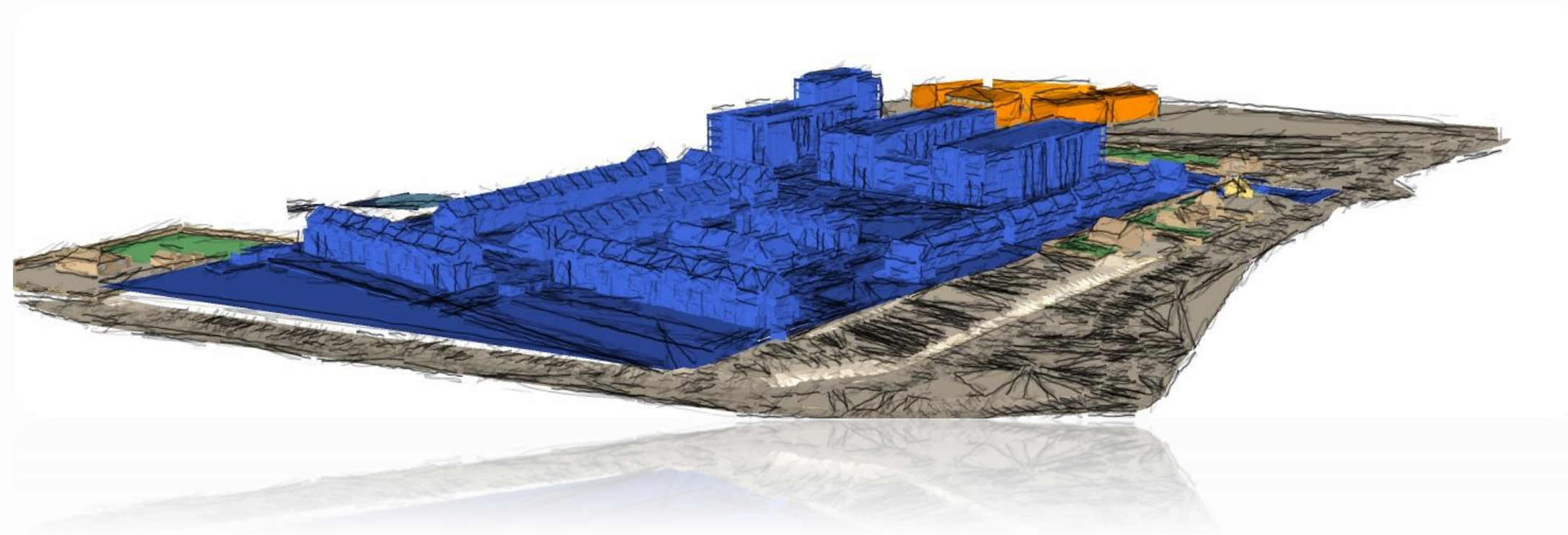


STRATEGIC HOUSING DEVELOPMENT ON SITE AT MILL ROAD, SAGGART, CO. DUBLIN

Sunlight, Daylight & Shadow Assessment (Impact Neighbours and Development Performance)



V2

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Executive Summary

This report examines the impact the proposed Development will have on neighbours in terms of daylight, sunlight & shadow. We will also examine how the proposed development performs in terms of light. The report is, in accordance with "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" and BS 8206 Lighting for Buildings, Part 2: Code of Practice for Daylighting.

It should be noted at the outset that the BRE document sets out in its introduction that:

"Summary Page . . . It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location."

" 1.6 . . . The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design. . . . "

Change/Impact to neighbouring buildings in the adjoining residential areas.

- **Skylight- VSC**
 - 100% of windows pass the relevant VSC checks.
 - The average change ratio for VSC is **0.88**
- **Sunlight APSH & WPSH**
 - Few windows face within 90° of due South
 - All those that do pass the relevant Annual APSH, Winter WPSH or overall sunlight checks.
 - The average change ratios are APSH: **0.98** & WPSH: **0.94**
- **Shadow**
 - **100%** of tested neighbouring amenity spaces pass the 2-hour test requirements for the 21st March.
 - The average change ratio for shadow/sunlight is **1.00**

Performance of the proposed design

- **Light Distribution ADF**
 - **99%** of tested rooms on the representative 1st floor pass the strict BRE requirements.
 - One room is marginal at this level and passes on subsequent levels.
 - The development shows excellent ADF results.
 - Average high ADFs for all tested living rooms is **2.8%** and for bedrooms **1.8%**
- **Sunlight to Living rooms:**
 - **100%** of windows receive some sunlight as per Department Guidelines.
 - On the strict BRE targets **56%** comply with Annual APSH requirements & **86%** with the winter WPSH
 - Including marginal results **75%** pass the Annual APSH requirements & **94%** pass the winter WPSH.
 - This is generally in accordance with the guidelines example of "careful" design 80% also rooms on higher floor levels will achieve better results as they are subject to less obstruction.
 - This is a relative dense development and so it is not unexpected that some sunlight will be limited.
 - This quality of sunlight coupled with the excellent ADF detailed above show that the living rooms to the apartments tested will receive an excellent quality of light

- **Shadow:**

- All tested Shared and Public amenity spaces receive > 2hrs of sunlight over 50% of their area on the 21st of March.
- The shared/public amenity spaces have been designed to be well sunlit.

The application generally complies with the recommendations and guidelines of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings and Part 2: Code of Practice for Daylighting.

The Architect has provided a commentary and the end of this report and detailed compensatory measures for the one marginal Living room on the 1st floor. We would direct the reader to this and the Architect's own report on the design.

This development has been successfully designed to maximise the occupant's access to light and reduce the impact on existing buildings. As such the design has used the guidelines in the spirit they have been written and balanced the requirements of this report with other constraints to arrive at this design.

Introduction

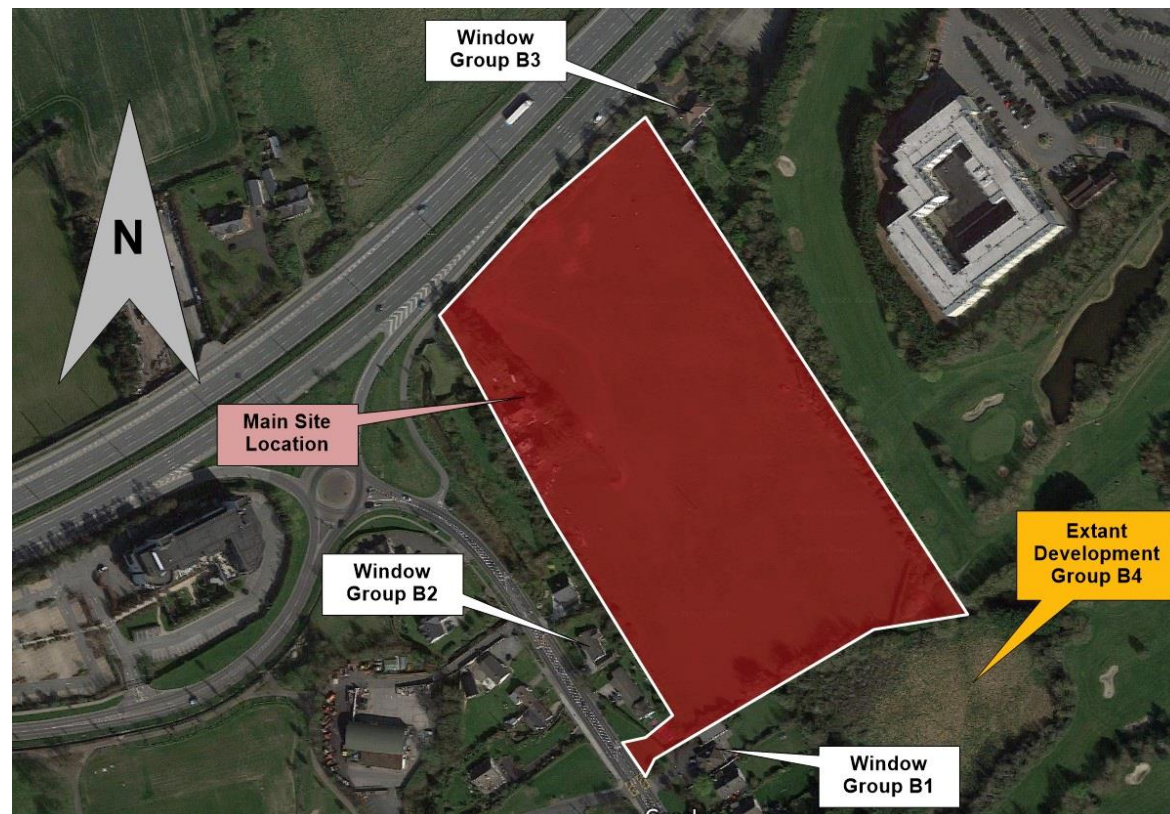
Chris Shackleton Consulting (CSC) have been asked to examine the impact that the proposed development will have on the existing neighbouring properties in terms of sunlight, daylight & shadow. The proposed development consists of Housing and Apartment units. We have also been asked to examine how the proposed development performs in terms of light.

This analysis has been carried out in accordance with the recommendations of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings and Part 2: Code of Practice for Daylighting.

All references quoted in this report are from BRE document "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice – Second Edition – 2011 (BR 209) by Paul Littlefair" unless specifically noted otherwise.

Preliminary Overview

The aerial view shows the context for the site and the closest neighbouring window groups.



