

7TH WAVE ACOUSTICS

32-34 Marine Parade, Bath Place, Worthing
Noise Assessment

Planning Conditions 12, 14 & 15

Final Report

23 January 2026

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32-34 Marine Parade, Bath Place, Worthing

Noise Assessment : Planning Conditions 12, 14 & 15

Connaught House (Marine Parade) Limited

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CONTENTS

1 INTRODUCTION 4

2 SITE AND DEVELOPMENT DESCRIPTION 5

3 LOCAL AUTHORITY REQUIREMENTS 6

4 NOISE UNITS, METHODOLOGY & ASSESSMENT CRITERIA 7

5 NOISE ASSESSMENT 9

6 SUMMARY AND CONCLUSIONS 17

7 REFERENCES..... 18

1 Introduction

7th Wave Acoustics has been commissioned by Connaught House (Marine Parade) Limited to prepare an acoustic report to assist with the discharge of the noise related planning conditions attached to planning decision notice AWDM/1174/23[1] for the proposed development located at 32 - 34 Marine Parade, Worthing, West Sussex. These conditions are presented in full in Chapter 3.

2 Site and Development Description

2.1 Site Description and Development

32-34 Marine Parade is a part three, part four storey vacant mixed-use building located on Worthing seafront, opposite Worthing Pier.

The site comprises two grand Victorian buildings which are linked internally at the first and second floors.

The surrounding area is a mix of town centre uses, such as shops, restaurants, offices and leisure venues. There are also residential dwellings, particularly on the upper floors of the surrounding buildings.

A location plan is presented in Figure A1.

2.2 Consented Development

The scheme consists of *'Part change of use of ground floor from restaurant and amusement arcade to restaurant and use class e (commercial/business) space with new shopfronts to Bath Place and Marine Parade; change of use of upper floors from vacant pool / snooker hall; associated extensions and alterations at ground, first, second and third floor rear and at fourth floor and roof level to create 21 no residential dwellings.'*

Floor plans and elevations of the proposed development are presented in Figures A2 to A7 of Appendix A.

2.3 Subjective Observations

Subjective observations undertaken on site indicate that the main sources of noise affecting the site are road traffic on Marine Parade and the occasional operation of fixed plant associated with surrounding commercial premises to the north of the site.

3 Local Authority Requirements

As part of the planning permission, a number of noise related conditions were attached to the consent, which includes the following:

12. Work to implement the development shall not commence unless and until a scheme for protecting the proposed noise sensitive development from external noise has been submitted to and approved by the local planning authority. All works, which form part of the scheme, shall be completed before any part of the noise sensitive development is occupied. The scheme shall have regard to the principles contained within the World Health Organisation community noise guidelines and achieve the indoor ambient noise levels for dwellings specified in BS8233:2014. The scheme should include full details of glazing and a strategy to prevent overheating. The noise level of any ventilation units when in use should not exceed the levels specified in BS8233:2014 and all duct work should be fitted on anti-vibration mounts. Following approval and completion of the scheme, a test shall be undertaken to demonstrate that the attenuation measures proposed in the scheme are effective and protect the residential units from noise.

Reason: *In the interests of residential amenity and to comply with policy DM5 of the Worthing Local Plan.*

14. The sound insulation of the floor/ceiling between the ground and first floor shall achieve a minimum airborne sound insulation value of 50dB (DnTw + Ctr dB). Before any residential unit is occupied a test shall be undertaken to demonstrate compliance with this level.

Reason: *In the interests of residential amenity and to comply with policy DM5 of the Worthing Local Plan.*

15. No works to implement the development shall take place unless and until an acoustic assessment of the impact of noise from the basement commercial unit (No33-34) upon the residential units above has been undertaken and submitted to the local planning authority. The impact assessment shall include details of any mitigation necessary for protecting the residential units having regard to the principles contained within the World Health Organisation community noise guidelines and ensure the standards within Table 4 of BS8233:2014 are achieved in the residential units. All works which form part of the scheme shall be completed in accordance with the approved details before any parts of the residential units are occupied.

Reason: *In the interests of residential amenity and to comply with policy DM5 of the Worthing Local Plan.*

This report has been produced to specifically address the assessment requirements of Conditions 12, 14 and 15.

The results of the validation test, as requested in Condition 12 shall be presented in a separate report, following completion of the development.

4 Noise Units, Methodology & Assessment Criteria

4.1 Noise Units

There is a million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is, therefore, weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that a change in noise level of 1 dB is not perceptible by the normal ear under normal conditions, a 3 dB change is just perceptible, whilst a change of 10 dB is perceived as a doubling or halving of the noise level.

An indication of the range of noise levels commonly found in the environment is given below in Table 4.1.

Table 4.1: Typical Noise Levels

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night
40	Residential area at night
60	Conversation
80	Inside general factory premises
100	Near to pneumatic hammer
120	Near to speaker at rock concert
140	Threshold of pain

A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

- $L_{A90,T}$ This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.
- $L_{Aeq,T}$ This is the equivalent continuous A-weighted sound pressure level and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period, T. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.

$L_{Amax,F}$ This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

4.2 British Standard 8233:2014

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings[2] gives recommendations for the control of noise in and around buildings. The Standard suggests appropriate criteria and limits for different situations to guide the design of new or refurbished buildings undergoing a change of use.

Desirable upper noise levels inside residential habitable rooms are specified in the Standard and are reproduced below in Table 4.2.

Table 4.2: BS8233 Desirable Indoor Ambient Noise Levels For Dwellings

Activity	Room	Ambient Indoor Noise Level 07:00 to 23:00 hrs, dB $L_{Aeq,16\text{ hr}}$	Ambient Indoor Noise Level 23:00 to 07:00 hrs, dB $L_{Aeq,8\text{ hr}}$
Resting	Living Room	35	-
Dining	Dining room/ area	40	-
Sleeping (daytime resting)	Bedroom	35	30

4.3 World Health Organisation

The WHO 'Guidelines for Community Noise' [3] document. The guideline values are presented in Table 4.3.

Table 4.3: WHO Guideline Noise Values

Specific Environment	Critical Health Effect(s)	dB $L_{Aeq,T}$	Time Base hours	dB $L_{Amax,F}$
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

Note 1: For a good sleep, the WHO states that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night.

5 Noise Assessment

5.1 Overview

The noise assessments for Conditions 12, 14 and 15 are addressed under the following sub-headings:

- External Noise Attenuation – Condition 12;
- Sound Insulation Between Ground and First Floor Space – Condition 14; and
- Internal Noise Transfer – Basement to Residential – Condition 15.

5.2 External Noise Attenuation - Condition 12

Condition 12 requires several acoustic elements to be considered:

- Sound reduction performance of the proposed glazing;
- Sound reduction performance of the passive and ventilation system; and
- Internal noise from any mechanical ventilation system.

5.2.1 Internal Noise Levels - Proposed Glazing & Ventilations Systems

The detailed calculation method described in Annex G of BS 8233:2014 has been used to predict noise levels inside a selection of worst-case habitable rooms i.e. the rooms with the smallest room area and/or the areas with the largest areas of glazing.

The acoustic algorithm used to calculate the façade sound reduction and the internal noise levels is reproduced below.

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$$

Where:

$L_{eq,ff}$	is the equivalent, free-field, continuous sound pressure level outside the room elements under consideration;
A_0	is a reference absorption area of 10 m ² and is independent of frequency;
$D_{n,e}$	is the insulation of the trickle ventilator measured according to BS EN ISO 10140;
S_{wi}	is the area in square metres (m ²) of the windows of the room;
R_{wi}	is the sound reduction index (octave band value) of the window;
S_{ew}	is the area in square metres (m ²) of the external wall of the room;
R_{ew}	is the sound reduction index (octave band value) of the external wall;
S_{rr}	is the area in square metres (m ²) of the ceiling of the room;
R_{rr}	is the sound reduction index (octave band values) of the roof/ceiling;
S_f	is the total façade area in square metres (m ²) of the room in question;
S	is the total area in square metres (m ²) of elements through which sound enters the room, i.e. $S_f + S_{rr}$;
A	is the equivalent absorption area of the receiving room being considered; and
+3	is a correction factor

Details of the façade elements used in the calculations are provided in the subsections below.

5.2.2 Glazing Specification

The selected glazing for the development is provided by Pilkington and is displayed in Figure A8 of Appendix A. The sound reduction for the selected glazing systems is presented below in Table 5.1.

Table 5.1: Glazing Specification

Building Element	Façade	Source	Glass Type	R _w	1/1-Octave Band Frequency, Sound Reduction Index, dB					
					125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Glazing	South	Pilkington	6mm-16mm-8.8 Optiphon	41	26	26	37	45	51	54
	North & West	Pilkington	4mm-16mm-6.8 Optiphon	36	23	23	32	41	47	48

5.2.3 Background Ventilation

The majority of the site will be ventilated using passive acoustic trickle ventilators. However, to protect from external plant noise associated with commercial premises, areas that overlook operating commercial plant will be ventilated using mechanical ventilation with Heat Recovery (MVHR). The proposed locations of the mechanical ventilation with heat recovery (MVHR) systems are shown in Figures A10 to A13 of Appendix A.

The selected acoustic trickle vents are provided by Titon Vents and summarised below in Table 5.2 and in Figure A9 of Appendix A.

Table 5.2: Specification of Acoustic Trickle Ventilators – Titon Vents

Building Element	Façade	Source	Vent Type	1/1-Octave Band Frequency, Sound Reduction Index, dB					
				125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Passive Vents	South	Titon	SFXSA V75/C50	40	37	34	43	50	53
	North & West	Titon	Standard C25	36	38	36	32	37	39

Where MVHR units are proposed, this will alleviate the requirement for passive vents, which removes an additional pathway for noise to enter the building. As such, only the locations where passive vents are proposed has been considered in the detailed noise calculations.

5.2.4 Wall Construction

The assumed SRI of the wall construction are presented in Table 5.3.

