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ACOUSTIC CONSULTANTS

DEVELOPMENT AT UNITY STREET, BRISTOL

BUILDING ENVELOPE ACOUSTIC ASSESSMENT

REPORT REFERENCE NO. J003251-4769-ECE-01

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Details of Assessment	
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Issue	Date	Author	Remark	Status
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1.0 SUMMARY

1.1 PDA have been commissioned by Watkin Jones Group to carry out an assessment of the building envelope and external noise ingress for the proposed student residential accommodation scheme at Unity Street, Bristol.

1.2 Typical daytime and night-time ambient noise levels have been taken from the Noise Impact Assessment Report previously prepared by Acoustic Consultants Ltd (Ref: 7379/PR dated March 2019) for this site. In addition it is noted that these measurements have been supplemented by measurements reported within the Cole Jarman Planning Acoustic Report (Ref: 15/0476/R1 dated 11 December 2015) for the adjacent development located between Unity Street and Jacob Street.

1.3 The results of the surveys were used to evaluate the sound insulation of the respective building envelopes of the residential accommodation and to assess compliance with the guidance contained within BS8233:2014 “Guidance on sound insulation and noise reduction for buildings” and WHO Guidelines for Community Noise. These assessments have demonstrated that utilising the window and ventilation specification recommended within this report the internal ambient noise levels comply with the design criterion.

1.4 We would therefore consider that the site will be suitable for the proposed residential use based upon the measured noise levels experienced and the proposed mitigation measures detailed within this report.

2.0 DEVELOPMENT DESCRIPTION

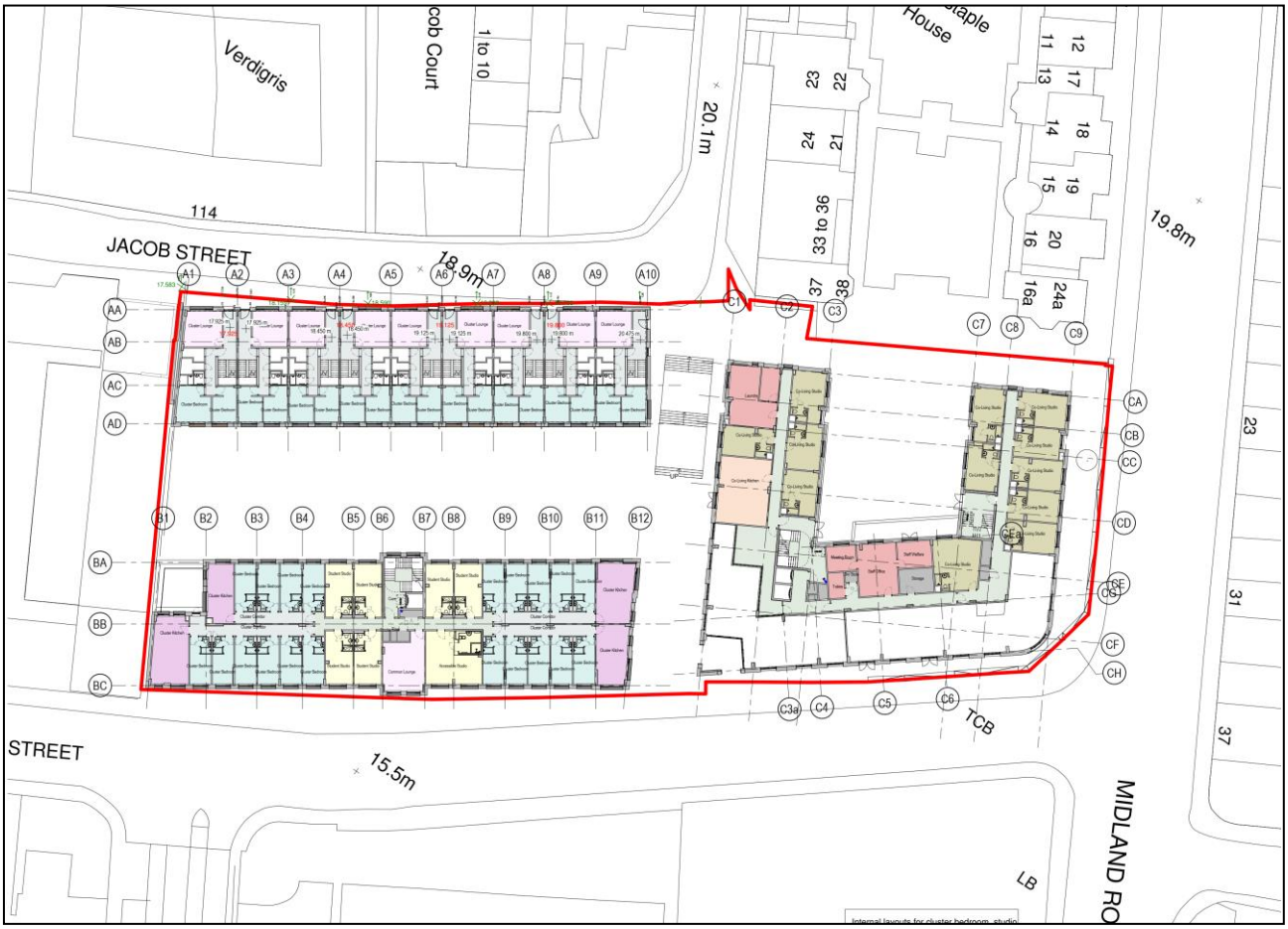
2.1 The proposals are for a student accommodation scheme with approximately 102 co-living studios, 189 student bedrooms and 525 sqm of co-working/employment floorspace alongside associated cycle and refuse storage, plant equipment and car parking. The scheme will be arranged in three blocks up to 5 storey height.

