

Daylight Analysis and Overshadowing

Residential Development,
Courtstown, Little Island, Co. Cork
19/06/2024





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1. Executive Summary

H3D were engaged by Ruden Homes to provide a report on the impact of the proposed residential development at Courtstown, Little Island, Co. Cork. H3D were instructed to conduct the following:

- To create a 3D computer analysis model of the scheme based upon drawings provided by BG Architecture.
- Conduct an analysis to investigate the Daylight provision to the proposed units in the apartment blocks.
- Conduct a study to investigate if the amenity areas within the site achieve 2 hours of sunlight on March 21st.
- Conduct a Vertical Sky Component (VSC) analysis on the adjacent windows facing the proposed development.
- Prepare a report setting out the analysis and the findings.

Methodology

The assessment of the proposed development was prepared using the methodology's set out in the British Standard: Lighting for Buildings – Part 2: Code for Practice for Daylighting, BRE 209, 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice', Third Edition 2022, by P. J. Littlefair, the Design Standards for New Apartments - Guidelines for Planning Authorities (July 2023).

It is noted that BS 8206-2:2008: Lighting for buildings - Part 2: Code of practice for daylighting was replaced with BS EN 17037:2018 Daylight in Buildings. For that reason, the BS EN 17037:2018 standards will be used to measure the performance of the proposed development.

BRE Guide and Advisory Note

The numerical guidelines given in these documents are purely advisory. The BRE Guide states that:

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

“It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location” (Section 1.6, p1)

Daylight Provision

The daylight standards are in a period of transition with various planning authorities referencing:

- BR 209 (Second Edition)
- BR 209 (Third Edition)
- BS 8205:2008
- BS EN 17037:2018.

As the BR 209 document (Third Edition) has been updated to reference the latest standard BS EN 17037:2018 the Daylight analysis was considered against this standard:

- BS EN 17037:2018

For the BS EN 17037:2018 standards 100% of rooms analysed met the target lux levels which were 100 lux for bedrooms and 200 lux for Kitchen/Living/Dining.

All 18 no. spaces assessed meet or exceed the target levels in the BS EN 17037:2018 standard, so the proposed apartments are considered to provide an acceptable standard of amenity from a daylight perspective.

Amenity Overshadowing – Within Site

Of the 146 no. garden amenity spaces and 3 no. communal amenity spaces analysed within the site, 140 spaces complied with the BRE guideline level for Amenity Overshadowing which is a pass rate of 94.0%. This is a high level of compliance for the amenity spaces for the development and should be considered an excellent provision for private amenity.

Vertical Sky Component (VSC)

Of the 16 no. window openings analysed on the neighbouring properties to the north, all windows complied with the BRE guideline level for Vertical Sky Component.

Overall Conclusion

After conducting a comprehensive daylight and sunlight assessment of the proposed development using simulation modelling and comparing results achieved against the BRE Guide and BS recommended guidelines, the proposed development would not cause an unacceptable overshadowing impact on the neighbouring rear properties. The development will also provide an excellent level of daylight and sunlight for future inhabitants.



Cian Heffernan
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2. Daylight to Proposed Development

The purpose of this section is to investigate the percentage of units that achieve the recommended levels of daylight provision.

The daylight provision to the proposed development was assessed against the following standard.

- BS EN 17037:2018

Prior to 2018, Ireland had no standard for daylight. In 2018, the National Standards Authority of Ireland adopted EN 17037 to directly become IS EN 17037. It does not contain a national annex. It offers only a single target for new buildings (there are no space-by-space targets – e.g., a kitchen would have the same target as a warehouse or office). It does not offer guidance on how new developments will impact on surrounding environments. Most Development Plans do not reference the new BS EN 17037:2018 standard however Appendix 16 of a neighbouring planning authority's Dublin City Development Plan 2022-2028 recommends that:

“These limitations make it unsuitable for use in planning policy or during planning applications. BR 209 must still be used for this purpose.”