Table 5.3: Sound Reduction of Wall Construction

Building Element	Source	1/1-Octave Band Frequency, Sound Reduction Index, dB					
		125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Wall	Woods	34	34	40	56	73	76

5.2.5 Adopted Noise Spectra

A computer model was developed at planning stage to predict the external noise at the development facades, with the results presented in 7WA's previous report (reference: 1186.001R.2.OJP).

The L_{eq} and $L_{max,F}$ noise spectra summarised below in Table 5.4 are the logarithmic averages of the octave band noise levels measured during the unattended monitoring at the site in February 2025.

The spectra have been adopted for the road traffic noise source for the daytime and night-time periods and are adjusted according to the final receptor levels calculated in the noise prediction model at each location.

Table 5.4: Derived L_{eq} and L_{max} Noise Spectra

Parameter	Derived 1/1-Octave Band Frequency, dB					
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
$L_{eq,16hr}$	60	58	56	57	54	48
$L_{eq,8hr}$	57	57	54	54	52	45
$L_{max,F}$	66	63	59	60	60	54

The detailed calculation method described in Annex G of BS 8233:2014 has been used to predict noise levels inside a selection of worst-case habitable rooms i.e. the rooms with the smallest room area and/or the areas with the largest areas of glazing.

5.2.6 Assessment

Planning Condition 12 specifies that indoor ambient noise levels shall comply with the requirements specified in BS8233 and WHO Community Noise guidance.

The guideline internal noise level presented in BS8233:2014 for the daytime and night-time periods are 35 dB $L_{Aeq,16hr}$ and 30 dB $L_{Aeq,8hr}$. The calculated internal daytime and night-time noise levels have been assessed against the BS8233:2014 guideline noise levels. The results are set out in Tables 5.5 and 5.6 below.

The WHO Guidelines for Community Noise publication specifies an $L_{Amax,F}$ threshold level of 45 dB. The calculated internal night-time $L_{Amax,F}$ noise levels, along with an assessment against the 45 dB threshold level (more than 10-15 times per night) is also presented below in Table 5.7.

Table 5.5: Assessment of Internal Daytime $L_{Aeq,16hr}$ Noise Levels

Period	Façade	Floor	Plot No.	Room	Free-Field External Noise Level, dB $L_{Aeq,T}$	Calculated Internal Noise Level, dB $L_{Aeq,T}$	Room Activity	Noise Limit, dB $L_{Aeq,T}$	Noise Limit Achieved
Daytime (07:00 to 23:00 hrs)	South	First	3	Bedroom 2	70	34	Daytime Resting	35	Yes
	North	First	1	Bedroom 1	62	30			Yes
	West	Third	18	Bedroom 1	59	29			Yes

Table 5.6: Assessment of Internal Night-time $L_{Aeq,8hr}$ Noise Levels

Period	Façade	Floor	Plot No.	Room	Free-Field External Noise Level, dB $L_{Aeq,T}$	Calculated Internal Noise Level, dB $L_{Aeq,T}$	Room Activity	Noise Limit, dB $L_{Aeq,T}$	Noise Limit Achieved
Night-time (23:00 to 07:00 hrs)	South	First	3	Bedroom 2	68	30	Sleeping	30	Yes
	North	First	1	Bedroom 1	60	29			Yes
	West	Third	18	Bedroom 1	59	29			Yes

Table 5.7: Assessment of Internal Night-time $L_{Amax,Fr}$ Noise Levels

Period	Façade	Floor	Plot No.	Room	Free-Field External Noise Level, dB $L_{Amax,F}$	Calculated Internal Noise Level, dB $L_{Amax,F}$	Room Activity	Noise Limit, dB $L_{Amax,F}$	Noise Limit Achieved
Night-Time (23:00 to 07:00 hrs)	South	First	3	Bedroom 2	82	45	Sleeping	45	Yes
	North	First	1	Bedroom 1	74	43			Yes
	West	Third	18	Bedroom 1	73	43			Yes

Based on the calculated façade sound reductions at the selected worst case dwellings, the noise predictions show that internal noise levels fall below the daytime and night-time criterion of 35 dB and 30 dB $L_{Aeq,T}$ at all dwellings assessed, with windows closed.

During the night-time period, the calculated sound reductions at the selected worst case dwellings also meet the internal night-time criteria of 45 dB $L_{Amax,F}$ in bedrooms, with closed windows.

The selected glazing and ventilation products are therefore deemed to be suitable to achieve the internal noise criteria for the development.

If the glazing or passive ventilation products change during detailed design or procurement, the 1/1-octave band sound levels for any replacement products must, at minimum, match those presented in Tables 5.1 and 5.2.

5.2.6 Internal Noise Levels - Proposed MVHR Systems

The proposed MVHR plant is a Zehnder Comfortair 155 system. The details, including the manufacturer's sound power data, are presented in Figure A14 of Appendix A.

The proposed in-duct silencer is presented in Figure A15 of Appendix A.

MVHR will be utilised in the following locations:

- Flat 7 – Living room;
- Flat 7 Bedroom;
- Flat 6 Bedroom;
- Flat 6 Living room;
- Flat 13 Bedroom; and
- Flat 13 Living Room.

The proposed duct arrangement for these areas is shown in Figures A10 to A13 of Appendix A.

The calculation of noise through the ventilation system was undertaken at a worst-case location, i.e. an area with the least number of bends and shortest duct length, following the principles set out in Woods Practical Guide to Noise Control (Chapter 5 – Calculation of noise in ventilation systems)[4].

A summary of the duct calculation results is shown in Figure A16 below.

Table 5.8: Summary of MVHR Supply Duct Calculations

Supply Flat / Room	Overall
	dB(A) Lp
Flat 7 – Living Room	29

Planning Condition 12 specifies that indoor ambient noise levels from the mechanical installation shall comply with the requirements specified in BS8233.

5.3 Sound Insulation Testing Between Ground & First Floor Spaces : Condition 14

Airborne sound insulation testing was undertaken on Tuesday 18th November 2025 to determine the airborne sound insulation between the ground floor commercial space and the first-floor residential space.

Planning Condition 14 specifies a minimum requirement of 50 dB a $D_{ntw} + C_{tr}$ between the ground and first floor.

The airborne sound insulation tests were conducted in accordance with BS EN ISO 16283-1: 2014: Acoustics – Field measurement of sound insulation in buildings and of building elements – Airborne sound insulation and rated in accordance with BS EN ISO 717-1: 2013: Acoustics – Rating of sound insulation in buildings and of building elements, Part 1: Airborne sound insulation.

The measured airborne sound insulation is summarised in Table 5.9 and presented in Figure A17 of Appendix A.

Table 5.9: Summary of Sound Insulation Test Results

Test	Source Room	Receive Room	Measured $D_{nTw} + C_{tr}$
Airborne Floor	Ground Floor	First Floor	52

The results show the measured $D_{ntw} + C_{tr}$ of 52 dB meets the minimum requirements specified in Planning Condition 14. No further noise mitigation measures are therefore required.

5.4 Assessment of Basement Noise Levels : Condition 15

5.4.1 Overview

This section of the report presents an assessment of noise transmission from the basement at 32-34 Marine Parade into proposed residential spaces on the first floor.

The purpose of the assessment is to evaluate compliance with internal noise criteria specified in Planning Condition 15.

The basement was previously used as a bar (sui generis), comprising an open-plan space with the bar located on one side and toilets at the rear.

The space is currently vacant.

A plan showing the existing basement layout is provided in Figure A6, Appendix A.

Structural observations during an on-site inspection revealed:

- Ceiling formed by the underside of the concrete slab, with horizontal concrete beams visible.
- Vertical concrete pillars present, indicating a beam-and-column structural system.

5.4.2 Sound Insulation Testing

Airborne sound insulation testing between the basement bar and the first-floor residential space was also undertaken on Tuesday 18th November 2025.

The measured airborne sound insulation is summarised in Table 5.10 and presented in Figure A18 of Appendix A.

Table 5.10: Summary of Sound Insulation Test Results

Test	Source Room	Receive Room	Measured $D_{nTw}+C_{tr}$
Airborne Floor	Basement Bar	First Floor Space	58

5.4.3 Internal Noise Transmission Assessment

7WA has reference sound level data from a busy 'lively' bar that shall assist with the estimate of bar sound levels at the nearest noise sensitive receptors. The source term reference data that is relevant in this instance was obtained within a busy bar and consisted of amplified background music sound and raised voices of patrons using the bar.

The measurements were obtained using fully calibrated Class 1 precision instrumentation, calibrated within permitted tolerance ranges before and after measurements. The source term

reference data is provided below in Table 5.11 and has been used as the adopted internal reverberant sound in the bar for assessment purposes.

Table 5.11: Bar Source Noise Level

Source Location	Measured Sound Level, dB A
	dB(A)
Bar, Tower Bridge, London	79

The measured sound insulation value between basement and first floor space ($D_{nTw} + C_{tr}$ (58 dB)) was applied to the reference bar sound level to estimate noise levels in the first-floor residential spaces.

Condition 15 requires internal sound levels from the bar to not exceed the internal guideline noise levels specified in Table 4 of BS 8233:2014. The adopted assessment value of 30 dB, which is the guideline value for inside bedrooms at night, has been adopted as the assessment criteria.

Table 5.12 below shows the estimate of the noise from the bar, inside the first-floor residential dwellings, along with a comparison against the adopted internal noise criteria.

Table 5.12: Assessment of Internal Basement Noise

Item	Sound Level, dB
(a) Sound Level within Bar, dB (A)	79
(b) Measured Sound Insulation Level, ($D_{nTw} + C_{tr}$) Between Basement and First Floor	58
(c) Estimated Bar Sound Level Inside First Floor Residential Space, dB (A)	21
(d) Internal Residential Noise Criteria	30
(e) Level Difference (c minus d)	-9

As shown in Table 5.12 above, the risk of noise transmission from the basement into the first-floor residential spaces is low and the estimated internal noise level from the operation of the bar, inside the first floor residential space is 21 dB, which falls below the adopted noise criteria of 30 dB.

The assessment confirms that the risk of noise disturbance from the basement bar is low, and the internal noise requirements of Condition 15 will be achieved.

