Residential Development at Edmondstown, Co. Dublin

Daylight, Sunlight & Overshadowing Assessment

Project Ref: 20090

Client: BCDK Holdings Ltd. & Coill Avon Ltd

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Report by:
Building Performance Consulting Engineers

BPC ENGINEERS

BUILDING PERFORMANCE CONSULTING

Rev	Description	Date:	Written By	Approved By:
P3-01	Final Analysis: Issue for Comment	28/11/2021	S. O'Riordan	S. O'Riordan
P5-01	Final Analysis: Updated based on latest design package	17/02/2022	S. O'Riordan	S. O'Riordan
P5-02	Final Analysis: Updated text	04/03/2022	S. O'Riordan	S. O'Riordan
P5-03	Update to site areas (text)	08/03/2022	S. O'Riordan	S. O'Riordan

Contents

1 Glossary

Average Daylight Factor (ADF)
Ratio of total daylight flux incident on the working plane area to the area of the working plane, expressed as a percentage of outdoor illuminance on a horizontal plane due to an unobstructed sky of assumed or known luminance distribution, usually CIE standard overcast sky.

Daylight
Part of global solar radiation capable of causing a visual sensation. (CIE, 2020) (Combined skylight and sunlight.)

Obstruction Angle
The angular altitude of the top of an obstruction above the horizontal, measured from a reference point in a vertical plane in a section perpendicular to the vertical plane.

Skylight
Part of *diffuse* sky radiation capable of causing a visual sensation. (CIE, 2020)

Sunlight
Part of direct solar radiation capable of causing a visual sensation. (CIE, 2020)

Vertical Sky Component (VSC)
Ratio of that part of illuminance, at a point on a given vertical plane, that is received directly from a sky of assumed or known luminance distribution (usually 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.

Working Plane
Horizontal, vertical or inclined plane in which a visual task lies. Normally the working plane may be taken to be horizontal, 0.85 m above the floor in houses and factories, 0.7 m above the floor in offices.

Spatial Daylight Autonomy (sDA)
Spatial Daylight Autonomy (sDA) is a metric describing annual sufficiency of ambient daylight levels in interior environments. It is defined as the percent of an analysis area that meets a minimum daylight illuminance level for a specified fraction of the operating/daylight hours per year. The sDA value is expressed as a percentage of area.

2 Executive Summary

There are no neighbouring buildings or gardens/amenity spaces in close enough proximity to the proposed development to be affected in terms of availability of daylight/sunlight.

The development itself is expected to experience good levels of internal daylight, with all rooms exceeding the minimum recommendations of the BRE Guide. With a higher ADF, indoor daylight will be sufficient for more of the year. Therefore, the apartments will rely less on electric lighting. In cases where the ADF is very high (>6%), care needs to be taken to mitigate potential overheating in summer and/or excessive heat loss in winter.

The results show that the majority of amenity spaces tested in the proposed development meet the BRE's minimum recommendations for sunlight to gardens or open spaces. All areas meeting the criterion should appear adequately sunlit throughout the year. The back gardens of the Duplex Type T units do not meet the minimum recommendation for sunlight. The layout and orientation of these units have been developed to address the need raised by the planning authority to provide passive surveillance of the new link street. To mitigate the fact that these gardens are north facing, additional compensatory amenity spaces are provided to the front (south) of the units in the form of "winter gardens" for the middle units and front gardens for the end-terrace units. These spaces have minimal overshadowing and should enjoy excellent levels of sunlight through the year.

Overall, the development has been designed with due consideration for sunlight and daylight and largely meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2011)."

3 Introduction

Site layout planning to achieve good daylighting and sunlighting, within buildings and in the open spaces around them is an important aspect in designing new buildings or developments. Daylight animates an interior and makes it attractive and interesting, as well as providing light to work or read by. Good daylight and sunlight can contribute to making a building energy-efficient; they can reduce the need for electric lighting, while winter solar gain can reduce heating requirements.

This report provides information on the daylight and sunlight analysis undertaken for the proposed development at Edmondstown, Co. Dublin.

The application site consists of two green field sites that are located west of the Whitechurch Road and north of the M50. There are some existing derelict buildings on site and existing residential properties to the north of the site. The county boundary with Dun Laoghaire Rathdown and Marlay Park are located to the east of the site. To the west of the site there are fields and the Edmondstown Golf Club.

The analysis and assessments in this report have been carried in line with the recommendations of BRE's "Site Layout Planning for daylight and sunlight, a Guide to good practice" (PJ Littlefair), 2011 and *BS 8206-2008*. The aforementioned BRE guide is also know as BRE Guide BR 209 and may be referenced as such or simply as the "BRE Guide" hereafter in this document.

The report assesses the daylight and sunlight provision for the proposed development by means of:

- Average Daylight Factor (ADF)
- Overshadowing (Sunlight to Amenity)

The analysis focuses on the higher density accommodation such as apartment blocks and duplexes and their surrounding amenity areas.

Additionally, Appendix B provides shadow plots for the proposed development.

There are no neighbouring properties in close enough proximity to the proposed development to be adversely impacted by it with respect to their access to daylight, therefore no analysis has been performed for any existing neighbouring properties.

4 Site Description

4.1 Location & Context

The application site consists of two green field sites that are located west of Whitechurch Road and north of the M50. Beyond Whitchurch road, to the east, are Grange Golf Club and Marlay Park. To the west of the site there are agricultural lands that are zoned for residential development and the Edmondstown Golf Club. To the north of the site, there is low density suburban housing, a church, school and graveyard. Beyond that, there are large tracts of traditional suburban developments. There are some existing derelict houses and outbuildings on the site. The site is approximately 6.77Ha.

Figure 1: Site Location (Source: Bing Maps)

Figure 2: Site Context - Detailed View

4.2 Proposed Development

The site is predominantly greenfield, with some existing derelict houses and outbuildings. The proposed development involves the construction of 178 dwellings, a creche, shops and café in a neighbourhood centre and two basement carparks. The dwellings are a mix of houses and apartments. The apartments are a combination of one, two and three bedroom units and the houses range from 2-4 bedrooms.

The development includes the first section of a link street (approx. 438 linear metres) from the junction of Whitechurch Road and College Road, several upgrades to the existing road network, and all associated and ancillary site development works.

The vision for Edmondstown is to create a place of high quality in the middle of a community that connects the surrounding amenities.

Figure 3: Proposed Architectural Model (North Site)

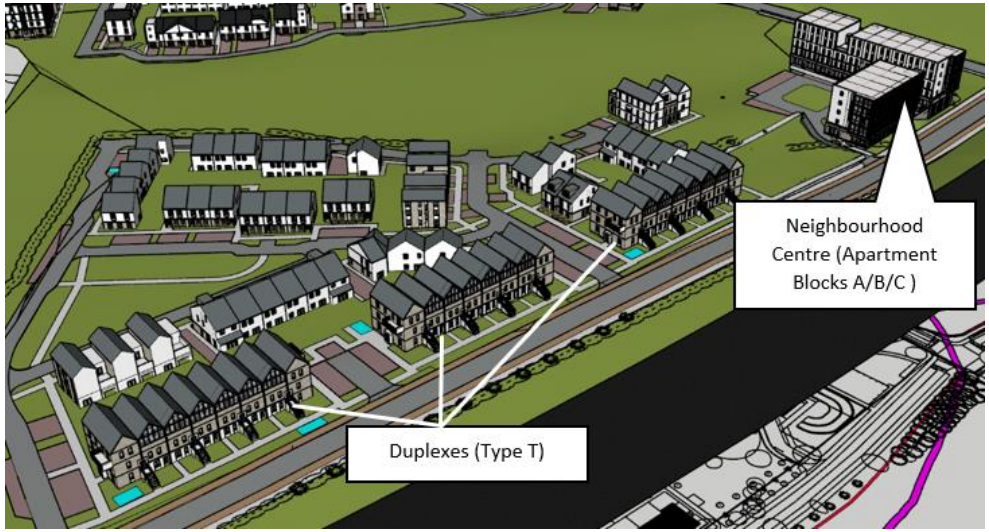


Figure 4: Proposed Architectural Model (South Site)

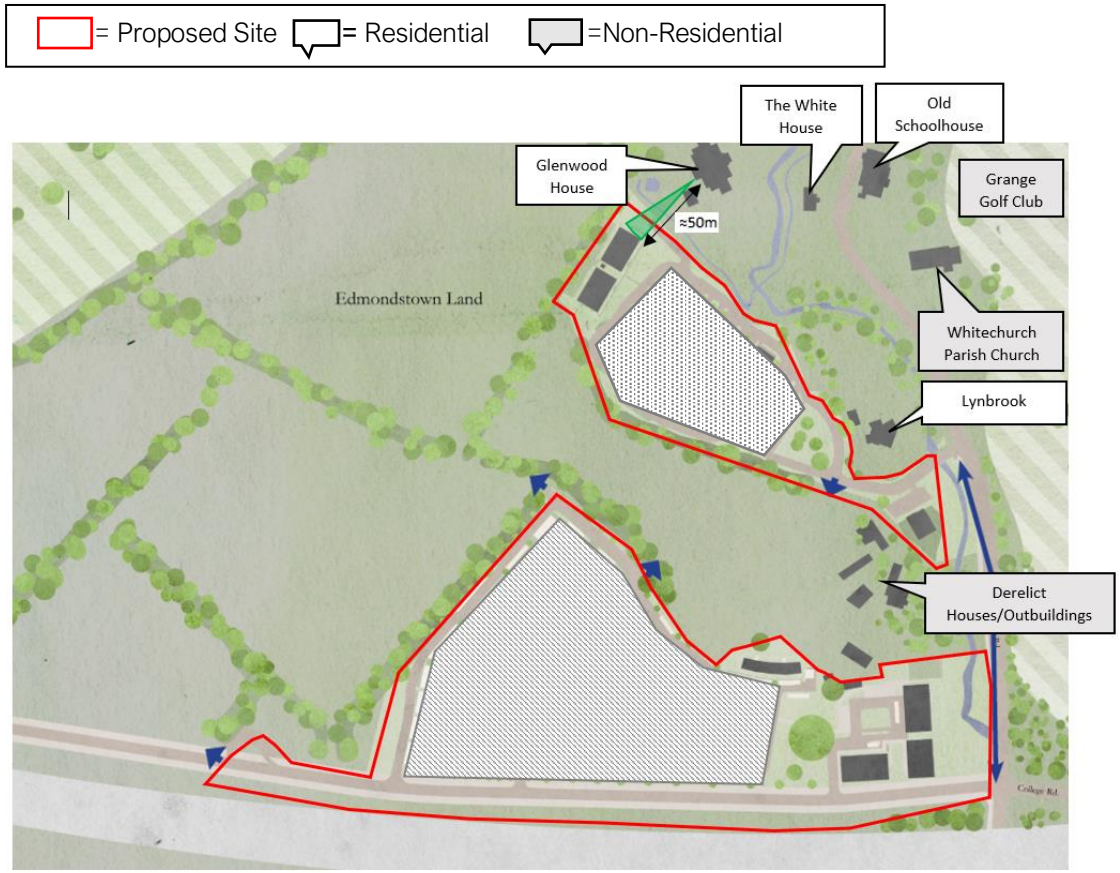
4.3 Sensitive Receptors

The BRE guide states that when assessing the potential effects of a proposed development on existing buildings, only those windows and rooms that have a 'reasonable expectation' of daylight and sunlight need to be considered. Windows and rooms which meet this criteria are considered to be 'sensitive receptors'. Paragraph 2.2.2 of the BRE guide clarifies what are considered sensitive receptors with respect to sunlight and daylight as follows:

"The guidelines given here are intended for use for 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 analysed. The guidelines may also be applied to any existing nondomestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices."

The image below shows the existing surrounding buildings. None of the surrounding buildings were deemed as potentially sensitive receptors.

Existing Surrounding Buildings



No sensitive receptors have been identified in close enough proximity to the proposed development to be affected by it. The scale of the proposed buildings and their distance from any existing neighbouring houses or gardens/amenity areas means they will not have any significant impact on sunlight/daylight to existing neighbouring properties.

5 Methodology & Assessment Criteria

The analyses and assessments are based on the guidelines set out in the BRE guide (BR 209) "Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice" (Paul Littlefair, 2011). This guide is intended to be used in conjunction with interior lighting recommendations in BS 8206-2: 2008 'Lighting for Buildings – Part 2: Code of Practice for Daylighting', and in CIBSE Lighting guide (LG10): daylighting and window design.

It should be noted that that BS 8206: 2008 has now been withdrawn and is superseded by BS EN 17037:2018 which was officially adopted in May 2019. The UK National Annex published as part of BS EN 17037:2018, which is also relevant to Ireland, recommends minimum indoor lighting levels derived from the previous BS 8206-2:2008 targets. The BRE have stated that, "Until BR 209 is rewritten, we are adopting a flexible approach to applying the two standards" and they consider it reasonable for local authorities to accept either average daylight factors using BS 8206 or median daylight factors/median illuminances calculated using EN 17037. Taking this into account, the approach adopted in this report for assessing daylight levels in the *proposed* development is average daylight factors (ADF). Additional analysis has been performed with respect to the recommendations in BS EN 17037:2018 National Annex (UK & Channel Islands) and these results are presented in Appendix D. It should be noted however, that the new BRE Guide 'Site layout planning for daylight and sunlight: a guide to good practice' has not yet been published and therefore the exact recommendations of this guide are as yet unknown. The analysis and results in appendix D are therefore based on the *expected* recommendations of the new BR209 guide which are likely to reflect the recommendations in BS EN 17037. (More details on the newly published British Standard BS EN 17037:2018 "Daylight in buildings" and BPC Engineers' approach for the "transitionary period" until the new BR209 guide is published can be found in Appendix C of this report.)

It should also be noted that although the BRE guide gives numerical guidelines, "*these should be interpreted flexibly since natural lighting is only one of many factors in site layout design.*" (Littlefair, 2011)

Advanced lighting simulation software is used to perform the analysis. The software combines 3D modelling capabilities with a suite of programs which employ advanced ray-tracing. The software fully meets all relevant guidelines set out in Building Research Establishment (BRE) document "Site Layout Planning for Daylight and Sunlight – A Guide to Good Practice" by P J Littlefair.

Throughout this report an effort will be made to differentiate between metrics used to assess skylight versus sunlight. As defined in the glossary of the BRE Guide, "Daylight" is an umbrella term that includes both skylight and sunlight—the diffuse and direct components of light from the sky respectively. Unfortunately, as can be seen from the title of the BRE Guide itself, "Site Layout Planning for *Daylight and Sunlight*" and the BS 8206 standard, the terms daylight and skylight are often used interchangeably but this report will aim to specify when daylight specifically refers to skylight or when it also encompasses sunlight.

The following sub-sections outline the methodology and assessment criteria used.

5.1 Existing Buildings

An assessment of the site determined that there are no existing neighbouring houses or gardens/amenity areas in close enough proximity to buildings in the proposed development to be adversely impacted by it (with respect to daylight/sunlight). Therefore, no analysis was required for any existing neighbouring buildings.

5.2 New Buildings

The quantity and quality of daylight was also checked for the proposed development. The analysis focused on the higher density housing:

- Apartment Block E (North Site)
- Apartment Blocks A/B & C (Neighbourhood Centre, Southern Site)
- Duplex Type T Blocks (x3) (Southern Site)

Section 2.1.8 of the BRE Guide states that:

"Daylight provision in new rooms may be checked using the average daylight factor (ADF)."

5.2.1 Average Daylight Factor (ADF)

The ADF is a measure of the overall amount of daylight in a space.

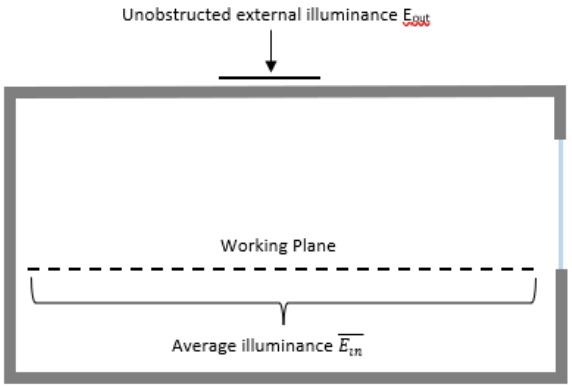


Figure 5: Average Daylight Factor (ADF)

$$ADF = \frac{\overline{E_{in}}}{E_{out}} \times 100\%$$

More specifically it is:

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

Therefore, for a 10,000 lux overcast sky, an average daylight factor of 1.5% would equate to 150lux.

BS 8206-2 recommends a minimum ADF of 2% for kitchens, 1.5% for living rooms and 1% for bedrooms. No analysis is required for bathrooms, ancillary or circulatory spaces. BS 8206-2 also recommends that in situations where an open plan space includes both a living room and a kitchen, the room should be assessed against the higher of the two thresholds. Therefore, the kitchen/dining/living room area has been assessed against an ADF of 2%. It should be noted that this higher threshold is only suitable in certain scenarios, e.g. in low density suburban or rural environments where kitchens can be designed to have direct access to windows. The higher threshold is generally not achievable for internal kitchens and is not appropriate when applied to typical higher density housing units such as apartments.

The ADF for each room has been calculated computationally. The software calculates the daylight factor at different points on a grid using ray tracing techniques and then these values can be averaged over the grid. As the average daylight factor approach takes account of light which has been reflected from both external and internal surfaces, reasonable reflectance values have been attributed to all of the surfaces which are present within the computational model.

The settings used in the computational model for the calculation of the Average Daylight Factor (ADF) are outlined below:

- The working plane is taken to be 0.85m above the floor.

- Window frame factor is set to 20% (This is an estimate based on the size of the window openings and the area of the window which is framing.)
- The glazing transmittance (normal) was set to 0.70.
- The glazing maintenance factor is set to 92% (This accounts for the reduction in glazing transmittance due to dirt.)
- See Table 1 below for reflectance values adopted for different building elements.

Table 1: Surface Reflectances

Surface Type	Reflectance
Interior Wall	0.68
Exterior Wall	0.20
Interior Floor	0.40
Interior Ceiling	0.81
Balconies	0.45
Landscape Hard (e.g. paving)	0.2
Landscape Soft (e.g. Grass/Vegetation)	0.1
Surrounding Buildings/Walls	0.20
Surrounding Roads	0.14

Table 2: Balcony Glazing Properties

Surface Type	Properties
Balcony Glazing	Transmittance: 0.80 (Transmissivity: 0.8715) Refractive Index: 1.52

5.2.2 Sunlight to Proposed Amenity Areas

Good site layout planning for daylight and sunlight should not limit itself to providing natural lighting inside buildings. Sunlight in the spaces between buildings has an important impact on the overall appearance and ambience of a development.

The BRE Guide recommends:

"[…] that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March."

The communal open spaces and gardens associated the apartment blocks and duplex "Type T" blocks were analysed and assessed against the above criterion. The public open space surrounding block E was also analysed. The areas analysed are shown in the following figures.

