MJM/NC/5853

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ACOUSTIC CONSULTANTS

110 TIB STREET, MANCHESTER
ACOUSTIC ASSESSMENT FOR PLANNING APPLICATION

architectural

environmental

occupational

industrial

noise control at source

project management

planning

legal services

expert witness

Report Prepared For:-

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CONTENTS

1.0 SUMMARY

2.0 BRIEF FOR CONSULTANCY

3.0 SURVEY DETAILS

- 3.1 Site Description
- 3.2 Survey Times and Personnel
- 3.3 Weather
- 3.4 Equipment
- 3.5 Measurement Positions

4.0 PPG24 ASSESSMENT

- 4.1 Assessment Criteria
- 4.2 Subjective Results
- 4.3 Measured Results
- 4.4 Noise Exposure Categories
- 4.5 Discussion

5.0 CALCULATION OF INTERNAL NOISE LEVELS

- 5.1 Standards
- 5.2 Internal Noise Level Calculation
- 5.3 Calculations
- 5.4 Plots Facing Tib Street (Position 1)
- 5.5 Rear Facing Plots
- 5.6 Discussion

6.0 CONCLUSION

Figure 1
Calculation Sheets
Appendix 1: Definition of Acoustic Terms

1.0 SUMMARY

At the request of Mr. Alan Hegarty, an acoustic assessment has been conducted at the proposed residential development at 110 Tib Street, Manchester.

As per the request of Manchester City Council, measurements have been made over a typical weekend night-time period. This has been considered in order to quantify incident levels of noise on the proposed façade, given the development's inner city location and it's proximity to a number of late-night bars.

It has been found that the development is subject to Noise Exposure Categories (NECs) 'B and 'C' and is due to a variety of noise sources, however, road and noise from by passing pedestrians present the loudest noise sources in the area.

Using measured data, 'break-in' internal noise levels have been calculated within the development. It has been shown that throughout the development, the 'reasonable' resting criteria as stated in BS 8233 'Sound insulation and noise reduction for buildings – Code of practice' can be achieved. It should be noted that in order to meet this criteria, the guidance on noise mitigation measures within this report should be adhered to.

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2.0 BRIEF FOR CONSULTANCY

PDA Ltd. was engaged to undertake the following:

A) Environmental Noise Survey

We will undertake ambient noise surveys in order to determine ambient noise levels in the area of the development. In the email sent to PDA on 7th June 2008 it was stated that the requirement from Manchester City Council was:-

"The study should identify ambient noise levels during daytime, night-time and weekends, along with an indication of noise levels that you propose to achieve within the accommodation and details of the acoustic glazing and acoustically treated ventilation you propose to use."

B) Building Envelope

The results of the survey will be assessed in the light of PPG24 'Planning and Noise'. Transportation noise sources will be assessed in accordance with the Noise Exposure Categories as defined within PPG24. Industrial noise sources will be assessed to BS4142 'Method for rating industrial noise affecting mixed residential and industrial'.

If measurements indicate unfavourable levels we will prepare calculations, based on available room data/drawings, to predict internal noise levels within the exposed development. The results of these calculations will be compared to the requirements of BS8233 'Sound Insulation and Noise Reduction for Buildings – Code of Practice'.

The results of this assessment will be incorporated into the body of the report of Part A. Further to this we will recommend a mitigation scheme so as to ensure suitable internal noise levels within the development. This will involve specification of elements such as external walls, roof, glazing and ventilation. The report will be in a format suitable for submission to the local authority to discharge planning conditions.

3.0 SURVEY DETAILS

3.1 Site Description.

The development is positioned at the lower end of Tib St, Central Manchester and is in close proximity to the junction with Great Ancoats Street. The immediate area can be considered as being residential with a number of houses directly opposite the site. The current planning application includes for the new build of two, new-build, apartment blocks.

Locally, the development is in close proximity to a number of bars and pubs. The current development, presently in use for residential purposes, lies approximately two streets away from Manchester's "Northern Quarter" and is a small area populated by a number of bars. At the top of Tib St, there also exists a small number of bars including a live Jazz bar.

