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**GLAZING & CONSTRUCTION SPECIFICATION
ADDITIONAL APARTMENTS**

Barclay House,
53 Whitworth St West
Manchester M1 5NG

Client:
Mr Ka Fan

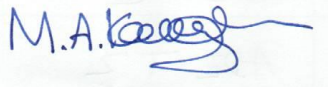
Report Date: 7th October 2020

Ref: 20201005 8016 Manchester ProPG-3.docx

Site Visit by: M A Kenyon

Site Visit date: 18th to 25th September 2017 & 18th to 21st September 2020

Prepared by: M A Kenyon MSc BSc MIOA



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1.0 INTRODUCTION

WSP UK Ltd, acting on behalf of their client Mr Ka Fan, instructed Martec Environmental Consultants Ltd to prepare an acoustic glazing and ventilation specification at Barclay House, 53 Whitworth St West, Manchester M1 5NG. This was in relation to a planning application to create additional residential units, firstly by converting the car parking space within the building and secondly by adding two storey rooftop extension to the building.

This report follows on from our earlier report which detailed the results of the external noise measurements [Ref.20170927 8016 Whitworth-1].

This report details the measurements taken on this site, briefly considers the requirements of current government guidance and makes recommendations for noise mitigation as necessary. Acoustic Terminology is set out at Appendix 1, the consultants' qualifications are at Appendix 2 with References at Appendix 3, and detailed noise prediction results at Appendix 4.

2.0 PROJECT BACKGROUND

The building is located close to the centre of Manchester and the front façade overlooks Whitworth Street West as well as the railway viaduct on

the western approaches to Manchester Oxford Road Station. The rear of the building is located on the Rochdale Canal towpath.

The front [south] façade is affected by both road traffic and railway noise, as are the side facades [west and east], the rear [north] façade is affected by more distant road traffic noise from the city centre.

There would be four duplex units located on the Ground Floor and Ground Floor Mezzanine levels; these would be at the rear of the building with three units with windows overlooking the Rochdale Canal, and one [G.14] with windows on the west façade screened from the canal towpath by a wall [See Figure 1 below]. The roof extension would consist of 9 duplex units, three on the front façade, two on each of the sides and two units are the rear of the building [See Figure 2 below].

This current assessment was undertaken during **coronavirus restrictions**, when the following noise sources are all lower than ‘usual’ by an unknown amount:

1. city-centre road traffic flows,
2. rail traffic flows
3. pedestrian footfall, both generally and in relation to the nighttime economy.

Given the above, it is considered that the previous measurements, made on site in 2017, are the best available information on ‘normal’ levels affecting the building.

Nevertheless, additional monitoring was conducted at the rear of the building from 18th to 21st September 2020 at the rear of the building to determine if noise from pedestrians on the towpath was likely to be an issue.

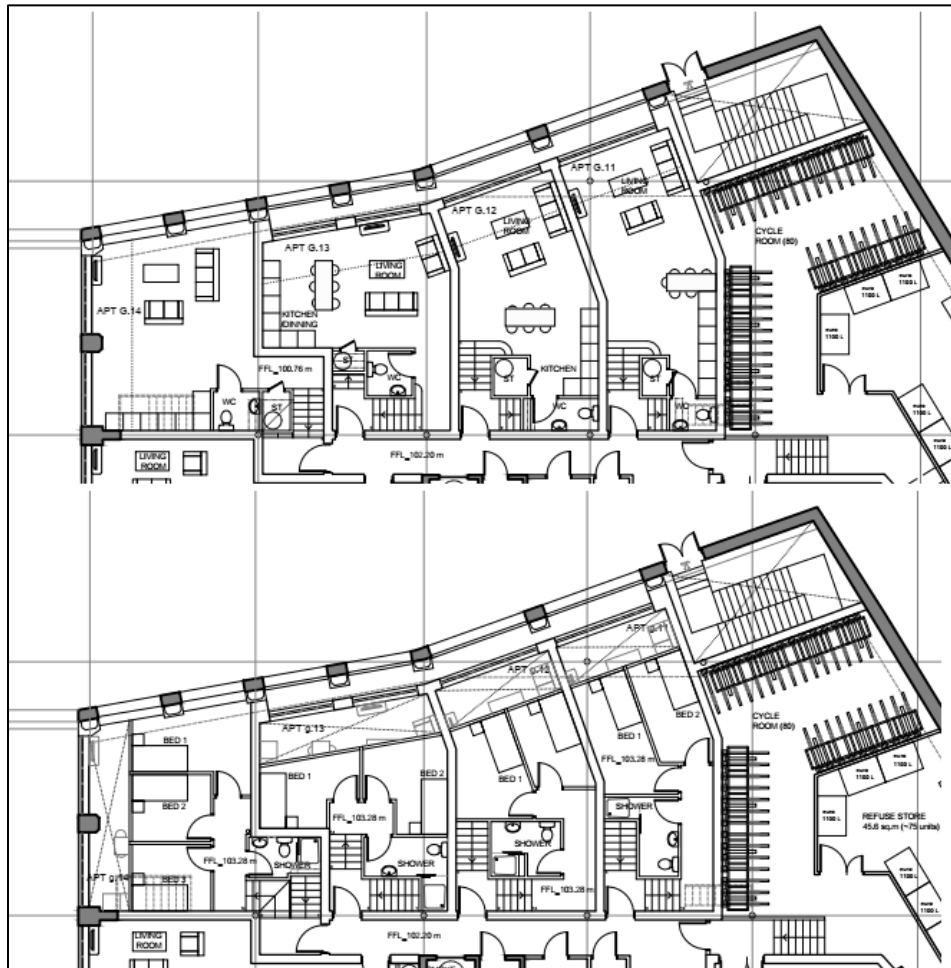


Figure 1: Lower Apartments [Ground Floor shown @ top - Mezzanine shown below] from 12,982M10B

