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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

Project Reference: Revision Ref: Date Prepared: Date Issued: Prepared By: J590 C 4th December 2020 17th December 2020 Jonathan Kirwan & Martin Obst

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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 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%		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 ANALISYS

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 daylit 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 daylit space and 2% for partly daylit 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 Ly at an angle of elevation γ above the horizontal to the luminance L ₂ at the zenith is given by:
	$L_y = L_z \frac{(1+2\sin y)}{3}$
	A CIE standard overcast sky is darkest at the horizon and brightest at the

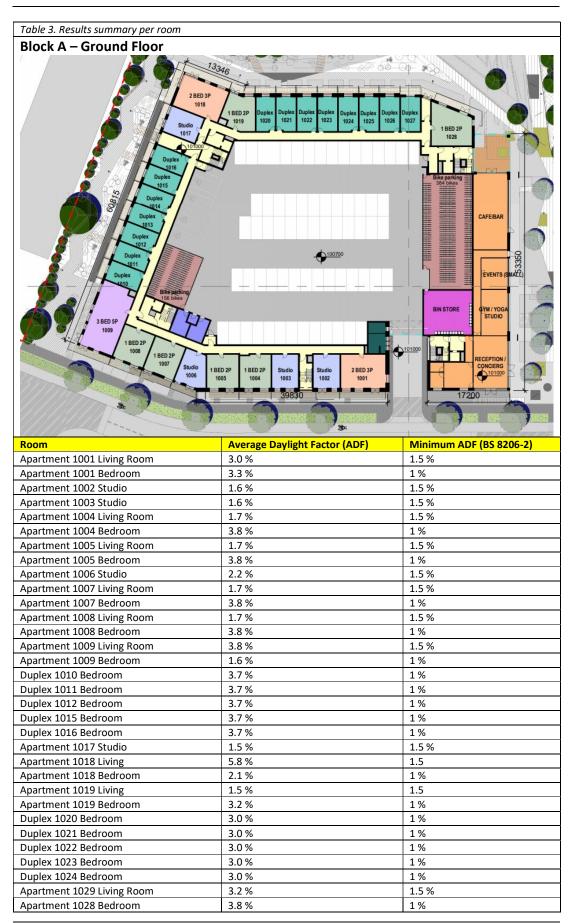
Analysis results

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

zenith (vertically overhead).

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.







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2003 2002 2001		
	77724	
	A REAL PROPERTY AND A REAL	
Room	Average Daylight Fact	or (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 %







Rom Average Daylight Factor (ADF) Minimum ADF (ES 8205-2) Apartment 2203 Bedroom 3.9 % 1.5 % Apartment 2205 Bedroom 3.9 % 1.5 % Apartment 22	Block B – Second Floor		
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Duplex 2227 Bedroom 3.2% 1% Apartment 2228 Living Room 1.6% 1.5%			
Apartment 2228 Living Room 1.6% 1.5%			
	Apartment 2228 Bedroom	3.9%	1%





