Noise impact assessment

YA332.P1

Proposed change of use and exterior alterations of a former photography studio (Use Class E) to three flats (Use Class C3) and associated infrastructure

23 Whalley Road
Blackburn
BB1 9LQ

Manchester, UK
Version 2.0
October 8, 2021

YAcoustics
ACOUSTICS & VIBRATION CONSULTANTS

Identification

Title: Noise impact assessment: Proposed change of use and exterior alterations of a former photography studio (Use Class E) to three flats (Use Class C3) and associated infrastructure

YA332.P1

Client: TL Connections Ltd

Date: October 8, 2021

Local: Manchester, UK

Version: 2.0

Prepared by: Luis Pereira

Prepared for: TL Connections Ltd

Revisions

Date	Changes / Comments	Reviser
08/10/2021	Site layout updated in line with latest changes	LP

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Acronyms

ADF Aproved Document F. 8, 9, 15, 16

BDBC Blackburn with Darwen Borough Council. 8, 17

DEFRA Department for Environment, Food and Rural Affairs. 12

IANLs Internal Ambient Noise Levels. 8, 9, 12, 15, 16

LOAEL Lowest Observed Adverse Effect Level. 11, 12

NPPF National Planning Policy Framework. 11, 17

NPSE Noise Policy Statement for England. 11, 17

ProPG Professional Practice Guidance on Planning & Noise. 8, 11, 12

SLM Sound Level Meter. 13

SOAEL Significant Observed Adverse Effect Level. 12

Glossary

C_{tr} correction term applied against the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$) to provide a weighting against low frequency performance. 8, 9, 15, 16

$D_{ne,w}$ element normalized level difference of small building elements - difference of the sound pressure level produced in two rooms by a source in one room, where sound transmission is only due to a small technical element (e.g. transfer air devices, electrical cable ducts, transit sealing systems). 8, 9, 15, 16

L_{Aeq} equivalent A-weighted sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a steady sound that has the same mean-squared sound pressure as the sound under consideration that varies with time. 11, 13, 14

$L_{Aeq,16hr}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within the period 07:00-23:00 hours has the same mean-squared sound pressure as the sound under consideration that varies with time. 9, 11, 12, 16

$L_{Aeq,8hr}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within the period 23:00-07:00 hours has the same mean-squared sound pressure as the sound under consideration that varies with time. 8, 9, 11, 15, 16

$L_{Aeq,T}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time. 11, 12

L_{AFmax} maximum A-weighted sound pressure level - value of the maximum A-weighted sound pressure level obtained using time-weighting "F", during a specified time interval. 8, 9, 11, 12, 14, 15, 16

R_w weighted sound reduction index - single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. 8, 9, 15, 16

RT reverberation time - time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. 15

Summary

This report has been prepared in support of a planning application for a change of use from a former photography studio (Use Class E) to three flats (Use Class C3) at 23 Whalley Road, Blackburn, BB1 9LQ.

The criteria and guidelines set out in Professional Practice Guidance on Planning & Noise (ProPG) [6] and the Blackburn with Darwen Borough Council (BDBC) planning policies o have been considered.

Noise affecting the proposed development has been measured during the day and night for a total of 24 hours to determine noise impacts relating to the existing traffic noise.

Facade requirements

With windows open, the resulting ambient noise levels in the relevant internal areas of the development have the potential to cause significant adverse effects and as such the recommended facade solutions are considered with windows closed, requiring that provisions for background ventilation are made.

Flat 1

Calculations indicate that Flat 1 **bedrooms** require glazing with a minimum performance of 32 dB R_w+C_{tr} (e.g. 10/16/6 mm glazing) and that Aproved Document F (ADF) System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The maximum anticipated Internal Ambient Noise Levels (IANLs), with such solutions in place, would be 28 dB $L_{Aeq,8hr}$ and 41 dB L_{AFmax}(10^{th} loudest event).

Living spaces and dining areas require glazing with a minimum performance of 29 dB R_w+C_{tr} (e.g. 8/16/4 mm glazing), and ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The entrance door to the kitchen and dining area must provide a minimum performance of 32 dB R_w (e.g. 40-50 mm weather-resistant reinforced wood fibre door). The manufacturer must confirm the selected door performance.