It continues by stating that:

“The planning authority understand that, at present there is some ambiguity in what may be considered the appropriate standard to apply for daylight and sunlight assessments. There is a period of transition at present during which BS8206-2 has been superseded, but the relevant guidance within BR 209 has not yet been updated. This both BS 8206-2 and BS EN 17037 have relevance. As such, both for clarity and as an interim measure during this transition period, the planning authority will look to receive relevant metrics from BR 209, BS 8206-2, and BS 17037. If over the coming years, a revised version of BR 209 is to be issued, the guidance within this new version will take precedence.”

The third edition of BRE 209 has been issued since the above development plan was released. This updated guidance now references BS EN 17037.

The following section summarise the various requirement of this standard.

BS EN 17037:2018 National Annex

In the UK, EN17037:2018 was adopted to form “BS EN 17037:2018”. However, a “National Annex NA” was included which states:

“The UK committee supports the recommendations for daylight in buildings given in BS EN 17037:2018; however, it is the opinion of the UK committee that the recommendations for daylight provision in a space (see Clause A.2) may not be achievable for some buildings, particularly dwellings. The UK committee believes this could be the case for dwellings with basement rooms or those with significant external obstructions (for example, dwellings situated in a dense urban area or with tall trees outside), or for existing buildings being refurbished or converted into dwellings. This National Annex therefore provides the UK committee’s guidance on minimum daylight provision in all UK dwellings.”

Whereas IS EN 17037:2018 does not provide different illuminance targets for different space types, the BS EN 17037:2018 National Annex provides target illuminance values for bedrooms, living rooms and kitchens within residential developments as per Table NA.1 below. It is also important to note that as the climate in Ireland is similar to the UK, the targets outlined in the BS EN National Annex could also be applied to dwellings in Ireland.

Room type	Target illuminance E_T (lx)
Bedroom	100
Living room	150
Kitchen	200

Figure 1: Table NA.1 – Values of target illuminance for room types in UK dwellings

The BS National Annex also states:

“Where one room in a UK dwelling serves more than a single purpose, the UK committee recommends that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx.”

Therefore, combined KLDs are to be assessed using a 200-lux target illuminance (E_T).

Finally, the BS National Annex also states that:

“It is the opinion of the UK committee that the recommendation in Clause A.2 – that a target illuminance level should be achieved across the entire (i.e., 95 %) fraction of the reference plane within a space – need not be applied to rooms in dwellings.”

Therefore, when assessing the daylight provisions in residential dwellings in accordance with BS EN 17037:2018, only the target illuminance (E_T) or target daylight factor (DT) will be assessed for Bedrooms, Living Rooms, Kitchens (or combined KLDs) on over 50% of the floor area over 50% of the available daylight hours. The minimum target illuminance (E_{TM}) or minimum target daylight factor (DTM) will not be assessed.



Based on the above criteria, the daylight provision to the proposed development has been assessed using an adequate software (i.e., IES VE), using the Method 2 climate-based approach and targeting the minimum recommended values outlined in Table NA.1 of BS EN 17037:2018.

The following inputs were used in the study:

BS EN 17037:2018

Sky Conditions: Standard CIE overcast sky.
 Time (24hr): 12:00
 Date: 21 September
 Weather File: Dublin.epw (15-year average)

Element	Value	Source/Description
Sky Conditions	CIE Overcast Sky	Software Climate File

Light Reflectance Values (LRV)		
Ceiling	85%	White Paint
Internal Walls	85%	White Paint
Floors	40%	Light Veneer
External Ground	20%	Paving
External Wall	30%	Brickwork

Window Properties:		
Visible Light transmission	70%	-
Average frame thickness	0.05m	-

Other Properties:		
Working plane height	0.85m	BS8206 Part 2: 2008 & BS EN 17037:2018
Area of interest (perimeter border depth)	0.50m	CIBSE Code for Interior Lighting
Window surface maintenance factor for cleaning	0.9	-
Grid size for assessment area	0.30m	-

Table 1: Analysis Input Data

Daylight Results

The following tables summarise the daylight provision results for the proposed development assessed against the BS EN 17037:2018 standard. Individual room results can be viewed in Tables 8-11 below.

