

REPORT TITLE: NOISE IMPACT ASSESSMENT FOR BARN CONVERSION DWELLINGS AT
WINCH HILL HOUSE, WINCH HILL ROAD, LUTON LU2 8PB

North Hertfordshire District Council Reference: 21800019/PIP

REPORT REF: 23006-002

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SUMMARY

- This report provides a noise assessment for proposed barn conversion residential dwellings at Winch Hill House, Winch Hill Road, Luton LU2 8PB.
- The proposed dwellings are granted permission by North Hertfordshire District Council via application reference 21/00019/PIP (Permission in Principle) decision notice dated 23 March 2021.
- The noise assessment is as required by the Council's decision notice Informative/s section; to form part of the technical details stage for the proposed development following the grant of permission in principle.
- A noise survey has been conducted at the development site as part of the assessment. Day and night period noise levels at the site are predominantly due to aircraft associated with London Luton Airport. The site is approximately 1.8km east from the airport's passenger terminal and circa 570m north-east from the eastern end point of the airport's runway. The site lies between the airport's 60dB & 63dB noise contours.
- There is also some noise contribution to the site due to occasional passing traffic along Winch Hill Road, however this is minimal (not materially significant) as compared with noise from aircraft.
- The noise assessment is with reference to North Hertfordshire District Council planning policy (noise), relevant British Standards including BS8233:2014, plus other guidance documents. The assessment also takes account of possible future expansion of London Luton Airport.
- The assessment indicates the site is suitable for residential development subject to appropriate/commensurate noise mitigation measures to protect future occupiers against aircraft noise.
- A scheme of noise insulation measures for the development is established and provided in Section 7 of the report, verified using the rigorous procedure calculations outlined in Annex G of BS8233:2014. Noise mitigation measures include high acoustic performance glazing, use of mechanical ventilation and acoustic linings to the proposed dwellings' external wall and roof structures.

1. INTRODUCTION

North Hertfordshire District Council as Local Planning Authority has granted permission for the proposed conversion of a redundant barn into two residential dwellings at Winch Hill House, Winch Hill Road, Luton LU2 8PB.

The development's grant permission decision notice is North Hertfordshire District Council application reference 21/00019/PIP (Permission in Principle) dated 23 March 2021.

The decision notice Informative/s section includes advice to the applicant as reproduced below that a noise impact assessment (for the development) would be expected to form part of the technical details stage following the grant of permission in principle:

Informative/s:

- The applicant is advised that the following matters would be expected to form part of the Technical Details stage following the grant of permission in principle:
- Scaled drawings showing all floor plans and elevations of the barn to be converted
- External materials
- Preliminary Risk Assessment concerning land contamination
- Noise Impact assessment
- Provision of electric vehicle re-charging infrastructure
- Details of refuse collection point

Although not referenced in the Council's decision notice or the associated Officer report, it is expected the requirement for a noise impact assessment relates to aircraft noise, principally for reason of the site's proximity to London Luton Airport.

This report provides a noise impact assessment for the development and includes:

- Qualifications & experience;
- Description of the proposed development and surrounding area;
- Noise assessment methodology and criteria for residential development, with reference to North Hertfordshire District Council planning policy (noise), relevant British Standards and other guidance documents;
- Details, procedure, results & observations of an extended period noise levels survey conducted at the site;
- Consideration of future expansion of London Luton Airport;
- Noise assessment;
- Scheme of noise mitigation measures.

2. QUALIFICATIONS & EXPERIENCE

This report is prepared and issued by David Philip. David Philip graduated in 1989 from The University of Salford Department of Applied Acoustics with a BEng Honours degree in Electroacoustics. David Philip has been since 1995, and continues to be, a fully elected Member of the Institute of Acoustics (MIOA).

David Philip has been the owner / managing director of Philip Acoustics since the firm was formed in 2002. Prior to the formation of Philip Acoustics, David Philip held senior acoustic consultant positions at Sound Research Laboratories (London office) and Spectrum Acoustic Consultants.

Philip Acoustics has held full membership of the Association of Noise Consultants (ANC) since 2003 and is also a full member of the ANC Registration Scheme of approved independent organisations to undertake Building Regulations Approved Document Part E pre-completion certification sound insulation testing.

David Philip has over 30 years-experience as an Acoustic Consultant both in the UK and internationally and has considerable experience undertaking noise surveys and noise assessments for a wide range of scenarios.

This experience includes a substantial quantity of noise assessments specifically associated with proposed new residential developments in proximity to roads, railways, aircraft flight paths and other types of noise sources, plus also for proposed developments within the jurisdiction of North Hertfordshire District Council and the directly neighbouring Local Planning Authority - Luton Borough Council.

David Philip is fully familiar with Government national planning policy / guidance with respect to noise, the provisions of the current (and previous) editions of relevant British Standards including BS4142 and BS8233, plus also other acoustics / noise assessment related standards and guidance documents.

The opinions expressed in this report are the true and professional opinions of David Philip. Neither David Philip nor Philip Acoustics is appointed on any incentive fee basis.

3. DEVELOPMENT DESCRIPTION

The proposed development is for the conversion and sub-division of a redundant barn into two residential dwellings with associated parking and external amenity space (gardens).

The barn is located approximately 40m east of Winch Hill House; an existing detached house with extensive grounds.

The site is in a rural setting accessed from Winch Hill Road, surrounded by woodland and arable farmland, approximately 1.3km west of Breachwood Green village.

An aerial view, site location plan, block plan and proposed development floor plans & elevations drawing are provided in Appendix A.

The site is in proximity to London Luton Airport; approximately 1.8km east from the airport's passenger terminal and circa 570m north-east from the eastern end point of the airport's runway. The site lies between the airport's 60dB & 63dB noise contours.

4. RESIDENTIAL DEVELOPMENT NOISE ASSESSMENT METHODOLOGY & CRITERIA

This section provides details for relevant noise assessment guidance, standards, methodology and criteria as applicable for the proposed residential development.

4.1 North Hertfordshire District Council Planning Policy (*Noise*)

North Hertfordshire District Council Local Development Framework - *Design Supplementary Planning Document* (SPD) July 2011 *Appendix A: Relevant Guidance* includes reference to Government Planning Policy Guidance Note 24: Planning and Noise (PPG24) 1994. However, PPG24 is now withdrawn from use, see Section 4.2 of the report.

North Hertfordshire District Council Local Plan 2011-2031 (proposed submission) October 2016 also includes reference to noise associated with development proposals.

Relevant Policy D3: *Protecting Living Conditions* from Section 9: *Design* of Local Plan 2011-2031 is reproduced below:

Policy D3: Protecting living conditions

Planning permission will be granted for development proposals which do not cause unacceptable harm to living conditions.

Where the living conditions of proposed developments would be affected by an existing use or the living conditions of an existing development would be affected by a proposed use, the Council will consider whether there are mitigation measures that can be taken to mitigate the harm to an acceptable level. If the Council is not satisfied that mitigation proposals would address the identified harm, development proposals will not be permitted.

Neither Policy D3, its associated supporting paragraphs nor other planning guidance or policies of the Council provide any specific guidance on noise standards (criteria) and/or assessment methodology, including as would be applicable for the proposed new residential development.

Notwithstanding the above, Philip Acoustics has carried out noise surveys and assessments for other proposed residential developments under the jurisdiction of the North Hertfordshire District Council, including where permission for development was granted subject to various conditions, including with respect to noise.

The Council's noise requirements/criteria commonly included as part of planning consent conditions for new and/or change of use residential development is generally based on the guidance and standards for internal ambient noise levels to within residential dwellings contained within relevant British Standard BS8233:2014.

4.2 Government National Planning Policy Guidance

4.2.1 Planning Policy / Practice Guidance

Government national planning policy guidance relating to noise was until 2012 principally provided by Planning Policy Guidance Note 24: Planning and Noise (PPG24) 1994. PPG24 was withdrawn upon the Government's (DEFRA) publication of the National Planning Policy Framework (NPPF) – see Sub-Section 4.2.2.

Government's Planning Practice Guidance for noise (PPG-N), current edition July 2019 update, is an online resource providing general guidance for noise in respect to planning.

PPG-N does not provide any prescriptive noise assessment methodology or noise limits criteria, and instead provides more of an overview for aims and objectives, all as aligned with the Government's Policy documents NPPF and NPSE as detailed in Sub-Section 4.2.2.

However, PPG-N does refer to other guidance and documents which do provide noise assessment methodology and/or criteria, including British Standard BS8233:2014 and ProPG: *Planning & Noise New Residential Development*, as detailed in Sections 4.3 & 4.5 respectively.

4.2.2 National Planning Policy Framework (NPPF) & Noise Policy Statement For England (NPSE)

The National Planning Policy Framework (NPPF) was first published March 2012. The current edition of NPPF is dated February 2019.

In addition, and to provide context for NPPF regarding noise, the Noise Policy Statement for England (NPSE) was published March 2010.

