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**Assessment of the Existing Noise Climate in the Vicinity of
409 Wilbraham Road, Manchester**

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Report Reference: DRUK/ACC/RS/Acoustic Tests

Date: 12th January 2022

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1.0 Summary

Planning permission has been granted permitting the demolition of the existing house at 409 Wilbraham Road and its replacement with a new residential dwelling. The planning permission was granted subject to the imposition of a number of planning conditions one of which, condition 11, specifically relates to the acoustic requirements that are to be applied to the new dwelling.

In accordance with the requirements of the planning conditions Acoustic Tests were commissioned to undertake an evaluation of the existing noise climate in the vicinity of the permitted new dwelling. This assessment would be combined with an evaluation of the likely internal noise levels within the permitted dwelling, resulting from external noise break-in. With reference to the existing noise climate in the vicinity of the proposed residential development, this was regarded as being typical of a sub-urban environment, primarily influenced by road traffic on Wilbraham Road itself.

The noise climate in the vicinity of the existing house at 409 Wilbraham Road highlighted that it was typical of a sub-urban environment, primarily influenced by road traffic on Wilbraham Road itself. Applying the obtained measured noise levels relating to the existing noise climate in the immediate vicinity of 409 Wilbraham Road, calculations have been undertaken to assess the likely internal noise levels within the permitted replacement house resulting from external noise break-in. The calculations have indicated that the internal noise climate within the house would comply with the adopted design guide values, expressed in terms of the L_{Aeq} and L_{Amax} levels, for both the day and night time periods. As a result it is suggested that the sound insulation provided by the building envelope components, detailed in this report, would be sufficient to control the 'break-in' of external noise in compliance with the adopted design guide values.

Turning to the situation within the rear garden, the principal external amenity area, the shielding provided by the permitted house itself should be sufficient to ensure that the upper guideline value of 55dB $L_{Aeq,T}$ contained within BS 8233:2014 is not exceeded. Consequently it is suggested that the requirements imposed by the first part of planning condition 11 would be met.

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Robert Smith

2.0 Introduction

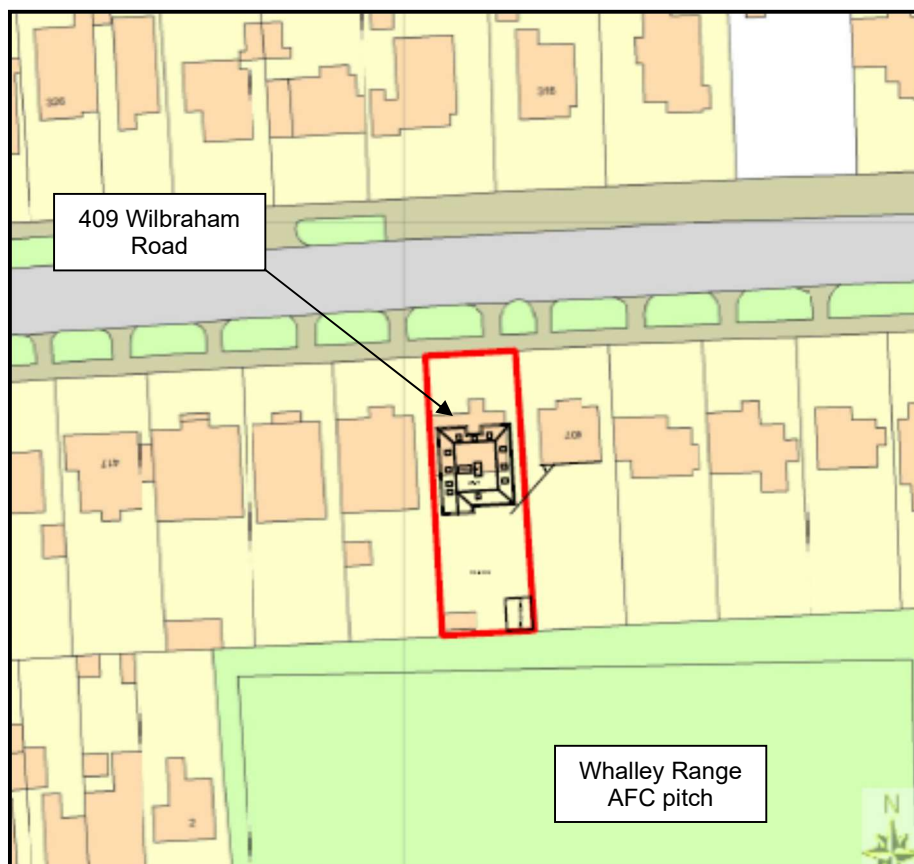
Planning permission has been granted permitting the demolition of the existing house at 409 Wilbraham Road and its replacement with a new residential dwelling. The planning permission was granted subject to the imposition of a number of planning conditions one of which, condition 11, specifically relates to the acoustic requirements that are to be applied to the new dwelling.

In accordance with the requirements of the planning conditions Acoustic Tests were commissioned to undertake an evaluation of the existing noise climate in the vicinity of the permitted new dwelling. This assessment would be combined with an evaluation of the likely internal noise levels within the permitted dwelling, resulting from external noise break-in. With reference to the existing noise climate in the vicinity of the proposed residential development, this was regarded as being typical of a sub-urban environment, primarily influenced by road traffic on Wilbraham Road itself.

3.0 Site Description

The permitted residential dwelling will replace the existing dwelling that is located at 409 Wilbraham Road in Manchester (figure 1 below) which is a mainly a mature residential area. To the North of 409 Wilbraham Road is Wilbraham Road itself (photograph 1 overleaf) with mature residential dwellings beyond (photograph 2 overleaf). To the East and West of 409 Wilbraham Road are further mature residential dwellings and immediately to the rear of 409 Wilbraham Road is the Whalley Range amateur football club pitch.

Figure 1. 409 Wilbraham Road (edged in red) and surrounding environment



Photograph 1. Wilbraham Road, Looking West



Photograph 2. Existing residential dwellings opposite 409 Wilbraham Road



4.0 Assessment Criteria

The planning permission for the development, granted in October 2021, contained a number of conditions, of which condition 11 specifically related to the acoustic conditions to be achieved within the new dwelling. The full wording of planning condition 11 is reproduced overleaf.

11) Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Wilbraham 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 approved noise insulation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data must include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria will be required to be achieved:

Bedrooms (night time - 23.00 - 07.00)	30 dB LAeq (individual noise events shall not exceed 45 dB L _{Amax,F} by more than 15 times)
Living Rooms (daytime - 07.00 - 23.00)	35 dB LAeq
Gardens and terraces (daytime)	55 dB LAeq

b) Prior to first occupation of the residential units, a verification report will 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 safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy.

The specific noise criteria detailed within planning condition 11 largely reproduce the guide values contained within British Standard (BS) 8233:2014 "Guidance on sound insulation and noise reduction for buildings". As such this guidance will be considered in greater detail below.

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 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 residential dwellings, BS 8233:2014 summarises this guidance within table 4 of section 7.7.2. The main elements of this guidance are reproduced in table 1 overleaf.

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 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 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 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, the design guidance detailed within the previous 1999 version of BS 8233 relating to individual noise events, expressed as L_{Amax} levels, will be adopted for this assessment. This guidance stated: "*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}* ", and this guidance complies with the provisions contained within the WHO document. It must however be stated that many regard the 45dB L_{Amax} criterion as stringent.

Additional guidance relating to individual noise events is contained within the Planning and Noise: Professional Guidance on Planning and Noise (ProPG) document issued in May 2017. The ProPG document was a collaboration between representatives of the Chartered Institute of Environmental Health (CIEH), the Institute of Acoustics (IoA) and the Association of Noise Consultants (ANC) and sought to provide additional guidance in addition to complementing the wider aims contained within documents such as: the Noise Policy Statement for England (NPSE), the National Planning Policy Framework (NPPF), the WHO "Guidelines for Community Noise" and (BS) 8233:2014 "Guidance on sound insulation and noise reduction for buildings".