The purpose of the calculations is to quantify an overall percentage of rooms which exceed the recommendations of the various standards that were assessed. The objective of the design team is to maximise the number of units which exceed the recommendations.

As outlined previously, where there are combined Living/Kitchen/Dining areas (LKDs) within the development, these have been assessed as whole spaces against an initial 200 lx target.

The results are summarised in the following tables:

Total for The Development

The overall daylight provision results for the tested spaces in the development under the various standards are summarised below. Under BS EN 17037:2018 a compliance rate of 100% is achieved also achieved. Overall, the quality of daylight provision across the development is excellent.

For the purposes of efficiency, and space with an identical room below was omitted from the analysis. If the room below passes it is fair to assume the room above will also pass.

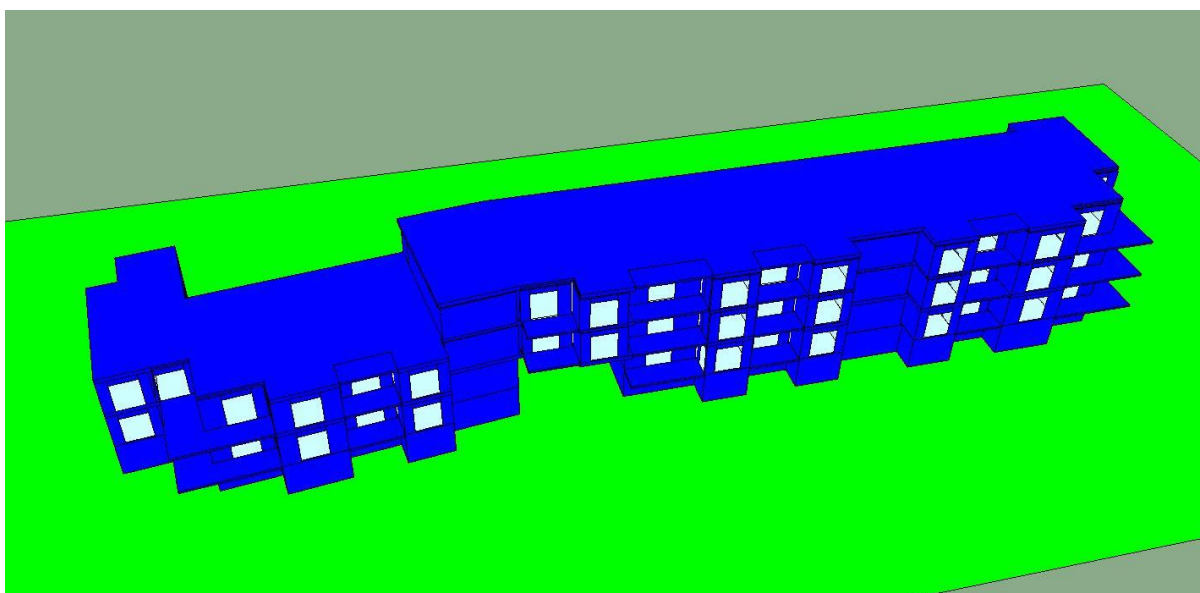


Figure 2: IES VE Analysis Model

Rooms Tested	No. Rooms
Bedrooms	10
KLDs	8
Total Spaces Tested	18

Table 2: Room Breakdown - Summary

BS EN 17037:2018 Method 2 Assessment – National Annex				
Rooms	Pass (No.)	Pass (%)	Fail (No.)	Fail (%)
Bedrooms	10	100	0	0
KLDs	8	100	0	0
Total Spaces Tested	18	100	0	0

