

37-39 Conway Street, London W1T

AVERAGE DAYLIGHT FACTOR (ADF) ASSESSMENT

Proposed conversion of mezzanine to create 4no. residential units

June 2021

37-39 Conway Street, London W1T

Average Daylight Factor (ADF) Assessment

Document Issue Register

- 1.0 Planning Issue
- 2.0 Revised layout

Contents

- 1 Introduction
- 2 Executive Summary
- 3 Methodology
- 4 ADF Calculation Theory
- 5 ADF Calculation Summary
- 6 Appendix 1: ADF Calculation Results

1 Introduction

- 1.1 This report details an Average Daylight Factor (ADF) Calculation for the proposed conversion at 37-39 Conway Street, London W1T. The existing property comprises an office building with part mezzanine between ground and 1st floor.
- 1.2 The proposed conversion incorporates the existing mezzanine of the building, with void infill to create new floor space at this level. The proposed conversion will create 4no. new residential apartments.
- 1.3 The purpose of this report is to perform an Average Daylight Factor (ADF) Calculation for all the habitable spaces within the proposed new residential units, and to compare with guidance provided by the BRE (BR209: Site Layout Planning for Daylight and Sunlight 2011) along with BS 8206-2 'Code of practice for Daylighting' and CIBSE Guide LG10 – Daylighting and Window Design.



Figure 1: 37-39 Conway Street, London (image: Google Earth)

2 Executive Summary

- 2.1 The Average Daylight Factor (ADF) is a measure of the percentage of horizontal diffuse illumination outdoors (daylight) received within an internal environment. BS 8206-2 'Code of practice for Daylighting' recommends a minimum ADF of 1% for bedrooms, 1.5% for living rooms and 2% for kitchens.
- 2.2 The results of this investigation indicate that all of the habitable zones meet the recommended minimum ADF levels. The flat layouts have prioritised spaces which require more daylight (living rooms and kitchens), thereby following the BRE guidance.
- 2.3 The following assumptions have been made with regards to internal surfaces:

Internal Element:	Reflectance	Transmittance
Wall / Ceiling (white)	0.85	N/A
Window	0.07	0.65
Floor	0.40	N/A

2.4 A summary of the ADF calculation results is shown below:

Room	ADF (%)	Min. ADF (%)
1a B1	4.7 %	1.0 %
1a B2	5.0 %	1.0 %
1a LKD	2.5 %	1.5 %
1b B1	5.7 %	1.0 %
1b B2	3.4 %	1.0 %
1b LKD	1.8 %	1.5 %
1c B1	2.7 %	1.0 %
1c B2	1.0 %	1.0 %
1c LKD	1.5 %	1.5 %
1d B1	2.4 %	1.0 %
1d B2	3.1 %	1.0 %
1d B3	1.0 %	1.0 %
1d LD	2.3 %	1.5 %

3 Methodology

- 3.1 The Average Daylight Factor (ADF) is largely dependent on the geometry of the room and the window sizes, thus the drawings of the proposed development have been analysed and modelled based on the internal surface areas of walls, floor, ceiling and windows.
- 3.2 Additional variables include:
 - Diffuse transmittance of the glass, including dirt factor & frame factor
 - Angle subtended by sky visible from the centre of the window
 - Total area of internal surfaces
 - Area weighted average reflectance of internal surfaces
- 3.3 The assessment has been carried out to assess the daylight levels within the proposed extension, using the Average Daylight Factor (ADF) methodology. Analysis has been performed using the FlucsDL software package within the IES Virtual Environment.
- 3.4 The guidance stated within the BRE document 'Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice' has been followed.

4 ADF Calculation Theory

4.1 A simplified formula for determining the Average Daylight Factor (ADF) is:

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

4.2 The angle (θ) is the angle subtended, in the vertical plane normal to the window, by sky visible from the centre of the window.

- 4.3 In order to determine whether the daylight levels in a new building will be acceptable, BS 8206-2 'Code of practice for Daylighting' gives the following minimum ADF values:
 - 2% for kitchens;
 - 1.5% for living rooms; and
 - 1% for bedrooms.
- 4.4 The FlucsDL software package within the IES Virtual Environment implements a more detailed point-by-point methodology, which generates an average daylight factor for each zone along with a graphical representation of the daylight factor distribution.



