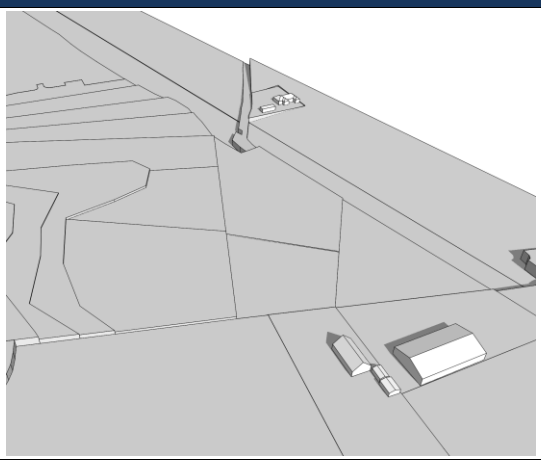
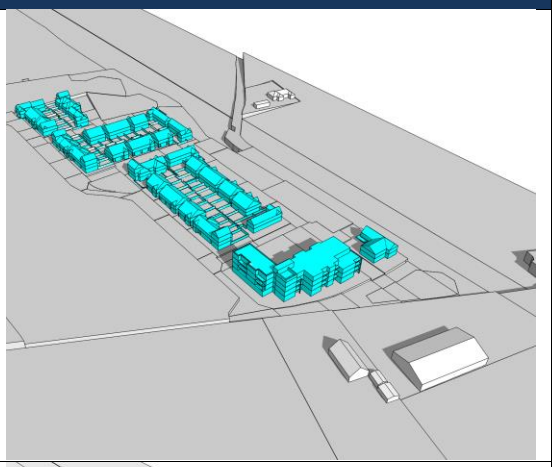
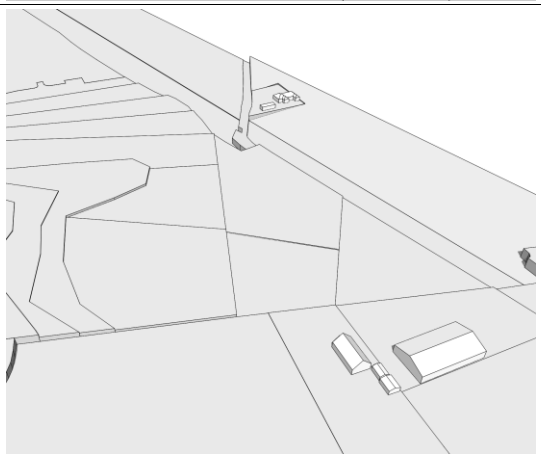
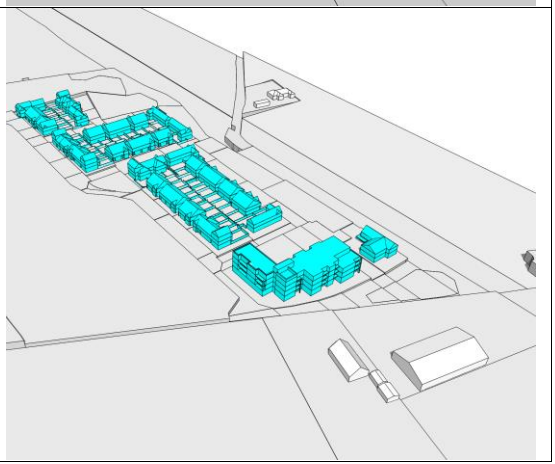
	Existing	Proposed
March 21st - 8:00		
March 21st - 10:00		

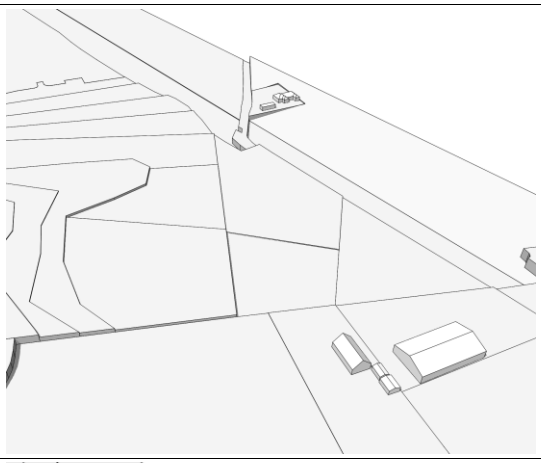
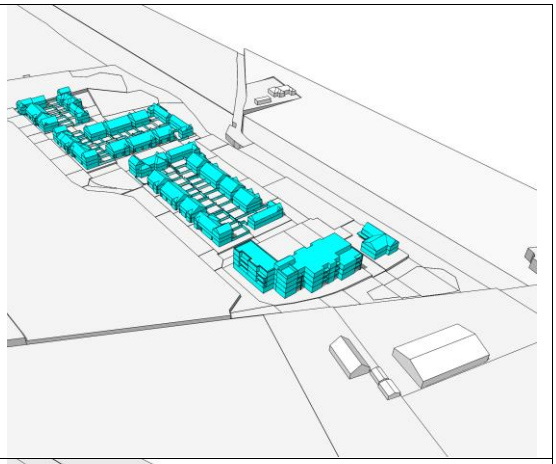
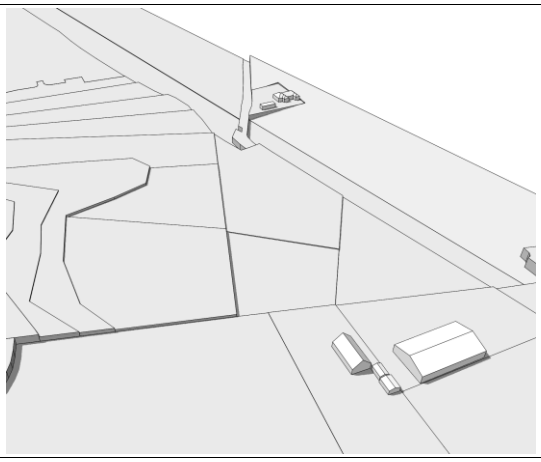
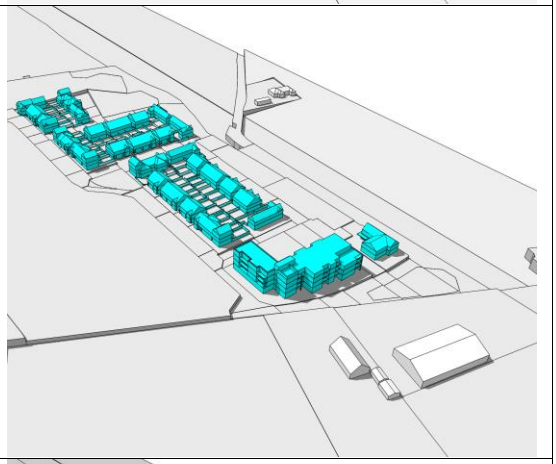
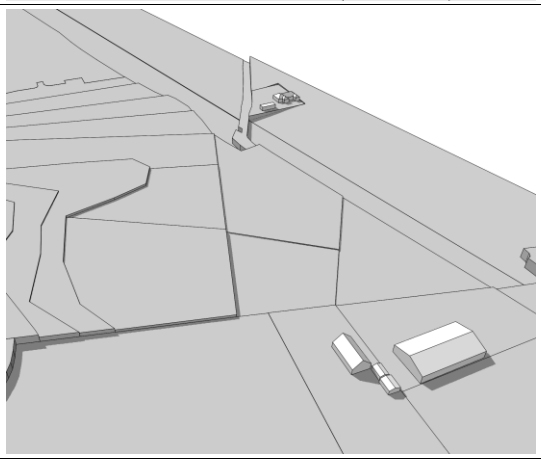
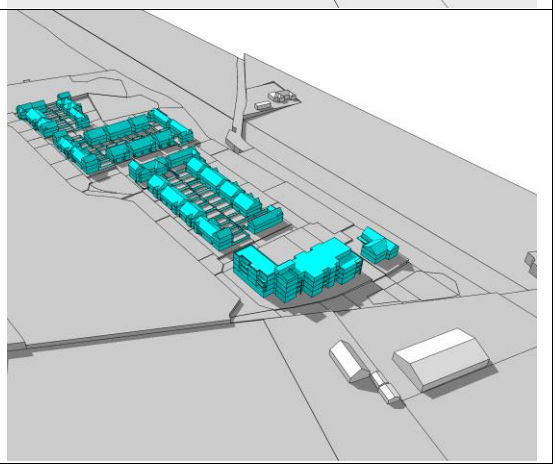
March 21st - 12:00		
March 21st - 14:00		
March 21st - 16:00		

7.2.2 June 21st

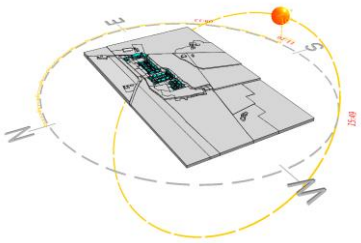


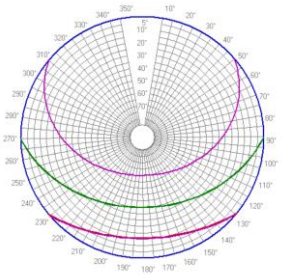


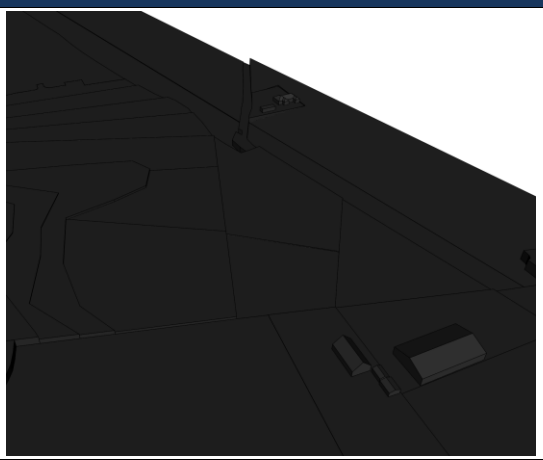
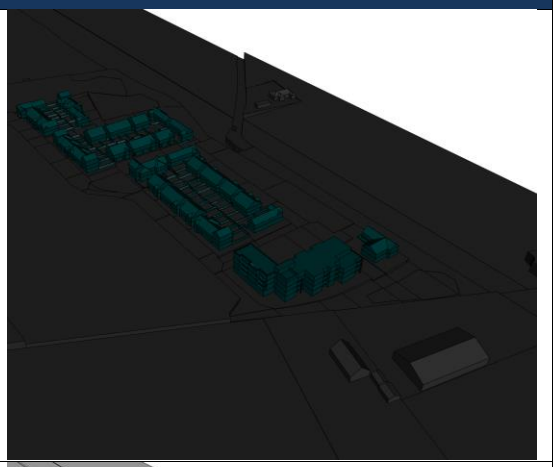
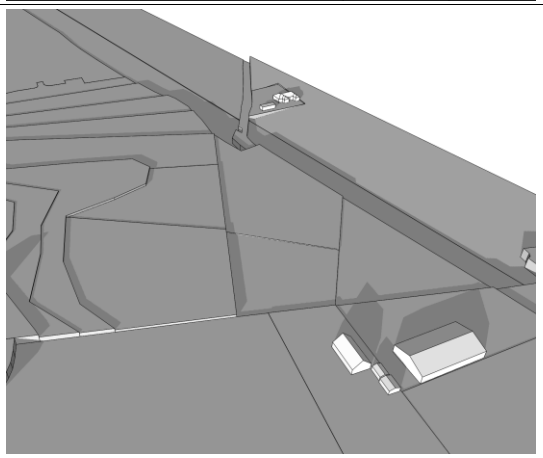
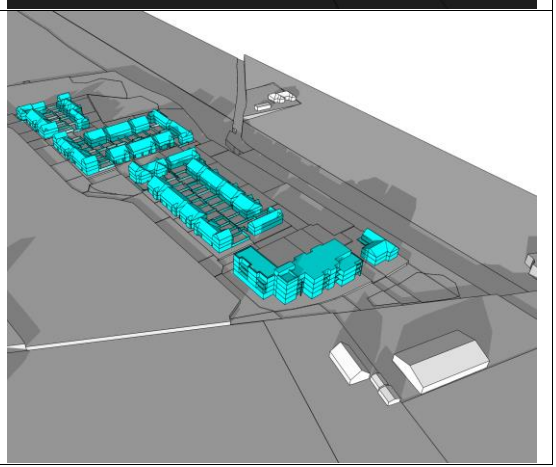
	Existing	Proposed
June 21st - 8:00		
June 21st - 10:00		

