



5020

Daylight Reception Report

DAYLIGHT RECEPTION IN HABITABLE ROOMS WITHIN THE PROPOSED DEVELOPMENT

Belcamp SHD

Proposed Residential Development

**Belcamp,
Malahide Road,
Dublin 17**

Gerard Gannon Properties

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1 Introduction

1.1 Report purpose

This report gives information on the level of achieved daylight reception in habitable rooms within the proposed new development.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Belcamp, Malahide Road, Dublin 17.

1.3 Development description

A 10-year planning permission is sought by Gerard Gannon Properties for a proposed Strategic Housing Development on lands at Belcamp Hall (protected structure), Malahide Road, the R139 road and Carr's Lane, Belcamp, Dublin 17. The proposed development will consist of the construction of 2,527 no. residential units comprising houses, apartments and duplex units, 2 no. childcare facilities; 1 no. sports changing facilities building; 3 no. cafés/restaurants; 18 no. retail/commercial units; and all associated engineering and site works necessary to facilitate the development.

1.4 Policy and building regulation requirements

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document "Site layout planning for daylight and sun light".

2 Executive summary

2.1 Analysis conducted

This report details the achieved calculated daylight reception in habitable rooms within the new development and compares these for compliance with the recommendations of the relevant guidelines and standards.

2.2 Daylight reception and building orientation

Day light reception in habitable rooms within the proposed development under the BRE, CIBSE and BS EN17037/EN17037 is calculated using the area of the glazed element, the room depth/height ratio, the room light reflection capability and the amount of direct or blocked/partially blocked daylight it receives. i.e. building orientation is not relevant to day light reception or daylight reception calculations. In other words day light factor analysis is equal to all orientations. This note is for clarity as day light is often confused with sunlight or sunlight energy which is effected by orientation.

2.3 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following;

- The Building Research Establishment (BRE) report, site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- British European Standard BS EN17037/EN17037 Day lighting standards and contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.4 Technical analysis

The amount of daylight received in a room is calculated and expressed as a daylight factor. This calculated daylight factor is then compared with the BRE recommended room daylight factor to ensure sufficient daylight reception. Calculations were conducted in accordance with the BRE guidelines to determine the average day light factor in a number of selected rooms within the new development. These selected rooms are generally in (daylight) challenging locations typically based at the lowest (ground floor) levels given that these would receive the least amount of day light. Once the ground floor rooms achieve compliance all other rooms at higher levels with similar room/window configurations and parameters will also achieve compliance as the vertical daylight impact angle will improve increasing the daylight reception typically 0.3%-0.5% per floor level (3m).

2.5 Daylight reception in rooms within the new development conclusion

The BRE report recommends as a methodology for assessing sufficient daylight reception in a habitable room, that the calculated average daylight factor (ADF) of a habitable room to be in excess of the BRE bench marks of a kitchen at 2%, a living room at 1.5%, a bedroom at 1%, a living/kitchen/dining room at 2% and a living room/bedroom at 1.5%. Calculation findings are as follows; (see images throughout chapter 5 for receptor locations):

The assessment has been segregated according to individual block, these are;

- Residential Apartment Block 1
- Residential Apartment Block 2
- Residential Apartment Block 3
- Residential Apartment Block 4
- Residential Apartment Block 5
- Residential Apartment Block 6

Residential Apartment Block 1: From the calculation results in table 5.1 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 2: From the calculation results in table 5.2 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 3: From the calculation results in table 5.3 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 4: From the calculation results in table 5.4 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 5: From the calculation results in table 5.5 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- All floors above the first floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 6: From the calculation results in table 5.6 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Given the results and conclusions above, DKP deem the residential project at Belcamp to be in line with the recommendations in the BRE design guidelines 'site layout and planning for daylight and sunlight - a guide to good practice' and therefore in compliance with the BRE design guide.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google arial) site map below indicates the location of the site, approximately outlined.



Image 3.1 Google maps arial view - proposed development site boundary

4 Approach and methodology

4.1 General approach

This report covers the day light reception of habitable rooms within the new proposed development. The day light reception is expressed as the average day light factor (ADF) in the following rooms:

- Bed rooms within dwellings
- Living rooms/dining rooms
- Kitchens
- Any combination of the above

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still comes in through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that new buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations:

The government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- British European Standard BS EN17037 / EN17037 Day Lighting for buildings.
BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings.
CIBSE lighting guide 10, BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – "Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice"

The BRE report contains guidance on how to design developments whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values these should be interpreted flexibly since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts.

As well as advice the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. Table 4.1 below details the BRE assessment criteria for daylight reception within the proposed development.

Analysis	Description	Acceptable parameters
Daylight reception criterion	Average daylight factor (ADF)	Habitable rooms to have ADF factors between 1% and 2% pending room type

Table 4.1

There are also recommendations with regards to minimum proposed glazed area in facades in relation to the available sky view component angle. BS EN17037/EN17037 gives guidance on the minimum glazed area with different virtual sky component angles to maintain sufficient daylight reception. Table 4.2 presents the minimum glazed areas fractions relative to the available sky view angle.

Room depth	VSC <=25°	VSC >=25° <=45°	VSC >=45° <=65°	VSC >=65°	Comments
1 to 8	20%	20% - 31%	31% - 35%	35% - 40%	
8 – 11	25%	25% - 40%	40% - 44%	44% - 50%	
11 – 14	30%	30% - 47%	47% - 53%	53% - 60%	
14 - 20	35%	35% - 54%	54% - 61%	61% - 70%	

Table 4.2

4.5 ADF or Average day light factor

The average day light assessment is the amount of day light received by the habitable rooms in the proposed development only. Whereas there are no standards applied for day light factors there are recommendations published in the CIBSE guides and BRE documents in relation to the percentage and minimum area of the room/area to conform to same. Table 4.4 below represents recommended minimum day light factors.

Habitable room types	Minimum day light factor	Minimum floor area cover
Multi-residential buildings Kitchen	2%	75%
Multi-residential buildings Living rooms, dining rooms,	1.50%	70%
Multi-residential buildings Bedrooms	1%	50%

Table 4.3

4.6 ADF or Average Daylight Factor calculation method

The average daylight factor provides a useful technique for assessing the daylight potential of interior spaces under standard overcast conditions. The average daylight factor df is defined as;

$$df = TAw q / [A (1-R^2)] \%$$

where,

T is the diffuse visible transmittance of the glazing, including corrections for dirt on glass

Aw is the net glazed area of the window (m²)

A is the total area of the room surfaces: ceiling, floor, walls and windows (m²)

R is their average reflectance of the ceiling, walls and floor surfaces

q is the angle of visible sky in degrees (VSC)

4.7 Project ADF calculation parameters

The following calculation parameters have been applied. For T (Em), the overall maintained light transmittance into the room we applied a conservative 0.66. Current triple glazed elements can now be supplied with light emittance in excess of 0.72 effecting/improving the final resultant ADF by a further 0.3% to 0.5%.

Glass light emittance	0.72
Glazing maintenance factor	8%
Maintained light emittance Em	0.66

For R (Rf), the average reflectance of the walls, ceiling and floor we have used an overall average figure 0.63 representing a medium dark floor, medium dark walls and a light ceiling. R can also be significantly improved by implementing lighter colours on the walls and floor effecting/improving the ADF by 0.5% to 0.7%.

Ceiling	0.8	95%	Light
Walls	0.6	80%	Medium dark
Floor	0.6	70%	Medium dark
Combined Rf	0.63		

For q, the vertical sky component angle we use the combined calculated vertical sky component over the full visual horizontal plane from the relevant window/room point. i.e. at each obstacle in the general 180° horizontal view plane the vertical sky component is measured and combined to form the overall resultant VSC. The illustration 4.1 below shows the room analysed to be effected by 3 different vertical sky component angles A, B and C on its horizontal plane. The resultant VSC is a calculated combination of all three VSC angles.

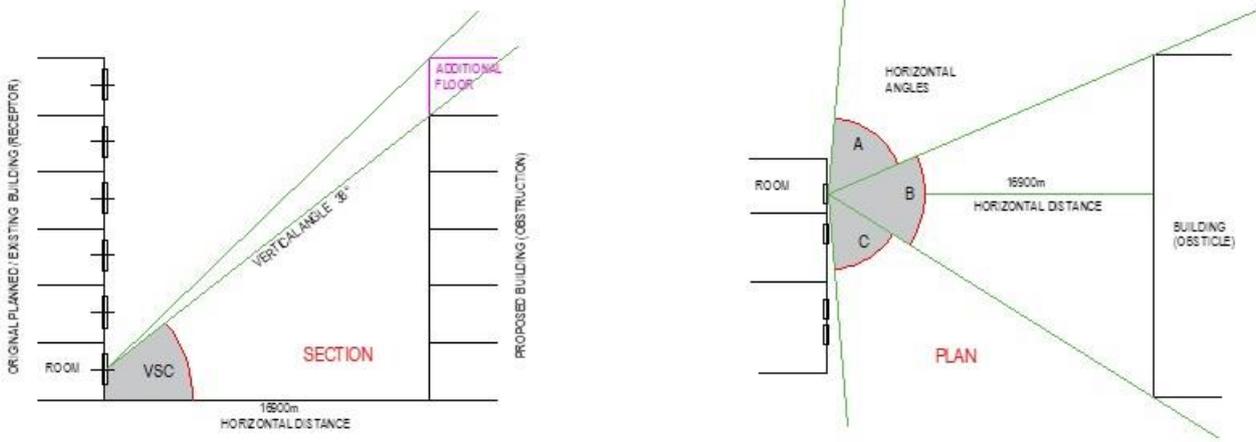


Image 4.1

5 Basis of receptor selection of habitable rooms within the development and Calculation results

5.1 Basis of receptor (room) selection

The daylight reception assessment has been targeted to rooms which are perceived to receive less day light i.e. ground floor rooms / first floor room / rooms facing close-by large obstacles. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms. Room locations have been selected on the basis that these locations are more daylight challenging.

5.2 Assessment approach and colour indicators

The assessment has been segregated according to individual block, these are;

- Residential Apartment Block 1
- Residential Apartment Block 2
- Residential Apartment Block 3
- Residential Apartment Block 4
- Residential Apartment Block 5
- Residential Apartment Block 6

Image 5.1 below provides an overview of the proposed DCC development.



Image 5.1: Overall proposed site plan, showing blocks 1 to 6.

The result tables within this chapter provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards. The ADF calculation results have been given the following colour code guide depending on its level of resulting compliance. The overall conclusion is presented at the end of the chapter.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

5.3 Apartment Block 1 – receptors and ADF calculation results

Receptors: Images 5.2 to 5.6 indicate the locations of the rooms chosen from residential apartment block 1 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

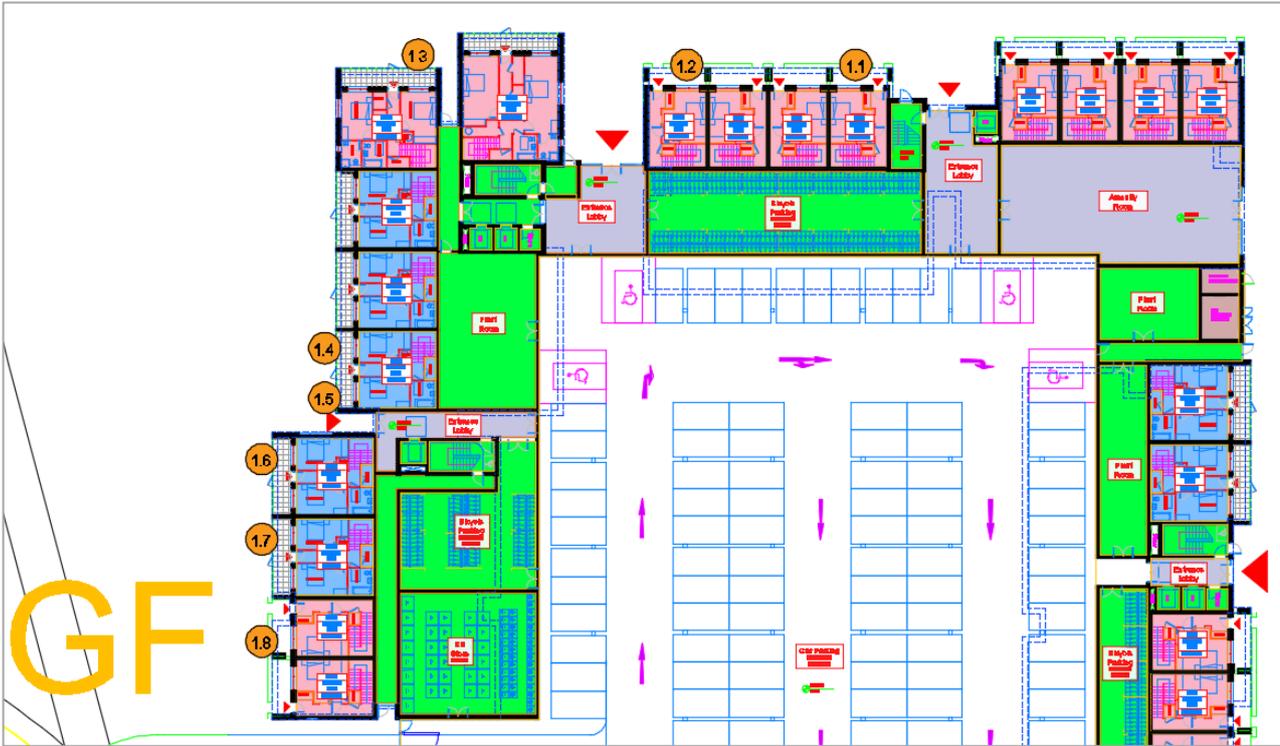


Image 5.2: Level 00 with selected rooms – Apartment block 1

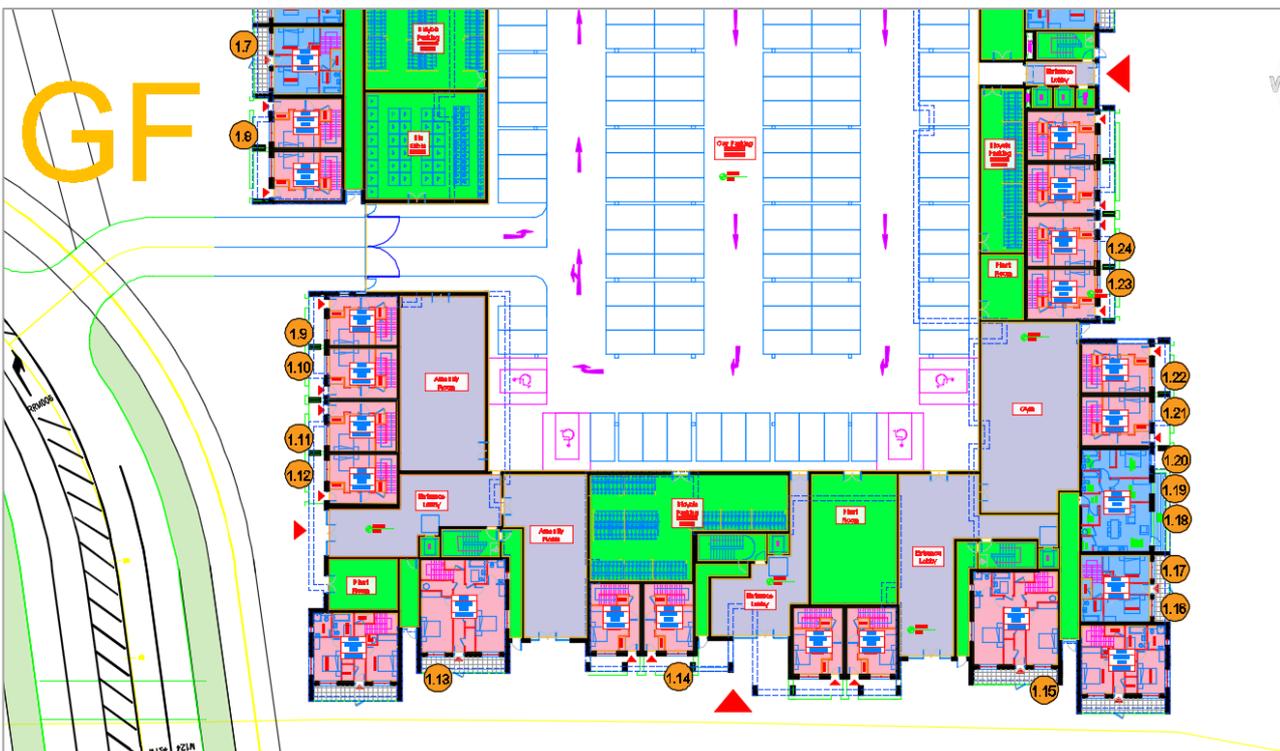


Image 5.3: Level 00 with selected rooms – Apartment block 1

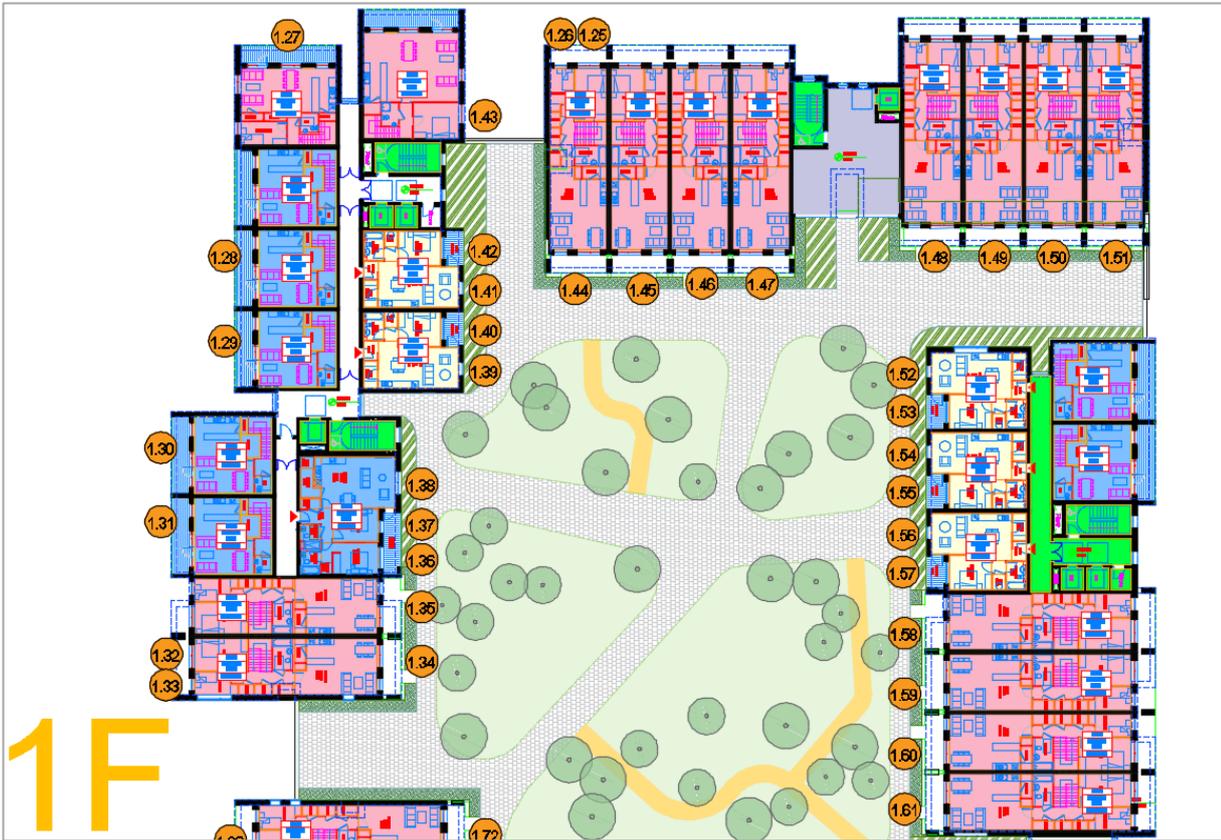


Image 5.4: Level 01 with selected rooms – Apartment block 1



Image 5.5: Level 01 with selected rooms – Apartment block 1



Image 5.6: Level 02 with selected rooms – Apartment block 1

Apartment Block 1 - ADF calculation results:

The table below provides the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor L	Σ VSC L	glass area m2	Room				Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°				width m	depth m	height m									
1.01	1	1.023	00	Bed room	113	12	67	80					180	22%	4.00	2.80	4.10	3.70	3.20	1.00	
1.02	1	1.026	00	Bed room	114	12	66	80					180	23%	4.00	2.80	4.10	3.70	3.22	1.00	
1.03	1	1.028	00	Bed room	115	12	65	80					180	23%	3.50	2.80	4.10	3.70	2.84	1.00	
1.04	1	1.031	00	Bed room	57	10	38	22	85	80			180	19%	3.50	2.80	4.10	3.70	2.36	1.00	
1.05	1	1.031	00	Bed room	83	10	19	22	78	80			180	21%	3.50	2.80	4.50	3.70	2.40	1.00	
1.06	1	1.030	00	Bed room	48	9	68	23	64	80			180	21%	3.50	2.80	4.10	3.70	2.68	1.00	
1.07	1	1.033	00	Bed room	48	9	72	23	60	80			180	22%	3.50	2.80	4.10	3.70	2.75	1.00	
1.08	1	1.034	00	Bed room	65	9	46	24	69	80			180	21%	4.00	2.80	4.10	3.70	3.03	1.00	
1.09	1	1.036	00	Bed room	49	8	55	27	76	80			180	20%	4.00	2.80	4.10	3.70	2.78	1.00	
1.10	1	1.037	00	Bed room	32	8	50	29	33	8	65	80	180	21%	4.00	2.80	4.10	3.70	3.05	1.00	
1.11	1	1.038	00	Bed room	45	8	71	32	64	80			180	20%	4.00	2.80	4.10	3.70	2.85	1.00	
1.12	1	1.039	00	Bed room	21	8	49	33	40	8	70	80	180	20%	4.00	2.80	4.10	3.70	2.87	1.00	
1.13	1	1.002	00	Bed room	117	9	63	80					180	24%	3.50	3.20	5.70	3.70	2.21	1.00	
1.14	1	1.004	00	Bed room	103	9	77	80					180	22%	3.50	2.80	4.10	3.70	2.69	1.00	
1.15	1	1.007	00	Bed room	117	9	63	80					180	24%	3.50	3.20	5.70	3.70	2.21	1.00	
1.16	1	1.009	00	Bed room	55	80	26	9	69	12	30	7	180	25%	3.50	2.80	4.60	3.70	2.86	1.00	
1.17	1	1.009	00	Bed room	56	80	70	13	54	7			180	25%	3.50	2.80	4.10	3.70	3.08	1.00	
1.18	1	1.010	00	Living - Kitchen	42	80	71	13	27	9	40	7	180	27%	5.50	5.00	5.20	3.70	3.14	2.00	
1.19	1	1.010	00	Bed room	53	80	77	13	50	7			180	25%	2.63	2.30	4.00	3.70	2.67	1.00	
1.20	1	1.010	00	Bed room	110	80	63	13	7	7			180	16%	2.63	2.80	4.00	3.70	1.47	1.00	
1.21	1	1.011	00	Bed room	68	80	76	13	36	7			180	22%	4.00	2.80	4.10	3.70	3.21	1.00	
1.22	1	1.012	00	Bed room	68	80	23	10	73	13	16	7	180	22%	4.00	2.80	4.10	3.70	3.19	1.00	
1.23	1	1.013	00	Bed room	97	80	13	10	70	13			180	18%	4.00	2.80	4.10	3.70	2.50	1.00	
1.24	1	1.014	00	Bed room	77	80	33	10	70	13			180	21%	4.00	2.80	4.10	3.70	2.97	1.00	
1.25	1	1.026	01	Bed room	68	78	68	9	44	10			180	23%	4.00	2.80	4.70	2.70	3.76	1.00	
1.26	1	1.026	01	Bed room	76	78	61	9	43	10			180	22%	2.63	2.00	3.20	2.70	3.72	1.00	
1.27	1	1.028	01	Living - Kitchen	57	78	25	9	98	10			180	25%	7.75	8.50	4.00	2.70	4.03	2.00	
1.28	1	1.030	01	Living - Kitchen	78	9	50	18	52	78			180	25%	6.25	6.90	5.00	2.70	3.31	2.00	
1.29	1	1.031	01	Living - Kitchen	76	9	29	18	75	78			180	22%	6.25	6.90	5.00	2.70	2.87	2.00	
1.30	1	1.032	01	Living - Kitchen	77	9	58	21	45	78			180	25%	6.25	6.90	5.00	2.70	3.38	2.00	
1.31	1	1.033	01	Living - Kitchen	73	9	62	22	45	78			180	25%	6.25	6.90	5.00	2.70	3.35	2.00	
1.32	1	1.035	01	Bed room	41	8	58	23	10	7	71	78	180	21%	4.00	2.80	4.70	2.70	3.41	1.00	
1.33	1	1.035	01	Bed room	61	8	58	23	61	78			180	23%	2.63	2.00	3.20	2.70	3.86	1.00	
1.34	1	1.035	01	Living - Kitchen	30	20	75	26	16	23	59	78	180	21%	7.00	5.00	6.30	2.70	3.28	2.00	
1.35	1	1.034	01	Living - Kitchen	34	20	72	26	15	23	59	78	180	21%	7.00	5.00	6.30	2.70	3.28	2.00	
1.36	1	1.109	01	Bed room	48	26	51	26	81	78			180	17%	4.00	2.80	3.40	2.70	3.55	1.00	
1.37	1	1.109	01	Bed room	21	26	86	26	73	78			180	18%	2.63	2.80	4.00	2.70	2.19	1.00	
1.38	1	1.109	01	Living - Kitchen	35	74	40	30	67	26	38	19	180	23%	3.75	4.50	6.60	2.70	2.09	2.00	
1.39	1	1.108	01	Living - Kitchen	13	8	74	48	62	28	31	17	180	24%	3.55	3.70	6.90	2.70	2.20	2.00	
1.40	1	1.108	01	Bed room	90	80	48	48	42	28			180	13%	4.00	3.00	3.80	2.70	2.37	1.00	
1.41	1	1.107	01	Living - Kitchen	18	8	69	65	64	28	29	16	180	22%	3.55	3.70	6.90	2.70	2.02	2.00	
1.42	1	1.107	01	Bed room	90	80	56	65	34	28			180	11%	4.00	3.00	3.80	2.70	1.89	1.00	
1.43	1	1.027	01	Bed room	48	8	105	68	27	16			180	20%	2.63	3.20	4.00	2.70	2.14	1.00	
1.44	1	1.026	01	Living - Kitchen	26	29	29	14	40	29	85	78	180	17%	7.00	5.00	6.20	2.70	2.77	2.00	
1.45	1	1.025	01	Living - Kitchen	25	48	29	14	67	29	59	78	180	19%	7.00	5.00	6.20	2.70	3.08	2.00	
1.46	1	1.024	01	Living - Kitchen	27	29	30	14	64	41	59	78	180	18%	7.00	5.00	6.20	2.70	2.97	2.00	
1.47	1	1.023	01	Living - Kitchen	28	29	29	14	64	41	59	78	180	18%	7.00	5.00	6.20	2.70	2.96	2.00	
1.48	1	1.022	01	Living - Kitchen	64	59	22	14	42	22	52	78	180	17%	7.00	5.00	6.20	2.70	2.73	2.00	
1.49	1	1.021	01	Living - Kitchen	85	60	22	21	14	20	59	78	180	14%	7.00	5.00	6.20	2.70	2.20	2.00	



1.50	1	1.020	01	Living - Kitchen	100	60	8	21	13	20	59	78	180	13%	7.00	5.00	6.20	2.70	2.01	2.00
1.51	1	1.019	01	Living - Kitchen	35	11	76	60	10	19	59	78	180	15%	7.00	5.00	6.20	2.70	2.47	2.00
1.52	1	1.106	01	Living - Kitchen	77	52	46	29	30	26	27	16	180	23%	3.63	3.70	7.00	2.70	2.09	2.00
1.53	1	1.106	01	Bed room	25	52	48	29	17	26	90	78	180	15%	4.00	3.00	3.80	2.70	2.59	1.00
1.54	1	1.105	01	Living - Kitchen	66	40	52	27	33	28	29	19	180	25%	3.50	3.70	7.00	2.70	2.23	2.00
1.55	1	1.105	01	Bed room	68	27	22	28	90	78			180	16%	4.00	3.00	3.80	2.70	2.89	1.00
1.56	1	1.104	01	Living - Kitchen	56	20	56	41	35	28	33	20	180	26%	3.50	3.70	7.00	2.70	2.33	2.00
1.57	1	1.104	01	Bed room	90	78	63	20	27	28			180	17%	4.00	3.00	3.80	2.70	3.07	1.00
1.58	1	1.016	01	Living - Kitchen	74	24	47	31	59	78			180	20%	7.00	5.00	6.30	2.70	3.16	2.00
1.59	1	1.015	01	Living - Kitchen	70	24	51	31	59	78			180	20%	7.00	5.00	6.30	2.70	3.15	2.00
1.60	1	1.014	01	Living - Kitchen	65	24	56	32	59	78			180	20%	7.00	5.00	6.30	2.70	3.11	2.00
1.61	1	1.013	01	Living - Kitchen	59	24	62	32	59	78			180	19%	7.00	5.00	6.30	2.70	3.09	2.00
1.62	1	1.012	01	Living - Kitchen	23	22	25	32	45	40	87	78	180	15%	7.00	5.00	6.30	2.70	2.38	2.00
1.63	1	1.011	01	Living - Kitchen	40	22	24	32	53	48	63	78	180	17%	7.00	5.00	6.30	2.70	2.68	2.00
1.64	1	1.102	01	Living - Kitchen	21	74	48	21	95	40	16	6	180	23%	3.50	3.70	7.00	2.70	2.03	2.00
1.65	1	1.102	01	Bed room	20	21	20	32	50	42	90	78	180	14%	4.00	3.00	3.80	2.70	2.58	1.00
1.66	1	1.007	01	Bed room	12	65	23	19	113	66	32	6	180	17%	2.63	3.20	4.00	2.70	1.91	1.00
1.67	1	1.007	01	Living - Kitchen	52	78	33	6	95	7			180	26%	7.75	8.50	6.20	2.70	3.16	2.00
1.68	1	1.006	01	Living - Kitchen	59	78	60	47	27	14	34	20	180	18%	7.00	5.00	6.30	2.70	2.91	2.00
1.69	1	1.005	01	Living - Kitchen	59	78	55	46	28	14	38	20	180	19%	7.00	5.00	6.30	2.70	2.99	2.00
1.70	1	1.004	01	Living - Kitchen	59	78	41	32	30	14	50	32	180	20%	7.00	5.00	6.30	2.70	3.12	2.00
1.71	1	1.003	01	Living - Kitchen	59	78	37	32	29	14	55	52	180	17%	7.00	5.00	6.30	2.70	2.70	2.00
1.72	1	1.036	01	Living - Kitchen	39	40	82	29	59	78			180	18%	7.00	5.00	6.30	2.70	2.89	2.00
1.73	1	1.037	01	Living - Kitchen	47	44	74	29	59	78			180	18%	7.00	5.00	6.30	2.70	2.79	2.00
1.74	1	1.038	01	Living - Kitchen	54	59	67	29	59	78			180	16%	7.00	5.00	6.30	2.70	2.44	2.00
1.75	1	1.039	01	Living - Kitchen	53	62	53	29	74	78			180	14%	7.00	5.00	6.30	2.70	2.12	2.00
1.76	1	1.002	01	Bed room	34	25	107	66	39				180	11%	2.63	3.20	4.00	2.70	1.24	1.00
1.77	1	1.002	01	Living - Bedroom	126	7	54	78					180	26%	7.75	8.50	6.20	2.70	3.12	1.50
1.78	1	1.001	01	Living - Kitchen	45	7	38	78	97	7			180	29%	7.75	8.50	6.20	2.70	3.43	2.00
1.79	1	1.001	01	Bed room	87	7	39	32	54	8			180	32%	2.63	2.00	4.10	2.70	4.72	1.00
1.80	1	1.101	01	Bed room	29	7	38	32	113	80			180	14%	2.63	2.80	4.00	2.70	1.63	1.00
1.81	1	1.101	01	Bed room	44	7	47	32	19	8	70	78	180	21%	2.63	2.80	4.00	2.70	2.49	1.00
1.82	1	1.101	01	Living - Kitchen	73	7	67	32	40	8			180	31%	3.75	3.50	7.00	2.70	3.06	2.00
1.83	1	1.039	01	Bed room	86	32	19	8	75	78			180	18%	2.63	2.10	3.20	2.70	2.97	1.00
1.84	1	1.038	01	Bed room	72	32	39	7	69	78			180	20%	4.00	2.80	4.70	2.70	3.15	1.00
1.85	1	1.037	01	Bed room	85	32	30	8	65	78			180	19%	2.63	2.10	3.20	2.70	3.25	1.00
1.86	1	1.036	01	Bed room	58	32	41	7	81	78			180	18%	4.00	2.80	4.70	2.70	2.96	1.00
1.87	1	1.233	02	Living - Kitchen	28	70	85	18	48	50	19	5	180	24%	3.50	3.60	6.80	2.70	2.22	2.00
1.88	1	1.232	02	Bed room	28	18	62	56	90	78			180	13%	4.00	3.00	3.80	2.70	2.23	1.00
1.89	1	1.232	02	Living - Kitchen	9	62	44	18	96	56	31	5	180	22%	3.50	3.60	6.80	2.70	2.03	2.00
1.90	1	1.230	02	Bed room	15	18	90	56	75	78			180	12%	2.63	2.80	4.00	2.70	1.43	1.00
1.91	1	1.230	02	Living - Kitchen	68	5	85	65	27	18			180	23%	3.75	4.50	6.60	2.70	2.07	2.00
1.92	1	1.220	02	Living - Kitchen	55	71	29	19	43	25	53	41	180	20%	3.75	3.50	6.90	2.70	2.01	2.00
1.93	1	1.220	02	Bed room	40	27	36	42	104	80			180	13%	2.63	2.80	4.00	2.70	1.50	1.00
1.94	1	1.208	02	Living - Kitchen	48	52	64	19	68	31			180	24%	3.75	4.50	6.60	2.70	2.18	2.00
1.95	1	1.208	02	Bed room	36	52	72	19	72	78			180	18%	2.63	2.80	4.00	2.70	2.08	1.00

Table 5.1: apartment block 1 calculation results



5.4 Apartment Block 2 – receptors and ADF calculation results

Receptors: Image 5.7 to 5.9 indicate the locations of the rooms chosen from residential apartment block 2 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.



Image 5.7: Level 00 with selected rooms – Apartment block 2



Image 5.8: Level 01 with selected rooms – Apartment block 2

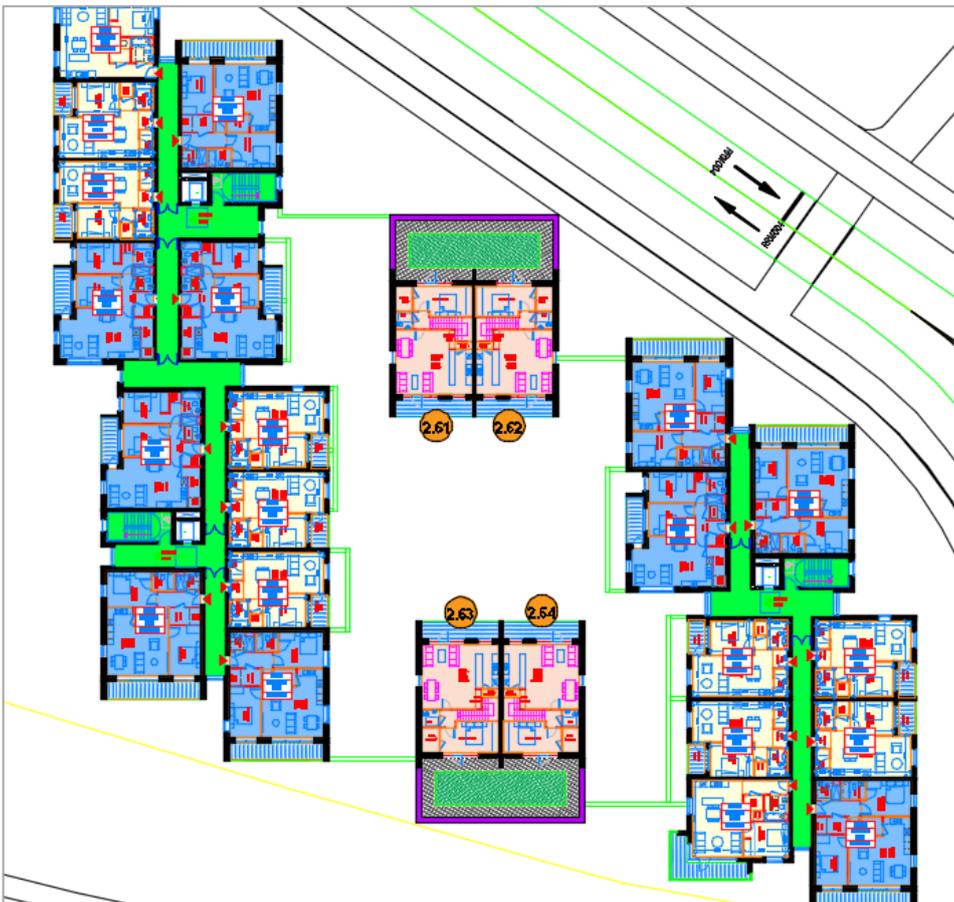


Image 5.9: Level 02 with selected rooms – Apartment block 2

Apartment Block 2 - ADF calculation results:

The table below provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor L	Σ VSC L	glass area m2	Room				Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°				width m	depth m	height m									
2.01	2	2. G01	00	Bed room	59	7	79	36	42	5			180	30%	3.75	4.40	2.80	3.80	3.75	1.00	
2.02	2	2. G20	00	Bed room	92	36	31	5	57	80			180	19%	3.50	2.80	4.10	3.80	2.36	1.00	
2.03	2	2. G20	00	Bed room	35	7	82	36	63	80			180	19%	3.50	2.80	4.50	3.80	2.15	1.00	
2.04	2	2. G19	00	Bed room	79	36	37	6	64	80			180	19%	3.50	2.80	4.10	3.80	2.31	1.00	
2.05	2	2. G19	00	Bed room	30	7	88	36	62	80			180	19%	3.50	2.80	4.50	3.80	2.13	1.00	
2.06	2	2. G18	00	Bed room	60	36	36	6	84	80			180	17%	4.00	2.80	4.10	3.80	2.34	1.00	
2.07	2	2. G17	00	Bed room	72	36	31	6	77	80			180	17%	4.00	2.80	4.10	3.80	2.40	1.00	
2.08	2	2. G16	00	Bed room	48	35	53	7	79	80			180	19%	4.00	2.80	4.10	3.80	2.58	1.00	
2.09	2	2. G15	00	Bed room	56	35	47	8	77	80			180	18%	4.00	2.80	4.10	3.80	2.54	1.00	
2.10	2	2. G14	00	Bed room	105	8	75	80					180	22%	3.50	3.10	5.70	3.80	2.02	1.00	
2.11	2	2. G13	00	Bed room	105	8	75	80					180	22%	3.50	2.90	7.00	3.80	1.78	1.00	
2.12	2	2. G11	00	Bed room	118	8	62	80					180	24%	3.50	2.80	4.50	3.80	2.78	1.00	
2.13	2	2. G10	00	Bed room	117	8	63	80					180	24%	3.50	3.20	4.10	3.80	2.73	1.00	
2.14	2	2. G08	00	Bed room	40	8	84	32	56	80			180	21%	3.50	2.80	4.10	3.80	2.51	1.00	
2.15	2	2. G08	00	Bed room	61	8	59	32	60	80			180	21%	3.50	2.80	4.50	3.80	2.44	1.00	
2.16	2	2. G07	00	Bed room	33	7	93	32	54	80			180	21%	3.50	2.80	4.10	3.80	2.50	1.00	
2.17	2	2. G07	00	Bed room	54	7	69	32	57	80			180	21%	3.50	2.80	4.50	3.80	2.45	1.00	
2.18	2	2. G06	00	Bed room	45	7	55	8	80	80			180	21%	3.50	3.10	5.70	3.80	1.95	1.00	
2.19	2	2. G05	00	Bed room	56	7	54	8	70	80			180	23%	3.50	3.20	4.10	3.80	2.61	1.00	
2.20	2	2. G03	00	Bed room	18	62	57	7	51	8	54	80	180	23%	3.50	2.80	4.50	3.80	2.69	1.00	
2.21	2	2. G02	00	Bed room	50	7	54	8	76	80			180	22%	3.50	3.20	5.70	3.80	1.97	1.00	
2.22	2	2. G20	01	Living - Kitchen	31	6	79	32	22	5	48	80	180	22%	6.25	7.00	5.10	2.80	2.82	2.00	
2.23	2	2. G19	01	Living - Kitchen	25	6	78	32	28	5	49	80	180	22%	6.25	7.00	5.10	2.80	2.80	2.00	
2.24	2	2. G16	01	Bed room	54	32	21	5	105	80			180	14%	2.63	2.10	3.20	2.80	2.27	1.00	
2.25	2	2. G16	01	Bed room	39	32	54	5	87	80			180	18%	3.50	2.80	4.70	2.80	2.51	1.00	
2.26	2	2. G15	01	Bed room	85	32	95	80					180	14%	2.63	2.10	3.20	2.80	2.24	1.00	
2.27	2	2. G15	01	Bed room	56	32	49	5	75	80			180	19%	3.50	2.80	4.70	2.80	2.66	1.00	
2.28	2	2. G13	01	Living - Kitchen	130	7	50	80					180	26%	7.00	8.50	6.10	2.80	2.84	2.00	
2.29	2	2. G13	01	Bed room	68	18	86	55	26	7			180	24%	2.63	3.20	4.00	2.80	2.55	1.00	
2.30	2	2. 108	01	Bed room	50	40	39	55	91	80			180	12%	4.00	3.10	3.80	2.80	1.95	1.00	
2.31	2	2. 108	01	Living - Kitchen	52	27	49	45	60	33	19	5	180	25%	3.50	3.70	6.90	2.80	2.18	2.00	
2.32	2	2. G15	01	Living - Kitchen	16	6	49	38	55	45	60	32	180	23%	6.50	5.00	6.30	2.80	3.33	2.00	
2.33	2	2. G16	01	Living - Kitchen	21	6	55	50	50	45	54	31	180	22%	6.50	5.00	6.30	2.80	3.17	2.00	
2.34	2	2. G17	01	Living - Kitchen	30	38	78	35	72	80			180	16%	6.50	5.00	6.30	2.80	2.22	2.00	
2.35	2	2. G18	01	Living - Kitchen	9	6	76	35	16	35	79	80	180	16%	6.50	5.00	6.30	2.80	2.23	2.00	
2.36	2	2. G02	01	Bed room	104	6	54	35	22	32			180	30%	2.63	3.20	4.00	2.80	3.28	1.00	
2.37	2	2. G02	01	Living - Kitchen	112	6	68	78					180	24%	7.00	8.50	6.10	2.80	2.57	2.00	
2.38	2	2. G03	01	Living - Kitchen	106	6	26	68	48	80			180	23%	7.00	6.80	5.20	2.80	3.33	2.00	
2.39	2	2. 101	01	Bed room	78	22	46	43	56	78			180	19%	3.50	2.80	4.10	2.80	2.93	1.00	
2.40	2	2. 101	01	Bed room	101	22	25	43	54	78			180	21%	3.50	2.80	3.60	2.80	3.44	1.00	
2.41	2	2. 102	01	Bed room	71	22	55	58	54	78			180	17%	3.50	2.80	3.60	2.80	2.86	1.00	
2.42	2	2. 102	01	Bed room	54	78	82	43	44	22			180	18%	3.50	2.80	4.10	2.80	2.70	1.00	
2.43	2	2. G05	01	Living - Kitchen	110	7	30	68	40	80			180	24%	7.00	8.50	4.00	2.80	3.38	2.00	
2.44	2	2. 103	01	Bed room	55	39	53	43	72	80			180	14%	2.63	2.80	3.60	2.80	1.78	1.00	
2.45	2	2. 103	01	Bed room	31	37	78	42	71	80			180	15%	4.00	2.80	4.00	2.80	2.56	1.00	
2.46	2	2. 103	01	Living - Kitchen	11	5	90	43	79	37			180	22%	4.01	4.40	6.70	2.80	2.04	2.00	
2.47	2	2. 106	01	Bed room	49	49	38	22	33	70	60	78	180	14%	3.50	2.80	4.10	2.80	2.15	1.00	
2.48	2	2. 106	01	Bed room	26	50	41	22	55	68	58	78	180	14%	3.50	2.80	3.60	2.80	2.27	1.00	
2.49	2	2. 107	01	Bed room	56	52	44	22	21	54	59	78	180	16%	3.50	2.80	3.60	2.80	2.60	1.00	