2.2 The site is bounded to the north by Jacob Street, to the south of the site is Unity Street, to the East is Midland Road and to the West are existing residential properties. The surrounding area is predominantly residential with a car park to the south of the site.

2.3 Please refer to Figure 1 and Figure 2 below which details the existing site layout and the proposed site layout respectively.

Figure 1. Existing Site Layout

Figure 2. Proposed Site Layout



3.0 ASSESSMENT CRITERIA

Planning Condition 24

3.1 Detailed within the planning approval for the Application No. 19/01690/F condition 24 references the requirements for external noise. Condition 24 states the following:

All recommendation detailed in Section 6 of the submitted Noise Assessment (Acoustic Consultants Limited March 2019) with regards to sound insulation and ventilation shall be implemented in full prior to the commencement of the use permitted and be permanently maintained.

3.2 It is noted that the Acoustic Consultants Limited report references the noise limits described within BS8233:2014 and WHO Guidelines for Community Noise 1999.

BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

3.3 British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 1. BS8233 Recommended Indoor Ambient Noise Levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 $L_{Aeq,16hour}$	–
Dining	Dining room/area	40 $L_{Aeq,16hour}$	–
Sleeping (daytime resting)	Bedrooms	35 $L_{Aeq,16hour}$	30 $L_{Aeq,8hour}$

3.4 It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

3.5 In addition, BS 8233 suggests, '*regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values'.*

3.6 As well as a criteria for acceptable internal noise levels BS 8233 also suggests that for private external spaces such as gardens or balconies, it is desirable that the noise level does not exceed 50db $L_{Aeq,T}$ with an upper limit of 55dB $L_{Aeq,T}$ during the daytime.

3.7 BS8233:2014 stated that the Building Regulations' supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used. However, it is advised that windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

WHO Guidelines for Community Noise

3.8 In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following noise levels are applicable to residential dwellings.

Table 2. WHO Guidelines for Community Noise Criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours) *
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night-time	30	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

3.9 The WHO Guidelines state that, "it is recommended that $L_{Aeq,T}$ be used to evaluate more-or-less continuous environmental noises. Where the noise is principally composed of a small number of discrete events, the additional use of L_{Amax} or SEL is recommended."

3.10 The WHO Guidelines also state that for a good sleep, the indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10 – 15 times a night.