3.2 Survey Times and Personnel

Measurements were made on the night of Friday 3rd October 2008 between the hours of 2000 – 0200. All measurements were made and attended by Mr Liam Kavaney of PDA Ltd.

Note A : Since the time of proposed works, it has been agreed with Manchester City Council that noise measurements would be acceptable between the hours of 2000 and 0200 on a weekend night.

3.3 Weather

Recorded temperatures during the survey ranged between 6 - 10°C, cloud cover was approximately 80-100%. Wind speed was an average of 1m/s.

3.4 Equipment

The survey was conducted using a single CEL Instruments 593 sound level meter, full details of the equipment can be found at the rear of this document.

The CEL 593 sound level meter is a precision grade 1 (as per BS EN 60651: 1994 and IEC 651) computing sound level meter capable of operating as an integrating sound level meter complying with BS EN 60204: 1994 (IEC 804). The meter was set to measure both linear and 'A' weighted sound pressure levels linear and the time weighting was set to fast response. The microphone was of the 'free field' type. The meter was field calibrated before, after and during the survey as required, during which time no significant calibration drift was observed.

Measurements were made at least 3.5 metres from any potentially reflecting surfaces utilising a microphone boom and a microphone windshield were used throughout the survey.

3.5 Measurement Positions

The measurement location was situated outside the existing second floor living area, facing directly onto Tib Street with the microphone boom being utilised for this purpose.

For the purposes of the PPG 24 assessment, the exact measurement locations are detailed in Figure 1 at the end of this report.

4.0 PPG 24 ASSESSMENT

4.1 Assessment Criteria

Planning Policy Guidance Note 24 (PPG24): - Planning and Noise, determines whether noise should be a major factor when granting planning permission for development of residential homes.

The method used to assess whether noise dominates a development site is through the use of Noise Exposure Categories (NEC's).

There are four NEC's that the site could fall into; all of these are shown in the table below.

Table 1: Definition of NEC categories

NEC	Description of NEC Level
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

The NEC level is selected by it's noise level and source category, as shown in the table below.

Table 2: Definition of NEC categories

Noise Source	A	B	C	D
Road traffic:				
0700-2300	<55	55-63	63-72	>72
2300-0700	<45	45-57	57-66	>66
Rail traffic:				
0700-2300	<55	55-66	66-74	>74
2300-0700	<45	45-59	59-66	>66
Air traffic:				
0700-2300	<57	57-66	66-72	>72
2300-0700	<48	48-57	57-66	>66
Mixed sources:				
0700-2300	<55	55-63	63-72	>72
2300-0700	<45	45-57	57-66	>66

Furthermore, when individual night-time noise events regularly exceed 82dB (A) $L_{s,\ max}$, the site should be classified as NEC level C.

4.2 Subjective Results

Incident noise at the receiver location comprised of a number of differing noise sources however a constant noise source was found to be that of traffic on Great Ancoats Street. This also produced occasional contributions from passing emergency service vehicles with activated sirens.

With regards to entertainment noise, a small amount of faint music was audible from the 'City' pub next door. Entertainment noise from bars at the top of Tib St (Matt and Phreds, Centro, Cord etc) was generally not perceived throughout measurements however, some noise was faintly audible in lulls of traffic.

Noise contributions from people walking to and from bars along Tib Street was the cause of many of the elevated L_{max} readings in each period. People were heard to be talking and shouting during each hour of the survey period.

4.3 Measured Results

Full details of the measured results can be seen in the table included at the end of this report.

4.4 Noise Exposure Categories

The measurement position is representative of the noise levels incident on proposed facades. It should be noted that the proposed development is essentially a vertical extension of the current one. As such, proposed floors are likely to experience a reduction in the amount of incident noise due to the increased source-receiver distances involved.

The noise exposure categories for all the proposed façade facing Tib St are detailed below.

Table 3: Average noise levels – Position 1

Measurement Period	Average Calculated Noise Level dB L_{Aeq}	Noise Exposure Category
Daytime: 2000 - 2300 hours	65	C
Night-Time: 2300 – 0200 hours	63	C
Whole Period* 2000-0200	64	C

* Assumes that the whole period covers a typical "Night-Time" period, as such a comparison against the night-time criteria of PPG24 has been implemented.

