



Westfields Construction Ltd.

MEADOWSIDE PLOTS 2 & 3

Planning Condition 32 Noise Report





Westfields Construction Ltd.

MEADOWSIDE PLOTS 2 & 3

Planning Condition 32 Noise Report

STAGE 4 ACOUSTIC REPORT (V1) PUBLIC

PROJECT NO. 70051606

OUR REF. NO. 70051606-409-R02

DATE: NOVEMBER 2021

WSP

8 First Street

Manchester

M15 4RP

Phone: +44 161 200 5000

WSP.com



QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	04/11/2021			
Prepared by	R Marriner			
Signature				
Checked by	W Neale			
Signature				
Authorised by	R Marriner			
Signature				
Project number	70061606			
Report number	409-R02			

CONTENTS

1	INTRODUCTION	1
2	REQUIREMENTS AND TECHNICAL GUIDANCE	2
2.1	OVERVIEW	2
2.2	PLANNING CONDITION	2
2.3	INTERNAL NOISE CRITERIA-APARTMENTS	2
	BACKGROUND VENTILATION	2
3	BASELINE NOISE SURVEY & INTERNAL NOISE CRITERIA	3
3.1	PREVAILING LOCAL SOUND ENVIRONMENT	3
3.2	OVERVIEW	3
3.3	MEASUREMENT LOCATIONS	3
3.4	EQUIPMENT	5
3.5	SURVEY RESULTS	5
4	NOISE MODELLING AND INCIDENT NOISE LEVELS	7
4.1	OVERVIEW OF NOISE MODELLING	7
4.2	NOISE MODELLING RESULTS	7
5	BUILDING ENVELOPE	10
5.1	GLAZING SOUND INSULATION PERFORMANCE	10
5.2	NON-GLAZED EXTERNAL WALL SOUND INSULATION PERFORMANCE	10
5.3	PROPOSED CONSTRUCTIONS	10
	PROPOSED GLAZING – APARTMENTS	10
	Plot 2	11
	Plot 3	11
	PROPOSED NON-GLAZED AREAS OF EXTERNAL WALL	11

APPENDICES

APPENDIX A

TECHNICAL GLOSSARY

APPENDIX B

LIMITATIONS OF REPORT

1 INTRODUCTION

WSP is appointed by Westfields Construction Limited, to provide acoustic advice in relation to Plots 2 and 3 of the Angel Meadows development, Manchester.

The scheme comprises 2 residential towers, Plot 2 of 21 storeys and Plot 3 of 16 storeys tall. Both have space for a commercial unit at ground floor and Plot 3 also has a residents' gym and private dining room at Level 2.

The scheme received planning consent from Manchester City Council (MCC), with a planning condition (no. 32) relating to noise ingress from external sources. This report addresses the requirement for a design stage assessment of external noise ingress, in response to that condition.

This report is necessarily technical in nature, and a glossary is provided in Appendix A to assist the reader.

2 REQUIREMENTS AND TECHNICAL GUIDANCE

2.1 OVERVIEW

The following standards and documents are referenced in this report:

- Planning consent 124120/JO/2019 issued by MCC
- Manchester City Council Planning & Noise Technical Guidance dated December 2015
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

2.2 PLANNING CONDITION

Planning condition 32 of the scheme's planning consent (124120/JO/2019) relates to ingress of external noise and is reproduced below for reference:

"32

(a) prior to the first occupation of the residential accommodation with a phase hereby approved, the accommodation shall be insulated [against external noise ingress] in accordance with a scheme submitted for approval in writing by the City Council, as Local Planning Authority.

(b) The approved scheme shall be implemented and prior to the first occupation of the residential element within a phase and [sic.] [a] post construction survey (including appropriate mitigation measures and timescales for implementation as necessary) shall be submitted for approval in writing by the City Council, as Local Planning Authority.

The measures agreed thereafter retained and maintained in situ."

This condition has two components, each of which is to be discharged for each plot of the development. This report relates to part (a) – details of the sound insulation scheme – for plots 2 and 3. Part (b) will be discharged at a later date once the construction stage is complete.