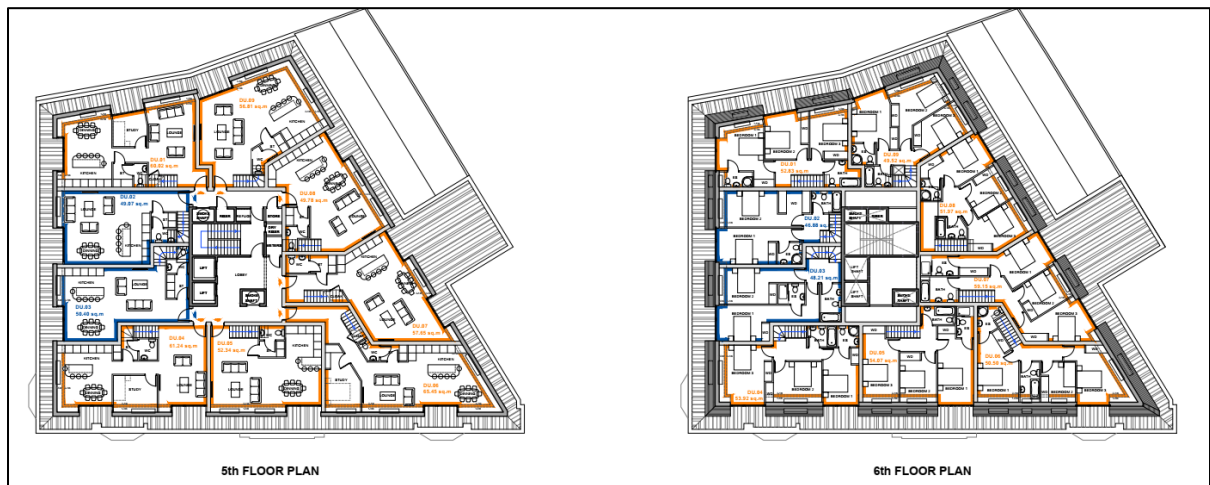


Figure 2: Upper Apartments from 12,982M05F

3.0 ASSESSMENT CRITERIA

Appropriate Criteria were considered in more detail in our earlier report [Ref.20170927 8016 Whitworth-1]. A brief summary follows.

The ProPG's [Ref.1] target noise levels are broadly as set out in BS8233:2014 [Ref. 2] with additional guidance on nighttime noise events based on World Health Organisation advice.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 LAeq,16hr	--
Dining	Dining Room/Area	40 LAeq,16hr	--
Sleeping (daytime resting)	Bedroom	35 LAeq,16hr	30 LAeq,8hr 45 LAm _{ax} ,F [1]

Table 1: ProPG - Target Internal Noise Levels

[1] Added from WHO and applies to 10th highest nighttime event.

The footnotes to this table make it clear that the guidance is based on the current WHO recommendations and that the above internal levels can be relaxed by 5dB to achieve “reasonable” internal conditions.

4.0 MEASUREMENTS

4.1 Previous Measurements

These measurements presented in more detail in our earlier report [Ref.20170927 8016 Whitworth-1]. Summary results are as shown in Table 2:

Location	Day LAeq,16hr	Night LAeq,8hr	Night LAm _{ax} ,F
Front of Building	65	64	85
Rear of Building	55	52	75

Table 2: Collated External Levels [dBA free field]

The measurements have been further analysed to provide spectra for the purposes of predictions as shown in Table 3 below. The spectra used for LA_{max} predictions is the log average of the nighttime LA01 results, the LA_{eq} is the average of the daytime and nighttime LA_{eq} results.

	Octave Band Centre Frequency [Hz]				
	125	250	500	1k	2k
LA _{max} - Front	74.2	73.9	71.9	73.3	69.3
LA _{eq} - Front	64.3	63.4	62.7	64.4	58.8
LA _{max} - Rear	63.3	60.9	58.0	60.2	56.2
LA _{eq} - Rear	50.9	54.2	58.9	62.1	62.3

Table 3: Calculation Spectra [dBA free field]

4.2 2020 Measurements

4.2.1 Methodology

It had been intended to monitor noise levels at a position representative of the windows of the proposed ground floor apartments at the rear of the building, in case significant noise was generated by persons on the towpath; however, the building is currently surrounded in scaffolding meaning that the best location was adjacent to the building [See Figures 1 and 2 below, 2014 photographs have been used so that the relationship between the measurement position and the building is clearer]; the measurement position had a representative 'view' of the towpath, but was also exposed to noise from the road and railway at the front of the

building.