Table 3: BS EN 17037:2018 Daylight Results – Summary

Unit	Room	BS EN 17037:2018			
		Minimum Lux recommended in BS EN 17037:2018	Minimum Required Floor Area > ET (%)	Floor Area > ET (%)	Pass/Fail
102	Bedroom 1	100	50	100	Pass
	KLD	200	50	100	Pass
103	Bedroom 1	100	50	100	Pass
	Bedroom 2	100	50	100	Pass
	KLD	200	50	69.98	Pass
104	Bedroom 1	100	50	100	Pass
	KLD	200	50	99.68	Pass
105	Bedroom 1	100	50	100	Pass
	Bedroom 2	100	50	100	Pass
	KLD	200	50	100	Pass
106	Bedroom 1	100	50	100	Pass
	KLD	200	50	100	Pass
107	Bedroom 1	100	50	100	Pass
	KLD	200	50	100	Pass
108	Bedroom 1	100	50	100	Pass
	Bedroom 2	100	50	100	Pass
	Bedroom 3	100	50	100	Pass
	KLD	200	50	100	Pass

Table 4: BS EN 17037:2018 Results – First Floor

Unit	Room	BS EN 17037:2018			
		Minimum Lux recommended in BS EN 17037:2018	Minimum Required Floor Area > ET (%)	Floor Area > ET (%)	Pass/Fail
112	Bedroom 1	100	50	100	Pass
	KLD	200	50	99.72	Pass

Table 5: BS EN 17037:2018 Results – Second Floor

3. Amenity Overshadowing – Within Site

As per section 3.3 of ‘Site layout Planning for daylight and Sunlight’ by Paul Littlefair it is recommended that at least half of the amenity areas should receive at least two hours of sunlight on March 21st.

To investigate this, the area of sunlit amenity space is calculated as a percentage of the total area. Paragraph 3.3.11 states that if the area is poorly lit and does not achieve the minimum two hours but the value is no less than 0.8 times the current state then further loss of light would not be significant.

An analysis of the neighbouring garden amenity areas was conducted by calculating the area of sunlight that received a minimum of two hours of sunlight on March 21st. Below are results in numerical and graphical form.

