

BALLYOGAN COURT PHASE 2

Sunlight, Daylight & Shadow Assessment



Chris Shackleton Consulting
19 Waterside Crescent
Swords Road, Malahide,
Co Dublin, K36 DF74
email: chris@shackleton.ie
Tel: +353-1-5653239
Mob: +353-86-8206374

Executive Summary

This report examines the impact the proposed Phase 2 development on the existing Ballyogan housing estate we will concentrate on the impact of the proposed apartment blocks on the nearest properties in terms of sunlight, daylight & shadow. We shall also examine how the apartment blocks of the proposed design perform in terms of light distribution, sunlight and amenity space.

The report is, in accordance with "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice, BS 8206 Lighting for Buildings, Part 2: Code of Practice for Daylighting and other updated relevant documents".

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."

" 1.6The 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.... "

The results are as follows:

- **Change/Impact to existing buildings groups designated A, B C & D**
 - **Skylight- VSC**– All test points pass the relevant VSC checks.
 - **Sunlight APSH & WPSH** –All test points pass the relevant tests both Annual and Winter even though many are not within 90° of due South.
 - **Shadow** – Shadows are not cast on the private amenity spaces (back gardens) on the 21st March. The development passes the relevant requirement
- **Performance of the revised design in relation to test for the full 1st floor on all apartment blocks**
 - **Room depth** – All tested rooms comply with the guideline requirements for light constancy.
 - **Sunlight APSH & WPSH** – All living rooms receive > 25% of APSH sunlight and > 5% of the winter sunlight hours
 - **Daylight- ADF** – All tested rooms pass the relevant check ADF % for light distribution.
 - **Shadow** – All private balconies receive 2hrs of sunlight over > 50%

The application fully 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 and other updated relevant documents. It has successfully been designed to maximise the occupants' access to light and reduced the impact on "existing" approved 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 design constraints to arrive at this design.

Introduction

CSC have been asked to examine the impact the proposed Phase 2 development on the existing Ballyogan housing estate we are to concentrate on the impact of the proposed apartment blocks on the nearest properties in terms of sunlight, daylight & shadow. We are also to examine how the apartment blocks of the proposed design perform in terms of room depth, sunlight, light distribution and amenity space.

This work has been done in accordance with the recommendations of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (BRE 2011), BS 8206 Lighting for Buildings, Part 2: Code of Practice for Daylighting and other updated relevant documents'.

Preliminary Analysis

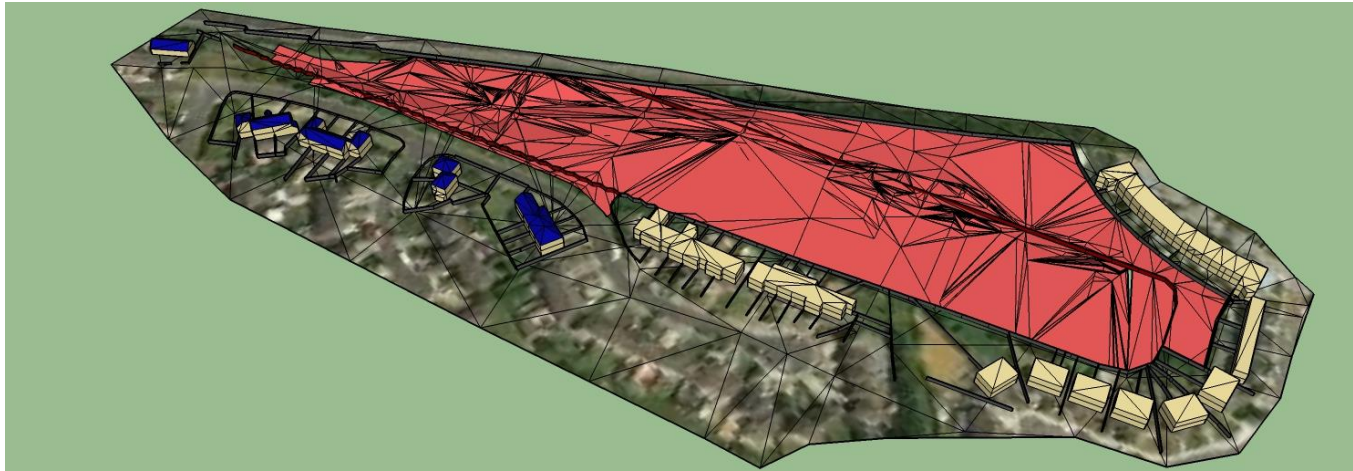
The aerial extract from Google Earth shows the context for the site.