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 %

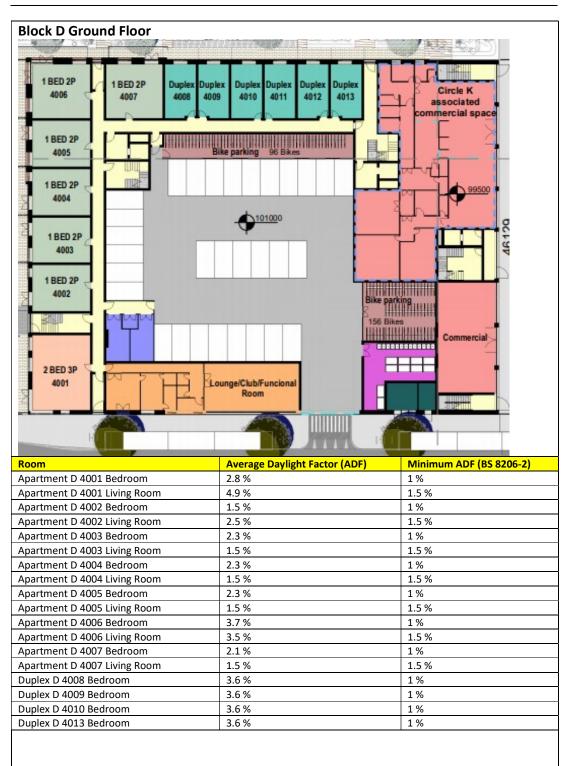


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Block C First Floor		
	A DECEMBER OF THE OWNER.	
Residential 2 BED 3P		
Amenity 3116 Duplex Duplex Duplex Duplex Duplex Duplex	Studio 3 BED 5P Duplex Duplex 3121 3122	
3240 3239 3238 3237 3236	3235 3234	
2 BED 3P 3114		
	3123	
1 BED 2P 3113	3124	
18ED 2P	1 BED 2P 3131 1 BED 2P	
3112 1BED 2P	1BED 2P 4 3125	
910422 ¹ 3118	3130	
1 BED 2P 3 5 1 BED 2P	1 BED 2P	
3111 3119	3129 3126	
1 BED 2P 2 7 1 BED 2P	1 BED 2P 4 7 1 BED 2P	
3110 3120	3128 3127	
	20	
29300	Lever Carlos P	
	18200	
Residential 1 BED 2P	1 BED 2P	
Amenty 3106	3140 2 BED 3P 3132	
7 1 BED 2P	1 BED 2P	
2 BED 3P 3107		
1 BED 2P		
3103 3108	2 BED 3P 1 BED 2P 3138 3134	
Studio	3138 3134	
	3138 3134 Studio 3135	
Studio	3138 3134 Studio 3135	
Studio 3102 Duplex Duplex Duplex Duplex Duplex	Duplex Duplex	
Studio 3102 3 BED SP Studio	3138 3134 Duptex Studio 3009 Studio Studio 3 BED SP	
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Studio 3102 3 BED SP 3101 3109 Studio 3003 3004 3005 3007 3005 3007 3005 3007 3005 3007 3005 3007 3005 3007 3005 3007 3007	3138 Duplex 3009 Studio 3135 3124 Studio 3135 3125 3126	Minimum ADF (BS 8206-2)
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Studio 3102 3 BED 5P 3109 3003 3004 3005 3006 3007 3005 3006 3007 3005 3006 3007 2008 3007 2008 3006 3007 2008 2009 2009 2009 2009 2009 2009 2009	J138 J134 Duplex Jupley J038 J009 Studio J125 Average Daylight Factor (ADF) 3.0 % 1.5 %	1 % 1.5 %
Studio 3102 Gupter Dupter	J138 J134 Duptex Studio J138 Studio J138 Studio J138 Studio J139 Studio J139 Studio J139 Studio J139 Studio J139 Studio J130 Studio J131 J136 J130 Studio Average Daylight Factor (ADF) J.0 % 1.5 % J.4 %	1 % 1.5 % 1 %
Studio Studio 3 BED 3P Studio 3	J138 J134 Duptex Jupter J038 J009 Studio J125 J138 J125 J138 J125 J138 J126 J139 J125 J139 J125 J139 J125 J139 J125 J130 J125 J137 J126 J130 M J.0 % J.5 % J.4 % J.8 %	1 % 1.5 % 1 % 1.5 %
Studio Studio 3 BED 5P Studio 3 BED 5P Studio 3 Undex Studio<	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 %	1 % 1.5 % 1 % 1.5 % 1.5 %
Studio Studio 3 BED SP Studio 3 BED SP Studio 3 Uppex Duplex Duplex C 3003 Buylex C 3003 Duplex C 3003 Buylex C 3004 Buylex C 3005 Buylex C 3006 Buylex Studio Studio C 3102 Apartment C 3106 Bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1 %
Studio Studio 3 BED 5P Studio 3 BED 5P Studio 3 Uppex Duplex Duplex C 3003 Buylex C 3003 Duplex C 3003 Buylex C 3003 Duplex C 3003 Living Apartment C 3101 Living Room Studio C 3102 Apartment C 3106 Bedroom Apartment C 3106 Bedroom Apartment C 3106 Bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 % 3.5 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 %
Studio Studio 3 BED 5P Studio 3 BED 5P Studio 3 Uppex Duplex Duplex C 3003 Bedroom Duplex C 3003 Living Apartment C 3101 Bedroom Studio C 3102 Apartment C 3106 Bedroom Studio C 3109	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 % 1.6 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 %