4.0 SURVEY DETAILS

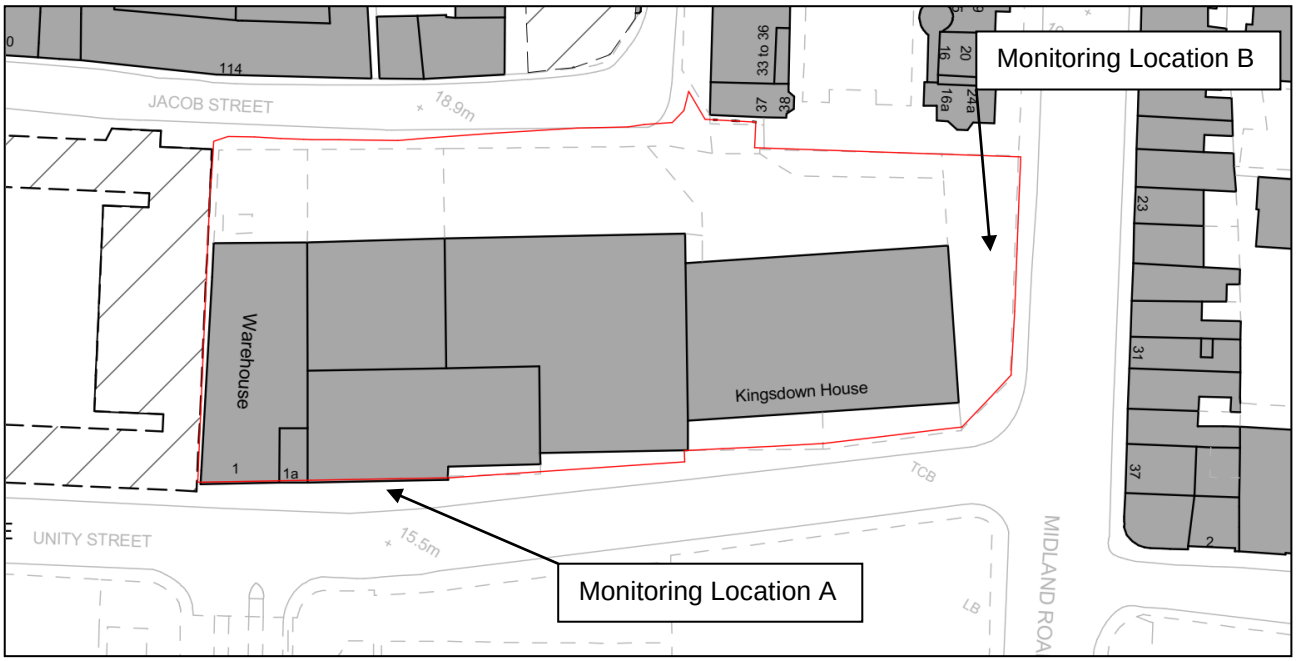
Acoustic measurement undertaken by Acoustic Consultants Ltd

4.1 It is noted that for the planning application for this scheme measurements were undertaken by Acoustic Consultants Ltd (Ref: 7379/PR Rev. A dated 26 March 2019).

4.2 Measurements were undertaken between 28th August 2018 – 30th August 2018 in order to measure road traffic along Unity Street. An additional set of measurements were undertaken between the 30th August 2018 – 31st August 2018 in order to measure road traffic along Midland Road.

4.3 The measurement locations were detailed as follows:

Figure 3. Acoustic Consultants Ltd Measurement Locations



4.4 Based upon these measurements the Acoustic Consultants Ltd report provides the following summary measurements:

Table 3. Octave Band Noise Levels (free-field level) at Monitoring Location A

Period	dB in Octave Band Centre Frequencies (Hz)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Daytime ($L_{eq\ 16hrs}$) (1)	69	63	60	58	59	56	52	45	63
Night Time ($L_{eq\ 16hrs}$) (1)	59	52	50	49	52	48	42	36	55
Night Time ($L_{max\ fast}$) (2)	77	70	72	71	74	72	70	63	78

Notes:
1. It is noted that the measurements were undertaken over a two consecutive days. The report does not reference which part of the survey the results refer to and it has been assumed that these are the worst case daytime and night time measurements.
2. The report describes this as the 10th Highest maximum noise level. As described within note 1 above it has been assumed that this is based upon the worst case night measurement.

Table 4. Octave Band Noise Levels (free-field level) at Monitoring Location B

Period	dB in Octave Band Centre Frequencies (Hz)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Daytime ($L_{eq\ 16hrs}$)	70	69	62	58	55	57	52	46	60
Night Time ($L_{eq\ 16hrs}$)	60	61	55	51	49	52	47	39	57(1)
Night Time ($L_{max\ fast}$) (2)	74	73	74	72	70	66	59	50	74

Notes:
1. This result is reported as 55dB(A) within the Acoustic Consultants Ltd report, however based upon the octave band data we have calculated that this should be 57dB(A).
2. The report describes this as the 10th Highest maximum noise level.

4.5 It is noted that no measurements have been provided to the rear of the site. The report indicates that the rear of the site is considered suitable shielded from noise to reduce the requirement for noise control measures. However as no further measurements have been undertaken at these shielded locations the report does not confirm the level at the rear of the site.

