

SUNLIGHT, DAYLIGHT AND SHADOW ASSESMENT REPORT**FOR****COOKSTOWN CASTLE DEVELOPMENT****AT****LANDS WEST OF OLD BELGARD ROAD AND NORTH, SOUTH AND WEST
OF COOKSTOWN ROAD, COOKSTOWN INDUSTRIAL ESTATE,
TALLAGHT, DUBLIN 24****FOR****JOSEPH COSTELLO, ABSOLUTE LIMOUSINES LTD AND BOHERKILL
PROPERTY DEVELOPMENT LTD**

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1. INTRODUCTION

The Cookstown Castle is a mixed-use development will consist of residential use and employment uses all located on Cookstown road.

The proposed development consists of construction of a mixed-use development featuring 1104 no. 'build-to-rent' apartments in 4 no. blocks varying in height from four to eleven storeys. The development also includes 4 no. commercial units at ground floor level of Blocks B and D, office space across first to seventh floor levels of Block D and a crèche at ground floor level of Block C. The development is served by parking spaces (including limited mobility parking spaces) and bicycle spaces.

The Cookstown Castle development provides high-quality architectural design which enhances the existing characteristics of this site.

2. EXECUTIVE SUMMARY

JAK have been retained by the Applicant to carry out a sunlight, daylight and shadow assessment for the proposed Cookstown Castle development on Cookstown road.

The calculations were carried out using the 'IES Virtual Environment' software and based on the layout drawings prepared by C+W O Architects.

The proposed architectural plans, elevations and sections were analysed relative to the documents BRE guide 'Site Layout Planning for Daylight and Sunlight; A Guide to Good Practice' BR209 (2011), IS EN 17037 (2018): Daylight in buildings and BS8208 Part 2:2008 Lighting for Buildings, Code of Practice for Daylighting. These documents include best practice guidelines for the provision of high-quality living spaces with all subsequent results greatly exceeding the minimum requirements.

The results of this study satisfy all the recommended values and the living spaces and outdoor spaces will provide pleasant sunlit experience. An analysis was also performed on the impact to surrounding developments by the proposed scheme with the overall impact categorised as acceptable.

The methods and standards used to carry out the analysis of the entire proposed scheme are examined in detail in this report and summarised in the table below.

| Element | Recommended(%) | Achieved (%) | Comment |
|--|---|---------------------------|--|
| Apartments Average daylight Factor (ADF) | BS8208: 1.5% Living room 1% Bedroom | 1.5 – 5.8 2.98 average | The minimum values are surpassed and all apartments achieve compliance |
| Average sunlight on 21st March | 50% | 57 - 91 % | Communal areas surpass the sunlight recommendation with average at 66% |

3. STATEMENT OF EXPERIENCE

The simulation and reporting is carried out by Martin Obst (Principal Modelling & Sustainability Engineer) and Jonathan Kirwan (Senior Consulting Engineer/ Managing Director). Martin has 5 years of experience using all modules of IES VE software and completed number of bespoke training sessions with IES VE focusing on areas covered in this report. Jonathan has 25 years of experience in building services consultancy.

JAK have vast experience of using the IES VE software and have In-depth knowledge & experience in understanding the significance of true modelling & its affects. As an experienced design & consultancy practice, we utilize & work with dedicated support to fully utilize functionality of the modelling programs we work with. We set our standards High & have a very good record in providing detailed reports for many state bodies, (inc. DOES, SEAI) and numerous successful planning applications for projects throughout Ireland & abroad.

4. DAYLIGHTING ANALYSIS

For the purpose of demonstrating clear analysis we have reviewed in detail approx. 25% of the apartments throughout the development. The selected apartments include the ones deemed to potentially have the poorest daylight due to development layout, orientation and obstructions externally to the apartment. All apartment types are included in each of the blocks/ Daylighting calculations were calculated using 'IES Virtual Environment' software.

The BRE guidelines recommend Daylight provision to new rooms which was checked using the Average Daylight Factor (ADF). Based on IS EN 17037 a space is considered to have adequate daylight if target illuminance (minimum daylight factor (D)) is achieved across a fraction of the reference plane within a space for at least half of the daylight hours.

In order to assess the quality of daylight enjoyed within the proposed development an Average Daylight Factor (ADF) calculation was used. The Average Daylight Factor is a ratio between indoor illuminance and outdoor illuminance expressed as a percentage and provides a measure of the overall amount of daylight in a space taken from the work plane level. Additional guidance also taken into consideration in our analysis in conjunction with the interior daylighting recommendations in CIBSE publication Lighting guide: daylighting and window design.

BRE Guidelines advise to use BS 8206-2 Code of practice for daylighting minimum values of ADF for residential units:

- ADF=1.5% for living rooms
- ADF=1% for bedrooms.

The kitchens in the apartments are generally at the rear of the space from the window wall. To provide a layout of multiple studios one- & two-bedroom apartments means that an internal galley-type kitchen is inevitable. We have followed the guidelines for this instance and the analysis clearly demonstrates that all kitchens are directly linked to a well daylighted living room.

The ADF results for living rooms summarised in table 3 includes the area of the internal gallery type kitchen. These are one open space and ADF for all living rooms are above the minimum set by BS 8206-2.

Methodology

Sky Conditions

The sky conditions used in this simulation study was an unobstructed CIE standard overcast sky. The CIE Overcast Sky is used to give the worst-case scenario (in design terms) for illuminance and therefore is the most suitable design sky for Daylight Factor simulations.

Light from the sky

For new rooms the BRE guidelines recommend Daylight provision to new rooms may be checked using the Average Daylight Factor (ADF). "The ADF is a measure of the overall amount of daylight in a space. BS 8206-2 Code of practice for daylighting, recommends an ADF of 5% for a well daylighted space and 2% for partly daylighted space. Below 2% the room will look dull and electric lighting is likely to be turned on. In housing BS 8206-2 gives minimum values of ADF of 1.5% for living rooms and 1% for bedrooms."



Fig 1. Keyplan of first floor the development

Excerpt of terms described in BR209-Site layout planning for daylight and sunlight, which are utilized in the modelling software used to produce data for this report.

Average daylight factor (ADF)

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.

CIE standard overcast sky

A completely overcast sky for which the ratio of its luminance L_γ at an angle of elevation γ above the horizontal to the luminance L_z at the zenith is given by:

$$L_\gamma = L_z \frac{(1 + 2 \sin \gamma)}{3}$$

A CIE standard overcast sky is darkest at the horizon and brightest at the zenith (vertically overhead).

Analysis results

The results in table 3 overleaf reflect the site conditions as per the IES model and satisfy BS 8206-2 and the BRE guidelines.

Average ADF of all rooms analysed is 2.98%. The dwellings assessed include mix of every apartment type and therefore this would represent good daylight in the apartments.

