

**Pre-completion Internal and External Noise Validation Exercise
at the New Residential Development on Blackrock Street
in Openshaw, Manchester.**

Report Prepared for:

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Contents

- 1.0 Summary**
- 2.0 Introduction**
- 3.0 Site Description**
- 4.0 Assessment Criteria**
- 5.0 Acoustic Insulation Compliance Assessment**
 - 5.1 External Walls
 - 5.2 Glazing
 - 5.3 Ventilation
- 6.0 Noise Climate Assessment Details**
 - 6.1 Survey Times and Personnel
 - 6.2 Weather
 - 6.3 Equipment
 - 6.4 Measurement Procedure
- 7.0 Noise Survey Results**
- 8.0 Discussion of Results and Conclusion**

Appendix 1. Measurement Survey Results

1.0 Summary

Planning permission was granted permitting the construction of 22 new residential houses on a roughly 'L' shaped area of land on Blackrock Street in Openshaw, Manchester. The planning permission was granted subject to the imposition of a number of conditions one of which, condition 17, related specifically to the requirement to undertake a validation report to evaluate the internal noise climate within the permitted houses upon completion.

In compliance with condition number 17, an assessment of the internal noise climate within two of the plots on the Blackrock Street development, plots 14 and 18, has been conducted. Both of the plots were representative of the typical noise climate on the development and both the use of these plots and the measurement procedure had previously been agreed with Manchester City Council.

The results of the assessment have indicated that the 'standardised' sound levels within both plots, under the MVHR 'off' condition, did not exceed the adopted guide values. This indicates that the sound insulation of the building envelope is capable of limiting the ingress of external noise, as per the original noise assessment report issued in September 2019. Turning to the 'standardised' sound levels under the MVHR 'on' condition, the results again demonstrate that although the sound levels were higher they again complied with the adopted guide values.

It should however be remembered that with respect to the daytime sound levels, these were subject to contributions from construction noise, which would not be representative of the noise climate upon completion of the project. Consequently it is contended that the daytime sound levels presented in this report may well be higher than would be the case in the absence of the construction noise contributions.

With respect to the measurements made within the gardens of the two plots during the morning period, the measured sound levels highlight that the operation of the MVHR systems made no contribution to the external noise climate and that the measured levels again complied with the adopted design values. As before, these measurements were subject to contributions from construction sources suggesting that the external noise climate, and the measured sound levels, were higher during the course of these surveys than would be anticipated upon final completion of the project.

With respect to both the internal and external sound levels it suggested that the obtained results indicate that the requirements of the planning condition have been complied with and no further sound insulation measures will be necessary.

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2.0 Introduction

Planning permission was granted permitting the construction of 22 new residential houses on a roughly 'L' shaped area of land on Blackrock Street in Openshaw, Manchester. The planning permission was granted subject to the imposition of a number of conditions one of which, condition 17, related specifically to the requirement to undertake a validation report to evaluate the internal noise climate within the permitted houses.

In compliance with condition number 17, an assessment of the internal noise climate within two of the plots on the Blackrock Street development, plots 14 and 18, has been conducted. Both of the plots were representative of the typical noise climate on the development and both the measurements within these plots and the measurement procedure had previously been agreed with Manchester City Council.

3.0 Site Description

The residential development at Blackrock Street comprises 22 residential dwellings arranged as per the layout detailed in figure 1 below. The two selected plots, plots 14 and 18, are two and four bedroom properties respectively (photographs 1 and 2 overleaf) and are typical of the houses on the development. The development on Blackrock Street is surrounded by the existing residential properties on Isca, Townley, Cyclone, Siam and Myrtle Streets, with the playing field serving the Ashbury Meadow Primary School to the west of the development.

Photograph 1. Layout of the residential development on Blackrock Street



Photograph 1. Plot 14, Blackrock Street



Photograph 2. Plot 18, Blackrock Street



4.0 Assessment Criteria

The requirement to provide a scheme for acoustically insulating the residential dwellings was contained within condition 16 of the planning condition, with the requirement to undertake a validation assessment of the acoustic conditions within the dwellings was contained within condition 17. Both of these conditions are reproduced below:

16) Before the development commences a scheme for acoustically insulating the residential accommodation against noise from Albert Street or otherwise noise generating uses shall be submitted to and approved in writing by the City Council as local planning authority. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.