2.3 INTERNAL NOISE CRITERIA-APARTMENTS

BACKGROUND VENTILATION

Table 2-1 provides a summary of the internal noise criteria specified by MCC for residential developments. These levels are the maximum internal noise levels, taking account of both contributions from external noise ingress and noise from building services.

As the apartments are mechanically ventilated, the façade sound insulation requirements have been determined allowing for noise from building services.

Table 2-1 – Manchester City Council internal noise criteria for residential developments

	Internal noise limits	
Internal space	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living rooms	35 dB $L_{Aeq,16hr}$	-
Bedrooms	-	30 dB $L_{Aeq,8hr}$ & 45 dB L_{AFmax} *

* MCC stipulate that individual noise events in bedrooms should not exceed 45 dB L_{AFmax} more than 15 times per night.

3 BASELINE NOISE SURVEY & INTERNAL NOISE CRITERIA

3.1 PREVAILING LOCAL SOUND ENVIRONMENT

Each of the site's individual plots (2, 3, 4 and 5) are located close to the A664 Angel Street, and the railway and Metrolink lines running into and out of Manchester Victoria Station. Consequently, the prevailing noise environment across the site is dominated by road traffic, trains and trams, although between approx. 00:00 and 06:00 road traffic is generally dominant over rail.

3.2 OVERVIEW

The prevailing noise environment across the site has been determined by means of a detailed baseline noise survey. The approach to the baseline noise survey was agreed during consultation with the Environmental Health Department of MCC and included both daytime (07:00 – 23:00) and night-time (23:00 – 07:00) measurements. The survey was used to determine the following:

- The levels of noise generated by road traffic movements on the Angel Street and Gould Street;
- The noise level generated by the rail and tram movements on the lines to the north of the site;
- The prevailing background noise levels at locations considered representative of existing noise sensitive receptors closest to the site.

3.3 MEASUREMENT LOCATIONS

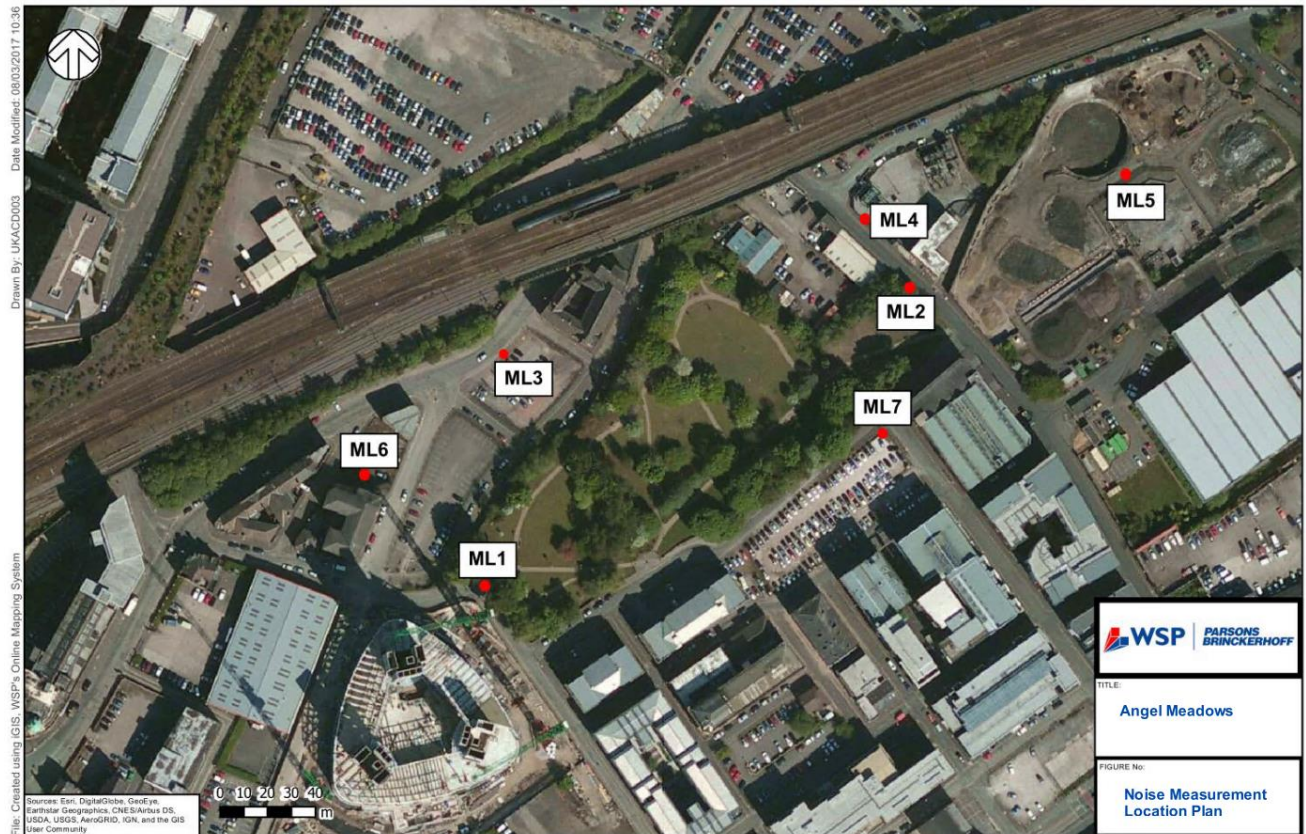
Noise monitoring locations were selected such that the dominant noise sources and a sample of existing sensitive receptors were represented. The locations of the measurement positions are shown in Figure 3-1 and are described as follows:

- **Measurement Location 1 (ML1)** – subject to free field conditions, approximately 1.5m above ground and 6m from the northern edge of Angel Street. Measurements were taken at this location between 10:15 and 13:15 on 19 January 2017, such that daytime road traffic noise levels generated from traffic on Angel Street could be determined in accordance with the shortened measurement procedure detailed within the Calculation of Road Traffic Noise memorandum (1988). A further measurement was undertaken between the hours of 06:00 and 07:00 on 21 February to determine the noise levels during what is considered to be the loudest hour of the night-time. The background sound level measured at ML1 is also considered to be representative of noise sensitive receptors located to the west of the site.
- **Measurement Location 2 (ML2)** – subject to free field conditions, approximately 1.5m above ground and 4m from the southern edge of Gould Street. Measurements were taken at this location between 11:00 and 13:00 on 24 January 2017, such that daytime road traffic noise levels generated from traffic on Gould Street could be determined in accordance with the shortened measurement procedure detailed within the Calculation of road Traffic Noise memorandum (1988). A further measurement was undertaken between the hours of 06:00 and 07:00 on 21 February so as to determine the noise levels during what is considered to be one of the loudest hours of the night time.
- **Measurement Location 3 (ML3)** – subject to free field condition, approximately 12m above ground level at the boundary of the car park currently on the site of Plot 3. The height of this monitoring location was approximately level with the railway, and representative of the location where the façade of the residential block proposed for Plot 3 will be located. A measurement was undertaken for a 1 hour period between 07:00 and 08:00 on 3 February 2017. This is considered

to represent the loudest daytime hour (rush hour) due to the frequency of train and tram movements. This location is also considered representative of background sound levels at the Ragged School. It has not been possible to measure at other times of the day due to ongoing, and noisy, road works (gas main) taking place on Dantzic Street.

- **Measurement Location 4 (ML4)** – subject to free field conditions, 1.5m above the ground, on the pavement on the northern edge of Gould Street immediately adjacent to the fence surrounding the electricity substation. A measurement of 2 minutes duration was taken, during which time no car, train or tram pass-bys occurred and therefore noise from the substation was the only significant noise source. The noise from the substation was sufficiently consistent to assume the results of the measurement are representative of all times. The measurement was undertaken at 15:20 on 19 December 2016;
- **Measurement Location 5 (ML5)** – Subject to free field conditions approximately 1.5m above the ground and 10m away from the gas pipe compound within the car park to the north west of Plot 4. A 10minute measurement was taken at 12:00 on 20 December 2016. The proximity to the gas pipes (noise source) combined with the noise level of the gas pipe's noise emissions meant no other noise source was audible at this location, and it has been assumed that the noise from the gas pipes remains consistent throughout the day and night. The measurement was undertaken at 11:00 on 20 December 2016.
- **Measurement Location 6 (ML6)** – subject to free field conditions, approximately 1.5m above the ground level and representative of the background level experienced at noise sensitive receptors to the north of the site. A series of short term attended measurements were undertaken in order to determine the background sound levels at the quietest periods of the day and night. Daytime measurements were taken between 07:10 to 08:10, and 22:00 to 23:00 on 26 January 2017. Night-time measurements were taken between 23:00 to 00:00 on 26 January 2017 and between 01:50 to 02:05, and 02:30 to 02:45 on 21 February 2017.
- **Measurement Location 7 (ML7)** – subject to free field conditions, approximately 1.5m above ground level at the north east corner of the existing car park to the south of the site. A series of short term attended measurements were undertaken at what are considered to be the quietest period of the daytime and night-time. Daytime measurements were taken between 12:30 and 13:30 on 19 December 2016, 08:20 to 08:50 and 09:40 to 10:10 on 20 December 2016. Night-time measurements were taken between 01:30 to 04:46 and 02:11 to 02:26 on 21 February 2017. The background sound at this location is considered to be representative of noise sensitive receptors to the south of the site.