Studio Studio 3 8ED SP Studio 3 8ED SP Studio 3 101 Studio 3 102 Studio Duplex C 3003 Bedroom Duplex C 3003 Living Apartment C 3101 Bedroom Studio C 3102 Apartment C 3106 Bedroom Apartment C 3106 Bedroom Studio C 3102 Apartment C 3106 Bedroom Apartment C 3106 Living Room Studio C 3109 Apartment C 3111 Bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 % 3.5 % 1.6 % 3.4 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 %
Studio Studio 3102 3003 3103 3004 3101 3109 3102 3003 Duplex C 3003 Bedroom Duplex C 3003 Living Apartment C 3101 Bedroom Apartment C 3102 Apartment C 3106 Bedroom Apartment C 3106 Bedroom Studio C 3102 Apartment C 3106 Bedroom Apartment C 3106 Living Room Studio C 3109 Apartment C 3111 Bedroom Apartment C 3111 Bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 % 3.5 % 1.6 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 %
Studio Studio 3162 3162 3163 3004 3161 3109 3162 3005 3163 3004 3160 3005 3161 3005 3162 3005 3161 3005 3162 3005 3163 3004 3164 3005 3165 3005 3161 3109 Apartment C 3106 Living Room Studio C 3109 Apartment C 3111 Apartment C 3111 Living Room Apartment C 3111 Bedroom Apartment C 3111 Bedroom	J138 J134 Studio J135 J138 Studio J139 Studio J139 Studio J130 Studio Average Daylight Factor (ADF) 3.0 % J1.5 % 3.4 % State 2.9 % J2.9 % 3.2 % J1.6 % J.4 % J1.6 % J.4 % J1.6 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1 % 1.5 % 1 %
Studio310231033103304431033005310131093101310931013109310131093101310031013101 <td< td=""><td>J138 J134 Duplex Duplex J318 J309 Studio J125 J135 J125 J138 J126 J138 J126 J138 J126 J139 J126 J120 J126 J121 J126 J121 J126 J121 J126 J120 J126 J</td><td>1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %</td></td<>	J138 J134 Duplex Duplex J318 J309 Studio J125 J135 J125 J138 J126 J138 J126 J138 J126 J139 J126 J120 J126 J121 J126 J121 J126 J121 J126 J120 J126 J	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
StudioStudio3102Juplex Duplex D	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.6 % 3.4 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 %
Studio310231033103304431033005310131093101310931013109310131093101310031013101 <td< td=""><td>J138 J134 Duplex Duplex J318 J309 Studio J125 J135 J125 J138 J126 J138 J126 J138 J126 J139 J126 J120 J126 J121 J126 J121 J126 J121 J126 J120 J126 J</td><td>1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %</td></td<>	J138 J134 Duplex Duplex J318 J309 Studio J125 J135 J125 J138 J126 J138 J126 J138 J126 J139 J126 J120 J126 J121 J126 J121 J126 J121 J126 J120 J126 J	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
StudioStudio3102Juplex Duplex Duplex Duplex DuplexDuplex Duplex	J138 J134 Studio J135 J138 Studio J139 Studio J130 Studio J130 Studio J150 J120 J160 J120 J160 J120 J160 J120 J120 J120	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 %
StudioStudioJuplex Duplex Duplex Duplex DuplexJuplex Duplex	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 %
StudioStudioJuplex Duplex	J138 J134 Studio J135 J138 Studio J139 Studio J130 Studio J159 J139 J100 Studio J1.5 % J100 J1.5 % J100 J2.9 % J1.6 % J2.9 % J1.6 % J2.9 % J2.9 %	1 % 1.5 % 1 %
StudioStudioStudioJuplex Duplex Duplex Duplex DuplexDuplex Duplex Duple	Jis Jis Juppler Juppler Juppler Juppl	1 % 1.5 %