Reason - To secure a reduction in noise from Albert Street or otherwise noise generating uses in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy

17) Upon completion of the development and before first occupation of the development, a verification report shall be submitted for approval in writing the City Council as Local Planning Authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the internal noise criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the internal noise criteria. The additional mitigation measures shall be implemented within a timescale to be agreed with the City Council as Local Planning Authority.

Reason - To secure a reduction in noise from Albert Street or otherwise noise generating uses in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy

With respect to the approved acoustic report detailed within condition 17, this relates to the Druk Limited report, reference DRUK/ACC/RS/GWPAWCOM/2794BS issued on the 18th September 2019. This report contained an assessment of the existing noise climate in the vicinity of the then proposed development and an evaluation of the likely internal noise climate with reference to the sound insulation provided by the proposed building envelopes. In addition, the report also contained an assessment of the likely noise levels within the external amenity areas was also undertaken in the report.

With respect to the assessment of the desirable internal and external noise levels within and without the new dwellings, guidance relating to acceptable noise levels was obtained from a number of sources including: Manchester City Council's Planning and Noise Technical Guidance document, published in December 2015, the World Health Organisation's (WHO) "Guidelines for Community Noise" document and British Standard (BS) 8233:2014 "Guidance on sound insulation and noise reduction for buildings". With reference to the guidance relating to the internal and external noise climates, the guidance contained within the respective documents is summarised in tables 1 - 3 overleaf.

Table 1. Indoor ambient noise levels for dwellings (reproduced from page 16 of the Manchester City Council Technical Guidance document)

Assessment location	Time of day	$L_{Aeq,T}$	$L_{Amax,F}$
Bedrooms	Night time 2300 - 0700 hours	30dB	45dB*
Living rooms	Daytime 0700 - 2300 hours	35dB	-
Gardens and terraces	Daytime 0700 - 2300 hours	55 dB	-

* Individual noise events should not normally exceed this criterion on more than 15 occasions

Table 2. Guidelines for noise levels in specific environments (reproduced from Table 1 of the "Guidelines for Community Noise document, (WHO 1999))

Specific environment	Critical health effect(s)	L_{Aeq} [dB(A)]	Time base [hours]	L_{Amax} , fast dB
Outdoor living area	Serious annoyance, daytime and evening.	55	16	-
	Moderate annoyance, daytime and evening.	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening.	35	16	-
Inside bedrooms	Sleep disturbance, night time	30	8	45

Table 3. Indoor ambient noise levels for dwellings (reproduced from table 4 of BS8233:2014)

Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35dB L_{Aeq} , 16 hour	-
Dining	Dining room/area	40dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	35dB L_{Aeq} , 16 hour	30dB L_{Aeq} , 8 hour

In addition to the internal noise design guidance highlighted in table 3 above, BS 8233:2014 also provides guidance on the external noise environment. In this situation BS 8233:2014, at paragraph 7.7.3.2, states the following: *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise climate does not exceed 50dB $L_{Aeq,T}$ with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments"*.

With respect to the subsequent evaluation of the noise climate within and outside the new dwellings on Blackrock Street, the measured sound levels will be compared with the following internal and external criteria:

- Bedrooms (23:00 - 07:00 hours): 30dB L_{Aeq} and 45dB* L_{Amax}
- Bedrooms (07:00 - 23:00 hours): 35dB L_{Aeq}
- Living rooms (07:00 - 23:00 hours): 35dB L_{Aeq}
- Gardens (07:00 - 23:00 hours): $\leq$ 55dB L_{Aeq}

* Individual noise events should not normally exceed this criterion on more than 15 occasions

5.0 Acoustic Insulation Compliance Assessment

In compliance with the requirements of planning condition 16, an inspection of the building envelope elements, principally the external wall construction, the glazing and the ventilation provisions, assumed in the previous acoustic report was undertaken. All the inspections were undertaken on the on the 3rd September 2021 and at the time all the dwellings were unoccupied.

5.1 External Walls

The proposed external wall construction evaluated in the approved acoustic report was of the following specification: timber frame structure comprising an external brick leaf and an internal 89 x 38mm CLS timber frame filled with 70mm rigid PIR insulation and lined with one layer of 9mm OSB board and one layer of 12.5mm plasterboard separated from the brick outer leaf by a 125mm cavity.

Although it was not possible to confirm the external wall construction directly, some of the separating walls had been opened up for the purposes of the recent air testing. Inspection of these element highlighted that the above construction had indeed been utilised.