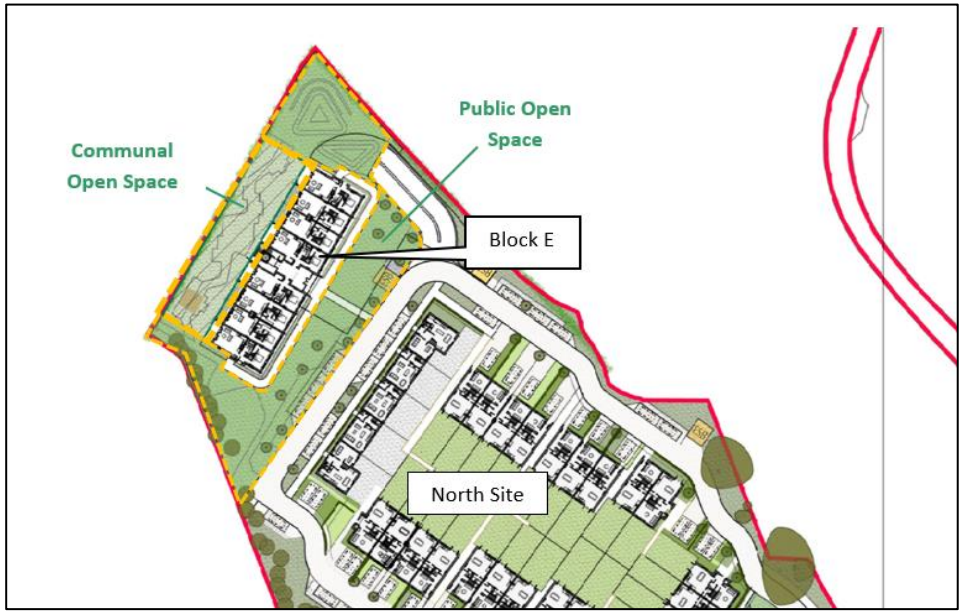


Figure 6: Block E (North Site) Amenity Spaces

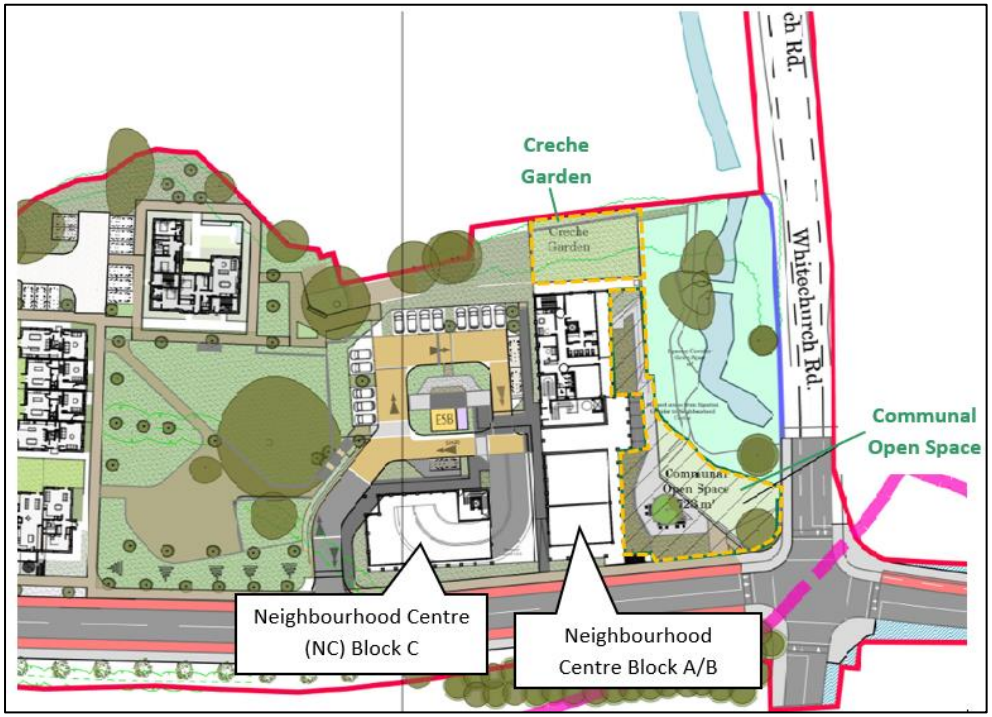


Figure 7: Neighbourhood Centre (Block A/B & C) Amenity Spaces (South Site)

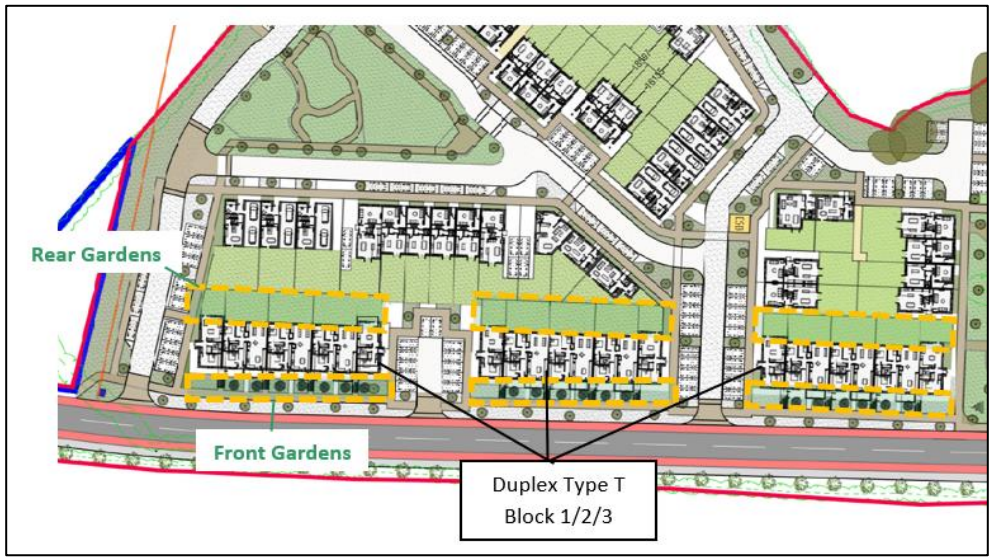


Figure 8: Duplex Type T Gardens (South Site)

It should be noted that large public open spaces are provided throughout the site. None of these spaces are significantly overshadowed by surrounding buildings and therefore no detailed analysis was required for these areas; all public open spaces will greatly exceed the BRE's recommendations for sunlight to gardens/open spaces.

5.2.3 Shadow Plots

The BRE guide states:

"Where a large building is proposed which may affect a number of gardens or open spaces it is often illustrative to plot a shadow plan showing the location of shadows at different times of day and year."

While this type of analysis pertains to assessing a proposed building's impact on existing neighbouring properties/amenity spaces, shadow plots for the proposed site have been created to illustrate the shadows cast *within* the sites (north and south site) at various times of the year. In interpreting the shadow plots, it must be borne in mind that nearly all structures will create areas of shadow, and some degree of overshadowing of spaces is to be expected.

Shadow plots were created for March 21st and June 21st. March 21st is the equinox and as such provides the average level of shadowing that can be expected. June 21st is a summertime plot and represents the best case for shadow. (December 21st has not been plotted as at this time of year even low buildings will cast long shadows. In a built up area, it is common for large areas of the ground to be in shadow in December.)

The shadow plots are purely illustrative (as opposed to other quantitative or quantitative metrics used in the analysis) and are shown in Appendix B.

5.3 Impact Classification

Appendix I of the BRE Guide – "Environmental Impact Assessment" states that the impact of a new building on its surroundings can be classified as negligible, minor, moderate or major adverse. Where the loss of skylight or sunlight fully meets the guidelines in the BRE guide, the impact is assessed as negligible or minor adverse. Where the loss of skylight or sunlight does not meet the BRE guidelines, the impact is assessed as minor, moderate or major adverse.

Table 3 below provides a more detailed description of the impact classification.

Table 3: Environmental Impact Assessment: Impact Classification

Negligible adverse impact	• Loss of light well within guidelines, **or** • only a small number of windows losing light (within the guidelines) **or** • limited area of open space losing light (within the guidelines)

Minor adverse impact (a)	• Loss of light only just within guidelines **and**
	  ○ a larger number of windows are affected **or**
	  ○ larger area of open space is affected (within the guidelines)

Minor adverse impact (b)	• only a small number of windows or limited open space areas are affected • the loss of light is only marginally outside the guidelines • an affected room has other sources of skylight or sunlight • the affected building or open space only has a low level requirement for skylight or sunlight • there are particular reasons why an alternative, less stringent, guideline should be applied
Major adverse impact	• large number of windows or large open space areas are affected • the loss of light is substantially outside the guidelines • all the windows in a particular property are affected • the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight (living rooms / playground)

6 Analysis

6.1 Overview of Computational Models

3D models of the proposed buildings and surrounding context were created. The site plans and 3D models of the site provided by the architect were used to correctly position the buildings relative to each other.

The proposed buildings, which are the subject of the daylight analysis, are shown in blue in the following figures.

Figure 9: Block E Apartments (North Site)

Figure 10: Neighbourhood Centre Block A/B (South Site)

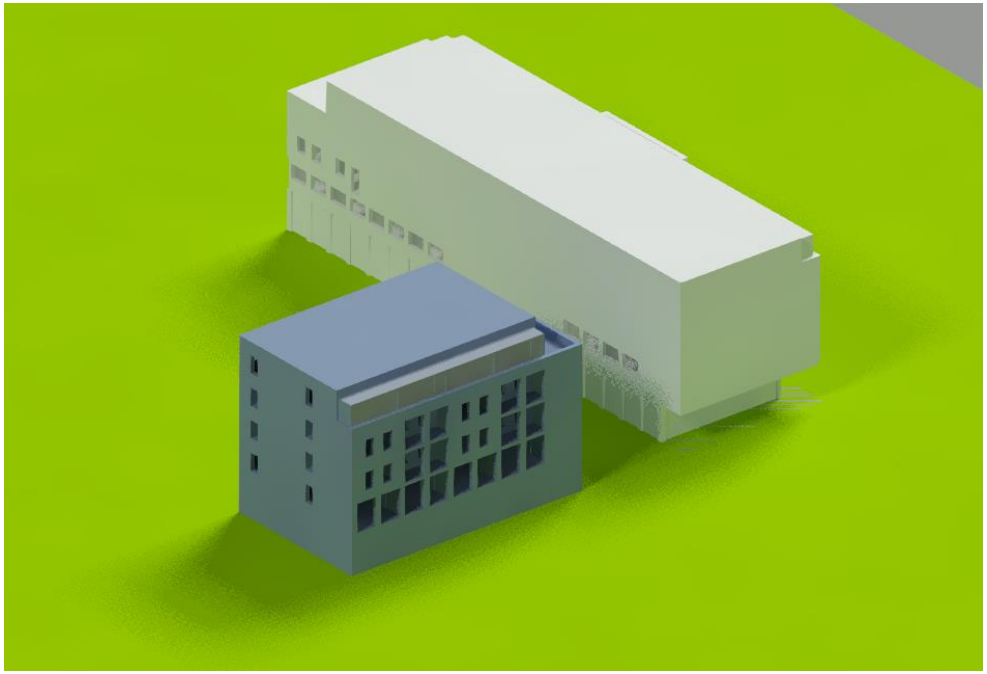


Figure 11: Neighbourhood Centre Block C (South Site)

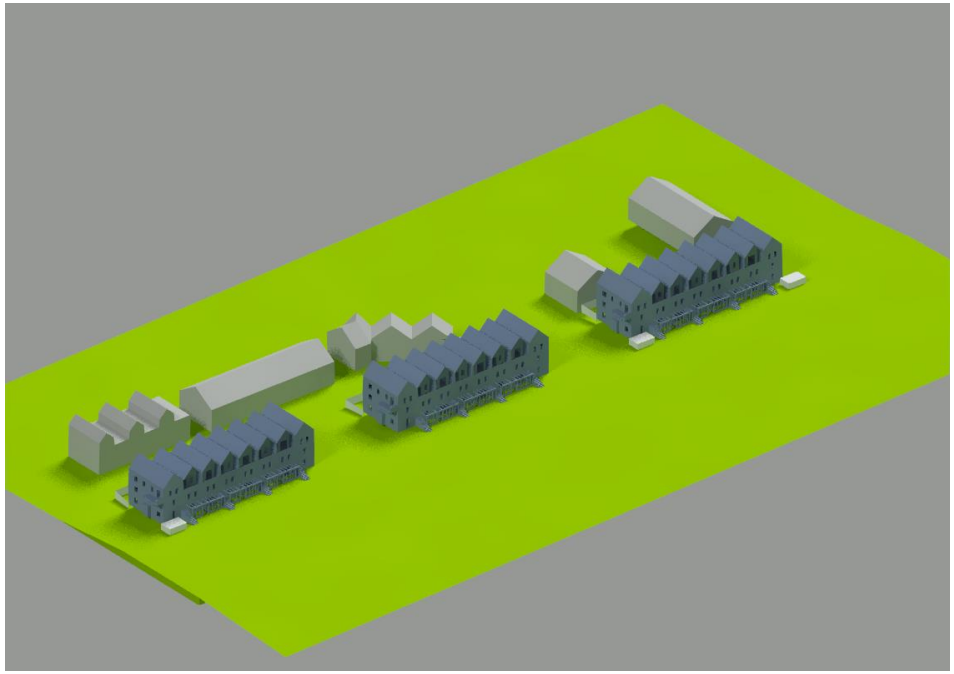


Figure 12: Duplex Type T Block 1-3 (South Site)

6.2 Proposed Development

6.2.1 Daylight Analysis for Proposed Development

The daylight provision in the apartment blocks shown in section 6.1 were checked using the average daylight factor (ADF). See Appendix A for the room legend and daylight factor contour images.

6.2.1.1 Block E (North Site) ADF Results

Table 4: Block E ADF Results – Ground Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Ground	R1	Bedroom	1	6.64	YES
	R2	Bedroom	1	4.35	YES
	R3	Bedroom	1	4.39	YES
	R4	Bedroom	1	4.38	YES
	R5	Bedroom	1	4.60	YES
	R6	Bedroom	1	4.82	YES
	R7	Bedroom	1	4.92	YES
	R8	Bedroom	1	7.31	YES
	R9	LKD	2	5.05	YES
	R10	LKD	2	4.92	YES
	R11	LKD	2	4.88	YES
	R12	LKD	2	2.57	YES
	R13	LKD	2	2.56	YES
	R14	LKD	2	4.91	YES
	R15	LKD	2	4.95	YES
	R16	LKD	2	5.05	YES

Table 5: Block E ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	Bedroom	1	7.06	YES
	R2	Bedroom	1	4.72	YES
	R3	Bedroom	1	4.74	YES
	R4	Bedroom	1	4.80	YES
	R5	Bedroom	1	4.93	YES
	R6	Bedroom	1	5.01	YES
	R7	Bedroom	1	5.08	YES
	R8	Bedroom	1	7.47	YES
	R9	LKD	2	3.91	YES
	R10	Bedroom	1	5.21	YES
	R11	Bedroom	1	5.19	YES
	R12	LKD	2	2.93	YES
	R13	LKD	2	2.93	YES
	R14	Bedroom	1	5.21	YES
	R15	Bedroom	1	5.32	YES
	R16	LKD	2	3.92	YES

Table 6: Block E ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	Bedroom	1	7.35	YES
	R2	Bedroom	1	5.00	YES
	R3	Bedroom	1	5.02	YES
	R4	Bedroom	1	5.05	YES
	R5	Bedroom	1	5.11	YES
	R6	Bedroom	1	5.15	YES
	R7	Bedroom	1	5.20	YES
	R8	Bedroom	1	7.58	YES
	R9	LKD	2	3.92	YES
	R10	Bedroom	1	2.88	YES
	R11	Bedroom	1	2.89	YES
	R12	LKD	2	2.85	YES
	R13	LKD	2	2.87	YES
	R14	Bedroom	1	2.89	YES
	R15	Bedroom	1	2.94	YES
	R16	LKD	2	3.94	YES

Table 7: Block E ADF Results - Third Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Third	R1	Bedroom	1	7.50	YES
	R2	Bedroom	1	5.16	YES
	R3	Bedroom	1	5.17	YES
	R4	Bedroom	1	5.18	YES
	R5	Bedroom	1	5.22	YES
	R6	Bedroom	1	5.25	YES
	R7	Bedroom	1	5.28	YES
	R8	Bedroom	1	7.65	YES
	R9	LKD	2	6.21	YES
	R10	LKD	2	3.51	YES
	R11	LKD	2	3.51	YES
	R12	LKD	2	3.60	YES
	R13	LKD	2	3.60	YES
	R14	LKD	2	3.51	YES
	R15	LKD	2	3.60	YES
	R16	LKD	2	6.22	YES

6.2.1.2 Neighbourhood Centre Block A/B (South Site) ADF Results

Table 8: Block A/B ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	LKD	2	3.12	YES
	R2	LKD	2	3.07	YES
	R3	LKD	2	3.06	YES
	R4	LKD	2	2.68	YES
	R5	LKD	2	2.50	YES
	R6	LKD	2	2.82	YES
	R7	LKD	2	3.09	YES
	R8	LKD	2	3.16	YES
	R9	LKD	2	3.16	YES
	R10	Bedroom	1	6.24	YES
	R11	Bedroom	1	6.29	YES
	R12	Bedroom	1	6.25	YES
	R13	Bedroom	1	5.12	YES
	R14	Bedroom	1	6.38	YES
	R15	Bedroom	1	5.23	YES
	R16	Bedroom	1	4.58	YES
	R17	Bedroom	1	4.05	YES
	R18	Bedroom	1	4.36	YES

Table 9: Block A/B ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	LKD	2	3.15	YES
	R2	Bedroom	1	3.64	YES
	R3	Bedroom	1	1.95	YES
	R4	LKD	2	3.15	YES
	R5	Bedroom	1	2.82	YES
	R6	LKD	2	10.07	YES
	R7	LKD	2	3.11	YES
	R8	Bedroom	1	1.96	YES
	R9	LKD	2	3.74	YES
	R10	Bedroom	1	1.97	YES
	R11	Bedroom	1	7.38	YES
	R12	Bedroom	1	7.39	YES
	R13	Bedroom	1	7.39	YES
	R14	Bedroom	1	7.29	YES
	R15	Bedroom	1	6.91	YES
	R16	Bedroom	1	6.45	YES
	R17	Bedroom	1	5.98	YES
	R18	Bedroom	1	5.49	YES
	R19	Bedroom	1	8.13	YES

Table 10: Block A/B ADF Results - Third Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Third	R1	LKD	2	3.19%	YES
	R2	Bedroom	1	3.67%	YES
	R3	Bedroom	1	1.97%	YES
	R4	LKD	2	3.29%	YES
	R5	Bedroom	1	2.92%	YES
	R6	LKD	2	10.13%	YES
	R7	LKD	2	3.21%	YES
	R8	Bedroom	1	1.99%	YES
	R9	LKD	2	3.80%	YES
	R10	Bedroom	1	1.99%	YES
	R11	Bedroom	1	4.94%	YES
	R12	Bedroom	1	7.44%	YES
	R13	Bedroom	1	7.46%	YES
	R14	Bedroom	1	7.39%	YES
	R15	Bedroom	1	7.17%	YES
	R16	Bedroom	1	6.89%	YES
	R17	Bedroom	1	6.64%	YES
	R18	Bedroom	1	6.35%	YES
	R19	Bedroom	1	8.69%	YES

Table 11: Block A/B ADF Results - Fourth Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Fourth	R1	LKD	2	7.85	YES
	R2	LKD	2	5.86	YES
	R3	LKD	2	5.87	YES
	R4	LKD	2	5.89	YES
	R5	LKD	2	7.62	YES
	R6	LKD	2	5.92	YES
	R7	LKD	2	5.88	YES
	R8	LKD	2	4.99	YES
	R9	Bedroom	1	6.58	YES
	R10	Bedroom	1	6.57	YES
	R11	Bedroom	1	6.56	YES
	R12	Bedroom	1	6.47	YES
	R13	Bedroom	1	6.38	YES
	R14	Bedroom	1	6.26	YES
	R15	Bedroom	1	6.18	YES
	R16	Bedroom	1	9.25	YES

6.2.1.3 Neighbourhood Centre Block C (South Site) ADF Results

Table 12: Block C ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	LKD	2	4.26	YES
	R2	LKD	2	3.20	YES
	R3	LKD	2	3.20	YES
	R4	LKD	2	3.09	YES
	R5	Bedroom	1	5.11	YES
	R6	Bedroom	1	5.25	YES
	R7	Bedroom	1	5.34	YES
	R8	Bedroom	1	7.65	YES

Table 13: Block C ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	LKD	2	3.28	YES
	R2	Bedroom	1	1.97	YES
	R3	LKD	2	2.62	YES
	R4	Bedroom	1	1.97	YES
	R5	Bedroom	1	6.94	YES
	R6	Bedroom	1	7.11	YES
	R7	Bedroom	1	7.18	YES
	R8	Bedroom	1	8.28	YES

Table 14: Block C ADF Results - Third Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Third	R1	LKD	2	3.31	YES
	R2	Bedroom	1	2.00	YES
	R3	LKD	2	2.64	YES
	R4	Bedroom	1	1.99	YES
	R5	Bedroom	1	7.12	YES
	R6	Bedroom	1	7.22	YES
	R7	Bedroom	1	7.26	YES
	R8	Bedroom	1	8.35	YES

Table 15: Block C ADF Results - Fourth Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Fourth	R1	LKD	2	4.11	YES
	R2	LKD	2	2.91	YES
	R3	LKD	2	2.91	YES
	R4	LKD	2	2.91	YES
	R5	Bedroom	1	6.42	YES
	R6	Bedroom	1	6.46	YES
	R7	Bedroom	1	6.49	YES
	R8	Bedroom	1	8.78	YES