Figure 3-1 – Noise survey measurement positions



3.4 EQUIPMENT

All sound level meters had been calibrated to traceable standards within the preceding 2 years, with the handheld calibrators being calibrated within the previous 12 months. The calibration of each measurement system was checked with a field calibrator at the beginning and end of the survey. No significant measurement drift occurred at any time. Full details of the equipment used in the survey can be found in the environmental statement via the planning portal.

3.5 SURVEY RESULTS

The measurement results from ML1, ML2 and ML3, ML4 and ML5 were all used to determine the noise levels from the dominant noise sources at the site, and in turn inform the calibration of the noise model. Summaries of the results from these locations are provided in Table 3-1 and Table 3-2.

Table 3-1 – Summary of measured daytime noise levels at ML1 and ML2

Location	Start time	Period	Duration	$L_{A10,3hr}$	$L_{Aeq,16hr}$
ML1	11:16 19/01/2017	Daytime (07:00 – 23:00)	3 hours	72	69*
ML2	10:55 24/01/2017	Daytime (07:00 – 23:00)	3 hours	69	66*

*Calculated based on measured $L_{A10,3hr}$ value. CRTN states that $L_{A10,16hr}$ road traffic noise levels are approximately equal to the $L_{A10,3hr}$ level minus 1 dB, and PPG24 stated that the $L_{Aeq,16hr}$ road traffic noise level is approximately equal to the $L_{A10,16hr}$ level minus 2 dB. Both corrections have been applied.

Table 3-2 – Summary of measured noise levels at ML1 - ML5

Pos.	L_{Aeq}	Equivalent continuous level (dB L_{Zeq}) at octave bands (Hz)									Typical maximum (dB L_{AFmax})
		31.5	63	125	250	500	1000	2000	4000	8000	
ML1	69	69	75	69	66	64	66	61	55	48	75**
ML2	66	67	72	65	61	61	62	59	53	54	74**
ML3	66	72	72	69	66	63	63	57	48	41	76 (train***) 72 (tram***)
ML4	65	66	70	72	60	58	62	57	49	44	N/A
ML5	71	62	61	56	54	54	62	66	66	59	N/A

* L_{Aeq} derived as shown in Table 4-2, with measured octave band spectrum adjusted accordingly.

** L_{AFmax} taken to be 97th percentile value from the 06:00 to 07:00 measurement period.

*** Derived by considering average L_{max} noise levels during distinct train and tram pass by events where minimal contribution from other noise sources was present.

4 NOISE MODELLING AND INCIDENT NOISE LEVELS

4.1 OVERVIEW OF NOISE MODELLING

The results of the environmental noise surveys have been used to produce a 3-D computer-based noise model of the development proposals in order to determine the noise levels expected across the façades of the development.

The following assumptions have been made in the noise model:

- The noise model was set up to apply the noise prediction methodology set out in ISO 9613-2;
- In general, the ground absorption for the model has been set to $G=1$. Tarmacked and concrete areas have been modelled as $G=0$;
- The existing topography of the site and the surrounding land has been taken into account;
- The model was set to include up to second order reflected noise from solid structures;
- The model has taken into consideration the layout of existing building surrounding the site as well as the proposed development building layout.