The maximum anticipated IANLs, with such solutions in place, would be 35 dB $L_{Aeq,16hr}$.

The solutions above do not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer.

Annex C includes details of a suitable trickle ventilation system.

Flats 2 and 3

Calculations indicate **that all areas part of Flats 2 and 3** require glazing with a minimum performance of 29 dB R_w+C_{tr} (e.g. 8/16/4 mm glazing), and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The maximum anticipated IANLs, with such solutions in place, would be 27 dB $L_{Aeq,8hr}$ and 40 dB L_{AFmax} for bedrooms and 34 dB $L_{Aeq,16hr}$ for living spaces and dining areas.

The solution above does not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer.

Annex C includes details of a suitable trickle ventilation system.

1 Introduction

A change of use from a former photography studio (Use Class E) to three flats (Use Class C3) is proposed at 23 Whalley Road, Blackburn, BB1 9LQ.

YAcoustics Ltd has been commissioned to assess the potential noise impacts on the proposed development.

Thus, relevant local and national acoustic requirements have been identified and suitable design solutions and recommendations have been provided accordingly.

Figure 1 shows the site location.

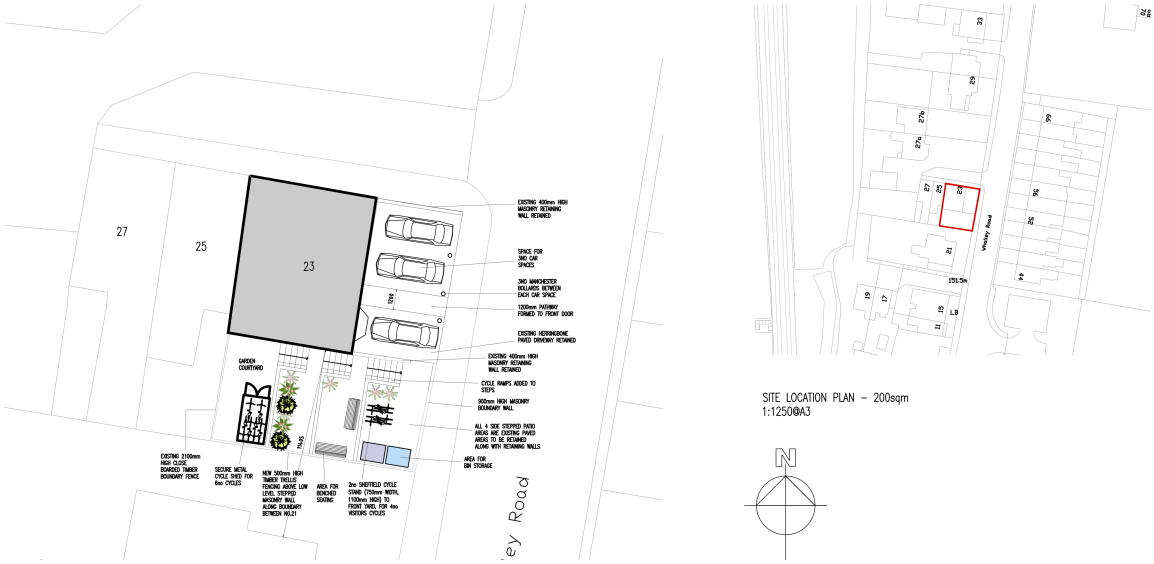


Figure 1 – Site location (in red)

2 Planning policy and relevant criteria

2.1 ProPG guidance

The ProPG [6] sets out criteria and guidelines for noise management concerning new residential development.

The document provides noise level limits for internal and external amenity areas that are an intrinsic part of the overall design.

These limits are in line with what the Noise Policy Statement for England (NPSE) [2] identifies as the Lowest Observed Adverse Effect Level (LOAEL) and as such it is considered that by meeting these targets the aims of the National Planning Policy Framework (NPPF) [7] and the NPSE [2] are achieved (see Annex A).