5.2 Glazing

The assessments undertaken in the approved acoustic report were based on the application of sealed unit triple glazing to all the windows. The glazing specification used in the calculations is as follows:

- 4mm pane - 12/16mm cavity - 4mm pane – 12/16mm cavity – 4mm pane.

During the course of the measurement surveys the glazing specification was checked using a glass thickness measuring gauge. The check revealed that triple glazed units with a thickness of 52mm (photograph 3 overleaf) had been used throughout. This was equivalent to a 4mm pane - 20mm cavity - 4mm pane – 20mm cavity – 4mm pane specification, which exceeded that previously assumed.

5.3 Ventilation

Again, the calculations within the approved acoustic report were based on the houses being provided with a full mechanical ventilation with heat recovery (MVHR) system, so negating the requirement for ventilation openings in the building envelope. Photograph 4 overleaf details the MVHR system that had been utilised throughout the development.

With reference to the requirement contained within planning condition 16, the evidence detailed above indicates that all the measures that formed part of the approved acoustic report had been installed in compliance with the requirements of this condition.

Photograph 3. Measurement of the typical glazing thickness



Photograph 4. MVHR system used throughout the development



6.0 Noise Climate Assessment Details

The assessment of the internal and external noise climate on the Blackrock Street development was undertaken in accordance with the protocol agreed by Mr. Steven Brown of John Southworth Builders Ltd with Manchester City Council. The assessment protocol is detailed below.

2, no Houses to be tested on one day through the week (any day)

Internal spot measures to be taken with MVHR on tested in living room and bedroom at 08.00, 12.30 and 23.00

Internal spot measures to be taken with MVHR off tested in living room and bedroom at 08.00, 12.30 and 23.00

External spot measures to be taken with MVHR on tested in rear garden at 08.00 and 12.30

External spot measures to be taken with MVHR off tested in rear garden at 08.00 and 12.30

As previously detailed, the assessments were to be completed within plots 14 and 18. Within plot 14 measurements were made within the front and back bedrooms and the living room. Within plot 18 measurements were made within what will be termed the double and single aspect bedrooms, which were directly exposed to noise from Blackrock Street and Blackrock and Albert Streets respectively.

6.1 Survey Times and Personnel

Measurements of the internal noise climate within plots 14 and 18 were made between 23:00 - 01:30 hours on the 2nd - 3rd September 2021 and between 08:00 - 14:00 hours on the 3rd September 2021. Measurements of the external noise climate were made during the daytime on the 3rd September.

6.2 Weather

At the commencement of all the noise measurements made on the 3rd September, the external weather conditions were as follows:

3rd September 2021

All surfaces were dry, cloud cover was 100%, the external temperature was 16°C, the barometric pressure was approximately 1018mb and the wind speed was approximately 0.6m/s from a northerly direction.

6.3 Equipment

The noise assessments were conducted using the equipment detailed in the table 4 overleaf.

The sound level meters were field calibrated before, after and during the surveys as necessary, during which time no significant deviation in the calibrated level was observed.

All the equipment used is calibrated by a UKAS accredited calibration laboratory and the calibration certificates are available on request.

Table 4. Equipment used during the noise surveys

Equipment description	Manufacturer	Model number	Serial number
Sound level meter	Norsonic AS	Nor 140	1402738
Microphone pre-amplifier	Norsonic AS	Nor 1209	12075
Microphone	Norsonic AS	Nor 1225	72843
Sound level meter	NTI Audio	XL2-TA	A2A-10232-E
Microphone pre-amplifier	NTI Audio	MA220	5537
Microphone	NTI Audio	M2230	8636
Acoustic calibrator	Norsonic AS	Nor 1251	31522

6.4 Measurement Procedure

With respect to these internal measurements due regard, where appropriate, was paid to the guidance provided within the Association of Noise Consultants (ANC) – Measurement of Sound Levels in Buildings, Version 1.0, June 2020.

Throughout the noise assessments the measurement time interval was 5 minutes. Two consecutive measurements were made in each room for the two ventilation conditions, MVHR system off and on, making a total of four measurements per room. During the course of the assessments, the sound level meters were placed in positions that approximated to the likely position of the bed within the bedrooms and a sofa within the open plan living/dining room.

During the internal noise surveys the sound level meter microphones were tripod mounted, such that they were approximately 1.2 metres above floor level and approximately 1.2m from the internal walls. The microphones were connected to the sound level meters via 5 metre extension cables, so permitting the operator to remain outside the assessment spaces. All measurements were made with the ‘fast’ time weighting engaged. During the internal measurements all the windows were closed and when activated the MVHR system was run at a normal duty.

