

**Assessment of the Existing Noise Climate in the Vicinity of the
Permitted Houses at Lathbury Road, Harpurhey, Manchester**

Report Prepared for:

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1.0 Summary

Planning consent has been granted permitting the construction of six new semi-detached, two and three bedroom, houses on a parcel of land bounded by Lathbury Road and Carrisbrook Street in Manchester. The permission was granted subject to a number of conditions one of which, condition 12, related specifically to the acoustic environment in which the permitted houses would be built. In compliance with the requirements contained within condition 12 of the Planning Permission, Druk Limited was commissioned to undertake an assessment of the existing noise climate in the immediate vicinity of the permitted dwellings and to assess what, if any, mitigation measures may be necessary to limit the ingress of external noise. In addition, this version 3 of the report has been updated to include a consideration of the "*potential noise impacts from the proposed air source heat pumps (ASHPs)*".

The existing noise climate in the vicinity of the permitted development on Lathbury Road in Manchester was characteristic of a sub-urban environment, subject to noise contributions primarily from road traffic, although during the course of the afternoon and evening survey additional noise contributions were made by people attending football practice on the nearby sports pitches.

Applying the obtained sound levels from the noise surveys and combining these with the stated assumptions relating to the sound insulation of the proposed façade elements, calculations have been undertaken to assess the likely internal noise levels within the permitted semi-detached houses. The calculations have demonstrated that the sound insulation of the proposed façade elements would, including the provision of a mechanical ventilation with heat recovery (MVHR) ventilation system to each house, ensure that the calculated break-in sound levels within the permitted houses would not exceed the adopted design guide values contained within BS 8233:2014.

Turning to the noise climate within the rear external amenity areas, the measured noise levels from the surveys have indicated that the likely noise climate in what would be the rear gardens of the permitted houses should not exceed the upper guideline value contained within BS 8233: 2014 as it is. Despite this, the scheme drawings indicate that the rear gardens will be enclosed by timber fencing, which providing they are of reasonably robust close boarded type with no gaps between the boards and around 1.8 metres in height, would be assumed to provide at least 5B of attenuation to the rear gardens. Consequently, it is suggested that the likely noise climate in the rear gardens of the permitted houses should not exceed guidance contained within BS 8233:2014, therefore it is suggested that the existing noise climate would not prejudice the noise climate in the external amenity areas serving the houses.

As a consequence of the foregoing, it is suggested the sound insulation of the proposed façade elements incorporating the proposed alternative ventilation provision, would be sufficient to limit the ingress of external noise to the permitted houses in compliance with the adopted design guidance.

In addition, as per Manchester City Council's requirement to undertake a "*consideration of potential noise impacts from the proposed air source heat pumps (ASHPs)*", the initial assessment of the sound emission from the ASHPs has suggested that it would be very unlikely that this would have a detrimental effect on the existing noise climate in the vicinity of the nearest noise sensitive locations. Despite this, the required post

completion validation assessment would provide an opportunity, in the unlikely event that the assessment highlights a problem with the emission of sound from the ASHPs, to specify suitable and efficient mitigation measures to address the situation.

Report Prepared by:

A handwritten signature in black ink, appearing to read 'R. Smith'.

.....
Robert Smith

2.0 Introduction

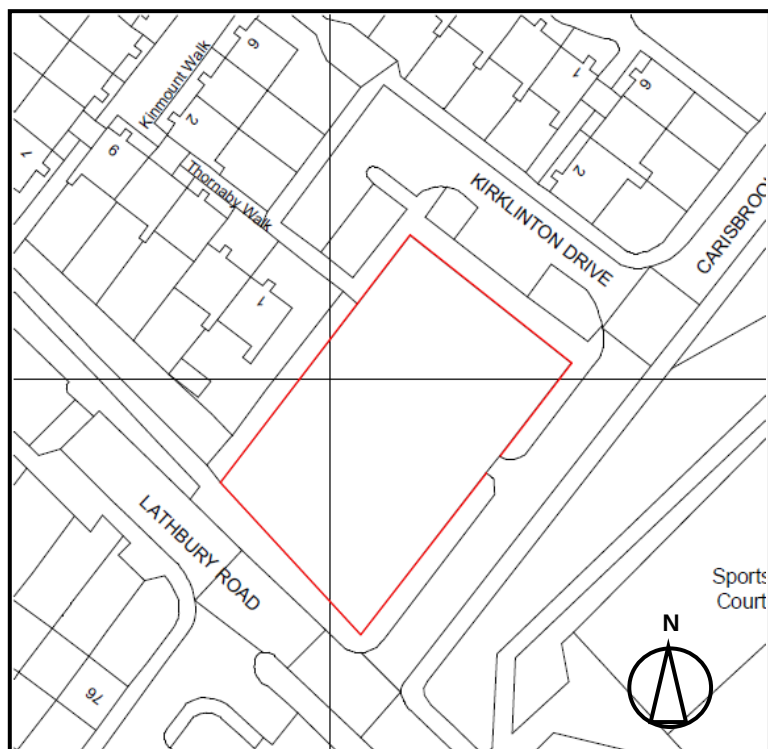
Planning consent has been granted permitting the construction of six new semi-detached, two and three bedroom, houses on a parcel of land bounded by Lathbury Road and Carrisbrook Street in Manchester. The permission was granted subject to a number of conditions one of which, condition 12, related specifically to the acoustic environment in which the permitted houses would be built. In compliance with the requirements contained within condition 12 of the Planning Permission, Druk Limited was commissioned to undertake an assessment of the existing noise climate in the immediate vicinity of the permitted dwellings and to assess what, if any, mitigation measures may be necessary to limit the ingress of external noise.

In compliance with an additional request made by Manchester City Council, this revised version of the existing noise climate assessment report (version 3) contains an initial evaluation of the potential emission of sound from the proposed air source heat pumps that will serve each of the permitted dwellings.

3.0 Site Description

The permitted houses will be built on a parcel of largely overgrown land bounded by Lathbury Road to the West, Carrisbrook Street to the South and Kirklington Drive to the North (figure 1 below and photograph 1 overleaf). To the North of the development site are the existing residential houses on Kirklington Drive (photograph 2 overleaf). To the South of the development site is Lathbury Road (Photographs 2 and 3 overleaf) with a copse of trees beyond. To the East of the development site is Carrisbrook Road with a number of sports pitches and the Manchester P A Pump Park beyond (photographs 3 and 4 overleaf). To the West of the development site is Lathbury Road with a number of existing residential houses beyond (photograph 5 overleaf).

Figure 1. Site of the permitted residential development (edged in red), Lathbury Road, Manchester



Photograph 1. Permitted development site on the corner of Lathbury Road and Carrisbrook Street



Photograph 2. Lathbury Road, looking North West



Photograph 3. Lathbury Road, looking South East



Photograph 4. Carrisbrook Road and the sports pitches to the East of the development site



Photograph 5. Lathbury Road and the existing houses to the West of the development site



4.0 Assessment Criteria

The planning permission, dated 21st December 2023 contained a number of conditions of which one, condition 12, dealt specifically with the issue of the existing noise climate in the vicinity of the permitted dwellings. The text of planning condition 12 is reproduced below:

- 12)** *a) Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Rochdale Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The potential for overheating shall also be assessed and the noise insulation scheme shall take this into account. The approved noise insulation and ventilation scheme shall be completed before any of the dwelling units are occupied. Noise survey data shall include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary.*
- b) Prior to first occupation of the residential units, a verification report shall be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the internal noise criteria have 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.*

Reason - To secure a reduction in noise from traffic or other sources in order to protect future residents from noise disturbance, pursuant to policies SP1 and DM1 of the Core Strategy for the City of Manchester.

Planning condition 12 does not make any specific reference to the acoustic conditions that are to be met within the permitted houses, therefore the guidance contained within British Standard (BS) 8233:2014 “Guidance on sound insulation and noise reduction for buildings” will be applied and the details of the guidance will be discussed in more detail below. In addition, planning condition 12 makes specific reference to the emission of noise from Rochdale Road, which is approximately 230 metres to the West of the development site and to the potential for overheating.

Consequently the aim of this report will be to assess the existing noise climate and to evaluate what sound insulation measures may be necessary to ensure suitable acoustic conditions will prevail within the permitted houses and any external amenity areas serving the houses. The report will also briefly consider the interaction of the proposed sound insulation measures with any ventilation measures. These assessments will be undertaken with appropriate reference to the guidance contained within British Standard (BS) 8233:2014 “Guidance on sound insulation and noise reduction for buildings”, the Acoustics, Ventilation and Overheating - Residential Design Guide and Approved Documents F and O (ADF and ADO).

4.1 BS 8233:2014 “Guidance on Sound Insulation and Noise Reduction for Buildings”

BS 8233:2014 draws together research and best practice relating to building design, providing guidance to facilitate the development of buildings that have internal noise environments that are consistent with and appropriate for their intended use. The Standard states that the guidance it contains is applicable to the design of new buildings, or refurbished buildings undergoing a change of use and as such it is deemed applicable to this proposal.

The British Standard highlights methods for the control of noise from a number of sources including external noise and building services etc., as well as evaluating the effect that noise from these sources may have on the acoustics of the internal spaces. With reference to the design guidance relating to the internal noise climate of dwelling houses flats and rooms in residential use, it is suggested that the guidance is applicable to 'anonymous' noise without a 'specific' character, and this is typically the situation where road traffic type noise is the dominant or principal contributor to the existing noise climate. This being the case BS 8233:2014 indicates that it would be desirable for the internal noise levels, resulting from the break-in of external noise, not to exceed the guide values detailed within table 4 of section 7.7.2. The main elements of the guidance contained within table 4 of section 7.7.2 of BS 8233:2014 are reproduced in table 1 below.