For plots facing away from Tib St, noise levels would be expected to decrease significantly. A typical 10dB reduction would be provided if a complete line of sight were provided to noise sources. This would result in noise levels to the order of those given in the following table.

Table 4: Average noise levels – Rear Façade.

Measurement Period	Average Calculated Noise Level dB L_{Aeq}	Noise Exposure Category
Daytime: 2000 - 2300 hours	55	B
Night-Time: 2300 – 0200 hours	53	B
Whole Period* 2000-0200	54	B

For sites falling into NEC B, the advice given in PPG24 is as follows,

Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.

For sites falling into NEC C, the advice given in PPG 24 is as follows;

'Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.'

Despite the sentiments raised in the description of NEC categories C, it is PDA's experience that most urban town, or city type developments, will fall into these categories. In the current climate, NEC categories provide planners guidance on the requirement (if needed), or degree of (if necessary), acoustic attenuation via the glazing and ventilation, which are traditionally the acoustic weak points of a façade.

Given this, and also that the area is in the vicinity of other recent residential developments, PDA would suggest that the area is suitable for development on the proviso that the guidance regarding glazing and ventilation given in this report is adhered to.

During the night-time measurements, maximum noise levels measured did not regularly exceed of 82dB (A) $L_{s, max}$

4.5 Discussion

As stated in the above section, noise sensitive areas within the proposed development fall into a combination of NEC B and C categories.

It is PDA's experience that developments falling into these categories are suitable for residential development provided that adequate acoustic attenuation is provided to habitable areas. Considering the acoustic weak points of the system, typically the glazing and the ventilation, an increased performance specification in these areas will ensure that internal noise levels as stated in BS 8233 - 'Sound Insulation and Noise Reduction for Buildings – Code of Practice' can be realistically achieved.

It should also be noted that the measurement periods chosen were representative of the noisiest parts of the day. Measurements over a longer duration, typically encompassing a full 24-hour period, would likely produce a lower L_{Aeq} value to those stated in the tables below due to L_{eq} values being effectively averaged down.

Furthermore, given that the proposed development is adjacent to an area already comprising of residential properties, it is felt that the development will be suitable for residential purposes provided that suitable acoustic provisions are made.

5.0 CALCULATION OF INTERNAL NOISE LEVELS

The following section of the report considers the proposed envelope design development and calculates resultant internal noise levels within the habitable spaces inside the apartments.

5.1 Standards

British Standard 8233 'Sound insulation and noise reduction for buildings – Code of practice' provides the following values for good and reasonable resting conditions in indoor spaces:

Table 5: BS8233 Design Criteria

Criterion	Typical Situation	Design Target in dB $L_{Aeq,T}$
Reasonable resting conditions (Daytime)	Living Rooms	40
Good resting conditions (Daytime)	Living Rooms	30
Reasonable sleeping conditions (Night-time)	Bedrooms	35
Good sleeping conditions (Night-time)	Bedrooms	30

Further to this for a reasonable level standard in bedrooms at night, individual noise events should not normally exceed 45 dB $L_{(F)max}$ although it should be borne in mind that this is a particularly stringent criterion. As such, this criterion is commonly relaxed if it can be shown that L_{Aeq} design targets are met.

5.2 Internal Noise Level Calculation

The sound insulation provided by the building envelope is a combination of the sound reduction indices of the individual façade elements and the area of the façade they cover. The result is a composite sound insulation value for the whole façade.

Details of the proposed development have been provided by Remote Architecture and consist of proposed site plans and elevations in the form of architect's drawings.

The external wall and roof constructions are as follows

External Walls

102mm Facing Brickwork,
100mm clear cavity with insulation,
100mm blockwork inner leaf
1 No. 12.5mm Plasterboard wall finish.

Roof Construction

The current roof construction has been assumed to comprise of the following:

Timber trussed rafters with Type 1F felt and 50x25mm timber battens. Concrete interlocking tiles utilising a dry ridge, Hip system to suitable pitch.
12.5mm Fireline board with a minimum 100mm insulation in ceiling void.