NPPF and NPSE are both “high level” documents that, in terms of noise, define noise management aims, objectives and outcomes in terms of achieving sustainable development.

The NPPF and NPSE documents do not prescribe any noise assessment methodology or criteria, such as numerically defining or categorising the acceptability of noise levels affecting a residential development site, including from such as road traffic or aircraft etc.

4.3 British Standard BS8233

This standard is referenced by the Government's Planning Practice Guidance for noise (PPG-N) and also by most Local Planning Authorities as noise assessment methodology and criteria for new residential development, including for sites as potentially affected by noise from road traffic and/or aircraft etc.

Full title of the current edition of the standard is BS8233:2014 “*Guidance on Sound Insulation and Noise Reduction for Buildings*”.

To ensure protection for residential occupiers against noise, BS8233:2014 provides relevant guidance for indoor ambient noise levels within dwellings plus also noise levels within external amenity spaces.

Indoor Ambient Noise Levels Within Dwellings

The guidance for indoor ambient noise levels within dwellings of BS8233:2014 is contained within Table 4 in Section 7.7.2 *Internal ambient noise levels for dwellings* of the standard as reproduced below:

Activity	Location	07:00 to 23:00 (day period)	23:00 to 07:00 (night period)
Resting	Living room	$\leq 35\text{dB } L_{Aeq,16\text{hour}}$	-
Dining	Dining room/area	$\leq 40\text{dB } L_{Aeq,16\text{hour}}$	-
Sleeping (daytime resting)	Bedroom	$\leq 35\text{dB } L_{Aeq,16\text{hour}}$	$\leq 30\text{dB } L_{Aeq,8\text{hour}}$

The above are appropriate / relevant applied as noise criteria for the proposed new dwellings.

In addition to the above, Note 4 to Table 4 in Section 7.7.2 *Internal ambient noise levels for dwellings* of BS8233:2014 advises that regular individual noise events (for example, night period scheduled aircraft or passing trains) can cause sleep disturbance and that a guideline noise limit value may be set for bedrooms (at night) in terms of SEL or L_{AFmax} depending on the character and number of events per night.

The development site is affected by noise from aircraft therefore it is appropriate to apply a L_{AFmax} criterion for bedrooms of the dwellings during the night period.

BS8233:2014 does not provide any specific guidance on night period L_{AFmax} values for noise into bedrooms. The L_{AFmax} limit guidance for bedrooms at night contained within the previous edition BS8233:1999 is removed from BS8233:2014. Notwithstanding this, the noise assessment in this report uses a criterion L_{AFmax} 45dB for bedrooms during the night period (as per BS8233:1999) and as per the guidance of other documents including ProPG: *Planning & Noise New Residential Development*.

In accordance with normal acoustic design practice and as per advice contained within the ProPG document, the criterion is applied on the basis that individual noise events should not regularly exceed L_{AFmax} 45dB in bedrooms at night, defined as occurring generally more than 10 times a night or several times in any one hour during the night. It is not intended the requirement be applicable to infrequent night period very high noise events such as sirens of passing emergency vehicles, sounding of vehicle horns or fireworks celebrations etc.

In applying the above indoor ambient noise levels criteria, then in accordance with normal acoustic design practice and definition, it is taken that:

- The internal noise levels criteria are to be achieved due to all-encompassing prevailing external noise affecting the development, which is predominantly noise from aircraft associated with London Luton Airport, including as “worse case” with the airport operating in Easterly mode;
- The internal noise levels criteria are to be achieved inside unoccupied but completed and normally furnished rooms of the dwellings;
- The day period noise level criterion for living rooms is also applicable for any kitchen and/or dining areas as open plan to living rooms (i.e. the dwellings’ combined living/kitchen/diners).

Noise Levels Within External Amenity Spaces

BS8233:2014 also provides guidance regarding noise to external amenity spaces associated with residential dwellings. External amenity space of the development relates to the dwellings' private garden areas.

The guidance of BS8233:2014 for noise within external amenity space of dwellings such as gardens is reproduced below, and generally taken as applicable for the 16-hour day period (07:00-23:00):

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments".

However, BS8233:2014 recognises the guidance on noise levels within external amenity spaces as outlined above (including the upper value $L_{Aeq,T}$ 55dB) is not achievable in all circumstances, and that in such situations is development should not be prohibited.

4.4 British Standard BS4142

In the scenario of a proposed residential development site (and/or existing residential premises) affected by a specific, dominant and/or otherwise significant commercial and/or industrial type noise then it is generally appropriate to consider assessment of the noise using British Standard BS4142.

Full title of the current edition of the standard is BS4142:2014+A1:2019 "*Methods for rating and assessing industrial and commercial sound*".

Noise levels at the site are due to aircraft. The site is not separately, significantly or otherwise adversely noise affected by contributions from activity or plant / equipment, or other sources as associated with any commercial or industrial use premises. Therefore, it is not necessary to undertake any separate assessment for the proposed development under the provisions of BS4142:2014.

4.5 ProPG: Planning & Noise New Residential Development

Although not constituting an official government document or code of practice, Professional Practice Guidance document ProPG: *Planning & Noise New Residential Development* dated May 2017 provides noise assessment guidance applicable for new residential development.

The ProPG document is issued by a working group of practitioners (including acoustic consultants and Local Authority Environmental Health Officers) allied with noise assessments for proposed new residential developments.

The ProPG document encourages early-stage consideration of noise within the planning process and good acoustic design including with significant reference to guidance of the current editions of British Standards BS8233 and BS4142.

In overview terms as applicable for the proposed development, advice of the ProPG document correlates with the guidance of BS8233:2014, including in respect to internal noise levels within dwellings and also noise levels to external amenity spaces.

In addition, a key aspect of guidance within the ProPG document as supplementary to BS8233:2014 is that it provides methodology for an initial Site Noise Risk Assessment, intended for use before a proposed residential development's planning submission.

Section 6 of this report uses the noise survey results to include a Site Noise Risk Assessment for the proposed development as per guidance of the ProPG document.

4.6 Acoustic Ventilation & Overheating Residential Design Guide

As similar to the ProPG document, and again although not constituting an official government document or guidance / advice, the Acoustic Ventilation & Overheating Residential Design Guide January 2020 (AVO document) issued jointly by the Association of Noise Consultants (ANC) & Institute of Acoustics (IOA) provides relevant noise guidance allied with noise assessments for new residential developments.

The AVO document is lengthy and technically complex, including with significant background reference to relevant legislation and guidance as well as British Standard BS8233:2014 and Building Regulations Approved Document Part F (Ventilation).

In simple overview terms; the AVO document guidance seeks to address issues associated with the competing demands of closed windows to mitigate external noise ingress into residential dwellings and of open windows to provide reasonable ventilation / thermal conditions.

Reference to guidance of the AVO document is included in Section 7.3 *Ventilation Provision* of the report.

5. NOISE LEVELS

To assess the development against noise guidance and establish a scheme of noise mitigation measures (Acoustic Design Statement), it is necessary to determine current prevailing day and night period noise levels at the site.

Details of a noise survey conducted at the development site are provided in Sections 5.1 & 5.2.

Consideration of the possible future expansion of London Luton Airport and how this may affect (alter) noise levels is provided in Section 5.3.

5.1 Noise Survey Details & Procedure

The noise survey was partly attended, conducted using a logging type sound level meter externally at the development site over a seven day period from Wednesday 18 January 2023 through to Tuesday 24 January 2023.

Weather conditions were monitored and were suitable for the survey. The weather included dry and calm conditions during the day and also the night periods of the survey.

The survey was conducted over an extended seven day period to ensure inclusion of London Luton Airport operating in both Westerly and Easterly modes.

For Westerly mode aircraft take off west from the airport runway in direction towards the M1 motorway and away from the development site.

For Easterly mode aircraft take off east from the runway in direction towards Stevenage including nominally towards the development site (albeit the site is diagonally opposed to the airport's runway alignment).

The noise survey measurement position is indicated on the site block plan in Appendix A. The position was in equivalent free-field conditions with the instrumentation microphone set at 1.5m above ground level.

Noise measurements were recorded principally in terms of continual 5-minute samples $L_{Aeq,T}$ dB ($T = 5 \text{ minutes}$) and L_{AFmax} dB values for the full survey duration. Other parameter noise level measurements including statistical values were recorded for information.

Samples of octave band values (including as worse case – higher magnitude noise for the airport operating in Easterly mode) were also obtained to provide frequency content information of noise levels to assist with establishing the development's scheme of noise mitigation measures.

Details of the noise survey instrumentation used are provided in Appendix B. The sound level meters were calibration verified before and after the survey measurements.

5.2 Noise Survey Results & Observations

Complete raw data results of the noise survey in terms of $L_{Aeq,T}$ and L_{AFmax} values are provided in Appendix C.