StudioStudioStudioJuplex Duplex C 3003 EditorRoomDuplex C 3003 BedroomApartment C 3101 BedroomApartment C 3111 BedroomApartment C 3112 BedroomApartment C 3112 BedroomApartment C 3119 BedroomApartment C 3119 BedroomApartment C 3119 Duplex Duplex Duplex Duplex Duplex C 3234 BedroomDuplex C 3234 BedroomDuplex C 3234 Living	Jis Jis Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.2 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.0 % 1.5 %	1 % 1.5 % 1 % 1.5 %
StudioStudioStudioJuplex Duplex	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.15 % 1.5 % 3.15 % 1.5 % 3.2 % 3.5 % 1.6 % 3.4 % 1.5 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.5 % 2.9 % 3.0 % 1.5 % 2.9 %	1 % 1.5 % 1 % 1.5 %
StudioStudioStudioJuplex Duplex	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.2 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.1 % 1.5 % 3.1 % 1.5 % 3.2 % 3.2 % 3.1 % 1.5 % 2.9 % 3.0 % 1.5 % 2.9 % 3.0 % 1.5 % 2.9 % 3.0 % 1.5 % 2.9 % 5.8 %	1 % 1.5 % 1 % 1.5 %
StudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioDuplex C 3003 BedroomDuplex C 3003 BedroomApartment C 3101 BedroomApartment C 3106 BedroomApartment C 3106 BedroomApartment C 3106 Living RoomStudio C 3109Apartment C 3111 BedroomApartment C 3112 BedroomApartment C 3112 Living RoomApartment C 3119 BedroomApartment C 3120 BedroomApartment C 3120 BedroomApartment C 3120 Living RoomStudio C 3121Duplex C 3234 BedroomDuplex C 3234 LivingStudio C 3135Apartment C 3136 LivingApartment C 3136 bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.2 % 3.5 % 1.6 % 3.4 % 1.5 % 3.4 % 1.5 % 3.1 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 2.9 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.0 % 1.5 % 2.9 % 5.8 % 3.4 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
StudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioDuplex C 3003 BedroomDuplex C 3003 BedroomApartment C 3101 BedroomApartment C 3106 BedroomApartment C 3106 BedroomApartment C 3106 Living RoomStudio C 3109Apartment C 3111 BedroomApartment C 3112 BedroomApartment C 3112 Living RoomApartment C 3112 Living RoomApartment C 3119 BedroomApartment C 3120 BedroomApartment C 3120 Living RoomStudio C 3121Duplex C 3234 BedroomDuplex C 3234 LivingStudio C 3135Apartment C 3136 LivingApartment C 3136 bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.2 % 3.2 % 3.5 % 1.6 % 3.4 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.2 % 3.0 % 1.5 % 2.9 % 5.8 % 3.4 % 1.6 %	1 % 1.5 %
StudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioStudioDuplex C 3003 BedroomDuplex C 3003 BedroomApartment C 3101 BedroomApartment C 3106 BedroomApartment C 3106 BedroomApartment C 3106 Living RoomStudio C 3109Apartment C 3111 BedroomApartment C 3112 BedroomApartment C 3112 Living RoomApartment C 3119 BedroomApartment C 3120 BedroomApartment C 3120 BedroomApartment C 3120 Living RoomStudio C 3121Duplex C 3234 BedroomDuplex C 3234 LivingStudio C 3135Apartment C 3136 LivingApartment C 3136 bedroom	Average Daylight Factor (ADF) 3.0 % 1.5 % 3.4 % 5.8 % 2.9 % 3.5 % 1.6 % 3.4 % 1.6 % 3.4 % 1.5 % 3.2 % 3.5 % 1.6 % 3.4 % 1.5 % 3.4 % 1.5 % 3.1 % 1.5 % 3.4 % 1.5 % 3.4 % 1.5 % 2.9 % 3.2 % 3.1 % 1.5 % 2.9 % 3.0 % 1.5 % 2.9 % 3.0 % 1.5 % 2.9 % 5.8 % 3.4 %	1 % 1.5 % 1 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %



Block C Second Floor		
3216 3217		3223 3224
	18 3219 3220 3221 3222 67 m ² 28 m ² 28 m ² 28 m ²	'9 m' 101.6 m'
	╘╻╧╺╴┶╷┵┍┶╷╧	
	39 3238 3237 3236 3235 3234	
275 m 27	5 m² 28 m² 28 m² 27.5 m² 27.5 m² 28 m²	
☆┫━━━━┥│ ′ ┝━╌┯┻╸	╺┻╴┷╶┷╶┯	
3214 3241 44.3 m ² 78 m ²	29250	3233 78 m ² 3226
		P
	2	
3213 4 45 m ²	7	2227 45 m ²
		3232 45 m ²
4 X 3243 R	R	R R
44.3 m ²		3231 45 m ² 3228 44.3 m ²
		4
	r I	
3211 4 9244		3230 4 7 3229
45 m ² 45 m ²	4	45 m ² 45 m ²
Apartment C 3211 Bedroom	3.4 %	1%
Apartment C 3211 Euroom	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 %
•	3.2 %	1%
Apartment C 3244 Bedroom	0.2 / 0	1,0







Block D First Floor		
	Section 20	
		- 51
		*
2 BED 4P 1 BED 2P	2 BED 3P	
4106 4107	2 BED 3P 4108	
Duplex Duplex D		1
4008 4009 4	4010 4011 4012 4013	
d 1BED2P		TELET .
4105		FFICE
1BED 2P		•
	9	
4103 1 BED 2P	1 BED 2P	4612
4112	4113	4
1 BED 2P 1 BED 2P		
A 4102 4111	2 BED 3P	
	4114	
1 BED 2P		FFICE
4110		ATTOC .
2 BED 3P		+
4101 1 BED 2P	1 BED 2P	
4109	4115	
		*
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 %
· · ·	3.4 %	
Apartment D 4104 Bedroom		
•		1%
Apartment D 4104 Living Room	1.5 %	1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom	1.5 % 3.4 %	1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room	1.5 % 3.4 % 1.5 %	1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom	1.5 % 3.4 % 1.5 % 3.4 %	1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Living Room Apartment D 4112 Bedroom	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Living Room Apartment D 4112 Living Room Apartment D 4112 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Living Room Apartment D 4112 Bedroom Apartment D 4112 Bedroom Apartment D 4112 Living Room Apartment D 4113 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Living Room Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Living Room Apartment D 4112 Bedroom Apartment D 4112 Bedroom Apartment D 4113 Living Room Apartment D 4113 Living Room Apartment D 4113 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Bedroom Apartment D 4106 Bedroom Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4109 Bedroom Apartment D 4109 Bedroom Apartment D 4110 Bedroom Apartment D 4112 Bedroom Apartment D 4112 Bedroom Apartment D 4113 Bedroom Apartment D 4113 Living Room Apartment D 4114 Living Room Apartment D 4114 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Bedroom Apartment D 4106 Bedroom Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Bedroom Apartment D 4109 Bedroom Apartment D 4109 Bedroom Apartment D 4112 Bedroom Apartment D 4112 Bedroom Apartment D 4113 Bedroom Apartment D 4113 Living Room Apartment D 4114 Living Room Apartment D 4114 Bedroom Apartment D 4114 Bedroom Apartment D 4114 Bedroom Apartment D 4114 Bedroom	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 %
Apartment D 4104 Living Room Apartment D 4105 Bedroom Apartment D 4105 Bedroom Apartment D 4106 Bedroom Apartment D 4106 Living Room Apartment D 4107 Bedroom Apartment D 4107 Living Room Apartment D 4109 Bedroom Apartment D 4109 Bedroom Apartment D 4112 Bedroom Apartment D 4112 Bedroom Apartment D 4113 Bedroom Apartment D 4113 Living Room Apartment D 4113 Living Room Apartment D 4114 Living Room Apartment D 4115 Living Room Apartment D 4115 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
Apartment D 4104 Living RoomApartment D 4105 BedroomApartment D 4105 Living RoomApartment D 4106 BedroomApartment D 4106 Living RoomApartment D 4107 BedroomApartment D 4107 BedroomApartment D 4107 Living RoomApartment D 4109 BedroomApartment D 4109 BedroomApartment D 4109 Living RoomApartment D 4112 BedroomApartment D 4112 BedroomApartment D 4113 BedroomApartment D 4113 BedroomApartment D 4114 Living RoomApartment D 4115 Living RoomApartment D 4115 BedroomApartment D 4115 Living RoomApartment D 4115 Living Room	1.5 % 3.4 % 1.5 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 2.3 %	1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1% 1.5 % 1%
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Block D Second Floor		
4266 4207 73.5 m² 73.5 m²	4208 46.5 m²	2000
4265 45 m' 4214 65 m' 4214 65 m' 107150	4319 4320 4321 4322 65.4 m ² 65.4 m ² 65.4 m ² 65.4 m ² 4215 65.1 m ² 220000	
4200 45m ² 45m ²		
4202 45m ² 45m		5271 106.9 m*
73 m ² 4210 45 m ²	61400	
Room	Average Daylight Factor (ADF)	Minimum ADF (BS 8206-2)
Apartment D 4201 Bedroom	2.4.0/	
•	3.4 %	1%
•	5.8 %	1 % 1.5 %
Apartment D 4201 Living Room		
Apartment D 4201 Living Room Apartment D 4202 Bedroom	5.8 %	1.5 %
Apartment D 4201 Living Room Apartment D 4202 Bedroom Apartment D 4202 Living Room	5.8 % 3.4 %	1.5 % 1 %
Apartment D 4201 Living Room Apartment D 4202 Bedroom Apartment D 4202 Living Room Apartment D 4206 Bedroom	5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 %
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Apartment D 4201 Living Room Apartment D 4202 Bedroom Apartment D 4202 Living Room Apartment D 4206 Bedroom Apartment D 4206 Living Room Apartment D 4207 Bedroom Apartment D 4207 Living Room	5.8 % 3.4 % 5.8 % 3.4 % 5.8 % 3.4 % 5.8 %	1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 % 1 % 1.5 %
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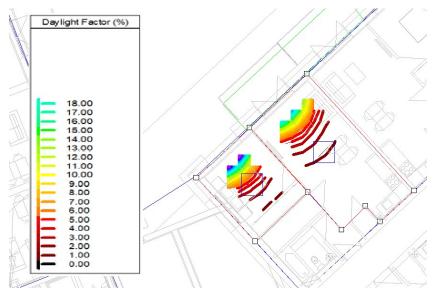