6.2.1.4 Duplex Type T Block 1 (West Block) ADF Results

Table 16: Duplex T Block 1 (West Block) ADF Results - Ground Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Ground	R1	Bedroom	1	5.31	YES
	R2	Bedroom	1	2.44	YES
	R3	LKD	2	3.97	YES
	R4	Bedroom	1	2.42	YES
	R5	LKD	2	3.98	YES
	R6	LKD	2	2.41	YES
	R7	Bedroom	1	3.86	YES
	R8	Bedroom	1	4.97	YES
	R9	LKD	2	5.38	YES
	R10	Bedroom	1	4.79	YES
	R11	Bedroom	1	3.20	YES
	R12	Bedroom	1	4.71	YES
	R13	Bedroom	1	3.17	YES
	R14	Bedroom	1	4.82	YES
	R15	Bedroom	1	2.82	YES
	R16	LKD	2	5.89	YES

Table 17: Duplex T Block 1 (West Block) ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	Bedroom	1	3.57	YES
	R2	Bedroom	1	4.41	YES
	R3	Bedroom	1	3.87	YES
	R4	Bedroom	1	4.39	YES
	R5	Bedroom	1	4.37	YES
	R6	Bedroom	1	4.38	YES
	R7	Bedroom	1	4.38	YES
	R8	Bedroom	1	5.40	YES
	R9	Bedroom	1	1.50	YES
	R10	Bedroom	1	3.90	YES
	R11	Bedroom	1	3.90	YES
	R12	Bedroom	1	3.88	YES
	R13	Bedroom	1	3.88	YES
	R14	Bedroom	1	3.89	YES
	R15	Bedroom	1	3.89	YES
	R16	Bedroom	1	3.76	YES

Table 18: Duplex T Block 1 (West Block) ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	LKD	2	4.90	YES
	R2	LKD	2	3.40	YES
	R3	LKD	2	3.39	YES
	R4	LKD	2	3.39	YES
	R5	LKD	2	3.38	YES
	R6	LKD	2	3.39	YES
	R7	LKD	2	3.39	YES
	R8	LKD	2	4.71	YES
	R9	Bedroom	1	3.64	YES
	R10	Bedroom	1	3.83	YES

6.2.1.5 Duplex Type T Block 2 (Middle Block) ADF Results

Table 19: Duplex T Block 2 (Middle Block) ADF Results - Ground Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Ground	R1	Bedroom	1	5.10	YES
	R2	Bedroom	1	2.44	YES
	R3	LKD	2	3.99	YES
	R4	Bedroom	1	2.41	YES
	R5	LKD	2	3.86	YES
	R6	LKD	2	2.41	YES
	R7	Bedroom	1	3.84	YES
	R8	Bedroom	1	4.97	YES
	R9	LKD	2	5.71	YES
	R10	Bedroom	1	4.54	YES
	R11	Bedroom	1	3.03	YES
	R12	Bedroom	1	4.67	YES
	R13	Bedroom	1	3.18	YES
	R14	Bedroom	1	4.83	YES
	R15	Bedroom	1	2.85	YES
	R16	LKD	2	5.50	YES

Table 20: Duplex T Block 2 (Middle Block) ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	Bedroom	1	3.18	YES
	R2	Bedroom	1	4.40	YES
	R3	Bedroom	1	3.87	YES
	R4	Bedroom	1	4.39	YES
	R5	Bedroom	1	4.36	YES
	R6	Bedroom	1	4.39	YES
	R7	Bedroom	1	4.37	YES
	R8	Bedroom	1	5.42	YES
	R9	Bedroom	1	6.04	YES
	R10	Bedroom	1	1.56	YES
	R11	Bedroom	1	3.91	YES
	R12	Bedroom	1	3.84	YES
	R13	Bedroom	1	3.86	YES
	R14	Bedroom	1	3.85	YES
	R15	Bedroom	1	3.93	YES
	R16	Bedroom	1	3.79	YES

Table 21: Duplex T Block 2 (Middle Block) ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	LKD	2	4.64	YES
	R2	LKD	2	3.40	YES
	R3	LKD	2	3.39	YES
	R4	LKD	2	3.39	YES
	R5	LKD	2	3.39	YES
	R6	LKD	2	3.40	YES
	R7	LKD	2	3.40	YES
	R8	LKD	2	4.71	YES
	R9	Bedroom	1	3.65	YES
	R10	Bedroom	1	3.58	YES

6.2.1.6 Duplex Type T Block 3 (East Block) ADF Results

Table 22: Duplex T Block 3 (East Block) ADF Results - Ground Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Ground	R1	Bedroom	1	4.99	YES
	R2	Bedroom	1	2.44	YES
	R3	LKD	2	3.92	YES
	R4	Bedroom	1	2.42	YES
	R5	LKD	2	4.08	YES
	R6	LKD	2	2.41	YES
	R7	Bedroom	1	3.24	YES
	R8	Bedroom	1	5.26	YES
	R9	LKD	2	4.11	YES
	R10	Bedroom	1	4.57	YES
	R11	Bedroom	1	3.21	YES
	R12	Bedroom	1	4.96	YES
	R13	Bedroom	1	3.31	YES
	R14	Bedroom	1	3.99	YES
	R15	Bedroom	1	2.13	YES
	R16	LKD	2	4.69	YES

Table 23: Duplex T Block 3 (East Block) ADF Results - First Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
First	R1	Bedroom	1	3.27	YES
	R2	Bedroom	1	4.41	YES
	R3	Bedroom	1	3.87	YES
	R4	Bedroom	1	4.39	YES
	R5	Bedroom	1	4.37	YES
	R6	Bedroom	1	4.39	YES
	R7	Bedroom	1	4.38	YES
	R8	Bedroom	1	5.71	YES
	R9	Bedroom	1	1.79	YES
	R10	Bedroom	1	3.56	YES
	R11	Bedroom	1	3.78	YES
	R12	Bedroom	1	3.95	YES
	R13	Bedroom	1	3.93	YES
	R14	Bedroom	1	3.88	YES
	R15	Bedroom	1	3.75	YES
	R16	Bedroom	1	3.74	YES

Table 24: Duplex T Block 3 (East Block) ADF Results - Second Floor

Floor	Room Ref.	Room Use	ADF		Meets Criteria
			Minimum Target (%)	Predicted Level (%)	
Second	R1	LKD	2	4.66	YES
	R2	LKD	2	3.40	YES
	R3	LKD	2	3.40	YES
	R4	LKD	2	3.41	YES
	R5	LKD	2	3.40	YES
	R6	LKD	2	3.38	YES
	R7	LKD	2	3.36	YES
	R8	LKD	2	4.91	YES
	R9	Bedroom	1	3.82	YES
	R10	Bedroom	1	3.58	YES

6.2.1.7 Discussion

The results show that all rooms meet/exceed the BRE's recommendations for daylight provision. Therefore, each apartment can be expected to enjoy adequate levels of natural light.

With a higher ADF, indoor daylight will sufficient for more of the year. Therefore the apartments will rely less on electric lighting. In cases where the ADF is very high (>6%), care needs to be taken to mitigate potential overheating in summer and/or excessive heat loss in winter.

6.2.2 Sunlight to Proposed Amenity Spaces

The BRE guide recommends:

"that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March."

The shared amenity spaces for each apartment block were analysed. The public open space surrounding Block E was also analysed. (All other public open spaces are in areas with minimal overshadowing so they do not require detailed analysis; they will greatly exceed the minimum recommendations for sunlight to amenity spaces.

6.2.2.1 Block E - Sunlight to Amenity Areas

Block E has an area of approximately 485m^2 designated as communal open space for the apartment block. There is also approximately 1,600m^2 of public open space surrounding this block as shown in Figure 13.

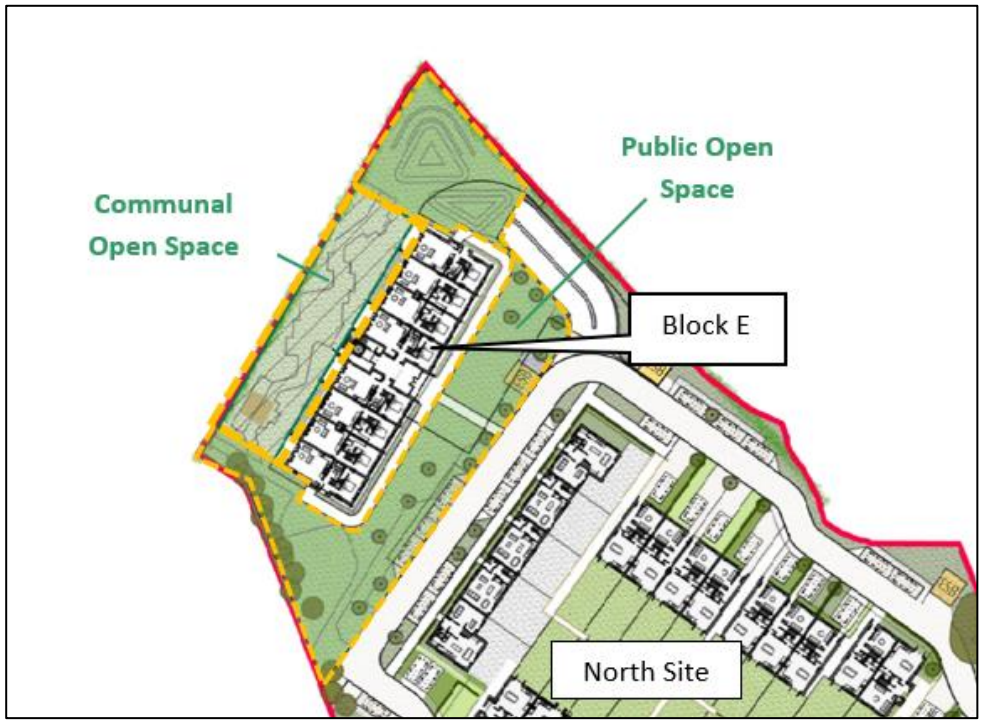


Figure 13: Block E Amenity Spaces

The analysis assesses the communal and public open spaces associated with Block E as one amenity space. No undue benefit is gained from this simplification; as can be seen in Figure 14, each space would still meet the criterion if assessed on its own.

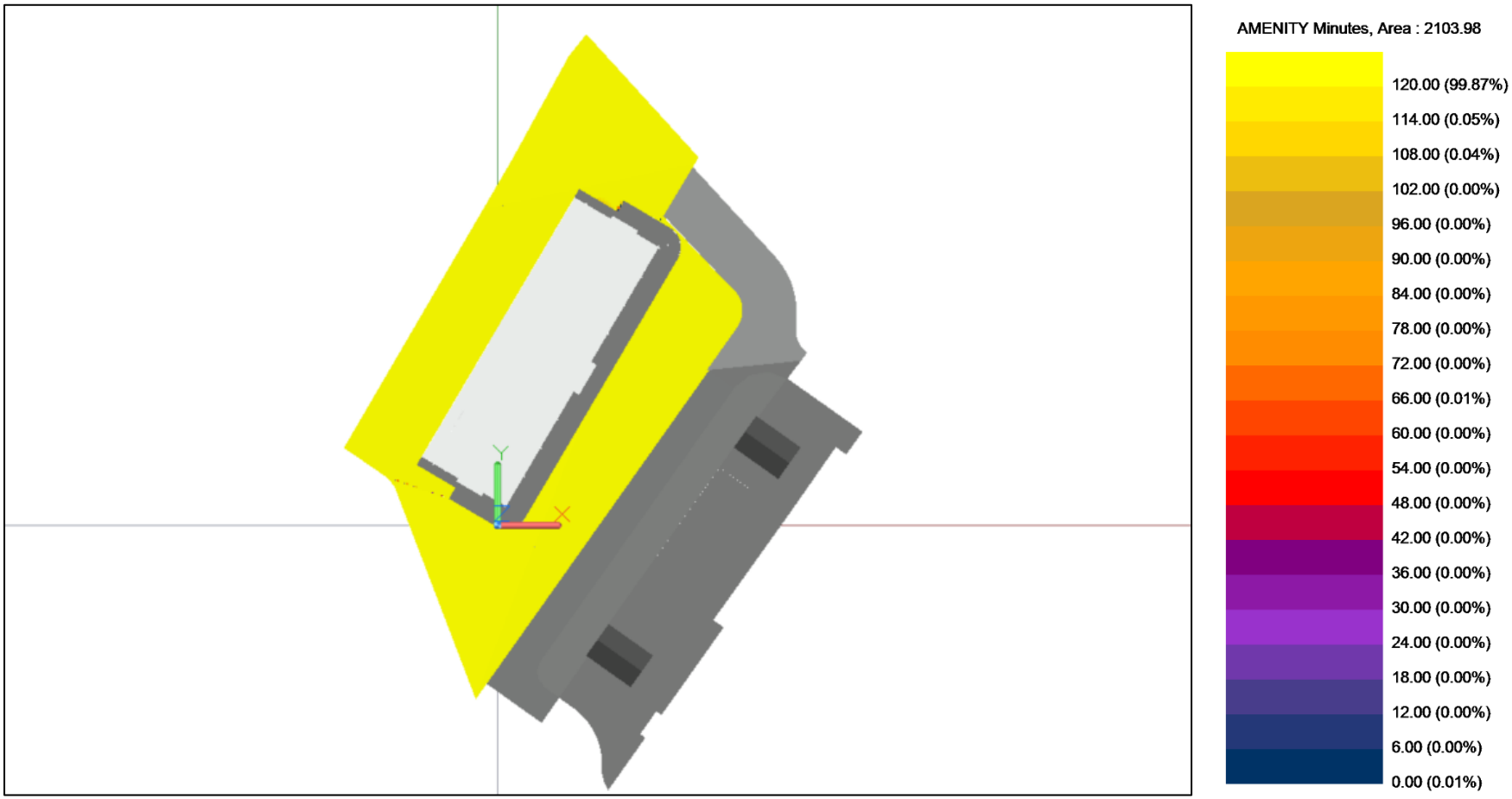


Figure 14: Block E Amenity 2hr Sunlight Test

The results show that close to 100% of the amenity area surrounding Block E will achieve at least 2hrs of sunlight on March 21st. Therefore, these spaces exceed the BRE 's recommendation for sunlight to open spaces and should appear adequately sunlit throughout the year.

There may be a slight variation in this result with the addition of landscaping features (e.g. low walls, raised flower beds, etc.), but the overall percentage area receiving at least 2hrs of sunlight on March 21st should nevertheless remain close to 100%.

6.2.2.2 Neighbourhood Centre (NC) (Blocks A/B & C) - Sunlight to Amenity Areas

The neighbourhood centre's communal open space, east of Block A/B, and the Creche garden's sunlight were analysed. The communal open space is approximately 730m^2. The creche garden is approximately 268m^2.

Figure 15: Neighbourhood Centre (Blocks A/B & C) Amenity Spaces

The results of the analysis are shown in Figure 16 and Table 25 below.

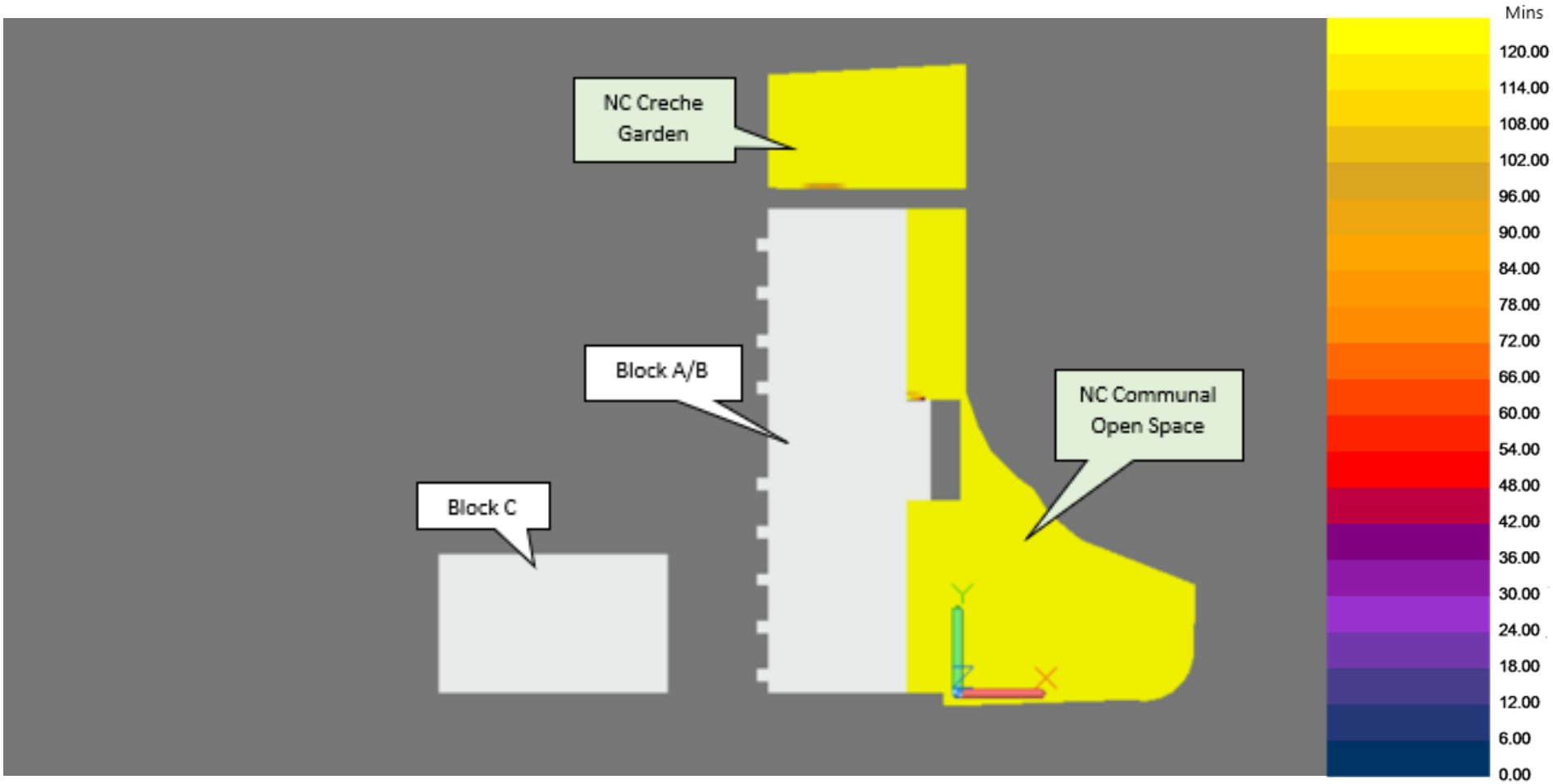


Figure 16: Neighbourhood Centre (NC) Amenity Areas 2hr Sunlight Test

Table 25: Neighbourhood Centre (NC) Amenity Areas 2hr Sunlight Test Results

Garden	Area (m^2)	2hr Sun Area (m^2)	% Area	Meets Criteria
NC Communal Open Space	732.5	731.18	99.82	Yes
NC Creche Garden	268	265.61	99.11	Yes

The results show that close to 100% of both amenity areas analysed will achieve at least 2hrs of sunlight on March 21st. Therefore, these spaces exceed the BRE 's recommendation for sunlight to open spaces and should appear adequately sunlit throughout the year.

The addition of landscaping features such as low walls, raised flower beds, etc. may change the results slightly, but the overall percentage area receiving at least 2hrs of sunlight on March 21st should remain close to 100%.

6.2.2.3 Block T - Sunlight to Amenity Areas (Block 2: Middle Block)

The centre ground floor duplex apartments are served by winter gardens to the south. The end-terrace units for each block have a south facing front garden. Rear gardens have also been provided to the north for all units. This configuration has been developed to address the issues raised by the planning authority of the need to provide passive surveillance to the new link street.

The gardens of the Duplex Type T block (Block 2) were analysed with respect to their access to sunlight. These gardens serve the ground floor units, numbers 57-61. This block was chosen as a sample of the Block T Duplex blocks. The results for this block will be representative of the results for the two adjacent blocks (Block 1 & 3, west and east respectively.)

