



Noise Impact Assessment

Former Albert Jones Textiles, Manchester, M33 4QH

Eminence Development Ltd

MAN.751.001.NO.R.001

'Experience and expertise working in union'



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Noise Impact Assessment

Project:	MAN.751.001
For:	Eminence Development Ltd
Status:	DRAFT
Date:	November 2022
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1 Introduction

1.1 Project Introduction

- 1.1.1 Enzygo Limited has been commissioned by Eminence Development Ltd to undertake a noise assessment to support a planning application for the proposed residential development of the former Albert Jones Textiles building at No.51 to No.53 Richmond Street, Manchester.
- 1.1.2 The development is to include the conversion of the existing building in to four apartments and the construction of a new townhouse on the site.
- 1.1.3 The assessment has considered the potential impact of the existing noise climate on the proposed development and has outlined façade mitigation advice to ensure appropriate internal noise levels can be achieved.
- 1.1.4 It is noted that the existing building is Grade II listed and is therefore obligated to retain the façade appearance including windows etc. This is pertinent in the mitigation advice provided in this document.
- 1.1.5 Details of the assessment methodology employed, together with the results of the noise survey, predictions, assessment and conclusions are presented within this report.

1.2 Site Location

- 1.2.1 The site is located off Richmond Street in Manchester, backing on to Canal Street, a popular area with a significant night-time economy during both weekdays and weekends. Richmond Street is a narrow road running between Princess Street and Sackville Street.
- 1.2.2 The site is approximately 450m from Manchester Piccadilly train station and 400m from Oxford Road station.
- 1.2.3 The site is typical of a city centre location, surrounded by a mix of commercial and residential properties.
- 1.2.4 The area around Richmond Street has seen a number of residential developments constructed in recent years including a site on the opposite side of Richmond Street and the property immediately adjacent (No.49 Richmond Street).
- 1.2.5 The location of this application site is presented in Figure 1-1 below.

Figure 1-1: Site Location Plan



1.3 Existing Building

- 1.3.1 The existing building is a former textile merchant's premises off Richmond Street. The building was constructed around 1860 and has not undergone any significant changes since then. The building is four storeys in height with a pitched roof.
- 1.3.2 The external building envelope is understood to be solid brick/masonry construction and is, relatively speaking, in a serviceable state of repair with no significant holes in the façade etc.
- 1.3.3 Windows make up a significant proportion of the façade with large (2m x 0.95m) single glazed, timber framed windows on all floors. The opening element is at the top of the window frame, with a bottom hung element, opening inwards. As a function of the buildings designation these windows will be retained and made good (subject to a condition report). The existing window reveals are 15cm in depth.
- 1.3.4 The large timber access doors in the Richmond Street façade will be retained and the intention is that they will be for the access for the upper ground floor apartment and potentially a small, raised patio/balcony area.

1.4 Development Proposals

- 1.4.1 As indicated above, the existing building is to be converted into four residential apartments (one on each floor). The open space adjacent to the existing building is to accommodate a new build, townhouse style dwelling.
- 1.4.2 The conversion of the existing building will see the construction of 4no. two-bedroom dwellings. The conversion will entail upgrades to the existing building envelope including lining the interior of the walls with insulated plasterboard. This will add to both the thermal performance of the building envelope and to the depth of the internal window reveals.
- 1.4.3 The townhouse is to be a new construction. Ground floor of the property is to be the access point, with plant and bin store. Bedrooms and bathrooms are located at first and second floors, kitchen on third floor and living room at fourth floor.
- 1.4.4 There are small balcony (external amenity) areas at each floor above ground, overlooking Richmond Street. A larger private balcony area is provided at fourth floor level.

2 Standards and Guidance

- 2.1.1 A noise assessment for the development has been informed by the guidance detailed in Manchester City Council Planning and Noise document and British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* (BS8233). This is considered the relevant guidance for developments of a residential nature. Reference has also been made to the Professional Practice Guidance on Planning and Noise. A summary of the relevant standards and guidance is presented below.
- 2.1.2 This report does not address any requirements under the building regulations, i.e., Approved Document E.

2.2 Professional Practice Guidance on Planning and Noise

- 2.2.1 The Professional Practice Guidance (ProPG) on Planning and Noise (May 2017) provides guidance on transport noise affecting new residential developments. The guidance was prepared by a working group formed from members of the Institute of Acoustics (IoA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH). It has no formal planning status but nevertheless represents industry good practice. It is specifically for assessing noise from predominantly transportation sources so has not been used in this assessment.

2.3 Manchester City Council Planning and Noise – Technical Guidance

- 2.3.1 Manchester City Council's guidance on noise in the planning arena is presented in their technical guidance document dated October 2022. This includes guidance on relevant planning policy and standards and Council specific guidance on appropriate noise criteria.
- 2.3.2 With regards residential developments, the Council guidance promotes the following criteria:
- Bedrooms (night-time – 23:00 – 07:00) 30dB L_{Aeq} (individual noise events should not normally exceed 45dB $L_{Amax,f}$ more than 10 times);
 - Living Rooms (daytime – 07:00 – 23:00) 35dB L_{Aeq} ;
 - Gardens and terraces (daytime) 55dB L_{Aeq} .
- 2.3.3 The above criteria are common with those detailed in BS8233.
- 2.3.4 With regards music noise as it relates to 'new residential developments that are structurally connected to entertainment venues', the guidance states the following:
- Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB ($L_{eq,5mins}$), respectively.
- 2.3.5 The guidance later clarifies that the guidance may also be applicable for new residential developments that are structurally separate from an existing entertainment venue as is the case in this situation.

2.4 British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings

- 2.4.1 National guidance on noise limits for dwellings is set out in BS8233:2014. This sets limits in terms of two noise parameters: the ambient level L_{Aeq} and the maximum level, L_{AFmax} . The L_{AFmax} is the highest noise level in a given period and is determined by individual events such as a vehicle pass-bys. An L_{AFmax} limit is usually only applied at night, when sleep disturbance is more likely to be an issue. The L_{Aeq} is defined as the steady-state noise level which has the same energy as the actual time-varying noise over the same time period. It is effectively the energy average noise level.
- 2.4.2 Appropriate internal noise levels are recommended in BS8233:2014 (shown in Table 1 below) and in the World Health Organisation (WHO) Guidance “Guidelines for Community Noise”, 1999.

Table 2-1: BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 Hours	23:00 to 07:00 Hours
Resting	Living room	35dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

- 2.4.3 The guidance values are generally taken as applying to noise sources without specific character, previously termed ‘anonymous noise’ in earlier versions of the standard.
- 2.4.4 Whilst it is considered desirable to achieve these internal noise levels with the windows open, it is not stipulated within the Standard which states:
- “If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.”*
- 2.4.5 BS8233 also sets out a design-criteria for external noise in external amenity spaces such as gardens and patios stating:
- “it is desirable that the external noise level does 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.”*

3 Supporting Information

3.1 Introduction

- 3.1.1 As indicated above, the area around the site, particularly on Richmond Street, has undergone some significant development in recent years (and less recent years). These developments are largely residential in nature and have a bearing on this application.
- 3.1.2 A number of planning applications of a similar nature to this assessment have been identified on the Manchester City Council planning portal. These are detailed in Table 3-1 and summarised below.

Table 3-1: Pertinent Planning Applications

Planning Application Reference	Application Address	Application Type	Decision Outcome	Decision Date
115894/FO/2017	Land at Richmond St, Manchester	Residential Development	Approved with Conditions	Sept 2017
118558/FO/2017	58 Richmond Street	Residential Development	Approved with Conditions	Nov 2020
059597/FO/CITY2/00	61 Bloom Street	Residential Development	Approved with Conditions	Dec 2000
051107/FO/CITY2/96	43 to 49 Richmond St	Residential Development	Approved with Conditions	Mar 1997

- 3.1.3 The older planning applications identified above (refs 059597 and 051107) are for residential developments and were approved with conditions. Given the age of the application, there is limited information available on the Council's planning portal. They do, however, provide context to the area, where residential developments are a feature and are acceptable to the Council.
- 3.1.4 The locations of the above applications are identified on Figure 3-1 below:

Figure 3-2: Supporting Information Location Plan



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3.2 115894/FO/2017

- 3.2.1 The application under reference 115894/FO/2017 is one of the more recent developments in the area. Consent for the development was granted 2017 and was supported by a noise assessment prepared by Lighthouse Acoustics which included a baseline noise survey undertaken in March 2017.
- 3.2.2 The measurement survey was undertaken at a number of locations in the vicinity of their development site. Of particular relevance to this assessment is the survey undertaken in the vicinity of Richmond Street, covering a period including a weekend. The octave band noise levels measured during the survey are summarised in Table 3-2 below. This is copied directly from the Lighthouse Acoustics Report.

Table 3-2: 115894/FO/2017 Survey Data

Position	Period	Leq Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
A	Daytime (16 hour)	66	63	58	59	57	46	40	35	60
	Night-time (8-hour)	64	63	59	60	57	43	41	39	61

3.2.3 The supporting report includes information on the highest individual $L_{Amax,f}$ sound levels during the survey though these are omitted from this report for brevity.

3.3 118558/FO/2017

3.3.1 The application under reference 118558/FO/2017 included a noise assessment undertaken by Martec Environmental Consultants Ltd and included baseline noise survey with measurements made on Richmond Street. The Survey covered both weekday and weekend periods in April 2018.

3.3.2 The measurements are summarised in the Martec report and include a table presenting the differing noise levels between daytime and night-time periods for each day of the survey period. The Saturday night-time period reports the highest overall noise levels and octave band noise levels for this period are summarised below.

Table 3-3: 118558/FO/2017 Survey Data

Period	Leq Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
Saturday Night	75.0	63.4	58.3	58.7	61.3	55.1	48.0	63.9

4 Baseline Survey Information & Results

4.1 Introduction

- 4.1.1 To inform the assessments in this report, a baseline noise survey was undertaken by Enzygo at one location to the rear of the existing building. The survey was undertaken by means of longer duration, unattended monitoring covering both daytime and night-time periods, for the weekday and weekend.
- 4.1.2 The monitoring was undertaken between Thursday 20th and Monday 24th October 2022. The location is detailed in Table 4-1 below.

Table 4-1: Noise Monitoring Locations

Monitoring Location	Distance from façade	OS Grid Co-ordinates		Justification for Choice of Measurement Location
		Easting	Northing	
MP1	1m	384326	397804	Location representative of the rear façade of the existing building, facing towards Canal Street

4.2 Measuring Equipment

- 4.2.1 The noise monitoring equipment used during the surveys is shown in Table 4-2 and was set to record the $L_{Aeq,T}$, L_{A90} , L_{A10} and L_{Amax} parameters in consecutive 15-minute periods.
- 4.2.2 The following set-up parameters were used on the sound level meter during all the noise measurements undertaken:
- Time Weighting: Fast
Frequency Weighting: "A"
- 4.2.3 The sound level meters were field calibrated, using an acoustic calibrator, prior to and upon completion of the overall survey. No significant drift in calibration was noted.