Figure 2: 37-39 Conway Street, London – 3D IES model

5 ADF Calculation Summary

- 5.1 The proposed development includes 4no. residential properties, comprising 3no. 2bedroom apartments and 1no. 3-bedroom apartment. The apartments feature open plan living/kitchen/dining areas.
- 5.2 The following assumptions have been made with regards to internal surfaces:

Internal Element:	Reflectance	Transmittance
Wall / Ceiling (white)	0.85	N/A
External Window	0.07	0.65
Floor	0.40	N/A

- 5.3 The results of the ADF analysis indicate that all of the assessed zones meet the minimum recommended ADF levels for kitchens (2.0%); living rooms (1.5%); and bedrooms (1.0%); these zones are thus considered to be adequately daylit.
- 5.4 The flat layouts optimise daylight levels to the living room and kitchen areas which the BRE guidance considers more important:

2.1.13 Living rooms and kitchens need more daylight than bedrooms, so where there is a choice it is best to site the living room or kitchen away from obstructions.

5.5 The following image (overleaf) depicts a visual representation of the daylight factor achieved throughout the assessed zones (images generated through the FlucsDL package within the IES-Virtual Environment). Full results are presented in Appendix 1: ADF Calculation Results.

37-39 Conway Street, London W1T

Average Daylight Factor (ADF) Assessment



Figure 3: Mezzanine – Average Daylight Factor Levels

Appendix 1: ADF Calculation Results

Analysis calculation summary:

Room ID	Room name	Calculation succeeded
RM00002D	1a B1	ОК
RM00002E	1a B2	ОК
RM00002C	1a LKD	ОК
RM00002A	1b B1	ОК
RM000029	1b B2	ОК
RM00002F	1b LKD	ОК
RM000027	1c B1	ОК
1C000001	1c B2	ОК
1C000002	1c LKD	ОК
RM000032	1d B1	ОК
RM000036	1d B2	ОК
1D000001	1d B3	ОК
RM000037	1d LD	ОК

Construction/Material	External area	External	Internal	Internal
ID	(m²)	reflectance (%)	area (m²)	reflectance (%)
STD_CEIL	732.08	85	236.88	40
STD_FL01	14707.89	0	0.00	0
STD_PART	15751.63	85	456.25	85
STD_ROOF	14707.89	10	236.88	85
STD_WAL1	84734.84	10	103.87	85

Room RM00002D (1a B1)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Valu				Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	05%	47%	198%	0.10	0.02
Reflectance=0%	factor	0.0 /0	 1 /0	10.0 /0	0.10	0.02
Transmittance=100%	Daylight	55.73	569.49	2419.83	0.10	0.02
Grid size=0.50 m	illuminance	lux	lux	lux	0.10	0.02
Area=11.316m ² Margin=0.00 m	Sky view	0.00	0.96	1.00	0.00	0.00

Room RM00002E (1a B2)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
Sunace	Quantity	Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.6 %	5.0 %	19.7 %	0.12	0.03
Reflectance=0%	factor					
Transmittance=100%	Daylight	70.65	607.00	2401.38	0.12	0.03
Grid size= 0.50 m	illuminance	lux	lux	lux		
Margin=0.00 m	Sky view	0.00	0.98	1.00	0.00	0.00

Room RM00002C (1a LKD)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Valu				Uniformity	Diversity
	N	Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	04%	25%	195%	0.15	0.02
Reflectance=0%	factor	0.4 /0	2.0 /0	10.0 %	0.10	0.02
Transmittance=100%	Daylight	45.32	308.39	2377.63	0.15	0.02
Grid size=0.50 m	illuminance	lux	lux	lux	0.15	0.02
Area=24.734m ² Margin=0.00 m	Sky view	0.00	0.52	1.00	0.00	0.00

Room RM00002A (1b B1)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
	Quantity	Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.9 %	5.7 %	19.8 %	0.15	0.04
Reflectance=0%	factor					
Grid size=0.50 m	Daylight	107.84	696.66	2413.62	0.15	0.04
Area=15.836m ²	illuminance	lux	lux	lux		
Margin=0.00 m	Sky view	1.00	1.00	1.00	1.00	1.00