The relevant criteria is presented as Table 1.

Table 1 – Internal and external ambient noise levels for dwellings (sources: BS 8233:2014 and ProPG:2017)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dinning	Dinning room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (day-time resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$
			45[1] dB L_{AFmax}
Leisure	Gardens and balconies	50 – 55[2] $L_{Aeq,T}$	

Note: The presented noise limits relate to steady external noise sources.
1: In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 times a night.
2: External noise level should not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$which would be acceptable in noisier environments.

Section 2.27 of the ProPG states the following: "Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as *"unacceptable"* by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing *"unacceptable"* noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form."

As such, IANLs more than 10 dB above the daytime and night-time values in Table 1 are identified as the Significant Observed Adverse Effect Level (SOAEL).

Appendix A of the ProPG states the following: "it can be concluded that at night (23:00 to 07:00 hrs) a significant effect on sleep disturbance e.g. behavioural awakening, is likely to occur where the maximum sound level at the façade of a building **with partially open windows** is above:

- 85 dB L_{AFmax} (where the number of events exceeding this value is ≤ 20); or
- 80 dB L_{AFmax} (where the number of events exceeding this value is > 20)."

The above L_{AFmax} values and number of events are therefore identified as the SOAEL where windows are partially open.

Regarding external amenity areas, the 50 dB $L_{Aeq,T}$ limit identified in BS 8233 [3] is considered to be the LOAEL and the 66 dB $L_{Aeq,16hr}$ limit identified in the Department for Environment, Food and Rural Affairs (DEFRA) [4] guidance is considered to be the SOAEL.

3 Site survey

3.1 Methodology

The primary noise source affecting the proposed development is the road traffic on Whalley Road. Thus, a 24-hour noise survey was carried out from the 30th of September to the 1st of October 2021 in line with BS 7445 [1], to quantify typical noise levels at the building east facade.

The Sound Level Meter (SLM) was directly attached to the 1st Floor facade surface and was set up to measure L_{Aeq} values over 1-second intervals. A windshield was used as a precaution against interference.

The measurements were carried out in the absence of rain or wind speeds higher than $5m.s^{-1}$.

The SLM used meets the technical specifications of BS 7445 [1] and have current calibration certificates traceable to national standards. The equipment was field-calibrated before and after the measurement with no significant drift in sensitivity noted.

Figure 2 – Measurement positions (source: Google)

Table 2 – Equipment used

Equipment	Model	Serial no.
Sound Level Meter	Svantek SV307	82048
Calibrator	(with built-in calibrator)	

3.2 Results

The measured day and night time noise levels including ts corresponding octave-band spectrum are presented as Table 3.

The ten highest recorded values of L_{AFmax}, associated with specific events during the night are shown in Table 4.

Table 3 – Recorded day and night-time noise levels - Position P1

Position	Period	Octave band (Hz) L_{Aeq}(dB)							Global
		63	125	250	500	1k	2k	4k	L_{Aeq}dB
P1	Daytime (07:00 - 23:00 hrs)	37	47	58	65	69	61	51	71
	Night-time (23:00 - 07:00 hrs)	35	46	56	63	65	57	44	68

Table 4 – Night-time measured L_{AFmax} events - Position P1

Event type	Recorded L_{AFmax}	Time period
car pass	81	23:50
car pass	79	00:21
car pass	79	00:44
car pass	78	04:18
car pass	78	05:14
car pass	78	06:20
car pass	77	06:19
car pass	75	02:21
car pass	75	06:10
car pass	75	03:18

4 Internal ambient noise levels

4.1 Impacts with open windows

The difference between free field and internal ambient noise levels trough a partially open window is approximately 13 dB [6].

Based on this assumption and the noise levels stated as Table 3, to achieve suitable IANLs, windows are required to remain closed and to provide sufficient insulation. Therefore, suitable facade and ventilation solutions have been calculated.

4.2 Facade acoustic requirements

4.2.1 Methodology

To determine facade and ventilation solutions to achieve suitable IANLs within each relevant space, the methodology laid out in BS 8233 [3] and BS EN ISO 12354-3 [5] have been considered.