Glazing

As detailed in the tables below, different glazing types have been specified in different living/sleeping areas. In general, glazed areas are considered an acoustic weak point of any system. Where areas of a façade contain a larger glazed area than compared to others, the specification should be upgraded to provided a commensurate level of noise attenuation. Facades that do not directly face Tib Street can expect to achieve similar noise levels to those detailed in the tables below using a lower specification.

Ventilation

As each of the developments have fallen into NEC B and C it follows that it will be insufficient to provide ventilation via open windows alone. The ventilation required is in the form of background ventilation for general living conditions.

A suitable system to provide background and rapid ventilation would involve continuous mechanical extract ventilation. This method would involve extract fans within the wet areas and acoustically treated inlets within habitable rooms. This method can be used in combination with any suitable trickle ventilator or air-brick. In addition a boost control could be fitted to the extract system to provide the rapid ventilation requirements.

A suitable system to provide sufficient ventilation would involve the installation of window trickle vents. In our calculations we have considered two trickle vents, namely the Titon Trimvent 4000 and the Fresh AL-dB 450. It should be noted that other products will also be suitable for this development however, the product must satisfy the following minimum values for octave-band $D_{ne,w}$ performance as shown in the table below.

Table 6: Octave Band $D_{ne,w}$ Performance Values

Vent Type	Octave Band Frequency (Hz)	$D_{ne,w}$ (dB)								
		32	63	125	250	500	1k	2k	4k	8k
V1	Fresh AL-dB 450	28	34	45	44	36	40	42	55	55
V2	Titon Trimvent 4000	26	32	32	37	37	36	36	35	40

5.3 Calculations

Internal noise levels have been calculated throughout the proposed development. During the assessment the following assumptions have been made.

A) Glazing throughout the development has been specified in accordance with that detailed in Tables 7 and 8. Note that other products with similar performance criteria will also be suitable. PDA should verify any deviation from the glazing stated.

B) Average measured noise level in terms of dB L_{Aeq} during the day and night were used in assessments.

C) Wall construction has been taken from direct correspondence with Remote Architecture. Room sizes have been taken from architect's drawings.

D) Reverberation time in habitable rooms has been assumed at 0.5 seconds.

5.4 Plots Facing Tib Street (Position 1)

The following tables detail the results of the calculations for dwellings facing north.

Table 7: Ground and Second Floor Internal Noise Levels, Daytime

Room	Glazing Specification (mm)	Trickle Vent Specification	Calculated Internal Noise Level dB(A)	Maximum Internal Noise Level Requirement dB(A)
Flat 2, Bedroom 1	10/12/6	V1	35	35
Flat 4, Bedroom 1	10/12/6	V1	32	35
Flat 6, Bedroom 1 (Upper)	10/12/6	V1	28	35

5.5 Rear Facing Plots

Expected noise levels for rear facing plots are detailed below, values have been assumed on the provision of 10dB screening due to complete line of sight blockage from noise sources.

Table 8: Ground and Second Floor Internal Noise Levels, Night-time

Room	Glazing Specification (mm)	Trickle Vent Specification	Calculated Internal Noise Level dB(A)	Maximum Internal Noise Level Requirement dB(A)
Flat 1, Typical Bedroom	4/12/4	V2	33	35

5.6 Discussion

With regard to night-time internal noise levels, it can be seen that all of the bedrooms will meet the 'reasonable' sleeping criteria as detailed in BS 8233, provided a suitable glazing specification is used.

Alternatives to the trickle vents specified in our report can be used, although it is imperative that the vent is of a similar performance. PDA will be happy to validate these on request.

Notes on Glazing Installation

It is noted that all sound insulation values quoted in the tables above must be achieved by the **overall combination of frame and glazing**, and not just by the glazing alone. PDA Ltd would be happy to look over manufacturers tender submissions for glazing systems to assess suitability.

Glazing frame systems must be fully sealed with any small gaps (<10mm nominal) around the perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic, with additional weathering protection to be applied additionally externally to this. No gaps should be left unsealed, and in no instance should lightweight foams be used as a sealant behind weathering protection.