7.0 Noise Survey Results

At the time of the validation noise surveys both plots 14 and 18 were complete, unfurnished, unoccupied and uncarpeted. As a result of the construction programme it was not possible to halt construction activity on the site. In this respect, undertaking validation noise measurement surveys on an active building site presents a number of challenges, with the potential for extraneous construction site noise to affect the measured levels being the most obvious of these. Consequently, despite best efforts to ensure that construction noise was kept to a minimum during the assessments, the daytime measurements were inevitably affected by noise contributions from construction noise that would be absent upon final completion of the project. The construction noise contributions emanated from other parts of the Blackrock Street development itself and ground works, using heavy earth moving machinery, that were

being conducted on the Ashbury Meadow Primary School playing field. As a result, it is suggested that the measured daytime external noise levels may well have been higher than would have been the case in the absence of the construction noise. As a consequence the results from the daytime surveys may be regarded as worst cases acoustically.

As both plots were complete but not occupied or furnished, it was likely that the sound absorption of the bedrooms and living rooms would be different from that which would prevail when the dwellings were occupied and fully furnished. In order to permit the obtained results to be 'standardised', sample reverberation time measurements were made within the bedrooms and living rooms of the two plots. The mean reverberation times for the bedrooms and living/dining room are presented in Tables 5 and 6 below.

Table 5. Mean reverberation time measurements, plot 14

Room	Mean Reverberation Time, T_{20} , seconds
Living room	1.84
Front bedroom	1.67
Rear bedroom	1.44

Table 6. Mean reverberation time measurements, plot 18

Room	Mean Reverberation Time, T_{20} , seconds
Living room	1.03
Double aspect bedroom	1.47
Single aspect bedroom	1.57

For the purposes of the subsequent assessments the measured internal ambient noise levels will be 'standardised' to a reverberation time of 0.5 seconds, which would be typical of a furnished and occupied dwelling.

The 'standardised' internal noise levels from the noise measurements surveys are summarised and presented in tables 7 - 12 overleaf. The results of the surveys have been rounded to the nearest whole decibel. Full data are available in Appendix 1

Turning to the noise assessments in the gardens of the two plots, measurements were only possible during the morning period. The lack of measurements during the afternoon period was a result of the fact that the noise contributions from both the Blackrock Street site and the groundworks at the Ashbury Meadow Primary School significantly increased after midday. Consequently, measurements made under these conditions would not have been representative of the conditions that would normally prevail within the garden spaces.

Table 7. Standardised internal noise levels - night time, plot 14, 2nd & 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Front bedroom	15	31	29	33
Rear bedroom	13	28	29	34
Living room	12	-	19	-

Table 8. Standardised internal noise levels - daytime (morning), plot 14, 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Front bedroom	24	-	30	-
Rear bedroom	24	-	30	-
Living room	23	-	25	-

Table 9. Standardised internal noise levels - daytime (afternoon), plot 14, 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Front bedroom	24	-	29	-
Rear bedroom	27	-	30	-
Living room	22	-	23	-

Table 10. Standardised internal noise levels - night time, plot 18, 2nd & 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Double aspect bedroom	17	29	30	36
Single aspect bedroom	20	44	29	34
Living room	15	-	24	-

Table 11. Standardised internal noise levels - daytime (morning), plot 18, 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Double aspect bedroom	22	-	31	-
Single aspect bedroom	22	-	32	-
Living room	20	-	25	-

Table 12. Standardised internal noise levels - daytime (afternoon), plot 18, 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Double aspect bedroom	20	-	30	-
Single aspect bedroom	22	-	30	-
Living room	23	-	25	-

Turning to the assessments of the prevailing noise levels within the gardens of the two plots, by virtue of the considerable amount of extraneous construction noise during the afternoon period it was only possible to obtain representative measurements during the morning period. The results of these assessments are detailed in table 13 below.