The proposed design sits between the existing Ballyogan housing estate West and the M50 to the East on patch of unused land. The design consists of 3 x 4-storey (over basement) apartment blocks to the North and more traditional 2 storey terrace housing to the south.

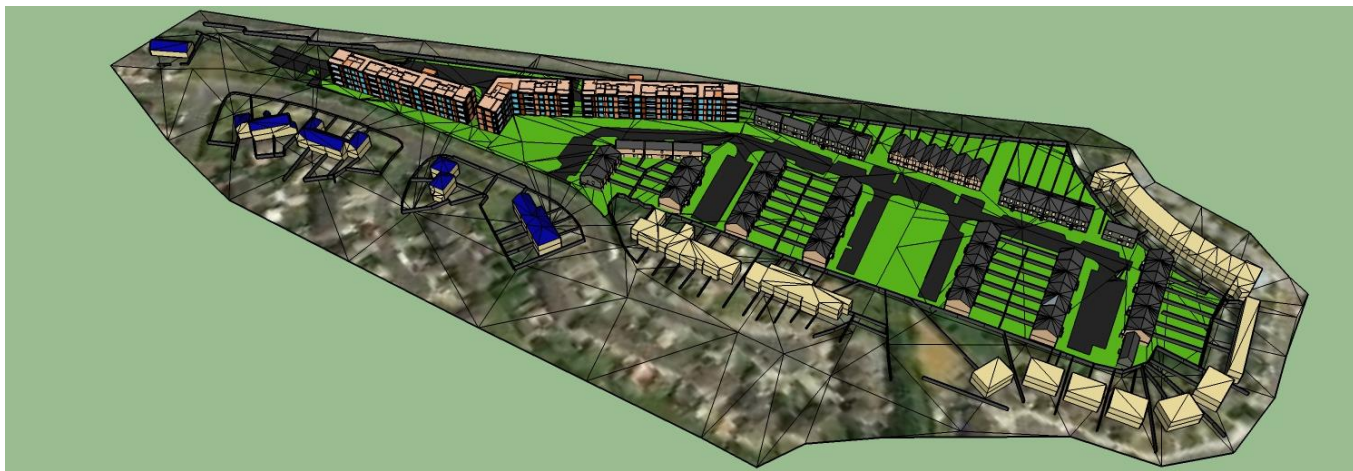


Design Model

A 3D model of the site and environs was created from information provided by the client and proposed building block were created from AutoCAD plans and elevations, for this analysis. This model was geo-referenced to its correct location and an accurate solar daylight system was introduced.



Existing Model



Proposed Model

Existing Impact Neighbours

In this document we will look at the impact that the design will have on the neighbouring housing estate. We will test for the following in relation to impact:

- Existing facing windows for:
 - Impact/Change for Skylight – VSC
 - Impact/Change for Annual & Winter probable sunlight hours - APSH
- 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 Consistency – Room Depth
- Sunlight availability to living room spaces.
- Light distribution Average Daylight Factor - ADF
- Proposed amenity spaces to be for sunlight/shadow

When examining the internal performance of the development we note that the layout and sizes of rooms and window positions are the same floor to floor. When testing the blocks performance, we have chosen to test an entire floor at 1st floor level to provide a good representative indication of the building's performance.

We have confined testing to the apartment blocks as the housing is of a standard design.