Google Earth extract © Google 2021

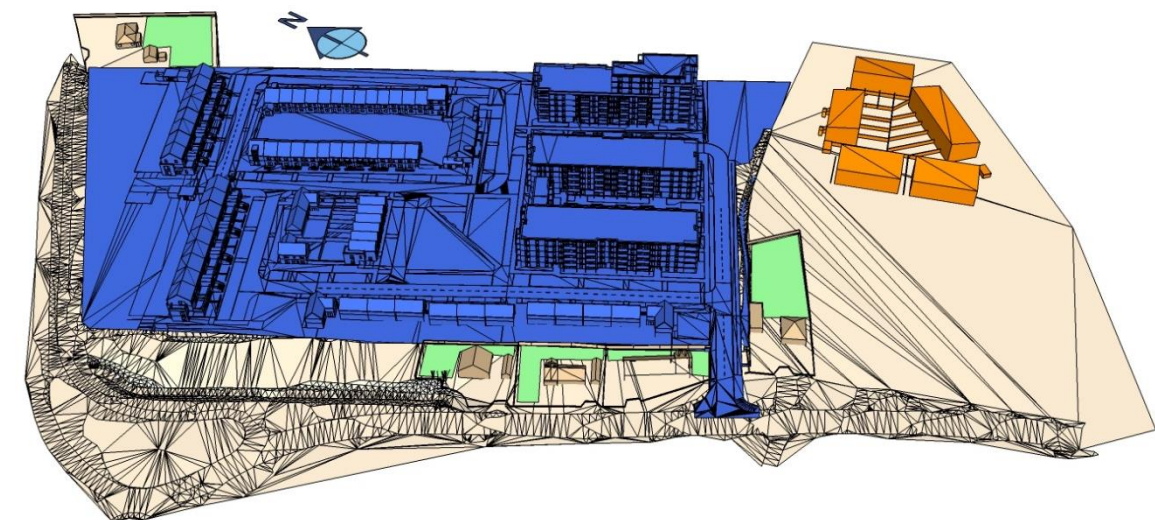
Design Model

A 3D model of the proposed development and the surrounding neighbouring properties was provided by the Architect. These had been modelled from survey information and drawings provided in plan, elevation, and section formats. The model was geo-referenced to its correct location and an accurate solar daylight system was introduced. Here "Cream" indicates surrounding environment, "Purple" the existing development to be demolished, "Blue" this proposal. "Orange" note an extant permission ref: SD13A/00221/EP

The analysis is based on the information provided.



Existing Model



Proposed Model

Scope of this Report

We have been asked to address the following specific items in this report and our scope is limited to the same:

Impact on Existing Neighbours

In this document we will assess the potential impact of the proposed development on the neighbouring residential houses. We will test for the following in relation to impact:

- Existing facing windows for:
 - Impact/Change for Skylight – Vertical Sky Component - VSC
 - Impact/Change for Probable Sunlight Hours – Annual APSH and Winter WPSH
- Existing amenity spaces for impact/change on Sunlight/Shadow

Development Performance

For the proposed development we will examine the performance of the development under the following headings:

- Light distribution Average Daylight Factor – ADF – All habitable rooms
- Sunlight availability - Living room spaces APSH/WPSH.
- Shadow performance proposed shared and private (balcony) amenity spaces

When examining the internal performance of the development we note that the layout and rooms follow similar design principles floor to floor. When testing the blocks performance, we have chosen to test the entire floor at 1st floor level which provides a good representative indication of the overall building performance.

The Ground floor was discounted for analysis since it has many non-standard spaces in its layout, communal facilities, bike store, bin store, entrances, etc. which would not provide a representative analysis.

Please see the Architect’s commentary and compensatory measures for additional information on the design and principles.

Adjacent Properties Details

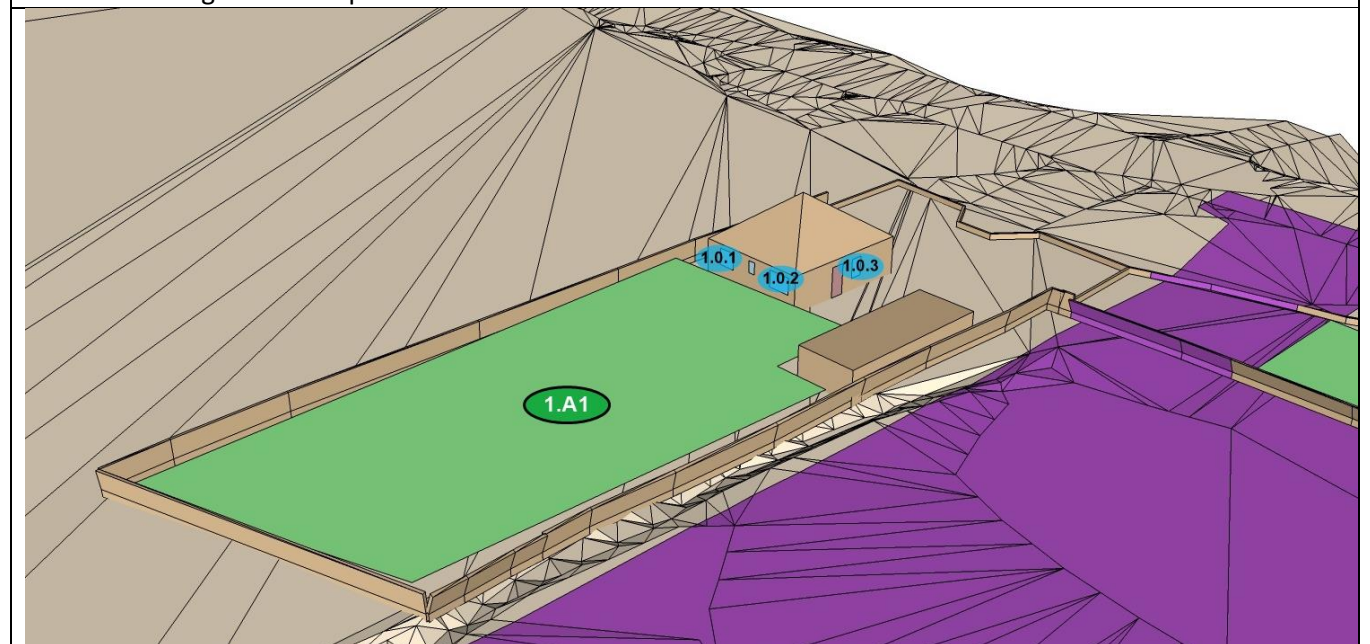
The numbering used later for windows in each of the blocks is detailed below.

Neighbours – Window Group B1

Oblique imagery © Bing Birds Eye 2021



Windows facing the development



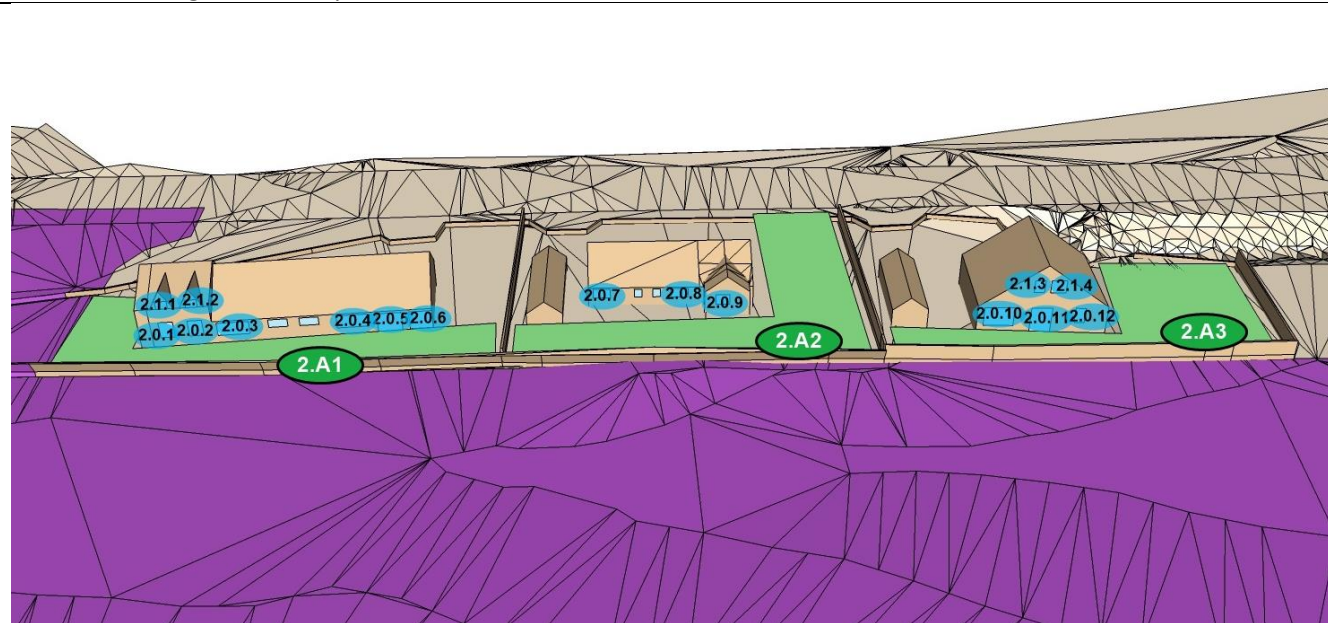
The numbering used later in this report for this group of windows is indicated in cyan above. Amenity spaces (gardens) are noted in green

Neighbours – Window Group B2

Oblique imagery © Bing Birds Eye 2021



Windows facing the development



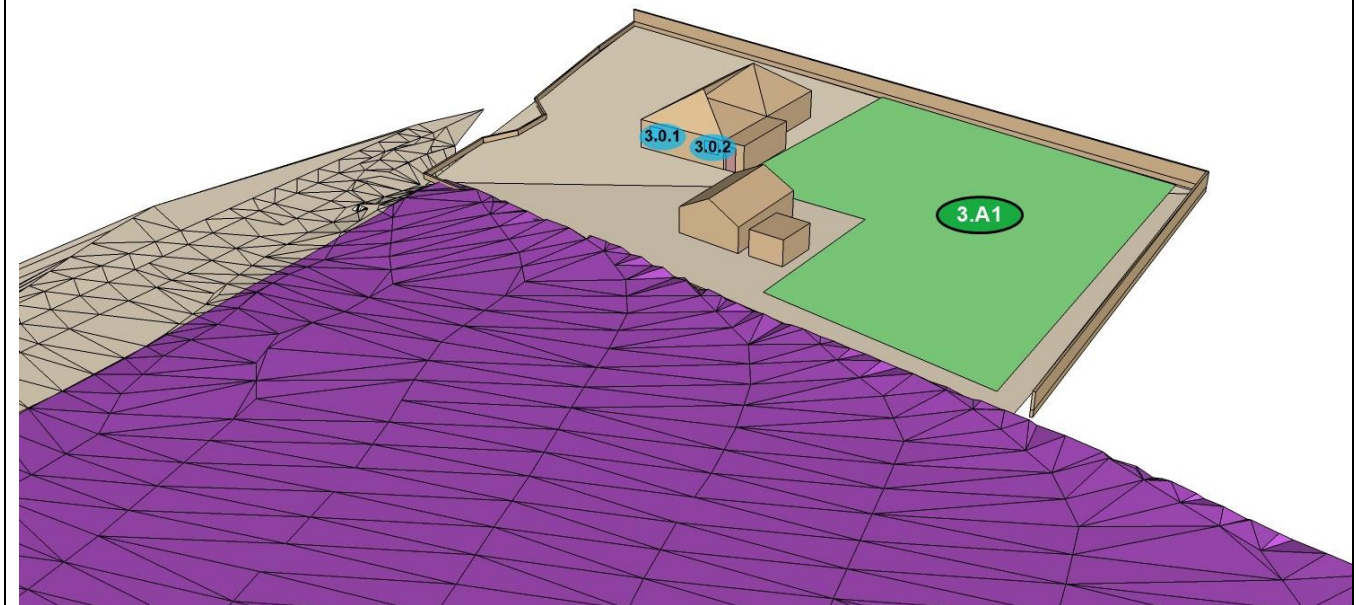
The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Neighbours – Window Group B3

Oblique imagery © Bing Birds Eye 2021



Windows facing the development



The numbering used later in this report for this group of windows is indicated in cyan above.
Amenity spaces (gardens) are noted in green

Impact on neighbours

Adjacent Properties - Light from the Sky impact on neighbouring properties

Tests were carried out to establish the quantity and quality of skylight (daylight) available to a room's windows. Locations tested are based on guideline recommendations for the closest facades which have windows with potential for impact.