The site was visited on Friday 18th September 2020 and instrumentation was installed, when construction works had ceased for the weekend; however, they had recommenced by the time the instrumentation was collected on Monday 21st September 2020.



Figure 3: 2014 Photo from Whitworth St West - 2020 Measurement Location

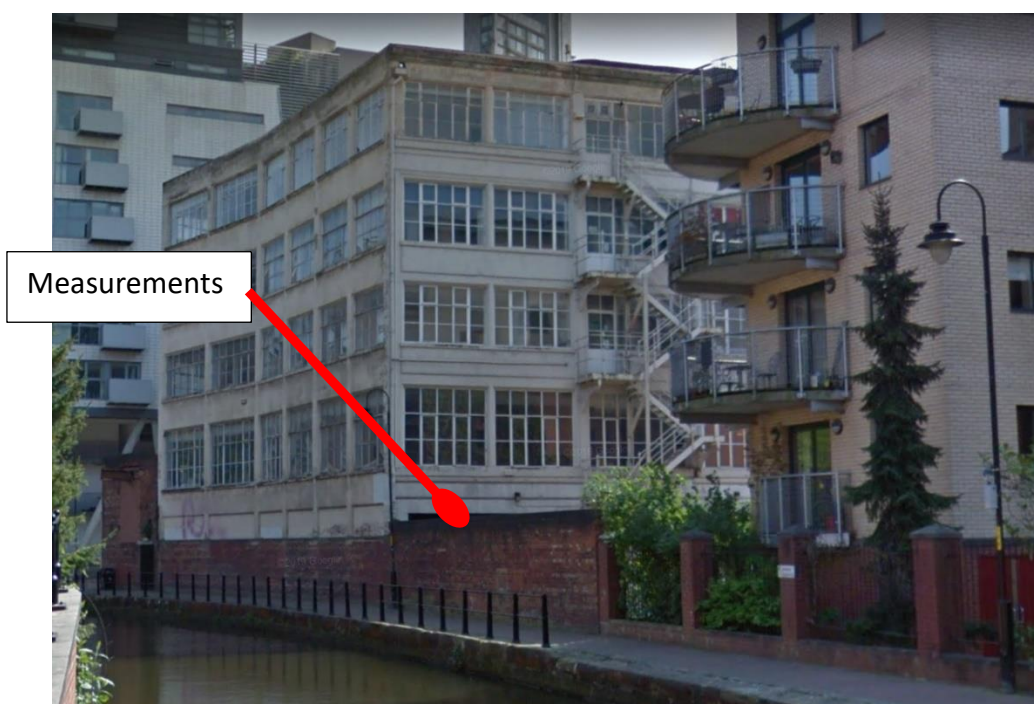


Figure 4: 2014 Photo from Opposite Towpath - 2020 Measurement Location

Model	Instrument	Serial No.	Lab Cal Certificate	Re-Calibration Due
E Svan 957	Sound Level Meter	23202	14012420-1	21/03/2021
Svan SV12L	Preamp	24264	14012420-1	21/03/2021
PCB 377B02	Microphone	LW135130	14012420-1	21/03/2021
RION NC74	Calibrator	34262041	14014839-4	20/02/2022

Table 4: Instrumentation used on site - 2020

The noise measurements were made with the meter mounted on a pole at a height of 3.4m above towpath ground height and fitted with a RION WS02 all-weather windmuff. The instrumentation calibrated correctly before and after measurements and had been laboratory calibrated in the preceding two years.

The meter was located in free field conditions. On installation the weather conditions were 50% cloud cover, a temperature around 15 degrees Centigrade and winds of Beaufort 2 to 3 from the west. Conditions were similar throughout the monitoring. It is not considered that these conditions would have significantly affected the measurements.

When the meter was removed on Monday 21st construction works had already commenced and would have affected the measurement results.

4.2.2 Results

The results have been processed to produce period results as shown in Table 2 below.

Period		Measured Levels			Derived Traffic	
Day	Date	Day LAeq,16hr	Night LAeq,8hr	Day LA10,18hr	Day LAeq,16hr	Night LAeq,8hr
Fri	18-Sep	60.5	54.8	58.3	56.2	48.7
Sat	19-Sep	59.6	55.4	57.9	55.9	48.4
Sun	20-Sep	57.0	52.9	55.1	53.2	45.8
Mon	21-Sep	69.1	--	61.0	58.8	--

Table 5: Period Results - 2020

The LA_{max,F} results for the 'noisiest' night, which was Saturday, have been plotted in Figure 3 below. The 10th highest event was 77.3 LA_{max,F}.