Room RM000029 (1b B2)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Value				Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	03%	34%	176%	0.08	0.01
Reflectance=0%	factor	0.0 /0	0.170	11.0 %	0.00	0.01
Transmittance=100%	Daylight	31.78	421.14	2145.16	0.08	0.01
Grid size=0.50 m	illuminance	lux	lux	lux	0.00	0.01
Area=10.010m ² Margin=0.00 m	Sky view	0.00	0.85	1.00	0.00	0.00

Room RM00002F (1b LKD)

Analysis calculation for room -

Surface	Quantity Min.		6		Uniformity	Diversity
Cunace			Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	00%	18%	172%	0.00	0.00
Reflectance=0%	factor	0.0 /0	1.0 //	11.2 /0	0.00	0.00
Transmittance=100%	Daylight	0.00	218.75	2102.87	0.00	0.00
Grid size=0.50 m	illuminance	lux	lux	lux	0.00	0.00
Area=31.027m ² Margin=0.00 m	Sky view	0.00	0.33	1.00	0.00	0.00

Room RM000027 (1c B1)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Quantity	Values			Uniformity	Diversity
Sundoe	Quantity	Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	03%	27%	172%	0.11	0.02
Reflectance=0%	factor	0.0 /0	2.1 /0	11.2 /0	0.11	0.02
Transmittance=100%	Daylight	38.35	335.17	2095.27	0.11	0.02
Grid size=0.50 m	illuminance	lux	lux	lux	0.11	0.02
Area=17.273m ² Margin=0.00 m	Sky view	0.00	0.63	1.00	0.00	0.00

Room 1C000001 (1c B2)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.3 %	1.0 %	2.0 %	0.33	0.17
Reflectance=0%	factor					
Transmittance=100%	Daylight	41.13	124.07	244.06	0.33	0.17
Grid size=0.50 m	illuminance	lux	lux	lux		
Area= 11.515m² Margin=0.00 m	Sky view	0.00	0.06	1.00	0.00	0.00

Room 1C000002 (1c LKD)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.2 %	1.5 %	17.5 %	0.13	0.01
Reflectance=0%	factor					
Transmittance=100%	Daylight	23.54	177.35	2132.43	0.13	0.01
Grid size=0.50 m	illuminance	lux	lux	lux		
Area= 36.277m ² Margin=0.00 m	Sky view	0.00	0.26	1.00	0.00	0.00

Room RM000032 (1d B1)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.4 %	2.4 %	15.0 %	0.15	0.02
Reflectance=0%	factor					
Transmittance=100%	Daylight	43.64	294.83	1827.17	0.15	0.02
$\Delta rea = 15.608 m^2$	illuminance	lux	lux	lux		
Margin=0.00 m	Sky view	0.00	0.54	1.00	0.00	0.00

Room RM000036 (1d B2)

Analysis calculation for room -

Summary results for working planes and floor

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	05%	31%	137%	0.16	0.04
Reflectance=0%	factor	0.0 /0	0.1 /0	10.7 /0	0.10	0.04
Transmittance=100%	Daylight	58.58	376.12	1670.44	0.16	0.04
Grid size=0.50 m	illuminance	lux	lux	lux	0.10	0.04
Area=10.041m ² Margin=0.00 m	Sky view	0.00	0.98	1.00	0.00	0.00

Room 1D000001 (1d B3)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	0.5 %	1.0 %	1.8 %	0.50	0.26
Reflectance=0%	factor					
Transmittance=100%	Daylight	58.00	116.98	220.28	0.50	0.26
Grid size=0.50 m	illuminance	lux	lux	lux		
Area= 11.420m² Margin=0.00 m	Sky view	0.00	0.07	1.00	0.00	0.00

Room RM000037 (1d LD)

Analysis calculation for room -

Surface	Quantity	Values			Uniformity	Diversity
		Min.	Ave.	Max.	(Min./Ave.)	(Min./Max.)
Working plane 1	Daylight	03%	23%	16.2 %	0.11	0.02
Reflectance=0%	factor	0.0 /0	2.0 /0	10.2 /0	0.11	0.02
Transmittance=100%	Daylight	32.12	281.27	1978.70	0.11	0.02
Grid size=0.50 m	illuminance	lux	lux	lux	0.11	0.02
Area=24.986m² Margin=0.00 m	Sky view	0.00	0.85	1.00	0.00	0.00