We have investigated this impact under clause 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.

2.2.6 Any reduction in the total amount of skylight can be calculated by finding the VSC at the centre of each main window. In the case of a floor-to-ceiling window such as a patio door, a point 1.6 m above ground (or balcony level for an upper storey) on the centre line of the window may be used. For a bay window, the centre window facing directly outwards can be taken as the main window. If a room has two or more windows of equal size, the mean of their VSCs may be taken. The reference point is in the external plane of the window wall. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. . . .

Neighbours – Window Group B4

Elevations from Application

Windows facing the development

The numbering used later in this report for this group of windows is indicated in cyan above.

Tabulated results

Skylight to habitable rooms							
VSC							
Report <i>Check > 27% or ratio > 0.8</i>							
Group	Floor	Win	Ref	Existing	Proposed	Ratio	Result
B1	F0	W1	1.0.1	38.5	36.3	0.94	Pass
B1	F0	W2	1.0.2	38.5	36.0	0.93	Pass
B1	F0	W3	1.0.3	38.1	35.8	0.94	Pass
B2	F0	W1	2.0.1	38.9	32.0	0.82	Pass
B2	F0	W2	2.0.2	39.0	31.3	0.80	Pass
B2	F0	W3	2.0.3	38.6	30.0	0.78	Pass
B2	F0	W4	2.0.4	38.9	29.1	0.75	Pass
B2	F0	W5	2.0.5	36.6	28.1	0.77	Pass
B2	F0	W6	2.0.6	37.8	28.8	0.76	Pass
B2	F0	W7	2.0.7	37.2	30.4	0.82	Pass
B2	F0	W8	2.0.8	36.6	29.8	0.82	Pass
B2	F0	W9	2.0.9	38.2	30.5	0.80	Pass
B2	F0	W10	2.0.10	37.3	28.1	0.75	Pass
B2	F0	W11	2.0.11	35.1	27.3	0.78	Pass
B2	F0	W12	2.0.12	38.1	28.3	0.74	Pass
B2	F1	W1	2.1.1	36.5	31.6	0.87	Pass
B2	F1	W2	2.1.2	36.5	31.3	0.86	Pass
B2	F1	W3	2.1.3	39.5	32.8	0.83	Pass
B2	F1	W4	2.1.4	39.5	32.8	0.83	Pass
B3	F0	W1	3.0.1	39.0	37.3	0.96	Pass
B3	F0	W2	3.0.2	38.3	36.9	0.96	Pass
B4	F0	W1	4.0.1	39.5	36.8	0.93	Pass
B4	F0	W2	4.0.2	39.5	36.5	0.92	Pass
B4	F0	W3	4.0.3	39.5	36.3	0.92	Pass
B4	F0	W4	4.0.4	39.5	35.9	0.91	Pass
B4	F1	W1	4.1.1	39.6	37.4	0.94	Pass
B4	F1	W2	4.1.2	39.6	37.1	0.94	Pass
B4	F1	W3	4.1.3	39.6	37.0	0.93	Pass
B4	F1	W4	4.1.4	39.6	36.7	0.93	Pass
B4	F2	W1	4.2.1	39.6	37.8	0.95	Pass
B4	F2	W2	4.2.2	39.6	37.8	0.95	Pass
B4	F2	W3	4.2.3	39.6	37.7	0.95	Pass
B4	F2	W4	4.2.4	39.6	37.6	0.95	Pass
B4	F2	W5	4.2.5	39.6	37.5	0.95	Pass
B4	F2	W6	4.2.6	39.6	37.5	0.95	Pass
B4	F2	W7	4.2.7	39.6	37.4	0.94	Pass
B4	F2	W8	4.2.8	39.6	37.3	0.94	Pass

Note: When the proposed value exceeds the minimum requirement the ratio check is not required, and the result is coloured grey.

Conclusion

When tested with the new development in place, the VSC for all tested windows was greater than 27%, or not breaching the 0.8 times its former value limit for habitable rooms.

The average change ratio for VSC is **0.88**

The proposed development complies with the requirements of the BRE guidelines in relation to maintaining skylight availability for neighbours.

Adjacent Properties - Sunlight into living spaces

Tests for the amount of sunlight that windows to living room and/or conservatory can receive over both annual and winter periods.

3.2.3 To assess loss of sunlight to an existing building, it is suggested that all main living rooms of dwellings, and conservatories, should be checked if they have a window facing within 90° of due south. . . .

3.2.11 . . . 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.

While not all windows relate to living rooms, we have for completeness tested all of them. Note only Window Group B3 face within 90° of due South require testing and are reported on here. The results are tabulated below:

Sunlight on windows to living room spaces check															
Annual - 25% and Winter - 5%															
Design		<i>Check > 25% or ratio > 0.8</i>						<i>Check > 5% or ratio > 0.8</i>							
Group	Floor	Win	Ref	Existing	Proposed	Ratio	Result	Existing	Proposed	Ratio	Result	Existing	Proposed	Ratio	Result
B3	F0	W1	3.0.1	73.8	72.9	0.99	Pass	27.4	26.5	0.97	Pass				
B3	F0	W2	3.0.2	73.8	71.6	0.97	Pass	27.4	25.2	0.92	Pass				

Note: When the proposed value exceeds the minimum requirement the ratio check is not required, and the result is coloured grey.

Conclusion

When tested with the proposed development in place:
All tested windows comply with the annual APSH and winter WPSH requirements for sunlight.

The average change ratio for sunlight is APSH:**0.98** and WPSH: **0.94**

The proposed development complies with the requirements of the BRE guidelines in relation to both annual and winter sunlight availability to neighbours as it applies to living rooms and conservatories.

Adjacent Properties - Shadow/Sunlight - Gardens and Open spaces

Tests for the availability of sunlight in amenity areas.

Shadow/Sunlight - Clause 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.

3.3.3 The availability of sunlight should be checked for all open spaces where it will be required. This would normally include:

- gardens, usually the main back garden of a house
- parks and playing fields
- children's playgrounds
- outdoor swimming pools and paddling pools
- sitting out areas such as those between non-domestic buildings and in public squares
- focal points for views such as a group of monuments or fountains.

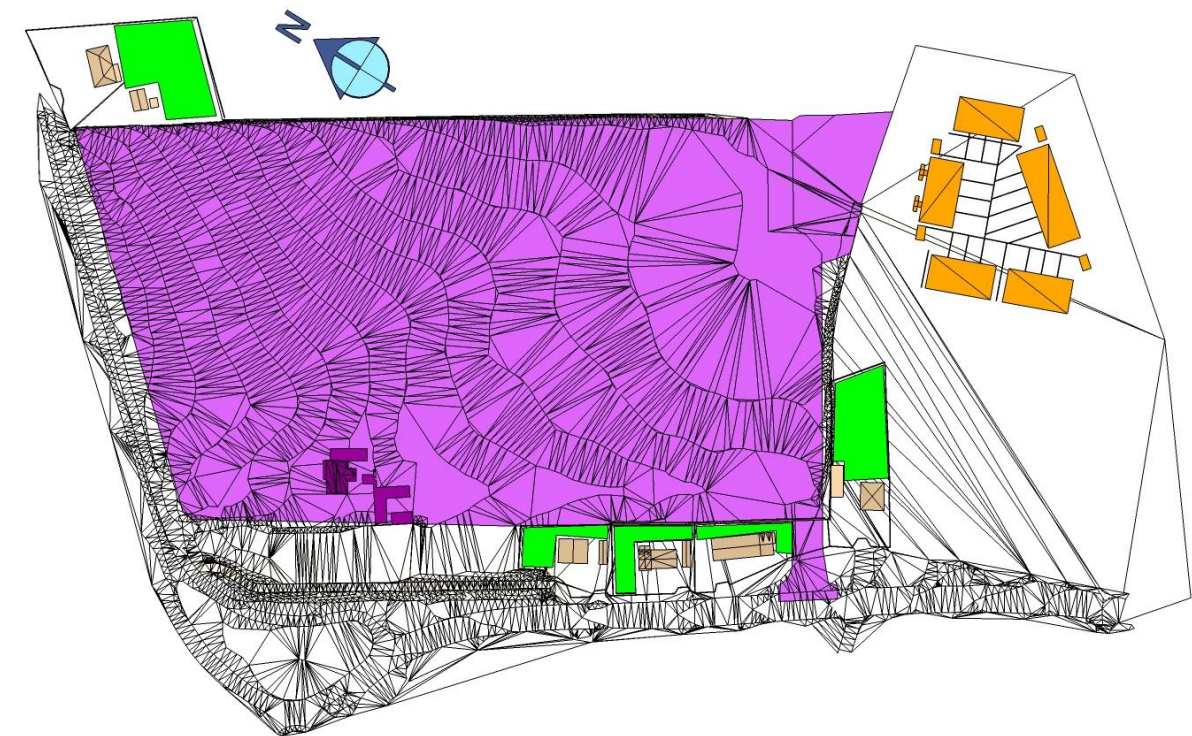
The amenities of the following properties were tested.