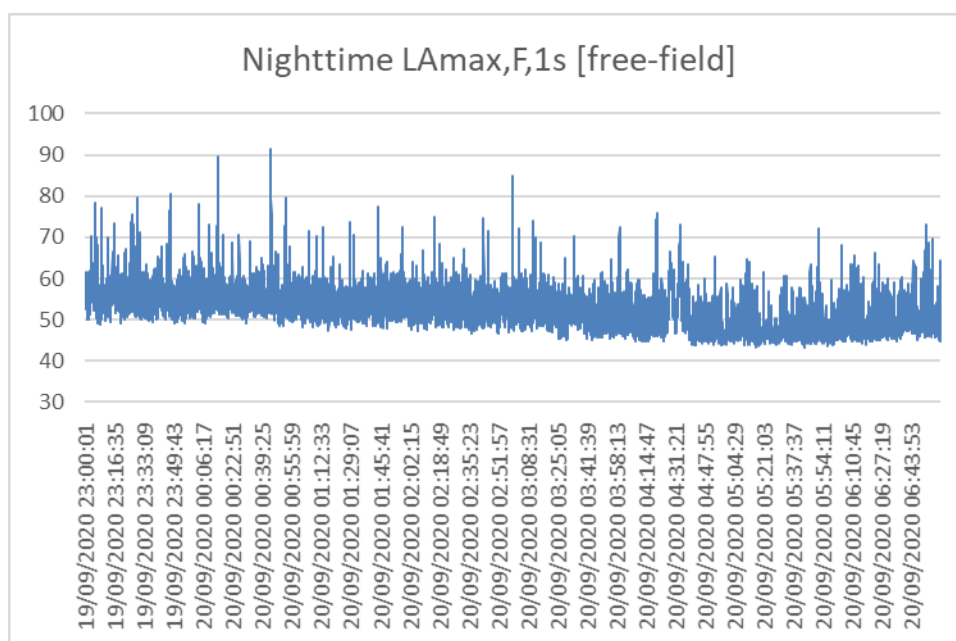


Figure 5: Nighttime LMax,F levels

From listening to the simultaneous recordings, all of the loud events were associated with vehicular noise, or emergency vehicle sirens, i.e. noise from the persons on the towpath was not a significant factor.

The recent measurement results are consistent with the previous readings made on the front façade of the building, allowing for the increased separation distance from the road and railway. They do not indicate that noise from pedestrians at the rear of the building is a significant factor, although there may be reasons for this, associated with the coronavirus lockdown. Accordingly, it is proposed to use the previous readings to represent the noise climate at the rear of the building.

5.0 GLAZING AND VENTILATION PREDICTIONS

It is possible to predict internal noise levels based on the measured external levels detailed in Table 2, the spectra from Table 3, room and window dimensions taken from the Howard & Seddon Architects drawings and the provisions of Reference 5.

The predictions for various apartments are contained within Appendix 4. It has been assumed that the reverberation times for bedrooms and other habitable rooms are 0.3s and 0.5s respectively.

We have assumed that vents will not be required; i.e. the ventilation would conform with Approved Document F “System 4” with no vents.

Previously the predictions demonstrated that for bedrooms the most critical target to meet is the nighttime L_{Amax} levels, i.e. if this requirement is met, the other requirements will ‘automatically’ be met. Accordingly, only L_{Amax,F} predictions have been performed for the bedrooms.

5.1 Lower Apartments G11, G12, G13 & G14

The light for these three apartments would be by means of a recessed secondary internal window; light & sound would pass into a joint plenum chamber via four high-level windows above the towpath, cross the plenum chamber [effectively a room], then enter in the respective kitchen/living rooms of the individual apartments via glazing, after that it would enter the bedrooms via the internal windows of the bedrooms [assumed to be floor-ceiling], i.e. to reach the bedrooms sound would have to pass through three sets of glazing and two other 'rooms'.

A prediction for G12 has been performed at A4.1 in Appendix 4. It can be seen that if the external level is 75 dB L_{Amax,F}, the corresponding level inside Bedroom 2 is [theoretically] 2 dB L_{Amax,F}, i.e. the proposed construction would produce a very substantial reduction and mean that disturbance to the occupants is unlikely. It should also be noted that the predictions assume that all the glazing is 4mm glass, which is unlikely given structural, thermal and safety requirements; more substantial glazing, which is more likely, would provide increased performance.

The prediction for G14 [A4.2 in Appendix 4], with windows on the side façade of the building has been performed using the same glazing specification as used in other apartments on this façade of the building.

5.2 Upper Apartments DU.01 to DU.09 Inclusive

Various predictions have been performed for the 5th floor rooms, and because all the rooms are non-bedrooms only daytime predictions have been undertaken [See A4.3, A4.4, A4.7, A4.8 & A4.9].

It has been assumed that the same mansard roof construction would be used for the whole 5th/6th floor.

Sample predictions for the 6th floor are shown in A4.5, A4.6 & A4.10, A4.12 & A4.12.

6.0 ASSESSMENT & CONCLUSIONS

The predictions demonstrate that for apartments with any view of Whitworth Street West that 10mm glass/20mm air gap/8.4mm acoustic laminate glass [Saint Gobain data] would be appropriate.

Similarly, for the rear façade of the building [no view of Whitworth Street West], that 10/12/6 glazing would be appropriate for the upper floors. For the lower floors the proposed plenum and internal bedroom construction, means that the performance of each of the individual panels does not need to be very high. However, it should be stressed that the stated performance for the lower floors glazing [see below] is for each panel between internal and external spaces and not for the overall 'path' from outside to in.