Analysis of the noise survey results in terms of overall free-field $L_{Aeq,T}$ values for the separate day and night periods plus L_{AFmax} values for the night period of the completed whole days of the survey is shown in Table 1 on the following page.

Noise levels to the development site are predominantly due to aircraft flyovers associated with London Luton Airport. There is some noise contribution due to occasional passing traffic along Winch Hill Road, however this is minimal (not materially significant) as compared with noise from aircraft.

No noise was observed as audible or measurable from any commercial / industrial premises.

Description		Overall Period $L_{Aeq,T}$	Night Period Typical / Regular Occurring High $L_{AFmax}^{(1)}$
Thursday 19 January 2023 <u>Airport operating majority Westerly mode</u>	Day period 07:00-23:00	56dB (16hour)	
	Night period 23:00-07:00	52dB (8hour)	Up to 77 - 78dB
Friday 20 January 2023 <u>Airport operating majority Westerly mode</u>	Day period 07:00-23:00	56dB (16hour)	
	Night period 23:00-07:00	51dB (8hour)	Up to 77 - 78dB
Saturday 21 January 2023 <u>Airport operating majority Easterly mode</u>	Day period 07:00-23:00	67dB (16hour)	
	Night period 23:00-07:00	62dB (8hour)	Up to 86 - 87dB
Sunday 22 January 2023 <u>Airport operating split Westerly mode & Easterly mode</u>	Day period 07:00-23:00	62dB (16hour)	
	Night period 23:00-07:00	54dB (8hour)	Up to 75dB
Monday 23 January 2023 <u>Airport operating majority Easterly mode</u>	Day period 07:00-23:00	66dB (16hour)	
	Night period 23:00-07:00	60dB (8hour)	Up to 86 - 87dB
Note (1): Night period typical / regular occurring high L_{AFmax} values are the highest aircraft event levels as occur more than 10 times during the night period or several times in any one hour during the night period (11pm to 7am).			

Table 1: Noise levels at the development site

The survey results indicate (as expected) a significant variation in noise levels at the proposed development site dependent upon whether the airport is operating Westerly or easterly mode.

Overall value noise levels are circa 10dBA higher with the airport operating Easterly mode as compared with Westerly mode.

The noise survey result overall day period noise level $L_{Aeq,16hour}$ 62dB for the Sunday of the survey with the airport operating in split Westerly and Easterly modes is broadly consistent with London Luton Airport's noise contour map, which places the development site between the airport's 60 and 63dB noise contours (noise contours as day period $L_{Aeq,16hour}$ values).

This confirms the noise survey results as valid and representative.

London Luton Airport's website – *sustainability noise section* advises that on average the split between Easterly mode and Westerly mode operation is 30/70, i.e. Easterly mode occurs less often and on average 30% of the time. This is mainly due to that for most of the time the wind direction is from the west, which suits Westerly mode operation.

Thus results of the noise survey for the Saturday and Monday of the survey as including Easterly mode operation for majority of the 24-hour survey period is as typical / representative of "worse-case" conditions and for much of the time noise levels will be lower with the airport operating more in Westerly mode, i.e. as other days of the survey.

Notwithstanding this, the noise assessment in Section 6 of the report and scheme of noise mitigation in Section 7 of the report is based on the airport operating as "worse case" Easterly mode.

5.3 London Luton Airport Future Expansion

In consideration of any alteration / increase in noise from aircraft associated with expansion of the airport it is important to note that there will anyhow be a duty on the airport and other relevant parties regarding protection for the many existing residential dwellings in local proximity to the airport and wider area generally, such as limitation on night flying etc. This duty will also, and by default, apply for the proposed development in respect to noise as may be associated with the expansion.

As associated with other similar noise assessments, the author has previously contacted Luton Borough Council for further details in respect to expansion of London Luton Airport.

Initial contact was to Luton Borough Council Environmental Health (i.e. with respect to noise associated with the expansion), however Environmental Health were unable to assist and instead referred to Luton Rising (as part of the Council) in respect to the expansion.

Luton Rising advised details for the expansion are as an online resource at <https://lutonrising.org.uk/consultation/> and technical documents can be found under the "documents vault" tab.

The quantity of general information via the Luton Rising online resource and elsewhere online is vast. But extremely difficult to pin down technically in terms of what effect of the expansion may be in terms of change (increase) in aircraft noise as affecting residential properties in the local or wider area.

Much of the proposed expansion details refer to improvements to be made to increase passenger numbers and advise about a Phase 1 proposal for expansion of Terminal 1 to increase capacity from 18 to approximately 21.5 million passengers per annum (mppa). Then a Phase 2 proposal for a new Terminal 2 to increase capacity to 27mppa, plus then a further expansion of Terminal 2 to increase to 32mppa. Thus and in overall simplistic terms a possible expansion from 18 to finally 32mppa passengers; i.e. a circa 77% increase.

However, document *Draft Compensation Policies and Measures (Statutory Consultation 2022)* from the Luton Rising online resource includes three airport noise contour maps, as per the current noise contour map as day period $L_{Aeq,16hour}$ values, projected for years 2027, 2039 & 2043.

The noise contour maps show nil materially significant difference in noise levels from 2027 to 2039, but with a slight increase in noise (lengthening and slight broadening of the noise contours' extent) to 2043.

Comparison of the proposed development site's position on the airport's current noise contour map with the projected 2043 noise contour map indicates a relatively small potential uplift in noise, from being between the airport's 60 and 63dB noise contours as currently to same or possibly marginally closer (by 1dB) to the 63dB contour projected for 2043.

The main difference between the airport's current noise contour map with the projected 2043 noise contour map is related to the length of the contours' extent as directly aligned east & west with the airport's runway. Width of the contours' extent as affecting the proposed development site is much less affected / less different between the current and 2043 noise contours.

Thus it is considered reasonable based on this available information to allow up to a 1dB increase in overall day period noise levels at the proposed development site as associated with the airport's future expansion to 2043.

No airport noise contours are provided for the night period. However for the purpose of this report the same allowance for up to a 1dB increase is applied for night period noise levels at the development site as associated with the airport's future expansion to 2043.

The airport's future expansion uplift allowance as detailed above relates to overall day and night period noise level $L_{Aeq,T}$ dB values at the development site.

Night period noise level L_{AFmax} dB values at the site are associated with the magnitude of noise from individual aircraft flyover events and are not influenced / altered by an increase in aircraft numbers. The same magnitude L_{AFmax} dB values will occur regardless of the airport's future expansion and therefore it unnecessary to include any uplift allowance specifically in terms of night period L_{AFmax} dB values.

6. NOISE ASSESSMENT

In terms of a general subjective and observational noise assessment, then although the site is noise affected by aircraft, in overall planning context day period overall $L_{Aeq,T}$ dB noise levels are in relative terms not higher as compared with many planning approved residential development sites in more urban areas and/or town/city centre locations immediately adjacent to busy major route roads, railway lines or commercial / industrial premises, etc.

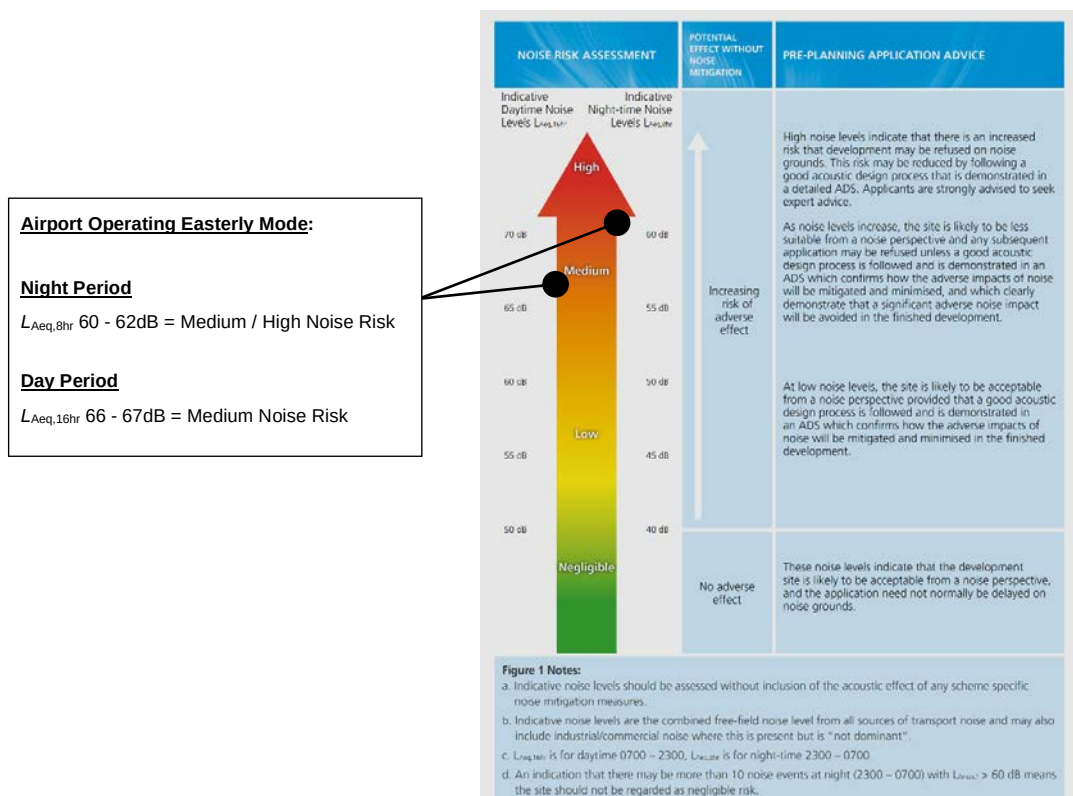
However, night period overall $L_{Aeq,T}$ dB noise levels and L_{AFmax} dB values (airport operating Easterly mode) are in relative terms higher as compared with noise levels at most development sites.