The noise model has been used to predict the daytime (07:00-23:00) and night-time (23:00 – 07:00) $L_{Aeq,T}$ noise levels as well as the typical night-time L_{AFmax} noise levels across the full building envelopes at every level and on each façade in each octave band from 63 Hz to 8 kHz.

4.2 NOISE MODELLING RESULTS

The figures below show the results of the noise model.

Figure 4-1 – Southern view, daytime (dB $L_{Aeq,16hr}$)

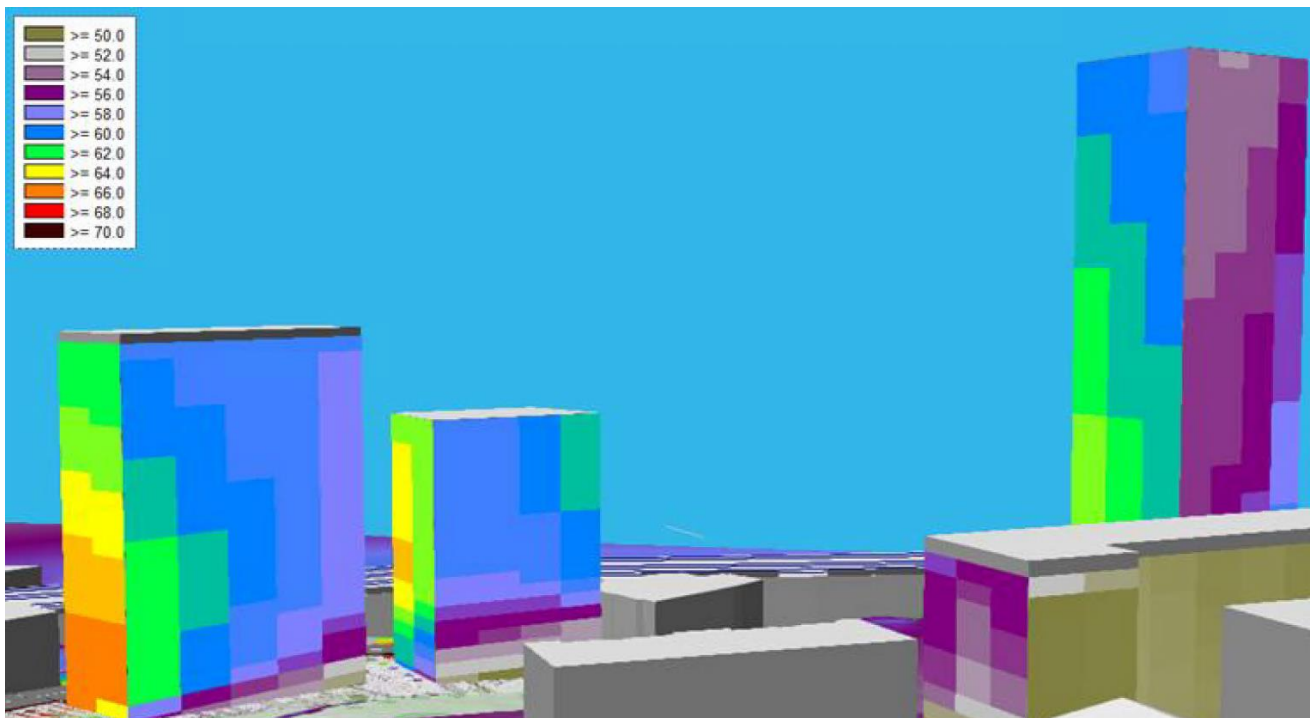
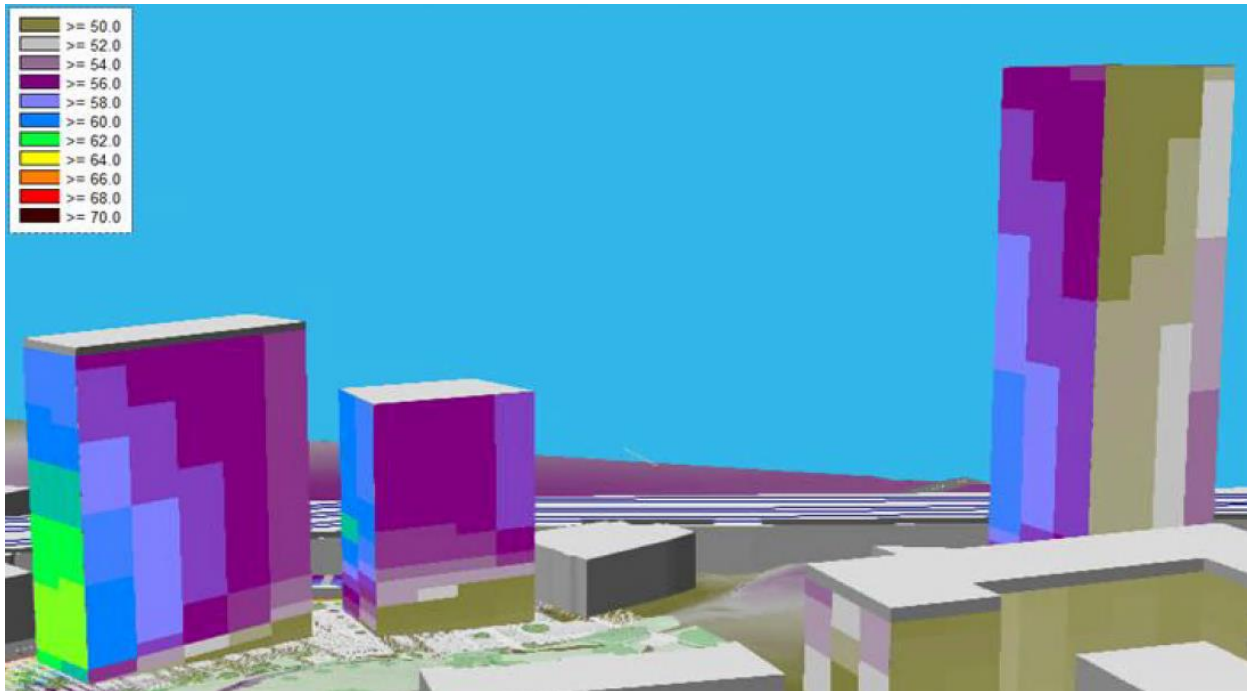