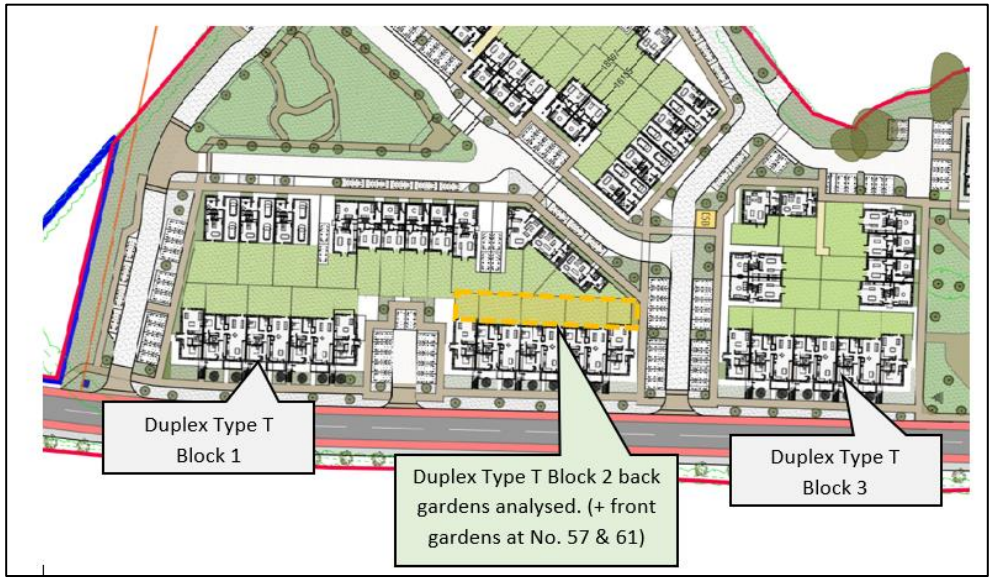


Figure 17: Duplex Type T Block 2 Gardens

The results of the analysis are shown in Figure 18 and Table 26.

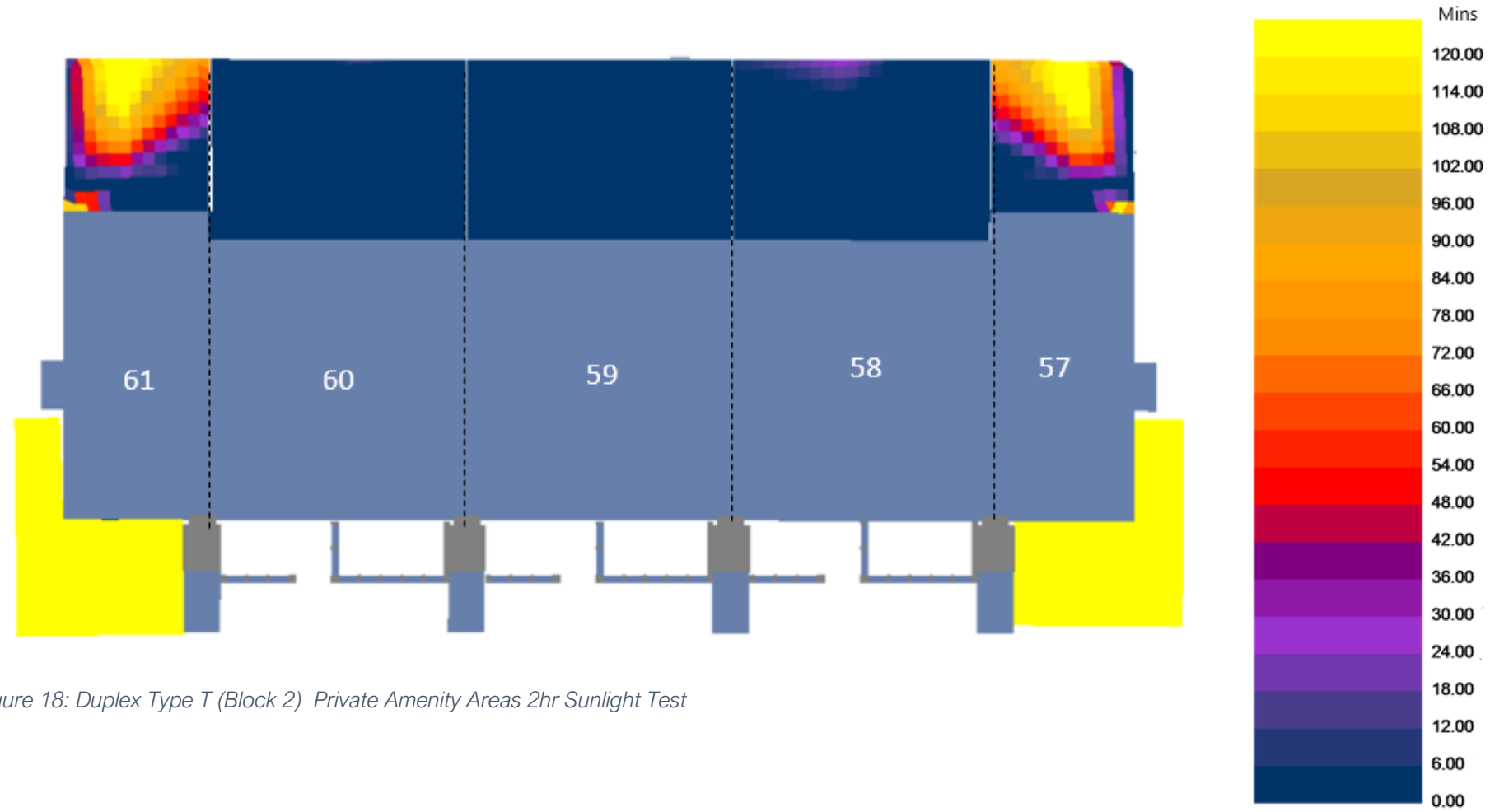


Figure 18: Duplex Type T (Block 2) Private Amenity Areas 2hr Sunlight Test

Table 26: Duplex Type T (Block 2) 2hr Sunlight Test Results

Garden	Area (m^2)	2hr Sun Area (m^2)	% Area	Meets Criteria
No. 57 Front	37.8	37.8	100	Yes
No. 57 Back	37.14	2.1	5.66	No
No. 58 Back	78.26	0	0	No
No. 59 Back	80.21	0	0	No
No. 60 Back	78.25	0	0	No
No. 61 Front	40.21	40.21	100	Yes
No. 61 Back	37.34	2.21	5.92	No

The two end-terrace units (No. 57 & 61) have front gardens to the south which meet the minimum recommendations of the BRE guide for sunlight to gardens/open spaces. The north facing gardens to the rear of the duplexes do not meet the 2hr sunlight test, however winter gardens have been provided to the south of these units to mitigate this fact. These winter gardens will experience good levels of sunlight throughout the year as they are south facing with minimal overshadowing.

It should also be noted that the end-units (57 and 61) pass the 2hr sunlight to amenity test when the area of front and rear gardens are combined, i.e. the *total* garden area (front + back) receiving at least 2hrs of sunlight on March 21st for these units is greater than 50% of the total garden area.

The three duplex Type T blocks are identical and the garden configurations are also very similar. Therefore, the above results are also indicative of the results for Duplex Type T Block 1 and 3 (west and east blocks respectively.)

6.2.2.4 Sunlight to Amenity Areas - Discussion

The results show that the majority of spaces tested meet the BRE's minimum recommendations for sunlight to gardens or open spaces . All areas meeting the criterion should appear adequately sunlit throughout the year.

As discussed in section 6.2.2.3, the back gardens of the Duplex Type T units do not meet the minimum recommendation for sunlight. The layout and orientation of these units have been developed to address the need raised by the planning authority to provide passive surveillance of the new link street. To mitigate the fact that these gardens are north facing, additional compensatory amenity spaces are provided to the front (south) of the units in the form of "winter gardens" for the middle units and front gardens for the end-terrace units will receive excellent levels of sunlight. The winter gardens comply with standards for private amenity space for apartments (Sustainable Urban Housing- Design Standards for New Apartments) in such noise sensitive locations.

Trees/Shrubs have not been modelled in the gardens/open areas as the shadows they produce are almost impossible to predict and "*the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies particularly to deciduous trees).*" (Littlefair, 2011) Nevertheless, the location for planting trees should be chosen with care. "*The aim should normally be to have some areas of partial shade under trees while leaving other parts of the garden or amenity area in full sun.*" (Littlefair, 2011)

7 Conclusion

There are no neighbouring buildings or gardens/amenity spaces in close enough proximity to the proposed development to be affected in terms of availability of daylight/sunlight.

The development itself is expected to experience good levels of internal daylight, with all rooms exceeding the minimum recommendations of the BRE Guide. With a higher ADF, indoor daylight will sufficient for more of the year. Therefore, the apartments will rely less on electric lighting. In cases where the ADF is very high (>6%), care needs to be taken to mitigate potential overheating in summer and/or excessive heat loss in winter.

The results show that the majority of amenity spaces tested in the proposed development meet the BRE's minimum recommendations for sunlight to gardens or open spaces. All areas meeting the criterion should appear adequately sunlit throughout the year. The back gardens of the Duplex Type T units do not meet the minimum recommendation for sunlight. The layout and orientation of these units have been developed to address the need raised by the planning authority to provide passive surveillance of the new link street. To mitigate the fact that these gardens are north facing, additional compensatory amenity spaces are provided to the front (south) of the units in the form of "winter gardens" for the middle units and front gardens for the end-terrace units.

Overall, the development has been designed with due consideration for sunlight and daylight and largely meets the recommendations as set out in the BRE Guide – BR 209 "Site Layout Planning for Daylight and Sunlight, A guide to good practice (2011)."