Further Acoustic Works

This report has examined the external noise incident on the building and calculated internal noise levels based on the proposed building envelope.

So as to meet the requirements of the building regulations, Approved Document E, it is recommended that an assessment of the sound insulation of the internal separating walls and floors be completed.

6.0 CONCLUSION

At the request of Mr. Alan Hegarty, an acoustic assessment has been conducted at the proposed residential development at 110 Tib Street, Manchester.

As per the request of Manchester City Council, measurements have been made over a typical weekend night-time period. This has been considered in order to quantify incident levels of noise on the proposed façade, given the development's inner city location and it's proximity to a number of late-night bars.

It has been found that the development is subject to Noise Exposure Categories (NECs) 'B and 'C' and is due to a variety of noise sources, however, road and noise from by passing pedestrians present the loudest noise sources in the area.

Using measured data, 'break-in' internal noise levels have been calculated within the development. It has been shown that throughout the development, the 'reasonable' resting criteria as stated in BS 8233 'Sound insulation and noise reduction for buildings – Code of practice' can be achieved. It should be noted that in order to meet this criteria, the guidance on noise mitigation measures within this report should be adhered to.

FIGURE 1

This drawing, the works & concepts depicted are copyright & may not be reproduced or made use of, either directly or indirectly without the express written consent of the Architect. Do not scale from this drawing. All heights, levels, sizes & dimensions to be checked on site before any work is put in hand.



Rev 0

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Drawing Number: L(80)001 Rev: -

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CALCULATION SHEETS

Octave Band Composite SRI Break In Sheet

INPUT DATA

Project: 110 Tib Street
Room: Flat 2, Bedroom 1

SA Wall	5.5
SA Glazing	3.6
No of vents	1
Room Volume	22 8
Room RT	0.5

	Ref	Description
Wall	**26**	102mm brick, 100mm cavity, 100mm block 1 x 12.5mm p'd, 100mm insulation plus board on dab
Glazing	**15**	10/12/6
Vent	**3**	Fresh AL-dB 450
Source type	**1**	Free field point source

Frequency (Hz)	*32*	*63*	*125*	*250*	*500*	*1000*	*2000*	*4000*	*8000*
Average Noise Level (dB)	65.0	68.9	61.5	57.7	57.6	61.0	55.8	45.8	36.0
Max Noise Level (dB)	89.7	92.9	79.8	73.0	80.0	83.3	78.4	70.4	59.0

SRI DATA

Total Facade Area	9.1	Effective Façade Area	19.1

Frequency (Hz)	*32*	*63*	*125*	*250*	*500*	*1000*	*2000*	*4000*	*8000*
SRI wall	35	41	44	42	46	54	62	68	70
SRI Glazing	14	20	26	27	34	40	38	46	46
D_{ne} Vent	28	34	45	44	36	40	42	55	55
T_{wall} X S_{wall}	0.002	0.000	0.000	0.000	0.000	0 000	0.000	0.000	0.000
$T_{glazing}$ X $S_{glazing}$	0.143	0.036	0.009	0.007	0.001	0.000	0.001	0.000	0.000
T_{vent} X $S_{eff\text{-}vent}$	0.016	0.004	0.000	0.000	0.003	0.001	0.001	0.000	0.000
Composite T	0.008	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Composite SRI (dB)	21	27	33	34	37	41	42	52	52

BREAK IN CALCULATIONS

Frequency (Hz)	*32*	*63*	*125*	*250*	*500*	*1000*	*2000*	*4000*	*8000*
External Noise Level (dB)	65	69	62	58	58	61	56	46	36
Max External Level (dB)	90	93	80	73	80	83	78	70	59
Composite SRI	21	27	33	34	37	41	42	52	52
Surface Area Correction	13	13	13	13	13	13	13	13	13
Absorption Correction	9	9	9	9	9	9	9	9	9
Source type correction	6	6	6	6	6	6	6	6	6
Max level source correction	6	6	6	6	6	6	6	6	6

RESULTS

Frequency (Hz)	*32*	*63*	*125*	*250*	*500*	*1000*	*2000*	*4000*	*8000*
Internal Noise Level (dB)	54	52	39	34	31	30	24	4	-6
A weighted	15	26	23	25	28	30	25	5	-7