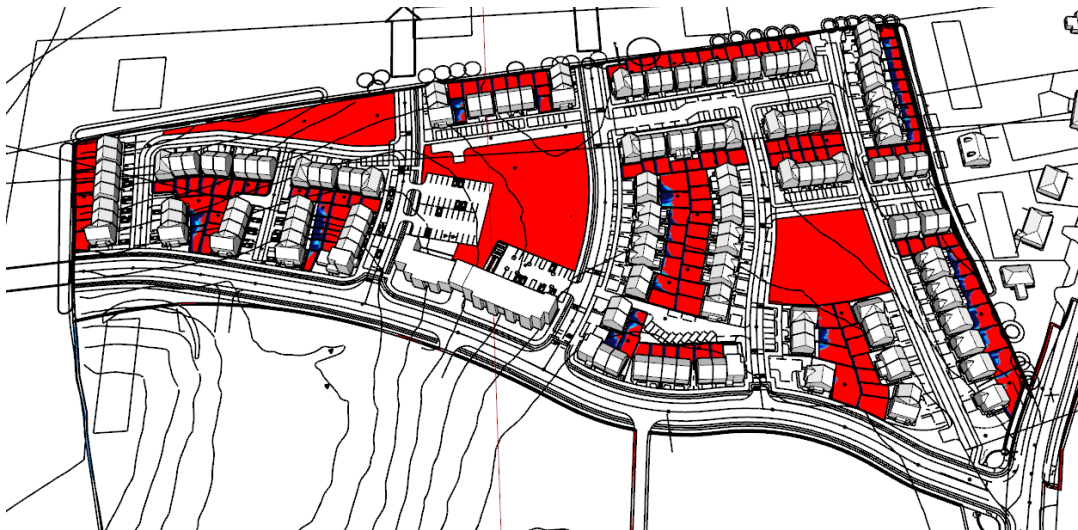


Figure 3: Amenity Overshadowing: Red > 2 hours



Number	Garden Area (m2)	Area receiving 2 hours of sunlight on March 21st (%)	Minimum area receiving 2 hours of sunlight on March 21st (%)	Compliance Demonstrated
1	66.54	97.49	50.0%	Yes
2	47.57	52.26	50.0%	Yes
3	51.02	60.49	50.0%	Yes
4	49.41	63.03	50.0%	Yes
5	46.49	60.67	50.0%	Yes
6	56.08	61.91	50.0%	Yes
7	48.52	69.68	50.0%	Yes
8	49.23	63.99	50.0%	Yes
9	50.79	59.83	50.0%	Yes
10	51.68	71.44	50.0%	Yes
11	61.25	86.60	50.0%	Yes
12	40.85	80.86	50.0%	Yes
13	38.35	79.73	50.0%	Yes
14	30.66	74.96	50.0%	Yes
15	65.47	86.26	50.0%	Yes
16	46.86	80.81	50.0%	Yes
17	51.89	80.33	50.0%	Yes
18	40.81	77.21	50.0%	Yes
19	63.85	73.95	50.0%	Yes
20	68.39	67.24	50.0%	Yes
21	69.15	69.13	50.0%	Yes
22	69.74	72.48	50.0%	Yes
23	123.66	63.27	50.0%	Yes
24	124.58	68.38	50.0%	Yes
25	115.74	70.26	50.0%	Yes
26	137.47	84.08	50.0%	Yes
27	94.98	94.93	50.0%	Yes
28	66.91	89.17	50.0%	Yes
29	56.66	85.97	50.0%	Yes
30	51.88	88.13	50.0%	Yes
31	70.83	89.03	50.0%	Yes
32	50.09	85.92	50.0%	Yes
33	82.76	87.89	50.0%	Yes
34	87.02	91.87	50.0%	Yes
35	78.61	64.72	50.0%	Yes
36	104.53	87.99	50.0%	Yes
37	168.62	94.47	50.0%	Yes
38	63.08	85.47	50.0%	Yes
39	47.91	78.54	50.0%	Yes
40	47.58	77.92	50.0%	Yes



41	43.53	74.25	50.0%	Yes
42	68.91	87.81	50.0%	Yes
43	70.92	87.21	50.0%	Yes
44	43.36	76.17	50.0%	Yes
45	46.70	76.60	50.0%	Yes
46	48.37	76.72	50.0%	Yes
47	69.13	85.76	50.0%	Yes
48	74.09	85.92	50.0%	Yes
49	53.46	79.87	50.0%	Yes
50	54.59	80.50	50.0%	Yes
51	64.11	82.57	50.0%	Yes
52	68.85	83.58	50.0%	Yes
53	71.02	91.71	50.0%	Yes
54	51.33	81.38	50.0%	Yes
55	49.94	80.98	50.0%	Yes
56	56.42	83.16	50.0%	Yes
57	56.11	81.78	50.0%	Yes
58	60.36	83.93	50.0%	Yes
59	54.35	82.00	50.0%	Yes
60	69.05	80.73	50.0%	Yes
61	62.04	86.60	50.0%	Yes
62	72.14	85.57	50.0%	Yes
63	45.93	76.27	50.0%	Yes
64	59.86	80.61	50.0%	Yes
65	43.99	81.29	50.0%	Yes
66	43.51	79.90	50.0%	Yes
67	65.10	81.13	50.0%	Yes
68	50.04	77.26	50.0%	Yes
69	72.62	85.81	50.0%	Yes
70	79.10	86.64	50.0%	Yes
71	66.63	87.13	50.0%	Yes
72	64.81	88.30	50.0%	Yes
73	62.77	92.23	50.0%	Yes
74	71.48	90.33	50.0%	Yes
75	71.08	89.90	50.0%	Yes
76	69.20	90.18	50.0%	Yes
77	69.67	89.28	50.0%	Yes
78	82.78	91.46	50.0%	Yes
79	88.70	91.51	50.0%	Yes
82	39.95	76.87	50.0%	Yes
83	48.31	80.90	50.0%	Yes
84	50.72	81.00	50.0%	Yes
85	36.35	76.86	50.0%	Yes
86	36.78	76.71	50.0%	Yes
87	38.54	88.19	50.0%	Yes
88	68.84	77.22	50.0%	Yes
89	42.25	18.86	50.0%	No