Technical noise assessment of the proposed development using results of the noise survey with the airport operating "worse case" in majority Easterly mode and following the guidance of Stage 1: Initial Site Noise Risk Assessment of ProPG: *Planning & Noise New Residential Development* indicates the following.

- **Day Period:** $L_{Aeq,16hr}$ 66 - 67dB = Medium Noise Risk (airport "worse case" Easterly mode);
- **Night Period:** $L_{Aeq,8hr}$ 60 - 62dB = Medium / High Noise Risk (airport "worse case" Easterly mode).

Allowance of the uplift in noise levels associated with possible future expansion of London Luton Airport does not materially alter / effect the ProPG Site Noise Risk Assessment.

Noise Risk Assessment guidance of the ProPG document is on a visually represented sliding scale figure and deliberately without fixed numerical boundary defined categories of noise risk from Negligible to High Risk as indicated / explained by Figure 1 diagram of the ProPG document reproduced below. It is important to note the "Noise Risk" relates to the potential adverse effect (to future residential occupiers) without any noise mitigation measures being considered within the development's scheme design, i.e. the noise risk assessment is for a development with nil acoustic design consideration (no scheme of noise mitigation).



7. SCHEME OF NOISE MITIGATION MEASURES

A scheme of noise mitigation measures for proposed new residential developments may include consideration of building positioning on the site's overall land extent, plus boundary treatments such as earth bunds and/or acoustic barriers / fences to provide screening against noise from road traffic, railways and/or other sources.

These considerations are not applicable for the proposed development in this instance; conversion of an existing redundant barn (i.e. at a fixed position on the site) and as being principally affected by noise from aircraft.

Thus, and as for many other residential developments, the scheme of noise mitigation in this instance relates to the acoustic design and specification of noise (sound) insulation performance for elements of the overall building envelope to protect against external noise ingress into rooms of the dwellings, plus also consideration of noise to associated external amenity spaces.

By following the rigorous calculation method outlined in Annex G (item G.2) of BS8233:2014 a specification for the acoustic performance of glazing plus other elements of the overall building envelope has been established and an item-by-item scheme of noise mitigation measures is provided in Sections 7.1 to 7.4 on the following pages.

An outline summary for the scheme of noise mitigation measures is provided below:

- **External Walls:** High performance acoustic grade insulation & resilient plasterboard linings internally;
- **Glazing:** Very high acoustic performance glazing to bedrooms plus associated bedroom 1 en-suites (typically achieved by use of secondary glazing or specialist glass bespoke double glazing). High acoustic performance double glazing to other rooms / areas including combined living/kitchen/dining areas (typically achieved by use of specialist glass bespoke double glazing);
- **Ventilation Provision:** Mechanical ventilation as Approved Document F System 4 (typically whole house MVHR type ventilation system), not using passive trickle type ventilators;
- **Roof Structure:** High performance acoustic grade insulation & resilient plasterboard ceilings / linings internally (to first floor rooms / areas).

Consideration of noise to associated external amenity space of the dwellings is provided in Section 7.5.

Copy of example BS8233:2014 rigorous calculations for day period and night period noise intrusion are provided in Appendix D. The calculations demonstrate that with the scheme of noise mitigation measures, noise levels will comply the criteria.

The calculations use a spreadsheet based on BS8233:2014 and BS EN 12354-3:2000 and are for the following "worse case" conditions. The calculations are cautious/robust and actual noise levels into rooms of the dwellings subject to compliance with the scheme of noise insulation measures would be expected to be generally lower than those predicted:

- The calculations are with worse case noise levels (highest measured overall day and night period noise survey results plus night period typical highest regularly occurring $L_{A_{fmax}}$ noise level 87dB) for the airport operating in majority easterly mode;
- The calculations are with these highest noise levels incident upon all parts of the dwellings' external building envelope structure.

7.1 External Walls

External walls of the dwellings are to be formed by the barn's existing timber framed structure, with insulation, room side plasterboard linings and outer finish cladding.

The following acoustic specification is advised as upgrade / enhancement to ensure sufficient noise mitigation performance for the dwellings' external walls structure and comprises a very high specification insulated acoustic lining:

- The timber framed structure cavity void insulation to incorporate minimum 100mm thick acoustic grade mineral wool type insulation minimum density 45kg/m³ (typically such as Rockwool RWA45 slab or equivalent). *As for similar residential developments with composite structure timber framed type external walls, it is anticipated that thicker insulation than the quoted minimum 100mm insulation would likely be required anyhow for thermal efficiency reasons;*
- Room side plasterboard linings to the timber framed structure of minimum 2 x layers 15mm acoustic grade plasterboard (typically such as British Gypsum SoundBloc or Knauf SoundShield or other equivalent) with staggered joins;
- The plasterboard linings attached to the timber framed structure using resilient bars or other resilient / non direct fix method (such as British Gypsum GypLyner system).

Values in Table 2 show the expected minimum sound insulation performance for this overall external wall construction / build up to provide adequate mitigation against external noise ingress for the dwellings.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Timber framed structure external walls with outer cladding; upgraded with acoustic insulation and resilient (non-direct) fixed room side linings of double layer 15mm acoustic grade plasterboard Sound Reduction Index R dB	32	42	49	54	55 ⁽¹⁾	55 ⁽¹⁾
Note ⁽¹⁾: Sound insulation limited to upper values 55dB. Higher values likely by default at these frequencies but are not stated.						

Table 2: External walls sound insulation performance

7.2 Glazing

Informative: Glazing Acoustic Performance

The schedule of glazing acoustic performance as part of a residential development's scheme of noise mitigation measures will typically / normally set differing acoustic performance (sound insulation) requirements for differing parts of the overall development and/or differing facades of dwellings.

This, because very often differing parts of a development and/or differing facades of dwellings will be subject to differing levels of external noise, i.e. usually some parts / facades are overlooking a road or railway line as the dominant source and subject to higher noise levels, with other parts / facades being farther from and/or naturally shielded from (by the dwellings themselves – as “building block” acoustic screening) dominant noise sources and subject to lower noise levels.

However, because in this instance noise levels are predominantly due to aircraft flyovers, then the specifications for acoustic performance of glazing to living areas and to bedrooms (i.e. habitable rooms of dwellings) is applied across all parts and facades of the dwellings.

In addition, for most developments (as generally affected principally by noise from road traffic) it is typical that the glazing acoustic performance specification is the same for living areas and bedrooms. For this proposed development subject to noise from aircraft, then a higher specification of acoustic performance glazing is required for bedrooms as compared with living areas. This is specifically associated with ensuring compliance with night period L_{AFmax} dB noise levels into bedrooms.

Notwithstanding this, it would be acceptable, if the developer wished, to use the specified bedrooms glazing minimum acoustic performance also for living areas and other rooms / areas of the dwellings (i.e. as betterment to the specified living areas glazing), but not visa-versa.

Values in Table 3 show the advised specification for glazing minimum acoustic performance. Glazing includes windows, roof lights and glazed exterior doors leading directly into habitable rooms (i.e. patio style doors).

Description	Octave Band Centre Frequency (Hz)						Comment
	125	250	500	1k	2k	4k	
Living Areas <i>(including all parts of combined living/kitchen/diners)</i>	21	28	36	39	40 ⁽¹⁾	40 ⁽¹⁾	Overall performance ≥ Rw 37dB. Achieved typically using asymmetric high acoustic performance double glazing such as 6 to 8mm laminated glass / airgap / 4mm glass configuration, or alternatively using a secondary glazing system
Bedrooms <i>(including bedroom 1 en-suites)</i>	26	34	43	47	50 ⁽¹⁾	50 ⁽¹⁾	Overall performance ≥ Rw 45dB. Achieved typically using a secondary glazing system or alternatively very high acoustic performance (specialist / bespoke) double glazing such as 10 to 12mm laminated glass / airgap / 10mm glass configuration
Other Areas / Room Types	<i>Although for most residential developments no acoustic performance typically need be specified for glazing to other areas / room types (non-habitable parts, i.e. not living areas or bedrooms). For this development it is advised as good practice the glazing specification for Living Areas is applied throughout to non-habitable other areas / room types of the dwellings.</i>						
Note ⁽¹⁾: Values limited to 40dB (living areas) & 50dB (bedrooms). Higher values likely by default at these frequencies but need not be specified.							