8 Appendix A: Proposed Daylight Factor Contours & Room Legend

8.1 Block E

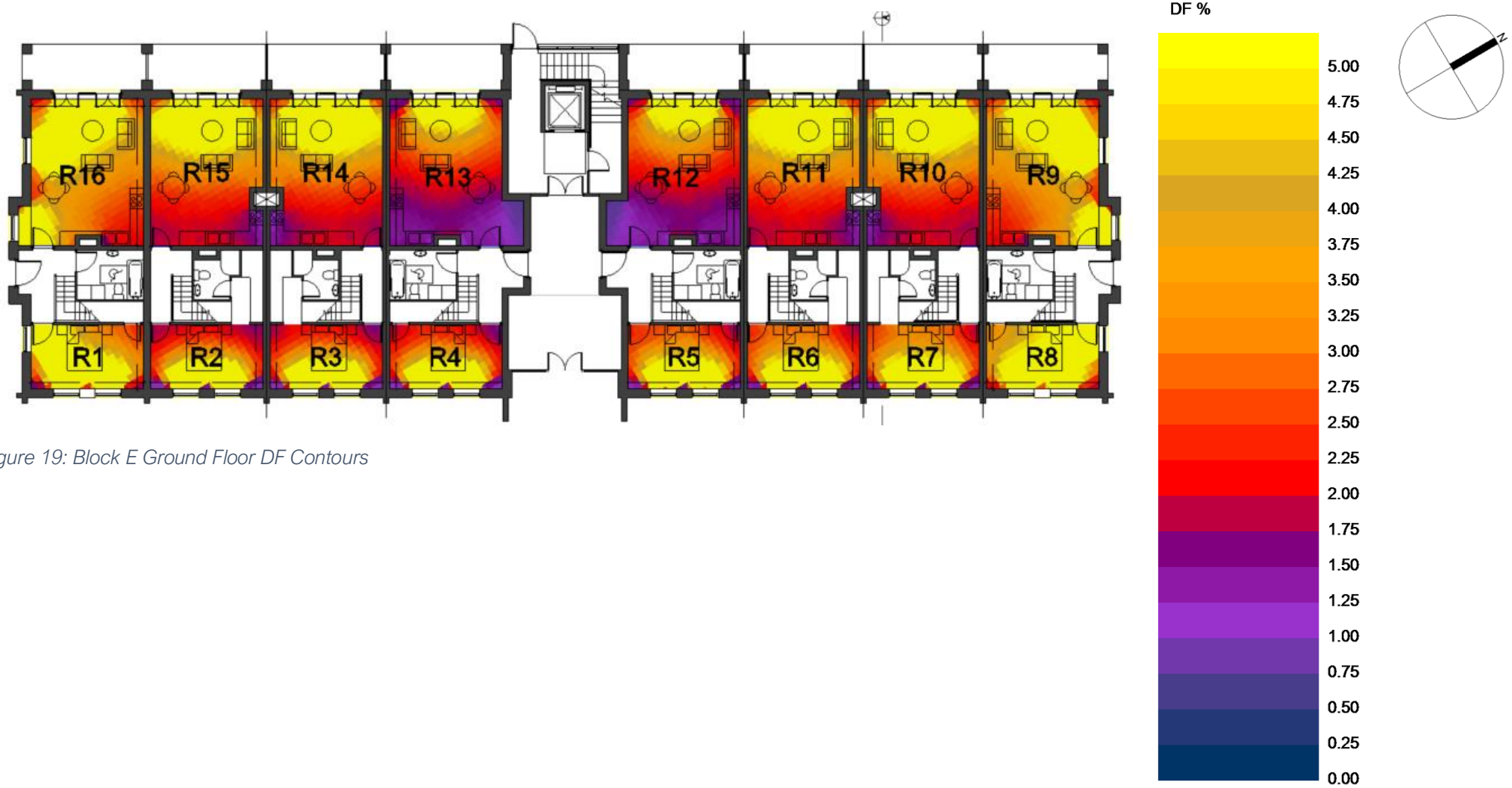


Figure 19: Block E Ground Floor DF Contours

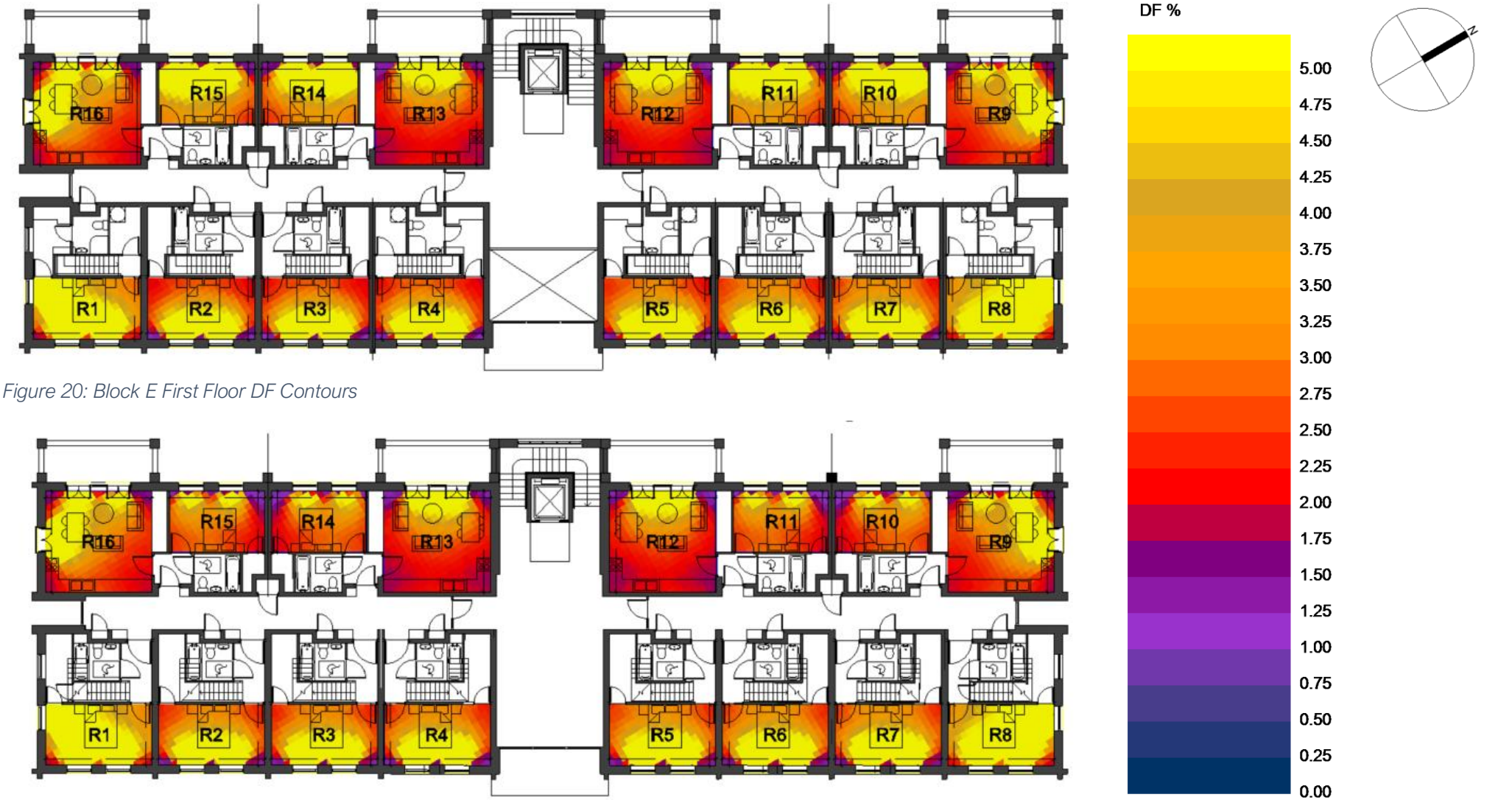


Figure 20: Block E First Floor DF Contours

Figure 21: Block E Second Floor DF Contours

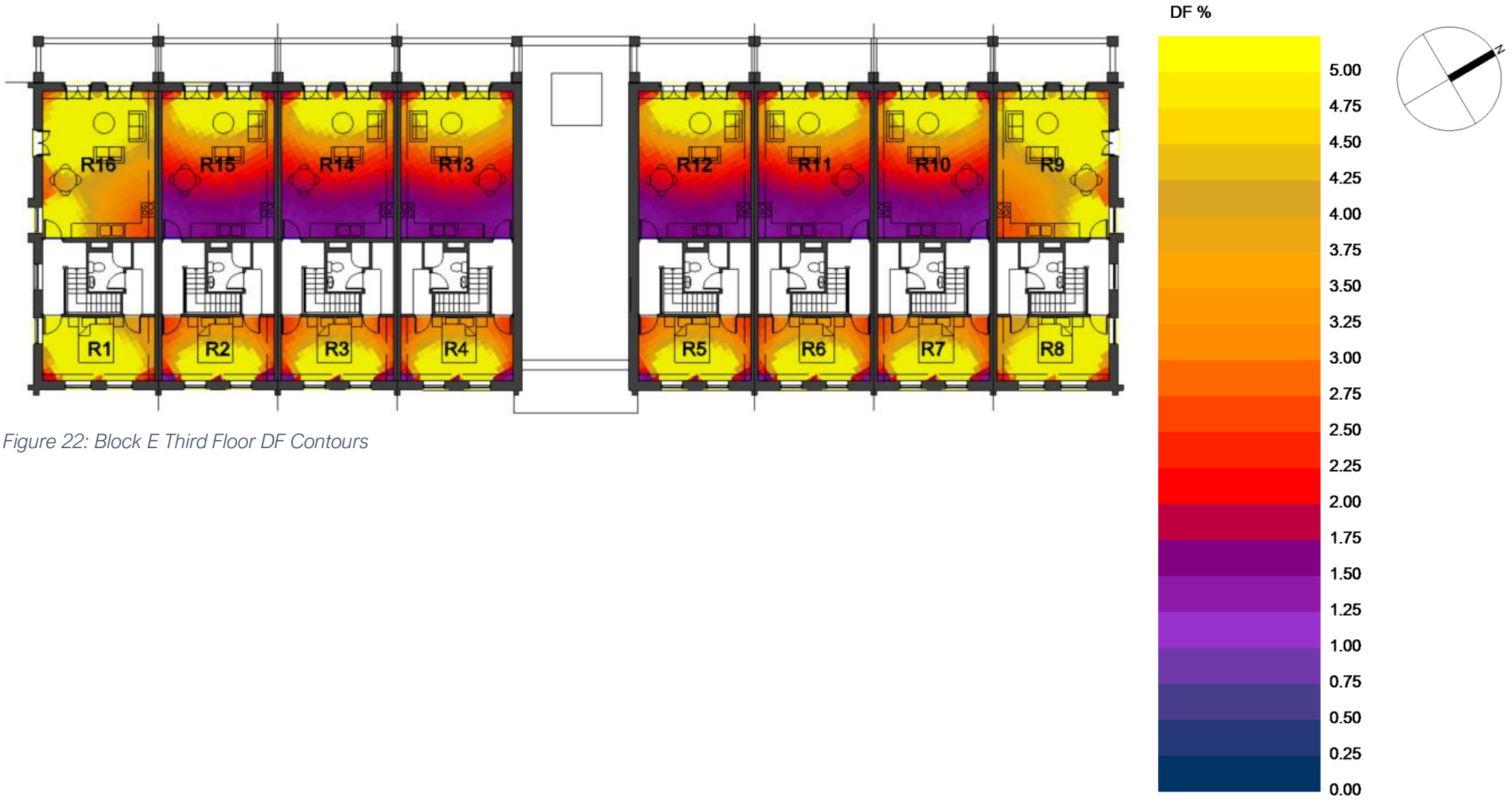


Figure 22: Block E Third Floor DF Contours

8.2 Block A/B (Neighbourhood Centre)

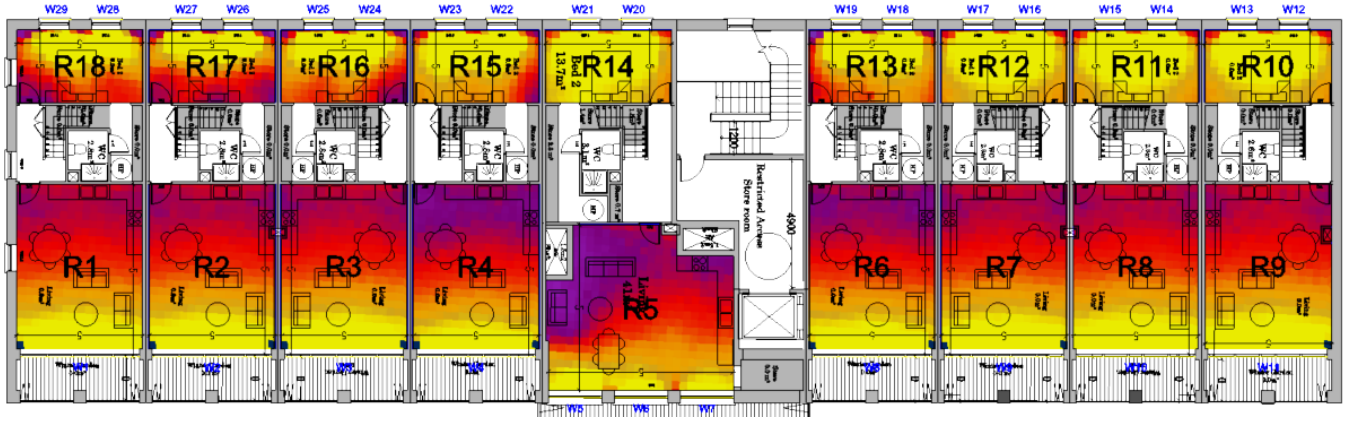


Figure 23: Block A/B First Floor DF Contours

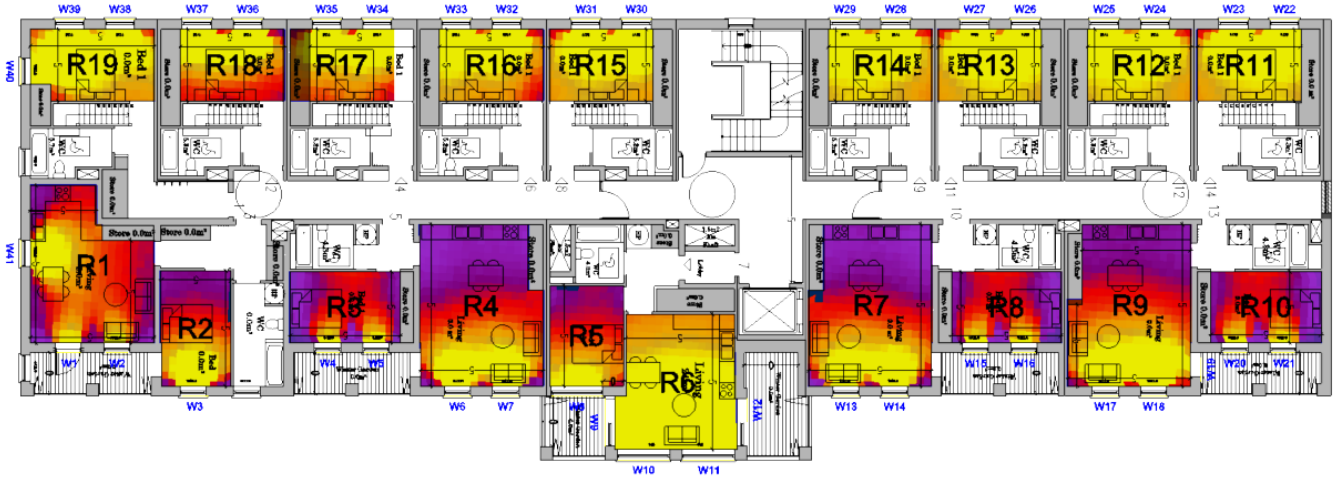
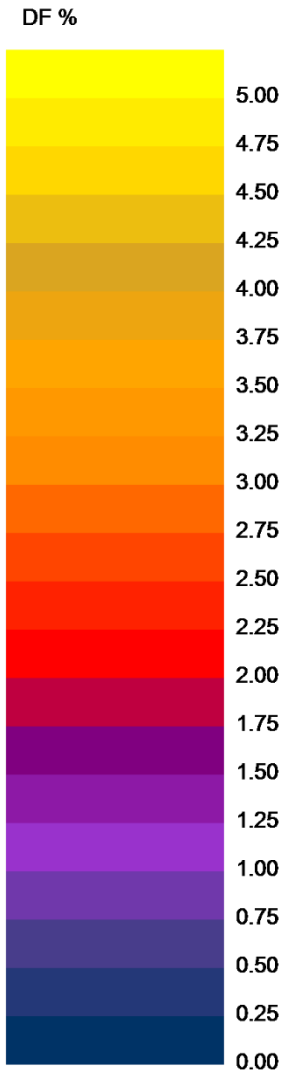


Figure 24: Block A/B Second Floor DF Contours



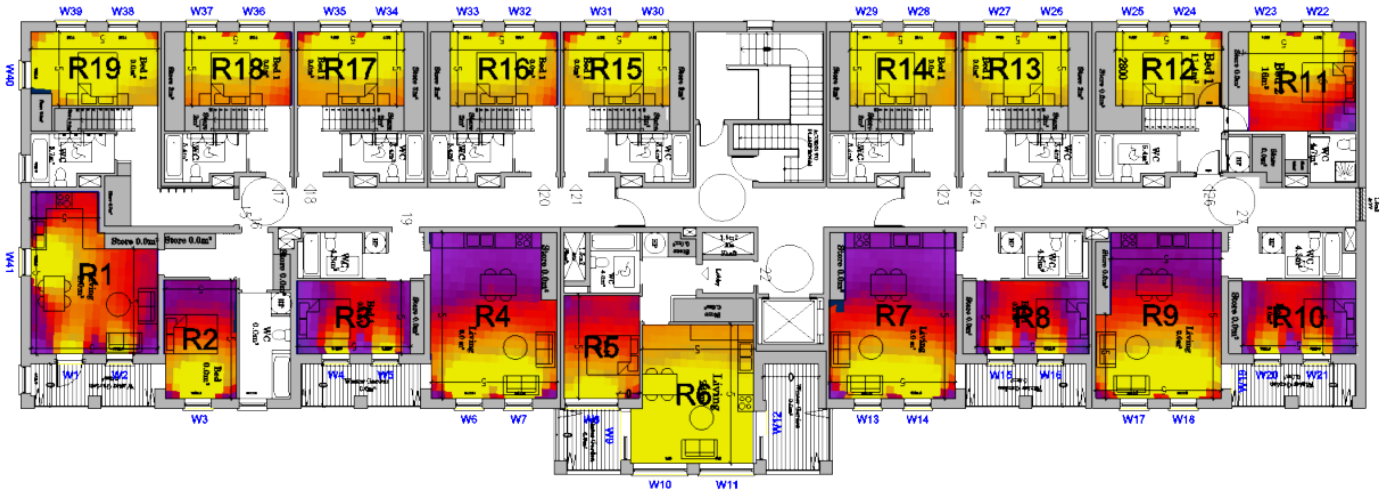


Figure 25: Block A/B Third Floor DF Contours

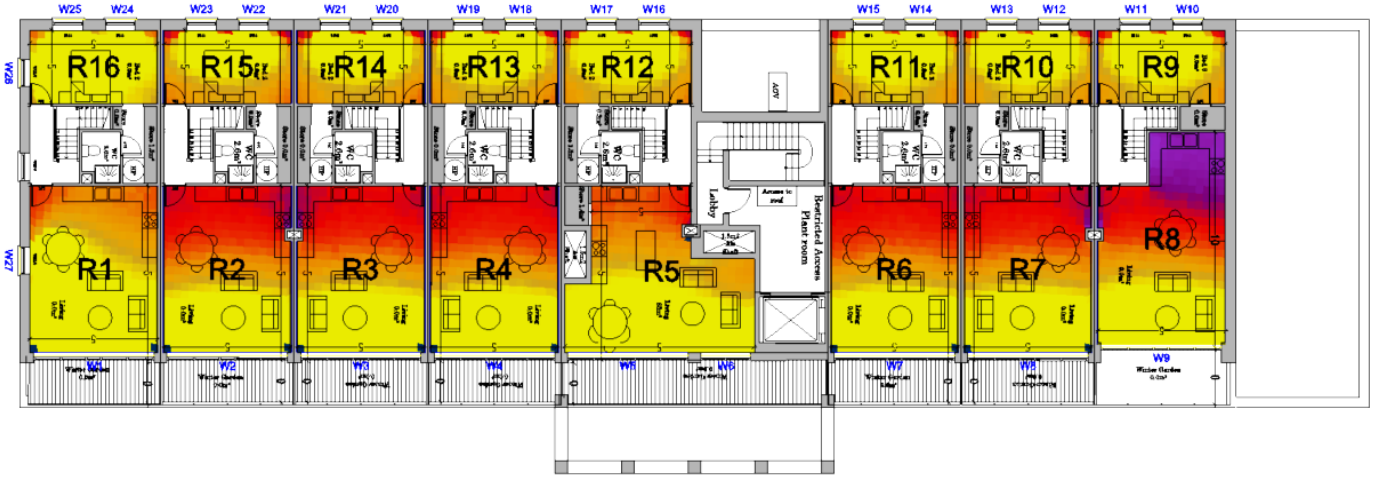
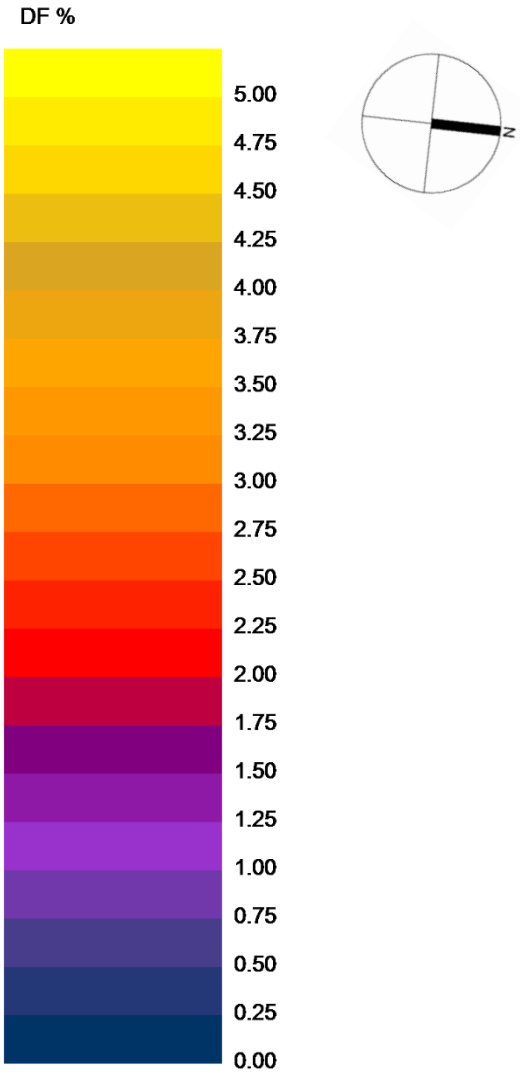