Table 4-2: Noise Monitoring Equipment

Equip. Make & Model	Class	Calibration Level, dB	Serial No.	Calibration Date Prior to Survey
Cirrus Class 1 Sound Level Meter	1	94.0	G301158	November 2021
Cirrus CR:515 Acoustic Calibrator	-	-	90331	November 2021

- 4.2.4 The external calibration documentation for the equipment used is available upon request.

4.3 Weather Conditions

4.3.1 As indicated, the monitoring was undertaken on an unattended basis therefore no direct records of weather conditions were recorded at the site. To that end, third party, commercially available weather data has been used to provide an overall review of the weather conditions during the unattended period. The forecast data indicates the following:

- Friday 21st October. Light rain throughout the day. Relatively light winds with strong gusting elements. Ambient daytime temperature of between 11°C and 16°C;
- Saturday 22nd October. Very light rain around 03:00hrs though dry for the rest of the day. Ambient daytime temperatures of between 9°C and 15°C. Wind speeds brisk, up to 5m/s;
- Sunday 23rd October. Light rain again around 03:00hrs and heavier rain from 15:00. Wind speeds low, around 1m/s.

4.3.2 The forecast data above has been augmented by brief subjective reviews of the weather on Saturday and Sunday nights:

- Saturday 22nd October (between 18:45 and 21:00). 0% cloud cover around 18:45. No rain. Dry roads. 14°C ambient air temperature. Light rain from 20:30 onwards.
- Sunday 23rd October (from 18:30 onwards). 100% cloud cover. No rain, dry road surfaces. Ambient air temperature 11°C.

4.3.3 The recorded weather conditions are generally within appropriate parameters and, with the periods of rain removed, would have no detrimental effect on the measured survey data.

4.4 Existing Noise Climate

4.4.1 Subjective field notes indicate the noise climate in the area was governed by road traffic noise during both the set up and collection periods.

4.4.2 At the front of the building, construction noise was audible from the nearby works. This included drilling and metal works. Richmond Street was closed to traffic due to the construction works.

4.4.3 At the rear of the building, plant noise was audible from a number of the condenser units in the area. Traffic noise was also audible though considerably screened by the intervening building.

4.5 Survey Details and Results

4.5.1 The results of the baseline surveys are summarised in Table 4-3 below and can be found in full in Appendix A. This includes time history charts for each 24-hour period.

4.5.2 The values reported in Table 4-3 are representative of façade noise levels given the location of the microphone relative to the building façade.

Table 4-3: Summary of Baseline Survey Results

Period	Duration Hh:mm	Period	Average $L_{Aeq,T}$, dB ¹	Max $L_{A_{fmax}}$, dB ²	Average, L_{A90} dB ³	Average, L_{A10} , dB ³
Thursday 20 th October 2022	12:00	Day	68.6	86.7	61.4	65.0
	08:00	Night	60.7	75.6	58.3	60.2
Friday 21 st October 2022	16:00	Day	70.1	83.4	61.4	63.9
	08:00	Night	66.6	84.8	62.9	65.0
Saturday 22 nd October 2022	16:00	Day	69.2	85.5	60.2	62.6
	08:00	Night	69.8	88.0	65.2	67.1
Sunday 23 rd October 2022	16:00	Day	68.9	85.6	60.2	63.4
	08:00	Night	65.1	86.0	59.6	61.6
Monday 24 th October 2022	13:30	Day	65.4	81.8	55.1	59.0
1) The logarithmic average of the L_{Aeq} parameter is presented. 2) The maximum recorded $L_{A_{max}}$ event is reported. 3) The arithmetic average and minimum background sound level (L_{A90}) are presented.						

4.5.3 While not relied on for the assessments, the measured noise levels have been compared with the risk categories detailed in the ProPG. When the façade values are corrected to free field¹, the measured noise levels would fall within the ‘medium’ risk category during the daytime period and ‘high’ during the night-time period.

4.5.4 The time history charts demonstrate frequent periods where both the L_{Aeq} and L_{A90} are high and are within 1dB of each other. This is likely a result of static plant adjacent to the building, running at a consistent output level, rather than music noise. Music is likely to demonstrate more variation in levels particularly between different days.

4.5.5 That said, music noise is likely a factor in the noise incident on the rear façade of the building.

¹ Free field noise levels are approximated by subtracting 3dB for a façade reflection from the building.

5 Assessment of Impacts

5.1 Introduction

- 5.1.1 Sound insulation calculations for habitable rooms have been prepared in accordance with BS EN 12354-3 to determine the extent of the sound insulation required to meet the noise limits discussed earlier in the report. The assessment has been completed using the noise levels as shown in Table 5-1. Example calculations are provided in Appendix B.
- 5.1.2 The historical noise data (section 3), and the survey data (section 4) have been used to inform the assessments undertaken in this report.

5.2 Noise Levels

- 5.2.1 Construction activities were being undertaken on Richmond Street which, coupled with security concerns, made it difficult to establish a noise monitoring station on this elevation of the site. To that end, the noise levels established in the planning applications 118558/FO-2017 and 115894/FO/2017 summarised in sections 3.2 and 3.3 (resp.) have been used to inform this assessment. It is reiterated that this information is publicly available on the Manchester City Council Planning portal. Further to this, as the Council granted planning consent, it is considered to be robust and appropriate for use to inform noise levels on the Richmond Street elevation.
- 5.2.2 The noise levels established during the Enzygo survey, summarised in section 4, have been used to inform the assessments to the rear of the building. The data presented in Table 4-3 above demonstrates that noise levels during the daytime period are relatively consistent, at around 66dB L_{Aeq} (free field). During the night-time periods there is more variation, with the Saturday night reporting higher values, at 67dB $L_{Aeq, 8hr}$ (free field).
- 5.2.3 Further analysis of the data indicates that the period 17:30 to 01:15 on the Saturday night period reports the highest noise levels, being consistently 71dB L_{Aeq} (free field) throughout the period. The period also reports the highest values in the 63Hz to 250Hz octave bands.
- 5.2.4 L_{Amax} events at the rear façade are consistent on the Friday and Saturday night periods, with the 10th highest value reported at 73.7dB $L_{Amax, 1min}$ (free field) on both days.
- 5.2.5 Given the above, the following noise levels have been used in the assessments:

Table 5-1: Assessment Noise Levels

Elevation	Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)							dBA
		63	125	250	500	1k	2k	4k	
Richmond Street	L _{Aeq,16hr} Daytime	63.6	57.5	58.3	57.3	54.3	51.0	48.7	59.6
	L _{Aeq,8hr} Night-time	75.0	63.4	58.3	58.7	61.3	55.1	48.0	63.9
	L _{Afmax} Night-time	81.0	74.0	68.0	82.0	75.0	61.0	51.0	81.0
Rear Elevation	L _{Aeq,16hr} Daytime	60.0	60.6	69.7	59.3	59.6	58.8	51.8	65.8
	L _{Aeq,8hr} Night-time	66.6	67.6	74.8	64.2	64.7	63.6	56.9	70.9
	L _{Afmax} Night-time	76.7	78.2	76.7	68.2	67.5	66.0	60.4	73.7

5.2.6 In all instances, the noise levels are considered representative of free field values at the façade of each dwelling. Given the nature of the rear elevations of the building, it is unlikely there will be any attenuations due to distance from noise sources, given reflections from facades, etc.

5.2.7 Given the listed status of the existing building and the likely difference in construction with the proposed town house, the two elements of the development are addressed separately below.

5.3 Existing Building

5.3.1 The existing building will have habitable rooms on all floors and on both facades. The existing building is Grade II listed which will require the retention of certain elements of the building and will inherently necessitate a compromise between the acoustic requirements and the heritage concerns of the building.

5.3.2 Discussions with the architects indicate the intention to mechanically ventilate the existing building.

Glazing

5.3.3 In this instance, the development will be obligated to retain the existing windows which, evidently removes the possibility of replacing the windows with more acoustically robust modern double-glazed units.

5.3.4 To that end, it is proposed to use secondary glazing to enhance the sound insulation of the existing windows. The window reveals were noted to be 150mm which, with an internal thermal lining, could be made to accommodate a 200mm deep cavity between glazed panels.

- 5.3.5 For bedroom spaces, secondary glazed units affording **R_w 49dB** are required. The glazing would need to achieve R_{65Hz} 31dB and R_{125Hz} 35dB which, can be achieved by a unit consisting of 6mm external glazing/200mm cavity/10mm internal glazing.
- 5.3.6 For living rooms, where L_{Amax} levels are less of a consideration, a slightly less onerous construction can be used. In this instance 4mm external glazing/150mm cavity/6mm internal glazing achieving **R_w 47dB** can be used affording R_{63Hz} 20dB and R_{125Hz} 29dB.

Walls

- 5.3.7 The walls of the existing building are understood to be solid masonry, with no internal cavity. As such, to enhance the thermal performance of the walls, the architect is proposing to internally line the building with insulated plasterboard. The particular build up has not been confirmed at this time however it is likely to achieve **R_w 55dB**.
- 5.3.8 Any holes or penetrations in the façade would need to be addressed and made good.

Ventilation

- 5.3.9 As indicated above, the intention is to mechanically ventilate the building therefore there is no requirement to include ventilation openings in the facades. Open windows could still be provided for future residents but should not be relied on for purge ventilation or cooling/overheating control. It is recommended that any mechanical ventilation system include some provision for heating control.

5.4 Town House Construction

- 5.4.1 The proposed town house is a new construction and is not bound by the heritage concerns of the existing building. To that end, modern, window units can be used in the construction.
- 5.4.2 The arrangement of the building is such that no bedroom windows are located on the rear façade of the building.

Glazing

- 5.4.3 The bedrooms have two glazed elements on the Richmond Street façade: one tall, narrow window element and a second glazed door to a small balcony area. The arrangement of the balcony is such that it steps the glazed door back from the street elevation, reducing the exposure of the door to noise from the street slightly through angle of view and distance from the street. Further to this the balustrade forms a partial screen from the street below.
- 5.4.4 Distance attenuation has been included in the calculations, assuming the noise source is at 1.5m above street level on the Richmond Street Elevation. Distances have then been calculated to the centre of the respective facades above ground level. The ambient (L_{Aeq}) noise level is assumed to be a line source and the L_{Amax} events are assumed to be a point source.
- 5.4.5 With the above assumptions, the calculations have demonstrated that for the bedroom spaces, a relatively robust glazed unit affording **R_w 39dB** is required. The glazing should provide R_{65Hz} 26dB and R_{125Hz} 30dB.

- 5.4.6 The living spaces at floors three and four, being at a greater distance from street level and not obligated to consider L_{Amax} events, are afforded a lower specification, with standard thermal double glazing (**R_w 33dB**) achieving the appropriate internal noise levels.

Walls

- 5.4.7 The specific construction of the walls has not been confirmed at this time. Discussions with the architect indicate either a CLT frame construction with cladding or a brick/block with steel frame and external cladding are being considered. For the purposes of the calculations, a simple brick/block construction has been assumed, giving **R_w 55dB**.