Table 3: Specification for glazing sound insulation performance, Sound Reduction Index R dB (minimum values)

The comment typical glazing configurations in Table 3 are as indicative for the type of glazing capable of compliance with the specified acoustic performance (Sound Reduction Index R dB).

However, there are different permutations of possible glass and airgap configurations, and different specialist glazing suppliers will tend to use their own preferred configurations.

Providing that the selected glazing has overall R_w dB performance and individual octave band Sound Reduction Index R dB performance not less than those specified in Table 3 then it is advised any alternative configuration glazing can be used.

The specified glazing sound insulation performance is applicable for the glazing system as a whole, i.e. including framework. To comply with the specification the glazing will be required to have effective seals all round, typically such as rubber or neoprene beaded type that compress all around on closure of opening casement elements.

7.3 Ventilation Provision

Informative: Scope Of Ventilation Provision Within Noise Assessment

Details in this report are with respect to the noise aspect associated with ventilation provision for the development's dwellings. Adequacy of ventilation provision in of itself and in respect to compliance with Building Regulations Approved Document F or other relevant guidance (i.e. such as ventilation airflow change rates etc) is outside the scope of a noise assessment and would be by others.

This aspect is unavoidably complex. Therefore to assist in the consideration of this and to include advice for the necessary ventilation details as part of the development's scheme of noise mitigation measures in a straight-forward a way as possible, assessment of the development in respect to ventilation associated noise issues is provided in sub-sections.

7.3.1 Overview - Ventilation Provision & Noise Mitigation

New residential dwellings require mandatory ventilation provision compliant with Building Regulations Approved Document F (Ventilation), generally facilitated as per one of the system methods outlined in Document F.

Full title of the current edition of Document F is "*The Building Regulations 2010 Approved Document F Ventilation – F1 Means of Ventilation (2010 edition incorporating 2010 and 2013 amendments)*".

Typically, a developer is able to decide in outline terms an appropriate ventilation strategy / scheme for new dwellings in conjunction with advice and agreement from the appointed Building Control Officer or Approved Inspector as responsible for Building Regulations compliance issues of a development.

This process may include input from the project acoustic consultant to determine whether, if passive ventilators are to be used as part of the scheme, they are required to be to a certain acoustic performance, or whether in case of developments subject to very high external noise levels, use of a mechanical ventilation system would be appropriate.

As well as compliance with the mandatory ventilation provisions as Building Regulations Approved Document F, many Local Planning Authorities now additionally stipulate (as part of a development's planning approval process) a requirement with regard to the potential issue of excessive external noise ingress into dwellings under open windows conditions as may be associated with thermal comfort (i.e. overheating in warm weather).

A typical Local Planning Authority requirement in this respect is such as "...*alternative forms of ventilation* (i.e. as alternative to open windows) *should be provided so that an occupant can choose to keep the noise out whilst having sufficient ventilation* (under overheating conditions) *when windows are closed...*".

7.3.2 Open Windows Noise Assessment

To determine any requirement for alternative forms of ventilation (i.e. as alternative to open windows for thermal comfort) it is necessary to assess noise ingress into the dwellings under open windows conditions.

It is well documented in many acoustic texts and other documents that the overall ambient noise level within a residential room with windows open is circa 10 to 15dB lower than the prevailing noise level immediately external (i.e. outside of) the room.

The Acoustic Ventilation and Overheating Residential Design Guide January 2020 (*AVO document*) as referenced in Section 4.6 of the report and also in Sub-Section 7.3.3 below, advises using a value of 13dB lower.

Thus, for dwellings at a development site to be compliant with the indoor noise levels guidance of BS8233:2014 with windows open, means that the external noise climate at the site must be no higher than circa 13dB above the indoor noise levels guidance. This is summarised in Table 4, separately for living areas and bedrooms plus for the day and night period as relevant.

Room Type	Day Period (7am to 11pm)		Night Period (11pm to 7am)	
	Internal Noise Criterion / Limit Guidance	Noise Level Externally (requirement for compliance with open windows)	Internal Noise Criterion / Limit Guidance	Noise Level Externally (requirement for compliance with open windows)
Living Areas	≤35dB $L_{Aeq,16hour}$	≤48dB $L_{Aeq,16hour}$		
Bedrooms	≤35dB $L_{Aeq,16hour}$	≤48dB $L_{Aeq,16hour}$	≤30dB $L_{Aeq,8hour}$ ≤45dB L_{AFmax}	≤43dB $L_{Aeq,8hour}$ ≤58dB L_{AFmax}

Table 4: External noise levels requirement for compliance with indoor noise levels guidance with open windows

Assessment of the noise survey results as Table 4 indicates noise levels externally at the development site are substantially above the requirement for compliance with the indoor noise levels guidance with open windows.

Therefore it is necessary to include for an alternative form of ventilation (i.e. as alternative to open windows for thermal comfort) as part of the development's scheme of noise mitigation measures.

Regardless of whether a development site is within an urban, sub-urban or rural area and regardless of whether especially noise affected or not, very few development sites/locations have a noise climate sufficiently low (at or below the values in Table 4) as per the requirement for compliance with open windows.

7.3.3 AVO Document Guidance

This document is an applicable / valid information source in terms of establishing ventilation system acceptability for the development with respect to noise.

As described in Section 4.6 of the report, the AVO document is lengthy and technically complex, with significant background reference to relevant legislation and guidance including BS8322:2014 as well as description for the four ventilation system methods (System 1 to 4) outlined in Building Regulations Approved Document F (Ventilation).

However, and specifically in terms of establishing an appropriate ventilation system / strategy for proposed development dwellings, Table B-3 within Appendix B – *Example Application Of This Guide* of the AVO document provides guidance.

The guidance of AVO document Table B-3 sets out which of the four ventilation system methods of Approved Document F would be appropriate depending on the magnitude of external noise levels.

It is important to note the document's guidance does not set out any fixed prescriptive form of ventilation system / strategy as should be used for residential dwellings in any given noise scenario. Thus, it is not the case that given certain noise levels as affecting this (or any other) development site, then a certain ventilation system / strategy be used.

The guidance is provided more as a discussion document outlining the various ventilation system / strategy options and whether they be appropriate, depending on the magnitude of noise levels a development is exposed to.

Assessment of the proposed development as per the guidance of AVO document Table B-3 is provided in Table 5 on the following page.

The assessment determines for which of the four ventilation system methods of Approved Document F would be appropriate / acceptable for living areas and bedrooms of the dwellings as then compliant with the indoor noise levels guidance of BS8233:2014.

As elsewhere in this report the assessment is based on worse case highest noise levels for the airport operating in majority easterly mode, plus uplift allowance for the airport's possible future expansion.

The assessment indicates Approved Document F System 4 ventilation would be required and appropriate for the dwellings; continuous mechanical supply & extract (typically such as MVHR system), no trickle ventilators.

The assessment indicates Approved Document F System 3 ventilation would be just (marginally) appropriate for living areas, albeit day period noise levels are at the upper limit range for this. Therefore it is advised System 4 ventilation be applied for the dwellings as a whole, i.e. not with separate system types for different rooms of the dwellings.

Acoustic specification for the proposed dwellings' required System 4 ventilation is provided in Sub-Section 7.3.4. As per guidance of the AVO document, the acoustic specification details include mechanical system noise consideration.

Approved Document F Ventilation System	Ventilation System Outline Description	External Noise Limits*	Ventilation System Acceptability For The Proposed Development
1 or 2	System 1: Passive type trickle ventilators & intermittent extract fans (typically to bathroom & kitchen hob)	With standard double glazing & standard trickle ventilators: $\leq 56\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 51\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 67\text{dB } L_{AFmax}$ night period	Living Areas - NO Bedrooms - NO
	System 2: Passive stack ventilation (no mechanical components specifically as part of the system)	With acoustic performance glazing & acoustic trickle ventilators: $\leq 66\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 61\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 80\text{dB } L_{AFmax}$ night period	Living Areas - NO Bedrooms - NO
3	Passive type trickle ventilators & continuous mechanical extract (MEV)	With standard double glazing & standard trickle ventilators: $\leq 58\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 53\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 69\text{dB } L_{AFmax}$ night period	Living Areas - NO Bedrooms - NO
		With acoustic performance glazing & acoustic trickle ventilators: $\leq 68\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 63\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 83\text{dB } L_{AFmax}$ night period	Living Areas - YES Bedrooms - NO
4	Continuous mechanical supply & extract (typically such as MVHR system), no trickle ventilators	With standard double glazing: $\leq 62\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 57\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 76\text{dB } L_{AFmax}$ night period	Living Areas - NO Bedrooms - NO
		With acoustic performance glazing: $\leq 73\text{dB } L_{Aeq,16\text{hour}}$ day period $\leq 68\text{dB } L_{Aeq,8\text{hour}}$ night period $\leq 90\text{dB } L_{AFmax}$ night period	Living Areas - YES Bedrooms - YES

* Note: The external noise limits day period values are applicable for living areas & bedrooms, the night period values are applicable for bedrooms. The external noise limits values are the approximate guideline free-field external noise limits as stated in Table B-3 Appendix B of the AVO Document; for System 1 with allowance of 2 x trickle ventilators per room & for System 3 with allowance of 1 x trickle ventilator per room.