6 Summary and Conclusions

7th Wave Acoustics has been commissioned by the Connaught House (Marine Parade) Limited to prepare an acoustic report to assist with the discharge of the noise related planning conditions (Conditions 12, 14 and 15) attached to planning decision notice AWDM/1174/23 for the proposed development at 32–34 Marine Parade, Worthing, West Sussex.

Detailed noise calculations have been carried out to assess the suitability of the proposed glazing and ventilation systems in providing adequate protection against the ingress of external noise sources into habitable rooms. For areas served by a mechanical ventilation system, duct-borne noise calculations have also been undertaken.

The results indicate that the proposed glazing and ventilation specifications are sufficient to achieve desirable internal noise conditions in all habitable rooms. Therefore, no additional noise mitigation measures are considered necessary to satisfy the requirements of Condition 12.

Sound insulation testing between the ground floor commercial space and first floor residential space indicates the requirements of Condition 14, which specifies a minimum $D_{ntw} + C_{tr}$ of 50 dB, is met and no further noise mitigation measures are therefore required.

An assessment of internal noise transmission between the basement bar area and the proposed first floor residential areas has also been completed, based on site sound insulation measurements of the existing structure. The assessment indicates that the risk of noise disturbance from the basement bar is low, and that the internal noise requirements of Condition 15 will be achieved.

7 References

1. Worthing Borough Council. Planning Permission. AWDM/1174/23.
2. British Standard BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings
3. World Health Organisation. 1999. Guidelines for Community Noise.
4. Woods Practical Guide to Noise Control. Ian Sharland. Sixth Edition. 1990.