Octave Band Composite SRI Break In Sheet

INPUT DATA

Project: 110 Tib Street, Manchester
Room: Flat 4, Bedroom 1

Distance Correction -3 dB

SA Wall	5 5
SA Glazing	3.6
No of vents	1
Room Volume	22.8
Room RT	0 5

	Ref	Description							
Wall	**26**	102mm brick, 100mm cavity, 100mm block 1 x 12.5mm p'd, 100mm insulation plus board on dab							
Glazing	**16**	10/12/6.4 pvb							
Vent	**3**	Fresh AL-dB 450							
Source type	**1**	Free field point source							
Original SPL 1st floor	**65**	**69**	**62**	**58**	**58**	**61**	**56**	**46**	**36**
Corrected Level - 2nd Floor	**62.3**	**66.2**	**58.8**	**55.0**	**54.9**	**58.3**	**53.1**	**43.1**	**33.3**
Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Average Noise Level (dB)	62.3	66.2	58.8	55.0	54.9	58.3	53.1	43.1	33.3
Max Noise Level (dB)	89.7	92.9	79.8	73.0	80.0	83.3	78 4	70.4	59.0

SRI DATA

Total Facade Area	9.1	Effective Façade Area	19.1

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
SRI wall	35	41	44	42	46	54	62	68	70
SRI Glazing	15	21	27	29	36	41	42	52	52
D_{ne} Vent	28	34	45	44	36	40	42	55	55
T_{wall} X S_{wall}	0 002	0.000	0 000	0.000	0.000	0.000	0.000	0 000	0.000
$T_{glazing}$ X $S_{glazing}$	0.114	0.029	0.007	0.005	0.001	0.000	0.000	0 000	0.000
T_{vent} X $S_{eff\text{-}vent}$	0 016	0.004	0 000	0.000	0.003	0.001	0.001	0 000	0.000
Composite T	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0 000	0.000
Composite SRI (dB)	22	28	34	36	37	42	43	55	55

BREAK IN CALCULATIONS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
External Noise Level (dB)	62	66	59	55	55	58	53	43	33
Max External Level (dB)	90	93	80	73	80	83	78	70	59
Composite SRI	22	28	34	36	37	42	43	55	55
Surface Area Correction	13	13	13	13	13	13	13	13	13
Absorption Correction	9	9	9	9	9	9	9	9	9
Source type correction	6	6	6	6	6	6	6	6	6
Max level source correction	6	6	6	6	6	6	6	6	6

RESULTS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Internal Noise Level (dB)	51	49	35	30	28	27	20	-2	-12
A weighted	11	23	19	21	25	27	21	-1	-13

Octave Band Composite SRI Break In Sheet

INPUT DATA

Project: 110 Ti
Room: Flat 6 (upper) Bedroom 2

Distance Correction -6 dB

SA Wall	17.8
SA Glazing	1.5
No of vents	1
Room Volume	50 1
Room RT	0 5

	Ref	Description							
Wall	**19**	1 layer 18mm Euroform Versapanel 150mm stud 50mm 10kg/m3 insulation 12.5mm soundblock							
Glazing	**16**	10/12/6.4 pvb							
Vent	**3**	Fresh AL-dB 450							
Source type	**1**	Free field point source							
Original SPL 1st floor	**65**	**69**	**62**	**58**	**58**	**61**	**56**	**46**	**36**
Corrected Level - 2nd Floor	**59.5**	**63.3**	**56.0**	**52.1**	**52.0**	**55.5**	**50.2**	**40.3**	**30.5**
Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Average Noise Level (dB)	59.5	63.3	56.0	52.1	52.0	55.5	50.2	40.3	30.5
Max Noise Level (dB)	89.7	92.9	79.8	73.0	80.0	83.3	78.4	70.4	59.0