Table 5: Assessment to establish ventilation system acceptability for the development

7.3.4 Development Ventilation System & Acoustic Specification

For reason of noise mitigation it is advised the dwellings are required to have Approved Document F System 4 ventilation; continuous mechanical supply and extract, typically facilitated by such as a “whole house” MVHR system. System 4 ventilation does not include trickle ventilators.

System 4 ventilation would be acceptable for the dwellings subject to compliance with the mechanical system specification noise limits detailed in Table 6.

The specification is based on the guidance of Figure 3-4 *Indoor Ambient Noise Levels From Mechanical Services – ADF Condition* from Section 3 *Internal Ambient Noise level Guidelines* of the AVO document.

The mechanical component noise limits are to ensure that noise generated by the system itself (i.e. noise from the mechanical ventilation system's fan and any other associated components) does not cause unacceptable / undesirable noise levels within rooms of dwellings.

Where self-noise from a mechanical system can potentially exceed these limits then noise of the system would be sufficiently reduced typically by using in-line ductwork attenuators or acoustic type flexible ducting as opposed to standard type ducting between the mechanical system unit and individual room grilles.

Ventilation Condition	Ventilation System	Desirable Internal Ambient Noise Level From Mechanical Services
Approved Document F: Whole Dwelling Ventilation	System 4: Continuous mechanical supply & extract (MVHR), minimum low ventilation rate	Bedrooms $\leq 26\text{dB } L_{Aeq}$ Living Areas $\leq 30\text{dB } L_{Aeq}$
Approved Document F: Extract Ventilation	System 4: Continuous mechanical supply & extract (MVHR), minimum high ventilation rate	Bedrooms $\leq 26\text{dB } L_{Aeq}$ Living Areas $\leq 35\text{dB } L_{Aeq}$ Bathrooms / WCs $\leq 45\text{dB } L_{Aeq}$
Approved Document F: Purge Ventilation	As per guidance of the AVO document, no internal ambient noise levels are applied under purge ventilation conditions	

Table 6: Ventilation system mechanical component acoustic specification (system self-noise limits)

7.4 Roof & Associated Ceilings

Roof structure of the dwellings is to be formed by a conventional timber rafters pitched structure with insulation, breather membrane and concrete tiles, plus with plasterboard linings / ceilings room side internally. The roof and associated ceilings' structure is notionally in two parts; sloped ceiling parts to underside of the rafters either side of the building plus a main horizontal ceiling part centrally.

The following acoustic specification is advised as upgrade / enhancement to ensure sufficient noise mitigation performance for the dwellings' roof and associated ceilings' structure. The specification is similar to that for the external walls and comprises a very high specification insulated acoustic ceiling (lining):

- The roof structure cavity void insulation (between rafters & over ceiling joists) to incorporate minimum 100mm thick acoustic grade mineral wool type insulation minimum density 45kg/m³ (typically such as Rockwool RWA45 slab or equivalent).
As for similar residential developments with conventional tile over rafter pitched roof structures, it is anticipated that thicker insulation than the quoted minimum 100mm insulation would likely be required anyhow for thermal efficiency reasons;
- Room side plasterboard linings to the rafters (sloped part) and ceilings (main horizontal part) of minimum 2 x layers 15mm acoustic grade plasterboard (typically such as British Gypsum SoundBloc or Knauf SoundShield or other equivalent) with staggered joints;
- The plasterboard linings / ceilings attached to the timber rafters framework / ceiling joists structures using resilient bars or other resilient / non direct fix method (such as British Gypsum GypLyner system).

Values in Table 7 show the expected minimum sound insulation performance for this overall roof and associated ceilings construction / build up to provide adequate mitigation against external noise ingress for the dwellings.

Difference in sound insulation performance between the different roof and associated ceilings' structure parts is due to that the sloped ceiling parts are more directly coupled to the roof structure rafters whereas the main horizontal ceiling part centrally is set well below and more separate from (de-coupled from) the roof structure rafters.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
<u>Roof & Associated Ceilings - Sloped Ceiling Parts To Underside Of Rafters:</u> Conventional tiled / insulated pitched roof structure; upgraded with acoustic insulation and resilient (non-direct) fixed ceilings room side to rafters of double layer 15mm acoustic grade plasterboard Sound Reduction Index R dB	32	42	49	54	55 ⁽¹⁾	55 ⁽¹⁾
<u>Roof & Associated Ceilings: Main Horizontal Ceiling Part Centrally:</u> Conventional tiled / insulated pitched roof structure; upgraded with acoustic insulation and resilient (non-direct) fixed ceilings room side to horizontal ceiling joists set below rafters of double layer 15mm acoustic grade plasterboard Sound Reduction Index R dB	35	45	52	55 ⁽¹⁾	55 ⁽¹⁾	55 ⁽¹⁾
Note ⁽¹⁾: Sound insulation limited to upper values 55dB. Higher values likely by default at these frequencies but are not stated.						

Table 7: Roof & associated ceilings sound insulation performance

7.5 External Amenity Space

External amenity space of the development relates to the dwellings' private garden areas. Results of the survey show overall day period noise levels externally at the site are due to aircraft flyovers and vary from day to day between circa $L_{Aeq,T}$ 56dB to 67dB depending upon the airport's operational mode:

- Airport Operating Majority Westerly Mode: Overall day period noise levels circa $L_{Aeq,T}$ 56dB;
- Airport Operating Majority Easterly Mode: Overall day period noise levels circa $L_{Aeq,T}$ 66 - 67dB;
- Airport Operating Part Westerly & Easterly Mode: Overall day period noise levels circa $L_{Aeq,T}$ 62dB.

Simple assessment of the survey results indicates overall day period noise levels at the development site as above the BS8233:2014 external amenity space upper guidance $L_{Aeq,T}$ 55dB. The magnitude of exceedance being dependent upon the airport's operational mode.

The exceedance is as expected and regardless of findings from the noise survey; simply due to that the development site lies between the airport's 60 & 63dB noise contours and thus anyhow above the BS8233:2014 external amenity space upper guidance noise level $L_{Aeq,T}$ 55dB. The airport's possible future expansion does not significantly / materially increase the exceedance.

However, BS8233:2014 recognises the guidance on noise levels within external amenity spaces including the upper value $L_{Aeq,T}$ 55dB is not achievable in all circumstances where development might be desired and states:

"In higher noise areas, such as city centres or urban areas adjoining the strategic transport network (i.e. London Luton Airport in this instance), a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making use of land resources to ensure development needs can be met, might be warranted".

BS8233:2014 advised that in such situation's development should not be prohibited, as long as noise levels in external amenity spaces are designed to be as low as practicable. The development's already granted planning approval (permission in principle) by North Hertfordshire District Council is consistent with this advice.

Noise levels at the development site are predominantly due to aircraft (overhead noise source) and therefore without means of practicable mitigation as may otherwise typically be applied in respect to the reduction of noise into external amenity spaces from road traffic or railway lines through development layout design and/or the use of acoustic bunds or acoustic barriers / fences etc.

As indicated elsewhere in the report, on average the split between Easterly and Westerly mode operation of the airport is 30/70, i.e. Easterly mode occurs less often and on average 30% of the time. Therefore for the majority of the time (airport operating Westerly mode on average 70% of the time), day period external noise levels into external amenity space are only slightly (by 1 or 2dB so not significantly) above the BS8233:2014 upper value $L_{Aeq,T}$ 55dB. Thus it is not the case that all day / everyday noise levels significantly exceed the BS8233:2014 guidance.

Based on consideration of the BS8233:2014 advice / guidance as a whole, plus in combination that external noise levels for the majority of the time (airport operating Westerly mode) are only slightly above the external amenity space guidance $L_{Aeq,T}$ 55dB, it is considered reasonable that noise levels into external amenity spaces for the proposed dwellings be acceptable.