Impact on neighbours

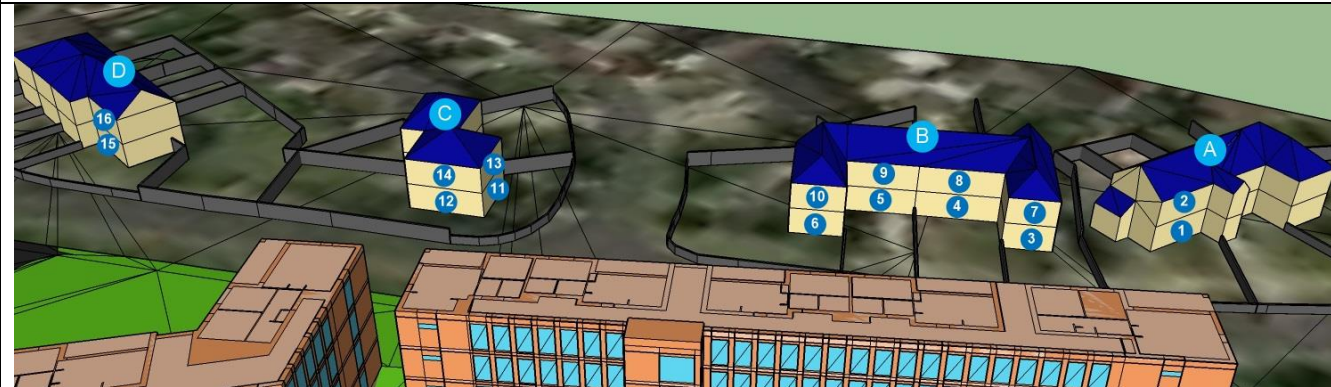
Neighbours Houses to the North West of apartment Blocks

The house blocks indicated below A..D are those with windows closest to the Northern apartment blocks of the development.



The Bing maps "bird's eye" shows the general layout.

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We were not able to establish exact locations of windows and so in accordance with recommendations of the guidelines have tested each primary façade at a point 1.6m from ground level. For information proposes we have also tested at 1st floor for 15 locations in total.

Section 2 Light from the Sky impact on neighbouring properties

Tests for the quantity and quality of skylight (daylight) available to a room's windows.

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.

Tabulated results

Skylight to habitable rooms						
VSC						
Check > 27% or ratio > 0.8						
Ref	Window	Type	Existing	Proposed	Ratio	Result
HseBlockA	1		37.05	35.37	0.95	Pass
	2		37.43	36.21	0.97	Pass
HseBlockB	3		39.31	30.96	0.79	Pass
	4		34.41	27.13	0.79	Pass
	5		32.60	26.00	0.80	Pass
	6		39.21	28.96	0.74	Pass
	7		39.15	33.03	0.84	Pass
	8		36.60	31.30	0.86	Pass
HseBlockC	9		35.60	30.82	0.87	Pass
	10		39.15	31.67	0.81	Pass
	11		38.44	35.37	0.92	Pass
HseBlockD	12		38.53	31.25	0.81	Pass
	13		38.12	35.96	0.94	Pass
	14		39.22	33.58	0.86	Pass
	15		37.15	33.72	0.91	Pass
	16		38.91	36.87	0.95	Pass

Summary

All tested points pass the 25% **annual** and 5% **annual winter** probable sunlight hours for living rooms and or factor change other than the following:

Conclusion

All tested points do not receive less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March and less than 0.8 times its former sunlight hours during either period.

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

Section 3 - Shadow/Sunlight - Gardens and Open spaces

Tests for the availability of sunlight in amenity areas.

Test 4 - 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.

We have not provided results for this test as the proposed development can only cast shadows over the neighbouring properties at 08:00 on the 21st of March and to front gardens which are typically not defined as private amenity. After that time shadows are cast away from neighbours and towards the M50 Motorway.

Please see shadow plots attached to the end of this report for details.