Ventilation

- 5.4.8 Both facades of the town house are exposed to reasonably high noise levels, with particularly high L_{Amax} events on the Richmond Street façade. Given this, it would be difficult to naturally ventilate the living spaces. Wall mounted vents such as the Greenwood MA3051 ($D_{n,e,w}$ 55dB) can provide high levels of attenuation however in combination with break in through the windows, would exceed the Manchester City Council criteria in the 65Hz and 125Hz octave bands.
- 5.4.9 Considering the above, it is recommended that mechanical ventilation be provided for the town house. Again, open windows could still be provided for residents but should not be relied on for purge ventilation or cooling/overheating control. It is recommended that any mechanical ventilation system include some provision for heating control.

5.5 External Amenity Areas

- 5.5.1 The proposed town house has small balcony areas on the Richmond Street elevation at 1st, 2nd and 3rd floors and a larger enclosed amenity space at 4th floor level. The measured ambient noise level on the Richmond Street elevation is 59.6dB L_{Aeq} (free field) which is higher than the typical noise limit detailed in the Manchester City Council guidance (55dB L_{Aeq}).
- 5.5.2 The arrangements of the balconies on 1st, 2nd, and 3rd floors are such that the angle of view to Richmond Street is reduced by the façade of the existing building, affording a modicum of attenuation. Further to this, absorption applied to the soffit above would afford approximately 1dB of attenuation depending on the line of sight relative to the street. The soffit absorption is likely to be of mineral fibre covered in a perforated mesh and provides a benefit by reducing reflections from the underside of the soffit.
- 5.5.3 Calculations indicate that the daytime noise levels at first floor level would be around 55dB L_{Aeq} . The noise levels at 2nd and 3rd floor levels would be moderately lower, given the increased distance to the street below.
- 5.5.4 The fourth-floor balcony is a larger space and is partially enclosed by a robust screen, providing additional attenuation, reducing noise levels to approximately 50dB L_{Aeq} when the enclosed nature of the balcony and balustrade are taken into account.
- 5.5.5 It is recommended that the balustrade of the balconies be solid, rather than open railings, to provide a screen when viewed from the street. With this in place, the noise levels in the balconies are considered to have been reduced as far as practicable for the setting.
- 5.5.6 It is noted, in this instance that BS8233 states the following:

‘.....it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.’

5.6 Assessment Summary

- 5.6.1 The assessments presented in this report demonstrate that, with detailed consideration of the various façade elements, appropriate internal noise levels can be achieved in both the converted, existing building and the proposed new town house.
- 5.6.2 Table 5-2 below summarises the required façade attenuation for each Building. It is reiterated that both buildings are to be mechanically ventilated and the walls are to achieve R_w 55dB.

Table 5-2: Glazing Summary

Building	Bedroom	Lounge
Existing Building	R_w 49dB 10/200/6 secondary glazing	R_w 47dB 6/150/4 secondary glazing
New Town House	R_w 39dB Enhanced double glazing	R_w 33dB Standard double glazing

- 5.6.3 Consideration should be given to the octave band R-values specified in sub-section 5.4 above when selecting glazing types.
- 5.6.4 The glazing specification for the existing building is governed by the assumption that the existing windows are to be retained. In this instance, a secondary (internal) glazed panel is to be used to enhance the existing windows.
- 5.6.5 If it is found that the existing windows can be replaced with more robust units, it is recommended that additional calculations be undertaken. The specification is likely to be different to that for the town house due to the glazed area in the façade.

Low Frequency Noise

- 5.6.6 The Manchester City Council guidance includes criteria for music noise from an entertainment venue. The criteria states that it ‘may also be applicable for new residential developments that are structurally separate from and existing entertainment venue’.
- 5.6.7 The Council’s criteria requires that music noise is controlled to achieve 47dB (63Hz) and 41dB (125Hz) $L_{eq,5mins}$.
- 5.6.8 The calculations undertaken in this assessment demonstrate the following:

Table 5-3: Low Frequency Noise

Building	Bedroom		Lounge	
	63Hz	125Hz	63Hz	125Hz
Existing Building	38dB to 47dB	32dB to 36dB	43dB to 47dB	27dB to 32dB
New Town House	46dB to 47dB	30dB to 32dB	41dB to 43dB	29dB to 30dB

5.6.9 Table 5-3 demonstrates that the conversion of the existing building and the new town house will achieve the criteria in both lounge and bedroom areas.

6 Conclusion

- 6.1.1 Enzygo Limited has been commissioned by Eminence Development Ltd to undertake a noise assessment to support a planning application for their proposed residential development of the former Albert Jones Textiles building at No.51 to No.53 Richmond Street, Manchester.
- 6.1.2 The noise assessment has been undertaken to assess the potential impact of the existing noise climate on the proposed development and future residents of the dwellings.
- 6.1.3 The assessment included a review of similar planning applications in the area and their supporting baseline noise data. In addition, this assessment included a baseline noise survey undertaken to the rear of the existing building covering both daytime and night-time periods for the weekday and weekend periods.
- 6.1.4 Using both the survey and historical noise data for the area, noise ingress calculations were undertaken and façade mitigation measures have been proposed. With these measures in place, appropriate internal noise levels can be achieved, complying with Manchester City Council's guidance.

6.2 Noise Assessment

- 6.2.1 Both the Enzygo survey and the historical data for the area indicate that the site is exposed to relatively high noise levels during both the daytime and night-time period.
- 6.2.2 Noise ingress calculations have been undertaken in line with BS EN 12354-3 and appropriate façade attenuation measures have been prescribed to ensure internal criteria are achieved. These internal criteria include both broadband, single figure criteria and the criteria in the 63Hz and 125Hz required by Manchester City Council.
- 6.2.3 The assessments demonstrate that, with the façade treatments proposed in this report, there are no reasons, on noise grounds, why planning consent for the proposed residential development cannot be granted.

Glossary of Terminology

Noise is defined as unwanted sound. The range of audible sound is known to be from 0dB (threshold of hearing) to 140dB (threshold of pain). Examples of typical noise levels relating to 'everyday' occurrences are given in Table G-1 below.

Table G-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Gun shot	160	Perforation of eardrum
Military Jet take-off	140	Threshold of pain
Jet Aircraft at 100m	120	Very Loud
Rock Concert, front seats	110	Threshold of Sensation
Pneumatic Drill at 5m	100	Very Loud
Heavy goods vehicle from pavement	90	
Traffic at kerb edge	70 – 85	Loud
Vacuum Cleaner, Hair Dryer	70	
Normal conversation at 1m	60	Moderate
Typical Office	50 – 60	
Residential area at night	40	Quiet
Rural area at night, still air	30	
Leaves Rustling	20	
Rubbing together of fingertips	10	
	0	Threshold of hearing

The frequency response of the human ear to noise is usually taken to be around 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level; it is more sensitive in the mid-frequency range than lower and higher frequencies and, because of this when undertaking the measurement of noise, the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurement.

For variable noise sources within an area an increase of 3dB(A) would be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regards to environmental noise levels (in the open air), these are rarely steady but rise and fall according to the activities being undertaken within the surrounding area at any given time. Attempting produce a figure that relates this variable nature of noise to human subjective response, various statistical noise metrics have been developed. These and other useful terminology and descriptors are presented in Table G-2 below.

Table G-2: Terminology

Term	Definition
Sound	Pressure fluctuations in a fluid medium within the audible range of amplitudes and frequencies which stimulate the organs of hearing.
Noise	Unwanted sound emitted from a source and received by the sensitive receptor.
Decibel (dB)	Unit most often used to describe the sound pressure level. A logarithmic number, it correlates closely to the way in which humans perceive sound. Its wide range of values helps quantify sound pressures from a large variety of magnitudes.
A-Weighting (dB(A))	Human perception of sound is frequency dependant. A-weighting applies a range of corrections at each frequency to provide a 'human-averaged'. Can be frequency band or broadband values.
Frequency (Hz)	The number of cycles per second, for sound this is closely related (and often mistaken for) pitch.
Frequency Spectrum	A more detailed analysis of the frequency components that comprise a sound source.
L_{A10,T}	The 10 th statistical percentile of a measurement period, i.e., the level that is exceeded for 10% of the measurement duration. Closely correlates with traffic sources, A-weighted.
L_{A90,T}	The 90 th statistical percentile of a measurement period, i.e., the level that is exceeded for 90% of the measurement duration. Used to describe background sound levels, as this value is affected less by short, transient sound sources, A-weighted.
L_{Amax}	The root mean square (RMS) maximum sound pressure level within a measurement period, A-weighted.
Ambient Sound	The total sound climate of all noise sources incident at one location, both in the near- and far-field (<i>The ambient sound comprises the residual sound and the specific sound when present</i>).
Ambient Sound Level L_a = L_{Aeq,T}	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level L_{A90,T}	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Equivalent Continuous A-weighted Sound Pressure Level L_{Aeq,T}	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

Term	Definition
	$L_{Aeq,T} = 10 \lg_{10} \left\{ \left(\frac{1}{T} \right) \int_{t_1}^{t_2} \left[p_A \frac{(t)^2}{p_0^2} \right] dt \right\}$ Where p_0 is the reference sound pressure (20μPA); and $p_A(t)$ is the instantaneous A-weighted sound pressure level at time t.
Measurement Time Interval T_m	Total time over which measurements are taken (<i>This may consist of the sum of several non-contiguous, short-term measurement time intervals</i>)
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound, over time, T .
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (This is 1hr during the day from 07:00 to 23:00 hours and a shorter period of 15-min at night from 23:00 to 07:00 hours).
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T .
Sound Pressure Level	The level of fluctuation in air pressure, caused by airborne sound sources. Measured in Pascals (Pa).
Sound Power Level	The rate at which sound is radiated by a source. This parameter is useful as it describes sound energy before environmental or decay factors. Quantified in dB and notated usually as L_w or SWL.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T .
Specific Sound Source	Sound source being assessed.

Statement of Uncertainty

This report is based upon a range of measurements, a system of calculations and noise predictions. As such, this report attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this report must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

All measurement values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systemic tolerance of $\pm 1\text{dB}$;
- Meteorology – allowance of $\pm 1.9\text{dB}$; and
- CadnaA noise propagation modelling software – operational accuracy of $\pm 2.1\text{dB}$

The most influential uncertainty factors for the assessment of noise are deemed to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of $\pm 3\text{dB}$.

Statement of Competency

The assessment has been undertaken by Mr Mark Harrison, Principal Acoustic Consultant at Enzygo Limited. Mr Harrison holds a Bachelor of Science degree in Music Technology and a post graduate Diploma in Acoustics and Noise Control.