A P P E N D I X A

Aerial View, Site Location Plan, Block Plan & Proposed Floor Plans / Elevations Drawing

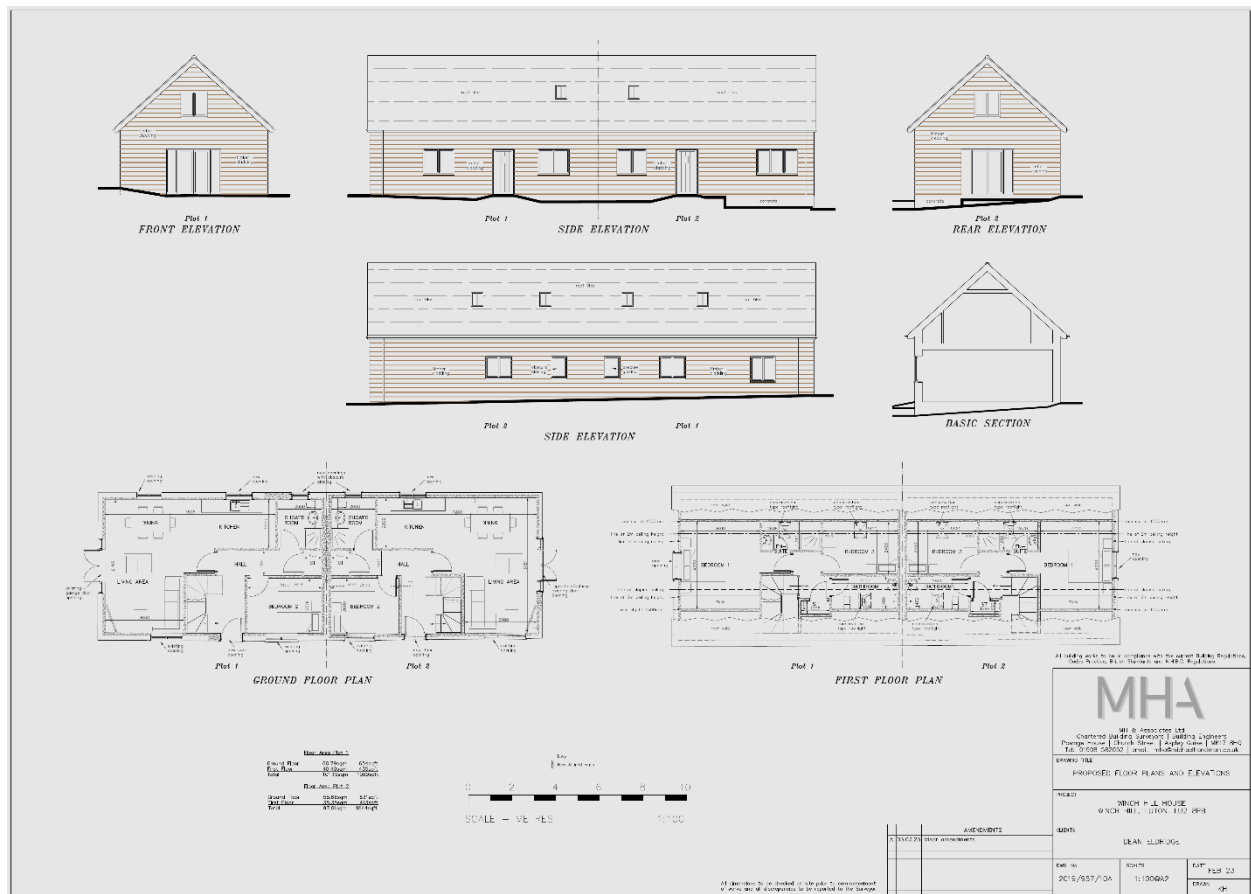
Consultants in Noise & Vibration
Building Regulations Certification Sound Insulation Testing

Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix A (page 2 of 2)

Date: May 2023

PROPOSED FLOOR PLANS / ELEVATIONS DRAWING



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A P P E N D I X B

Noise Survey Instrumentation

Consultants in Noise & Vibration
Building Regulations Certification Sound Insulation Testing

Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix B (page 1 of 2)

Date: May 2023

NOISE SURVEY INSTRUMENTATION

Seven-Day Noise Survey

Instrumentation Used:

- Rion sound level meter type NL-31 Class 1 serial number 00773045, Rion preamplifier type NH-21 serial number 25056, Rion microphone type UC-53A serial number 313002, Rion microphone windshield type WS-10, Rion microphone extension cable type EC-04A and tripod / boom arrangement;
- Bruel & Kjaer calibrator type 4231 serial number 2454786.
- Speedtech Instruments Skymaster model SM-28 serial number 19370 (sample weather conditions data).

Instrumentation Calibration Certification:

Description	Type Number	Manufacturer	Date of Calibration Expiration	Calibration Certificate Number
Class 1 Sound Level Meter, s/n 00773045	NL-31	Rion	05/08/2024	TCRT22/1493
Microphone s/n 313002	UC-53A			
Preamplifier s/n 25056	NH-21			
Calibrator s/n 2454786	4231	Bruel & Kjaer	24/01/2025	TCRT23/1062

Instrumentation On-Site Calibration Check:

Description	Calibrator Reference Level	Measured Level	Comment
Before survey measurements	94.0dB	94.0dB	Pass
After survey measurements		94.0dB	Pass (nil significant drift)

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Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix B (page 2 of 2)

Date: May 2023

NOISE SURVEY INSTRUMENTATION

Octave Band Noise Levels

Instrumentation Used:

- Bruel & Kjaer sound level meter type 2260 Class 1 serial number 2497368, Bruel & Kjaer preamplifier type ZC0026 serial number 3268, Bruel & Kjaer microphone type 4189 serial number 2625249, Bruel & Kjaer windshield type UA 0237 & tripod;
- Bruel & Kjaer calibrator type 4231 serial number 2454786.

Instrumentation Calibration Certification:

Description	Type Number	Manufacturer	Date of Calibration Expiration	Calibration Certificate Number
Class 1 Sound Level Meter s/n 2497368	2260	Bruel & Kjaer	24/01/2025	TCRT23/1070
Microphone s/n 2625249	4189	Bruel & Kjaer		
Preamplifier s/n 3268	ZC0026	Bruel & Kjaer		
Calibrator s/n 2454786	4231	Bruel & Kjaer	24/01/2025	TCRT23/1062

Instrumentation On-Site Calibration Check:

Description	Calibrator Reference Level	Measured Level	Comment
Before survey measurements	94.0dB	93.9dB	Pass
After survey measurements		93.9dB	Pass (nil significant drift)

APPENDIX C

Noise Survey Results

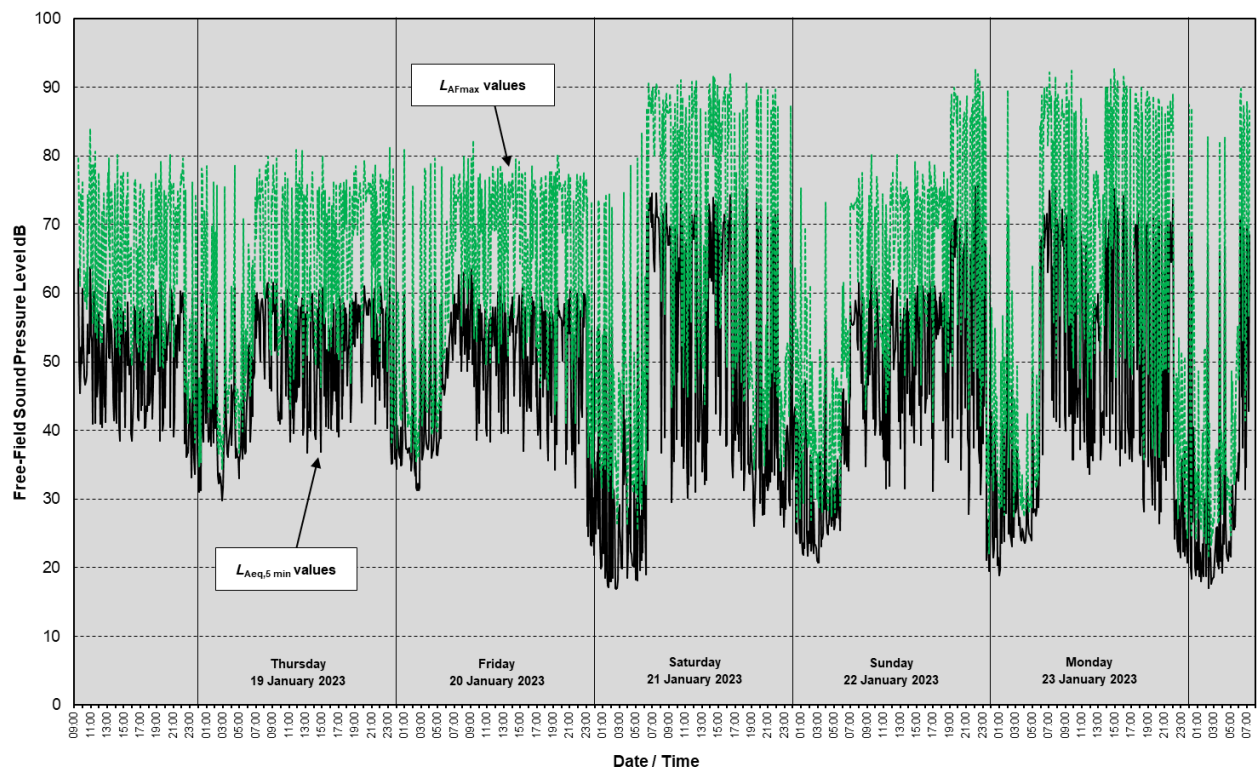
Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix C (page 1 of 1)