Table 3. Results summary per room

Block A – Ground Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|----------------------------|-------------------------------|-------------------------|
| Apartment 1001 Living Room | 3.0 % | 1.5 % |
| Apartment 1001 Bedroom | 3.3 % | 1 % |
| Apartment 1002 Studio | 1.6 % | 1.5 % |
| Apartment 1003 Studio | 1.6 % | 1.5 % |
| Apartment 1004 Living Room | 1.7 % | 1.5 % |
| Apartment 1004 Bedroom | 3.8 % | 1 % |
| Apartment 1005 Living Room | 1.7 % | 1.5 % |
| Apartment 1005 Bedroom | 3.8 % | 1 % |
| Apartment 1006 Studio | 2.2 % | 1.5 % |
| Apartment 1007 Living Room | 1.7 % | 1.5 % |
| Apartment 1007 Bedroom | 3.8 % | 1 % |
| Apartment 1008 Living Room | 1.7 % | 1.5 % |
| Apartment 1008 Bedroom | 3.8 % | 1 % |
| Apartment 1009 Living Room | 3.8 % | 1.5 % |
| Apartment 1009 Bedroom | 1.6 % | 1 % |
| Duplex 1010 Bedroom | 3.7 % | 1 % |
| Duplex 1011 Bedroom | 3.7 % | 1 % |
| Duplex 1012 Bedroom | 3.7 % | 1 % |
| Duplex 1015 Bedroom | 3.7 % | 1 % |
| Duplex 1016 Bedroom | 3.7 % | 1 % |
| Apartment 1017 Studio | 1.5 % | 1.5 % |
| Apartment 1018 Living | 5.8 % | 1.5 |
| Apartment 1018 Bedroom | 2.1 % | 1 % |
| Apartment 1019 Living | 1.5 % | 1.5 |
| Apartment 1019 Bedroom | 3.2 % | 1 % |
| Duplex 1020 Bedroom | 3.0 % | 1 % |
| Duplex 1021 Bedroom | 3.0 % | 1 % |
| Duplex 1022 Bedroom | 3.0 % | 1 % |
| Duplex 1023 Bedroom | 3.0 % | 1 % |
| Duplex 1024 Bedroom | 3.0 % | 1 % |
| Apartment 1029 Living Room | 3.2 % | 1.5 % |
| Apartment 1028 Bedroom | 3.8 % | 1 % |

Block A – First Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|----------------------------|-------------------------------|-------------------------|
| Apartment 1101 Living Room | 3.0 % | 1.5 % |
| Apartment 1101 Bedroom | 3.3 % | 1 % |
| Apartment 1102 Studio | 1.6 % | 1.5 % |
| Apartment 1106 Studio | 2.2 % | 1 % |
| Apartment 1107 Living Room | 1.7 % | 1.5 % |
| Apartment 1107 Bedroom | 3.8 % | 1 % |
| Apartment 1109 Living Room | 3.8 % | 1.5 % |
| Apartment 1109 Bedroom | 1.6 % | 1 % |
| Duplex 1010 Living Room | 1.5 % | 1.5 % |
| Duplex 1010 Bedroom | 3.3 % | 1 % |
| Duplex 1011 Living Room | 1.5 % | 1.5 % |
| Duplex 1011 Bedroom | 3.3 % | 1 % |
| Duplex 1012 Living Room | 1.5 % | 1.5 % |
| Duplex 1012 Bedroom | 3.3 % | 1 % |
| Duplex 1013 Living Room | 1.5 % | 1.5 % |
| Duplex 1013 Bedroom | 3.3 % | 1 % |
| Apartment 1115 Studio | 2.8 % | 1.5 % |
| Apartment 1116 Living Room | 5.8 % | 1.5 % |
| Apartment 1116 Bedroom | 2.1 % | 1 % |
| Apartment 1117 Living Room | 1.6 % | 1.5 % |
| Apartment 1117 Bedroom | 2.6 % | 1 % |
| Duplex 1020 Living Room | 1.5 % | 1.5 % |
| Duplex 1020 Bedroom | 3.0 % | 1 % |
| Duplex 1021 Living Room | 1.5 % | 1.5 % |
| Duplex 1021 Bedroom | 3.0 % | 1 % |
| Apartment 1139 Living Room | 2.4 % | 1.5 % |
| Apartment 1139 Bedroom | 2.8 % | 1 % |
| Apartment 1141 Living Room | 1.7 % | 1.5 % |
| Apartment 1141 Bedroom | 1.9 % | 1 % |

Block B – Ground Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|----------------------------|-------------------------------|-------------------------|
| Apartment 2001 Living Room | 1.9 % | 1.5 % |
| Apartment 2001 Bedroom | 3.9 % | 1 % |
| Apartment 2002 Living Room | 1.9 % | 1.5 % |
| Apartment 2002 Bedroom | 3.9 % | 1 % |
| Apartment 2003 Living Room | 2.6 % | 1.5 % |
| Apartment 2003 Bedroom | 1.5 % | 1 % |
| Apartment 2004 Studio | 2.0 % | 1.5 % |
| Apartment 2005 Studio | 2.0 % | 1.5 % |
| Apartment 2006 Studio | 2.0 % | 1.5 % |
| Apartment 2007 Living Room | 1.9 % | 1.5 % |
| Apartment 2007 Bedroom | 3.9 % | 1 % |
| Apartment 2008 Living Room | 1.9 % | 1.5 % |
| Apartment 2008 Bedroom | 3.9 % | 1 % |
| Apartment 2009 Studio | 2.0 % | 1.5 % |
| Apartment 2010 Living Room | 2.1 % | 1.5 % |
| Apartment 2010 Bedroom | 3.0 % | 1 % |
| Apartment 2011 Living Room | 2.1 % | 1.5 % |
| Apartment 2011 Bedroom | 3.9 % | 1 % |
| Apartment 2012 Living Room | 2.1 % | 1.5 % |
| Apartment 2013 Studio | 2.0 % | 1.5 % |
| Apartment 2014 Bedroom | 3.9 % | 1 % |
| Apartment 2014 Living Room | 2.1 % | 1.5 % |
| Apartment 2015 Bedroom | 3.9 % | 1 % |
| Apartment 2015 Living Room | 2.1 % | 1.5 % |
| Apartment 2016 Living Room | 1.9 % | 1.5 % |
| Apartment 2016 Bedroom | 3.9 % | 1 % |
| Apartment 2017 Living Room | 1.9 % | 1.5 % |
| Apartment 2017 Bedroom | 3.9 % | 1 % |
| Apartment 2018 Living Room | 2.6 % | 1.5 % |
| Apartment 2018 Bedroom | 1.5 % | 1 % |
| Apartment 2019 Living Room | 1.9 % | 1.5 % |
| Apartment 2019 Bedroom | 3.9 % | 1 % |
| Apartment 2020 Living Room | 1.9 % | 1.5 % |
| Apartment 2020 Bedroom | 3.9 % | 1 % |
| Apartment 2021 Studio | 1.9 % | 1.5 % |