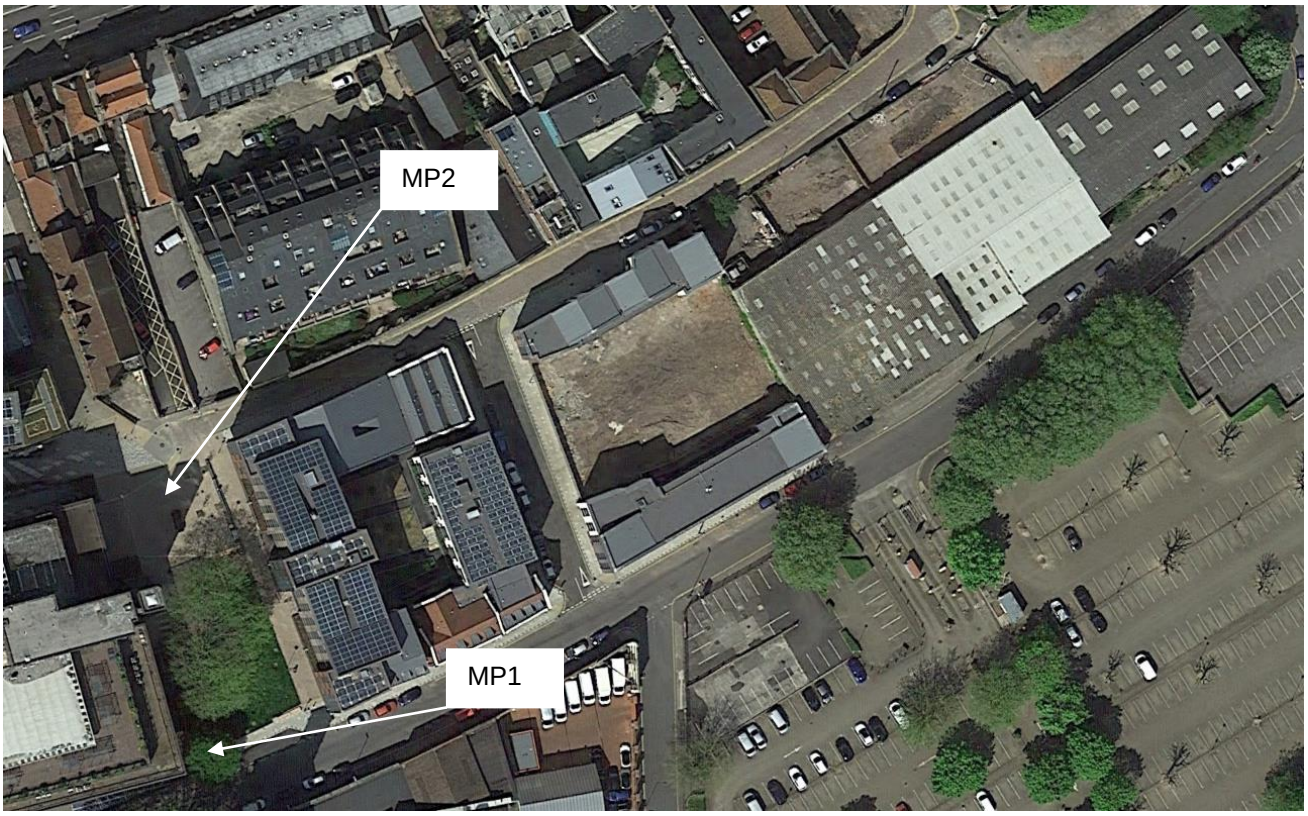
Acoustic Measurements undertaken by Cole Jarman Limited

4.6 It is noted that as part of the planning application for the adjacent site (application ref: 15/06483/F) an acoustic report was prepared by Cole Jarman Limited (Ref: 15/0476/R1). Within this report numerous measurements were undertaken and this included measurements off Jacob Street.

4.7 The long term measurements were undertaken adjacent to Unity Street and adjacent to Jacob Street. The measurements were undertaken between Thursday 17th September 2015 – Monday 21st September 2015.

4.8 The measurements were located as indicated within the following figure:

Figure 4. Cole Jarman Measurement Locations



4.9 Based upon these measurements the Cole Jarman report provides the following summary measurements:

Figure 5. Cole Jarman Measurement Summary

Location	Daytime(0700-2300)	Night time (2300-0700)	
	$L_{Aeq, 16h}$	$L_{Aeq,8h}$	$L_{Amax,fast}$[1]
MP1	62	56	72
MP2	56	51	63

Notes:
1. The report describes this as being based upon the 10-15 highest maximum noise level over the night period.

4.10 It is noted that the report indicates that the Daytime L_{Aeq} values measured over the weekend were significantly lower than those recorded during the weekdays at both positions and have been excluded from the averages presented within the report.

4.11 It is noted that the Cole Jarman Limited report does provide some details regarding the octave band at MP2 at night, however the data is incomplete as it is only reported up to 500Hz. It is noted that the levels were described in relation to Music Noise Level from The Exchange. The measurements suggest that low frequency noise was slightly elevated on a Saturday night than during the same period on the Friday night. However it is noted also that the music from The Exchange was only just perceivable in audio recordings to a trained ear.

4.12 It is noted that The Exchange is significantly further from the proposed scheme than the measurements at MP2 and would therefore have reduced noise levels. We have therefore based our assessment on the reported octave band measurements on the Friday night which were not impacted by the music noise.