Table 13. Measured external noise levels - daytime (morning), 3rd September 2021

Location	Mean (log) L_{Aeq} , dB. MVHR off	Mean (log) L_{Amax} , dB. MVHR off	Mean (log) L_{Aeq} , dB. MVHR on	Mean (log) L_{Amax} , dB. MVHR on
Plot 14, garden	52	-	51	-
Plot 18, garden	45	-	45	-

8.0 Discussion of Results and Conclusion

As can be seen from tables 7 - 12, none of the 'standardised' L_{Aeq} or L_{Amax} sound levels under the MVHR 'off' condition exceeded the guide values detailed in section 4 above. This indicates that the sound insulation of the building envelope is capable of limiting the ingress of external noise, as per the original noise assessment report issued in September 2019. Turning to the standardised sound levels under the MVHR 'on' condition, the results demonstrate that although the measured sound levels are higher they again comply with the guide values in section 4 above. It should however be remembered that with respect to the daytime sound levels, these were subject to contributions from construction noise, which would not be representative of the noise climate upon completion of the project. Consequently it is contended that the daytime sound levels presented in this report may well be higher than would be the case in the absence of the construction noise contributions.

Table 13 details the results of the measurements made within the gardens during the morning period. These measured sound levels highlight that the operation of the MVHR systems makes no contribution to the external noise climate. The results also demonstrate that despite the additional contributions made to the external noise climate by the extraneous construction noise, the measured levels again comply with the guide values detailed within section 4 above.

With respect to both the internal and external sound levels it suggested that the results presented above indicate that the requirements of the planning condition have been complied with and no further sound insulation measures will be necessary.

Appendix 1. Measurement Survey ResultsReverberation times, T_{20} , seconds

Blackrock Street										
Existing noise climate survey.										
<u>3rd September 2021</u>										
Octave Band Centre Frequency, Hz.	T_{20}	63	125	250	500	1k	2k	4k	8k	
P18, double aspect bedroom										
T_{20}	1.50	0.60	0.68	1.18	1.58	1.68	1.35	1.21	1.08	
T_{20}	1.48	0.56	0.68	1.17	1.52	1.59	1.35	1.26	1.01	
T_{20}	1.43	0.44	0.89	1.12	1.39	1.76	1.34	1.24	1.05	
T_{20}	1.45	0.67	0.82	1.1	1.44	1.62	1.41	1.33	1.06	
Mean	1.47	0.57	0.77	1.14	1.48	1.66	1.36	1.26	1.05	
P18, single aspect bedroom										
T_{20}	1.57	0.50	0.57	1.08	1.70	1.73	1.40	1.31	1.06	
T_{20}	1.51	0.27	0.51	1.17	1.81	1.61	1.27	1.26	1.05	
T_{20}	1.58	0.54	0.64	1.30	1.68	1.70	1.33	1.28	1.03	
T_{20}	1.60	0.65	0.61	1.16	1.74	1.78	1.40	1.23	1.02	
Mean	1.57	0.49	0.58	1.18	1.73	1.71	1.35	1.27	1.04	
P18, living room										
T_{20}	1.08	0.59	0.55	1.1	1.13	1.13	1.09	0.97	0.87	
T_{20}	0.98	0.42	0.55	1.13	1.02	1.13	1.11	1.04	0.83	
T_{20}	1.06	0.62	0.63	1.02	1.15	1.21	1.05	0.98	0.87	
T_{20}	1.00	0.41	0.52	1.02	1	1.12	1.15	1.02	0.84	
Mean	1.03	0.51	0.56	1.07	1.08	1.15	1.10	1.00	0.85	
P14 front bedroom										
T_{20}	1.60	0.32	0.41	1.34	1.5	1.86	1.57	1.45	1.17	
T_{20}	1.68	0.61	0.6	1.38	1.84	1.85	1.55	1.38	1.13	
T_{20}	1.69	0.33	0.51	1.11	1.66	2.04	1.6	1.43	1.14	
T_{20}	1.69	0.27	0.52	1.06	1.54	1.98	1.61	1.33	1.15	
Mean	1.67	0.38	0.51	1.22	1.64	1.93	1.58	1.40	1.15	
P14 rear bedroom										
T_{20}	1.41	0.55	0.28	0.98	1.46	1.58	1.26	1.16	0.97	
T_{20}	1.33	0.52	0.39	1.03	1.42	1.44	1.24	1.12	0.94	
T_{20}	1.51	0.43	0.37	1.08	1.74	1.48	1.23	1.02	0.94	
T_{20}	1.49	0.46	0.4	1.21	1.53	1.5	1.17	1.06	0.93	
Mean	1.44	0.49	0.36	1.08	1.54	1.50	1.23	1.09	0.95	
P14 living room										
T_{20}	1.47	0.42	0.42	1.02	1.48	1.51	1.25	1.14	0.96	
T_{20}	1.94	0.56	0.79	1.45	1.89	2.29	1.81	1.54	1.21	
T_{20}	1.98	0.49	1.26	1.43	2.02	2.12	1.9	1.53	1.28	
T_{20}	1.95	0.57	0.99	1.22	1.95	2.11	1.77	1.55	1.24	
Mean	1.84	0.51	0.87	1.28	1.84	2.01	1.68	1.44	1.17	