APPENDIX A: FIGURES

Figure A1: Site Location Plan



Figure A2: Basement Plan

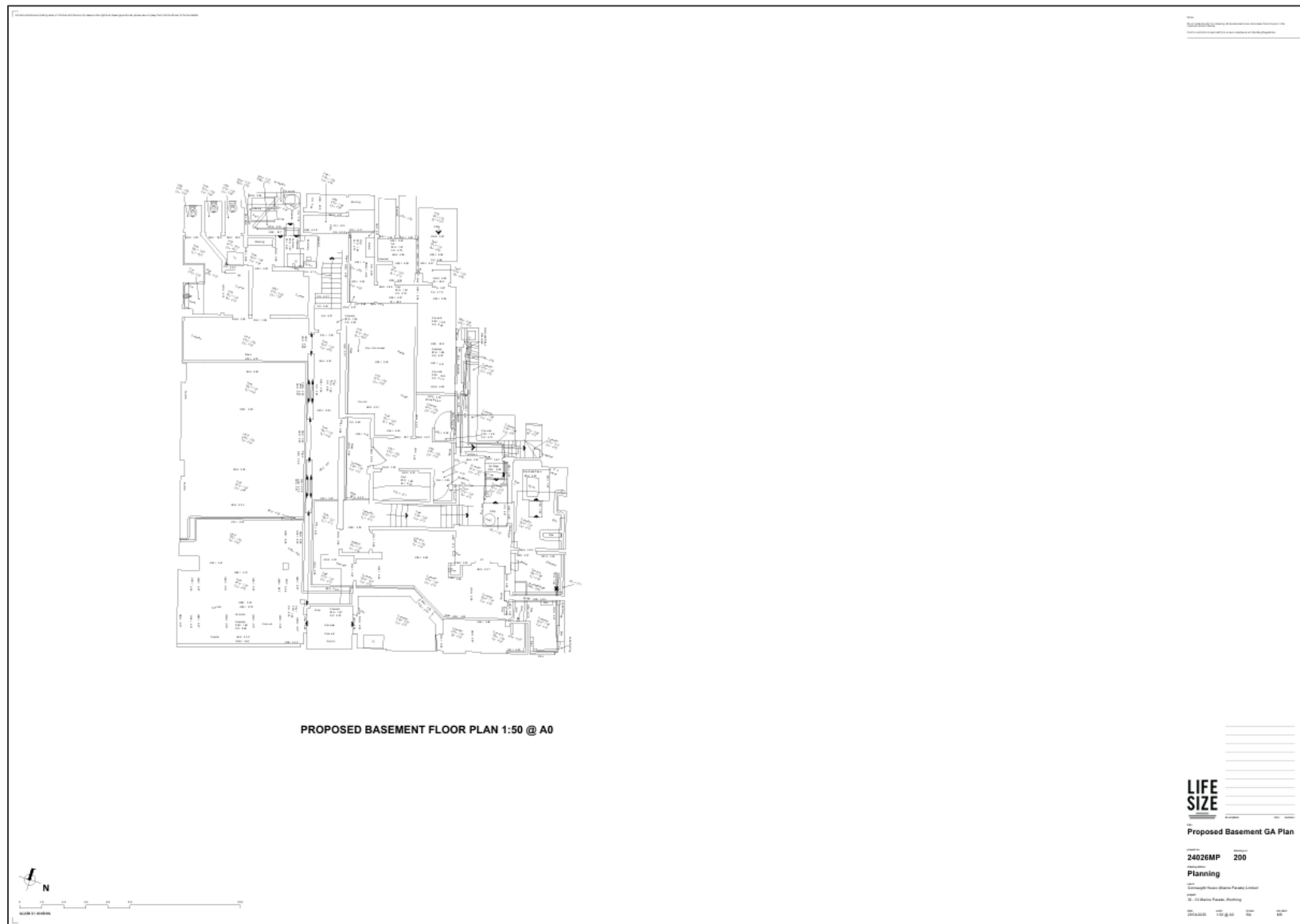


Figure A3: Ground Floor Plan

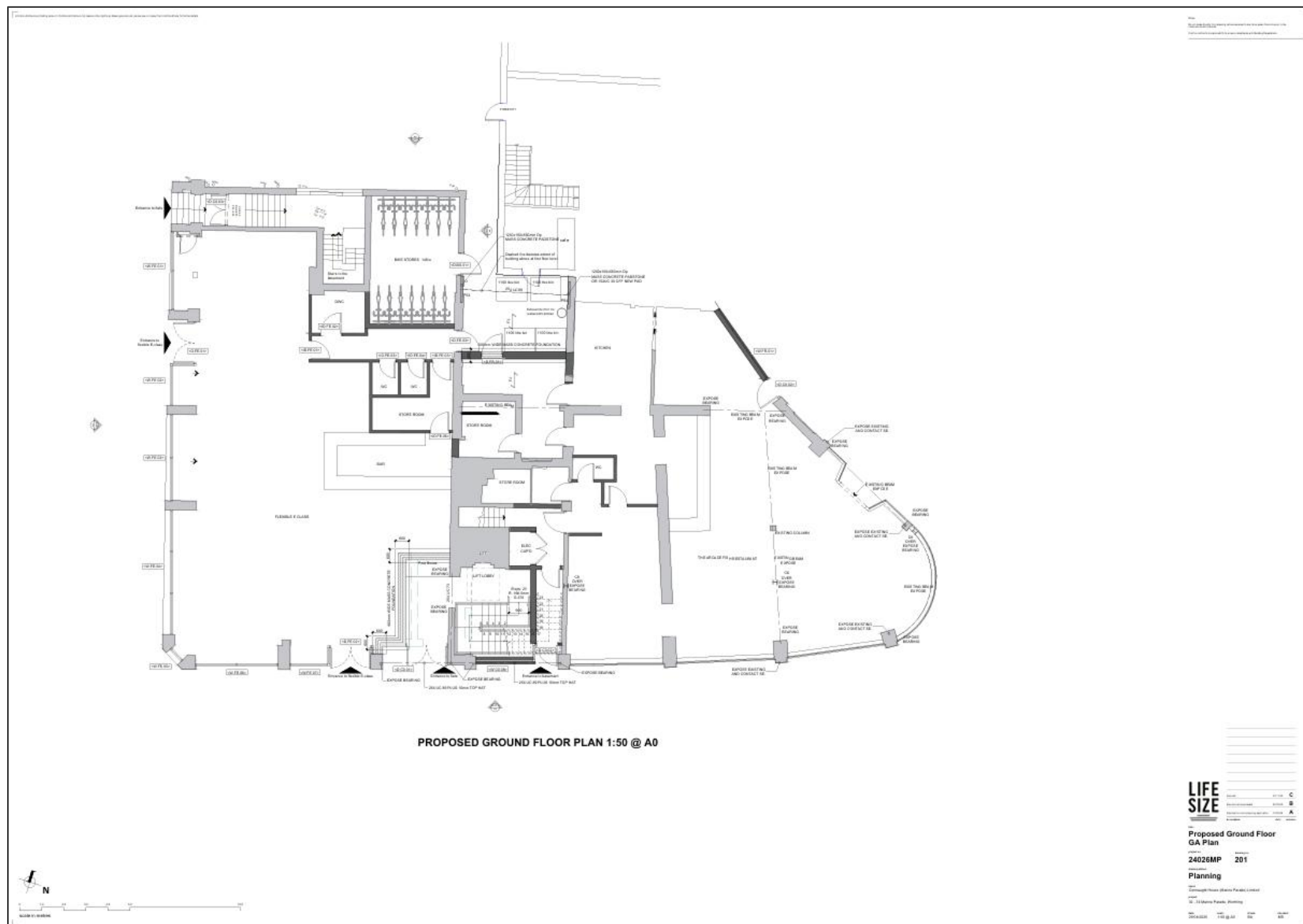


Figure A4:First Floor Plan

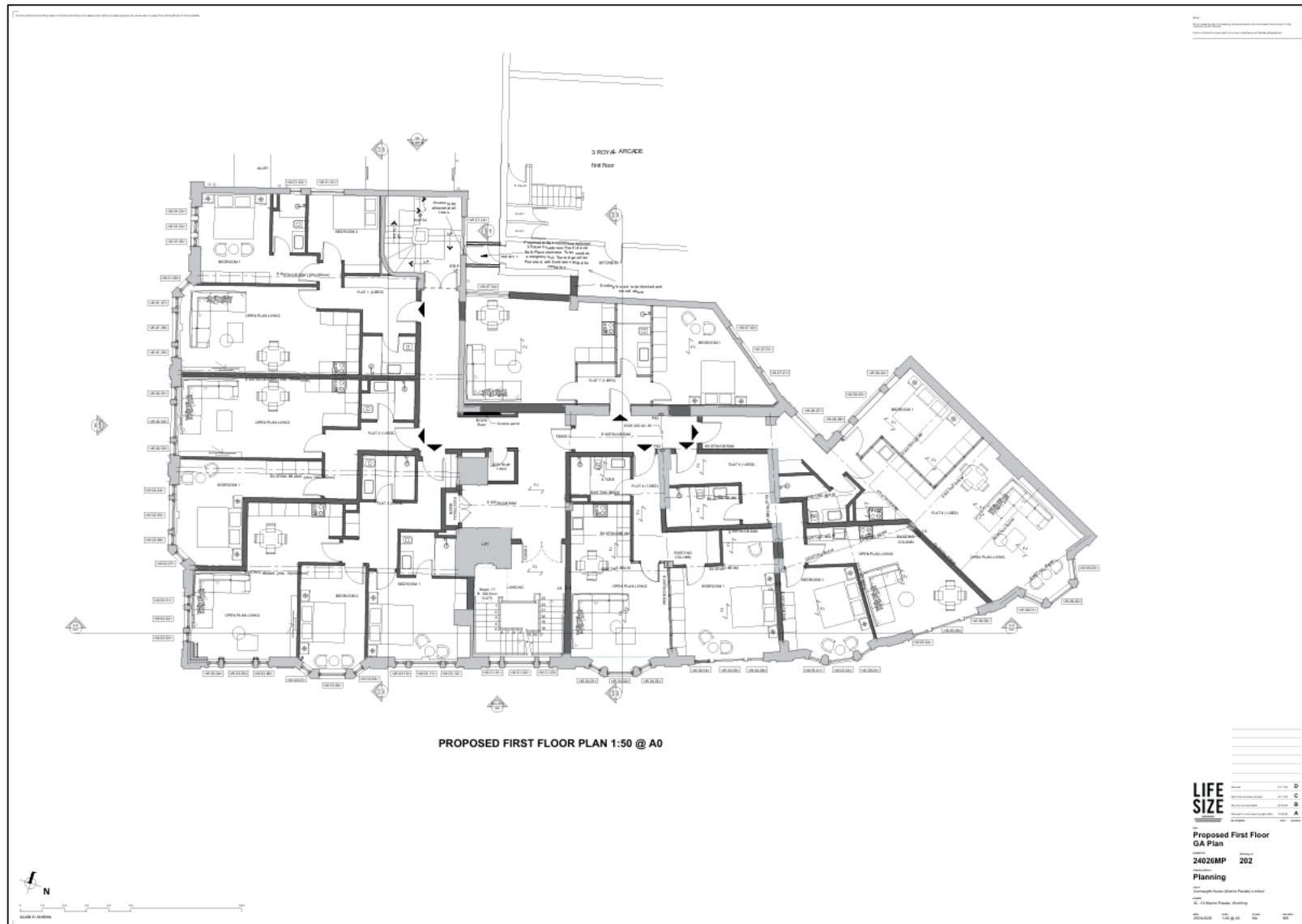


Figure A5: Second Floor Plan

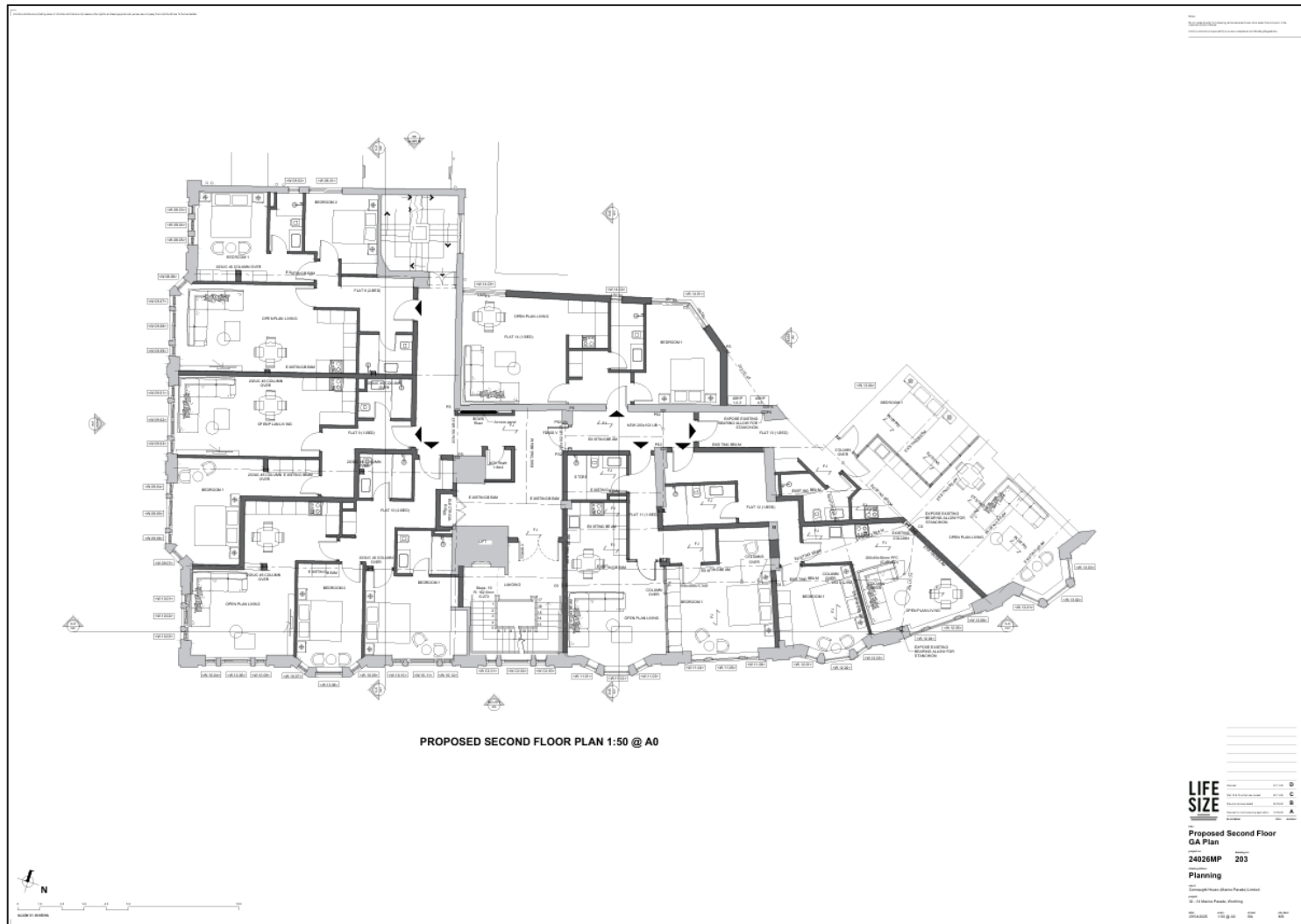


Figure A6: Third Floor Plan



Figure A7: Fourth Floor Plan

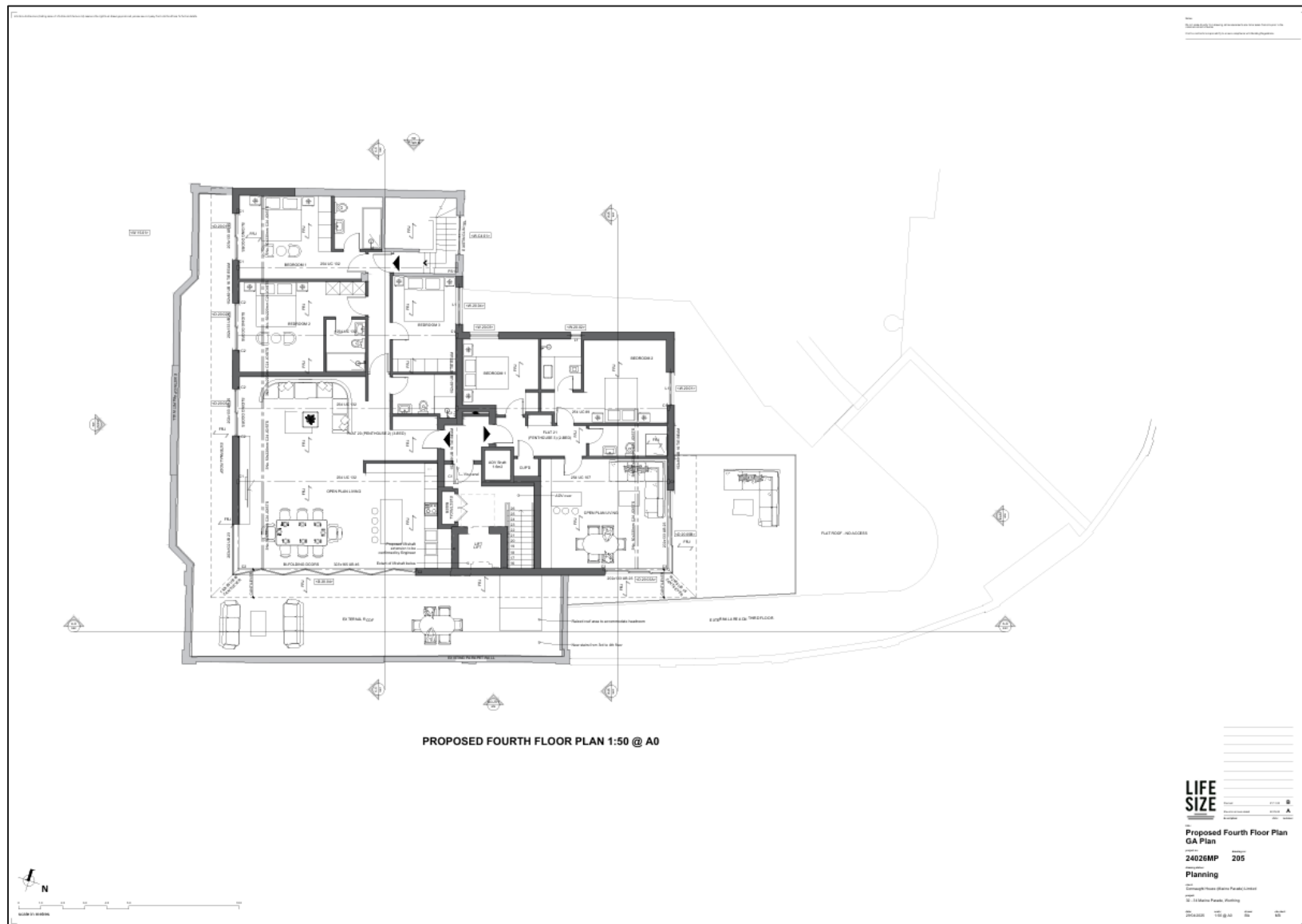


Figure A8: Glazing Specification


PILKINGTON

Pilkington Optiphon™ - acoustic performance data

Glass types	Acoustic performance data [dB]			Total thickness [mm]
	R _w	C	C _g	
Single glazing				
Pilkington Optiphon™ 6,8	36	-1	-4	6,8
Pilkington Optiphon™ 8,8	37	0	-2	8,8
Pilkington Optiphon™ 10,8	38	-1	-3	10,8
Pilkington Optiphon™ 12,8	40	-1	-3	12,8
Pilkington Optiphon™ 16,8	41	-1	-3	16,8
Pilkington Optiphon™ 20,8	42	-1	-3	20,8
Pilkington Optiphon™ 24,8	43	-1	-3	24,8
Double insulating glass units				
4 mm - 16 mm - Pilkington Optiphon™ 6,8	36	-2	-6	26,8
4 mm - 16 mm - Pilkington Optiphon™ 8,8	39	-3	-7	28,8
6 mm - 16 mm - Pilkington Optiphon™ 6,8	40	-2	-6	28,8
6 mm - 16 mm - Pilkington Optiphon™ 8,8	41	-2	-6	30,8
8 mm - 16 mm - Pilkington Optiphon™ 6,8	42	-3	-7	30,8
8 mm - 16 mm - Pilkington Optiphon™ 8,8	42	-3	-8	32,8
8 mm - 16 mm - Pilkington Optiphon™ 10,8	43	-2	-6	34,8
8 mm - 16 mm - Pilkington Optiphon™ 12,8	43	-2	-6	36,8
10 mm - 16 mm - Pilkington Optiphon™ 8,8	44	-2	-6	34,8
10 mm - 18 mm - Pilkington Optiphon™ 8,8	43	-2	-6	36,8
10 mm - 20 mm - Pilkington Optiphon™ 8,8	46	-2	-6	38,8
10 mm - 16 mm - Pilkington Optiphon™ 12,8	44	-1	-5	36,8
Pilkington Optilam™ 9,5 - 20 mm - Pilkington Optiphon™ 8,8	43	-3	-7	38,3
Pilkington Optilam™ 14,8 - 20 mm - Pilkington Optiphon™ 14,8	47	-1	-3	49,6
Pilkington Optiphon™ 8,8 - 16 mm - Pilkington Optiphon™ 12,8	48	-2	-7	37,6
Pilkington Optiphon™ 8,8 - 20 mm - Pilkington Optiphon™ 12,8	49	-2	-7	41,6
Pilkington Optiphon™ 10,8 - 24 mm - Pilkington Optiphon™ 16,8	52	-2	-6	51,6
Pilkington Optiphon™ 12,8 - 16 mm - Pilkington Optiphon™ 14,8	51	-2	-6	43,6
Pilkington Optiphon™ 12,8 - 16 mm - Pilkington Optiphon™ 16,8	51	-1	-6	45,6
Pilkington Optiphon™ 12,8 - 20 mm - Pilkington Optiphon™ 16,8	51	-1	-4	49,6