Block B – First Floor



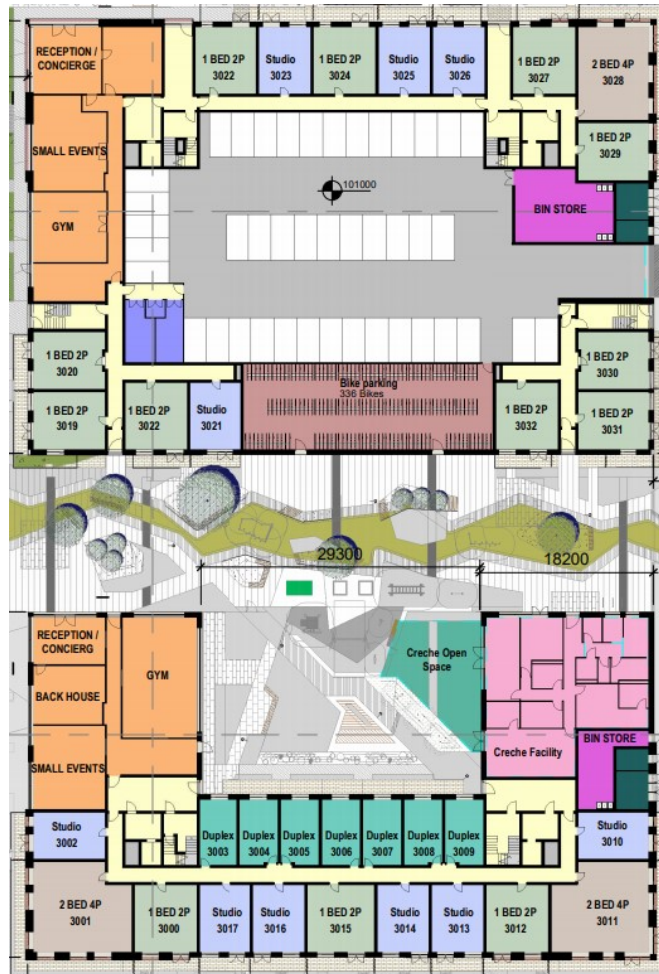
| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|----------------------------|-------------------------------|-------------------------|
| Apartment 2101 Bedroom | 3.0 % | 1 % |
| Apartment 2101 Living Room | 3.8 % | 1.5 % |
| Apartment 2102 Bedroom | 3.9 % | 1 % |
| Apartment 2102 Living Room | 1.9 % | 1.5 % |
| Apartment 2103 Bedroom | 3.9 % | 1 % |
| Apartment 2103 Living Room | 1.9 % | 1.5 % |
| Apartment 2105 Bedroom | 3.9 % | 1 % |
| Apartment 2105 Living Room | 1.9 % | 1.5 % |
| Apartment 2107 Bedroom | 3.9 % | 1 % |
| Apartment 2107 Living Room | 1.9 % | 1.5 % |
| Apartment 2109 Bedroom | 3.0 % | 1 % |
| Apartment 2109 Living Room | 3.8 % | 1.5 % |
| Apartment 2110 Bedroom | 3.0 % | 1 % |
| Apartment 2110 Living Room | 3.8 % | 1.5 % |
| Apartment 2115 Bedroom | 2.0 % | 1 % |
| Apartment 2115 Living Room | 4.2 % | 1.5 % |
| Apartment 2117 Bedroom | 1.6 % | 1 % |
| Apartment 2117 Living Room | 3.0 % | 1.5 % |
| Apartment 2118 Studio | 3.0 % | 1.5 % |
| Apartment 2120 Bedroom | 3.2 % | 1 % |
| Apartment 2120 Living Room | 3.5 % | 1.5 % |
| Apartment 2127 Bedroom | 1.6% | 1 % |
| Apartment 2127 Living Room | 3.9% | 1.5 % |
| Apartment 2128 Bedroom | 1.6% | 1 % |
| Apartment 2128 Living Room | 3.9% | 1.5 % |
| Apartment 2129 Bedroom | 1.5 % | 1 % |
| Apartment 2129 Living Room | 3.0% | 1.5 % |

Block B – Second Floor



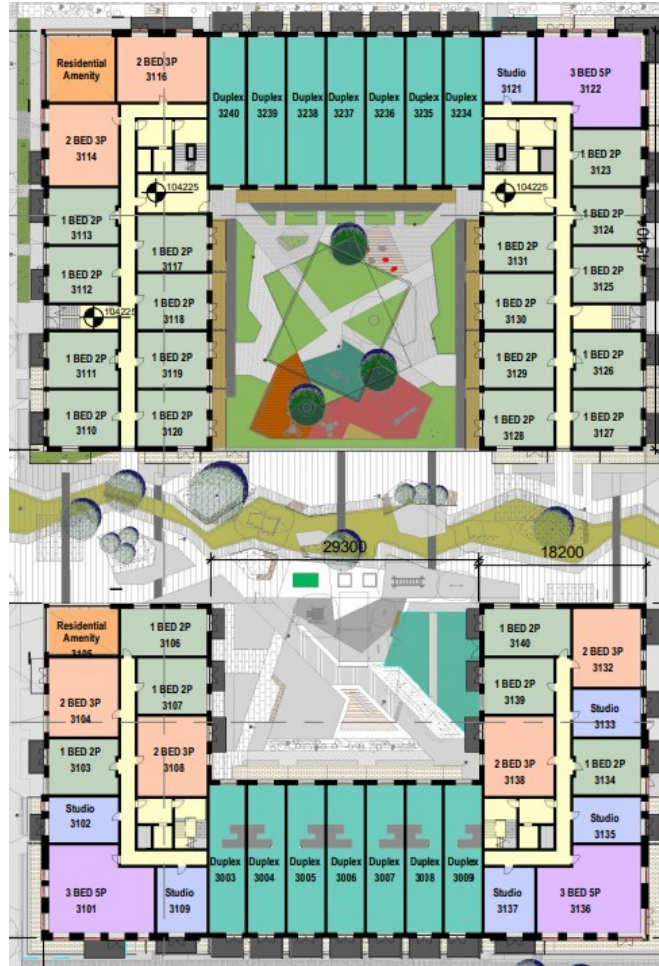
| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|----------------------------|-------------------------------|-------------------------|
| Apartment 2203 Bedroom | 3.9 % | 1 % |
| Apartment 2203 Living Room | 2.1 % | 1.5 % |
| Apartment 2204 Bedroom | 2.0 % | 1 % |
| Apartment 2204 Living Room | 2.1 % | 1.5 % |
| Apartment 2205 Bedroom | 3.9 % | 1 % |
| Apartment 2205 Living Room | 1.9 % | 1.5 % |
| Apartment 2206 Bedroom | 3.0 % | 1 % |
| Apartment 2206 Living Room | 2.8 % | 1.5 % |
| Apartment 2207 Bedroom | 3.9 % | 1 % |
| Apartment 2207 Living Room | 1.9 % | 1.5 % |
| Apartment 2208 Bedroom | 3.9 % | 1 % |
| Apartment 2208 Living Room | 1.9 % | 1.5 % |
| Apartment 2209 Bedroom | 3.9 % | 1 % |
| Apartment 2209 Living Room | 1.9 % | 1.5 % |
| Apartment 2214 Bedroom | 1.6 % | 1 % |
| Apartment 2214 Living Room | 1.6 % | 1.5 % |
| Apartment 2218 Bedroom | 2.0 % | 1 % |
| Apartment 2218 Living Room | 4.2 % | 1.5 % |
| Apartment 2218 Studio | 3.0 % | 1.5 % |
| Apartment 2220 Bedroom | 3.2 % | 1 % |
| Apartment 2220 Living Room | 3.5 % | 1.5 % |
| Duplex 2227 Bedroom | 3.2% | 1 % |
| Apartment 2228 Living Room | 1.6% | 1.5 % |
| Apartment 2228 Bedroom | 3.9% | 1 % |