2.50	2	2. 107	01	Bed room	31	59	47	22	42	53	60	78	180	15%	3.50	2.80	4.10	2.80	2.32	1.00
2.51	2	2. 104	01	Bed room	22	37	54	36	104	80			180	12%	4.00	3.10	3.80	2.80	2.09	1.00
2.52	2	2. 104	01	Living - Kitchen	33	71	27	21	84	42	36	4	180	23%	3.50	3.70	6.80	2.80	2.02	2.00
2.53	2	2. 105	01	Living - Kitchen	25	70	20	20	91	42	44	4	180	24%	3.50	3.70	6.80	2.80	2.09	2.00
2.54	2	2. 105	01	Bed room	74	42	17	4	89	80			180	14%	4.00	3.10	3.80	2.80	2.41	1.00
2.55	2	2. G10	01	Bed room	75	4	75	40	30	69			180	25%	2.63	2.00	4.00	2.80	3.59	1.00
2.56	2	2. G09	01	Bed room	60	30	36	6	84	4			180	32%	2.63	3.20	4.00	2.80	3.50	1.00
2.57	2	2. G08	01	Living - Kitchen	58	5	75	30	47	78			180	24%	5.50	7.00	5.20	2.80	2.56	2.00
2.58	2	2. G07	01	Living - Kitchen	47	5	86	30	47	78			180	23%	5.50	7.00	5.20	2.80	2.49	2.00
2.59	2	2. G06	01	Bed room	36	78	92	30	52	6			180	24%	2.63	3.20	4.00	2.80	2.61	1.00
2.60	2	2. G06	01	Living - Kitchen	37	74	94	6	11	25	38	80	180	23%	7.00	8.50	6.10	2.80	2.41	2.00
2.61	2	2. 101	02	Living - Kitchen	50	59	45	15	38	45	47	71	180	18%	7.00	7.00	5.40	2.80	2.40	2.00
2.62	2	2. 102	02	Living - Kitchen	39	45	46	15	49	59	46	71	180	18%	7.00	7.00	5.40	2.80	2.42	2.00
2.63	2	2. 106	02	Living - Kitchen	51	52	46	15	37	50	46	71	180	18%	7.00	7.00	5.40	2.80	2.46	2.00
2.64	2	2. 107	02	Living - Kitchen	42	45	39	15	52	59	47	71	180	17%	7.00	7.00	5.40	2.80	2.33	2.00

Table 5.2: apartment block 2 calculation results

5.5 Apartment Block 3 – receptors and ADF calculation results

Receptors: Images 5.10 to 5.13 indicate the locations of the rooms chosen from residential apartment block 3 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.



Image 5.10: Level 00 with selected rooms – Apartment block 3

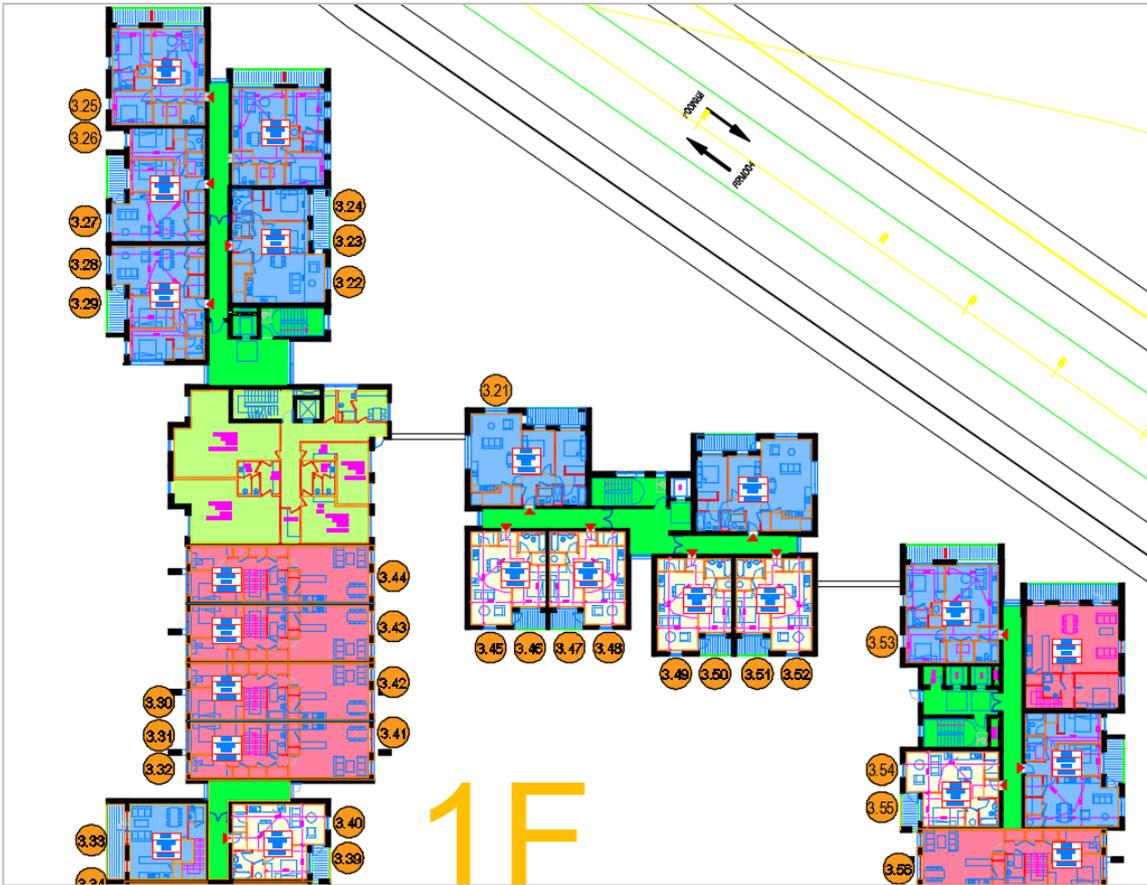


Image 5.11: Level 01 with selected rooms – Apartment block 3



Image 5.12: Level 01 with selected rooms – Apartment block 3

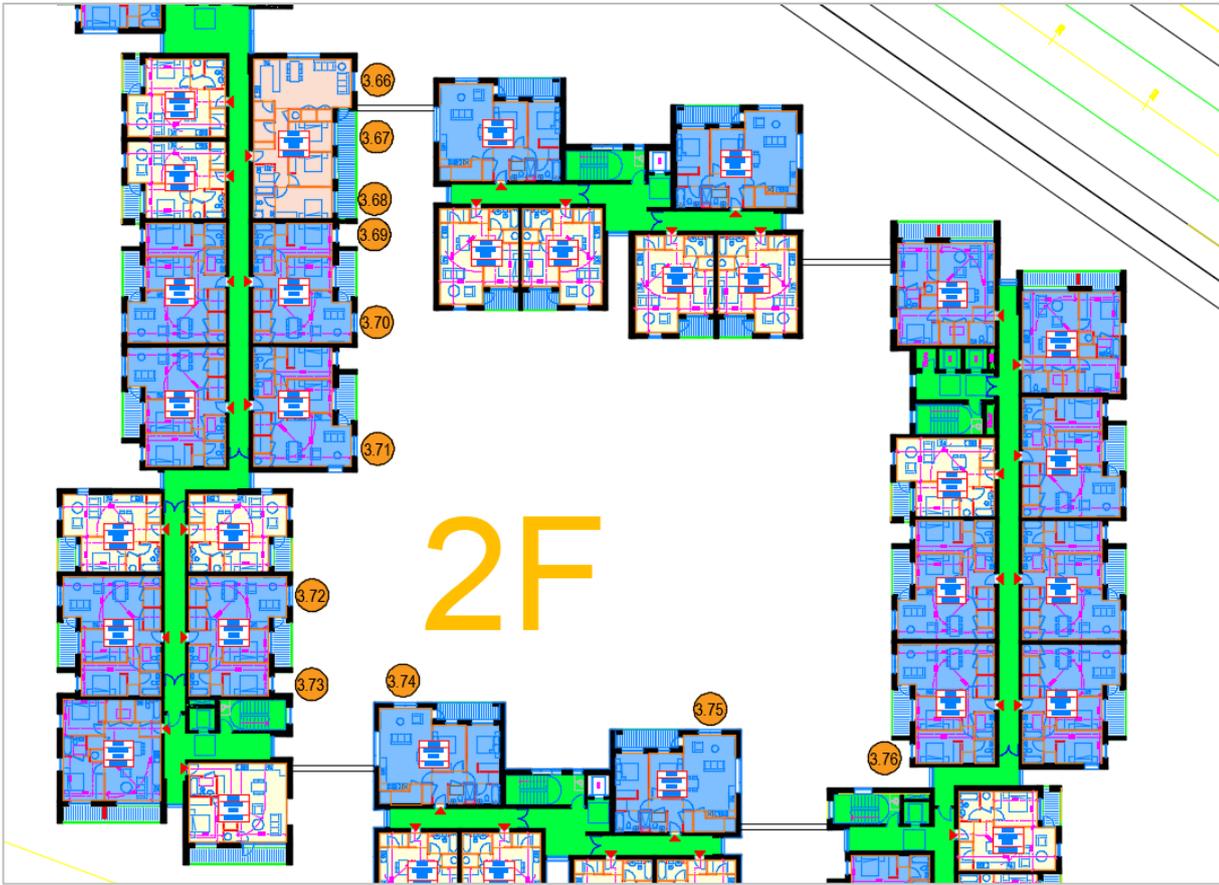


Image 5.13: Level 02 with selected rooms – Apartment block 3

Apartment Block 3 - ADF calculation results:

The table below provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor L	Σ VSC L	Room				Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°			glass area m2	width m	depth m	height m								
3.01	3	3.025	00	Bed room	59	28	48	9	73	80			180	20%	4.00	2.80	4.50	3.80	2.56	1.00
3.02	3	3.024	00	Bed room	19	10	72	28	89	80			180	16%	4.00	2.80	4.50	3.80	2.13	1.00
3.03	3	3.022	00	Bed room	16	10	74	28	90	80			180	16%	4.00	2.80	4.50	3.80	2.10	1.00
3.04	3	3.021	00	Bed room	66	9	60	28	54	80			180	23%	3.50	2.80	4.60	3.80	2.56	1.00
3.05	3	3.020	00	Bed room	49	9	76	28	55	80			180	22%	4.00	2.80	4.50	3.80	2.86	1.00
3.06	3	3.019	00	Bed room	24	9	62	28	94	80			180	16%	4.00	2.80	4.50	3.80	2.08	1.00
3.07	3	3.018	00	Bed room	117	9	63	80					180	24%	4.00	3.50	5.70	3.80	2.35	1.00
3.08	3	3.013	00	Bed room	84	9	29	65	67	80			180	19%	4.00	2.80	4.50	3.80	2.54	1.00
3.09	3	3.012	00	Bed room	84	68	45	41	51	80			180	11%	2.63	2.80	4.00	3.80	1.03	1.00
3.10	3	3.012	00	Bed room	88	73	19	10	73	80			180	9%	4.00	2.80	4.00	3.80	1.27	1.00
3.11	3	3.012	00	Living - Kitchen	85	7	68	73	27	17			180	24%	3.80	3.50	6.50	3.80	2.05	2.00
3.12	3	3.011	00	Bed room	107	8	73	80					180	22%	3.50	3.50	5.70	3.80	1.94	1.00
3.13	3	3.009	00	Bed room	30	10	95	42	55	80			180	18%	3.50	2.80	4.00	3.80	2.22	1.00
3.14	3	3.009	00	Bed room	87	42	35	10	58	80			180	18%	3.50	2.80	4.50	3.80	2.05	1.00
3.15	3	3.007	00	Bed room	25	10	83	42	72	80			180	16%	3.50	2.80	4.00	3.80	1.98	1.00
3.16	3	3.007	00	Bed room	86	42	26	10	68	80			180	16%	3.50	2.80	4.50	3.80	1.87	1.00
3.17	3	3.006	00	Bed room	59	42	51	10	70	80			180	18%	4.00	2.80	4.50	3.80	2.36	1.00
3.18	3	3.005	00	Bed room	65	42	13	9	102	80			180	13%	4.00	2.80	4.50	3.80	1.61	1.00
3.19	3	3.002	00	Living - Kitchen	107	10	50	41	23	9			180	30%	3.75	3.50	6.70	3.80	2.48	2.00
3.20	3	3.002	00	Bed room	78	10	30	41	72	80			180	20%	4.00	2.80	4.00	3.80	2.84	1.00
3.21	3	3.108	01	Living - Kitchen	64	58	116	9					180	27%	3.75	4.50	6.60	2.80	2.31	2.00
3.22	3	3.106	01	Living - Kitchen	72	52	108	9					180	27%	3.75	4.50	6.60	2.80	2.31	2.00
3.23	3	3.106	01	Bed room	91	9	23	52	66	78			180	21%	2.63	2.80	4.00	2.80	2.50	1.00
3.24	3	3.106	01	Bed room	50	9	47	52	83	78			180	16%	4.00	2.80	4.00	2.80	2.88	1.00
3.25	3	3.110	01	Bed room	59	9	84	30	37	7			180	30%	2.63	3.10	3.70	2.80	3.54	1.00
3.26	3	3.109	01	Bed room	73	30	107	80					180	13%	2.63	2.80	4.00	2.80	1.51	1.00
3.27	3	3.109	01	Living - Kitchen	50	9	88	30	42	7			180	30%	3.75	3.50	6.80	2.80	2.98	2.00
3.28	3	3.108	01	Living - Kitchen	48	9	88	30	44	7			180	30%	3.75	3.50	6.80	2.80	2.98	2.00
3.29	3	3.108	01	Bed room	47	9	89	30	44	7			180	30%	4.00	2.80	4.00	2.80	5.40	1.00
3.30	3	3.023	01	Bed room	93	27	13	8	74	78			180	19%	4.00	2.80	4.70	2.80	2.92	1.00
3.31	3	3.022	01	Bed room	84	27	29	8	67	78			180	20%	4.00	2.80	4.70	2.80	3.17	1.00
3.32	3	3.022	01	Bed room	61	27	12	8	107	78			180	15%	2.63	2.10	3.20	2.80	2.32	1.00
3.33	3	3.021	01	Living - Kitchen	70	27	67	8	43	78			180	24%	6.25	7.00	4.30	2.80	3.53	2.00
3.34	3	3.020	01	Bed room	32	27	65	8	83	78			180	20%	2.63	2.10	3.20	2.80	3.17	1.00
3.35	3	3.020	01	Bed room	62	27	29	8	89	78			180	18%	4.00	2.80	4.70	2.80	2.75	1.00
3.36	3	3.017	01	Bed room	8	47	37	16	108	70	27	8	180	18%	2.63	2.00	4.00	2.80	2.52	1.00
3.37	3	3.019	01	Living - Kitchen	60	26	55	67	65	78			180	14%	7.00	5.00	6.00	2.80	2.30	2.00
3.38	3	3.020	01	Living - Kitchen	40	65	44	26	65	78	31	29	180	16%	7.00	5.00	6.00	2.80	2.50	2.00
3.39	3	3.107	01	Bed room	62	65	33	26	85	78			180	11%	4.00	3.10	3.80	2.80	1.92	1.00
3.40	3	3.107	01	Living - Kitchen	11	6	56	39	67	28	46	74	180	21%	3.75	3.70	6.00	2.80	2.17	2.00
3.41	3	3.022	01	Living - Kitchen	47	49	69	28	64	78			180	17%	7.50	5.00	6.00	2.80	2.88	2.00
3.42	3	3.023	01	Living - Kitchen	53	64	46	28	64	78	17	34	180	14%	7.50	5.00	6.00	2.80	2.46	2.00
3.43	3	3.024	01	Living - Kitchen	57	67	43	28	64	78	16	26	180	14%	7.50	5.00	6.00	2.80	2.38	2.00
3.44	3	3.025	01	Living - Kitchen	81	67	35	22	64	78			180	12%	7.50	5.00	6.00	2.80	2.11	2.00
3.45	3	3.107	01	Living - Kitchen	73	59	50	30	57	31			180	20%	3.75	3.70	6.10	2.80	2.14	2.00
3.46	3	3.107	01	Bed room	85	78	95	30					180	16%	4.00	3.10	3.80	2.80	2.76	1.00
3.47	3	3.107	01	Bed room	85	78	95	30					180	16%	4.00	3.10	3.80	2.80	2.76	1.00
3.48	3	3.107	01	Living - Kitchen	62	48	48	30	42	30	28	70	180	20%	3.75	3.70	6.10	2.80	2.12	2.00
3.49	3	3.107	01	Living - Kitchen	54	41	48	30	78	46			180	21%	3.75	3.70	6.10	2.80	2.19	2.00
3.50	3	3.107	01	Bed room	85	78	49	30	46	46			180	14%	4.00	3.10	3.80	2.80	2.46	1.00



3.51	3	3.107	01	Bed room	85	78	43	30	52	46			180	14%	4.00	3.10	3.80	2.80	2.41	1.00
3.52	3	3.107	01	Living - Kitchen	87	61	43	30	42	32	8	5	180	19%	3.75	3.70	6.10	2.80	2.01	2.00
3.53	3	3.103	01	Bed room	23	6	78	67	79	28			180	20%	2.63	3.10	3.70	2.80	2.35	1.00
3.54	3	3.102	01	Living - Kitchen	15	6	58	49	53	28	54	35	180	23%	3.75	3.70	6.30	2.80	2.34	2.00
3.55	3	3.102	01	Bed room	85	78	25	49	70	28			180	15%	4.00	3.10	3.80	2.80	2.61	1.00
3.56	3	3.003	01	Living - Kitchen	29	39	43	28	44	44	64	78	180	17%	7.00	5.00	6.20	2.80	2.56	2.00
3.57	3	3.004	01	Living - Kitchen	38	37	39	28	39	47	64	78	180	16%	7.00	5.00	6.20	2.80	2.53	2.00
3.58	3	3.005	01	Living - Kitchen	31	34	39	28	46	53	64	78	180	16%	7.00	5.00	6.20	2.80	2.44	2.00
3.59	3	3.006	01	Living - Kitchen	40	67	37	28	28	22	75	78	180	14%	7.00	5.00	6.20	2.80	2.22	2.00
3.60	3	3.104	01	Bed room	84	67	45	28	51	78			180	13%	2.63	2.80	4.00	2.80	1.47	1.00
3.61	3	3.104	01	Living - Kitchen	85	6	68	67	27	16			180	25%	3.75	3.50	6.80	2.80	2.46	2.00
3.62	3	3.013	01	Living - Kitchen	64	78	29	34	44	30	43	46	180	17%	7.00	5.00	6.20	2.80	2.55	2.00
3.63	3	3.014	01	Living - Kitchen	64	78	34	37	46	30	36	44	180	17%	7.00	5.00	6.20	2.80	2.57	2.00
3.64	3	3.015	01	Living - Kitchen	64	78	57	53	45	30	14	33	180	15%	7.00	5.00	6.20	2.80	2.35	2.00
3.65	3	3.016	01	Living - Kitchen	64	78	64	57	43	30	9	32	180	14%	7.00	5.00	6.20	2.80	2.20	2.00
3.66	3	3.223	02	Living - Kitchen	88	5	74	63	18	23			180	25%	4.25	4.20	8.50	2.80	2.09	2.00
3.67	3	3.223	02	Bed room	24	5	92	63	19	22	45	78	180	15%	4.00	2.60	3.80	2.80	2.89	1.00
3.68	3	3.223	02	Bed room	27	5	102	63	51	78			180	14%	4.00	2.80	5.00	2.80	2.01	1.00
3.69	3	3.224	02	Bed room	75	63	105	78					180	8%	2.63	2.80	3.55	2.80	1.01	1.00
3.70	3	3.224	02	Living - Kitchen	17	5	76	63	44	25	43	26	180	22%	3.75	3.50	6.50	2.80	2.20	2.00
3.71	3	3.225	02	Living - Kitchen	76	49	51	25	53	34			180	22%	3.75	3.50	6.50	2.80	2.24	2.00
3.72	3	3.227	02	Living - Kitchen	26	75	80	25	60	57	14	5	180	21%	3.75	3.50	6.50	2.80	2.09	2.00
3.73	3	3.227	02	Bed room	105	78	37	25	38	62			180	12%	2.63	2.80	3.70	2.80	1.37	1.00
3.74	3	3.215	02	Living - Kitchen	93	41	43	24	44	27			180	24%	4.00	4.50	6.60	2.80	2.19	2.00
3.75	3	3.216	02	Living - Kitchen	56	29	46	24	78	49			180	23%	4.00	4.50	6.60	2.80	2.08	2.00
3.76	3	3.211	02	Bed room	30	24	32	49	118	78			180	12%	2.63	2.80	3.70	2.80	1.37	1.00