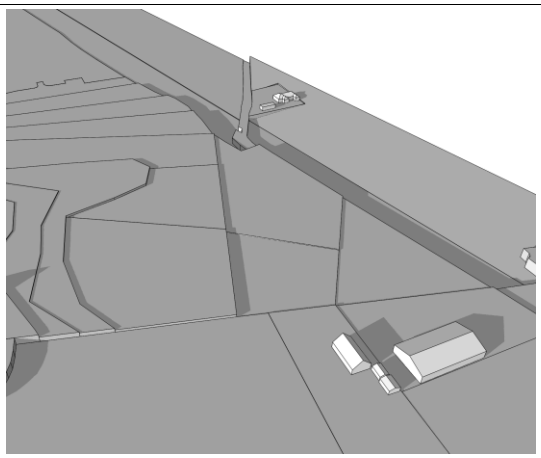
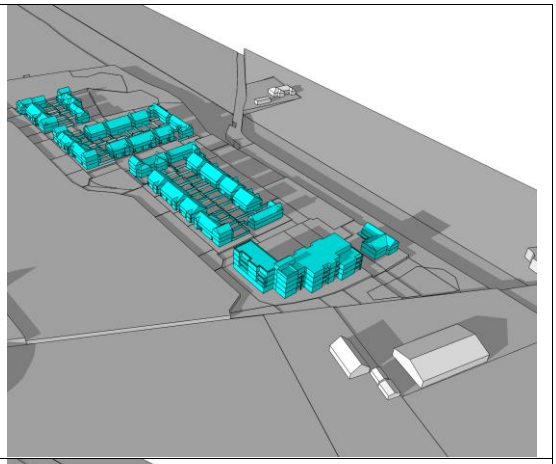
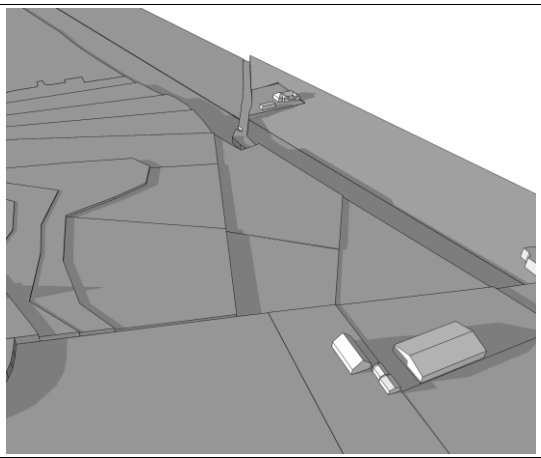
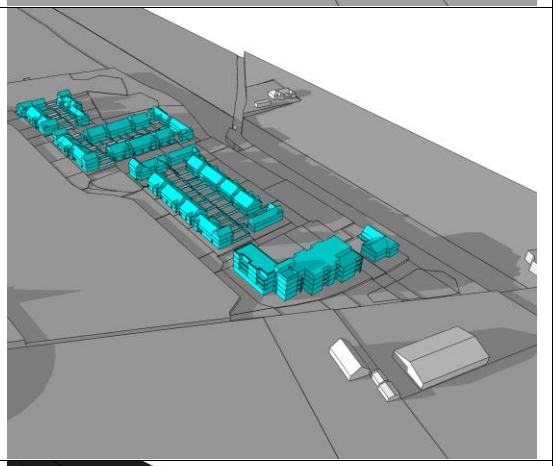
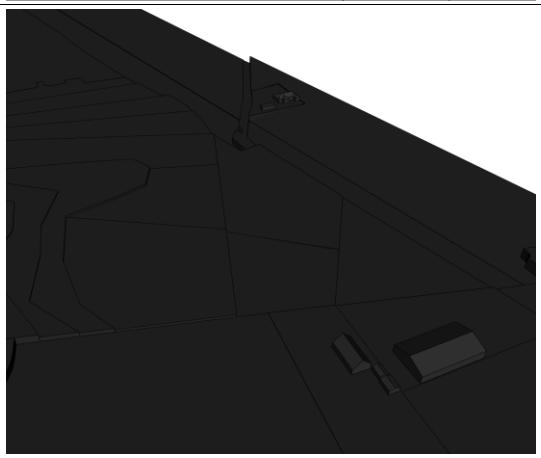
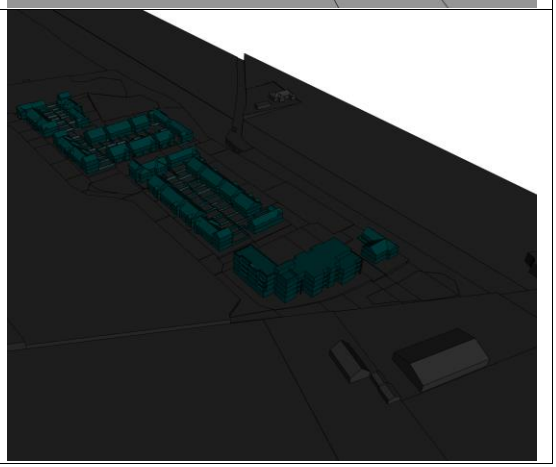
June 21st - 12:00		
June 21st - 14:00		
June 21st - 16:00		

7.2.3 December 21st





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

December 21st - 12:00		
December 21st - 14:00		
December 21st - 16:00		

7.3 Discussion

The shadow analysis illustrates different shadows being cast at three key times of the year for the existing scenario and the proposed development. The proposed development impact of overshadowing does not have an effect on the only close residential building near the site.

It should be noted that sunlight is less prevalent during the winter months and as such the impact of overshadowing will be greatly reduced. Taking this into account the overall impact of overshadowing can be classed as a minor adverse impact.

The proposed development's performance is further quantified within the daylight analysis to the existing buildings and sunlight to existing amenities sections of this report.

8 Sunlight to Proposed Amenity Spaces

8.1 Guidance Requirements

The impact of the development proposal on the sunlight availability in the amenity areas will be considered to determine how the amenities perform when assessed against the BRE Guidelines 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 Guidelines state in Section 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.

The following images illustrate the predicted results with respect to this space receiving at least 2 hours of sunlight on 21st March across the gridded cells. Any gridded cell areas below 2 hours are colour-coded in grey.

8.2 Amenity Areas

As stated previously, 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 amenity spaces illustrated in the image below.

Existing Amenities

Proposed Public Amenity

Proposed Roof Terrace

Proposed Private Gardens

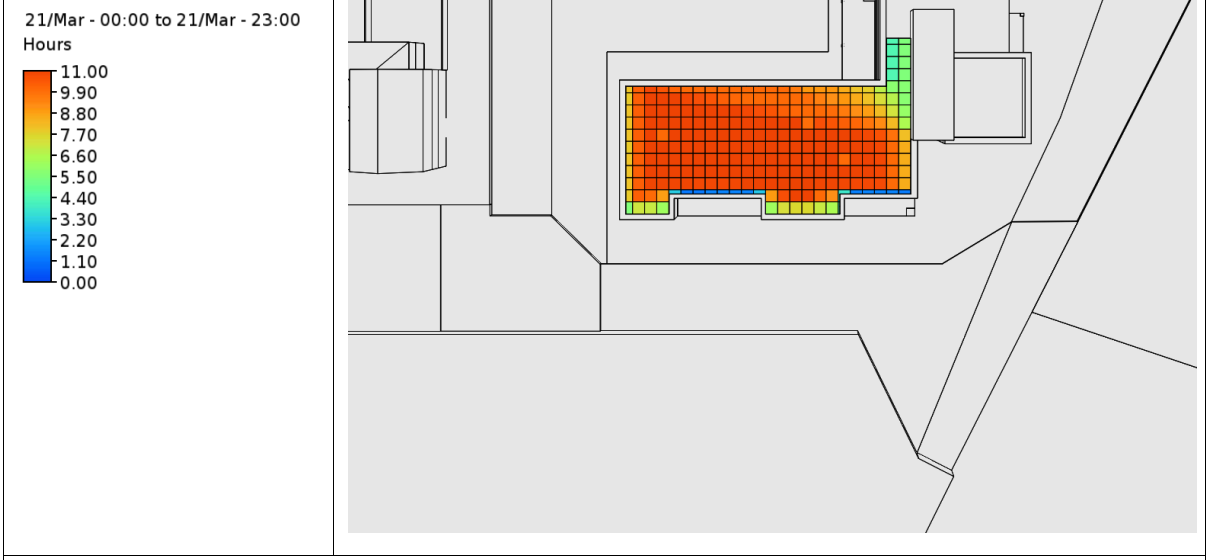
8.3 Sunlight Access Results

The following images illustrate the predicted results for sunlight access with respect to the proposed building roof terrace, public amenity open space and private gardens. The images on the following pages illustrate the areas that are receiving at least 2 hours of sunlight on 21st March.

Note, not all private gardens have been assessed. A representative sample have been tested to give an indication of how the overall private garden areas comply with the BRE Guidelines.