Table 1. 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 $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining room/area	40dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq, 16 \text{ hour}}$	30dB $L_{Aeq, 8 \text{ hour}}$

It should also be noted that BS 8233:2014 applies the frequently quoted 'rule of thumb' that where a window is partially open for ventilation purposes etc., the sound levels just outside the window will be around 15dB higher than the levels just inside the window. Despite this, a number of other documents indicate that the sound insulation provided by a partially open window would be in the region of 9 - 13dB.

In addition to the internal noise design guidance detailed above, supplementary notes 4, 5 and 7 to table 4 of section 7.7.2 are deemed appropriate to this assessment and state the following:

Note 4. *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.*

Note 5. *If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting sound level.*

Note 7. *Where development is considered as necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.*

With reference to note 4 it should be noted that the current version of BS 8233:2014 does not, unlike the previous 1999 version of BS 8233, contain specific guidance relating to the L_{Amax} criterion for bedrooms. Despite this, the guidance contained within the World Health Organisation's (WHO) "Guidelines for Community Noise" and the previous version of BS 8233, will be adopted for this assessment. The specific guidance contained within the 1999 version of BS 8233 guidance stated that: "*for a reasonable standard for bedrooms at night, individual noise events (measured with the fast time-weighting) should not normally exceed 45 dB L_{Amax}* ".

Further guidance relating to the L_{Amax} criterion is contained within the Planning and Noise: Professional Guidance on Planning and Noise (ProPG), published jointly by representatives of the Chartered Institute of Environmental Health (CIEH), the Institute of Acoustics (IoA) and the Association of Noise Consultants (ANC). At paragraph A.20 of the Pro PG document the following is stated: "*...therefore, it is considered that if, in bedrooms at night, the $L_{Amax,F}$ from individual noise events (from all sources) would not normally exceed 45dB more than 10 times a night, then this represents a reasonable threshold below which the events on sleep can be regarded as negligible*".

It must however be stated that many regard the 45dB L_{Amax} criterion as stringent. Additionally, it must be remembered that all of the above criteria are design guidance, they do not represent a set of rigid criteria, below which a development 'passes' and above which a development 'fails'.

In addition to the internal noise design guidance, BS 8233:2014 also provides guidance on the external noise environment. In this situation BS8233:2014, 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".

4.2 Approved Document F (ADF) - Ventilation

With reference to the relevant guidance relating to the ventilation of dwellings, this is contained within Approved Document F (ADF) guidance to the Building Regulations 2010, currently in the 2021 edition as it relates to dwellings.

In summary the ventilation strategies outlined in ADF relies on a combination of approaches, including: Extract ventilation to remove water vapour or pollutants; whole dwelling ventilation to provide fresh air to the building and to dilute, disperse and remove water vapour and pollutants not removed by extract ventilation and purge ventilation to remove high concentrations of pollutants and water vapour. With reference to extract ventilation in individual rooms this is typically achieved via intermittent extraction fans, whole house ventilation is often achieved through a combination of background (trickle) ventilators and/or continuous supply fans and. It is acknowledged that purge ventilation is typically achieved through the opening of windows. ADF also states that *"Other ventilation systems may be acceptable if they can be shown to meet an equal level of performance"*.

Approved Document F details four main types of ventilation systems that can be used to provide ventilation to dwellings, typically described as systems 1 to 4. A summary of these systems is provided within table 2 below and this table also provides additional annotation that is expands upon the details provided within ADF.

Table 2. Summary of the ADF ventilation systems 1 - 4

Ventilation system	Purge ventilation
System 1: background ventilation (trickle ventilators) and intermittent extraction fans	Typically provided by opening windows
System 2: passive stack (natural)	Typically provided by opening windows
System 3: Continuous mechanical extraction (MEV) (Trickle ventilators provide inlet air)	Typically provided by opening windows
System 4: Continuous mechanical supply and extract with heat recovery (MVHR)	Typically provided by opening windows

Ventilation provisions conforming to the descriptions of systems 1, 3 and 4 are most commonly found within dwellings. With reference to purge ventilation, in addition to securing rapid exchange of air to remove pollutants, this can and is typically used to address the thermal comfort of occupants. It must however be remembered that the issue of thermal comfort is not covered by Approved Document F, guidance to the Building Regulations.

It should however be borne in mind that when specifying the ventilation provision for a dwelling, the interaction of the ventilation provision with the internal noise levels should be considered. This interaction is a result of the fact that the provision of suitable ventilation openings in a building façade can affect that the sound insulation of the

façade elements, which in turn can affect the level of external noise break-in and so the internal noise levels that will prevail within a dwelling. Whilst this report will specify an appropriate type of ventilation provision in accordance with the general descriptions contained within table above, it is not intended to be a detailed ventilation design statement and a full evaluation of any ventilation provision is beyond the remit of this report.

The ventilation of the internal spaces of a dwelling can include the opening of windows to the provision of dedicated mechanical ventilation. With reference to the opening of windows, as suggested above this will not only permit the exchange of air but will also facilitate the ingress of external noise. In this respect the estimates of the sound insulation provided by a window partially open for ventilation purposes can and do vary. With respect to the level of sound insulation provided by an open window, BS 8233:2014 quotes the 15dB 'rule of thumb' which suggests that where a window is partially open for ventilation purposes etc., the sound levels just outside the window will be around 15dB higher than the levels just inside the window. The "Acoustics Ventilation and Overheating Residential Design Guidance", the AVO Guide, formulated by the Association of Noise Consultants (ANC) suggests that a partially open window can provide a sound insulation value of around 13dB. Finally, data presented by Søndergaard & Egedal (2016) suggested that for a top hung window with an opening equivalent to 0.35m^2 , a sound insulation value of around 9dB R_w would be expected.

Consequently, it is suggested that in all but the quietest of areas that the opening of windows would result in the internal noise levels exceeding the adopted internal design guide levels. As such, in the majority of locations it will be necessary to provide alternative methods of ventilation to ensure that the internal spaces can be adequately ventilated without having to resort to opening windows and so detrimentally affecting the internal noise climate.

4.3 Approved Document O - Overheating

The guidance relating to the limitation of unwanted solar gains in summer, in addition to providing an 'adequate means' of removing heat from the indoor environment, are contained within Approved Document O (ADO) of the Building Regulations 2010 which came into effect in June 2022. The requirements relate to: dwellings, institutions or *"any other building containing one or more rooms for residential purposes, other than a room in a hotel"*.

Section 3 of ADO considers the situation where the external noise climate is 'noisy' enough that it would tend to discourage the opening of windows, as this would lead to potentially unacceptable high internal noise levels. In this respect, ADO suggests at Section 3.3 that:

"Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. *40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).*
- b. *55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am)"*

Immediately it can be seen that the suggested indoor noise levels within bedrooms during the night time period detailed within Section 3.3 of ADO, are higher than the

guide values for the same environment detailed within BS 8233:2014. This being the case, where alternative ventilation strategies are considered appropriate it is suggested that these are based on securing compliance with the guide values contained within BS 8233:2014, although it would be prudent to discuss this with the Local Planning Authority.

5.0 Survey Details

5.1 Survey Times and Personnel

The noise surveys to evaluate the existing noise climate in the vicinity of the permitted development on Lathbury Road were undertaken between 16:00 - 19:10 hours on Tuesday 15th October and between 23:00 - 09:00 hours on Thursday 17th - Friday 18th October.

The existing noise climate surveys were attended throughout and all measurements were conducted by Mr. R Smith of Druk Limited.

5.2 Weather

Throughout the existing noise climate surveys the weather conditions were as follows:

15th October 2024

All surfaces remained dry, cloud cover was 100%, the temperature was approximately 14°C throughout the survey, the wind speed was approximately 0.4m/s from the South East and the barometric pressure was approximately 1003mb.

Thursday 17th - Friday 18th October 2024

All surfaces were damp and remained so, cloud cover was 100%, the temperature ranged between approximately 13 - 6°C throughout the survey, the wind speed was less than 0.3m/s and the barometric pressure was approximately 1004mb.

5.3 Equipment

All the noise surveys and measurements were conducted using the equipment detailed in the table 3 overleaf. The sound level meter was field calibrated before, after and during the surveys as necessary, during which time no significant deviations in the calibrated levels were observed.

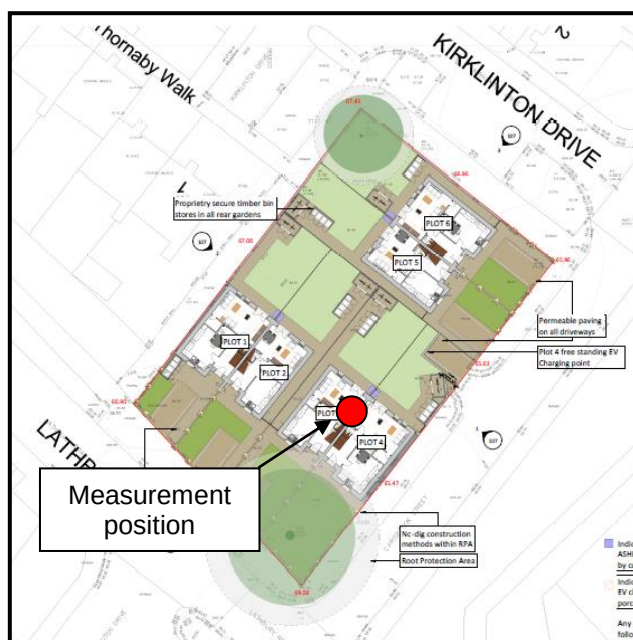
Table 3. Equipment used during the existing noise climate measurements

Equipment description	Manufacturer	Model number	Serial number
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
Microphone weather protection enclosures	NTI Audio	WP30	-

5.4 Measurement Procedure

The location of the permitted houses on Lathbury Road suggested that the principal contributor to the existing noise climate would be road traffic from vehicles on Lathbury Road and Carrisbrook Street, with the possibility for some additional contributions to be made from the use of the nearby sports pitches etc. No commercial or entertainment premises were obvious in the immediate vicinity of the development site.