Table 5.3: apartment block 3 calculation results

5.6 Apartment Block 4 – receptors and ADF calculation results

Receptors: Images 5.14 to 5.17 indicate the locations of the rooms chosen from residential apartment block 4 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

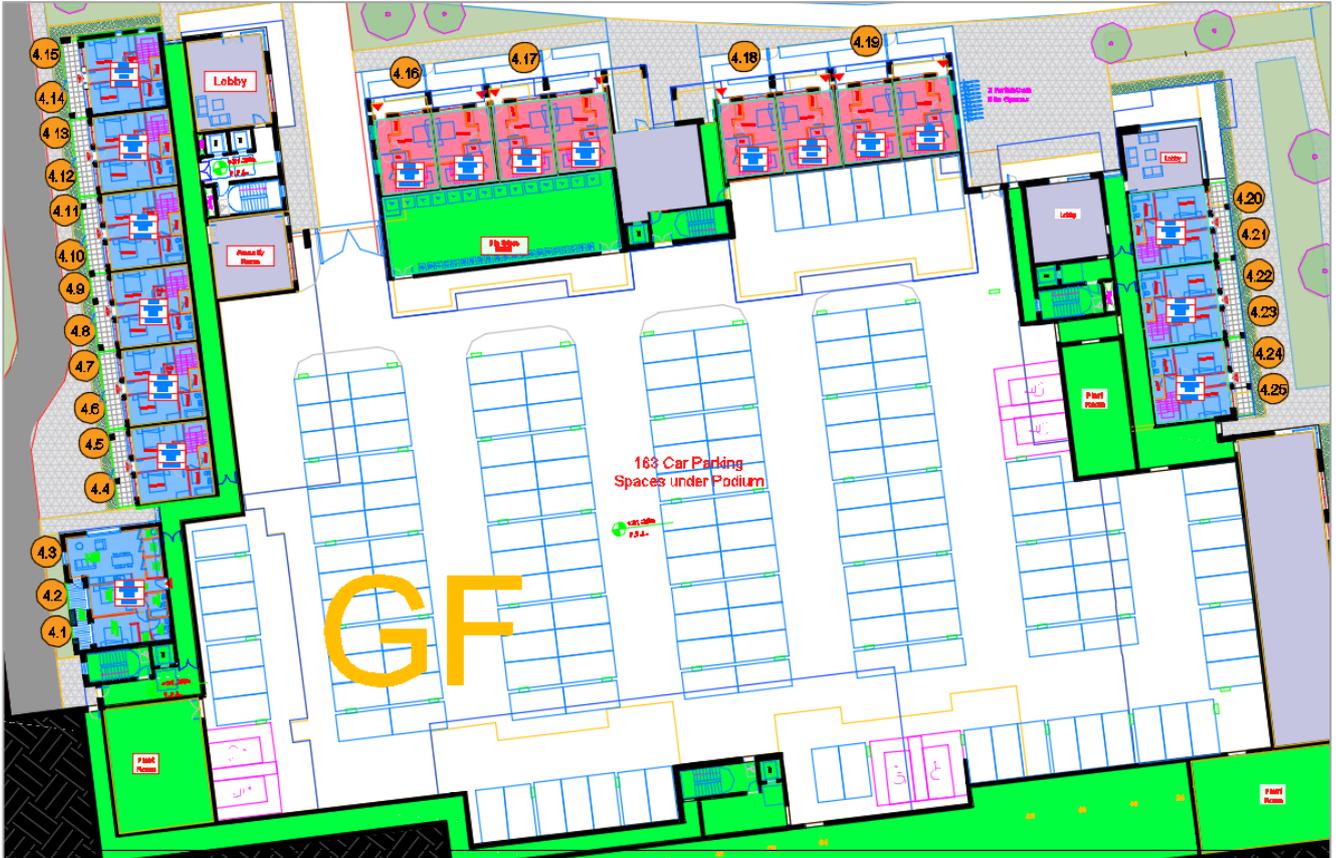


Image 5.14: Level 00 with selected rooms – Apartment block 4



Image 5.15: Level 01 with selected rooms – Apartment block 4



Image 5.16: Level 01 with selected rooms – Apartment block 4



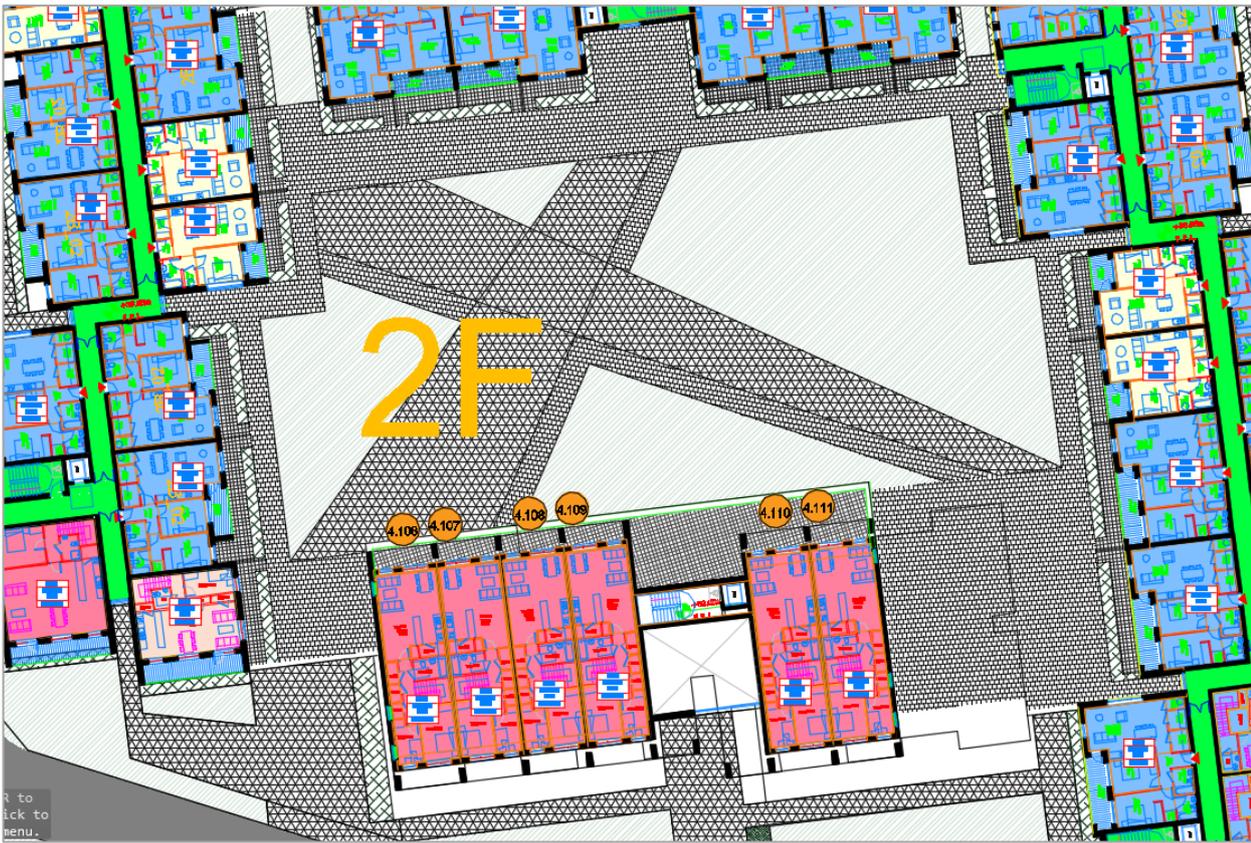


Image 5.17: Level 02 with selected rooms – Apartment block 4

Apartment Block 4 - ADF calculation results:

The table below provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor ↓	Σ VSC ↓	glass area m2	Room				Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°				width m	depth m	height m									
4.01	4	4.001	00	Bed room	114	80	19	75	47	28			180	11%	4.00	2.80	4.00	3.80	1.46	1.00	
4.02	4	4.001	00	Bed room	98	80	10	75	72	28			180	14%	4.00	2.90	4.00	3.80	1.84	1.00	
4.03	4	4.001	00	Living - Kitchen	27	18	41	11	32	28	80	6	180	32%	3.38	4.50	6.80	3.80	2.04	2.00	
4.04	4	4.002	00	Bed room	107	80	11	6	31	28	31	19	180	15%	3.50	2.80	4.60	3.80	1.63	1.00	
4.05	4	4.002	00	Bed room	76	80	27	6	44	28	33	19	180	19%	3.50	2.80	4.60	3.80	2.16	1.00	
4.06	4	4.003	00	Bed room	51	80	35	6	46	28	48	19	180	23%	3.50	2.80	4.60	3.80	2.58	1.00	
4.07	4	4.003	00	Bed room	69	80	39	6	47	28	25	19	180	20%	3.50	2.80	4.60	3.80	2.30	1.00	
4.08	4	4.004	00	Bed room	71	80	14	6	52	28	43	19	180	19%	3.50	2.80	4.60	3.80	2.17	1.00	
4.09	4	4.004	00	Bed room	88	80	29	6	63	19			180	19%	3.50	2.80	4.60	3.80	2.07	1.00	
4.10	4	4.005	00	Bed room	68	80	48	26	28	19	36	12	180	20%	3.50	2.80	4.60	3.80	2.27	1.00	
4.11	4	4.005	00	Bed room	36	6	38	26	16	31	90	80	180	17%	3.50	2.80	4.60	3.80	1.94	1.00	
4.12	4	4.006	00	Bed room	50	12	29	34	65	26	36	80	180	24%	3.50	2.80	4.60	3.80	2.67	1.00	
4.13	4	4.006	00	Bed room	57	14	28	34	32	26	63	80	180	20%	3.50	2.80	4.60	3.80	2.28	1.00	
4.14	4	4.007	00	Bed room	58	14	27	34	27	36	68	80	180	19%	3.50	2.80	4.60	3.80	2.14	1.00	
4.15	4	4.007	00	Bed room	43	14	32	34	30	25	75	80	180	18%	3.50	2.80	4.60	3.80	2.07	1.00	
4.16	4	4.008	00	Bed room	62	80	26	64	92	14			180	20%	4.00	2.80	4.50	3.80	2.56	1.00	
4.17	4	4.010	00	Bed room	69	80	4	37	107	14			180	21%	4.00	2.80	4.50	3.80	2.79	1.00	
4.18	4	4.012	00	Bed room	114	14	66	14					180	32%	4.00	2.80	4.50	3.80	4.22	1.00	
4.19	4	4.014	00	Bed room	112	14	68	80					180	22%	4.00	2.80	4.50	3.80	2.84	1.00	
4.20	4	4.016	00	Bed room	94	12	47	35	39	80			180	24%	3.50	2.80	4.60	3.80	2.74	1.00	
4.21	4	4.016	00	Bed room	57	12	25	35	98	80			180	16%	3.50	2.80	4.60	3.80	1.81	1.00	
4.22	4	4.017	00	Bed room	35	12	69	37	76	80			180	17%	3.50	2.80	4.60	3.80	1.90	1.00	
4.23	4	4.017	00	Bed room	62	12	47	37	71	80			180	19%	3.50	2.80	4.60	3.80	2.14	1.00	
4.24	4	4.018	00	Bed room	28	11	60	38	92	80			180	15%	3.50	2.80	4.60	3.80	1.66	1.00	
4.25	4	4.018	00	Bed room	46	38	134	80					180	9%	3.50	2.80	4.60	3.80	1.02	1.00	
4.26	4	4.007	01	Living - Kitchen	46	78	52	11	62	17	20	5	180	26%	6.25	7.00	4.30	2.80	3.61	2.00	
4.27	4	4.006	01	Living - Kitchen	37	78	46	11	64	17	33	5	180	27%	6.25	7.00	4.30	2.80	3.83	2.00	
4.28	4	4.005	01	Living - Kitchen	50	78	29	11	69	24	32	5	180	24%	6.25	7.00	4.30	2.80	3.37	2.00	
4.29	4	4.003	01	Living - Kitchen	48	78	24	10	70	25	38	5	180	24%	6.25	7.00	4.30	2.80	3.40	2.00	
4.30	4	4.002	01	Living - Kitchen	94	78	63	25	23	5			180	17%	6.25	7.00	4.30	2.80	2.38	2.00	
4.31	4	4.101	01	Bed room	41	80	113	6	26	75			180	24%	3.75	3.30	7.00	2.80	2.40	1.00	
4.32	4	4.101	01	Bed room	62	80	118	6					180	25%	3.50	3.50	5.70	2.80	2.60	1.00	
4.33	4	4.108	01	Bed room	51	78	23	55	106	6			180	24%	3.50	3.10	4.70	2.80	3.17	1.00	
4.34	4	4.108	01	Bed room	57	78	123	6					180	26%	3.50	2.60	4.40	2.80	3.93	1.00	
4.35	4	4.107	01	Bed room	110	80	32	62	38	21			180	11%	2.63	2.80	3.60	2.80	1.37	1.00	
4.36	4	4.107	01	Bed room	74	80	49	58	57	21			180	15%	4.00	2.80	4.00	2.80	2.62	1.00	
4.37	4	4.107	01	Living - Kitchen	21	5	60	58	79	21	20	56	180	23%	3.75	4.20	6.70	2.80	2.06	2.00	
4.38	4	4.107	01	Living - Kitchen	19	5	59	52	76	21	26	62	180	23%	3.75	4.20	6.70	2.80	2.05	2.00	
4.39	4	4.107	01	Bed room	76	80	34	51	59	21	11	70	180	15%	4.00	2.80	4.00	2.80	2.67	1.00	
4.40	4	4.107	01	Bed room	123	80	43	18	14	51			180	12%	2.63	2.80	3.60	2.80	1.44	1.00	
4.41	4	4.106	01	Bed room	92	80	31	31	57	23			180	16%	4.00	3.10	3.80	2.80	2.68	1.00	
4.42	4	4.106	01	Living - Kitchen	12	6	72	54	36	21	60	36	180	22%	3.50	3.70	6.10	2.80	2.11	2.00	
4.43	4	4.105	01	Living - Kitchen	14	6	73	59	36	21	57	35	180	21%	3.50	3.70	6.10	2.80	2.06	2.00	
4.44	4	4.105	01	Bed room	95	80	42	64	43	21			180	12%	4.00	3.10	3.80	2.80	2.05	1.00	
4.45	4	4.104	01	Living - Kitchen	20	6	89	64	20	19	51	23	180	21%	3.75	4.10	6.10	2.80	2.03	2.00	
4.46	4	4.104	01	Bed room	79	80	91	64	10	19			180	10%	4.00	2.80	4.00	2.80	1.62	1.00	
4.47	4	4.104	01	Bed room	9	75	28	6	88	64	55	80	180	13%	2.63	2.80	3.60	2.80	1.58	1.00	
4.48	4	4.103	01	Bed room	96	6	66	64	18	18			180	26%	2.63	3.10	3.50	2.80	3.14	1.00	
4.49	4	4.103	01	Bed room	124	6	41	64	15	17			180	29%	2.63	3.80	3.50	2.80	3.12	1.00	
4.50	4	4.008	01	Bed room	103	7	77	80					180	22%	2.63	2.60	3.80	2.80	2.77	1.00	
4.51	4	4.008	01	Bed room	87	7	23	72	70	80			180	20%	4.00	2.90	4.70	2.80	3.04	1.00	



4.52	4	4.012	01	Bed room	128	7	52	80						180	26%	2.63	2.60	3.80	2.80	3.31	1.00
4.53	4	4.012	01	Bed room	110	7	70	80						180	23%	4.00	2.90	4.70	2.80	3.59	1.00
4.54	4	4.008	01	Living - Kitchen	70	80	47	54	63	25				180	16%	7.00	5.00	6.30	2.80	2.36	2.00
4.55	4	4.009	01	Living - Kitchen	70	80	41	52	69	25				180	16%	7.00	5.00	6.30	2.80	2.45	2.00
4.56	4	4.010	01	Living - Kitchen	70	80	36	50	74	25				180	17%	7.00	5.00	6.30	2.80	2.53	2.00
4.57	4	4.011	01	Living - Kitchen	70	80	29	48	81	25				180	17%	7.00	5.00	6.30	2.80	2.61	2.00
4.58	4	4.012	01	Living - Kitchen	70	80	71	25	39	29				180	18%	7.00	5.00	6.30	2.80	2.80	2.00
4.59	4	4.013	01	Living - Kitchen	70	80	62	25	48	30				180	18%	7.00	5.00	6.30	2.80	2.77	2.00
4.60	4	4.014	01	Living - Kitchen	70	80	57	25	19	6	34	45		180	18%	7.00	5.00	6.30	2.80	2.74	2.00
4.61	4	4.015	01	Living - Kitchen	70	80	49	25	13	6	48	55		180	16%	7.00	5.00	6.30	2.80	2.42	2.00
4.62	4	4.122	01	Bed room	10	6	106	83	51	25	13	6		180	14%	2.00	3.10	3.60	2.80	1.27	1.00
4.63	4	4.121	01	Bed room	135	80	45	22						180	11%	4.00	2.80	3.60	2.80	1.99	1.00
4.64	4	4.121	01	Bed room	115	80	65	22						180	13%	4.00	2.80	4.00	2.80	2.34	1.00
4.65	4	4.121	01	Living - Kitchen	75	40	36	22	51	38	18	6		180	24%	3.75	4.20	6.70	2.80	2.15	2.00
4.66	4	4.018	01	Living - Kitchen	24	80	48	7	56	39	52	75		180	19%	6.25	7.00	4.30	2.80	2.61	2.00
4.67	4	4.017	01	Living - Kitchen	53	80	61	7	66	39				180	21%	6.25	7.00	4.30	2.80	2.97	2.00
4.68	4	4.016	01	Living - Kitchen	44	80	67	7	69	39				180	22%	6.25	7.00	4.30	2.80	3.15	2.00
4.69	4	4.123	01	Living - Kitchen	129	8	51	80						180	26%	6.25	4.20	6.90	2.80	3.77	2.00
4.70	4	4.123	01	Bed room	132	8	48	80						180	26%	3.50	2.90	3.90	2.80	4.13	1.00
4.71	4	4.122	01	Living - Kitchen	91	8	89	80						180	20%	5.00	4.80	6.80	2.80	2.10	2.00
4.72	4	4.122	01	Bed room	48	8	132	80						180	13%	2.63	3.50	3.80	2.80	1.30	1.00
4.73	4	4.120	01	Bed room	92	80	16	75	72	22				180	15%	4.00	3.10	3.80	2.80	2.48	1.00
4.74	4	4.120	01	Living - Kitchen	48	70	62	22	50	34	20	5		180	23%	3.50	3.60	7.00	2.80	2.02	2.00
4.75	4	4.119	01	Living - Kitchen	39	64	69	22	50	38	22	5		180	24%	3.50	3.60	7.00	2.80	2.10	2.00
4.76	4	4.119	01	Bed room	92	80	47	22	41	38				180	15%	4.00	3.10	3.80	2.80	2.55	1.00
4.77	4	4.118	01	Living - Kitchen	31	52	73	22	46	38	30	6		180	26%	3.75	4.20	6.70	2.80	2.32	2.00
4.78	4	4.118	01	Bed room	69	80	36	22	51	38	24	6		180	19%	4.00	2.80	4.00	2.80	3.27	1.00
4.79	4	4.118	01	Bed room	80	80	54	22	46	38				180	16%	4.00	2.80	3.60	2.80	3.10	1.00
4.80	4	4.117	01	Living - Kitchen	37	52	53	22	59	38	31	6		180	25%	3.75	4.20	6.70	2.80	2.24	2.00
4.81	4	4.117	01	Bed room	85	80	64	38	31	6				180	16%	4.00	2.80	4.00	2.80	2.84	1.00
4.82	4	4.117	01	Bed room	84	80	33	22	53	38	10	6		180	16%	4.00	2.80	3.60	2.80	3.02	1.00
4.83	4	4.116	01	Living - Kitchen	90	6	75	38	15	18				180	29%	3.75	4.20	6.70	2.80	2.61	2.00
4.84	4	4.116	01	Bed room	88	80	36	38	56	7				180	18%	4.00	2.80	4.00	2.80	3.10	1.00
4.85	4	4.116	01	Bed room	115	80	65	7						180	16%	4.00	2.80	3.60	2.80	2.96	1.00
4.86	4	4.115	01	Bed room	106	8	74	80						180	22%	3.50	3.10	4.10	2.80	3.19	1.00
4.87	4	4.129	01	Bed room	111	80	53	39	16	8				180	12%	3.50	2.80	4.60	2.80	1.70	1.00
4.88	4	4.129	01	Bed room	108	80	62	39	10	8				180	12%	3.50	2.80	4.10	2.80	1.83	1.00
4.89	4	4.128	01	Bed room	53	80	127	39						180	17%	3.50	2.80	4.60	2.80	2.32	1.00
4.90	4	4.128	01	Bed room	46	80	102	39	32	7				180	20%	3.50	2.80	4.10	2.80	3.00	1.00
4.91	4	4.127	01	Bed room	92	80	88	39						180	13%	3.50	2.80	4.60	2.80	1.79	1.00
4.92	4	4.127	01	Bed room	122	80	58	39						180	10%	3.50	2.80	4.10	2.80	1.51	1.00
4.93	4	4.126	01	Living - Kitchen	25	7	127	39	28	7				180	26%	4.30	5.00	7.50	2.80	2.12	2.00
4.94	4	4.126	01	Bed room	45	75	19	7	116	39				180	19%	4.00	2.60	4.00	2.80	3.58	1.00
4.95	4	4.126	01	Bed room	33	75	15	7	132	39				180	20%	4.00	3.10	4.00	2.80	3.34	1.00
4.96	4	4.126	01	Bed room	55	75	16	7	109	39				180	18%	4.00	3.00	3.80	2.80	3.22	1.00
4.97	4	4.125	01	Bed room	112	80	68	39						180	11%	2.63	2.80	3.60	2.80	1.36	1.00
4.98	4	4.125	01	Bed room	76	80	104	39						180	15%	4.00	2.80	4.00	2.80	2.54	1.00
4.99	4	4.125	01	Living - Kitchen	40	6	119	39	21	6				180	26%	3.75	4.20	6.70	2.80	2.33	2.00
4.100	4	4.124	01	Bed room	112	80	68	39						180	11%	2.63	2.80	3.60	2.80	1.36	1.00
4.101	4	4.124	01	Bed room	76	80	9	7	95	39				180	15%	4.00	2.80	4.00	2.80	2.66	1.00
4.102	4	4.124	01	Living - Kitchen	108	39	72	7						180	27%	3.75	4.20	6.70	2.80	2.39	2.00
4.103	4	4.114	01	Bed room	65	80	85	7	30	75				180	19%	3.50	2.80	4.10	2.80	2.94	1.00
4.104	4	4.112	01	Bed room	110	7	14	59	56	80				180	24%	3.50	2.80	4.10	2.80	3.65	1.00
4.105	4	4.109	01	Bed room	118	7	62	80						180	24%	3.50	2.80	4.10	2.80	3.75	1.00
4.106	4	4.114	02	Living - Kitchen	66	76	63	34	51	19				180	19%	6.75	5.00	6.30	2.80	2.83	2.00
4.107	4	4.113	02	Living - Kitchen	65	76	41	34	74	19				180	20%	6.75	5.00	6.30	2.80	2.97	2.00
4.108	4	4.112	02	Living - Kitchen	63	76	41	33	76	19				180	20%	6.75	5.00	6.30	2.80	3.02	2.00
4.109	4	4.111	02	Living - Kitchen	66	76	32	33	82	19				180	20%	6.75	5.00	6.30	2.80	3.01	2.00
4.110	4	4.110	02	Living - Kitchen	64	76	25	33	91	19				180	21%	6.75	5.00	6.30	2.80	3.08	2.00
4.111	4	4.109	02	Living - Kitchen	63	76	17	30	100	19				180	21%	6.75	5.00	6.30	2.80	3.16	2.00