The top floor apartments would be within a mansard roof construction, whose performance also needs to be specified in order to control noise ingress. The predictions are based on Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mineral wool insulation and an inner layer of 2x 15mm Soundbloc sheets.

The predictions demonstrate that the noise environment can be suitably ameliorated and should not bar the grant of planning consent for the development.

7.0 GLAZING AND CONSTRUCTION SPECIFICATION

The glazing and constructions of the following performances [or similar and approved] shown in Table 6 below should achieve the target internal noise levels.

Element	Unit	Octave Band Centre Frequency [Hz]				
		125	250	500	1k	2k
5th & 6th Floor Rear Façade Glazing	SRI	26	27	34	40	38
5th & 6th Floor Other Façade Glazing	SRI	31	38	42	46	50
5th & 6th Mansard Roof Constrn	SRI	53	60	66	71	73
Lwr Floors Rear Façade Glazing [Each Unit]	SRI	20	22	28	32	33
Lwr Floors Side Façade Glazing	SRI	31	38	42	46	50

Table 6: Element Sound Reduction Indices [dB]

We have assumed that the ventilation will be an Approved Document F “System 4” with no vents.

For dwellings on the 5th and 6th floors, the overall building sound attenuation will depend on the materials chosen for the mansard roof and the glazing and to some extent are a trade-off, i.e. if a ‘better’ roof is chosen, then ‘worse’ glazing could be chosen and vice-versa. Similarly the predictions assume that a ‘no-vent’ ventilation system is employed; however, should vents be required these may be capable of being incorporated into the design, but could necessitate improving the mansard roof and/or the glazing specification.

APPENDIX 1

EXPLANATION OF ACOUSTIC TERMS

The dB or the decibel, is the unit of noise. The number of decibels or the level, is measured using a sound level meter. It is common for the sound level meter to filter or 'weight' the incoming sound so as to mimic the frequency response of the human ear. Such measurements are designated **dB(A)**.

A doubling of the sound is perceived, by most people, when the level has increased by 10 dB(A). The least discernible difference is 2 dB(A). Thus most people cannot distinguish between, say 30 and 31 dB(A).

The Background level of noise is most commonly represented by the level which is exceeded for 90% of the time i.e. the LA90.

If a noise varies over time then the **equivalent continuous level, or LAeq**, is the notional constant level of noise which would contain the same amount of acoustic energy as the time varying noise.

The following table gives an approximate indication of the comparative loudness of various noises expressed in terms of the A weighted scale:

Source of noise	dB(A)	Nature of Noise
Inside Quiet bedroom at night	25-30	Very Quiet
Quiet office	40-45	
Rural background noise	35-45	
Normal conversational level	55-65	
Busy restaurant	65-75	
Inside suburban electric train	70-80	
Hand clap @ 1m	75-85	
HGV accelerating @ 5m away	85-90	Very Loud

APPENDIX 2

QUALIFICATIONS AND EXPERIENCE OF M.A. KENYON

My full name is Melville Alexander Kenyon. I am the principal of the firm of Martec Environmental Consultants Ltd, a consultancy company that specialises in environmental noise assessment and control. I graduated in 1982 with a Bachelor's degree in Engineering and subsequently a Master's degree in Environmental Acoustics. I have been a corporate member of the professional body for noise and vibration specialists, the Institute of Acoustics, since 1988, and have sat on the British Standards Committee dealing with noise in buildings [BS.8233:1999].

I have lectured at Liverpool John Moores University on the Diploma of Acoustics course and at Manchester Metropolitan University on their Environmental Health degree course.

The firm of Martec Environmental Engineering was formed in the 1970's and joined The Association of Noise Consultants in 1996. It is now known as Martec Environmental Consultants Ltd.

Since its formation, Martec has advised many groups of both residents and developers about the problems of noise and vibration in the environment.

APPENDIX 3

REFERENCES

- 1 “ProPG Planning and Noise - May 2017” The Association of Noise Consultants , Institute of Acoustics & Chartered Institute of Environmental Health.
- 2 BS.8233:2014 “Guidance on Sound Insulation and noise reduction for buildings.”
- 3 Calculation of Road Traffic Noise (CRTN) – Department of Transport and the Welsh Office, HMSO,1988, ISBN 0-11-550847-3
- 4 Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping – TRL/Cassella Stanger
<http://www.defra.gov.uk/environment/quality/noise/research/crtn/documents/noise-crtm-update2006.pdf>
- 5 BS EN 12354-3:2000 *Building Acoustics-Estimation of Acoustic Performance in buildings from the performance of elements. Part 3 Airborne Sound Insulation against Outdoor Sound.*
- 6 The Department of Transport “*Calculation of Railway Noise 1995*” - HMSO
- 7 BS4142:2014 “Methods for rating and assessing industrial and commercial sound”