Fig 2a. IES Model view – Apartment 1110 (block A) plan indicating daylighting percentage on working plane level.



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

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

Room BL00002B (a.1139 living)

Room BL00004A (a.1116 living)

Surface	Quantitu		Values		Uniformity (Min./Ave.)	Diversity (Min./Max.)
Surface	Quantity	Min.	Ave.	Max.		
Working plane 1	Daylight factor	0.6 %	5.8 %	22.7 %	0.11	0.03
Reflectance=0% Transmittance=100%	Daylight illuminance	71.08 lux	638.54 lux	2523.28 lux	0.11	0.03
Grid size=0.50 m	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	Diversity
Surface	Quantity	Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight factor	0.3 %	1.9 %	8.7 %	0.16	0.03
Reflectance=0% Transmittance=100%	Daylight illuminance	35.24 lux	226.44 lux	1068.51 lux	0.16	0.03
Grid size=0.50 m Area=6.350m ² Margin=0.50 m	Sky view	1.00	1.00	1.00	1.00	1.00

Room BL0000B1 (block a 1140 living)

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

Room BL000010 (b.2003 bed)

Surface	Quantitu		Values		Uniformity (Min./Ave.)	Diversity (Min./Max.)
Surface	Quantity	Min.	Ave.	Max.		
Working plane 1	Daylight factor	0.1 %	1.5 %	10.7 %	0.07	0.01
Reflectance=0% Transmittance=100%	Daylight illuminance	12.53 lux	177.73 lux	1308.05 lux	0.07	0.01
Grid size=0.50 m Area=11.397m ² Margin=0.50 m	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.)
Surface	Quantity	Min.	Ave.	Max.		
Working plane 1	Daylight factor	0.1 %	2.6 %	16.6 %	0.04	0.01
Reflectance=0% Transmittance=100%	Daylight illuminance	12.70 lux	317.02 lux	2027.76 lux	0.04	0.01
Grid size=0.50 m Area=20.055m ² Margin=0.50 m	Sky view	1.00	1.00	1.00	1.00	1.00