Of relevance to the issue of individual noise events is the guidance contained within Appendix A of the ProPG, which deals specifically with individual noise events and contains a short summary of research into the effects of individual noise events and the effect that these can have on sleep. In the light of this summary the document, at paragraph A.20, states the following, "*...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*".

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 subsequent assessments of the likely internal noise climate within the permitted house, all evaluations will be undertaken with respect to guidance detailed above. Despite this and with reference to both the versions of the guidance contained within BS 8233, it must be remembered that the advice within these documents is design guidance and the suggested levels are *desirable*. It does not represent a set of rigid criteria, below which a development ‘passes’ and above which a development ‘fails’. For instance, with windows open, there can be very few developments outside the quietest of areas where the internal levels would not exceed at least some of the various criteria.

5.0 Survey Details

5.1 Survey Times and Personnel

The noise surveys, to evaluate the existing noise climate in the vicinity of 409 Wilbraham Road were undertaken between 23:00 - 01:00 hours on the 16th - 17th December 2021 and between 15:45 - 19:00 hours on the 20th December 2021. Both time periods comply with the requirement contained within planning condition 11 to undertake the noise surveys during rush hour and night time periods.

All measurements were fully attended for the duration and the surveys and were conducted by Mr. R Smith of Acoustic Tests.

5.2 Weather

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

Night time, Friday/Saturday 16th - 17th December 2021

All surfaces damp, the cloud was 100%, the temperature was approximately 4°C, the barometric pressure was approximately 1037 mb and the wind speed was less the 0.3m/s.

Daytime, Tuesday 20th December 2021

All surfaces were dry, the cloud was 100%, the temperature was approximately 6°C, the barometric pressure was approximately 1025 mb and the wind speed was approximately 0.7m/s.

5.3 Equipment

All the noise surveys and measurements were conducted using the equipment detailed in the table 2 overleaf.

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

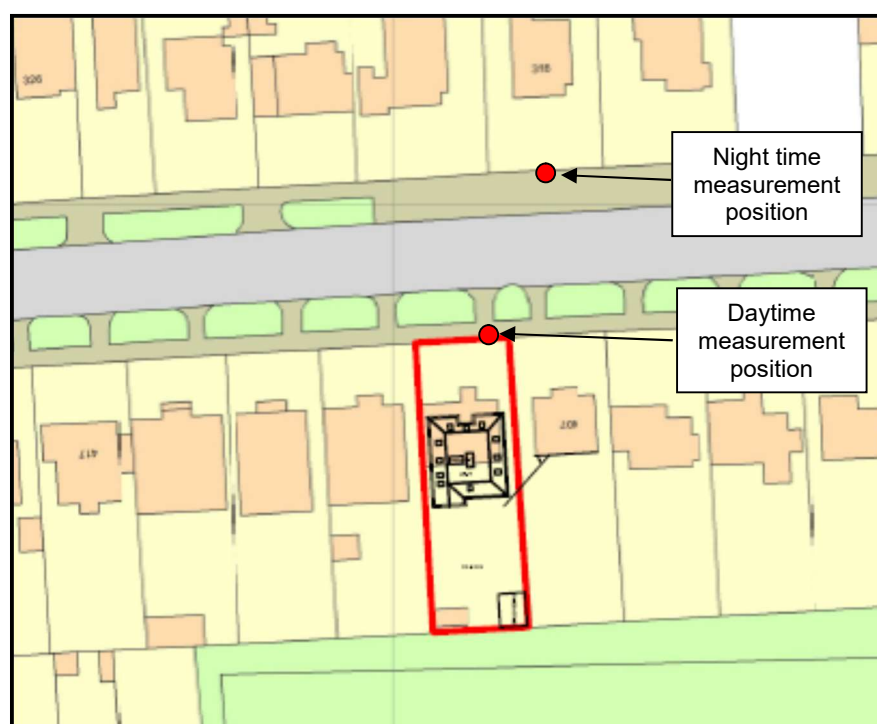
Table 2. Equipment used during the ambient noise surveys

Equipment description	Manufacturer	Model number	Serial number
Sound level meter	NTI Audio	XL2-TA	A2A-10232-E
Microphone pre-amplifier	NTI Audio	MA220	5537
Acoustic calibrator	Norsonic AS	Nor 1251	31522

5.4 Measurement Procedure

An initial walk-over survey of the area in the immediate vicinity of 409 Wilbraham Road suggested that the principal contributor to the existing noise climate would be road traffic on the busy Wilbraham Road itself. With this in mind, two measurement positions were adopted and these are detailed on figure 2 below.

Figure 2. Approximate location of the measurement positions



The night time measurement position was located directly outside the drive serving 409 Wilbraham Road, such that it was approximately 7 metres from the nearside kerb and 9 metres from the front elevation of the house itself. Measurements during the daytime were made in a location that was slightly obliquely opposite 409 Wilbraham Road, as at the time of the survey a mobile mechanic was attending to a vehicle on the drive of 409

Wilbraham Road. In this location the sound level meter was positioned approximately 6 metres from the nearside kerb.

In both locations the sound level meter was tripod mounted such the microphone was approximately 1.3 metres above ground level and at least 3 metres from any potentially reflecting surfaces. During both the day and night time surveys the measurement time interval was 15 minutes and all measurements were made with the 'fast' time weighting engaged.

6.0 Noise Survey Results

The existing noise climate in the vicinity of 409 Wilbraham Road was regarded as being essentially sub-urban in character with road traffic on the busy Wilbraham Road representing the main noise source during both the day and night time periods.

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

6.1 Qualitative Assessment: Night time Period

During this period the principal contributor to the existing noise climate was road traffic on Wilbraham Road and this comprised mainly private cars and taxis, with only two buses being noted during the period. The road traffic remained relatively steady through the measurement period. Some additional noise from the nearby houses was also audible, during the lulls in the traffic, and this comprised mainly central heating boilers and barking dogs although the neighbours from 411 could be heard talking to someone outside between approximately 23:30 - 23:40 hours.

6.2 Qualitative Assessment: Daytime Period

During the afternoon period the principal contributor to the existing noise climate was road traffic on Wilbraham Road and again this comprised mainly private cars and taxis, although a number of buses were also noted (travelling in both directions). A few cars were noted travelling at considerable speed Westwards along Wilbraham Road.

Additional noise sources noted at this time included pedestrians talking as they walked in both directions along Wilbraham Road and later in the measurement period a number of dog walkers with occasionally barking dogs were noted. Although a number of commercial aircraft were noted during the course of the survey, they were sufficiently distant so as not to make a particular contribution to the existing noise climate.

6.3 Basic Results

The measured noise levels from the measurement position are presented in tables 3 and 4 overleaf. In order to provide an indication of the representative noise climate at the façade of the permitted dwelling, an appropriate distance correction has been applied to the obtained measured sound levels. In this case a worst case has been applied and line source propagation has been assumed. Full data are presented in tabular form in Appendix 2 and this includes a description of any significant events that occurred during each measurement period.