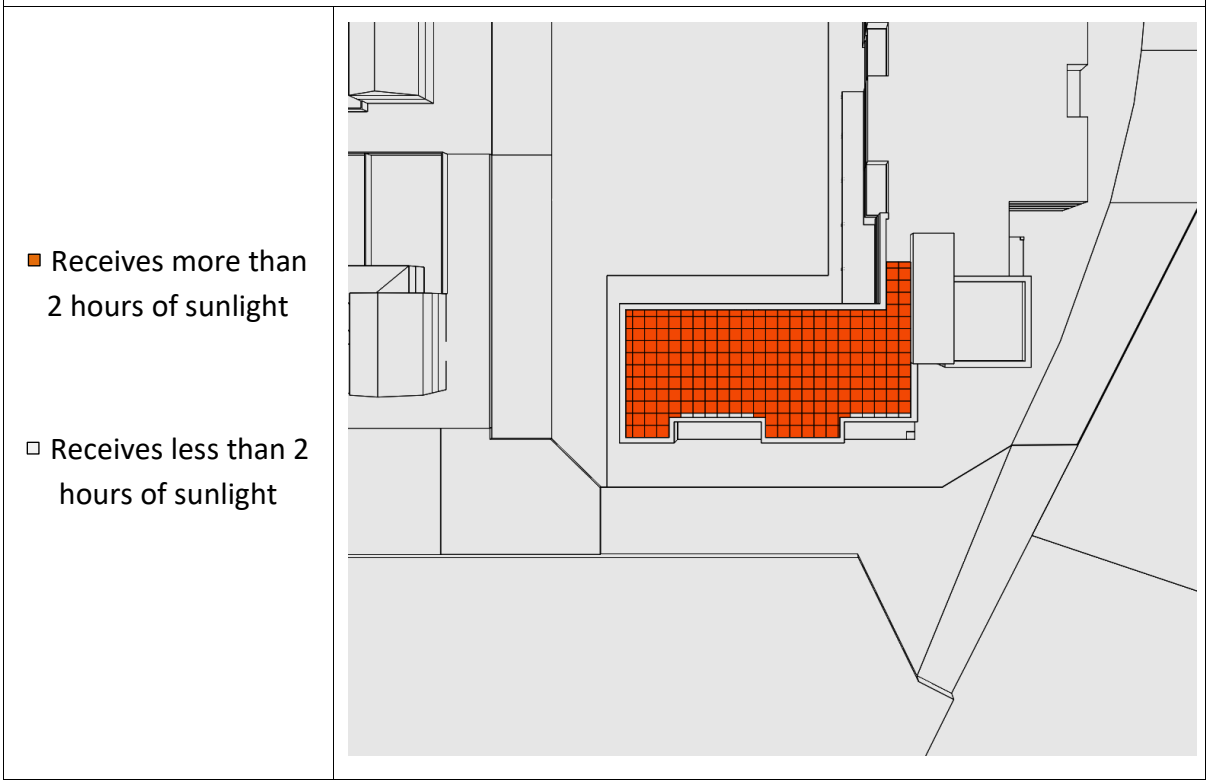
Absolute Scale Illustrating all Hours of Sunlight Received

Proposed Roof Terrace

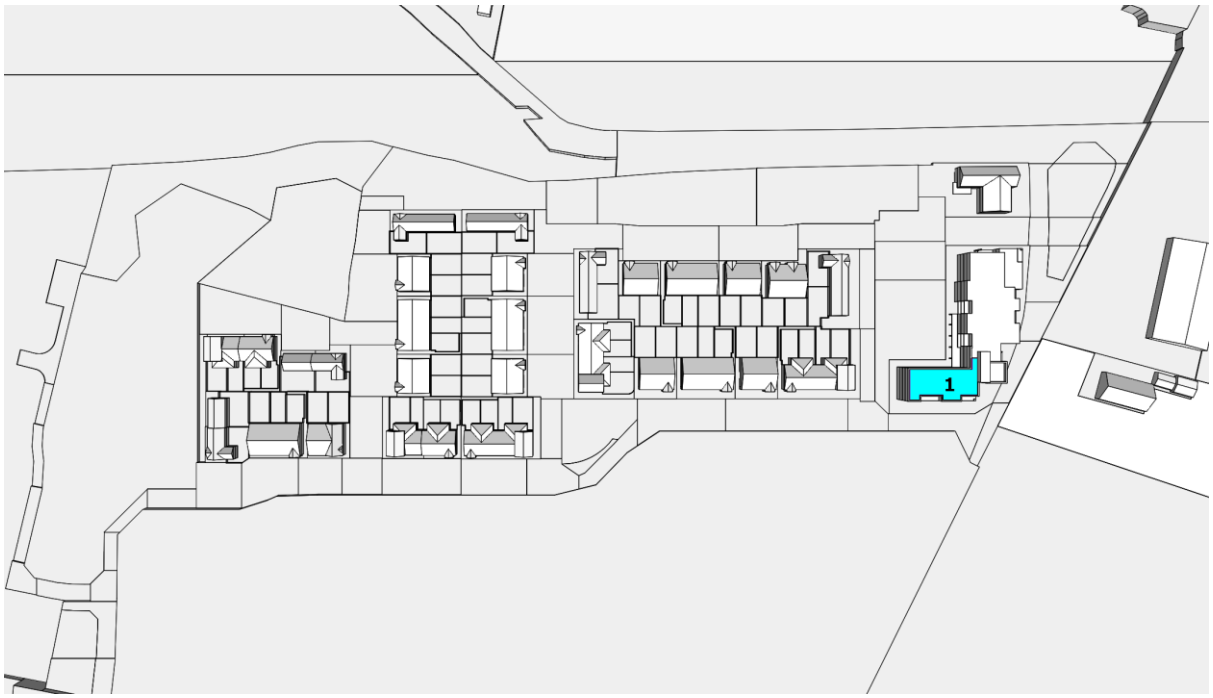


Hours of Sunlight > 2 Illustrated in Red

Proposed Roof Terrace

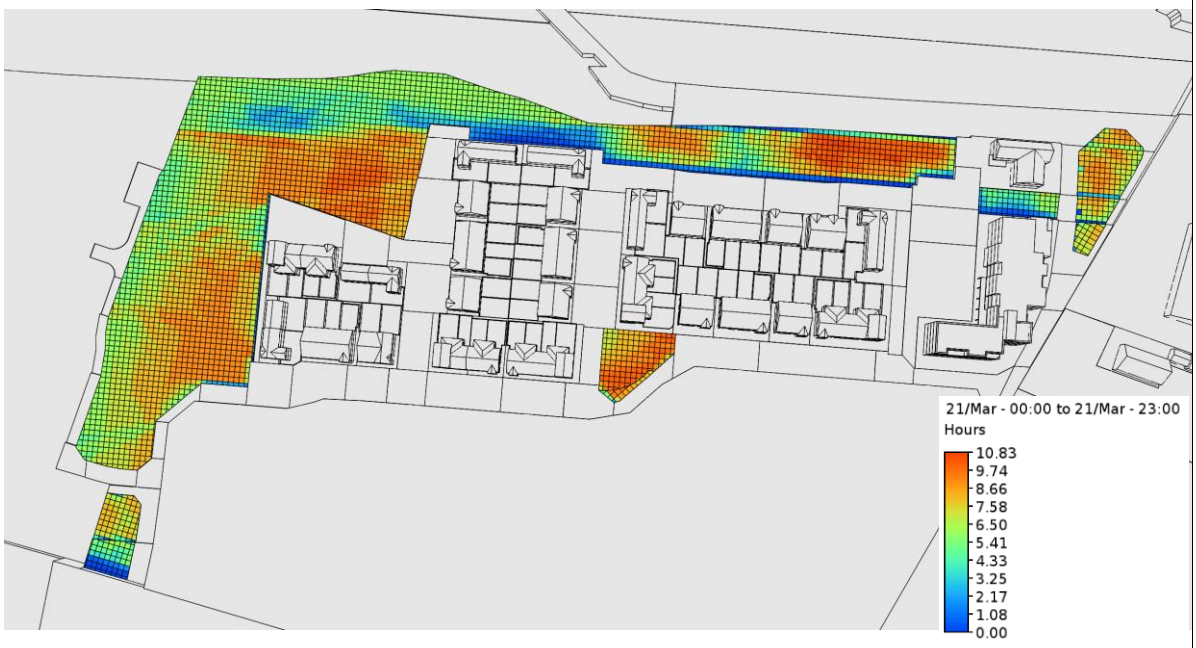


The results illustrated above are summarised in the following table. All areas comply with the minimum 50% requirement in accordance with the BRE Guidelines.



Amenity	Ref	Area (m^2)	Area (m^2) >2 hours on 21st March	Total % > 2 Hours 21st March
Roof Terrace	1	234	230	98%
Total		234	230	98%

Absolute Scale Illustrating all Hours of Sunlight Received
Proposed Public Amenity Areas



Hours of Sunlight > 2 Illustrated in Red
Proposed Public Amenity Areas

■ Receives more than 2 hours of sunlight

□ Receives less than 2 hours of sunlight

The results illustrated above are summarised in the following table. All areas comply with the minimum 50% requirement in accordance with the BRE Guidelines.

Amenity	Ref	Area (m^2)	Area (m^2) >2 hours on 21st March	Total % > 2 Hours 21st March
Public Amenity	2	449	380	85%
Public Amenity	3	14,947	14,650	98%
Public Amenity	4	526	526	100%
Public Amenity	5	312	234	75%
Public Amenity	6	755	727	96%
Total		**16,989**	**16,517**	**97%**

Absolute Scale Illustrating all Hours of Sunlight Received
Proposed Private Gardens

Hours of Sunlight > 2 Illustrated in Red
Proposed Private Gardens

■ Receives more than 2 hours of sunlight

□ Receives less than 2 hours of sunlight

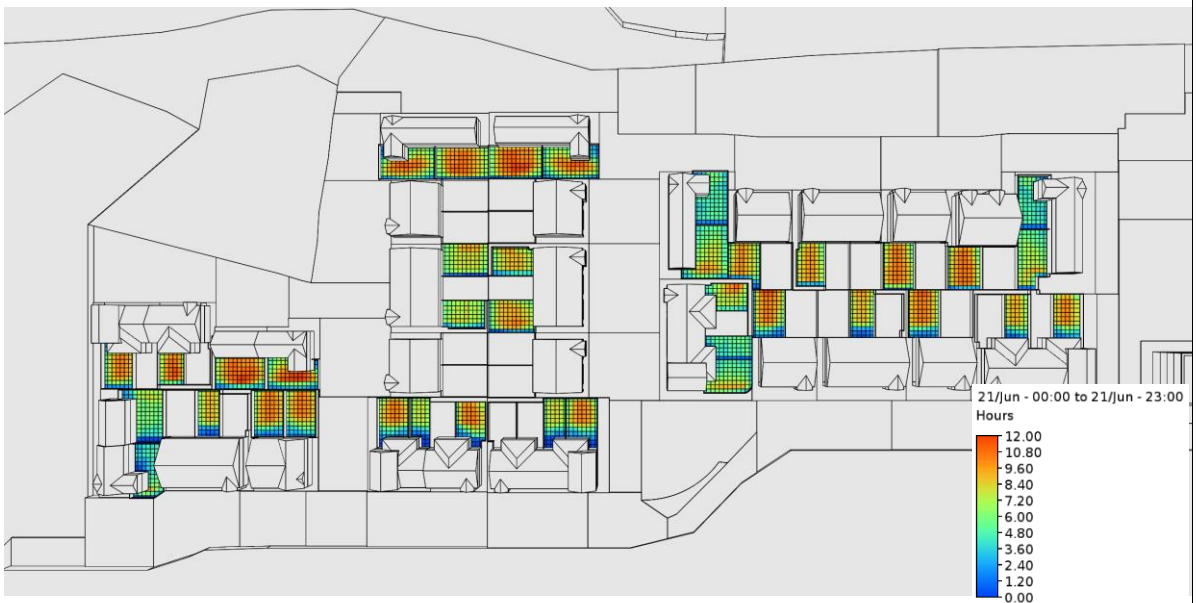
The results illustrated above are summarised in the following table. The overall combined area of the sample tested complies with the minimum 50% requirement in accordance with the BRE Guidelines.