Triple insulating glass units				
6 mm - 12 mm - 4 mm - 12 mm - Pilkington Optiphon™ 8,8	42	-3	-8	42,8
6 mm - 14 mm - 4 mm - 14 mm - Pilkington Optiphon™ 8,8	43	-2	-7	44,8
6 mm - 16 mm - 4 mm - 16 mm - Pilkington Optiphon™ 8,8	42	-2	-7	50,8
8 mm - 12 mm - 4 mm - 12 mm - Pilkington Optiphon™ 8,8	43	-2	-7	44,8
8 mm - 16 mm - 4 mm - 16 mm - Pilkington Optiphon™ 8,8	45	-3	-7	52,8
8 mm - 12 mm - 6 mm - 12 mm - Pilkington Optiphon™ 10,8	44	-2	-7	48,8
8 mm - 12 mm - 6 mm - 12 mm - Pilkington Optiphon™ 12,8	45	-1	-5	50,8
8 mm - 14 mm - 6 mm - 14 mm - Pilkington Optiphon™ 12,8	46	-2	-6	54,8
10 mm - 14 mm - 6 mm - 14 mm - Pilkington Optiphon™ 12,8	46	-1	-3	56,8
Pilkington Optiphon™ 8,8 - 12 mm - 4 mm - 12 mm - Pilkington Optiphon™ 8,8	46	-2	-7	45,6
Pilkington Optiphon™ 8,8 - 12 mm - 6 mm - 12 mm - Pilkington Optiphon™ 10,8	47	-2	-7	49,6
Pilkington Optiphon™ 8,8 - 12 mm - 6 mm - 12 mm - Pilkington Optiphon™ 12,8	49	-1	-7	51,6
Pilkington Optiphon™ 8,8 - 14 mm - 6 mm - 12 mm - Pilkington Optiphon™ 12,8	49	-1	-6	53,6
Pilkington Optiphon™ 8,8 - 14 mm - 6 mm - 14 mm - Pilkington Optiphon™ 12,8	50	-2	-7	55,6

R_w (C_w) are determined in accordance with EN 717-1.

Insulating glass units filled with argon (90%).

To calculate other performance data please use Pilkington Spectrum online calculator at <https://spectrum.pilkington.com> or Pilkington Spectrum mobile app.

Figure A9: Trickle Ventilation Specification

SFXSA Acoustic detail at defined frequencies.									
	Dn,e dB								
	2500EA								5000EA
Frequency Hz	V75 / C75	V75 /C50	V75 / Std. Canopy	V50 /C25	V50 / Std. Canopy	V25 /C25	V25 / Std. Canopy	Std. Vent/C25	V75/C75 5000EA
100									
125	37	40.2	37.8	37.9	34.4	37.8	35.9	35.7	37.5
160									
200									
250	37	37.2	36.5	37.7	36.8	37.6	37.6	37.7	35.4
315									
400									
500	36.1	34.4	34.8	33.4	34.5	34.4	36.3	36.1	32.1
630									
800									
1000	46.9	42.8	39.5	36.3	35.9	32.1	31.8	32.1	39.8
1250									
1600									
2000	49.2	50.1	41.5	47.1	40.8	42.4	36.8	37.1	46.1
2500									
3150									
4000	55.2	52.8	44.8	49.2	41.6	48.8	40.4	38.9	59.7
5000									
6300+									
8000+	61.3	62.9	53.8	57	51	55.4	47.8	47.8	58
10000+									
Rating D n.e.w.	44	42	40	39	38	36	35	35	40