Table 3. Existing noise climate, night time measured levels, distance corrected

Start time	dB L_{Aeq} , 15 minutes	dB L_{Amax} , 15 minutes	dB L_{A10} , 15minutes	dB L_{A90} , 15 minutes
23:00	61	75	66	42
23:15	62	75	66	42
23:30	60	74	64	38
23:45	63	83	66	40
00:00	62	76	66	42
00:15	61	76	66	42
00:30	61	76	65	40
00:45	60	78	64	39
Standard deviation	0.98	2.88	0.70	1.42
Mean levels	61	78	65	41

Table 4. Existing noise climate, daytime measured levels, distance corrected

Start time	dB L_{Aeq} , 15 minutes	dB L_{Amax} , 15 minutes	dB L_{A10} , 15minutes	dB L_{A90} , 15 minutes
15:45	67	78	70	59
16:00	68	89	70	54
16:15	67	81	69	54
16:30	67	78	69	59
16:45	66	79	69	55
17:00	67	86	70	53
17:15	68	90	70	58
17:30	66	86	69	53
17:45	66	79	69	57
18:00	67	77	70	57
18:15	67	78	70	54
18:30	66	76	69	54
18:45	67	79	70	56

Standard deviation	0.59	4.67	0.43	2.15
Mean (log) levels	67	84	70	56

As can be seen from the tables 3 and 4 the measured sound levels were, in terms of the L_{Aeq} , L_{A10} , and L_{A90} parameters, relatively steady, indicating the existing noise climate was subject to a dominant noise source. With reference to the L_{Amax} levels, these demonstrate a greater degree of variability and were largely a consequence of individually noisy vehicles travelling along Wilbraham Road.

In addition to the measurements summarised in tables 3 and 4 above a 'snapshot' measurement was made at the rear facade of 409 Wilbraham Road immediately prior to the commencement of the night time noise survey. This measurement was made to assess the difference in overall sound levels between the front and rear elevations, as a result of the shielding provided by the house itself. Again, the sound level meter was tripod mounted such the microphone was approximately 1.3 metres above ground level, at least 2 metres from any potentially reflecting surfaces, was of 15 minutes duration and made with the 'fast' time weighting engaged. The results of this 'snapshot' measurement are summarised in table 5 below.

Table 5. Snapshot noise measurement, rear elevation of 409 Wilbraham Road

Start time	dB L_{Aeq} , (15 minutes)	dB L_{Amax} , (15 minutes)	dB L_{A10} (15minutes)	dB L_{A90} , (15 minutes)
23:40	45	55	49	39

Comparing the results summarised in tables 3 and 4 above with those contained within table 5, it can be seen that the noise climate at the rear of the existing house was approximately 15dB lower than the situation at the front elevation of the existing house. This measured difference in the overall sound levels will be incorporated into the subsequent calculations in the following section.

7.0 Noise Transmission Calculations

Using the measured sound levels relating to the existing night time and daytime noise climate, calculations have been performed to assess the likely internal noise levels within the permitted house. All the assessments have been conducted with reference to the design guidance detailed in section 4.0 above.

The subsequent assessment of the potential internal noise levels within the permitted house have been undertaken using the highest measured levels from the noise surveys and these levels are detailed in table 6 overleaf. Consequently the following assessments may be regarded as worst case situations which are unlikely to persist for all but short periods of time.

Table 6. Highest measured noise levels, 409 Wilbraham Road

OBCF, Hz*	63	125	250	500	1k	2k	4k	8k	Overall, dB(A)
Daytime, L_{Aeq} , (16:45 - 17:00 hours)	67	62	62	61	65	60	56	50	68
Night time, L_{Aeq} , (23:45 - 00:00 hours)	62	59	59	56	60	56	48	37	63
Night time, L_{Amax} , (23:45 - 00:00 hours)	83	77	70	71	80	77	74	60	83

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 that can be considered as the 'weak' link acoustically, therefore increasing the sound insulation of the glazing will improve the overall sound insulation of the façade. The result of the calculations is a composite sound insulation value for the whole façade.

The assessments contained within the subsequent sections of this assessment report have been undertaken according to drawings issued by N. A. Design. To facilitate the calculations to be made the following assumptions have been employed:

- The reverberation times within the habitable rooms will be 0.5 seconds.
- The floor to ceiling height will be approximately 2.4 metres.

As the measured noise levels were regarded as being relatively typical of an essentially sub-urban environment, a ventilation strategy adopting a 'passive' type system incorporating background ventilators, similar to a system 1 ventilation strategy, with local mechanical extract ventilation (MEV) being provided in areas of potentially high humidity, has been utilised in the calculations.

In each case the calculations have been produced assuming the windows are closed but with the specified ventilation is in its open position. Although this is the case it should however be remembered that in this, as in the majority of other locations, the implicit assumption is that ventilating the internal spaces by opening windows will inevitably permit the ingress of external noise which would affect the internal noise climate.

7.1 Construction Specification

The building envelope constructional details described below and overleaf have been assumed for the purposes of the subsequent calculations.

External Walls

The external walls of the permitted house will be of cavity masonry type comprising: an external brick leaf, a 100 - 150mm cavity filled with PIR thermal insulation and a 100mm thick aggregate block inner leaf lined with one layer of 12.5mm plasterboard on

adhesive dabs. Test results for a similar construction suggest that external walls of this type should provide an overall sound insulation of around R_w 52dB, with the octave band sound insulation values being as detailed in table 7 overleaf.

Table 7. External Wall, Octave Band Sound Insulation Values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w dB(A)
Sound Insulation, dB	38	42	51	59	63	63	52

* Octave Band Centre Frequency

Glazing

The proposed glazing to the permitted house will be of the sealed unit type and will be of the following nominal specifications: 4mm pane - 16/20mm cavity - 4mm pane (Pilkington) and 6mm pane - 16/20mm cavity - 6.8mm pane Stadip Silence (Saint Gobain Glass). The locations of the two glazing options are detailed in the tables of results. Laboratory test data from Pilkington and Saint Gobain Glass indicate that these configurations should provide sound insulation values of 31 and 38dB R_w respectively. The octave band sound insulation values are as detailed in table 8 below.

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(A)
4mm, 6 - 20mm, 4mm	24	20	25	35	38	35	31 (- 6)
6mm, 6 - 20mm, 6.8mm	23	24	34	42	43	52	39 (- 6)

* Octave Band Centre Frequency

Ventilation

As previously stated a passive ventilation strategy has been adopted for the proposed dwelling. In this respect background ventilation provision in compliance with the requirements of Approved Document F, will be provided by window frame mounted ventilators of the Greenwood 4000S or Titan SFXSA V75/C50 type. The locations of the two glazing options are detailed in the tables of results. However, units offering equivalent sound insulation performance would be acceptable. It is also anticipated that local mechanical extract ventilation (MEV) being provided in areas of high humidity.

Laboratory test data indicates that the specified Greenwood and Titan window frame mounted ventilators should provide sound insulation values of 33 and 42dB $D_{n,e,w}$ in their open positions. The octave band sound insulation values for the selected window frame mounted ventilators are detailed in table 9 overleaf. Alternative ventilator configurations would be acceptable providing the sound insulation performance is at least equivalent to the specification detailed in table 9 overleaf.

Table 9. Background ventilation, octave band sound insulation values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, $D_{n,e,w}$ dB
Greenwood 4000S	36	37	34	30	33	38**	33
Titan SFXSA V75/C50	40	37	34	43	50	53	42

* Octave Band Centre Frequency

** Extrapolated value

Remaining with the issue of ventilation, the advice given in note 5 to paragraph 7.7.2 of BS8233:2014 should be borne in mind. This advice states the following: *"If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level"*. In this case, it is suggested that the passive type ventilation strategy with local mechanical extract ventilation (MEV), outlined above would comply with the advice given in note 5 to paragraph 7.7.2 of BS 8233:2014.

Roof Structure

The roof structure will comprise the following construction: Marley roof tiles with a 125mm overlap fixed to 25 x 50mm battens over a breathable membrane fixed to 50 x 150mm rafters with 100mm of rigid PIR insulation between the rafters. The rafters will be lined internally with Kingspan K18 thermal plasterboard. Test results for a similar construction suggest that a roof of this type should provide an overall sound insulation of around 46dB R_w , with the octave band sound insulation values being as detailed in table 10 below.