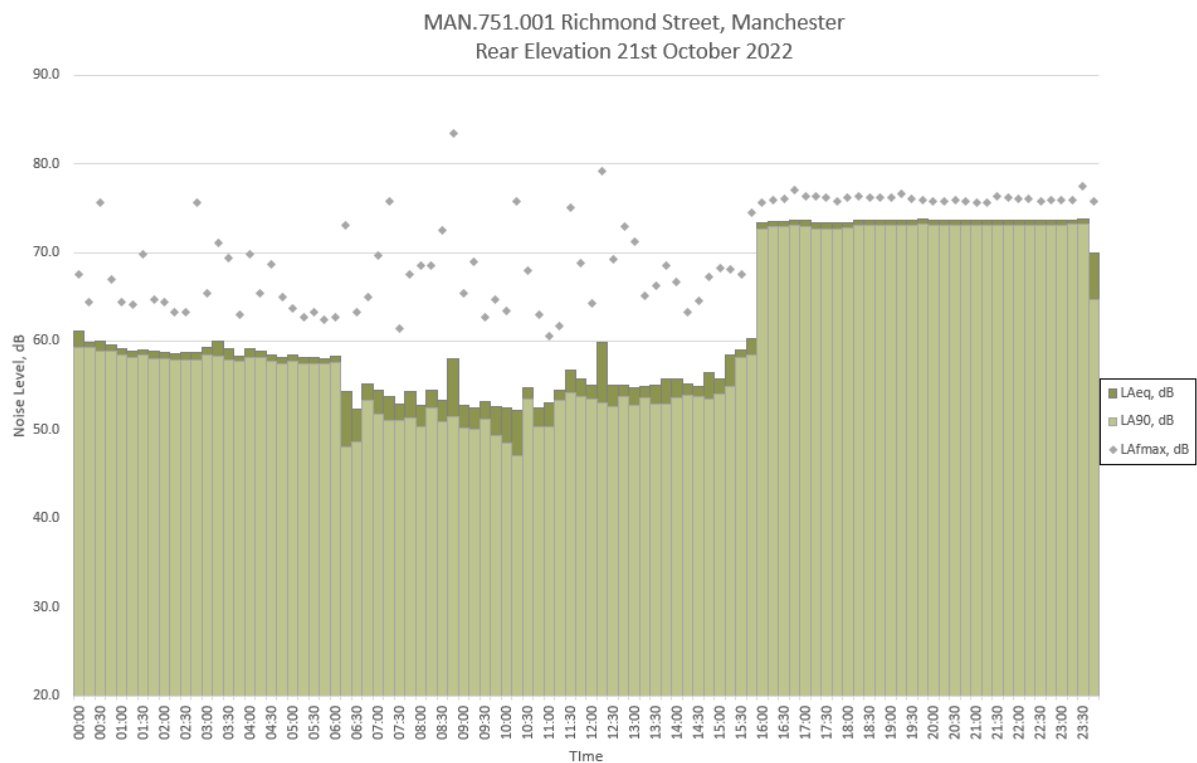
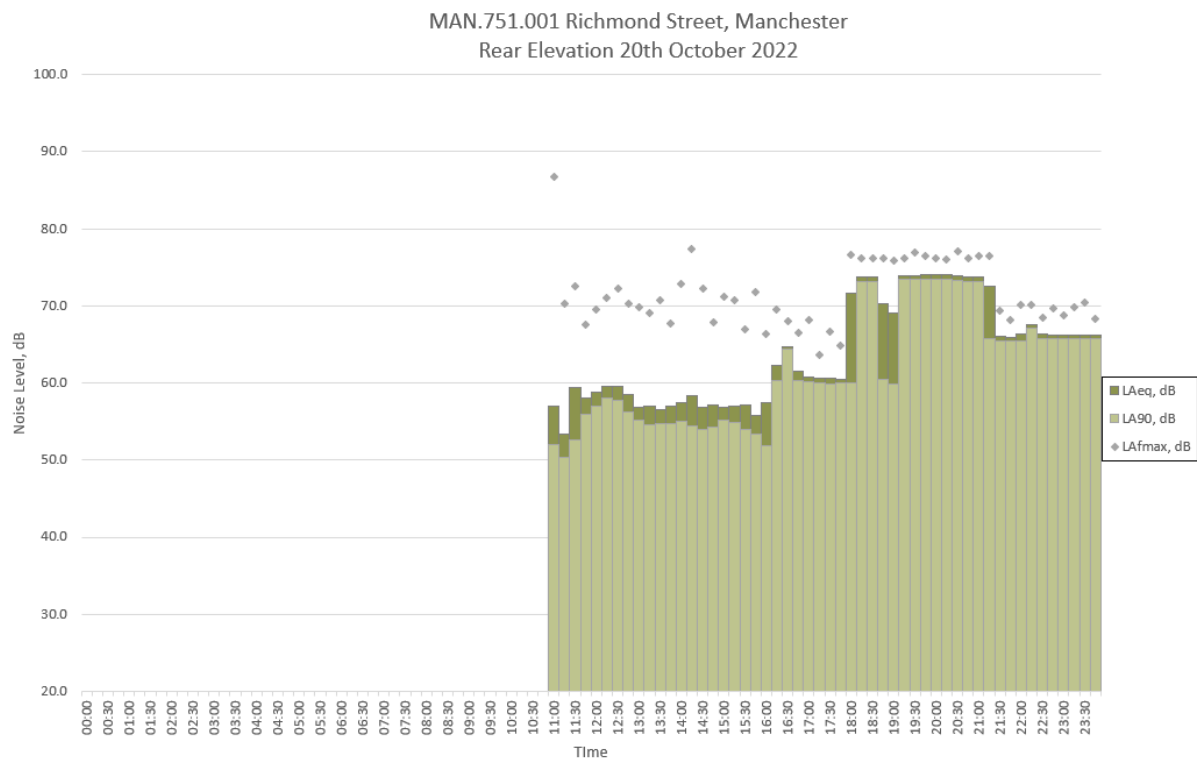
Mr Harrison has worked in acoustic consultancy since 2007 and has worked on noise and vibration assessments in several sectors including industrial / commercial developments; power generation and distribution; residential developments; transport schemes; and mineral extraction and processing.

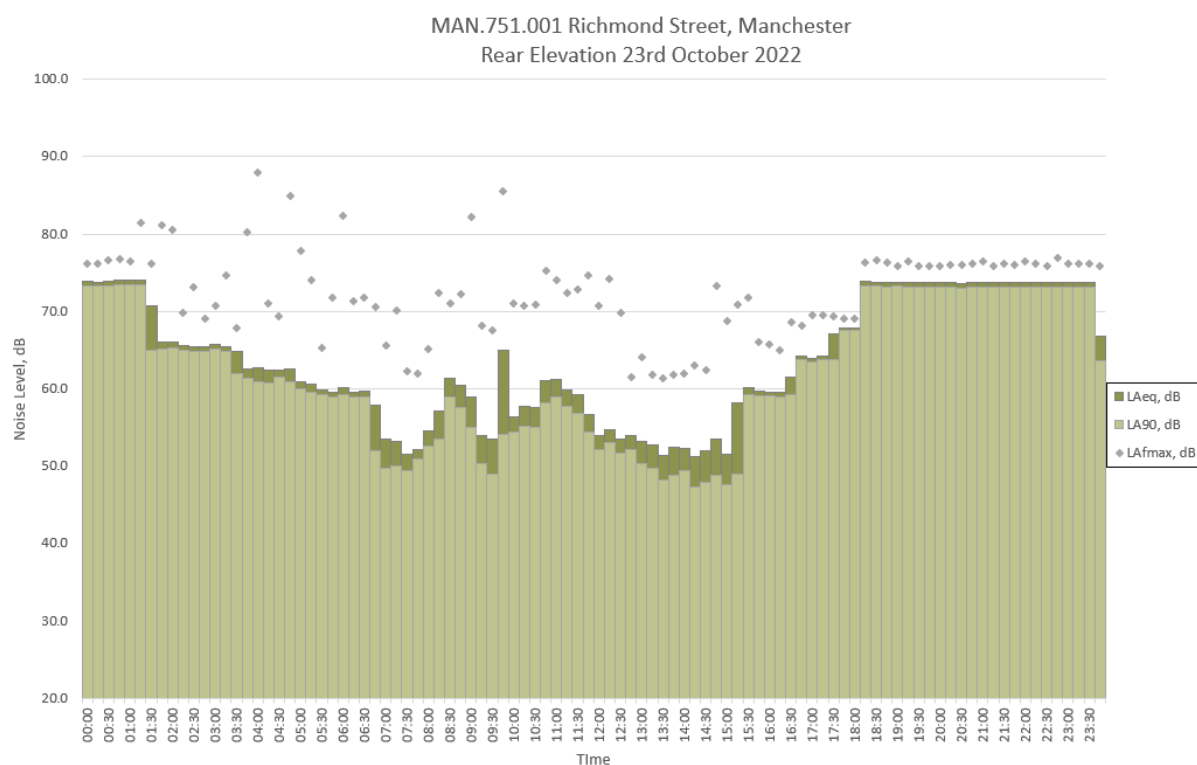
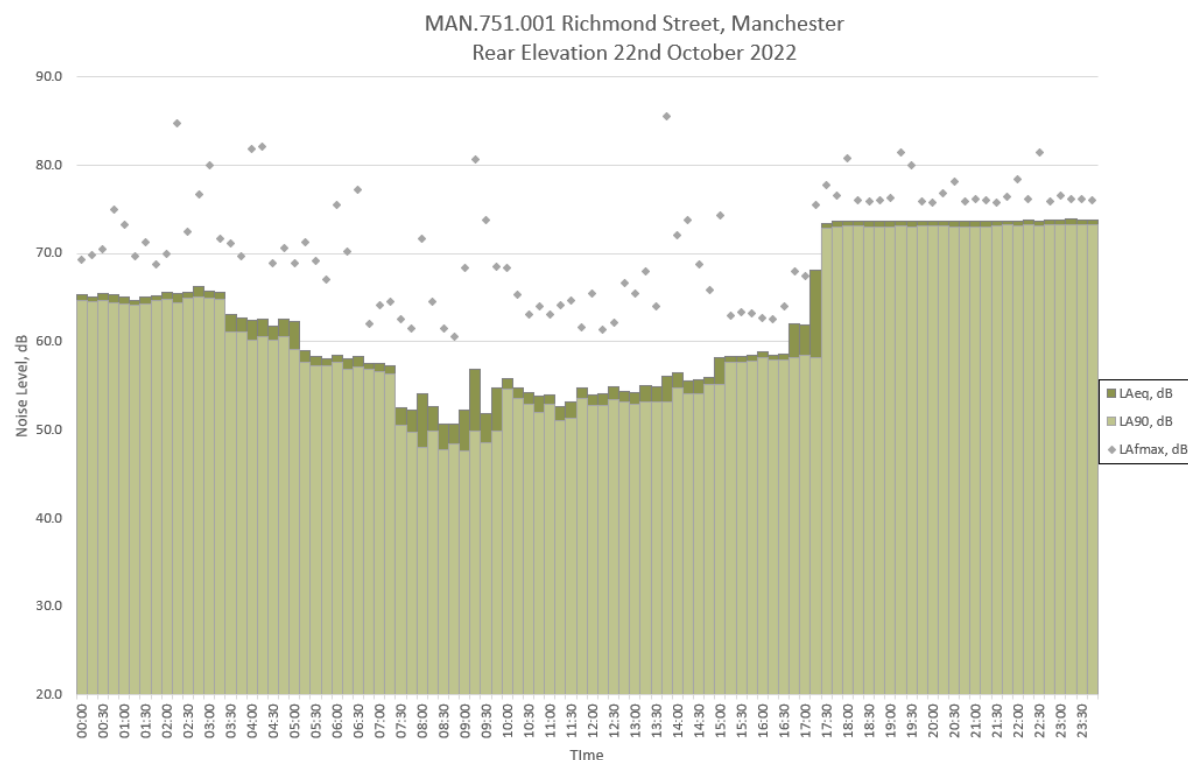
The report has been prepared under the supervision of Mr. Darren Lafon-Anthony who is the Director of Acoustics at Enzygo Limited. Mr. Lafon-Anthony holds a Master of Science Degree in Applied Acoustics and has been a Corporate Member of the Institute of Acoustics since July 2004 having previously been an Associate Member of the institute since October 2001. Mr. Lafon-Anthony is also a Fellow of the Institute of Quarrying based on his contribution to minerals and mining noise assessment and mitigation, a qualification he has held since September 2014.