Amenity	Ref	Area (m^2)	> 2 hours on 21st March Area (m^2)	> 2 Hours 21st March Total %
Private Garden	7	76	47	62%
Private Garden	8	51	25	49%
Private Garden	9	107	50	47%
Private Garden	10	81	21	26%
Private Garden	11	83	37	45%
Private Garden	12	103	55	53%
Private Garden	13	63	20	32%
Private Garden	14	83	28	34%
Private Garden	15	83	25	30%
Private Garden	16	89	33	37%
Private Garden	17	96	62	65%
Private Garden	18	96	62	65%
Private Garden	19	88	21	24%
Private Garden	20	84	55	65%
Private Garden	21	66	43	65%
Private Garden	22	65	40	62%
Private Garden	23	84	55	65%
Private Garden	24	72	20	28%
Private Garden	25	49	8	16%
Private Garden	26	63	6	10%
Private Garden	27	53	12	23%
Private Garden	28	72	22	31%
Private Garden	29	85	58	68%
Private Garden	30	105	67	64%
Private Garden	31	69	50	72%
Private Garden	32	66	41	62%
Private Garden	33	83	63	76%
Private Garden	34	82	57	70%

Private Garden	35	97	76	78%
Private Garden	36	81	56	69%
Private Garden	37	55	41	75%
Private Garden	38	53	35	66%
Private Garden	39	74	63	85%
Private Garden	40	83	30	36%
Private Garden	41	64	21	33%
Private Garden	42	83	28	34%
Private Garden	43	65	16	25%
Private Garden	44	75	16	21%
Total		**2,927**	**1,465**	**50%**

To show the private garden areas will still receive high level of sunlight access during the summer months when sunlight is most valuable, the following images illustrate the sunlight received for the private gardens on June 21st.

Absolute Scale Illustrating all Hours of Sunlight Received
Proposed Private Gardens (June 21st)



Hours of Sunlight > 2 Illustrated in Red
Proposed Private Gardens (June 21st)

■ Receives more than 2 hours of sunlight

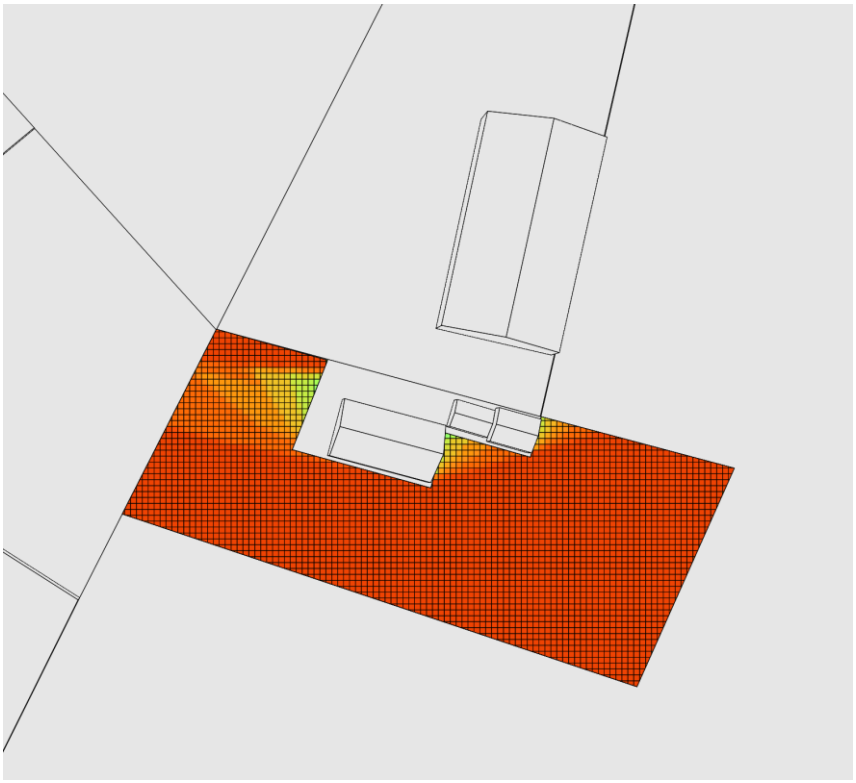
□ Receives less than 2 hours of sunlight

The results illustrated above are summarised in the following table. During the summer months the private gardens will receive excellent levels of sunlight. 95% of the combined areas will achieve a minimum 2 hours of sunlight.

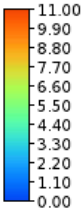
Amenity	Ref	Area (m^2)	>2 hours on 21st June Area (m^2)	> 2 Hours 21st June Total %
Private Garden	7	76	75	99%
Private Garden	8	51	51	100%
Private Garden	9	107	107	100%
Private Garden	10	81	79	98%
Private Garden	11	83	78	94%
Private Garden	12	103	97	94%
Private Garden	13	63	53	84%
Private Garden	14	83	80	96%
Private Garden	15	83	80	96%
Private Garden	16	89	87	98%
Private Garden	17	96	94	98%
Private Garden	18	96	94	98%
Private Garden	19	88	88	100%
Private Garden	20	84	76	90%
Private Garden	21	66	66	100%
Private Garden	22	65	65	100%
Private Garden	23	84	80	95%
Private Garden	24	72	68	94%
Private Garden	25	49	40	82%
Private Garden	26	63	55	87%
Private Garden	27	53	45	85%
Private Garden	28	72	65	90%
Private Garden	29	85	78	92%
Private Garden	30	105	105	100%
Private Garden	31	69	65	94%
Private Garden	32	66	66	100%
Private Garden	33	83	83	100%
Private Garden	34	82	82	100%
Private Garden	35	97	92	95%
Private Garden	36	81	75	93%
Private Garden	37	55	55	100%
Private Garden	38	53	46	87%
Private Garden	39	74	74	100%
Private Garden	40	83	76	92%
Private Garden	41	64	56	88%
Private Garden	42	83	79	95%
Private Garden	43	65	63	97%
Private Garden	44	75	73	97%
Total		**2,927**	**2,791**	**95%**

8.4 Existing Neighbouring Amenity Results

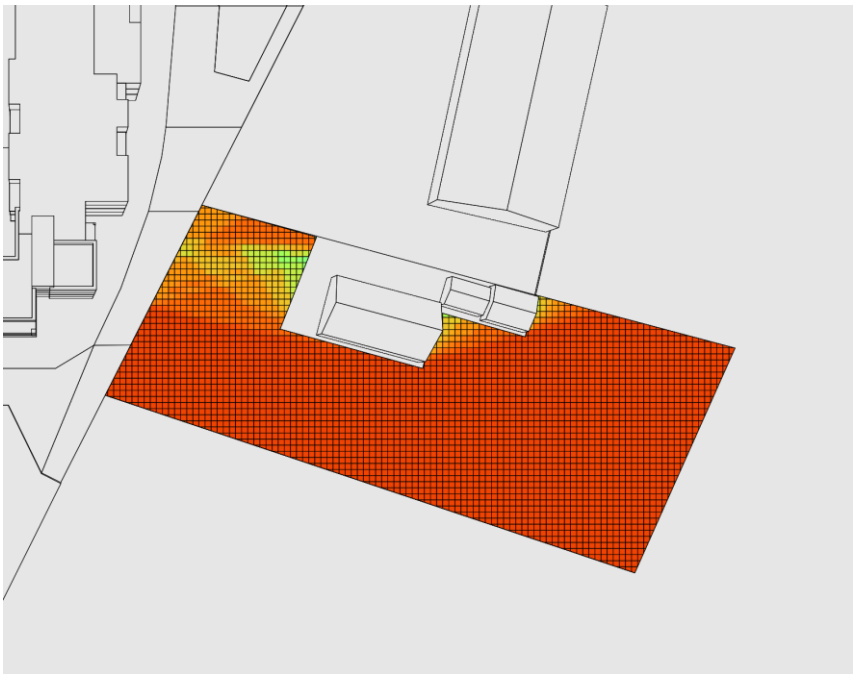
Absolute Scale Illustrating all Hours of Sunlight Received
Existing Amenity Areas



21/Mar - 00:00 to 21/Mar - 23:00
Hours

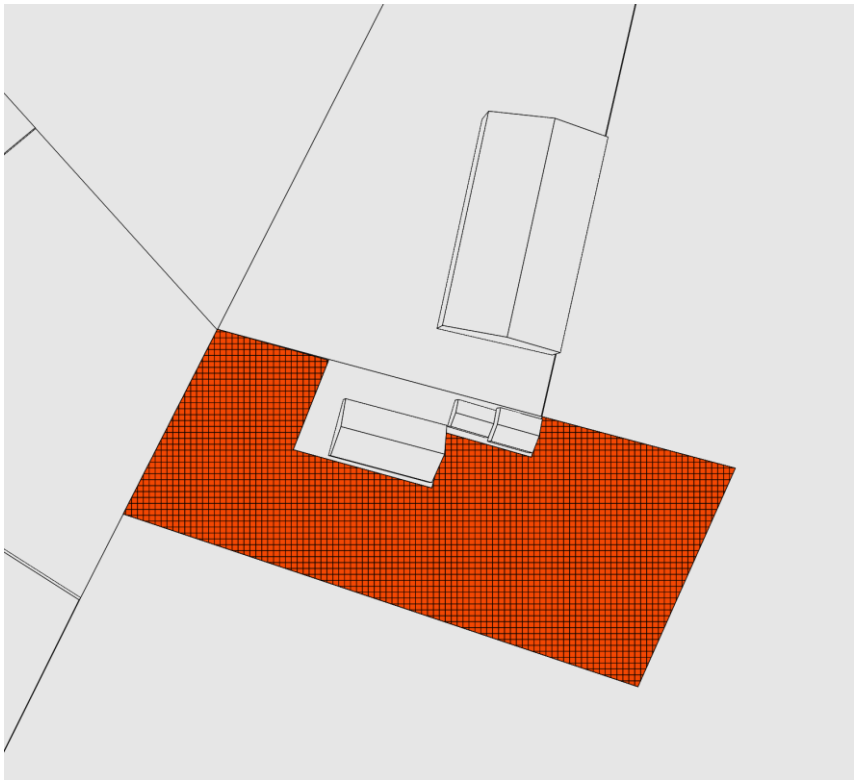


Absolute Scale Illustrating all Hours of Sunlight Received
Existing Amenity Areas with Proposed Development in Place