The calculations have been carried out for all rooms.

The dimensions and characteristics of each radiating surface and room volumes have been provided by the architect - see Annex B.

An average RT of 0.5 and 0.8 seconds was considered adequate for bed and living rooms, respectively, due to the average room volumes and surface finishes characteristics.

Noise break-in through masonry elements is considered to be negligible.

Annex D, includes details for the calculations carried out.

4.2.2 Flat 1

Calculations indicate that Flat 1 **bedrooms** require glazing with a minimum performance of 32 dB R_w+C_{tr} (e.g. 10/16/6 mm glazing) and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The maximum anticipated IANLs, with such solutions in place, would be 28 dB $L_{Aeq,8hr}$ and 41 dB L_{AFmax}(10^{th} loudest event).

Living spaces and dining areas require glazing with a minimum performance of 29 dB R_w+C_{tr} (e.g. 8/16/4 mm glazing), and ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The entrance door to the kitchen and dining area must provide a minimum performance of 32 dB R_w (e.g. 40-50 mm weather-resistant reinforced wood fibre door). The manufacturer must confirm the selected door performance.

The maximum anticipated IANLs, with such solutions in place, would be 35 dB $L_{Aeq,16hr}$.

The solutions above do not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer.

Annex C includes details of a suitable trickle ventilation system.

4.2.3 Flats 2 and 3

Calculations indicate **that all areas part of Flats 2 and 3** require glazing with a minimum performance of 29 dB R_w+C_{tr} (e.g. 8/16/4 mm glazing), and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The maximum anticipated IANLs, with such solutions in place, would be 27 dB $L_{Aeq,8hr}$ and 40 dB L_{AFmax} for bedrooms and 34 dB $L_{Aeq,16hr}$ for living spaces and dining areas.

The solution above does not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer.

Annex C includes details of a suitable trickle ventilation system.

Final considerations

A detailed assessment of noise impacts on the proposed development was carried out.

It has been determined that windows must remain closed to achieve adequate internal ambient noise levels. As such, suitable glazing and ventilation solutions have been calculated according to the relevant criteria.

Calculations indicate that all spaces require rated acoustic glazing and trickle vents, as stated in Section 4.

Based on the implementation of the recommendations provided in this report, the development is considered to be suitable in line with the BDBC planning policies, and the recommendations of the NPPF [7] and the NPSE [2].

Bibliography

[1] BS 7445-2:1991, Description and measurement of environmental noise - Part 2: Guide to the acquisition of data pertinent to land use. Standard, BSI, 1991. Cited in page 13.

[2] Noise Policy Statement for England (NPSE). Technical document, Department For Environmental, Food And Rural Affairs, 2010. Cited 3 on pages 11, 17, and 21.

[3] BS 8233:2014, Guidance on sound insulation and noise reduction for buildings. Standard, 2014. Cited 2 on pages 12 and 15.

[4] Possible options for the identification of SOAEL and LOAEL in support of the NPSE. Technical document, AECOM & Department for Environment, Food and Rural Affairs, 2015. Cited in page 12.

[5] BS EN ISO 12354-3:2017, Estimation of acoustic performance in buildings from the performance of elements - Part 3: Airborne sound insulation against outdoor sound. Standard, 2017. Cited in page 15.

[6] ProPG: Planning & Noise. Technical document, Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), 2017. Cited 3 on pages 8, 11, and 15.

[7] National Planning Policy Framework. Technical document, Ministry of Housing, communities and local government, 2018. Cited 3 on pages 11, 17, and 20.

Annexes

ANNEX A – National Planning Policy

A.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework [7] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

In regards to noise, Paragraphs 170, 180, 204 and 205 state the following:

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

    e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

    a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

    b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

204. Planning policies should:

    g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction.

205. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy. In considering proposals for mineral extraction, minerals planning authorities should:

    c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties.

A.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England [2] long term vision is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.