Table 10. Roof construction, octave Band Sound Insulation Values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w dB(A)
Sound Insulation, dB	23	34	47	52	58	66	46

7.2 Calculation Results

For the purposes of the calculations the highest measured noise levels detailed in table 6 were used. The results of the break-in noise calculations are presented, with reference to the design guidance contained within section 4.0 above, in table 11 overleaf. With respect to the presentation of the results the calculations relating to the night time L_{Aeq} and L_{Amax} results are presented in the same columns with the L_{Amax} results being contained in brackets. Full data are available in Appendix 2.

Table 11. Calculated internal noise levels

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})
Drawing room*	35	32	30 (45)	-
Study*	35	33	30 (45)	-
Family room**	35	24	30 (45)	-
Master bedroom**	35	23	30 (45)	16 (31)
Bedroom 2**	35	24	30 (45)	16 (32)
Bedroom 3*	35	32	30 (45)	28 (42)
Bedroom 4*	35	32	30 (45)	28 (42)
Bedroom 5	35	32	30 (45)	27 (43)
Bedroom 6	35	32	30 (45)	27 (43)

* 6mm - 16/20mm - 6.8mm glazing SS glazing/Titan SFXSA V75/C50 ventilator

** 4mm - 16/20mm - 4mm glazing/Greenwood 4000S ventilator

As can be seen from table 11 above, the application of the recommended sound insulation measures detailed above would be sufficient to limit the break-in of external noise such that the internal noise environment would comply with the guide values contained within section 4.

7.3 External Amenity Areas

With reference to the external amenity area appurtenant to the permitted house, it is the rear garden to the permitted dwelling that may be regarded as the principal amenity space. Being at the rear of the permitted house, the house itself would provide a considerable degree of shielding from the principal noise source road traffic on Wilbraham Road.

The previous comparison with the existing noise climate levels, presented in tables 3 and 4 above, and the measurements made within the rear garden, contained within table 6 above, indicate that the noise climate at the rear of the existing house was approximately 15dB lower than the situation at the front elevation of the existing house. Subtracting this 15dB level difference from the average daytime ambient (L_{Aeq}) level of 67dB, it can be seen that the likely noise levels within the rear garden would be in the region of 52dB. Noise levels of this order would comply with the "upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments", as defined within BS 8233:2014.

8.0 Conclusion

The noise climate in the vicinity of the existing house at 409 Wilbraham Road highlighted that it was typical of a sub-urban environment, primarily influenced by road traffic on Wilbraham Road itself. Applying the obtained measured noise levels relating to the existing noise climate in the immediate vicinity of 409 Wilbraham Road, calculations have been undertaken to assess the likely internal noise levels within the permitted replacement house resulting from external noise break-in. The calculations have indicated that the internal noise climate within the house would comply with the adopted design guide values, expressed in terms of the L_{Aeq} and L_{Amax} levels, for both the day and night time periods. As a result it is suggested that the sound insulation provided by the building envelope components, detailed in this report, would be sufficient to control the 'break-in' of external noise in compliance with the adopted design guide values.

Turning to the situation within the rear garden, the principal external amenity area, the shielding provided by the permitted house itself should be sufficient to ensure that the upper guideline value of 55dB $L_{Aeq,T}$ contained within BS 8233:2014 is not exceeded. Consequently it is suggested that the requirements imposed by the first part of planning condition 11 would be met.

Appendix 1: Existing noise climate survey, measured levels

409 Wilbraham Road, Manchester												
Existing noise climate survey - distance corrected												
17th December 2021												
Octave Band Centre Frequency, Hz.	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	16k	
23:00												
L_{eq}	61	60	62	57	58	56	59	54	45	37	25	
L_{max}	75	84	82	73	70	72	71	66	67	59	47	
L_{10}	66	63	65	61	62	60	63	58	49	39	27	
L_{90}	42	46	47	42	40	37	38	34	24	16	8	
23:15												
L_{eq}	62	59	62	57	58	56	60	55	45	35	22	
L_{max}	75	79	83	71	70	69	72	66	57	54	43	
L_{10}	66	62	64	61	62	60	63	59	49	39	25	
L_{90}	42	45	47	41	40	37	38	36	28	17	8	
23:30												
L_{eq}	60	58	60	56	57	54	57	53	43	33	20	
L_{max}	74	81	79	74	71	71	70	67	58	54	40	
L_{10}	64	61	63	60	61	58	62	57	47	37	23	
L_{90}	38	44	45	39	37	33	35	30	20	13	7	
23:45												
L_{eq}	63	61	62	59	59	56	60	56	48	37	25	
L_{max}	83	85	83	77	70	71	80	77	74	60	49	
L_{10}	66	62	64	62	63	60	63	58	49	39	25	
L_{90}	40	44	46	40	38	35	37	33	21	13	7	
00:00												
L_{eq}	62	57	60	58	58	56	59	54	44	35	22	
L_{max}	76	73	77	75	72	71	73	68	56	59	43	
L_{10}	66	60	62	61	62	60	63	58	48	39	24	
L_{90}	42	45	47	41	40	36	38	35	25	16	8	
00:15												
L_{eq}	61	59	61	58	58	55	59	54	45	37	24	
L_{max}	76	80	81	75	71	70	73	69	59	53	40	
L_{10}	66	61	64	61	62	59	63	58	49	40	26	
L_{90}	42	45	46	41	40	36	38	35	23	14	7	
00:30												
L_{eq}	61	57	61	57	58	55	58	53	43	34	21	
L_{max}	76	74	79	79	73	72	72	68	59	55	43	
L_{10}	65	60	64	60	62	59	62	57	48	38	23	
L_{90}	40	43	46	41	38	35	37	33	22	15	7	
00:45												
L_{eq}	60	57	62	58	58	55	57	52	43	41	39	
L_{max}	78	77	80	78	81	76	71	68	57	70	69	
L_{10}	64	59	64	61	61	58	61	57	47	37	24	
L_{90}	39	43	46	40	37	34	36	31	20	13	7	
Mean (log) level												
L_{eq}	61	59	61	57	58	55	59	54	45	37	31	
L_{max}	78	81	81	76	74	72	74	70	66	62	60	
L_{10}	65	61	64	61	62	59	63	58	48	39	25	
L_{90}	41	44	46	41	39	36	37	34	24	15	7	
Rear of the house												
01:00												
L_{eq}	45	49	52	43	41	41	43	37	26	22	14	
L_{max}	55	59	62	51	53	47	51	47	45	44	32	
L_{10}	49	52	55	46	44	44	47	40	29	23	15	
L_{90}	39	44	48	39	36	37	37	27	14	12	9	