8.5 Existing Neighbouring Amenity Results

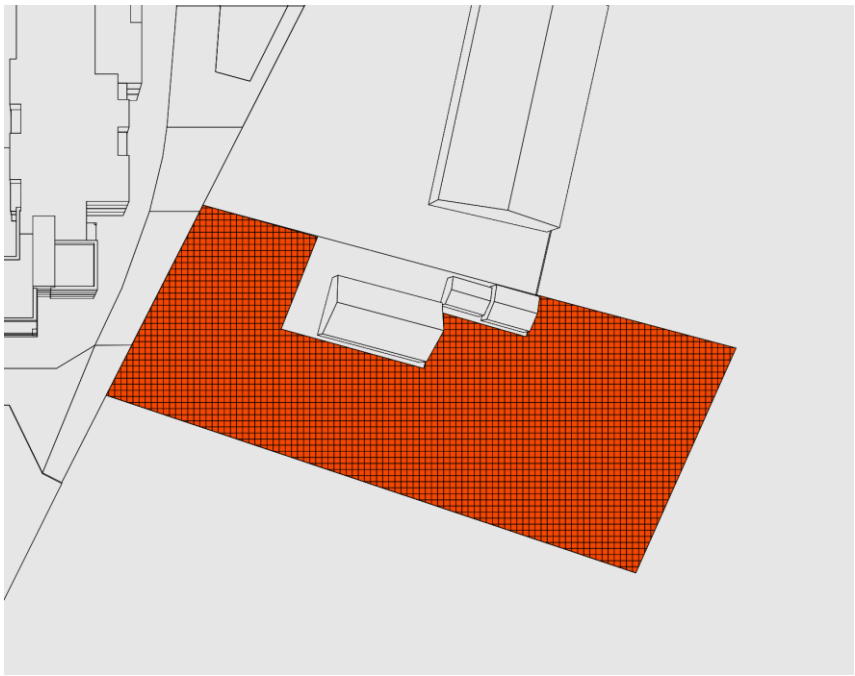
Hours of Sunlight > 2 Illustrated in Red
Existing Amenity Areas



■ Receives more than 2 hours of sunlight

□ Receives less than 2 hours of sunlight

Hours of Sunlight > 2 Illustrated in Red
Existing Amenity Areas with Proposed Development in Place



Neighbourhood Amenity Garden

Ref	Area (m^2)	Existing Area >2 hrs		Proposed Area >2 hrs		Proposed vs Existing (%)	Comment
		(m^2)	(%)	(m^2)	(%)		
1	2,908	2,908	100%	2,908	100%	100%	✓

The following conclusion can be made:

✓ The sunlight to existing amenity gardens achieves at least 0.8 times their former value with the proposed development in place, thus complying with BRE Guidelines.

8.6 Solar Amenity Discussion

As outlined in Section 3.3.17 of the BRE Guidelines, 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 Neighbouring Amenities

One existing amenity space was analysed and it still receives the same amount of sunlight even with the proposed development in place, thus complying with BRE Guidelines.

Proposed Amenities

On the 21st of March, the proposed roof terrace area situated within the development site will receive at least 2 hours of sunlight on 98% of its area, exceeding BRE recommendations.

On the 21st of March, the proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight on 97% of its area, exceeding BRE recommendations.

On the 21st of March, the sample of proposed private garden amenity areas tested will receive at least 2 hours of sunlight on 50% of its area, meeting BRE recommendations. When calculated for the 21st of June, this percentage increases to 95%.

When combined, all amenity areas including the roof terrace, public amenities and private garden sample areas, will receive at least 2 hours of sunlight on March 21st on 90% of their combined area, significantly exceeding the minimum BRE recommendations of 50%.

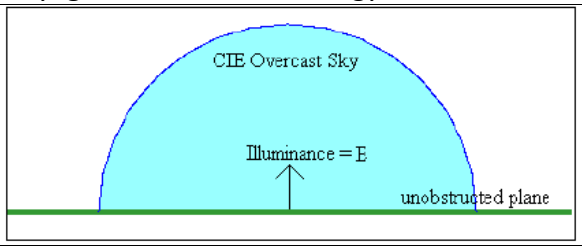
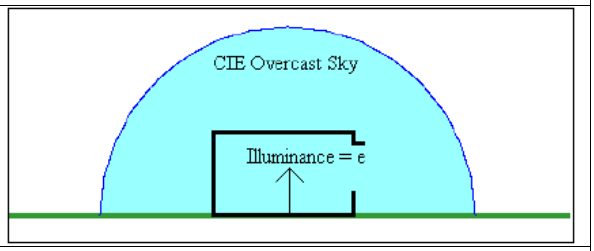
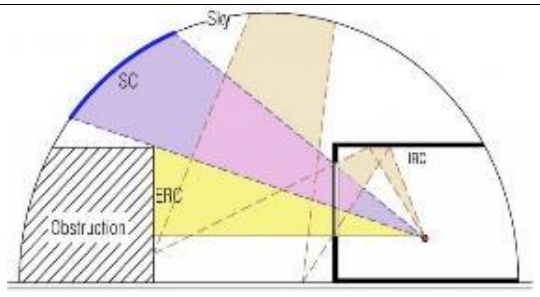
9 Average Daylight Factors (ADF)

This section addresses daylight to the proposed apartments. The purpose of the ADF calculations is to quantify an overall percentage of units which exceeds the BRE recommendations. Our proposed methodology is to complete the ADF calculations for ground, level one and level three as a representative sample. The objective of the design team was to maximise the number of units which exceed the BRE recommendations.

9.1 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.

9.2 Reference and Metrics

The BRE Guidelines state 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 summarised as follows:

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

9.3 Combined Function Spaces – Living / Kitchen / Dining

Note the BRE Guidelines do not provide explicit guidance for an open space that is a combination of Living/Kitchen/Dining (L/K/D) functions.

In addition, a separate document the "*BS 8206-2:2008: Lighting for Buildings - Part 2: Code of Practice for Daylighting*" focuses on internal daylighting performance and 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 this reason, it should be noted where there are open plan spaces within the development the initial target value will be 2%. In addition to this 2% target there will also be the provision of results based on a 1.5% target.

In line with the national policy guidance noted in the Sustainable Urban Housing: Design Standards for New Apartments, Section 6.7 which states:

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

In this context, the living area has been treated as the main activity, with the design constraint of the kitchen being placed at the back of the space. This design decision is understandable as the kitchen area is classed as a "non-habitable transient space" because their functional significant purpose is only to serve as food preparation and not as a long-term sitting area. Additionally, not every space within a commercially viable apartment development can be in direct connection with an exterior elevation, making the kitchen the obvious choice for this position given that it is a transient space that will require supplementary electric lighting. This is strong evidence that the 1.5% average daylight factor is the appropriate target on this basis.

In addition to complying with further Irish Design Standards for New Apartments, such as the provision of balconies (which reduce daylight within apartments as noted within the BRE Guidelines), the 1.5% ADF target is noted as the more appropriate method again in this instance. Although the design target value is lower, this is compensated with a much higher

valued outdoor private amenity provision which is noted to be a very desirable commodity for occupants to benefit their connection to the outdoors.

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

Ireland is currently in the midst of a widely recognised housing crisis with a need for quality domestic dwellings. This puts a premium on the number of properties to help overcome the national issue. Modern architectural design maximises the space function by creating open Living/Dining/Kitchen areas. Where previously solid partition walls may have existed to separate these functions, they are now removed to help maximise an open space that creates a more flexible and larger feeling habitable environment.

Therefore, where a kitchen may have been closed off into a cellular space with no access to daylight, the kitchen can now take advantage of daylight distribution from the adjoining living/dining area. Kitchen environments will still typically rely on artificial light, primarily for detail and safety precautions whilst preparing meals, but with this open layout form they will capture daylight that previously would not be available and which will help reduce artificial lighting needs at suitable times. This in turn helps to reduce electrical energy consumption.

With the kitchens positioned at the back of the space where artificial lighting will typically be required, then aspiring to achieve daylight contribution should be seen as the goal and not measuring it to fixed requirements. As the kitchens will be classed as a "non-habitable transient spaces", the daylight benefit is primary to the habitable spaces of the Living and Dining areas.

9.4 Planning Authority Guidelines

The BRE Guidelines state 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 (Urban Development and Building Heights, Guidelines for Planning Authorities 2018), where deep plan single aspect combine modern flexible living 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 Guidelines, *"Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."*

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.

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 have been noted to be accepted by An Bord Pleanala.

9.5 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: 3.15m (3.6m in L0) in Apartment Building
  3.1m in L0 – 2.3 to 2.45m in L1 in Houses

The following surface reflectance values are used in the study:

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

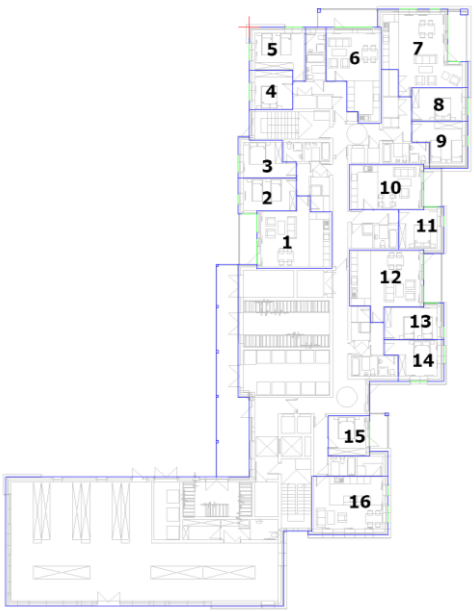
Glazing Transmittance:

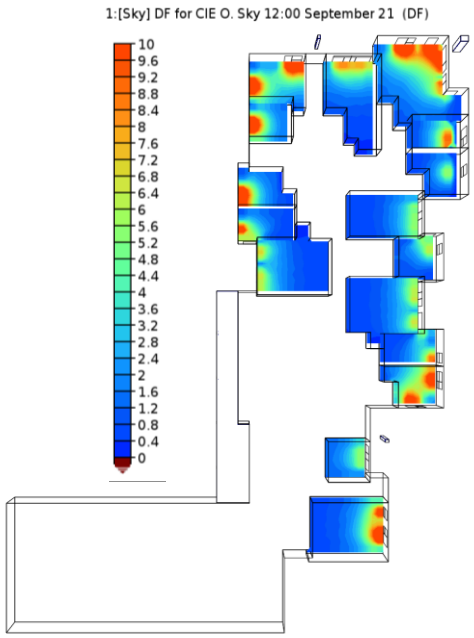
- Light Transmittance: 70%
- Window Frame thickness: 50 mm

9.6 Average Daylight Factor Results

The following floor plan highlights the rooms that were simulated to ascertain the Average Daylight Factors.