Figure A10: MVHR Plan – First Floor

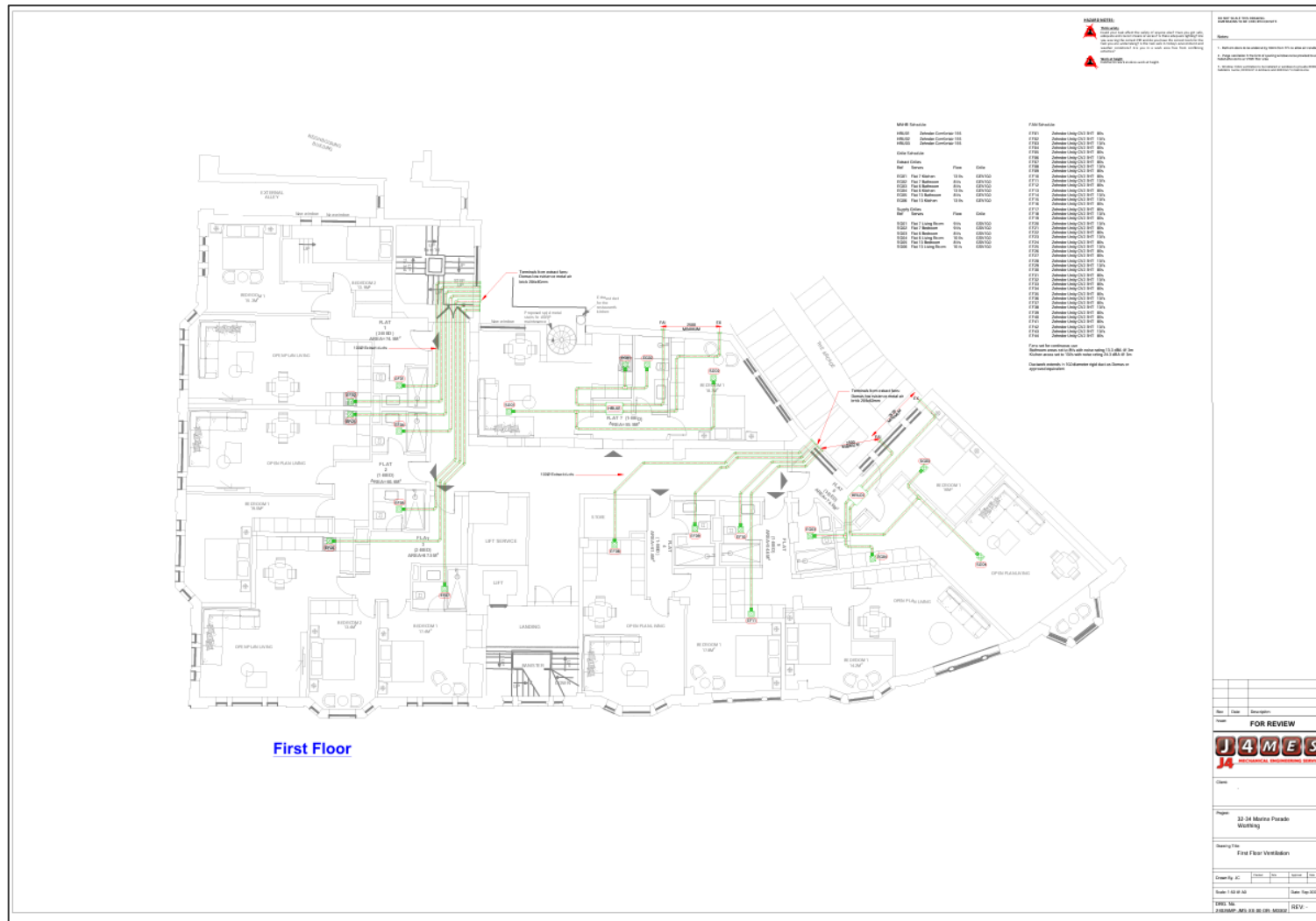


Figure A11: MVHR Plan – Second Floor

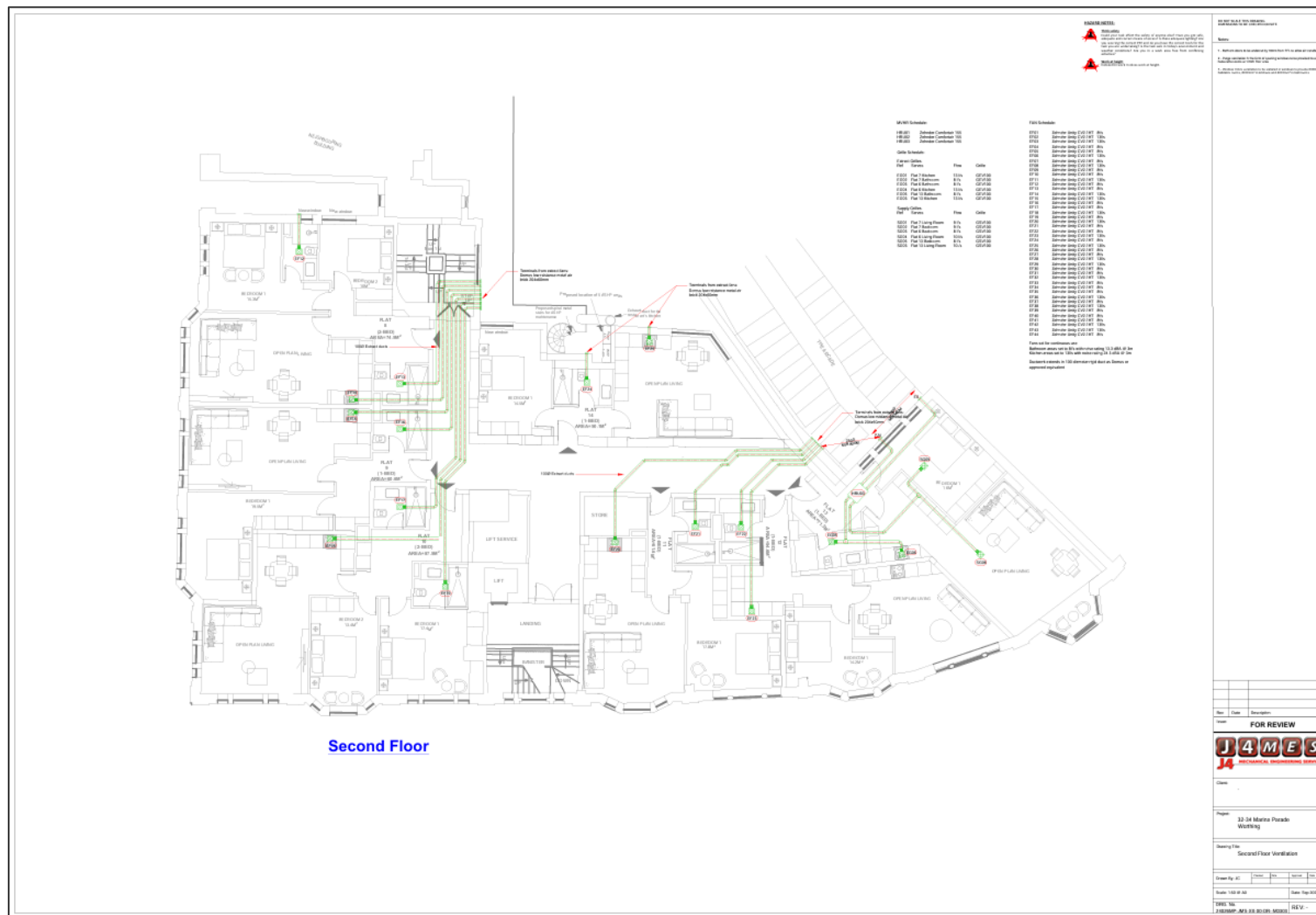


Figure A12: MVHR Plan – Third Floor

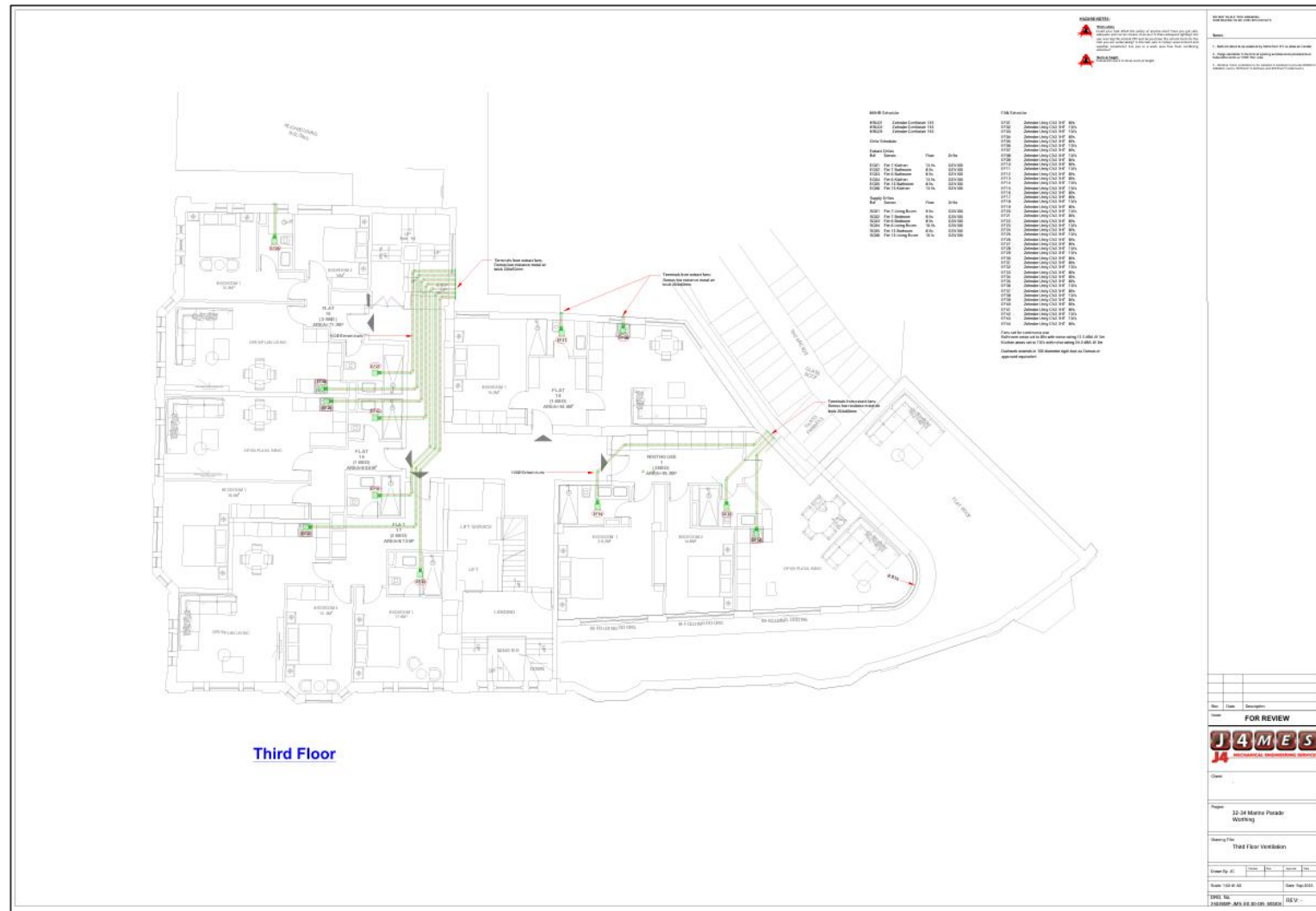