- Representative Rear Gardens as defined above.

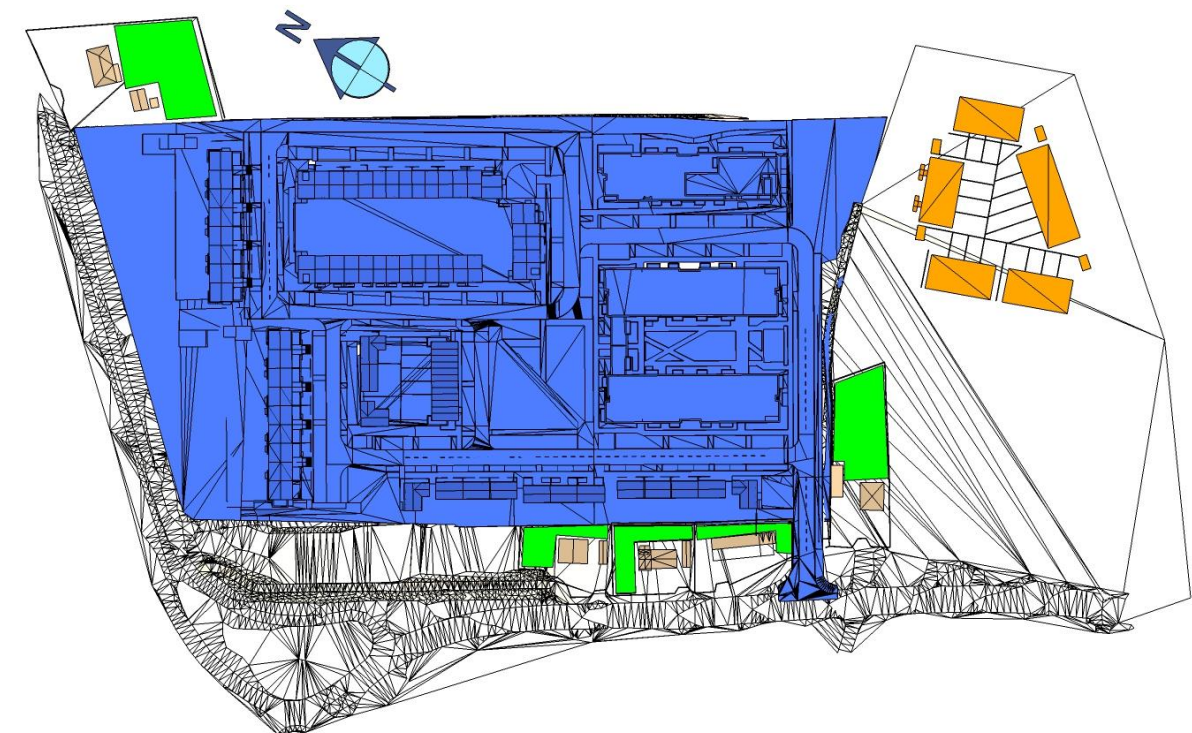
BRE 2-hour Shadow Plots

The graphic below indicates the areas which receive 2 hours of sunlight on the 21st March in accordance with the BRE guidelines.

- **Green** represents areas which exceed the 2-hour requirement - pass
- **Red** is less than the 2-hour requirement - fail
- **Orange** are marginal or borderline - just below the 2-hour requirement



Existing



Proposed

The results are tabulated below:

				Shadow to amenity spaces			
				2-hour Sunlight - 21st March			
				Check > 50% or ratio > 0.8			
Group	Area	Ref	Description	Existing	Proposed	Ratio	Result
B1	A1	1.A1	Amenity	100%	100%	1.00	Pass
B2	A1	2.A1	Amenity	100%	98%	0.98	Pass
B2	A2	2.A2	Amenity	100%	100%	1.00	Pass
B2	A3	2.A3	Amenity	100%	100%	1.00	Pass
B3	A1	3.A1	Amenity	100%	100%	1.00	Pass

Note: When the proposed value exceeds the minimum requirement the ratio check is not required, and the result is coloured grey.

Please note that passing the BRE requirements does not imply that shadows will not be cast over an amenity space at all. Shadows which are transient by nature may not impact on the percentage of the space which receives 2 hours of sunlight on the 21st of March.

Please also note that the Amenity space to 2.A1 represents the sub-divided garden.

There is extensive vegetation along many of the boundaries to the development site but in accordance with standard practice (and as a worst-case scenario) this has been excluded from the analysis.

Conclusion

All tested neighbouring amenity spaces pass the BRE requirement relating to the area receiving 2 hours of sunlight on the 21st of March > 50% or not breaching the 0.8 times its former value limit.

The average change ratio for the tested amenity spaces **1.00**

The proposed development has little BRE impact on these areas and complies with the requirements of the BRE guidelines.

Summary - Adjacent Properties

Neighbouring properties will generally not be affected by the proposed development and the impacts on Skylight, Sunlight and Shadow have been tested in accordance with the best practice guidelines.

Change/Impact to neighbouring buildings in the adjoining residential areas.

- **Skylight- VSC**
 - 100% of windows pass the relevant VSC checks.
 - The average change ratio for VSC is **0.88**
- **Sunlight APSH & WPSH**
 - Few windows face within 90° of due South
 - All those that do pass the relevant Annual APSH, Winter WPSH or overall sunlight checks.
 - The average change ratios are APSH: **0.98** & WPSH: **0.94**
- **Shadow**
 - **100%** of tested neighbouring amenity spaces pass the 2-hour test requirements for the 21st March.
 - The average change ratio for shadow/sunlight is **1.00**

The potential impact of the proposed development on neighbours complies with the requirements of "Site layout planning for daylight and sunlight a guide to good practice Second Edition" - 2011 by Paul J Littlefair - BR209

Development Performance

Development Performance - Average Daylight Factor - ADF

Internal light distribution within a room is examined by testing ADF (Average Daylight Factor) against pre-defined parameters. Calculation of average daylight factor is based the BRE guidance document BR 209 and the referenced *BS 8206-2:2008 Lighting for buildings – Part 2: Code of practice for daylighting*.

This is defined under **Clause 2.11.3**

Daylight Factor

Ratio of illuminance at a point on a given plane due to light received from a sky of known or assumed luminance distribution, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky [BS 6100-7:2008, 59011]

Defined in the **BRE 209 Glossary (similarly in the BS code Clause 2.11.4 and 5.5)**

Average daylight factor:

Ratio of total daylight flux incident on the working plane to the area of the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane due to an unobstructed CIE standard overcast sky. Thus a 1% ADF would mean that the average indoor illuminance would be one hundredth the outdoor unobstructed illuminance

The average daylight factor (see 2.11.4) is used as the measure of general illumination from skylight. It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylight appearance. In order to achieve this the average daylight factor should be at least 2%.

If the average daylight factor in a space is at least 5% then electric lighting is not normally needed during the daytime, provided the uniformity is satisfactory (see 5.7 BS or 2.1.8 BRE 209). If the average daylight factor in a space is between 2% and 5% supplementary electric lighting is usually required. Values greater than 6% might suggest that the room has too much daylight.

- For the purposes of the calculation of daylight factor in this standard, it is assumed that the sky has the luminance distribution of the standard overcast sky.
- Direct and reflected sunlight are excluded from all values of illuminance.

This Code also provides under **Clause 5.6** guidance for

Minimum values of average daylight factor in dwellings

Even if a predominantly daylight appearance is not achievable in a dwelling, it is recommended that the average daylight factor should be at least the relevant value as given in Table 2 or clause 2.1.8 BRE 209

Table 2 - Minimum average daylight factor

Room type	Minimum Average daylight factor %
Bedrooms	1
Living rooms	1.5
Kitchens	2

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%.

In accordance with BRE 209 & BS 8206-2 computations are based on the standard CIE (Commission Internationale de l'Eclairage) overcast sky model. With the exclusion of direct and reflected sunlight from the computation of room average daylight factor it may be considered as worst-case scenario.

Light distribution was computed by modelling the internal configuration of rooms and windows placed within the existing topography and the adjacent buildings and then running a radiance analysis on the same. This analysis was based on a standard working plane for residential of 0.850m and results are provided in terms of Average Daylight Factor for selected rooms. See code for definitions.

The following reflectance/transmittance values were used for the analysis
These are generally from BS 8206 Part 2 - tables A.1 & A.2

Surface	Description	Reflectance	
External Plane	Earth	0.2	
External Walls	Grey render / concrete	0.4	
Floor	Light Wood / cream carpet	0.4	
Internal Wall	Cream	0.7	
Ceiling	White	0.8	
Frame	Medium Grey	0.5	
Glass	Sealed double glazed unit	0.63	<Transmittance

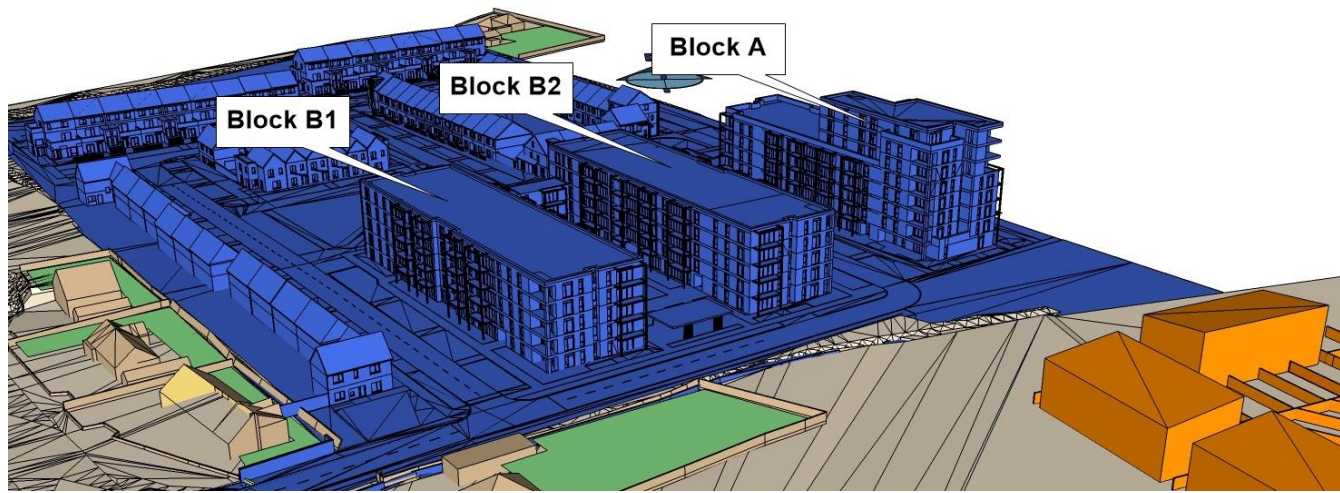
We note that for apartment developments the majority of councils in Ireland and the UK accept the lower value of 1.5% assigned to living rooms to also include those with a small food preparation area (kitchen) as part of this space. The higher kitchen figure of 2.0% is more appropriate to a traditional house layout and room usage. The use of a reduced value accepted by Local Authorities is still compliant within the terms of the guidelines. This has been confirmed as acceptable and standard practice by the author Dr Paul Littlefair.