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

Conclusion

Shadows are not cast towards the amenity spaces (back gardens) of neighbouring properties on the 21st March. The proposed development complies with the requirements of the BRE guidelines in relation to impact of shadow (sunlight) on the amenity spaces of neighbours

Overall summary for adjacent properties

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

- **Change/Impact to existing buildings groups designated A, B C & D**
 - **Skylight- VSC**– All test points pass the relevant VSC checks.
 - **Sunlight APSh & WPSH** –All test points pass the relevant tests both Annual and Winter even though many are not within 90° of due South.
 - **Shadow** – Shadows are not cast on the private amenity spaces (back gardens) on the 21st March. The development passes the relevant requirement

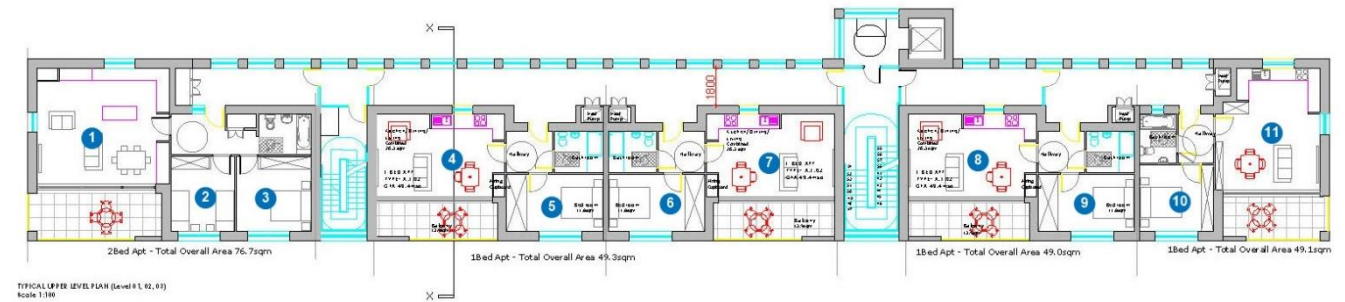
The development impact on neighbours complies fully with the requirements of "Site layout planning for daylight and sunlight a guide to good practice Second Edition" - 2011 by Paul J Littlefair - BR209

Development Performance

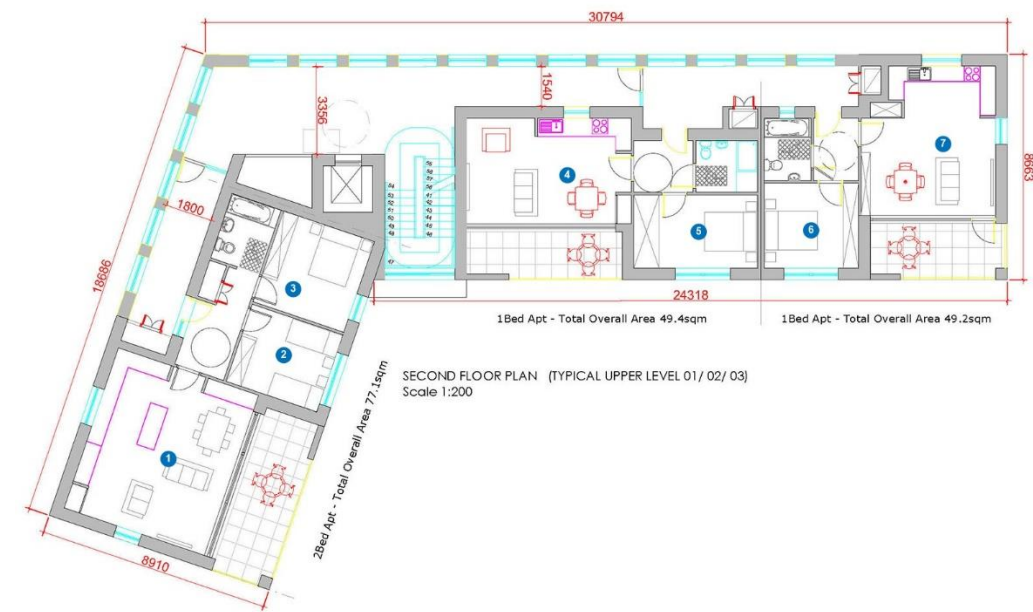
Naming conventions

For the purposes of this analysis we have named rooms sequentially left to right, as shown below:

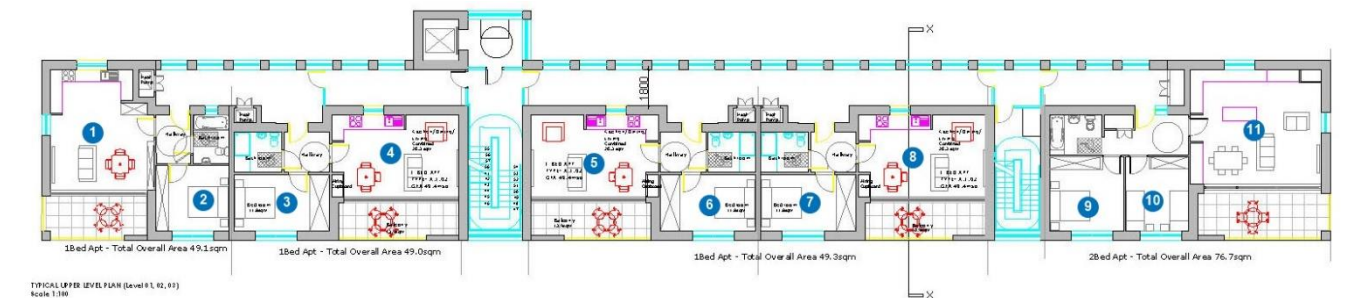
1st Floor - Block 1



1st Floor- Block 2



1st Floor- Block 3



Proposed development - Room Depth

Is a check made to calculate the relative consistency of daylight between front and back of a room.

Is computed using the following formula where a room is lit by windows in one wall only.

$$\frac{L}{W} + \frac{L}{H} < \frac{2}{1 - Rb}$$

L = Depth of the room from Window

W = Room Width parallel to window

H = Window Head Height above floor level

Rb = Average reflectance of surfaces in the rear half of room away from window

Room Depth check is not applicable to rooms with multiple windows on multiple walls since this test checks the relative consistency of daylight between front and back of the room. If the room has multiple light source directions then there is no "back wall" and thus the check is unnecessary. We will take Rb conservatively as 0.5

Results are tabulated overleaf, since the rooms depths do not consider orientation Blocks 1 & 2 which are mirrors are considered together

Proposed - Room Depth Conclusion

Room Depths for all rooms show compliance.

Room Depth Checks								
For rooms lit by windows in one wall only								
W	is the room width							
L	Length or depth of room		Rb	0.5				
H	is the window head height above floor level							
Rb	average reflectance of surfaces in the rear half of the room (away from the window).							
Block 1 - 1st Floor - Block 3 (Mirror)								
Block 1	Block 3	Type	W	L	H	L/W+L/H	2/(1-Rb)	Check
1	11	Living	Multi-Aspect					
2	10	bed	3.122	3.669	2.466	2.7	4	Pass
3	9	bed	3.676	3.669	2.466	2.5	4	Pass
4	8	Living	6.325	4.060	2.466	2.3	4	Pass **
5	7	bed	4.750	2.810	2.466	1.7	4	Pass
6	6	bed	4.750	2.810	2.466	1.7	4	Pass
7	5	Living	6.325	4.060	2.466	2.3	4	Pass **
8	4	Living	6.325	4.060	2.466	2.3	4	Pass **
9	3	bed	4.750	2.810	2.466	1.7	4	Pass
10	2	bed	3.625	3.260	2.466	2.2	4	Pass
11	1	Living	Multi-Aspect					
Block 2 - 1st Floor								
Block 2	Type	W	L	H	L/W+L/H	2/(1-Rb)	Check	
1	Living	Multi-Aspect						
2	bed	3.122	3.669	2.466	2.7	4	Pass	
3	bed	3.122	3.669	2.466	2.7	4	Pass	
4	Living	6.325	4.060	2.466	2.3	4	Pass	**
5	bed	4.750	2.810	2.466	1.7	4	Pass	
6	bed	3.625	3.260	2.466	2.2	4	Pass	
7	Living	Multi-Aspect						
** Additional aspect via light through glazed corridor								

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.

