

Interior Daylight Analysis

Mansfield Heights



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Document information

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Interior Daylight Analysis

Mansfield Heights

Executive Summary

Overview

An analysis of the daylight conditions of the Mansfield Heights (Tower Building) development has been carried out. The proposal comprises a 2-storey roof extension of the central block to create 2 duplex residential units.

The daylighting analysis has been calculated and assessed according to the BRE guidance "Site layout planning for daylight and sunlight – A guide to good practice" (second edition 2011) as well as the revised third edition published in 2022.

The daylighting analysis as per 2nd edition (2011) shows that:

- 100% of the rooms meet the daylight recommendations.
- 100% of the rooms meet the ADF requirement.
- 100% of the rooms can receive direct light from the sky.
- 100% of the rooms meet the room depth criterion.

The daylighting analysis as per 3rd edition (2022) shows that:

- 100% of the rooms meet the median daylight factor recommendations for half of the assessment grids.
- 100% of the rooms have windows that can receive a total of at least 1.5 hours of sunlight on 21st March.

Please note that the BRE report is a guide for good practice and not an assessment of "Pass" and "Fail". Therefore, the failure to meet the recommended values do not indicate that the development is unsuitable.

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Introduction

An analysis of the daylight conditions of the Mansfield Heights (Tower Building) development has been carried out. The proposal comprises a 2-storey roof extension of the central block to create 2 duplex residential units.

The daylighting analysis has been calculated and assessed according to the BRE guidance "Site layout planning for daylight and sunlight – A guide to good practice" (second edition 2011 as well as third edition 2022). The calculations are based on plans of the proposed development provided by Mutiny Architecture, issued in September 2022.

Interior Daylight Analysis

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BRE Guidelines (2011)

Average Daylight Factor (ADF)

ADF is the average illuminance on the working plane in a room, divided by the illuminance on an unobstructed horizontal surface outdoors. For dwellings the following ADF are recommended:

- Kitchen 2%
- Living room 1.5%
- Bedroom 1%

The ADF is calculated by the following formula:

$$ADF = \frac{TMA_w \theta}{A(1-R^2)}$$

Where:

- T, is the diffuse visible transmittance of the glazing
- M, is a maintenance factor, allowing for the effects of dirt
- Aw, is the net glazed area of the window (m2)
- A, is the total area of the room surfaces: ceiling, floor, walls and windows (m2)
- R, is their average reflectance
- θ, is the angle of visible sky in degrees.

Position of No-Sky Line (NSL)

More than 80% of the working plane is recommended to receive direct light from the sky.

Room depth

The room depth recommendation applies to rooms lit by windows on one wall only. In this case the depth of the room L should not exceed the limiting value given by:

$$\frac{L}{W} + \frac{L}{H} < \frac{2}{1-R_b}$$

Where:

- W, is the room width
- H, is the window head height above floor level
- Rb, is the average reflectance of surfaces in the rear half of the room (away from the window).

BRE Guidelines (2022)

Daylight Factor (DT)

The daylight factor is the illuminance at a point on the reference plane in a space, divided by the illuminance on an unobstructed horizontal surface outdoors. The CIE standard overcast sky is used, and the ratio is usually expressed as a percentage.

Table C3 of the guidance shows the daylight factor targets to be achieved over at least 50% of the assessment grid in domestic habitable rooms with vertical and/or inclined daylight apertures.

For London, recommendations are as follows

Location	DT for 100 lx Bedroom	DT for 150 lx Living Room	DT for 200 lx Kitchen
London (Gatwick Airport)	0.7%	1.1%	1.4%

Sunlight

A dwelling, or habitable space that has a particular requirement for sunlight, will appear reasonably sunlit provided:

- at least one main window wall faces within 90° of due south and
- a habitable room, preferably a main living room, can receive a total of at least 1.5 hours of sunlight on 21 March. This is assessed at the inside centre of the window(s); sunlight received by different windows can be added provided they occur at different times and sunlight hours are not double counted.