APPENDIX 4

Predictions of Internal Noise

A4.1 Apartment G12 at Rear Façade - Nighttime L_{Amax}

BS EN 12354-Calcs		Use	Volume	27.6					
Version 4.3		length	Volume		Building Atten dBA (75.0 - 54.5)				
© 2018 Martec Environmental Consultants Ltd		width	RT	1					
& Acute Acoustics Ltd		height							
			Octave Band Centre Frequency [Hz]					dBA	
			125	250	500	1k	2k		
Plenum Chamber	External Spectrum Leq (Free Field & Lin)		63.3	60.9	58.0	60.2	56.2	63.3	
Adjustment to Given Level if required								75.0	
External Spectrum Adjusted for Level			75.0	72.6	69.7	71.9	67.9	75.0	
Wall		Area m2	Element Sound Reduction Index [SRI]					Contrib	
Brick/block/cavity		27.6	41	45	45	54	58	36.5	
Drs/Wndws		Area m2	Element Sound Reduction Index [SRI]						
4mm_single_glazing		13.7	20	22	28	32	33	54.4	
Roof Lights		Area m2	Element Sound Reduction Index [SRI]						
None		0.0	0	0	0	0	0	0.0	
Door		Area m2	Element Sound Reduction Index [SRI]						
None		0.0	0	0	0	0	0	0.0	
Roof		Area m2	Element Sound Reduction Index [SRI]						
None		0.0	0	0	0	0	0	0.0	
Vent Dn,e		# Vents	Element Sound Reduction Index [SRI]						
None		0.0	0	0	0	0	0	0.0	
								dBA	
Plenum Chamber			Internal SPL/dBLin	63.0	58.6	49.8	47.9	42.8	54
			Octave Band Centre Frequency [Hz]					dBA	
			125	250	500	1k	2k		
Kitchen/Living Rm		Volume							
		RT							
		80.0							
		0.5							
Internal Glazing		Area m2	Element Sound Reduction Index [SRI]						
4mm_single_glazing		9	20	22	28	32	33		
Kitchen/Living Rm			Internal SPL/dBLin	38.4	32.0	17.2	11.3	5.3	26
			Octave Band Centre Frequency [Hz]					dBA	
			125	250	500	1k	2k		
Bedroom 2		Volume							
		RT							
		12.7							
		0.3							
Internal Glazing		Area m2	Element Sound Reduction Index [SRI]						
4mm_single_glazing		3.7	20	22	28	32	33		
Bedroom 2			Internal SPL/dBLin	15.8	7.3	-13.4	-23.4	-30.4	2

BS EN 12354-Calcs				Use	Volume	Volume	112.0					
Version				4.3	length					Building Atten dBA (85.0 - 41.1)	44	
© 2018 Martec Environmental Consultants Ltd				width		RT	0.5					
& Acute Acoustics Ltd				height		Octave Band Centre Frequency [Hz]						dBA
						125	250	500	1k	2k		
Kitchen/Living Rm				External Spectrum Leq (Free Field & Lin)		74.2	73.9	71.9	73.3	73.3	77.9	
				Adjustment to Given Level if required							85.0	
				External Spectrum Adjusted for Level		81.3	81.0	79.0	80.4	80.4	85.0	
Wall				Area m2	Element Sound Reduction Index [SRI]						Contrib	
Brick/block/cavity				27.6	41	45	45	54	58	36.2		
Drs/Wndws												
10 (20) 8.4A				13.0	31	38	42	46	50	39.4		
Roof Lights												
None				0.0	0	0	0	0	0	0.0		
Door												
None				0.0	0	0	0	0	0	0.0		
Roof												
None				0.0	0	0	0	0	0	0.0		
Vent Dn,e				# Vents								
None				0.0	0	0	0	0	0	0.0		
										dBA		
Plenum Chamber				Internal SPL/dB(Lin)	49.7	43.1	38.8	34.3	30.3	41		
Bedroom 1					Octave Band Centre Frequency [Hz]					dBA		
					125	250	500	1k	2k			
					Volume	19.6						
					RT	0.3						
Internal Glazing				Area m2	Element Sound Reduction Index [SRI]							
4mm_single_glazing				7.25	20	22	28	32	33			
Bedroom 1				Internal SPL/dB(Lin)	28.1	19.5	9.2	0.7	-4.3	15		

BS EN 12354-Calcs		Use	Volume	Volume	112.4					
Version	4.3	length						Building Atten dBA (65.0 - 21.1)		44
© 2018 Martec Environmental Consultants Ltd		width		RT	0.5					
& Acute Acoustics Ltd		height			Octave Band Centre Frequency [Hz]					dBA
					125	250	500	1k	2k	
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)			64.3	63.4	62.7	64.4	58.8	67.0
		Adjustment to Given Level if required								65.0
		External Spectrum Adjusted for Level			62.3	61.4	60.7	62.4	56.8	65.0
Wall			Area m2	Element Sound Reduction Index [SRI]					Contrib	
None			0.0	0	0	0	0	0	0.0	
Drs/Wndws										
10 (20) 8.4A			15.6	31	38	42	46	50	21.1	
Roof Lights										
None			0.0	0	0	0	0	0	0.0	
Door										
None			0.0	0	0	0	0	0	0.0	
Roof										
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mwv insl			22.0	53	60	66	71	73	-0.6	
Vent Dn,e			# Vents							
None			0.0	0	0	0	0	0	0.0	
									dBA	
			Internal SPL/dBLin	30.7	22.8	18.1	15.8	6.2	21	