We have used the minimum value of **1.0%** for bedrooms and tested against both **2.0%** strict and **1.5%** relaxed BRE targets for the Living room spaces.

Legend for radiance plots:



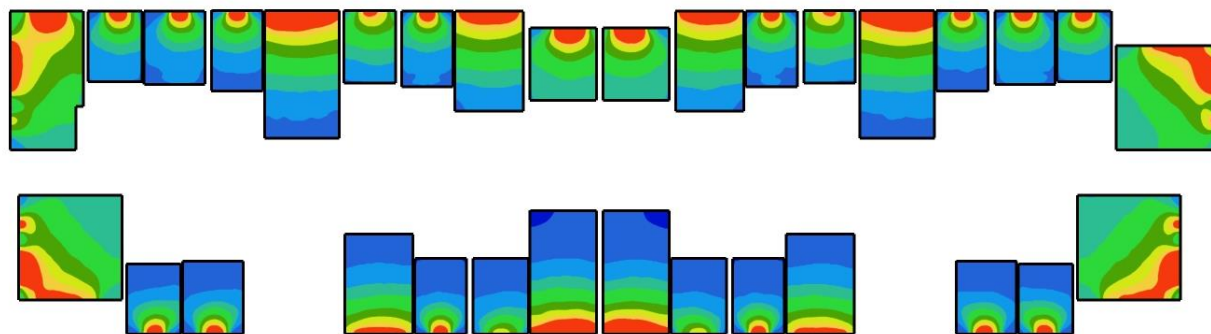
Block Naming



Block A Floor Layout - Naming Convention

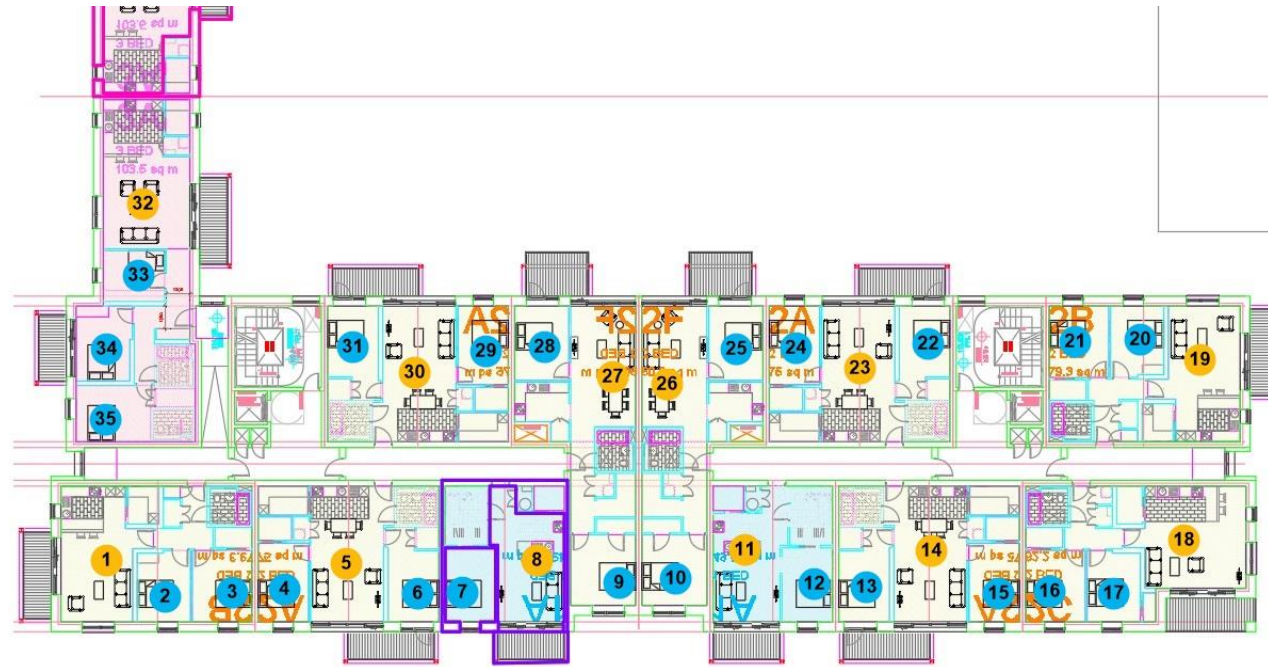


1st Floor Analysis

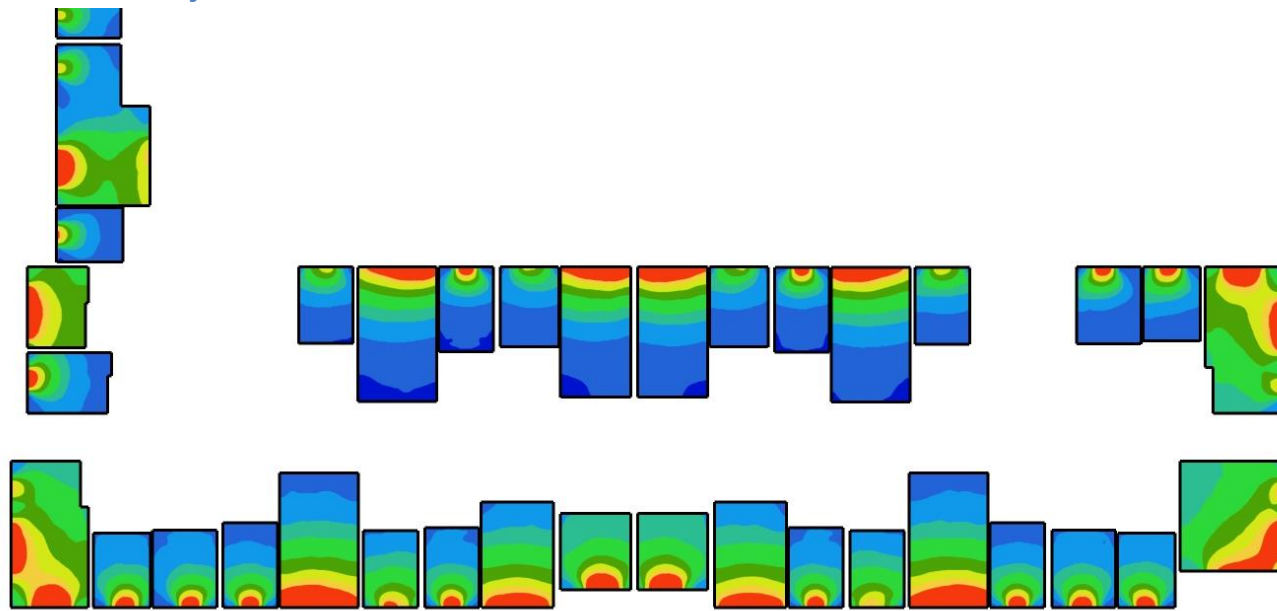


A Average Daylight Factor							
V3 For all habitable rooms							
ADF Values from radiance 3D model				Yes			
Type							
Ref	Ref	Type	ADF	Strict BRE Min	Check	Relaxed L/D/K Target	Check
	A0101L	Living Room	3.4	2.0	Pass	1.5	Pass
	A0102	Bedroom	1.7	1.0	Pass	1.0	Pass
	A0103	Bedroom	1.6	1.0	Pass	1.0	Pass
	A0104L	Living Room	2.2	2.0	Pass	1.5	Pass
	A0105	Bedroom	1.5	1.0	Pass	1.0	Pass
	A0106	Bedroom	1.3	1.0	Pass	1.0	Pass
	A0107L	Living Room	2.4	2.0	Pass	1.5	Pass
	A0108L	Living Room	2.4	2.0	Pass	1.5	Pass
	A0109	Bedroom	1.4	1.0	Pass	1.0	Pass
	A0110	Bedroom	1.5	1.0	Pass	1.0	Pass
	A0111L	Living Room	2.1	2.0	Pass	1.5	Pass
	A0112	Bedroom	1.5	1.0	Pass	1.0	Pass
	A0113	Bedroom	1.7	1.0	Pass	1.0	Pass
	A0114L	Living Room	3.4	2.0	Pass	1.5	Pass
	A0115L	Living Room	3.7	2.0	Pass	1.5	Pass
	A0116	Bedroom	2.1	1.0	Pass	1.0	Pass
	A0117	Bedroom	1.9	1.0	Pass	1.0	Pass
	A0118	Bedroom	1.9	1.0	Pass	1.0	Pass
	A0119L	Living Room	3.1	2.0	Pass	1.5	Pass
	A0120	Bedroom	2.3	1.0	Pass	1.0	Pass
	A0121	Bedroom	1.9	1.0	Pass	1.0	Pass
	A0122L	Living Room	3.1	2.0	Pass	1.5	Pass
	A0123	Bedroom	3.0	1.0	Pass	1.0	Pass
	A0124	Bedroom	3.1	1.0	Pass	1.0	Pass
	A0125L	Living Room	3.1	2.0	Pass	1.5	Pass
	A0126	Bedroom	2.0	1.0	Pass	1.0	Pass
	A0127	Bedroom	2.4	1.0	Pass	1.0	Pass
	A0128L	Living Room	3.1	2.0	Pass	1.5	Pass
	A0129	Bedroom	2.0	1.0	Pass	1.0	Pass
	A0130	Bedroom	1.9	1.0	Pass	1.0	Pass
	A0131	Bedroom	2.1	1.0	Pass	1.0	Pass
	A0132L	Living Room	3.9	2.0	Pass	1.5	Pass
					Pass	32	Pass
					Count	32	Count
					Percentage	100%	Percentage