Standardised Internal Sound Levels

Plot 14

02 & 03 September 2021. Night time - standardised levels										
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k	
Rear bed (MVHR off)										
L_{eq}	13	21	19	8	4	3	5	7	8	
L_{max}	30	39	34	26	29	26	12	16	12	
Rear bed (MVHR off)										
L_{eq}	13	19	19	8	2	3	5	7	8	
L_{max}	22	34	29	20	18	17	13	12	10	
L_{eq} mean (log) MVHR off	13									
L_{max} mean (log) MVHR off	28									
Rear bed (MVHR on)										
L_{eq}	29	35	40	34	26	16	10	8	8	
L_{max}	33	40	45	37	28	21	16	16	13	
Rear bed (MVHR on)										
L_{eq}	29	35	40	33	26	16	10	8	8	
L_{max}	35	40	45	37	29	25	28	20	11	
L_{eq} mean (log) MVHR on	29									
L_{max} mean (log) MVHR on	34									
Front bed (MVHR off)										
L_{eq}	15	32	24	14	4	3	4	7	8	
L_{max}	31	52	42	34	24	21	11	13	11	
Front bed (MVHR off)										
L_{eq}	15	33	24	12	4	3	4	7	8	
L_{max}	31	52	42	34	24	21	11	13	11	
L_{eq} mean (log) MVHR off	15									
L_{max} mean (log) MVHR off	31									
Front bed (MVHR on)										
L_{eq}	29	50	37	32	25	19	14	13	11	
L_{max}	32	53	44	32	24	23	14	14	8	
Front bed (MVHR on)										
L_{eq}	28	50	35	31	23	15	9	8	8	
L_{max}	34	57	39	34	26	22	23	17	11	
L_{eq} mean (log) MVHR on	29									
L_{max} mean (log) MVHR on	33									
Living room (MVHR off)										
L_{eq}	13	26	17	7	3	4	4	6	7	
Living room (MVHR off)										
L_{eq}	12	19	15	5	1	1	4	6	7	
Living room (MVHR on)										
L_{eq}	19	31	27	23	12	8	8	9	7	
Living room (MVHR on)										
L_{eq}	18	31	27	23	11	6	5	6	7	
L_{eq} mean (log) MVHR off	12									
L_{eq} mean (log) MVHR on	19									

03 September 2021. Daytime (morning) - standardised levels										
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k	
Rear bed (MVHR off)										
L_{eq}	24	32	39	22	12	10	9	8	8	
Rear bed (MVHR off)										
L_{eq}	24	36	38	22	12	12	10	8	8	
L_{eq} mean (log) MVHR off	24									
Rear bed (MVHR on)										
L_{eq}	30	38	43	34	25	18	13	9	8	
Rear bed (MVHR on)										
L_{eq}	30	38	43	34	25	18	13	8	8	
L_{eq} mean (log) MVHR on	30									
Front bed (MVHR off)										
L_{eq}	24	47	34	21	12	12	12	12	9	
Front bed (MVHR off)										
L_{eq}	23	46	35	21	10	7	8	8	9	
L_{eq} mean (log) MVHR off	24									
Front bed (MVHR on)										
L_{eq}	30	52	38	32	24	16	12	10	9	
Front bed (MVHR on)										
L_{eq}	30	52	38	32	24	16	12	10	9	
L_{eq} mean (log) MVHR on	30									
Living room (MVHR off)										
L_{eq}	23	40	33	25	14	12	11	10	9	
Living room (MVHR off)										
L_{eq}	23	40	33	25	14	12	11	10	9	
Living room (MVHR on)										
L_{eq}	25	42	35	20	13	14	19	17	11	
Living room (MVHR on)										
L_{eq}	24	40	33	19	14	16	17	17	11	
L_{eq} mean (log) MVHR off	23									
L_{eq} mean (log) MVHR on	25									