The NPSE states the three following policy aims:

First Aim:

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;

Second Aim:

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;

Third Aim:

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The NPSE uses two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. These are extended to the concept of a significant observed adverse effect level as follows:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

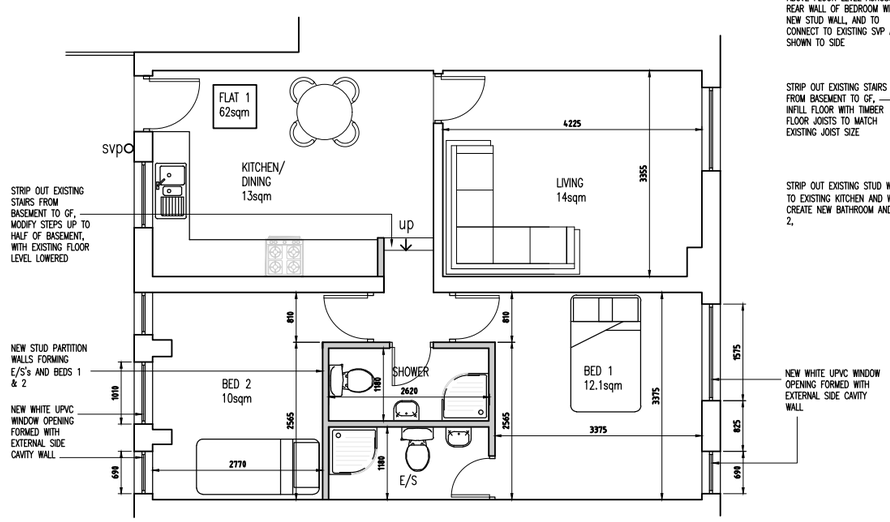
This is the level above which significant adverse effects on health and quality of life occur.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

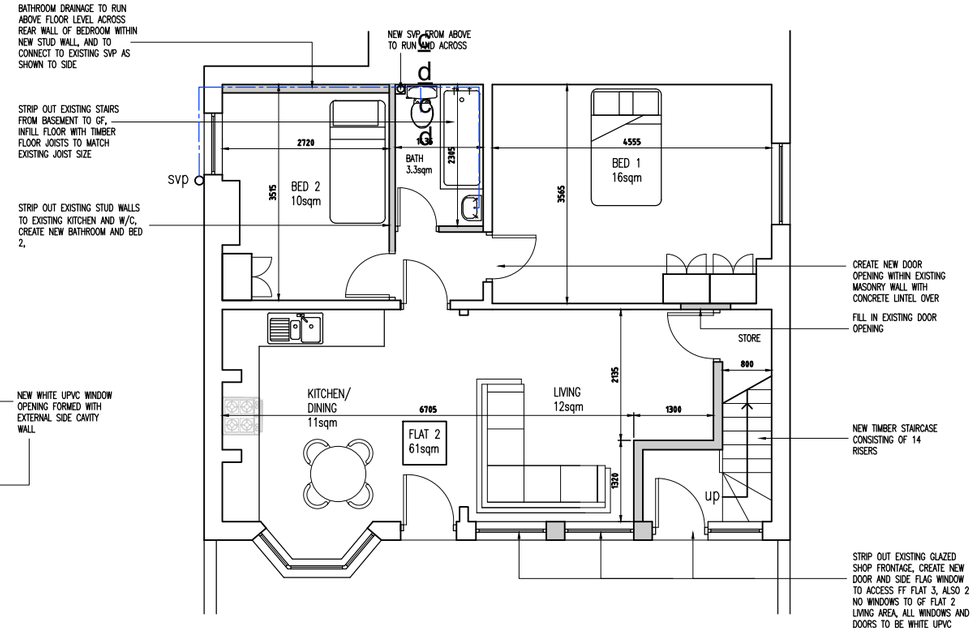
The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