Block B1 Floor Layout – Naming Convention



1st Floor Analysis

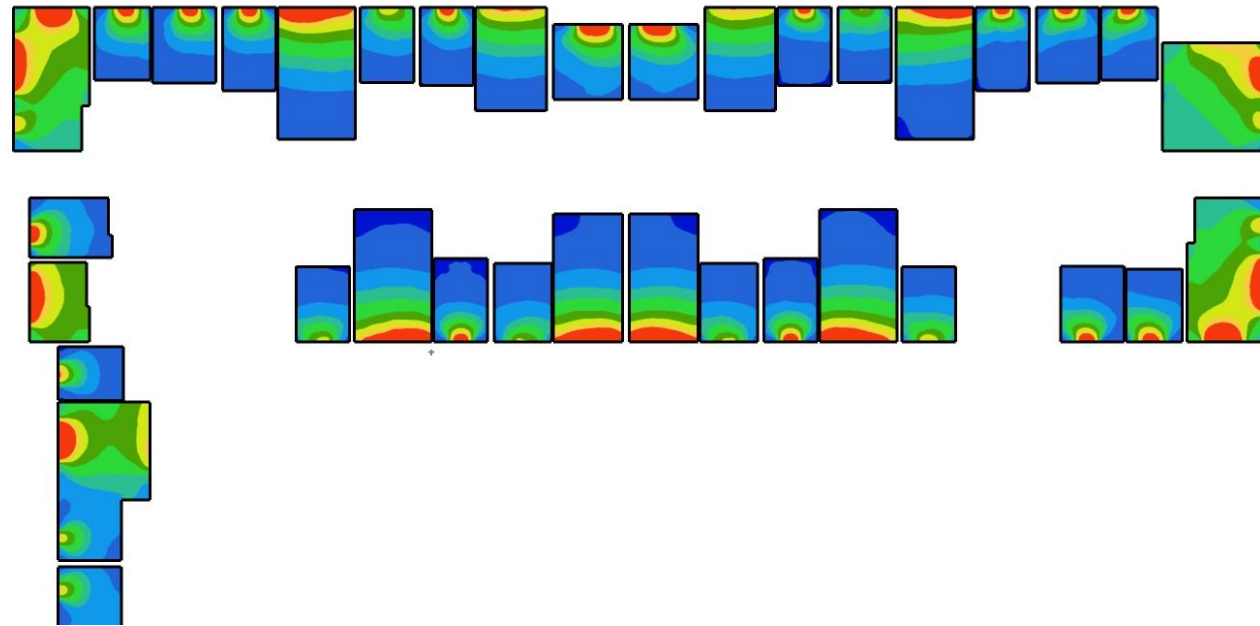


B1 Average Daylight Factor							
V3 For all habitable rooms							
ADF Values from radiance 3D model				Yes			
Type							
Ref	Ref	Type	ADF	Strict BRE Min	Check	Relaxed L/D/K Target	Check
	b10101L	Living Room	4.0	2.0	Pass	1.5	Pass
	b10102	Bedroom	2.1	1.0	Pass	1.0	Pass
	b10103	Bedroom	1.9	1.0	Pass	1.0	Pass
	b10104	Bedroom	1.9	1.0	Pass	1.0	Pass
	b10105L	Living Room	3.2	2.0	Pass	1.5	Pass
	b10106	Bedroom	2.3	1.0	Pass	1.0	Pass
	b10107	Bedroom	2.0	1.0	Pass	1.0	Pass
	b10108L	Living Room	3.1	2.0	Pass	1.5	Pass
	b10109	Bedroom	3.0	1.0	Pass	1.0	Pass
	b10110	Bedroom	3.0	1.0	Pass	1.0	Pass
	b10111L	Living Room	3.1	2.0	Pass	1.5	Pass
	b10112	Bedroom	2.0	1.0	Pass	1.0	Pass
	b10113	Bedroom	2.3	1.0	Pass	1.0	Pass
	b10114L	Living Room	3.2	2.0	Pass	1.5	Pass
	b10115	Bedroom	1.9	1.0	Pass	1.0	Pass
	b10116	Bedroom	1.9	1.0	Pass	1.0	Pass
	b10117	Bedroom	2.1	1.0	Pass	1.0	Pass
	b10118L	Living Room	3.7	2.0	Pass	1.5	Pass
	b10119L	Living Room	3.8	2.0	Pass	1.5	Pass
	b10120	Bedroom	1.7	1.0	Pass	1.0	Pass
	b10121	Bedroom	1.4	1.0	Pass	1.0	Pass
	b10122	Bedroom	1.5	1.0	Pass	1.0	Pass
	b10123L	Living Room	2.2	2.0	Pass	1.5	Pass
	b10124	Bedroom	1.4	1.0	Pass	1.0	Pass
	b10125	Bedroom	1.3	1.0	Pass	1.0	Pass
	b10126L	Living Room	2.3	2.0	Pass	1.5	Pass
	b10127L	Living Room	2.2	2.0	Pass	1.5	Pass
	b10128	Bedroom	1.2	1.0	Pass	1.0	Pass
	b10129	Bedroom	1.3	1.0	Pass	1.0	Pass
	b10130L	Living Room	2.0	2.0	Pass	1.5	Pass
	b10131	Bedroom	1.3	1.0	Pass	1.0	Pass
	b10132L	Living Room	2.7	2.0	Pass	1.5	Pass
	b10133	Bedroom	1.4	1.0	Pass	1.0	Pass
	b10134	Bedroom	4.3	1.0	Pass	1.0	Pass
	b10135	Bedroom	1.8	1.0	Pass	1.0	Pass
				Pass	35	Pass	35
				Count	35	Count	35
				Percentage	100%	Percentage	100%

Block B2 Floor Layout - Naming Convention



1st Floor Analysis



B2 Average Daylight Factor							
V3 For all habitable rooms							
ADF Values from radiance 3D model				Yes			
Type		Strict BRE		Relaxed L/D/K			
Ref	Ref	Type	ADF	Min	Check	Target	Check
	B20101L	Living Room	3.8	2.0	Pass	1.5	Pass
	B20102	Bedroom	1.8	1.0	Pass	1.0	Pass
	B20103	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20104	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20105L	Living Room	2.4	2.0	Pass	1.5	Pass
	B20106	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20107	Bedroom	1.4	1.0	Pass	1.0	Pass
	B20108L	Living Room	2.0	2.0	Pass	1.5	Pass
	B20109	Bedroom	2.1	1.0	Pass	1.0	Pass
	B20110	Bedroom	2.1	1.0	Pass	1.0	Pass
	B20111L	Living Room	1.9	2.0	Marginal	1.5	Pass
	B20112	Bedroom	1.2	1.0	Pass	1.0	Pass
	B20113	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20114L	Living Room	2.0	2.0	Pass	1.5	Pass
	B20115	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20116	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20117	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20118L	Living Room	3.2	2.0	Pass	1.5	Pass
	B20119L	Living Room	3.8	2.0	Pass	1.5	Pass
	B20120	Bedroom	1.7	1.0	Pass	1.0	Pass
	B20121	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20122	Bedroom	1.5	1.0	Pass	1.0	Pass
	B20123L	Living Room	2.2	2.0	Pass	1.5	Pass
	B20124	Bedroom	1.4	1.0	Pass	1.0	Pass
	B20125	Bedroom	1.2	1.0	Pass	1.0	Pass
	B20126L	Living Room	2.3	2.0	Pass	1.5	Pass
	B20127L	Living Room	2.2	2.0	Pass	1.5	Pass
	B20128	Bedroom	1.2	1.0	Pass	1.0	Pass
	B20129	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20130L	Living Room	2.0	2.0	Pass	1.5	Pass
	B20131	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20132L	Living Room	2.7	2.0	Pass	1.5	Pass
	B20133	Bedroom	1.3	1.0	Pass	1.0	Pass
	B20134	Bedroom	4.4	1.0	Pass	1.0	Pass
	B20135	Bedroom	1.8	1.0	Pass	1.0	Pass
				Pass	34	Pass	35
				Count	35	Count	35
				Percentage	97%	Percentage	100%

ADF Summary

Summary					
V3	Strict			Relaxed	
	Count	Pass	Rate	Pass	Rate
A	32	32	100%	32	100%
B1	35	35	100%	35	100%
B2	35	34	97%	35	100%
Overall	102	101	99%	102	100%

Only B2/01/11L drops marginally below the 2.0% target of 1.9%.

This living room faces towards the taller element of Block A, hence its slightly lower Result.

On higher floors there is less obstruction to skylight and the equivalent room tested on the 2nd floor passes with an ADF of 2.1%

Please see Architect’s Commentary and Compensatory measures for additional detail on the above.

ADF Check - Summary

ADF (average daylight factors) for 99% tested rooms on the 1st floor of all blocks comply with strict requirements. The one room which doesn’t is marginal

The development shows excellent ADF results with

Average ADF for the tested living rooms is **2.8%** and for bedrooms **1.8%**

The proposed development generally complies with the requirements of the BRE guidelines in relation to ADF light distribution.

Proposed Development - Sunlight Annual & Winter

Clause 3.1.2 of the guidance document BRE indicates that special checks should be applied to living rooms to ensure that these core rooms receive the necessary sunlight.

In Housing, the main requirement for sunlight is in living rooms. where it is valued at any time of day but especially in the afternoon.

Check Clauses

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

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

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

3.1.12..... If a room has two windows on opposite walls, the APSH due to each can be added together.

The guidelines accept the difficulty imposed by this requirement and that it will not always be possible to achieve this requirement for ALL living spaces. While it is preferred to have sunlight the guidelines are pragmatic in this regard.

The guidelines further define:

*3.1.8..... For larger developments of flats, especially those with site constraints, it may not be possible to have every living room facing within 90° of south.....
.....Arranging the flats so that living rooms are placed at the end corners of the building and hence can be dual aspect. That way, living rooms on the north side of the building can also have an east- or west-facing window which can receive some sun.....*

It then follows with an example of a careful layout for a relatively small block where 4/5 flats have south facing living rooms, and one North which would receive no sunlight at all. From this layout and results we can conclude that an 80% pass rate is considered good design.