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Methodology

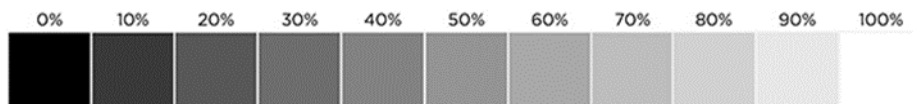
Basis for calculations

The daylight conditions of the residential units have been calculated using a daylight simulation software as opposed to the standard formula due to the complex nature of the room layouts. The simulation software will provide more accurate results when compared to the simple standard formula method, as it takes into account further parameters such as the room layout (shape) and ambient bounces.

The following values have been used for the daylight calculations:

- Area weighted reflectance of the room surface (ceiling, floor walls and windows) of 0.5*
- Correction factor for dirt of 1, which corresponds to vertical glazing that can be cleaned easily
- Glass transmission factor of 0.65 (double glazing with low emissivity coating)
- Working Plane of 0.85m above the floor

*0.5 surface reflectance refers to a grey colour (see image below). Painting the wall and ceiling surface white can achieve an average reflectance of more than 0.5.



Assessed areas

The scheme consists of 2 residential units in total. As recommended by the BRE, the daylight conditions of the kitchen cum living room, lounge, sitting spaces and bedrooms will be analysed for both units.

Assessed criteria

As described in the previous section, assessment factors demonstrating compliance with both second (2011) and third (2022) editions of the BR209 document will be demonstrated. Therefore, the following criteria have been assessed:

- Average Daylight Factor (ADF)
- No-sky line (NSL)
- Room Depth
- Daylight Factor (DT)
- Sunlight

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Results

Interior daylight results

The ADF, NSL and room depth results are shown in Appendix B1.

The Daylight Factor (DT) and sunlight results are shown in Appendix B2

Illustrations of the daylight factor and NSL are presented in Appendix A.

All rooms meet the BRE recommendations for both second and third editions.

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Conclusions

The daylighting analysis as per 2nd edition (2011) shows that:

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- 100% of the rooms meet the ADF requirement.
- 100% of the rooms can receive direct light from the sky.
- 100% of the rooms meet the room depth criterion.

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Please note that the BRE report is a guide for good practice and not an assessment of “Pass” and “Fail”. Therefore, the failure to meet the recommended values do not indicate that the development is unsuitable.