Figure A13: MVHR Plan – Fourth Floor

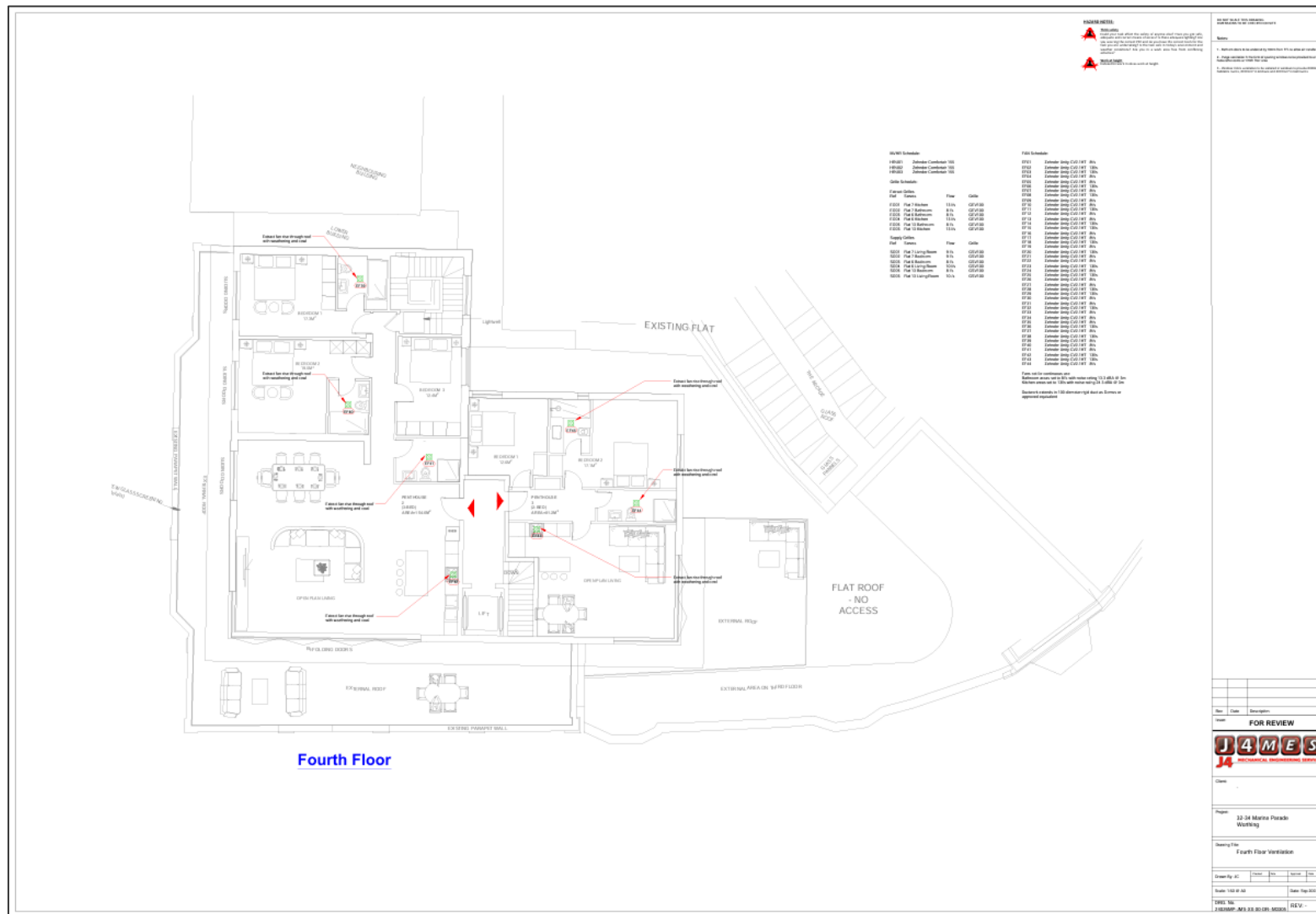
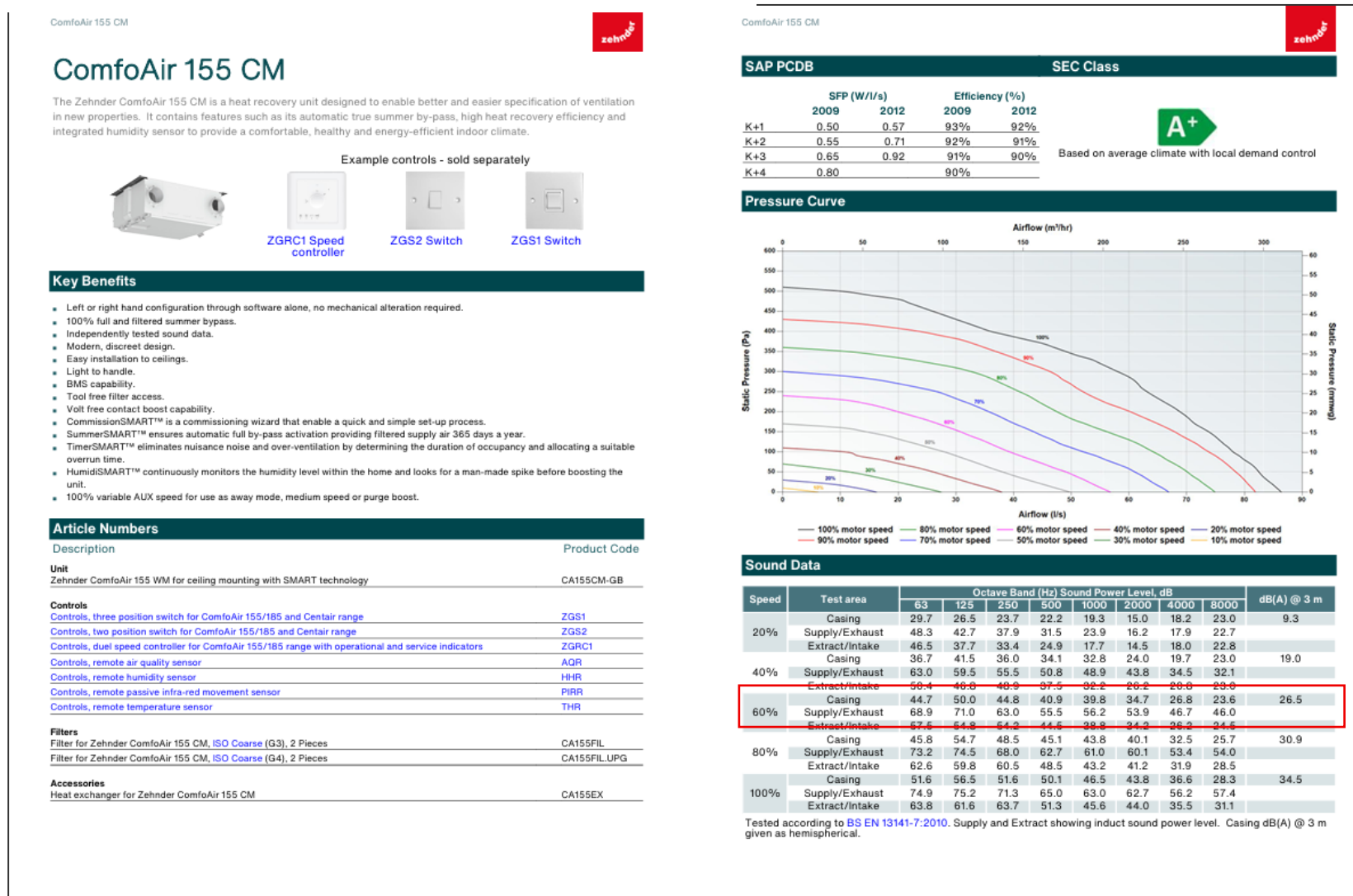


Figure A14: Proposed MVHR System



Note: The project MEP consultant has advised that the required fan speed will be 60%.