Figure 26: Careful layout design means that four out of the five flats shown have a south-facing living room

Tabulated results

Sunlight APSH - Living rooms							
				Annual > 25%		Winter > 5%	
Building	Floor	Room/Win	Ref	APSH		WPSH	
A	F1	W1	A.1.1	20	Marginal	6	Pass
A	F1	W4	A.1.4	27	Pass	14	Pass
A	F1	W7	A.1.7	49	Pass	13	Pass
A	F1	W8	A.1.8	31	Pass	7	Pass
A	F1	W11	A.1.11	30	Pass	18	Pass
A	F1	W14	A.1.14	78	Pass	31	Pass
A	F1	W15	A.1.15	80	Pass	31	Pass
A	F1	W19	A.1.19	30	Pass	7	Pass
A	F1	W22	A.1.22	20	Marginal	5	Pass
A	F1	W25	A.1.25	21	Marginal	6	Pass
A	F1	W28	A.1.28	17	Fail	5	Pass
A	F1	W32	A.1.32	30	Pass	7	Pass
B1	F1	W1	B1.1.1	70	Pass	25	Pass
B1	F1	W5	B1.1.5	35	Pass	17	Pass
B1	F1	W8	B1.1.8	38	Pass	23	Pass
B1	F1	W11	B1.1.11	37	Pass	22	Pass
B1	F1	W14	B1.1.14	63	Pass	25	Pass
B1	F1	W18	B1.1.18	80	Pass	31	Pass
B1	F1	W19	B1.1.19	45	Pass	30	Pass
B1	F1	W23	B1.1.23	8	Fail	5	Marginal
B1	F1	W26	B1.1.26	5	Fail	5	Marginal
B1	F1	W27	B1.1.27	20	Marginal	4	Marginal
B1	F1	W30	B1.1.30	17	Fail	3	Fail
B1	F1	W32	B1.1.32	13	Fail	7	Pass
B2	F1	W1	B2.1.1	20	Marginal	5	Pass
B2	F1	W5	B2.1.5	4	Fail	3	Fail
B2	F1	W8	B2.1.8	8	Fail	6	Pass
B2	F1	W11	B2.1.11	10	Fail	5	Pass
B2	F1	W14	B2.1.14	24	Marginal	7	Pass
B2	F1	W18	B2.1.18	80	Pass	31	Pass
B2	F1	W19	B2.1.19	44	Pass	29	Pass
B2	F1	W23	B2.1.23	24	Marginal	10	Pass
B2	F1	W26	B2.1.26	28	Pass	5	Pass
B2	F1	W27	B2.1.27	46	Pass	12	Pass
B2	F1	W30	B2.1.30	46	Pass	12	Pass
B2	F1	W32	B2.1.32	15	Fail	13	Pass

Careful layout Design – Extrapolation & Design Principles

It is reasonable to conclude that as the block cores increase then the number of inner apartments which would have to face North would also increase and that the percentage compliance would increase and still lie within the bounds of “careful layout design”.

We can extrapolate this somewhat for larger core developments we can see that even a 60% pass rate might be considered reasonable, especially when the interaction of individual blocks on each other are factored in.

Block Size Apartments	North Facing	Receiving Sunlight
5	1	80%
7	2	71%
9	3	67%
11	4	64%

However, the architect in this case has made a design choice and sought to and successfully achieved some sunlight to all apartments.

In this balancing process the individual sunlight percentages to some rooms have marginally dropped below the strict targets (marginal here is a ratio of 0.80)

Including these marginal values shows that an excellent proportion of the living rooms in such a high density development will receive a good quality of sunlight i.e. The relaxed compliance rate would be 75% Annual APSH and 94% Winter WPSH.

Sunlight to Living rooms - Summary

All windows receive some sunlight as per Department Guidelines.

On the strict BRE targets 56% comply with Annual APSH requirements and 86% with the winter WPSH. If we include the few marginal results **75%** pass the Annual APSH requirements and **94%** pass the winter WPSH.

Including the marginal results this is generally in accordance with the guidelines example of “careful” design 80% also rooms on higher floor levels will achieve better results as they are subject to less obstruction.

This high quality of sunlight coupled with the excellent ADF detailed above show that the living rooms to the apartments tested will receive an excellent quality of light

See Architects Commentary and Compensatory Measures for further information.

The proposed development generally complies with the requirements of the BRE guidelines in relation to Sunlight availability and careful layout design.

Development Performance - Shadow/Sunlight - Gardens and Open spaces

Tests for the availability of sunlight in amenity areas.

Shadow/Sunlight - Clause 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.

3.3.3 The availability of sunlight should be checked for all open spaces where it will be required. This would normally include:

- gardens, usually the main back garden of a house
- parks and playing fields
- children's playgrounds
- outdoor swimming pools and paddling pools
- sitting out areas such as those between non-domestic buildings and in public squares
- focal points for views such as a group of monuments or fountains.

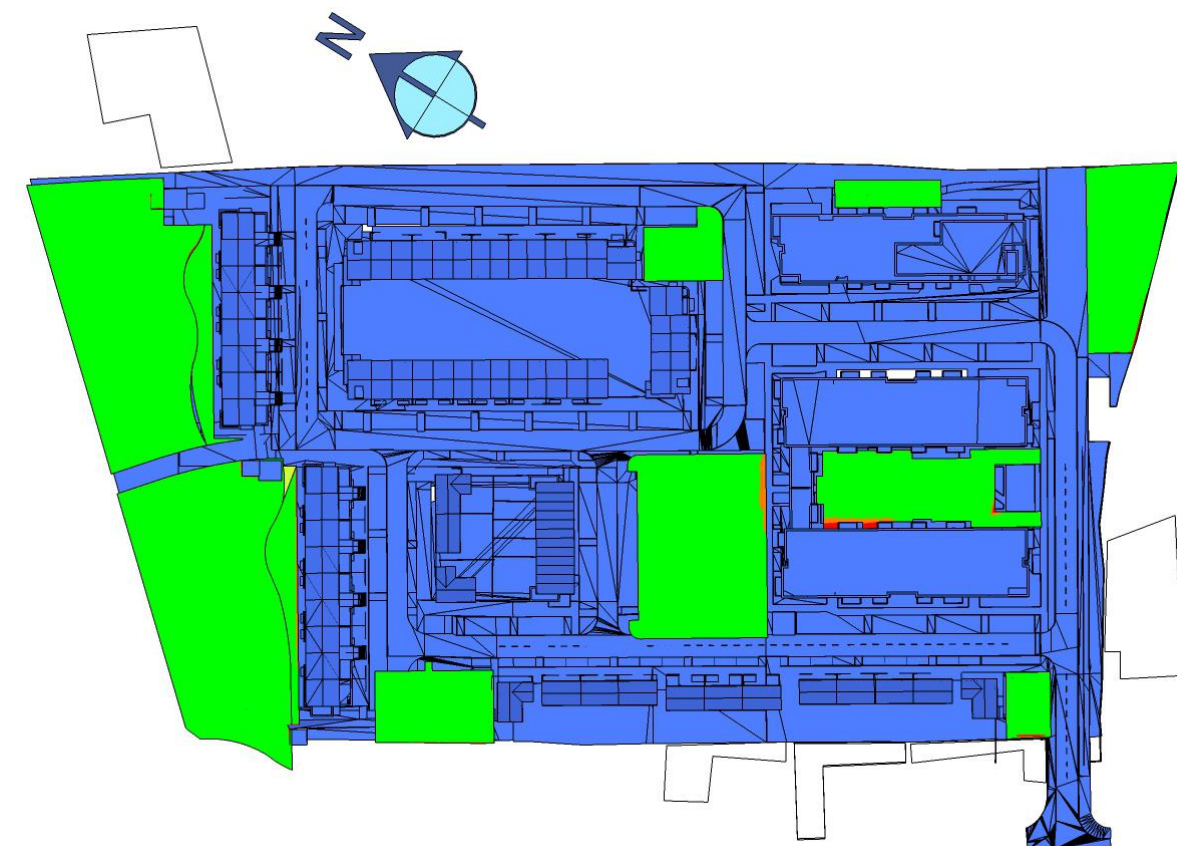
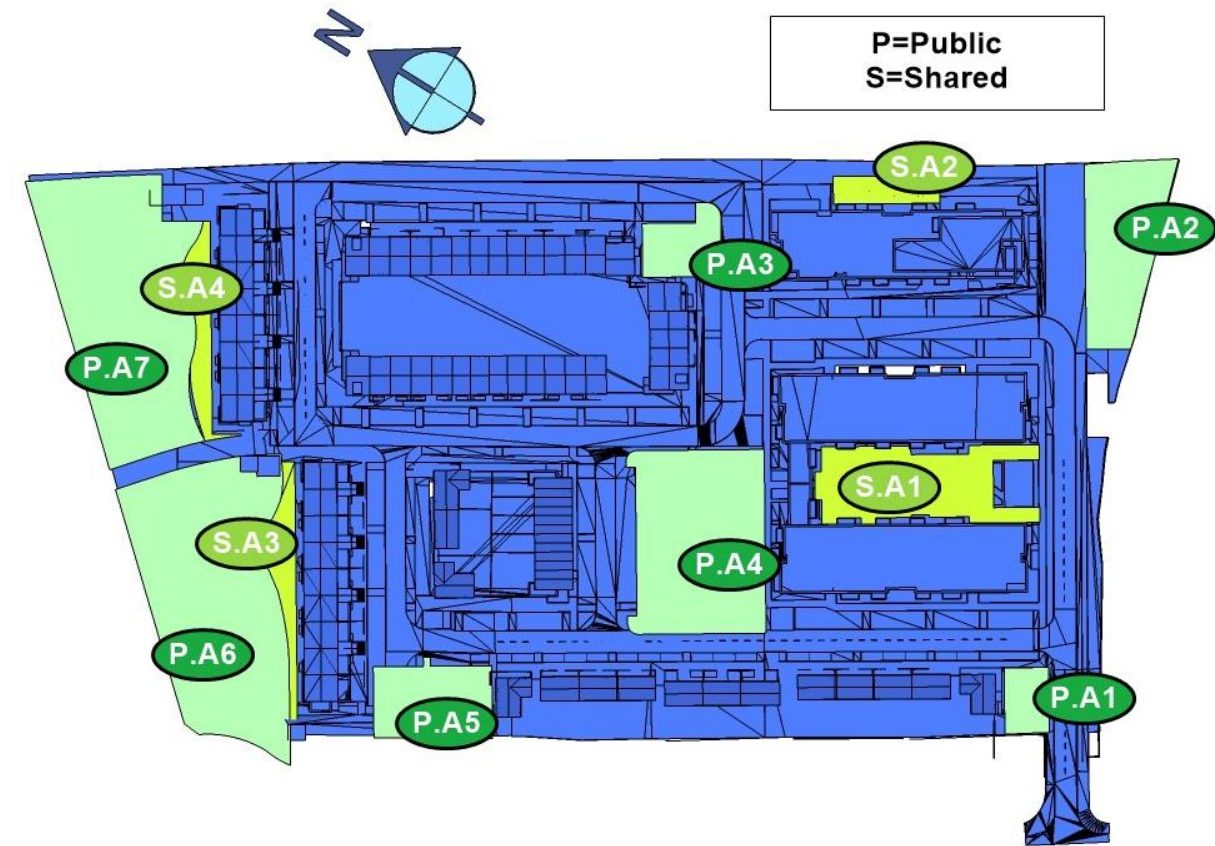
The amenities of the following properties were tested.