A4.4 DU.04 Front Façade Study Daytime LAeq

BS EN 12354-Calcs		Use	Volume	Volume	112.4					
Version	4.3	length			Building Atten dBA (65.0 - 21.1)					44
© 2018 Martec Environmental Consultants Ltd		width		RT	0.5					
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA	
				125	250	500	1k	2k		
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		64.3	63.4	62.7	64.4	58.8	67.0	
		Adjustment to Given Level if required							65.0	
		External Spectrum Adjusted for Level		62.3	61.4	60.7	62.4	56.8	65.0	
Wall		Area m2		Element Sound Reduction Index [SRI]					Contrib	
None		0.0		0	0	0	0	0	0.0	
Drs/Wndws										
10 (20) 8.4A		15.6		31	38	42	46	50	21.1	
Roof Lights										
None		0.0		0	0	0	0	0	0.0	
Door										
None		0.0		0	0	0	0	0	0.0	
Roof										
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu		22.0		53	60	66	71	73	-0.6	
Vent Dn,e		# Vents								
None		0.0		0	0	0	0	0	0.0	
									dBA	
		Internal SPL/dBLin		30.7	22.8	18.1	15.8	6.2	21	

A4.5 DU.04 Front Façade Bedroom 1 Nighttime LAmax,F

BS EN 12354-Calcs		Use	Volume	Volume	30.8					
Version	4.3	length						Building Atten dBA (85.0 - 41.2)		44
© 2018 Martec Environmental Consultants Ltd		width		RT	0.3					
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA	
				125	250	500	1k	2k		
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		74.2	73.9	71.9	73.3	69.5		76.5
		Adjustment to Given Level if required								85.0
		External Spectrum Adjusted for Level		82.7	82.4	80.4	81.8	78.0		85.0
Wall			Area m2	Element Sound Reduction Index [SRI]					Contrib	
None			0.0	0	0	0	0	0		0.0
Drs/Wndws										
10 (20) 8.4A			7.1	31	38	42	46	50		41.2
Roof Lights										
None			0.0	0	0	0	0	0		0.0
Door										
None			0.0	0	0	0	0	0		0.0
Roof										
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw ins.			15.0	53	60	66	71	73		21.4
Vent Dn,e			# Vents							
None			0.0	0	0	0	0	0		0.0
										dBA
			Internal SPL/dBLin	51.1	43.8	37.8	35.2	27.4		41

A4.6 DU.04 Front Façade Bedroom 3 Nighttime L_{Amax},F

BS EN 12354-Calcs		Use	Volume	Volume	36.8				
Version	4.3	length				Building Atten dBA (85.0 - 41.4)			44
© 2018 Martec Environmental Consultants Ltd		width		RT	0.3				
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA
				125	250	500	1k	2k	
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		74.2	73.9	71.9	73.3	69.5	76.5
		Adjustment to Given Level if required							85.0
		External Spectrum Adjusted for Level		82.7	82.4	80.4	81.8	78.0	85.0
Wall		Area m2		Element Sound Reduction Index [SRI]					Contrib
None		0.0		0	0	0	0	0	0.0
Drs/Wndws									
10 (20) 8.4A		8.8		31	38	42	46	50	41.4
Roof Lights									
None		0.0		0	0	0	0	0	0.0
Door									
None		0.0		0	0	0	0	0	0.0
Roof									
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu		15.0		53	60	66	71	73	20.6
Vent Dn,e		# Vents							
None		0.0		0	0	0	0	0	0.0
									dBA
		Internal SPL/dBLin		51.3	44.0	37.9	35.3	27.5	41

A4.7 DU.05 Rear Façade Kit/Liv L_{Aeq},16hr

BS EN 12354-Calcs		Use	Volume	Volume	114.4					
Version	4.3	length						Building Atten dBA (55.0 - 12.2)		43
© 2018 Martec Environmental Consultants Ltd		width		RT	0.5					
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA	
				125	250	500	1k	2k		
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		50.9	54.2	58.9	62.1	62.3		66.3
		Adjustment to Given Level if required								55.0
		External Spectrum Adjusted for Level		39.6	42.9	47.6	50.8	51.0		55.0
Wall		Area m2		Element Sound Reduction Index [SRI]					Contrib	
None		0.0		0	0	0	0	0		0.0
Drs/Wndws										
10/12/6_double_glazing		5.5		26	27	34	40	38		12.2
Roof Lights										
None		0.0		0	0	0	0	0		0.0
Door										
None		0.0		0	0	0	0	0		0.0
Roof										
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu		21.0		53	60	66	71	73		-14.9
Vent Dn,e		# Vents								
None		0.0		0	0	0	0	0		0.0
										dBA
		Internal SPL/dBLin		8.4	10.7	8.4	5.6	7.8		12