Block C Ground Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|------------------------------|-------------------------------|-------------------------|
| Duplex C 3003 Bedroom | 3.6 % | 1 % |
| Apartment C 3011 Bedroom | 3.4 % | 1 % |
| Apartment C 3011 Living Room | 5.8 % | 1.5 % |
| Apartment C 3012 Bedroom | 3.7 % | 1 % |
| Apartment C 3012 Living Room | 2.1 % | 1.5 % |
| Studio C 3013 | 2.9 % | 1.5 % |
| Studio C 3014 | 2.9 % | 1.5 % |
| Apartment C 3019 Bedroom | 3.5 % | 1 % |
| Apartment C 3019 Living Room | 3.6 % | 1.5 % |
| Apartment C 3020 Bedroom | 3.4 % | 1 % |
| Apartment C 3020 Living Room | 1.6 % | 1.5 % |
| Apartment C 3021 Bedroom | 3.6 % | 1 % |
| Apartment C 3021 Living Room | 1.9 % | 1.5 % |
| Apartment C 3024 Bedroom | 2.8 % | 1 % |
| Apartment C 3024 Living Room | 2.1 % | 1.5 % |
| Apartment C 3027 Bedroom | 2.8 % | 1 % |
| Apartment C 3027 Living Room | 2.1 % | 1.5 % |
| Apartment C 3028 Bedroom | 3.4 % | 1 % |
| Apartment C 3028 Living Room | 5.8 % | 1.5 % |
| Apartment C 3030 Bedroom | 3.4 % | 1 % |
| Apartment C 3030 Living Room | 1.6 % | 1.5 % |
| Apartment C 3031 Bedroom | 3.5 % | 1 % |
| Apartment C 3031 Living Room | 3.4 % | 1.5 % |
| Apartment C 3032 Bedroom | 3.4 % | 1 % |
| Apartment C 3032 Living Room | 1.6 % | 1.5 % |

Block C First Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|------------------------------|-------------------------------|-------------------------|
| Duplex C 3003 Bedroom | 3.0 % | 1 % |
| Duplex C 3003 Living | 1.5 % | 1.5 % |
| Apartment C 3101 Bedroom | 3.4 % | 1 % |
| Apartment C 3101 Living Room | 5.8 % | 1.5 % |
| Studio C 3102 | 2.9 % | 1.5 % |
| Apartment C 3106 Bedroom | 3.2 % | 1 % |
| Apartment C 3106 Living Room | 3.5 % | 1.5 % |
| Studio C 3109 | 1.6 % | 1.5 % |
| Apartment C 3111 Bedroom | 3.4 % | 1 % |
| Apartment C 3111 Living Room | 1.6 % | 1.5 % |
| Apartment C 3112 Bedroom | 3.4 % | 1 % |
| Apartment C 3112 Living Room | 1.6 % | 1.5 % |
| Studio C 3121 | 2.9 % | 1.5 % |
| Apartment C 3119 Bedroom | 3.2 % | 1 % |
| Apartment C 3119 Living Room | 3.5 % | 1.5 % |
| Apartment C 3120 Bedroom | 3.2 % | 1 % |
| Apartment C 3120 Living Room | 3.5 % | 1.5 % |
| Studio C 3121 | 2.9 % | 1.5 % |
| Duplex C 3234 Bedroom | 3.0 % | 1 % |
| Duplex C 3234 Living | 1.5 % | 1.5 % |
| Studio C 3135 | 2.9 % | 1.5 % |
| Apartment C 3136 Living | 5.8 % | 1.5 % |
| Apartment C 3136 bedroom | 3.4 % | 1 % |
| Studio C 3137 | 1.6 % | 1.5 % |
| Apartment C 3140 Bedroom | 3.2 % | 1 % |
| Apartment C 3140 Living Room | 3.5 % | 1.5 % |

Block C Second Floor



| | | |
|------------------------------|-------|-------|
| Apartment C 3211 Bedroom | 3.4 % | 1 % |
| Apartment C 3211 Living Room | 1.6 % | 1.5 % |
| Apartment C 3212 Bedroom | 3.4 % | 1 % |
| Apartment C 3212 Living Room | 1.6 % | 1.5 % |
| Apartment C 3213 Bedroom | 3.4 % | 1 % |
| Apartment C 3213 Living Room | 1.6 % | 1.5 % |
| Apartment C 3216 Bedroom | 3.2 % | 1 % |
| Apartment C 3216 Living Room | 3.5 % | 1.5 % |
| Apartment C 3217 Bedroom | 3.2 % | 1 % |
| Apartment C 3217 Living Room | 2.9 % | 1.5 % |
| Duplex C 3218 Bedroom | 3.6 % | 1 % |
| Duplex C 3221 Bedroom | 3.6 % | 1 % |
| Apartment C 3223 Bedroom | 3.4 % | 1 % |
| Apartment C 3223 Living Room | 1.6 % | 1.5 % |
| Apartment C 3224 Bedroom | 3.4 % | 1 % |
| Apartment C 3224 Living Room | 1.6 % | 1.5 % |
| Apartment C 3225 Bedroom | 3.4 % | 1 % |
| Apartment C 3225 Living Room | 1.6 % | 1.5 % |
| Apartment C 3226 Bedroom | 3.4 % | 1 % |
| Apartment C 3226 Living Room | 1.6 % | 1.5 % |
| Apartment C 3227 Living Room | 1.6 % | 1.5 % |
| Apartment C 3227 Bedroom | 3.4 % | 1 % |
| Apartment C 3229 Bedroom | 3.2 % | 1 % |
| Apartment C 3229 Living Room | 3.5 % | 1.5 % |
| Apartment C 3230 Bedroom | 3.2 % | 1 % |
| Apartment C 3230 Living Room | 3.5 % | 1.5 % |
| Duplex C 3234 Bedroom | 3.0 % | 1 % |
| Duplex C 3240 Bedroom | 3.0 % | 1 % |
| Apartment C 3241 Bedroom | 3.0 % | 1 % |
| Apartment C 3241 Living Room | 1.6 % | 1.5 % |
| Apartment C 3242 Bedroom | 3.4 % | 1 % |
| Apartment C 3242 Living Room | 1.6 % | 1.5 % |
| Apartment C 3244 Bedroom | 3.2 % | 1 % |
| Apartment C 3244 Living Room | 3.5 % | 1.5 % |