Figure 26: Block A/B Fourth Floor DF Contours



8.3 Block C (Neighbourhood Centre)

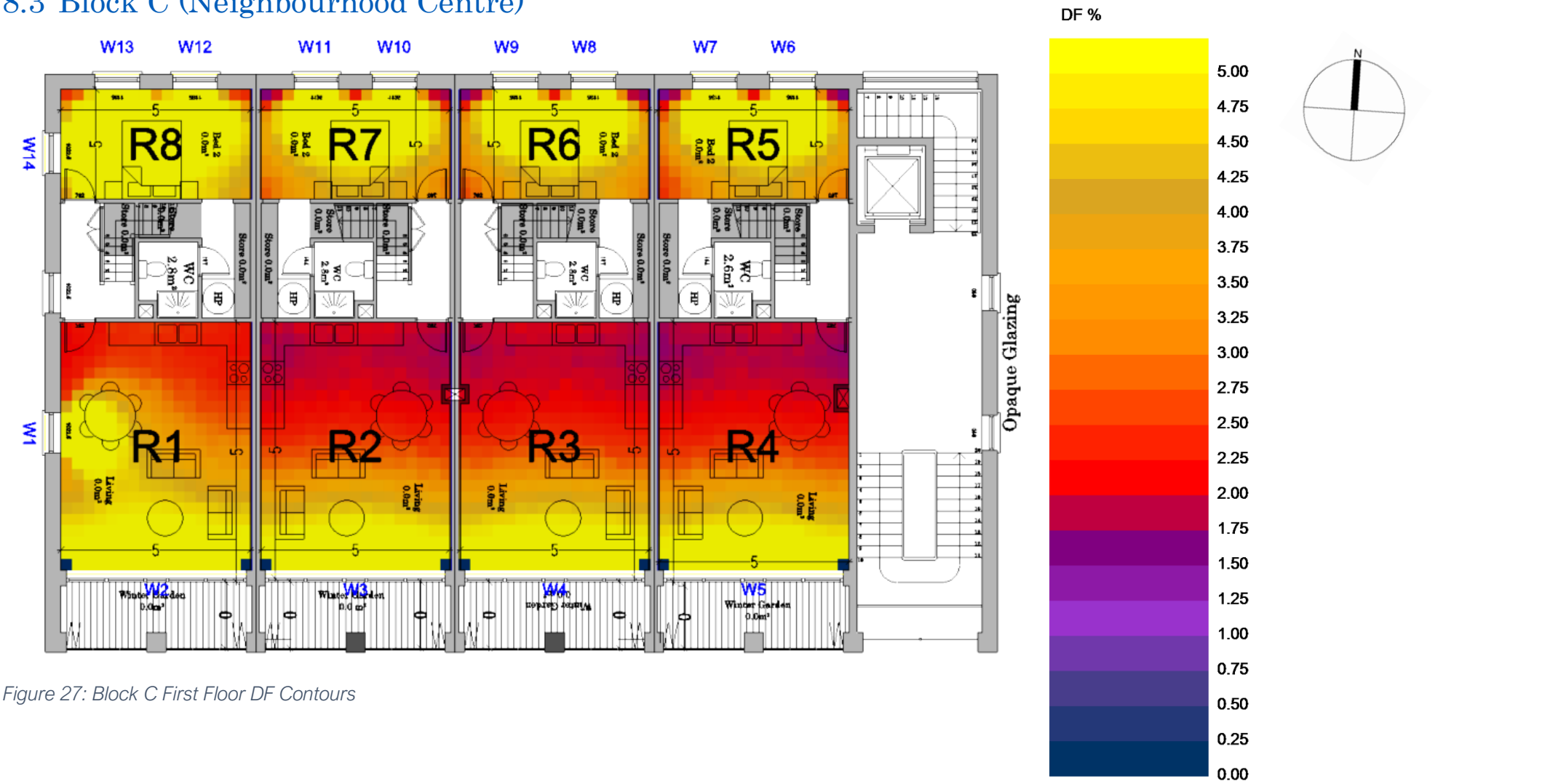


Figure 27: Block C First Floor DF Contours

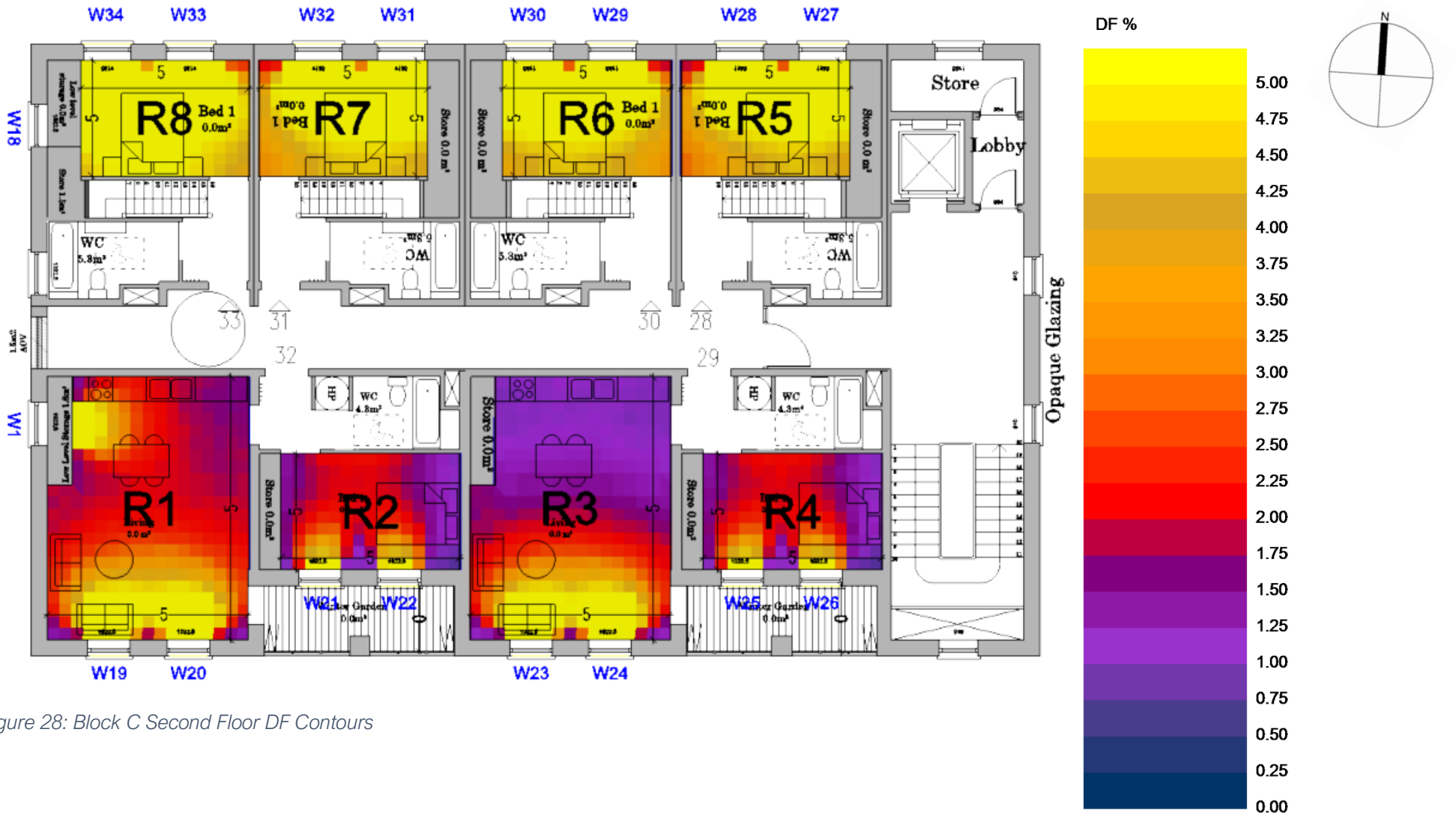


Figure 28: Block C Second Floor DF Contours

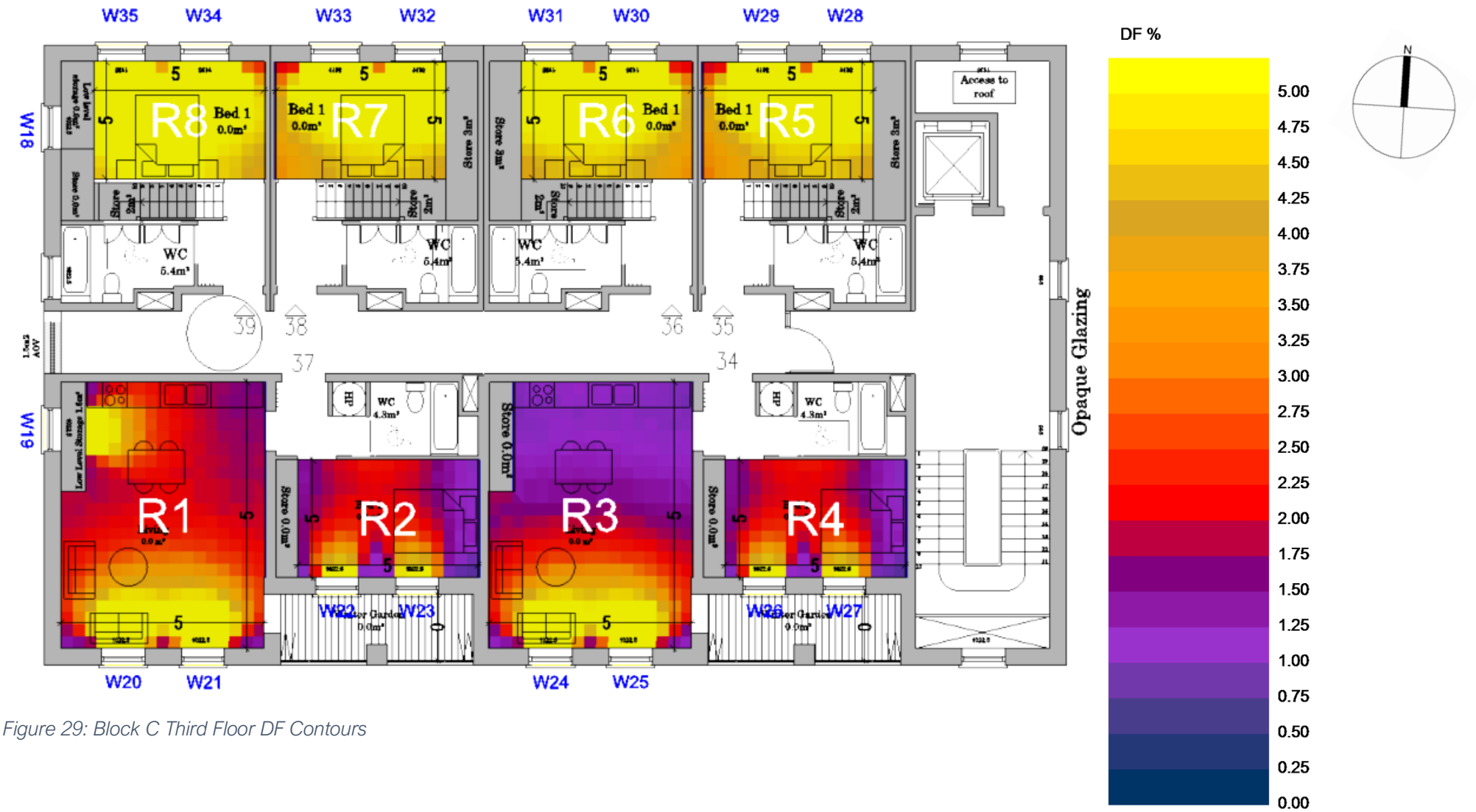


Figure 29: Block C Third Floor DF Contours

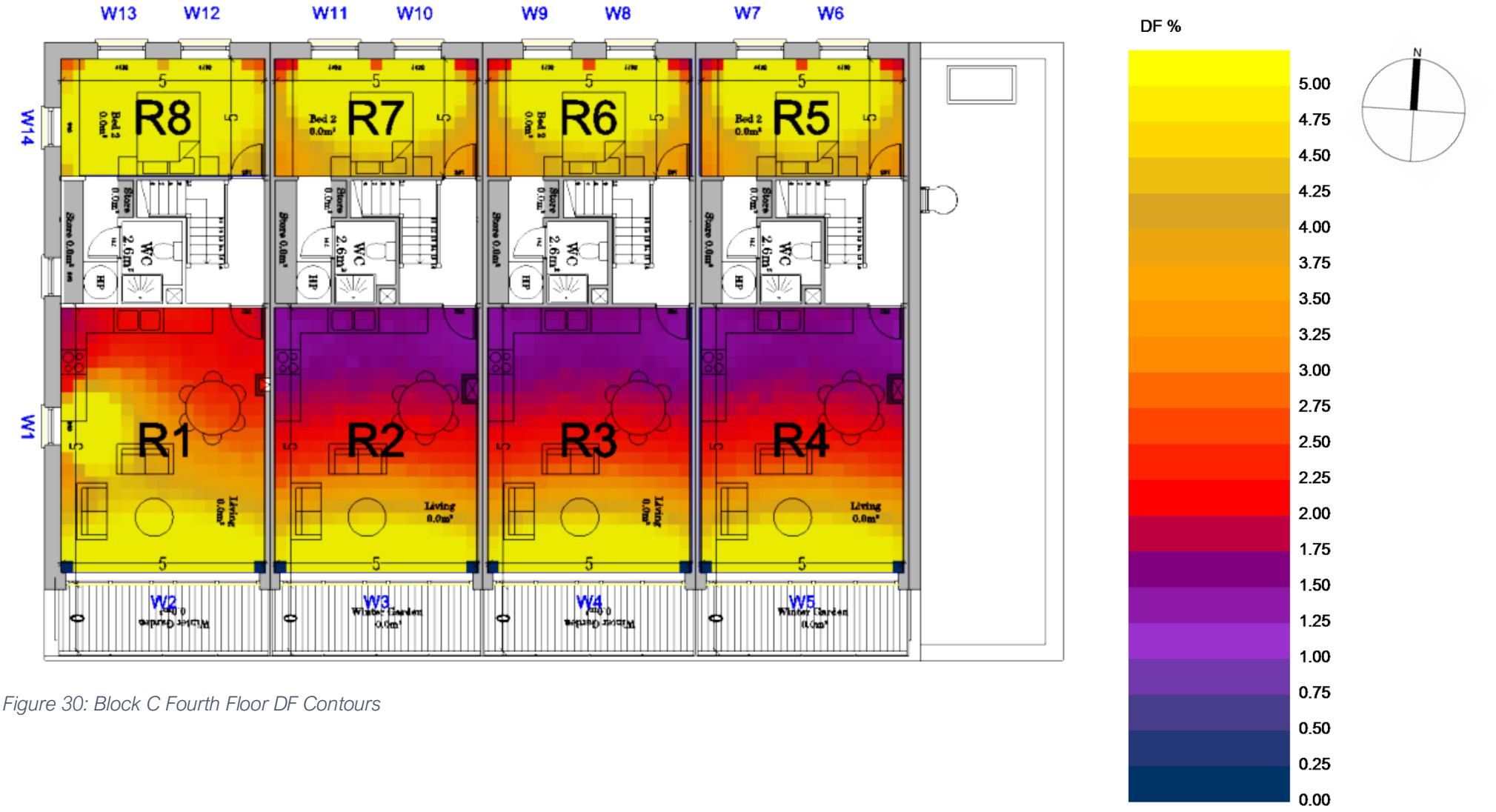


Figure 30: Block C Fourth Floor DF Contours

8.4 Duplex Type T Apartments

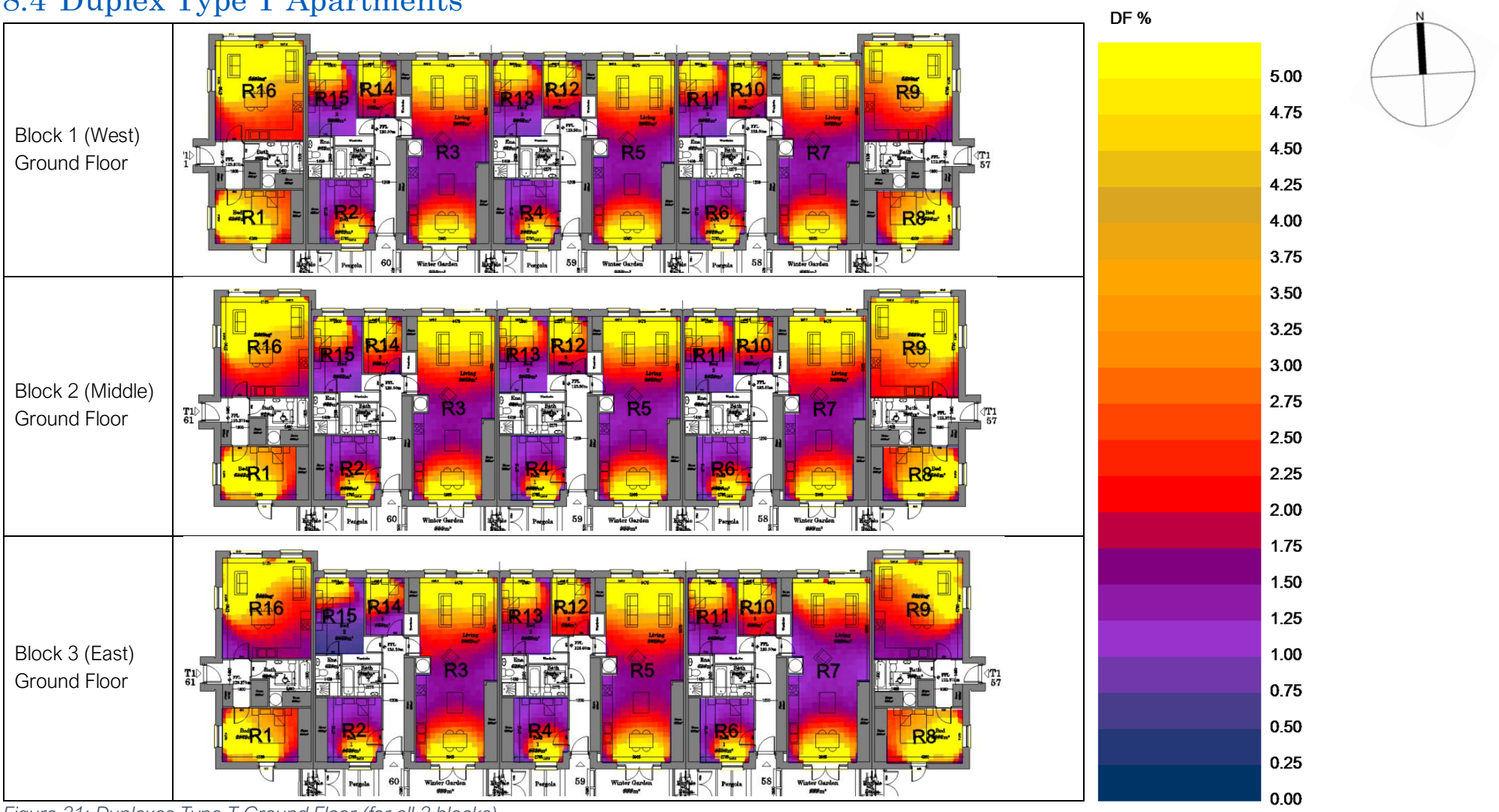


Figure 31: Duplexes Type T Ground Floor (for all 3 blocks)

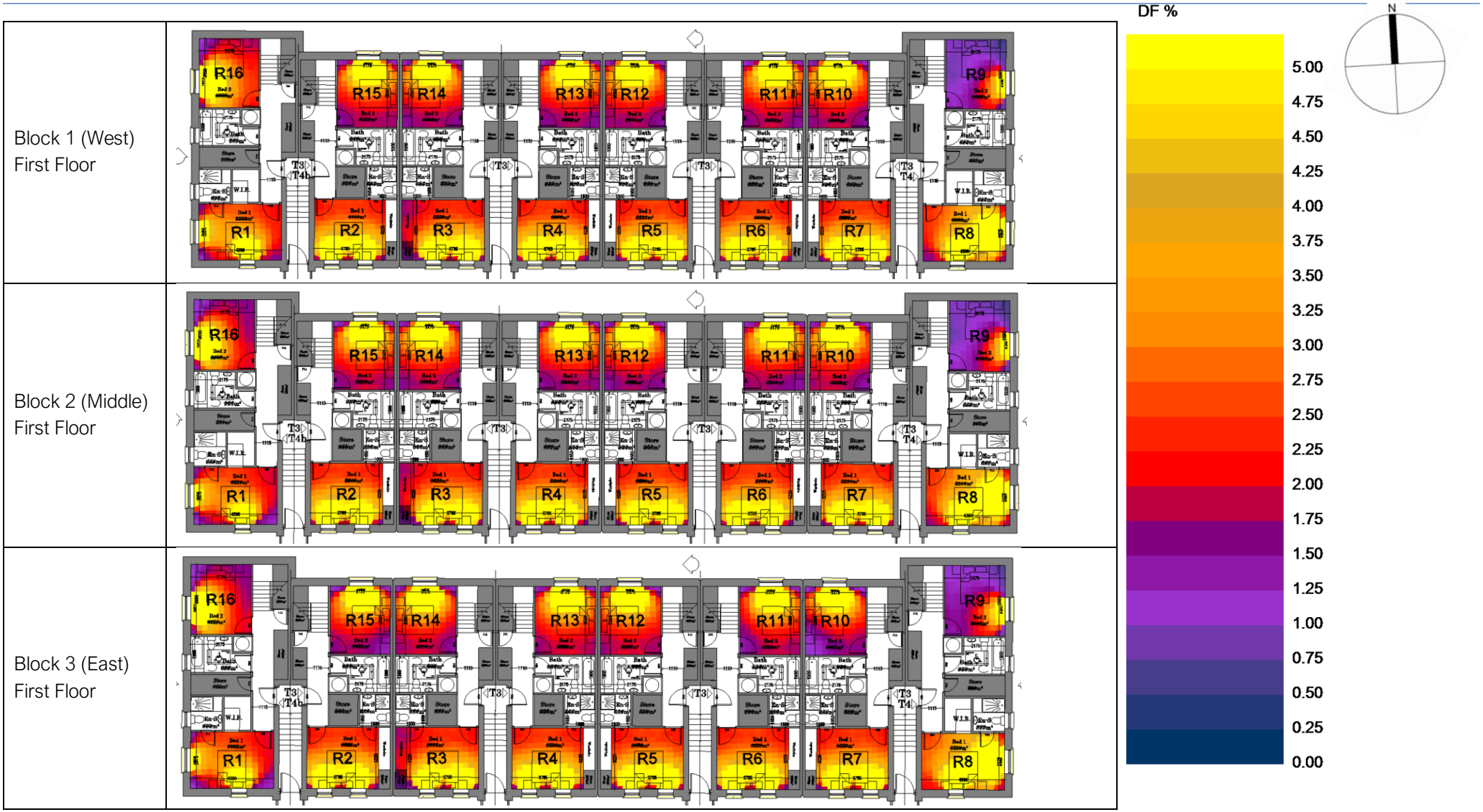


Figure 32: Duplexes Type T First Floor (for all 3 blocks)

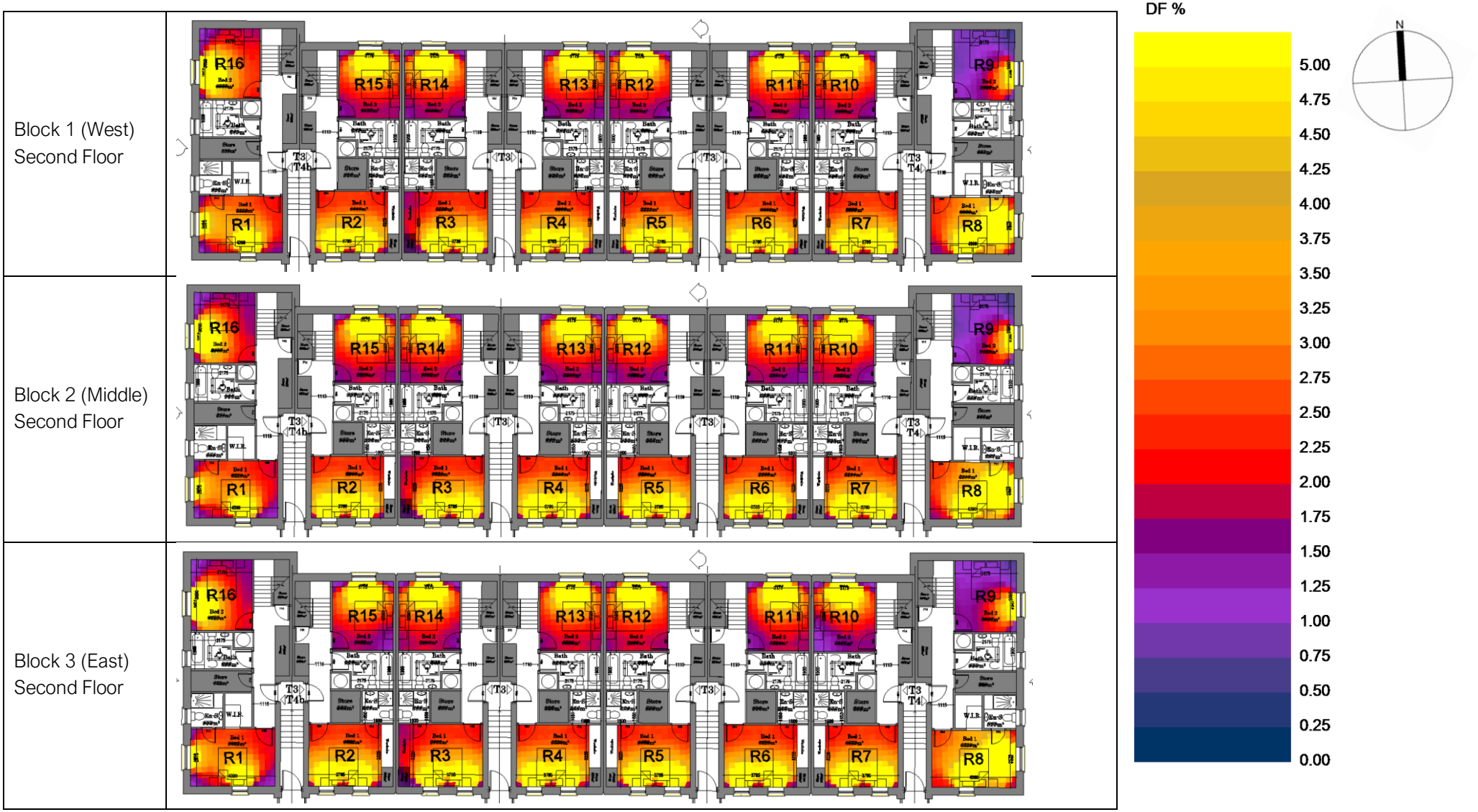
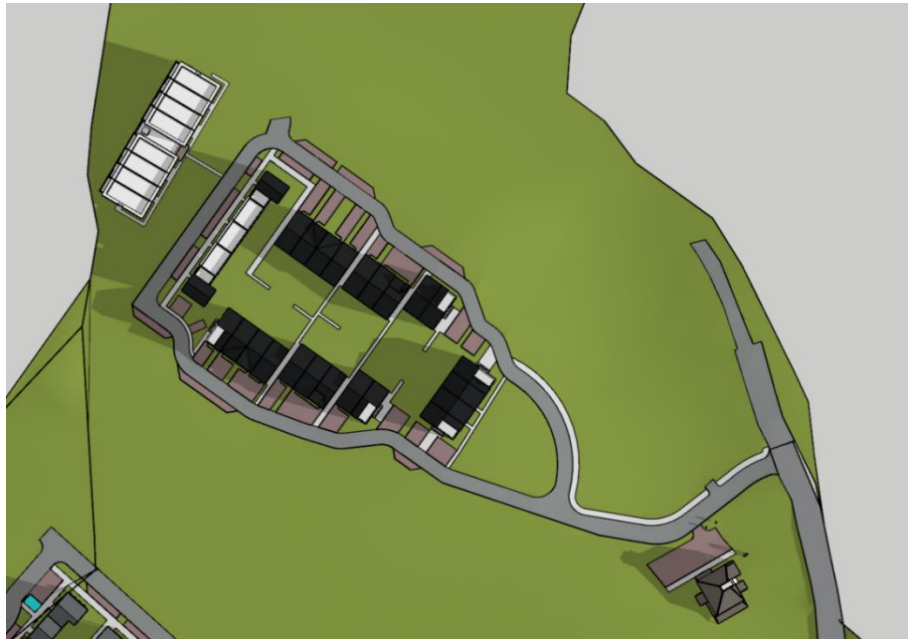