Figure 4-2 – Southern view, night-time (dB $L_{Aeq,8hr}$)



The calculated noise levels are presented in the Table 5-1 for each façade referenced in Figure 4-3 below. Note that sound levels are shown as free-field levels and only the resultant broadband, $L_{Aeq,T}$ and L_{AFmax} , A-weighted noise levels are shown.

Figure 4-3 – Excerpt of site layout showing façade zones

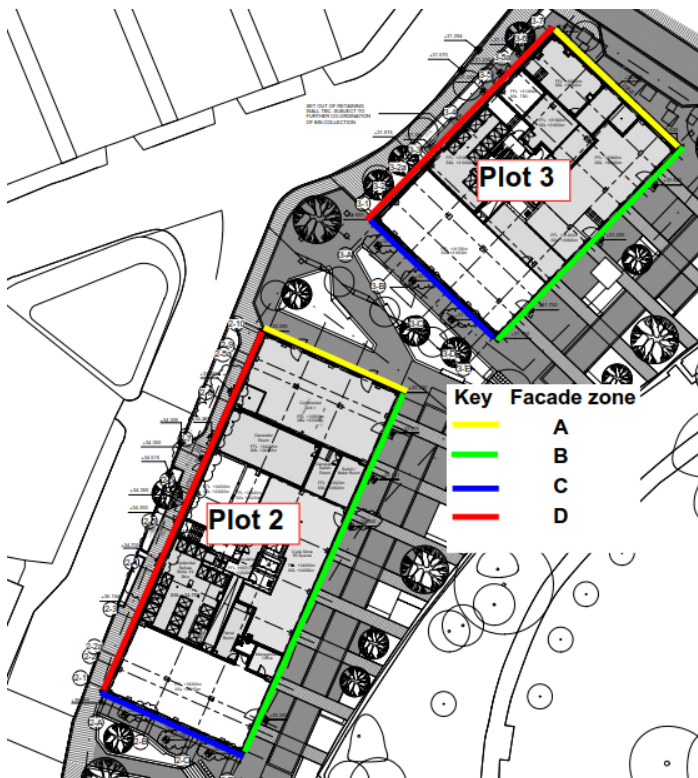
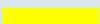
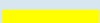