Date: May 2023

NOISE SURVEY RESULTS

Seven-Day Noise Survey Wednesday 18 January 2023 - Tuesday 24 January 2023:



A P P E N D I X D

BS8233:2014 Annex G Rigorous Procedure Calculations

Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix D (page 1 of 7)

Date: May 2023

BS8233:2014 ANNEX G RIGOROUS PROCEDURE CALCULATIONS

SAMPLE ROOM: Plot 1 Living Area (sample combined living/kitchen/diner)

NOISE CONDITION: Day Period (07:00 to 23:00) $L_{Aeq,16hr}$ 67dB (airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{Aeq,16hr} \leq 35dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	67	65	67	65	62	57	47
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	33.0	Timber frame external walls w ith acoustic grade insulation & plasterboard linings					
Glazing	5.2	High acoustic performance glazing ≥ R _w 37dB					
Exterior Doors	2.9	Patio type doors to room; High acoustic performance glazing ≥ R _w 37dB					
Roof		N/A - room at ground floor					
Passive Ventilators		N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	33.0	32	42	49	54	55	55
Glazing	5.2	21	28	36	39	40	40
Exterior Doors	2.9	21	28	36	39	40	40
Roof							
Passive Ventilators (Dn,e)							
Overall Sound Reduction All Elements Combined		-26.8	-34.4	-42.2	-45.5	-46.5	-46.5
Sample Room Volume (m³):		78					
Sample Room Building Envelope Surface Area (m²):		41.1					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living/Kitchen/Diner	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.50	0.50	0.45	0.40	0.40	0.40
Calculated Internal Sound Pressure Level In Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	32	43	38	27	21	15	5

Site: Winch Hill House, Winch Hill Road, Luton LU2 8PB

Report: 23006-002 Appendix D (page 2 of 7)

Date: May 2023

BS8233:2014 ANNEX G RIGOROUS PROCEDURE CALCULATIONS

SAMPLE ROOM: Plot 1 Bedroom 2 (sample ground floor bedroom)

NOISE CONDITION: Day Period (07:00 to 23:00) $L_{Aeq,16hr}$ 67dB (airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{Aeq,16hr} \leq 35dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	67	65	67	65	62	57	47
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	6.8	Timber frame external walls w ith acoustic grade insulation & plasterboard linings Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing) N/A - no exterior doors to room N/A - room at ground floor N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Glazing	1.4						
Exterior Doors							
Roof							
Passive Ventilators							
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	6.8	32	42	49	54	55	55
Glazing	1.4	26	34	43	47	50	50
Exterior Doors							
Roof							
Ventilation (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.2	-39.2	-47.2	-51.7	-53.6	-53.6
Sample Room Volume (m³):		21					
Sample Room Building Envelope Surface Area (m²):		8.2					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	24	36	29	19	10	3	-7

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SAMPLE ROOM: Plot 1 Bedroom 2 (sample ground floor bedroom)

NOISE CONDITION: Night Period (23:00 to 07:00) $L_{Aeq,8hr}$ 62dB (airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{Aeq,8hr} \leq 30dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	62	60	62	60	57	52	42
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	6.8	Timber frame external walls w ith acoustic grade insulation & plasterboard linings Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing) N/A - no exterior doors to room N/A - room at ground floor N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Glazing	1.4						
Exterior Doors							
Roof							
Passive Ventilators							
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	6.8	32	42	49	54	55	55
Glazing	1.4	26	34	43	47	50	50
Exterior Doors							
Roof							
Ventilation (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.2	-39.2	-47.2	-51.7	-53.6	-53.6
Sample Room Volume (m³):		21					
Sample Room Building Envelope Surface Area (m²):		8.2					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	19	31	24	14	5	-2	-12

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SAMPLE ROOM: Plot 1 Bedroom 2 (sample ground floor bedroom)

NOISE CONDITION: Night Period (23:00 to 07:00) L_{AFmax} 87dB (typical high value, airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{AFmax} \leq 45dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Typical High Lfmax,ff	87	84	87	86	82	79	69
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	6.8	Timber frame external walls w ith acoustic grade insulation & plasterboard linings Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing) N/A - no exterior doors to room N/A - room at ground floor N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Glazing	1.4						
Exterior Doors							
Roof							
Passive Ventilators							
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	6.8	32	42	49	54	55	55
Glazing	1.4	26	34	43	47	50	50
Exterior Doors							
Roof							
Passive Ventilators (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.2	-39.2	-47.2	-51.7	-53.6	-53.6
Sample Room Volume (m³):		21					
Sample Room Building Envelope Surface Area (m²):		8.2					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,2	44	55	49	39	30	25	15

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SAMPLE ROOM: Plot 1 Bedroom 1 (sample first floor bedroom)

NOISE CONDITION: Day Period (07:00 to 23:00) $L_{Aeq,16hr}$ 67dB (airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{Aeq,16hr} \leq 35dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	67	65	67	65	62	57	47
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	7.0	Timber frame external walls w ith acoustic grade insulation & plasterboard linings					
Glazing	1.2	Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing)					
Exterior Doors		N/A - no exterior doors to room					
Roof (sloped ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (to rafters)					
Roof (main ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (set below roof)					
Passive Ventilators		N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	7.0	32	42	49	54	55	55
Glazing	1.2	26	34	43	47	50	50
Exterior Doors							
Roof (sloped ceiling part)	7.5	32	42	49	54	55	55
Roof (main ceiling part)	7.5	35	45	52	55	55	55
Passive Ventilators (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.3	-39.8	-47.3	-51.7	-52.8	-52.8
Sample Room Volume (m³):		32					
Sample Room Building Envelope Surface Area (m²):		15.7					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Day 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	25	37	30	19	11	5	-5

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SAMPLE ROOM: Plot 1 Bedroom 1 (sample first floor bedroom)

NOISE CONDITION: Night Period (23:00 to 07:00) $L_{Aeq,8hr}$ 62dB (airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{Aeq,8hr} \leq 30dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	62	60	62	60	57	52	42
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	7.0	Timber frame external walls w ith acoustic grade insulation & plasterboard linings					
Glazing	1.2	Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing)					
Exterior Doors		N/A - no exterior doors to room					
Roof (sloped ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (to rafters)					
Roof (main ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (set below roof)					
Passive Ventilators		N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	7.0	32	42	49	54	55	55
Glazing	1.2	26	34	43	47	50	50
Exterior Doors							
Roof (sloped ceiling part)	7.5	32	42	49	54	55	55
Roof (main ceiling part)	7.5	35	45	52	55	55	55
Passive Ventilators (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.3	-39.8	-47.3	-51.7	-52.8	-52.8
Sample Room Volume (m³):		32					
Sample Room Building Envelope Surface Area (m²):		15.7					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	20	32	25	14	6	0	-10

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SAMPLE ROOM: Plot 1 Bedroom 1 (sample first floor bedroom)

NOISE CONDITION: Night Period (23:00 to 07:00) L_{AFmax} 87dB (typical high value, airport operating "worse case" Easterly mode)

NOISE CRITERION: Internal Noise Limit In Room $L_{AFmax} \leq 45dB$

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Typical High Lfmax,ff	87	84	87	86	82	79	69
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
External Walls	7.0	Timber frame external walls w ith acoustic grade insulation & plasterboard linings					
Glazing	1.2	Very high acoustic performance glazing ≥ Rw 45dB (typically secondary glazing)					
Exterior Doors		N/A - no exterior doors to room					
Roof (sloped ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (to rafters)					
Roof (main ceiling part)	7.5	Tile pitched roof w ith acoustic grade insulation & plasterboard ceilings (set below roof)					
Passive Ventilators		N/A - ADF System 4 ventilation (MVHR mechanical ventilation - no passive vents)					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
External Walls	7.0	32	42	49	54	55	55
Glazing	1.2	26	34	43	47	50	50
Exterior Doors							
Roof (sloped ceiling part)	7.5	32	42	49	54	55	55
Roof (main ceiling part)	7.5	35	45	52	55	55	55
Passive Ventilators (Dn,e)							
Overall Sound Reduction All Elements Combined		-30.3	-39.8	-47.3	-51.7	-52.8	-52.8
Sample Room Volume (m³):		32					
Sample Room Building Envelope Surface Area (m²):		15.7					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.25	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,2	44	56	49	40	31	27	17