Table 5.4: apartment block 4 calculation results

5.7 Apartment Block 5 – receptors and ADF calculation results

Receptors: Images 5.18 to 5.20 indicate the locations of the rooms chosen from residential apartment block 5 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.

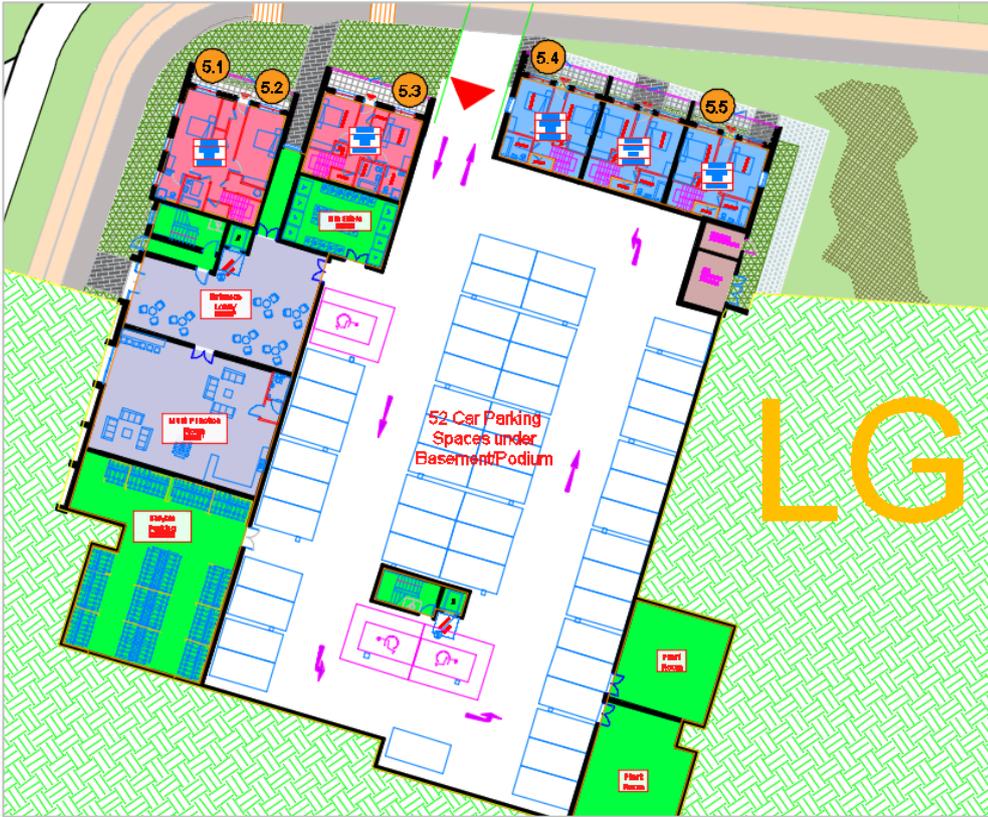


Image 5.18: Level 00 (lower) with selected rooms – Apartment block 5



Image 5.19: Level 00 with selected rooms – Apartment block 5



Image 5.20: Level 01 with selected rooms – Apartment block 5

Apartment Block 5 - ADF calculation results:

The table below provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor L	Σ VSC L	glass		Room		Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°			area m2	width m	depth m	height m								
5.01	5	5.LG01	-00	Bed room	54	80	58	42	68	11			180	21%	3.50	2.90	6.90	3.80	1.67	1.00
5.02	5	5.LG01	-00	Bed room	64	80	116	11					180	23%	3.50	3.10	5.60	3.80	2.14	1.00
5.03	5	5.LG02	-00	Bed room	54	80	126	11					180	25%	3.50	2.80	4.40	3.80	2.88	1.00
5.04	5	5.LG03	-00	Bed room	58	80	122	11					180	24%	3.50	2.80	4.60	3.80	2.72	1.00
5.05	5	5.LG05	-00	Bed room	58	80	122	11					180	24%	3.50	2.80	4.60	3.80	2.72	1.00
5.06	5	5.LG01	00	Bed room	80	10	42	36	24	32	34	4	180	30%	2.63	3.20	4.10	2.80	3.23	1.00
5.07	5	5.G14	00	Living - Kitchen	65	4	39	37	35	31	41	4	180	31%	2.63	3.70	6.80	2.80	2.07	2.00
5.08	5	5.G14	00	Bed room	98	80	82	37					180	13%	4.00	3.00	3.80	2.80	2.22	1.00
5.09	5	5.G13	00	Living - Kitchen	54	7	43	36	34	37	49	4	180	30%	2.63	3.70	6.80	2.80	2.01	2.00
5.10	5	5.G13	00	Bed room	98	80	82	37					180	13%	4.00	3.00	3.80	2.80	2.22	1.00
5.11	5	5.G12	00	Bed room	98	80	82	37					180	13%	4.00	3.00	3.80	2.80	2.22	1.00
5.12	5	5.G12	00	Living - Kitchen	44	8	36	37	38	39	62	4	180	30%	2.63	3.70	6.80	2.80	2.01	2.00
5.13	5	5.G11	00	Bed room	58	80	32	4	90	7			180	25%	3.50	3.10	4.10	2.80	3.65	1.00
5.14	5	5.G03	00	Bed room	120	80	14	25	46	59			180	9%	2.63	2.80	3.30	2.80	1.11	1.00
5.15	5	5.G03	00	Bed room	72	80	45	25	63	59			180	14%	4.00	2.80	4.00	2.80	2.35	1.00
5.16	5	5.G03	00	Living - Kitchen	83	65	44	19	53	16			180	22%	4.00	3.60	6.20	2.80	2.38	2.00
5.17	5	5.G02	00	Bed room	120	80	60	22					180	13%	2.63	2.80	3.30	2.80	1.66	1.00
5.18	5	5.G02	00	Bed room	72	80	34	24	34	23	40	53	180	16%	4.00	2.80	4.00	2.80	2.82	1.00
5.19	5	5.G02	00	Living - Kitchen	11	9	64	34	35	23	70	51	180	23%	3.25	3.50	6.20	2.80	2.07	2.00
5.20	5	5.G01	00	Living - Kitchen	13	9	68	41	33	23	66	49	180	22%	3.25	3.50	6.20	2.80	2.01	2.00
5.21	5	5.G01	00	Bed room	72	80	51	43	31	23	26	46	180	15%	4.00	2.80	4.00	2.80	2.66	1.00
5.22	5	5.G01	00	Bed room	120	80	60	43					180	10%	2.63	2.80	3.30	2.80	1.27	1.00
5.23	5	5.LG02	00	Bed room	23	11	117	50	40	35			180	21%	2.63	2.00	4.00	2.80	2.88	1.00
5.24	5	5.LG02	00	Living - Kitchen	40	80	140	12					180	27%	7.00	8.50	4.00	2.80	3.76	2.00
5.25	5	5.G15	00	Bed room	71	68	71	50	38	18			180	17%	4.00	2.90	4.00	2.80	2.93	1.00
5.26	5	5.G16	00	Bed room	62	68	74	50	44	20			180	18%	4.00	2.90	4.00	2.80	3.04	1.00
5.27	5	5.G17	00	Bed room	53	65	74	50	53	24			180	18%	4.00	2.90	4.00	2.80	3.20	1.00
5.28	5	5.G18	00	Bed room	49	63	71	50	60	25			180	19%	4.00	2.90	4.00	2.80	3.31	1.00
5.29	5	5.G04	00	Living - Kitchen	63	52	54	27	63	23			180	24%	3.75	3.60	6.20	2.80	2.44	2.00
5.30	5	5.G04	00	Bed room	68	80	59	27	53	23			180	19%	2.63	2.80	3.30	2.80	2.50	1.00
5.31	5	5.G04	00	Bed room	71	80	80	27	29	24			180	18%	4.00	2.80	4.00	2.80	3.21	1.00
5.32	5	5.G05	00	Bed room	71	80	50	27	59	27			180	18%	4.00	2.80	4.00	2.80	3.18	1.00
5.33	5	5.G05	00	Living - Kitchen	35	35	47	26	98	30			180	25%	3.75	4.40	6.60	2.80	2.21	2.00
5.34	5	5.110	01	Bed room	98	78	82	36					180	14%	4.00	3.00	3.80	2.80	2.34	1.00
5.35	5	5.109	01	Living - Kitchen	54	7	43	35	34	36	49	3	180	30%	2.63	3.70	6.80	2.80	2.02	2.00
5.36	5	5.108	01	Bed room	98	78	82	36					180	14%	4.00	3.00	3.80	2.80	2.34	1.00
5.37	5	5.108	01	Living - Kitchen	44	7	36	36	38	37	62	3	180	30%	2.63	3.70	6.80	2.80	2.03	2.00
5.38	5	5.105	01	Bed room	120	78	14	23	46	56			180	10%	2.63	2.80	3.30	2.80	1.24	1.00
5.39	5	5.105	01	Bed room	72	78	45	23	63	56			180	14%	4.00	2.80	4.00	2.80	2.53	1.00
5.40	5	5.105	01	Living - Kitchen	83	61	44	17	53	10			180	23%	4.00	3.60	6.20	2.80	2.58	2.00
5.41	5	5.104	01	Bed room	120	78	60	16					180	14%	2.63	2.80	3.30	2.80	1.85	1.00
5.42	5	5.104	01	Bed room	72	78	34	13	34	17	40	48	180	18%	4.00	2.80	4.00	2.80	3.20	1.00
5.43	5	5.104	01	Living - Kitchen	11	8	64	18	35	17	70	47	180	26%	3.75	3.60	6.20	2.80	2.69	2.00
5.44	5	5.103	01	Living - Kitchen	13	8	68	19	33	17	66	45	180	26%	3.75	3.60	6.20	2.80	2.74	2.00
5.45	5	5.103	01	Bed room	72	78	51	27	31	17	26	43	180	18%	4.00	2.80	4.00	2.80	3.17	1.00
5.46	5	5.103	01	Bed room	120	78	60	27					180	13%	2.63	2.80	3.30	2.80	1.64	1.00
5.47	5	5.G15	01	Bed room	75	56	68	41	37	17			180	20%	2.00	2.10	3.00	2.80	2.59	1.00
5.48	5	5.G15	01	Bed room	72	55	69	41	39	17			180	21%	4.00	2.80	4.60	2.80	3.31	1.00
5.49	5	5.G16	01	Bed room	63	53	74	41	43	19			180	21%	4.00	2.80	4.60	2.80	3.41	1.00

Table 5.5: apartment block 5 calculation results



5.8 Apartment Block 6 – receptors and ADF calculation results

Receptors: Images 5.21 to 5.23 indicate the locations of the rooms chosen from residential apartment block 6 for the ADF analysis. Once a (lowest level) room is compliant, rooms at higher levels with similar configuration / parameters are deemed compliant on the basis that the room daylight factor would have improved due to the better vertical sky view angle of higher located rooms.



Image 5.21: Level 00 with selected rooms – Apartment block 6



Image 5.22: Level 01 with selected rooms – Apartment block 6





Image 5.23: Level 02 with selected rooms – Apartment block 6

Apartment Block 6 - ADF calculation results:

The tables below provide the full calculation results of the selected rooms including the overall calculated vertical sky component together with the 'to-be-achieved' BRE minimum daylight factor standards.

Receptor	Block	Unit ID	Receptor		Hor Sec a		Hor Sec b		Hor Sec c		Hor Sec d		Σ Hor L	Σ VSC L	glass area m2	Room				Room ADF %	BRE ADF %
			Level	Room / type	Hor L°	Vert L°				width m	depth m	height m									
6.01	6	6.014	00	Bed room	63	80	82	7	35	5			180	24%	3.50	2.80	4.50	3.80	2.81	1.00	
6.02	6	6.012	00	Bed room	63	80	32	76	85	7			180	19%	3.50	2.80	4.10	3.80	2.35	1.00	
6.03	6	6.011	00	Bed room	63	80	117	7					180	24%	3.50	3.10	4.10	3.80	2.81	1.00	
6.04	6	6.007	00	Bed room	63	80	75	7	42	5			180	24%	3.50	2.80	4.40	3.80	2.86	1.00	
6.05	6	6.006	00	Bed room	63	80	32	35	85	11			180	22%	3.50	3.10	4.10	3.80	2.48	1.00	
6.06	6	6.004	00	Bed room	63	80	14	19	103	11			180	23%	3.50	2.80	4.10	3.80	2.82	1.00	
6.07	6	6.102	01	Living - Kitchen	29	71	95	10	46	26	10	33	180	27%	3.75	4.50	6.60	2.80	2.35	2.00	
6.08	6	6.102	01	Bed room	64	80	30	75	86	10			180	19%	2.63	2.80	4.00	2.80	2.19	1.00	
6.09	6	6.102	01	Bed room	64	80	24	77	71	10	21	24	180	19%	4.00	2.80	4.00	2.80	3.36	1.00	
6.10	6	6.101	01	Living - Kitchen	22	15	158	10					180	33%	3.75	4.50	6.60	2.80	2.87	2.00	
6.11	6	6.012	01	Living - Kitchen	51	80	29	72	100	6			180	22%	6.25	6.90	4.00	2.80	3.30	2.00	
6.12	6	6.011	01	Bed room	45	6	135	85					180	11%	2.10	2.00	4.10	2.80	1.16	1.00	
6.13	6	6.008	01	Living - Kitchen	73	6	71	63	36	35			180	24%	7.00	8.50	4.00	2.80	3.33	2.00	
6.14	6	6.008	01	Bed room	61	6	77	63	42	36			180	22%	2.10	2.00	4.10	2.80	2.46	1.00	
6.15	6	6.007	01	Bed room	64	6	70	53	46	15			180	27%	2.10	2.00	4.10	2.80	2.96	1.00	
6.16	6	6.103	01	Living - Kitchen	54	6	73	53	53	17			180	26%	3.50	3.40	6.70	2.80	2.48	2.00	
6.17	6	6.103	01	Bed room	100	80	66	53	14	19			180	11%	4.00	3.00	3.80	2.80	1.85	1.00	
6.18	6	6.104	01	Bed room	100	80	55	53	25	23			180	12%	4.00	3.00	3.80	2.80	1.97	1.00	
6.19	6	6.104	01	Living - Kitchen	37	6	53	53	90	26			180	25%	3.50	3.35	6.70	2.80	2.43	2.00	
6.20	6	6.004	01	Living - Kitchen	48	80	13	59	119	9			180	25%	6.25	6.90	4.00	2.80	3.69	2.00	
6.21	6	6.105	01	Living - Kitchen	60	7	48	20	32	41	40	75	180	25%	3.50	3.35	6.70	2.80	2.36	2.00	
6.22	6	6.105	01	Bed room	100	80	24	7	56	20			180	17%	4.00	3.00	3.80	2.80	2.89	1.00	
6.23	6	6.005	01	Bed room	87	80	93	9					180	20%	2.10	2.00	4.10	2.80	2.18	1.00	
6.24	6	6.006	01	Bed room	66	8	61	40	53	4			180	30%	2.10	2.00	4.10	2.80	3.38	1.00	
6.25	6	6.106	01	Living - Kitchen	15	60	41	9	60	42	64	4	180	28%	3.75	4.50	6.60	2.80	2.44	2.00	
6.26	6	6.106	01	Bed room	59	80	60	40	61	5			180	21%	2.63	2.80	4.00	2.80	2.41	1.00	
6.27	6	6.106	01	Bed room	59	80	81	40	40	5			180	19%	4.00	2.80	3.30	2.80	3.85	1.00	
6.28	6	6.107	01	Bed room	43	8	52	40	85	5			180	31%	2.63	2.80	4.40	2.80	3.42	1.00	
6.29	6	6.107	01	Bed room	43	8	48	40	89	5			180	31%	2.63	2.70	4.40	2.80	3.53	1.00	
6.30	6	6.107	01	Living - Kitchen	40	8	62	38	78	5			180	31%	5.00	8.60	4.50	2.80	2.87	2.00	
6.31	6	6.204	02	Bed room	36	80	122	8	22	34			180	27%	3.20	3.00	3.80	2.80	3.86	1.00	
6.32	6	6.204	02	Living - Kitchen	11	65	120	8	49	30			180	30%	3.75	4.20	7.50	2.80	2.49	2.00	
6.33	6	6.205	02	Bed room	67	4	75	56	11	32	27	7	180	26%	4.00	3.10	3.80	2.80	4.57	1.00	
6.34	6	6.211	02	Living - Kitchen	84	80	35	5	29	5	32	48	180	18%	5.00	3.50	8.00	2.80	2.06	2.00	
6.35	6	6.211	02	Bed room	39	8	67	48	74	5			180	29%	2.63	2.70	5.00	2.80	2.92	1.00	
6.36	6	6.212	02	Bed room	60	75	44	7	76	48			180	18%	4.00	2.80	5.00	2.80	2.75	1.00	
6.37	6	6.212	02	Bed room	60	75	32	7	62	48	26	6	180	20%	4.00	2.50	3.80	2.80	3.88	1.00	
6.38	6	6.212	02	Living - Kitchen	82	6	62	48	36	5			180	29%	3.75	4.20	7.50	2.80	2.39	2.00	
6.39	6	6.213	02	Living - Kitchen	95	6	33	40	13	28	39	70	180	26%	3.50	3.35	6.70	2.80	2.50	2.00	
6.40	6	6.213	02	Bed room	100	80	44	28	36	6			180	16%	4.00	3.00	3.80	2.80	2.82	1.00	

Table 5.6: apartment block 6 calculation results



5.9 Daylight reception in buildings within the new development overall conclusion

The BRE report recommends as a methodology for assessing sufficient daylight reception in a habitable room, that the calculated average daylight factor (ADF) of a habitable room to be in excess of the BRE bench marks of a kitchen at 2%, a living room at 1.5%, a bedroom at 1%, a living/kitchen/dining room at 2% and a living room/bedroom at 1.5%. Calculation findings are as follows; (see images throughout chapter 5 for receptor locations):

The assessment has been segregated according to individual block, these are;

- Residential Apartment Block 1
- Residential Apartment Block 2
- Residential Apartment Block 3
- Residential Apartment Block 4
- Residential Apartment Block 5
- Residential Apartment Block 6

Residential Apartment Block 1: From the calculation results in table 5.1 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 2: From the calculation results in table 5.2 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 3: From the calculation results in table 5.3 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 4: From the calculation results in table 5.4 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 5: From the calculation results in table 5.5 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines or are equal to minimum recommendations.
- All floors above the first floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Residential Apartment Block 6: From the calculation results in table 5.6 we note;

- Level 00: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- Level 01: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.