We will only look at the open plan living / kitchen / dining areas. We will choose only the best window on each an adjacent wall although we can add opposite walls (not applicable in this design). Thus we will look those windows within 90 of South. Results are tabulated overleaf.

All living room spaces receive at least 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

Proposed - Sunlight Summary

All living rooms in the proposed development received at least 25% of annual probable sunlight hours, and at least 5% of the annual probable sunlight hours between 21 September and 21 March.

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

Sunlight APSH - Living rooms					
		Annual > 25%		Winter > 5%	
	Ref	APSH		WPSH	
Block 1	1	28.0	Pass	11.0	Pass
	4	31.0	Pass	15.0	Pass
	7	34.0	Pass	11.0	Pass
	8	33.0	Pass	17.0	Pass
	11	29.0	Pass	17.0	Pass
Block 2	1	26.0	Pass	24.0	Pass
	4	31.0	Pass	23.0	Pass
	7	28.0	Pass	23.0	Pass
Block 3	1	28.0	Pass	15.0	Pass
	4	31.0	Pass	15.0	Pass
	5	29.0	Pass	21.0	Pass
	8	30.0	Pass	14.0	Pass
	11	28.0	Pass	24.0	Pass

ADF - Average Daylight Factor

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 on 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'Éclairage) 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 0.85 and results are provided in terms of Average Daylight Factor for selected rooms. See code for definitions.

For apartment layouts we have tested against a value of 1.5% be used rather than the figure of 2.0% which is more appropriate to a traditional house layout and room usage. We note that for apartment developments a majority of councils in Ireland and the UK now accept the lower value of 1.5% normally assigned to living rooms as the primary test value. The usage of a reduced value accepted by Local Authorities is still compliant within the terms of the guidelines. This has been confirmed as acceptable by the author Dr Paul Littlefair.

We have thus used the minimum values of **1.0%** for bedrooms and **1.5%** for the Living room spaces.