Table 4-1 – Predicted free-field sound levels for proposed buildings

Plot	Façade	Daytime (dB $L_{Aeq,16hr}$)	Night-time (dB $L_{Aeq,8hr}$)	Typical night-time maximum (dB L_{AFmax})
2	A 	64 – 67	58 – 62	65 – 73
	B 	59 – 62	56 – 59	59 – 66
	C 	62 – 66	58 – 63	59 – 68
	D 	65 – 68	60 – 63	65 – 73
3	A 	61 – 68	55 – 64	65 – 76
	B 	52 – 60	48 – 56	45 – 64
	C 	60 – 64	54 – 60	64 – 72
	D 	66 – 70	62 – 65	71 – 77

5 BUILDING ENVELOPE

5.1 GLAZING SOUND INSULATION PERFORMANCE

Based on the results of the noise modelling described above, calculations have been undertaken to produce sound insulation specifications for glazing to apartments on plots 2 and 3. External glazing to apartments shall be selected to meet the minimum sound insulation performances in Table 5-1.

The term 'glazing' refers to the complete window assembly, including frame, seals and associated hardware.

Table 5-1 – Minimum glazing sound insulation for each façade zone (apartments)

Location/Façade zone (refer to Figure 4-3)	Minimum sound reduction index (R dB) at each octave band (Hz)					Weighted SRI (dB $R_w + C_{tr}$)
	125	250	500	1k	2k	
Plot 2 zone B	24	22	29	39	33	29
Plot 2, Zones A, C & D	24	27	36	39	42	34
Plot 3, zone B	24	22	29	39	33	29
Plot 3, zones A, C & D	24	31	41	46	46	36

These performances have been determined assuming a reverberation time in apartments of 0.8 s. Should commissioning measurements be required they shall be corrected to a reverberation time of 0.8 s from 63 Hz to 4 kHz, if the measured reverberation time is higher.

5.2 NON-GLAZED EXTERNAL WALL SOUND INSULATION PERFORMANCE

Non-glazed external wall areas shall provide a minimum sound reduction index of 46 dB $R_w + C_{tr}$.

5.3 PROPOSED CONSTRUCTIONS

PROPOSED GLAZING – APARTMENTS

Table 5-2 provides a summary of the sound insulation data received for the proposed glazing configurations proposed for apartments at Plots 2 and 3. Any alternative glazing configurations are subject to review by the Acoustic Consultant. Calculations indicate that the glazing types proposed are capable of adequately controlling external noise ingress to the apartments. Further details are provided below.

Table 5-2 – Sound insulation performance data for proposed glazing configurations

GlassHus ref.	Guardian Glass configuration	Minimum sound reduction index (<i>R</i> dB) at each octave band (Hz)					Weighted SRI (dB $R_w + C_{tr}$)
		125	250	500	1k	2k	
GL 101	10.8 mm LamiGlass (PVB), 20 mm cavity, 8.8 mm LaminGlass (PVB)	31	37	42	39	42	38
GL 101b	10.8 mm LamiGlass (PVB) 20 mm cavity, 8.8 mm LaminGlass (PVB) Sound Reduction	27	35	42	47	52	39
GL 101c	12.8 mm LamiGlass (PVB), 20 mm cavity, 8.8 mm LaminGlass (PVB)	30	35	39	40	48	37

Plot 2

Glazing type GL 101 is proposed throughout Plot 2 residential areas.

Plot 3

Glazing type GL 101b is proposed for façades A, C and D of Plot 3 as shown in Figure 4-3. It exceeds the requirements in all octave bands, and is therefore capable of adequately controlling external noise break-in.

Glazing type GL 101c is proposed to corner rooms of Plot 3 – i.e. all zones but only for corner units. It is noted that this type does not meet the specification at 500 Hz and 1 kHz, but exceeds the requirements at other octave bands. Calculations carried out using the data in Table 5-2 have verified that the shortfalls at 500 Hz and 1 kHz are not expected to result in the indoor noise level criteria being exceeded, and the glazing type is therefore capable of adequately controlling external noise break-in.