- Level 02: All selected habitable rooms have achieved an ADF in excess of the recommended guidelines.
- All floors above the second floor apartments are further deemed compliant as they naturally would have an improved vertical daylight impact angle thus increasing the daylight reception factor typically 0.3%-0.5% per floor level.

Given the results and conclusions above, DKP deem the residential project at Belcamp to be in line with the recommendations in the BRE design guidelines 'site layout and planning for daylight and sunlight - a guide to good practice' and therefore in compliance with the BRE design guide.



5025

Effect on Daylight Reception Analysis Report

EFFECT ON DAYLIGHT RECEPTION IN EXISTING NEIGHBOURING BUILDINGS

Belcamp SHD

Proposed Residential Development

Belcamp,
Malahide Road,
Dublin 17

Gerard Gannon Properties

DKP-L00-5025-1P
2022-05-04

Document control

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Draft
 G General/Information
 P Planning
 S Scheme/concept
 D Design
 T Tender
 C Construction
 A As-build/constructed

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1 Introduction

1.1 Report purpose

This report gives information on the level of achieved daylight reception in habitable rooms in existing neighbouring buildings before and after the introduction of the new development.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Belcamp, Malahide Road, Dublin 17.

1.3 Development description

A 10-year planning permission is sought by Gerard Gannon Properties for a proposed Strategic Housing Development on lands at Belcamp Hall (protected structure), Malahide Road, the R139 road and Carr's Lane, Belcamp, Dublin 17. The proposed development will consist of the construction of 2,527 no. residential units comprising houses, apartments and duplex units, 2 no. childcare facilities; 1 no. sports changing facilities building; 3 no. cafés/restaurants; 18 no. retail/commercial units; and all associated engineering and site works necessary to facilitate the development.

1.4 Statutory requirement

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document "Site layout planning for daylight and sun light". The aforementioned documents do refer to a "right to a sky view" relating to existing buildings facing a new adjacent development in so far that it compares an existing sky view with the sky view when the new development is constructed. The difference, if any, must be within a certain acceptable threshold.

2 Executive summary

2.1 Analysis conducted

This report details the achieved calculated daylight reception in selected rooms in neighbouring buildings before and after the introduction of the new proposed development and compares these for compliance with the recommendations of the relevant guidelines and standards.

2.2 Daylight reception and building orientation

Day light reception under the BRE, CIBSE and BS 8206 is calculated using the room area of the glazed element, the room depth/height ratio, the room light reflection capability and the amount of direct or blocked/partially blocked daylight it receives. i.e. building orientation is not relevant to day light reception or daylight reception calculations. In other words day light factor analysis is equal to all orientations. This note is for clarity as day light is often confused with sunlight or sunlight energy which is effected by orientation.

2.3 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following:

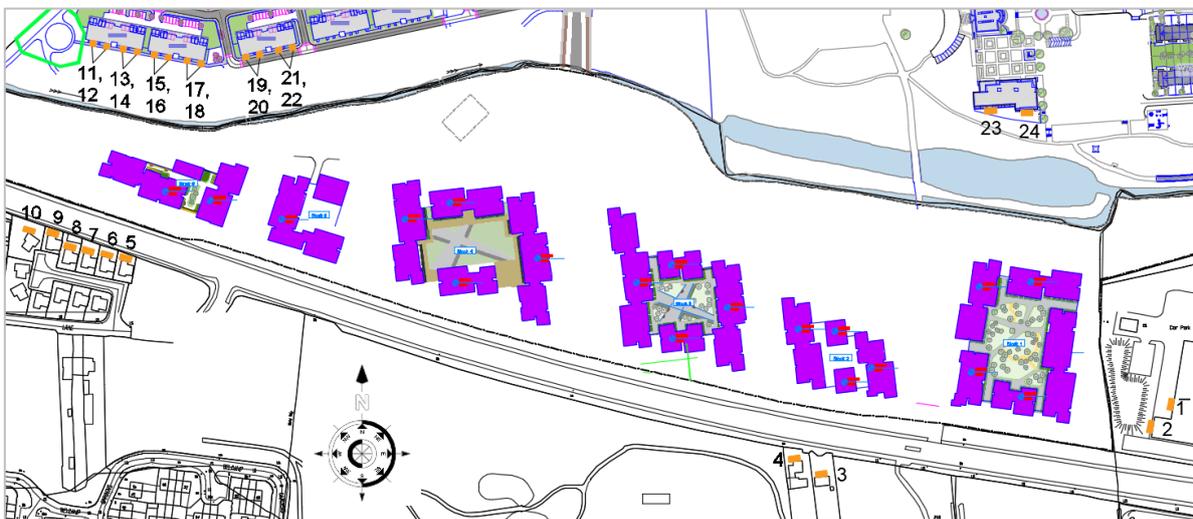
- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- European/British Standard EN17037/BS EN17037 Lighting for buildings code of practice for day lighting. EN17037/BS EN17037 contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.4 Technical analysis

Initially the daylight reception is assessed using the vertical sky component factor and where this is marginally in excess of the maximum allowable change under the BRE recommendations the daylight reception is calculated using the more in-depth daylight factor calculation analysis. The calculated daylight factor is then compared with the BRE recommended room daylight factor to ensure sufficient daylight reception. In basic terms the change in sky views/day light reception between the original and current proposed should not be more than 0.8 its previous value unless other measures (increased glazed areas) have been taken to maintain sufficient day light reception.

2.5 Daylight reception in neighbouring habitable rooms/buildings conclusion

The BRE recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. However, the calculated change in daylight reception in all of the analysed neighbouring receptors resulted in a change factor ranging from 0.82 to 0.94 . Summarized result findings are as follows (see image 5.1 for receptor locations):



(For reference) Image 5.1 Neighbouring receptors

- East receptors: BRE guidelines consider VSC calculations for habitable rooms only. Although not strictly habitable we have treated receptors 1 and 2 (Bewley's Tea and Coffee Head Office) as such. These receptors are both well within the guidelines with a change factor of 0.94.
- South receptors: Receptors 3 and 4 are residential houses located along the R139 with ground floor windows/rooms. These dwellings were examined and resulted in a change factor of 0.85. These receptors are within the recommended guidelines. Receptors 5 to 10 are residential houses located in the Northern CI, Belcamp, estate. These dwellings were examined and resulted in a change factor range of 0.82-0.93. These receptors are well within the recommended guidelines.
- North receptors: Receptors 11 to 24 are residential units part of the Belcamp development (Duplex 1.1, 1.2, 1.3 and Apartment block 6) with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.89-0.94. These receptors are comfortably within the recommended guidelines.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms are all within the constraints and recommendations of the BRE Report – "Site Layout and Planning for Daylight and Sunlight and we therefore deem the development to be compliant with this element.

2.6 Mitigation measures/actions

No mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google arial) site map below indicates the location of the site, approximately outlined.



Image 3.1 Google maps arial view - proposed development site boundary

4 Approach and methodology

4.1 General approach

This report covers the day light reception in habitable rooms in existing neighbouring buildings. The day light reception is applied as the vertical sky component (angle) but where found to be marginally in excess of the maximum allowable change a second more in depth analysis in the form of an average day light factor calculation is conducted to ensure sufficient levels of daylight is being received.

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still comes in through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight and direct sun received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings and late evenings during the summer months. It is therefore important to ensure that new buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations: The government does not have an adopted policy on daylight, sunlight and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- European / British standard EN17037 / BS EN17037 Lighting for buildings: Code of practice for day lighting. EN17037/BS EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings.
CIBSE lighting guide 10, like BS EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – "Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice"

The BRE report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values, these should be interpreted with flexibility since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts. As well as advice the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. The table below summarises the criteria used to assess the daylight reception in properties.

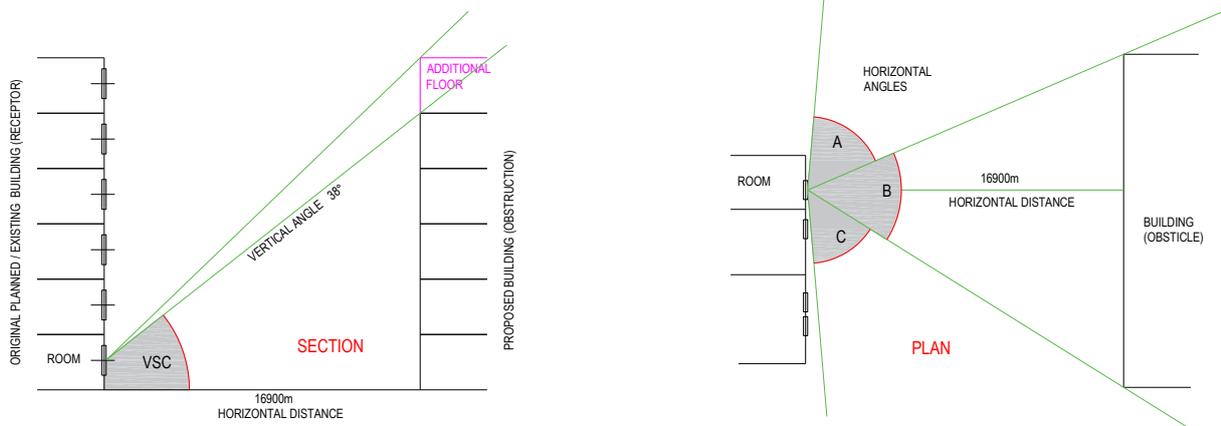
4.5 Day light reception analysis, Sky view component

The day light assessment is the effects the proposed development has on adjoining existing buildings. The assessment of daylight is required for windows serving rooms in adjoining dwellings where daylight is required including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be assessed.

The guidelines also apply to any room that may have a reasonable expectation of daylight, including schools, hospitals, hotels and some offices. When assessing daylight, the numerical criteria must be viewed with flexibility and should be considered against other site layout constraints. In addition, it is important to consider whether the existing building is itself a good neighbour, standing a reasonable distance from the boundary and not taking more than its fair share of light.

The assessment takes on several specific stages:

- The distance test: loss of light to windows need not be analysed if the distance from the existing window to the development is three or more times its height above the centre of the existing window;
- The 25° rule: loss of light to windows need not be analysed if the angle to the horizontal subtended by the new development from the centre of the existing window is less than 25° (an angle of 25° equates to a VSC of 27%).
- Daylight assessment: diffuse daylight of an existing building may be adversely affected by a proposed development if either: the vertical sky component measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value; or the area of the working plane which can receive direct skylight is reduced to less than 0.8 times its former value.



4.6 Criteria for daylight reception effects on neighbouring receptors

Table 4.1 details the BRE assessment criteria for daylight reception.

Analysis	Description	Acceptable parameters
Daylight reception criterion	Existing daylight incoming angle	Existing angles should not be effected more then 0.8 time its former value or a maximum loss of 20%.

Table 4.1

If the vertical sky component angles are beyond the maximum allowable change factor a further analysis can be conducted to establish the effects on daylight reception more accurately. The average day light factor can be applied to calculate the amount of day light received before and after the introduction of the new proposed development however this requires more accurate data on the room effected by the relevant window/receptor.

5 Receptor selection and calculation results

5.1 Basis of receptor (room/window) selection

The VSC assessment has been targeted to neighbouring windows/rooms/dwellings that are perceived to be in challenging locations i.e. basement rooms, ground floor rooms and dwellings/rooms in the near vicinity of the new proposed development on the basis that if these rooms pass the minimum requirements all rooms at higher levels will definitely pass the minimum recommendations as a result of the improving vertical sky view angle. Selected neighbouring buildings are listed below and also shown in image 5.1.

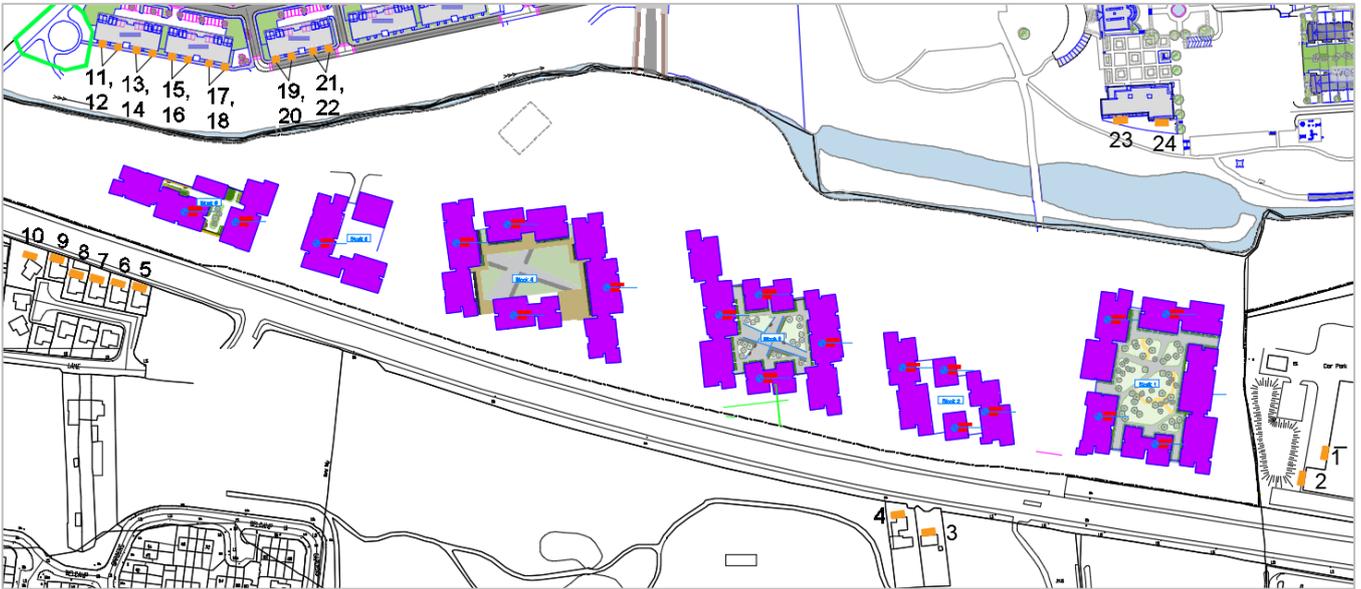


Image 5.1: Selected neighbouring receptors

Receptor/window	Address	Description	Level description
1, 2,	Bewley's Tea and Coffee Head Office. Malahide Rd, Northern Cross, Dublin	Office/commercial	GF living space
3	Belcamp Ln, Priorswood, Dublin 17	Residential	GF living space
4	Belcamp Ln, Priorswood, Dublin 17	Residential	GF living space
5,6,7,8,9,10	House no. 12, 11, 10, 9, 8 & 7 Northern Cl, Belcamp, Dublin	Residential	GF living space
11,12,13,14	Duplex 1.1, Belcamp, Dublin	Residential	GF living space
15,16,17,18	Duplex 1.2, Belcamp, Dublin	Residential	GF living space
19,20,21,22	Duplex 1.3, Belcamp, Dublin	Residential	GF living space
23,24	Apartment Block 6, Belcamp, Dublin	Residential	GF living space

Table 5.3: List of receptors selected for analysis

5.2 Distance test

We would normally execute a distance test to any selected rooms to determine if any further calculations are required to establish the effects on sky views however despite the fact that in a number of the circumstances the distance test alone would have sufficed, we have executed full VSC calculations for all selected neighbouring buildings habitable rooms.

5.3 Vertical sky component (VSC)

The VSC has been calculated for potentially affected windows within the neighbouring /adjacent properties. When undertaking a daylight assessment, the BRE Report recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.8. The tables below provide the full calculation results of selected neighbouring locations including the overall calculated vertical sky component before and after the introduction of the new development. The VSC calculation results have been given the following colour code guide depending on its level of resulting compliance.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
X	10% In excess of

5.4 Calculation results

DAYLIGHT RECEPTION ANALYSIS																		
1	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	66 m																	
Target distance	65m																	
window	GF-living	73	4	70	3	37	3	180	36%	73	3	70	19	37	3	180	34%	0.94
2																		
2	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	66 m																	
Target distance	65m																	
window	GF-living	83	4	68	3	29	3	180	36%	83	3	68	21	29	3	180	34%	0.94
3																		
3	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	76 m																	
Target distance	67m																	
window	GF-living	68	4	112	3			180	36%	68	27	69	17	43	3	180	30%	0.85
4																		
4	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	76 m																	
Target distance	67m																	
window	GF-living	65	4	115	3			180	36%	65	27	76	17	39	3	180	30%	0.85
5																		
5	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	76 m																	
Target distance	50m																	
window	GF-living	94	4	86	3			180	36%	94	31	34	14	52	3	180	29%	0.82
6																		
6	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	76 m																	
Target distance	55m																	
window	GF-living	85	4	95	3			180	36%	85	31	31	14	64	3	180	30%	0.83
7																		
7	EXISTING							NEW							change			
	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor°	Ver°		Σ	VSC	
VSC test distance	76 m																	
Target distance	65m																	
window	GF-living	75	4	105	3			180	36%	75	31	27	14	78	3	180	31%	0.86



8	EXISTING								NEW								change	
	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC	Section 1	Section 2	Section 3	Section 4	Hor ^o	Ver ^o	Σ	VSC		
VSC test distance 76 m																		
Target distance 70m	Hor ^o	Ver ^o																
window GF-living	63	4	117	3			180	36%	63	31	25	13	92	3		180	31%	0.88
9	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 75m	Hor ^o	Ver ^o																
window GF-living	53	4	127	3			180	36%	53	31	20	13	107			180	33%	0.93
10	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 80m	Hor ^o	Ver ^o																
window GF-living	42	3	138	3			180	36%	42	31	20	13	118	3		180	33%	0.92
11	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 99m	Hor ^o	Ver ^o																
window GF-living	100	4	80	3			180	36%	100	4	50	18	30	14		180	34%	0.94
12	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 97m	Hor ^o	Ver ^o																
window GF-living	94	4	86	3			180	36%	94	4	54	18	32	14		180	34%	0.94
13	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 95m	Hor ^o	Ver ^o																
window GF-living	87	4	93	3			180	36%	87	4	58	18	35	14		180	33%	0.93
14	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 87m	Hor ^o	Ver ^o																
window GF-living	80	4	100	3			180	36%	80	4	63	19	37	14		180	33%	0.91
15	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 85m	Hor ^o	Ver ^o																
window GF-living	73	4	107	3			180	36%	73	4	65	19	42	14		180	33%	0.91
16	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 85m	Hor ^o	Ver ^o																
window GF-living	65	4	115	3			180	36%	65	4	70	19	45	14		180	32%	0.90
17	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 85m	Hor ^o	Ver ^o																
window GF-living	56	4	124	3			180	36%	56	4	72	19	52	14		180	32%	0.90
18	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 85m	Hor ^o	Ver ^o																
window GF-living	51	4	129	3			180	36%	51	4	72	19	57	15		180	32%	0.89
19	EXISTING								NEW								change	
VSC test distance 76 m																		
Target distance 80m	Hor ^o	Ver ^o																
window GF-living	78	4	102	3			180	36%	96	19	35	14	49	3		180	32%	0.89

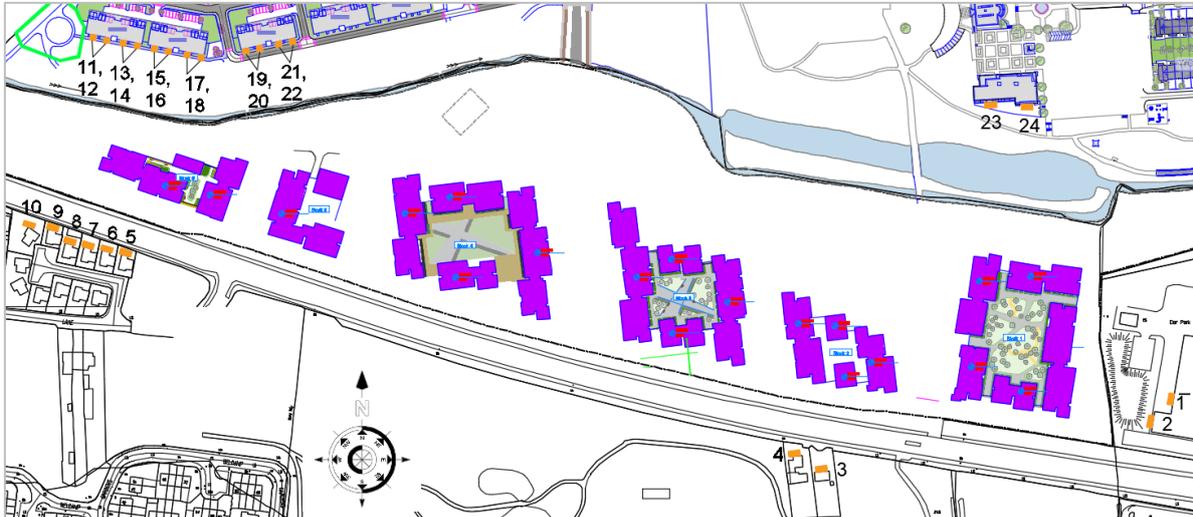


	EXISTING								NEW								change				
	Section 1		Section 2		Section 3		Section 4		Σ Hor	Σ VSC	Section 1		Section 2		Section 3			Section 4		Σ Hor	Σ VSC
	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°	Hor°	Ver°			Hor°	Ver°	Hor°	Ver°	Hor°	Ver°		Hor°	Ver°		
20																					
VSC test distance	76 m																				
Target distance	80m																				
window GF-living	79	4	101	3					180	36%	93	19	40	14	47	3			180	32%	0.89
21																					
VSC test distance	76 m																				
Target distance	80m																				
window GF-living	65	4	115	3					180	36%	105	19	33	14	42	3			180	32%	0.89
22																					
VSC test distance	76 m																				
Target distance	80m																				
window GF-living	62	4	118	3					180	36%	111	19	24	14	45	3			180	32%	0.89
23																					
VSC test distance	85 m																				
Target distance	110m																				
window GF-living	60	4	120	3					180	36%	60	4	77	17	43	13			180	33%	0.91
24																					
VSC test distance	85 m																				
Target distance	110m																				
window GF-living	71	4	109	3					180	36%	71	4	71	17	38	13			180	33%	0.91



5.5 Daylight reception in neighbouring habitable rooms conclusion

The BRE recommends that the effects of a new development on daylight reception should not affect any existing VSC by more than 20% or have a maximum change factor in excess of 0.80. From the calculation results we note all selected neighbouring habitable receptors are affected to some degree with regards to daylight reception due to the introduction of the proposed development in their respective habitable rooms facing the proposed development. However, the calculated change in daylight reception in all of the analysed neighbouring receptors resulted in a change factor ranging from 0.82 to 0.94. Summarized result findings are as follows (see image 5.1 for receptor locations):



(For reference) Image 5.1 Neighbouring receptors

- East receptors: BRE guidelines consider VSC calculations for habitable rooms only. Although not strictly habitable we have treated receptors 1 and 2 (Bewley's Tea and Coffee Head Office) as such. These receptors are both well within the guidelines with a change factor of 0.94.
- South receptors: Receptors 3 and 4 are residential houses located along the R139 with ground floor windows/rooms. These dwellings were examined and resulted in a change factor of 0.85. These receptors are within the recommended guidelines. Receptors 5 to 10 are residential houses located in the Northern Cl, Belcamp, estate. These dwellings were examined and resulted in a change factor range of 0.82-0.93. These receptors are well within the recommended guidelines.
- North receptors: Receptors 11 to 24 are residential units part of the Belcamp development (Duplex 1.1, 1.2, 1.3 and Apartment block 6) with ground floor windows/rooms. These dwellings were examined and resulted in a change factor range of 0.89-0.94. These receptors are comfortably within the recommended guidelines.