9.6.1 Apartment Building – Level 00





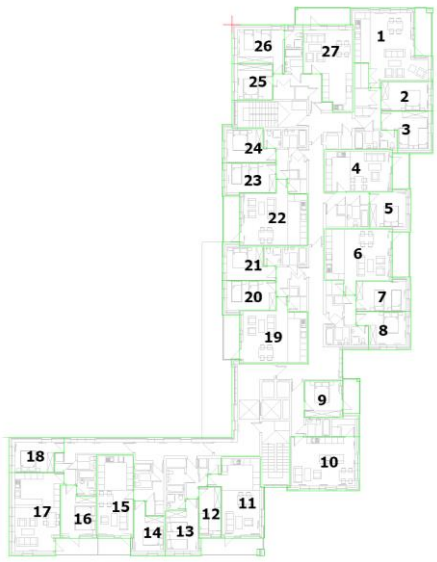
Ref.	Room Reference	Room Activity	External Window Area (m^2)	Whole Space ADF (%)	Comment
1	L00: Apt Bldg-05_LKD	L/K/D	9.1	1.89	x/✓
2	L00: Apt Bldg-05_Bedroom 01	Bedroom	5	2.60	✓
3	L00: Apt Bldg-05_Bedroom 02	Bedroom	3.7	3.89	✓
4	L00: Apt Bldg-06_Bedroom 01	Bedroom	3.6	4.46	✓
5	L00: Apt Bldg-06_Bedroom 02	Bedroom	7.2	5.52	✓
6	L00: Apt Bldg-06_LKD	L/K/D	9.5	2.34	✓
7	L00: Apt Bldg-01_LKD	L/K/D	15.6	4.05	✓
8	L00: Apt Bldg-01_Bedroom 01	Bedroom	3.7	2.92	✓
9	L00: Apt Bldg-01_Bedroom 02	Bedroom	2.2	1.83	✓
10	L00: Apt Bldg-02_LKD	L/K/D	7.3	1.69	x/✓
11	L00: Apt Bldg-02_Bedroom	Bedroom	5	2.26	✓
12	L00: Apt Bldg-03_LKD	L/K/D	8.9	1.90	x/✓
13	L00: Apt Bldg-03_Bedroom 01	Bedroom	5.1	2.18	✓
14	L00: Apt Bldg-03_Bedroom 02	Bedroom	7.5	5.89	✓
15	L00: Apt Bldg-04_Bedroom	Bedroom	5.4	2.61	✓
16	L00: Apt Bldg-04_LKD	L/K/D	5.9	2.85	✓

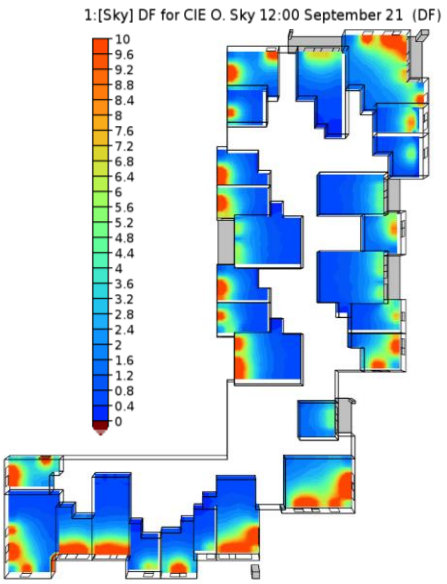
The following conclusions can be made:

✓ 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 Guidelines.

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 the 1.5% ADF target.

9.6.2 Apartment Building – Level 01





Ref.	Room Reference	Room Activity	External Window Area (m^2)	Whole Space ADF (%)	Comment
1	L01: Apt Bldg-01_LKD	L/K/D	19.4	4.13	✓
2	L01: Apt Bldg-01_Bedroom 01	Bedroom	3.7	2.50	✓
3	L01: Apt Bldg-01_Bedroom 02	Bedroom	2.2	1.58	✓
4	L01: Apt Bldg-02_LKD	L/K/D	7.3	1.50	x/✓
5	L01: Apt Bldg-02_Bedroom	Bedroom	6.6	3.18	✓
6	L01: Apt Bldg-03_LKD	L/K/D	8.9	1.65	x/✓
7	L01: Apt Bldg-03_Bedroom 01	Bedroom	4.9	2.12	✓
8	L01: Apt Bldg-03_Bedroom 02	Bedroom	7.4	5.17	✓
9	L01: Apt Bldg-04_Bedroom	Bedroom	5.4	2.24	✓
10	L01: Apt Bldg-04_LKD	L/K/D	13.8	5.27	✓
11	L01: Apt Bldg-05_LKD	L/K/D	11.2	3.85	✓
12	L01: Apt Bldg-05_Bedroom 01	Bedroom	1.9	1.24	✓
13	L01: Apt Bldg-05_Bedroom 02	Bedroom	3.6	3.30	✓
14	L01: Apt Bldg-06_Bedroom	Bedroom	2.1	2.05	✓
15	L01: Apt Bldg-06_LKD	L/K/D	7.4	2.70	✓
16	L01: Apt Bldg-07_Bedroom 01	Bedroom	6.6	4.68	✓
17	L01: Apt Bldg-07_LKD	L/K/D	7.7	2.98	✓
18	L01: Apt Bldg-07_Bedroom 02	Bedroom	6.4	5.62	✓
19	L01: Apt Bldg-08_LKD	L/K/D	9.1	2.84	✓
20	L01: Apt Bldg-08_Bedroom 01	Bedroom	5	2.58	✓
21	L01: Apt Bldg-08_Bedroom 02	Bedroom	3.7	3.47	✓
22	L01: Apt Bldg-09_LKD	L/K/D	8.9	1.74	x/✓
23	L01: Apt Bldg-09_Bedroom 01	Bedroom	6.6	3.81	✓
24	L01: Apt Bldg-09_Bedroom 02	Bedroom	3.7	3.49	✓
25	L01: Apt Bldg-10_Bedroom 01	Bedroom	2.2	2.27	✓
26	L01: Apt Bldg-10_Bedroom 02	Bedroom	5.8	3.94	✓
27	L01: Apt Bldg-10_LKD	L/K/D	8	2.01	✓

The following conclusions can be made:

✓ 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 Guidelines.

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 the 1.5% ADF target.

9.6.3 Houses – Level 00

Ref.	Room Reference	Room Activity	External Window Area (m^2)	Whole Space ADF (%)	Comment
1	L00: Blk K-L-04-Apt 01_Kitchen/Dining	K/D	9.4	3.62	✓
2	L00: Blk K-L-04-Apt 01_Living	Living	7.3	3.77	✓
3	L00: Blk G-01-Apt 04_Kitchen/Dining	K/D	6.3	2.26	✓
4	L00: Blk G-01-Apt 04_Living	Living	3	3.45	✓
5	L00: Blk G-01-Apt 01_Living	Living	5.9	4.29	✓
6	L00: Blk G-01-Apt 01_Kitchen/Dining	K/D	6.2	2.63	✓
7	L00: Blk K-L-03-Apt 01_Living	Living	7.3	4.09	✓
8	L00: Blk K-L-03-Apt 01_Kitchen/Dining	K/D	9.4	3.62	✓
9	L00: Blk H-H1-Apt 02_Kitchen/Dining	K/D	8.1	4.76	✓
10	L00: Blk H-H1-Apt 02_Living	Living	6.3	4.58	✓
11	L00: Blk H-H1-Apt 01_Kitchen/Dining	K/D	6.3	3.30	✓
12	L00: Blk H-H1-Apt 01_Living	Living	3.4	3.73	✓
13	L00: Blk M-03-Apt 02_Kitchen/Dining	K/D	6.9	3.33	✓
14	L00: Blk M-03-Apt 02_Living	Living	3.5	3.24	✓
15	L00: Blk G-02-Apt 03_Kitchen/Dining	K/D	6.2	2.90	✓
16	L00: Blk G-02-Apt 03_Living	Living	5.2	3.72	✓