An initial walkover assessment of the development site indicated that the noise levels across the site did not vary significantly. As such, it was decided that measurements in a single position would adequately evaluate the existing noise climate across the development site. As a consequence a single measurement location towards the South of the site was selected and this position is detailed on figure 2 below. The selected measurement position was approximately between what would be plots 3 and 4, with these plots being exposed to potentially the highest noise levels from traffic on Lathbury Road and Carrisbrook Street. With this in mind, measurements obtained from this position could be regarded as representing a worst case with respect to the houses on the remainder of the site.

Figure 2. Approximate location of the measurement position, proposed development layout

In the measurement position the sound level microphone was placed within a weather protection enclosure, with both the microphone and enclosure being tripod mounted such that they were approximately 1.5 metres above ground level. The microphone was connected to the sound level meter via a 10 metre extension cable and the position of the microphone meant that it was least 5 metres away from any large and potentially reflecting surfaces.

Throughout the surveys, all measurements were made with the 'fast' time weighting engaged, the measurement time interval was 5 minutes and all the measurements were attended throughout the surveys.

6.0 Noise Survey Results

The existing noise climate in the vicinity of the permitted development site was characteristic of a sub-urban environment, subject to noise contributions primarily from road traffic, although during the course of the afternoon and evening survey additional noise contributions were made by people attending the football practice on the nearby sports pitches. It was also the case that for the vast majority of the time during the existing noise climate surveys, the noise climate was regarded as comprising mainly 'anonymous' noise without specific character. No evidence of any significant commercial or industrial noise sources or noise sources associated with hospitality venues or the night time economy were audible or noted within the vicinity.

The following paragraphs contain brief subjective descriptions of the noise sources noted during the survey periods.

6.1 Qualitative Assessment: Afternoon/Evening Period, 15th October 2024

During the course survey the principal contributor to the existing noise climate was road traffic, primarily from vehicles travelling in both directions along Lathbury Road and slightly fewer vehicles being noted, again travelling in both directions, along Carrisbrook Street. The vast majority of the traffic comprised private cars and taxis with relatively few vans and light goods vehicles being noted. In addition and during the relative lulls in traffic on Lathbury Road and Carrisbrook Street, some distant lower frequency road traffic noise was noted.

Remaining with the traffic on Lathbury Road and Carrisbrook Street, the volume of traffic on both roads remained relatively steady throughout the majority of the survey period, although an increase in the numbers of vehicles occurred from around 18:00 hours. This increase in road traffic resulted from the arrival of a number of people attending football practice on the nearby sports pitches. This period was also characterised by an increase in pedestrians attending the matches and general conversational noise.

Additional noise sources audible during the survey included the sound of distant emergency vehicles sirens, occasional aircraft overflights and some noise from the surrounding residential dwellings. With reference to the aircraft noise, at around 17:23 hours a relatively helicopter overflight occurred which resulted in a short term but very pronounced increase in the overall noise levels.

6.2 Qualitative Assessment: Night time/Early Morning Period, 17th - 18th October 2024

As was the case during the daytime survey, the principal contributor to the noise climate during the night time period into the early morning was again road traffic with private cars and taxis representing the dominant class of vehicles. Overall the level of traffic on both Lathbury Road and Carrisbrook Street was reduced, when compared with the daytime situation, and displayed a generally reducing trend until around 01:00 hours. After this period the passage of the site by vehicles was a relatively infrequent occurrence although the volume of traffic began to increase from around 04:00 hours with a further and noticeable increase in traffic from around 08:00 hours. Between around 01:00 - 06:00 hours, in the absence of any road traffic the overall noise climate was regarded as being quite low. With respect to the number of vehicles on both Lathbury Road and Carrisbrook Street, the volume of traffic began to increase from around 04:00 hours with a further and noticeable increase in traffic from around 08:00 hours.

Additional noise sources audible during the survey included the sound of distant emergency vehicles, occasional aircraft overflights up to and including the period around 02:00 hours, the sound of wildlife both in the neighbourhood and in the undergrowth on the development site and from around 08:00 hours a considerable increase in pedestrian traffic on both Lathbury Road and Carrisbrook Street.

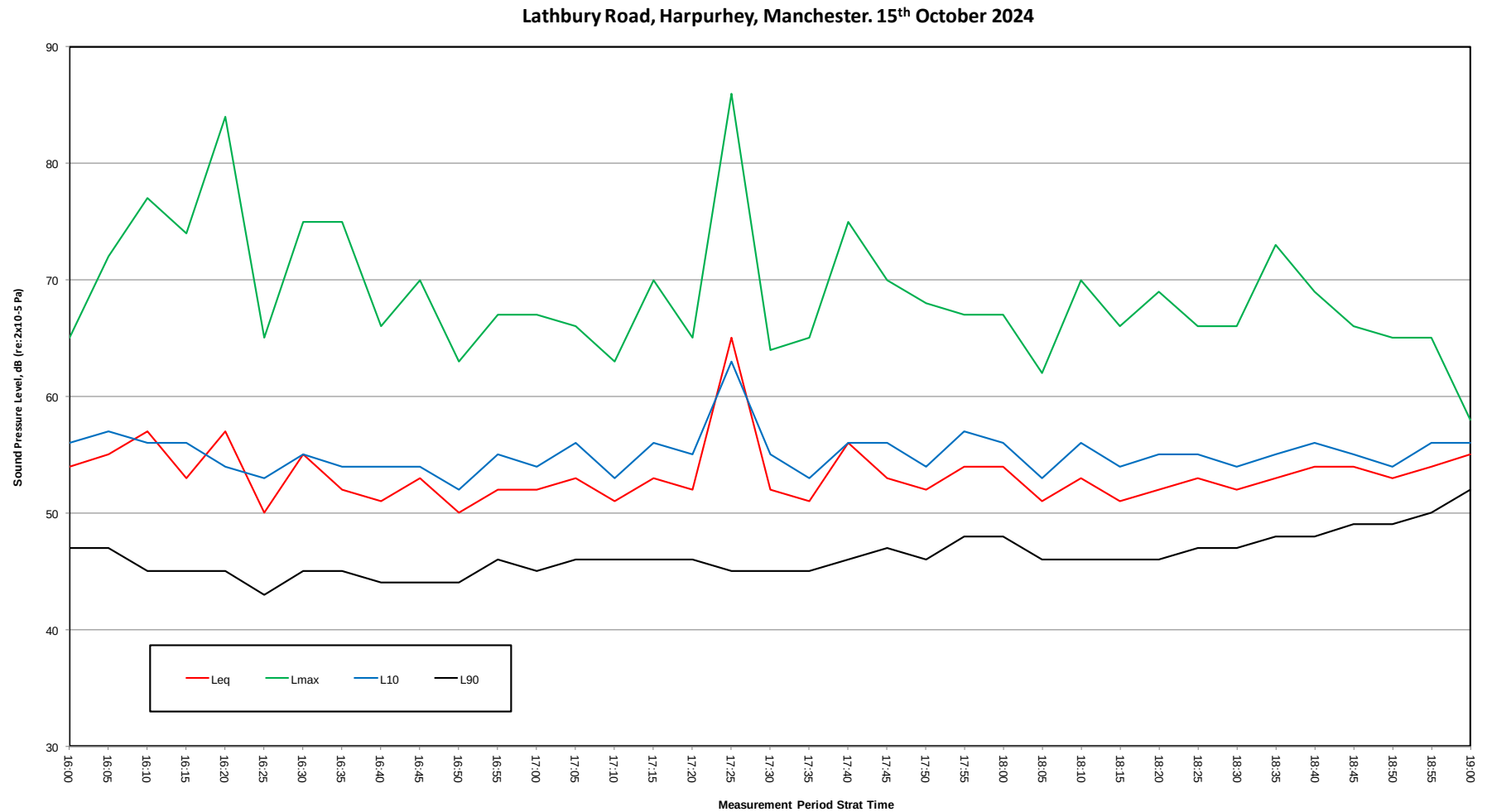
6.3 Basic Results and Discussion

By virtue of the significant amounts of measured noise data collected during the noise surveys table 4 and graphs 1 (containing the data from the afternoon/evening survey) and 2 overleaf (containing the data from the night time/early morning survey) overleaf contain summaries of the noise data from the noise measurement surveys. With reference to the results within table 6, the daytime results combined the results from both survey periods that fall within the daytime period (07:00 - 23:00 hours). Table 5 overleaf contains a brief summary of any noise events that were discernible above the general more 'anonymous' noise climate. Summaries of the measured noise data are presented in Appendix 1.

Table 4. Measured sound level summary, Lathbury Road

	$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
Standard deviation, daytime period	2.45	4.91	2.08	1.65
Standard deviation, night time period	4.21	7.43	4.44	3.52
Mean (log), daytime period	54	72	56	47
Mean (log), night time period	43	60	44	38
Modal value, daytime period	53	65	56	46
Modal value, night time period	42	56	39	33
Maximum value daytime period	65	86	63	52
Minimum value daytime period	47	58	48	43
Maximum value night time period	51	69	53	45
Minimum value night time period	35	41	35	32