Interior Daylight Analysis

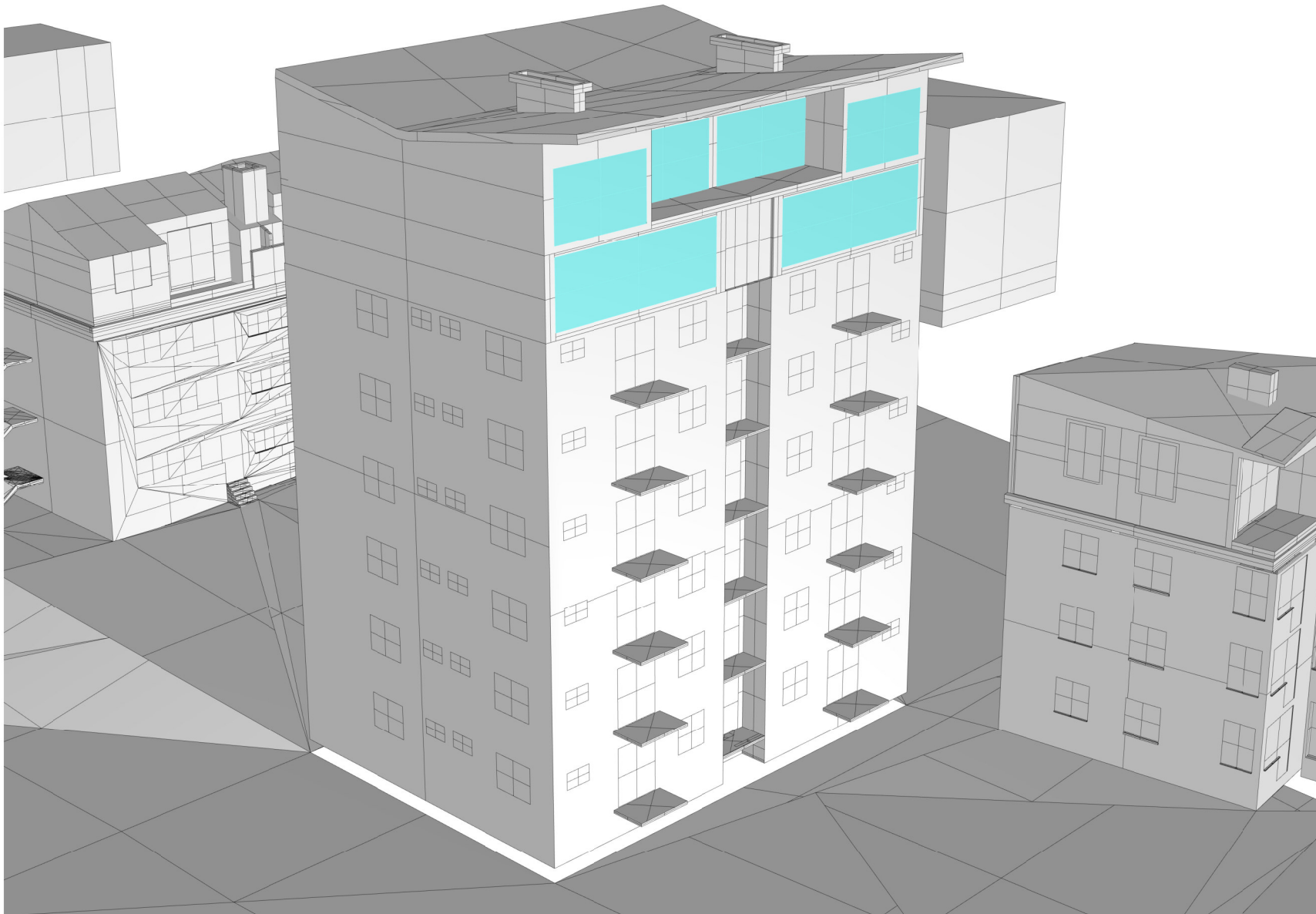
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Appendix A

Appendix A - Illustrations



Project Name:

Mansfield Heights

Drawing Name

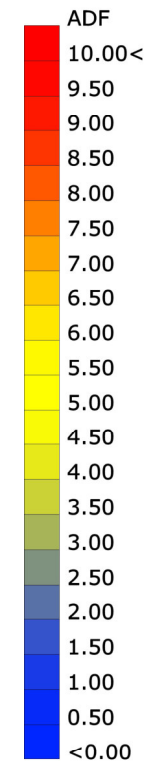
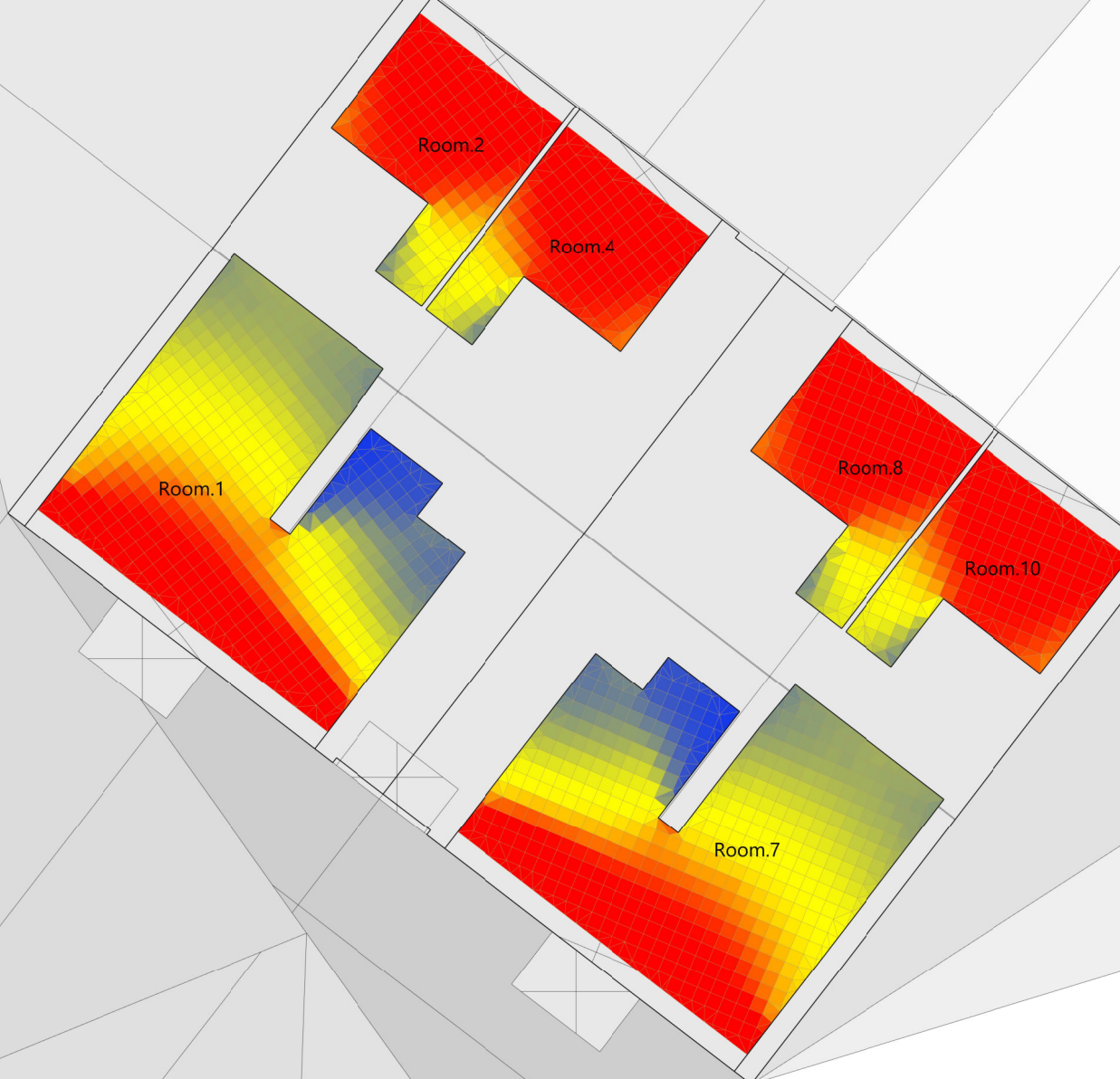
Proposed development

Date:

30/09/2022

Drawing Number:

5193_A_01



Project Name:

Mansfield Heights

Drawing Name

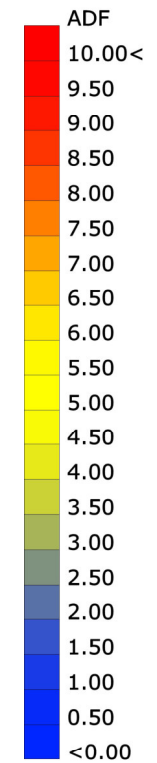
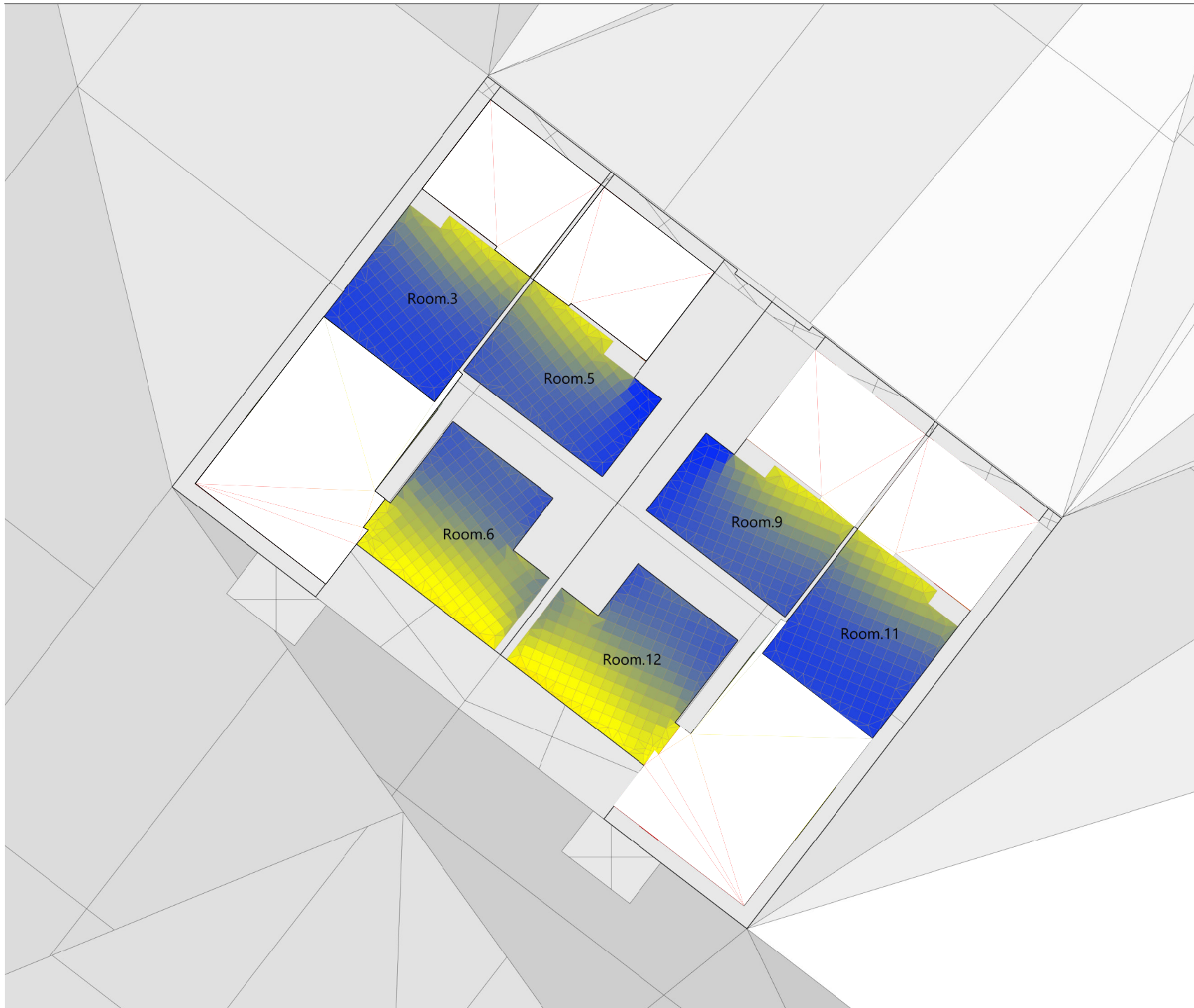
ADF - 6th Floor

Date:

30/09/2022

Drawing Number:

5193_B_01



Project Name:

Mansfield Heights

Drawing Name

ADF - 7th Floor

Date:

30/09/2022

Drawing Number:

5193_B_02



- Area with sky view
- Area without sky view

Project Name:

Mansfield Heights

Drawing Name

NSL - 6th Floor

Date:

30/09/2022

Drawing Number:

5193_C_01



- Area with sky view
- Area without sky view

Project Name:

Mansfield Heights

Drawing Name

NSL - 7th Floor

Date:

30/09/2022

Drawing Number:

5193_C_02

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Appendix B1

Appendix B- Results (as per second edition 2011)

Interior Daylight (BR209-2011 Edition)

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Property			Average Daylight Factor		No-sky Line		Room depth criterion	
Flat	Room Function	No.	Calculated ADF (%)	Compliance	NSL (%)	Compliance	Room depth - Maximum room depth	Compliance
Flat 1	Kitchen/Living	Room 1	6.32	Pass	100.00	Pass	5.8<6.9	Pass
	Bedroom 1 Sitting	Room 2	10.12	Pass	100.00	Pass	4.2<5.2	Pass
	Bedroom 1	Room 3	1.86	Pass	100.00	Pass	3.7<5.2	Pass
	Bedroom 2 Sitting	Room 4	10.14	Pass	100.00	Pass	4.2<5.2	Pass
	Bedroom 2	Room 5	2.05	Pass	92.70	Pass	4.1<4.8	Pass
	Lounge	Room 6	3.01	Pass	100.00	Pass	3.2<5.9	Pass
Flat 2	Kitchen/Living	Room 7	6.36	Pass	100.00	Pass	5.8<6.9	Pass
	Bedroom 1 Sitting	Room 8	10.14	Pass	100.00	Pass	4.2<5.2	Pass
	Bedroom 1	Room 9	2.06	Pass	92.70	Pass	4.1<4.8	Pass
	Bedroom 2 Sitting	Room 10	10.12	Pass	100.00	Pass	4.2<5.2	Pass
	Bedroom 2	Room 11	1.87	Pass	100.00	Pass	3.7<5.2	Pass
	Lounge	Room 12	3.05	Pass	100.00	Pass	3.2<5.9	Pass
			Total No of rooms	12	Total No of rooms	12	Total No of rooms	12
			Pass	12	Pass	12	Pass	12
				100.0%		100.0%		100.0%
			Fail	0	Fail	0	Fail	0
				0.0%		0.0%		0.0%

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Appendix B2

Appendix B- Results (as per third edition 2022)

Interior Daylight (BR209-2022 Edition)

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Property			Daylight Factor (DT)			Sunlight Hours			
Flat	Room Function	No.	Target Daylight Factors (%)	Median Daylight Factors (%)	Compliance	No.	Required Sunlight (No of hrs)	Calculated Sunlight (No of hrs)	Compliance
Flat 1	Kitchen/Living	Room 1	1.4	4.73	Pass	Windows 1 & 2	1.50	9.00	Pass
	Bedroom 1 Sitting	Room 2	1.1	9.31	Pass	Window 3	1.50	3.00	Pass
	Bedroom 1	Room 3	0.7	1.58	Pass	Window 4	1.50	3.00	Pass
	Bedroom 2 Sitting	Room 4	1.1	9.3	Pass	Window 5	1.50	3.00	Pass
	Bedroom 2	Room 5	0.7	1.79	Pass	Window 6	1.50	3.00	Pass
	Lounge	Room 6	1.1	2.82	Pass	Window 7	1.50	4.00	Pass
Flat 2	Kitchen/Living	Room 7	1.4	4.75	Pass	Windows 8 & 9	1.50	9.00	Pass
	Bedroom 1 Sitting	Room 8	1.1	9.27	Pass	Window 10	1.50	3.00	Pass
	Bedroom 1	Room 9	0.7	1.8	Pass	Window 11	1.50	3.00	Pass
	Bedroom 2 Sitting	Room 10	1.1	9.31	Pass	Window 12	1.50	3.00	Pass
	Bedroom 2	Room 11	0.7	1.6	Pass	Window 13	1.50	3.00	Pass
	Lounge	Room 12	1.1	2.84	Pass	Window 14	1.50	4.00	Pass
			Total No of rooms		12			Total No of rooms	12
			Pass		12			Pass	12
					100.0%				100.0%
			Fail		0			Fail	0
					0.0%				0.0%