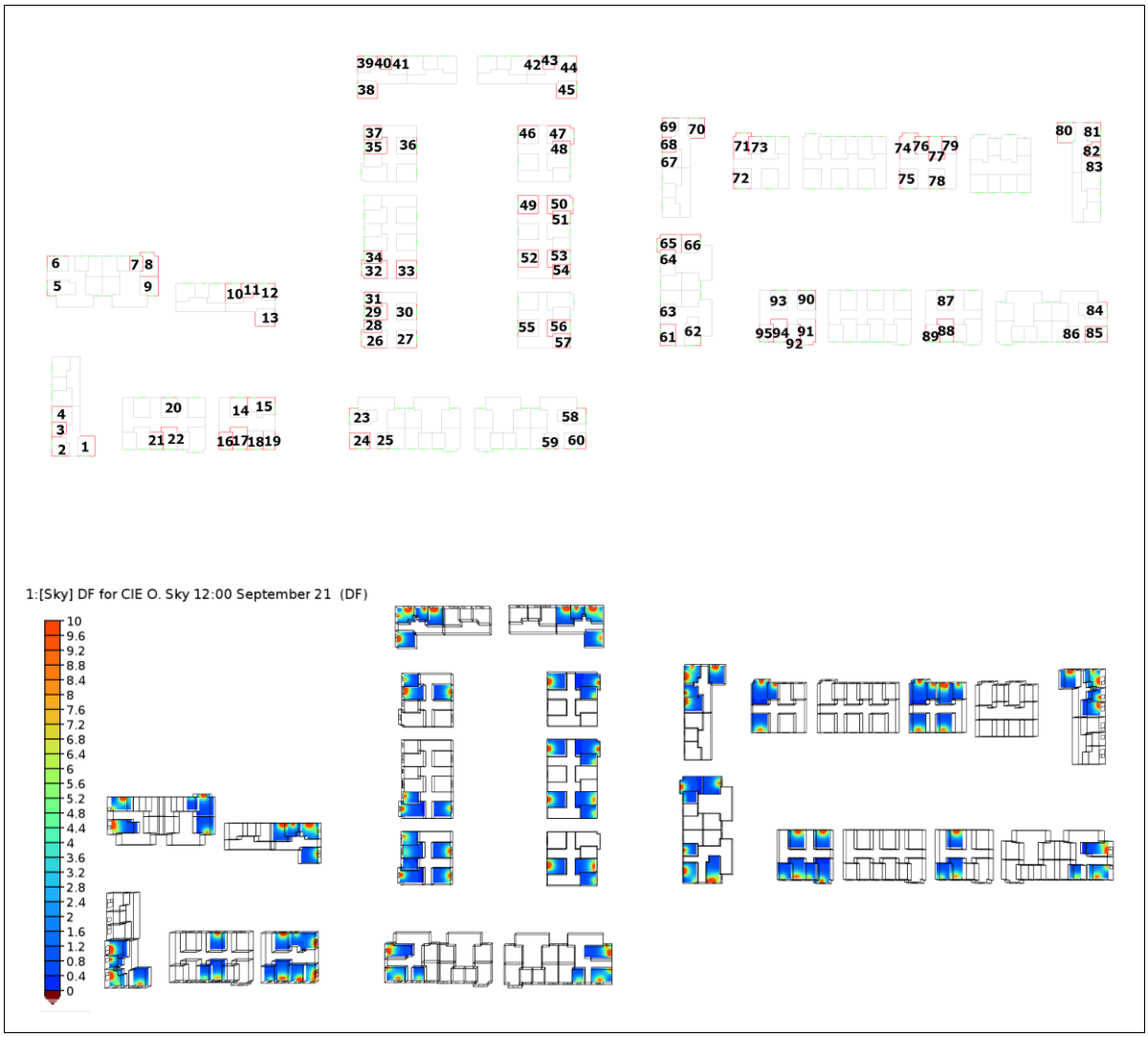
17	L00: Blk G-02-Apt 04_Kitchen/Dining	K/D	6.3	2.97	✓
18	L00: Blk G-02-Apt 04_Living	Living	3	2.68	✓
19	L00: Blk J-03-Apt 01_Living	Living	4.2	3.66	✓
20	L00: Blk J-03-Apt 01_Kitchen/Dining	K/D	6.9	2.78	✓
21	L00: Blk J-03-Apt 02_Living	Living	2.9	3.04	✓
22	L00: Blk J-03-Apt 02_Kitchen/Dining	K/D	6.8	2.84	✓
23	L00: Blk M-02-Apt 01_Living	Living	4.1	3.70	✓
24	L00: Blk M-02-Apt 01_Kitchen/Dining	K/D	6.8	2.72	✓
25	L00: Blk J-01-Apt 02_Living	Living	3.2	3.80	✓
26	L00: Blk J-01-Apt 02_Kitchen/Dining	K/D	6.8	2.84	✓
27	L00: Blk K-L-01-Apt 01_Kitchen/Dining	K/D	9.4	3.58	✓
28	L00: Blk K-L-01-Apt 01_Living	Living	7.3	3.86	✓
29	L00: Blk K-L-02-Apt 01_Living	Living	7.3	3.80	✓
30	L00: Blk K-L-02-Apt 01_Kitchen/Dining	K/D	9.4	3.61	✓
31	L00: Blk J-02-Apt 01_Kitchen/Dining	K/D	6.9	3.32	✓
32	L00: Blk J-02-Apt 01_Living	Living	4.2	2.31	✓
33	L00: Blk M-01-Apt 01_Kitchen/Dining	K/D	6.8	3.26	✓
34	L00: Blk M-01-Apt 01_Living	Living	4.1	2.34	✓
35	L00: Blk M-01-Apt 03_Kitchen/Dining	K/D	6.8	3.30	✓
36	L00: Blk M-01-Apt 03_Living	Living	2.8	2.69	✓
37	L00: Blk J-04-Apt 02_Kitchen/Dining	K/D	6.8	3.29	✓
38	L00: Blk J-04-Apt 02_Living	Living	3.2	3.09	✓
39	L00: Blk G-03-Apt 03_Kitchen/Dining	K/D	6.2	2.98	✓
40	L00: Blk G-03-Apt 03_Living	Living	5.2	2.82	✓
41	L00: Blk G-03-Apt 04_Kitchen/Dining	K/D	6.3	3.15	✓
42	L00: Blk G-03-Apt 04_Living	Living	3	3.68	✓
43	L00: Blk D-01-Apt 04_Living	Living	3	3.21	✓
44	L00: Blk D-01-Apt 04_Kitchen/Dining	K/D	6.3	2.32	✓
45	L00: Blk D-01-Apt 01_Living	Living	5.8	3.31	✓
46	L00: Blk D-01-Apt 01_Kitchen/Dining	K/D	6.2	2.92	✓
47	L00: Blk E-F-01-Apt 01_Living	Living	7.3	4.01	✓
48	L00: Blk E-F-01-Apt 01_Kitchen/Dining	K/D	9.4	3.53	✓
49	L00: Blk B-01-Apt 01_Living	Living	4.2	3.62	✓
50	L00: Blk B-01-Apt 01_Kitchen/Dining	K/D	6.9	2.82	✓
51	L00: Blk B-01-Apt 02_Living	Living	3.2	4.18	✓
52	L00: Blk B-01-Apt 02_Kitchen/Dining	K/D	6.8	2.87	✓
53	L00: Blk B-02-Apt 01_Living	Living	4.2	3.61	✓
54	L00: Blk B-02-Apt 01_Kitchen/Dining	K/D	6.9	2.86	✓
55	L00: Blk B-02-Apt 02_Living	Living	3.2	4.18	✓
56	L00: Blk B-02-Apt 02_Kitchen/Dining	K/D	6.8	2.89	✓
57	L00: Blk E-F-02-Apt 01_Kitchen/Dining	K/D	10.9	3.42	✓
58	L00: Blk E-F-02-Apt 01_Living	Living	7.3	3.98	✓
59	L00: Blk D-02-Apt 04_Kitchen/Dining	K/D	6.3	3.00	✓
60	L00: Blk D-02-Apt 04_Living	Living	3	2.81	✓
61	L00: Blk B-04-Apt 01_Kitchen/Dining	K/D	6.9	3.32	✓
62	L00: Blk B-04-Apt 01_Living	Living	4.5	2.77	✓
63	L00: Blk B-04-Apt 02_Kitchen/Dining	K/D	6.8	3.28	✓
64	L00: Blk B-04-Apt 02_Living	Living	3.8	1.94	✓
65	L00: Blk B-03-Apt 01_Kitchen/Dining	K/D	6.9	3.33	✓

66	L00: Blk B-03-Apt 01_Living	Living	4.2	2.62	✓
67	L00: Blk B-03-Apt 02_Kitchen/Dining	K/D	6.8	3.32	✓
68	L00: Blk B-03-Apt 02_Living	Living	3.2	3.04	✓

The following conclusions can be made:

✓ These rooms have an ADF greater than the recommended minimum values (2.0% for combined K/Ds, 1.5% for Living Rooms only and 1.0% for bedrooms) as stated within the BRE Guidelines.

9.6.4 Houses – Level 01



Ref.	Room Reference	Room Activity	External Window Area (m^2)	Whole Space ADF (%)	Comment
1	L01: Blk K-L-04-Apt 01_Bedroom 02	Bedroom	2.1	2.24	✓
2	L01: Blk K-L-04-Apt 01_Bedroom 03	Bedroom	4.4	5.04	✓
3	L01: Blk K-L-04-Apt 01_Bedroom 04	Bedroom	1.2	2.74	✓
4	L01: Blk K-L-04-Apt 01_Bedroom 01	Bedroom	2.3	3.10	✓
5	L01: Blk G-01-Apt 04_Bedroom 01	Bedroom	4.5	3.52	✓
6	L01: Blk G-01-Apt 04_Bedroom 02	Bedroom	4.5	4.01	✓
7	L01: Blk G-01-Apt 01_Bedroom 03	Bedroom	2	1.28	✓
8	L01: Blk G-01-Apt 01_Bedroom 02	Bedroom	2.3	2.09	✓
9	L01: Blk G-01-Apt 01_Bedroom 01	Bedroom	1.9	1.63	✓
10	L01: Blk K-L-03-Apt 01_Bedroom 01	Bedroom	2.3	3.11	✓
11	L01: Blk K-L-03-Apt 01_Bedroom 04	Bedroom	1.2	2.78	✓
12	L01: Blk K-L-03-Apt 01_Bedroom 03	Bedroom	4.4	5.01	✓
13	L01: Blk K-L-03-Apt 01_Bedroom 02	Bedroom	2.1	2.12	✓

14	L01: Blk H-H1-Apt 01_Bedroom 01	Bedroom	2.3	3.34	✓
15	L01: Blk H-H1-Apt 02_Bedroom 01	Bedroom	3.9	2.81	✓
16	L01: Blk H-H1-Apt 02_Bedroom 03	Bedroom	3.9	1.25	✓
17	L01: Blk H-H1-Apt 02_Bedroom 02	Bedroom	2.7	2.61	✓
18	L01: Blk H-H1-Apt 01_Bedroom 02	Bedroom	3.5	2.99	✓
19	L01: Blk H-H1-Apt 01_Bedroom 03	Bedroom	1.1	5.05	✓
20	L01: Blk M-03-Apt 02_Bedroom 01	Bedroom	1.9	2.70	✓
21	L01: Blk M-03-Apt 02_Bedroom 03	Bedroom	1.2	1.75	✓
22	L01: Blk M-03-Apt 02_Bedroom 02	Bedroom	2.7	2.01	✓
23	L01: Blk G-02-Apt 04_Bedroom 01	Bedroom	1.2	3.74	✓
24	L01: Blk G-02-Apt 04_Bedroom 02	Bedroom	4.5	3.48	✓
25	L01: Blk G-02-Apt 03_Bedroom 03	Bedroom	4.5	2.08	✓
26	L01: Blk J-03-Apt 01_Bedroom 02	Bedroom	2.2	1.90	✓
27	L01: Blk J-03-Apt 01_Bedroom 01	Bedroom	2.2	2.27	✓
28	L01: Blk J-03-Apt 01_Bedroom 03	Bedroom	0.6	0.85	x
29	L01: Blk J-03-Apt 02_Bedroom 02	Bedroom	2.8	2.09	✓
30	L01: Blk J-03-Apt 02_Bedroom 01	Bedroom	2.2	2.26	✓
31	L01: Blk J-03-Apt 02_Bedroom 03	Bedroom	1.7	2.88	✓
32	L01: Blk M-02-Apt 01_Bedroom 02	Bedroom	2.3	2.00	✓
33	L01: Blk M-02-Apt 01_Bedroom 01	Bedroom	1.9	1.92	✓
34	L01: Blk M-02-Apt 01_Bedroom 03	Bedroom	1.7	2.81	✓
35	L01: Blk J-01-Apt 02_Bedroom 02	Bedroom	3.6	3.78	✓
36	L01: Blk J-01-Apt 02_Bedroom 01	Bedroom	2.2	2.26	✓
37	L01: Blk J-01-Apt 02_Bedroom 03	Bedroom	1	1.92	✓
38	L01: Blk K-L-01-Apt 01_Bedroom 02	Bedroom	2.1	2.99	✓
39	L01: Blk K-L-01-Apt 01_Bedroom 03	Bedroom	4.4	5.26	✓
40	L01: Blk K-L-01-Apt 01_Bedroom 04	Bedroom	1.2	2.89	✓
41	L01: Blk K-L-01-Apt 01_Bedroom 01	Bedroom	2.3	3.13	✓
42	L01: Blk K-L-02-Apt 01_Bedroom 01	Bedroom	2.3	3.16	✓
43	L01: Blk K-L-02-Apt 01_Bedroom 04	Bedroom	1.2	2.77	✓
44	L01: Blk K-L-02-Apt 01_Bedroom 03	Bedroom	4.4	5.09	✓
45	L01: Blk K-L-02-Apt 01_Bedroom 02	Bedroom	2.1	2.22	✓
46	L01: Blk J-02-Apt 01_Bedroom 01	Bedroom	2.2	3.13	✓
47	L01: Blk J-02-Apt 01_Bedroom 02	Bedroom	2.2	1.50	✓
48	L01: Blk J-02-Apt 01_Bedroom 03	Bedroom	1.1	1.63	✓
49	L01: Blk M-01-Apt 01_Bedroom 01	Bedroom	1.9	2.63	✓
50	L01: Blk M-01-Apt 01_Bedroom 02	Bedroom	2.3	1.62	✓
51	L01: Blk M-01-Apt 01_Bedroom 03	Bedroom	1.1	1.65	✓
52	L01: Blk M-01-Apt 03_Bedroom 01	Bedroom	1.9	2.68	✓
53	L01: Blk M-01-Apt 03_Bedroom 02	Bedroom	2.2	2.05	✓
54	L01: Blk M-01-Apt 03_Bedroom 03	Bedroom	1.1	1.61	✓
55	L01: Blk J-04-Apt 02_Bedroom 01	Bedroom	2.2	3.16	✓
56	L01: Blk J-04-Apt 02_Bedroom 02	Bedroom	3.7	2.60	✓
57	L01: Blk J-04-Apt 02_Bedroom 03	Bedroom	1.1	1.62	✓
58	L01: Blk G-03-Apt 04_Bedroom 01	Bedroom	4.5	3.50	✓
59	L01: Blk G-03-Apt 04_Bedroom 02	Bedroom	4.5	2.08	✓
60	L01: Blk G-03-Apt 03_Bedroom 03	Bedroom	1.2	3.47	✓
61	L01: Blk D-01-Apt 04_Bedroom 02	Bedroom	4.5	3.88	✓
62	L01: Blk D-01-Apt 04_Bedroom 01	Bedroom	4.5	3.35	✓