Graph1. Measured sound level summary, Lathbury Road, 15th October 2024



Graph 2. Measured sound level summary, Lathbury Road, 17th - 18th October 2024

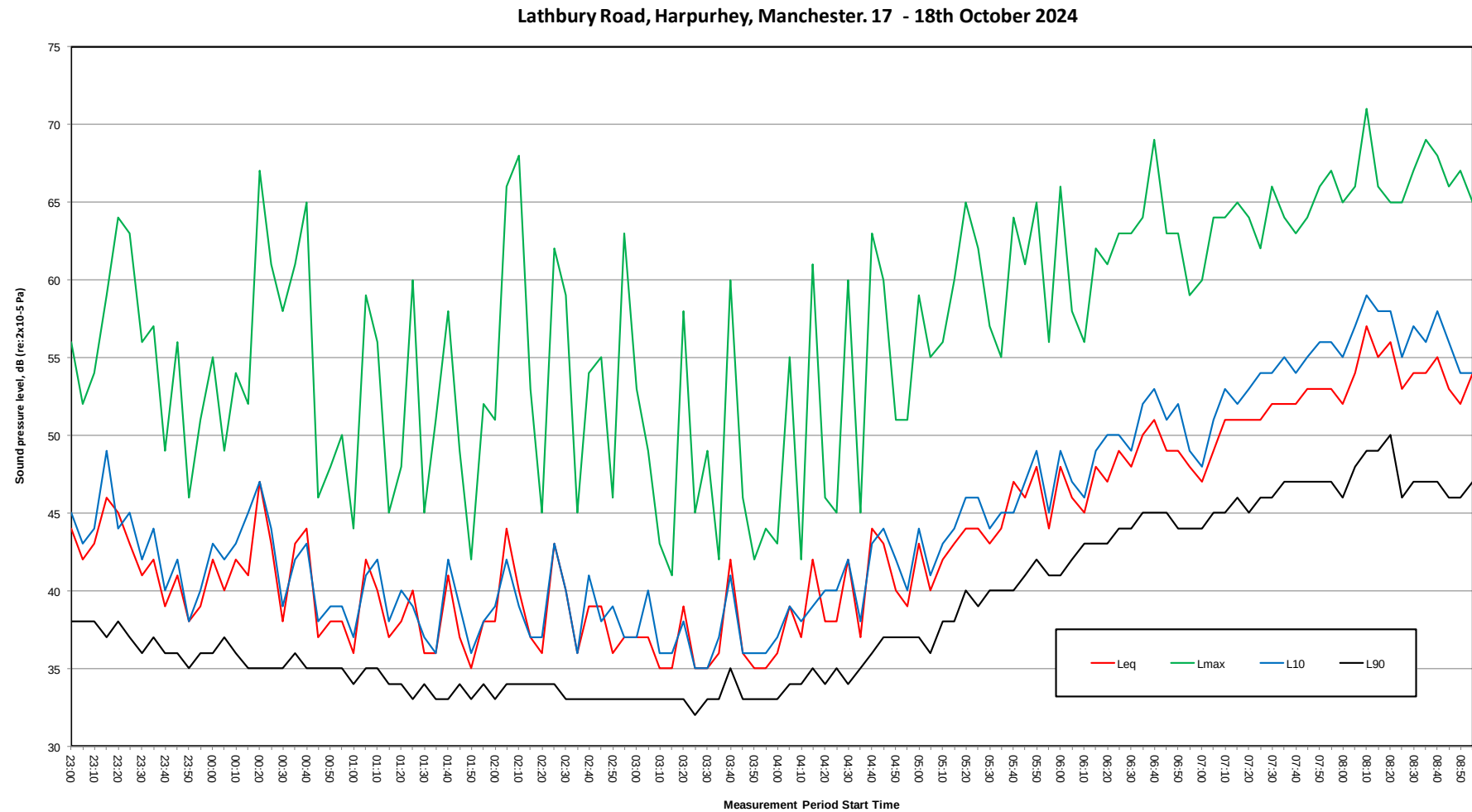


Table 5. Summary of discrete noise emission events, Lathbury Road

Time period	Comment
16:24	Car horn sounding just outside the development site
16:49	Emergency vehicle siren
17:07	Emergency vehicle siren
17:23	Low altitude helicopter overflight
18:00 - 18:45	Cars, attending the sports pitches, pulling in to park on Carrisbrook Road
01:20	High altitude aircraft overflight
01:50	High altitude aircraft overflight
02:43	High altitude helicopter overflight
04:35	Foxes barking close to the development site
04:35	Foxes barking close to the development site

As can be seen from table 4 and graphs 1 and 2 the noise climate during the afternoon/evening period was relatively steady, whereas the night time noise climate was more variable. The variability in the night time noise climate is quite typical as the daytime levels reduce, followed by a relatively quieter period through the dead of night before the levels begin to increase again towards the early daytime period. During the daytime period the mean (log) and modal values for the L_{eq} parameter were 54 and 53dB respectively, reducing to 43 and 42dB respectively during the night time period.

The measured noise levels from the surveys also have implications for the ventilation proposals for the permitted houses. As the existing noise climate was regarded as comprising mainly 'anonymous' noise without specific character, the internal noise levels calculations will be undertaken with reference to the design guide values detailed within BS 8233:2014. As a initial evaluation the 9 - 15dB 'rule of thumb' for the sound attenuation provided by a window partially open for ventilation purposes to the mean (log) day and night time values will be applied to the day and night time mean (log) L_{eq} noise levels. Under these conditions it is suggested that during the daytime the external noise climate would probably result in the internal noise guide value contained within BS 8233;2014 being exceeded. Turning to the night time situation it can be seen that the likely resulting noise level within a bedroom would be around the guide value detailed within BS 8233:2014.

Looking at the situation with respect to the guidance offered within Approved Document O, it should be remembered that this states: "*Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*"

- a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am)"

Again, applying the above range of values for an open window to the mean (log) L_{eq} night time level, it can be seen that it may be possible to have partially open windows

and still comply with the 40dB guide value. With reference to the night time L_{Amax} situation and taking the best case sound insulation for a partially open window, 15dB, this would suggest that proving the external noise level did not exceed 70dB just outside the bedroom more than 10 times per night, the guide value within the Pro PG and ADO documents would be met. As the night time L_{Amax} level did not exceed 70dB all night, this would suggest that the L_{Amax} guide value within ADO would also be met.

As a consequence it is suggested that in order to meet the daytime internal noise guide values within both BS 8233:2014 and ADO the windows would need to be kept closed and as such it is likely that some form of alternative ventilation provision would be required. However as the permitted houses will be provided with a full MVHR system, it is suggested that this would meet the alternative ventilation provision requirement. With reference to the night time situation, this is less clear cut as the initial evaluation indicates that applying the range of values for a partially open window to the mean L_{eq} value for the period, would result in the internal noise levels being at or very close to the guide values contained within BS 8233:2014 and ADO. It must however be stressed that suggesting the windows would need to be closed to comply with the internal noise criteria does not mean that the windows are to be unopenable, but merely that the occupants must be provided with the choice to open the windows or engage the alternative ventilation provision, the MVHR system, to ventilate the internal spaces whilst keeping the windows closed.

7.0 Noise Transmission Calculations

The subsequent assessment of the potential internal noise levels within the permitted houses will be assessed using the highest measured L_{Aeq} levels from the noise surveys on the front elevation and these levels are detailed in table 6 below. With reference the highest measured level of 65dB L_{Aeq} from the daytime period, this was a consequence of a low altitude helicopter overflight. As this occurred just once at around 17:23 hours, it was regarded as being untypical for the environment and as such the next highest measured noise level from the survey will be adopted.

Table 6. Measured sound levels used in the assessments

OBCF, Hz*	63	125	250	500	1k	2k	4k	8k	Overall, dB(A)
Daytime, L_{Aeq} , (16:20 - 16:25 hours)	63	54	47	49	53	52	44	34	57
Night time, L_{Aeq} , (06:40 - 06:5 hours)	59	51	47	46	48	44	36	32	51
Night time, L_{Amax} , (95 th percentile values)	72	67	60	58	61	59	53	51	65

With reference to the L_{Amax} levels, the assessment of the likely internal levels will be undertaken using the 95th Percentile value of the measured levels from the survey. The use of the 95th percentile ensures that the guidance contained within paragraph A.20 of the ProPg document which states "...therefore, it is considered that if, in bedrooms at night, the $L_{Amax,F}$ from individual noise events (from all sources) would not normally exceed 45dB more than 10 times a night, then this represents a reasonable threshold below which the events on sleep can be regarded as negligible", would be achieved. It is also the case that use of the 95th percentile will ensure that the requirement to deliver

"the optimum acoustic outcome for a particular site" without resorting to "overdesign or gold plating" would again be achieved.

The sound insulation provided by a building envelope is calculated from the sound insulation provided by the various façade elements, such as the glazing, external walls etc., and the areas they cover. In the majority of cases it is the glazing and ventilation provision that can be considered as the 'weak' links acoustically, therefore increasing the sound insulation of these elements will improve the overall sound insulation of the façade. The result of the calculation is a composite sound insulation value for the whole façade.

The following assessments of the likely internal noise levels within the permitted houses have been undertaken according to the room and façade dimensions detailed on the drawings issued by B T P Architects of Heaton Mersey, Stockport. To facilitate the calculations, the following assumptions have been employed:

- The reverberation times within the houses will be 0.5 seconds.
- The floor to ceiling height will be approximately 2.4 metres.
- The calculations have been produced assuming the windows would be closed with ventilation provided, where necessary via an alternative system.
- The sound levels detailed in table 6 above would be equally incident upon the front and rear elevations of the permitted houses.

7.1 Construction Specification

The permitted houses will be of timber frame construction with the following general specification: an external brick leaf, a 50mm cavity between the brick leaf and the 140mm timber stud frame filled with a combination of rigid PIR and mineral fibre insulation, lined internally with one layer of 12.5mm plasterboard. Test results for a similar construction suggest that cavity masonry walls of this type should provide a sound insulation value of around 60B R_w . The octave band sound insulation values being as detailed in table 7 below.

Table 7. Timber frame construction with masonry external leaf, Octave Band Sound Insulation Values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w dB(A)
Sound Insulation, dB	37	49	65	79	85	82	60

* Octave Band Centre Frequency

Glazing

The suggested glazing would be of the sealed unit type and would be of the following nominal specification: 4mm pane - 12 to 20mm cavity - 4mm pane. Laboratory test data obtained from Pilkington Glass indicate that this configuration should provide a sound insulation value of around 29dB R_w . The octave band sound insulation values are as detailed in table 8 overleaf.

Alternative glazing configurations would be acceptable providing the sound insulation performances are at least equivalent to the specifications detailed in table 8 overleaf.