Mr. Lafon-Anthony has worked in acoustics since January 1981. Initially as an engineer designing and overseeing manufacture of noise control equipment for the water industry, standby power diesel generator and power generation markets for several noise control equipment manufacturers and, since February 2004, as an environmental noise consultant in various sectors, including mineral and mining sites, waste disposal and recycling sites, large industrial developments, energy supply projects (EfW, STOR and Battery Energy sites) and residential developments in the UK, Europe and sub-Saharan Africa.

Appendix A – Baseline Noise Data

Survey Data - Time History Charts





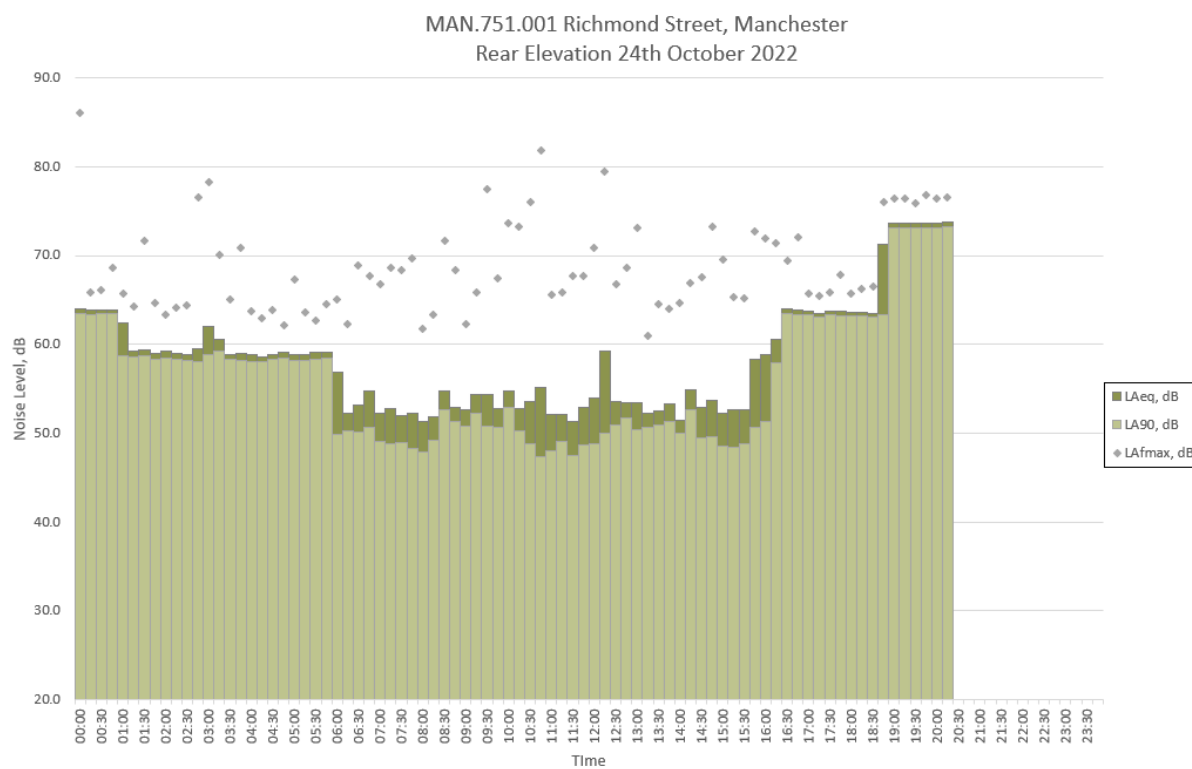


Table A-1: Rear Façade Noise Data

Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB	Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB
20/10/2022 11:00	57.0	86.7	55.9	52.0	20/10/2022 22:15	67.5	70.2	67.8	67.1
20/10/2022 11:15	53.4	70.3	54.5	50.4	20/10/2022 22:30	66.3	68.5	67.3	65.7
20/10/2022 11:30	59.4	72.6	61.8	52.6	20/10/2022 22:45	66.2	69.7	66.5	65.7
20/10/2022 11:45	58.1	67.5	59.5	55.9	20/10/2022 23:00	66.2	68.7	66.5	65.7
20/10/2022 12:00	58.8	69.5	60.1	57.0	20/10/2022 23:15	66.2	69.8	66.5	65.7
20/10/2022 12:15	59.6	71.0	60.9	58.0	20/10/2022 23:30	66.2	70.4	66.5	65.7
20/10/2022 12:30	59.5	72.2	60.7	57.8	20/10/2022 23:45	66.2	68.3	66.6	65.8
20/10/2022 12:45	58.5	70.3	60.2	56.2	21/10/2022 00:00	61.2	67.5	65.8	59.3
20/10/2022 13:00	56.9	69.8	58.1	55.2	21/10/2022 00:15	59.8	64.4	60.2	59.3
20/10/2022 13:15	57.0	69.0	58.5	54.6	21/10/2022 00:30	60.0	75.6	60.3	58.8
20/10/2022 13:30	56.5	70.8	57.8	54.7	21/10/2022 00:45	59.5	66.9	60.0	58.9
20/10/2022 13:45	57.0	67.7	58.7	54.8	21/10/2022 01:00	59.1	64.4	59.6	58.4
20/10/2022 14:00	57.5	72.9	59.8	55.0	21/10/2022 01:15	58.8	64.1	59.3	58.1
20/10/2022 14:15	58.4	77.4	59.9	54.5	21/10/2022 01:30	59.0	69.8	59.5	58.4
20/10/2022 14:30	56.8	72.2	59.1	53.9	21/10/2022 01:45	58.8	64.7	59.3	58.0
20/10/2022 14:45	57.1	67.8	59.7	54.3	21/10/2022 02:00	58.7	64.4	59.2	58.0
20/10/2022 15:00	56.8	71.2	58.0	55.2	21/10/2022 02:15	58.6	63.2	59.2	57.9
20/10/2022 15:15	57.0	70.8	58.8	54.9	21/10/2022 02:30	58.7	63.2	59.2	57.8
20/10/2022 15:30	57.2	66.9	59.6	54.0	21/10/2022 02:45	58.7	75.6	59.3	57.8
20/10/2022 15:45	55.8	71.8	56.9	53.3	21/10/2022 03:00	59.3	65.4	59.9	58.5
20/10/2022 16:00	57.5	66.3	60.9	51.9	21/10/2022 03:15	60.0	71.1	60.7	58.3
20/10/2022 16:15	62.3	69.5	64.8	60.3	21/10/2022 03:30	59.1	69.4	59.2	57.9
20/10/2022 16:30	64.7	68.0	65.0	64.4	21/10/2022 03:45	58.3	63.0	58.7	57.7
20/10/2022 16:45	61.5	66.5	64.5	60.3	21/10/2022 04:00	59.2	69.8	59.4	58.1
20/10/2022 17:00	60.7	68.2	61.1	60.1	21/10/2022 04:15	58.9	65.4	59.4	58.1
20/10/2022 17:15	60.6	63.7	61.0	60.0	21/10/2022 04:30	58.4	68.6	58.9	57.7
20/10/2022 17:30	60.6	66.6	61.0	59.9	21/10/2022 04:45	58.2	64.9	58.8	57.5
20/10/2022 17:45	60.5	64.8	60.9	60.0	21/10/2022 05:00	58.4	63.7	58.9	57.7
20/10/2022 18:00	71.6	76.6	74.0	60.0	21/10/2022 05:15	58.1	62.7	58.6	57.4
20/10/2022 18:15	73.7	76.2	74.2	73.1	21/10/2022 05:30	58.1	63.3	58.7	57.4
20/10/2022 18:30	73.7	76.2	74.2	73.1	21/10/2022 05:45	58.0	62.4	58.6	57.4
20/10/2022 18:45	70.3	76.2	73.8	60.4	21/10/2022 06:00	58.3	62.7	58.9	57.6
20/10/2022 19:00	69.1	75.8	73.7	59.9	21/10/2022 06:15	54.3	73.1	58.0	48.1
20/10/2022 19:15	73.9	76.1	74.4	73.4	21/10/2022 06:30	52.3	63.2	55.0	48.6
20/10/2022 19:30	73.9	76.9	74.4	73.4	21/10/2022 06:45	55.1	64.9	56.2	53.3
20/10/2022 19:45	74.0	76.4	74.4	73.4	21/10/2022 07:00	54.4	69.7	55.9	51.7
20/10/2022 20:00	74.0	76.1	74.4	73.4	21/10/2022 07:15	53.7	75.8	54.3	51.1
20/10/2022 20:15	74.0	76.0	74.5	73.4	21/10/2022 07:30	52.9	61.3	54.1	51.0
20/10/2022 20:30	73.9	77.0	74.4	73.3	21/10/2022 07:45	54.3	67.6	55.4	51.3
20/10/2022 20:45	73.8	76.1	74.3	73.2	21/10/2022 08:00	52.7	68.5	53.8	50.4
20/10/2022 21:00	73.7	76.4	74.2	73.1	21/10/2022 08:15	54.4	68.5	55.8	52.4
20/10/2022 21:15	72.6	76.4	74.1	65.8	21/10/2022 08:30	53.3	72.4	54.3	50.9
20/10/2022 21:30	66.0	69.3	66.3	65.5	21/10/2022 08:45	58.0	83.4	56.8	51.5
20/10/2022 21:45	65.9	68.1	66.3	65.5	21/10/2022 09:00	52.8	65.4	54.2	50.2
20/10/2022 22:00	66.3	70.2	67.5	65.5	21/10/2022 09:15	52.5	68.9	53.1	50.1

Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB	Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB
21/10/2022 09:30	53.2	62.7	54.2	51.2	21/10/2022 20:45	73.7	75.8	74.1	73.1
21/10/2022 09:45	52.6	64.6	54.3	49.3	21/10/2022 21:00	73.6	75.6	74.1	73.1
21/10/2022 10:00	52.5	63.5	54.8	48.5	21/10/2022 21:15	73.6	75.6	74.1	73.0
21/10/2022 10:15	52.2	75.7	53.9	47.1	21/10/2022 21:30	73.7	76.3	74.1	73.1
21/10/2022 10:30	54.7	68.0	55.7	53.4	21/10/2022 21:45	73.6	76.1	74.1	73.1
21/10/2022 10:45	52.5	62.9	53.8	50.4	21/10/2022 22:00	73.6	76.0	74.1	73.1
21/10/2022 11:00	53.0	60.6	55.0	50.3	21/10/2022 22:15	73.6	76.0	74.1	73.0
21/10/2022 11:15	54.5	61.8	55.3	53.3	21/10/2022 22:30	73.6	75.8	74.1	73.1
21/10/2022 11:30	56.8	75.1	56.8	54.2	21/10/2022 22:45	73.7	75.9	74.1	73.1
21/10/2022 11:45	55.8	68.8	57.4	53.7	21/10/2022 23:00	73.7	75.9	74.2	73.1
21/10/2022 12:00	55.0	64.2	56.0	53.4	21/10/2022 23:15	73.7	75.9	74.2	73.2
21/10/2022 12:15	59.9	79.2	62.6	53.0	21/10/2022 23:30	73.8	77.5	74.3	73.2
21/10/2022 12:30	55.0	69.3	56.1	52.6	21/10/2022 23:45	70.0	75.8	74.0	64.7
21/10/2022 12:45	55.0	73.0	55.4	53.7	22/10/2022 00:00	65.3	69.3	65.9	64.6
21/10/2022 13:00	54.7	71.2	55.9	52.7	22/10/2022 00:15	65.1	69.8	65.6	64.5
21/10/2022 13:15	54.9	65.0	55.8	53.6	22/10/2022 00:30	65.4	70.5	66.0	64.6
21/10/2022 13:30	55.0	66.3	56.4	52.9	22/10/2022 00:45	65.3	74.9	66.0	64.4
21/10/2022 13:45	55.8	68.5	57.0	52.9	22/10/2022 01:00	65.0	73.2	65.5	64.3
21/10/2022 14:00	55.7	66.6	56.8	53.6	22/10/2022 01:15	64.6	69.7	64.9	64.1
21/10/2022 14:15	55.2	63.4	56.1	53.9	22/10/2022 01:30	65.0	71.3	65.6	64.3
21/10/2022 14:30	54.9	64.5	55.6	53.8	22/10/2022 01:45	65.2	68.7	65.7	64.7
21/10/2022 14:45	56.4	67.3	58.6	53.5	22/10/2022 02:00	65.6	70.0	66.3	64.8
21/10/2022 15:00	55.8	68.2	57.2	54.0	22/10/2022 02:15	65.4	84.8	65.9	64.4
21/10/2022 15:15	58.4	68.1	59.6	54.9	22/10/2022 02:30	65.6	72.4	66.1	64.9
21/10/2022 15:30	59.0	67.5	59.5	58.2	22/10/2022 02:45	66.2	76.7	67.0	65.1
21/10/2022 15:45	60.3	74.4	59.8	58.4	22/10/2022 03:00	65.7	80.0	66.3	64.9
21/10/2022 16:00	73.3	75.6	73.9	72.7	22/10/2022 03:15	65.6	71.7	66.2	64.8
21/10/2022 16:15	73.5	75.9	74.1	72.9	22/10/2022 03:30	63.1	71.1	64.7	61.1
21/10/2022 16:30	73.5	76.0	74.1	72.9	22/10/2022 03:45	62.7	69.7	63.9	61.1
21/10/2022 16:45	73.7	77.1	74.2	73.1	22/10/2022 04:00	62.4	81.8	63.3	60.1
21/10/2022 17:00	73.6	76.3	74.1	72.9	22/10/2022 04:15	62.5	82.1	63.7	60.5
21/10/2022 17:15	73.4	76.3	73.9	72.7	22/10/2022 04:30	61.8	68.9	63.4	60.2
21/10/2022 17:30	73.3	76.1	73.9	72.7	22/10/2022 04:45	62.5	70.6	63.9	60.6
21/10/2022 17:45	73.4	75.7	73.9	72.7	22/10/2022 05:00	62.3	68.9	64.0	59.1
21/10/2022 18:00	73.4	76.1	73.9	72.8	22/10/2022 05:15	59.0	71.2	60.0	57.6
21/10/2022 18:15	73.7	76.3	74.2	73.1	22/10/2022 05:30	58.3	69.1	59.1	57.2
21/10/2022 18:30	73.6	76.1	74.1	73.0	22/10/2022 05:45	58.0	67.0	58.5	57.2
21/10/2022 18:45	73.6	76.1	74.1	73.0	22/10/2022 06:00	58.4	75.5	58.9	57.6
21/10/2022 19:00	73.7	76.1	74.1	73.1	22/10/2022 06:15	58.1	70.2	58.7	56.9
21/10/2022 19:15	73.6	76.7	74.1	73.0	22/10/2022 06:30	58.3	77.2	58.7	57.1
21/10/2022 19:30	73.6	76.0	74.1	73.1	22/10/2022 06:45	57.5	62.0	58.1	56.8
21/10/2022 19:45	73.8	75.9	74.2	73.2	22/10/2022 07:00	57.5	64.1	58.1	56.6
21/10/2022 20:00	73.7	75.7	74.1	73.1	22/10/2022 07:15	57.3	64.5	58.0	56.3
21/10/2022 20:15	73.6	75.8	74.1	73.0	22/10/2022 07:30	52.5	62.6	53.5	50.5
21/10/2022 20:30	73.6	75.9	74.1	73.1	22/10/2022 07:45	52.3	61.5	53.4	49.7

Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB	Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB
22/10/2022 08:00	54.1	71.6	54.4	48.0	22/10/2022 19:15	73.6	81.5	74.1	73.1
22/10/2022 08:15	52.7	64.5	54.2	49.8	22/10/2022 19:30	73.6	80.0	74.1	73.0
22/10/2022 08:30	50.7	61.5	52.1	47.7	22/10/2022 19:45	73.7	75.9	74.1	73.1
22/10/2022 08:45	50.7	60.6	51.7	48.4	22/10/2022 20:00	73.6	75.7	74.1	73.1
22/10/2022 09:00	52.2	68.3	53.3	47.6	22/10/2022 20:15	73.6	76.8	74.1	73.1
22/10/2022 09:15	56.9	80.7	55.4	49.8	22/10/2022 20:30	73.6	78.1	74.1	73.0
22/10/2022 09:30	51.9	73.8	52.9	48.6	22/10/2022 20:45	73.6	75.9	74.1	73.0
22/10/2022 09:45	54.8	68.5	56.7	49.9	22/10/2022 21:00	73.6	76.1	74.1	73.0
22/10/2022 10:00	55.8	68.3	56.1	54.6	22/10/2022 21:15	73.6	76.0	74.1	73.0
22/10/2022 10:15	54.8	65.3	55.5	53.5	22/10/2022 21:30	73.7	75.8	74.1	73.1
22/10/2022 10:30	54.2	63.1	55.4	52.9	22/10/2022 21:45	73.7	76.4	74.2	73.2
22/10/2022 10:45	53.8	64.0	55.1	52.0	22/10/2022 22:00	73.7	78.4	74.2	73.1
22/10/2022 11:00	54.0	63.1	54.7	52.9	22/10/2022 22:15	73.8	76.1	74.3	73.2
22/10/2022 11:15	52.7	64.1	53.8	51.1	22/10/2022 22:30	73.7	81.5	74.2	73.1
22/10/2022 11:30	53.1	64.6	54.1	51.3	22/10/2022 22:45	73.8	75.9	74.2	73.2
22/10/2022 11:45	54.8	61.6	55.5	53.6	22/10/2022 23:00	73.8	76.5	74.3	73.2
22/10/2022 12:00	54.0	65.5	54.8	52.8	22/10/2022 23:15	73.9	76.2	74.4	73.3
22/10/2022 12:15	54.1	61.4	55.2	52.8	22/10/2022 23:30	73.8	76.2	74.3	73.2
22/10/2022 12:30	54.9	62.1	55.8	53.4	22/10/2022 23:45	73.8	76.0	74.3	73.2
22/10/2022 12:45	54.3	66.6	54.9	53.2	23/10/2022 00:00	73.9	76.1	74.4	73.3
22/10/2022 13:00	54.2	65.4	54.9	52.9	23/10/2022 00:15	73.8	76.2	74.3	73.3
22/10/2022 13:15	55.0	68.0	55.7	53.2	23/10/2022 00:30	73.9	76.6	74.4	73.3
22/10/2022 13:30	54.9	64.0	56.0	53.2	23/10/2022 00:45	74.0	76.7	74.5	73.4
22/10/2022 13:45	56.1	85.5	55.6	53.2	23/10/2022 01:00	74.1	76.5	74.5	73.5
22/10/2022 14:00	56.5	72.1	57.4	54.8	23/10/2022 01:15	74.1	81.4	74.6	73.5
22/10/2022 14:15	55.5	73.8	55.9	54.1	23/10/2022 01:30	70.8	76.2	74.2	65.0
22/10/2022 14:30	55.7	68.8	56.4	54.1	23/10/2022 01:45	66.0	81.1	66.5	65.2
22/10/2022 14:45	55.9	65.8	56.4	55.1	23/10/2022 02:00	66.0	80.5	66.4	65.3
22/10/2022 15:00	58.2	74.3	59.1	55.1	23/10/2022 02:15	65.6	69.8	66.0	65.0
22/10/2022 15:15	58.3	62.9	58.8	57.7	23/10/2022 02:30	65.4	73.1	65.8	64.9
22/10/2022 15:30	58.3	63.3	58.7	57.6	23/10/2022 02:45	65.5	69.1	66.1	64.9
22/10/2022 15:45	58.4	63.2	58.8	57.8	23/10/2022 03:00	65.8	70.7	66.3	65.2
22/10/2022 16:00	58.9	62.7	59.4	58.2	23/10/2022 03:15	65.4	74.7	65.8	64.8
22/10/2022 16:15	58.5	62.5	59.0	57.9	23/10/2022 03:30	64.9	67.8	65.8	62.0
22/10/2022 16:30	58.6	64.0	59.1	57.9	23/10/2022 03:45	62.6	80.2	63.4	61.4
22/10/2022 16:45	62.0	68.0	64.1	58.2	23/10/2022 04:00	62.7	88.0	63.1	60.9
22/10/2022 17:00	61.9	67.4	63.8	58.4	23/10/2022 04:15	62.4	71.1	63.5	60.7
22/10/2022 17:15	68.1	75.5	73.5	58.2	23/10/2022 04:30	62.5	69.4	63.4	61.5
22/10/2022 17:30	73.4	77.7	73.9	72.8	23/10/2022 04:45	62.6	84.9	63.4	60.9
22/10/2022 17:45	73.6	76.6	74.1	73.0	23/10/2022 05:00	60.9	77.9	61.4	60.0
22/10/2022 18:00	73.6	80.8	74.1	73.1	23/10/2022 05:15	60.6	74.1	61.3	59.6
22/10/2022 18:15	73.6	76.0	74.1	73.1	23/10/2022 05:30	59.9	65.3	60.4	59.3
22/10/2022 18:30	73.6	75.9	74.1	73.0	23/10/2022 05:45	59.6	71.8	60.1	59.0
22/10/2022 18:45	73.6	76.0	74.1	73.0	23/10/2022 06:00	60.2	82.4	60.5	59.2
22/10/2022 19:00	73.6	76.3	74.1	73.0	23/10/2022 06:15	59.6	71.4	60.0	58.9

Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB	Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB
23/10/2022 04:15	62.4	71.1	63.5	60.7	23/10/2022 15:30	60.1	71.8	60.5	59.3
23/10/2022 04:30	62.5	69.4	63.4	61.5	23/10/2022 15:45	59.7	66.0	60.2	59.1
23/10/2022 04:45	62.6	84.9	63.4	60.9	23/10/2022 16:00	59.6	65.8	60.0	59.1
23/10/2022 05:00	60.9	77.9	61.4	60.0	23/10/2022 16:15	59.6	65.0	60.0	59.0
23/10/2022 05:15	60.6	74.1	61.3	59.6	23/10/2022 16:30	61.5	68.6	64.7	59.2
23/10/2022 05:30	59.9	65.3	60.4	59.3	23/10/2022 16:45	64.2	68.2	64.4	63.8
23/10/2022 05:45	59.6	71.8	60.1	59.0	23/10/2022 17:00	63.9	69.5	64.2	63.5
23/10/2022 06:00	60.2	82.4	60.5	59.2	23/10/2022 17:15	64.2	69.6	64.5	63.8
23/10/2022 06:15	59.6	71.4	60.0	58.9	23/10/2022 17:30	67.1	69.3	68.0	63.8
23/10/2022 06:30	59.7	71.8	60.0	58.9	23/10/2022 17:45	67.9	69.1	68.1	67.5
23/10/2022 06:45	57.9	70.6	59.9	52.0	23/10/2022 18:00	67.9	69.0	68.1	67.5
23/10/2022 07:00	53.5	65.6	55.0	49.8	23/10/2022 18:15	73.9	76.3	74.4	73.3
23/10/2022 07:15	53.2	70.1	53.9	50.1	23/10/2022 18:30	73.8	76.6	74.3	73.3
23/10/2022 07:30	51.6	62.3	52.7	49.4	23/10/2022 18:45	73.7	76.3	74.2	73.2
23/10/2022 07:45	52.2	62.0	54.2	51.0	23/10/2022 19:00	73.8	75.9	74.3	73.3
23/10/2022 08:00	54.6	65.1	56.5	52.6	23/10/2022 19:15	73.7	76.4	74.2	73.1
23/10/2022 08:15	57.1	72.4	59.7	53.5	23/10/2022 19:30	73.7	75.8	74.2	73.1
23/10/2022 08:30	61.3	71.1	63.0	58.9	23/10/2022 19:45	73.7	75.8	74.2	73.1
23/10/2022 08:45	60.4	72.3	62.1	57.6	23/10/2022 20:00	73.7	75.9	74.2	73.2
23/10/2022 09:00	58.9	82.2	60.2	55.0	23/10/2022 20:15	73.7	76.0	74.1	73.1
23/10/2022 09:15	54.0	68.1	56.1	50.4	23/10/2022 20:30	73.6	76.0	74.1	73.0
23/10/2022 09:30	53.5	67.6	55.6	49.0	23/10/2022 20:45	73.7	76.1	74.1	73.1
23/10/2022 09:45	65.0	85.6	66.0	54.2	23/10/2022 21:00	73.8	76.5	74.2	73.2
23/10/2022 10:00	56.4	71.0	57.7	54.4	23/10/2022 21:15	73.8	75.8	74.2	73.2
23/10/2022 10:15	57.8	70.7	59.5	55.2	23/10/2022 21:30	73.8	76.2	74.3	73.2
23/10/2022 10:30	57.6	70.9	59.3	55.0	23/10/2022 21:45	73.8	76.0	74.2	73.2
23/10/2022 10:45	61.0	75.3	62.6	58.2	23/10/2022 22:00	73.8	76.4	74.2	73.2
23/10/2022 11:00	61.2	74.0	62.7	59.0	23/10/2022 22:15	73.7	76.2	74.2	73.1
23/10/2022 11:15	59.9	72.4	61.3	57.8	23/10/2022 22:30	73.7	75.9	74.1	73.1
23/10/2022 11:30	59.2	72.8	60.7	56.9	23/10/2022 22:45	73.7	76.9	74.2	73.1
23/10/2022 11:45	56.7	74.6	58.2	54.4	23/10/2022 23:00	73.7	76.1	74.2	73.1
23/10/2022 12:00	54.0	70.8	55.0	52.2	23/10/2022 23:15	73.7	76.1	74.2	73.1
23/10/2022 12:15	54.8	74.2	55.7	53.0	23/10/2022 23:30	73.7	76.2	74.2	73.1
23/10/2022 12:30	53.5	69.8	54.3	51.7	23/10/2022 23:45	66.8	75.9	69.0	63.7
23/10/2022 12:45	53.9	61.5	55.0	52.1	24/10/2022 00:00	64.0	86.0	64.1	63.5
23/10/2022 13:00	53.2	64.1	54.8	50.4	24/10/2022 00:15	63.8	65.9	64.1	63.4
23/10/2022 13:15	52.8	61.8	54.6	49.7	24/10/2022 00:30	63.9	66.1	64.2	63.5
23/10/2022 13:30	51.4	61.3	53.6	48.3	24/10/2022 00:45	63.9	68.6	64.2	63.5
23/10/2022 13:45	52.5	61.8	54.3	48.9	24/10/2022 01:00	62.4	65.7	64.0	58.7
23/10/2022 14:00	52.3	62.0	53.9	49.5	24/10/2022 01:15	59.3	64.2	59.8	58.6
23/10/2022 14:15	51.3	63.0	53.0	47.4	24/10/2022 01:30	59.4	71.6	59.7	58.7
23/10/2022 14:30	52.0	62.5	53.9	47.9	24/10/2022 01:45	59.0	64.7	59.4	58.3
23/10/2022 14:45	53.5	73.3	54.2	48.9	24/10/2022 02:00	59.2	63.3	59.6	58.5
23/10/2022 15:00	51.5	68.7	53.3	47.6	24/10/2022 02:15	59.0	64.1	59.5	58.3
23/10/2022 15:15	58.2	70.9	60.2	49.0	24/10/2022 02:30	58.9	64.4	59.3	58.2

Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB	Period Start	L _{Aeq} dB	L _{Afmax} dB	L _{A10} dB	L _{A90} dB
24/10/2022 02:45	59.5	76.6	59.5	58.1	24/10/2022 11:45	52.9	67.7	53.6	48.7
24/10/2022 03:00	62.0	78.3	64.5	58.8	24/10/2022 12:00	53.9	70.8	55.3	48.8
24/10/2022 03:15	60.6	70.1	61.7	59.2	24/10/2022 12:15	59.2	79.4	61.0	50.0
24/10/2022 03:30	58.9	65.0	59.4	58.3	24/10/2022 12:30	53.5	66.8	54.6	50.9
24/10/2022 03:45	59.0	70.9	59.5	58.2	24/10/2022 12:45	53.4	68.6	54.3	51.7
24/10/2022 04:00	58.9	63.7	59.5	58.1	24/10/2022 13:00	53.4	73.1	54.6	50.4
24/10/2022 04:15	58.6	63.0	59.1	58.0	24/10/2022 13:15	52.3	60.9	53.7	50.6
24/10/2022 04:30	58.9	63.9	59.4	58.3	24/10/2022 13:30	52.5	64.5	53.5	50.9
24/10/2022 04:45	59.1	62.1	59.6	58.5	24/10/2022 13:45	53.3	64.0	54.6	51.3
24/10/2022 05:00	58.9	67.3	59.4	58.2	24/10/2022 14:00	51.5	64.7	52.4	50.0
24/10/2022 05:15	58.8	63.6	59.2	58.2	24/10/2022 14:15	54.9	66.9	57.1	52.6
24/10/2022 05:30	59.1	62.7	59.7	58.3	24/10/2022 14:30	52.9	67.6	54.3	49.5
24/10/2022 05:45	59.1	64.5	59.6	58.5	24/10/2022 14:45	53.7	73.3	54.6	49.6
24/10/2022 06:00	56.8	65.1	59.2	49.9	24/10/2022 15:00	52.2	69.6	53.6	48.6
24/10/2022 06:15	52.3	62.3	53.5	50.2	24/10/2022 15:15	52.6	65.3	54.9	48.4
24/10/2022 06:30	53.2	68.9	54.0	50.1	24/10/2022 15:30	52.7	65.2	54.6	48.8
24/10/2022 06:45	54.7	67.7	55.2	50.7	24/10/2022 15:45	58.3	72.7	61.3	50.7
24/10/2022 07:00	52.2	66.8	54.1	49.1	24/10/2022 16:00	58.9	71.9	60.3	51.3
24/10/2022 07:15	52.8	68.6	53.5	48.8	24/10/2022 16:15	60.6	71.4	64.1	57.9
24/10/2022 07:30	52.0	68.4	54.2	49.0	24/10/2022 16:30	64.0	69.4	64.3	63.5
24/10/2022 07:45	52.2	69.7	53.7	48.3	24/10/2022 16:45	63.8	72.0	64.2	63.3
24/10/2022 08:00	51.3	61.8	52.7	47.9	24/10/2022 17:00	63.7	65.7	64.0	63.3
24/10/2022 08:15	51.8	63.4	53.3	49.2	24/10/2022 17:15	63.5	65.4	63.8	63.1
24/10/2022 08:30	54.8	71.7	56.4	52.7	24/10/2022 17:30	63.7	65.8	64.0	63.3
24/10/2022 08:45	52.9	68.4	54.0	51.3	24/10/2022 17:45	63.7	67.8	63.9	63.2
24/10/2022 09:00	52.7	62.3	54.1	50.8	24/10/2022 18:00	63.6	65.7	63.9	63.2
24/10/2022 09:15	54.4	65.8	55.2	52.3	24/10/2022 18:15	63.6	66.2	63.8	63.2
24/10/2022 09:30	54.4	77.5	56.1	50.8	24/10/2022 18:30	63.5	66.5	63.8	63.1
24/10/2022 09:45	52.8	67.4	54.1	50.7	24/10/2022 18:45	71.3	76.0	74.0	63.3
24/10/2022 10:00	54.7	73.7	55.6	52.9	24/10/2022 19:00	73.7	76.4	74.2	73.1
24/10/2022 10:15	52.8	73.3	54.2	50.3	24/10/2022 19:15	73.7	76.4	74.2	73.1
24/10/2022 10:30	53.6	76.0	55.1	48.8	24/10/2022 19:30	73.7	75.9	74.2	73.1
24/10/2022 10:45	55.2	81.8	52.9	47.4	24/10/2022 19:45	73.7	76.8	74.2	73.1
24/10/2022 11:00	52.1	65.6	53.7	48.0	24/10/2022 20:00	73.7	76.4	74.2	73.1
24/10/2022 11:15	52.1	65.9	53.2	49.1	24/10/2022 20:15	73.8	76.6	74.2	73.2
24/10/2022 11:30	51.3	67.7	52.4	47.5	24/10/2022 20:30	0.0	0.0	0.0	0.0