Block D Ground Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|------------------------------|-------------------------------|-------------------------|
| Apartment D 4001 Bedroom | 2.8 % | 1 % |
| Apartment D 4001 Living Room | 4.9 % | 1.5 % |
| Apartment D 4002 Bedroom | 1.5 % | 1 % |
| Apartment D 4002 Living Room | 2.5 % | 1.5 % |
| Apartment D 4003 Bedroom | 2.3 % | 1 % |
| Apartment D 4003 Living Room | 1.5 % | 1.5 % |
| Apartment D 4004 Bedroom | 2.3 % | 1 % |
| Apartment D 4004 Living Room | 1.5 % | 1.5 % |
| Apartment D 4005 Bedroom | 2.3 % | 1 % |
| Apartment D 4005 Living Room | 1.5 % | 1.5 % |
| Apartment D 4006 Bedroom | 3.7 % | 1 % |
| Apartment D 4006 Living Room | 3.5 % | 1.5 % |
| Apartment D 4007 Bedroom | 2.1 % | 1 % |
| Apartment D 4007 Living Room | 1.5 % | 1.5 % |
| Duplex D 4008 Bedroom | 3.6 % | 1 % |
| Duplex D 4009 Bedroom | 3.6 % | 1 % |
| Duplex D 4010 Bedroom | 3.6 % | 1 % |
| Duplex D 4013 Bedroom | 3.6 % | 1 % |

Block D First Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|------------------------------|-------------------------------|-------------------------|
| Apartment D 4101 Bedroom | 3.4 % | 1 % |
| Apartment D 4101 Living Room | 5.8 % | 1.5 % |
| Apartment D 4102 Bedroom | 2.5 % | 1 % |
| Apartment D 4102 Living Room | 1.5 % | 1.5 % |
| Apartment D 4103 Bedroom | 3.4 % | 1 % |
| Apartment D 4103 Living Room | 1.5 % | 1.5 % |
| Apartment D 4104 Bedroom | 3.4 % | 1 % |
| Apartment D 4104 Living Room | 1.5 % | 1.5 % |
| Apartment D 4105 Bedroom | 3.4 % | 1 % |
| Apartment D 4105 Living Room | 1.5 % | 1.5 % |
| Apartment D 4106 Bedroom | 3.4 % | 1 % |
| Apartment D 4106 Living Room | 5.8 % | 1.5 % |
| Apartment D 4107 Bedroom | 3.4 % | 1 % |
| Apartment D 4107 Living Room | 5.8 % | 1.5 % |
| Apartment D 4109 Bedroom | 3.4 % | 1 % |
| Apartment D 4109 Living Room | 5.8 % | 1.5 % |
| Apartment D 4112 Bedroom | 3.4 % | 1 % |
| Apartment D 4112 Living Room | 5.8 % | 1.5 % |
| Apartment D 4113 Bedroom | 3.4 % | 1 % |
| Apartment D 4113 Living Room | 5.8 % | 1.5 % |
| Apartment D 4114 Bedroom | 3.4 % | 1 % |
| Apartment D 4114 Living Room | 5.8 % | 1.5 % |
| Apartment D 4115 Bedroom | 3.4 % | 1 % |
| Apartment D 4115 Living Room | 5.8 % | 1.5 % |
| Duplex D 4008 Bedroom | 2.3 % | 1 % |
| Duplex D 4008 Living | 1.5 % | 1.5 % |
| Duplex D 4010 Bedroom | 2.3 % | 1 % |
| Duplex D 4010 Living | 1.5 % | 1.5 % |
| Duplex D 4013 Bedroom | 2.3 % | 1 % |
| Duplex D 4013 Living | 1.5 % | 1.5 % |
| Apartment D 4301 Bedroom | 2.7 % | 1 % |
| Apartment D 4301 Living Room | 4.6 % | 1.5 % |
| Apartment D 4302 Bedroom | 3.4 % | 1 % |
| Apartment D 4302 Living Room | 1.5 % | 1.5 % |

Block D Second Floor



| Room | Average Daylight Factor (ADF) | Minimum ADF (BS 8206-2) |
|------------------------------|-------------------------------|-------------------------|
| Apartment D 4201 Bedroom | 3.4 % | 1 % |
| Apartment D 4201 Living Room | 5.8 % | 1.5 % |
| Apartment D 4202 Bedroom | 3.4 % | 1 % |
| Apartment D 4202 Living Room | 5.8 % | 1.5 % |
| Apartment D 4206 Bedroom | 3.4 % | 1 % |
| Apartment D 4206 Living Room | 5.8 % | 1.5 % |
| Apartment D 4207 Bedroom | 3.4 % | 1 % |
| Apartment D 4207 Living Room | 5.8 % | 1.5 % |
| Apartment D 4209 Bedroom | 3.4 % | 1 % |
| Apartment D 4209 Living Room | 5.8 % | 1.5 % |
| Apartment D 4212 Bedroom | 3.4 % | 1 % |
| Apartment D 4212 Living Room | 5.8 % | 1.5 % |
| Apartment D 4213 Bedroom | 3.4 % | 1 % |
| Apartment D 4213 Living Room | 5.8 % | 1.5 % |
| Apartment D 4214 Bedroom | 3.4 % | 1 % |
| Apartment D 4214 Living Room | 5.8 % | 1.5 % |
| Apartment D 4215 Bedroom | 3.4 % | 1 % |
| Apartment D 4215 Living Room | 5.8 % | 1.5 % |
| Duplex D 4319 Bedroom | 2.3 % | 1 % |
| Duplex D 4319 Living | 1.5 % | 1.5 % |
| Duplex D 4322 Bedroom | 2.3 % | 1 % |
| Duplex D 4322 Living | 1.5 % | 1.5 % |
| Apartment D 4301 Bedroom | 2.7 % | 1 % |
| Apartment D 4301 Living Room | 4.6 % | 1.5 % |
| Apartment D 4302 Bedroom | 3.4 % | 1 % |
| Apartment D 4302 Living Room | 1.5 % | 1.5 % |

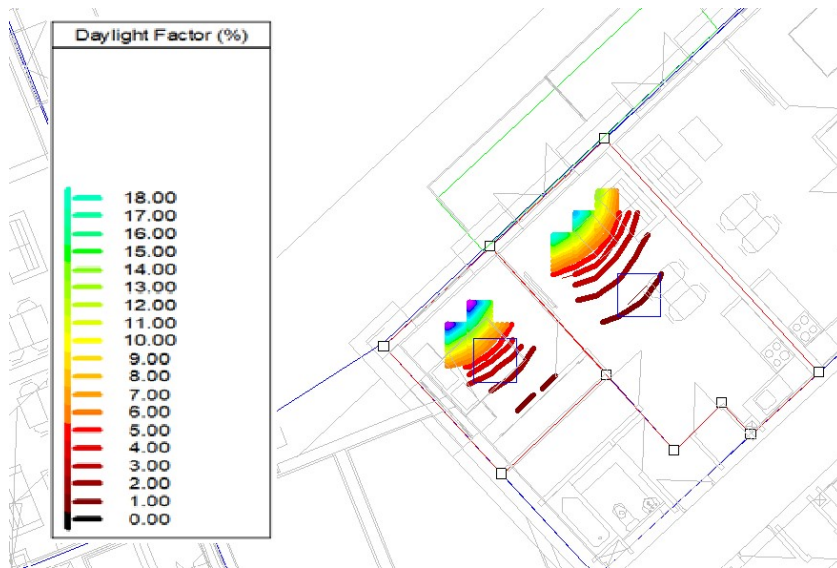


Fig 2a. IES Model view – Apartment 1110 (block A) plan indicating daylighting percentage on working plane level.