Table 8. Glazing, octave band sound insulation values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w (C_{tr}) dB
4mm, 12 - 20mm, 4mm	21	17	25	35	37	315	29 (-4)

* Octave Band Centre Frequency

Ventilation

The noise survey has indicated that the existing environment is sub-urban in nature but was not regarded as being particularly noisy. It is understood from the principal contractor that the new houses will be provided with a mechanical ventilation with heat recovery (MVHR) system. As a consequence this system should ensure that, where necessary or desirable, the internal spaces of the houses could be adequately ventilated without having to open the windows. This being the case there will be no need for the provision of background ventilation etc. Despite this it is recommended that the noise emission from the operation of the MVHR is adequately controlled, such that it would not result in the guide levels relating to the internal noise climate being exceeded.

7.2 Calculation Results and Discussion

For the purposes of the calculations the noise levels detailed in table 6 above were used. As the development will comprise two styles of semi-detached houses, two and three bedroom variants, calculations have been performed for both house styles. For the purposes of the calculations it has been assumed that the windows would remain closed, as an alternative ventilation strategy is to be provided. As the existing noise climate was regarded as comprising mainly 'anonymous' noise without specific character, the internal noise levels calculations will be undertaken with reference to the design guide values detailed within BS 8233:2014.

The results of the break-in noise calculations for the permitted dwellings, including the assumptions relating to the proposed façade elements detailed above, are presented in tables 9 and 10 below and overleaf. With respect to the presentation of the results of the calculations, with reference to the night time L_{Aeq} and L_{Amax} results these are presented in the same columns with the L_{Amax} results being contained within brackets. Full data are available in Appendix 3.

Table 9. Calculated noise levels, two bedroom house

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Living/dining room	35	27	-	-
Bedroom 1	35	27	30 (45)	23 (36)
Bedroom 2	35	28	30 (45)	23 (37)

Table 10. Calculated noise levels, two bedroom house

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Living room	35	27	-	-
Kitchen/dining room	35	27		
Bedroom 1	35	27	30 (45)	22 (36)
Bedroom 2	35	27	30 (45)	22 (36)
Bedroom 3	35	29	30 (45)	24 (38)

As can be seen from tables 9 and 10 above, based on the stated assumptions relating to the sound insulation of the proposed façade elements, under the windows closed scenario and employing the measured levels from the noise surveys, the calculated internal noise levels within the permitted houses, resulting from external noise break-in, would not exceed the design guidance contained within BS 8233:2014 for both the L_{Aeq} and L_{Amax} parameters.

It should however be remembered that the results presented in the tables overleaf must be considered as a worst case using the highest measured L_{Aeq} levels. With this in mind it is suggested that the internal levels within the permitted dwellings would, for the majority of the time, be below the levels presented within tables 9 and 10. It is also the case that the on completion, the houses on the development may well provide some additional screening to their neighbours, so potentially further reducing their noise exposure.

7.3 External Amenity Areas

In addition to the internal noise design guidance, BS 8233:2014 also provides guidance on the external noise environment. In this situation BS8233:2014, 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 reference to the permitted dwellings it is suggested that the area to the rear of the houses would represent the primary amenity spaces. This being the case the mean value from the measurements made on the afternoon/evening of the 15th October would appear to be the most applicable to this situation. The mean level from this period was 55dB L_{Aeq} which does not exceed the upper guideline value detailed within BS 8233:2014.

The scheme drawings indicate that the rear gardens will be enclosed by timber fencing, providing a break in the line of sight between the rear gardens and the principal noise source - road traffic. With reference to the garden fences, providing they are of reasonable robust close boarded type with no gaps between the boards and around 1.8 metres in height, it would be assumed that such a provision would provide at least 5B of

attenuation to the rear gardens. Consequently, it is suggested that the likely noise climate in the rear gardens of the permitted houses should not exceed guidance contained within BS 8233:2014, therefore it is suggested that the existing noise climate would not prejudice the noise climate in the external amenity areas serving the houses.

7.4 Air Source Heat Pumps

In their email of the 20th December 2024 (reproduced in Appendix 4), Manchester City Council revised their earlier comments, contained in their email of the 4th December 2024 (reproduced in Appendix 4), relating to the provision of air source heat pumps (ASHPs) to the permitted dwellings. The most recent comments received from Manchester City Council indicated that they required the potential sound emission from the proposed ASHPs and any "*potential noise impacts*" to be considered. The following paragraphs contain an initial assessment of the possible sound emission from the proposed units.

At present the specification of the air source heat pumps has to be finalised, however it is very likely that they will be of the Mitsubishi PUZ-WZ50VAA(-BS) Ecodan R290 type. It is assumed that the ASHPs will be located within the rear gardens of each of the permitted dwellings, making a total of six ASHPs in total. Data obtained from the Mitsubishi technical manual indicates that in operation the sound emission (sound pressure level, L_p) from each unit would be 40dB at 1 metre in the heating mode.

In order to evaluate what effect the emission of sound from the ASHPs may have on the existing noise climate, a comparison will be made with the existing night time noise climate, as it is the night time period that is typically regarded as the most noise sensitive. Table 4 above reveals that the night time modal values for the L_{Aeq} and L_{A90} parameters were 42 and 33dB respectively. Site measurements suggest that at their closest points, the new houses will be approximately 7 - 9 metres from the gable of 1 Lathbury Road and 25 metres from the front elevation and gable of 1 Kirklington Drive and 2 Carrisbrook Road respectively.

In order to evaluate the likely sound level at the nearest noise sensitive location (the gable of 1 Lathbury Road) a number of assumptions will be employed. Starting with the emission of sound from the ASHPs, the published sound pressure levels will be employed. Therefore the resulting sound levels at the reception points will be assessed according to normal propagation convention. For the purposes of the calculations the following further assumptions have been applied:

- The sound emission from the ASHPs will be based on the units operating in the heating mode, typically the 'noisier' mode.
- It is anticipated that during the colder winter months, the units would operate for around 40 - 50% of the day and this would represent a worst case scenario with reference to the calculations.
- During the warmer months of the year when the temperature exceeds around 15°C, it is likely that the preferential operating mode of the ASHPs would be to provide hot water rather than space heating.
- The intervening surfaces would be relatively absorbent, so minimising ground reflections.

In addition, an assumption will be made that an ASHP was located 7 metres from the nearest house of Lathbury Road, at which distance the ASHP would be regarded as a point source, it would be anticipated that the sound level would reduce by around 16dB at the reception point. This would suggest that the resulting level, based on the manufacturer's sound level, would be around 24dB which would be comfortably below the modal L_{A90} values of her night time period. This initial assessment does not take into account the screening that would be provided by the 1.8m high close boarded fences that will surround the gardens or the shielding provided by some of the permitted houses themselves. Consequently, it is suggested that the overall level would be even lower at the nearest of the noise sensitive locations.

Further, assuming the highly unlikely scenario where all six AHSPs were operating simultaneously from one position closest to the nearest noise sensitive location, rather than the real situation where the ASHPs would be located across the development, the resulting noise level at the nearest noise sensitive location would be around 32dB. This level would still be below the modal night time L_{A90} value and would in reality be lower than this by virtue of the shielding provided by intervening structures and the fact that the units would be distributed across the development site.

Although it is suggested that the emission of sound from the operation of the ASHPs would be very unlikely to have a detrimental effect on the existing noise climate of the surrounding houses, the requirement to undertake validation testing of the completed development should include an assessment of the sound emission from the ASHPs. In the unlikely event that the assessment highlights that a problem exists, suitable and efficient mitigation measures could be specified to address the situation.

8.0 **Conclusion**

The existing noise climate in the vicinity of the permitted development on Lathbury Road in Manchester was characteristic of a sub-urban environment, subject to noise contributions primarily from road traffic, although during the course of the afternoon and evening survey additional noise contributions were made by people attending the football practice on the nearby sports pitches.

Applying the obtained sound levels from the surveys and combining these with the stated assumptions relating to the sound insulation of the proposed façade elements, the calculations have demonstrated that the sound insulation of the proposed façade elements would, including the provision of a mechanical ventilation with heat recovery (MVHR) ventilation system to each house, ensure that the calculated break-in sound levels within the permitted houses would not exceed the adopted design guide values contained within BS 8233:2014.

Turning to the noise climate within the rear external amenity areas, the measured noise levels from the surveys have indicated that the likely noise climate in what would be the rear gardens of the permitted houses should not exceed the upper guideline value contained within BS 8233: 2014 as it is. Despite this, the scheme drawings indicate that the rear gardens will be enclosed by timber fencing, which they are of reasonable robust close boarded type with no gaps between the boards and around 1.8 metres in height, would be assumed to provide at least 5B of attenuation to the rear gardens. Consequently, it is suggested that the likely noise climate in the rear gardens of the

permitted houses should not exceed guidance contained within BS 8233:2014, therefore it is suggested that the existing noise climate would not prejudice the noise climate in the external amenity areas serving the houses.

As a consequence of the foregoing, it is suggested the sound insulation of the proposed façade elements incorporating the proposed alternative ventilation provision, would be sufficient to limit the ingress of external noise to the permitted houses in compliance with the adopted design guidance.

In addition, as per Manchester City Council's requirement to undertake a "*consideration of potential noise impacts from the proposed air source heat pumps (ASHPs)*", the initial assessment of the sound emission from the ASHPs has suggested that it would be very unlikely that this would have a detrimental effect on the existing noise climate in the vicinity of the nearest noise sensitive locations.