03 September 2021. Daytime (afternoon) - standardised levels											
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k		
Rear bed (MVHR off)											
L_{eq}	26	33	40	18	12	10	13	15	9		
Rear bed (MVHR off)											
L_{eq}	28	37	43	25	13	10	8	8	8		
L_{eq} mean (log) MVHR off	27										
Rear bed (MVHR on)											
L_{eq}	30	36	42	34	26	18	13	11	9		
Rear bed (MVHR on)											
L_{eq}	30	39	42	34	26	19	15	14	9		
L_{eq} mean (log) MVHR on	30										
Front bed (MVHR off)											
L_{eq}	25	43	38	24	19	10	13	14	9		
Front bed (MVHR off)											
L_{eq}	23	43	36	20	9	6	7	8	9		
L_{eq} mean (log) MVHR off	24										
Front bed (MVHR on)											
L_{eq}	28	47	37	32	24	16	12	11	9		
Front bed (MVHR on)											
L_{eq}	29	47	39	33	25	18	18	13	9		
L_{eq} mean (log) MVHR on	29										
Living room (MVHR off)											
L_{eq}	22	37	33	24	13	10	11	9	9		
Living room (MVHR off)											
L_{eq}	22	37	32	25	13	9	9	11	9		
Living room (MVHR on)											
L_{eq}	26	38	40	23	15	13	12	10	9		
Living room (MVHR on)											
L_{eq}	24	39	36	24	16	14	12	9	9		
L_{eq} mean (log) MVHR off	22										
L_{eq} mean (log) MVHR on	23										

Plot 18

Plot 18 Blackrock Street, Droylesden										
Existing noise climate survey.										
02 & 03 September 2021. Night time - standardised levels										
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k	
Double aspect bedroom (MVHR off) (run 3)										
L_{eq}	18	23	13	12	12	15	9	7	8	
L_{max}	32	32	22	26	29	30	19	12	9	
Double aspect bedroom (MVHR off) (run 4)										
L_{eq}	16	23	12	10	10	12	7	6	8	
L_{max}	22	28	18	17	18	17	14	10	9	
L_{eq} mean (log) MVHR off	17									
L_{max} mean (log) MVHR off	29									
Double aspect bedroom (MVHR on) (run 5)										
L_{eq}	30	42	36	35	28	22	17	9	8	
L_{max}	38	49	40	38	32	34	31	18	14	
Double aspect bedroom (MVHR on) (run 6)										
L_{eq}	30	42	36	35	27	19	14	8	8	
L_{max}	34	49	40	38	30	25	21	15	11	
L_{eq} mean (log) MVHR on	30									
L_{max} mean (log) MVHR on	36									
Single aspect bedroom (MVHR off)										
L_{eq}	15	24	24	12	3	3	5	7	9	
L_{max}	28	43	40	29	16	18	16	14	12	
Single aspect bedroom (MVHR off)										
L_{eq}	22	31	26	18	10	13	15	17	11	
L_{max}	47	55	46	40	30	36	40	43	33	
L_{eq} mean (log) MVHR off	20									
L_{max} mean (log) MVHR off	44									
Single aspect bedroom (MVHR on)										
L_{eq}	30	44	40	34	25	17	13	11	10	
L_{max}	34	47	42	40	30	22	21	18	14	
Single aspect bedroom (MVHR on)										
L_{eq}	28	41	38	32	26	15	11	9	9	
L_{max}	34	48	42	40	29	17	18	13	10	
L_{eq} mean (log) MVHR on	29									
L_{max} mean (log) MVHR on	34									
Living room (MVHR off) (run 9)										
L_{eq}	16	22	17	7	6	11	7	8	9	
Living room (MVHR off) (run 10)										
L_{eq}	15	22	16	8	6	10	6	7	8	
Living room (MVHR on) (run 11)										
L_{eq}	24	36	35	29	16	12	8	8	9	
Living room (MVHR on) (run 12)										
L_{eq}	25	36	35	29	17	16	12	9	9	
L_{eq} mean (log) MVHR off	15									
L_{eq} mean (log) MVHR on	24									