92	36.47	51.31	50.0%	Yes
93	36.06	47.51	50.0%	No
94	79.08	94.28	50.0%	Yes
95	77.02	72.52	50.0%	Yes
96	75.92	81.64	50.0%	Yes
97	56.39	77.47	50.0%	Yes
98	68.52	79.07	50.0%	Yes
99	72.98	78.39	50.0%	Yes
100	103.71	57.29	50.0%	Yes
101	121.19	82.05	50.0%	Yes
122	54.66	75.20	50.0%	Yes
123	40.16	80.84	50.0%	Yes
124	62.13	82.35	50.0%	Yes
125	75.41	84.18	50.0%	Yes
126	60.27	80.13	50.0%	Yes
127	71.33	82.95	50.0%	Yes
128	70.89	83.05	50.0%	Yes
129	78.99	84.31	50.0%	Yes
130	63.96	100.00	50.0%	Yes
131	35.42	10.30	50.0%	No
132	37.30	40.65	50.0%	No
133	36.40	79.42	50.0%	Yes
134	42.83	83.13	50.0%	Yes
135	48.20	84.86	50.0%	Yes
138	63.16	87.84	50.0%	Yes
139	60.51	86.59	50.0%	Yes
140	37.51	81.56	50.0%	Yes
141	48.92	86.28	50.0%	Yes
142	42.65	77.18	50.0%	Yes
143	39.93	78.50	50.0%	Yes
144	45.68	85.21	50.0%	Yes
145	40.23	38.69	50.0%	No
146	31.66	14.85	50.0%	No
147	30.85	11.90	50.0%	No
148	29.18	6.97	50.0%	No
149	37.91	81.53	50.0%	Yes
150	39.98	76.41	50.0%	Yes
151	39.96	76.62	50.0%	Yes
152	51.61	81.57	50.0%	Yes
153	72.13	82.86	50.0%	Yes
154	58.05	76.63	50.0%	Yes
155	58.97	76.32	50.0%	Yes
156	52.91	75.13	50.0%	Yes
157	56.82	86.69	50.0%	Yes
158	106.61	90.14	50.0%	Yes
159	67.83	88.63	50.0%	Yes
160	65.79	89.11	50.0%	Yes

161	56.90	86.79	50.0%	Yes
162	65.48	88.41	50.0%	Yes
163	61.88	87.89	50.0%	Yes
164	46.71	85.37	50.0%	Yes
165	72.06	84.79	50.0%	Yes
166	106.28	85.48	50.0%	Yes
167	48.54	30.75	50.0%	No
168	63.59	59.67	50.0%	Yes
169	52.50	80.06	50.0%	Yes
170	45.41	82.94	50.0%	Yes
171	45.24	82.89	50.0%	Yes
172	67.94	85.86	50.0%	Yes