Appendix 1: Existing Noise Climate Surveys, Measured Sound LevelsAfternoon/evening period, 15th October 2024

Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$	Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$
16:00	54	65	56	47	18:00	54	67	56	48
16:05	55	72	57	47	18:05	51	62	53	46
16:10	57	77	56	45	18:10	53	70	56	46
16:15	53	74	56	45	18:15	51	66	54	46
16:20	57	84	54	45	18:20	52	69	55	46
16:25	50	65	53	43	18:25	53	66	55	47
16:30	55	75	55	45	18:30	52	66	54	47
16:35	52	75	54	45	18:35	53	73	55	48
16:40	51	66	54	44	18:40	54	69	56	48
16:45	53	70	54	44	18:45	54	66	55	49
16:50	50	63	52	44	18:50	53	65	54	49
16:55	52	67	55	46	18:55	54	65	56	50
17:00	52	67	54	45					
17:05	53	66	56	46					
17:10	51	63	53	46					
17:15	53	70	56	46					
17:20	52	65	55	46					
17:25	65	86	63	45					
17:30	52	64	55	45					
17:35	51	65	53	45					
17:40	56	75	56	46					
17:45	53	70	56	47					
17:50	52	68	54	46					
17:55	54	67	57	48					

Night time/Early Morning Period, 17th - 18th October 2024

Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$	Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$
23:00	44	56	45	38	01:00	36	44	37	34
23:05	42	52	43	38	01:05	42	59	41	35
23:10	43	54	44	38	01:10	40	56	42	35
23:15	46	59	49	37	01:15	37	45	38	34
23:20	45	64	44	38	01:20	38	48	40	34
23:25	43	63	45	37	01:25	40	60	39	33
23:30	41	56	42	36	01:30	36	45	37	34
23:35	42	57	44	37	01:35	36	51	36	33
23:40	39	49	40	36	01:40	41	58	42	33
23:45	41	56	42	36	01:45	37	49	39	34
23:50	38	46	38	35	01:50	35	42	36	33
23:55	39	51	40	36	01:55	38	52	38	34
00:00	42	55	43	36	02:00	38	51	39	33
00:05	40	49	42	37	02:05	44	66	42	34
00:10	42	54	43	36	02:10	40	68	39	34
00:15	41	52	45	35	02:15	37	53	37	34
00:20	47	67	47	35	02:20	36	45	37	34
00:25	43	61	44	35	02:25	43	62	43	34
00:30	38	58	39	35	02:30	40	59	40	33
00:35	43	61	42	36	02:35	36	45	36	33
00:40	44	65	43	35	02:40	39	54	41	33
00:45	37	46	38	35	02:45	39	55	38	33
00:50	38	48	39	35	02:50	36	46	39	33
00:55	38	50	39	35	02:55	37	63	37	33

Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$
03:00	37	53	37	33
03:05	37	49	40	33
03:10	35	43	36	33
03:15	35	41	36	33
03:20	39	58	38	33
03:25	35	45	35	32
03:30	35	49	35	33
03:35	36	42	37	33
03:40	42	60	41	35
03:45	36	46	36	33
03:50	35	42	36	33
03:55	35	44	36	33
04:00	36	43	37	33
04:05	39	55	39	34
04:10	37	42	38	34
04:15	42	61	39	35
04:20	38	46	40	34
04:25	38	45	40	35
04:30	42	60	42	34
04:35	37	45	38	35
04:40	44	63	43	36
04:45	43	60	44	37
04:50	40	51	42	37
04:55	39	51	40	37

Start Time	$L_{Aeq, 5mins}$	$L_{Amax, 5mins}$	$L_{A10, 5mins}$	$L_{A90, 5mins}$
05:00	43	59	44	37
05:05	40	55	41	36
05:10	42	56	43	38
05:15	43	60	44	38
05:20	44	65	46	40
05:25	44	62	46	39
05:30	43	57	44	40
05:35	44	55	45	40
05:40	47	64	45	40
05:45	46	61	47	41
05:50	48	65	49	42
05:55	44	56	45	41
06:00	48	66	49	41
06:05	46	58	47	42
06:10	45	56	46	43
06:15	48	62	49	43
06:20	47	61	50	43
06:25	49	63	50	44
06:30	48	63	49	44
06:35	50	64	52	45
06:40	51	69	53	45
06:45	49	63	51	45
06:50	49	63	52	44
06:55	48	59	49	44

Start Time	L_{Aeq} 5mins	L_{Amax} , 5mins	L_{A10} , 5mins	L_{A90} , 5mins
07:00	47	60	48	44
07:05	49	64	51	45
07:10	51	64	53	45
07:15	51	65	52	46
07:20	51	64	53	45
07:25	51	62	54	46
07:30	52	66	54	46
07:35	52	64	55	47
07:40	52	63	54	47
07:45	53	64	55	47
07:50	53	66	56	47
07:55	53	67	56	47
08:00	52	65	55	46
08:05	54	66	57	48
08:10	57	71	59	49
08:15	55	66	58	49
08:20	56	65	58	50
08:25	53	65	55	46
08:30	54	67	57	47
08:35	54	69	56	47
08:40	55	68	58	47
08:45	53	66	56	46
08:50	52	67	54	46
08:55	54	65	54	47

Appendix 2: Break-in Noise Calculations

2 Bedroom House														
L _{Aeq} Assessment, daytime														
Living/dining room - rear elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L _{eq}	12 39.6	57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²		10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	
C	Volume of receiving room, m ³													
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))		-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	
F	Composite SRI			18.2	23.2	28.2	24.5	29.6	39.6	42.6	39.6	44.6	49.6	
G	A + B + E - F		21	44.2	39.3	25.2	21.7	18.9	13.0	9.0	4.5	-10.5	-25.9	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		24	47.2	42.3	28.2	24.7	21.9	16.0	12.0	7.5	-7.5	-22.9	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				31	36	37	34	30	33	38	43		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				31.0	16.9	8.8	14.0	22.1	18.1	5.6	-9.4		
N	Internal room noise level, vent open		27		42.6	28.5	24.8	22.6	23.1	19.1	9.7	-5.3		
Glazing:				4mm, 16/20mm, 4mm										
Ventilator type:				Greenwood 4000S										
Living/dining room - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L _{eq}	8 39.6	57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
C	Volume of receiving room, m ³													
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))		-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	
F	I bed existing			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		5	33.6	28.7	14.6	-4.5	-18.3	-28.2	-35.2	-39.7	-54.7	-65.1	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		8	36.6	31.7	17.6	-1.5	-15.3	-25.2	-32.2	-36.7	-51.7	-62.1	
Glazing:				-										
Ventilator type:				-										
			Combined sound level, dB(A)	27										
Bedroom 1 - rear elevation														
* Oc			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
		12 36.2	57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²		10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	
C	Volume of receiving room, m ³													
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))		-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	
F	Composite SRI			19.2	24.2	29.2	25.7	30.7	40.7	43.7	40.7	45.7	50.7	
G	A + B + E - F		20	43.6	38.7	24.6	20.9	18.1	12.2	8.2	3.7	-11.3	-26.7	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		23	46.6	41.7	27.6	23.9	21.1	15.2	11.2	6.7	-8.3	-23.7	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				31	36	37	34	30	33	38	43		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				31.0	16.9	8.8	14.0	22.1	18.1	5.6	-9.4		
N	Internal room noise level, vent open		27		42.0	27.9	24.1	21.9	22.9	18.9	9.2	-5.8		
Glazing:				4mm, 16/20mm, 4mm										
Ventilator type:				Greenwood 4000S										
Bedroom 1 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L _{eq}	7 36.2	57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
C	Volume of receiving room, m ³													
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))		-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		4	33.4	28.5	14.4	-4.7	-18.5	-28.4	-35.4	-39.9	-54.9	-65.3	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		7	36.4	31.5	17.4	-1.7	-15.5	-25.4	-32.4	-36.9	-51.9	-62.3	
Glazing:				4mm, 16/20mm, 4mm										
Ventilator type:				Greenwood 4000S										
			Combined sound level, dB(A)	27										

Bedroom 2 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}	6.2	57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²		7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
C	Volume of receiving room, m ³		31.2										
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1
F	Composite SRI			19.3	24.3	29.3	25.9	30.9	40.9	43.9	40.9	45.9	50.9
G	A + B + E - F		18	41.3	36.4	22.3	18.6	15.8	9.9	5.9	1.4	-13.6	-29.0
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		21	44.3	39.4	25.3	21.6	18.8	12.9	8.9	4.4	-10.6	-26.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$				33.9	19.8	11.7	16.9	25.0	21.0	8.5	-6.5	
N	Internal room noise level, vent open		28		40.4	26.3	22.0	20.9	25.2	21.2	9.9	-5.1	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
Bedroom 2 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}	7	57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
C	Volume of receiving room, m ³		31.2										
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0
G	A + B + E - F		5	34.1	29.2	15.1	-4.0	-17.8	-27.7	-34.7	-39.2	-54.2	-64.6
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		8	37.1	32.2	18.1	-1.0	-14.8	-24.7	-31.7	-36.2	-51.2	-61.6
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
		Combined sound level, dB(A)	28										
L_{Aeq} Assessment, night time													
Bedroom 1 - rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}	12	51	58	59	51	47	46	48	44	36	32	17
B	Exposed façade, m ²		10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
C	Volume of receiving room, m ³		36.2										
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7
F	Composite SRI			19.2	24.2	29.2	25.7	30.7	40.7	43.7	40.7	45.7	50.7
G	A + B + E - F		17	39.3	34.4	22.0	21.7	14.9	6.9	0.4	-4.7	-13.4	-34.0
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		20	42.3	37.4	25.0	24.7	17.9	9.9	3.4	-1.7	-10.4	-31.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$				26.7	14.3	9.6	10.8	16.8	10.3	-2.8	-11.5	
N	Internal room noise level, vent open		22		37.7	25.3	24.9	18.7	17.6	11.1	0.8	-7.9	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
Bedroom 1 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}	7	51	58	59	51	47	46	48	44	36	32	17
B	Exposed façade, m ²		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
C	Volume of receiving room, m ³		36.2										
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0
G	A + B + E - F		1	29.1	24.2	11.8	-3.9	-21.7	-33.7	-43.2	-48.3	-57.0	-72.6
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		4	32.1	27.2	14.8	-0.9	-18.7	-30.7	-40.2	-45.3	-54.0	-69.6
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
		Combined sound level, dB(A)	23										