Appendix B – Noise Ingress Calculations

Table B-1 – Existing Building: Ground Floor Living Space

Label	Parameter		Octave Band Centre Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	
	Leq	Spectrum	4.1	-2	-1.2	-2.2	-5.2	-8.5	-10.8	-59.5	59.5
		Noise Level	63.6	57.5	58.3	57.3	54.3	51	48.7	0	
	Lmax	Spectrum									
		Noise Level									
Overheating	Openable Windows	Level Diff	13	13	13	13	13	13	13	13	
	Internal L _{eq}		50.6	44.5	45.3	44.3	41.3	38	35.7	-13	46.5
	Internal L _{max}		-13	-13	-13	-13	-13	-13	-13	-13	-6
Vents	Mech Vent	D _{ne,w}	100	100	100	100	100	100	100	100	
	B		4.6E-11	4.6E-11	4.6E-11	4.6E-11	4.6E-11	4.6E-11	4.6E-11	4.6E-11	
	Internal L _{eq}		-38.6	-44.7	-43.9	-44.9	-47.9	-51.2	-53.5	-102.2	-42.7
	Internal L _{max}		-102.2	-102.2	-102.2	-102.2	-102.2	-102.2	-102.2	-102.2	-95.2
Windows	6/150/4 secondary glazing	R _{wi}	20	29	35	45	56	52	50	50	
	C		0.00826	0.00104	0.00026	2.6E-05	2.1E-06	5.2E-06	8.3E-06	8.3E-06	
	Internal L _{eq}		47.0	31.9	26.7	15.7	1.7	2.4	2.1	-46.6	23.9
	Internal L _{max}		-13.6	-22.6	-28.6	-38.6	-49.6	-45.6	-43.6	-43.6	-32
Wall	Rw 55 Wall	R _{ew}	41	47	49	47	56	66	76	70	
	D		6.6E-05	1.6E-05	1E-05	1.6E-05	2.1E-06	2.1E-07	2.1E-08	8.3E-08	
	Internal L _{eq}		26.0	13.9	12.7	13.7	1.7	-11.6	-23.9	-66.6	12.3
	Internal L _{max}		-34.6	-40.6	-42.6	-40.6	-49.6	-59.6	-69.6	-63.6	-41.9
Door	None/Infinite	R _{ew}	100	100	100	100	100	100	100	100	
	E	0	8.3E-11	8.3E-11	8.3E-11	8.3E-11	8.3E-11	8.3E-11	8.3E-11	8.3E-11	
	Internal L _{eq}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Internal L _{max}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
10 log (B+C+D+E) = F			-20.8	-29.8	-35.7	-43.7	-53.8	-52.7	-50.8	-50.8	
Total Internal L _{eq}			47.0	31.9	26.8	17.8	4.7	2.5	2.1	-46.6	24.2
Total Internal L _{max}			-13.6	-22.6	-28.5	-36.5	-46.6	-45.5	-43.6	-43.6	-31.6

Table B-2 – Existing Building: Ground Floor Bedroom

Label	Parameter		Octave Band Centre Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	
	Leq	Spectrum	-4.3	-3.3	3.9	-6.7	-6.2	-7.3	-14	-23.9	70.9
		Noise Level	66.6	67.6	74.8	64.2	64.7	63.6	56.9	47	
	Lmax	Spectrum	3	4.5	3	-5.5	-6.2	-7.7	-13.3	-22.9	73.7
		Noise Level	76.7	78.2	76.7	68.2	67.5	66	60.4	50.8	
Overheating	Mech Ovh Control	Level Diff	100	100	100	100	100	100	100	100	
	Internal L _{eq}		-33.4	-32.4	-25.2	-35.8	-35.3	-36.4	-43.1	-53	-29.1
	Internal L _{max}		-23.3	-21.8	-23.3	-31.8	-32.5	-34	-39.6	-49.2	-26.3
Vents	Mech Vent	D _{ne,w}	100	100	100	100	100	100	100	100	
	B		1.4E-10	1.4E-10	1.4E-10	1.4E-10	1.4E-10	1.4E-10	1.4E-10	1.4E-10	
	Internal L _{eq}		-28.7	-27.7	-20.5	-31.1	-30.6	-31.7	-38.4	-48.3	-24.5
	Internal L _{max}		-18.6	-17.1	-18.6	-27.1	-27.8	-29.3	-34.9	-44.5	-21.6
Windows	10/200/6 secondary glazing	R _{wi}	31	35	46	46	46	56	65	50	
	C		0.00036	0.00014	1.1E-05	1.1E-05	1.1E-05	1.1E-06	1.4E-07	4.5E-06	
	Internal L _{eq}		38.2	35.2	31.4	20.8	21.3	10.2	-5.5	-0.4	27
	Internal L _{max}		51.3	48.8	36.3	27.8	27.1	15.6	1.0	6.4	35.6
Wall	Rw 55 Wall	R _{ew}	41	47	49	47	56	66	76	70	
	D		3.6E-05	9.1E-06	5.7E-06	9.1E-06	1.1E-06	1.1E-07	1.1E-08	4.5E-08	
	Internal L _{eq}		28.2	23.2	28.4	19.8	11.3	0.2	-16.5	-20.4	22.2
	Internal L _{max}		41.3	36.8	33.3	26.8	17.1	5.6	-10.0	-13.6	28.7
Door	None/Infinite	R _{ew}	100	100	100	100	100	100	100	100	
	E	0	4.5E-11	4.5E-11	4.5E-11	4.5E-11	4.5E-11	4.5E-11	4.5E-11	4.5E-11	
	Internal L _{eq}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Internal L _{max}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	10 log (B+C+D+E) = F		-34.0	-38.2	-47.7	-46.9	-49.0	-59.0	-68.1	-53.4	
	Total Internal L _{eq}		38.7	35.5	33.2	23.4	21.8	10.7	-5.1	-0.3	28.2
	Total Internal L _{max}		51.8	49.1	38.1	30.4	27.6	16.1	1.4	6.5	36.4

Table B-3: Town House: 1st Floor Bedroom

Label	Parameter		Octave Band Centre Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	
	Leq	Spectrum	11.1	-0.5	-5.6	-5.2	-2.6	-8.8	-15.9	-63.9	59.0
		Noise Level	70.1	58.5	53.4	53.8	56.4	50.2	43.1	-4.9	
	L _{max}	Spectrum	0.5	-6.5	-12.5	1.5	-5.5	-19.5	-29.5	-37.5	70.8
		Noise Level	71.3	64.3	58.3	72.3	65.3	51.3	41.3	33.3	
Overheating	Mech Ovh Control	Level Diff	100	100	100	100	100	100	100	100	
	Internal L _{eq}		-29.9	-41.5	-46.6	-46.2	-43.6	-49.8	-56.9	-104.9	-41
	Internal L _{max}		-28.7	-35.7	-41.7	-27.7	-34.7	-48.7	-58.7	-66.7	-29.2
Vents	Mech Vent	D _{ne,w}	100	100	100	100	100	100	100	100	
	B		1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	
	Internal L _{eq}		-27.6	-39.2	-44.3	-43.9	-41.3	-47.5	-54.6	-102.6	-38.7
	Internal L _{max}		-26.4	-33.4	-39.4	-25.4	-32.4	-46.4	-56.4	-64.4	-26.9
Windows	10/12/6.4 acoustic pvb double glazing	R _{wi}	26	30	27	34	41	47	53	50	
	C		0.00166	0.00066	0.00132	0.00026	5.2E-05	1.3E-05	3.3E-06	6.6E-06	
	Internal L _{eq}		47.0	31.4	29.3	22.7	18.3	6.1	-7.0	-52.0	26.3
	Internal L _{max}		51.2	40.2	37.2	44.2	30.2	10.2	-5.8	-10.8	41.7
Wall	Example Wall from BS8233 (Brick and Block)	R _{ew}	36	40	44	45	51	56	58	50	
	D		0.00017	6.6E-05	2.6E-05	2.1E-05	5.2E-06	1.7E-06	1E-06	6.6E-06	
	Internal L _{eq}		37.0	21.4	12.3	11.7	8.3	-2.9	-12.0	-52.0	15.1
	Internal L _{max}		41.2	30.2	20.2	33.2	20.2	1.2	-10.8	-10.8	30.7
Door	None/Infinite	R _{ew}	100	100	100	100	100	100	100	100	
	E	0	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	
	Internal L _{eq}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Internal L _{max}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	10 log (B+C+D+E) = F		-27.4	-31.4	-28.7	-35.5	-42.4	-48.3	-53.6	-48.8	
	Total Internal L _{eq}		47.4	31.8	29.3	23.0	18.7	6.6	-5.8	-49.0	26.6
	Total Internal L _{max}		51.6	40.6	37.2	44.5	30.6	10.7	-4.6	-7.8	42

Table B-4: Town House: 3rd Floor Lounge

Label	Parameter		Octave Band Centre Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	
	Leq	Spectrum	4.1	-2	-1.2	-2.2	-5.2	-8.5	-10.8	-59.5	51.0
		Noise Level	55.1	49	49.8	48.8	45.8	42.5	40.2	-8.5	
	Lmax	Spectrum									
		Noise Level									
Overheating	Openable Windows	Level Diff	13	13	13	13	13	13	13	13	
	Internal L _{eq}		42.1	36	36.8	35.8	32.8	29.5	27.2	-21.5	38
	Internal L _{max}		-13	-13	-13	-13	-13	-13	-13	-13	-6
Vents	Mech Vent	D _{ne,w}	100	100	100	100	100	100	100	100	
	B		1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	1.2E-10	
	Internal L _{eq}		-44.1	-50.2	-49.4	-50.4	-53.4	-56.7	-59.0	-107.7	-48.1
	Internal L _{max}		-99.2	-99.2	-99.2	-99.2	-99.2	-99.2	-99.2	-99.2	-92.2
Windows	6/12/6 double glazing	R _{wi}	14	20	19	29	38	36	45	0	
	C		0.02626	0.0066	0.00831	0.00083	0.0001	0.00017	2.1E-05	0.65972	
	Internal L _{eq}		42.5	30.4	32.2	21.2	9.2	7.9	-3.4	-7.1	25.8
	Internal L _{max}		-9.6	-15.6	-14.6	-24.6	-33.6	-31.6	-40.6	4.4	3.3
Wall	Example Wall from BS8233 (Brick and Block)	R _{ew}	36	40	44	45	51	56	58	50	
	D		0.00017	6.6E-05	2.6E-05	2.1E-05	5.2E-06	1.7E-06	1E-06	6.6E-06	
	Internal L _{eq}		20.5	10.4	7.2	5.2	-3.8	-12.1	-16.4	-57.1	5.3
	Internal L _{max}		-31.6	-35.6	-39.6	-40.6	-46.6	-51.6	-53.6	-45.6	-39.1
Door	None/Infinite	R _{ew}	100	100	100	100	100	100	100	100	
	E	0	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	6.6E-11	
	Internal L _{eq}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Internal L _{max}		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	10 log (B+C+D+E) = F		-15.8	-21.8	-20.8	-30.7	-39.6	-37.8	-46.6	-1.8	
	Total Internal L _{eq}		42.5	30.4	32.2	21.3	9.4	7.9	-3.2	-7.1	25.8
	Total Internal L _{max}		-9.6	-15.6	-14.6	-24.5	-33.4	-31.6	-40.4	4.4	3.3



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