03 September 2021. Daytime (morning) - standardised levels										
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k	
Double aspect bedroom (MVHR off) (run 3)										
L_{eq}	21	36	25	18	16	14	14	9	9	
Double aspect bedroom (MVHR off) (run 4)										
L_{eq}	22	35	28	21	17	16	14	12	8	
L_{eq} mean (log) MVHR off	22									
Double aspect bedroom (MVHR on) (run 5)										
L_{eq}	31	45	36	35	28	20	17	13	10	
Double aspect bedroom (MVHR on) (run 6)										
L_{eq}	31	46	38	35	26	21	18	12	10	
L_{eq} mean (log) MVHR on	31									
Single aspect bedroom (MVHR off)										
L_{eq}	24	37	34	24	16	15	14	15	11	
Single aspect bedroom (MVHR off)										
L_{eq}	18	35	27	15	8	8	8	9	9	
L_{eq} mean (log) MVHR off	22									
Single aspect bedroom (MVHR on)										
L_{eq}	32	44	43	36	29	21	18	16	11	
Single aspect bedroom (MVHR on)										
L_{eq}	32	43	44	36	28	19	14	11	9	
L_{eq} mean (log) MVHR on	32									
Living room (MVHR off)										
L_{eq}	20	37	32	16	11	10	9	11	10	
Living room (MVHR off)										
L_{eq}	20	36	33	15	9	8	7	9	10	
Living room (MVHR on)										
L_{eq}	25	39	35	29	16	13	11	10	10	
Living room (MVHR on)										
L_{eq}	25	39	35	29	16	13	11	10	10	
L_{eq} mean (log) MVHR off	20									
L_{eq} mean (log) MVHR on	25									

03 September 2021. Daytime (afternoon) - standardised levels										
Octave Band Centre Frequency, Hz.	dB(A)	63	125	250	500	1k	2k	4k	8k	
Double aspect bedroom (MVHR off) (run 3)										
L_{eq}	20	36	26	17	13	14	12	9	8	
Double aspect bedroom (MVHR off) (run 4)										
L_{eq}	21	37	29	19	15	15	11	8	8	
L_{eq} mean (log) MVHR off	20									
Double aspect bedroom (MVHR on) (run 5)										
L_{eq}	30	45	37	35	27	17	13	11	9	
Double aspect bedroom (MVHR on) (run 6)										
L_{eq}	30	45	38	35	27	17	13	11	9	
L_{eq} mean (log) MVHR on	30									
Single aspect bedroom (MVHR off)										
L_{eq}	23	36	30	17	11	13	15	18	13	
Single aspect bedroom (MVHR off)										
L_{eq}	20	37	32	19	7	7	8	9	9	
L_{eq} mean (log) MVHR off	22									
Single aspect bedroom (MVHR on)										
L_{eq}	30	42	38	36	26	17	14	12	10	
Single aspect bedroom (MVHR on)										
L_{eq}	30	43	38	36	26	16	13	12	10	
L_{eq} mean (log) MVHR on	30									
Living room (MVHR off)										
L_{eq}	22	37	36	18	12	11	9	9	10	
Living room (MVHR off)										
L_{eq}	24	40	37	22	14	16	11	11	10	
Living room (MVHR on)										
L_{eq}	25	37	37	29	15	11	10	10	10	
Living room (MVHR on)										
L_{eq}	25	40	38	29	15	11	10	9	10	
L_{eq} mean (log) MVHR off	23									
L_{eq} mean (log) MVHR on	25									

Gardens

Plots 14 & 18 Blackrock Street, Droylesden												
External noise climate survey.												
03 September 2021. Daytime (morning)												
Plot 14 measurements: 09:30 - 09:45 hours												
Octave Band Centre Frequency, Hz.	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Plot 14, garden (MVHR off)												
L_{eq}	51	58	62	56	46	43	48	45	38	28	14	
Plot 14, garden (MVHR off)												
L_{eq}	52	57	60	55	46	45	47	46	45	33	15	
L_{eq} mean (log) MVHR off	52											
Plot 14, garden (MVHR on)												
L_{eq}	50	56	61	56	45	43	46	44	36	26	13	
Plot 14, garden (MVHR on)												
L_{eq}	52	56	60	56	45	45	47	45	41	29	14	
L_{eq} mean (log) MVHR on	51											
Plot 18 measurements: 10:05 - 10:20 hours												
Octave Band Centre Frequency, Hz.	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Plot 18, garden (MVHR off)												
L_{eq}	44	54	60	48	42	39	39	35	32	27	15	
Plot 18, garden (MVHR off)												
L_{eq}	47	59	62	52	46	41	41	38	34	28	15	
L_{eq} mean (log) MVHR off	45											
Plot 18, garden (MVHR on)												
L_{eq}	45	59	61	51	42	39	40	37	35	34	16	
Plot 18, garden (MVHR on)												
L_{eq}	46	57	61	49	44	39	40	38	35	33	18	
L_{eq} mean (log) MVHR on	45											