A4.8 DU.05 Side Façade Kit/Liv LAeq,16hr & Combined from Both Facades

BS EN 12354-Calcs				Use	Volume	Volume	114.4					
Version		4.3		length						Building Atten dBA (65.0 - 18.1)		47
© 2018 Martec Environmental Consultants Ltd				width		RT	0.5					
& Acute Acoustics Ltd				height		Octave Band Centre Frequency [Hz]						dBA
					125	250	500	1k	2k			
Kitchen/Living Rm					External Spectrum Leq (Free Field & Lin)		64.3	63.4	62.7	64.4	58.8	67.0
					Adjustment to Given Level if required							65.0
					External Spectrum Adjusted for Level		62.3	61.4	60.7	62.4	56.8	65.0
Wall					Area m2	Element Sound Reduction Index [SRI]						Contrib
None					0.0	0	0	0	0	0	0	0.0
Drs/Wndws												
10 (20) 8.4A					7.9	31	38	42	46	50	18.0	
Roof Lights												
None					0.0	0	0	0	0	0	0.0	
Door												
None					0.0	0	0	0	0	0	0.0	
Roof												
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu					7.0	53	60	66	71	73	-5.7	
Vent Dn,e					# Vents							
None					0.0	0	0	0	0	0	0.0	
											dBA	
					Internal SPL/dBLin	27.6	19.7	15.0	12.7	3.1	18	
					Total Internal	27.7	20.3	15.9	13.5	9.1	19	

4.10 DU.01 Rear Façade Kit/Liv LAeq,16hr Bedroom 2 Nighttime L_{Amax},F

BS EN 12354-Calcs		Use	Volume	Volume	29.3								
Version	4.3	length				Building Atten dBA (75.0 - 40.4)			35				
© 2018 Martec Environmental Consultants Ltd		width		RT	0.3								
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA				
			125	250	500	1k	2k						
Kitchen/Living Rm			External Spectrum Leq (Free Field & Lin)					63.3	60.9	58.0	60.2	56.2	63.3
			Adjustment to Given Level if required					75.0					
			External Spectrum Adjusted for Level					75.0	72.6	69.7	71.9	67.9	75.0
Wall			Area m2	Element Sound Reduction Index [SRI]					Contrib				
None			0.0	0	0	0	0	0	0.0				
Drs/Wndws													
10/12/6_double_glazing			7.3	26	27	34	40	38	40.3				
Roof Lights													
None			0.0	0	0	0	0	0	0.0				
Door													
None			0.0	0	0	0	0	0	0.0				
Roof													
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu			15.0	53	60	66	71	73	12.5				
Vent Dn,e			# Vents										
None			0.0	0	0	0	0	0	0.0				
									dBA				
			Internal SPL/dBLin	48.7	45.3	35.4	31.6	29.6	40				

4.11 DU.01 Rear Façade Kit/Liv LAeq,16hr Bedroom 1 Nighttime L_{Amax},F

BS EN 12354-Calcs		Use	Volume	Volume	33.3				
Version	4.3	length					Building Atten dBA (75.0 - 33.5)		
© 2018 Martec Environmental Consultants Ltd		width		RT	0.3				
& Acute Acoustics Ltd		height		Octave Band Centre Frequency [Hz]					dBA
				125	250	500	1k	2k	
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		63.3	60.9	58.0	60.2	56.2	
		Adjustment to Given Level if required						75.0	
		External Spectrum Adjusted for Level		75.0	72.6	69.7	71.9	67.9	
								75.0	
Wall		Area m2	Element Sound Reduction Index [SRI]					Contrib	
None		0.0	0	0	0	0	0	0.0	
Drs/Wndws									
10/12/6_double_glazing		1.7	26	27	34	40	38	33.5	
Roof Lights									
None		0.0	0	0	0	0	0	0.0	
Door									
None		0.0	0	0	0	0	0	0.0	
Roof									
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu		9.5	53	60	66	71	73	9.9	
Vent Dn,e		# Vents							
None		0.0	0	0	0	0	0	0.0	
								dBA	
		Internal SPL/dBLin	41.9	38.4	28.5	24.7	22.7	33	

4.12 DU.01 Side Façade Kit/Liv LAeq,16hr Bed1 Nighttime LAmx,F & Combined Level from Both Facades

BS EN 12354-Calcs		Use	Volume	Volume	33.3					
Version	4.3	length					Building Atten dBA (85.0 - 41.0)			44
© 2018 Martec Environmental Consultants Ltd		width		RT	0.3					
& Acute Acoustics Ltd		height			Octave Band Centre Frequency [Hz]					dBA
				125	250	500	1k	2k		
Kitchen/Living Rm		External Spectrum Leq (Free Field & Lin)		74.2	73.9	71.9	73.3	69.5		76.5
		Adjustment to Given Level if required								85.0
		External Spectrum Adjusted for Level		82.7	82.4	80.4	81.8	78.0		85.0
Wall			Area m2	Element Sound Reduction Index [SRI]					Contrib	
None			0.0	0	0	0	0	0		0.0
Drs/Wndws										
10 (20) 8.4A			7.3	31	38	42	46	50		41.0
Roof Lights										
None			0.0	0	0	0	0	0		0.0
Door										
None			0.0	0	0	0	0	0		0.0
Roof										
Roofing Slates on 18mm Nuraply sheet, 500mm cavity, 200mm mw insu			9.5	53	60	66	71	73		19.1
Vent Dn,e			# Vents							
None			0.0	0	0	0	0	0		0.0
										dBA
			Internal SPL/dBLin	50.9	43.6	37.5	34.9	27.2		41
			Total Internal	51.4	44.7	38.1	35.3	28.5		42