The results of the analysis are shown below

Average Daylight Factor – Tabulated

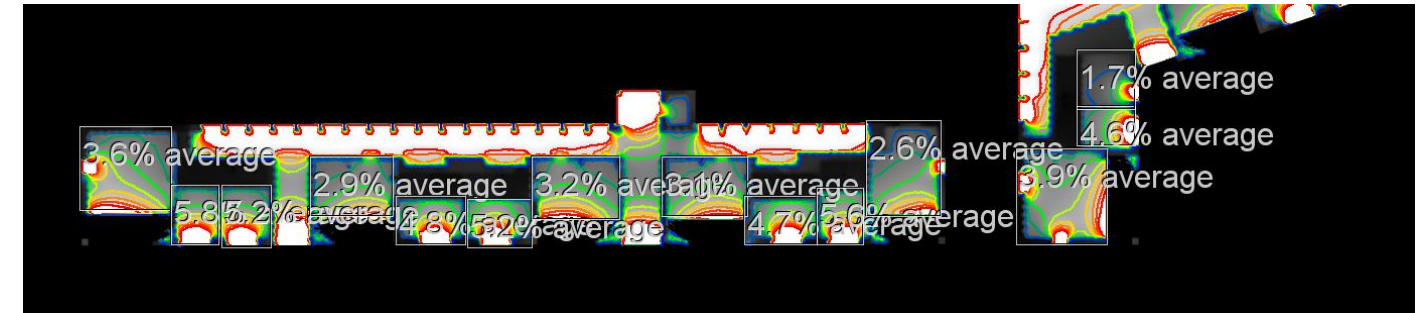
Average Daylight Factor					Bedroom	1.0
ADF Values from radiance 3D model					Living Room	1.5
For all habitable rooms					Kitchen	2.0
Room	Type	Min	ADF	Check		
Block 1	Type					
1	Living Room	1.5	3.6	Pass		
2	Bedroom	1.0	5.8	Pass		
3	Bedroom	1.0	5.2	Pass		
4	Living Room	1.5	2.9	Pass		
5	Bedroom	1.0	4.8	Pass		
6	Bedroom	1.0	5.2	Pass		
7	Living Room	1.5	3.2	Pass		
8	Living Room	1.5	3.1	Pass		
9	Bedroom	1.0	4.7	Pass		
10	Bedroom	1.0	5.6	Pass		
11	Living Room	1.5	2.6	Pass		
Block 2	Type					
1	Living Room	1.5	3.9	Pass		
2	Bedroom	1.0	4.6	Pass		
3	Bedroom	1.0	1.7	Pass		
4	Living Room	1.5	3.0	Pass		
5	Bedroom	1.0	4.4	Pass		
6	Bedroom	1.0	5.4	Pass		
7	Living Room	1.5	4.5	Pass		
Block 3	Type					
1	Living Room	1.5	2.8	Pass		
2	Bedroom	1.0	4.9	Pass		
3	Bedroom	1.0	4.7	Pass		
4	Living Room	1.5	2.9	Pass		
5	Living Room	1.5	3.1	Pass		
6	Bedroom	1.0	4.6	Pass		
7	Bedroom	1.0	4.8	Pass		
8	Living Room	1.5	3.0	Pass		
9	Bedroom	1.0	4.2	Pass		
10	Bedroom	1.0	5.3	Pass		
11	Living Room	1.5	3.0	Pass		

Average ADF on this floor for all living rooms 3.2% and Bedrooms 4.7%

Average Daylight Factor – Graphical Results showing distribution

Plots below show light distribution from radiance 3D model

(Note: These images are to show the light distribution the numerical results are tabulated previously)



Block 1 & Block 2(part)



Block 2(part) & Block 3

ADF Check - Summary

ADF (average daylight factors) for all rooms comply with the requirements. The development shows excellent ADF results with averages well in excess of the minimum values.

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

Shadow/Sunlight - Amenity Spaces

Reference guidelines

Section 3.3.17 of the Building Research Establishment's Site layout planning for daylight and sunlight: a guide to good practice states

" 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.

Please note: The BRE check is related solely to the amount of amenity area that can receive a minimum of 2 hours of sunlight. Our analysis relates to the balconies again on the 1st floor.

Shadow / Sunlight Amenity			
>50% receives 2 hours of sunlight on 21st March)			
	Ref	% 2hr Sunlight	Check
Block 1	1	64.99	Pass
	4	62.45	Pass
	7	55.95	Pass
	8	62.44	Pass
	11	70.46	Pass
Block 2	1	90.92	Pass
	4	91.44	Pass
	7	91.77	Pass
Block 3	1	66.36	Pass
	4	64.52	Pass
	5	72.83	Pass
	8	63.30	Pass
	11	86.41	Pass

Shadow check – Summary

All private balconies receive at least 2hrs of sunlight over 50% of their area on the 21st of March.

All balconies comply with the requirements.

Overall Summary

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 revised design in relation to test for the full 1st floor on all apartment blocks**
 - **Room depth** – All tested rooms comply with the guideline requirements for light constancy.
 - **Sunlight APSH & WPSH** – All living rooms receive > 25% of APSH sunlight and > 5% of the winter sunlight hours
 - **Daylight- ADF** – All tested rooms pass the relevant check ADF % for light distribution.
 - **Shadow** – All private balconies receive 2hrs of sunlight over > 50%

The application fully 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 and other updated relevant documents. It has successfully been designed to maximise the occupants' access to light and reduced the impact on "existing" approved 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 design constraints to arrive at this design.

March 21st - Shadow plots North section of site - Proposed shadows shown in Blue