Bedroom 2 - front elevation																								
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*											
A	Measured L_{eq}	6.2	51	58	59	51	47	46	48	44	36	32	17											
B	Exposed façade, m ²			7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9											
C	Volume of receiving room, m ³			31.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5										
D	Reverb Time, seconds																							
E	10 x Log(RT60/(0.163 x V))	-10.1	-10.1												-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1			
F	Composite SRI	19.3	24.3												29.3	25.9	30.9	40.9	43.9	40.9	45.9	50.9		
G	A + B + E - F	15	37.0	32.1	19.7	19.4	12.6	4.6	-1.9	-7.0	-15.7	-36.3												
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0												
I				18	40.0	35.1	22.7	22.4	15.6	7.6	1.1	-4.0	-12.7	-33.3										
J	Calculated internal noise level																							
K	Number of ventilators	1														31	36	37	34	30	33	38	43	
L	Ventilator $D_{n,e}$																							
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$			29.6	17.2	12.5	13.7	19.7	13.2	0.1	-8.6													
N	Internal room noise level, vent open			23	36.1	23.7	22.8	17.7	19.9	13.4	1.5	-7.2												
Glazing:		4mm, 16/20mm, 4mm																						
Ventilator type:		Greenwood 4000S																						
Bedroom 2 - gable																								
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*											
A	Measured L_{eq}	7	51	58	59	51	47	46	48	44	36	32	17											
B	Exposed façade, m ²			8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5										
C	Volume of receiving room, m ³			31.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5										
D	Reverb Time, seconds																							
E	10 x Log(RT60/(0.163 x V))	-10.1	-10.1												-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1			
F	Composite SRI	27.0	32.0												37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0		
G	A + B + E - F	1	29.8	24.9	12.5	-3.2	-21.0	-33.0	-42.5	-47.6	-56.3	-71.9												
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0												
I				4	32.8	27.9	15.5	-0.2	-18.0	-30.0	-39.5	-44.6	-53.3	-68.9										
J	Calculated internal noise level																							
Glazing:		4mm, 16/20mm, 4mm																						
Ventilator type:		Greenwood 4000S																						
			Combined sound level, dB(A)	23																				
L_{Amax} Assessment, night time																								
Bedroom 1 - rear elevation																								
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*											
A	L_{max} , 95th Percentile	12	65	75	72	67	60	58	61	59	53	51	41											
B	Exposed façade, m ²			10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8										
C	Volume of receiving room, m ³			36.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5										
D	Reverb Time, seconds																							
E	10 x Log(RT60/(0.163 x V))	-10.7	-10.7												-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7			
F	Composite SRI	19.2	24.2												29.2	25.7	30.7	40.7	43.7	40.7	45.7	50.7		
G	A + B + E - F	31	55.6	48.4	37.8	34.8	27.8	20.1	14.8	12.5	5.4	-9.9												
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0												
I				34	58.6	51.4	40.8	37.8	30.8	23.1	17.8	15.5	8.4	-6.9										
J	Calculated internal noise level																							
K	Number of ventilators	1														31	36	37	34	30	33	38	43	
L	Ventilator $D_{n,e}$																							
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$			40.7	30.1	22.7	23.6	29.9	24.7	14.3	7.2													
N	Internal room noise level, vent open			36	51.7	41.1	38.0	31.5	30.7	25.5	17.9	10.8												
Glazing:		4mm, 16/20mm, 4mm																						
Ventilator type:		Greenwood 4000S																						
Bedroom 1 - gable																								
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*											
A	L_{max} , 95th Percentile	7	65	75	72	67	60	58	61	59	53	51	41											
B	Exposed façade, m ²			8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5										
C	Volume of receiving room, m ³			36.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5										
D	Reverb Time, seconds																							
E	10 x Log(RT60/(0.163 x V))	-10.7	-10.7												-10.7	-10.7	-10.7	-10.7	-10.7	-10.7	-10.7			
F	Composite SRI	27.0	32.0												37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0		
G	A + B + E - F	15	45.5	38.2	27.6	9.2	-8.8	-20.5	-28.8	-31.1	-38.2	-48.5												
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0												
I				18	48.5	41.2	30.6	12.2	-5.8	-17.5	-25.8	-28.1	-35.2	-45.5										
J	Calculated internal noise level																							
Glazing:		4mm, 16/20mm, 4mm																						
Ventilator type:		Greenwood 4000S																						
			Combined sound level, dB(A)	36																				

Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	L_{max} , 95th Percentile		65	75	72	67	60	58	61	59	53	51	41	
B	Exposed façade, m ²	6.2		7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	
C	Volume of receiving room, m ³	31.2												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	$10 \times \text{Log}(\text{RT60}/(0.163 \times V))$			-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	
F	Composite SRI			19.3	24.3	29.3	25.9	30.9	40.9	43.9	40.9	45.9	50.9	
G	A + B + E - F		29	53.3	46.0	35.4	32.5	25.4	17.7	12.5	10.1	3.0	-12.3	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		32	56.3	49.0	38.4	35.5	28.4	20.7	15.5	13.1	6.0	-9.3	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \times \text{Log}(10) - B$				43.6	33.0	25.6	26.5	32.8	27.6	17.2	10.1		
N	Internal room noise level, vent open		37		50.1	39.5	35.9	30.6	33.1	27.8	18.6	11.5		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Bedroom 2 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	L_{max} , 95th Percentile		65	75	72	67	60	58	61	59	53	51	41	
B	Exposed façade, m ²	7		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
C	Volume of receiving room, m ³	31.2												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	$10 \times \text{Log}(\text{RT60}/(0.163 \times V))$			-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		16	46.1	38.9	28.3	9.9	-8.2	-19.9	-28.1	-30.5	-37.6	-47.8	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		19	49.1	41.9	31.3	12.9	-5.2	-16.9	-25.1	-27.5	-34.6	-44.8	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined sound level, dB(A)			37											

3 Bedroom House													
L _{Aeq} Assessment, daytime													
Living room - rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L _{eq}		57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²	14		11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
C	Volume of receiving room, m ³	45.3											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7
F	Composite SRI			17.8	22.8	27.8	24.1	29.1	39.1	42.1	39.1	44.1	49.1
G	A + B + E - F		21	44.7	39.8	25.7	22.2	19.4	13.5	9.5	5.0	-10.0	-25.4
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		24	47.7	42.8	28.7	25.2	22.4	16.5	12.5	8.0	-7.0	-22.4
K	Number of ventilators	1											
L	Ventilator D _{n,e}				31	36	37	34	30	33	38	43	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				30.3	16.2	8.1	13.3	21.4	17.4	4.9	-10.1	
N	Internal room noise level, vent open		27		43.0	28.9	25.3	22.9	22.7	18.7	9.8	-5.2	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
Studio flat, Western gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L _{eq}		57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²	7.7		8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
C	Volume of receiving room, m ³	45.3											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7
F	I bed existing			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0
G	A + B + E - F		4	32.9	28.0	13.9	-5.2	-19.0	-28.9	-35.9	-40.4	-55.4	-65.8
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		7	35.9	31.0	16.9	-2.2	-16.0	-25.9	-32.9	-37.4	-52.4	-62.8
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
		Combined sound level, dB(A)	27										
Kitchen/dining - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L _{eq}		57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²	7.7		8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
C	Volume of receiving room, m ³	34.3											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	Composite SRI			20.1	25.1	30.1	26.8	31.8	41.8	44.8	41.8	46.8	51.8
G	A + B + E - F		17	41.0	36.1	22.0	18.2	15.4	9.5	5.5	1.0	-14.0	-29.4
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		20	44.0	39.1	25.0	21.2	18.4	12.5	8.5	4.0	-11.0	-26.4
K	Number of ventilators	1											
L	Ventilator D _{n,e}				31	36	37	34	30	33	38	43	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				32.9	18.8	10.7	15.9	24.0	20.0	7.5	-7.5	
N	Internal room noise level, vent open		27		40.1	26.0	21.6	20.3	24.3	20.3	9.1	-5.9	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
Studio flat, Western gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L _{eq}		57	63	63	54	47	49	53	52	44	34	24
B	Exposed façade, m ²	9.6		9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
C	Volume of receiving room, m ³	34.3											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	I bed existing			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0
G	A + B + E - F		6	35.0	30.1	16.0	-3.1	-16.9	-26.8	-33.8	-38.3	-53.3	-63.7
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		9	38.0	33.1	19.0	-0.1	-13.9	-23.8	-30.8	-35.3	-50.3	-60.7
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
		Combined sound level, dB(A)	27										

Bedroom 1 - rear elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²	8		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
C	Volume of receiving room, m ³	35.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
F	Composite SRI			20.2	25.2	30.2	27.0	32.0	42.0	45.0	42.0	47.0	52.0	
G	A + B + E - F		17	40.9	36.0	21.9	18.0	15.2	9.3	5.3	0.8	-14.2	-29.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		20	43.9	39.0	24.9	21.0	18.2	12.3	8.3	3.8	-11.2	-26.6	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				32.8	18.7	10.6	15.8	23.9	19.9	7.4	-7.6		
N	Internal room noise level, vent open		27		39.9	25.8	21.4	20.2	24.2	20.2	9.0	-6.0		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Bedroom 1 - gable														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²	10.7		10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
C	Volume of receiving room, m ³	35.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		6	35.4	30.5	16.4	-2.7	-16.5	-26.4	-33.4	-37.9	-52.9	-63.3	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		9	38.4	33.5	19.4	0.3	-13.5	-23.4	-30.4	-34.9	-49.9	-60.3	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined sound level, dB(A)				27										
Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²	7.9		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
C	Volume of receiving room, m ³	34.3												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	Composite SRI			20.2	25.2	30.2	26.9	31.9	41.9	44.9	41.9	46.9	51.9	
G	A + B + E - F		17	41.0	36.1	22.0	18.2	15.4	9.5	5.5	1.0	-14.0	-29.4	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		20	44.0	39.1	25.0	21.2	18.4	12.5	8.5	4.0	-11.0	-26.4	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				32.8	18.7	10.6	15.8	23.9	19.9	7.4	-7.6		
N	Internal room noise level, vent open		27		40.1	26.0	21.5	20.3	24.2	20.2	9.0	-6.0		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Bedroom 2 - gable														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²	10.3		10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
C	Volume of receiving room, m ³	34.3												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		6	35.3	30.4	16.3	-2.8	-16.6	-26.5	-33.5	-38.0	-53.0	-63.4	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		9	38.3	33.4	19.3	0.2	-13.6	-23.5	-30.5	-35.0	-50.0	-60.4	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined sound level, dB(A)				27										