- Shared and Public Amenity spaces as noted below.

BRE 2-hour Shadow Plots

The graphic below indicates the areas which receive 2 hours of sunlight on the 21st March in accordance with the BRE guidelines.

- **Green** represents areas which exceed the 2-hour requirement - pass
- **Red** is less than the 2-hour requirement - fail
- **Orange** are marginal or borderline - just below the 2-hour requirement



The results are tabulated below:

Shadow / Sunlight Amenity					
>50% receives 2 hours of sunlight on 21st March)					
Type	Floor	Nr	Ref	% 2hr Sunlight	Check
AP	F0	A1	P.A1	99%	Pass
AP	F0	A2	P.A2	100%	Pass
AP	F0	A3	P.A3	100%	Pass
AP	F0	A4	P.A4	98%	Pass
AP	F0	A5	P.A5	100%	Pass
AP	F0	A6	P.A6	100%	Pass
AP	F0	A7	P.A7	100%	Pass
AS	F0	A1	S.A1	96%	Pass
AS	F0	A2	S.A2	100%	Pass
AS	F0	A3	S.A3	100%	Pass
AS	F0	A4	S.A4	100%	Pass

Please note that passing the BRE requirements does not imply that shadows will not be cast over an amenity space at all. Shadows which are transient by nature may not impact on the percentage of the space which receives 2 hours of sunlight on the 21st of March.

Conclusion

100% of the new provided shared and public amenity spaces pass the BRE requirement relating to the area receiving 2 hours of sunlight on the 21st of March > 50%.

The tested spaces comply with the requirements of the BRE guidelines.

Summary – Development Performance

This report is in compliance with: "Site layout planning for daylight and sunlight a guide to good practice Second Edition - 2011 by Paul J Littlefair - BR209". It also references "BS 8206-2:2008 Lighting for buildings – Part 2: Code of practice for daylighting" as and where called for in the above BRE guidance document.

Performance of the proposed design

- **Light Distribution ADF**
 - 99% of tested rooms on the representative 1st floor pass the strict BRE requirements.
 - One room is marginal at this level and passes on subsequent levels.
 - The development shows excellent ADF results.
 - Average high ADFs for all tested living rooms is **2.8%** and for bedrooms **1.8%**
- **Sunlight to Living rooms:**
 - 100% of windows receive some sunlight as per Department Guidelines.
 - On the strict BRE targets **56%** comply with Annual APSH requirements & **86%** with the winter WPSH
 - Including marginal results **75%** pass the Annual APSH requirements & **94%** pass the winter WPSH.
 - This is generally in accordance with the guidelines example of "careful" design 80% also rooms on higher floor levels will achieve better results as they are subject to less obstruction.
 - This is a relative dense development and so it is not unexpected that some sunlight will be limited.
 - This quality of sunlight coupled with the excellent ADF detailed above show that the living rooms to the apartments tested will receive an excellent quality of light
- **Shadow:**
 - All tested Shared and Public amenity spaces receive > 2hrs of sunlight over 50% of their area on the 21st of March.
 - The shared/public amenity spaces have been designed to be well sunlit.

The application generally complies with the recommendations and guidelines of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings, Part 2: Code of Practice for Daylighting.

Architect's Commentary / Compensatory Design Measures

Summary of Apartments Location

The 2no. Apartment blocks, A & B are located in the southern area of the site to ensure a strong sense of place is delivered, and the taller Block A acts as an urban marker for the entrance to the Citywest lands to the east, to ensure legibility of the entrance boulevard for future development of those lands.

Block A is a linear volume, which forms an edge to take advantage of the wooded eastern boundary, with a gradual stepping down to the northern area of the block to address the adjacent 3 storey duplex units at POS 02. The orientation of Block B in the site is to ensure a high level of light penetration into the inner facades of the Block and communal courtyard as this area to the south is proposed as an open to the entrance boulevard, with a 3-storey link proposed to the northern edge of the block. The placement of Block B also results in an active and defined urban edge of the centrally located POS 01.

Summary Solar Orientation Design

Care has also been taken to ensure there are no north facing single aspect apartment units, we have sought to achieve a high level of sunlight. The design and layout of the floor plans ensures all living spaces receive some sunlight and that a high proportion will receive a high quality of the same.

In the balancing process the individual sunlight percentages to some rooms have marginally dropped below the strict BRE targets but if a relaxed target is examined the compliance rate, would be 75% Annual APSH and 94% Winter WPSH. Given that the proposed development is a high-density proposal this is positive for the scale of the apartment units and may also be balanced against excellent ADF results. The results are coupled with positive sunlight for external Communal Open Spaces for the apartment residents, as these are also orientated to receive a maximum level of sunlight, unobstructed by adjacent development.

Summary of Public and Communal Open Spaces

The site layout has been designed to ensure the usability and quality of the proposed communal and public open spaces is in easy reach for future residents, of various scales and character.

POS 01 has been centrally located in the scheme to offer a generous, high quality, and passively supervised green space for future residents. The legibility of this primary open space is extended throughout the site by POS 2, 3 & 4 which act as pocket parks for the adjacent streets and add to a variety of linked character amenity spaces. With a proposed provision of approximately 16.5% public open space, with all areas are accessed by accessible pathways.

Open spaces towards the site boundaries allow for a high level of light penetration and are all generously sized with careful landscape treatment & planting areas proposed. Communal open spaces for residents of the 2no.

apartment blocks and the duplex units are located in areas which are well lit, and receive have high levels of natural sunlight penetration.

Floor Selection Process for Testing:

The ground floors were discounted for testing as they are not representative of the development as whole

For Apartment Blocks A & B the floor plans for each block are void of a number of apartment units, in lieu of service and ancillary rooms, and the plans being classed as a non-standard arrangement.

Within each of the ground floor plans, individual rooms are dedicated for uses including bin stores, bike stores, mechanical & electrical plant space, and battery units to support Photovoltaic panels on the roof of each block. In Block A, these rooms are proposed to the façade opposing Block B, and two of each of these rooms are proposed within each linear section of Block B ground floor. In Block B, these spaces face into the internal courtyard, and are located closer to the inward corner of the communal courtyard.

When apartment units are proposed within the ground floor plan, these are primarily along the outer edges of each block, which will receive satisfactory levels of light. The floor to ceiling heights on the ground floor are significantly higher than those above, with 2700mm being implemented, as opposed to 2475mm on the floors above. This increase of 225mm allows for increase glazing, which will naturally allow for greater levels of daylighting into the individual apartment units.

Noting these design measures taken for the ground floor of each block, it is considered unnecessary to complete a test for these floor plates, as more accurate results are typically obtained from the first-floor plan arrangement.

Compensatory Measures Living room (B2/01/11L)

In testing of the ADF only one living room B02/01/11L drops marginally below the 2.0% KLD target at 1.9%.

This is compensated by the unit being oversized and its GFA is 49.5sqm, against a minimum area of 45sqm, which is 10% larger than the minimum size required.

The minimum width of the living space is also oversized at 3.7m, against a minimum width requirement of 3.3m.

The room was additionally tested at the 2nd floor level and achieved a ADF result of 2.1% (which is in strict compliance).

Overall Summary

Change/Impact to neighbouring buildings in the adjoining residential areas.

- **Skylight- VSC**
 - 100% of windows pass the relevant VSC checks.
 - The average change ratio for VSC is **0.88**
- **Sunlight APSH & WPSH**
 - Few windows face within 90° of due South
 - All those that do pass the relevant Annual APSH, Winter WPSH or overall sunlight checks.
 - The average change ratios are APSH: **0.98** & WPSH: **0.94**
- **Shadow**
 - **100%** of tested neighbouring amenity spaces pass the 2-hour test requirements for the 21st March.
 - The average change ratio for shadow/sunlight is **1.00**

Performance of the proposed design

- **Light Distribution ADF**
 - **99%** of tested rooms on the representative 1st floor pass the strict BRE requirements.
 - One room is marginal at this level and passes on subsequent levels.
 - The development shows excellent ADF results.
 - Average high ADFs for all tested living rooms is **2.8%** and for bedrooms **1.8%**
- **Sunlight to Living rooms:**
 - **100%** of windows receive some sunlight as per Department Guidelines.
 - On the strict BRE targets **56%** comply with Annual APSH requirements & **86%** with the winter WPSH
 - Including marginal results **75%** pass the Annual APSH requirements & **94%** pass the winter WPSH.
 - This is generally in accordance with the guidelines example of “careful” design 80% also rooms on higher floor levels will achieve better results as they are subject to less obstruction.
 - This is a relative dense development and so it is not unexpected that some sunlight will be limited.
 - This quality of sunlight coupled with the excellent ADF detailed above show that the living rooms to the apartments tested will receive an excellent quality of light
- **Shadow:**
 - All tested Shared and Public amenity spaces receive > 2hrs of sunlight over 50% of their area on the 21st of March.
 - The shared/public amenity spaces have been designed to be well sunlit.

The application generally complies with the recommendations and guidelines of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011) and BS 8206 Lighting for Buildings and Part 2: Code of Practice for Daylighting.