SRI DATA

Total Facade Area	19.3	Effective Façade Area	29.3

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
SRI wall	13	19	31	38	43	47	42	47	47
SRI Glazing	15	21	27	29	36	41	42	52	52
D_{ne} Vent	28	34	45	44	36	40	42	55	55
T_{wall} X S_{wall}	0.890	0.223	0.014	0.003	0.001	0.000	0.001	0.000	0.000
$T_{glazing}$ X $S_{glazing}$	0.047	0.012	0.003	0.002	0.000	0.000	0.000	0.000	0.000
T_{vent} X $S_{eff\text{-}vent}$	0.016	0.004	0.000	0.000	0.003	0.001	0.001	0.000	0.000
Composite T	0.033	0.008	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Composite SRI (dB)	15	21	32	38	39	43	42	49	49

BREAK IN CALCULATIONS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
External Noise Level (dB)	59	63	56	52	52	55	50	40	30
Max External Level (dB)	90	93	80	73	80	83	78	70	59
Composite SRI	15	21	32	38	39	43	42	49	49
Surface Area Correction	15	15	15	15	15	15	15	15	15
Absorption Correction	12	12	12	12	12	12	12	12	12
Source type correction	6	6	6	6	6	6	6	6	6
Max level source correction	6	6	6	6	6	6	6	6	6

RESULTS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Internal Noise Level (dB)	53	51	32	23	22	21	17	0	-10
A weighted	14	25	16	15	19	21	18	1	-11

Octave Band Composite SRI Break In Sheet

INPUT DATA

Project: 110 Tib Street, Manchester
Room: Typical Rear Facing Bedroom

Screening Correction -10 dB

SA Wall	5.5
SA Glazing	3.6
No of vents	1
Room Volume	22.8
Room RT	0.5

	Ref	Description							
Wall	**26**	102mm brick, 100mm cavity, 100mm block 1 x 12.5mm p'd, 100mm insulation plus board on dab:							
Glazing	**11**	4/12/4							
Vent	**5**	Titon Trimvent 4000							
Source type	**1**	Free field point source							
Original SPL 1st floor	**65**	**69**	**62**	**58**	**58**	**61**	**56**	**46**	**36**
Corrected Level - Rear Façade	**55.0**	**58.9**	**51.5**	**47.7**	**47.6**	**51.0**	**45.8**	**35.8**	**26.0**
Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Average Noise Level (dB)	55.0	58.9	51.5	47.7	47.6	51.0	45.8	35.8	26.0
Max Noise Level (dB)	89.7	92.9	79.8	73.0	80.0	83.3	78.4	70.4	59.0

SRI DATA

Total Facade Area	9 1	Effective Façade Area	19.1

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
SRI wall	35	41	44	42	46	54	62	68	70
SRI Glazing	12	18	24	20	25	23	29	35	35
D_{ne} Vent	26	32	32	37	37	36	36	35	40
T_{wall} X S_{wall}	0 002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$T_{glazing}$ X $S_{glazing}$	0 227	0.057	0.014	0.036	0.011	0.018	0.005	0.001	0.001
T_{vent} X $S_{eff\text{-}vent}$	0.028	0.007	0.006	0.002	0.002	0.002	0.002	0.003	0.001
Composite T	0.013	0.003	0.001	0.002	0.001	0.001	0.000	0.000	0.000
Composite SRI (dB)	19	25	30	27	32	30	34	36	40

BREAK IN CALCULATIONS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
External Noise Level (dB)	55	59	52	48	48	51	46	36	26
Max External Level (dB)	90	93	80	73	80	83	78	70	59
Composite SRI	19	25	30	27	32	30	34	36	40
Surface Area Correction	13	13	13	13	13	13	13	13	13
Absorption Correction	9	9	9	9	9	9	9	9	9
Source type correction	6	6	6	6	6	6	6	6	6
Max level source correction	6	6	6	6	6	6	6	6	6

RESULTS

Frequency (Hz)	***32***	***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***
Internal Noise Level (dB)	46	44	32	31	26	31	22	10	-3
A weighted	7	18	16	22	23	31	23	11	-4

APPENDIX 1

DEFINITION OF ACOUSTIC TERMS

Definition of Acoustic Terms (Environmental)

The decibel

This is the basic unit of noise, denoted dB

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max}, dB L_{Amax}, etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.