

Façade sound insulation performance New homes examples

1. Introduction

This document has been prepared to provide worst case calculated examples of the façade sound insulation performance necessary to achieve applicable internal noise level criteria. Prevailing ambient environmental noise and entertainment noise sources have been considered.

Detailed design development will inevitably be required to tailor the sound insulation performance to the final internal layout design considering orientation to the external noise sources and information about the final façade construction make-ups, dimensions and habitable room arrangements.

2. Assessment criteria

There are two conditions for which different sets of internal noise level criteria are necessary as defined in the sub-sections below.

2.1 Road traffic/Commercial noise sources

British Standard (BS) 8233:2014 Guidance on sound insulation and noise reduction for buildings (BS8233) provides guidance on internal noise levels for newly constructed homes. Table 1 below provides the guidance criteria applicable from external road traffic and steady commercial type noise sources.

Table 1: BS8233 internal noise criteria

Activity	Location	Day (07.00 to 23.00)	Night (23.00 to 07.00)
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room / area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

BS8233 does not provide a guidance value for individual maximum event noise levels at night. Manchester City Council (MCC) Environmental Protection document Planning & Noise Technical Guidance (June 2022) (PNTG) indicates a level of 45 dB $L_{AFmax,T}$ for schemes of façade sound insulation.

2.2 Entertainment noise sources

MCC's PNTG provides guidance on low frequency noise control of entertainment noise internally within habitable rooms of new dwellings. The criteria are limited to the 63 Hz and 125 Hz octave bands and are based on an $L_{Aeq, 5min}$ measurement parameter. Table 2 below provides the octave band criteria considered.

Table 2: Entertainment noise internal criteria

Parameter	63 Hz	125 Hz
$L_{Aeq, 5min}$ dB	47	41

3. Facades

The following sub-sections outline the detailed design provisions forming the assessment of sound insulation requirements.

3.1 Main façade construction

The main façade to the Proposed Scheme new homes areas of Building A is expected to be a unitised system comprising glazed components and thermally insulated panels. Behind various parts of the main façade there will be an independent drylining system with mineral wool type full-fill insulation.

The independent drylining is expected to comprise a deep void and a double layer of fire protection plasterboard to provide compliance with Approved Document E Resistance to the passage of sound (2003 edition incorporating 2004, 2010, 2013 and 2015 amendments).

Table 3 below provides the estimated sound reduction for the main façade system, without glazing. The spectrum of Table 3 is equivalent to approximately 42dB $R_w + C_{tr}$.

Table 3: Estimated sound reduction of main façade element

	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
R dB	20	22	29	40	53	65	65	65	65

3.2 Glazing

The Proposed Scheme Building A glazing design for new homes areas is for double glazed sealed units to achieve the necessary thermal requirements. The sound reduction performance of the glazing units is derived on a worst-case basis in section 5 below.

3.3 Ventilation

The Proposed Scheme Building A ventilation design strategy is as listed below:

- Purge ventilation is to be provided through openable windows within the unitised facades;
- Permanent ventilation is to be provided by mechanical means through ducted paths to the external façade, permitting glazing to be in a closed position (unless purge ventilation is required); and
- Overheating conditions will in part rely on the type of glazing and shading by the external façade forms and will be supplemented by increased mechanical ventilation flow rates where necessary, permitting glazing to be in a closed position (unless purge ventilation is required at the same time).

4. External noise levels

The following sub-sections provide the measured or calculated external noise levels for the two noise sources, road traffic/commercial and entertainment noise. The sound levels align with those either measured or calculated in support of the Environmental Impact Assessments (EIA) carried out.

4.1 Road traffic/commercial noise sources

The results of the environmental noise measurements carried out for the Proposed Scheme have informed the expected external noise levels of Table 4 below. The noise levels for the north and east facades have been estimated by the subtraction of 5dB from the noise levels measured along Bridge Street to account for self-screening by the presence of Building A in the future.

Table 4: Overall measured noise levels

Facade	Daytime $L_{Aeq,16hr}$ dB	Night $L_{Aeq,8hr}$ dB	Night $L_{AFmax,15min}$ dB
Building A (Residential) south and west facing	67	63	79
Building A (Residential) north and east facing	62	58	74

4.2 Entertainment noise sources

The results of the environmental noise measurements carried out for the Proposed Scheme have informed the expected low frequency external noise levels of Table 5 below. The noise levels for the north and east facades have been estimated by the subtraction of 5dB from the noise levels measured along Bridge Street to account for self-screening by the presence of Building A in the future. The noise levels have been taken to be consistent throughout the daytime (07:00 to 23:00 hours) and at night (23:00 to 07:00 hours).