20th December 2021												
Octave Band Centre Frequency, Hz.	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k	16k	
15:45												
L_{eq}	67	65	69	65	63	62	65	58	49	40	27	
L_{max}	78	81	89	82	78	73	75	69	61	58	43	
L_{10}	70	67	69	66	65	64	68	61	52	43	30	
L_{90}	59	55	64	61	55	55	56	50	43	35	21	
16:00												
L_{eq}	68	66	67	62	62	61	65	60	56	50	38	
L_{max}	89	86	88	75	75	72	81	83	82	82	73	
L_{10}	70	68	69	65	65	64	68	62	52	43	30	
L_{90}	54	54	55	50	50	49	52	45	34	22	9	
16:15												
L_{eq}	67	65	66	62	62	61	64	58	48	40	28	
L_{max}	81	81	83	77	84	78	77	70	66	58	53	
L_{10}	69	68	69	65	65	64	67	61	51	42	29	
L_{90}	54	54	53	49	49	47	52	44	33	21	9	
16:30												
L_{eq}	67	65	65	62	62	61	65	58	49	39	28	
L_{max}	78	83	79	78	74	73	74	66	72	57	53	
L_{10}	69	68	68	64	65	64	67	61	51	42	30	
L_{90}	59	56	57	54	54	53	57	50	38	25	10	
16:45												
L_{eq}	66	64	66	61	61	60	64	57	47	38	30	
L_{max}	79	81	82	78	75	72	77	69	60	57	61	
L_{10}	69	67	69	64	64	63	67	61	50	42	29	
L_{90}	55	54	53	49	50	49	53	47	34	21	9	
17:00												
L_{eq}	67	64	66	62	63	61	65	58	49	40	27	
L_{max}	86	78	80	79	86	83	81	76	75	66	53	
L_{10}	70	66	69	64	65	64	68	61	51	41	28	
L_{90}	53	52	52	48	49	48	51	44	31	19	8	
17:15												
L_{eq}	68	65	66	62	63	63	66	60	51	45	36	
L_{max}	90	83	85	75	82	89	85	81	76	73	65	
L_{10}	70	68	68	64	65	64	68	61	51	42	29	
L_{90}	58	55	55	53	53	52	56	50	37	23	10	
17:30												
L_{eq}	66	64	65	61	61	60	64	58	49	40	30	
L_{max}	86	82	82	80	76	74	84	77	73	69	57	
L_{10}	69	67	68	64	64	63	67	61	51	42	29	
L_{90}	53	53	53	48	49	47	51	44	31	20	9	
17:45												
L_{eq}	66	64	65	61	61	61	64	58	47	38	26	
L_{max}	79	81	79	72	71	72	77	70	62	57	47	
L_{10}	69	67	68	64	64	64	67	61	51	42	28	
L_{90}	57	53	54	51	52	51	55	48	35	21	9	
18:00												
L_{eq}	67	64	67	61	62	61	65	58	48	39	27	
L_{max}	77	78	87	75	74	72	74	70	62	59	48	
L_{10}	70	67	68	64	65	64	68	62	51	42	29	
L_{90}	57	54	54	51	52	51	55	49	35	22	9	

18:15												
L_{eq}		67	64	66	62	62	61	65	58	48	39	28
L_{max}		78	81	81	79	74	72	76	68	64	58	53
L_{10}		70	66	69	65	65	64	68	61	51	42	28
L_{90}		54	53	54	50	51	49	52	46	32	19	8
18:30												
L_{eq}		66	64	66	61	61	60	64	57	47	40	27
L_{max}		76	79	85	74	71	72	73	66	58	66	51
L_{10}		69	67	68	64	64	63	67	61	51	42	29
L_{90}		54	52	54	50	50	49	52	46	32	20	9
18:45												
L_{eq}		67	64	66	62	62	61	65	58	48	39	31
L_{max}		79	81	84	74	83	74	74	69	61	56	62
L_{10}		70	67	69	65	65	64	68	62	52	43	29
L_{90}		56	53	54	50	51	50	54	47	33	21	9

Appendix 2. Break-in Noise Calculations

409 Wilbraham Road													
Break-in Noise Calculations													
L_{eq} Assessment, daytime													
Study													
Study - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9.8		9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
C	Volume of receiving room, m ³	39.2											
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))			-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1
F	Composite SRI			16.5	21.5	26.5	27.6	37.5	45.5	46.6	55.1	60.1	64.2
G	A + B + E - F		28	48.2	44.5	34.7	33.5	22.5	18.2	11.8	-0.1	-11.8	-27.2
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		31	51.2	47.5	37.7	36.5	25.5	21.2	14.8	2.9	-8.8	-24.2
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				32.3	22.5	25.3	27.3	22.0	9.7	3.3	-13.4	
N	Internal room noise level, vent open		32		47.7	37.9	36.8	29.5	24.6	16.0	6.1	-7.5	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											
Study													
Study - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9		9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
C	Volume of receiving room, m ³	39.2											
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))			-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1	-11.1
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		15	36.4	32.7	22.9	18.7	9.7	5.4	-3.9	-7.3	-19.0	-30.4
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		18	39.4	35.7	25.9	21.7	12.7	8.4	-0.9	-4.3	-16.0	-27.4
Glazing:		-											
Ventilator type:		-											
			Combined noise level, dB(A)	33									
Drawing room													
Drawing room - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9.8		9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
C	Volume of receiving room, m ³	51.1											
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))			-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2
F	I bed existing			16.5	21.5	26.5	27.6	37.5	45.5	46.6	55.1	60.1	64.2
G	A + B + E - F		27	47.1	43.4	33.6	32.3	21.4	17.1	10.7	-1.2	-12.9	-28.4
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		30	50.1	46.4	36.6	35.3	24.4	20.1	13.7	1.8	-9.9	-25.4
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				32.3	22.5	25.3	27.3	22.0	9.7	3.3	-13.4	
N	Internal room noise level, vent open		32		46.6	36.8	35.7	29.1	24.1	15.1	5.6	-8.3	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											

Drawing room													
Drawing room - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	12.9		11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
C	Volume of receiving room, m ³	51.1											
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))			-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2	-12.2
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		15	36.8	33.1	23.3	19.1	10.1	5.8	-3.5	-6.9	-18.6	-30.0
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		18	39.8	36.1	26.3	22.1	13.1	8.8	-0.5	-3.9	-15.6	-27.0
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			32										
Family room													
Family 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}		53	58	60	49	47	48	51	44	36	38	30
B	Exposed façade, m ²	13.1		11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
C	Volume of receiving room, m ³	78											
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))			-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1
F	Ibed existing			16.8	21.8	26.8	23.0	28.0	38.0	41.0	38.0	43.0	48.0
G	A + B + E - F		18	38.2	35.5	19.7	21.4	17.4	10.1	-0.2	-4.6	-8.3	-20.7
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		21	41.2	38.5	22.7	24.4	20.4	13.1	2.8	-1.6	-5.3	-17.7
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.0	12.2	9.0	13.0	19.7	9.4	-3.0	-6.7	
N	Internal room noise level, vent open		24		38.9	23.1	24.5	21.1	20.6	10.3	0.7	-3.0	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											
Family room													
Family room - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		62	60	61	56	56	55	59	54	50	44	32
B	Exposed façade, m ²	14.8		11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
C	Volume of receiving room, m ³	78											
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))			-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		8	29.5	25.8	16.0	11.8	2.8	-1.5	-10.8	-14.2	-25.9	-37.3
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		11	32.5	28.8	19.0	14.8	5.8	1.5	-7.8	-11.2	-22.9	-34.3
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			24										
Master bedroom													
Master bedroom - rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		53	58	60	49	47	48	51	44	36	38	30
B	Exposed façade, m ²	13.2		11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
C	Volume of receiving room, m ³	47.2											
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9
F	Ibed existing			21.3	26.3	31.3	28.0	33.1	43.1	46.1	43.1	48.1	53.0
G	A + B + E - F		16	35.9	33.2	17.4	18.5	14.4	7.2	-3.2	-7.6	-11.3	-23.6
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		19	38.9	36.2	20.4	21.5	17.4	10.2	-0.2	-4.6	-8.3	-20.6
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.0	12.2	9.0	13.0	19.7	9.4	-3.0	-6.7	
N	Internal room noise level, vent open		23		36.8	21.0	21.7	18.8	20.2	9.9	-0.7	-4.4	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Greenwood 4000S											