Glazing type GL 101 is proposed for zone B as shown in Figure 4-3. The data above exceed the requirements for this zone in all bands, and it is therefore capable of adequately controlling external noise break-in.

PROPOSED NON-GLAZED AREAS OF EXTERNAL WALL

Summaries of the proposed non-glazed external wall build-ups are presented in Table 5-3. These constructions are capable of meeting the specified sound insulation performance of 46 dB $R_{wI} + C_{tr}$.

Table 5-3 – Proposed non-glazed external wall build-ups

Location	Proposed external wall construction
Level 1	100 mm thick precast concrete panel ($\geq 1800 \text{ kg/m}^3$), 90 mm mineral fibre insulation ($\geq 60 \text{ kg/m}^3$), 140 mm blockwork ($\geq 1450 \text{ kg/m}^3$), 80 mm cavity with 25 mm mineral fibre insulation ($\geq 30 \text{ kg/m}^3$), 2 x 12.5 mm plasterboard internal lining.
All other levels	Double glazed unit to match windows, 50 mm cavity, 125 mm composite panel enclosed in Fireboard ($\geq 12 \text{ kg/m}^2$) with 1.5 mm steel backing plate, 80 mm cavity with 25 mm mineral fibre insulation ($\geq 30 \text{ kg/m}^3$), 2 x 12.5 mm plasterboard internal lining.

6 CONCLUSIONS

WSP is appointed by Westfields Construction Limited, to provide acoustic advice in relation to Plots 2 and 3 of the Angel Meadows development, Manchester.

The scheme received planning consent from Manchester City Council (MCC), with a planning condition (no. 32) relating to noise ingress from external sources. This report addresses the requirement for a design stage assessment of external noise ingress, in response to that condition.

Sound insulation requirements for the facades of Plots 2 and 3 have been determined based on a computer-based noise model for the development calibrated against the results of a noise survey at the site.

Sound insulation data for the proposed glazing types have been reviewed against the specifications, and are found to be capable of adequately controlling external noise break-in to the apartments, so that the indoor sound level criteria can be achieved.

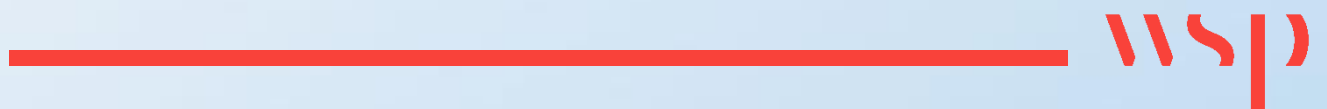
It is therefore considered that the information herein should be sufficient to enable part (a) of planning condition 32 to be discharged for plots 2 and 3.

Part (b) of the planning condition requires an indoor sound level survey to be carried out upon completion of the construction phase, to verify the indoor sound levels, and will therefore be discharged at a later date.

Limitations to this report are presented in Appendix B.

Appendix A

TECHNICAL GLOSSARY



Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10 ⁻⁵ Pa).
L _{Aeq,T}	L _{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L _{Amax}	L _{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L _{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L ₁₀ and L ₉₀	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L10 is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L90 is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L10 index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.
Ambient Sound Level	The all-encompassing noise level measured in L _{Aeq,T} . The Ambient Sound Level incorporates background sounds as well as the industrial source noise under consideration.
Residual Sound Level	The Ambient Sound Level in the absence of the industrial source noise under consideration, measured in L _{Aeq,T} .
Specific Sound Level	The sound level measured in L _{Aeq,T} attributed to the industrial noise source under consideration alone.
Background Sound Level	The sound level in the absence of the industrial source noise under consideration, measured in L _{A90} .

Appendix B

LIMITATIONS OF REPORT





This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of WSP UK Limited. WSP UK Limited accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/ or WSP UK Limited and agree to indemnify WSP UK Limited for any and all loss or damage resulting therefrom. WSP UK Limited accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

The findings and opinions expressed are relevant to the dates of the site works and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations WSP UK Limited reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.



8 First Street
Manchester
M15 4RP

wsp.com

PUBLIC