Figure A15: In-duct Silencer

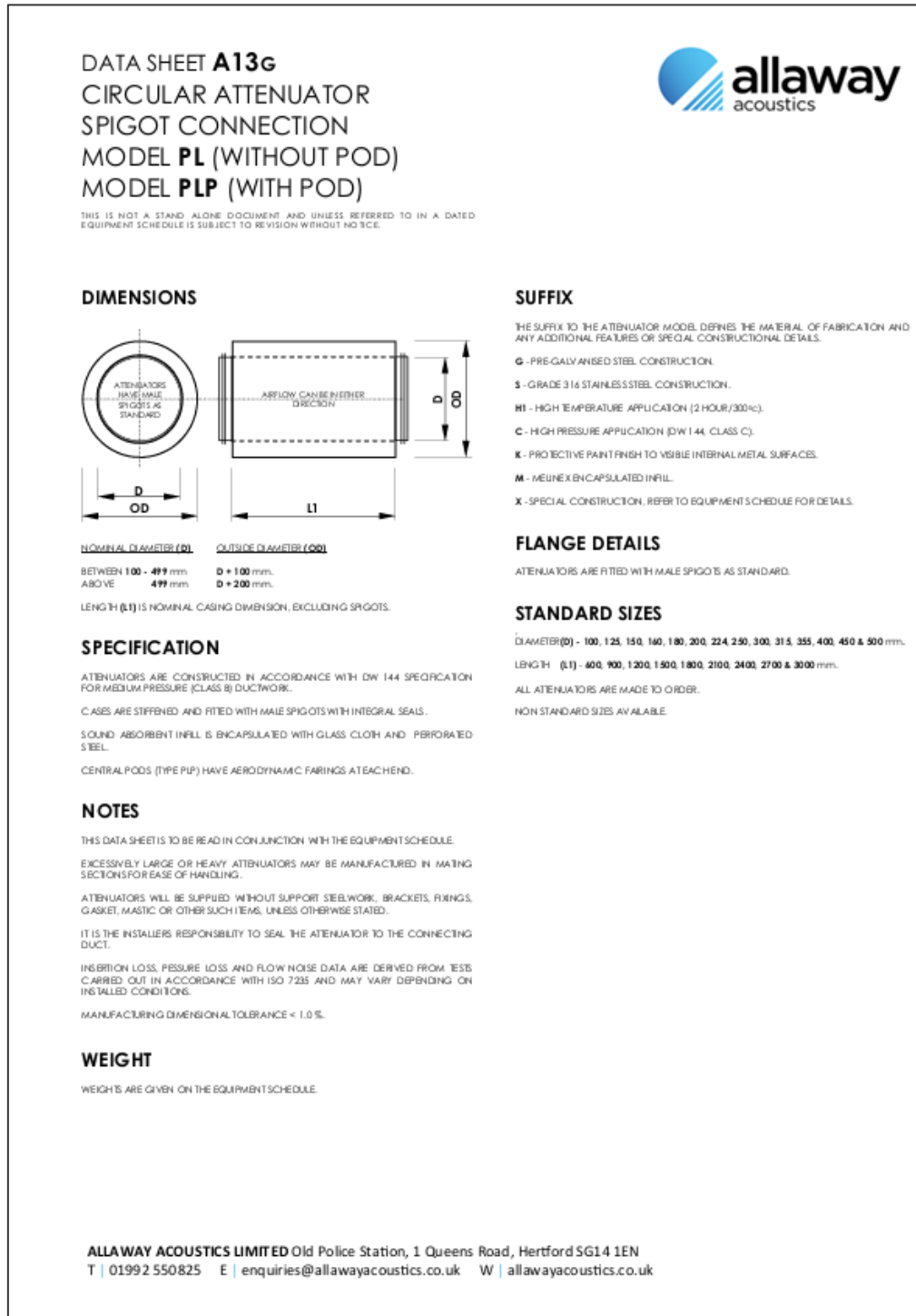


Figure A16: Duct Calculation

Stage		Frequency (Hz)								dB	dB(A)
		63	125	250	500	1k	2k	4k	8k		
		68.3	66.6	58.9	57.4	58.6	55.3	45.9	44.8	71	62.4
In-Duct Silencer	Attenuation, dB	6	14	24	43	55	55	55	52		
	Sum	62	53	35	14	4	0	-9	-7	63	39.5
Straight Duct (3m)	Attenuation Per M	0.8	0.6	0.5	0.4	0.3	0.3	0.3	0.3		
	Attenuation, dB	-2.3	-1.8	-1.4	-1.1	-0.9	-0.9	-0.9	-0.9		
	Sum	60	51	34	13	3	-1	-10	-8		
	Regen	31	31	30	30	29	27	20	8		
	Sum	60	51	35	30	29	27	20	8	61	39
Termination	Attenuation	5.6	2.2	0.2	0	0	0	0	1.76		
	Sum	54	49	35	30	29	27	20	6		
	Regen	31	31	30	30	29	27	20	8		
	Sum	54	49	36	33	32	30	23	10	56	38
Room Effect	Swl at Termination	54.5	48.7	35.9	32.6	31.6	29.6	22.5	9.8		
	Room Volume C (240	0	-1	-2	-3	-4	-5	-6	-6		
	Distance C (1.5m)	7	7	7	7	7	7	7	7		
	Spl in Room	47.5	40.7	26.9	22.6	20.6	17.6	9.5	-3.2	48	29

Figure A17: Sound Insulation Test Results – Ground to First

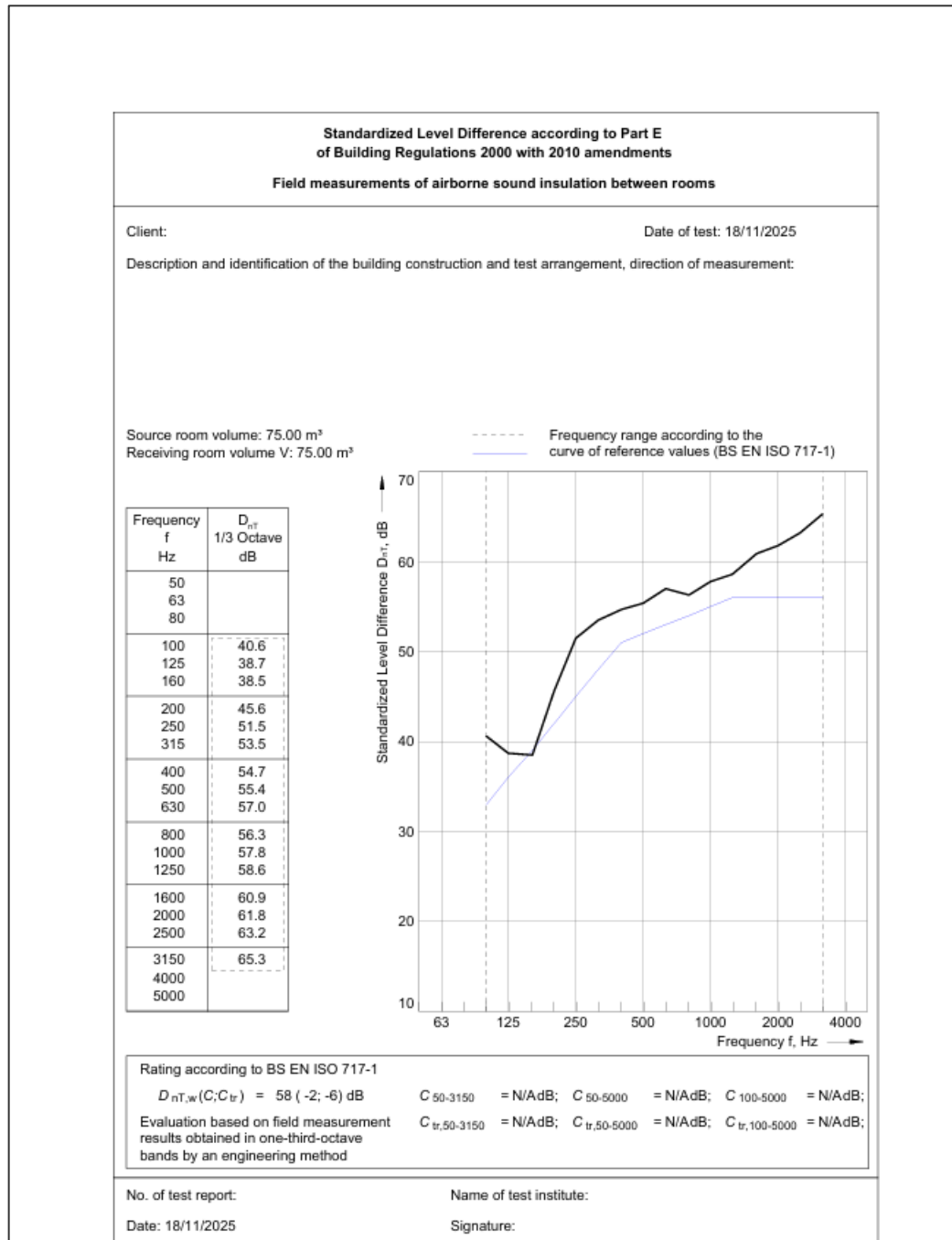
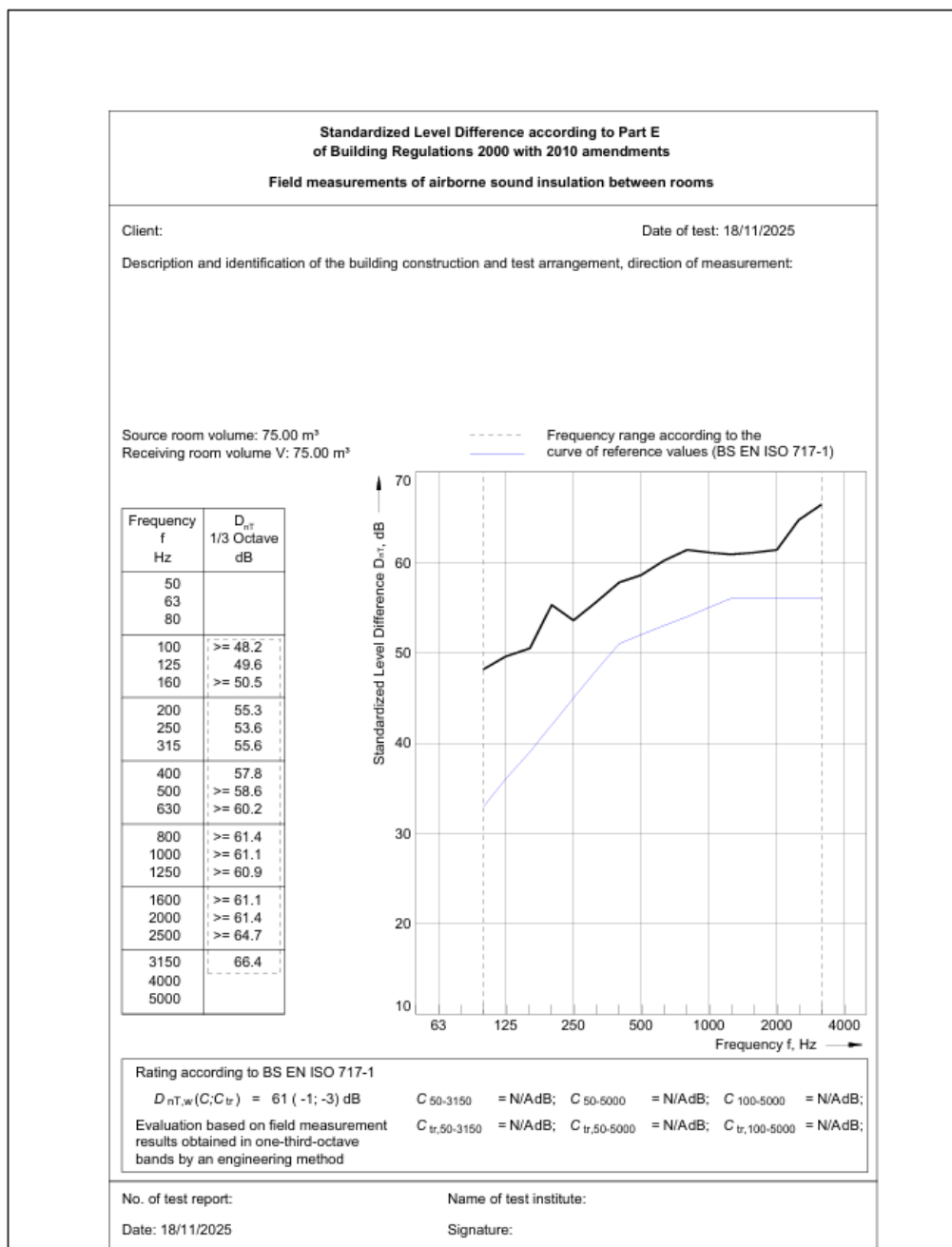


Figure A18: Airborne Sound Insulation Test Results – Basement to First



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