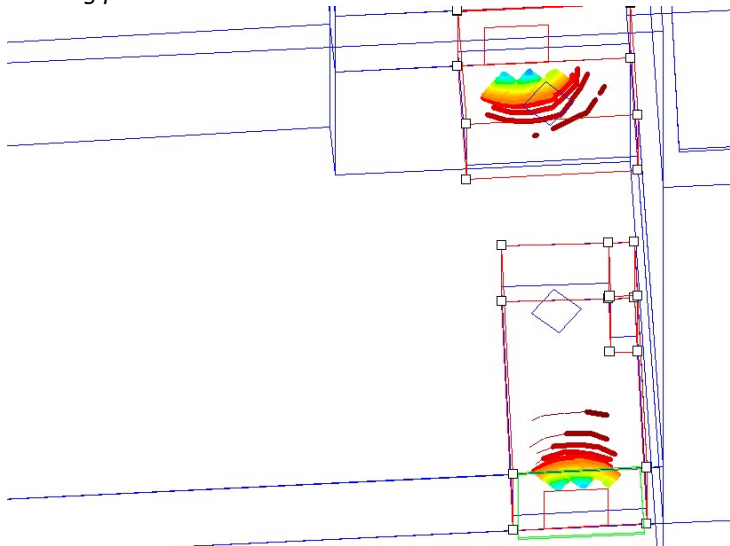


Fig 2b. IES Model view – Apartment 2239 (block B) axonometric view of average daylight factor

Detailed Results Output from EIS VE (FlucsDL Module) for selected apartments

Room BL00002B (a.1139 living)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|-----------|------------|-------------|------------------------|-----------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=16.258m ² Margin=0.50 m | Daylight factor | 0.1 % | 2.4 % | 16.1 % | 0.05 | 0.01 |
| | Daylight illuminance | 12.39 lux | 262.86 lux | 1782.21 lux | 0.05 | 0.01 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room BL00004A (a.1116 living)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|-----------|------------|-------------|------------------------|-----------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m | Daylight factor | 0.6 % | 5.8 % | 22.7 % | 0.11 | 0.03 |
| | Daylight illuminance | 71.08 lux | 638.54 lux | 2523.28 lux | 0.11 | 0.03 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

| | | | | | | |
|--|--|--|--|--|--|--|
| Area=20.884m ² Margin=0.50 m | | | | | | |
|--|--|--|--|--|--|--|

Room BL0000B0 (block a 1140 bed)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|--|----------------------|-----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=6.350m ² Margin=0.50 m | Daylight factor | 0.3 % | 1.9 % | 8.7 % | 0.16 | 0.03 |
| | Daylight illuminance | 35.24 lux | 226.44 lux | 1068.51 lux | 0.16 | 0.03 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room BL0000B1 (block a 1140 living)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=14.119m ² Margin=0.50 m | Daylight factor | 0.1 % | 1.7 % | 13.7 % | 0.04 | 0.01 |
| | Daylight illuminance | 8.53 lux | 207.53 lux | 1679.65 lux | 0.04 | 0.01 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room BL000010 (b.2003 bed)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|-----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=11.397m ² Margin=0.50 m | Daylight factor | 0.1 % | 1.5 % | 10.7 % | 0.07 | 0.01 |
| | Daylight illuminance | 12.53 lux | 177.73 lux | 1308.05 lux | 0.07 | 0.01 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room B2000000 (b.2003 living)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|-----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=20.055m ² Margin=0.50 m | Daylight factor | 0.1 % | 2.6 % | 16.6 % | 0.04 | 0.01 |
| | Daylight illuminance | 12.70 lux | 317.02 lux | 2027.76 lux | 0.04 | 0.01 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room BL00005D (block b 2011 living)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|---|----------------------|-----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=14.131m ² Margin=0.50 m | Daylight factor | 0.1 % | 2.1 % | 15.6 % | 0.04 | 0.01 |
| | Daylight illuminance | 10.23 lux | 254.72 lux | 1906.91 lux | 0.04 | 0.01 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Room BL0000A9 (block d 4007 bed)

| Surface | Quantity | Values | | | Uniformity (Min./Ave.) | Diversity (Min./Max.) |
|--|----------------------|-----------|------------|-------------|---------------------------|--------------------------|
| | | Min. | Ave. | Max. | | |
| Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.50 m Area=9.486m ² Margin=0.50 m | Daylight factor | 0.2 % | 2.1 % | 11.6 % | 0.11 | 0.02 |
| | Daylight illuminance | 27.81 lux | 252.63 lux | 1416.29 lux | 0.11 | 0.02 |
| | Sky view | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

5. SHADOW ANALYSIS & SUNLIGHT TO COURTYARD AND PUBLIC SPACES

While providing good levels of daylight and sunlight in living spaces is important, it is also essential to apply the same mentality to outside spaces and amenity areas. An adequately lit open space creates a rich ambience that any occupant would find appealing. The basis of this calculation is to assess if 50% of the public areas will achieve more than two hours' worth of sunlight during the spring equinox (21st March).

The design approach of breaking down the massing and using orientation of the site allows sunlight and daylight to access the public spaces throughout the course of a day and throughout different times of the year.

The predicted sunlight to the public spaces within the proposed development has been assessed based on BRE guidelines to verify that the amenity for residents will fall within acceptable parameters. It is demonstrated below that the proposed amenity space, can be described as adequately sunlit throughout the year. The BRE guidelines recommend that front gardens need not be assessed for sunlight. The communal spaces between the apartment blocks are assessed & keyplan below highlights in red the public areas assessed for sunlight hours.