External Noise Level Assessment

4.13 Therefore based upon these survey results we have utilised the Acoustic Consultants Ltd measurements for the facades of the proposed scheme adjacent to Unity Street and Midland Road and the Cole Jarman Limited report for the facades shielded from these roads.

4.14 The Acoustic Consultants Ltd have provided full details of octave band spectrum, however the Cole Jarman Ltd report only provides these measurements of the night L_{Aeq} up to 500Hz. We have therefore utilised this data and normalised the higher frequency octave bands derived from the Unity Street measurements from the Acoustic Consultant Ltd Report. This has also been normalised to correspond with the Day L_{Aeq}. For the night $L_{max,fast}$ we have utilised the octave band spectrum provided at Unity Street measurements from the Acoustic Consultant Ltd report and normalised this to correspond to the broadband $L_{Amax,fast}$ level report within the Cole Jarman Ltd report.

4.15 The derived noise levels at shielded facades are detailed as follows:

Table 6. Octave Band Noise Levels (free-field level) at Shielded Facades based upon Cole Jarman Ltd Report with derived spectrum.

Period	dB in Octave Band Centre Frequencies (Hz)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Daytime ($L_{eq\ 16hrs}$)	63	59	56	53	52	48	42	36	56
Night Time ($L_{eq\ 16hrs}$)	58	54	51	48	47	43	37	31	51
Night Time ($L_{max\ fast}$)	62	55	57	56	59	57	55	48	63

5.0 NOISE MITIGATION MEASURES

Internal Ambient Noise Levels

5.1 Utilising the calculated noise levels incident on the façade as described within Section 4, the sound ingress into the habitable rooms has been predicted by determining the sound insulation properties of the building envelope.

5.2 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.

5.3 Our calculations have indicated that the minimum requirements are detailed within Figure 5 and Table 9 below:

Figure 5. Block A Building Envelope Requirements

Table 7. Sound insulation requirements

Plots	Room	Minimum Glazing Requirement R_w dB	Minimum ventilator rating $D_{n,e,w}$	Internal Noise Target Level dB (Day L_{Aeq} / Night L_{Aeq} / Night L_{Amax})	Calculated Internal Noise Level dB (Day L_{Aeq} / Night L_{Aeq} / Night L_{Amax})
	All rooms	37	44	35 / 30 / 45	34 / 26 / 43
	All rooms	31	31	35 / 30 / 45	33 / 28 / 38

Design Assumptions

5.4 Assessment and specification of the acoustic performance of the building envelope, has been undertaken based on achieving the internal ambient acoustic conditions, highlighted in Section 3 above.

5.5 Information on the sound insulation properties for specific element details has either been sourced from manufacturer's literature or from Insul® Sound insulation prediction software.

5.6 In accordance with the reverberation time standardisation detailed within ISO 140-4 the reverberation time within residential habitable rooms have been assumed as 0.5 seconds.

5.7 The room and façade dimensions have been scaled from the following drawings prepared by Tim Groom Architects:

1074-TGA-XX-LG-DR-A-0300
1074-TGA-XX-UG-DR-A-0301
1074-TGA-XX-01-DR-A-0302
1074-TGA-XX-02-DR-A-0303

1074-TGA-XX-03-DR-A-0304
1074-TGA-XX-04-DR-A-0305
1074-TGA-XX-ZZ-DR-A-0510
1074-TGA-XX-ZZ-DR-A-0511
1074-TGA-XX-ZZ-DR-A-0512
1074-TGA-XX-ZZ-DR-A-0530
1074-TGA-XX-ZZ-DR-A-0531
1074-TGA-XX-ZZ-DR-A-0532
1074-TGA-XX-ZZ-DR-A-0550
1074-TGA-XX-ZZ-DR-A-0551
1074-TGA-XX-ZZ-DR-A-0552
1074-TGA-XX-ZZ-DR-A-0553
1074-TGA-XX-ZZ-DR-A-0554

External Façade Specification

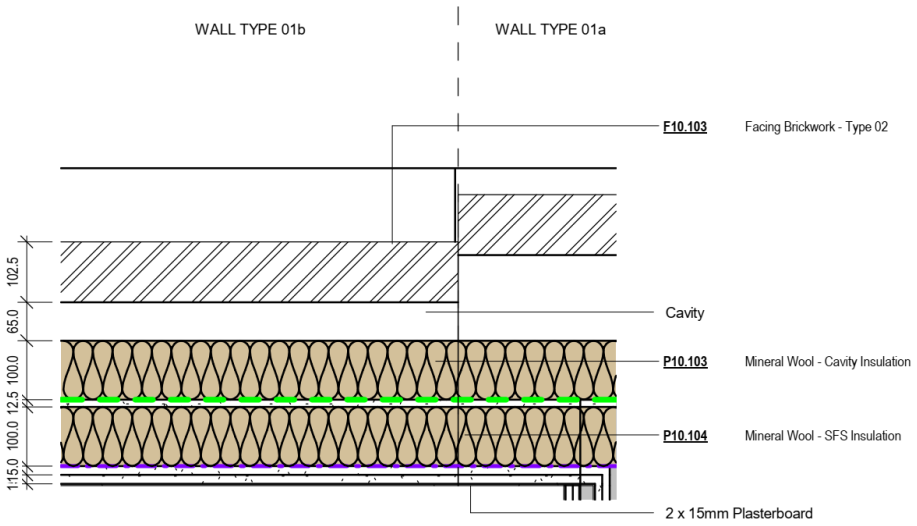
5.8 It will need to be ensured the following minimum sound insulation values are achieved. The elevation drawings suggest that there are two main external wall types, brick elevations and zinc cladding panels. The construction of these has been estimated as follows:

Masonry Construction:

100mm Brick outer leaf, cavity (min 65mm), 100mm mineral wool type insulation, 12mm sheathing board (recommend a minimum density of 1050 kg/m^3), 100mm SFS stud with mineral wool insulation within the cavity, 2 x 15mm plasterboard (assumed to be standard wallboard).

Typical drawing showing this construction is as follows:

Figure 6. Masonry Construction



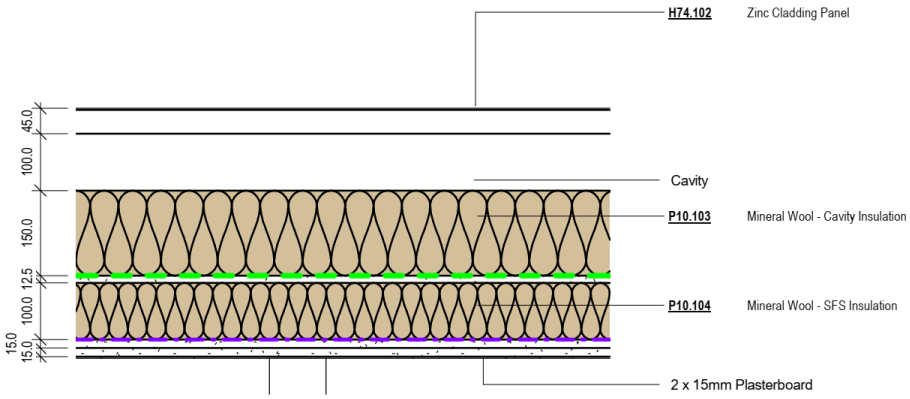
Metal Cladding Construction:

Zinc cladding panels (assumed to be 0.6mm thick), 100mm cavity, 150mm mineral wool type insulation, 12mm sheathing board (recommend a minimum density of 1050 kg/m^3), 100mm SFS stud with mineral wool insulation within the cavity, 2 x 15mm plasterboard (assumed to be standard wallboard).

Typical drawing showing this construction is as follows:

Figure 7. Metal Cladding Construction

5.9



5.10 We would estimate the performance of the external as follows:

Table 8. External Wall Acoustic Properties

Façade Element	Octave Band (Hz) Sound Insulation, R (dB)							R_w
	63	125	250	500	1000	2000	4000	
Metal Cladding	16	39	51	56	60	61	64	59
Brick	43	51	52	61	66	69	71	64

Glazing Specification

5.11 It must be ensured that the acoustic performance of the window frames matches the performance of the glazing that is fitted within them. Glazing framing systems must be fully sealed with any small gaps (<10mm nominal) around perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic. No gaps should be left unsealed, and in no instance should lightweight foams be used as a sealant behind weathering protection without additional acoustically suitable sealant.

5.12 Minimum performance requirements for the combination of glazing and framing recommended in the above tables are as follows:

Table 9. Window Acoustic Properties

Octave Band (Hz) Sound Insulation, R (dB)							R_w	Typical Construction
63	125	250	500	1000	2000	4000		
23	28	26	34	40	39	45	37	10mm glass, 12mm space, 6mm glass
16	22	19	25	36	42	36	31	4mm glass, 12mm space, 4mm glass

Ventilation Requirements

5.13 The ventilator requirements described Table 9 are predicted to have adequate sound insulation to maintain the required internal noise level. It will need to be ensured that the trickle vents selected achieve following minimum sound insulation requirements:

Table 10. Ventilator Acoustic Properties

Octave Band (Hz) Sound Insulation, D (dB)							$D_{n,e,w}$	Example Vent
63	125	250	500	1000	2000	4000		
30	37	37	36	47	49	55	44	Titon SFX V75 / SFSA
32	36	33	33	31	29	31	31	RW Simon Framevent

5.14 It is noted that our calculations have assumed that there would be two trickle vents within the Living / Kitchen / Dining and a one trickle vent within the Bedrooms / Studios.