Master bedroom														
Master bedroom - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		62	60	61	56	56	55	59	54	50	44	32	
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	
C	Volume of receiving room, m ³	47.2												
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		8	29.8	26.1	16.3	12.1	3.1	-1.2	-10.5	-13.9	-25.6	-37.0	
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		11	32.8	29.1	19.3	15.1	6.1	1.8	-7.5	-10.9	-22.6	-34.0	
Glazing:		-												
Ventilator type:		-												
Combined noise level, dB(A)			23											
Bedroom 2														
Bedroom 2 - rear elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		53	58	60	49	47	48	51	44	36	38	30	
B	Exposed façade, m ²	12.5		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
C	Volume of receiving room, m ³	37.3												
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	
F	I bed existing			21.1	26.1	31.1	27.8	32.9	42.8	45.9	42.9	47.9	52.8	
G	A + B + E - F		17	36.9	34.2	18.4	19.5	15.4	8.2	-2.1	-6.6	-10.3	-22.6	
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		20	39.9	37.2	21.4	22.5	18.4	11.2	0.9	-3.6	-7.3	-19.6	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43		
M	$L_{Aeq} - D_{n,e} + 10 \log(10) - B$				28.2	12.4	9.2	13.2	19.9	9.6	-2.8	-6.5		
N	Internal room noise level, vent open		23		37.7	21.9	22.7	19.6	20.5	10.2	-0.2	-3.9		
Glazing:		4mm, 16/20mm, 4mm												
Ventilator type:		Greenwood 4000S												
Bedroom 2														
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}		62	60	61	56	56	55	59	54	50	44	32	
B	Exposed façade, m ²	7.1		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	37.3												
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		8	29.6	25.9	16.1	11.9	2.9	-1.4	-10.7	-14.1	-25.8	-37.2	
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		11	32.6	28.9	19.1	14.9	5.9	1.6	-7.7	-11.1	-22.8	-34.2	
Glazing:		-												
Ventilator type:		-												
Combined noise level, dB(A)			24											
Bedroom 3														
Bedroom 3 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38	
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	
C	Volume of receiving room, m ³	37.6												
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7	
G	A + B + E - F		27	47.2	43.5	33.7	32.4	21.4	17.1	10.7	-1.0	-12.7	-27.7	
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		30	50.2	46.5	36.7	35.4	24.4	20.1	13.7	2.0	-9.7	-24.7	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \log(10) - B$				32.5	22.7	25.5	27.5	22.2	9.9	3.5	-13.2		
N	Internal room noise level, vent open		32		46.7	36.9	35.8	29.2	24.3	15.2	5.8	-8.1		
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm												
Ventilator type:		Titan SFXSA V75/C50												

Bedroom 3													
Bedroom 3 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		15	36.7	33.0	23.2	19.0	10.0	5.7	-3.6	-7.0	-18.7	-30.1
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		18	39.7	36.0	26.2	22.0	13.0	8.7	-0.6	-4.0	-15.7	-27.1
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			32										
Bedroom 4													
Bedroom 4 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7
G	A + B + E - F		27	47.2	43.5	33.7	32.4	21.4	17.1	10.7	-1.0	-12.7	-27.7
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		30	50.2	46.5	36.7	35.4	24.4	20.1	13.7	2.0	-9.7	-24.7
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				32.5	22.7	25.5	27.5	22.2	9.9	3.5	-13.2	
N	Internal room noise level, vent open		32		46.7	36.9	35.8	29.2	24.3	15.2	5.8	-8.1	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											
Bedroom 4													
Bedroom 4 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		68	66	67	62	62	61	65	60	56	50	38
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		15	36.7	33.0	23.2	19.0	10.0	5.7	-3.6	-7.0	-18.7	-30.1
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		18	39.7	36.0	26.2	22.0	13.0	8.7	-0.6	-4.0	-15.7	-27.1
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			32										
Bedroom 5													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3
G	A + B + E - F		24	47.5	43.8	34.0	26.5	19.2	13.5	4.4	3.5	-7.7	-22.6
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		27	50.5	46.8	37.0	29.5	22.2	16.5	7.4	6.5	-4.7	-19.6
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				26.6	16.8	19.6	21.6	16.3	4.0	-2.4	-19.1	
N	Internal room noise level, vent open		28		46.8	37.0	29.9	24.9	19.4	9.1	7.0	-4.5	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Titan SFXSA V75/C50											

Bedroom 5														
Bedroom 5 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33	
B	Exposed façade, m ²	7.8		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	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3	
G	A + B + E - F		23	45.8	42.1	32.3	25.8	18.9	13.0	4.2	3.4	-7.9	-23.3	
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		26	48.8	45.1	35.3	28.8	21.9	16.0	7.2	6.4	-4.9	-20.3	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.3	18.5	21.3	23.3	18.0	5.7	-0.7	-17.4		
N	Internal room noise level, vent open		28		45.2	35.4	29.5	25.7	20.1	9.5	7.2	-4.7		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Titan SFXSA V75/C50														
Bedroom 5														
Bedroom 5 - flat roof														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33	
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	
C	Volume of receiving room, m ³	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	I bed existing			14.0	19.0	24.0	35.0	44.0	52.0	58.0	60.0	60.0	60.0	
G	A + B + E - F		22	47.6	43.9	34.1	22.9	12.9	8.6	-2.7	-8.1	-14.8	-26.2	
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		25	50.6	46.9	37.1	25.9	15.9	11.6	0.3	-5.1	-11.8	-23.2	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined noise level, dB(A)			32											
Bedroom 6														
Bedroom 6 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33	
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	
C	Volume of receiving room, m ³	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3	
G	A + B + E - F		24	47.5	43.8	34.0	26.5	19.2	13.5	4.4	3.5	-7.7	-22.6	
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		27	50.5	46.8	37.0	29.5	22.2	16.5	7.4	6.5	-4.7	-19.6	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				26.6	16.8	19.6	21.6	16.3	4.0	-2.4	-19.1		
N	Internal room noise level, vent open		28		46.8	37.0	29.9	24.9	19.4	9.1	7.0	-4.5		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Titan SFXSA V75/C50														

Bedroom 6													
Bedroom 6 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33
B	Exposed façade, m ²	7.8		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	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3
G	A + B + E - F		23	45.8	42.1	32.3	25.8	18.9	13.0	4.2	3.4	-7.9	-23.3
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		26	48.8	45.1	35.3	28.8	21.9	16.0	7.2	6.4	-4.9	-20.3
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				28.3	18.5	21.3	23.3	18.0	5.7	-0.7	-17.4	
N	Internal room noise level, vent open		28		45.2	35.4	29.5	25.7	20.1	9.5	7.2	-4.7	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Titan SFXSA V75/C50													
Bedroom 6													
Bedroom 6 - flat roof													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	57	57	56	60	55	51	45	33
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	I bed existing			14.0	19.0	24.0	35.0	44.0	52.0	58.0	60.0	60.0	60.0
G	A + B + E - F		22	47.6	43.9	34.1	22.9	12.9	8.6	-2.7	-8.1	-14.8	-26.2
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		25	50.6	46.9	37.1	25.9	15.9	11.6	0.3	-5.1	-11.8	-23.2
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Greenwood 4000S													
Combined noise level, dB(A)			32										
L_{eq} Assessment, night time													
Master bedroom													
Master bedroom - rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		45	49	52	43	41	41	43	37	26	22	14
B	Exposed façade, m ²	13.2		11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
C	Volume of receiving room, m ³	47.2											
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9
F	I bed existing			21.3	26.3	31.3	28.0	33.1	43.1	46.1	43.1	48.1	53.0
G	A + B + E - F		8	27.2	25.2	10.7	12.5	6.9	-0.6	-10.3	-18.1	-27.3	-39.8
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		11	30.2	28.2	13.7	15.5	9.9	2.4	-7.3	-15.1	-24.3	-36.8
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				20.0	5.5	3.0	5.5	11.9	2.3	-13.5	-22.7	
N	Internal room noise level, vent open		15		28.8	14.3	15.7	11.3	12.4	2.8	-11.2	-20.4	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Greenwood 4000S													