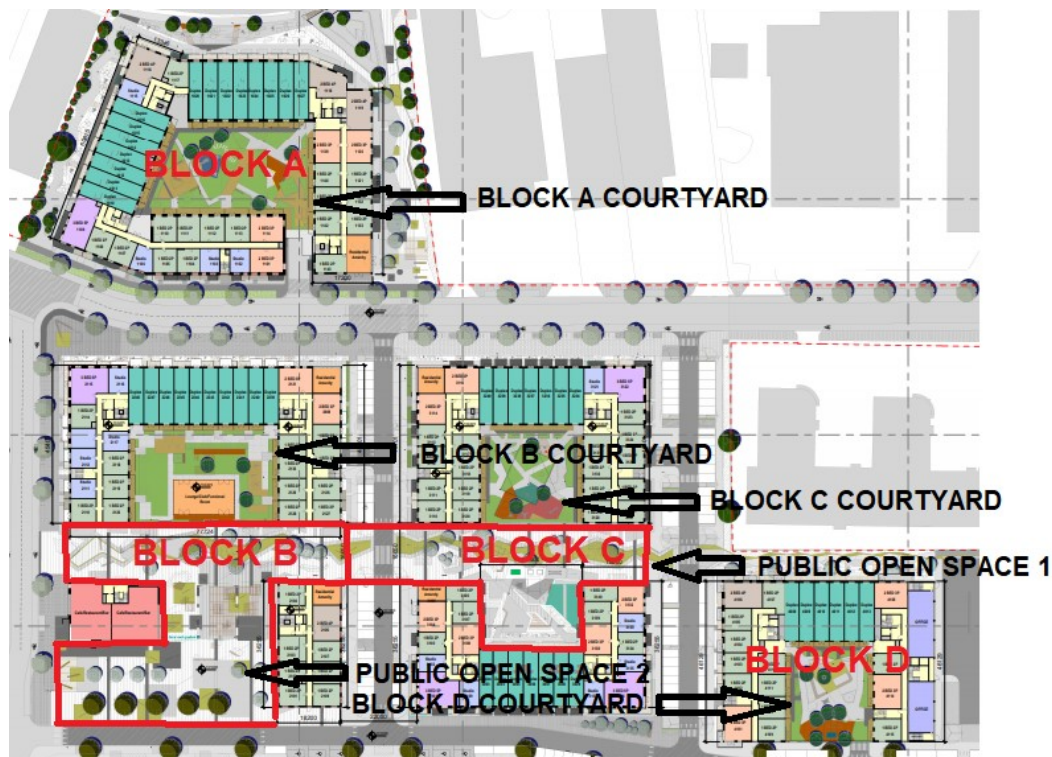


Fig.3 Site plan with red outline of public open space areas and podiums above car parking.

Sunlight hours modelling

Using the IES VE software model in the SunCast module an accurate shadow casting analysis was produced. This program replicates the azimuth and altitude of the sun for any specified time and date of the year, orientation, site latitude and site longitude at site location.

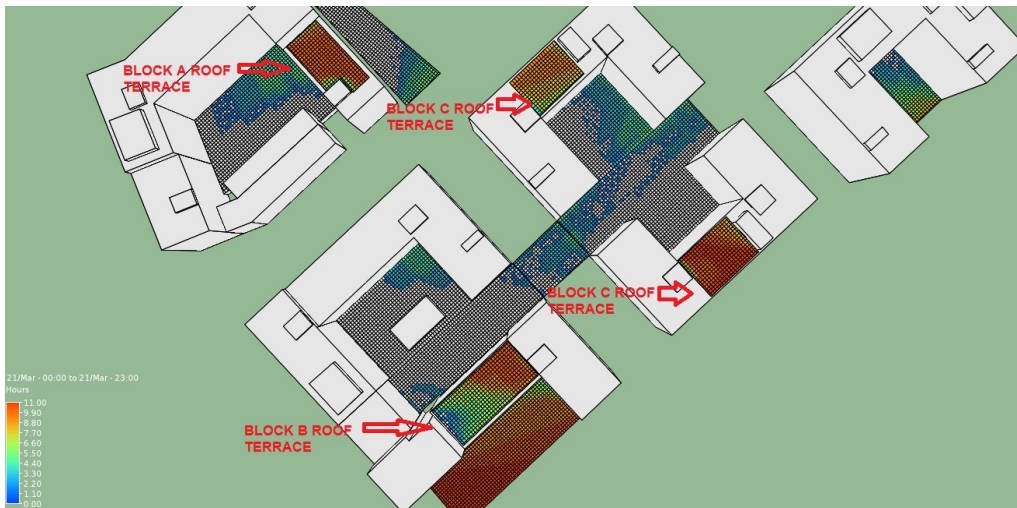


Fig.4a Sunlight hours contour map for the Block B1 and open space 1 (note fig 4c, 4d for additional detail view under the bridge)

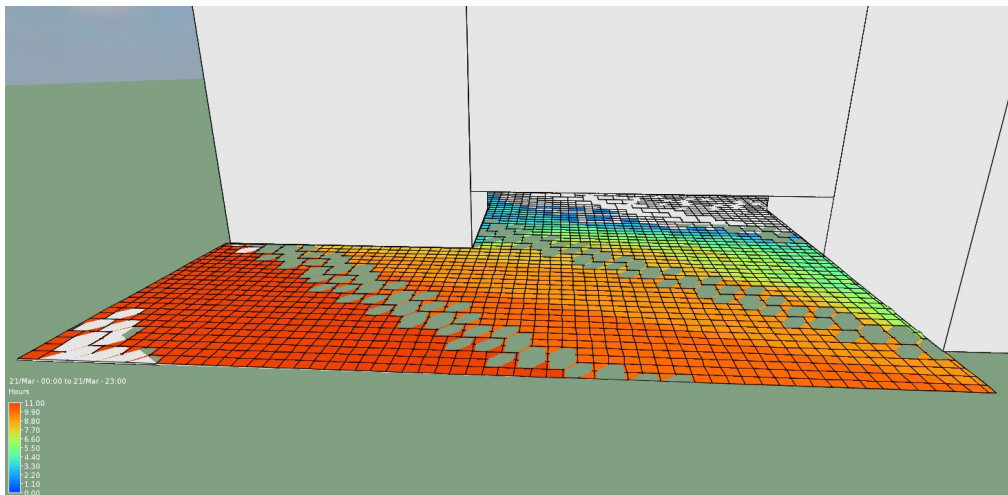


Fig.4b Sunlight hours contour map for the Block B Courtyard looking from the south