Table 6: Amenity Overshadowing Results – Garden Areas

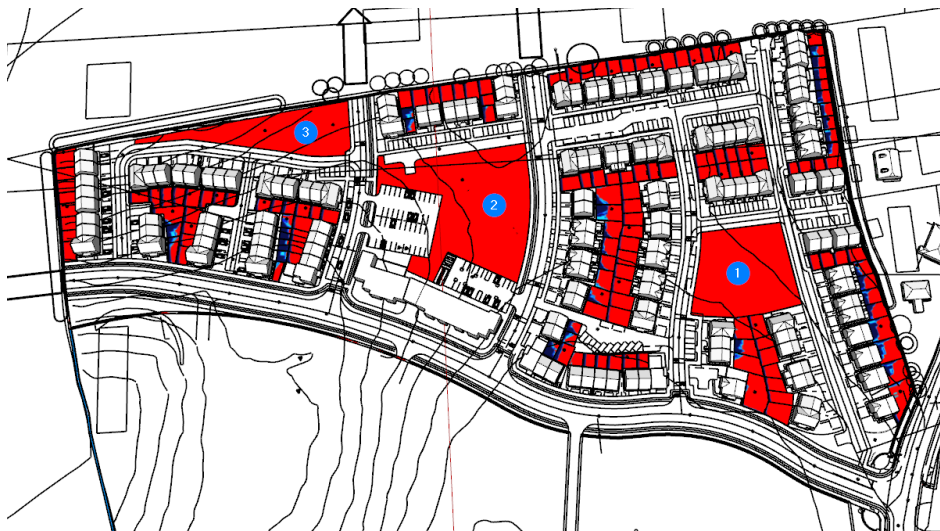


Figure 4: Amenity Overshadowing: Red > 2 hours Communal Areas

Number	Garden Area (m ²)	Area receiving 2 hours of sunlight on March 21st (%)	Minimum area receiving 2 hours of sunlight on March 21st (%)	Compliance Demonstrated
1	1987	100	50.0%	Yes
2	3240	100	50.0%	Yes
3	1546	100	50.0%	Yes

Table 7: Amenity Overshadowing Results – Communal Areas

Of the 146 no. garden amenity spaces and 3 no. communal amenity spaces analysed within the site, 140 spaces complied with the BRE guideline level for Amenity Overshadowing which is a pass rate of 94.0%. This is a high level of compliance for the amenity spaces for the development and should be considered an excellent provision for private amenity.

4. Vertical Sky Component (VSC)

The BRE document definition of the (VSC) is: Ratio of the part of illuminance, at a point on a given vertical plane, which is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. Usually the 'given vertical plane' is the outside of a window wall. The VSC does not include reflected light, either from the ground or from other buildings.

The VSC is usually expressed as a percentage and the maximum value for a completely unobstructed window is slightly less than 40%. The recommendations set down in the BRE report, 'Site layout for daylight and sunlight, a guide to good practice,' would indicate, for residential properties, that a VSC value of greater than 27% is acceptable. However, a 20% VSC is good for an urban area.

It should be noted that the Guide itself, within the introduction, states that the advice given was not mandatory and the Guide should not be an instrument of planning policy, its aim being to help rather constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly.

A VSC Analysis was conducted on the rear windows of the property to the north of the proposed residential development. As the window locations on the adjacent buildings are unknown, notional windows were used on each for the analysis.