Table 5: Entertainment noise contributions at low frequency

Facade	L _{Aeq,5min} dB at 63 Hz	L _{Aeq,5min} dB at 125 Hz
Building A south and west facing	72	64
Building A north and east facing	67	59

5. Sound insulation performance analysis

The following sub-sections define the method applied to calculate the information regarding the sound reduction required to achieve the internal noise level criteria of section 2 above. For all the calculations a sample only has been undertaken at this stage for a typical 54m² home (1 bed 2 person) at a lower level affected floor level. The habitable room details used are provided below.

Kitchen / Living / Dining:

- Exposed overall façade area directly open to the room space is 21.2m²;
- Floor area of the room is 40m²;
- Internal clear height is 2.5m;
- Volume of the room is 100m³;
- Reverberation time in the room is 0.5s (at each octave band); and
- The correction applied to convert from level difference D to sound reduction R is -2dB (see below).

Bedroom:

- Exposed overall façade area directly open to the room space is 8.4m²;
- Floor area of the room is 14.9m²;
- Internal clear height is 2.5m;
- Volume of the room is 37.3m³;
- Reverberation time in the room is 0.5s (at each octave band); and
- The correction applied to convert from level difference D to sound reduction R is -2dB (see below).

The relationship between sound reduction and level difference at each octave band has been taken from the following:

$$R = D + 10 \times \log_{10} (S / A)$$

Where: R is the sound reduction in dB

D is the level difference in dB

S is the area of the separating building element (façade) in m²

A is the absorptive area of the habitable room, defined as $A = 0.32 \times V$ for a 0.5s reverberation time

V is the volume of the habitable room in m³

The calculations have been undertaken to one decimal place with the results presented rounded to a whole number value.

5.1 Road traffic/commercial noise

The external noise levels of Table 4 above have been used to determine a level difference D that would be necessary to satisfy the overall dB(A) internal criterion of Table 1 above. The level difference D has been

corrected to a sound reduction R value taking into account habitable room conditions. The calculated levels and a typical $R_w + C_{tr}$ weighted sound reduction rating for the façades are presented in Table 6 below.

Table 6: Sound reduction requirements, ambient conditions

Parameter	Level Difference D dB	Sound Reduction R dB	Typical $R_w + C_{tr}$ dB
Building A (Residential) south and west facing façades			
Daytime $L_{Aeq,16hr}$ dB	32	30	27
Night $L_{Aeq,8hr}$ dB	33	31	28
Night $L_{AFmax,T}$ dB	34	32	29
Building A (Residential) north and east facing façades			
Daytime $L_{Aeq,16hr}$ dB	27	25	22
Night $L_{Aeq,8hr}$ dB	28	26	23
Night $L_{AFmax,T}$ dB	29	27	24

5.2 Entertainment noise

The predicted and measured external entertainment noise levels of Table 5 above have been used to determine a level difference D by the subtraction of respective criteria from Table 2 above. The level difference D has been corrected to a sound reduction R value taking into account habitable room conditions. The calculated levels and a typical $R_w + C_{tr}$ weighted sound reduction rating for the façades are presented in Table 7 below.

Table 7: Sound reduction requirements, entertainment noise

Octave Band Frequency	Level Difference D dB	Sound Reduction R dB	Typical R _w + C _{tr} dB
Building A (Residential) south and west facing façades			
L _{Aeq,5min} dB at 63 Hz	25 (30*)	23 (28*)	38 (41*)
L _{Aeq,5min} dB at 125 Hz	23 (28*)	21 (26*)	
Building A (Residential) north and east facing façades			
L _{Aeq,5min} dB at 63 Hz	20 (25*)	18 (23*)	24 (29*)
L _{Aeq,5min} dB at 125 Hz	18 (23*)	16 (21*)	
Note (*) a tolerance has been included for less screening reduction of up to +5dB due to the potential that mid to upper floor levels of Building A (Residential) may have a more direct line of sight.			