We conclude that the new proposed development's effect on daylight reception in the neighbouring rooms are all within the constraints and recommendations of the BRE Report – "Site Layout and Planning for Daylight and Sunlight and we therefore deem the development to be compliant with this element.



5060

Sunlight Reception Analysis Report

SUNLIGHT RECEPTION IN AMENITY SPACES WITHIN THE PROPOSED DEVELOPMENT

Belcamp SHD

Proposed Residential Development

**Belcamp,
Malahide Road,
Dublin 17**

Gerard Gannon Properties

DKP-L00-5060-1P
2022-05-04

Document control

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Clients	Gerard Gannon Properties	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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Planning consultants	Downey Planning	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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Sketch/draft
 P Planning
 C Concept
 D Design
 G General information
 T Tender
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 Z As-build/constructed

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3 Geographical project overview	6
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5 Receptor selection and calculation results (amenity spaces within development)	9

Appendix

A 5070 One hourly overall site shadow – sunlight status illustrations	Attached
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1 Introduction

1.1 Report purpose

This report gives information on the level of achieved sunlight reception in amenity spaces within the proposed new development.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Belcamp, Malahide Road, Dublin 17.

1.3 Development description

A 10-year planning permission is sought by Gerard Gannon Properties for a proposed Strategic Housing Development on lands at Belcamp Hall (protected structure), Malahide Road, the R139 road and Carr's Lane, Belcamp, Dublin 17. The proposed development will consist of the construction of 2,527 no. residential units comprising houses, apartments and duplex units, 2 no. childcare facilities; 1 no. sports changing facilities building; 3 no. cafés/restaurants; 18 no. retail/commercial units; and all associated engineering and site works necessary to facilitate the development.

1.4 Statutory requirement

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document "Site layout planning for daylight and sun light". The aforementioned documents do refer to a "right to a sky view" relating to existing buildings facing a new adjacent development in so far that it compares an existing sky view with the sky view when the new development is constructed. The difference, if any, must be within a certain acceptable threshold.

2 Executive summary

2.1 Analysis conducted

This report details the sunlight/shadow status of new amenity spaces within the proposed development and examines if the results are within the limits of the recommendations of the relevant guidelines and standards.

2.2 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following;

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- British European Standard BS EN17037/EN17037 Day lighting standards and contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.3 Technical analysis

Calculations were conducted in accordance with the BRE guidelines to determine the extent of achieved sunlight in amenity spaces within the new proposed development. For new amenity spaces, in basic terms, the minimum criteria is that at least 50% of the total amenity spaces should receive at least two hours of sunlight on the 21st March.

2.4 Amenity spaces within the proposed development sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March. From the calculation results we note the vast majority of the new amenity spaces received more than the recommended sunlight. Calculation findings are summarised as follows (see image 5.1 for amenity locations):

Primary – Class 1 - Parkland/Habitat area

Amenity area outlined in A.1 was calculated to have 09.00 hours at 50% area.

Primary – Class 1 – Urban Plaza/Pocket Parks

Amenity area outlined in A.2 was calculated to have 04.00 hours at 50% area.

Secondary – Class 2 – Street Frontage

Amenity area outlined in B.1 was calculated to have 08.00 hours at 50% area.

Tertiary – Class 3 – Communal courtyard

Amenity area outlined in C.1 was calculated to have 03.00 hours at 50% area.

Amenity area outlined in C.2 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.3 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.4 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.5 was calculated to have 01.50 hours at 50% area.

Amenity area outlined in C.6 was calculated to have 02.00 hours at 50% area.

We conclude that the new amenity spaces outlined in Class 1 and Class 2 areas will receive well in excess of the sunlight recommendations of the BRE Report Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element. Class 3 amenity area C.1,2,3,4 and 6 will receive at least two hours of sunlight at 50% area, these are also in line with BRE recommendations. Amenity area C.5 was calculated to have 01.50 hours at 50% area. This receptor falls shy of the BRE recommendation, however, in context of the overall development, it is listed as Class 3 where it is envisioned many of the future occupants would be spending outdoor time more so in Class1 or Class 2 amenity areas.

2.5 Mitigation measures / actions

No mitigation measures deemed necessary.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google arial) site map below indicates the location of the site, approximately outlined.



Image 3.1 Google maps arial view - proposed development site boundary

4 Approach and methodology

4.1 General approach

This report covers the level of achieved sunlight reception in amenity space of the new proposed development.

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still shines through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight and direct sun received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings, and late evenings during the summer months. It is therefore important to ensure that buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations.

The government does not have an adopted policy on daylight, sunlight, and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report). Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- British European Standard BS EN17037/EN17037 Day Lighting for buildings. BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings. CIBSE lighting guide 10 like BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – "Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice"

The BRE report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values, these should be interpreted with flexibility since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts.

As well as advice, the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. The table below summarises the criteria used to assess the overshadowing/sunlight reception in amenity spaces.

4.5 Criterion for sunlight / shadow analysis

Acceptable criterion for sunlight reception / shadow forming are as follows:

Analysis	Criteria on March 21 st	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 50% of the total area to receive at least 2 hours sunshine

Table 4.1

4.6 Sunlight reception / Overshadowing effects measured

The minimum sunlight requirement in this report measured in sunlight time 2 hours (120 minutes) multiplied by 50% area m² or the minimum requirement = 120 (min) * 0.5a (m²) = [] min·m².

The overshadowing/sun light assessment is executed in using a 3D model of the project with the results illustrated in tabular format showing the hourly status of the shadow/sunlight fraction in the relevant amenity spaces. The impacts of vegetation: It is important to note that according to the BRE Report, calculations do not normally take into account vegetation. The exception is when evergreen vegetation exists that forms a continuous barrier and would be permanent throughout the seasons.

5 Receptor selection and Calculation results - Amenity spaces within the proposed development

5.1 Amenity spaces within the proposed development

Image 5.1 below indicates the amenity areas that have been selected and analysed on the basis that the shadow casted from the proposed development may effect the amenity areas given its geographical location in relation to the development.



Image 5.1: Overall proposed site plan – amenity spaces (DCC)

Receptor	Description	Area m ²
A.1	A. Primary – Class 1 - Parkland/Habitat area	58,887
A.2	A. Primary – Class 1 – Urban Plaza/Pocket Parks	16,983
B.1	B. Secondary – Class 2 – Street Frontage	12,046
C.1	Tertiary – Class 3 – Communal (block 1 courtyard)	3,233
C.2	Tertiary – Class 3 – Communal (block 2 courtyard)	515
C.3	Tertiary – Class 3 – Communal (block 3 courtyard)	1,722
C.4	Tertiary – Class 3 – Communal (block 4 courtyard)	2,198
C.5	Tertiary – Class 3 – Communal (block 5 courtyard)	413
C.6	Tertiary – Class 3 – Communal (block 6 courtyard)	399
	Total – Class 3	8,480

Table 5.1: New proposed amenity spaces

5.2 Assessment approach

The tables below represent the one hourly sunlight/shadow status of the respective new amenity spaces provided within the new development on March 21st. To compare against the BRE guidelines, the calculation results have been given the following colour code guide depending on its level of resulting compliance. See appendix A for the modelled shadow/sunlight imaging per hour on March 21st.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

5.3 Proposed development amenity space calculation results

SUNLIGHT/SHADOW CALCULATION DATA

A.1	A. Primary – Class 1 - Parkland/Habitat	58,887	m ²		
NEW STATUS March 21st					
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m ²	min*m ²
6.00	100%	0%	60	0	0
7.00	71%	29%	60	17077	1,024,634
8.00	59%	41%	60	24144	1,448,620
9.00	48%	52%	60	30621	1,837,274
10.00	39%	61%	60	35921	2,155,264
11.00	32%	68%	60	40043	2,402,590
12.00	32%	68%	60	40043	2,402,590
13.00	24%	76%	60	44754	2,685,247
14.00	24%	76%	60	44754	2,685,247
15.00	27%	73%	60	42988	2,579,251
16.00	31%	69%	60	40632	2,437,922
17.00	43%	57%	60	33566	2,013,935
18.00	77%	23%	60	13544	812,641
19.00	100%	0%	60	0	0
Required sun hours @ 50% area			2		
Achieved sun hours on @ 50% area			9.00		
Achieved total sun time (hrs)			6.93		
Achieved daily sun time * area			24485215		

A.2	A. Primary – Class 1 – Urban Plaza/Poc	16,983	m ²		
NEW STATUS March 21st					
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m ²	min*m ²
6.00	100%	0%	60	0	0
7.00	88%	12%	60	2038	122,278
8.00	84%	16%	60	2717	163,037
9.00	86%	14%	60	2378	142,657
10.00	70%	30%	60	5095	305,694
11.00	59%	41%	60	6963	417,782
12.00	23%	77%	60	13077	784,615
13.00	19%	81%	60	13756	825,374
14.00	26%	74%	60	12567	754,045
15.00	48%	52%	60	8831	529,870
16.00	64%	36%	60	6114	366,833
17.00	77%	23%	60	3906	234,365
18.00	89%	11%	60	1868	112,088
19.00	100%	0%	60	0	0
Required sun hours @ 50% area			2		
Achieved sun hours on @ 50% area			4.00		
Achieved total sun time (hrs)			4.67		
Achieved daily sun time * area			4758637		

B.1	B. Secondary – Class 2 – Street Fronta	12,046	m ²		
NEW STATUS March 21st					
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m ²	min*m ²
6.00	100%	0%	60	0	0
7.00	89%	11%	60	1325	79,504
8.00	65%	35%	60	4216	252,966
9.00	41%	59%	60	7107	426,428
10.00	39%	61%	60	7348	440,884
11.00	40%	60%	60	7228	433,656
12.00	41%	59%	60	7107	426,428
13.00	43%	57%	60	6866	411,973
14.00	44%	56%	60	6746	404,746
15.00	47%	53%	60	6384	383,063
16.00	47%	53%	60	6384	383,063
17.00	66%	34%	60	4096	245,738
18.00	85%	15%	60	1807	108,414
19.00	100%	0%	60	0	0
Required sun hours @ 50% area			2		
Achieved sun hours on @ 50% area			8.00		
Achieved total sun time (hrs)			5.53		
Achieved daily sun time * area			3996863		

C.1	Tertiary – Class 3 – Communal (block 1	3,233	m ²		
NEW STATUS March 21st					
Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %	% / %	min	m ²	min*m ²
6.00	100%	0%	60	0	0
7.00	85%	15%	60	485	29,097
8.00	85%	15%	60	485	29,097
9.00	81%	19%	60	614	36,856
10.00	68%	32%	60	1035	62,074
11.00	53%	47%	60	1520	91,171
12.00	31%	69%	60	2231	133,846
13.00	27%	73%	60	2360	141,605
14.00	44%	56%	60	1810	108,629
15.00	70%	30%	60	970	58,194
16.00	84%	16%	60	517	31,037
17.00	90%	10%	60	323	19,398
18.00	90%	10%	60	323	19,398
19.00	100%	0%	60	0	0
Required sun hours @ 50% area			2		
Achieved sun hours on @ 50% area			3.00		
Achieved total sun time (hrs)			3.92		
Achieved daily sun time * area			760402		



C.2 Tertiary – Class 3 – Communal (block 2) **515** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	86%	14%	60	72	4,326
8.00	86%	14%	60	72	4,326
9.00	86%	14%	60	72	4,326
10.00	81%	19%	60	98	5,871
11.00	65%	35%	60	180	10,815
12.00	23%	77%	60	397	23,793
13.00	41%	59%	60	304	18,231
14.00	57%	43%	60	221	13,287
15.00	84%	16%	60	82	4,944
16.00	87%	13%	60	67	4,017
17.00	90%	10%	60	52	3,090
18.00	90%	10%	60	52	3,090
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
 Achieved sun hours on @ 50% area **2.00**
 Achieved total sun time (hrs) 3.24
 Achieved daily sun time * area 100116

C.3 Tertiary – Class 3 – Communal (block 3) **1,722** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	85%	15%	60	258	15,498
8.00	85%	15%	60	258	15,498
9.00	82%	18%	60	310	18,598
10.00	77%	23%	60	396	23,764
11.00	59%	41%	60	706	42,361
12.00	45%	55%	60	947	56,826
13.00	45%	55%	60	947	56,826
14.00	71%	29%	60	499	29,963
15.00	82%	18%	60	310	18,598
16.00	90%	10%	60	172	10,332
17.00	90%	10%	60	172	10,332
18.00	90%	10%	60	172	10,332
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
 Achieved sun hours on @ 50% area **2.00**
 Achieved total sun time (hrs) 2.99
 Achieved daily sun time * area 308927

C.4 Tertiary – Class 3 – Communal (block 4) **2,198** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	85%	15%	60	330	19,782
8.00	85%	15%	60	330	19,782
9.00	79%	21%	60	462	27,695
10.00	73%	27%	60	593	35,608
11.00	67%	33%	60	725	43,520
12.00	47%	53%	60	1165	69,896
13.00	46%	54%	60	1187	71,215
14.00	68%	32%	60	703	42,202
15.00	70%	30%	60	659	39,564
16.00	82%	18%	60	396	23,738
17.00	90%	10%	60	220	13,188
18.00	90%	10%	60	220	13,188
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
 Achieved sun hours on @ 50% area **2.00**
 Achieved total sun time (hrs) 3.18
 Achieved daily sun time * area 419378

C.5 Tertiary – Class 3 – Communal (block 5) **413** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	85%	15%	60	62	3,717
8.00	85%	15%	60	62	3,717
9.00	80%	20%	60	83	4,956
10.00	26%	74%	60	306	18,337
11.00	64%	36%	60	149	8,921
12.00	80%	20%	60	83	4,956
13.00	85%	15%	60	62	3,717
14.00	85%	15%	60	62	3,717
15.00	85%	15%	60	62	3,717
16.00	85%	15%	60	62	3,717
17.00	85%	15%	60	62	3,717
18.00	90%	10%	60	41	2,478
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
 Achieved sun hours on @ 50% area **1.50**
 Achieved total sun time (hrs) 2.65
 Achieved daily sun time * area 65667

C.6 Tertiary – Class 3 – Communal (block 6) **399** m2

NEW STATUS March 21st

Time	Shadow	Sunlight	Sun time	Sun area	Sun time.area
24 Hr	% / %		min	m2	min*m2
6.00	100%	0%	60	0	0
7.00	85%	15%	60	60	3,591
8.00	85%	15%	60	60	3,591
9.00	85%	15%	60	60	3,591
10.00	85%	15%	60	60	3,591
11.00	85%	15%	60	60	3,591
12.00	71%	29%	60	116	6,943
13.00	39%	61%	60	243	14,603
14.00	38%	62%	60	247	14,843
15.00	51%	49%	60	196	11,731
16.00	74%	26%	60	104	6,224
17.00	90%	10%	60	40	2,394
18.00	90%	10%	60	40	2,394
19.00	100%	0%	60	0	0

Required sun hours @ 50% area 2
 Achieved sun hours on @ 50% area **2.00**
 Achieved total sun time (hrs) 3.22
 Achieved daily sun time * area 77087



5.4 Amenity spaces within the proposed development sunlight results conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March. From the calculation results we note the vast majority of the new amenity spaces received more than the recommended sunlight. Calculation findings are summarised as follows (see image 5.1 for amenity locations):

Primary – Class 1 - Parkland/Habitat area

Amenity area outlined in A.1 was calculated to have 09.00 hours at 50% area.

Primary – Class 1 – Urban Plaza/Pocket Parks

Amenity area outlined in A.2 was calculated to have 04.00 hours at 50% area.

Secondary – Class 2 – Street Frontage

Amenity area outlined in B.1 was calculated to have 08.00 hours at 50% area.

Tertiary – Class 3 – Communal courtyard

Amenity area outlined in C.1 was calculated to have 03.00 hours at 50% area.

Amenity area outlined in C.2 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.3 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.4 was calculated to have 02.00 hours at 50% area.

Amenity area outlined in C.5 was calculated to have 01.50 hours at 50% area.

Amenity area outlined in C.6 was calculated to have 02.00 hours at 50% area.

We conclude that the new amenity spaces outlined in Class 1 and Class 2 areas will receive well in excess of the sunlight recommendations of the BRE Report Site Layout and Planning for Daylight and Sunlight - and therefore deem these to be compliant to this element. Class 3 amenity area C.1,2,3,4 and 6 will receive at least two hours of sunlight at 50% area, these are also in line with BRE recommendations. Amenity area C.5 was calculated to have 01.50 hours at 50% area. This receptor falls shy of the BRE recommendation, however, in context of the overall development, it is listed as Class 3 where it is envisioned many of the future occupants would be spending outdoor time more so in Class1 or Class 2 amenity areas.



5065

Effect on Sunlight Reception Analysis Report

EFFECT on SUNLIGHT RECEPTION IN NEIGHBOURING AMENITY SPACES

Belcamp SHD

**Belcamp,
Malahide Road,
Dublin 17**

Gerard Gannon Properties

DKP-L00-5065-1P
2022-05-04

Document control

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Appendix

A 5070 One hourly overall site shadow – sunlight status illustrations	Attached
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1 Introduction

1.1 Report purpose

This report gives information on the effects of the proposed development on sunlight reception in existing neighbouring amenity spaces.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Belcamp, Malahide Road, Dublin 17.

1.3 Development description

A 10-year planning permission is sought by Gerard Gannon Properties for a proposed Strategic Housing Development on lands at Belcamp Hall (protected structure), Malahide Road, the R139 road and Carr's Lane, Belcamp, Dublin 17. The proposed development will consist of the construction of 2,527 no. residential units comprising houses, apartments and duplex units, 2 no. childcare facilities; 1 no. sports changing facilities building; 3 no. cafés/restaurants; 18 no. retail/commercial units; and all associated engineering and site works necessary to facilitate the development.

1.4 Statutory requirement

There are no particular building regulations in relation day light/shadow effect standards other than recommendations outlined or referred to in the CIBSE lighting guide 10, BS EN17037/EN17037 and the BRE document "Site layout planning for daylight and sun light". The aforementioned documents do refer to a "right to a sky view" relating to existing buildings facing a new adjacent development in so far that it compares an existing sky view with the sky view when the new development is constructed. The difference, if any, must be within a certain acceptable threshold.

2 Executive summary

2.1 Analysis conducted

This report details the effects on the sunlight/shadow status of existing neighbouring amenity spaces as a result of the new proposed developments and examines if these effects are within the limits of the recommendations of the relevant guidelines and standards.

2.2 Guidelines and standards applied

For this report we applied the recommendations and guideline of the following;

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report).
- British European Standard BS EN17037/EN17037 Day lighting standards and contains guidance on the minimum recommended levels of interior day lighting.
- CIBSE guide 10 Day light and lighting for buildings.

2.3 Technical analysis

Calculations were conducted in accordance with the BRE guidelines to determine the extent to which the proposed development could affect the shadow/sun light reception in any existing neighbouring amenity spaces. For "existing" amenity spaces any loss of sunlight should not be greater than 0.8 times its former size on March 21st.