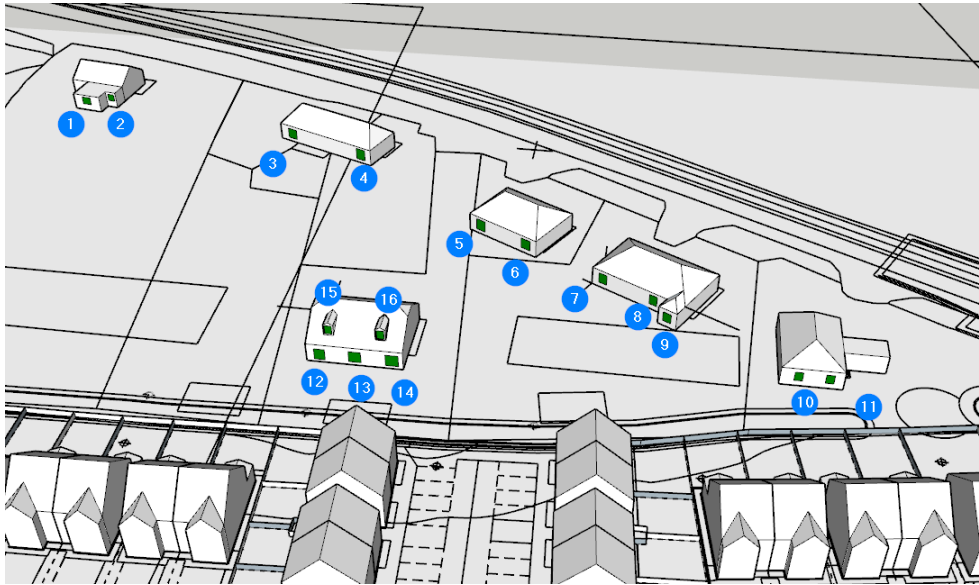


Figure 5: VSC Window Key Plan

Window	Proposed	<27% Pass/Fail	Existing	Difference	>0.8 Existing	Compliance Demonstrated
1	38.09	Pass	38.39	0.99	Yes	Yes
2	31.41	Pass	31.73	0.99	Yes	Yes
3	37.80	Pass	38.24	0.99	Yes	Yes
4	37.56	Pass	38.07	0.99	Yes	Yes
5	37.00	Pass	37.28	0.99	Yes	Yes
6	36.87	Pass	37.18	0.99	Yes	Yes
7	36.61	Pass	37.36	0.98	Yes	Yes
8	34.51	Pass	35.27	0.98	Yes	Yes
9	36.01	Pass	37.50	0.96	Yes	Yes
10	32.80	Pass	37.32	0.88	Yes	Yes
11	32.45	Pass	37.34	0.87	Yes	Yes
12	33.94	Pass	37.31	0.91	Yes	Yes
13	33.95	Pass	37.28	0.91	Yes	Yes
14	33.77	Pass	37.21	0.91	Yes	Yes
15	36.65	Pass	38.04	0.96	Yes	Yes
16	36.71	Pass	37.99	0.97	Yes	Yes

Table 8: VSC Results

Of the 16 no. windows openings analysed on the neighbouring properties to the north all windows complied with the BRE guideline level for Vertical Sky Component.



5. Conclusion

Daylight Provision

The daylight standards are in a period of transition with various planning authorities referencing:

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- BR 209 (Third Edition)
- BS 8205:2008
- BS EN 17037:2018.

As the BR 209 document (Third Edition) has been updated to reference the latest standard BS EN 17037:2018 the Daylight analysis was considered against this standard:

- BS EN 17037:2018

For the BS EN 17037:2018 standards 100% of rooms analysed met the target lux levels which were 100 lux for bedrooms and 200 lux for Kitchen/Living/Dining.

All 18 no. spaces assessed meet or exceed the target levels in the BS EN 17037:2018 standard, so the proposed apartments are considered to provide an acceptable standard of amenity from a daylight perspective.

Amenity Overshadowing – Within Site

Of the 146 no. garden amenity spaces and 3 no. communal amenity spaces analysed within the site, 140 spaces complied with the BRE guideline level for Amenity Overshadowing which is a pass rate of 94.0%. This is a high level of compliance for the amenity spaces for the development and should be considered an excellent provision for private amenity.

Vertical Sky Component (VSC)

Of the 16 no. window openings analysed on the neighbouring properties to the north, all windows complied with the BRE guideline level for Vertical Sky Component.

Overall Conclusion

After conducting a comprehensive daylight and sunlight assessment of the proposed development using simulation modelling and comparing results achieved against the BRE Guide and BS recommended guidelines, the proposed development would not cause an unacceptable overshadowing impact on the neighbouring rear properties. The development will also provide an excellent level of daylight and sunlight for future inhabitants.

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