5.15 In addition please note that in accordance with the guidance contained within BS8233:2014, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

6.0 CONCLUSION

6.1 PDA have been commissioned by Watkin Jones to carry out a noise impact assessment and building envelope assessment at the proposed student accommodation development on Unity Street, Bristol.

6.2 This assessment has been based upon previous noise measurements undertaken by Acoustic Consultants Ltd that have been undertaken on the site. These measurements were supplemented by noise measurements undertaken by Cole Jarman from the adjacent site.

6.3 Based upon these measurements we have calculated the noise ingress into habitable rooms. This has been based upon the current room layout and elevation drawings for the site and the acoustic performance of the building envelope.

6.4 With the proposed building envelope construction details described within this report, the predicted internal noise level due to the external noise sources have demonstrated compliance with the internal noise limits derived from BS8233:2014 and WHO Guidelines for Community Noise 1999.

APPENDIX A – DEFINITION OF ACOUSTIC TERMS

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.

APPENDIX B – CALCULATION RESULTS

Project	Unity Street
Calculation Details	Noise Ingress Calculations

Calculation:	**Cluster Bedroom Facing Unity Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	43	47	51	55	59	57	53	44
Night External Noise Level LAeq, [dB]		55	33	36	41	46	52	49	43	35
Night External Noise Level LAmax, [dB]		78	51	54	63	68	74	73	71	62
Surface Areas [m^2]:		Wall:	1.9	Win:	3.9	Roof:	0	Vents:	1	
		Other 1	0	Other 2	0					
Room Volume [m^3]:		26	Reverberation [S]:			0.5				
Composite SRI [dB]:			23.2	32.4	31.3	35.8	44.3	44.1	50.4	51.7
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**31**	25	20	26	25	21	19	8	-2
Night Internal Noise Level LAeq, [dB]		**22**	15	9	16	16	14	11	-2	-11
Night Internal Noise Level LAmax, [dB]		**43**	33	27	38	38	36	35	26	16

Calculation:	**Cluster Kitchen Facing Unity Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	43	47	51	55	59	57	53	44
Night External Noise Level LAeq, [dB]		55	33	36	41	46	52	49	43	35
Night External Noise Level LAmax, [dB]		78	51	54	63	68	74	73	71	62
Surface Areas [m^2]:		Wall:	11.2	Win:	12.8	Roof:	0	Vents:	2	
		Other 1	0	Other 2	0					
Room Volume [m^3]:		58	Reverberation [S]:			0.5				
Composite SRI [dB]:			20.8	32.0	30.9	36.3	44.2	43.8	50.1	51.1
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**33**	29	22	27	25	22	20	10	0
Night Internal Noise Level LAeq, [dB]		**24**	19	11	17	16	15	12	0	-9
Night Internal Noise Level LAmax, [dB]		**45**	37	29	39	38	37	36	28	18

Project	Unity Street									
Calculation Details	Noise Ingress Calculations									
Calculation:	**Co Living Studio Facing Unity Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	43	47	51	55	59	57	53	44
Night External Noise Level LAeq, [dB]		55	33	36	41	46	52	49	43	35
Night External Noise Level LAmax, [dB]		78	51	54	63	68	74	73	71	62
Surface Areas [m^2]:		Wall:	4.0	Win:	4.4	Roof:	0	Vents:	1	
		Other 1:	0	Other 2:	0					
Room Volume [m^3]:		39	Reverberation [S]:			0.5				
Composite SRI [dB]:			21.4	32.5	31.5	36.3	44.6	44.4	50.6	51.9
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**30**	26	19	25	23	19	17	7	-3
Night Internal Noise Level LAeq, [dB]		**21**	16	8	15	14	12	9	-3	-12
Night Internal Noise Level LAmax, [dB]		**42**	34	26	37	36	34	33	25	15
Calculation:	**Co Living Kitchen Facing Unity Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	43	47	51	55	59	57	53	44
Night External Noise Level LAeq, [dB]		55	33	36	41	46	52	49	43	35
Night External Noise Level LAmax, [dB]		78	51	54	63	68	74	73	71	62
Surface Areas [m^2]:		Wall:	26.7	Win:	15.5	Roof:	0	Vents:	2	
		Other 1:	0	Other 2:	0					
Room Volume [m^3]:		137	Reverberation [S]:			0.5				
Composite SRI [dB]:			19.1	32.5	31.6	37.4	45.0	44.6	50.8	51.8
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**31**	28	19	24	22	19	17	7	-3
Night Internal Noise Level LAeq, [dB]		**22**	18	8	14	13	12	9	-3	-12
Night Internal Noise Level LAmax, [dB]		**42**	36	26	36	35	34	33	25	15