Master bedroom													
Master bedroom - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		57	55	56	53	53	50	54	50	42	31	19
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	47.2											
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		4	24.4	20.7	12.4	8.6	-1.9	-6.3	-14.6	-21.9	-38.3	-50.6
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		7	27.4	23.7	15.4	11.6	1.1	-3.3	-11.6	-18.9	-35.3	-47.6
Glazing:													
Ventilator type:													
Combined noise level, dB(A)			16										
Bedroom 2													
Bedroom 2 -rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		45	49	52	43	41	41	43	37	26	22	14
B	Exposed façade, m ²	12.5		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
C	Volume of receiving room, m ³	37.3											
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8
F	lbed existing			21.1	26.1	31.1	27.8	32.9	42.8	45.9	42.9	47.9	52.8
G	A + B + E - F		9	28.2	26.2	11.7	13.5	7.9	0.4	-9.2	-17.1	-26.3	-38.8
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		12	31.2	29.2	14.7	16.5	10.9	3.4	-6.2	-14.1	-23.3	-35.8
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$				20.2	5.7	3.2	5.7	12.1	2.5	-13.3	-22.5	
N	Internal room noise level, vent open		16		29.7	15.2	16.7	12.1	12.7	3.1	-10.7	-19.9	
Glazing:			4mm, 16/20mm, 4mm										
Ventilator type:			Greenwood 4000S										
Bedroom 2													
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	55	56	53	53	50	54	50	42	31	19
B	Exposed façade, m ²	7.1		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	37.3											
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8
F	lbed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		3	24.2	20.5	12.2	8.4	-2.1	-6.5	-14.8	-22.1	-38.5	-50.8
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		6	27.2	23.5	15.2	11.4	0.9	-3.5	-11.8	-19.1	-35.5	-47.8
Glazing:													
Ventilator type:													
Combined noise level, dB(A)			16										
Bedroom 3													
Bedroom 3 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	59	59	56	60	56	48	37	25
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7
G	A + B + E - F		23	41.8	38.1	29.8	28.9	16.4	12.0	6.6	-9.0	-25.4	-41.3
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		26	44.8	41.1	32.8	31.9	19.4	15.0	9.6	-6.0	-22.4	-38.3
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10*\log(10) - B$				27.1	18.8	22.0	22.5	17.1	5.8	-4.5	-25.9	
N	Internal room noise level, vent open		27		41.3	33.0	32.3	24.2	19.2	11.1	-2.2	-20.8	
Glazing:			Pilkington 6mm, 16/20mm, 6.8mm										
Ventilator type:			Titan SFXSA V75/C50										

Bedroom 3													
Bedroom 3 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	59	59	56	60	56	48	37	25
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		11	31.3	27.6	19.3	15.5	5.0	0.6	-7.7	-15.0	-31.4	-43.7
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		14	34.3	30.6	22.3	18.5	8.0	3.6	-4.7	-12.0	-28.4	-40.7
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			28										
Bedroom 4													
Bedroom 4 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	59	59	56	60	56	48	37	25
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7
G	A + B + E - F		23	41.8	38.1	29.8	28.9	16.4	12.0	6.6	-9.0	-25.4	-41.3
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		26	44.8	41.1	32.8	31.9	19.4	15.0	9.6	-6.0	-22.4	-38.3
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				27.1	18.8	22.0	22.5	17.1	5.8	-4.5	-25.9	
N	Internal room noise level, vent open		27		41.3	33.0	32.3	24.2	19.2	11.1	-2.2	-20.8	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											
Bedroom 4													
Bedroom 4 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		63	61	62	59	59	56	60	56	48	37	25
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		11	31.3	27.6	19.3	15.5	5.0	0.6	-7.7	-15.0	-31.4	-43.7
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		14	34.3	30.6	22.3	18.5	8.0	3.6	-4.7	-12.0	-28.4	-40.7
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			28										
Bedroom 5													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3
G	A + B + E - F		20	42.1	38.4	30.1	23.0	14.2	8.4	0.3	-4.5	-20.4	-36.2
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		23	45.1	41.4	33.1	26.0	17.2	11.4	3.3	-1.5	-17.4	-33.2
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				21.2	12.9	16.1	16.6	11.2	-0.1	-10.4	-31.8	
N	Internal room noise level, vent open		24		41.4	33.1	26.4	19.9	14.3	5.0	-1.0	-17.2	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Titan SFXSA V75/C50											

Bedroom 5														
Bedroom 5 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20	
B	Exposed façade, m ²	7.8		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	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3	
G	A + B + E - F		19	40.4	36.7	28.4	22.3	13.9	7.9	0.1	-4.6	-20.6	-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	
I														
J	Calculated internal noise level		22	43.4	39.7	31.4	25.3	16.9	10.9	3.1	-1.6	-17.6	-33.9	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				22.9	14.6	17.8	18.3	12.9	1.6	-8.7	-30.1		
N	Internal room noise level, vent open		23		39.8	31.5	26.0	20.7	15.0	5.4	-0.8	-17.4		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Titan SFXSA V75/C50														
Bedroom 5														
Bedroom 5 - flat roof														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20	
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	
C	Volume of receiving room, m ³	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3	
G	A + B + E - F		18	42.2	38.5	30.2	19.4	7.9	3.5	-6.8	-16.1	-27.5	-39.8	
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		21	45.2	41.5	33.2	22.4	10.9	6.5	-3.8	-13.1	-24.5	-36.8	
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Greenwood 4000S														
Combined noise level, dB(A)			27											
Bedroom 6														
Bedroom 6 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20	
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	
C	Volume of receiving room, m ³	30.7												
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3	
G	A + B + E - F		20	42.1	38.4	30.1	23.0	14.2	8.4	0.3	-4.5	-20.4	-36.2	
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		23	45.1	41.4	33.1	26.0	17.2	11.4	3.3	-1.5	-17.4	-33.2	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				21.2	12.9	16.1	16.6	11.2	-0.1	-10.4	-31.8		
N	Internal room noise level, vent open		24		41.4	33.1	26.4	19.9	14.3	5.0	-1.0	-17.2		
Glazing: 4mm, 16/20mm, 4mm														
Ventilator type: Titan SFXSA V75/C50														

Bedroom 6													
Bedroom 6 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20
B	Exposed façade, m ²	7.8		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	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3
G	A + B + E - F		19	40.4	36.7	28.4	22.3	13.9	7.9	0.1	-4.6	-20.6	-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
I													
J	Calculated internal noise level		22	43.4	39.7	31.4	25.3	16.9	10.9	3.1	-1.6	-17.6	-33.9
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$			22.9	14.6	17.8	18.3	12.9	1.6	-8.7	-30.1		
N	Internal room noise level, vent open		23		39.8	31.5	26.0	20.7	15.0	5.4	-0.8	-17.4	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Titan SFXSA V75/C50													
Bedroom 6													
Bedroom 6 - flat roof													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{eq}		58	56	57	54	54	51	55	51	43	32	20
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	1 bed existing			14.0	19.0	24.0	35.0	44.0	52.0	58.0	60.0	60.0	60.0
G	A + B + E - F		18	42.2	38.5	30.2	19.4	7.9	3.5	-6.8	-16.1	-27.5	-39.8
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		21	45.2	41.5	33.2	22.4	10.9	6.5	-3.8	-13.1	-24.5	-36.8
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Greenwood 4000S													
Combined noise level, dB(A)			27										