The third aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

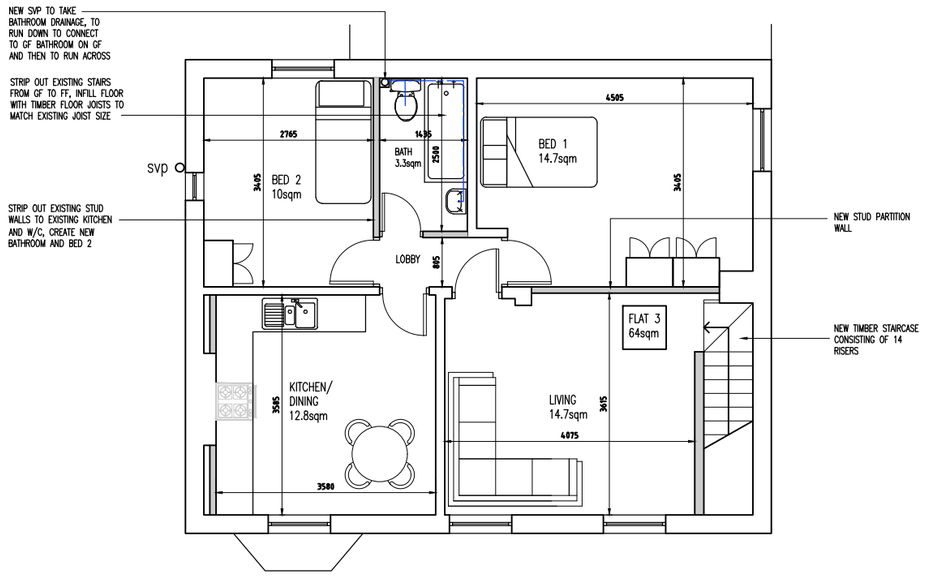
ANNEX B – Proposed architectural plans



PROPOSED LOWER GROUND FLOOR PLAN
1:100 @ A3



PROPOSED GROUND FLOOR PLAN
1:100 @ A3



PROPOSED FIRST FLOOR PLAN
1:100 @ A3

FLAT 1 = 62sqm

FLAT 2 = 61sqm

FLAT 3 = 64sqm

Rev	Amendments	Date	Ints
P2	Amendments to Flat 1 bathroom/E/S	28.06.21	MG
P1	Amendments after client comments	28.06.21	MG

Mark Gordon Design + Associates

Project

23 WHALLEY ROAD
BLACKBURN, BB1 9LQ

Drawing Title

PROPOSED PLAN LAYOUTS

Drawn TW	Checked _
Date APR 2021	Scale@A3 1 : 100
Drawing No. 23WR/203/PL	Rev. P2

ANNEX C – Example of a suitable trickle ventilation system

2500EA / 5000EA

Acoustic window ventilator

Physical specification

All measurements in millimetres unless otherwise indicated

Materials: Aluminium Alloy

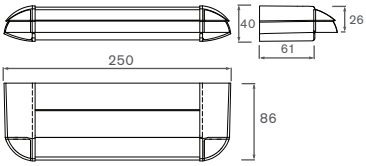
Installation

1. Prepare the window frame with the correct slot sizes.

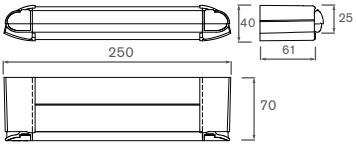
2. Use the self tapping screws to install the acoustic parts.

3. Use standard pyramid vent screws to install the canopy and vent.

2500EA Acoustic

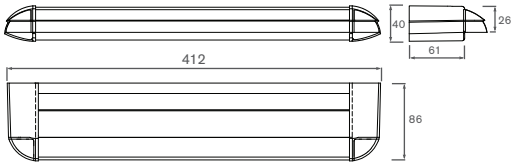


External

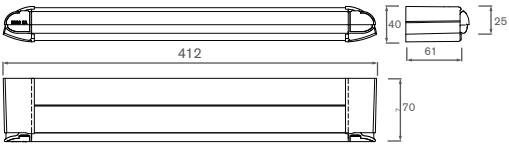


Internal

5000EA Acoustic



External



Internal

2500EA Acoustic slot size

Height: 13mm

Length
192mm

5000EA Acoustic slot size

Height: 13mm

Length	Central gap	Length
172mm	10mm	172mm

The best of both worlds... achieves Building Regulations' EA requirements along with fantastic acoustic performances up to 45dB(A)