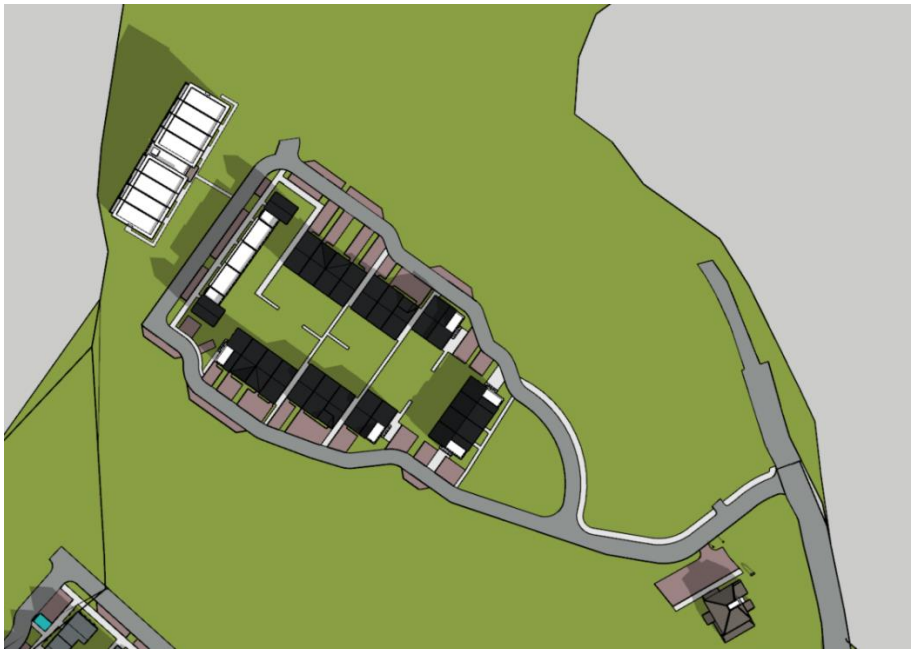
Figure 33: Duplexes Type T Second Floor (for all 3 blocks)

9 Appendix B: Shadow Images

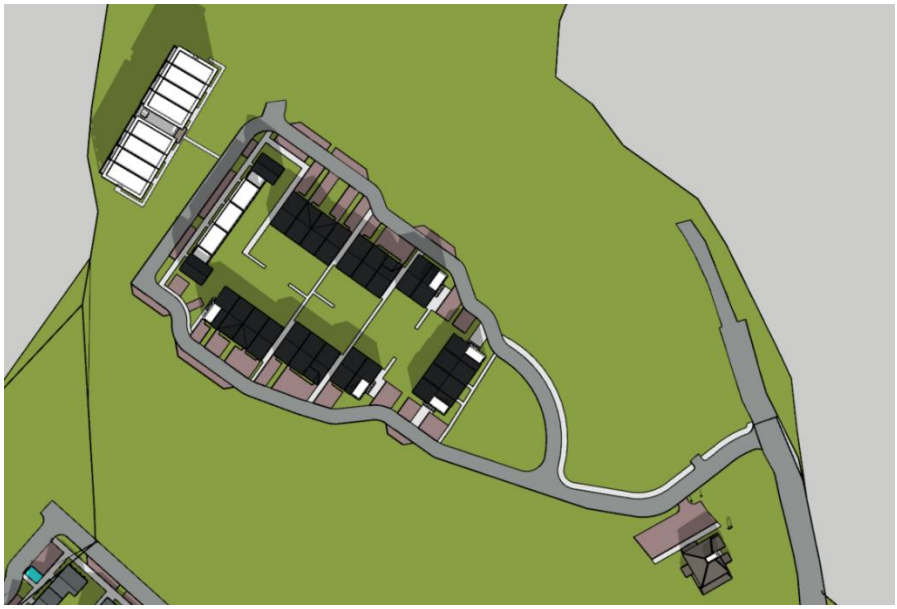
9.1 March 21st

	North Site	South Site
March 21st - 8:00 (UTC)		

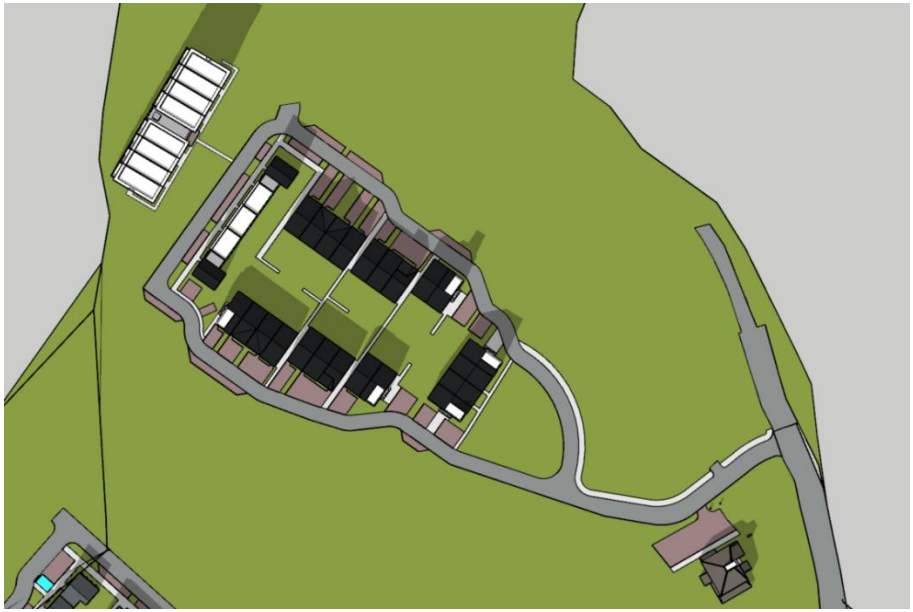
March 21st - 10:00 (UTC)



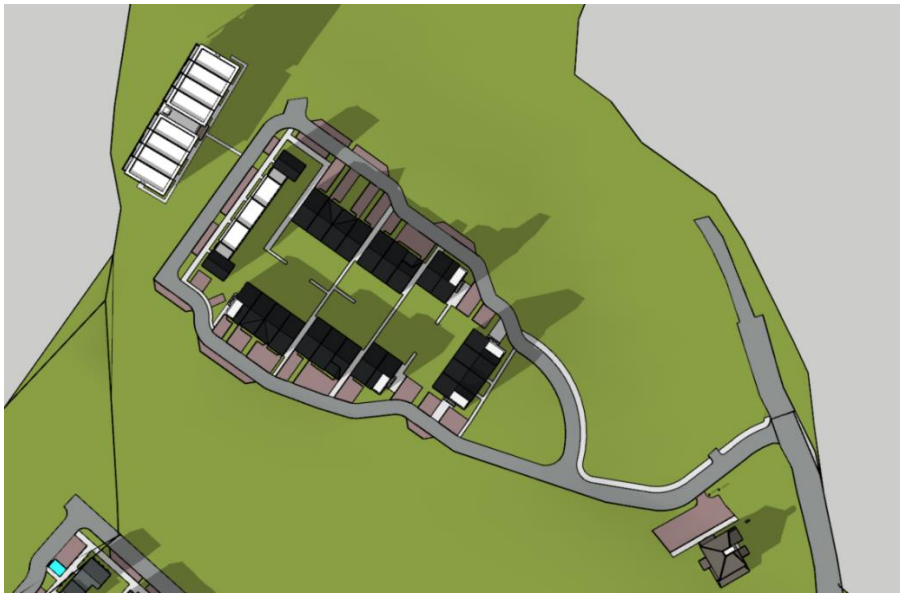
March 21st - 12:00 (UTC)



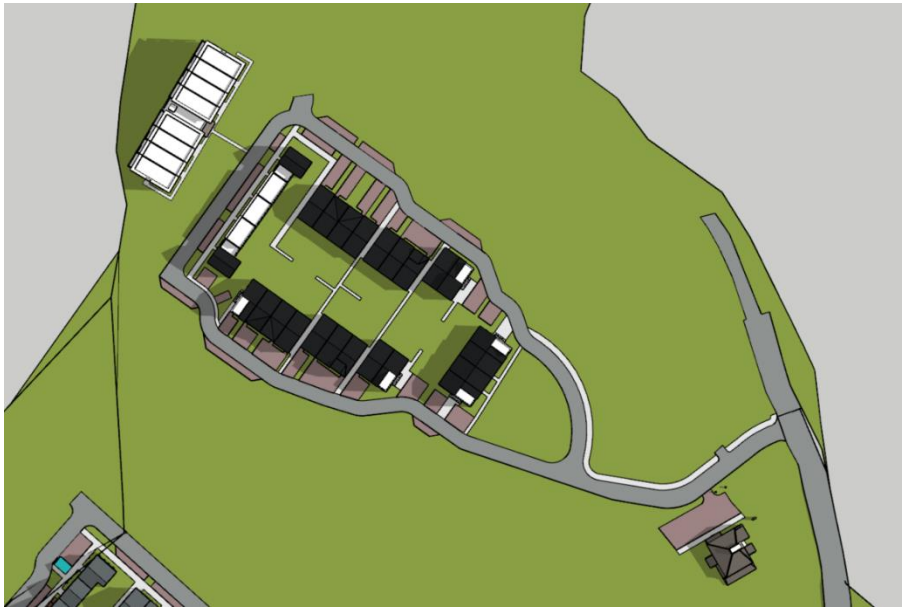
March 21st - 14:00 (UTC)



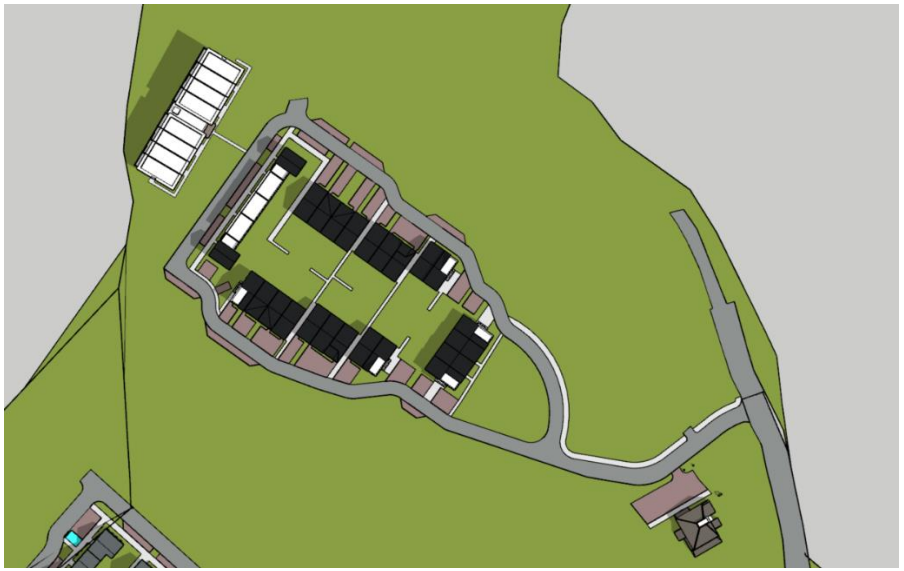
March 21st - 16:00 (UTC)



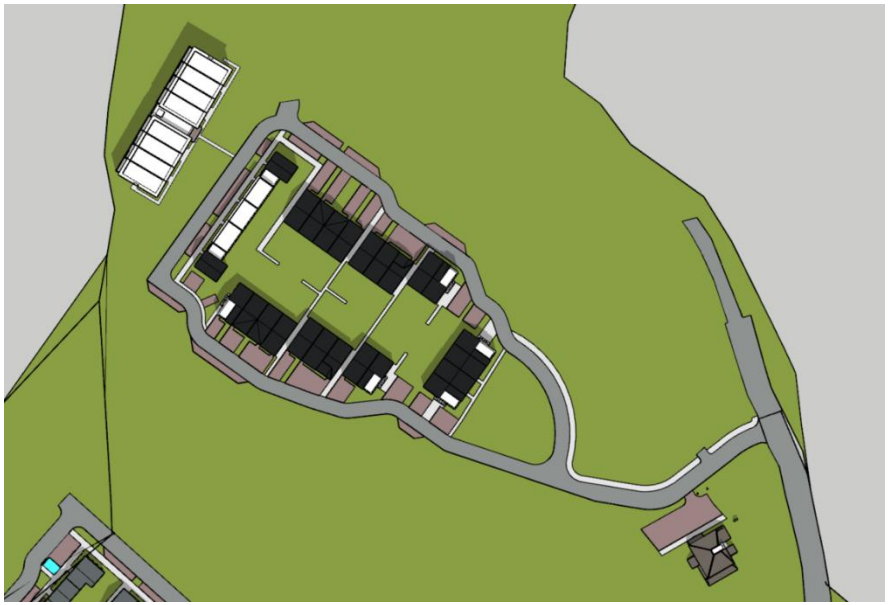
9.3 June 21st

	North Site	South Site
June 21st - 8:00 (UTC+1)		

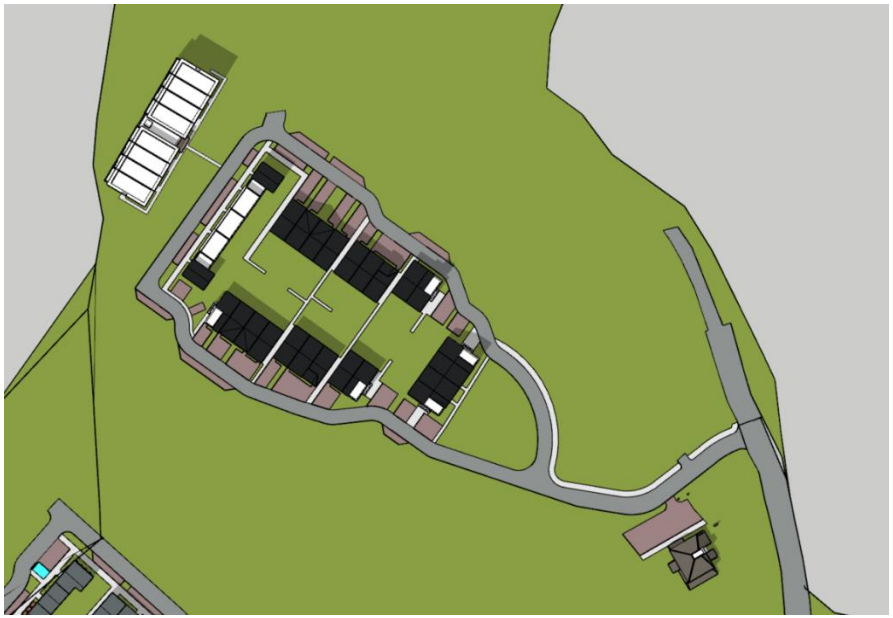
June 21st - 10:00 (UTC+1)



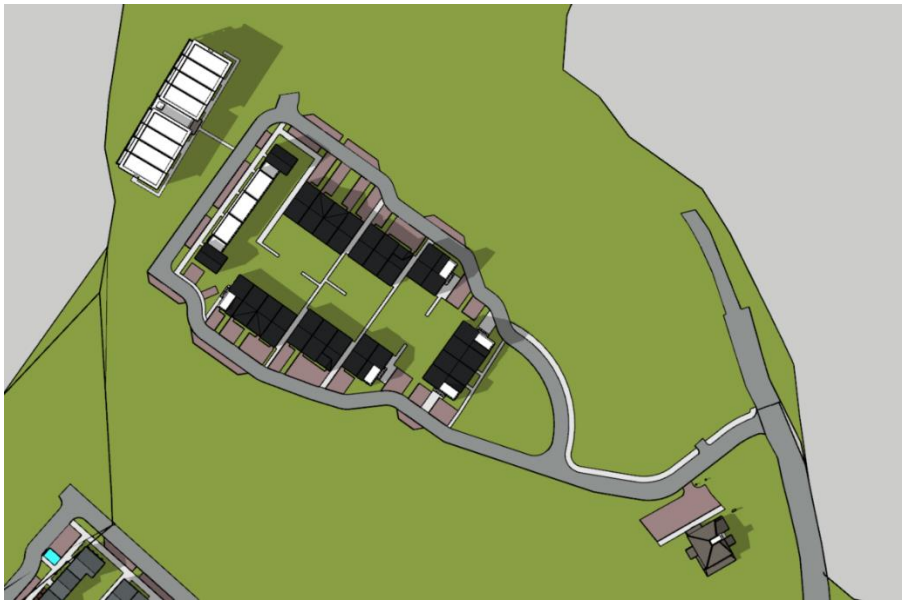
June 21st - 12:00 (UTC+1)



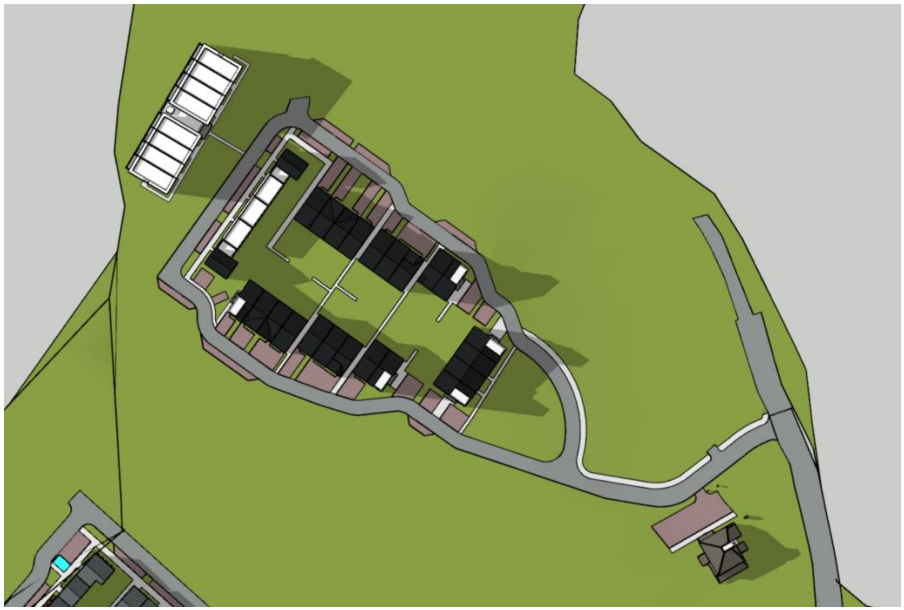
June 21st - 14:00 (UTC+1)



June 21st - 16:00 (UTC+1)



June 21st – 18:00 (UTC+1)



10 Appendix C: Transition to BS EN 17037:2018 Standard

The new British Standard "BS EN 17037:2018 Daylight in buildings" based on the European Standard EN 17037 was officially adopted in May 2019 and supersedes the previous standard "BS 8206-2:2008 Lighting for buildings – Part 2: Code of practice for Daylighting"

The standard adopts new ways (and/or variations of previous methodologies) to assess daylight and sunlight in proposed developments, including views out, protection against glare, and exposure to sunlight. The standard addresses daylighting performance over the year. It encourages both higher levels of indoor daylight and the use of climatic data as opposed to assessment using a standard overcast sky.

Following a review of the standard by a dedicated commission of UK experts, including Dr Paul Littlefair of BRE, the British Standards Institute (BSI) included, as part of its publication, a UK National Annex which brings the minimum indoor lighting levels in line with the previous BS 8206 targets. The commission reduced the minimum targets in recognition of the UK's need to increase urban density and deliver more accommodation. The above needs are also applicable to Ireland and in line with government policy and the policy of city councils across Ireland.

Local Authorities' Development Plans still refer to BRE's "BR 209:2011- Site Layout Planning for Daylight and Sunlight – A guide to good practice" when discussing daylight as part of their policies. Given that the new standard is only applicable to proposed developments, BR 209 remains the basis for assessing impacts upon existing neighbouring properties. However, the BRE Guide (BR 209), references the superseded BS 8206 which can cause uncertainty as to the correct approach when assessing daylight in a proposed development, i.e. whether to use the BS 8206 average daylight factor calculation or the BS EN 17037 median daylight factor calculation. It is worth noting that the minimum daylight provision targets in the UK Annex of BS EN 17037:2018 are derived from BS 8206-2:2008 and that the technical change concerns assessing for the median daylight factor value now, as opposed to the average daylight factor previously.

The uncertainty surrounding which methodology to use when assessing daylight levels in proposed developments was addressed in a post by Dr. Littlefair on the Planning Daylight & Sunlight Group (BRE BR209) published on LinkedIn, where BRE'S position is summarised as:

"Until BR 209 is rewritten, we are adopting a flexible approach to applying the two standards, for example in assessing the daylight and sunlight available in new buildings. So, for example, if we were reviewing a daylight report for a local authority, we would consider it reasonable to accept either average daylight factor tables using BS 8206 or median daylight factors/median illuminances calculated using EN 17037, provided they were calculated and presented properly."