Project	Unity Street									
Calculation Details	Noise Ingress Calculations									
Calculation:	**Co Living Studio Facing Midland Road**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	44	53	53	55	55	58	53	45
Night External Noise Level LAeq, [dB]		57	34	45	46	48	49	53	48	38
Night External Noise Level LAmax, [dB]		74	48	57	65	69	70	67	60	49
Surface Areas [m^2]:		Wall:	17.0	Win:	5.8	Roof:	0	Vents:	1	
		Other 1:	0	Other 2:	0					
Room Volume [m^3]:		45	Reverberation [S]:			0.5				
Composite SRI [dB]:			18.5	33.6	32.9	38.2	46.2	45.8	52.1	53.1
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**34**	32	26	27	23	15	19	8	-2
Night Internal Noise Level LAeq, [dB]		**26**	22	18	20	16	9	14	3	-9
Night Internal Noise Level LAmax, [dB]		**43**	36	30	39	37	30	28	15	2
Calculation:	**Co Living Kitchen Facing Midland Road**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	10/12/6	37	23	28	26	34	40	39	45	46
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	SFX V75 / SFSA	44	30	37	37	36	47	49	55	61
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		63	44	53	53	55	55	58	53	45
Night External Noise Level LAeq, [dB]		57	34	45	46	48	49	53	48	38
Night External Noise Level LAmax, [dB]		74	48	57	65	69	70	67	60	49
Surface Areas [m^2]:		Wall:	18.0	Win:	15.3	Roof:	0	Vents:	2	
		Other 1:	0	Other 2:	0					
Room Volume [m^3]:		123	Reverberation [S]:			0.5				
Composite SRI [dB]:			19.9	32.0	31.0	36.7	44.4	43.9	50.2	51.2
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**32**	28	25	27	22	15	19	7	-2
Night Internal Noise Level LAeq, [dB]		**24**	18	17	20	15	9	14	2	-9
Night Internal Noise Level LAmax, [dB]		**42**	32	29	39	36	30	28	14	2

Project	Unity Street									
Calculation Details	Noise Ingress Calculations									
Calculation:	**Cluster Bedroom Facing Jacob Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	4/12/4	31	16	22	19	25	36	42	36	35
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	Simon Framevent	31	32	36	33	33	31	29	31	36
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		56	37	43	47	50	52	49	43	35
Night External Noise Level LAeq, [dB]		51	32	38	42	45	47	44	38	30
Night External Noise Level LAmax, [dB]		63	36	39	48	53	59	58	56	47
Surface Areas [m^2]:		Wall:	2.7	Win:	4.0	Roof:	0	Vents:	1	
		Other 1	0	Other 2	0					
Room Volume [m^3]:		25	Reverberation [S]:			0.5				
Composite SRI [dB]:			19.8	28.1	25.2	30.0	32.4	30.8	33.0	36.7
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**33**	23	21	28	26	26	25	16	4
Night Internal Noise Level LAeq, [dB]		**28**	18	16	23	21	21	20	11	-1
Night Internal Noise Level LAmax, [dB]		**38**	22	17	29	29	33	34	29	16
Calculation:	**Co Living Kitchen Facing Jacob Street**									
Material Sound Insulation Performance										
Surface:	**Description**	**w**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Wall, [dB R]	Zinc Clad Walls	59	16	39	51	56	60	61	64	64
Window, [dB R]	4/12/4	31	16	22	19	25	36	42	36	35
Roof, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Ventilation, [dB $D_{n,e}$]	Simon Framevent	31	32	36	33	33	31	29	31	36
Other 1, [dB R]	N/A	0	0	0	0	0	0	0	0	0
Other 2, [dB R]	N/A	0	0	0	0	0	0	0	0	0
		dB L_A	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Day External Noise Level LAeq, [dB]		56	37	43	47	50	52	49	43	35
Night External Noise Level LAeq, [dB]		51	32	38	42	45	47	44	38	30
Night External Noise Level LAmax, [dB]		63	36	39	48	53	59	58	56	47
Surface Areas [m^2]:		Wall:	4.4	Win:	5.2	Roof:	0	Vents:	2	
		Other 1	0	Other 2	0					
Room Volume [m^3]:		40	Reverberation [S]:			0.5				
Composite SRI [dB]:			20.6	29.2	26.3	30.7	32.0	30.3	32.7	36.8
Other Attenuation Factors [dB]:			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Day Internal Noise Level LAeq, [dB]		**33**	23	20	28	26	27	26	17	5
Night Internal Noise Level LAeq, [dB]		**28**	18	15	23	21	22	21	12	0
Night Internal Noise Level LAmax, [dB]		**39**	22	16	29	29	34	35	30	17