Features and benefits

- Smallest acoustic window vents providing 2500mm² or 5000mm² equivalent area ventilation on the market
- Achieves the best acoustic performance for window ventilators available within the UK – up to 45dB(A)
- A simple, yet adaptable, solution to meet required specification/ Building Regulation requirements incorporating both high levels of equivalent area ventilation and acoustic noise reduction
- Modularity of acoustic sets provides flexibility for installation and acoustic performance
- Aesthetically pleasing design which is easy to open and control by the homeowner
- Excellent airtightness performance with upward air deflection to reduce the risk of draughts
- May require add on section in some window installations

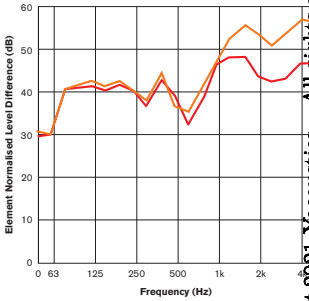
Sets comprise of:

1 EA vent + 1 external acoustic module – providing noise reduction with discreet internal aesthetics.

1 EA vent + 2 acoustic modules (for internal and external install) – providing maximum noise reduction.

Performance

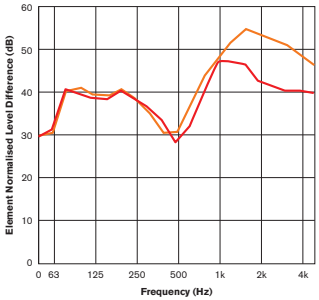
2500EA acoustic performance



Key

2500EAW.AC1 2500EAW.AC2

5000EA acoustic performance



Key

5000EAW.AC1 5000EAW.AC2

Models, control options and key data

			Acoustic performance				
Product code	**Description**	**Controls**	**Dn,e,w**	**Dn,e,w (C)**	**Dn,e,w (Ctr)**	**Equivalent area mm²**	**Colour**
2500EAW.AC1 *	Vent + 1 Acoustic External Module	Front	42dB(A)	41dB	40dB	2670	White
2500EAW.AC2 *	Vent + 2 Acoustic Modules	Front	45dB(A)	43dB	42dB	2670	White
5000EAW.AC1 *	Vent + 1 Acoustic External Module	Front	39dB(A)	38dB	37dB	5350	White
5000EAW.AC2 *	Vent + 2 Acoustic Modules	Front	42dB(A)	40dB	38dB	5350	White

* Pricing is variable depending on quantity ordered - please call for details

ANNEX D – Calculation details

ROOM DETAILS	
ID	Flat 1 - Bed 1
Type	Bedroom
Volume (m3)	30.3
Wall (m2)	0.0
Window 1 (m2)	2.2
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.2

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	29	40	50	57	59	51	38	62
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	10	10	10	10	10	10	10	-
10log A	10log A	-	10	10	10	10	10	10	10	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	10 mm / (6-16mm) / 6 mm	35 (-1; -3)	22	24	24	32	37	37	44	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	18	23	23	31	35	36	42	-
LAeq,16hrs	IANLs	-	7	13	23	23	21	11	-8	28

ROOM DETAILS	
ID	Flat 1 - Bed 2
Type	Bedroom
Volume (m3)	25.0
Wall (m2)	0.0
Window 1 (m2)	2.2
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.2

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	29	40	50	57	59	51	38	62
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	10 mm / (6-16mm) / 6 mm	35 (-1; -3)	22	24	24	32	37	37	44	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	18	23	23	31	35	36	42	-
LAeq,16hrs	IANLs	-	8	14	24	24	22	12	-7	28

ROOM DETAILS	
ID	Flat 1 - Living
Type	Living room
Volume (m3)	25.0
Wall (m2)	0.0
Window 1 (m2)	1.8
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.8

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	29	40	50	57	59	51	38	62
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	5	5	5	5	5	5	5	-
10log A	10log A	-	7	7	7	7	7	7	7	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	16	22	20	27	35	38	44	-
LAeq,16hrs	IANLs	-	12	17	28	28	23	11	-7	32