Room BL00005D (block b 2011 living)

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

Room BL0000A9 (block d 4007 bed)

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



5. SHADOW ANALISYS & 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.



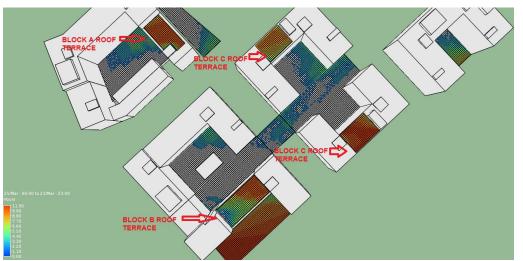


Fig.4a Sunlight hours contour map for the Block B1 and open space 1 (note fig 4c, 4d for additional detail view under the bridge)

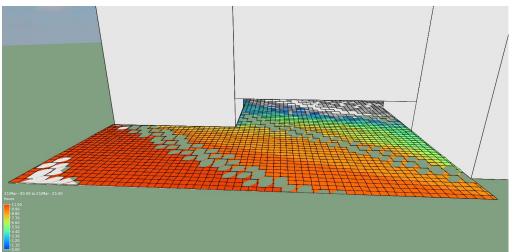


Fig.4b Sunlight hours contour map for the Block B Courtyard looking from the south

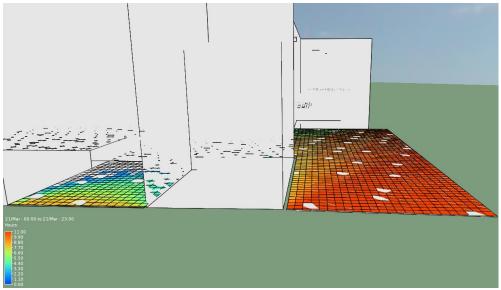


Fig.4c Sunlight hours contour map for the Block B Courtyard looking from the west

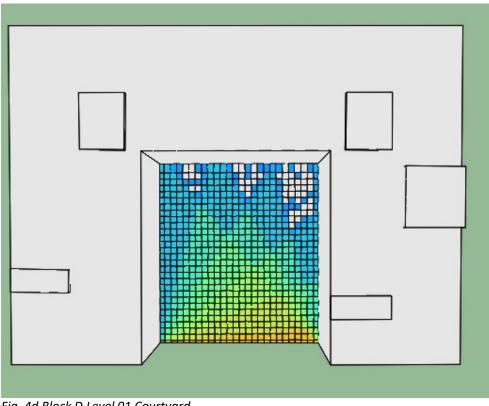


Fig. 4d Block D Level 01 Courtyard

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.

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.

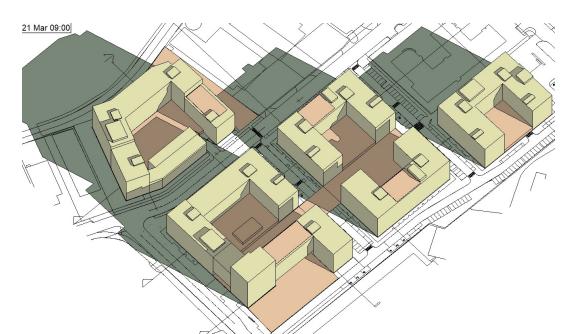


Fig 5. Shadows cast on the public spaces on the 21st of March at 9:00



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





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



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





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



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





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

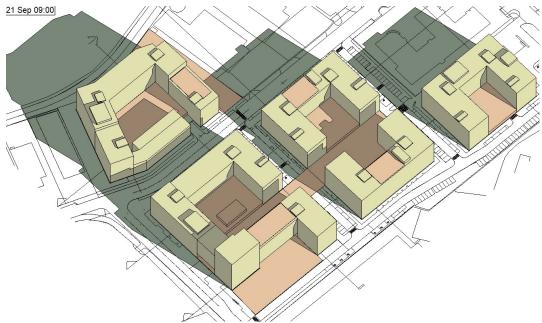


Fig 12. Shadows cast on the public spaces on the 21st of September at 09:00





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



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.