Bedroom 3 - rear elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	63	63	54	47	49	53	52	44	34	24	
B	Exposed façade, m ²	5.5		7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
C	Volume of receiving room, m ³	18												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7
F	Composite SRI			18.9	23.9	28.9	25.3	30.4	40.4	43.4	40.4	45.4	50.4	
G	A + B + E - F		20	43.6	38.7	24.6	21.0	18.2	12.3	8.3	3.8	-11.2	-26.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		23	46.6	41.7	27.6	24.0	21.2	15.3	11.3	6.8	-8.2	-23.6	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				34.4	20.3	12.2	17.4	25.5	21.5	9.0	-6.0		
N	Internal room noise level, vent open		29		42.4	28.3	24.2	22.7	25.9	21.9	11.0	-4.0		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
<u>L_{Aeq} Assessment, night time</u>														
Bedroom 1 - rear elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		51	58	59	51	47	46	48	44	36	32	17	
B	Exposed façade, m ²	8		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
C	Volume of receiving room, m ³	35.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
F	Composite SRI			20.2	25.2	30.2	27.0	32.0	42.0	45.0	42.0	47.0	52.0	
G	A + B + E - F		14	36.6	31.7	19.3	18.8	12.0	4.0	-2.5	-7.6	-16.3	-36.9	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		17	39.6	34.7	22.3	21.8	15.0	7.0	0.5	-4.6	-13.3	-33.9	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.5	16.1	11.4	12.6	18.6	12.1	-1.0	-9.7		
N	Internal room noise level, vent open		22		35.6	23.2	22.2	17.0	18.9	12.4	0.6	-8.1		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Bedroom 1 - gable														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		51	58	59	51	47	46	48	44	36	32	17	
B	Exposed façade, m ²	10.7		10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
C	Volume of receiving room, m ³	35.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6	-10.6
F	Composite SRI			27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F		3	31.1	26.2	13.8	-1.9	-19.7	-31.7	-41.2	-46.3	-55.0	-70.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		6	34.1	29.2	16.8	1.1	-16.7	-28.7	-38.2	-43.3	-52.0	-67.6	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined sound level, dB(A)			22											
Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		51	58	59	51	47	46	48	44	36	32	17	
B	Exposed façade, m ²	7.9		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
C	Volume of receiving room, m ³	34.3												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	Composite SRI			20.2	25.2	30.2	26.9	31.9	41.9	44.9	41.9	46.9	51.9	
G	A + B + E - F		15	36.7	31.8	19.4	19.0	12.2	4.2	-2.3	-7.4	-16.1	-36.7	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		18	39.7	34.8	22.4	22.0	15.2	7.2	0.7	-4.4	-13.1	-33.7	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.5	16.1	11.4	12.6	18.6	12.1	-1.0	-9.7		
N	Internal room noise level, vent open		22		35.8	23.4	22.3	17.1	18.9	12.4	0.6	-8.1		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														

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Bedroom 2 - front elevation															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	L _{max} , 95th Percentile	7.9	34.3	65	75	72	67	60	58	61	59	53	51	41	
B	Exposed façade, m²				9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
C	Volume of receiving room, m³														
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))				-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	
F	Composite SRI				20.2	25.2	30.2	26.9	31.9	41.9	44.9	41.9	46.9	51.9	
G	A + B + E - F				28			53.1	45.8	35.2	32.1	25.0	17.3	12.1	9.7
H	K = 3	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I															
J	Calculated internal noise level	1		31	56.1	48.8	38.2	35.1	28.0	20.3	15.1	12.7	5.6	-9.7	
K	Number of ventilators														
L	Ventilator D _{n,e}														
M	L _{Aeq} - D _{n,e} + 10*log(10) - B														
N	Internal room noise level, vent open														
Glazing:		4mm, 16/20mm, 4mm													
Ventilator type:		Greenwood 4000S													
Bedroom 2 - gable															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	L _{max} , 95th Percentile	10.3	34.3	65	75	72	67	60	58	61	59	53	51	41	
B	Exposed façade, m²				10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
C	Volume of receiving room, m³														
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))				-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5	-10.5
F	Composite SRI				27.0	32.0	37.0	49.0	65.0	79.0	85.0	82.0	87.0	87.0	
G	A + B + E - F				17			47.4	40.1	29.5	11.1	-6.9	-18.6	-26.9	-29.2
H	K = 3	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I															
J	Calculated internal noise level			20	50.4	43.1	32.5	14.1	-3.9	-15.6	-23.9	-26.2	-33.3	-43.6	
K	Number of ventilators														
L	Ventilator D _{n,e}														
M	L _{Aeq} - D _{n,e} + 10*log(10) - B														
N	Internal room noise level, vent open														
Glazing:		4mm, 16/20mm, 4mm													
Ventilator type:		Greenwood 4000S													
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Bedroom 3 - rear elevation															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	L _{max} , 95th Percentile	5.5	18	65	75	72	67	60	58	61	59	53	51	41	
B	Exposed façade, m²				7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
C	Volume of receiving room, m³														
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))				-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7	-7.7
F	Composite SRI				18.9	23.9	28.9	25.3	30.4	40.4	43.4	40.4	45.4	50.4	
G	A + B + E - F				31			55.6	48.3	37.7	34.8	27.8	20.1	14.9	12.5
H	K = 3	3.0	3.0	3.0				3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I															
J	Calculated internal noise level	1		34	58.6	51.3	40.7	37.8	30.8	23.1	17.9	15.5	8.4	-6.9	
K	Number of ventilators														
L	Ventilator D _{n,e}														
M	L _{Aeq} - D _{n,e} + 10*log(10) - B														
N	Internal room noise level, vent open														
Glazing:		4mm, 16/20mm, 4mm													
Ventilator type:		Greenwood 4000S													

Appendix 3: References

L.S. Søndergaard, R. Egeda. "Open windows with better sound insulation", DELTA Acoustics, Denmark, 2016.

Appendix 4: Emails

From: Katie Raw <Katie.Raw@manchester.gov.uk>

Sent: 20 December 2024 10:02

To: Patrick Beesley <patrick.beesley@johnsouthworth.co.uk>

Subject: RE: CDN/24/1010- Land Junction Of Lathbury Road And Carisbrook Street

Hello Patrick,

In regard to my email dated 4 December 2024 and in regard to the above planning application CDN/24/1010- Land Junction Of Lathbury Road And Carisbrook Street, further consideration has been made in respect of condition 12a noise by colleagues in Environmental Health.

The following information is required by colleagues in Environmental Health:

The noise report should include a consideration of potential noise impacts from the proposed air source heat pumps (ASHPs) as per our email of 13 December 2023. The submitted Druk report (ref. DRUK/ACC/RS/JSBLRHM/3306, dated 23rd October 2024) does not consider the ASHPs and we are therefore currently unable to recommend discharge of part a of the condition.

As such, only condition 13 can be recommended for approval and this shall be reflected within the decision notice of any approval granted.

Best wishes,

Katie Raw (she/her)

Planning Officer

Area Team

Planning Building Control and Licensing - Growth and Development Directorate.

Manchester City Council

Tel: 0161 234 4164/ 07970 684150

Email: katie.raw@manchester.gov.uk

www.manchester.gov.uk

From: Katie Raw

Sent: 04 December 2024 16:55

To: patrick.beesley@johnsouthworth.co.uk

Subject: CDN/24/1010- Land Junction Of Lathbury Road And Carisbrook Street

Hello,

I am the case officer for the above application.

Please see comments from Environmental Health in relation to the discharge of condition 12 (noise) and 13 (ground conditions):

12 (noise)

The conclusions of the submitted Druk Limited noise report (ref. DRUK/ACC/RS/JSBLRHM/3306, dated 23rd October 2024) are accepted and, as per the report's recommendations, glazing specs should be as suggested, noise from the MVHR system to each house should be adequately controlled such that it does not result in relevant internal noise criteria being exceeded, and gardens should be enclosed by 1.8m

high close-boarded (no gaps) timber fencing. The proposed scheme satisfies part a of the condition, however part b requires verification reporting therefore we cannot currently recommend the full discharge of the condition. (The application form acknowledges this.)

13 (ground conditions)

The submitted IGE Consulting Ltd Remedial Strategy Report (ref. 4259-01, dated October 2024) makes the following recommendations, which are generally accepted with the below caveat against point 2:

1. 600mm clean cover system (minimum 150mm topsoil underlain by subsoil and high vis geotextile marker) in private gardens, and 450mm clean cover (minimum 150mm topsoil) in soft landscaped areas.
2. Validation testing of imported topsoil and subsoil. Note: In-situ validation testing of imported fill materials is generally required; for exceptions refer to Section 6.4 of the Council's guidance.
3. Characteristic Situation 2 ground gas protection measures.
4. Remedial measures verification reporting.
5. DoW:CoP MMP recommendations.

The remediation strategy fulfils part a of the condition only; part b requires verification reporting therefore we cannot currently recommend the full discharge of the condition. (The application form acknowledges this.)

I will continue to progress with the application with a recommendation for approval. As the application is due on 25 December 2024, you should receive the decision notice prior to 24 December 2024.

Kind regards,

Katie Raw (she/her)

Planning Officer

Area Team

Planning Building Control and Licensing - Growth and Development Directorate.
Manchester City Council

Tel: 0161 234 4164/ 07970 684150

Email: katie.raw@manchester.gov.uk

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