2.4 Neighbouring amenity spaces sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March and that any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that all of the selected existing amenity spaces received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Summary of results are as follows (see image 5.1 for receptor locations):



(For reference) Image 5.1: existing neighbouring amenity spaces

- North receptors: Receptor 1, 2 and 3 is part of the Belcamp development with open space amenity areas. Receptor 1 (part of Belcamp duplexes) resulted in change factor of 0.91 meaning the new proposed development has a small effect on the amenity space. This effect happens between the hours of 09.00-18.00. Receptor 2 (part of Belcamp hall) resulted in a change factor of 0.99 meaning the new proposed development has a very small effect. This effect happens in the late afternoon hours of 17.00-18.00. Receptor 3 (part of Belcamp hall) resulted in a change factor of 0.99 meaning the new proposed development has a very small effect. This effect happens in the late afternoon hours of 17.00-18.00. Receptor 1, 2 and 3 calculation findings are comfortably within BRE guidelines.
- East receptor: Receptors 4 and 5 is Bewley's Tea and Coffee Head Office with potential open space amenity areas. These receptors resulted in change factor of 0.92 and 0.89 meaning the new proposed development has a small effect on the amenity space. This effect happens in the late afternoon hours of 16.00-18.00. The calculation findings are well within BRE guidelines.

We conclude that the sunlight reception in the existing neighbouring amenity spaces after the introduction of the new development is in excess of the minimum recommendations of the BRE Report– “Site Layout and Planning for Daylight and Sunlight and therefore deem this to be compliant to this element.

2.5 Mitigation measures / actions

No mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google arial) site map below indicates the location of the site, approximately outlined.



Image 3.1 Google maps arial view - proposed development site boundary

4 Approach and methodology

4.1 General approach

This report covers the effects on achieved sunlight reception in existing neighbouring amenity spaces as a result of the new proposed development.

4.2 The nature and effects of day light and sun light

When assessing the effects of proposed building projects on the potential to cause issues relating to light, it is important to recognise the distinction between daylight and sunlight. Daylight is the combination of all direct and indirect sunlight during the daytime, whereas sunlight (for the purposes of this report) comprises only the direct elements of sunlight. For example, on a cloudy or overcast day diffused daylight still shines through windows, even when sunlight is absent. Any development within a built-up area has the potential to alter the amount of daylight and direct sun received by nearby residential properties.

Care should be taken when designing new buildings in built-up areas, especially when the proposed development is relatively tall or situated to the south of existing buildings, because in the northern hemisphere the majority of the sunlight comes from the south. In Ireland (and other northern hemisphere countries) south-facing facades will in general, receive the most sunlight, while the north facing facades will receive sunlight on only a handful of occasions, specifically early mornings, and late evenings during the summer months. It is therefore important to ensure that buildings to the south of any development do not cause over shadowing to existing dwellings and therefore reduce their capacity to receive sunlight.

4.3 Assessment criteria

National Policy/building regulations.

The government does not have an adopted policy on daylight, sunlight, and the effects of overshadowing, and does not have targets, criteria or relevant planning guidance in the way it has for other environmental impacts such as noise, landscape or air quality. However, there are a number of guidance documents which are relevant when considering daylight, sunlight and overshadowing in dwellings:

- The Building Research Establishment (BRE) report, "Site layout planning for daylight and sunlight – a guide to good practice (referred to as the BRE Report). Although not Government guidance, this report is commonly referenced as the main guide in Ireland/UK in determining the minimum standards of daylight and sunlight and for determining the impact of a development.
- British European Standard BS EN17037/EN17037 Day Lighting for buildings. BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces some of the calculation procedures used in the BRE Report.
- CIBSE guide 10 Day light and lighting for buildings. CIBSE lighting guide 10 like BS EN17037/EN17037 contains guidance on the minimum recommended levels of interior day lighting and introduces recommended day light levels for general buildings.

4.4 The BRE Report – "Site Layout and Planning for Daylight and Sunlight – A Guide to Good Practice"

The BRE report contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. The advice provided within the guide is not mandatory and should not be seen as an instrument of planning policy, its aim is to help rather than constrain the designer. Although it gives numerical guidance values, these should be interpreted with flexibility since natural lighting is one of many factors in site layout design. The guidance should be applied appropriately to developments to assist in gaining the best development possible without adverse impacts.

As well as advice, the report contains a methodology to assess levels of daylight, sunlight and over shadowing and contains criteria to determine the potential impacts of a new development on surrounding buildings. The table below summarises the criteria used to assess the overshadowing/sunlight reception in amenity spaces.

4.5 Criterion for effects on existing sunlight / shadow analysis

Acceptable criterion for effects on existing sunlight reception / shadow forming are as follows:

Analysis	Criteria on March 21 st	Acceptable sunlight reception parameters
Sunlight reception	Minimum sunlight reception in amenity spaces	At least 80% or 0.8 x it former sunlight reception.

Table 4.1

4.6 Sunlight reception / Overshadowing effects measured

The minimum sunlight requirement in this report measured in sunlight time 2 hours (120 minutes) multiplied by 50% area m² or the minimum requirement = 120 (min) * 0.5a (m²) = [] min·m².

The overshadowing/sun light assessment is executed in using a 3D model of the project with the results illustrated in tabular format showing the hourly status of the shadow/sunlight fraction in the relevant amenity spaces. The impacts of vegetation: It is important to note that according to the BRE Report, calculations do not normally take into account vegetation. The exception is when evergreen vegetation exists that forms a continuous barrier and would be permanent throughout the seasons.

5 Receptor selection and Calculation results - Existing neighbouring amenity spaces

5.1 Existing neighbouring amenity spaces

Image 5.1 below indicates the neighbouring amenity areas that have been selected and analysed on the basis that the shadow casted from the new development may effect these amenity areas given its geographical location in relation to the proposed development.



Image 5.1: existing neighbouring amenity spaces

Receptor	Location / Address	Amenity description	Approx. Area m ²
1	Belcamp Duplexes, open space	Open green space	15,000
2	Belcamp Hall, open space	Open green space	14,500
3	Belcamp Hall, open space	Open green space	12,000
4	Bewley's Tea and Coffee Head Office. Malahide Rd, Northern Cross, Dublin	Potential amenity space	4,000
5	Bewley's Tea and Coffee Head Office. Malahide Rd, Northern Cross, Dublin	Potential amenity space	1,500

Table 5.1: existing neighbouring amenity spaces

5.2 Assessment approach

The left-hand side calculation tables below represent the one hourly sunlight/shadow status of the respective existing amenity space before the introduction of the new development and the right-hand side tables below represent the one hourly sunlight/shadow status of the respective existing amenity space after the introduction of the new development. See appendix A for the predicted sunlight/shadow imaging per hour. Note: The calculation results have been given the following colour code guide depending on its level of resulting compliance.

Compliance guide

☑	0% Over /equal to
☑	5% Within
!!	10% Within
x	10% In excess of

5.3 Existing amenity spaces calculation results

SUNLIGHT/SHADOW CALCULATION DATA

1							15,000 m ²							
EXISTING STATUS							NEW STATUS							
Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	change
24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	min/m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0	0
7.00	85%	15%	60	2250	135,000	0	7.00	85%	15%	60	2250	135,000	0	0
8.00	64%	36%	60	5400	324,000	0	8.00	64%	36%	60	5400	324,000	0	0
9.00	21%	79%	60	11850	711,000	0	9.00	24%	76%	60	11400	684,000	-27,000	0
10.00	19%	81%	60	12150	729,000	0	10.00	26%	74%	60	11100	666,000	-63,000	0
11.00	19%	81%	60	12150	729,000	0	11.00	26%	74%	60	11100	666,000	-63,000	0
12.00	19%	81%	60	12150	729,000	0	12.00	26%	74%	60	11100	666,000	-63,000	0
13.00	19%	81%	60	12150	729,000	0	13.00	26%	74%	60	11100	666,000	-63,000	0
14.00	19%	81%	60	12150	729,000	0	14.00	27%	73%	60	10950	657,000	-72,000	0
15.00	19%	81%	60	12150	729,000	0	15.00	27%	73%	60	10950	657,000	-72,000	0
16.00	19%	81%	60	12150	729,000	0	16.00	28%	72%	60	10800	648,000	-81,000	0
17.00	19%	81%	60	12150	729,000	0	17.00	29%	71%	60	10650	639,000	-90,000	0
18.00	54%	46%	60	6900	414,000	0	18.00	64%	36%	60	5400	324,000	-90,000	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	8.24	Achieved total sun time (hrs)	7.48
Achieved daily sun time * area	7416000	Achieved daily sun time * area	6732000
			0.91
			0.91

2							14,500 m ²							
EXISTING STATUS							NEW STATUS							
Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	change
24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	min/m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0	0
7.00	86%	14%	60	2030	121,800	0	7.00	86%	14%	60	2030	121,800	0	0
8.00	74%	26%	60	3770	226,200	0	8.00	74%	26%	60	3770	226,200	0	0
9.00	61%	39%	60	5655	339,300	0	9.00	61%	39%	60	5655	339,300	0	0
10.00	43%	57%	60	8265	495,900	0	10.00	43%	57%	60	8265	495,900	0	0
11.00	39%	61%	60	8845	530,700	0	11.00	39%	61%	60	8845	530,700	0	0
12.00	31%	69%	60	10005	600,300	0	12.00	31%	69%	60	10005	600,300	0	0
13.00	21%	79%	60	11455	687,300	0	13.00	21%	79%	60	11455	687,300	0	0
14.00	21%	79%	60	11455	687,300	0	14.00	21%	79%	60	11455	687,300	0	0
15.00	21%	79%	60	11455	687,300	0	15.00	21%	79%	60	11455	687,300	0	0
16.00	26%	74%	60	10730	643,800	0	16.00	26%	74%	60	10730	643,800	0	0
17.00	28%	72%	60	10440	626,400	0	17.00	30%	70%	60	10150	609,000	-17,400	0
18.00	75%	25%	60	3625	217,500	0	18.00	78%	22%	60	3190	191,400	-26,100	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	8.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	6.74	Achieved total sun time (hrs)	6.69
Achieved daily sun time * area	5863800	Achieved daily sun time * area	5820300
			0.99
			0.99

3							12,000 m ²							
EXISTING STATUS							NEW STATUS							
Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	change
24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	min/m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0	0
7.00	86%	14%	60	1680	100,800	0	7.00	86%	14%	60	1680	100,800	0	0
8.00	67%	33%	60	3960	237,600	0	8.00	67%	33%	60	3960	237,600	0	0
9.00	46%	54%	60	6480	388,800	0	9.00	46%	54%	60	6480	388,800	0	0
10.00	29%	71%	60	8520	511,200	0	10.00	29%	71%	60	8520	511,200	0	0
11.00	21%	79%	60	9480	568,800	0	11.00	21%	79%	60	9480	568,800	0	0
12.00	21%	79%	60	9480	568,800	0	12.00	21%	79%	60	9480	568,800	0	0
13.00	21%	79%	60	9480	568,800	0	13.00	21%	79%	60	9480	568,800	0	0
14.00	21%	79%	60	9480	568,800	0	14.00	21%	79%	60	9480	568,800	0	0
15.00	21%	79%	60	9480	568,800	0	15.00	21%	79%	60	9480	568,800	0	0
16.00	21%	79%	60	9480	568,800	0	16.00	21%	79%	60	9480	568,800	0	0
17.00	32%	68%	60	8160	489,600	0	17.00	32%	68%	60	8160	489,600	0	0
18.00	74%	26%	60	3120	187,200	0	18.00	84%	16%	60	1920	115,200	-72,000	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	9.00
Achieved total sun time (hrs)	7.4	Achieved total sun time (hrs)	7.3
Achieved daily sun time * area	5328000	Achieved daily sun time * area	5256000
			0.99
			0.99

4							4,000 m ²							
EXISTING STATUS							NEW STATUS							
Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	Time	Shadow	Sunlight	Sun time	Sun area	time * area	March 21st	change
24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	24 Hr	% / %	% / %	min	m ²	min*m ²	min/m ²	min/m ²
6.00	100%	0%	60	0	0	0	6.00	100%	0%	60	0	0	0	0
7.00	71%	29%	60	1160	69,600	0	7.00	71%	29%	60	1160	69,600	0	0
8.00	38%	62%	60	2480	148,800	0	8.00	38%	62%	60	2480	148,800	0	0
9.00	9%	91%	60	3640	218,400	0	9.00	9%	91%	60	3640	218,400	0	0
10.00	9%	91%	60	3640	218,400	0	10.00	9%	91%	60	3640	218,400	0	0
11.00	9%	91%	60	3640	218,400	0	11.00	9%	91%	60	3640	218,400	0	0
12.00	9%	91%	60	3640	218,400	0	12.00	9%	91%	60	3640	218,400	0	0
13.00	9%	91%	60	3640	218,400	0	13.00	9%	91%	60	3640	218,400	0	0
14.00	9%	91%	60	3640	218,400	0	14.00	9%	91%	60	3640	218,400	0	0
15.00	9%	91%	60	3640	218,400	0	15.00	9%	91%	60	3640	218,400	0	0
16.00	9%	91%	60	3640	218,400	0	16.00	16%	84%	60	3360	201,600	-16,800	0
17.00	12%	88%	60	3520	211,200	0	17.00	21%	79%	60	3160	189,600	-21,600	0
18.00	24%	76%	60	3040	182,400	0	18.00	86%	14%	60	560	33,600	-148,800	0
19.00	100%	0%	60	0	0	0	19.00	100%	0%	60	0	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	11.00	Achieved sun hours on (hrs) @ 50% area	10.00
Achieved total sun time (hrs)	9.83	Achieved total sun time (hrs)	9.05
Achieved daily sun time * area	2359200	Achieved daily sun time * area	2172000
			0.92
			0.92



5						1,500 m ²						
EXISTING STATUS						NEW STATUS						
March 21st						March 21st						
Time	Shadow % / %	Sunlight % / %	Sun time min	Sun area m ²	time * area min*m ²	Time	Shadow % / %	Sunlight % / %	Sun time min	Sun area m ²	time * area min*m ²	change min*m ²
6.00	100%	0%	60	0	0	6.00	100%	0%	60	0	0	0
7.00	88%	12%	60	180	10,800	7.00	88%	12%	60	180	10,800	0
8.00	85%	15%	60	225	13,500	8.00	85%	15%	60	225	13,500	0
9.00	56%	44%	60	660	39,600	9.00	56%	44%	60	660	39,600	0
10.00	21%	79%	60	1185	71,100	10.00	21%	79%	60	1185	71,100	0
11.00	16%	84%	60	1260	75,600	11.00	16%	84%	60	1260	75,600	0
12.00	13%	87%	60	1305	78,300	12.00	13%	87%	60	1305	78,300	0
13.00	9%	91%	60	1365	81,900	13.00	9%	91%	60	1365	81,900	0
14.00	9%	91%	60	1365	81,900	14.00	9%	91%	60	1365	81,900	0
15.00	9%	91%	60	1365	81,900	15.00	9%	91%	60	1365	81,900	0
16.00	9%	91%	60	1365	81,900	16.00	21%	79%	60	1185	71,100	-10,800
17.00	9%	91%	60	1365	81,900	17.00	49%	51%	60	765	45,900	-36,000
18.00	24%	76%	60	1140	68,400	18.00	65%	35%	60	525	31,500	-36,900
19.00	100%	0%	60	0	0	19.00	100%	0%	60	0	0	0

Required sun hours @ 50% area (hr)	2	Required sun hours @ 50% area (hr)	2
Achieved sun hours on (hrs) @ 50% area	9.00	Achieved sun hours on (hrs) @ 50% area	8.00
Achieved total sun time (hrs)	8.52	Achieved total sun time (hrs)	7.59
Achieved daily sun time * area	766800	Achieved daily sun time * area	683100

5.4 Existing neighbouring amenity spaces sunlight assessment conclusion

Based on the BRE guidelines at least 50% of the amenity space should receive at least two hours of sunlight on the 21st of March and that and any loss of sunlight should not be greater than 0.8 (20% reduction) times its former size. From the calculation results we note that all of the selected existing amenity spaces received 2 hours of sunlight or more on at least 50% of the area before and after the introduction of the new development. Summary of results are as follows (see image 5.1 for receptor locations):

- North receptors: Receptor 1, 2 and 3 is part of the Belcamp development with open space amenity areas. Receptor 1 (part of Belcamp duplexes) resulted in change factor of 0.91 meaning the new proposed development has a small effect on the amenity space. This effect happens between the hours of 09.00-18.00. Receptor 2 (part of Belcamp hall) resulted in a change factor of 0.99 meaning the new proposed development has a very small effect. This effect happens in the late afternoon hours of 17.00-18.00. Receptor 3 (part of Belcamp hall) resulted in a change factor of 0.99 meaning the new proposed development has a very small effect. This effect happens in the late afternoon hours of 17.00-18.00. Receptor 1, 2 and 3 calculation findings are comfortably within BRE guidelines.
- East receptor: Receptors 4 and 5 is Bewley’s Tea and Coffee Head Office with potential open space amenity areas. These receptors resulted in change factor of 0.92 and 0.89 meaning the new proposed development has a small effect on the amenity space. This effect happens in the late afternoon hours of 16.00-18.00. The calculation findings are well within BRE guidelines.

We conclude that the sunlight reception in the existing neighbouring amenity spaces after the introduction of the new development is in excess of the minimum recommendations of the BRE Report– “Site Layout and Planning for Daylight and Sunlight and therefore deem this to be compliant to this element.





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Appendix A

APPENDIX to SUNLIGHT RECEPTION REPORT
1 (one) HOURLY SUNLIGHT / SHADOW STATUS ILLUSTRATIONS

Belcamp SHD

Proposed Residential Development

**Belcamp,
Malahide Road,
Dublin 17**

Gerard Gannon Properties

DKP-L00-5070-1P
2022-05-04

Document control

DKP project no: L00
 DKP document no: 5070
 Project file no: DKP-L00-5070

Circular	Issue >	1#	1P
Clients	Gerard Gannon Properties	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Architects	Wilson Architecture	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Planning consultants	Downey Planning	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

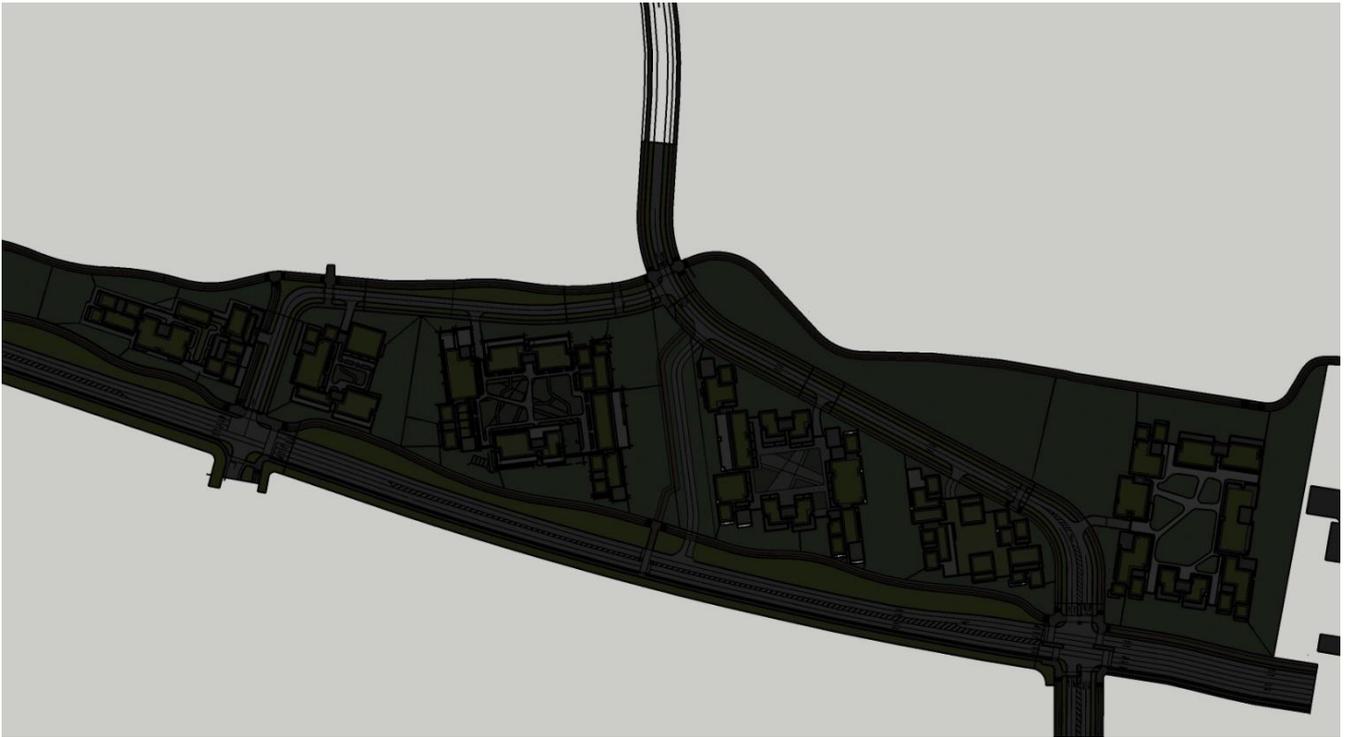
Issue	1#	2022-04-08	Draft issue, for review
Issue	1P	2022-05-04	Issue for planning

Document issue status ID

Sketch/draft
 P Planning
 C Concept
 D Design
 G General information
 T Tender
 W Works/construction
 Z As-build/constructed

Issue	Prepared	Checked	Approved
1#	201	208	201
1P	201	208	201

06.00 - March 21st



07.00 - March 21st



08.00 - March 21st



09.00 - March 21st



10.00 - March 21st



11.00 - March 21st



12.00 - March 21st



13.00 - March 21st



14.00 - March 21st



15.00 - March 21st



16.00 - March 21st



17.00 - March 21st



18.00 - March 21st



19.00 - March 21st