L_{max} Assessment, night time													
Master bedroom													
Master bedroom - rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		63	64	63	57	50	50	59	56	53	40	29
B	Exposed façade, m ²	13.2		11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
C	Volume of receiving room, m ³	47.2											
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9
F	Ibed existing			21.3	26.3	31.3	28.0	33.1	43.1	46.1	43.1	48.1	53.0
G	A + B + E - F		21	42.0	35.9	24.7	20.8	16.4	15.7	9.6	9.3	-9.0	-25.0
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		24	45.0	38.9	27.7	23.8	19.4	18.7	12.6	12.3	-6.0	-22.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				30.7	19.5	11.3	15.0	28.2	22.2	13.9	-4.4	
N	Internal room noise level, vent open		31		39.5	28.3	24.0	20.8	28.7	22.7	16.2	-2.1	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Greenwood 4000S													
Master bedroom													
Master bedroom - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		75	76	75	69	62	62	71	68	65	52	41
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	47.2											
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))			-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		19	45.9	39.8	28.6	17.4	10.1	11.3	4.3	1.0	-17.3	-28.4
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		22	48.9	42.8	31.6	20.4	13.1	14.3	7.3	4.0	-14.3	-25.4
Glazing: -													
Ventilator type: -													
Combined noise level, dB(A)			31										
Bedroom 2													
Bedroom 2 -rear elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		63	64	63	57	50	50	59	56	53	40	29
B	Exposed façade, m ²	12.5		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
C	Volume of receiving room, m ³	37.3											
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8
F	Ibed existing			21.1	26.1	31.1	27.8	32.9	42.8	45.9	42.9	47.9	52.8
G	A + B + E - F		22	43.0	36.9	25.7	21.8	17.4	16.7	10.7	10.3	-8.0	-24.0
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		25	46.0	39.9	28.7	24.8	20.4	19.7	13.7	13.3	-5.0	-21.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				31	36	37	34	30	33	38	43	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				30.9	19.7	11.5	15.2	28.4	22.4	14.1	-4.2	
N	Internal room noise level, vent open		31		40.4	29.2	25.0	21.6	29.0	23.0	16.7	-1.6	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Greenwood 4000S													

Bedroom 2													
Bedroom 2 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		75	76	75	69	62	62	71	68	65	52	41
B	Exposed façade, m ²	7.1		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	37.3											
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))			-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8
F	l bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		19	45.7	39.6	28.4	17.2	9.9	11.1	4.1	0.8	-17.5	-28.6
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		22	48.7	42.6	31.4	20.2	12.9	14.1	7.1	3.8	-14.5	-25.6
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			32										
Bedroom 3													
Bedroom 3 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		81	82	81	75	68	68	77	74	71	58	47
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7
G	A + B + E - F		37	63.3	57.2	46.0	37.7	28.4	29.6	25.5	13.9	-4.4	-19.1
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		40	66.3	60.2	49.0	40.7	31.4	32.6	28.5	16.9	-1.4	-16.1
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				46.2	35.0	30.8	34.5	34.7	24.7	18.4	-4.9	
N	Internal room noise level, vent open		42		60.4	49.2	41.1	36.2	36.8	30.0	20.7	0.2	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											
Bedroom 3													
Bedroom 3 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		81	82	81	75	68	68	77	74	71	58	47
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	l bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		26	52.8	46.7	35.5	24.3	17.0	18.2	11.2	7.9	-10.4	-21.5
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		29	55.8	49.7	38.5	27.3	20.0	21.2	14.2	10.9	-7.4	-18.5
Glazing:		-											
Ventilator type:		-											
Combined noise level, dB(A)			42										
Bedroom 4													
Bedroom 4 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		81	82	81	75	68	68	77	74	71	58	47
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	Composite SRI			17.5	22.5	27.5	28.7	38.6	46.6	47.7	56.0	61.0	64.7
G	A + B + E - F		37	63.3	57.2	46.0	37.7	28.4	29.6	25.5	13.9	-4.4	-19.1
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		40	66.3	60.2	49.0	40.7	31.4	32.6	28.5	16.9	-1.4	-16.1
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				46.2	35.0	30.8	34.5	34.7	24.7	18.4	-4.9	
N	Internal room noise level, vent open		42		60.4	49.2	41.1	36.2	36.8	30.0	20.7	0.2	
Glazing:		Pilkington 6mm, 16/20mm, 6.8mm											
Ventilator type:		Titan SFXSA V75/C50											

Bedroom 4													
Bedroom 4 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		81	82	81	75	68	68	77	74	71	58	47
B	Exposed façade, m ²	9.4		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
C	Volume of receiving room, m ³	37.6											
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))			-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9
F	I bed existing			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0
G	A + B + E - F		26	52.8	46.7	35.5	24.3	17.0	18.2	11.2	7.9	-10.4	-21.5
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		29	55.8	49.7	38.5	27.3	20.0	21.2	14.2	10.9	-7.4	-18.5
Glazing:		-											
Ventilator type:		-											
		Combined noise level, dB(A)	42										
Bedroom 5													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	I bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3
G	A + B + E - F		36	63.6	57.5	46.3	31.8	26.2	26.0	19.2	18.4	0.6	-14.0
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		39	66.6	60.5	49.3	34.8	29.2	29.0	22.2	21.4	3.6	-11.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				40.3	29.1	24.9	28.6	28.8	18.8	12.5	-10.8	
N	Internal room noise level, vent open		39		60.5	49.3	35.2	31.9	31.9	23.9	21.9	3.8	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Titan SFXSA V75/C50											
Bedroom 5													
Bedroom 5 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	7.8		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	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3
G	A + B + E - F		34	61.9	55.8	44.6	31.1	25.9	25.5	19.0	18.3	0.4	-14.7
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		37	64.9	58.8	47.6	34.1	28.9	28.5	22.0	21.3	3.4	-11.7
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				42.0	30.8	26.6	30.3	30.5	20.5	14.2	-9.1	
N	Internal room noise level, vent open		38		58.9	47.7	34.8	32.7	32.6	24.3	22.1	3.6	
Glazing:		4mm, 16/20mm, 4mm											
Ventilator type:		Titan SFXSA V75/C50											
Bedroom 5													
Bedroom 5 - flat roof													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	I bed existing			14.0	19.0	24.0	35.0	44.0	52.0	58.0	60.0	60.0	60.0
G	A + B + E - F		35	63.7	57.6	46.4	28.2	19.9	21.1	12.1	6.8	-6.5	-17.6
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		38	66.7	60.6	49.4	31.2	22.9	24.1	15.1	9.8	-3.5	-14.6
Glazing:		-											
Ventilator type:		-											
		Combined noise level, dB(A)	43										

Bedroom 6													
Bedroom 6 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	11.5		10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	1 bed existing			14.0	19.0	24.0	31.3	37.6	47.0	50.8	48.3	52.8	56.3
G	A + B + E - F		36	63.6	57.5	46.3	31.8	26.2	26.0	19.2	18.4	0.6	-14.0
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		39	66.6	60.5	49.3	34.8	29.2	29.0	22.2	21.4	3.6	-11.0
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$			40.3	29.1	24.9	28.6	28.8	18.8	12.5	-10.8		
N	Internal room noise level, vent open		39		60.5	49.3	35.2	31.9	31.9	23.9	21.9	3.8	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Titan SFXSA V75/C50													
Bedroom 6													
Bedroom 6 - gable													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	7.8		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	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	Composite SRI			14.0	19.0	24.0	30.3	36.2	45.8	49.3	46.7	51.3	55.3
G	A + B + E - F		34	61.9	55.8	44.6	31.1	25.9	25.5	19.0	18.3	0.4	-14.7
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		37	64.9	58.8	47.6	34.1	28.9	28.5	22.0	21.3	3.4	-11.7
K	Number of ventilators	1											
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63	
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				42.0	30.8	26.6	30.3	30.5	20.5	14.2	-9.1	
N	Internal room noise level, vent open		38		58.9	47.7	34.8	32.7	32.6	24.3	22.1	3.6	
Glazing: 4mm, 16/20mm, 4mm													
Ventilator type: Titan SFXSA V75/C50													
Bedroom 6													
Bedroom 6 - flat roof													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	Measured L_{max}		76	77	76	70	63	63	72	69	66	53	42
B	Exposed façade, m ²	11.7		10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
C	Volume of receiving room, m ³	30.7											
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))			-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
F	1 bed existing			14.0	19.0	24.0	35.0	44.0	52.0	58.0	60.0	60.0	60.0
G	A + B + E - F		35	63.7	57.6	46.4	28.2	19.9	21.1	12.1	6.8	-6.5	-17.6
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		38	66.7	60.6	49.4	31.2	22.9	24.1	15.1	9.8	-3.5	-14.6
Glazing: -													
Ventilator type: -													
Combined noise level, dB(A)			43										