BRE have previously discussed updating BR209 to align the guidance with the BS EN 17037 standard but to date no update has been published. It is expected, however, that an update will be published in the near future. For the time being, BPC Engineers is satisfied that the recommendations given in the BRE guide which refer target values for daylight from BS 8206 for proposed buildings can still be adopted. Specifically, based on the BRE's guidance, BPC understands that either Average Daylight Factor (ADF) using BS 8206 or median Daylight Factors using BS EN 17037 can be used for assessing daylight levels in proposed residential properties.

Should Local Authorities request specific methodologies/metrics outlined in BS EN 17037, BPC will work to the requested methodology.

11 Appendix D: BS EN 17037:2018 Analysis

11.1 Introduction

A daylight assessment has also been performed based on the recommendations of the UK national Annex to BS EN 17037:2018. The recommendations in this annex are expected to be reflected in the upcoming revised edition of the BRE Guide (BR 209: Site Layout Planning for Daylight and Sunlight – A guide to good practice.) It should be noted however that the *current* guidelines are still as outlined in the main body of the report. This section should only be used for additional information and not as a basis for assessment of the development's daylight provision in the context of deciding planning permission.

11.2 Methodology & Assessment Criteria

The UK committee, which reviewed the recommendations of BS EN 17037:2018, supported the recommendations of the standard in general, but was of the opinion that the recommendations for daylight provision in a space (see Clause A.2 of standard) may not be achievable for some buildings, particularly dwellings. Within the National Annex, the UK committee has therefore provided recommendations for minimum daylight provision in UK dwellings (Clause NA.2) which are likely to also be adopted for Ireland. These minimum recommendations form the basis of this assessment.

The new standard uses a Spatial Daylight Autonomy (sDA) metric which assesses how much of a space receives sufficient daylight on a working plane during daylight hours on an annual basis. It is a "dynamic daylight metric", meaning it assesses daylight over time, as opposed to a discrete point-in-time metric such as ADF. The recommendation is that the target illuminance values in Table 27 are exceeded over at least 50% of the points on a reference plane 0.85m above the floor, for at least half of *daylight* hours.

Table 27: Values of target illuminance

Room Type	Target illuminance E_T (lux)
Bedroom	100
Living Room	150
Kitchen	200

Where one room in a dwelling serves more than a single purpose, it's recommended 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.*" (CEN, 2019)

Clause A.2 of the standard recommends that a target illuminance level should be achieved across the entire (i.e. 95%) fraction of the reference plane. Based on the UK Annex, this recommendation need not be applied to rooms in dwellings.

The analysis uses climatic weather data specific to the project location, in this case, Dublin. The illuminance levels therefore vary over the course and each day and year. The median levels of illuminance for Dublin are shown in Table 28.

Table 28: Dublin Median Sky Illuminances

Location	Median External Diffuse Illuminance (Lux)	Global External Diffuse Illuminance (Lux)
Dublin	14,900	18,200

It is worth noting that the median diffuse sky illuminance for the climate based calculations is considerably higher than the discrete illuminance figure at the zenith of the CIE overcast sky that is used for the ADF calculation which is slightly over 11,000 lux.

The model settings, including surface reflectance and glazing transmittance, are as per the settings previously detailed for the ADF analysis in section 5.2.1. As per BS EN 17037:2018, the area of the grid points within each room excludes a band of 0.5m from the walls. This is because the illuminances can be excessively high (near windows) or

excessively low next to opaque walls. The area assessed (excluding the perimeter band) is known as the "Effective Area".

11.3 Analysis

The analysis focused on the same blocks that were analysed as part of the ADF assessment. The results for each block are shown in the following sections.

11.3.1 Block E sDA Results

Table 29: Block E sDA Results - Ground Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Ground	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	LKD	200	50	50	100.00	YES
	R11	LKD	200	50	50	100.00	YES
	R12	LKD	200	50	50	99.69	YES
	R13	LKD	200	50	50	99.54	YES
	R14	LKD	200	50	50	100.00	YES
	R15	LKD	200	50	50	100.00	YES
	R16	LKD	200	50	50	100.00	YES

Table 30: : Block E sDA Results - First Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
First	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	LKD	200	50	50	100.00	YES
	R13	LKD	200	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	LKD	200	50	50	100.00	YES

Table 31: Block E sDA Results - Second Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Second	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	LKD	200	50	50	100.00	YES
	R13	LKD	200	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	LKD	200	50	50	100.00	YES

Table 32: Block E sDA Results - Third Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Third	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	LKD	200	50	50	100.00	YES
	R11	LKD	200	50	50	100.00	YES
	R12	LKD	200	50	50	100.00	YES
	R13	LKD	200	50	50	100.00	YES
	R14	LKD	200	50	50	100.00	YES
	R15	LKD	200	50	50	100.00	YES
	R16	LKD	200	50	50	100.00	YES

Figure 34: Block E Ground Floor sDA Pass/Fail Contours

Figure 35: Block E First Floor sDA Pass/Fail Contours

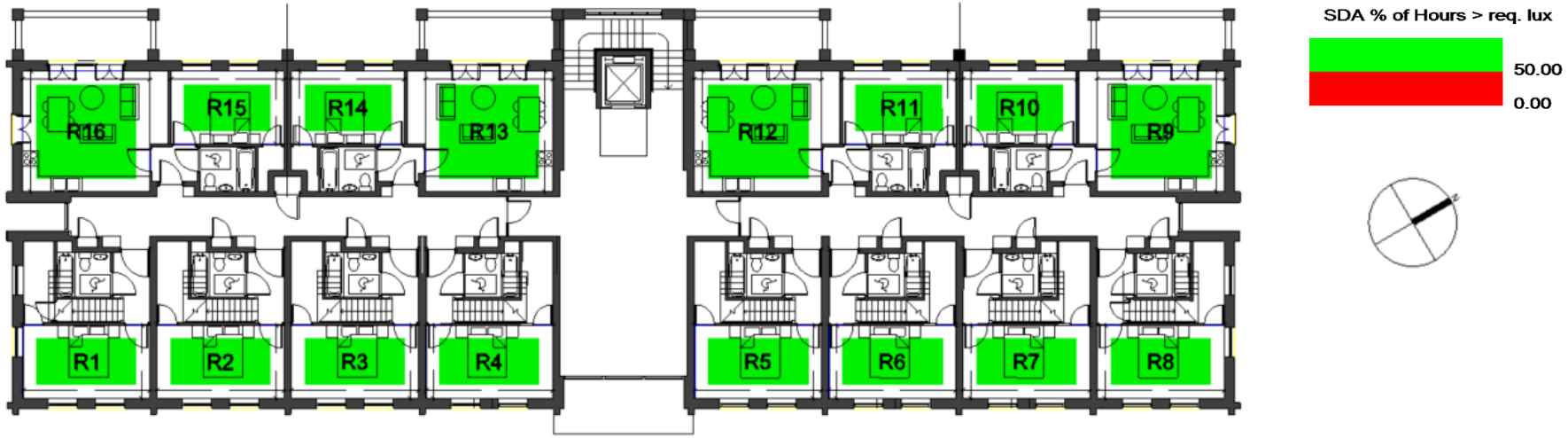


Figure 36: Block E Second Floor sDA Pass/Fail Contours

Figure 37: Block E Third Floor sDA Pass/Fail Contour

11.3.2 Block A/B (Neighbourhood Centre) sDA Results

Table 33: Block A/B sDA Results - First Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
First	R1	LKD	200	50	50	100.00	YES
	R2	LKD	200	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	LKD	200	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	LKD	200	50	50	100.00	YES
	R8	LKD	200	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	Bedroom	100	50	50	100.00	YES
	R17	Bedroom	100	50	50	100.00	YES
	R18	Bedroom	100	50	50	100.00	YES

Table 34: Block A/B sDA Results - Second Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Second	R1	LKD	200	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	LKD	200	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	Bedroom	100	50	50	100.00	YES
	R17	Bedroom	100	50	50	100.00	YES
	R18	Bedroom	100	50	50	100.00	YES
	R19	Bedroom	100	50	50	100.00	YES

Table 35: Block A/B sDA Results - Third Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Third	R1	LKD	200	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	LKD	200	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	Bedroom	100	50	50	100.00	YES
	R17	Bedroom	100	50	50	100.00	YES
	R18	Bedroom	100	50	50	100.00	YES
	R19	Bedroom	100	50	50	100.00	YES

Table 36: Block A/B sDA Results - Fourth Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Fourth	R1	LKD	200	50	50	100.00	YES
	R2	LKD	200	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	LKD	200	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	LKD	200	50	50	100.00	YES
	R8	LKD	200	50	50	100.00	YES
	R9	Bedroom	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	Bedroom	100	50	50	100.00	YES

Figure 38: Block A/B First Floor sDA Pass/Fail Contour

Figure 39: Block A/B Second Floor sDA Pass/Fail Contour

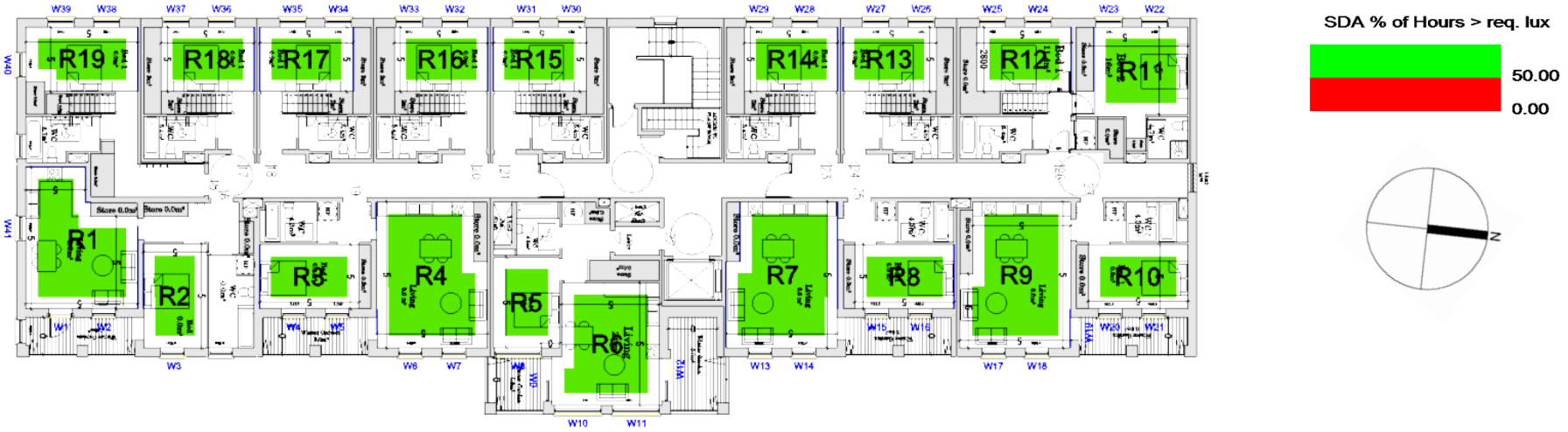


Figure 40: Block A/B Third Floor sDA Pass/Fail Contour

Figure 41: Block A/B Fourth Floor sDA Pass/Fail Contour

11.3.3 Block C (Neighbourhood Centre) sDA Results

Table 37: Block C sDA Results - First Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
First	R1	LKD	200	50	50	100.00	YES
	R2	LKD	200	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES

Table 38: Block C sDA Results - Second Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Second	R1	LKD	200	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES

Table 39: Block C sDA Results - Third Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Third	R1	LKD	200	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES

Table 40: Block C sDA Results - Fourth Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	% Area Meeting Criteria	
Fourth	R1	LKD	200	50	50	100.00	YES
	R2	LKD	200	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES

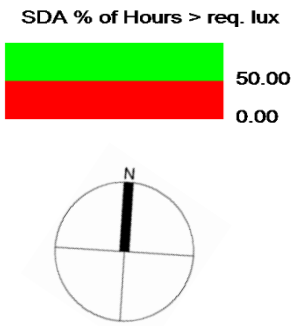


Figure 42: Block C First Floor sDA Pass/Fail Contour

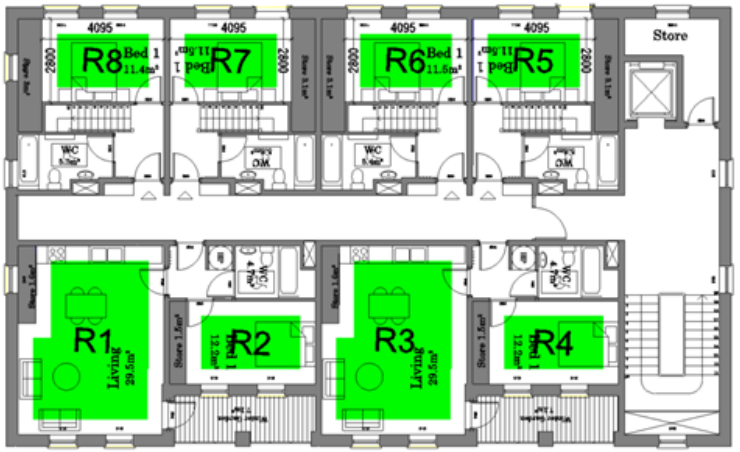


Figure 44: Block C Third Floor sDA Pass/Fail Contour

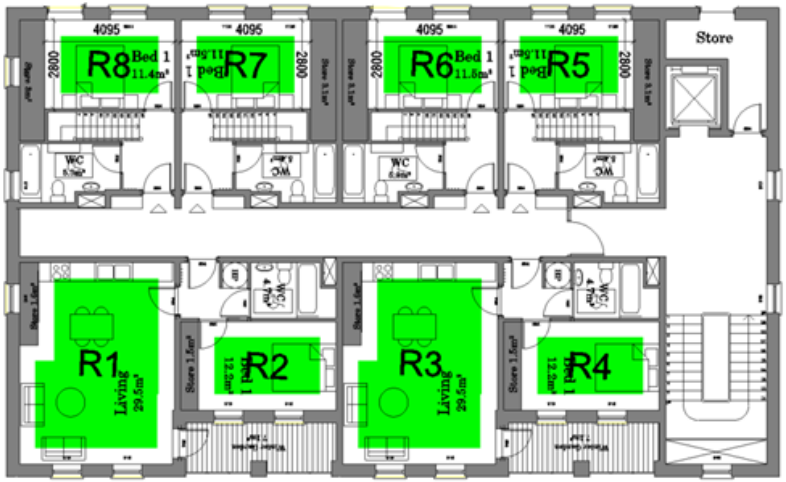


Figure 43: Block C Second Floor sDA Pass/Fail Contour

Figure 45: Block C Fourth Floor sDA Pass/Fail Contour

11.3.4 Duplex Type T sDA Results

The results shown here are for the middle duplex "Type T" block (Block 2). The results for the other two block are the same in that each room achieves an sDA figure of 100%.

Table 41: Duplex Type T Block 2 sDA Results - Ground Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	sDA % of Area	
Ground	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	LKD	200	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	LKD	200	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	LKD	200	50	50	100.00	YES

Table 42: Duplex Type T Block 2 sDA Results - First Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	sDA % of Area	
First	R1	Bedroom	100	50	50	100.00	YES
	R2	Bedroom	100	50	50	100.00	YES
	R3	Bedroom	100	50	50	100.00	YES
	R4	Bedroom	100	50	50	100.00	YES
	R5	Bedroom	100	50	50	100.00	YES
	R6	Bedroom	100	50	50	100.00	YES
	R7	Bedroom	100	50	50	100.00	YES
	R8	Bedroom	100	50	50	100.00	YES
	R9	Bedroom	100	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES
	R11	Bedroom	100	50	50	100.00	YES
	R12	Bedroom	100	50	50	100.00	YES
	R13	Bedroom	100	50	50	100.00	YES
	R14	Bedroom	100	50	50	100.00	YES
	R15	Bedroom	100	50	50	100.00	YES
	R16	Bedroom	100	50	50	100.00	YES

Table 43: Duplex Type T Block 2 sDA Results - Second Floor

Floor	Room Ref.	Room Use	sDA				Meets Criteria
			Req Lux	Req % of Space	Req % of Hours	sDA % of Area	
Second	R1	LKD	200	50	50	100.00	YES
	R2	LKD	200	50	50	100.00	YES
	R3	LKD	200	50	50	100.00	YES
	R4	LKD	200	50	50	100.00	YES
	R5	LKD	200	50	50	100.00	YES
	R6	LKD	200	50	50	100.00	YES
	R7	LKD	200	50	50	100.00	YES
	R8	LKD	200	50	50	100.00	YES
	R9	Bedroom	100	50	50	100.00	YES
	R10	Bedroom	100	50	50	100.00	YES

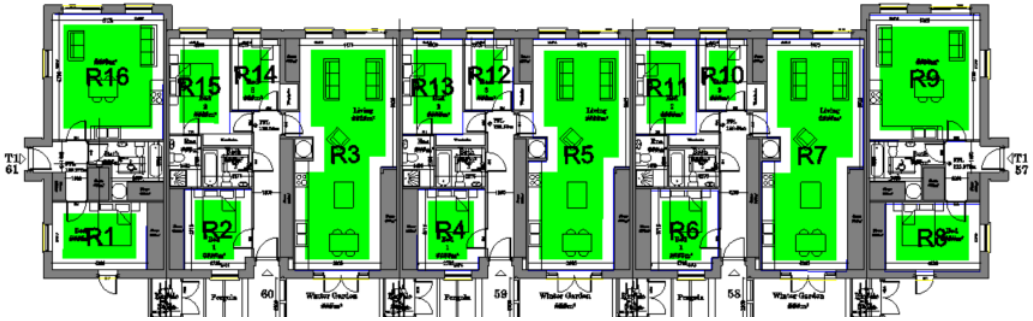


Figure 46: Duplex Type T Block 2 Ground Floor sDA Pass/Fail Contour

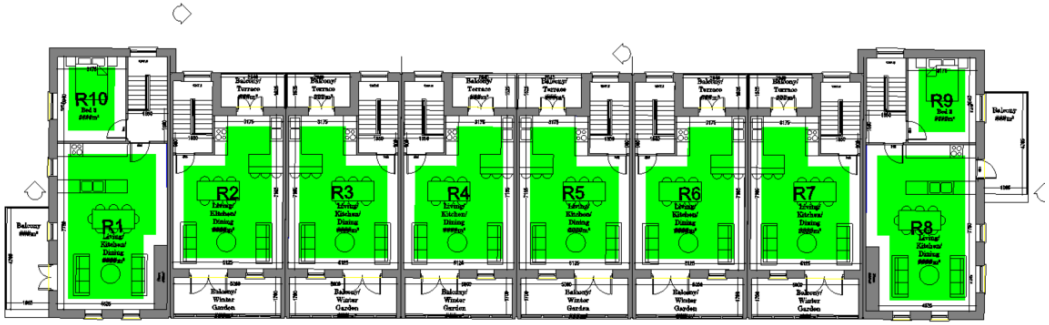


Figure 47: Duplex Type T Block 2 First Floor sDA Pass/Fail Contour

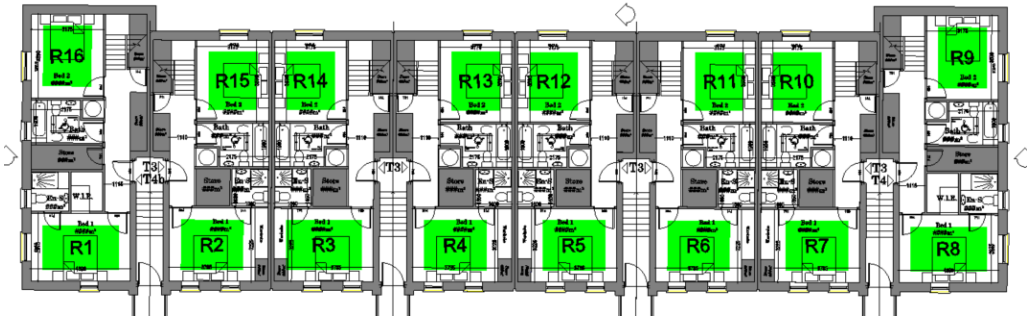


Figure 48: Duplex Type T Block 2 Second Floor sDA Pass/Fail Contour

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