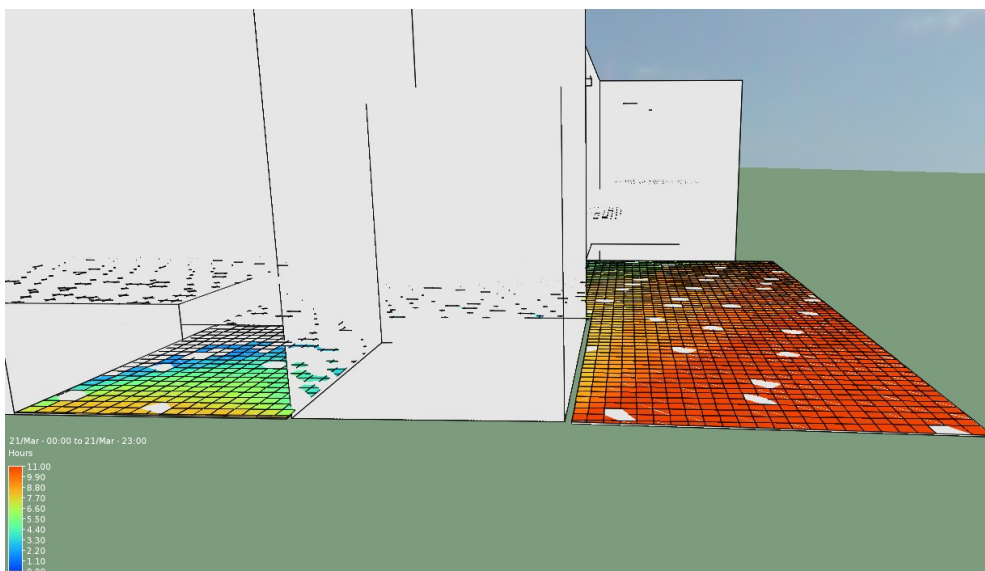


Fig.4c Sunlight hours contour map for the Block B Courtyard looking from the west

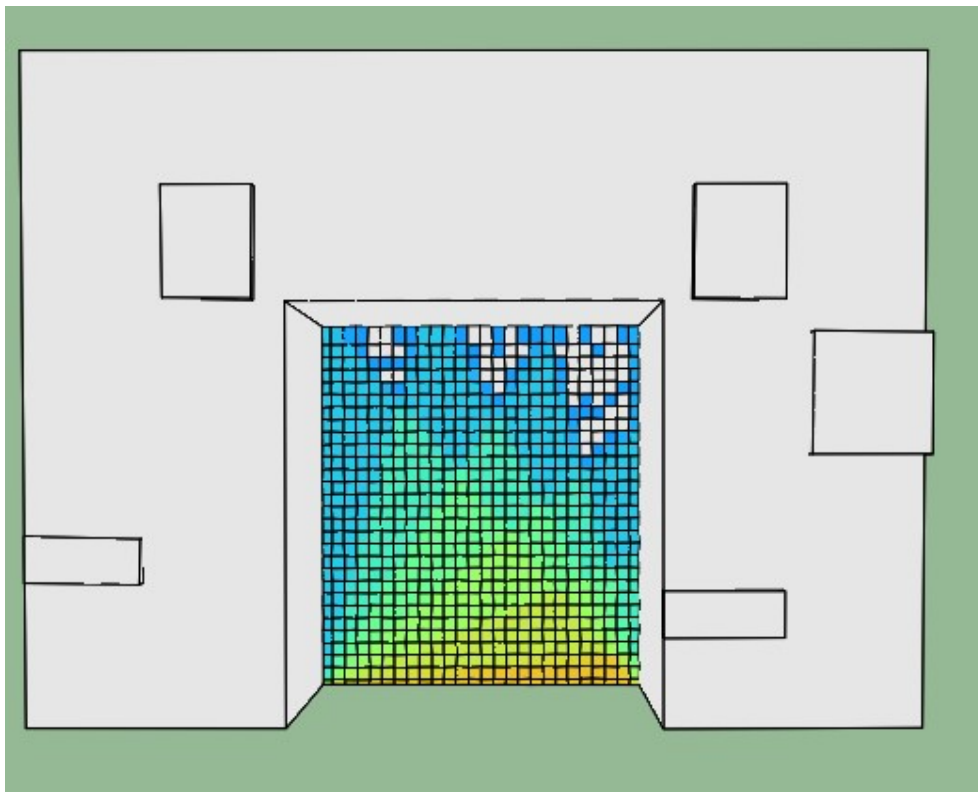


Fig. 4d Block D Level 01 Courtyard

Figures above illustrate the results of the modelling. The coloured squares indicate areas which receive more than 2 hours of sunlight and the white represent the areas below the 2 hour requirement.

Average value of all the assessed spaces is 66% which exceeds the recommendations of the BRE guidelines and should be pleasant spaces.

Table 4. Results summary for public & residents spaces

| Public Space | Area that receives 2 or more hours of sunlight on the 21st March | Minimum BRE requirement |
|----------------------------|--|-------------------------|
| Block A – Communal area | 57% | 50 % |
| Block B – Communal area | 61% | 50 % |
| Block C – Communal area | 68% | 50 % |
| Block D – Podium | 91% | 50 % |
| Public Open Space 1 | 59% | 50 % |
| Public Open Space 2 | 60% | 50 % |
| Overall Development | 66% | 50% |

The assessment shows that the courtyards in the proposed development meets the recommendations of the BRE and can be described as adequately sunlit throughout the year.

Wind Study review of the roof terraces confirms this space would provide good quality communal space in addition to the apartment courtyards.

6. SHADOW DIAGRAMS

The BRE guidelines recommend using the 21st March for plotting shadow diagrams. Pages overleaf contain the shadow diagram based on the sun position at the given date & time. In addition Shadow diagrams for summer & autumn are included to illustrate the impact on the surrounding environment throughout the year.



Fig 5. Shadows cast on the public spaces on the 21st of March at 9:00



Fig 6. Shadows cast on the public spaces on the 21st of March at 12:00

21 Mar 15:00



Fig 7. Shadows cast on the public spaces on the 21st of March at 15:00

21 Jun 09:00



Fig 8. Shadows cast on the public spaces on the 21st of June at 09:00

21 Jun 12:00



Fig 9. Shadows cast on the public spaces on the 21st of June at 12:00

21 Jun 15:00



Fig 10. Shadows cast on the public spaces on the 21st of June at 15:00

21 Jun 19:00



Fig 11. Shadows cast on the public spaces on the 21st of June at 19:00

21 Sep 09:00



Fig 12. Shadows cast on the public spaces on the 21st of September at 09:00

21 Sep 12:00



Fig 13. Shadows cast on the public spaces on the 21st of September at 12:00

21 Sep 15:00



Fig 14. Shadows cast on the public spaces on the 21st of September at 15:00

7. NOTES ON THE USE OF IS EN 17037 (2018), BS 8026-2 2008 AND BRE BR209 (2011)

The standard 'IS EN 17037 (2018): Daylight in buildings' gives information on how to use daylighting to provide lighting within interiors. It defines metrics used for the evaluation of daylighting conditions and gives principles of calculation and verification. These principles allow users to deal with the issue of variability of daylight over the course of a day and year.

Neither the IS EN, BS nor the BRE Guide set out rigid standards or limits. The values provided in these documents are recommended values. The BRE Guide is preceded by the following very clear warning as to how the design advice contained therein should be used:

"The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aims 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."

That the recommendations of the Standards and BRE Guide are not suitable for rigid application to all developments in all contexts is of particular importance in the context of national and local policies for the consolidation and densification of urban areas. Given that the British Standard and the BRE Guide were drafted in the UK in the context of UK strategic planning policy, recommendations or advices provided in either document that have the potential to conflict with Irish statutory planning policy have been disregarded for the purposes of this analysis.