ROOM DETAILS	
ID	Flat 1 - Kit + dinning
Type	Dinning room
Volume (m3)	25.0
Wall (m2)	0.0
Window 1 (m2)	1.4
Door (m2)	2.1
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	3.5

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	29	40	50	57	59	51	38	62
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	5	5	5	5	5	5	5	-
10log A	10log A	-	7	7	7	7	7	7	7	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Door)	39 mm wooden fibre door	29 (-1;-1)	23	25	25	29	30	28	26	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	18	23	22	28	31	30	28	-
LAeq,16hrs	IANLs	-	12	18	29	30	29	23	11	35

Flat 2 - Kitchen + dining + lvg

ROOM DETAILS	
ID	Flat 2 - Kitchen + dining + lvg
Type	Living room/dinning room
Volume (m3)	57.5
Wall (m2)	0.0
Window 1 (m2)	4.4
Window 2 (m2)	3.7
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	8.1

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,16hrs	External ff noise	-	31	41	52	59	63	55	45	65
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	12	12	12	12	12	12	12	-
10log A	10log A	-	11	11	11	11	11	11	11	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	20	24	23	30	39	42	48	-
LAeq,16hrs	IANLs	-	12	18	30	30	26	14	-2	34

ROOM DETAILS	
ID	Flat 2 - Bed 1
Type	Bedroom
Volume (m3)	40.0
Wall (m2)	0.0
Window 1 (m2)	2.5
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.5

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	26	37	47	54	56	48	35	59
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	13	13	13	13	13	13	13	-
10log A	10log A	-	11	11	11	11	11	11	11	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	16	22	21	27	35	39	44	-
LAeq,16hrs	IANLs	-	6	11	22	22	16	5	-14	26

ROOM DETAILS	
ID	Flat 2 - Bed 2
Type	Bedroom
Volume (m3)	25.0
Wall (m2)	0.0
Window 1 (m2)	1.8
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.8

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	26	37	47	54	56	48	35	59
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	16	22	20	27	35	38	44	-
LAeq,16hrs	IANLs	-	7	12	23	23	18	6	-12	27

ROOM DETAILS	
ID	Flat 3 - Kit + din
Type	Dinning room
Volume (m3)	32.0
Wall (m2)	0.0
Window 1 (m2)	1.5
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.5

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	31	41	52	59	63	55	45	65
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	6	6	6	6	6	6	6	-
10log A	10log A	-	8	8	8	8	8	8	8	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	15	21	20	27	34	38	43	-
LAeq,16hrs	IANLs	-	12	16	28	28	26	14	-2	32

Flat 3 - Living - DAY

ROOM DETAILS	
ID	Flat 3 - Lvg
Type	Living room
Volume (m3)	36.8
Wall (m2)	0.0
Window 1 (m2)	2.8
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.8

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	31	41	52	59	63	55	45	65
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	7	7	7	7	7	7	7	-
10log A	10log A	-	9	9	9	9	9	9	9	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	16	22	21	28	36	39	45	-
LAeq,16hrs	IANLs	-	13	18	30	30	26	15	-1	34

ROOM DETAILS	
ID	Flat 3 - Bed 1
Type	Bedroom
Volume (m3)	36.8
Wall (m2)	0.0
Window 1 (m2)	1.4
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.4

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	26	37	47	54	56	48	35	59
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	12	12	12	12	12	12	12	-
10log A	10log A	-	11	11	11	11	11	11	11	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	15	21	20	27	34	38	43	-
LAeq,16hrs	IANLs	-	5	9	20	21	16	4	-14	24

ROOM DETAILS	
ID	Flat 3 - Bed 2
Type	Bedroom
Volume (m3)	25.0
Wall (m2)	0.0
Window 1 (m2)	1.5
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.5

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,8hrs	External ff noise	-	26	37	47	54	56	48	35	59
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-
R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	8 mm / (6-16mm) / 4 mm	33 (-1; -4)	18	22	21	28	38	40	47	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	
R (Facade)	All façade elements	-	15	21	20	27	34	38	43	-
LAeq,16hrs	IANLs	-	6	11	22	23	17	6	-13	26

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