63	L01: Blk D-01-Apt 03_Bedroom 03	Bedroom	1.2	2.88	✓
64	L01: Blk D-01-Apt 01_Bedroom 03	Bedroom	2	1.13	✓
65	L01: Blk D-01-Apt 01_Bedroom 02	Bedroom	2.3	2.01	✓
66	L01: Blk D-01-Apt 01_Bedroom 01	Bedroom	1.9	1.74	✓
67	L01: Blk E-F-01-Apt 01_Bedroom 01	Bedroom	2.3	3.47	✓
68	L01: Blk E-F-01-Apt 01_Bedroom 04	Bedroom	1.2	2.80	✓
69	L01: Blk E-F-01-Apt 01_Bedroom 03	Bedroom	4.4	5.13	✓
70	L01: Blk E-F-01-Apt 01_Bedroom 02	Bedroom	2.1	3.01	✓
71	L01: Blk B-01-Apt 01_Bedroom 02	Bedroom	2.2	1.76	✓
72	L01: Blk B-01-Apt 01_Bedroom 01	Bedroom	2.2	2.27	✓
73	L01: Blk B-01-Apt 01_Bedroom 03	Bedroom	1.1	2.15	✓
74	L01: Blk B-02-Apt 01_Bedroom 02	Bedroom	2.2	1.75	✓
75	L01: Blk B-02-Apt 01_Bedroom 01	Bedroom	2.2	2.29	✓
76	L01: Blk B-02-Apt 01_Bedroom 03	Bedroom	1.1	2.14	✓
77	L01: Blk B-02-Apt 02_Bedroom 02	Bedroom	3.7	4.02	✓
78	L01: Blk B-02-Apt 02_Bedroom 01	Bedroom	2.2	2.31	✓
79	L01: Blk B-02-Apt 02_Bedroom 03	Bedroom	1.1	2.09	✓
80	L01: Blk E-F-02-Apt 01_Bedroom 02	Bedroom	3.2	2.95	✓
81	L01: Blk E-F-02-Apt 01_Bedroom 03	Bedroom	4.9	4.85	✓
82	L01: Blk E-F-02-Apt 01_Bedroom 04	Bedroom	1.2	2.81	✓
83	L01: Blk E-F-02-Apt 01_Bedroom 01	Bedroom	2.3	2.82	✓
84	L01: Blk D-02-Apt 04_Bedroom 01	Bedroom	4.5	3.18	✓
85	L01: Blk D-02-Apt 04_Bedroom 02	Bedroom	4.5	3.36	✓
86	L01: Blk D-02-Apt 03_Bedroom 03	Bedroom	1.2	2.06	✓
87	L01: Blk B-04-Apt 02_Bedroom 01	Bedroom	2.2	3.11	✓
88	L01: Blk B-04-Apt 02_Bedroom 02	Bedroom	3.5	2.35	✓
89	L01: Blk B-04-Apt 02_Bedroom 03	Bedroom	2.2	1.73	✓
90	L01: Blk B-03-Apt 01_Bedroom 01	Bedroom	2.2	3.12	✓
91	L01: Blk B-03-Apt 01_Bedroom 02	Bedroom	2.2	1.67	✓
92	L01: Blk B-03-Apt 01_Bedroom 03	Bedroom	1.1	1.86	✓
93	L01: Blk B-03-Apt 02_Bedroom 01	Bedroom	2.2	3.12	✓
94	L01: Blk B-03-Apt 02_Bedroom 02	Bedroom	3.6	2.54	✓
95	L01: Blk B-03-Apt 02_Bedroom 03	Bedroom	1.1	1.60	✓

The following conclusions can be made:

✓ These rooms have an ADF greater than the recommended minimum values (1.0% for bedrooms) as stated within the BRE Guidelines.

x The ADF in these rooms falls below the BRE recommended minimum values (1.0% for bedrooms) as stated within the BRE Guidelines.

9.7 Discussion

The purpose of the ADF calculations is to quantify an overall percentage of units which exceeds the BRE recommendations and the BS 8206-2:2008 recommendations. Our proposed methodology is to complete the ADF calculations for the units located in the lower floors which would be considered "worst-case" units. As the floor levels increase so too does access to daylight so the daylight levels will improve in the apartment block on the upper floors. The objective of the design team is to maximise the number of units which exceed the BRE and the BS 8206-2:2008 recommendations.

As noted previously in Section 9.3, where there are combined living/kitchen/dining areas within the development, specifically within the apartment block, these have been assessed as whole spaces against a 2% target as well as a 1.5% target value.

The results for the Apartment Building are summarised in the following tables.

Rooms Tested	No. Rooms
Total Bedrooms Tested	27
Total Living/Kitchen/Dining Areas Tested	16
Total Spaces Tested	43

Apartment Building Summary of Results (2% ADF Target for combined L/K/Ds)		%
Bedrooms Pass (1% ADF)	27	100%
L/K/D Areas Pass (2% ADF)	10	62%
Total Overall	37	86%

Apartment Building Summary of Results (1.5% ADF Target for combined L/K/Ds)		%
Bedrooms Pass (1% ADF)	27	100%
L/K/D Areas Pass (1.5% ADF)	16	100%
Total Overall	43	100%

The results for the Houses are summarised in the following tables.

Rooms Tested (Houses)	No. Rooms
Total Bedrooms Tested	95
Total Kitchen/Dining Areas Tested (Houses)	34
Total Living Areas Only Tested (Houses)	34
Total Spaces Tested	163

Summary of Results (Houses)		%
Bedrooms Pass (1% ADF)	94	99%
K/D Areas Pass (2% ADF)	34	100%
Living Areas Only Pass (1.5% ADF)	34	100%
Total Overall	162	99%

Across the proposed development, 86% of the tested rooms in the Apartment Building are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines when Living/Kitchen/Dining spaces are assessed as whole rooms against a 2% ADF target. This increases to 100% when Living/Kitchen/Dining spaces are assessed as whole rooms against a 1.5% ADF target.

Furthermore, 99% of the tested rooms in the Houses are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines (1.5% ADF target for the Living areas and 2% ADF target for the Kitchen/Dining areas).

10 Conclusion

The following can be concluded based on the studies undertaken:

10.1 Daylight Analysis of Existing Buildings

This study considers the proposed scheme and tests if the VSC results for the windows of the adjacent existing buildings are greater than either 27% or 0.8 times their former value (that of the existing situation). All points tested exceed the BRE requirements.

10.2 Shadow Analysis

The shadow analysis illustrates different shadows being cast at three key times of the year (March 21st, June 21st and December 21st) for the existing scenario and with the proposed development in place. It should be noted that sunlight is less prevalent during the winter months and as such the impact of overshadowing will be greatly reduced. Taking this into account, the proposed development has a negligible overshadowing impact on the adjacent residential building nearest the site.

10.3 Sunlight to Existing and Proposed Amenity Spaces

One existing amenity space was analysed and it still receives the same amount of sunlight even with the proposed development in place, thus complying with BRE Guidelines.

On the 21st of March, the proposed roof terrace area situated within the development site will receive at least 2 hours of sunlight on 98% of its area, exceeding BRE recommendations.

On the 21st of March, the proposed public amenity areas situated within the development site will receive at least 2 hours of sunlight on 97% of its area, exceeding BRE recommendations.

On the 21st of March, the sample of proposed private garden amenity areas tested will receive at least 2 hours of sunlight on 50% of its area, meeting BRE recommendations. When calculated for the 21st of June, this percentage increases to 95%.

When combined, all amenity areas including the roof terrace, public amenities and private garden sample areas, will receive at least 2 hours of sunlight on March 21st on 90% of their combined area, significantly exceeding the minimum BRE recommendations of 50%.

10.4 Annual Probable Sunlight Hours

Even though there is more than a 4% drop in APSH when comparing the annual results for each window, the loss of sunlight will not be noticeable as both the annual and winter APSH results are more than 25% for annual and 5% for winter respectively with the proposed development in place. Furthermore, both the APSH annual and winter APSH results are more than 0.8 times their former value. Taking all the APSH results into consideration, the impact of the proposed development on surrounding existing buildings will comply with the BRE Guidelines.

10.5 Average Daylight Factors

Across the proposed development, 86% of the tested rooms in the Apartment Building are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines when Living/Kitchen/Dining spaces are assessed as whole rooms against a 2% ADF target. This increases to 100% when Living/Kitchen/Dining spaces are assessed as whole rooms against a 1.5% ADF target.

Furthermore, 99% of the tested rooms in the Houses are achieving Average Daylight Factors (ADF) above the BRE and BS 8206-2:2008 guidelines (1.5% ADF target for the Living areas and 2% ADF target for the Kitchen/Dining areas).

10.6 Observations

It should be noted that the guidance in the BRE Guidelines are not mandatory and the guide 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 the above, the site performs well in relation to the metrics considered in this report.

In addition, the BS 8206-2:2008 it also notes, "*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.*"

The approach within this report is further supported by the national policy guidance noted in the Sustainable Urban Housing: Design Standards for New Apartments, Section 6.7 which states:

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

Taking all of the above information into account, overall the results demonstrate that the proposed development performs well when compared to the BRE recommendations in the BRE 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" by Paul Littlefair, 2011 sometimes referred to as BRE Digest 209 and the "BS 8206-2:2008: Lighting for Buildings - Part 2: Code of Practice for Daylighting".